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In Flight USA

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April 2019



***Vectored thrust
performance without tilting the
wings or engine?***

***BLAINJETT AVIATION has the solution with this proposed
proof of concept rendering.***

COVER STORY

NEW INNOVATIONS TAKE FLIGHT AT BLAINJETT

An Interview with Founder Cary Zachary

By Annamarie Buonocore

The world of aviation is an exciting place where new innovations are constantly changing the space. With the introduction of new manned and unmanned aircraft, there comes a need for other aviation-related products and services. Blainjett Aviation is a Delaware-based startup that has released a breakthrough in dynamic-variable-pitch technology, which can dramatically improve the performance of both vertical takeoff and landing aircraft as well as contemporary fixed wing aircraft. The most rapidly moving aspect of flight technology today, drones, will also see yet another leap forward in performance while saving precious battery power. Here at *In Flight USA*, we are featuring the new technology on our cover, a fixed wing concept aircraft that uses Blainjett technology to optimize the efficiency of a low aspect ratio fan based propulsion system that can vector thrust without tilting the wings or engines. We had the pleasure of speaking to the startup's founder and



Flying over the clouds.

(Blainjett Aviation)

president, Cary Zachary. Zachary has a diverse background and is truly an inventor. Please read on for more information about him and his dynamic new startup.

In Flight USA: Tell me a little bit about your background. What made you want to invent this new technology?

Cary Zachary: My background is in product development. I worked for various technology companies and I'm

also an inventor. I have invented some products while out on my own that have had some success. Some of those include medical and exercise devices that made it to the market and even on TV. I have been inventing since I was young, so it is a passion of mine. I also have a little bit of an aviation background. When I was 12, I used to fly gas-powered RC helicopters. Just to put it into perspective, back

then, you had to build them. You learned a lot about how the aircraft functioned. I have some full-sized helicopter flight training as well. I don't have a commercial license or even a private license yet, but I hope to have one some day.

IF USA: How long has Blainjett been around and what are some of your accomplishments to date?

CZ: I founded Blainjett in July of 2016. I filed the patents a couple of months before that. We built some early proof-of-concept prototypes. Our biggest accomplishments are the results of the proofs that we developed on test stands. The first proof-of-concept prototype was a thrust-vectoring cam mated to a propeller system designed to vector thrust without the need to tilt the entire disc, as is done today. Engineering studies, proof-of-concept modeling and our data has shown that Blainjett technology is a concept with proven capabilities. We built a fully functioning scaled helicopter test vehicle, complete with the cam system that was statically tested. We were able to

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create significant dissymmetry of thrust (thrust vectoring) without the need to tilt the entire rotor system.

IF USA: Please describe dynamic-variable-pitch technology and explain why it is so important.

CZ: Dynamic-variable-pitch means that we are controlling each rotor or propeller blade independently through a unique curved path. It is a new more versatile pitch technology unlike existing pitch technologies such as variable pitch on an airplane, or the typical cyclic pitch

on a helicopter. A variable pitch propeller (constant speed prop) or helicopter cyclic pitch control varies all the blades at the same time or tilted in a straight line. On an airplane, the current system works pretty well until you increase the angle of attack and enter a climb. The well understood phenomenon of "P-factor" kicks in, meaning the relative angle of attack on the upward moving blade on the pilots left side has less angle of attack than the downward moving blade on the pilot's right side. This results in the need to hold right rudder (or trim) and results in a

potential loss of 20 percent to 30 percent of usable thrust. With the use of Blainjett cam technology, the pitch of the upward moving blade could be increased independent of the downward moving right blade, resulting in no P-factor and significant climb performance. Rotorcraft can gain two big benefits. It is well known that the maximum speed of a rotorcraft is limited by the lifting efficiency of the retreating rotor. Basically, the retreating rotor loses lift, as it is moving in the opposite direction of the aircraft, eventually causing a roll-off and loss of control.



Outer propellers shown (90 degrees) fully turned. (Blainjett Aviation)

The pitch of the rotors can be changed with the cyclic control, but this countermeasure has its limits because it is performing this action in a straight line. Now, envision that the retreating blade can hold the higher pitch angles for a longer sweep throughout the retreating motion, significantly delaying roll-off. This is all possible with Blainjett cam technology.

But the Blainjett cam can also be used for much more than correcting well-known existing propeller/rotor limita-

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Piper Arrow IV PA-28R1-201	1979-1982
Piper Arrow IV Turbo PA-28R1-201T	1979-1990
Piper Cherokee 140 PA-28-140	1964-1977
Piper Cherokee 150 PA-28-150	1961-1967
Piper Cherokee 160 PA-28-160	1961-1967
Piper Cherokee 180 PA-28-180	1963-1973
Piper Dakota PA-28-236	1979-1994
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EAA

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conventions in the city. The award came during Oshkosh's annual State of the City program on March 18.

In announcing the award, Oshkosh Common Council members Steve Herman and Matt Mugerauer highlighted the annual economic impact of EAA AirVenture Oshkosh week – an estimated \$170 million annually for the region – as well as the worldwide visibility Oshkosh receives because of the event and EAA's year-round presence.

Karen Kryzaniak, EAA's vice president of risk management and human resources, and Dick Knapinski, EAA director of communications, accepted the award on behalf of EAA. Knapinski noted that AirVenture came to Oshkosh because EAA founder Paul Poberezny was seeking a new home for the fly-in in late 1969 after the event outgrew its Rockford, Illinois, site. He also noted that over the past five decades, the name Oshkosh has become synonymous with an annual experience and culture, beyond just an event.

"On behalf of the entire aviation world, we thank you," Knapinski told the audience. "EAA is very proud to call Oshkosh our hometown." EAA AirVenture Oshkosh 2019 is July 22-28, with the latest news on features and activities regularly updated at www.EAA.org/airventure.

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tions. By varying the pitch of propeller/rotor blades independently, we can effectively vector thrust without the need to tilt the aircraft. For example, a helicopter must angle the entire airframe forward to achieve forward flight. This basically tilts the entire rotor disc, resulting in the horizontal component of thrust. With the Blainjet cam system, we can create horizontal thrust for a helicopter or drone, especially a quad, while the fuselage stays absolutely level. In a fixed wing aircraft, thrust can be vectored down without an engine or wing tilt system. Given low aspect ratio fan technology, this would result in much improved STOL performance with much less complexity than other thrust vectoring methods. The concept of partial thrust vectoring has been well proven with the Harrier jet, utilizing a combination of forward speed and thrust vectoring to significantly increase take off weight.

IF USA: Who are you trying to sell this technology to?

CZ: We see this as having many applications and going in many different areas. It can be used on quadcopters, helicopters, and fixed wing planes. We have some unique aircraft based around those concepts that we have come up with. We show about nine or 10 on our website. We envision this technology being used on unmanned drones and manned aircraft. There are about 100 companies working on manned air taxis right now, believe it or not, so those are the two markets we plan to go after. We can give them something unique. Eventually, we plan to reach out to other companies manufacturing bigger aircraft that weigh more than 3,000 pounds.

IF USA: So, this works on both manned and unmanned systems?

CZ: Yes, our technology is scalable and will work on both. We are starting to push into the unmanned market in the short term and then we plan to really push into the manned aircraft space.

IF USA: How much will the cam cost?

CZ: The cam is not an expensive part to manufacture. The process and the materials are pretty standard. The most exotic material that we use is flexible steel, which is a very commonly used type of steel.

IF USA: When will it officially become available to the public?

CZ: It is actually available for us to license the technology right now. The patents have been approved. We are just waiting for the patent to issue, which will happen in a few weeks, but we can sign a licensing agreement now. We are current-

ly in talks with Praxis Aerospace Concepts about retrofitting one of their drones for a short take-off and landing airplane. We are also talking with a helicopter manufacturer about retrofitting one of their heli's with our cam for speed improvements. The product itself will be finalized by the manufacturer. They might take six months to a year or more to finalize the production version of it. We're gonna work with them on their application to help them to prove the con-

cept and give them ongoing support. They will proceed from there to get it production ready.

IF USA: In what countries will it be available?

CZ: Aviation is a worldwide industry. We have filed patents in China, India, Japan, Mexico, Canada, the United States, and all the countries in Europe. The U.S. patent has a notice of allowance. In the foreign countries,

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Short take-off simulation. (Blainjet)

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because they're part of the patent cooperation treaty, they are expected to follow suit once the U.S. patent office approves it. That is not to say there won't be glitches. We are expecting to get the foreign patents within six months or a year.

IF USA: How many people work for Blainjett now?

CZ: There are two others besides me. We have Keith Hertzog, a retired Vietnam war veteran and combat engineer who spent time in the old Huey helicopter. He has experience flying UAV's and is an automation engineer and inventor. Alex Hobson, a mechanical engineer and patent agent, is handling our patent development and consults on the design as well.

IF USA: Does this technology improve the safety of flight and do you think it will encourage more people to get into flying?

CZ: I do. I think it will encourage a lot of people because it is so unique. This kind of technology has never been seen.

Using a common propeller or rotor system to change the thinking around flight dynamics will have a big impact I believe. For safety, we have a significant benefit to offer compared to the now popular tilt-rotors that came out in the '60s. We eliminate the precarious transition from vertical to horizontal flight with the ability to generate lift and forward thrust at the same time. This redundancy has great safety benefits for vertical takeoff and landing craft and adds a new dimension to fixed wing aircraft.

IF USA: How did you choose the name Blainjett?

CZ: I named the company after my family members. My fiancée's name is Blake, our daughter is Ainsley, and our son is Jett.

IF USA: Do you have anything else you would like to add?

CZ: We have several new aircraft concepts that are not shown on our website that we plan to introduce sometime in the future, so stay tuned.

IF USA: Thank you!

Women in Aviation

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ly secretive Skunk Works; and The U.S. Coast Guard's First Women Aviators and Aviation-Related Enlisted Women, a group of three officers and six enlisted women who proved women had a place in Coast Guard aviation and who opened the door for future generations of women to pursue their military aviation dreams.

Visits to the active exhibit hall were interspersed with general sessions on Friday and Saturday mornings, with dozens of educational sessions held both afternoons where attendees could choose which session was best for their career goals and interests.

Girls in Aviation Day Long Beach

With the enthusiastic participation of the Long Beach Unified School District, Girls in Aviation Day Long Beach was the biggest conference Girls in Aviation Day to date. More than 250 girls, along with their chaperones, were hosted by more than 100 WAI volunteers. The girls visited 20 activity stations, heard about 10 different aviation careers from a career panel, met role models, and simply had fun while they learned about aviation. The older girls had the opportunity to meet with college representatives, including those from U.S. Air Force Academy, Embry-Riddle

Aeronautical University, Kent State University, Ohio University, Western Michigan University, St. Louis University, Delta State University, and more. Each participant earned a WAI Aviation Girl Fun Patch.

Other conference highlights include:

- A total attendance of 4,500 includes 136 international representatives from 33 countries. Most international attendees are from Nigeria, followed by Canada, Ghana, and Australia.

- The attendees are 76 percent women and 24 percent men.

- The exhibit hall hosted 170 separate companies and organizations, representing all aspects of the aviation community, including drones.

- 156 scholarships were distributed to WAI members at every stage of life from for both academic use, lifestyle enhancement, and flight training, including type ratings. A total \$875,065 in scholarships was awarded, which put the total scholarships awarded since 1995 to more than \$12 million.

The 31st Annual International Women in Aviation Conference will be held March 5-7, 2020, at Disney's Coronado Springs Resort in Lake Buena Vista, Florida. For more information, visit www.wai.org.