

## **MARSH BROTHERS AVIATION MATERIALS EXPERTISE ADDS TO LOW-WEIGHT APPEAL OF DARKAERO COMPOSITE KIT AIRCRAFT**

A partnership between Marsh Brothers Aviation and DarkAero is generating considerable interest in the use of composite materials across the wider aviation industry.

The collaboration between the companies, which started in 2018 with a chance meeting at an aviation event, is yielding results for Canada's Marsh Brothers and the three-sibling start-up DarkAero with the development of the latter's high-performance self-build aircraft kit.

Conceived as a self-build solution similar to the kit car concept, the *DarkAero 1* features a range of composite materials, with Marsh Brothers Aviation providing the Wisconsin-based aviators with composite bearings for three different applications for the soon-to-launch aircraft kit.

Engineered specifically for high-speed, long-range flight, *DarkAero 1* is a two-seater optimized for efficient cross-country flight. Interested customers have already been invited to reserve production slots for the kit.

The core package includes the carbon fibre airframe, canopy, engine mount, landing gear, control hardware, fittings, and fasteners. The UL power 520iS engine, which is 50-70lb lighter than traditional aircraft engines at the same horsepower, is available separately, as are the avionics and electrical hardware, propeller wheels, brakes, and paint. An Airmaster Propeller electrically actuated constant-speed propeller that comes with the kit specifically set up to work with the UL520iS engine and is optimized for high-speed flight.

All DarkAero's carbon fibre parts are made using an infusion process, which involves placing dry carbon fibre cloth into a mould, compressing it under a vacuum bag, and then infusing it with epoxy resin. According to the company, this process achieves similar results to prepreg autoclave but with significantly reduced lower overheads.

According to DarkAero, the complete flyaway cost of the aircraft is around US\$150k to US\$200k, with the builder's choice of avionics, propeller, engine accessories, and paint affecting the total cost.

"Interest is growing due to the reliability, reduced maintenance and longevity of composite material but also because it weighs less than conventional materials, reducing fuel consumption," says DarkAero President and co-founder Ryley Karl.

"We built this as an airplane for ourselves. We live in the Midwest [of the United States] and all the cool stuff like mountains and oceans are on the coasts. Our mission was to fly from the middle of the country to either coast, on a single tank of gas. So, we had to do a

lot of work optimising the design to get the efficiency we need. It's a unique combination of speed, range, and efficiency that we're trying to target with the aircraft," he adds.

When the three brothers met Marsh Brothers Aviation founder Sandy Thompson at an aviation event, their kit aircraft prototype caught his eye. "He was the first person to sign up for our email subscriber list and he gave us a sample bearing at that time," recalls Karl.

"We've corresponded with him over the years, but that little sample bearing stuck with us, ending up in a materials library we had.

"Later, when a salesperson reached out from Marsh Brothers, we ordered a batch of polymer bearings to replace some bronze bearings that we had. We have continued swapping out conventional bearing materials for Marsh Brothers' materials. There are probably at least a dozen different bearings on the aircraft that are made from their lightweight polymer materials."

Marsh Brothers and Dark Aero believe that the future of aircraft manufacturing will see increasing growth of interest in the use of composite materials.

"There are so many options out there with composite materials as far as tuning the structure for your application, whether it's strength or weight, or stiffness. There's just so much you can do with it. And we're still just scratching the surface," says Karl.

Marsh Brothers Aviation's Director of Business Development, Nicholas Choo-Son, concurs. "If you look at some of the newer Airbus and Boeing aircraft, they are over 50% composite material by structural weight, and composite materials are now being used in structural applications. So yes, it's going to continue to grow and we see the entire industry shifting in that direction."

A core principle of the *DarkAero 1* is that it is a 'quick build' kit that can be fabricated and assembled using common tools that are readily available from hardware stores. This means that there is no need for customers to undertake messy and time-consuming tasks such as hand carving or sanding. As a project, it has an estimated build time of 1,000 to 1,500 work hours. Once constructed and in use, the time before overhaul (TBO) of the airplane is 1,500 hours.

The fully retractable landing gear is a particular focus when it comes to deploying Marsh Brothers Aviation's lightweight materials, says Choo-Son.

"On the nose landing gear, we have a big sleeve bearing and in the main landing gear, we have a couple of different pivot mechanisms for the retract and then the suspension, which is a trailing link design on the main landing gear. All the pivots for that are our bearings."

Given the availability of various kit systems for those who wish to build their own aircraft, what does DarkAero bring to this market that is unique?

Karl says that although the composite airframe itself is not new, the company has focused on designing its carbon fibre airframe in a way that makes it easier to work with composite materials and components.

“Traditionally, building a composite kit aircraft has involved a lot of filling, sanding, and working with itchy fiberglass. This means build times for composite airplanes end up being two to three times more than a riveted aluminum aircraft.

“We’ve improved the build experience and enhanced the level of performance, speed and range that’s not often seen in the kit realm. We are chasing better efficiency, speed and range, and a large part of that is enabled through weight reduction and optimization of design. The benefit with Marsh Brothers’ materials is that they are much lower density than conventional bearing materials. So, it was an easy win for weight reduction.”

Following completion of flight testing and the accompanying validation of engineering work later this year, DarkAero plans to commence kit production in early 2023 to supply the pre-orders, of which there had been more than 150 at the time of going to press. *DarkAero 1* retails for an initial target price of US\$80,000 for the kit and between US\$150,000 and US\$120,000 fully built.

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### **About Marsh Brothers Aviation**

Marsh Brothers, a Thomson-Gordon Group company, designs, engineers and manufactures proprietary self-lubricating and grease-free polymer technologies to improve the performance, reliability and service costs for aircraft owners, manufacturers and maintainers. Marsh Brothers’ polymers replace traditional metal bearings, seals and washers reducing component weight by over 80% in comparison. Less weight equals more fuel savings. Typical application includes landing gear pneumatic struts (bearings, dynamic seals and piston wipers), landing gear structures (link bushings), hydraulic actuators (seals, glands, piston rod wipers), flight controls (hinge bushings, rollers), passenger and cargo door hinge bushings and rollers.