

AOPA UK

2018 FLIGHT DIRECTORY

The all-inclusive guide to aviation companies and flying schools around the UK

WATER WATER

Adam Winter explains how water, and its changing states, can alter your flight

COLLISION AVOIDANCE

FLARM offers an affordable collision avoidance solution... but will it solve GA's problems?



The Swiss Army Knife of the Skies

We look at one of the world's most versatile turboprops; the impressive Pilatus PC-12



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WHAT DOES POST-BREXIT MEAN FOR GA?

AOPA has been a consistent supporter of the Annual Duxford Safety Day over past years. We were there again on 14 April as one of fourteen table-top displays from GA associations and other relevant organisations. Lecture presentations were available from the CAA General Aviation Department, NATS, the Royal Institute for Navigation GA Navigation Group (GANG), and D&D. If you have not attended one of these events before, think about doing so; the effort is worth making as, apart from the networking opportunities, the talks provide a good way of catching up with the latest safety issues and developments in GA. Overall, the event was judged highly successful with over 60 aircraft flying in.

Six of us from the AOPA Board attended to answer queries from members and non-members alike. It is always a pleasure meeting AOPA members, and gratifying to receive feedback such as: "keep up the good work...". We are very conscious that pilots and owners have no obligation to join; so we concentrate on doing what is expected of us to maintain the current and future viability of General Aviation in the UK and further afield.

Several questions focussed on general aviation in the UK post-Brexit. Since June 2017, when the topic of this column was just that, it is disappointing to say that there has been little detail emerging from Government regarding the envisaged outcome on the day we leave. This is despite regular engagement with the CAA and the DfT. Recently, however, articles have appeared in the national press expressing concern about future UK involvement in Galileo, the EU's Global Satellite Navigation System (GNSS). Similar concern has also been expressed following the issue on 13 April 2018 of a 'Notice to Stakeholders' from the EC regarding 'Withdrawal of the UK and EU Aviation Safety Rules'. This affects a multitude of areas such as airworthiness, certification, licensing, aircraft operations and registration. AOPA maintains a completely neutral political position on Brexit in view of the wide variation of opinions of our members. However, this does not stop us working hard to achieve the best possible outcome for General Aviation in the UK, as well as pushing for an early resolution, so that businesses relying on GA can plan ahead. CEO Martin Robinson met recently with Baroness Sugg CBE, Parliamentary Under Secretary of State for Transport, with responsibility for aviation, to discuss such topics (see page 7). If a member is concerned that Government is not addressing the situation with due expedition, we recommend that they write to their MP, preferably with a copy to AOPA and the aviation minister. Mention should be made of the contribution to the UK economy that GA makes.

AeroExpo UK 2018 takes place again at Wycombe Airpark on 14–16 June, by which time we should know more. I look forward to seeing many of you there. ■



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CLASSIFIEDS Search for your new aircraft or a share in an aircraft right here! Or if your pride and joy needs something, these are the pages for you.



EDITOR'S MOMENT

It finally seems as if summer is here, at last! It's lovely to sit in the garden in the evening and hear the familiar sounds of a piston engine bimbbling overhead – I just hope that it's a trial flight, or someone taking their first lesson who is about to get bitten by the flying bug. Martin Robinson (page 7) talks about the need to get more people into aviation and how reducing costs will help. Elsewhere in the June 2018 issue there is the AOPA Flight Directory to offer everything you need to know about the UK's aviation businesses. Probably most exciting though is that it's now the season of airshows, expos, fly-ins and gatherings. It's where we as lovers of aviation, can all come together and share our passion of flying. On 14-16 June Aero Expo is taking place at Wycombe. I'll be there and I hope you will too. If you see me, come and say "hi," I'd love to chat about aircraft of any kind over a coffee. Whatever your aviation plans are this summer, I hope you enjoy them and make the most of it.

David Rawlings

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WE NEED THE COST OF AVIATION TO DROP TO KEEP GA ALIVE



Over the past 30 years I've seen a great deal of change in General Aviation and not all of it due to regulation but also due to a lack of a positive policy towards the industry.

Since the 1980's we've been through a national regulatory system to a set of European regulations under the JAA, and in 2003 EASA was born out of the fact that the JAA system only achieved some harmonisation. The EU set the regulatory requirements through the basic regulation which EASA delivered on through rule making activity. The focus in the Basic Regulation was towards the 'highest uniform level of safety' – unfortunately this statement was also applied to the part of General Aviation that fell within the scope of EASA.

Annex II aircraft (now annex I), and their operations, remained part National Aviation Authorities over sight responsibilities. Some states across Europe have large numbers of Annex II aircraft whereas smaller EU member states do not, and it is these states that have sought to integrate Annex II aircraft into the remit of EASA.

With each change the GA industry has had to absorb the financial impact.

The original EASA/commission idea was that by moving the rules and regulations to a higher standard you will improve safety. If you audit a business, and it can be shown it has complied with the rules and regulations then it must be delivering safety. If the rules meet the 'high uniform level of safety' statement, then the system must be safe! The problem with this approach is that sooner or later each rule begins to look like a nail.

Here is why I consider that EASA/Commission in part has failed GA – part of the regulatory process is a Regulatory Impact Assessment (RIA) however the European Basic Regulation never had, as far as I can tell, any form of impact assessment. When EASA

"These projects are research and development only and do not lead to any implementation or mandatory equipment fit"

publishes a rule that delivers on what the basic regulations requires they are required to publish a Regulatory Impact Assessment (RIA) – but there is no form of qualification with respect to the quality of the EASA RIA – I was once told by a senior EASA employee "I don't know how we do it, but we do". This is a shambles, trying to do an impact assessment that fits all EU member states. In the UK, regulators are required to revisit the rules two years after implementation to check if the change achieved what it was supposed to do – if it didn't then they must amend it. But there is no post two-year rule in EASA land! The measurement for success would, in my opinion, be an increase in GA activity, fewer accidents and lower costs – however we have seen accident rates stay roughly the same, declining activity and higher costs.

Back in 1975 a new C172 Skyhawk cost \$20,335 (\$2.02 to the pound) and the average wage in the UK was £15,000. Today a new C172 will cost \$400,000 and the UK average wage is £28,000. Wages have not even doubled in 43 years whereas aircraft prices have risen out of all proportion.

It was reported recently that 17 million people in the UK do not even have £100 saved – so whereas a new Cirrus will set you back £800,000 and an RV10 home built about £100,000 we can see how the non-EASA certified aircraft offer a

cheaper alternative. When I asked the CAA to tell me if EASA aircraft were less safe, the same, or safer than Annex II aeroplanes, the response was EASA aircraft are slightly, ever so slightly safer – but at what cost to the owner? Since the mid 80's the GA fatal accident rates have remained largely unchanged. I do not want to see costs rise for Annex II aircraft owners, but we need prices to fall for EASA-certified aircraft.

The rules for GA still need to be simplified, I hear pilots who are leaving the system say "there are just too many regulations", and too high a price to pay for the activity – When you look at pilot ages, the age profile is rising – again medicals can be and do become an issue, so again if the national medical system is seen to be safe and less costly that is a change that needs to be addressed. The CAA has been progressing this but the EASA system is less enthusiastic – globally this is an issue, and places like New Zealand and Australia are also looking at simplifying medical requirements.

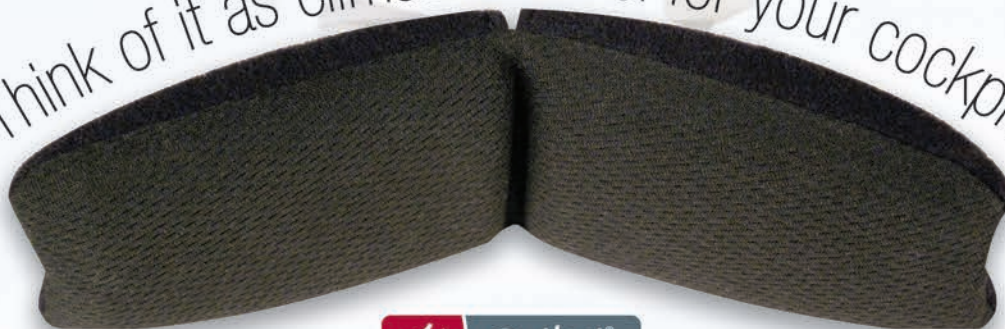
I struggle to believe that since 2003 EASA has improved GA safety overall, mainly due to the perceived complexity of the rules and higher costs (part M for example) – Part-M light, ELA I and ELA II will not reduce cost significantly in my view (happy to be proven wrong) there are fewer student pilot starts and the effect is felt throughout the industry. UK Government needs to develop policies now that will encourage more people to get new skills through general aviation, if the UK is to become the best place in the world for GA. ■



M Robinson

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HELPING YOU STAY FLYING

Welcome to the AOPA Community section of the magazine, bringing you all the news and insight from the world of AOPA...



WORKING FOR YOU

All the news from the MWG



AIRFIELDS UPDATE

Latest on the UK's airfields



PPL CORNER

How water can affect flying



DATA PROTECTION

What GDPR means for AOPA



WORDS Pauline Vahey IMAGES Bruce Cowan

AOPA ENSURING THAT AVIATION IS IMPROVING FOR EVERYONE

The latest updates from the meetings within AOPA that aim to protect you, the pilot, and ensure you're able to fly as and when you want...

The Members Working Group (MWG) and Corporate Members Committee (CMC) both have regular meetings to ensure the world of General Aviation is being taken care of, and that the businesses involved in GA are protected. All members are welcome to attend the Members Working Group meetings. In the latest MWG meeting, which took place on 7 April 2018 at White Waltham, the following subjects were discussed...

APPG GA UPDATE

There was a long discussion of the work the APPG GA is doing including:

AIRFIELDS: The change of licence at Gloucestershire Airport was discussed – the merits of public versus ordinary, and the EASA requirement for airports with over 10,000 movements and a hard runway longer than 800m to switch to public licence.

Concerns were expressed at the recent reported changes at Biggin Hill, where all Flight

"A wider discussion ensued about the data and tools that were being used to justify airspace grabs"

Training Schools had been given six months' notice to cease operations and leave.

The general opinion was that it was in order to gain more movement slots for the increase in the lucrative business aviation activity. Cost sharing flights had also been banned as well as some individuals, although most of those with GA aircraft based at Biggin Hill had not been asked to leave.

John Walker presented his latest report on Airfield closures.



White Waltham, home of the West London Aero Club (WLAC) and the location of April's meeting

AIRSPACE INCLUDING PROGRESS ON LPV APPROACHES:

The AOPA response to the so-called 'Brize Norton and Oxford Airport Airspace grab' had been prepared and submitted by AOPA board directors Mick Elborn and Nick Wilcock, benefitting from Wilcock's previous RAF experience and knowledge as an RAF pilot based at Brize Norton. Wilcock committed to circulating their response.

A wider discussion ensued about the data and tools that were being used to justify 'airspace grabs', referring to the article by Steve Slater, LAA CEO published in the LAA and HCAP magazines. It was also suggested that GA need to be more co-operative and that competence in the operation of RT needs to be improved.

The question was raised as to why the CAA had stalled in approving new LPV approaches. It was discussed that the CAA was fundamentally risk averse and since they approved the approach they believed they bore some risk. However, there was no evidence of deaths using an LPV approach and plenty of evidence of deaths using VFR procedures in IFR conditions.

HERITAGE: Concerns were expressed about RAF Bicester and its longevity, with particular reference to the proposed move into a centre of excellence for Vintage Aircraft as well as Vintage Cars.

Concerns were raised that the Controlled Airspace Infringement Tool now being used by NATS could provide grounds and a final date for closing airfields.

AOPA CEO'S UPDATE

The CEO spoke about the progress of GAINS. The issue was interoperability versus standardisation. GAINS is an aid to support visual

acquisition. Most of the conspicuity world is TAS and TCAS with no interoperability with FLARM and ADSB.

The GAINS project was looking for volunteer pilots and airfields to participate in the testing. This would be 100% funded by AOPA using the funding secured from Europe. The request for volunteers is to be distributed on the website and AOPA e-newsletter.

NEXT MEETING

The next meeting will be at Earls Colne on Saturday 2 June with a presentation to the Club on the previous evening.

DAVID SCOULLER & AOPA

David Scouller, well known to AOPA members, is retiring after more than 20 years as our Chief Flying Instructor who runs the Flight Instructor Refresher Seminars. In that time he has overseen almost 60 seminars. He was also the Chairman of the AOPA Flight Instructor Committee from 2001 to 2010.

He trained initially as an instructor at the RAF Central Flying School and his extensive flying experience includes over 16,000 hours, in more than 200 types of aircraft. Much of this was test flying, attaining responsibilities such as Chief Test Pilot at the Empire Test Pilots School, oversight for the MoD of all military test flying, and Head of Training at Old Sarum and latterly for Western Air at Thruxton, where he will continue to instruct. We shall miss his expertise, and wish him well in his retirement.

At David's final instructor seminar in May, he was presented with a case of specially selected wines in recognition of the long service he has given so willingly to AOPA and all instructors that have undertaken the seminars. His post will be taken over by David Cockburn, whose career includes service in the RAF and with the CAA. The next Flight Instructor Refresher Seminar will be on 7-8 November. ■








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WORDS John Walker IMAGES Wyrldlight

ALL THE LATEST NEWS ON UK AIRFIELDS

John Walker shares his latest findings on the developments of the UK's aerodromes

There are airfields across the UK currently under the threat of closure. Here are the latest developments, updated 27 April 2018.

DEENETHORPE

Site accepted under the Government's Garden Village scheme for development with up to 1,500 homes. The development is supported by the Brudenell Estate, the site owner. Public consultations on a proposed site masterplan commenced in March 2018 prior to a planning application being made in Summer 2018.

FAIROAKS

Surrey Heath Council made a confidential, unsuccessful bid to establish a Garden

Village with 1,500 homes on site under the Government scheme. Tenants were advised later of the proposal and public consultations started in February 2017, with further public exhibitions for a revised scheme with 1,000 homes taking place in April 2018. A local group opposing the Garden Village presented a proposal at public meetings held in January 2018 for an alternative scheme that retains the airfield. Two parties are reportedly interested in purchasing the site as an on-going aerodrome.

MANSTON

An application was submitted on 9 April 2018 by River Oak Strategic Partners for a

"Thanet District Council has rejected the definitive Local Plan submission"

Development Consent Order for the aerodrome as a Nationally Significant Infrastructure Project. Site owners are consulting on a revised masterplan for mixed use which retains 1,199 metres of the runway. Thanet District Council has rejected the definitive Local Plan submission that included mixed use development of the site.

REDHILL

The land owner has proposed a 6,000 to 8,000 home Garden Village. Tandridge District Council public consultation on four potential Garden Village sites including Redhill ended on 9 October 2017. A further consultation on the definitive Local Plan is expected to start in July 2018. ■



Fairoaks is reported to remain as an on-going aerodrome

WORDS Adam Winter

WATER WATER EVERYWHERE BUT NO NEED TO NOT FLY

We all learned in school that water has three states, but how do they affect flying when they're changing from one to the other? Adam Winter explains all...

One of the great things about flying is your interaction with the weather. Unlike coping with the disappointment of a wet picnic, the effects weather can have on aviation can wreak havoc. This is clearly a big subject in the world of aviation so this will be a two-part article with the second part to be published in the August issue of AOPA UK. So now, it's time to start at the beginning.

In order to understand what is going on out there we need to understand water in its three states and what happens during the transition between them. We need to know about heat energy and its absorption and release during these phase changes, and we need to know how water vapour behaves with other gases undergoing expansion and compression.

In this article I am going to discuss the three states of water and the energy exchanges that occur during phase changes. In my next article we will look at the results of these changes in the atmosphere.

START WITH THE BASICS

To state the obvious, water exists on Earth in three different forms or 'states', namely solid, liquid and gas (or vapour). We name the changes between states: melting, evaporating, condensing, freezing and sublimating (when vapour turns directly into a solid without going

ADAM WINTER



Adam is a commercial pilot with more than 30 years' experience. His career has included bush flying in Africa and island hopping in the West Indies, as well as a stint in the airlines. He is also a physics teacher with three years' classroom experience.

through the liquid phase).

We know that the temperature and pressure of the water dictates in which state it will be found. When we measure the temperature of water (or anything really) what we are doing is taking a measure of how much energy the water molecules possess. Heat is a form of kinetic energy; it is the energy due to movement of the molecules in a substance.

IT'S GETTING HOT IN HERE

If we heat water, we are simply making the water molecules move faster. They collide more with each other and we understand and feel this form of energy as 'heat'. Temperature is therefore a measure of the kinetic energy within a substance. The temperature scale and unit commonly used in meteorology is Celsius. Water freezes at 0°C and boils at 100°C at standard sea level pressure. That is how Mr Celsius defined his unit. So when we say that the temperature is 23°C, we are really saying that it is 23°C above the freezing point of water; we are making a comparison. I cook my chicken at around 60°C above the boiling point of water.

If we take one gram of water (about a thimble-full at sea level) and heat it by 1°C we have added one calorie of heat energy – not exactly the same as food energy value kilocalorie. (Specific heat

energy is more commonly measured in joules, about four to the calorie.)

So we can take a gram of water at 15°C, and start adding calories to it until it reaches 100°C (if we add 85 calories). If we now continue adding heat energy, we know the temperature does not go any higher. Something else must be happening to the energy we keep adding.

WATER ABSORPTION

When water absorbs energy and that energy is absorbed without a temperature change, it is called 'latent heat'. The energy is used to break the bonds between the water molecules; once free they become individual molecules of H₂O, and they are very energetic.

This freeing up of molecules is the evaporation process. The water changes state and not temperature. The molecules move around fast and freely and when they come close with each other they bounce away.

The original gram of water contained literally trillions of molecules, and the amount of heat energy needed to break all the bonds in just that one gram of water is a whopping 540 calories! Considering just one calorie can raise the temperature by a degree, the implications become daunting when we consider cooling that gram of water down again because for every gram of water gas that condenses back



Water in all its states needs to be respected, even more so when it's changing from one state to another

into liquid, that latent heat (of evaporation) is re-released. Think of it this way.

IN AMONGST THE CLOUDS

Clouds are made up of liquid water. A smallish fair weather cumulus about a kilometre square at the base weighs about 500,000 kg. A decent thunderstorm can contain over a million gallons of water. Multiply that by 540 calories for every gram and the energies are getting very large.

The phase change from liquid to solid can also be thought of in terms of energy exchanges. one gram of ice at 0°C needs to absorb 80 calories of heat energy to become a gram of water at 0°C.

Air contains water. It is not counted as one of the gases in air (nitrogen, oxygen etc) and indeed reduces the density of air with its presence. At 100% humidity the water content is about 4%. The water vapour molecules in air are very energetic. If we cool the air down, then the H₂O molecules

slow down as well. They don't collide so often and we feel this as a cooling effect. The other effect the slowing down has is that eventually they will slow enough that when the molecules interact or get closer together, they are able to bond (the hydrogen atoms can exchange electrons freely – this is called covalent bonding).

This bonding causes another change of state from gas to liquid called condensation. The temperature at which the molecules start to bond and condensation occurs is called the dew point.

MEASURING TEMPERATURE

If you get a thermometer you can measure the temperature in the room you are in. You then get a piece of cloth or tissue, wet it and wrap it around the bulb of the thermometer. As the water starts to evaporate, it takes energy from its surroundings and the bulb will cool.

Once it is at its coolest, you have (with a certain degree or

"The phase change from liquid to solid can also be thought of in terms of energy exchanges"

two of inaccuracy) the dew point.

In the summer the difference will be greater than in the winter.

NEXT ISSUE...

In the next article we will see how the release of latent energy can convert to thousands of volts of electrical energy, huge lumps of ice and cause vertical winds of hundreds of feet per minute. If air is forced upwards, the pressure decreases, and just as when you let air out of a tyre or gas out of an aerosol, it cools due to expansion.

We will also look at the dry and saturated adiabatic lapse rates, the international standard lapse rate and the environmental lapse rate, and the stability of air masses. ■

If you have any questions or would like to join our PPL ground school on Sundays please contact me through AOPA or phone 07985 969018.

WORDS Mick Elborn

HOW GDPR WILL AFFECT YOUR AOPA MEMBERSHIP

With the changing laws in data protection, members might be wondering what happens with their information. Here's what AOPA does with your info

In recent weeks you have probably received emails or items in the post advising you that the organisation concerned has updated their Privacy Notice in advance of GDPR becoming law on 25 May 2018. GDPR extends existing Data Protection Regulation to give you greater control over your personal data. It also places additional controls on Data Collectors and Data Processors.

AOPA is both a Data Collector and Data Processor and also uses other Data Processors external to AOPA, who may use data provided to them by AOPA for a specific purpose. External Data Processors operate under a contract with AOPA, ensuring that they are handling this data in compliance with GDPR.

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AOPA NEWS

General Aviation news from around the world



The airshow at Wycombe will be an Expo highlight

THE UK'S FESTIVAL OF AVIATION IS BACK!

Don't miss out on AeroExpo UK, when it returns on 14-16 June, with a packed schedule that will keep every aviation fan in attendance riveted

by **Robert Care**

Chances are that you're probably not the owner of a coveted ticket for Aero Friedrichshafen or Sun 'n Fun, and you won't be heading to Oshkosh either. But there's no need to panic that you're missing out! The UK's best aviation show is back this summer.

Whether you're an experienced pilot or just have a passion for aviation, AeroExpo UK is the event to attend in 2018.

We'll be showcasing the best in General Aviation over three

days at Wycombe Air Park in Buckinghamshire. Get up close and even demo-fly the latest aircraft on the market, and browse a range of related aviation products and services.

An aerobatic air display, free seminar series, pleasure and demo flight opportunities, lifestyle area and evening entertainment mean there really is something for everyone at this year's AeroExpo UK.

More than 200 exhibitors from around the globe will be on site for the weekend, including the likes of Diamond Aircraft, Cirrus, Piper Garmin

and Jeppesen (see pages 22-23 on their latest announcements). More than 10,000 visitors are expected to visit over the three days and more than 1,000



Be at Wycombe 14-16 June

aircraft will pass through.

But the main highlight of the three-day event will be the airshow. There will be thrilling air displays on Saturday 16 June. Some of Europe's finest display pilots will demonstrate their skills, pushing their aircraft to its limits.

The organisers have promised several acts, each with something different to offer. So get down to the flight line at 14:00 to get a good viewpoint for all the air display action. Tickets are on sale now and start at £17 for a day ticket, and £40 for a three-day pass. Don't miss out. ■

AUSSIE HALL WINS FIRST FRENCH AIR RACE

by **David Rawlings**

The long-awaited premiere of the Red Bull Air Race in France sparked high drama over the Riviera. Looking for a return to the form that has twice made him runner-up in the World Championship, Australia's Hall flew first in the Final 4, clocking 57.692s. The time held up when World Champion Yoshihide Muroya of Japan earned a two-second penalty and Dolderer finished 0.072s behind the Australian. But the shock of the round came when it was announced that Czech pilot Martin Šonka, who had apparently advanced to the

Final 4, would in fact finish eighth due to evidence found after the end of the Round of 8: a technical infraction of exceeding the maximum RPM limit. As a result, it was 2018 World Championship leader Michael Goulian of the USA who leaped into his raceplane and concluded the final round, his third-place finish keeping him at the top of the overall leaderboard. With the World Championship wide open, the next stop in Japan could be pivotal. Not only is it a pressure-filled home race for the defending titleholder Muroya who currently sits in third place overall, but Goulian has had



IMAGE: Jero Mitter/Red Bull Content Pool

Hall's first win since 2016

his best start in more than nine seasons of racing. Plus, after a full year of improvements to a new raceplane, Hall is hungry to take the crown for himself, with only three points between him and Goulian in the top spot. Dolderer, the 2016 World Champion, is chasing hard in fourth, and at fifth in the standings, Šonka will particularly feel he has something to prove after disqualifications in two races.

Hall declared, "It's been a long, hard transition from our former MXS to our new Edge, but now with a new team, this plane and a new sponsor, it feels awesome. We're feeling set to make a run for the World Championship." ■



IMAGE: Jero Mitter/Red Bull Content Pool

Raceplane woes seem to be over for the Australian pilot

ELIXIR USES SIMPLER CS-23 TYPE CERTIFICATION STANDARDS TO BRING AIRCRAFT TO MARKET

by **Lucy Field**

French company Elixir Aircraft announced that it will certify its all-new, two-seater to EASA's simplified CS-23 type certification standards, instead of LSA.

According to a recent statement the choice was simple for the manufacturer.

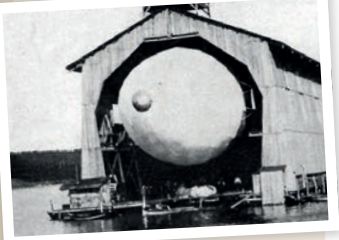
"Considering its performance,

our plane would have felt cramped in the CS-LSA," Elixir said. "CS-23 allows night VFR, IFR, payload increase, and an opening to a greater number of countries... Elixir is full of potential, it would be a shame to deprive it of that with the wrong certification!"

The work that Elixir has already carried out towards a CS-LSA standard is not

wasted. Instead, it will all count towards CS-23 and, in fact, Elixir took the decision eight months ago but waited until now to release it. Elixir was recently boosted by receiving 29 pre-orders at the recent AeroExpo in Friedrichshafen, and the company is still targeting early 2019 for certification and first customer deliveries. ■

LOOK BACK... THIS MONTH 118 YEARS AGO



ZEPPELIN LZ-1 TAKES FIRST FLIGHT

The production of Count Ferdinand von Zeppelin's first airship, LZ-1, began in June, 1898 in a floating wooden hangar on the Bodensee in Friedrichshafen in Southern Germany. The ship was completed in the winter of 1899 but von Zeppelin decided to wait until the summer of 1900 before attempting to fly his invention. The ship made its maiden flight on July 2, 1900. The first flight lasted about 18 minutes and covered around three miles over the lake.

LZ-1 was 420ft long, 38ft in diameter, and contained approximately 399,000 cubic feet of hydrogen in 17 gas cells made of rubberised cotton fabric. Two metal gondolas were suspended below the ship and each gondola housed a 4-cylinder water-cooled Daimler gasoline engine, producing about 14 horsepower. The first flight of LZ-1 showed the ship had weaknesses; it was overweight, and a severe lack of engine power and speed made it difficult to control, even in light winds.

While LZ-1 itself was not a success, Count von Zeppelin's basic concept was sound, and formed the basis for all future zeppelin airships.

**AOPA NEWS
HIGHLIGHTS****PAY ATTENTION PEOPLE**

The recent and tragic accident at Southwest Airlines with the fatal engine failure showed one worrying thing – passengers don't listen to the safety briefing. The most obvious was that they weren't using the oxygen masks properly. Video from the emergency shows several passengers with masks only over their mouths. Given how much effort goes into these videos, there needs to be a new school of thought on how to make them more effective.

EPIC AIR CEO GUILTY

Former Epic Air CEO Fred Schrameck has pleaded guilty to a single count of wire fraud, according a statement released by the United States Attorney's Office for the District of Oregon. Schrameck was charged with soliciting customers to purchase and help build experimental aircraft—to the tune of more than \$1.4 million each—then misrepresenting how the customers' funds were being used.

CLEAN SKIES GROWING

16 European countries have signed up to a project called Horizon 2020 which will make significant investments in making aviation and aerospace industries greener. For several years, the EU's Clean Sky project has sponsored aviation research projects to fund environmentally-friendly aviation technology and now, with €4 billion in additional funding, Horizon 2020 will focus on airframe and wing designs.



Piper will be bringing
a Jet-A P-44 to
market

PIPER UP IN Q1 & PLANS A JET-A P-44

New M600 is given the credit for the company's strong start to 2018 and announcement a new Jet-A Seminole

by **Robert Care**

Piper recently announced its aircraft sales and delivery results for the first quarter of 2018, ending 31 March, and it seems as if there'll be smiles all round in Vero Beach. The company continued to grow its new aircraft deliveries and revenue with its newest product, the turbine-powered M600, leading to Piper's performance success. Additionally, Piper trainer sales growth continues to be led by the Archer, with a sales backlog into late 2019.

The first quarter performance of 2018 showed a positive trend on the heels of a 27% growth in billings for 2017. Aircraft deliveries increased more than 36% to 34 aircraft in the first quarter of 2018, up from 25 aeroplanes during the first quarter of 2017. New aircraft sales revenue grew more than 77% to \$41,379,227, when

compared with sales of \$23,383,514 during the same period the previous year. The growth in revenue reflects strong demand for M-class products, with the M600 sales expanding by over 100%.

Piper President and CEO Simon Caldecott said: "It is important to note that not only did M-Class sales increase, but deliveries of our trainer products continued to grow as well. In the first quarter of 2018 we delivered nearly 16% more trainers than we did in Q1 of 2017, which was a combination of the single engine Archer, the single engine, complex Arrow, and the twin engine Seminole. With our unwavering commitment to the trainer market, along with the only complete trainer line of products, we expect demand for Piper trainer products to remain strong."

Piper also announced it plans to bring a Jet-A powered P-44 Seminole to market. Piper

has chosen the Continental Motors Group's new CD-170 compression ignition engine fuelled with Jet-A to power the Seminole. It will also feature counter rotating engines, giving flight schools and training organisations a single lever, FADEC training system with a history of innovation, simplicity and economy.

After selecting the CD-155 Jet-A engine to power the Archer DX, Piper Aircraft extends its Jet-A powered range of trainer aircraft with the PA-44. "Our experience with the Archer DX convinced us and our customers that we could deliver the best twin-engine training platform using the Continental Jet-A engine. We are extremely happy with our collaboration with Continental Motors. As the undisputed leader of Jet-A engines in GA they understand perfectly the pilot training market and our own needs," concluded Caldecott. ■

ALWAYS KNOW WHERE YOUR TBM IS AND WHAT CONDITION IT IS IN

by **Lucy Field**

TBM Aircraft owners and operators probably feel that their time is very important and they need to know where their plane is, what state it's in and what maintenance is needed in the coming months. Well Daher-Socata has developed what they believe is the answer.

This means that TBM aircraft owners now have another smartphone application to get their heads around, but it seems it'll be worth it. The 'Me & My TBM' app has been designed to significantly enhance operating efficiency; it optimises maintenance management and ensures their aircraft are operating to

the highest safety standards.

The cloud-based app for Android and iOS leverages data that is automatically collected during every phase of flight.

"The 'Me & My TBM' app provides unique and valuable feedback on TBM flights, from key parameters of the engine and other systems to a full range of statistics, accessible wherever the aircraft goes," explained Nicolas Chabbert, Senior Vice President of the Daher Airplane Business Unit.

This eliminates the need to send flight logs, as well as trend and report data files to the CAMP maintenance tracking system, avoiding the fastidious task of downloading data on a



The app is available on both iOS and Android

personal computer – while also directly updating aircraft counters on the CAMP system.

Available for all TBM 910 and TBM 930 model, year

2018 aircraft, Me & My TBM can be downloaded from Google Play Store for Android phones and from Apple Store for iOS phones. ■

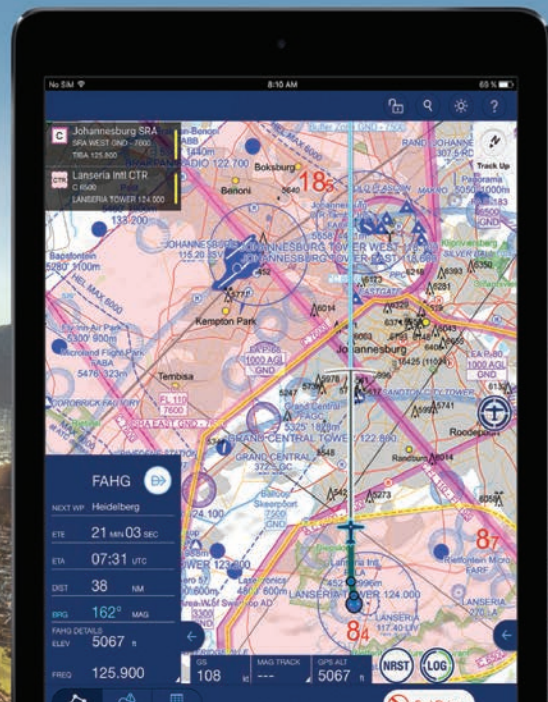
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JEPPESEN STORMS THE MARKET WITH BUNDLE OF ANNOUNCEMENTS

The Boeing-owned company is bringing new advancements to its platforms, and now it's coming to Europe

by **David Rawlings**

Jeppesen has announced several tie-ups that are set to improve its platform for all users.

First up, Jeppesen has said that its ForeFlight Mobile featuring Jeppesen Visual Flight Rules (VFR) data will now be available in Europe. Data-driven VFR charting information will be dynamically rendered on ForeFlight Mobile maps, enhancing situational

awareness and flight safety.

Jeppesen, in partnership with ForeFlight — an innovative provider of mobile and web aviation applications — announced that interactive Jeppesen European VFR information will be available within the ForeFlight Mobile iOS-based app for general and business aviation flying.

Jeppesen first started working alongside ForeFlight last year for its American customers, but has now decided to expand the

service. “After announcing our strategic alliance with ForeFlight last year, embedding Jeppesen European VFR data furthers our shared dedication to providing the right data at the right time for the general and business aviation market, in both IFR and VFR conditions,” said William Ampofo, vice president, Business & General Aviation, Boeing Global Services. “This data integration continues to leverage the strengths of both

companies to deliver world-class flight data through industry-leading mobile technology on a global scale.”

Jeppesen VFR Manual information will be available this summer for use within ForeFlight Mobile, included with any regional European ForeFlight subscription tier. Jeppesen VFR Manual data provides the most comprehensive European VFR flight information available, covering more than 2200 airports in 29 countries.

Jeppesen VFR chart data will be rendered as an overlay on the ForeFlight Mobile map, customised and filtered per pilot preference.

"Through our strategic partnership with Jeppesen, ForeFlight will offer digital VFR data and IFR chart coverages to supplement Jeppesen's high quality global aeronautical data," said Tyson Weihs, co-founder and chief executive officer, ForeFlight. "It enables us to offer a broad suite of navigation and safety features in one application to deliver a uniquely powerful and affordable integrated flight application for VFR and IFR flying."

Jeppesen and ForeFlight had previously introduced Jeppesen's global IFR enroute database and NavData, along with Terrain and Obstacle data for use with ForeFlight Mobile. Jeppesen IFR data is available today within ForeFlight Mobile, including European coverage.

BAD ELF ON BOARD

Jeppesen has introduced a new mobile version of its Jeppesen Distribution Manager (JDM) flight data update technology, and announced a new strategic alliance with Bad Elf, a provider of aviation hardware and software solutions. Together, Jeppesen and Bad Elf have now established a wireless data transfer system for aircraft owners and operators, using JDM Mobile and the Bad Elf Wombat portable device to update avionics data cards.

"Previously, many aircraft operators needed to update data cards offsite, which often meant working a long distance from their aircraft due to a dependency on traditional landline PC technology," said Mike Abbott, director, Jeppesen Data Solutions, Product & Portfolio Management. "Through our relationship with Bad Elf, most of our general and business

aviation customers will now be able to use JDM Mobile and the Wombat device to wirelessly update essential charts and data, right in the cockpit. This capability also extends to tens of thousands of customers operating legacy avionics that are not designed for wireless navigation data update capabilities."

Initially, Garmin and Avidyne avionics systems will be supported by the JDM Mobile and Bad Elf Wombat integrated technology. In the coming months, additional avionics systems will be supported across general and business aviation, in total reaching more than 80% of JDM customers.

Jeppesen data subscribers using supported avionics platforms are now able to use JDM Mobile to download data updates on an iPhone or iPad and then wirelessly connect to the Bad Elf Wombat device. The Wombat mobile device then transfers flight information to avionics data cards, which allows pilots to update their avionics with current data before flying.

"We are excited to team with Jeppesen to provide a world-class mobile experience, related to what had become a tedious task for pilots to update their data," said John Cunningham, CEO, Bad Elf. "Additionally with Wombat, pilots can easily collect flight and engine logs for analysis by several partner apps and services. We look forward to providing wireless data transfer capabilities with Jeppesen for the leading avionics platforms of choice."

Jeppesen navigation data is developed from a comprehensive aviation database, which is composed of more than one million records. To ensure accuracy, analysts edit and verify approximately 150,000 transactions generated from worldwide aviation data source documents during every 28-day revision cycle. ■



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Aerobility is a registered charity founded in 1993 offering disabled people, without exception, the opportunity to fly an aeroplane



The Pilatus PC-12 is one of the most recognisable turboprops on the market. It has strong presence on the apron and is lusted after by many pilots across the world.

It's not a new aircraft – it was first announced at NBAA in 1989, but after some design changes during the certification process, it didn't come on to the market until 1994. Since then it has become a huge hit with more than 1,500 built, and for several years has been

the world's best-selling pressurised single-engine turbine-powered aircraft.

To learn more about this globally popular aircraft, I was invited to Oriens Aviation – the official UK distributor of PC12s, based at Biggin Hill – to find out more about the PC-12 and what it can offer.

BUSINESS OR PLEASURE

"There are many ways to describe the aircraft, and one way I would describe it is to say it's a Swiss Army knife of the skies," said Craig Lammiman, Sales Director at Oriens. "Many aircraft are

judged by their appearance. It's a vanity issue, but the PC-12 is fantastic because it really is judged on its ability to go and do things. It's a tool for a job and it's got some exciting missions."

Lammiman isn't wrong. Not only is the PC-12 used for business and pleasure, but it's also a popular air ambulance, search and rescue aircraft, surveillance aircraft, and is used by the US Air Force for special ops.

"With the PC-12, you can choose. Do I want to take the family for lunch in Jersey? Do I want to take it on a business

WORDS David Rawlings IMAGES Oriens Aviation

The Swiss Army Knife of the Skies

The Pilatus PC-12-NG is one versatile beast. It can go almost anywhere and do anything... making it one of the most flexible turboprops on the market

trip? Do I want to go skiing in the Swiss Alps? Do I want to fly low level, flying VFR through the Alps, or high level flying into Monaco or Nice? It can be for business, for pleasure, or a family holiday... you can go anywhere and it's all about practicality, usability, and fun!" Lammiman added.

OWNERS

As with any turboprop, the 'type' of owner is wide ranging, but most owners will use the PC-12 for a mixture of business and pleasure. They will usually have an extra property elsewhere in

Europe and often they will have a need for a business use, which allows them to have flexibility. They can get to their meetings, but also get home for the evening. "It's a perfect aircraft for cost-conscious individuals," said Lammiman. "The PC-12 is a \$5m product and the depreciation is only around 25% over five years – which is incredible for the marketplace – and the running costs are potentially a third cheaper than many of its rivals. For owners that means they have an aircraft they can fly more often, at a lower cost, keep it

longer, and not worry about losing out on the resale."

Oriens says that in the UK, typically around 85% of PC-12 owners will be sitting in the back of the aircraft. "We do have a number of owners who fly the aircraft, with a safety pilot, but it's how they get their flying fix. However, we do have at least one client that flies it himself," explained Lammiman.

The typical PC-12 spec is a six-plus-two in executive mode. It is six inches wider than one of the other main competitors in the turboprop market. It has a flat floor

and in comparison will have have a very voluminous and comfortable cabin. "On Friday, I'm flying from Luton to Faro, Portugal with six adults and two children – including the pilots. That will be 1,000 miles, but it'll be a comfortable flight," Lammiman added.

IN THE OFFICE

To get to know more about the business end of the PC-12 I also spoke with Edwin Brenninkmeyer, the CEO of Oriens Aircraft, and a very experienced pilot.

"The avionics in the PC-12 is the Honeywell Apex suite – which is unique to the PC-12. It's a scaled-down version of the Honeywell Epic suite you would find in a Dassault Falcon. It's a very powerful piece of avionics equipment formed of four screens, which is unusual. Most of our competitors have three screens," explained Brenninkmeyer. "Unlike Garmin, which began in GA and scaled up to business

jets, the Honeywell has come from an airline background, scaled-down and the PC-12 is possibly the smallest aircraft on the market that you'll see a Honeywell suite in," he added.

The key difference for the PC-12 is the fourth screen. With a Garmin avionics suite you get three. Which works perfectly well, but you can find yourself scrolling through screen after screen to find what you're looking for. With the Honeywell suite, the information is all right there for you. You never really have to scroll through pages, unless one of the screens has failed.

"The Honeywell screens are a little smaller than Garmin's, but if you're flying an ILS and you've got a geo-reference Jeppesen plate of one of your MFDs, you can split it so you can see all the information. You can have the plan view big in front of you and the profile view beneath. You don't have to shrink the whole thing, and that's

"The PC-12 is possibly the smallest aircraft on the market that you'll see a Honeywell suite in"

how it compensates," said Brenninkmeyer.

Garmin has full VFR charts, which does offer one advantage over the Honeywell set up: users can get the ICAO half-mile charts overlaid on the MFD, which you can't get on the Honeywell. If you are flying VFR in the PC-12, you will always need to cross-reference it with your accurate ICAO charts. You just have to be a bit careful flying VFR.

IN THE AIR

Looking at a PC-12 compared with a single-engine piston, it may appear very daunting, but it's an easy aircraft to fly and very stable at the same time. "If a GA pilot has flown glass, then they'll be used to the presentation of the glass cockpit and be able to work their way around the avionics," explained Brenninkmeyer. "The speed will take a little bit more of getting used to. It's not a jet, but it's still faster than a piston single or twin. You have to think a little bit



Versatile and able to land almost anywhere, the PC-12 has been called the SUV of the skies

Grass strips?
Not a problem,
the PC-12 can
take it





Suitable for everyone whether they want to go on holiday, on business or skiing... the PC-12 can take you"

further ahead of the aircraft, but again it's not a jet, so it won't get away from you that quickly. To counter that, you do have a disc-ing effect from the propeller, so if you reduce the power you in effect have this huge disc of drag in front of you, unlike a jet, so you do slow down very quickly. And you don't have to worry about shock cooling like you do with a piston – you have none of that with a turboprop."

The engine management of a PC-12 is also a lot easier when compared with an older piston, which can be very complicated; you have three levers, six in a twin, shock cooling, and so much more to contend with. Of course you have none of that with a turbo prop. The only thing you have to watch with the turbine is starting it. You don't want a hot start.

In terms of handling, the PC-12 is as you would expect. "The control mechanism has a mixture of rods and cables so to keep it straight and level it is very, very responsive. There is an instantaneous response. If you want to roll

"Brenninkmeyer also flies many other aircraft and says the PC-12 handles in a similar fashion to a high-performance piston aircraft"

it rapidly from 45 degrees one side to the other side, it's heavy. So it's a very stable aircraft and just sits there. It will require tiny inputs to keep it sat there, but to really manoeuvre it, that's where it starts to get heavy," explained Brenninkmeyer.

Brenninkmeyer also flies many other aircraft and says the PC-12 handles in a similar fashion to a high-performance piston aircraft. "They fly the same way. With some pistons there can be a slight lag, and give in the controls, whereas there's none of that in the PC-12," he said, adding: "It's so comfortable to fly as everything is adjustable. The seat can move in every conceivable way and the rudder pedals are also adjustable. It's extremely comfortable. I also fly a Citation XLS and I have less room in the XLS than I do in the PC-12. The crew seats are very well-made in the Pilatus – it's not just about the people in the back."

THE JET AGE

With Pilatus' PC-24 jet recently

certified, it might seem logical that it will brush aside the PC-12 in terms of sales, but not so.

For the owner-pilot the PC-24 would be the logical step up as it boasts the same avionics suite. "We have customers with Cirruses and Bonanzas and they're cutting their teeth on the PC-12, getting used to the speed and avionics and it will make the transition to the jet that much easier. The speeds in the jet are significantly higher. The rate of climb is phenomenal and everything happens very quickly, so you're almost learning to fly again in a jet. So if you're getting used to the speed and the avionics, it could be overload, whereas if you're confident in the PC-12 its one less thing to focus on," explained Brenninkmeyer.

For the owner that's sitting in the back of either aircraft, they're two completely different products. So the PC-12 is 24 years in the making and still going strong. "I think the jet will actually improve sales of the PC-12," concluded Brenninkmeyer. ■

TECH SPEC PILATUS PC-12

PERFORMANCE

Powerplant: PT6A-67P, flatrated to 1,200 SHP

Max Cruise Speed: 285KTAS

Max Range 4 Pax: 1,617nm

Max Range 6 Pax: 1,460nm

Max Altitude: 30,000ft

Stall Speed: 67KIAS

WEIGHT

Max Ramp: 10,495lb

Max Take-Off Weight: 10,450lb

Max Landing Weight: 9,920lb

Max Zero Fuel: 9,039lb

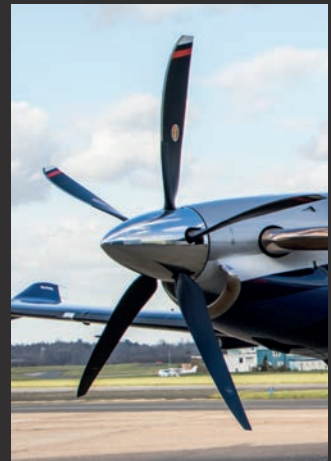
Usable Fuel: (402 U.S. gal) 2,704lb

DIMENSIONS

Length: 43ft 3in (14.40m)

Height: 14ft (4.26m)

Wingspan: 53ft 4in (16.28m)



HOW FLARM COULD PUT AN END TO MOST MIDAIR COLLISIONS

Midair collisions are a blight on aviation and installing equipment in GA aircraft can be a costly affair. FLARM believes it has the answer, and that it doesn't need over-regulation for it to be implemented

Product PowerFLARM
Maker FLARM Technology Ltd

Every year, around 40 aircraft are involved in midair collisions and even more in near misses. Many of these accidents are fatal. Another common denominator is that most collisions happen during daylight, in good visibility. Pilots are now raising their voices, demanding something must be done to put an end to these accidents, since the technology to do so has been available for years.

From early on during pilot training, we are taught to keep a continuous lookout and always scan the sky for traffic. We are taught that VFR collision avoidance is based on the 'see-and-avoid' principle, implying that a prudent pilot will be able to detect an approaching aircraft and make an avoidance manoeuvre before it is too late. However, it has been known for decades, through numerous research studies, that this is a false assumption. The human visual and perceptual systems are so inadequate for this task, that the chance of detecting and avoiding an approaching aircraft is close to flying blind. And this is when the intruder is already approaching from within one's own cockpit field of view, which covers only around 10-20% of the sky in many aircraft types.

The Australian Transport Safety Bureau (ATSB) published a now well-

known research report titled "Limitations of the See-and-Avoid Principle" in 1991. It concluded that: "The see-and-avoid principle in the absence of traffic alerts is subject to serious limitations. The most effective response to the many flaws of see-and-avoid is to minimise the reliance on see-and-avoid in Australian airspace".

In 1993, the US NTSB published accident report AAR-93-05 on a midair collision between two GA aeroplanes. The probable cause was "the inherent limitations of the see-and-avoid concept of separation of aircraft operating under visual flight rules that precluded the pilots from recognising a collision hazard and taking actions to avoid the midair collision". In the report, NTSB reiterated an earlier safety recommendation, that an affordable anti-collision system should be developed for GA.

When it comes to anti-collision systems, most pilots think of TCAS, which is now mandatory in airplanes above 5,700kg. It is possible to install TCAS (or a variant named TAS) in light aircraft, but for most owners this is prohibitively expensive. What many people don't realise is that TCAS was developed for IFR and is not very suitable for VFR. TCAS detection logic is based on IFR separation minima (1,000ft vertically and several nm horizontally).

A portable PowerFLARM is also available



When flying under VFR and especially when close to aerodromes and in the traffic circuit, aircraft are often intentionally close to each other and fly much less predictably than IFR aircraft. TCAS would be unusable since it would continually issue traffic or resolution advisories.

FLARM was introduced in 2004, initially as a portable device for gliders, but has since been installed in powered aeroplanes and helicopters. It solved many of the shortcomings of TCAS for VFR use, including the frequent nuisance alerts for aircraft which are not a threat; as well as affordability. Aircraft with a FLARM system broadcast their exact

GPS-based future flight path to all other FLARM-equipped aircraft. The future flight paths of proximate aircraft are then compared with one's own future flight path. When an imminent collision is detected, a collision warning is issued together with the relative bearing and altitude difference of the intruder. Both pilots then have ample time to try to identify the intruder and to change the flight path.

To date, 35,000 aircraft have now been equipped with FLARM across Europe and over 28,000 drones are said to be equipped with FLARM as well.

The main criticism of FLARM has been that both aircraft need to be equipped



A V4 display (top centre of the instrument panel) warns and shows direction of the intruder

for it to work. This is less of an issue today since more than half of all GA aircraft are already equipped, but many FLARM devices also come with an integrated ADS-B and Mode-C/S transponder receiver. The challenge with the latter is the inherent technical limitations with just receiving transponder signals for collision avoidance purposes, and that very few GA aircraft have ADS-B Out.

One remedy would be that the rest of GA also installs FLARM. Several appeals have been made and initiatives are underway to make this happen.

The first appeal came from Eurocontrol, who in 2005 recommended voluntary equipage of FLARM for GA aircraft. In 2010, following several midair collisions, the Swiss CAA, FOCA, recommended that GA in general and specifically all helicopters should install FLARM. Several national CAAs and accident investigation

bodies have made similar recommendations.

In Switzerland, the government is sponsoring FLARM installations in all Swiss GA aircraft. Almost all helicopters and most fixed-wing aircraft today have FLARM. In France, FLARM is mandatory for all gliders. In other European countries, national aviation associations and insurance companies are pushing hard for all GA aircraft to be equipped. It is hard to find any other non-mandatory system that has been so unanimously recommended by the aviation community.

An advantage of FLARM is that it is fully symmetric: it combines radio broadcast ("electronic conspicuity") with reception. This is especially important, for instance, in overtaking situations, where the other aircraft will come from behind and possibly also from above or below. In these situations, the other aircraft will have to make the avoidance

manoeuvre, so it is essential that their FLARM system can see you.

Pilots of FLARM equipped aircraft can of course also see proximate aircraft on a radar-like display (if the other aircraft is equipped with either FLARM, ADS-B Out or a Mode-C/S transponder, depending on the type of FLARM system). This can be especially useful when flying to busy airports, to get a picture of the traffic situation beforehand.

For an effective co-operative collision avoidance system, it is inevitable that all participants need not only to speak with each other but also speak the same language, i.e. be interoperable. TCAS regulation made this happen

for large aircraft. This, however, has also led to TCAS being a rigid standard with almost no innovation (the first and only update came two decades after TCAS was introduced and took another decade to implement, costing each aircraft owner the equivalent of buying a used aircraft). FLARM, conversely, innovates continuously. Software updates with new and improved features are released annually at no cost.

The GA community has a unique opportunity to not only increase its own safety by simple means, but also to show the regulators that it can do so without rigorous regulations. The FLARM system is one feasible solution that could help. ■

NEED TO KNOW

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- ✦ Recommended by European aviation authorities.
- ✦ Needs FLARM in other aircraft to work.

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HISTORY OF THE CESSNA TWINS

George Done takes an indepth look at the world of Cessna twins

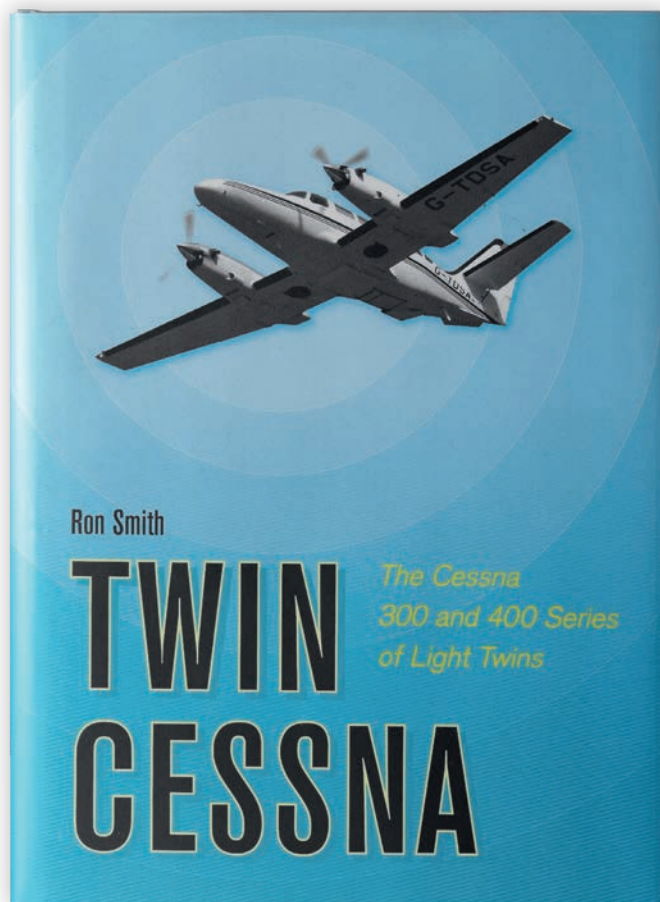
Book Twin Cessna - The Cessna 300 and 400 Series of Light Twins
Author Ron Smith

This is another book from Ron Smith, a prolific writer of books on aviation that cover a spectrum ranging from general aviation aircraft types through to British aircraft manufacturing history.

The light twin seems almost to have disappeared from the skies in the UK, and so this book comes at the right time to remind us of what we are now missing. The Cessna twins, particularly the later variants, are handsome aeroplanes, in my view, with classic lines, and the development of the type is fascinating. The author's ability to cover the history is remarkable, being sufficiently detailed yet without adversely affecting one's desire to read on.

The story begins in 1953 with the Cessna 310 and its many variants through the 320 and 340, then covering the 400 Series and ending in 1987 with the Cessna 425. Approximately 14,500 aircraft in the whole family were produced over this 34 year period.

The large number of photographs attracts the itinerant reader to its pages and it is this aspect that makes the book so attractive to a prospective purchaser. The photographs are of excellent quality with many taken by the author himself and his brother. One has to wonder at how much time was spent seeking out aerodromes in far off places in order to capture an image of a particular variant!



There is more in the book than simply how the type developed – the summary of features on the 400 Series that aid identification is welcome.

As someone previously engaged in aspects of aircraft design, I could not help wondering about the introduction of dihedral to the tailplane, and why it became necessary to raise it halfway up the fin,

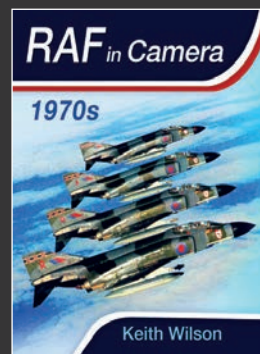
presumably something to do with improving an aspect of the flight handling quality. Also, I particularly enjoyed reading of the exploits, some very amusing, of an air taxi pilot in the Cessna 404 Titan.

This book is a fantastic read and will make an excellent addition to one's aeronautical bookshelf, and I thoroughly recommend it. ■

NEED TO KNOW

- ✦ Huge number of high-quality photographs.
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- ✦ In-depth insight to every Cessna twin.

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The start of the 1970s saw the retirement of the Dakota from service, followed shortly after by the formation of the first Buccaneer NATO Squadron. In 1972, the landmark RAF Museum at Hendon was opened by HRH Queen Elizabeth. The midpoint of the decade was particularly notable due to the fact that it saw the ending of the Vietnam War and, in the dying hours of the conflict in March 1975, RAF Hercules planes were used to evacuate civilians from Cambodia.

Each chapter focuses on a specific year, relaying all of the highlights that characterised it. As with the two previous releases, this new addition to the *In Camera* series is sure to be regarded as something of a collector's edition and an enthusiast's favourite.

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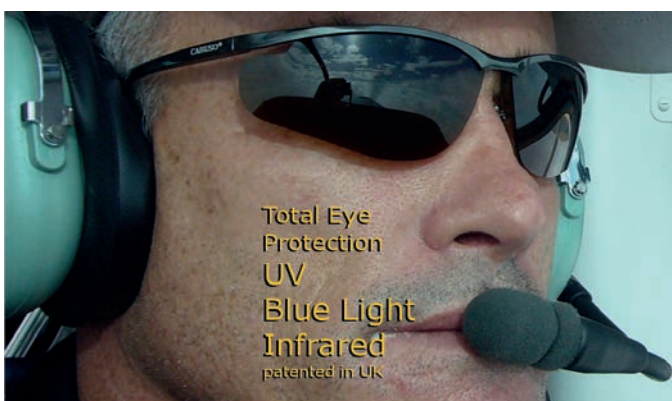
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