OVER A CENTURY OF MANUFACTURING TECHNOLOGY INSIGHT

MACHINERY

AEROSPACE SUPPLEMENT

E-Thrust serial hybrid propulsion system – Airbus

XYZ UMC 4+1

FROM £129,915 +VAT

DIRECT DRIVE HIGH TORQUE MOTOR 90 RPM NO WORM OR WHEEL

5 axis (4+1) multi face or 5 axis simultaneous ?

Stay ahead of the pack with either full blown simultaneuos 5 axis or 5 axis via 4+1.
Many companies don't actually use 5 axis simultaneous, the complexity means CAD/CAM is essential to write and develop these complex components, but multi-face machining can save hours of time even on simple jobs that are currently done on a 3 axis VMC, to machine 6 sides of a dice requires 6 set ups on a VMC and 2 on a Multi-face machine.

- **Siemens 840DSL ShopMill (iTNC 640 HSCI Heidenhain optional).** *UMC-5X only.*
- **Front loading 600mm diameter trunnion rotary table *90 rpm*.**
- **High accuracy rotary axis direct drive high torque motor *90 rpm no worm and wheel.***
- **Tilting axis servo worm drive with brake +/- 120° (2.5 sec full rotation, torque motor optional).**
- **Maximum table load of 600 kg.**
- **Traori / Kinematic functions for 5 axis simultaneous machining.** *UMC-5X only.*
- **12,000 / 15,000 rpm in-line spindle or high speed 18,000 / 24,000 rpm motorised built-in spindle.**
- **High pressure through spindle coolant system.**

All **XYZ** CNC machine tools come with free training, full 12 month warranty,

XYZ Machine Tools

To learn more please call 01823 674200

MACHINE TOOL DEMOS ARE AVAILABLE AT ANY OF THE XYZ UK

XYZ UMC-5X

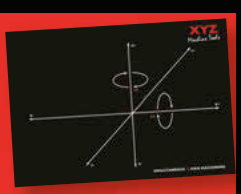
BOTH COME WITH **FREE TRAINING** for 3 people over 3 days.

FROM £149,625 +VAT

DIRECT DRIVE HIGH TORQUE MOTOR 90 RPM NO WORM OR WHEEL

- Side-mounted 24, 30, 48 or 60 tools ATC for quick tool changing.
- Linear scales X Y and Z (optional on XYZ UMC 4+1).
- High precision encoders on A and C axis pivot centres.
- Thermal growth compensation.
- Gantry frame machine.
- Over 200 installed in Europe.
- Comes with fully dedicated 5 axis XYZ Service, Programming and Sales Engineers.

Call today for the full technical 12 page brochure.



ISO 9001:2015 FM 538421 · ISO 14001:2015 EMS 546518 · ISO 50001:2011 EXMS 642457

Call today to book your demo

How many set-ups does it take to produce a dice on a VMC ?

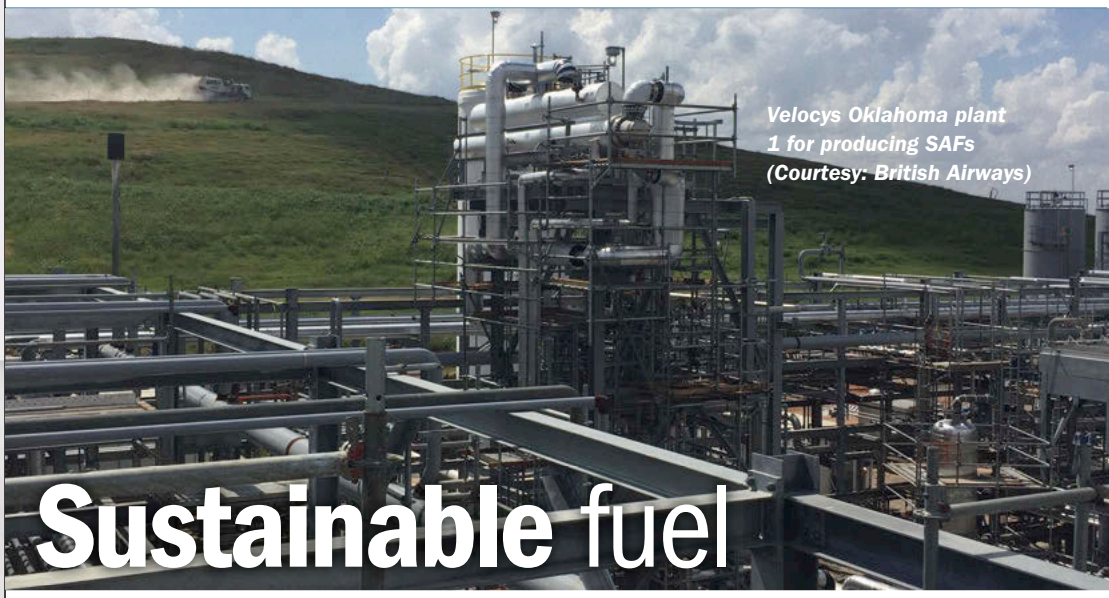
On a normal VMC:	*6 set ups*
XYZ UMC-5X:	*2 set ups*
XYZ UMC-5X + XYZ 2-OP:	*1 set up*

extended warranties available, free programming helplines, nationwide service engineers.

ALL IN UK STOCK NOW

sales@xyzmachinetools.com **www.xyzmachinetools.com**

SHOWROOMS DEVON BLACKBURN NUNEATON SHEFFIELD & LONDON



Velocys Oklahoma plant 1 for producing SAFs (Courtesy: British Airways)

Sustainable fuel

Andrew Allcock reviews current progress on sustainable aviation fuels (SAFs). Less sexy than the topic of electric aircraft (p9), it is, however, technically the nearer term solution for cleaner air travel

Our feature on p9 gives a detailed overview of the interesting developments in electric propulsion, but the nearer term solution to reducing aircraft emissions is greater use of biofuels, or SAFs.

According to Ilkka Räsänen, director of public affairs at renewable diesel producer Neste, quoted in *biofuels-news.com*: "Air traffic is predicted to double during the next 15 years. The aviation industry has committed to carbon neutral growth starting from 2020, all while reducing net carbon emissions by 50% by 2050 [from 2005 levels]. Currently, renewable jet fuel offers the only viable alternative to fossil liquid fuels for powering aircrafts." That's not hard to understand. With the average service-life of passenger and freight aircraft around 21 and 33 years respectively, were all new aircraft manufactured from tomorrow fully electric, the transition would take two to three decades. But SAFs are not a new area; Virgin Atlantic undertook the very first biofuel flight in 2008.

The go-to official document on aviation environmental matters is the *European Environment Agency's European Aviation Environmental Report*, with the 2019 edition being only the second such publication. Aviation currently accounts for 3% of global carbon emissions, something under 10% of all transportation emissions globally, but growing. The report states that alternatively fuelled aircraft are unlikely to be commercially ready before 2030. On the other hand, it says "the last decade has seen considerable progress in developing SAFs produced from bio-based feedstocks that have a lower carbon intensity, and which consequently could play an important role in mitigating the environmental impact of aviation".

It notes that there are a number of processes to produce SAF, of which six 'production pathways' have been certified for blending with conventional aviation fuel, but that "only a few of the ASTM-certified pathways are supplying fuel on a commercial scale". (ASTM-compliant SAFs are effectively drop-in replacements.)

Europe is a key player in the wider biofuel production technology sector and has a maximum potential output of approximately 2.3 million tonnes/year; about 4% of the total EU conventional fossil aviation fuel demand. But that potential is not being realised. Says the report: "The uptake of SAF is likely to remain limited to below 1% of total EU aviation fuel consumption in the near future… It is clear that the goal previously set by the group

Editor – **Andrew Allcock** MIET
Art editor – **Neil Young**
Sales director – **Joe Opitz**
Sales manager – **Beverly Jepson**
Circulation manager – **Chris Jones**
Production – **Chloe Jeakins**
Publisher – **Jon Benson**
Cover image: E-Thrust serial hybrid propulsion system – Airbus

Machinery (incorporating *Sheet Metal Industries*)
MA Business, Hawley Mill, Hawley Rd, Dartford, Kent DA2 7TJ
Tel: 01322 221144

(ISSN print 1753-0482/online 2049-3312)
Printed in the UK by Pensord Press

MA BUSINESS
. MARK ALLEN GROUP COMPANY

for 2 million tonnes of SAF to be produced annually by 2020 will not be met."

The issue is demand, of which the report says: "The price of bio-based aviation fuel relative to fossil-based kerosene is one of the major barriers to its greater market penetration." The EU is undertaking a number of actions to stimulate greater use of SAF, but the report notes that aviation bio-fuels are not part of the Renewable Energy Directive (RED) targets adopted in 2009. Though it adds that in 2015, the RED was amended to recognise the possibility of a so-called 'voluntary aviation opt-in' to implement in national legislation, which was taken up by the Netherlands and, how about this, the UK.

So what action is underway? According to the *European Aviation Environmental Report 2019*, since May 2016, Airbus has offered customers the option of taking delivery of new aircraft that can use a blend of biofuel. More than 25 aircraft have been delivered to date to three different airlines. And in February this year, Deutsche Lufthansa AG signed a letter of intent with Raffinerie Heide (Heide refinery) for the production and use of environmentally friendly synthetic kerosene. Last October, Virgin Atlantic said it had teamed up with American bioengineering firm LanzaTech to create renewable jet fuel that will power planes travelling from Shanghai and Delhi to Heathrow within two to three years. More recently, Neath Port Talbot council and LanzaTech are working on a plan to use gases from Tata's Port Talbot steel-making plant to produce fuel.

Also here in the UK, the 'Sustainable Aviation Fuel Special Interest Group' of the Innovate UK-backed Knowledge Transfer Network held an event earlier in the year.

Following that, Leigh Hudson, sustainable fuels manager at British Airways and chair of the Fuels Working Group at Sustainable Aviation, said: "We see massive potential. One of the most important outcomes is the strong evidence base showing how many organisations there are in the UK working on SAF. We didn't know this before SAF SIG." IAG, British Airways' parent company, has stated that biofuels could provide up to 25% of its fuel by 2050. It will invest a total of $400m on alternative sustainable fuel development over the next 20 years.

Indeed, in August this year, Italto Immingham Ltd, a collaboration between Velocys, British Airways (BA) and Shell, submitted a planning application for a commercial-waste-to-fuel plant. It is the first waste-to-jet-fuel plant in the UK and Europe, it is claimed. The proposed plant will take hundreds of thousands of tonnes of household and commercial solid waste, with the SAF reducing net greenhouse gases by 70%, compared to the fossil fuel equivalent – equal to taking up to 40,000 cars per year off the road, it is further claimed. The site is near Immingham, close to the Humber Estuary. Commercial volumes will be produced in 2024. IAG, British Airways' parent company, underlines that it was the first airline group worldwide to set its own carbon emissions targets, as it happens. In 2016, it announced that it would improve the group's performance, moving from 95.4 grammes of CO_2 per passenger-kilometre in 2015 to 87.3 by 2020, but its reduction efforts also include reducing emissions from non-flying assets/services, it should be understood (see IAG's latest report: *https://is.gd/udiyur*).

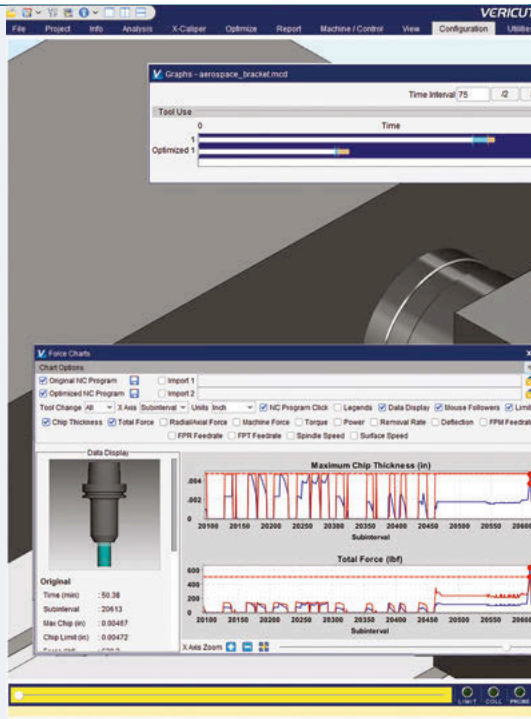
The 'Sustainable Aviation Fuel Special Interest Group' event also saw University of Birmingham present an update on its flexJET project. Set up in the 2018, this €15m project, which involves three partners across five EU countries, aims to build a demonstration plant that converts food waste and waste vegetable oil into SAF. One of the objectives is to deliver 1,200 tons of SAF (ASTM D7566 Annex 2) for commercial flights to British Airways. The project runs until 2022.

Just last month, University of Birmingham announced it is to lead the UK's NewJet+ Network, which also runs to 2022, commencing next month. The network will explore the barriers to adopting SAF, such as stakeholder confidence and infrastructure, as well as the benefits, including reducing CO_2 and, importantly, the non-CO_2 emissions.

Finland is working at the opposite end of the process, creating demand. The country's government aims for Finland to be a carbon-neutral country by 2035, with a target of 30% biofuel share in aviation part of that ambition. And the Norwegian government has set a goal of achieving emission-free domestic aviation by 2040 (although this is much linked with electric aircraft developments, see p10).

The second UN International Civil Aviation Organization (ICAO) on Aviation and Alternative Fuels meeting in 2017 adopted a 2050 vision for SAFs that called on states and all stakeholders to ensure that a significant proportion of fossil-based aviation fuels be substituted with SAF by 2050. Quantified targets will only be agreed at the next conference, to take place by 2025, however. So, although SAFs seem less of a challenge than electric/electric-hybrid aircraft, the race is closer than might have been imagined. ■

Keeping pace with aerospace



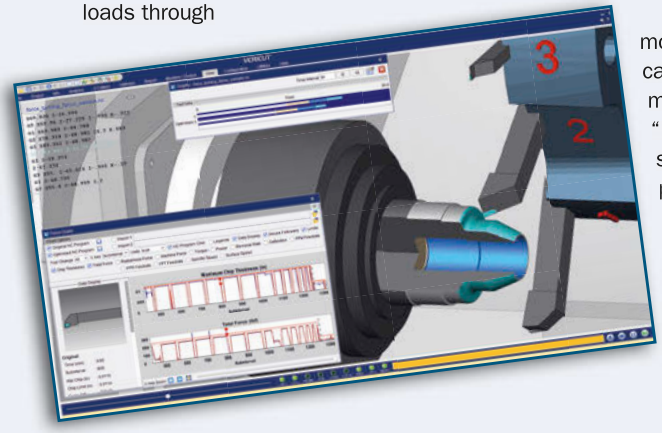
With an ongoing demand to improve both the efficiency of the finished aircraft, as well as the manufacturing process, to meet order books that stretch out years ahead, businesses in the aerospace sector are constantly striving to gain any advantage. NC simulation, verification and optimisation software VERICUT provides many with the opportunity to improve. *Machinery* spoke to CGTech's Technical Director, Gavin Powell, about the latest software developments

Of course, simulation technology must keep pace with rapid advances in manufacturing so that businesses can learn to use and protect new equipment. Recent advances in VERICUT include support for additive manufacturing and hybrid manufacturing methods, robotic welding and laser sintering, as well as grinding while dressing to change the shape of the grinding wheel, including for creep-feed grinding used to produce fan blade roots.

Explains Mr Powell: "Simulation data can come from many sources, such as CAD/CAM systems, tool data management systems, PLM systems and the Internet. Interfaces provide quick access to these sources to streamline simulation set-up, create more robust simulations, run faster and catch potential problems.

"The optimisation of the cutting process is achieved with VERICUT Force, using multi-channel dyno-tested and proven cutting data to predict cutting forces, deflection potential and spindle loads through simulation. It works extremely well with the range of difficult-to-cut materials used in the aerospace sector. The Force module calculates ideal feed rates for each cut while simultaneously limiting cutting forces and spindle power demands to safe levels. Interactive Force Charts show trends, expose overload conditions and identify underused tools with the potential for optimisation.

Within the aerospace sector, as well as other advanced manufacturing industries, simulation, verification and optimisation have become critical. On-machine prove-outs are time-consuming and visibility is often poor. With simulation, users get clear views of the cutting process, regardless of machine or set-up complexity. By using digital machines to simulate the NC programs that will run on real machines, customers eliminate potential crashes and tool reach problems, analyse cutting methods and prove out new NC programs faster; keeping CNC machines free to produce parts.



"New CNC machines cost more, move faster and are more capable than older generation machines," Mr Powell adds. "For new CNC machines, simulation plays a vital role in post-processor development and preparing NC programs in advance for when the machines come online. Simulation can prevent problems such as: machine crashes; improper code use; set-ups, cutting strategies and tools that do not work; and incorrectly machined parts.

"Machine shops need to make parts faster and with cost in mind. NC program optimisation enables cutters and machines to be used to their full potential, increasing throughput and efficiency. As companies acquire new NC equipment, simulation helps evaluate part manufacturing strategies to determine which equipment will work best even before production starts."

So, what can these simulation and verification techniques offer today that was not possible a few years ago? Says Mr Powell: "Simulation incorporates digital twins of CNC machines to show how machines will react to the codes in NC programs and more accurately predict machining times. Simulation that also incorporates a machine's subroutines, cycles and parameter settings improves digital twin accuracy by accounting for machine limitations and nuances.

"Meaning users can simulate entire NC manufacturing processes end-to-end, not just one operation or program. By linking manufacturing operations (set-ups) and transferring the stock workpieces between them, users see the effects of all operations applied in the order planned to produce parts.

"Cloud-based repositories and some tooling manufacturers' websites also offer 'smart' tooling; tool assemblies accompanied by recommended cutting feeds, speeds and usage parameters.

VERICUT Force supports both milling and turning (below) operations, delivering safe cutting and optimisation

A vast number of the world's aerospace manufacturers trust VERICUT to deliver safe and productive NC code

This information helps NC programmers to set cutting limits to improve performance and tool life."

Automated electronic reports can be generated to document the manufacturing process, including set-ups, cutting tools used and machining times, and to prove the simulated finished part matched the intended design. This information can help with shopfloor planning and scheduling while providing useful data for more accurate cost estimation.

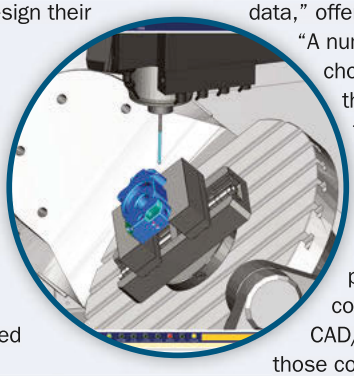
Simulation has more to offer than just verifying NC programs, though. For example, states Mr Powell: "VERICUT can save a Review file of the entire simulated manufacturing process. Machinists, QA and other personnel can use licence-free Review files to see how tools approach and exit the workpiece, check simulated cut part condition at any stage of cutting and compare it to real parts at the same stage, and share machining strategies or concerns with others."

Simulating NC code programs on digital twin machines that mimic the real machine's capabilities and limitations is the only reliable way to know how the NC codes will be interpreted by the machine's control system, and how it will move to cut the part.

Many companies in the aerospace sector looking for a simulation product are also looking for optimisation capabilities. Even if they are not ready to optimise NC programs today, they want to be prepared.

"Choosing a simulation provider with a reputation for great support, training and consulting options can determine how quickly and how well software gets implemented. Access to local support, prompt responses to technical challenges plus partnering to create innovative solutions are critical," Mr Powell points out.

New from CGTech is a Force Calibration product that enables customers with dynamometer equipment or proprietary materials to design their own scientific cutting tests, measure cutting forces and calibrate materials for use in Force optimisation.



Two-way communication between leading CAD/CAM systems such as Siemens NX and VERICUT sends NX operations to VERICUT for optimisation, then updates CAM operations with optimised feed rates and motions.

VERICUT Version 9 allows users to control what is seen, with graphics that display sharper views of the cutting process and more realistic CNC machines, tooling and machined parts. Enhancements for hiding/showing objects, translucency and sectioning offer clear views of the cutting process, regardless of machine or set-up complexity. The flexible viewing environment enables users to rotate or zoom the part while cutting, switch between view types or desktop layouts, and use VERICUT's X-Caliper, Section and AUTO-DIFF functions in any view.

Big data from simulation can provide detailed cutting information, such as predicted machining times, material removal rates, chip loads, cutting forces at the tool tip and spindle power. The information is useful for balancing machine workloads, judging effectiveness of NC programs and providing more accurate quotes for incoming work.

"It doesn't matter how you created the data," offers Mr Powell, adding: "A number of customers choose simulation software that runs independently from, but tightly integrated within the CAD/CAM systems, and is driven by NC code data. This is particularly important for companies with multiple CAD/CAM systems, for those considering changing CAD/CAM providers, or who may edit NC programs after creation."

He concludes: "And you don't have to see it to know if it's good. There are a growing number of companies that do not watch the simulations of their parts. They use batch processing that queues jobs to run, then look at the results, such as VERICUT reports, log files and optimisation output. If a problem is identified, users can open in-process models saved automatically during the simulation or look at a Review file to investigate further." ■

VERICUT®

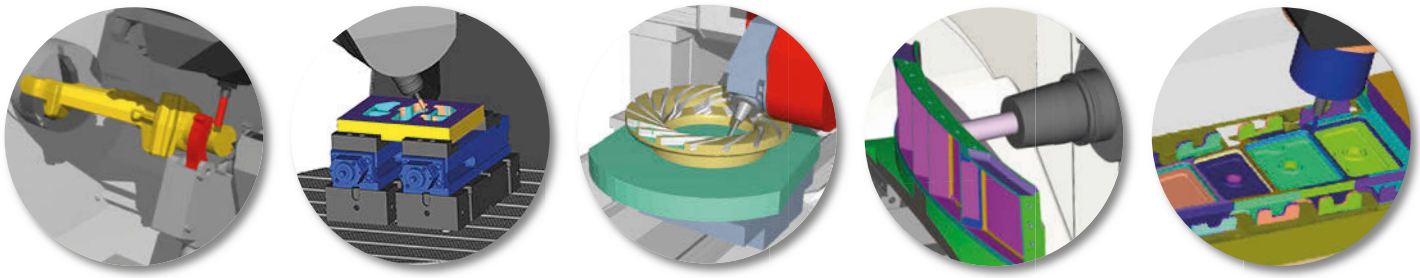
Save time and money with the world's leading CNC verification software

ADVANCED ENGINEERING 2019

30 & 31 October 2019 | NEC, Birmingham

See VERICUT on stand L152

- ✓ Avoid collision, scrap parts and broken tools.
- ✓ Reduce down time & increase productivity.
- ✓ Train without using production time.
- ✓ Speed implementation of new CNC machines.
- ✓ Optimise feed rates for faster cycle times.



In today's competitive manufacturing environment, software verification is essential to your ability to produce on-time, high quality parts at a minimum cost. With VERICUT you can run a part on an unmanned machine and be confident that it will be right the first time, every time.

Visit www.cgtech.co.uk to learn more

Right first time. Every time.

Curtis House, 34 Third Avenue, Hove, BN3 2PD
+44 (0)1273 773538 • info.uk@cgtech.com

CGTECH.co.uk

Rolls-Royce and Airbus are working together on the E-Fan X project

Airbus

Charged & ready

While electric cars are today a reality, albeit we will see many further strides yet in the development of that technology, the aerospace industry has a larger challenge and is still early into its journey. Andrew Allcock offers this snapshot

The ever-ebullient and publicity-friendly Elon Musk of electric car maker Tesla fame was reported by online organ Electrek (*https://is.gd/axirol)* in July this year as saying that electric aircraft would be put into use within five years. He already has a design for an electric vertical take-off and landing aircraft, in fact. But battery technology must improve, he adds, saying that Li-Ion batteries need to achieve a 400 Wh/kg energy density in order for batteries to best kerosene and make his electric aircraft viable. Today, high cycling battery cells are achieving about 300 Wh/kg of energy density, the article adds.

It should be said that Musk has not yet said that his company is going to produce such a plane, however, or revealed much detail about the design. It is likely that it is one of the many small, personal or taxi-type electric aircraft currently being developed. According to an article on the Royal Aeronautical Society's website published in December 2017 (*https://is.gd/elitun*), there were some 300+ start-ups and established companies active in that area even then.

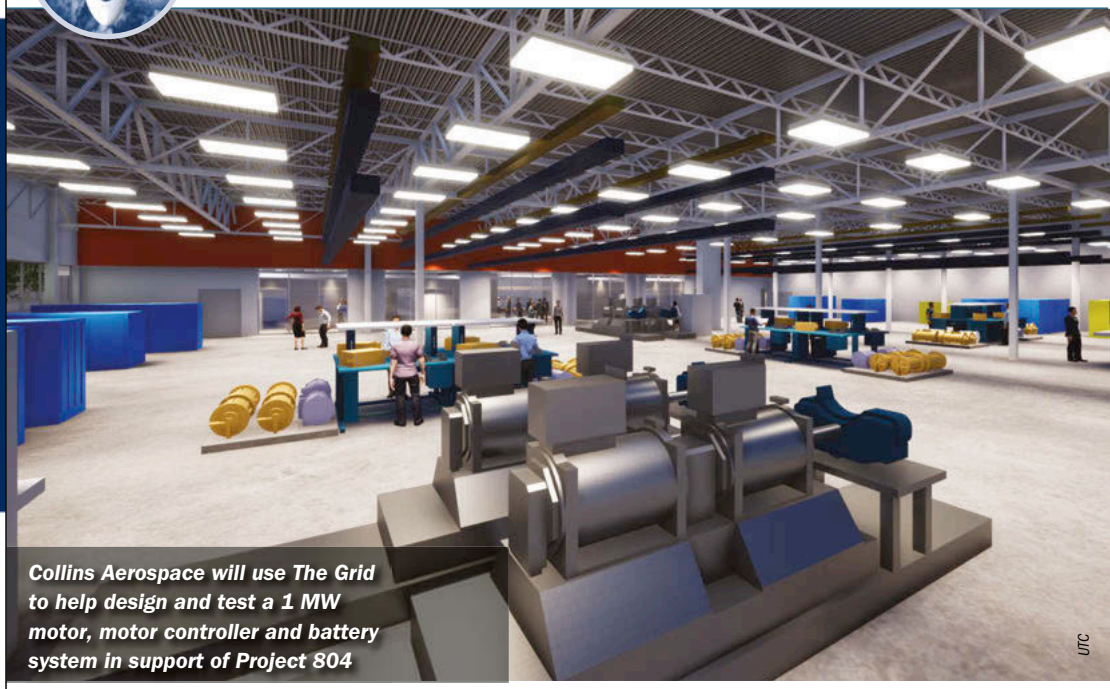
A little bit larger in scale and in June this year, US firm Ampaire's hybrid-electric Cessna 337 Skymaster made its first test flight. The aircraft is a six-seater typically powered by twin 210 hp engines. Ampaire replaced one engine (the rear unit) with an electric motor, creating a system in which the two propulsion devices work in concert (video: *https://is.gd/upemir*).

Ampaire says it plans to establish a pilot programme with Mokulele Airlines on a short commercial route on the Hawaiian island of Maui, using another retrofitted Cessna 337, later this year. The company is also establishing a pilot programme with Puerto Rican regional operator Vieques Air Link and Ampaire says it has signed letters of interest with 14 other airlines around the world.

Going up in scale a bit more and United Technologies Corp (UTC) recently unveiled its hybrid-electric flight demonstrator, Project 804. Its goal is to re-engine and fly a regional turbo-prop aircraft powered by a 2 MW hybrid-electric propulsion system. A twin turbo-prop Bombardier Dash-8 (19 passengers) with a 2 MW hybrid-electric powertrain will be the subject aircraft. The project's group combines the engineering expertise and experience of UTC companies Collins Aerospace and Pratt & Whitney, plus the company's research centre.

To support this effort, Collins Aerospace is making a $50m investment in a lab as part of a larger $150m total investment it expects to make in electric systems over the next three years and builds on the $3 billion it says it has spent on advancing its electric architectures over the past decade. Work on the 25,000-ft^2 lab, called The Grid (video: *https://is.gd/ogasif*) is already underway in Rockford, Illinois, with the project expected to be complete and fully operational by 2021.

Collins Aerospace will use The Grid to help design and test a 1 MW motor, motor controller and battery system in support Project 804. The 1 MW motor will, says the



Collins Aerospace will use The Grid to help design and test a 1 MW motor, motor controller and battery system in support of Project 804

UTC

company, be the aerospace industry's most power-dense and efficient to date. It and the associated motor controller will be used to assist the demonstrator's fuel-burning engine as part of its hybrid-electric propulsion system.

UTC has this to say overall about electric/electric-hybrid propulsion: "Our internal UTC studies indicate that commercial electric and hybrid-electric propulsion could reduce aircraft noise by up to 85%, improve fuel consumption by up to 40%, reduce carbon dioxide emissions by more than 20% and reduce airline operating and maintenance costs by up to 20%."

This project follows an ambitious one that was backed by Boeing but which was aborted in July this year, following America's Zunum Aero's demise. The company was developing a hybrid-to-electric aircraft that seats up to 12 passengers and was to have been available for delivery in 2022. It was to have been a 700-mile commercial aircraft, but the company had 1,000-mile range aircraft in its sights for 2030.

Zunum didn't just have a change of motor technology in mind though, it was also about changing how airlines operate. Said Ashish Kumar, CEO and founder, Zunum Aero: "The shift of the industry to large aircraft and long ranges driven by gas turbines has concentrated almost all air traffic to just two percent of our airports, creating a massive transport gap over regional distances where there is no high speed alternative. As a result, door-to-door times for most journeys are no better than they were 50 years ago. Hybrid propulsion is an industry-changing solution, enabling mid-sized aircraft on regional routes to have better cost efficiencies than airliners."

He may still be right on that, but how airlines operate is not a prominent discussion.

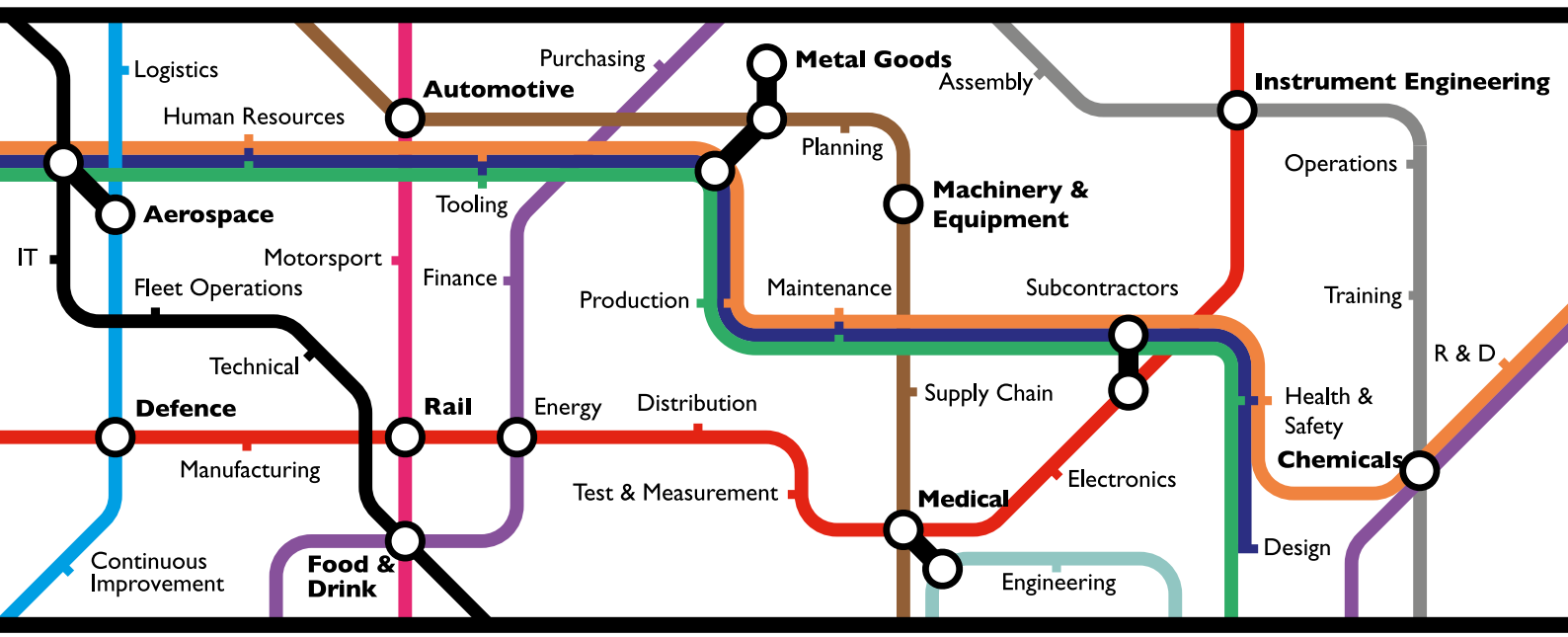
Behind all this activity, though, is the fact that the Global Aviation Industry (ATAG) has committed to achieving carbon-neutral growth as a whole from 2020 onwards, cutting aviation net emissions by 50% by 2050 (versus 2005). In the Europe, there are the technical environmental goals of the European Commission's Flightpath 2050 Vision for Aviation (reductions in: CO_2 by 75%; NO_x by 90%; noise by 65%).

In Europe and in a plane size category similar to UTC's effort, Rolls-Royce has just announced it is to work with Norwegian ailrline Widerøe to electrify its fleet. It is part of the airline's aim to replace and electrify its regional fleet of 30+ aircraft by 2030. (The Norwegian government has set a goal of achieving emission-free domestic aviation by 2040.) Widerøe operates a fleet of 43 aircraft, mainly DeHavilland Dash 8 models, but has recently added four Embraer E2-190 regional jets

Moving to slightly larger aircraft, back in November 2017, Rolls-Royce, Airbus and Siemens announced their E-Fan X project. The hybrid-electric technology demonstrator was anticipated as flying in 2020 (now 2021), provisionally on a BAe 146 flying testbed, with one of the aircraft's four gas turbine engines replaced by a 2 MW electric motor (BAe 146 models have seat capacity from 70 to 112). Provisions will be made to replace a second gas turbine with an electric motor, once system maturity has been proven.

The 2 MW motors and their power electronic control unit, as well as the inverter, DC/DC converter and power distribution system, will come from Siemens. Airbus and Siemens had already started collaborating in 2016, through the so-called E-Aircraft Systems House

The most comprehensive map for reaching UK manufacturing and engineering



MA Knowledge – providing the perfect route to new business

www.ma-knowledge.com

Prospecting	**Data Cleaning**	**Emailing**	**Lead Generation**
Telemarketing	**Postal Marketing**	**Research**	**Data Enhance**

01322 221144 **joe.opitz@markallengroup.com**

MA KNOWLEDGE
A DIVISION OF MA BUSINESS

Wright Electric

EasyJet and Wright Electric are collaborating on a 270 nautical mile range aircraft for 2027

collaboration. It was to develop and mature various electric propulsion system components and demonstrate them, on the ground, across various power classes. Since then, Rolls-Royce has purchased Siemens' E-Aircraft unit, which has been running for some 10 years and made notable achievements. Its 260 kW, 50 kg motor powered a plane in the certification category CS23, winning for the first time a Permit-to-Fly in purely electric mode. A plane powered by the motor set a speed record in 2017, in fact (200+ mph, *https://is.gd/aviwac*).

Rolls-Royce will supply the rear AE2100 gas turbine (used in the C-130 Hercules' turboprop), the 2 MW generator and will, with Airbus, convert the fan to take an electric motor. An existing RR design from its AE3007 engine will provide the fan and nacelle.

In August, it was revealed that ground tests of a compact 2.5 MW generator had started in Norway, at Rolls-Royce Electrical Norway's Trondheim facility. The unit will be integrated with the Rolls-Royce AE2100 turbo-prop.

Moving to larger aircaft still and Airbus signed a Memorandum of Understanding (MoU) with SAS Scandinavian Airlines in May for hybrid and electric aircraft eco-system and infrastructure requirements research. Collaboration started in June 2019 and continues until the end of 2020.

Priot to that, in September 2017, EasyJet announced it was developing an electric 180-seater, 270 nautical mile range model for 2027 with US company Wright Electric. The latter's web page says: "Wright Electric's goal is for every short flight to be zero-emissions within 20 years. Our first plane is an airliner designed for flights like New York-Boston, London-Paris, and Seoul-Jeju."

It is starting off with a smaller target, however. Wright reports it has been working for the past year on a hybrid-electric nine-seater for the private market. "The design for our hybrid-electric plane is a little like that of a Porsche Panamera — a fuel engine and an electric motor work together to power the same vehicle. Applications of this plane include island hopping, crop dusting, skydiving, and bush piloting." The company has posted a video of its fuel engine and electric motor running simultaneously – *https://is.gd/exilaj*. First test aircraft flight is scheduled for Q4-2019, the company says.

These are just a few of the current initiatives globally, but they give a sense of the direction of travel. Electric and electric-hybrid power systems will gradually and very definitely come to the aviation sector. ■

RR electric record initiative

Combining aerospace engineering and Formula E auto racing's high power battery development, Rolls-Royce's ACCEL initiative is developing a small plane that is all-electric, aiming to do so in two years, with completion stated as this year. The plan is to set a new benchmarks for an electrically powered aircraft, including highest power density achieved for a propulsion battery system and gaining the all-electric air speed record, targeting over 300 mph. *https://is.gd/donelo*

10TH ANNIVERSARY

beea

british engineering excellence awards

Celebrating

A DECADE OF EXCELLENCE

Join the UK's leading design engineers and tomorrow's rising stars as we unveil the winners of the 2019 British Engineering Excellence Awards

Where
The Landmark London

When
11th October 2019, 11.30am

What
Drinks reception followed by a 3-course lunch

Host
Dr Lucy Rogers, science author, inventor, and a judge on the BBC2 show Robot Wars.

Book your seat now and join us as we celebrate British innovation and engineering at its very best

BOOK YOUR PLACE NOW

WWW.BEEAS.CO.UK

HEADLINE SPONSOR
DISTRUPOL
A Univar company

GALLERY SPONSOR
RS

CATEGORY SPONSORS
GoodFellow
LGMOTION UK MOTION TECHNOLOGY SPECIALISTS
MiniTec THE ART OF SIMPLICITY

ORGANISED BY
MA BUSINESS
newelectronics
Eureka!

Keeping the swarf flying

Seven-figure investment in Mazak machines at Middlesex Aerospace; Haas Automation's help rewarded with CLP Engineering's loyalty; Excel returns to Sodick EDM tech; ITC slashes cycle times with Widia tooling; Schunk Intec/Walter aerospace machining demo impresses; Lang clamping/workholding partnered with Matsuura machines at Merc Aerospace

Mazak machinery supports Middlesex Aerospace past, present and future

Hampshire-based aerospace manufacturer Middlesex Aerospace invested Mazak (*https://is.gd/otocah*) full 5-axis machining and automation technologies, signing a seven-figure sum order to purchase three machining centres to be supplied by its long-term machine tool making partner.

Says Laurence Foulds, managing director: "We have worked with Mazak as our principal machinery partner for over 20 years. We initially started with some mill-turn lathes, but quickly progressed to the Integrex multi-tasking range. Given the application-critical nature of the parts we manufacture, we need absolute trust and confidence in our production equipment to work to the ultra-precise tolerances mandated by our customers. Having worked with Mazak for over two decades and purchased over 16 models, our confidence in their machines is unwavering."

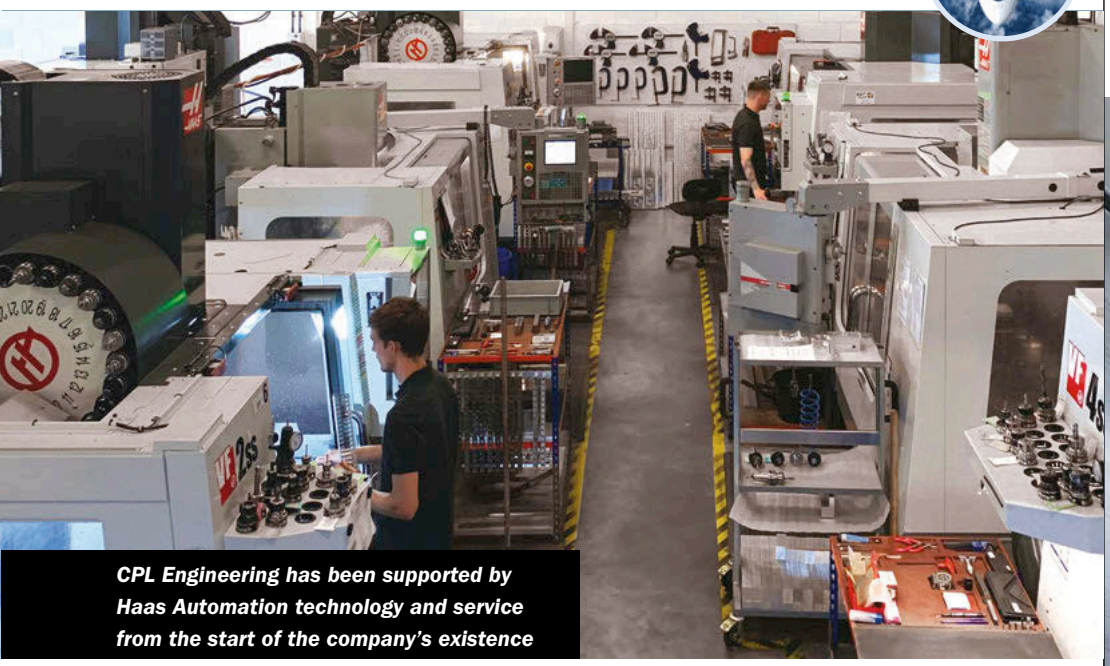
The company's most recent investment comprises two Variaxis i-series simultaneous, full 5-axis machining centres, including one with an expandable large-capacity tool magazine to support high-mix, low-volume production, as well as a horizontal machining centre from Mazak's HCN-4000 series, also complete with extended tool storage system.

Automation and 5-axis Mazak technology are powering Middlesex Aerospace's ambition

The new machines will allow Middlesex Aerospace to boost its production capacity, particularly in the manufacture of smaller workpieces, and keep pace with demand from its customers around the globe. In addition, the new machines will help the company further improve component quality whilst also increasing its production volumes.

Foulds adds: "One of our major focuses going forward is increasing our unmanned production capacity. We've worked very closely with Mazak with our most recent investments to achieve high-value-added machining on an unmanned basis, on very complicated parts. Historically, unmanned production has largely been about fairly simple components. Now we're able to make some very, very sophisticated components from difficult-to-machine materials; not just from aluminium, but different steels, iron and other harder materials. Ultimately, we aspire to achieve a 90%-plus running uptime for lights-out unmanned manufacturing, 168 hours a week. That is our objective and we believe it is achievable."

And he concludes: "We are very confident we will be able to double our current eight-figure turnover over the next 10 years. We will do that, not by producing twice as much as we do now, but by branching out into new products. As such, investing in two 5-axis multi-tasking machines and a customised horizontal machining centre was absolutely necessary."



CPL Engineering has been supported by Haas Automation technology and service from the start of the company's existence

Haas Automation helps start-up, wins loyalty

Haas Automation helped Chris Edmondson and Paul Foster when they were setting up their company, CPL Engineering.

Today, aerospace is the largest industry served, but CPL also works hand in hand with companies such as Teledyne Defence and Space to develop products used in space, telecommunications and the Ministry of Defence. CPL is also well respected in the motorsport industry.

Taking the company's first steps, managing director Edmondson began looking for a CNC machine, but found that most of the suppliers were not eager to help a fledgling business. It was at this point that he contacted his local Haas Automation (*https://is.gd/fucuba*) salesman. He says: "Haas bent over backwards to support us. We had no idea which model we needed, but they spent hours with us going through the options, then we had a day at the showroom viewing demos. We were sold. It was obvious that the build quality was second to none. Like for like, the Haas machines stand head and shoulders above the rest."

Edmondson opted for two VF-2 vertical machining centres, with one having recently been traded in for a new model, the other has run every day since the company began. "It's as good for repeatability as a brand new machine and it's been very reliable."

Investments have been made in a further nine Haas machines over the past few years, including six Super Speed vertical machining centres, which boast 12,000 rpm spindle, 24+1-pocket side-mount toolchanger and 35.6 m/min rapids.

Edmondson again: "The Super Speed machines are superb. They have improved our cycle times by ten-fold. All our programming is completed offline, so we simply load the programs in and press 'Go'. We can run an extra shift overnight, unmanned without any worry.

"What I like most about the machines is that, old or new, the controls are the same. The buttons are laid out and labelled identically and this consistency helps our operators enormously. Whenever we get a new machine in, we have half an hour with the trainer to show us any improvements, then we're cutting metal."

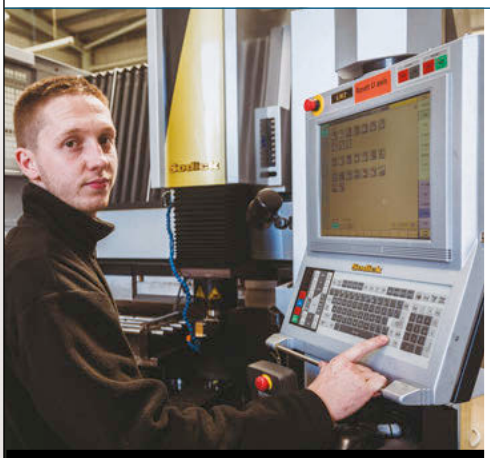
Service is also an important factor, he notes: "Across 11 machines, in all the years we've been using Haas our downtime has totalled less than two weeks. The service is absolutely top class. It's something we can rely on."

Having been awarded ISO 9001 certification, the company is applying for AS9100 and is putting the finishing touches to an additional unit, increasing total capacity to 3,200 ft^2.

"Our existing customers are always asking us to do more for them. This facility will enable us to offer them everything they need," Edmondson concludes. More Haas machines look a likely need, then.

Excel switches back to Sodick, praising the technology's capabilities

EDM specialist Excel Precision Group has enhanced its wire and spark erosion capabilities by acquiring two new Sodick machines from Sodi-Tech EDM (*https://is.gd/muvegi*). Installed at the company's Gloucester facility, which has AS9100 rev D and NADCAP AC7116/3 Rev B approval in place for both



Excel Precision has opted for Sodick EDM technology

spark and wire erosion, the arrival of the Sodick ALC600G wire EDM and AG60L die-sink EDM will underpin a number of important contracts across both the civil and military aerospace markets.

Established in 1978, Excel Precision Group operates from two modern facilities in Gloucester and Leeds, which together house over 30 CNC wire and spark erosion machines.

"Few EDM subcontractors have both AS9100 and NADCAP approval," states Steve Batt, operations director at the Gloucester facility. "This level of process control allows us to serve an extensive number of aerospace and defence customers. In addition, we currently hold company approvals from BAE Systems, Rolls-Royce, Goodrich, Safran Landing Systems, Dowty Propellers, Messier Dowty, MT Satellite, GE Aviation, Moog Aircraft Group, UTC Aerospace Systems, Mettis Aerospace and Triumph Actuation Systems."

Along with the need to replace older machines, part of the reason behind the company's investment in Sodick technology was due to the imminent ramp-up of an existing defence contract that is currently scheduled to run until 2022.

"We looked at both Sodick and our existing supplier of EDM machines, but the test cuts provided by Sodi-Tech EDM were simply better," Batt says. "In particular, the surface finish produced by the AG60L spark eroder really caught our attention. Due to the presence of debris, some machines struggle to replicate the surface finish achieved on the sides of parts on the bottom face. However, this proved no such issue for the AG60L."

The AG60L has been set to work producing a variety of aerospace parts, including stainless steel actuator components. In total, the aerospace sector commands about 40% of the machine's time. The other Sodick machine, the ALC600G wire EDM, has around 50% of its output sent to aerospace customers, including the titanium defence part mentioned.

"Compared with our old machines and process, using the ALC600G has transformed our operation for this component," Batt highlights. "For a start, we previously needed two machines, whereas now the part is completed in its entirety on the ALC600G. Also, our old machine would only achieve a 90% pass rate on an angled face with a 5 micron tolerance. With the Sodick machine, the pass rate is 100%. That step-up in quality makes a real difference on high-value-added parts such as these."

He concludes: "We've not had Sodick machines at Excel since before 1995, but we're very pleased to make the switch back. The technology has moved on considerably and we cannot fault the machines or the team at Sodi-Tech EDM, who have been very supportive since installation in early 2019. Through our own mistake, we once accidently set off the fire extinguisher on the AG60L, but the response was excellent and we were back up and running the next day."

ITC sets Widia tooling to work at aerospace firm, delivers welcome benefits

With a host of 3- and 5-axis machine tools from DMG Mori (*https://is.gd/equmos*), Mazak (*https://is.gd/otocah*) and Hurco (*https://is.gd/utebev*), a Preston-based company has benefitted from the technical expertise of Industrial Tooling Corporation (ITC, *https://is.gd/etamit*).

The aerospace firm boasts accreditations from OEMs like Airbus, BAE Systems, Leonardo, Gardner, Magellan and many more, and challenged ITC with the task of improving productivity on an aluminium solid billet sub-assembly for the aerospace industry that initially saw competitor tooling used.

Working against the other firm's 50 mm

ITC put Widia tooling to work at a leading aerospace firm, scoring multiple benefits

diameter shell-mill tool, ITC technical sales engineer Gary Murrey introduced the Widia VHSC indexable end-mill range, with impressive results. The existing cutting tool with four insert pockets was running at 11,000 rpm (1,700 m/min) at 4,000 mm/min feed rate and 4.5 mm depth of cut.

The Widia VHSC end-mill was applied with a 2 mm radius insert and run at a surface speed of 1,800 m/min at a feed of 0.2 mm per tooth, which equates to a feed rate of 9 m/min, and with the 4.5 mm depth of cut retained. That said, the better stability of the Widia VHSC is offering the opportunity to increase the depth of cut to further advance cycle time reductions. However, with an initial cycle time reduction in the region of 50% over a leading competitor, this prominent aerospace manufacturer is said to be delighted with the improved cycle time and extended tool life. The cycle time for the aluminium solid billet sub-assembly with the Widia VHSC was 12 minutes, 18 seconds, more than 50% less than the previous cycle time. Not only did the ITC solution improve cycle times for this end user, it also equated to a unit price reduction of 40%.

Walter & Schunk Intec put on a machining demonstration in Sheffield recently

Aerospace structural part machining and workholding demo wins praise

Tooling expert Walter GB (*https://is.gd/xowamo*) joined forces with workholding specialist Schunk Intec (*https://is.gd/nuyevi*) to host a customer innovation day to showcase best-in-class 5-axis aerospace machining at the Knowledge Transfer Centre in Sheffield.

Aerospace production specialists learnt how the companies' new tooling and workholding innovations can bring substantial benefits to the machining of aluminium wing ribs, witnessing the reality at the AMRC with Boeing Centre where a demonstration part was machined on a Starrag (*https://is.gd/akakav*) Ecospeed machining centre.

Jim Dale, Walter's component manager, business & application development, outlined the distortion and machining challenges presented when producing one-hit finishes and tight corners, for example, on aluminium workpieces having wall thicknesses of only 1.5 mm thick and with 6 mm radii.

The sample wing rib, measuring 1,500 mm long by 280 mm wide and 80 mm high, and with pockets up to 50 mm deep, was jointly designed by Walter and Schunk Intec to show the ability of the firms' tooling strategies and workholding technology in overcoming these difficulties in a controlled manner.

Says Dale: "In addition to applying a number of new Walter milling cutters, including an innovative three-flute cutter and inserts with a newly-developed coating for extended tool life, together with Schunk Intec's Vero-S Aviation system, we have arrived at the ideal solution."

Vero-S (a pneumatic system) enables all component stresses to be relieved between machining operations by simply releasing then re-clamping the workpiece in-situ – without the need for separate set-ups. "Importantly, we wanted to achieve similar cycle times as if we were using a 'fixed' clamping system," he adds.

Walter created a 'toolbox' specifically to suit the Ecospeed and the workpiece in question, with pre-set feeds and speeds for the tooling to match the machine's 120 kW/30,000 rpm spindle and the capabilities of its Sprint Z3 machining head.

"Developing and supplying 'pre-set' tooling packages to suit specific machining platforms and processes is one of the strengths of Walter's Engineering Kompetenz strategy," Dale explains. "And in terms of our aerospace customers, it is successfully being applied globally to titanium and aluminium structures, as well as to engines and landing gear programmes."

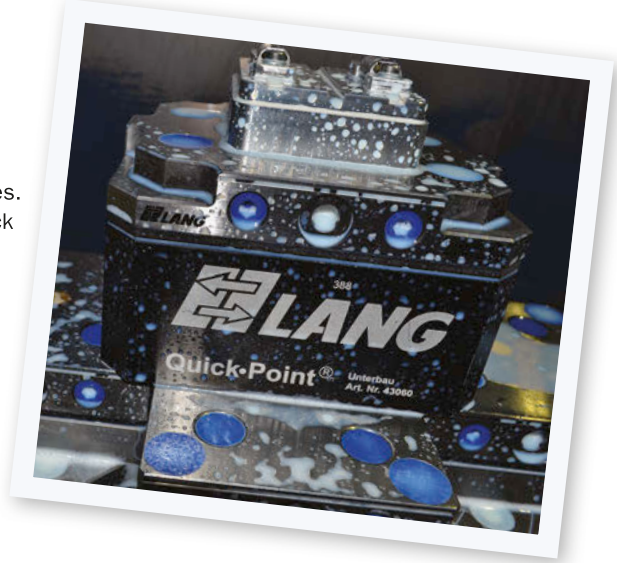
Commenting on the success of the event, Walter GB's business development manager, Neil McKinnell, says: "The event was a great success, when taking into account we were addressing a niche part of the aerospace manufacturing industry.

"There is significant movement in the aerostructure machining sector with regard to establishing best practice, in line with

projects aimed at next-generation aircraft, and we were able to show that we are fully aligned with these OEM and Tier 1 initiatives.

"We have received very positive feedback and significant interest in the machining strategies and tooling that were demonstrated."

Likewise, Schunk Intec's general manager, Marcel Machado, adds: "We couldn't be happier. The event was a great opportunity to show a complex technology performing live. Attended by a highly technical group representing all the main names in the aerospace industry, the event was a true reflection of the work being performed at the AMRC."



Merc Aerospace has complemented each of its four Matsuura 5-axis machining centres with Lang workholding technology

Lang clamping system suits multi-machine cell for Merc Aerospace

Merc Aerospace has added an additional Matsuura MX-330 PC10 5-axis machining centre, bringing the number of machines up to four for its dedicated Matsuura (*https://is.gd/voxovu*) cell and has tooled it with Lang workholding purchased from Thame Workholding (*https://is.gd/fahawo*), in similar fashion to its existing equipment.

Based in Lancashire's 'Aerospace Valley', Merc Aerospace specialises in the manufacture of tight-tolerance parts to demanding deadlines in small to medium volumes. The company has been serving the aerospace sector for more than 40 years, with aerospace-related work representing the vast majority of its work.

Prior to the installation of the company's two original Matsuura 5-axis machining centres, thorough research was undertaken into the most suitable workholding systems so as to realise the machines' maximum productive potential. The Lang Makro-Grip 5-axis workholding system was chosen, along with Lang's zero-point clamping system to complement that.

Makro-Grip clamps on just 3 mm of material, courtesy of Lang's stamping technology, while the zero-point system, which is said to be the lowest profile zero-point-system on the market at only 27 mm high, provides precise and repeatable mounting of different fixtures.

Explains Merc Aerospace commercial director Richard Meade: "As we purchased both of our original Matsuura MX-520 machining centres and our recently installed models to satisfy increasing demand, we knew that installing these high-yield 5-axis machines was only half of the answer.

"To make certain that we delivered the volumes of high quality components demanded by the ambitious contacts we had committed to, we needed to source a superior range of robust workholding that would not only hold our workpieces securely, but would also be able to minimise our non-productive time spent on set-ups and maximise our machine tools' available production time.

"After considering several alternatives, a demonstration made by Tony Lewis of Thame Workholding convinced us that the Lang workholding ticked all of our boxes. Having now used the ingenious system for some time, we have estimated that we have slashed the time previously spent on set-ups by as much as 75%. In addition, the Lang system provides exceptional rigidity and repeatability of location, when for instance, moving a Lang vice that is holding a part to a second machine tool for further operations.

"When undertaking tight tolerance work, the secure and robust nature of the system has helped us to achieve the required levels of precision and surface finish, thereby enabling us to further reduce our already low scrap rate. It also helps that the various elements of our Lang workholding have the kind of compact designs and profiles that give us excellent workpiece accessibility. This enables us to adopt our preferred, highly efficient one-hit machining approach and to achieve further timesaving."

Praise is also made of the system's cost-effectiveness. "Lang workholding was less expensive than some of the other less able products that we considered," Meade highlights, who adds that a much quicker return on its investment has been achieved than was first calculated. ■

UNITED. EXPERIENCED. METAL CUTTING.

The new Team Cutting Tools from the CERATIZIT Group.

4 experts make up a strong team! **That is the CERATIZIT Group when it comes to metal cutting.** As technology leader we offer the most comprehensive products and knowledge in all areas of the metal cutting industry. Together with our manufacturing expertise Team Cutting Tools should be the first point of contact for our customers. **Our competence brands CUTTING SOLUTIONS BY CERATIZIT, KOMET, WNT and KLENK bring together an all-encompassing service concept with the most modern logistics available.** This allows us to provide a wide selection of innovative products as quickly as possible – when necessary even next day.

CERATIZIT is a high-tech engineering group specialised in tooling and hard material technologies.

CERATIZIT GROUP

Tooling the Future

www.ceratizit.com