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OCTOBER 2025

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AEROSPACE

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EDITORIAL

Hard and soft power

In the Cold War, impressive military parades by the Soviet Union served as a way of messaging sheer power, technology and strength – serving to intimidate potential enemies and reassure allies in the Communist bloc. Massed displays of tanks and missiles in Red Square with flypasts of the latest aircraft overhead were closely scrutinised by Western observers to gauge the extent in which Soviet military technology was advancing and which new weapon systems were being fielded.

Fast forward to 2025 and last month China stunned the world with its own massive display of military prowess – with new hardware and weapons unveiled including multiple variants of drones, 'Guam Killer' missiles and stealth fighters. Yet, these events can sometimes backfire. Repeated May Day flypasts in the early days of the Cold War, where Soviet bombers circled back around to inflate numbers convinced the US that the threat was more dangerous than it actually was. The result was US efforts to close the perceived bomber and missile gap and investment in computer and information technology to shift the balance. Also unknown from merely viewing these parades is a military's level of doctrine and training. As can be seen from the 1991 Gulf War and, more recently, Ukraine, doctrine, training and combined arms, let alone multi-domain warfare do not always match the perception that synchronised marching and smart uniforms convey.

Yet a more insidious challenge to the US' already declining geopolitical influence is coming in space as China firms up plans to land a human on the Moon – potentially beating NASA's Artemis to the lunar surface (see p11). Though some would argue that this is only a repeat of Apollo – and not a sustained presence – the effect of this on China's influence and global 'soft power' will be hard to underestimate impressing friends, cowing adversaries and shifting the undecided to fall in line behind Beijing. Many alternate histories ponder what would have happened had the Soviets won the race to the Moon in the 1960s. Would the US have surrendered or redoubled its efforts? In the 21st Century we may be about to find out.

Finally this month, the *AEROSPACE* team warmly welcomes Features Editor, Bella Richards, back from maternity leave.

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Front cover: Sink or skim? Will the WIG finally get its day? (REGENT)

AEROSPACE INSIGHT

Additional content is available to view online at: aerosociety.com/aerospaceinsight
Including: GASCC 2025, Controlling the clouds: next steps in contrail management, AI and the Loss of Critical Thinking (A-LOC), Bader's Big Wing to fly again, Militarised murmurations, Showcasing sovereign firepower, R J Mitchell – the Battle of Britain, the Spitfire and all that.

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Blueprint

Mid-air launch

After entering through the thin Martian atmosphere using aerobraking, the capsule would descend using a parachute to deploy the helicopters. This avoids the most tricky part of a Mars mission – gently landing on the surface – with previous missions using retrorockets, inflatable cushions or even the 'Sky Crane' method to get delicate science instruments on the ground.

Scouting landing sites

The helicopters would serve as scouts and forerunners for future crewed Mars missions to locate optimal landing sites with maximum amounts of water, ice and other resources to sustain a human expedition.

Simpler and cheaper

Eliminating the heavy and complex landing platform, traditionally the riskiest part of landing on Mars, enables a lighter and simpler descent platform to deploy the drones once in the Martian atmosphere.

Autonomous flight

Building on *Ingenuity's* advanced autopilot and control with the communications' time lag to Mars precluding direct control, the six rotorcraft will be completely autonomous and be able to transfer high-resolution surface imaging and sub-surface radar data to locate water deposits back to Earth for analysis.

SPACEFLIGHT

Helicopter swarm from orbit

US drone developer, AeroVironment (AV), which was responsible for developing the Mars *Ingenuity* helicopter, alongside NASA's Jet Propulsion Laboratory, has announced its latest exploration concept, Skyfall, a platform designed to deliver six rotorcraft to the Red Planet simultaneously. The Virginia-based company is looking at a 2028 launch of the spacecraft, which will deploy six helicopters onto the Mars surface during the descent phase, eliminating the need for a traditional landing platform, which the company claims is the "most expensive, complex and risky" element of typical Mars missions. The helicopters will not only scout larger areas of Mars (specific areas have not been revealed) but will collect data that could provide more details about the planet's potentially habitable history. AV is confident that it can manufacture the helicopters for less than the $85m that was spent on *Ingenuity*.

Radome

DEFENCE

RAF to bolster Polish air defence

The RAF is to mount combat air patrols of Typhoon fighters to help protect Polish airspace. Flying directly from RAF Coningsby, the fighters will provide additional air defence against intrusions and probes by Russia under Operation Eastern Sentry. Meanwhile, France has also deployed three Rafale fighters to strengthen Poland's defences. The move comes after 19 Russian one-way attack drones entered Polish airspace on 9-10 September on their way to Ukraine as part of an attack involving over 400 UAVs, with three or four being shot down by Polish fighters and Dutch F-35s.

AIR TRANSPORT

Mental Health in Aviation Act set to pass

The US House of Representatives passed the Mental Health in Aviation Act on 8 September. If approved, the new legislation will make changes to how the FAA handles mental health issues to encourage both pilots and air traffic controllers to seek help and disclose conditions or symptoms. It will require the FAA to expand the list of available drugs acceptable to treat mental health conditions in pilots, increase training for existing aviation medical examiners (AMEs) and recruit more psychiatrists as AMEs – as well as encouraging voluntary disclosure and removing the stigma. The bill will now go to the Senate for ratification before the president signs it into law.

● Register now for the RAeS Mental Health in Aerospace Awareness Event, 6 October, RAeS HQ, London.

SPACEFLIGHT

Russian space industry now in 'critical' condition

The head of Russia's main spacecraft manufacturer has spoken out about the state the industry is in, warning that RSC Energia has reached "critical" condition and the situation cannot go on like it is – predicting that it will close unless there is a 'miracle.' CEO, Igor Maltsev, cited a number of issues, including debt levels, loan interest and a lack of team motivation – saying in an internal message to employees: "We need to stop lying to ourselves and others about the state of affairs, convincing ourselves and others that everything is fine with us." His remarks were published by the Russian *Gazeta.ru* news site before being picked up by Western media. The company is struggling to pay wages at a time when Russia's economy is being depleted of skilled labour by the war in Ukraine.

AEROSPACE

Airship 'warehouse' to be tested in LA

Airship designer, Aeros is proposing mooring a 555ft-long 'flying warehouse' over its home city of Los Angeles, allowing logistical companies to rendezvous with it with their drones to collect items for delivery to homes below. Designed by Igor Pasternak, the ML866 airship could also be used to ship wind turbines and other outsized cargo in its 8,800ft² envelope or to deliver 66t of humanitarian relief. The ship promises variable buoyancy, allowing it to operate in all weathers and off-load stores while hovering. A trial using a smaller blimp is set to take place later this year.

NEWS IN BRIEF

On 12 September US Transportation Secretary, Sean P Duffy announced a new pilot scheme to accelerate the deployment of advanced air mobility (AAM) vehicles. The Electric Vertical Takeoff and Landing Integration Pilot Program (eIPP) comes following President Trump's executive order to "unleash American drone dominance." According to the FAA, the programme will include five projects: short-range air taxis, longer-range fixed-wing flights, cargo, logistics and EMS services, and will investigate ways to increase automation safety.

UK passenger numbers are now at pre-pandemic levels, according to data from the CAA. The regulator has disclosed figures from April to June 2025 which show 81m passengers passed through UK airports. These statistics also showed an improvement in flight punctuality with 75% of flights departing on time, an 8% improvement on 2024.

The Singaporean government has selected the Boeing P-8A Poseidon as its next maritime patrol aircraft. The nation will acquire four P-8As to replace the five Fokker 50 aircraft currently operating in the role by the Republic of Singapore Air Force. Singapore had also been considering the Airbus C295 for the contract.

India has announced the success of its integrated air drop test for a crew module which will be part of its Gaganyaan human space mission. Scheduled for 2027, this programme aims for India to put two astronauts in low Earth orbit. An Indian Air Force Chinook carried the capsule over the Bay of Bengal and dropped it from around 13,000ft to test the deceleration characteristics, deployment of parachute and safety of landing in the sea.

Following a recommendation by the Air Accident Investigation Branch (AAIB), the UK CAA is to mandate the teaching of partial power loss handling as part of the PPL syllabus from 1 October. It will also be a 'recommended' exercise for

AEROSPACE

A320 set to overtake 737 as most popular airliner

The Airbus A320 family is set to overtake the Boeing 737 as the world's most popular airliner. As of the end of August 2025, Boeing had delivered 12,214 examples of its Boeing 737 family – for many years the most delivered jetliner of all time. However, with the FAA restricting production rates at Boeing's factory, the number of Airbus A320 family airframes delivered to customers has been rapidly catching up. As of the end of August, Airbus had delivered 12,198 airframes (including A318, 319 and 321 variants) – leaving it just 16 aircraft behind Boeing. Whereas Boeing made its first 737 delivery in December 1967, Airbus would deliver the first A320 more than two decades later in 1988.

GENERAL AVIATION

Supernal and Textron put eVTOL programmes on hold


Supernal

South Korean advanced air mobility developer, Supernal has announced the suspension of development work on its S-A2 five-seat eVTOL aircraft. The move came on 31 August, following the resignation of Jaiwon Shin and David McBride from their roles as CEO and CTO at the Hyundai car company subsidiary. Supernal conducted a maiden flight of its technology demonstrator in April 2025 at the Mojave Air and Space Port.

AIR TRANSPORT

Avelo Airlines orders up to 100 E195-E2 airliners


Embraer

In a bid to take on low-fare US rivals, Houston-based Avelo Airlines has announced a firm order for 50 Embraer E195-E2 airliners with purchase options for 50 more. The deal, worth $4.4bn, makes it the first US airline to acquire Embraer's E2 series of airliners. Deliveries are slated to start in the first half of 2027.

DEFENCE

Israeli air force strikes Hamas in Qatar

Aircraft from the Israel Defense Forces launched an air strike on the Qatari capital, Doha on 9 September in an attempt to strike the Hamas negotiating team that was meeting to discuss the latest US proposal for a ceasefire in Gaza. Five people were killed but Hamas claimed its senior members were unharmed. The strike reportedly involved around 12 IAF aircraft (eight F-15Is and four F-35Is) firing long-range air launched ballistic missiles from the Red Sea to avoid the jets overflying Arab airspace. Qatar's Prime Minister, Sheikh Mohammed bin Abdulrahman bin Jassim Al Thani claimed US warned him of the attack 10 minutes after it had started. Meanwhile, US President, Donald Trump said he was only informed of the attack afterwards by the US military.

microlight and motor glider training and encourage inclusion in existing pilots' biennial flight reviews.

Netherlands-based, Destinus, which flew a technology demonstrator in May 2023, has reportedly paused plans to build a hydrogen-powered hypersonic airliner due to a variety of technical and regulatory restrictions. It will now focus on developing hypersonic uncrewed vehicles for the defence sector and has also acquired Swiss avionics company, Daedalean for $225m.

On 29 August, US low-cost carrier, Spirit Airlines announced that it was filing for Chapter 11 bankruptcy protection. This is the second time in less than a year that Spirit Airlines has looked to restructure its debts but it exited Chapter 11 in March after restructuring $350m in equity investment.

The UK's newly constituted National Infrastructure and Service Transformation Authority watchdog has labelled the GCAP programme as a 'red' risk due to its complexity and challenges in a report. Under this delivery confidence assessment, the programme is not necessarily facing failure but acknowledges it is at an early stage.

Guangzhou-based commercial aerospace company, CAS Space, has announced plans to create China's first fully reusable sub-orbital space tourism vehicle. Designed to complete "more than 30 flights," the Lihong series is also envisaged as a space laboratory for research into microgravity.

Embraer has passed the major milestone of delivering 2,000 business jets since 2002. Embraer has recently supplied a Praetor 500 to an unidentified customer which took the company past the 2,000 mark.

Two eVTOLs were involved in a mid-air collision in China on 16 September. The Xpeng Aeroht vehicles crashed while practising a formation display for the Changchun Air Show with one person injured.

Radome

AIR TRANSPORT

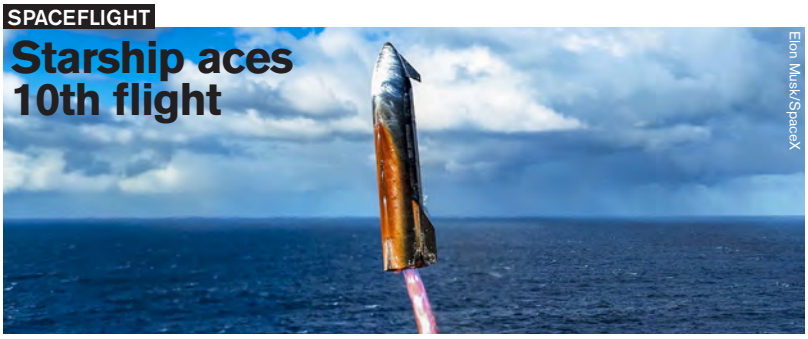
Pilot enters Top 10 'most aspired to' jobs

A careers' survey of 4,000 British 13-16 year olds, conducted by BBC Bitesize, has investigated young people's views on the job market. Entering the top ten list of 'most aspired to' jobs (at ten) for the first time is pilot, with engineer remaining at second place in the list behind doctor for the second year running. Interestingly, 47% said they hoped to go to university after finishing school with just 25% saying an apprenticeship would be their preferred route. Meanwhile, the NHS was rated as the most desirable organisation to work for, with NASA at number four below Google and Apple and 'government' a new entrant in tenth place.

● Register now for the RAeS Careers in Aerospace LIVE 2025, 5 November, RAeS HQ, London.

SPACEFLIGHT

Starship aces 10th flight



Elon Musk/SpaceX

On 26 August, SpaceX's Starship performed its tenth test flight which succeeded in its goals set, a remarkable contrast to the recent high-profile failures of the three previous attempts. Taking off from Starbase in Texas after two technical and weather-related delays, the booster successfully landed in the Gulf of Mexico with the main spacecraft carrying out a sub-orbital arc, deploying eight Starlink satellite simulators before splashing down in the Indian Ocean. The water landing showed off the upper stage's heatshield, charred orange from the heat of re-entry, with the vehicle landing only 10ft away from its intended target.

AEROSPACE

ATR to fly hybrid-electric aircraft by 2030

ATR

Franco-Italian turboprop aircraft manufacturer, ATR has been selected by the EU-funded Clean Aviation Joint Undertaking to lead two major initiatives aimed at flying the world's first hybrid-electric regional aircraft by 2030. The OEM will use an ATR 72-600 as a test platform, integrating hybrid-electric propulsion using high-performance batteries and a thermal engine that works with SAF. The concept will form part of Clean Aviation's Ultra-Efficient Regional Aircraft initiative, which envisions a next-generation regional aircraft concept with capacity for approximately 50-100 passengers and a design range of up to 580 miles.

DEFENCE

Drone factories open in UK

Ukrainian drone maker Ukrspecsystems is opening a new 11,000m² factory in Mildenhall, Suffolk and a test and training facility at Elmsett Airfield. Combined, the two sites represent a £200m investment and are said to generate up to 500 jobs directly and in the wider supply chain. Production is expected to start early next year. In addition, the British government has announced 'Project Octopus' – an industrial partnership between the UK and Ukraine to share designs for interceptor drones that will be mass-produced in the UK at a rate of "thousands per month."

● On 15 September Portuguese/UK drone manufacturer, Tekever announced a new £400m UAV factory in Swindon, Wiltshire which will create 1,000 jobs.

NEWS IN BRIEF

Cambodia Airways has signed a Memorandum of Understanding (MOU) with the Commercial Aircraft Corporation of China (COMAC) to acquire 20 C909 regional airliners. Previously the ARJ21, the C909 seats between 78-97 passengers.

The UK is looking to induct a tactical ballistic missile capability which can be produced rapidly if necessary. Specified range is in excess of 375miles carrying a payload of 660lb high explosive. Termed Project NIGHTFALL, the system must be able to operate in a GPS denied environment with each effector costing £50,000.

The US Space Force's X-37B space plane has been launched on its eighth mission from a SpaceX Falcon 9 rocket which took off from Cape Canaveral on 21 August. The booster stage of the rocket was successfully recovered with the main craft carrying the X-37B into LEO on its mission, which will include testing quantum navigation systems.

Piper Aircraft has teamed up with diesel engine manufacturer, DeltaHawk to launch the PA-44 Seminole DX. The latest variant of the twin-engined design will have two 180hp counter-rotating DHK4A180 engines that can run on heavy fuel (either diesel or Jet A1) and is claimed to have 40% better fuel efficiency than avgas-powered Seminoles.

One of the world's largest aircraft lessors, Air Lease Corp, has been sold for $7.4bn to a group of investors led by Japan's Sumitomo and rival lessor, SMBC Aviation Capital. Dublin-based Air Lease was founded in 2010 by Steven Udvar-Házy and the takeover will see the new holding company, Sumisho Air Lease also headquartered in Ireland. With its combined fleets exceeding 1,200 airliners, the new Air Lease/SMBC conglomerate will become the second largest lessor in the world, second only to AerCap.

Canada's WestJet is to acquire 60 Boeing 737-10s and seven 787-9 Dreamliners as part of its largest ever order. The deal also includes options for 25 Boeing 737s and four more Dreamliners and forms part of the Calgary-based carrier's

GENERAL AVIATION

Mexico certifies first indigenous aircraft in over 70 years

Horizontec

Mexican authorities have certified the Horizontec Halcón 2.1 light aircraft, making it the first domestically developed type to receive approval in seven decades. The all-composite two-seater is powered by a Rotax 915 iS engine and Horizontec hopes to market it for export to the US under the FAA's new MOSAIC rules.

DEFENCE

French MALE UAV makes first flight

The prototype of Turgis Gaillard's AAROK drone performed its maiden flight from Blois-Le Breuil on 9 September. First unveiled at the 2023 Paris Air Show, the Medium Altitude Long Endurance (MALE) drone flew for an hour, albeit with a pilot on board for safety reasons. Founded in 2011 to develop the Gerfaut system that integrates precision-guided munitions under the wings of a C-130 Hercules, the company has now grown to 300 employees. The AAROK has been designed as an ITAR-free ISR and strike platform and is larger and more heavily armed than the US-built MQ-9 Reaper drones currently operated by France. Turgis Gaillard is also working with Thales to develop a surveillance variant equipped with the AirMaster S radar.

AEROSPACE

Boeing 777 still behind schedule, admits Ortberg

Speaking at the Morgan Stanley Laguna Conference on 11 September, Boeing CEO, Kelly Ortberg confirmed that certification of the new 777-9 widebody still remains behind schedule, describing the process ahead as a "mountain of work." Currently, Boeing anticipates delivering the first 777-9 in 2026, six years later than originally expected when the aircraft was launched in 2013. However, the slippage is not linked to technical issues and airline interest in the type remains strong. In early August Cathay Pacific Airways placed an order for 14 additional airframes – taking the order book for the 777X series in excess of 550 airframes.

AIR TRANSPORT

Green airline prunes staff back

ZeroAvia

UK-based 'green airline,' Ecojet, which was founded by renewable energy company, Ecotricity's boss, Dale Vince in 2021, has laid off 11 of its 13 staff and delayed its planned launch to 2026, having failed to raise the £20m needed for its air operator certificate (AOC). While initially planning to operate DHC-6 Twin Otters, Ecojet has plans to retrofit these with ZeroAvia's hydrogen-electric powertrains as soon as they receive CAA approval. It has also signed a LoI with ARC Aerosystems to purchase 20 LINX P9 compound autogyros.

major fleet renewal and expansion strategy.

A second prototype Northrop Gruman B-21 Raider flew for the first time on 11 September. Ferried to Edwards AFB, it will now join the first example in the flight test programme, including expanding into weapons integration trials.

Arianespace is considering bolstering the launch cadence of its Ariane 6 rocket beyond ten per year if there is increased demand, the company said at World Space Business Week on 16 September. Currently, the two-stage vehicle has completed three launches since its maiden flight in July 2024.

Following Joby Aviation's acquisition of Blade's passenger helicopter business in August, it has announced plans to integrate passenger air mobility flights into the Uber app by 2026. Although Blade flights currently use conventional helicopters, Joby plans to roll out its fleet of eVTOLs as soon as they are certified.

UK UAV manufacturer, Windracers has inaugurated a new production facility which will enable it to increase its rates of production. Measuring 240,000ft^2 and creating over 50 skilled jobs with more to come, the facility in Hampshire will build hundreds of ULTRA aircraft over the next two years.

Australia's national carrier, Qantas has placed an order for 20 extra Airbus A321XLR airliners. This is in addition to the 26 the carrier already has on order, taking the total planned number to 46, with two having already been delivered.

Peru has received US State Department approval for the potential procurement of 12 Lockheed Martin F-16 Block 70 fighters in a $3.4bn FMS deal.

Northrop Grumman's latest Cygnus XL resupply craft, carrying a record-breaking 11,000lb of equipment and supplies, launched to the ISS on 14 September on a Falcon 9 rocket from Cape Canaveral in Florida. At the time of publishing, NASA announced the spacecraft would rendezvous with the station later than planned on 18 September.

Radome

SPACEFLIGHT

UK pulls funding from TRUTHS mission

The UK has axed £200m in funding to support the ESA TRUTHS (Traceable Radiometry Underpinning Terrestrial and Helio Studies) satellite mission – intended to provide a 'gold standard' in climate data that other measurements can be compared against. The UK is the lead nation in the ESA mission, which was developed by National Physical Laboratory, with Airbus as the prime contractor. In a report in *The Times*, ESA said that the funding cut had been "due to affordability constraints related to a spending review." Meanwhile, the UK government has said that the UKSA will be folded back into the Department for Science, Innovation & Technology (DSIT) by April 2026. (See p34)

DEFENCE

Chinese Internet

China shows off military might

A military parade in Beijing on 3 September to mark the 80th anniversary of China's victory in WW2 offered a rare public glimpse of some of the nation's latest arms and weaponry. Hypersonic missiles, such as YingJi-21, DongFeng-17 and DongFeng-26D, passed through Tiananmen Square while a flypast included J-35, J-15DT, J-20 fighters, the KJ-600 and Y-9FQ AEW aircraft and Y-20 tanker. A number of previously unknown combat drones, including what appeared to be tailless CCA types, were also seen.

AIR TRANSPORT

Korean Air places record order

Boeing

Korean Air is to purchase 103 Boeing aircraft, marking the carrier's largest ever order. This is broken down as 20 777-9s, 25 787-10s, 50 737-10s and eight 777-8 freighters. The order comes at a time when the airline is expanding its operations in line with the integration with Asiana Airlines.

AEROSPACE

GE Aerospace invests in AAM developer, BETA

US-engine OEM, GE Aerospace, is to invest $300m in aircraft manufacturer, BETA Technologies. The move is linked to a collaboration to develop a new hybrid-electric turbogenerator for use on BETA's all-electric CX300 ALIA aircraft and other designs. According to GE, the work will combine BETA's "expertise in high-performance, permanent magnet electric generators" with GE Aerospace's certification, safety and large-scale manufacturing expertise. The engine manufacturer also confirmed that the hybrid system would "tap into existing infrastructure and capabilities, such as GE Aerospace's CT7 and T700 engines," opening up longer ranges and payloads for military versions of its ALIA eVTOL.

NEWS IN BRIEF

Gulfstream has announced that it has fitted the 100th example of the Starlink high-speed internet system to one of its aircraft. The system was fitted to a G650ER business jet at the company's Fort Worth Alliance Service Centre in Texas.

Dublin-based software firm, Better Futures has emerged from stealth mode, launching an AI assistant platform for engineers. Engineering Verified Assistants (EVA) 2.0 is intended to streamline systems engineering and certification by creating auto-generated documents, such as test plans and advanced requirements and traceability checking.

On 4 September, US President, Donald Trump signed an executive order to rename the Department of Defense (DoD) as the Department of War. This returns it to the name it carried for 158 years from 1789 to September 1947 when it was split into the Department of the Army, Department of the Air Force and Department of the Navy – becoming the DoD in 1949. The DoD will initially use its 'new' name as a secondary title while the administration seeks congressional approval to make the change permanent.

ON THE MOVE

Following the sudden death of co-founder, Frank Strang, Scott Hammond has taken over as CEO of SaxaVord Spaceport. Strang's widow, and former COO, Debbie Strang, is to take over Hammond's role as Deputy CEO.

Former CEO of airBaltic, Martin Gauss has been named the new CEO of Bahrain flag carrier, Gulf Air – replacing Jeffrey Goh, effective 4 November.

François Lassale has been chosen to succeed James Viola of Vertical Aviation International.

Former New Hampshire Governor, Chris Sununu is to become President and CEO of the Airlines for America (A4A) action group. He succeeds Nick Calio, who is stepping down after 15 years.

News Analysis

SPACEFLIGHT

Will China beat the US back to the Moon?

Bella Richards

The US reigned supreme in the first space race to the Moon and, now, in this new era of seeking to return to the lunar surface for the first time in over 50 years, competition to get there first is on the rise. Recently, China has made some significant strides in its lunar mission, with ambitions to send taikonauts to the Moon by 2030 and, with ongoing delays that have pushed NASA's plans further back, the US' dominance has been thrown onto rocky ground.

China ramps up progress

The latest indication occurred on 6 August, when the China Manned Space Agency (CMSA) said in a statement it conducted vital verification tests of its Lanyue lunar lander, validating its landing and take-off system scheme, control scheme, lunar touchdown and shutdown scheme, and the interface between the GNC (guidance, navigation and control) and propulsion subsystems.

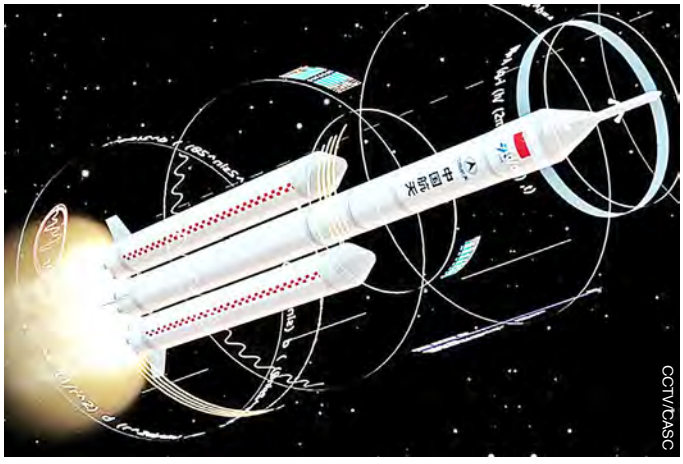
China's lunar space programme has been in progress for years but the nation got serious in July 2023 when it announced it was formalising a human exploration element to its future projects. The mission comprises two astronauts launching to the Moon's orbit atop a Long March 10 rocket – a three-stage heavy lifter under development – on board the Mengzhou spacecraft, which will rendezvous with the Lanyue lunar lander in the Moon's orbit, which is then responsible for completing the final landing phase and transporting the astronauts to the surface.

The Lanyue will primarily be used to transport the astronauts to the surface of the Moon from lunar orbit, and will serve as the propulsion unit. "It can carry two astronauts for a round-trip, and can carry a lunar rover and scientific payloads," CMSA said in its statement. "It will serve as the lunar life centre, energy centre and data centre for astronauts after they land on the Moon, and can support lunar residence and activities."

The recent testing was performed at the Extraterrestrial Landing Test Site in Huailai County, Hebei Province. Huang Zhen from CASC told a Chinese news station in August that the tests also validated the lander's ability to withstand the cislunar thermal temperatures, as it will orbit the Moon for a prolonged period. Before these recent milestones, the Chinese agency also completed a vehicle-abort systems test of its Mengzhou spacecraft in June and a Long March 10 static fire in August, firing up its seven YF-100K engines, which burn kerosene and liquid oxygen, for 30 seconds.

A threat to NASA?

Amid China's acceleration in the modern space race, the US Senate Commerce Committee held a hearing to discuss the risks if its East Asian competitor defeats the Artemis programme's epic comeback to the Moon. During the hearing, several US officials claimed that the nation's back-and-forth administration, programme delays, and budget cuts have undermined their ability to dominate lunar exploration. Most tellingly, former NASA administrator, Jim Bridenstine claimed these reasons, together with the agency's reliance on SpaceX, would make it "highly unlikely the US will beat China's projected timeline" – a harsh statement considering the US is quick to defend its capabilities, regardless of setbacks or competition. Bridenstine was the administrator during President Donald Trump's first term in office in 2017, and was necessary in pioneering the Artemis programme, despite major kickback against his lack of science or engineering qualifications.



China's Long March 10 will launch a lunar lander and crew spacecraft in two seperate flights.

Conversely, while the Artemis programme's ambitions to complete even just a flyby around the Moon have been plagued by delays, NASA's interim administrator, Sean P Duffy, responded to the comments made during the hearing in a meeting with employees, according to the *Ars Technica*, news website stating: "That was shade thrown on all of NASA. I heard it, and I gotta tell you what, maybe I am competitive, I was angry about it. I can tell you what, I'll be damned if that is the story that we write. We are going to beat the Chinese to the Moon."

Is it really a race?

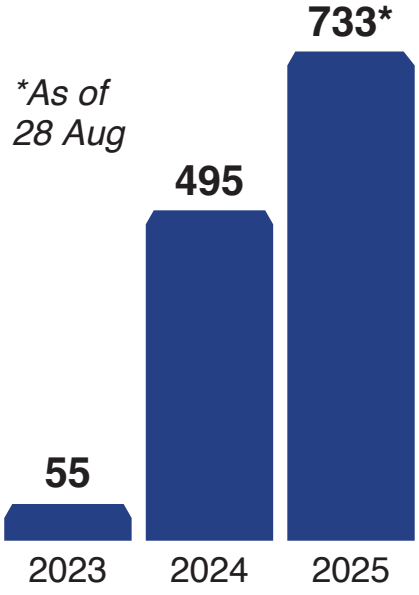
The commotion over the US' potential loss in returning to the Moon to China is warranted to an extent, considering the recent budget slashing of its science programmes (a major element of NASA's credibility) – but, ultimately, the question of whether China is a true threat will only surface with time. Some say the US already won the first race and has no reason to worry now, and others are cautious over China's secretive technological advancements.

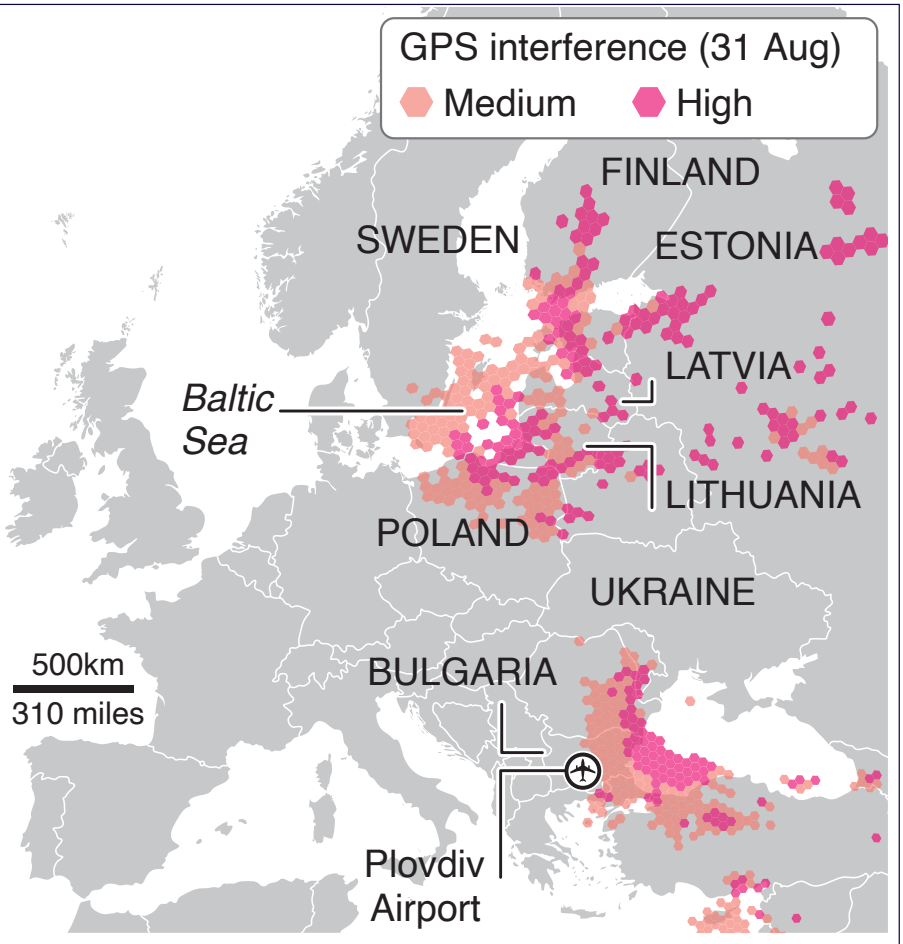
By the Numbers

Understanding the world of Aerospace through data

Sharp rise in GPS jamming

Sweden accuses Russia of being behind a significant rise in GPS signal jamming over the Baltic Sea, raising concerns for aviation in Europe and beyond. Moscow denies the allegations.





GPS DISRUPTIONS: Sweden says incidents have grown both geographically and in scope, becoming an almost daily occurrence.

Sources: Swedish Transport Agency (STA), GPSJam Picture: Getty Images

Pushing the Envelope

Exploring advances on the leading edge of aerospace

Robert Coppinger

Flinging interstellar phones

As the Comet 3 Interstellar Asteroid Terrestrial-impact Last Alert System (3I/ATLAS) barrels towards the Sun on its multi-billion year voyage through the stars, mankind continues to think about how humanity would reach distant suns. NASA's Voyager and Pioneer probes are heading out to the stars and Pioneer 11 will pass 'near' (near being a relative term) the binary star system of Lambda Aquilae in about four million years' time.

Since its discovery in July, 3I/ATLAS has been the centre of debate about whether it is an asteroid, comet or something else – but travelling at 38 miles per second there is no question that it has been travelling through interstellar space for thousands of millennia. One of the astronomers who has entered that debate is British academic, Dr David Kipping, an Associate Professor of Astronomy at Columbia University and podcaster who is currently on a year's sabbatical. He has considered the challenge of flinging spacecraft across the void, and he and his colleagues' concept uses solar radiation to send a small object at dizzying speeds to reach the stars.

While astronomers argue over whether 3I/ATLAS is about 6km wide or 46km wide, Kipping's spacecraft is mobile phone sized. Like other interstellar concepts, from Imperial College London's 'Project Svarog' solar sail CubeSat to the privately financed Breakthrough Starshot's laser propelled sails, Kipping's idea uses sails, albeit in a different way.

TARS to the stars

Called Torqued Accelerator using Radiation from the Sun (TARS), his launch station would have two thin wing-like surfaces, each with contrasting albedos and reflectivity, and also use solar radiation pressure to spin the TARS. The total structure would span "tens of metres," yet weigh just 1kg, Kipping states in his 29 July paper. His states that Carbon Nanotube (CNT) sheets, which are now commercially available, could be used to make the TARS that lightweight and, once launched and deployed, the material would unfold to extend to its full size.

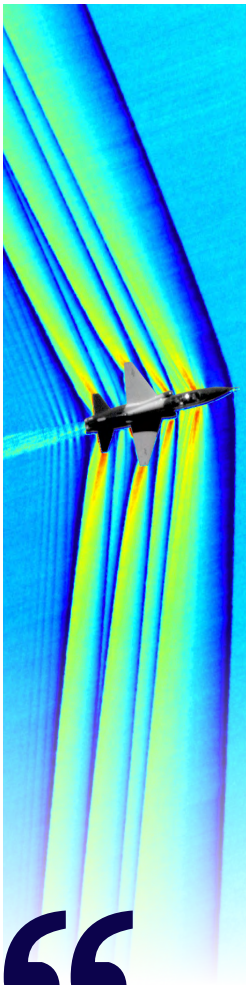
While the compact folded TARS is very light it still needs to be propelled to its final orbit and Kipping suggests that the necessary accelerator would trail the Earth in the kind of solar orbit already used for NASA's Spitzer and Kepler space telescopes. However, as the TARS is so lightweight and compact, he suggests that "hundreds of these things" could be launched into space. To escape the Sun's gravitational pull and take an interstellar journey, an object would need to attain a speed of 26 miles per second and Kipping states that a TARS flung payload could achieve that. Increasing its rate of rotation over weeks and months, he said a TARS would eventually spin "as fast as a blender." However, that spin has to become gyroscopically stable, and Kipping proposes fine-tuning this with micro thrusters or directed energy fired against the sails from an accompanying spacecraft or a terrestrial source.

Flinging payloads

According to Kipping, the TARS would spin a "phone-sized payload to reach interstellar velocities in less than a year." To aim at the target star, he explained that the target has to be along the TARS' orbital plane, an invisible trajectory extending from the TARS' own orbit to the target's distant Solar System. The release of the object has to occur at the same time that TARS is in the correct orbital position to maximise its speed along that plane. However, the release mechanism would have to be very fast to ensure the object was flung at the correct fraction of a second. Kipping's and his colleagues' work on TARS is funded by donations, with around 400 online donors so far signed up. These private donations have enabled Kipping to hire an engineering undergraduate student to work on TARS for the summer. Kipping has also had offers of a free launch for a CubeSat sized TARS demonstrator and is trying to organise some students to work on the test demonstrator next year as a project.

He explained that as US government grants are risk-averse, TARS is not something the government would fund. He sees the unfurling of the CNT sail and obtaining telemetry from the demonstrator as "the two engineering challenges."

Kipping and his students will be working on the TARS challenge while other astronomers debate the outcome of 3I/ATLAS' visit. However, will there be a debate on Lambda Aquilae Prime in four million years' time about the NASA Pioneer probe passing by?



> SINCE ITS DISCOVERY IN JULY, 3I/ATLAS HAS BEEN THE CENTRE OF DEBATE ABOUT WHETHER IT IS AN ASTEROID, COMET OR SOMETHING ELSE

LETTERS

Trial by social media or a real Just Culture?

A friend who is a member pointed your editorial out to me [*AEROSPACE*, August 2025, p3].

As an aircraft accident and safety investigator working for a government authority in Asia, I found your comments timely and very much to the point.

There is so much speculation on social media, which is now AI driven, that the whole concept of Just Culture and confidentiality involved in accident reports is now almost impossible. That is why it is encouraging to see editorials/articles, like yours, questioning their validity.

Ian Quinn

ONLINE

On Freedom's Wings


Claire Harley/BBMF

Response to 'Battle of Britain Memorial Flight Lancaster PA474 overflies the new On Freedom's Wings installation in Lincolnshire.'

Graham Henderson GAvA

Brilliant! It just had to be done.

The use of AI in academia


Tim Robinson/Flickr

Response to 'Is AI – Loss of Critical Thinking (A-LOC) a rising risk for students, academics and aerospace professionals?'[1]

Robin Trewinnard-Boyle

AI certainly has its uses but also its limitations. Responses are deliberately designed to produce documents for the layperson, hence the style of language, but does using more advanced language help the reader or just help the author feel intellectually superior? It is also trained on certain styles of writing so do not expect it to produce a piece of military style staff writing based on JSP101. I would like to think that AI could look at wider aerospace regulation than just the FAA but maybe that would need deliberate prompting? Knowing what is an AI hallucination and what is not is where experience comes in, so critical review of work, by someone suitably qualified and experienced (assisted by LLM) becomes more important. Meanwhile, AI is rapidly becoming much more of a feature in aerospace fields, such as synthetic training.

Controlling the clouds

Response to 'As the potential benefits of contrail management in reducing aviation's climate impact are becoming better known, how would this affect the different stakeholders?'[2]

Nigel Hitchman I guess this is at least the third such article about this in the past couple of years. I never hear anything about it except via the RAeS.

While they now seem to have seen that there is a cost to flying at non optimal altitudes to not form contrails, they still do not seem to have figured out that in many areas you have no choice where you fly. This is because the levels are full, especially transatlantic where it was often impossible to get the level you wanted or to get a climb once you start on track. It should be a bit better with satellite monitoring of ADS-B if that means separation can be reduced. The author speaks about mythical extra fuel that is carried, saying that this can be used to fly at different levels to avoid contrail forming. This is just not true. The fuel required is worked out scientifically by the planning people, including the legal diversion and reserve fuel. The only time crews take extra fuel is due to a bad weather forecast or known delays – you do not know if you are going to use this until you land so there is no way to decide to use it earlier.

Similarly, there is a percentage of contingency fuel in the planning where you fuel for an intermediate destination and you can continue to your real destination if you still have enough fuel when you pass that point. Yes, you could use some of this – and do so in some cases – but that means you could only use the fuel to avoid contrails at the end of the flight.

Air traffic control and the management of the airspace really hold all the cards. A bigger environmental impact would come from building more runways so that you do not end up holding as often and can always get an expeditious arrival.

Gains can also be made by getting rid of the landing curfew times that force aircraft to hold and wait for the curfew to end.

The last WW2 VC


S Bridgewater/RAeS

Response to 'The last WW2 recipient of the Victoria Cross, Catalina pilot, John Cruickshank, has passed away aged 105.'

Trev Graham Very sad to hear of his passing. I was privileged to interview John many years ago and he was both charming and the epitome of the reluctant hero.

Richard Mallory It is extraordinary that he survived being hit in 72 places, receiving two serious wounds in the lungs and ten in his lower limbs... let alone surviving long enough to reach 105. What extraordinary courage.

Peter Anderson A brave, selfless, wonderful man.

Heralding the future


RAeS/NAL

Response to 'On this day in history, the Handley Page Herald performed its maiden flight. The four Alvis Leonides radials were soon swapped for a pair of Dart turboprops.'

Joe Fuller I suspect I am not the only one here who was not aware of the Herald's piston engine origin, so effective was the Dart Herald branding back in the late 50s.

John Stubbs The Fokker F.27 always seemed a better worked out aircraft, designed for twin Darts from the start. I will never forget those screaming engines. Without ear defenders your eardrums would burst.

A bag for life?

Response to 'If you were a passenger and you needed to evacuate, would you reach up and grab your bag?'[3]

Adam Frampton-Scrase That accident [Aeroflot Flight 1492] was the one that convinced me that we should be looking into introducing overhead bins that lock while the seatbelt sign is on so the temptation is removed. People cannot be trusted and practically every time there is an evacuation you see some ignorant person wandering around the apron with hand luggage.

Barry Cross I agree, except on some flights I have been on the seatbelt signs are on nearly all the time – so everybody (including me) ignores it, otherwise you can never go to the loo or get your stuff out of the overhead lockers. When I flew on Air China they really were on for nearly the whole 11-hour flight when there was no turbulence at all. So maybe overhead lockers could be locked below 10,000ft?

Tim Kern While that would be one good suggestion, I would guess that there is a lot of 'indispensable' luggage under the seats.

Another bag for life?

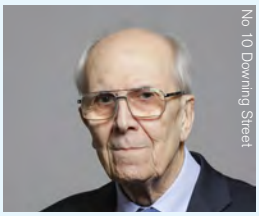
Response to 'Passengers die as others grab bags'[3]

Sam Wise I think one crucial aspect is missed in assigning blame to the passengers (I do not think they are blameless, but they are a very easy scapegoat

for the media). The flames are licking at the windows, smoke is filling the cabin – the average member of the public's brain immediately throws rational thinking out the back and goes into survival mode. You cannot attribute logical thought to the actions of people in these situation. This is why I have beaten the drum for many years that a large contributor to these incidents is, as mentioned in the article, the fact that airlines now do everything to push passengers into carrying their life-essentials in the cabin with them, not helped by tales of abominable handling of luggage at airports. In panic mode, it is easy to understand how someone is going to grab their most important possessions because they are right there, at hand. If everything was stowed below, out of reach, it might be another story. This is as much a fault of a squeeze-every-penny industry as it is people ignoring instructions (which they, most certainly, are).

A friend offered a very salient point about why the Japan Airlines A350 had a totally different outcome. Japanese people are subjected to frequent disaster and emergency drills throughout their life, especially in childhood, so the instinct is well instilled to follow instructions and act calmly and collectedly during an emergency.

Lord Tebbit



Response to 'The September 2025 issue of *AEROSPACE* pays tribute to Lord Norman Tebbit.'

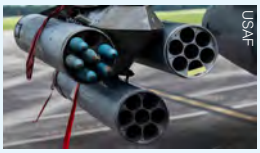
Robert Courts KC Honoured to pay tribute to Lord Tebbit in this edition. I will never forget him grilling me.

Aerial origami?

Response to 'Japanese cardboard UAV is 90% cheaper than existing fixed-wing drones and biodegradable.'[4]

@ASobester There are so many applications where shaving the last few counts off the drag coefficient is immaterial but cost is very important. How much of the avionics is biodegradable? Paper substrate electronics with silver ink tracks should be about TRL8-9-ish by now.

Low-cost, high-volume



Response to 'Feasibility studies to integrate APKWS laser-guided rockets with Typhoon as a lower-cost, counter-drone weapon under way, says BAE at DSEI.'[4]

@Speranskylives Step up the pace BAE. It is hard to switch thinking from high-markup, cutting-edge to low-markup mass production, but it can be profitable with a huge market.

CCA collaboration

Response to 'FalconWorks and Skunk Works announce collaboration at DSEI to develop modular CCA family.'[4]

@hawk_ix Perhaps similar in concept to the Long Shot and Feanix? Seems BAE is not aiming for an ITAR free solution to pair with GCAP, at least for this application.

Tempest's nozzles

Response to 'GCAP mock-up at DSEI showing off 2D thrust-vectoring nozzles?'

@DarrentBruce It is looking distinctly 'Replica-esque' at the back end now. I notice the pelican chin is back again on the front of this mock-up – reduced from the first model but there again.

@mahonj Why are countries wasting billions on these exquisite fighters when what they need are swarms of drones, counter-drone technology and maybe stealth drone carriers? They are preparing for the last war.

Electric jets

Response to 'Electric jet engine for Kestrel drone interceptor from the UK's GreenJets at DSEI. Mach 0.8, super quiet, no thermal signature and, most importantly, very affordable to create combat mass.'[4]

@MartinLaGrang10 We have had electric ducted fans in model aircraft for ages. There is a reason they are for modellers: the range is woeful and will be until we get solid state batteries.

Sovereign drone tech

Response to 'Drone Evolution's all-British FPV at DSEI – with all components sourced from UK suppliers.'[4]

@hw97karbine Sourced from UK suppliers or UK manufacturers? An important caveat if you want to discuss supply chains.

Mitchell's legacy

Response to '"Without the 'technology demonstrator' of the S.5/S.6, the progress of the British aircraft industry in the lead up to WW2 could have been seriously lacking." Lessons from RJ Mitchell in Paul Beaver's new book *Mitchell – Father of the Spitfire*.'[5]

@TyphoonTornado It helped Supermarine but what benefit did it provide to Hawker? They managed to produce multiple successful fighters without 'tech demos'. Maybe the question for today is how we better share knowledge around UK enterprises from the few tech demos we do produce?

Bader's 'Big Wing'

Response to 'Before the action on 15 September, 1940, Luftwaffe crews had been told that they would face only the tattered remnant of an almost-defeated British fighter force.'[6]

@GarethJennings3 The RAF famously underestimated the damage it inflicted on the Luftwaffe while the Luftwaffe overestimated the damage it inflicted on the RAF, so come the end it was the Germans who got the nasty surprise rather than the British.

Awakening a giant

Response to 'Many argue that the West has been slow to realise the threat of new geopolitics following post-Cold War disarming – but at DSEI it was obvious how the defence industry is ramping up faster. "We have awakened a sleeping giant," as one WW2 foe said.'[4]

@HartreeFock I am concerned about the ability to scale up – but I love to see MBDA finally fielding a simpler but effective cruise missile.

@IanPsDarkCorner Industry may be ramping up, because Eastern Europe are buying but are governments in the West buying too? Until the populations of our countries start saying "We will pay more tax if you spend it on the military!" the answer will be no. Right now we are all focused on other things.

@PeterEl24449654 I will believe it when European governments start to acquire and hold war stocks of key munitions and consumables.

Certifying Aeralis

Response to 'One fuselage, multiple variants: Aeralis shows its modular jet concept at DSEI.'[4]

@Ls1Innit I am interested in how this modular platform will be certified to fly, considering its multiple configurations.

@wraggi74 An aeroplane needs to be flying ASAP to stand any chance of being chosen by the UK or anyone else as all the competition is already available.

1. aerosociety.com/news/ai-and-the-loss-of-critical-thinking-a-loc/
2. aerosociety.com/news/controlling-the-clouds-next-steps-in-contrail-management/
3. aerosociety.com/news/a-bag-for-life/
4. aerosociety.com/news/rearming-at-pace/
5. aerosociety.com/news/r-j-mitchell-the-battle-of-britain-the-spitfire-and-all-that/
6. aerosociety.com/news/bader-s-big-wing-to-fly-again/

Rearming at pace

Cheap, affordable mass, counter-UAS and the new UK Defence Industrial Strategy were some of the big themes at the 2025 DSEI exhibition, held in London on 9-12 September. **TIM ROBINSON** FRAeS reports.

Low-cost tactical nav – without GPS

Revealed at DSEI by the UK's Flarebright, Tactera uses a tiny downward-looking LIDAR to measure the terrain and compare this with a digital map database to enable high-speed, low-level flight with an accuracy of around 33ft. Paired with the company's Intera – which uses a 'digital twin' of the UAV to refine a smartphone class inertial measurement chip into an aerospace style INS – results in a navigation system that can give a cheap UAV, Tomahawk-class cruise missile level accuracy.

Opening the day after the release of the UK's new Def*ence Industrial Strategy*, this year's DSEI at the Excel Centre in London was punctuated by external geopolitical events that hammered home some of the top themes.

In the first instance, a raid by the Israeli Air Force saw fighters strike Hamas leadership in Doha, Qatar – a reminder of the reach and effect that top-tier air power can achieve. This news came on the heels of Israeli government officials being banned from the arms fair, ostensibly for their own protection from protesters.

Closer to home, the same 24 hours saw around 20 Russian attack drones penetrate Polish airspace, leading to Poland and Dutch fighters engaging them. Whether this was accidental or deliberate probing by Moscow is as yet unknown, but it served only to make the counter drone systems on show at DSEI even more important as the conflict on Europe's doorstep threatens to escalate further west. To that end, the third day of the exhibition saw UK Defence Secretary, John Healey MP announcing that he was directing "our forces to look at options of how we can bolster Poland's air defence." Thus, with nations investing in military kit and rapidly rearming, the 'defence dividend,' as one speaker called it, means this year's DSEI was the biggest ever – despite the chaos of tube strikes. Let's take a look at some of the highlights.

New RAF chief lays out priorities

Making his first public speech at DSEI since being assigned the new RAF Chief of the Air Staff (CAS) was ACM Harv Smyth, taking over from ACM Richard Knighton who has been appointed Chief of the Defence Staff (CDS). Smyth said: "This pace of change and challenge is phenomenal. My prime focus as the new CAS is to meet this pace of change head on by putting more AIR into Air – more agile, more integrated, more ready, to fly and fight, today, tomorrow and together." He added that this era of radical uncertainty was "the most perilous period in the whole of my 35-year military career."

He laid out his three priorities for the service – "reintroduction of an RAF nuclear capability; Integrated Air and Missile Defence; and our approach to Space" – adding that, of the UK regaining its tactical nuclear strike capability, "I would expect potential adversaries to take note of this change."

Transatlantic research divisions partner up on ACP family

The first day of the show saw BAE Systems' research division, FalconWorks and Lockheed Martin's legendary Skunk Works announce plans to team up to develop a family of modular Autonomous Collaborative Platforms (ACPs). Based on Lockheed's Common Multi-Mission Truck (CMMT) the as yet unnamed drone will be aimed at delivering affordable mass, that could be air or surface launched, or even dropped out of the back of a transport aircraft. Its first mission, say the companies, will be in EW.

GCAP partnership progress

Also announcing a new consortium at DSEI to supply the ISKANE and ICS (Integrated Sensing and Non-Kinetic Effects & Integrated


Communications Systems) for the trinational GCAP (Global Combat Air Programme) sixth-generation fighter were Leonardo UK, Leonardo's Electronics Division in Italy, ELT Group and Mitsubishi Electric.

The new consortium, which will supply the overall Edgewing GCAP joint venture, will be called GCAP Electronics Evolution (G2E) and, during the press conference to announce the partnership and name, it was revealed that each nation will now develop and fly aerial test beds to support this sensors and avionics effort. While the UK already has the Boeing 757-based Excalibur under conversion into a flying lab, Italy will acquire and modify a Gulfstream bizjet – chosen because a non-FBW platform is needed so as not to interfere with the electronics. Meanwhile, Japan's Mitsubishi hinted it was looking to convert a large transport aircraft such as the Kawasaki C-2 into a test bed.

As the Edgewing consortium itself awaits the imminent placing of the first GCAP contract ("significant and multiyear" according to insiders) a panel discussion outlined how this next-generation fighter programme is not only advancing military technology – but also how the trinational partnership is creating agile ways of collaborative working.

Edgewing CEO, Marco Zoff observed that the slogan for the programme, echoing Apple's iconic 'Think Different' should be 'Act/Deliver Different.' He said that GCAP was creating an "intimacy between partners that is unprecedented," creating a "new culture."

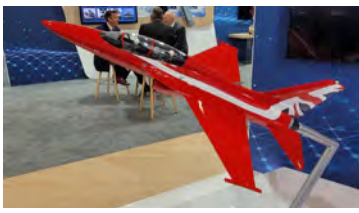
Resurrecting the Boneyard with AI

What if you could generate a giant air force practically overnight? Today some 4,000 obsolete US military aircraft are carefully stored at Davis-Monthan AFB in Arizona, ready for an unspecified future emergency. However, what if you could convert them to use AI and put them back into action to overwhelm an enemy? That was the intriguing idea put forward on the sidelines of the show by Dr Dan 'Animal' Javorsek – who was responsible for DARPA's Alpha Dogfight and AI F-16 VISTA (which demonstrated the potential of AI in air-to-air combat) and now works for US autonomy giant, Applied Intuition.

The selection of the F-16 for the VISTA programme (which even saw the US Secretary of the Air Force fly in the jet while its AI was dogfighting an opponent) was no accident. Noting the number of surplus F-16s around the world, Javorsek revealed that Applied Intuition has converted an off-road vehicle to an uncrewed

Drone interceptor developed in six weeks

Coming out of stealth mode at DSEI, after being formed only a year ago, was start-up, Cambridge Aerospace, which revealed two new products aimed at changing the cost balance equation when defending against massed swarm drone attacks or cruise missiles. Its Skyhammer anti-drone drone was developed from concept to first flight in just six weeks and is aimed at being ten to a hundred times cheaper than legacy air defence missiles. Tube launched, it is jet-powered with a speed of Mach 0.7 and a range of around 20 miles. Interestingly, it is also equipped with a mini-radar (developed in-house) for terminal guidance and lock-on. First flying earlier this year, it is now flying at a weekly cadence, according to the company. Cambridge Aerospace is also tapping into "rock star" students – such as those involved in the UK's Race2Space rocket engine contest – to help develop its own rocket motor for a larger and faster Mach 2 missile – the Starhammer – aimed at intercepting faster moving targets.

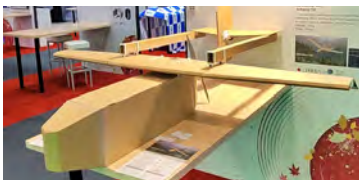


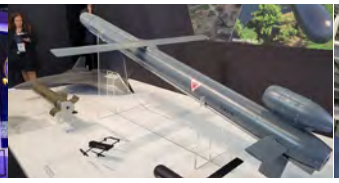
Seeing red

With the clock ticking for a replacement for the venerable Red Arrows' Hawk T.1 fleet – and moves afoot to replace the troubled Hawk T.2 as early as possible – spotted on the Lockheed Martin stand was a LM/KAI TF-50 in familiar-looking colours. With the LM/KAI T-50, Leonardo M346, Boeing/Saab T-7, Turkish Aerospace Hürjet, and Aeralis' modular concept all in the running for the contract, supplying the RAF's display team is likely to be a much sought-after contract.

Aerial origami

Spotted on the Japanese stand was an innovative cardboard UAV from AirKamuy. It is claimed to be 90% cheaper than existing fixed-wing drones and also biodegradable. Meanwhile, another cardboard UAV – the Corvo Precision Payload Delivery System from Australia's SYPAQ – has already seen use by Ukraine, attacking Russian targets as a simple, cheap and low-signature weapon.






Drone library

With advances in military drones happening at pace, it is vital for today's armed forces to keep up to date with the electronic order of battle. Enter Denmark's MyDefence, which launched a new Custom Drone Library which allows users to build their own electronic threat database. These can be static, vehicle-mounted or even worn. With a pre-loaded database of drone threat signatures, operators can then continually update the database as new drones or signals are encountered.

RAeS at DSEI

DSEI saw the RAeS President, CEO, Head of Policy and Corporate Partners Manager take the opportunity to catch up with existing and potential Fellows, Members and Corporate Partners. President, Alisdair Wood FRAeS, is seen here with Head of Space Command, Maj Gen Paul Tedman.

autonomous ground vehicle in just six days for the US Army and, while an aircraft is more complicated, the same principle applies. Could this mean aircraft from the 70s, 80s and 90s are put back into service as AI-powered combat drones?

Typhoon counter-drone weapon

With Russian drone intrusions into Poland uppermost in many people's minds at DSEI, during a briefing on the Eurofighter Typhoon future upgrades, Paul Smith, BAE Systems Head of Typhoon Strategy Delivery, revealed that "feasibility studies" are now under way for integration of the APKWS (Advanced Precision Kill Weapon System) with the aircraft.

APKWS, used on AH-64s, AV-8Bs, F-16s and now F-15Es marries a 70mm unguided rocket with laser guidance to create a low-cost missile for a wider range of targets. It has already been demonstrated in the air-to-air role against slow-moving, non-manoeuvrable drones – giving tactical fighters a counter-UAS capability. Discussions with customers regarding integration levels is going on, said Smith, although he cautioned that "clearly, we will have to prioritise that against other activities that the nations want us to look at."

Recycling Typhoon to Tempest

Announcing a new partnership at the show was Babcock and Uplift360, which signed an agreement to explore the recycling of composite Typhoon components into other composite components. This not only helps sustainability, but also serves as a strategic goal of making defence supply chains more resilient.

Tactical level SAR satellite analysis

Now the worldwide leader in commercial SAR satellite imagery, Finland's ICEYE used DSEI to reveal a deployable tactical imagery centre that allows SAR imagery to be co-located with a division-sized formation.

Previously, such a spy satellite capability would be kept at the national and strategic level, and stovepiped, but SAR is now more affordable with new AI-assisted automated tools, such as target recognition making it much easier to interpret the imagery. Its 24/7 night and day imaging capability and ability to see through clouds and fog make it even more important for military users. This new tactical ISR Cell is housed in a standard shipping container, with four operator stations to bring this intelligence closer to the users.

Next-gen command and control

With the Strategic Defence Review announcing a vision of a 'digital targeting web' – how will future commanders keep on top of the vast amounts of information that now flows in?

Unveiled at DSEI was Hadean's dominAI which fuses AI and simulation into the C2 system. This can include modelling the behaviour of populations, injecting AI-generated social media posts into exercises, or bringing disparate databases such as Moody's ratings, *Jane's* ORBATs, sea currents, underwater cables, ADS-B and AIS into a geospatial information display – allowing users to have the right information at their fingertips.

Greenjets shows off electric interceptor

Over in the UK Capability sector of the show was British start-up, Greenjets, which was showing off its electric jet engine range and the electric-powered Kestrel interceptor. Using a breakthrough technology, these electric ducted fans outperform traditional propellers, with the Kestrel interceptor aiming for speeds up to Mach 0.8 while also being very quiet, with no thermal signature and zero spool up time. The technology is also highly affordable to scale up in order to create combat mass.

Tekever unveils modular AR3 EVO drone

All images: Tim Robinson/ RAeS unless stated otherwise.

A light tactical drone with big capabilities, UK-Portuguese company, Tekever unveiled a new model of its AR3 at the show. The EVO variant is based on three years of combat proven experience from Ukraine and now features a modular design. Able to use conventional or electric powerplants and carry a range of sensors, the EVO can swap between a VTOL and fixed-wing variants. Endurance has now been boosted to 22hrs through the use of an F1 style fuel bladder. With a small radar and visual signature, the AR3 has already proven to be a large thorn in Russia's side in Ukraine – with it playing a part in the destruction of two high-end S400 SAM systems in the conflict. Tekever, which is opening a new factory in Swindon, UK, is already working on further upgrades to the EVO, including a rear-looking camera with AI that can spot incoming interceptor drones and command evasive action.

Sovereign British FPV drone

Another new product launched at DSEI was the sovereign all-British Scimitar FPV drone from Welsh firm, Drone Evolution. While all the components are sourced from UK suppliers instead of using cheap Chinese imports, this is not so much driven by security, says the firm (as FPV are too short-range to be hijacked or hacked) but in an attempt to build supply chain resilience where parts can be intentionally or unintentionally delayed or made scarce. The firm, which already provides FPV training and counter-drone awareness, says it is poised to scale up production with contract manufacturers to build thousands.

MBDA reveals new weapons

European missile house MBDA used DSEI to unveil new weapon systems, developed to meet the urgent new requirements for today's and tomorrows battlefield. Its Crossbow OWE (One Way Effector) Heavy is a simple and affordable long-range (800km) strike missile that was developed in just seven months. Truck launched, it could be ready for mass production by the second quarter of 2026.

The company also revealed a more affordable version of its SPEAR precision missile – the SPEAR GLIDE. With the turbojet removed this brings the cost point down to allow for massed saturation attacks. Finally MBDA revealed the Akeron tank-fired anti-tank non-line of sight missile – which allows MBTs to engage targets from safer positions.

Many have argued that the West has been slow to react after the invasion of Ukraine, especially in terms of the new geopolitics – preferring instead to pretend that it is business as usual. However, from the halls and briefings at DSEI, it is clear that the defence industry of like-minded nations is now ramping up production and ready to increase the pace of delivery. While exquisite weapon systems for a high-end fight (think GCAP) are still present, the focus this year is on cheap, affordable mass that can be produced in the thousands.

With AI, and the commercial sector (notable at the show was Amazon, promoting its Kuiper satellite megaconstellation) also joining the fight, a slumbering giant is now flexing its industrial muscles and discovering the power of manufacturing at scale again. However, while there was much hype from officials about "the biggest uplift in Britain's defence spending since WW2," conspicuously absent from the show were any actual contracts placed by the UK MoD with industry. The New Medium Helicopter, for example, still seems to be be stuck in limbo.

As other commentators have noticed, despite using buzzwords, such as "at pace," the UK still has to appoint a permanent National Armaments Director – possibly the single most important person to help to deliver the SDR's ambitions. Despite a reported salary of £400,000 the government is having difficulties finding candidates. Could this be a poisoned chalice?

Because, looming over the horizon, like a giant iceberg, is the UK's autumn Budget where the SDR's ambitions may meet fiscal reality.

Proteus set to fly

Standing out in the UK Capability showcase section was a mock-up of Leonardo's Proteus rotary UAV technology demonstrator for the Royal Navy, which is set to fly in the near future. The 3t drone, modified from the company's AW09 single-engine helicopter, is intended to trial uncrewed systems in naval roles and Leonardo has already tested this in a virtual environment with three Proteus working together in an ASW mission to hunt an enemy submarine. With the crew removed, this gives a sub-hunting helicopter more time on station, increased endurance and allows back-to-back missions without the limitations of crew fatigue or physiology.

Sustainability, safety and innovation

The American Institute of Aeronautics and Astronautics Aviation Forum took place in July. RAeS Head of Research, **NAOMI ALLEN** MRAeS reports from Las Vegas.

This year's AIAA Aviation Forum, held in Las Vegas on 21-25 July, was titled 'Sustainability, Safety and Innovation.' However, despite the prominence of 'sustainability' in the name, there was a notable reduction in the focus on that area in contrast with recent years. Rather, it seemed that the most prominent theme for the week was AI and its role in aerospace and aviation.

The keynote speaker on the first day, Dr Tim Persons, Principal and AI leader at PwC, envisaged a future in 2050 where AI played a role in every aspect of flight, from autonomous VTOL transport to the airport, through supersonic, pilotless air transport, to the use of tags in baggage handling for a more streamlined passenger experience. While Persons acknowledged that this vision sounded like science fiction, he emphasised the need to try to convert science fiction into science fact in order to accelerate change, and that digital disruption requires us to think differently.

A panel session also explored how aviation might look in 2050, starting off with a look back at how much it has changed in the last 25 years, and AI continued to be a topic of conversation. Brian Yutko, VP Product Development, Boeing, explained the two big trends he sees driving aviation in 2050: 'sustainability and the energy transition', and 'automation and autonomy'. Linda O'Brien, Vice President and Chief Engineer, Lockheed Martin Aeronautics, concurred that AI was a key component and also flagged the importance of

▼ The 'AI Certification: Busting the Myth' panel attempted to disprove common misconceptions.

> WHILE PERSONS ACKNOWLEDGED THAT THIS VISION SOUNDED LIKE SCIENCE FICTION, HE EMPHASISED THE NEED TO TRY TO CONVERT SCIENCE FICTION INTO SCIENCE FACT IN ORDER TO ACCELERATE CHANGE

data management and ensuring that knowledge is not lost with a generation of retiring engineers. Amanda Simpson, Founder and CEO of Third Segment LLC, reminded delegates that aircraft being built today will still be flying in 2050, and that there will only be one more generation of new aircraft between now and 2050. She identified a need to revolutionise air traffic management to work more effectively and efficiently, pointing out that today's systems still follow the same concept as in the 1940s. It will come as no surprise that the panel was unanimous that we would not have autonomous large commercial aircraft by 2050. However, Dr Michael Winter, Chief Scientist at RTX, reminded everyone that there is already automation without human intervention in places, such as the inner loops of control systems. He envisages that AI and the engineer of the future will work as partners, and highlighted the need for education to ensure that engineers can ask the right questions.

▼ Delegates from around the world at Caesars Palace for the AIAA Forum.

▼▼ The Wright Brothers' Lecture in Aeronautics was delivered by Susan Ying, Co-Founder of AMP2FLY, this year, talking about the emergence of hybrid-electric aircraft.

All: Naomi Allen /RAeS

Myth busting

Later in the week, a panel titled 'AI Certification: Busting the Myth' brought together a group of experts to discuss common misconceptions surrounding the use of AI and, where applicable, 'bust' them.

Some of the myths covered included 'AI and autonomy are the same thing', 'AI will directly control the aircraft', 'AI systems are not safe' and 'No regulatory agency would actually certify AI on an aircraft', all of which were discussed and dismissed with enthusiastic shouts of "Busted!" from the panel. Key takeaways included that, although AI and autonomy overlap, they can also exist entirely separately and that predictability is more important than having a deterministic system. This was summarised as the need to show what a system will do, that it does what it is supposed to do and that it does not do other things.

Sustainability or efficiency?

Despite current sensitivities in the US around discussing sustainability (a senior representative from a US university said earlier in the week: "We do not mention 'sustainability' anymore, we talk about 'efficiency' instead!"), there were still sessions devoted to the topic.

Notably the conference hosted a second iteration of the Sustainable Aviation Workshop, an event aiming to establish a unified vision of sustainable aviation for the AIAA community. The workshop included a series of sessions combining presentations and workshop discussions, covering a range of topics, such as energy systems, airspace operations and safety, military aviation and aircraft technology, all in the context of sustainability.

Phil Ansell, Associate Professor, University of Illinois Urbana-Champaign and architect of the Sustainable Aviation Workshop was also a member of a panel on the third day of the conference titled 'Efficiency: Analysing the Impact'. This highlighted the need to ensure that sustainability is taught in all engineering courses, and also that it should be embedded within engineering to ensure that it is not viewed as "someone else's problem" – a cogent reminder that it will remain a key challenge for young professionals entering the sector.

The conference also offered a wealth of technical sessions that delved deeper into specific research. A session on hydrogen-powered aircraft concepts was a personal highlight and it was interesting to hear about AI in a context that would not have sprung to mind, namely its integration into psychometric tools to assess pilot mental health.

It is probably safe to say that the AIAA Aviation Forum offers something of interest to everyone working in aerospace and aviation, including far more that deserves a mention than can be covered here.

Wayne J Davis/RAeS

Still no frills

As two of Europe's low-cost carriers celebrate significant anniversaries, the market faces ever narrower margins and fierce competition. **STEPHEN BRIDGEWATER** FRAeS asks what the future holds for budget airlines.

Forty years ago, on 8 July, 1985, a small Irish airline by the name of Ryanair flew its first commercial sector, connecting Ireland's Waterford Airport with London Gatwick. A decade later, Stelios Haji-Ioannou's easyJet conducted its first fare-paying flight from Luton to Glasgow on 10 November 1995.

After early financial losses, Ryanair changed strategy from a regional airline model to a low-cost carrier (LCC) in 1990 and today the airline operates a fleet of more than 600 Boeing 737 family aircraft (with over 300 more on order), serving 229 destinations in 36 countries. Meanwhile, easyJet's fleet has risen to over 350 Airbus A320 family aircraft (with orders and options for almost 400 more) serving more than 160 airports across 37 countries.

Out of the approximately 740 airlines in the world, more than 110 can now be classed as LCCs and in 2025 these provide 33% of all scheduled airline seats each week – up from 29% in 2019 and 25% in 2015. Business is clearly thriving, but what does the future hold for the LCC business model?

Take a Laker

Once the sole domain of the well-heeled traveller, the onset of the 'jet age' resulted in air travel beginning to appeal to the masses. The speed, reliability and economy offered by jets led to a flurry of package holiday charters but, with large national carriers protected by law, start-up charter operators had to be innovative, ingenious and efficient. High load factors and ultra-low operating costs were the order of the day and, via the use of ticket consolidators, the public had the opportunity to travel further than ever before.

One of those to prosper from the charter market was Sir Freddie Laker, who then spotted a gap in the market for low-cost transatlantic travel. Laker's Skytrain would allow passengers to 'walk-up' (no booking required) and fly one-way from the UK to the US for just £37.50 (around £580 in today's money). Although stymied by a mix of politics and subterfuge, after seven years Laker received official permission to launch his Skytrain service to New York in 1973.

A change of government saw the permissions withdrawn, but Laker's successful legal challenge proved the ministers had exceeded their powers.

While it would be an exaggeration to say that Laker's Skytrain service changed air travel for good – it lasted less than a decade – the cheap fares genie was out of the bottle and the path was laid for the likes of Southwest in the US and the UK's Ryanair, easyJet and Jet.com to take up the mantle.

The low-cost model

Today's LCCs provide lower fares by minimising the little luxuries found on traditional airlines – gone are the free meals, baggage allowances and seat allocation, with LCCs generating revenue by charging extra for such ancillaries. Meanwhile, operators fly from secondary airports – sometimes considerable distances from the city centre – which provide cheaper landing and handling fees. The majority also stick to a 'one type' fleet to improve efficiency and reduce maintenance and operating overheads and operate denser aircraft with a single-cabin layout to maximise occupancy (by providing a 30in seat pitch instead of 32in it is possible to fit more than 20 additional seats in a Boeing 737 size aeroplane). LCCs also fly those aircraft for as many hours as possible each day – often spending as much as 13 hours per day in the air – to maximise utilisation.

Sell, sell, sell

Every seat on an aircraft is a platform for an LCC to sell additional products to the occupant and the rise of a cashless society has provided endless opportunities for airlines to expand their offerings. The upselling begins at the initial booking stage, with passengers offered all manner of services and products beyond the basic airfare. This starts with premium seat selection, priority boarding and additional baggage and extends to rental car and hotel bookings.

Sunclass Airlines

▼ "Something from the trolley?" Every seat is an opportunity for LCCs to sell additional wares to passengers.

Now defunct UK-based LCC, Flybe is believed to have been the world's first airline to start charging passengers to check in cabin bags, levying a fee of £2 for a pre-booked item of luggage (£4 at the desk) in 2016. By 2024, US airlines made £5.75bn from check-in baggage fees alone.

Many LCCs have also expanded to offer holidays and even credit cards and mobile phone contracts – one recent success being easyJet Holidays, a package holiday subsidiary formed in 2019. In recent years, some LCCs have also entered into strategic partnerships with legacy airlines with Emirates now enjoying a collaboration with easyJet and US-based LCC, JetBlue having a number of similar relationships with US carriers.

Pioneering US LCC, Southwest long played on its 'bags fly free' unique selling point, even featuring "Grab your bag, it's on!" as its slogan for many years. However, in May 2025, it controversially started to charge $35 for a checked bag (and $45 for a second), a move that unsurprisingly sparked a backlash. Four months later, the airline announced passengers could once again check in two free bags – as long as they booked their trip via its new in-house travel agency, Getaways by Southwest.

The widespread use of digital technology, combined with increasing adoption of credit and debit cards in the developing world, has led to a new generation of LCC offerings. By employing artificial intelligence and machine learning, airlines are now able to upsell and cross-sell to customers like never before. Algorithms can analyse passengers' data, history and preferences to predict the appeal of any offerings. It can also optimise the pricing and timing of offers to maximise conversions. According to Aggregate Intelligence[1], airlines that have used AI for ancillary sales report up to a 20% increase in revenue and those that use dynamic pricing models powered by AI claim 15-25% increase in revenue.

Ryanair co-founder, Dec Ryan, speaking to *AEROSPACE* at an event to promote Tom Lyons' book, *Aer Dogs*, also sees potential in technology: "If you can do a loyalty programme at Tesco or Aldi it will work for an airline," he suggested. "I suspect more LCCs will get into the loyalty market and that will help ancillary sales, air miles and other products."

Recent years have seen the advent of the ultra-low-cost carrier (ULCC), which take the cost-cutting measures of LCCs to the extreme. By unbundling almost every aspect of the flying experience, ULCCs, such as AirAsia sell tickets that cover merely the seat and the flight – anything extra, such as seat selection or to carry-on luggage comes with an extra fee. This allows them to offer the cheapest fares but means profitability relies on ancillary selling.

Frustration

IATA predicts that the global revenue from ancillary charging in 2025 will reach £110bn. However,

this trend in 'unbundling' elements of a flight is increasingly frustrating many passengers, with some even challenging fees in the courts. Research conducted by travel insurance company, Quotezone earlier this year revealed the degree that European LCCs charge "hidden fees" for add-ons. The study of 18 European budget airlines found that Spanish airline, Vueling charges the most for extra fees, including more than £90 for a 20kg hold bag. Combined with other popular add-ons, like seat selection, cabin bag and extra legroom, the hidden fees were found to reach £163.36. On average, the survey found that a hold bag cost an additional £37 with cabin bags costing an average of £28.

Passengers travelling with FlyOne, HiSky, Jet2, PLAY, Ryanair and Wizz Air also incurred a fee of up to £55 for checking in at the airport rather than online in advance.

While these charges are not 'hidden' – they are disclosed during the booking process, screen by screen – a group of consumer organisations asked the European Commission in May 2025 to conduct an inquiry into such fees, arguing that it makes it difficult for passengers to compare prices. While some of the surcharges are avoidable, passengers have no choice but to purchase some 'optional' services. Some charge administrative fees for group bookings and other will levy a fee for paying by card.

Fuelling the problem

Fuel constitutes one of the largest costs for an LCC and oil price volatility is one of the most significant issues facing such operators. Conflict and geopolitical uncertainty can cause price spikes that, when combined with the reliance on older, less fuel-efficient aircraft, severely impact profit margins.

While they mostly operate new, more fuel-efficient fleets than other airlines, LCCs are often 'perceived' as large-scale polluters, with a report by the International Council on Clean Transportation citing them as "the major driver of US emissions growth."

"Network carriers offset almost 90% of their traffic growth via improvements in fuel efficiency from 2005 to 2019," the report continues. "In contrast, LCC traffic increased nearly three and a half times faster than fuel efficiency improved in terms of revenue passenger miles per gallon over the same period, driving large increases in fuel use and CO_2. This is despite LCCs having relatively high fuel efficiency due to factors like higher load factors and higher seating densities. As a result, LCCs were responsible for 88% of growth in fuel use and CO_2 emissions from US airlines between 2005 and 2019."

However, does the average LCC passenger care about the sustainability of their flight? Dec Ryan thinks not, telling *AEROSPACE*: "I don't think they do. If they can go to Paris for the weekend with their partner for £60 that is the real driver, rather than their views on sustainability."

Stephen Bridgewater/RAeS

▲ Dawn loading for the first Ryanair sector of the day. LCCs utilise their aircraft for as many hours and minutes as possible each day.

> "COMBINED WITH OTHER POPULAR ADD-ONS, LIKE SEAT SELECTION, CABIN BAG AND EXTRA LEGROOM, THE HIDDEN FEES WERE FOUND TO REACH £163.36

Ryan also pointed out that the biggest short-term available gains – in terms of both efficiencies and costs – come from engines. "Moving forward, I think the airlines that control their engine MROs are going to be more cost-efficient and will also have greater control of quality," he said. "The cost of an engine overhaul has multiplied in recent years ago and more MROs are badly needed."

Supply chain pinches have famously restricted the delivery of new airliners in recent years, airframes that are needed to both meet demand from passengers and reduce the operating costs associated with older aircraft. Ryanair CEO, Michael O'Leary has expressed frustration with Boeing deliveries since production of 737 MAX was capped following the Alaska Airlines door plug incident in 2024. Earlier in 2025 he wrote to US Congress to say Ryanair would "reassess" its Boeing order if costs rose due to US tariffs, claiming interest in the Chinese COMAC C919 as an alternative. However, in August 2025, O'Leary told *Reuters* that Boeing had now promised to deliver 25 new MAX 8-200 aircraft by October, ahead of schedule. The high-density, high-capacity version of the MAX 8 is optimised for LCCs with seating for up to 200 passengers.

In response, Ryanair co-founder, Dec Ryan told *AEROSPACE*: "I would love COMAC to be successful, because the industry badly needs another OEM."

Low-cost, long-haul

Harking back to the days of Freddie Laker, a number of LCCs are once again exploring the long-haul marketplace. Notably, Indian LCC, IndiGo, launched long-haul flights connecting Mumbai with Manchester and Amsterdam in July 2025, using Boeing 787-9 Dreamliners leased from Norse Atlantic Airways. It intends to expand this to other cities with large Indian diaspora when its own Airbus A350s arrive.

However, following the collapse of long-haul LCC, Norwegian in 2021, and others before it, many are questioning the business sense of the idea. The advent of extended range narrowbody airliners, such as the A321XLR, will enable long-haul routes to be flown more cheaply but do passengers want to fly long distances on no-frills airlines? A survey of 2,700 passenger, conducted for British newspaper *The Independent* in 2024, revealed that 65% of them were unwilling to travel more than four hours in LCC-style cabins with just 24% saying they would fly as long as it takes if the price was right.

Operating long-haul sectors in a market dominated by legacy carriers will always be challenging for an LCC and Ryan feels there is limited business sense in doing so. "Just because it hasn't worked in the past, it doesn't mean it won't work now," he admitted "but I think it's very easy for the 'big guys' to compete. All they have to do is offer 40 seats on their regular route at a very low fare – but keep the full-service benefits – and they will soon put an LCC out of business. When you're flying long distances the seat and the service are important."

Low-cost, short-range

While still a Ryanair shareholder, Ryan is now pursuing other business interests. Having sold its stakes in LCCs, Allegiant, Viva Aerobus and Tigerair – but retaining a 10% stake in Avianca – his Irelandia Group is "taking a break away from LCCs at the moment." This is "primarily because some markets are matured" but also because "the pandemic really helped the legacy guys, particularly in the US. The average subsidy in wages or loans that United received was around $145,000 per employee – and that just made them stronger."

Instead, Irelandia is now focusing on the eVTOL and hybrid-electric aviation sectors, among other areas. "Once certified, I foresee eVTOLs initially filling a niche connecting Heathrow to London for example," he continued. "However, I think if a company were to offer an UberX style business model, it would work." Ryan feels eVTOLs will benefit from US DoD funding and also predicts that "places like Brazil, Mexico City and LA that already have big helicopter networks will certainly devour a new form of transportation." However, he refers to the eVTOL market as "a slow burn" and confirmed that Irelandia is in discussions with "several parties about starting operations with four-seaters and cargo." Pressed on his eVTOL of choice, Ryan admitted that "if I was a betting man, I would say Joby, Beta and Embraer are going to be the winners. The first two have significant US military contracts, and that's just fool-proofing the whole technology. Once you get military investment you get yourself a lot safer and a better unit."

Rob Hodgkins/WikiCommons

▲ Ryanair's first flight took to the skies 40 years ago on 8 July, 1985. The first route used this 15-seat Embraer EMB-11 Bandeirante to connect Waterford with Gatwick.

Trouble in the States

Ryan's reticence over the future of LCCs seems to be born out in the US, where Spirit Airlines has recently files for Chapter 11 bankruptcy protection for the second time in a year. Even a rebranding to include Spirit First and Premium Economy offerings has not offset rising operational costs and fleet inefficiencies.

Furthermore, research conducted by McKinsey[2] indicates that the performance of the entire LCC sector in the US is slowing compared to legacy full-service carriers that have made a concerted effort to adapt their business models to appeal to cost savvy travellers. Many carriers have launched their own versions of 'basic' economy tickets, with United Airlines reporting that 15% of its sales now fit that category.

Research published by IndexBox[3] shows that United's stock has surged by more than 140% in 2024 with fellow full-service carrier, Delta Air Lines reporting a 60% rise. Conversely, LCCs, JetBlue and Southwest dropped by 5% and 10% respectively.

Although the post-pandemic pilot and wider labour shortages have increased staffing costs for all airlines, McKinsey's analysts suggest this has had a higher impact on LCCs (which traditionally pay lower wages) as a percentage of their operating costs. Research also suggests that post-pandemic spending habits have seen higher


Eutelsat

▼ Companies such as Eutelsat have enabled airlines to leverage the power of the credit card at 30,000ft.

murray/Flickr

earning households (which traditionally fly with legacy carriers) increase their spending above inflation levels whereas at the other end of the consumer-spending spectrum, inflation has cut into the discretionary spending budgets of lower-income households. As such, when these households spend less on travel, LCCs feel the effects more acutely than legacy carriers. More wealthy travellers are also those more likely to travel further afield, again favouring full-service carriers.

Regulating success

Data published by aerospace analytics company, OAG[4] shows that the global expansion of LCCs is often dictated by a combination of regulatory structures, available airport capacity and the dominance of existing legacy airlines.
This is the case in both China and Japan, where just 12% and 22% of air travel respectively was handled by LCCs in 2024. Conversely, 71% of Indian passengers, 64% of Indonesian travellers and 59% of Italians flew on LCCs. The UK saw a 51/49% split in favour of LCCs.

Elsewhere, Asia has proved to be a hotspot for LCC growth, with the demand for affordable air travel driven by both rising middle-class populations and increased tourism to the region. Even South America has untapped potential, with Ryan revealing that when Irelandia launched Viva Air in Colombia in 2012 "just 4% of the population of 50 million had been on an aeroplane." By 2023 that figure had increased to 30% "thanks to the average flight price of $50."

The future?

Despite its challenges, statistics published by *Fortune Business Insights*[5] in August 2025 show the global LCC market size was valued at $270.4bn in 2023, rising to £317bn in 2024. With a predicted 16.2% annual growth rate, analysts suggest the market will reach $1,054bn in 2032.

> THE ERA OF €9.99 TICKETS IS PROBABLY OVER, BUT THAT DOESN'T MEAN PEOPLE WILL STOP FLYING

Such growth is reliant on the industry's continued innovation to optimise operations and stay competitive while meeting the diverse and changing needs of travellers. The advent of new technologies has made it easier for legacy full-service carriers to compete with LCCs and many have adapted their business models to increase their market share in the domestic sector.

McKinsey's analysts caution that the downturn in LCC's fortunes in the US could spread to other countries, warning operators that, while cost control remains crucial, the customer experience is equally important. With legacy carriers offering lower prices without sacrificing the likes of free snacks and drinks, Wi-Fi, in-flight entertainment and – crucially – on-time performance, customers are likely to pick the carrier with the better customer experience if it is presented at an attractive price point.

Meanwhile, Ryanair reported another record-breaking month in August 2025, carrying 21m passengers, a 2% increase compared with the same month last year.

The airline also maintained a 96% load factor, matching last year's performance, while operating more than 114,000 flights. On a rolling annual basis, Ryanair welcomed 203.6m passengers, up 6% from 192m the previous year, with a steady 94% load factor.

As Ryanair's Michael O'Leary noted in 2022, "the era of €9.99 tickets is probably over, but that doesn't mean people will stop flying."

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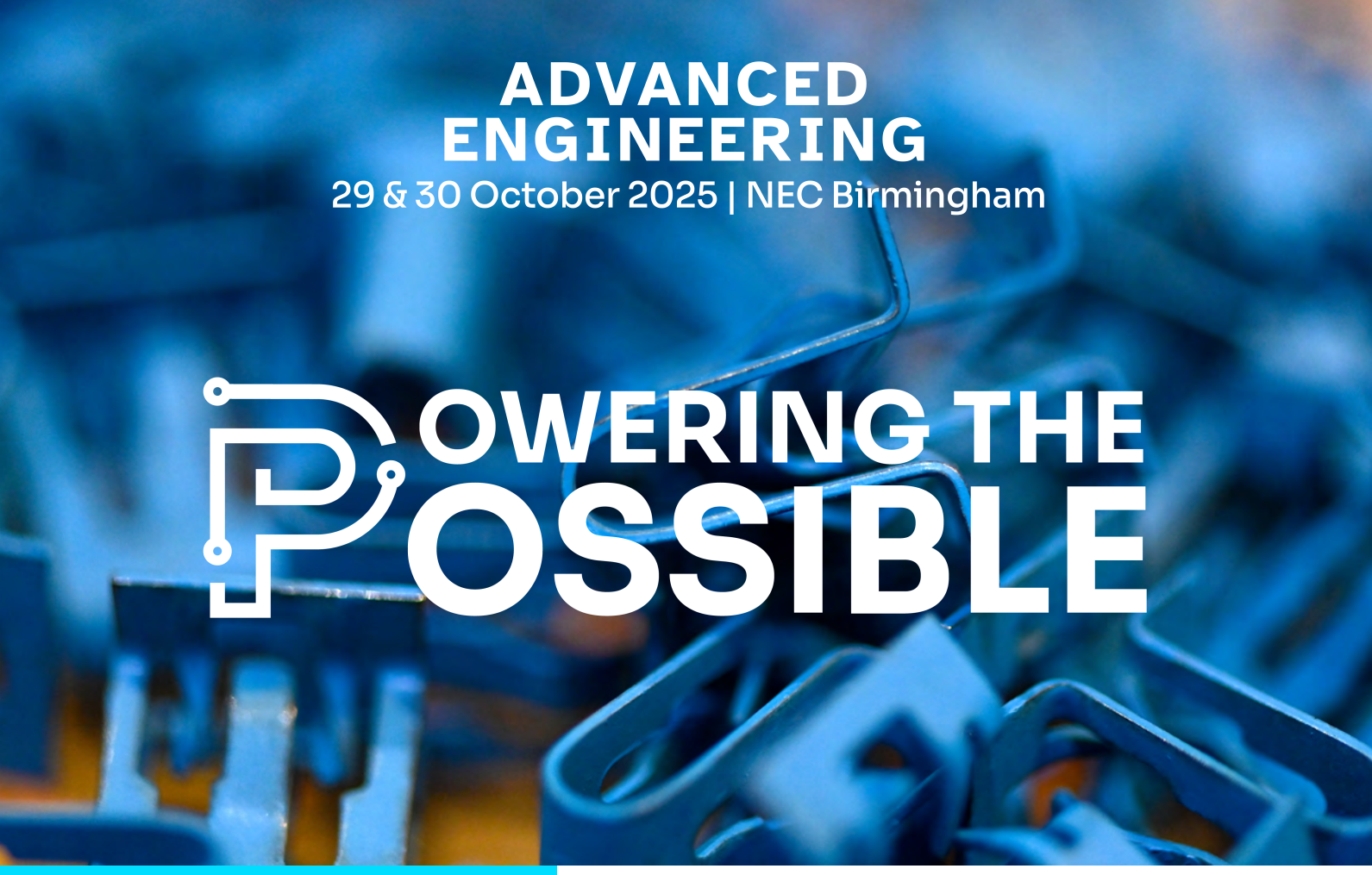

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Déjà drones

Eighty years after the US military first used drones in the Pacific, the idea is back on the table for any future operations in the South China Sea. **MARK PIESING** asks what lessons can be learned from the past.

According to US intelligence, President Xi Jinping has called on China's People's Liberation Army to be ready to invade Taiwan by 2027.

If so, the US military will have its work cut out to defend an island a long way from home against the country with probably the largest navy on Earth, the largest number of military aircraft in the region and what is likely to be a formidable arsenal of combat drones.

China's impressive industrial base means Chinese manufacturers currently control around 90% of the global commercial drone market and its components have been found in UAVs built for the US military.

In 2024, the commander of US Indo-Pacific Command, Admiral Samuel Paparo, declared that the US military's plan to ensure that the Chinese invasion does not succeed depends on its ability to turn the Taiwan Strait into an "unmanned hellscape."

Replicator

This plan seems to depend on the US' ability to rapidly build and deploy thousands of disposable AI-enabled attack drones that can operate either independently or as 'loyal wingmen' to buy the US some time. In turn, this seems to hang on the success of the US Department of Defense (DoD) directive to unleash "US military drone dominance" and initiatives, such as the Replicator programme.

Replicator's goal is 'rapid innovation' by using existing commercial technology to produce drones cheaply, quickly and in large numbers – all while bypassing the Pentagon's slow and bureaucratic acquisition process.

At a recent Pentagon event to demonstrate the results of these initiatives, 18 autonomous prototypes were revealed that, it is claimed, had been developed over 18 months rather than the usual four to five years. These included aerial systems, a 36ft span long-endurance uncrewed aerial system dubbed Vanilla, as well as surface and sub-surface systems.

"The affordability of drones is something that is very attractive to the US military, [given] the need for a lot of munitions and platforms to fight China," says Stacie L Pettyjohn, Senior Fellow at the Center for a New American Security, a Washington, DC think tank and co-author of the report *Swarms over the Strait: Drone Warfare in a Future Fight to Defend Taiwan*. "Some people argue they have been decisive in Ukraine and can offer a cheap form of standoff strike that the US just doesn't have right now." However, she warns

▼ Around 100 of the Naval Aircraft Factory's TDN-1 drones were built, with many later being expended as aerial targets. Many were built by the Brunswick-Balke-Collender Company, which was more familiar as a manufacturer of bowling balls and billiard tables. The TDN-1 holds the distinction of being the first US uncrewed aerial vehicle to launch unaided from a ship. This example is operating from the deck of the USS *Sable* during trials on 10 August 1943.

that "they just don't have the money in the near term. So, it is more aspirational than anything and, in reality, right now, most US combat power would still come from traditional, crewed platforms, whether it is B-52s or B-2s and short-range fighter aircraft early in the fight."

Project Option

However, this is not the first time that the US military has not had air supremacy, lacked an industrial base and turned to cheap, uncrewed platforms for a way to try to create a so-called 'unmanned hellscape' to defeat a formidable opponent.

In the first half of 1942, the US faced a precarious situation in the Pacific. The Japanese surprise attack on Pearl Harbor had crippled its Pacific fleet, in the Philippines it had suffered one of the worst military defeats in its history and Japan now seemed to be threatening Australia, the Solomon Islands and even Hawaii with invasion.

Moreover, the mobilisation of its industrial muscle and its population had only just begun, and the US lacked the pilots and aircraft needed to fight the Japanese. On 22 May 1942, less than two weeks before the Battle of Midway, Fleet Admiral Ernest King, Chief of US Navy Operations, launched Project Option, ordering the deployment of assault drones "at the earliest practical date."

Project Option was first envisaged to be a billion-dollar programme involving the construction of 5,000 remotely piloted assault drones. Their mission would be to overwhelm the Japanese defences in the Pacific for 'maximum impact' before countermeasures were launched against them.

King's order for 5,000 assault drones was reduced to 500 and, of these, only around 300 were eventually delivered. Their effectiveness is still a matter for debate 80 years later.

> CULTURAL RESISTANCE AMONG THE MILITARY TO ATTACK DRONES WAS A PROBLEM 80 YEARS AGO AND REMAINS A PROBLEM NOW

"Project Option was, in reality, literally that – an option on the table," says Roger Connor, curator in the National Air and Space Museum's aeronautics department. "It was a point of exploration. It was an experiment."

Lessons from the past

What then are the lessons from the past for the Pacific drone war of the future?

In 1939, anti-aircraft gunners of the battleship USS *Utah* had their first chance to try to shoot down the US Navy's latest piece of high-tech kit – uncrewed target drones.

These were in fact obsolete aircraft, such as Curtiss N2C Fledgling trainers, that had been "droned' by turning them into radio-controlled aircraft flown from an aircraft nearby. The *Utah* had recently been reclassified as a target ship and re-equipped with anti-aircraft guns for training gunners to shoot down the new generation of faster-turning aircraft. Two years later it would be sunk by Japanese torpedo bombers during the attack on Pearl Harbor.

However, in 1939, it immediately became clear that the US Navy had a problem. "During the gunnery trials in 1939 [in Guantanamo Bay], it was clear that the gunners were struggling to hit these manoeuvring drones," says Connor, "and the realisation dawned on those present that the ships themselves might be vulnerable to drones armed with a large explosive payload."

"It was then, even before Pearl Harbor, that the idea of the attack drone really starts to gain traction in the higher echelons of the US Navy," he says. "That they might be a useful contingency for when they are in a situation where they do not have air superiority and must attack an enemy battleship without needlessly risking a valuable aircraft and crew."

▼ Left: An Interstate TDR-1 being prepared for an operational mission on the Solomon Islands in late 1944. The TDR-1 was the more successful of the two Project Option candidates

Right: Among the vehicles displayed as a Project Replicator event at the Pentagon recently was Platform Aerospace's Vanilla. The long-endurance drone has already conducted flights lasting in excess of eight days.

Bryce Bennet/Edwards AFB

First-person view in the ‘40s

The fact that attack drones were even technologically possible was due to convergence with another new technology: television. What is today known as first-person view (FPV) technology is traced back to this innovation, which then allowed the pilot a remote ‘inside out view’, as though they were flying the drone itself – albeit on a 7in screen.

It was perhaps no wonder that King seemed at first to envisage Project Option involving thousands of attack drones, formed into 18 operational squadrons, with a workforce of 10,000 civilian and military personnel. However, the admiral’s vision hit the hard reality of a nation mobilising for war and conflicted with the need to maintain a supply of new aircraft and trained pilots, particularly after the battles of Midway and the Coral Sea.

Non-strategic materials

The US Navy’s Bureau of Aeronautics persuaded King to scale back the order of drones to 500, using non-strategic materials and manufactured by suppliers with little experience of making aircraft – such as the Wurlitzer musical instrument company and the Schwinn Bicycle Company.

“The programme was a challenge,” says Connor. “It needed to use non-strategic materials, like wood, and the assumption was that if you do that, it should also be probably easy to build, which was not really the case. It took a long time to iron the bugs out. Additionally, the corporate infrastructure for this project was such that it was not really well suited to mass production of military aircraft in a wartime environment. Some of it was using manufacturers that had little aircraft experience, so that the aircraft were really slow to roll out.”

The production run was split almost equally between two main types, those built by the Naval Aircraft Factory (designated TDN-1s) and the Interstate Aircraft and Engineering Corporation (known as TDR-1s). The two assault drones looked similar, although with its streamlined dihedral low wings the TDR-1 looked more the part compared to its rival’s more conventional shoulder-mounted overhead wings.

Both were equipped with a pair of low-performance six-cylinder Lycoming engines, yet could carry a 2,000lb bomb or torpedo and were controlled from a converted Grumman TBM Avenger torpedo bomber with the drone pilot and radar operator squeezed into the rear cockpit hunched over a black-and-white TV screen.

The drones came catapult-ready for carrier deployment and jettisoned their landing gear before heading for their target. There was a rudimentary cockpit for a human pilot – for testing and ferrying – which was replaced by a fairing flush with the fuselage to reduce drag when operational.

The first were delivered at the end of 1942, but delays meant that only around 300 were built (195 TDR-1s and around 100 TDN-1s) by the time the programme was abruptly cancelled in August 1944 at the apparent insistence of the Bureau of Aeronautics.

By then the US had achieved air superiority over the Japanese but opposition to the cancellation from the US Marine Corps meant that an estimated 50 TDR-1s did see action for evaluation purposes. During September and October 1944, Special Task Air Group One (STAG-1) operated TDR-1s from Banika on the Russell Islands, in combat action against enemy targets in the Solomon’s area. They were launched against Japanese anti-aircraft positions, bridges and airfields around bases with a

▼ The prototype General Atomics’ YFQ-42A during its maiden flight on 27 August, 2025.

total of 31 striking their targets. A further 19 were downed by radio interference or mechanical faults.

If they reached their target, it appears that the drones were often flown directly into the positions, bombs and all. In other cases, they dropped their bombs and – if they did not crash or were not shot down – crashed intentionally into the same, or secondary, target.

Too little, too late

"I think the story of Project Option is speaking to this moment," says Roger Connor. "One lesson with the TDN and TDR is that they were far too late to justify their places. If it had been earlier, when US air supremacy was nowhere in sight, there might have been a lot more interest in that kind of capability."

Scroll forward 80 years, and two US companies are working on drones that could also turn Paparo's plan into a reality as part of the USAF's Collaborative Combat Aircraft (CCA) programme. The sleek, shark-like and appropriately named YFQ-44A Fury is under development by Anduril Industries, while another is General Atomic's YFQ-42A which flew for the first time on 27 August, just 16 months after the contract was signed.

Another lesson, Connor believes, is the necessity for speed in innovation and production. "I think the ability to shorten the production tail, using 3D printing techniques and the kind of rapid prototyping ability, that the Ukrainians have shown, is vital," he says, "as well as the ability to modify a whole existing array of technologies in the field and deploy them within days or weeks."

These kinds of fast production capabilities are something the US has always struggled with. "We produce good stuff, but also, we spend a long time doing it right," Connor says. "The Ukrainians have shown that the ability to have something that is low-cost, easy to produce and easy to update, and able to adapt to changing conditions is crucial."

> THE SIMILARITIES IN THE CHALLENGES FACED BY THE US IN FIGHTING JAPAN IN THE PACIFIC IN 1942 AND CHINA IN 2025 MEAN THAT THE US MILITARY HAS TURNED TO THE ASSAULT DRONE AS THE SOLUTION IN BOTH SITUATIONS

This lesson may be evidenced in the Replicator programme itself. "If you talk to folks who ran early parts of the programme, it was as much about breaking the process, as [designing] the drones themselves," says Pettyjohn. "It was intended to establish the procedures and norms for buying things that you don't tend to keep for a long time."

"Most of the stuff the US military buys is around for decades and is built to last, and the Replicator programme was about trying to short-circuit this long arduous process and get Congress and the services used to spending money on things that probably would be obsolete within a few years."

According to Pettyjohn, this caused a great deal of consternation on the part of congressional appropriators. "Even though the dollar amounts were really, really small for the DoD, because it was being spent in a more flexible way … I think senior defence officials, including former Deputy Secretary Hicks, were on the Hill [Congress] four or five times a month justifying what they were doing."

Cultural resistance among the military to attack drones was a problem 80 years ago and remains a problem now. "There is a developing culture of resistance to drones in the USAF, because CCAs are seen as more of a replacement for a crewed fighter," she says.

"But for smaller drones I think the cultural resistance among the ground forces to drone dominance is more down to hubris on the part of the US and Western NATO countries that their ground forces fight differently than the Ukrainians or Russians and their sophisticated combined-arm manoeuvres would restrict the drones' acitivities."

However, this cultural resistance extends, conversely, to the threat posed by drones to US forces themselves. "I do not think they grasp the scale of the threat that they are going to face from these drones, which can be bought very cheaply and are very useful," adds Pettyjohn. "When you deal with a couple at a time, it is one problem but when you deal with dozens or hundreds, it becomes a very different problem, and it is much more difficult to defend yourself."

High above visitors to the US Navy's National Naval Aviation Museum in Pensacola, Florida hangs the sole surviving TDR-1. In the end, the similarities in the challenges faced by the US in fighting Japan in the Pacific in 1942 and China in 2025 mean that the US military has turned to the assault drone as the solution in both situations.

However, the feasibility of Poparo's vision of a 'hellscape' remains in doubt and, with the future of the Replicator programme uncertain, it is clear that the Pentagon has not fully taken on board the lessons learned from Project Option.

▼ Anduril Industries' YFQ-44A Fury was originally designed by Blue Force Technologies as an aggressor platform called Grackle, before the company was acquired by Anduril in 2023 and the airframe adapted to meet the USAF's requirements for a CCA.

Anduril Industries

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Failure to launch: the rise and fall of the UK Space Agency


Lockheed Martin

After a mere 15 years in existence, the UK Space Agency (UKSA) will cease to exist as an independent body in 2026. To insiders, its demise is not a surprise as discussions about its alignment with the UK's technological needs have echoed in government circles for some time. **TEREZA PULTAROVA** reports.

It was with great expectations that Gordon Brown's Labour government announced the formation of the UK Space Agency (UKSA) in 2009. The new body, entrusted with overseeing the growth of the UK's promising space sector, was to "bust bureaucracy," consolidate sources of funding and "improve strategic decision-making." However, 16 years later, the space agency has fallen victim to another Labour government's drive to "cut duplication" and improve "ministerial oversight."

Sources familiar with the situation inside UKSA, however, revealed that the agency has faced criticism in government circles for years and that its merits had been discussed since around 2020.

Although some think UKSA's absorption into the recently established Department of Science Innovation and Technology (DSIT) might weaken the UK's standing in the international space arena, others deem the merger a logical step that will not change much. UKSA, it says, will continue to exist as a dedicated department within DSIT, from which it had already been receiving all its funding.

"Not very joined-up"

"The main motivation [for the merger of UKSA and DSIT] is probably cost-cutting but I think there are also other reasons," one source who used to work at UKSA and preferred to remain anonymous, told *AEROSPACE*. "Another reason is to combine different bits of government to make it easier to manage. Right now, in the UK, it's not very joined-up."

In 2010, UKSA superseded the British National Space Centre (BNSC) – a partnership between ten UK government departments set up in 1985, whose task was to define the UK's interest across space, science, telecommunication, navigation and Earth observation. BNSC also served as a national interface with the European Space Agency (ESA), to which the UK has historically passed on most of its funding for civilian space projects.

BNSC, although staffed with experts, suffered one major drawback – it did not have its own budget and so its negotiations with ESA were cumbersome.

When will the first successful UK rocket launch take place and from where?

"The UK minister responsible for space would always go to the ESA ministerial meetings where they negotiate the ESA budget not fully knowing what money they actually had to negotiate with because it depended on all these government departments involved," a source who had worked at UKSA in the first decade of its existence and is also familiar with the transition from BNSC to UKSA, told *AEROSPACE*. "He would always have to call back to those individual departments and ask them what they wanted to support in response to what the other nations did."

UKSA, a new civil service entity with its own dedicated budget, was to solve this problem. Over the fifteen years of its existence, the agency has overseen a period of growth in the UK space sector. The latest *Size and Health of the UK Space Industry report*(1) report states that the sector has grown by 3.3% per year since 2010, although some question the numbers stating that nearly half of this growth comes from satellite TV subscriptions.

Red flags

However, insiders told *AEROSPACE* that red flags appeared early on in the agency's existence. First, the new ambitious body struggled to attract talent experienced in the space sector and instead became a sought-after next step on the career ladder for professional civil servants with no space sector background.

"The majority of the BNSC experts chose to return to their parent departments rather than joining UKSA," the source said. "The UK lost a lot of expertise and insight because of that. Instead, the space agency soon filled up with people who were civil service generalists and had no experience in space."

By 2020, ministers began noticing that the UKSA had become alienated from the rest of UK government and appeared more aligned with the visions of ESA, to which it had been allocating around 80% of its budget.

ESA is an intergovernmental organisation with a status that is unique among major space agencies. The agency is a voluntary association of 22 member states independent of the European Union and standing outside of any national and international jurisdiction. ESA's staff are protected by diplomatic immunity, and its documents are not subject to any freedom of information laws, raising transparency concerns. Yet for the UK, allocating most of its space funding to ESA has historically been a more alluring prospect than investing in the development of a full-blown domestic space programme. With three-year budget periods, ESA provides a safe depository for money that could otherwise be taken away by the Treasury and for the current three-year ESA budget period (covering years 2023 to 2025) the UK allocated just under €1.9bn (£1.65bn). That is equivalent to 11.2% of ESA's overall budget and the fourth largest contribution after Germany, France and Italy.

▲ NATO delegates visiting SaxaVord Spaceport in May 2025, getting a first-hand look at the UK's first fully licensed vertical launch site. However, the UK is yet to see a live launch from its soil.

UKSA to BEIS to DSIT

"Around 2020, the government started to argue that the policy team at UKSA was too focused on what ESA wanted," the source said. "The BEIS [Department of Business, Energy and Industrial Strategy], which oversaw UKSA at that time, started making an argument that UKSA was no longer able to understand the footprint that space has across the government because it had become isolated as the experts who were familiar with life in other government departments were no longer there and the linkage to the government was gradually lost."

A 2020 *Space Landscape Review* undertaken by the government recommended that the BEIS took over the strategy-setting role of UKSA, reducing the agency into a delivery body. At that time, some key staff members, including one of UKSA's Directors, Rebecca Evernden, began moving to BEIS. In 2023, BEIS and its nascent space department became part of the newly established DSIT.

A National Audit Office review(2) released last year identified additional efficiency shortcomings in the new set-up, paving the way for the ultimate absorption of UKSA into DSIT.

One of the sources described the new solution, to be put in place by April next year, as BNSC 2.0 "but more anchored into policy and strategy."

"[UKSA] will still keep its brand and its own CEO but will no longer report directly to the minister but to the head of DSIT," the source said. "I don't think it's a bad thing because DSIT is the department giving UKSA all of its money anyway."

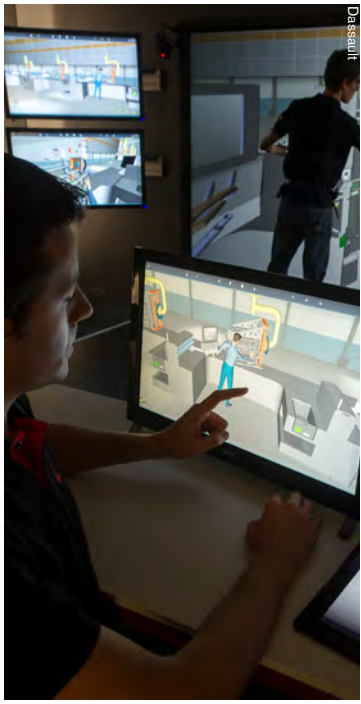
UKSA's end as an independent agency was announced by DSIT on 21 August, 2025 and prompted intense discussions with critics fearing the move would undermine the UK's ambition to become a significant space player. Other major European nations, such as Germany, France and Italy, have dedicated space agencies which oversee national space technology development programmes, in addition to managing relationships with ESA.

In a post on LinkedIn following the announcement, former UKSA CEO, Katherine Courtney said she did not "believe the change will achieve the stated aims" and will instead "create uncertainty and disruption for the hardworking UKSA team." Other sources said the transition might weaken the UK's position within ESA, especially as the announcement came only months before the next ministerial conference, which will negotiate ESA's budget for the upcoming three-year period from 2026 onward.

(1) gov.uk/government/publications/size-and-health-of-the-uk-space-industry-2024/size-and-health-of-the-uk-space-industry-2024
(2) nao.org.uk/wp-content/uploads/2024/07/national-space-strategy-and-the-role-of-the-uk-space-agency.pdf

Aerospace manufacturing in 2025

For the third consecutive year, the RAeS and digital manufacturing specialists, Protolabs, have conducted a joint survey into industry trends and challenges. **STEPHEN BRIDGEWATER** FRAeS analyses the data.


Dassault

First conducted in 2023, the annual Manufacturing in the Aerospace Industry survey is now in its third year and, whereas previous editions have been researched under the shadow of supply chain and quality control woes, the emphasis from participants in the 2025 survey shifted towards gearing up to meet the demands of the defence sector.

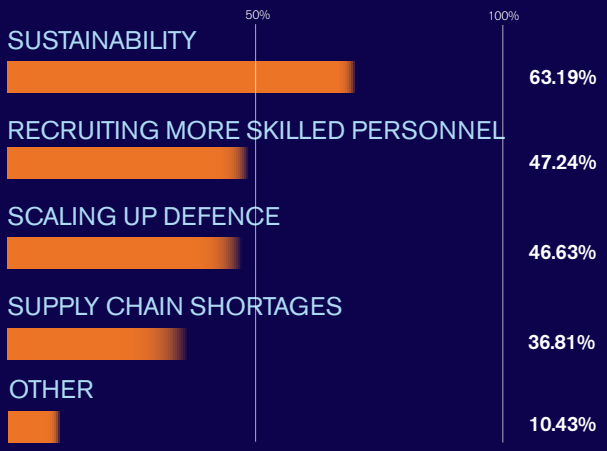
The 2025 survey saw 165 responses from RAeS members around the globe. Once again, the bulk of recipients (44.4%) listed their job titles as 'Engineers' (up from 37.62% in 2024 and 24.98% in 2023) followed by 'Other' (17.28%), down from 19.26% in 2024 but higher than 8.08% in 2023.

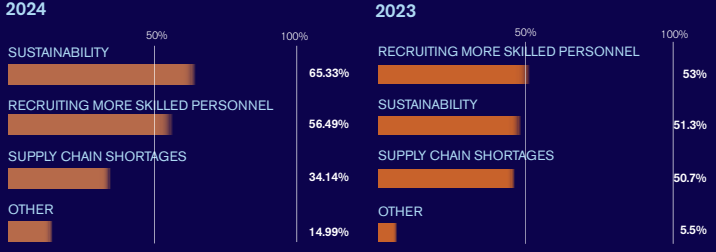
This year saw participation from students, employees and executives at companies as diverse as Airbus, BAE Systems, Boeing, GE Aerospace and Rolls-Royce, indicating a strong industry presence. The list of respondents also includes a large number of educational institutions, indicating a collaborative approach to aerospace manufacturing.

Prioritising defence

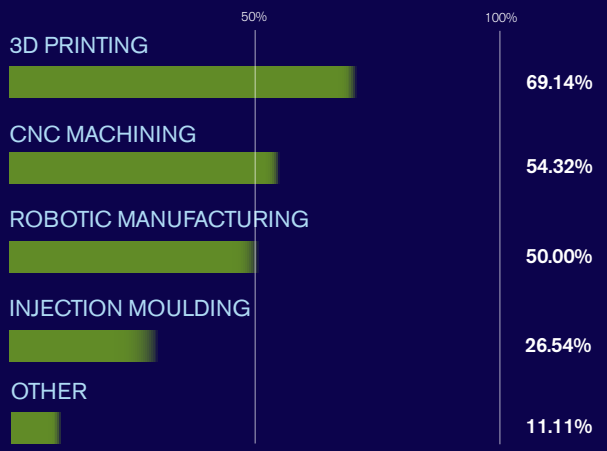
The first key question of the annual survey, which allowed respondents to tick all that applied, was: 'What is the main focus for the aerospace industry currently?' In 2023 the number one focus was the need to recruit more skilled personnel (52.9%), followed by sustainability (51.6%) and supply chain shortages (50.7%). In 2024, sustainability rose to the number one spot with 65.33% listing it as their major concern. This was followed by recruiting more skilled personnel (56.49%) and supply chain shortages (31.14%). This year, sustainability continued to lead the way (63.19% of respondents), with recruiting more skilled personnel remaining in second place (47.24%) but 'scaling up defence' jumped into third

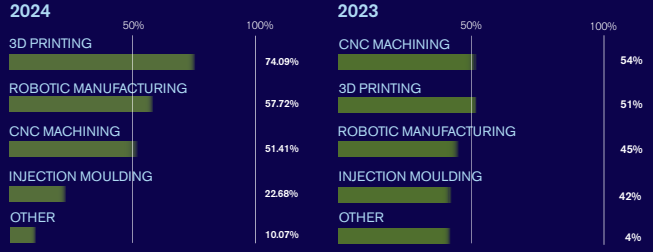
WHAT IS THE MAIN FOCUS FOR THE AEROSPACE INDUSTRY CURRENTLY?





WHAT ARE THE KEY PROTOTYPING/ MANUFACTURING TECHNOLOGIES CURRENTLY BEING USED IN THE AEROSPACE SECTOR?





– the key issues

place (46.63%). With conflict continuing to rage in Ukraine and the Middle East and an increasingly uncertain geopolitical horizon, the shift in emphasis towards defence and away from sustainability is perhaps to be expected. More than three quarters (79.50%) of the survey's respondents said their companies were adjusting their business models to meet demand from the defence sector.

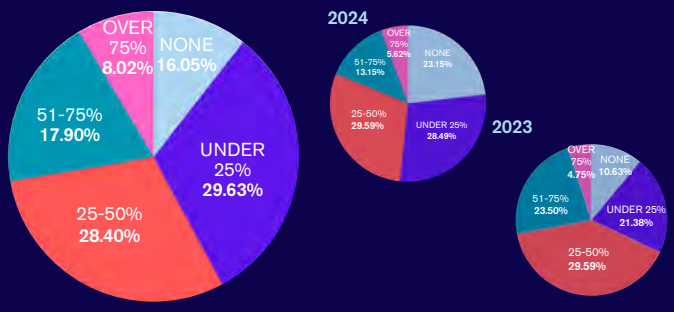
Meanwhile, although 36.81% still considered supply chain shortages to be an issue, this downward trend would appear to suggest that the worst of the crisis has passed.

Looking to the future, those surveyed were asked what areas they saw aerospace focusing on over the next three years. Of the categories provided, 'New technologies' was the most common response, with 61.96% including it in their future gazing. This was closely followed by 'Sustainability' (55.83%) with 'Recruiting more skilled personnel' and 'Scaling up defence' tying in third place, each with 50.31%. 'Ramping up civil production post-Covid' trailed with a score of just 33.13% – a drop from 47.9% in 2023, that once again suggests the supply chain issues in the civil aerospace sector are now considered far less of a concern. Respondents were given the option to answer 'Other' and specify their answers, which 6.13% did. The suggestions ranged from battling competition from China and India to cabin safety, but there were trends towards profitability, cost-efficiency and economic 'survival'.

Once again, the shift toward defence is an obvious change compared to previous survey results, and answers to the question 'What are the key factors considered when designing and manufacturing parts for the industry?' also suggested that the need to expedite design and delivery is becoming ever more important. In 2025, 54.66% of those surveyed said 'Speed' was a key factor, an increase from 36% in 2023. Understandably, 'Quality' remained the most popular answer (84.47% in 2025 compared to 94.22% in 2024 and 64% in 2023) but 'Cost' fell to the third most important priority this year. While 47.20% of respondents listed it as a priority this year, 57.21% did so in 2024 and 30% did so in 2023.

In 2023, having 'Experts on hand' was the third most popular answer to the question, but in 2024 this had fallen to fourth place and this year it lies in fifth, with automation jumping from sixth in 2024 to

HOW MUCH OF YOUR MANUFACTURING IS PRODUCED IN-HOUSE RATHER THAN THROUGH A SUPPLIER?



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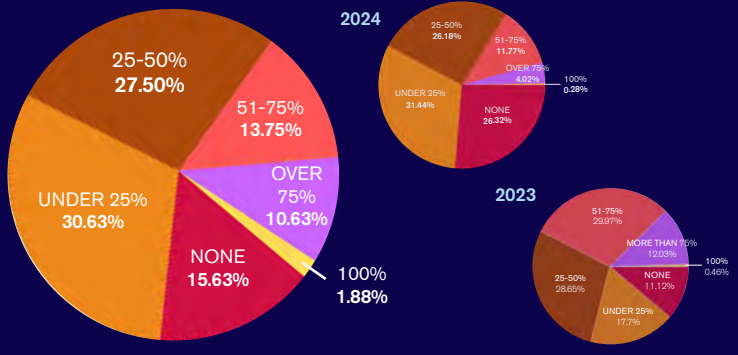
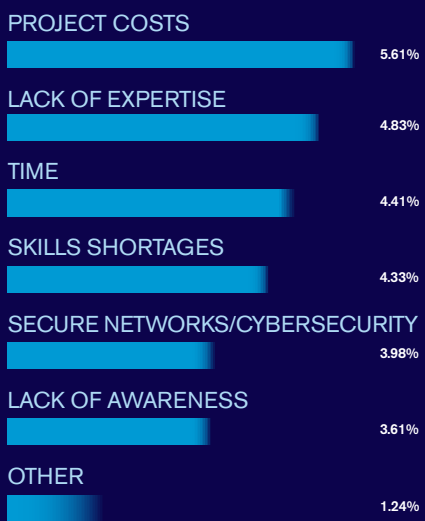
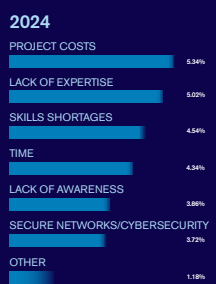


WHAT DO YOU THINK ARE THE GREATEST CHALLENGES FACING THE AEROSPACE INDUSTRY DURING THEIR ADOPTION OF DIGITAL MANUFACTURING TECHNIQUES?





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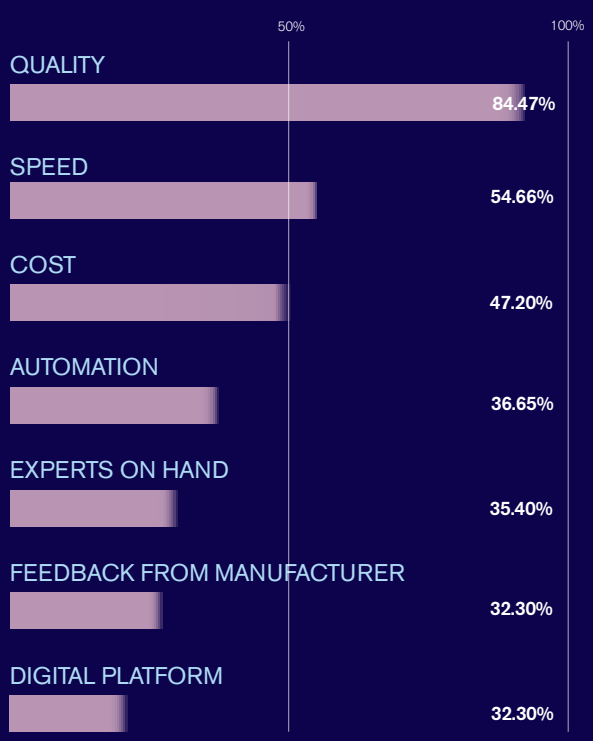
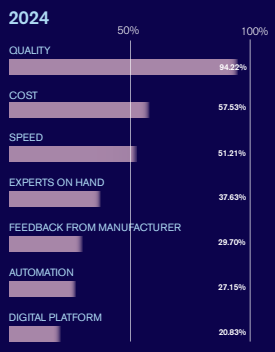
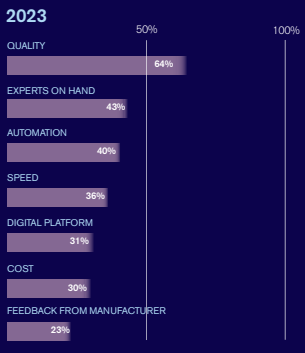
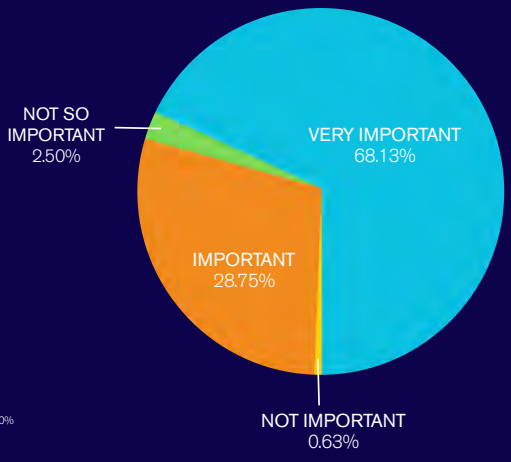
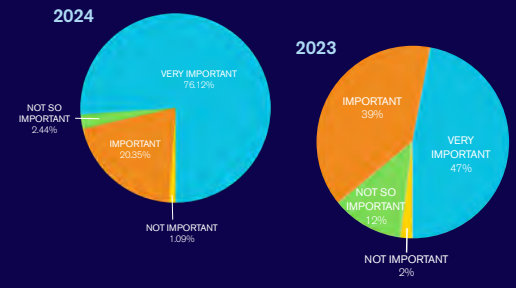






HOW IMPORTANT IS CERTIFICATION WHEN WORKING WITH MANUFACTURING PARTNERS?





third in 2025. Asked about what percentage of their business' manufacturing services are now automated, 1.88% said that all of their processes now used automation (an increase from 0.28% in 2024 and 0.46% in 2023). Conversely, the number stating that none of their business processes were automated fell to 15.63% in 2025 from 26.32% in 2024, albeit this was still higher than the 2023 level of 11.12%.

Printing the future

In response to the question 'What are the key prototyping/manufacturing technologies currently being used in the aerospace sector?', respondents could once again tick all options that applied and the 2025 results indicated that 3D printing was the most commonly used method (69.14%) followed by CNC machining (54.32%) and robotic manufacturing (50%). This compares to 2024 when 3D printing was 74.09%, robotic manufacturing was 57.72% and CNC machining was 51.41% and 2023 when CNC machining led the way at 53.85%, followed by 3D printing (51.51%) and robotic manufacturing (44.88%). This year, 11.11% of respondents listed 'Other' as key manufacturing techniques with many listing 'AI' as an option.

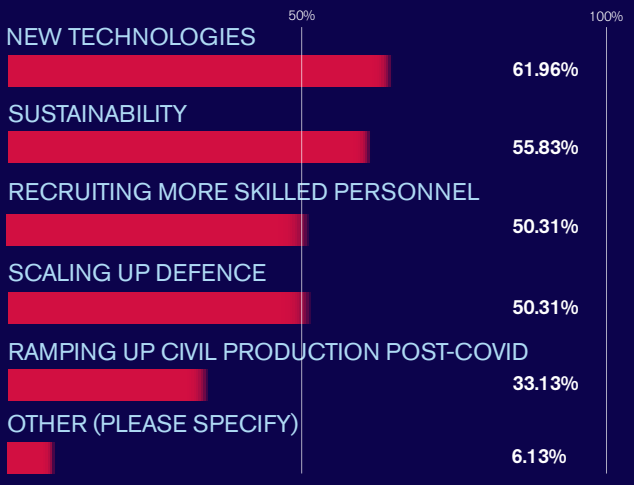
When quizzed specifically about their use of AI within the workplace, 54.19% of respondents said that they used it to assist with admin duties and 49.03% said they used it as a virtual assistant. Some 43.23% used AI transcription services but just 32.26% used AI for design work, 15.48% used it for certification and 14.19% for manufacturing.

Figures for in-house manufacturing remained reasonably consistent with previous years, with 16.05% saying they did produce in-house, 29.63% producing less than 25% of their material in-house and 28.40% producing between 25-50% in house. Just 17.9% produced 50-75% in-house with 8.02% producing more than 75% of their own material. These figures suggest a slight increase compared to previous years' responses, with just 10.83% in 2023 and 23.15% in 2024 producing no material in-house.

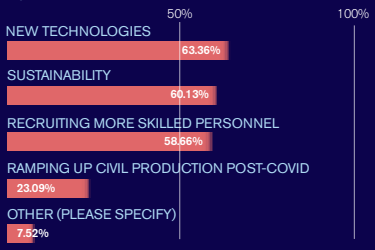
When quizzed on 'What do you think are the greatest challenges facing the aerospace industry during adoption of digital manufacturing techniques?' respondents were once again given six options and asked to rank them. 'Project costs' was ranked top of the challenges for the second consecutive year with 'Lack of expertise' once again ranking second and 'Skills shortages' in third place.

Once again, this collaboration between the RAeS and Protolabs provides a unique and valuable snapshot of the aerospace manufacturing industry in 2025 and how it continues to evolve to incorporate new technologies to meet the challenges of the future.

WHERE DO YOU SEE THE AEROSPACE FOCUS IN THE NEXT 3 YEARS?



2024



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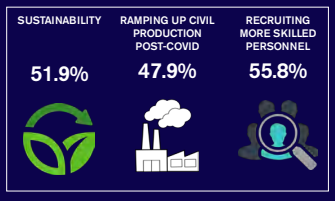


Dassault

REGENT

Sink or Skim?

Air and sea transport both have their advantages and disadvantages, but there has long existed a mode of transport which could combine the strengths and eliminate the weaknesses. **JACK RICHARDSON** explores whether this aviation niche's time has finally come.

As long-standing issues with aviation become more apparent, from the cost and ability to deliver ground infrastructure through to how to meet climate obligations, manufacturers are increasingly looking to alternative solutions, including wing-in-ground effect (WIG) vehicles.

Pioneered in the former USSR, where they were known as *ekranoplans* – the name coming from the Russian phrase 'ekran' (screen) and 'plan' (plane) – a WIG operates at low altitude (typically 10-20ft) using ground effect (a cushion of air) for lift. This results in a vehicle that is faster than a boat but more efficient than a conventional aircraft.

The Soviet Union conducted extensive research into the concept, with the so-called (by the West) Caspian Sea Monster captivating the attention of the world when it was first spotted in satellite photographs in the 1960s. Built by the Alexeyev Design Bureau as the *Korabl Maket* ('Model Ship'), the 544t behemoth was envisaged as a 50-seat military transport but just one was built. It did, however, spawn the missile-equipped Lun-class *ekranoplan* in the mid-70s, the only WIG so far to be operationally deployed by a military. While showing promise, it could only operate in calm sea states and, again, just one was completed.

Is it a boat, is it a plane?

While they may look like aeroplanes, WIGs are classified as maritime vehicles and are covered by the same legislation as waterborne ships. In recent years, a variety of designers have explored the WIG concept, including Boeing which drew up plans for a 3,000-seat troop carrying vehicle called the Pelican ULTRA in the early 2000s but, subsequently, abandoned plans after it was deemed unviable.

Today, Erdem Kazakli, Managing Director of Speeder Systems, argues that developments in artificial intelligence, allowing waterborne obstacles to be monitored and routes planned accordingly, as well as the responsiveness of electric engines, have unlocked the potential of WIGs in recent years.

First onto the water

Among a recent flurry of WIGs in development, one of the first to flight test a vehicle is Singapore-based STAirX, a joint venture between Singapore's

▲ Earlier this year, REGENT began hydrofoil testing of its prototype Viceroy.

> THE BIGGEST ISSUE IS HOW YOU TEST. WE'VE HAD TO DEVELOP TEST TECHNIQUES BECAUSE THERE IS NO KNOWLEDGE ANYWHERE

ST Engineering and Wigetworks. The AirFish is a distinctive looking vehicle with reverse swept-forward inverted delta wings) that was initially developed in Europe by Wigetworks before relocating to Australia and then to Singapore, where testing is being performed in Malaysian waters.

A small, single-engined, two-seat version of the AirFish first appeared in public at the 2024 Singapore Airshow and testing of the larger twin-engined AirFish 8 has now been carried out by British test pilot, Dan Griffith. Discussing his experience of the craft, Griffith commented on the benefit of removing any seasickness caused by boat voyages but at the same time cruising at an altitude accessible to those with a fear of flying.

As for its handling, he said: "the general flying is very similar [to an aeroplane]; it is quite unnerving the first time you fly a long distance at one or two metres but you very quickly get used to it." With a crew of two and eight or nine passengers, the AirFish is controlled by a traditional yoke instead of a joystick and powered by a conventional aero engine. The AirFish is currently powered by conventional petrol engines, something Griffith said is due to the excessive weight of batteries required for electric propulsion.

Company graphics depict the AirFish landing near beaches, thereby catering to the tourist market, but Griffith says that, in addition to a passenger version, the vehicle could be configured as a VIP transport with three to four seats, a coastguard craft or a cargo vehicle. He also revealed that the company has received enquiries from Japan with regard to using it to transport sushi.

Crucially, STAirX lists its product as being certifiable under international maritime organisation rules, meaning it requires a marine captain, rather than an airline pilot, to operate, considerably reducing costs. As a next step, STAirX plans to certify the AirFish in the third quarter of 2026 and, after this, scale up to a 24 seat passenger version.


DARPA

▲ DARPA's Liberty Lifter project received two WIG proposals from Boeing subsidiary, Aurora Flight Sciences (top) and GA-ASI (bottom). The latter included an unusual twin-boom design, with both utilised for cargo carrying.

Fighting WIGs

Another company which has successfully flown a prototype – albeit a scaled version – is Rhode Island-based Regional Electric Ground Effect Nautical Transport (REGENT). Its plan is to create a 12-seat passenger all-electric vehicle, called the Viceroy Seaglider, which operates in three modes using its hull, its hydrofoil or flying in ground effect.

In addition to the passenger, cargo, tourism and rescue roles, REGENT plans to market the Viceroy – which conducted its first crewed hydrofoil tests in June – for military applications. As such, it has launched REGENT Defense, a division focused on producing a hybrid-electric variant to provide the range needed for military missions, including anti-submarine warfare, combat search and rescue, as well as contested logistics, medical evacuation and patrol duties. Renderings even show the craft deploying a swarm of quadcopter UAVs and the company says it plans to provide the military version in crewed or fully autonomous variants. Completing this portfolio is the Squire, a smaller scale uncrewed WIG which could potentially be deployed in swarms. The company is keen to stress the ease in which WIGs can be deployed, with graphics

▼ A model of the WIG that UK-based Selby Piper plans to test next.

Selby Piper


Stephen Ellacombe/Warsash RAeS

showing them being transported in a C-17 Globemaster III aircraft, being launched from USMC expeditionary sea bases and recharged from vessels, such as the US Navy's Arleigh Burke class destroyers.

Seagliders would be particularly useful in any future conflict in the Asia-Pacific region with its large expanses of open water and the need for forces to manoeuvre between contested islands. This is a fact not lost on the Chinese, which is also making progress in the WIG domain.

Little is currently known about the so-called 'Bohai Sea Monster' (named after the Chinese waterway where it was first spotted) but it appears to have four propeller engines.

The US and China are not alone in having noticed the military potential of WIGs and in August, Turkish company, Solid AERO unveiled what it says is the world's first "sea skimming multipurpose UAV." With a top speed of around 110kt and a payload of 66lb, it claims Talay could be employed for a variety of roles, including ISR, logistics and attack. Company graphics show the vehicle conducting kamikaze attacks on ships and harbours.

September saw the Polish National Centre for Research and Development unveil a small uncrewed WIG called the Drozd. Designed to support special forces in maritime areas, it is optimised for reconnaissance, including mine deployment.

However, despite their apparent advantages, WIGs remain hampered by their ability to operate in high sea states. This reliance on calm waters is perhaps why the momentum has been swinging against WIGs in the US. DARPA's 2022 Liberty Lifter project to create a strategic transport WIG drew designs from both Boeing subsidiary, Aurora Flight Sciences and GA-ASI but, in July 2025, DARPA abruptly cancelled the programme, citing cost and questions about its effectiveness.

Cushioning the impact

Meanwhile, research into WIGs continues in the UK, with Selby Piper, founded by composite engineer, Jon Piper, building and testing a subscale model in 2016. Piper told *AEROSPACE* that he was considering several ways forward for the product including a two seat performance vehicle, a kit aircraft or focusing on the cargo market supplying remote island communities.

Others are targeting the cargo sector, including fellow UK developer, Speeder Systems, which emerged from wind tunnel tests at the University of Southampton. The company has since responded to a challenge from the Dutch government to develop a vehicle to service offshore energy installations, proposing an eVTOL WIG. After transiting to its destination in ground effect, the S30 will be able to ascend vertically to reach an oil rig platform. Measuring 9ft 10in in length, it has been designed with a 55lb cargo capacity, a cruise speed of up to 65kt and a range of 90 miles. The company claims that this is three times faster than boats and six times cheaper than a helicopter.

Speaking to *AEROSPACE*, MD, Erdem Kazakli explained that the design of the vehicle would allow it to deploy from London to Amsterdam

◤ On display at the 2023 Paris Air Show, the Speeder Systems S30 has the unique capability to hover above the ground effect to resupply oil rigs.

▼ Turkish company, Solid Aerospace's Talay sea skimming multipurpose UAV is designed with roles including ISR, logistics and even kamikaze attacks in mind.


Solid Aerospace

REGENT


Wigetworks

▲ REGENT sees multiple military use cases for its Viceroy design, including CASEVAC (illustrated). It has also developed the 25% scale uncrewed Squire variant, which it is about to start testing in Rhode Island Sound. REGENT sees the Squire, which can cruise at 80kt and carry a 50lb payload over 120 miles, as an ISR and anti-submarine UAV.

▶ Singapore-based STAirX has begun testing of the twin-engined AirFsh 8.

in two hours, moving up the Thames like a conventional boat before using the ground effect to cross the English Channel.

Tests have already been carried out on lakes in both the UK and the Netherlands with Kazakli stressing that the vehicle has the advantage of being sufficiently portable to be fitted into a road vehicle and then moved to the water where it is needed. Longer term, he explained that the S30 has other applications, such as maritime survey, acting as a mothership for other uncrewed vehicles.

With recent advances in technology, such as AI and ever-improving – although still not entirely sufficient – battery range and charge time, the potential of electric-WIG transports stands to be unlocked. However, hurdles, such as the certification process and sea state performance, remain.

Developing and certifying an entirely new type of vehicle that transcends aviation and maritime certification domains was always going to be a challenge, with Griffith concluding by pointing out that "the biggest issue is how you test. We've had to develop test techniques because there is no knowledge anywhere."

However, with so many companies taking different approaches to the WIG concept and creating vehicles optimised for passengers, cargo and military uses – both crewed and uncrewed – several routes exist to solve the challenges of these innovative craft.

London calling

For the first time in decades, all of the capital's airports are at various stages of planning expansions to handle the increasing numbers of travellers who want to fly, for business or pleasure. **ALAN DRON** looks at a sector gearing up for future growth.

While the UK economy may be flat – and environmental concerns are becoming ever more important – the British public's desire to fly shows no signs of weakening. After the four-year dip in travel caused by the pandemic, many UK airports have now climbed above their 2019 passenger figures once again and are handling steadily increasing numbers of travellers.

London remains the centre of gravity for UK passenger throughput and there is little secret that current airport capacity will have to increase in coming years to cope with future growth. Plans to improve all the capital's airports are being given a tailwind by the Labour government's desire for economic growth, which has resulted in approval for one expansion plan (at Luton), approval for a second runway expnasion for Gatwick granted on 21 September and a seemingly more favourable environment for the biggest project of all – the decades-long, on-off-on plan to build a third runway at Heathrow.

> "TRANSPORT SECRETARY, HEIDI ALEXANDER WENT AGAINST PLANNING INSPECTORS' RECOMMEN-DATIONS AND GRANTED DEVELOPMENT CONSENT FOR LUTON'S PLANS IN SPRING THIS YEAR

Heathrow's third runway

That last project seems closer today than ever with the airport's authorities having put forward earlier this year a plan for a third, full-length (3,500m) runway. However, in August 2025, another contender was announced in the shape of a consortium headed by the Arora Group – whose chairman, Surinder Arora, is one of the major hotel owners around both the airport and in central London.

This alternative plan would see a shorter (2,800m) runway constructed, with a major benefit of not having to bury the M25 London Orbital motorway, which skirts the airport's western perimeter, in a huge underground tunnel. That immense civil engineering project would contribute significantly to the eye-watering price tag of £49bn attached to Heathrow's own proposal (albeit this includes a sixth terminal costing £12bn).

Unsurprisingly, many of the airlines that operate from Heathrow, and already cite it as the world's most expensive airport and do not wish the cost palmed off


Heathrow

▲ The Arora Group's proposal for Heathrow involves a stylish new terminal.

▼ Heathrow's £49bn plans to create a third runway involve burying the M25 motorway in a tunnel.

◢ Gatwick's plan involves transforming the northern taxiway into a permanent second runway.

on them in the form of higher charges, are likely to favour the Arora proposal.

Volumes could be written about the Heathrow runway saga, which has been grinding on for decades. There is little doubt that a new runway is needed, with even a slight problem currently tending to cause knock-on delays that can persist for hours. However, whichever proposal eventually wins the contract is likely to be mired in planning and judicial processes for years to come and insiders consider it unlikely that a new runway will be operational before 2035. Trying to predict the outcome would be foolhardy.

Gatwick's gains

Meanwhile, Gatwick is in a much more favourable position. On 21 September the UK government announced approval for plans to upgrade the existing northern taxiway that runs parallel to its single runway into a full-scale second runway.

Among the factors that make the upgrade seem like a good bet are that it will remain inside the airport's existing perimeter, plus the fact that the taxiway already operates as a contingency runway when the main landing strip is out of action due to either maintenance or an emergency.

For years Gatwick has held the title of the world's busiest single-runway airport (although Mumbai now vies for that position). Nevertheless, its runway accounts for around 45m passengers annually and the airport operates at around 85% of capacity, according to transport consultants, IBA. This makes the need for extra runway capacity increasingly pressing.

The upgraded taxiway would be slightly shorter than the main runway, but capable of handling most aircraft that use the airport, namely narrowbodies, such as the Airbus A320 and Boeing 737 families. If governmental approval is confirmed imminently, as anticipated, the existing taxiway/runway could be upgraded to full runway status by the end of the decade. That could free up the main runway for more long-haul, widebody flights. Gatwick has long wanted to attract more long-haul traffic and has in recent

years added airlines, such as Emirates, Qatar Airways, Gulf Air, China Southern, Air India and US-based JetBlue to its roster.

Stansted's terminals

London Stansted, long a fiefdom of low-cost carrier, Ryanair, which accounts for more than 75% of the airport's flights, also has big plans, although these relate to its terminal buildings, not its single runway, which retains significant capacity.

May saw the opening of a new domestic arrivals building, an early milestone in the airport's £1.2bn development plan that will – if permission is granted – eventually see capacity rising to 51m passengers annually over the next 20 years.

The airport also has planning permission for a three-bay terminal extension, which will expand both the departure lounge and the immigration hall, as well as increase security and baggage capacity. Like many of the region's airports, it has also proposed plans to increase the capacity of public transport to and from the facility, easing congestion and pollution on local roads.

City stalls

London City Airport's traditional business-heavy clientele was already being diluted – and expanded – by increasing numbers of leisure passengers pre-pandemic, with the new streams of travellers seeing the airport handle 5.1m passengers in 2019. It has taken some time for the airport to recover with 2024's passenger total of 3.56m only slightly above that of 2023.

However, the pre-pandemic boom in passenger numbers led the airport to put in place plans for a major terminal extension that would raise capacity to 6.5m and include an additional seven aircraft stands built on a deck constructed on piles driven into the dock adjacent to the existing terminal.

That project should have reached fruition this year. Instead, it was an early casualty of the pandemic, which saw the project mothballed. "We are monitoring our recovery closely and will keep the recommencement of building our new terminal… under review, but will seek to deliver this in line with passenger growth," a spokesman said.

▲ Stansted's plans to increase its terminal space to increase capacity to 51m passengers annually over the next 20 years.

◀ London City is re-evaluating plans for a terminal extension and additional aircraft stands

▼ With the Transport Secretary going against planning inspectors' recommendations and granting development consent for Luton's plans, the expansion will capitalise on the success of the DART system which moves passengers from the nearby railway station to the airport in four minutes.

Luton's long-term plans

London Luton Airport is taking a flexible approach to future growth. Its operator, a consortium with a majority shareholder of Spain's AENA, the world's largest airport operator, and infrastructure investment manager, InfraBridge, said it handled more than 16.7m passengers in 2024 and has consent to take that total to 19m. Terminal capacity at present is 18m. Plans were announced earlier this year to increase Luton's capacity to 32m, but only to do so in response to demand. The plans set out how that capacity could be achieved by the mid-2040s, initially by growth of the existing terminal, with a 'vision' of adding a second terminal to the east of the current building, which would be built in two phases.

A new ramp and taxiways would also be constructed, together with associated infrastructure, such as an extension to the DART electrically powered people mover, which transports passengers from nearby Luton Parkway railway station to the

airport in four minutes, eliminating the previous road traffic jams that used to occur on the narrow approach road to the airport. No fixed timeline has been laid down for the project, although it is envisaged that the first phase of the second terminal would come on stream in the late 2030s.

In a sign of the government's desire to push through airport expansion plans, Transport Secretary, Heidi Alexander went against planning inspectors' recommendations and granted development consent for Luton's plans in spring this year.

Perhaps inevitably, a judicial review into the project has been sought by objectors on the basis of environmental grounds, with a High Court hearing scheduled for late this year or early 2026.

Unusually for the UK, Luton is owned by the local council through social investment firm, Luton Rising. Its involvement has seen more than £500m in revenue from the airport pumped into a plethora of local projects since 1998.

Luton's DART, together with the Luton Airport Express from London St Pancras, mirrors the efforts of the capital's other airports to make accessing their facilities more environmentally friendly. Heathrow has long had the Tube and Heathrow Express links to the city centre, now joined by the Elizabeth Line, while the Gatwick Express passes beside the airport terminal and the Stansted Express is slated for an upgrade as part of the airport's development. London City has the Docklands Light Railway passing beside it, while London Southend actually owns its associated train station. Luton occupies a hilltop site, which makes it virtually impossible to install a second runway. However, with Gatwick having moved 44m passengers off its single runway, Luton is in no doubt that its single runway will be adequate for years to come.

Southend sees potential

Also preparing for the future – albeit at a more modest scale – is London Southend. One of the UK's most important civil airfields in the 1950s, it largely languished as an MRO location until its then owners, the Stobart Group, built a new terminal in 2012.

Attracted by its ease of navigation, together with its own railway link to central London just yards from the terminal front doors, Southend attracted around 2m passengers in 2019, but suffered an almost complete collapse in numbers during the pandemic. However, in recent years it has been rebuilding, going from 288,000 passengers in 2024 to an estimated 750,000 this year and a predicted million or more in 2026.

Southend is now owned by US private equity investment companies, Carlyle Airport Group and Cyrus Capital Partners, which see considerable potential in the Essex site. Much of the infrastructure is new and, with a few tweaks, the airport has a terminal capacity of around 2.8m with room to either expand the existing building or to construct a nearby arrivals hall. With a railway at one end of the runway and an A-road at the other, extending the runway would be difficult, but not impossible, with the road being the easier to relocate. However, while short (1,799m), the existing runway is well-suited to new-generation narrowbodies, a point made by easyJet when it announced in late March that it was basing two A320neos there. The performance of both the neo and the Boeing 737 MAX enable them to use the runway with no payload restrictions, something that was not possible with earlier variants of both types.

▲ According to CAA data, Southend is the UK's fastest growing airport. Passenger numbers more than doubled between January and April 2025.

Additionally, said CEO, Jude Winstanley: "You're never going to get ATC delays, or taxiing delays. We're focusing on being a low-cost carrier airport. We keep our costs down and can pass that on to our customers."

Obvious new residents could be Ryanair or Wizz. "I'm not going to share names, but we're in talks with a small number of carriers in relation to them starting up operations here," Winstanley said. "The Southend name is more widely recognised in the airline industry than you might think. I'm very comfortable that we're punching well above our weight in terms of market awareness and understanding of what we've got."

Despite the relatively nearby presence of Stansted to the north and London City in the capital's Docklands, Southend is benefiting from a gradual eastward move in London's centre of gravity. Much of this was triggered by the 2012 Olympics centred around Stratford and there has been considerable housing construction in and around that area since then.

Its natural catchment area is estimated at 8.2m – roughly equivalent to the population of Switzerland – and has an average household income considerably above that of the national average of around £37,000. That bodes well for an airport catering largely for leisure passengers.

> WITH GATWICK HAVING MOVED 44M PASSENGERS OFF ITS SINGLE RUNWAY, LUTON IS IN NO DOUBT THAT ITS SINGLE RUNWAY WILL BE ADEQUATE FOR YEARS TO COME

Look out for Society position papers later this year on major airport expansions and implications and airfield and airport protection.

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Diary

8 October 2025

Cambridge Branch: A brief history of the U-2 Spyplane

Cambridge Museum of Technology, Old Pumping Station, Cambridge CB5 8LD

Although the Lockheed U-2 was previously slated for retirement in 2026, the 70-year-old design remains relevant and useful, igniting debate within US Congress about extending its service life further. A number of the remaining airframes have recently been modernised under the Avionics Tech Refresh programme with a new open mission systems (OMS)-compliant mission computer, modern cockpit displays and upgraded avionics. Earlier this summer, the US House Appropriations Committee barred the USAF from retiring more than eight U-2s in FY26 and authorised $55m for maintenance to fully restore three jets. On 8 October, U-2 expert (and regular *AEROSPACE* contributor), Chris Pocock, will present a history of the famous spyplane at the Cambridge Branch. USAF/Staff Sgt Robert M Trujillo

Message from RAeS

OUR PRESIDENT

Alisdair Wood

In early September I had the pleasure of attending the National Aerospace Library garden party to present the Distinguished Service Award to the Library volunteers for their immense contribution in making the library such a credit to the Society. This contribution extends from book conservation to digitising the library catalogue and everything in between. It has reminded me that volunteers are the beating heart of the Society and volunteering holds transformative power, not only for individuals and the Society but also for the sector as a whole. It bridges the gap between passion and profession, enabling students, professionals and enthusiasts to contribute meaningfully to an ever-evolving domain. Aerospace is driven by innovation, collaboration and global vision. Volunteers serve as the connective tissue that fuels educational outreach, technical advancement through our conference programme and specialist groups, and community engagement, especially in our Divisions and Branches. For students and early-career professionals, volunteering offers a unique pathway to build hands-on experience. Opportunities such as assisting with STEAM outreach can lead to valuable networking, mentoring and skills development. These roles not only boost CVs but also help solidify technical interests and career goals.

Also in September, the Next Generation Board held its annual Young Persons' Conference, sponsored by Leonardo UK. Developing young people in aerospace is crucial for ensuring the continued advancement and sustainability of one of the world's most innovative and strategically important industries. Aerospace drives progress in science, defence, transportation and global connectivity and careers demand not only technical expertise but also creativity, critical thinking and a passion for problem-solving. As experienced professionals retire and technology rapidly evolves, the sector faces a growing need for a new generation of skilled, diverse and visionary talent.

Investing in young people is an investment in the future – fuelling innovation, economic growth and technological leadership. It ensures that the sector remains dynamic, resilient and capable of shaping a better, more connected world; young minds bring fresh perspectives and are more likely to embrace emerging technologies like AI, sustainable propulsion and space exploration. Engaging young people early helps build a robust pipeline and their contributions can accelerate progress toward cleaner, safer and more efficient aviation and space systems. Through education, mentoring, apprenticeships and outreach, we can inspire the next generation to pursue these paths and equip them with the skills needed for success. In addition, outreach to underrepresented communities can break down barriers, ensuring a more diverse workforce that reflects the global society aerospace serves. This enriches the industry with broader ideas and enhances global collaboration.

▲ Presenting the Distinguished Service Award to the library volunteers at the NAL. via Alisdair Wood

Another excellent event in September was the 2025 Amy Johnson lecture, sponsored by Rolls- Royce. An insightful lecture by Smriti Hamal MRAeS, Senior Air Safety Consultant at AtkinsRéalis, and a subsequent panel discussion, highlighted the obstacles and challenges that prevent aerospace from achieving a diverse workforce, especially in gender equality. The shocking statistic that only 3% of licenced engineers are female demonstrates that the sector needs to put much more effort into addressing the imbalance – not just with licenced engineers but across all disciplines. With skilled resource urgently needed are we missing 47% of the available population and missing opportunities to enhance our diversity of thought.

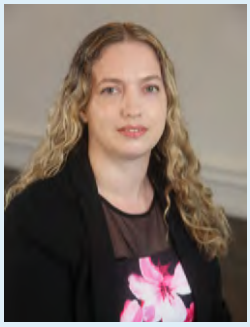
This year's Defence and Security Equipment International exhibition, DSEI 2025 (see p16), was themed on 'Preparing the Future Force' with a focus on both the supply of cutting-edge equipment and sustainable industrial and logistical networks. A major emphasis was on digital transformation: Artificial Intelligence, cyber security, data analytics and autonomous systems, to name but a few. With many of the keynote addresses majoring on the conflict in Ukraine, there was a heightened sense of urgency compared with previous shows and the future felt very close indeed.

Coinciding with DSEI week, the UK government issued its *Defence Industrial Strategy*, which followed the *Strategic Defence Review* and *Industrial Strategy* earlier in the year. Whilst some details remain to be announced, the government has received praise for giving a clearer 'demand signal' and a commitment to boost skills. I recall the comments made by Flt Lt Colin Bell FRAeS, 104, at the RAeS FCAS Summit 2025 fireside chat in June at which he urged governments to increase spending and, linking back to my thoughts on the next generation, expressed his confidence that our young people will react positively when the nation needs it most. Given the right deterrence, this should not need to be tested.

> “Volunteers are the beating heart of the Society and volunteering holds transformative power, not only for individuals and the Society but also for the sector as a whole.

OUR HEAD OF RESEARCH

Naomi Allen



> One aspect that seemed particularly pertinent at the current time was the risk of 'orphan' innovations due to a lack of infrastructure

▶ The ICAS ETF Welcome Reception was held at Brno Old Town Hall, where attendees were lucky enough to be able to climb the tower and observe the total lunar eclipse which was taking place that evening.

Sadly, for those readers who look forward to reading the column by our CEO, David Edwards every month, at the time of writing he is busy with planning budgets for Society activities in 2026 and is, therefore, unable to write his usual piece. It's a process that we go through every year to ensure that the Society can maximise its income and allow us to fund all the activities which benefit our members and the aerospace community. As you can imagine, there is significant discussion required to ensure that the Society's funds are being directed wisely and to ensure good value in the work that we do. However, important though the process is, it is not perhaps the most interesting thing to share with you all.

Happily, our usual activities continue in parallel, and I spent much of last week in beautiful Brno in the Czech Republic attending the International Council of the Aeronautical Sciences' Emerging Technology Forum.

For those unfamiliar with it, ICAS is an organisation founded in 1957 by Theodore von Kármán with the goal of providing opportunities for the discussion of aeronautical research and technology, and promoting international co-operation, collaboration and the exchange of knowledge.

Many people's familiarity with ICAS may extend only to its biennial Congress, which is a highlight of the conference calendar for many researchers. ICAS is composed of member societies from over 30 countries, with the RAeS being the UK's member society (RAeS Divisions can represent other countries in ICAS, as in the case of Australia). As well as having a representative on the ICAS Council, the RAeS also nominates experts from the UK to the Programme Committee. The Programme Committee shapes the Congress programme and ensures the quality of the papers accepted.

In the years between congresses, the Programme Committee comes together with the rest of the ICAS community and interested parties for the Emerging Technology Forum, which focuses on presenting the latest trends and technological innovations in aerospace.

This year's theme was 'Shaping Aviation for Society' and it was a fascinating couple of days, with some varied presentations around the central theme. One aspect that seemed particularly pertinent at the current time was the risk of 'orphan' innovations due to a lack of infrastructure. With recent setbacks to the aspiration for emission-free flight with hydrogen-fuelled aircraft, this is certainly something we all need to be aware of. One presentation covered the potential for multi-fuelled aircraft which could provide flexibility of operations independent of airport infrastructure, but perhaps there are further opportunities to mitigate this risk that we should seek to identify.

▲ The 2026 ICAS Congress will be hosted by the RAeS' Australia Division in Sydney.

Next year's ICAS Congress will be in Sydney, Australia from 13-18 September 2026, hosted by the RAeS' Australia Division, and will continue the theme, 'Shaping Aviation for Society.' It promises to be an interesting event, filled with opportunities to share research and ideas with your colleagues across the world. The Call for Papers is currently open, closing on 10 January, and I would encourage researchers to submit their abstracts – we look forward to hearing the highlights of global aerospace research. You can find details of next year's Congress at icas2026.com including the Call for Papers.

Finally, David has also asked me to include a reminder of the UK Aerospace Charity Symposium, which he discussed in this column last month. It will take place on 1 December, bringing together organisations to connect and identify new opportunities for shared impact.

Please email events@aerosociety.com to attend.

e-Library Additions

BOOKS

BIOGRAPHY AND FAMOUS FLIGHTS

Air Commodore Sir Frank Whittle: the Man Who Invented the Turbo-Jet by Robert L Evans, 1st ed, 2025, Pen & Sword Books, 214pp.

The remarkable story of the young RAF cadet whose invention of the turbo-jet engine revolutionised aviation and made global air travel accessible. Against the odds – working with a small team during wartime and facing widespread scepticism – Whittle's vision of high-speed, high-altitude flight became a reality. Drawing from first-hand experience with Whittle, the author also reveals new details of his colourful personal life and the personal and professional struggles behind one of the 20th Century's greatest engineering feats.

Flying and Preserving Historic Aircraft: The Memoirs of David Ogilvy OBE, Vice-President of the Historic Aircraft Association by David Frederick Ogilvy, 1st ed, 2023, Pen & Sword, 282pp.

David Ogilvy OBE FRAeS, a former RAF pilot, co-founded the Vintage Aeroplane Club in 1951 and was a key figure in preserving historic aircraft. As General Manager of the Shuttleworth Collection, he helped recover and fly rare aeroplanes, including a 1935 Hawker Hind from Afghanistan. The book highlights his career and experiences flying historic aircraft, some of which he may be the last to have piloted, offering a unique and invaluable insight into the flying characteristics of a wide range of vintage aeroplanes.

One More Good Flight: The Amelia Earhart Tragedy by Richard E Gillespie, 1st ed, 2024, Naval Institute Press, 400pp.

This book stems from The Earhart Project, a 34-year investigation by The International Group for Historic Aircraft Recovery (TIGHAR) into Amelia Earhart's disappearance. TIGHAR treated it as an aviation accident, seeking to uncover the facts by stripping away myths and examining the true causes of her ill-fated journey.

Solo2Darwin: In the Footsteps of Amy Johnson by Amanda Harrison, 1st ed, 2024, Grub Street, 241pp.

Inspired by past aviation pioneers, Amanda Harrison set out to fly her vintage Tiger Moth from Biggin Hill to Darwin, Australia in 2019, just as her idol, Amy Johnson had done in 1930. This book tells the story of the journey as she overcame weather challenges, engine failures and dangerous terrains, all while recovering from cancer.

Experimental Test Pilot Military Aircraft Research Flying by Chris Taylor, 1st ed, 2023, Pen & Sword Books, 289pp.

Chris Taylor's account of his ten years' service as an experimental test pilot from 1994 until 2004 at MoD Boscombe Down.

The turtle and the dreamboat: the Cold War flights that forever changed the course of global aviation by Jim Leeke, 2022, Potomac Books, 248pp.

The first detailed account of the US Army and Navy's race for long-distance flight records after WW2, as each branch sought to demonstrate its power in the new nuclear age.

AIRCRAFT COMPANY HISTORIES

Britain and the European Airbus: A Political History by Keith Hayward, 1st ed, 2025, Ethics International Press Limited, 238pp.

Traces the political and economic history of Britain's complex role in the Airbus project – one of Europe's most successful industrial collaborations. Despite repeated government hesitation, strong industry support and Airbus' commercial success secured its place in UK policy. Now a global rival to Boeing, Airbus faces new challenges, including transatlantic trade disputes and the push for carbon-neutral innovation.

Building Engines for War: Air-Cooled Radial Aircraft Engine Production in Britain and America in WW2 by Edward M Young, 1st ed, 2024, SAE International, 334pp.

Explores the wartime innovation that powered allied victory, highlighting the strategic collaboration between the aerospace and automotive industries. Through detailed research, Young reveals how companies, like Bristol and Pratt & Whitney, transformed aircraft engine manufacturing from traditional methods to revolutionary mass production, driving a new era of technological and organisational ingenuity.

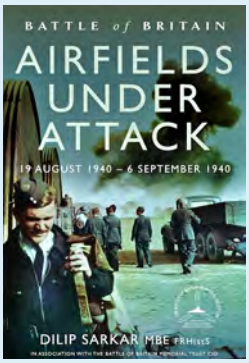
Hawker's Secret Projects – Cold War Aircraft That Never Flew by Christopher Budgen, 1st ed, 2024, Pen & Sword Books, 250pp.

Hawker Aircraft at Kingston was arguably the most successful and long-lasting manufacturer of military aircraft in Britain and Europe. The reasons for the failure of some of its designs are many and varied, often financial or political, but in each case the reasons behind the failure of the design are examined.

The Aircraft Designers: A Northrop Grumman Historical Perspective, Volume 2 by Michael V Ciminera, 2023, American Institute of Aeronautics & Astronautics, 2023, 557pp.

This second volume of the series exploring the history of aircraft design and innovation at Northrop and Northrop Grumman, focuses on the major technological milestones and programmes that shaped modern aerospace, such as stealth technology, uncrewed and autonomous systems. It also reflects on the changing role of aircraft designers, profiling over 40 individuals and honouring company retirees.

SERVICE AVIATION



Battle of Britain Airfields under Attack: 9 August 1940 - 6 September 1940 by Dilip Sarkar, 1st ed, 2024, Pen & Sword Books Limited, 357pp.

A comprehensive account of the critical period in 1940, when the Luftwaffe intensified its assault on 11 Group airfields, culminating in 'The Hardest Day'. Drawing on decades of research, first-hand accounts and personal papers, Sarkar challenges myths and explores the vital roles of Bomber and Coastal Commands. The book also delves into tactical tensions within Fighter Command, providing fresh insight into this pivotal air battle.

The Dambusters – Was It Worth It? Barnes Wallis and the Men Behind the Raid in Their Own Words by John Sweetman, 1st ed, 2024, Pen & Sword Books, 322pp.

Examines the historical significance and execution of Operation Chastise, providing a detailed analysis of the planning, preparation and impact of the operation. Includes personal accounts from those involved.

Eagle Days: Life and Death for the Luftwaffe in the Battle of Britain by Victoria Taylor, 1st ed, 2025, Head of Zeus, 361pp.

A comprehensive and refreshing account of the Luftwaffe during the Battle of Britain, drawing on a wide range of primary sources – from aircrew letters and diaries to combat reports and German newspapers.

F-35 in Service: With Air Forces Around the World by Gerard Keijsper, 1st ed, 2024, Pen & Sword Books, 490pp.

This is a fascinating and highly illustrated study of the development and service of the F-35 which, in Lockheed Martin's own words, is the most lethal, survivable and connected fighter in the world.

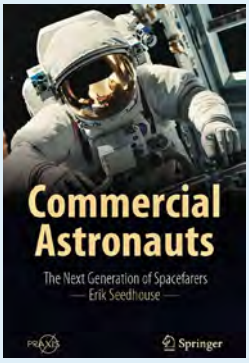
Flying Through the Ranks: The Extraordinary Experiences of Airmen to Air Marshals from the Cold War to the Gulf by G. A 'Black' Robertson, 1st ed, 2025, Grub Street, 217pp.

Stories and experiences of RAF men and women of all ranks – pilots, navigators, engineers, and airmen – during war and peace.

SPACE EXPLORATION

Starbound: Interstellar Travel and the Limits of the Possible by Edward Regis, 1st ed, 2025, Cambridge University Press, 240pp.

This book explores the dream of interstellar travel, examining whether humanity is truly destined to reach distant stars. Ed Regis critically analyses the immense challenges of crewed interstellar travel from the vast distances to the untested technologies required. Through a mix of science fiction and reality, he explores the feasibility of such journeys and whether we should even consider planning for them, offering insights on the technologies and practical hurdles.



Commercial Astronauts: The Next Generation of Spacefarers by Erik Seedhouse, 1st ed, 2024, Springer, 241pp.

This book delves into the rise of commercial astronauts aboard spacecraft, like SpaceX's Crew Dragon, Virgin Galactic's SpaceShipTwo, and Blue Origin's New Shepard. It examines the evolving landscape of commercial space travel, the future of astronaut training and how growing competition and reduced costs are creating new opportunities in this rapidly expanding industry.

RADAR

An introduction to passive radar by H Griffiths, Christopher J Baker, 2nd ed, 2022, Artech House, 269pp.

An overview of passive radar technology, covering its principles, differences from active radar, and the benefits and drawbacks of this innovative field. New chapters highlight advancements in systems on moving platforms (aircraft, UAVs), transmission types (including 5G) and processing techniques.

Principles of modern radar missile seekers by Evgeny Markin, 2022, Artech House, 443pp.

An in-depth analysis of interference shielding for on-board radar in anti-aircraft missile systems. It reviews current military threats and explains how radar and anti-missile systems address them.

Radar RF circuit design by Nickolas Kingsley, J R Guerci, 2nd ed, 2022, Artech House, 379pp.

Practical techniques for optimising RF and microwave circuits in radar systems design, covering both current and emerging technologies. It guides readers through designing RF components, selecting materials and packaging methods, including classic techniques and state-of-the-art innovations.

SAFETY SYSTEMS

Cybersecurity for Space: A Guide to Foundations and Challenges by Jacob G Oakley, 2nd ed, 2024, Apress, 229pp.

Space is one of the fastest-growing sectors and with everything connected to cyberspace, cybersecurity in space operations is critical. This revised edition covers the unique challenges to space operations and the impact of cyber threats on space systems. Readers will gain foundational knowledge of how space vehicles operate, their integration into cyberspace and the potential damage from cyber threats, as well as how cybersecurity must evolve to address these risks.

Safety management systems in aviation by Stolzer et al, 3rd ed, 2023, CRC Press, 384pp.

Explores the quality management foundations of safety management systems. The third edition includes new material on international requirements and the implications of harmonisation across international boundaries. It features updated chapters, case studies and a hypothetical airline safety scenario and is designed as a reference tool for both aviation students and SMS practitioners.

Requirements engineering for safety-critical systems by Tony Gorschek & Luiz Eduardo G Martins, 1st ed, 2021, Routledge, 173pp.

Safety-critical systems (SCS) are integral to daily activities, like air transport and air traffic control. This book focuses on the development of techniques, methods, processes, and tools that assist in the design of SCS.

LAW

Aircraft operating leasing: a legal and practical analysis in the context of public and private international air law by Donal Hanley, 3rd ed, 2022, Kluwer Law International BV, 369pp.

Expert guidance on the legal and practical aspects of aircraft leasing, featuring a real example and a detailed analysis of an operating lease for a used aircraft, as employed by a leading commercial aircraft leasing company.

Fundamentals of International Aviation Law and Policy by Benjamyn I Scott, 2nd ed, 2025, Routledge, 411pp.

This textbook covers the major areas of international aviation law in the sphere of public and private law from a regulatory and practical perspective with detailed analyses of existing and applicable legislations, as well as landmark court cases and decisions. Each chapter is tailored to confer to readers a thorough knowledge of international and European legislation. New chapters in this edition cover aircraft financing and advanced air mobility.

International Aviation Law: Regulations in Three Dimensions by Attila Sipos, 1st ed, 2024, Springer International Publishing, 475pp.

This book explores aviation's role in modern transport, focusing on its highly regulated nature and international air law. It covers key treaties, like the Chicago and Montreal Conventions, includes 100 legal cases and makes complex regulations accessible for aviation professionals, legal experts and enthusiasts.

Just Culture and the Criminalisation of Air Accidents by Simon Daniels, 1st ed, 2025, Taylor & Francis Group, 219pp.

This book gives readers the tools to understand criminalisation in the civil aviation industry and provides practical solutions for addressing risk management challenges within their professional roles.

Space Law: a treatise by Francis Lyall, 3rd ed, 2024, Taylor & Francis, 532pp.

This updated edition covers recent developments in space law, including UN Resolution 76/3, the Space3030 Agenda, and the growing commercialisation of space in areas, like tourism and mining. It also explores new technologies like satellite constellations and micro-satellites. With space tourism a reality and the Moon soon to be revisited, it is an essential resource for students, academics, space agencies, governments and space-active companies.

AVIATION MANAGEMENT

International cooperation in the aerospace industry: economics, politics, organization, and management of technology by Wesley E Spreen, 2024, Routledge, 358pp.

A comprehensive analysis of global collaboration in civil and military aircraft design and production, exploring historical, economic, organisational, operational and political perspectives, with case studies from around the world.

Strategic outsourcing, innovation and global supply chains a case study from the aviation industry by Luigi Cantone, 1st ed, 2023, Routledge, 226pp.

Outsourcing new product development involves managing strategic and operational risks that can increase costs and extend timelines. This book, based on the Boeing 787 Dreamliner case study, offers a comprehensive overview of decision-making models for outsourcing, emphasising the importance of careful supplier selection and effective management strategies in innovation-driven product development.

Smart and Sustainable Operations Management in the Aviation Industry by Turan Paksoy & Sercan Demir, 1st ed, 2025, CRC Press, 158pp.

Industry 4.0 and disruptive technologies have transformed supply chains into globally connected collaborative networks. As supply chains become flexible, digital structures, the planning and operation phases of key processes become more complex. This book presents chapters on smart and sustainable supply chain management in aviation.

Engineering economics for aviation and aerospace by Bijan Vasigh, 2nd ed, 2025, Routledge, 513pp.

Equips engineers with essential tools to understand cost structures, estimate cashflows and evaluate projects and designs economically. Focused on aviation and aerospace, this book will help students and practitioners make informed economic decisions for single or multiple projects.

Life Cycle Assessment in Aviation Theory and Applications by T Hikmet Karakoc, 1st ed, 2024, Springer, 121pp.

A comprehensive analysis of life cycle assessment that examines various elements within the aviation sector, including aircraft operations, maintenance and repair activities, aircraft gas turbine engine processes, airport vehicles and operations, airport construction, airport access, traffic and waste.

SUSTAINABLE AVIATION

Sustainable Aviation Fuels: Transitioning Towards Green Aviation by Joachim Buse, 1st ed, 2024, Taylor & Francis, 233pp.

This book explores the transition to carbon-neutral aviation, focusing on managing the shift to sustainable aviation fuels. It covers market considerations, investment strategies, cost challenges and competitive models alongside the oil industry. The book also addresses feedstock supply reliability and SAF production.

Sustainable Materials and Manufacturing Techniques in Aviation T Hikmet Karakoc, 1st ed, 2024, Springer, 130pp.

Covers materials and manufacturing techniques in aviation, focusing on reducing fuel consumption, improving operational efficiency and optimising resource use during manufacturing. It addresses lightweight materials that maintain safety, while considering performance, cost and environmental impacts. The role of AI, machine learning and digital twins in manufacturing is also explored.

AIR TRANSPORTATION

Urban air mobility: intelligent, safe and sustainable systems for future transportation edited by Vishnu Kumar et al, 1st ed, 2024, River Publishers, 269pp.

Serves as a resource for engineers and researchers developing intelligent, safe and sustainable systems for urban air mobility. UAM, powered by AI and intelligent algorithms, offers potential solutions for congestion and overcrowding. The book covers key challenges in modelling, navigation, traffic control, battery efficiency and safety.

Fundamentals of Global Air Transport Geography by George Arbuckle, 1st ed, 2025, Taylor & Francis, 502pp.

Examines how airlines, airports and aircraft are shaped by geography, and how air transport influences global trade, tourism, economic growth and cultural exchange. It also discusses the negative environmental impacts. Aimed at students and non-technical industry professionals, the book offers an accessible introduction to commercial air transport and its relationship with geography.

Harnessing Digital Innovation for Air Transportation by Ayse Asli Yilmaz, 1st ed, 2024, IGI Global, 199pp.

An in-depth look at how digital transformation is reshaping aviation from harnessing data analytics, managing safety, improving the passenger experience and delving into emerging technologies – offering strategies to address the challenges presented by the digital aviation era.

Strategies for Sustainable Air Services Development: An Airline-Destination Collaborative Approach by Chrystal Zhang, 1st ed, 2024, Taylor & Francis, 334pp.

Explores the decision-making process behind establishing air routes, highlighting the roles of airlines, airports, tourism authorities and other stakeholders. Including interviews and surveys with professionals, it presents a framework of best practices for developing air links.

Air Cargo Management: Air Freight and the Global Supply Chain by Michael Sales, 3rd ed, 2023, Routledge, 238pp.

An updated guide to the air cargo supply chain, highlighting its crucial role in global trade. It covers industry fundamentals, economics and the shift from traditional methods to technology and cloud-based solutions that streamline operations. New content includes security and crime issues, airport roles and road feeder services.

Society News

2026 MEMBERSHIP SUBSCRIPTIONS

Membership Grade	2026 Subscription Rate
Fellow or Companion	£427
Fellow or Companion – 20% Discount	£341
Member	£288
Member – 20% Discount	£231
Associate Member	£179
Associate	£164
E-Associate	£58
Affiliate	£148
Student Affiliate	£55
Apprentice Affiliate	£0
Baseline Rate	£148
Administration Fees	
Application Fee – Fellow or Companion	£181
Application Fee – All other grades	£90
Transfer Fee – All grades	£66

Notes

(1) CPIH Rate: Average 12 months to July 2025 – 3.6%

(2) 2026 Membership Subscriptions increase is proposed at 3.6%

(3) 2026 Membership Subscriptions increases are rounded up/down to nearest £.

(4) Members who have reached normal retirement age in 2026 are entitled to pay subscriptions at the Baseline Rate.

(5) Members who will be retiring during the course of the year can apply for the 20% discount on their subscriptions. Note – if the 20% discount takes the subscription below the Baseline Rate, the the Baseline Rate will apply.

(6) Members have the option to pay their subscriptions by Direct Debit either in one sum in January 2026 or in ten monthly instalments from January 2026.

(7) 2026 Application and Transfer fees as shown below:

2026 Engineering Council Registration Fees

Registration Level	Entry Fee	Annual Fee	Annual Fee (Reduced)
Chartered Engineer (CEng)	£64.31	£49.45	£22.36
Incorporated Engineer (IEng)	£54.29	£41.97	£18.62
Engineering Technician (EngTech)	£22.26	£24.06	£10.67
Interim Registration	£13.18	£17.67	£17.67

Update Your Details

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Stay connected with the Royal Aeronautical Society

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If you are unable to locate your username and password please contact the membership team at membership@aerosociety.com or by calling +44 (0)20 7670 4456

Diary

EVENTS

6 October
RAeS Mental Health Awareness Day
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

7-8 October
RAeS President's Conference 2025: People in Aerospace
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

8 October
Preston Branch: Electric Aircraft Update
Venue TBC

8 October
Weybridge Branch: The Venus Rover
University of Southampton Masters Degree Project in Spacecraft Engineering
Brooklands Museum Clubhouse, Brooklands Road, Weybridge, Surrey KT13 0QN

8 October
Cambridge Branch: A Brief History of the U-2 Spyplane
Chris Pocock
Cambridge Museum of Technology, Old Pumping Station, Cambridge CB5 8LD

9 October
Bedford Branch 2025 Sir John Charnley Lecture: Westland100 – Horseless Carriage to Helicopters (via low Earth orbit)
Dr Alisdair Wood FRAeS, President, Royal Aeronautical Society
Aircraft Research Association, Sports and Social Club, Manton MK41 7PF

9 October
Hamburg Branch: The Federal Office for Information Security (BSI) as a Major Player for Cybersecurity in Civil Aviation
Hendrik Dibbern, MSSc Head of Division Cybersecurity at Airports, BSI
HAW Hamburg, Berliner Tor 5, Hörsaal 01.10

9 October
Heathrow Branch: Advancing Aviation's Future with Sustainable Aviation Fuel
Aaron Robinson, Vice President – SAF (US/Global), International Airlines Group
British Airways HQ Waterside, Speedbird Way, Heathrow Airport UB7 0GA

13 October
Prestwick Branch: From Lightnings to Long Haul – A Pilot's Experiences
Graeme Smith
University of the West of Scotland, Ayr Campus, University Avenue, Ayr KA8 0SX

14 October
Loughborough Branch: Flying Concorde
Capt John Tye, Former Concorde Pilot
Brockington Building, Margaret Keay Rd, Loughborough LE11 3TU

14 October
Southend Branch: Aircraft Dismantling
Henry Hyde, MD of Aircraft Environmental Recycling Solutions
Holiday Inn, Southend Airport SS2 6XG

16 October
Birmingham, Wolverhampton and Cosford Branch: Flying Vintage Jet Aircraft
Rod Dean
RAF Museum Midlands, Shifnal TF11 8UP

21-22 October
RAeS Flight Simulation Conference 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

23 October
Celebrating National Mentoring Day 2025
Ruth Mallors-Ray FRAeS
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

23 October
Munich Branch: What Does a Test Pilot Actually Do?
Laurie Hilditch, Retired MoD Chief Test Pilot
TUM Campus Garching, MW 1801, Boltzmannstraße 15, Garching bei München

23 October
Hamburg Branch: Insights into Future Propulsion Technologies
James Hunt, Future Propulsion Lead, AMRC, University of Sheffield
HAW Hamburg, Berliner Tor 5, Hörsaal 01.10

4 November
Loughborough Branch: The life and times of FLYBY Technology
Annalisa Russell-Smith FRAeS, Chief Strategy Officer, Flyby Technology
Brockington Building, Margaret Keay Rd, Loughborough LE11 3TU

5 November
Careers in Aerospace and Aviation Live 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

5 November
Weybridge Branch: Life in the Cockpit from Grasshopper to Harrier
Group Captain Chris Burwell MBE RAF (retd)
Brooklands Museum Clubhouse, Brooklands Road, Weybridge, Surrey KT13 0QN

10 November
RAeS Light Aircraft Design Conference 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

10 November
Prestwick Branch: The Impact of the RAF on a Highland Glen – Personal Stories
Cameron Paterson
University of the West of Scotland, Ayr Campus, University Avenue, Ayr KA8 0SX

11 November
RAeS Rotorcraft Conference 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

11 November
Southend Branch: Air Cadets and Air Shows
Capt George Capon
Holiday Inn, Southend Airport SS2 6XG

12 November
Preston Branch: Young Persons' Network Mini Lecture Competition (1)
Venue TBC

12 November
Brough Branch: Embedding Conscience in Drones and Robots?
Dr Rashid Ali FRAeS
Cottingham Parks Golf & Leisure Club, Woodhill Way, Cottingham HU16 5SW

13 November
Munich Branch: The Eurodrone Programme
Sascha Hapke
TUM Campus Garching, MW 1801, Boltzmannstraße 15, Garching bei München

14 November
Celebrating LGBTQ+ People in STEM 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

18 November
Loughborough Branch: UltraFan Demonstrator – First Engine to Test
Brockington Building, Margaret Keay Rd, Loughborough LE11 3TU

20 November
RAeS Weapon Systems Weapon Integration Conference
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

20 November
Birmingham, Wolverhampton and Cosford Branch: Stalin's Night Witches
Debbie Land
RAF Museum Midlands, Shifnal TF11 8UP

24 November
RAeS Aerospace Medicine Group Annual Symposium 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

24 November
RAeS Stewart Memorial Lecture 2025
Prof David Newman, Visiting Professor of Aerospace Medicine at King's College
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

1-4 December
10th Council of European Aerospace Societies Aerospace Europe Conference / 28th Italian Association of Aeronautics and Astronautics International Congress / 10th Aerospace & Defense Meetings.
Centro Congressi Lingotto, Via Nizza, 280, 10126 Torino, Italy

For further information and booking, visit **aerosociety.com/events-calendar/**

Elections

FELLOWS

Hadi Azhari
Colin Bell
Stefano Bianchi
Ashoke De
Jonathan Hughes
Mahmud Khan
Chung Mak
Sarah Moorehead
Michael Peters
Justin James Richard Roberts
Antony Sherwin
Peter Stratten
Roger Taylor
Nicholas Winspear
David Zeitouni

MEMBERS

Feroz Ahmed
F. Frank Alparslan
Alireza Aslani
Mohamed Ben Saed
Paul Broadley
Ben Brown
Edward Buck
Andre Budel
Nuri Cizioglu
Paul Cumner
Judith Farman
Peter Firbank
Mark Grigg
George Hajdu
Joseph Hardy
Caroline Havill
Daniel Horner
Ron Karo
Adam Kippen
Avinash Kongala
Marcin Kubicki
David Langley
Michael Loweth
Matthew Maber
Callum McBryde
Joseph Ofosu
Craig Rolfe
Jonathan Slater
Frank Spitzer
Armindo Torres
Thozamile Wakaba
Richard Wakeman
Daniel Wand

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Jan Eldeblad
Abdelwahab Elsherbiny
Luca Filisetti
Ellie Gee
Lewis Gillin
Charlotte Hall
Charlotte Hastings
Thomas Hawthorn
Hannah Jones
Philip Koskei
Filip Lalovic
Alexander Maddock
Josef Martin
Steven Owen
Ben Roberts
Callum Smith
Alexander Thorpe-Morgan
Kieran Wheeler
Adam White

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Benjamin Abrams
Miagul Ahmad Farhan Bin Abdul Adziz
Wendy Hau
Rama Jazdan
Alessio Matri
Edward Rosser

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Abdulrahman Al-Obaid
Joseph Branagan
Alistair Hackshall
Abigail Hand
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Conor Bombak
William Chen
Marc Cordiera
Gwyneth Dowell
Chiti Gunatilake
Miguel Higino
Tom Lynch
Daniel Maloney
Imogen Maslen
Saxon McDonald
Bishoy Megally
Daniel Raimbach
Alexander Reid
Elliott Ridgway
Datta Aditya Sistla
Sharon Teja
Anandya Wardhana
Jaden Wordsworth

WITH REGRET

The Royal Aeronautical Society announces, with regret, the death of the following members:

A P O'Leary ARAeS 74
David Mowbray FRAeS 85
Mohammad Ahad MRAeS 56

CELEBRATING 50 YEARS

The Society congratulates the following members, who celebrate 50 years of membership in 2025:

Geoffrey Barrance MRAeS
Emma Bird MRAeS
Colin Cruddas FRAeS
Air Cdre John Delafield FRAeS
Air Cdre Barry Dickens MRAeS
Keith Dunn MRAeS
Ronald Eckersley MRAeS
Nevile Foster MRAeS
Ian Gilbert MRAeS
Keith Griffiths MRAeS
Robert John Heath FRAeS
Dr Paul Hennington AMRAeS
Sqn Ldr Horace Hollington FRAeS
Nicholas Issacs FRAeS
Barrie Kirk MRAeS
Richard Lucas MRAeS
Douglas Marr MRAeS
Helga Mutton (Nee Whitmore) MRAeS
Peter Oake MRAeS
Malcolm Ranson MRAeS
Dr George E A Reid FRAeS
John Rudin MRAeS
Phil Storrow MRAeS
George Taylor FRAeS
Capt David Warner FRAeS
Robert Winslow MRAeS
Wg Cdr Charlie Wray MRAeS

FROM THE ARCHIVE

The prototype Republic F-105 Thunderjet first took to the skies 70 years ago on 22 October, 1955. Tailored to high-speed, low-altitude penetration, the single-engined F-105 could deliver a bomb load greater than the USAAF WW2 four-engined bombers. More than 20,000 Thunderchief sorties were flown in the Vietnam War but 382 of the 833 airframes produced were lost. Illustrated is the first of three JF-105 prototypes, which was envisaged as a reconnaissance variant but the programme was subsequently cancelled in 1956. This aircraft is now on display at the USAF Airman Heritage Museum at Lackland AFB near San Antonio, Texas.

For daily historic aviation content see the 'On This Day in History' feature on the Society's Facebook and LinkedIn pages.

New Member Spotlight

CHARLOTTE HALL

Name: Charlotte Hall

Grade: Associate Member

Age: 33

Location: Bristol

Job title: Component Design Engineer & Technology Project Lead, Rolls-Royce Defence

What inspired you into aerospace? My lifelong passion for aerospace was ignited in childhood, thanks to my father. He is an avid model aircraft builder, meticulously crafting large-scale flying models. My weekends were often spent visiting airshows and aircraft museums, and I even had the chance to visit Concorde up close while on holiday in France.

What's the best thing about your current role? Whether it is a small component or a larger system, the process of designing, building and then successfully testing a piece of technology that contributes to a larger aerospace project is incredibly fulfilling. Knowing that my work plays a direct part in advancing a field I have been passionate about since childhood is the ultimate motivation and working in a collaborative environment is imperative to this goal. I am constantly surrounded by some of the brightest minds in the industry, and every day is a learning experience. The opportunity to innovate and contribute to cutting-edge technology alongside such a talented team is what I value the most.

What made you join the RAeS? I decided to join the Royal Aeronautical Society because of my deep passion for design and aviation. For me it was the perfect way to turn a personal interest into a professional pursuit. I wanted to join a community that would help me grow as a professional and aid my career development. The RAeS offers a path to becoming a professionally recognised engineer, which would be a huge personal and professional milestone – something I have strived towards ever since starting my apprenticeship all those years ago.

What do you hope to get out of your registration with the RAeS? First and foremost, I am looking to gain professional status and recognition. Becoming professionally recognised will validate my skills and expertise in the industry. The Society provides the structure and guidance I need to get there, and being part of this community shows my commitment to the highest professional standards. Secondly, the world of engineering and aerospace is always evolving, and I am excited to use the Society's resources to stay informed about the latest innovations, technologies and explorations. Finally, I am hoping to build a strong professional network of experts and peers that will lead to mentorship, collaborative projects and exciting opportunities.

What three items would you take with you to the space station? Firstly, a high-quality camera. Anyone who knows me knows I am a big admirer of sunsets, and I can only imagine the sheer beauty of seeing a sunrise or sunset from the perspective of orbit. Secondly, my water bottle. My husband bought me a lovely personalised water bottle that has completely changed how I approach my health and productivity. Bringing this represents my commitment to personal discipline, proactive health and a reminder of my spouse's unwavering support. Finally, my dog, Geoffrey. I understand that bringing a dog to the space station presents significant logistical challenges. However, Geoffrey would be a constant source of unconditional joy and companionship and would no doubt raise morale among my fellow crew members.

Who is your biggest inspiration? My biggest inspiration is not a single person but rather the collective talent of my colleagues. Their unwavering commitment to excellence is something I see every day. I have the privilege of working alongside engineers and specialists who are not just experts in their fields but are also relentlessly curious and dedicated to pushing the boundaries of what is possible. They always understand my curiosity and give me the confidence to speak up and ask 'what if?' Their high standards and dedication have inspired me to strive for the same level of rigour and creativity.

Piece of advice for someone looking to enter your field? Cultivate your passion and curiosity and continue to challenge why things are the way they are. I believe the most successful people are those who are constantly seeking new knowledge so keeping that desire to continuously bolster your learning is essential in a field which is ever evolving. As a woman in engineering, I have learnt that my voice and opinions serve as a unique perspective and are not just a valuable addition to the team but can also contribute to being a powerful driver of innovation too. In short, never lose your sense of wonder or desire to take things apart and understand how they work, and always challenge why. That curiosity is the true engine of innovation in this field and I believe the foundation upon which all innovation is built.

The Last Word

COMMENTARY FROM

Professor Keith Hayward
FRAeS

Nationalising US defence?

> THE WORLD OF THE 'GOVERNMENT-ORIENTATED COMPANY' HAS DEDICATED TEAMS OF LOBBYISTS AIMED AT SECURING CONTRACTS OR INFLUENCING GOVERNMENT (NOTE THE LONG-STANDING BAE SYSTEMS POSTER IN THE WESTMINSTER TUBE STATION) TO SUPPORT THEIR ACTIVITIES

A comment from US Commerce Secretary, Howard Lutnick has had the analytic hen house all of a cluck. Suggesting that the US government (USG) should/might (we cannot be sure just how serious this is) take a share of Lockheed Martin has raised quite a storm.

Many have piled into the idea, saying that such an act would be a poor commercial move, add uncertainty to where the USG might next throw taxpayers' dollars (at perhaps ailing companies) and possibly lay the dead hand of government on initiative and adaptability.

Scorn has also been thrown at countries elsewhere in the world that still have nationalised defence and aerospace companies. This is now largely confined to the Russian and Chinese industries, but highly diluted public shareholding is also common in France and elsewhere.

Now, if taking a share of overcooked profits is your aim, why not cut the allowable rate, or – even Heaven forbid – increase corporation taxes? So, is it about increasing control?

I'll sidestep that for the moment and slip back into my academic prime and recall some old concepts: 'The Military-Industrial Complex', which centred on the influence over government that the biggest defence companies might wield, either 'warranted or unwarranted', is well known and still alive in many research theses. Ken Galbraith's idea of 'technostructures,' where elites comprised of experts and specialists were increasingly shaping public affairs to the point that capitalist and communist systems were converging, has faded away.

The 'government-orientated company'

My own obsession is the 'government-orientated company' where output and effects are more relevant than ownership. This is more descriptive than normative and refers to the degree of market dependence on government (or governments) spending either in support of R&D or buying the resulting products. Operation in a highly regulated environment might also be added to the list of descriptors. This clearly describes defence companies but, when the state invests in airliner development, the same applies to civil aerospace.

The world of the 'government-orientated company' has dedicated teams of lobbyists aimed at securing contracts or influencing government (note the long-standing BAE Systems poster in the Westminster tube station) to support their activities. These are specialist teams of people aware of the arcane complexities of procurement policy, administration and accountability procedures. Marketing and selling the product may also involve groups of civil servants, as well as seconded executives in national export sales agencies. Plus, of course, the revolving door of officials, high-ranking service personnel and sometimes former ministers taking up well-paid positions in defence firms.

In such an environment, direct government or public ownership is the least deterministic factor. It is the complete picture of political, managerial and substantive activity that shapes events – and to some analysts and commentators, what makes improving the efficacy of procurement so difficult to achieve. The complex web of institutions, practices and personnel is also said to act as a barrier to new entrants, currently a highly sensitive issue as governments seek rapid answers to new threats, such as small combat drones or the application of AI to defence.

Ownership is not the critical issue

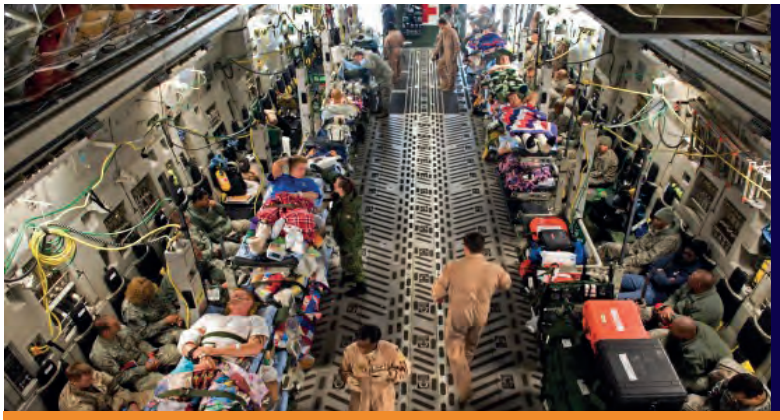
Ownership, or direct participation in a company's operations is not an insignificant factor in shaping government-corporate relations – the different appetite for risk in the Concorde programme on the part of British private companies and their nationalised French partners strung out negotiations on incentive contracting in the UK for over four years, and the result was to bring the UK close to French formulae.

However, in broad terms the relationship is more nuanced and harder to unravel than worrying whether the USG should buy Lockheed shares. Lutnick's musings might fade like morning mist, but the wider issues raised by his statement should not be left unconsidered.

RAeS HQ, LONDON
MONDAY 24 NOVEMBER 2025

ROYAL AERONAUTICAL SOCIETY

RAeS AEROSPACE MEDICINE GROUP ANNUAL SYMPOSIUM 2025



To find out more about attending or sponsoring the event, and how to enter the Next Gen Aerospace Medicine competition, please scan the QR code or visit: **www.aerosociety.com/aerospace-medicine-2025**

Booking is now open for the annual RAeS Aerospace Medicine Symposium, taking place on Monday 24 November at RAeS HQ in London, with early bird tickets available until Wednesday 1 October!

This RAeS symposium is traditionally the one day of the year when the whole field of aerospace medicine comes together in the UK. The programme will encompass civilian and military aerospace medicine, including physiology, case studies, aeromedical extraction and a panel discussion, and will finish with the Next Generation Aerospace Medicine student prize presentations.

LONDON/ONLINE
MONDAY 10 NOVEMBER 2025

ROYAL AERONAUTICAL SOCIETY

RAeS LIGHT AIRCRAFT DESIGN CONFERENCE 2025

Photo credit, Skyfly: Ed Hicks

To find out more about attending or sponsoring the event, please scan the QR code or visit: **www.aerosociety.com/light-aircraft-2025**

Book now for the RAeS Light Aircraft Design Conference 2025, taking place on Monday 10 November 2025 in London and online!

This conference is a unique opportunity to meet the General Aviation community and discuss the latest developments in the sector. Programme highlights include the application of new concepts, E Conditions, design and construction, flight testing, and project case studies, as well as an insight into the Design, Build, Fly initiative and of course the announcement of the winners of this year's Light Aircraft Design Competition!

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