

# CONTACT!

EXPERIMENTAL AIRCRAFT AND POWERPLANT NEWSFORUM FOR DESIGNERS AND BUILDERS



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# CONTACT!

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## MISSION

CONTACT! Magazine is published bi-monthly by Aeronautics Education Enterprises (AEE), an Arizona nonprofit corporation, established in 1990 to promote aeronautical education. CONTACT! promotes the experimental development, expansion and exchange of aeronautical concepts, information, and experience. In this corporate age of task specialization many individuals have chosen to seek fresh, unencumbered avenues in the pursuit of improvements in aircraft and powerplants. In so doing, they have revitalized the progress of aeronautical design, particularly in the general aviation area. Flight efficiency improvements, in terms of operating costs as well as airframe drag, have come from these efforts. We fully expect that such individual efforts will continue and that they will provide additional incentives for the advancement of aeronautics.

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# Switch on!

By the time you are reading this, John Moyle and I will be attending a new venue for us, the Light Sport Aircraft Expo at Sebring, FL. If all goes well, we will be adding this event to our annual travels. At the beginning of December, I attended the LSA tour in Camarillo CA. The tour is an incredible event that I would recommend to anyone interested in LSA.

Sun 'n Fun is right around the corner, and again this year I'm seeking volunteer help with the booth so I can get out and find stories for upcoming issues. I can offer a wristband for the week, cold drinks, and aviation camaraderie, but not much else in the way of payment. If you think you'd like to help me sell magazine subscriptions at this

year's SnF (or even Oshkosh for that matter), please let me know.

In this issue we have a special article by Anthony Liberatore. He's been following the Atlantica for some time, and wrote a nice piece for us. At the same time, he tipped me to the existence of Steve Lantz's "Lake Tahoe Special", our cover story for this issue. Anthony has been a great friend to CONTACT! Magazine, and we look forward to more of his contributions. And speaking of contributions, we are always looking for more stories to publish. We could certainly use your contributions, but at a minimum, we could use tips or requests like Anthony did for us with the Seabee information. As usual, I hope you enjoy this issue. See ya at the next fly-in! **Patrick Panzera**



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On the cover: Steve Lantz's "Lake Tahoe Special" Republic Seabee, over Lake Tahoe CA. This photo is credited to Ian Norman, a 16 year old, aspiring aviation photographer.

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# Edge Of the Envelope; Atlantica: Shape of Wings to Come

By Anthony J. Liberatore  
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I cannot help but wonder if it is déjà vu all over again. It wasn't that long ago many of us were stunned to see on the cover of "Air Progress" a small bird known as the VariEze. Its construction technique, use of the latest aerodynamics such as the GAW airfoil, winglets and the canard configuration, stunned us all and made many dreamers want one badly. And get one they did. Many were built as well as its follow-on sister, the Long-EZ. However, in a hangar in balmy Melbourne, Florida there is an aircraft that I cannot help wondering, may end up repeating the same phenomenon. This aircraft's name is Atlantica. For those of you not familiar with the project Atlantica, it's a four-place blended-wing-body aircraft, of all-composite construction, the brainchild of Alan Shaw.

Alan's background may not be familiar to many of you, but he is one of the original team members with the Velocity Aircraft. Since leaving the Velocity program, Alan has developed a proprietary composite technique that Atlantica utilizes in its construction. At an air show, Alan was discussing the technique with an individual who mentioned that the technique might lend itself well to some advanced work being done, which could not be discussed; however, he did mention the Blended Wing Body (BWB) configuration.

While testing iterations of design concepts within aero software programs, Alan tested the BWB configuration and was stunned by the efficiency gains over all other configurations. It was then that he decided to proceed with his own BWB design.

The blended wing body is the brainchild of McDonnell-Douglas (before it was bought by Boeing), but its origins can be traced back many years to the work done by the Horten Brothers in Germany. It should be noted that almost all major airframe manufacturers, and universities are currently investigating, or have investigated, the configuration at one time or another. It is an attempt to eliminate fuselage drag, increase L/D, create a large capacity airliner that would take the footprint off the current "Heavies", and distribute the load of the passengers



more evenly along the span to make it a more efficient "Span-Loader". The selling point of this configuration that has everyone's attention is that the drag is projected to be in the area of 32% less. With that in mind the fuel savings could be dramatic. Although no full-scale blended wing body airliner currently exists, universities such as Stanford have flown some large-scale models. Atlantica is the only general aviation aircraft of this configuration at this time. The current prototype is a four-seater powered by a 235 hp LOM inverted inline 6.

In the design process Alan utilized a great deal of aero software to help develop the Atlantica. For instance, not satisfied with available airfoils, Alan designed a series of laminar flow, low pitching moment airfoils for this application, with sections along the span tailored to the given Reynolds numbers at a given station. While Atlantica utilizes a "bell-curve" span loading as found in the Horten brothers' designs, one of Alan's team members came up with the concept of using a less cambered, almost inverted airfoil out near the tip to take the place of the large washout typically utilized in tailless, swept-wing designs. It is surmised that this will also reduce wingtip vortices for even greater efficiency. Another unique feature is that the center section has some reflex to help maintain a positive angle of attack at cruise. Alan attributes this to a successful vehicle, utilizing a form of trim or "toe-in" to help the vehicle track in a straight fashion. To truly understand some of the features of the configuration, read what Alan has to say:

*"The swept back wing tips always pull down. This is the key to the "bell curve" span loading and how Blended Wing and Body (BWB's) aircraft work. The "see saw" is balanced the same as conventional aircraft which require the addition of an aft wing (and drag) to pull the tail down. Understanding what happens when the pressures*



are reversed at the wing tip is the heart of this debate. As the elevons are deflected upward the angle of attack increases across the whole span, reducing the downward force at the aft wing tips, causing the nose to return to alpha zero when the stick is released. This is proof of pitch stability. Those who persist in rigging swept winged and all winged aircraft with "Elliptical Span" loading, which produces lift all the way to the wing tip, will realize instability in all three axes. The dihedral effect of a swept wing produces excessive roll stability at high alpha. Roll stability produces yaw stability. Good swept wing designs have anhedral to destabilize somewhat such that ample roll and yaw agility is regained for cross wind landings. Anhedral also has the benefit of more efficiency at cruise speed. The "Bell Curve" does several things for swept, all-winged aircraft. By reversing the pressure differential at the wingtips, vortex drag and spanwise flow are minimized. The lift and drag coefficients are much higher in the center of the aircraft than an elliptically loaded planform so a fuselage with wing intersections (a tube with wings) would result in little lift and high drag in this area. BWB's take advantage of the bell curve, high mid-wing loading, with an airfoil center section and a blended, no-intersection transition to the outer wing panels."

After the prototype was finished, one unique step in the testing program was to mount Atlantica on a trailer and tow the entire assembly behind a pickup truck on aircraft runways and taxiways. On the Atlantica website, [www.wingco.com](http://www.wingco.com), you can view movies of the tests (in Atlantica's original configuration), including the high alpha test. In January, 2003, during the flight test program with Alan as PIC of Atlantica, an incident occurred that has delayed the program's progress. During a high-speed taxi test, an inadvertent take-off occurred. Over controlling by Alan created a pitch up / pitch down scenario that resulted in a very hard landing that damaged



**The air-cooled, supercharged, 235 HP Walter-LOM inverted inline 6 cylinder engine.**

the Atlantica prototype. Nevertheless, even with this setbacks, all is not lost. In fact, while "flying" Atlantica within aero-simulation software, Alan has been able to replicate his incident many times and he is thoroughly convinced it was his piloting technique that led to the eventual outcome - not the stability or control of Atlantica.

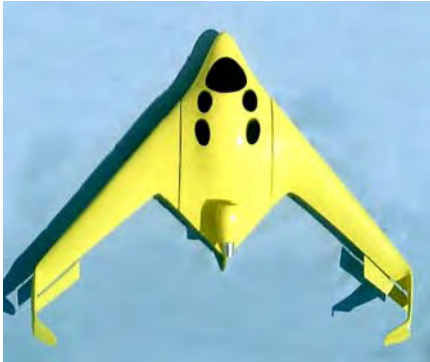
From this incident, a problem of trailing edge boundary layer flow separation came to light. The solution chosen is unique and involves moving the long-span narrow chord elevons off the wing and mounting a shorter narrow chord elevon aft and slightly above the wing, à la Junkers. Alan surmises that this elevon location may also act as "feathers" to dissipate the vortices much like an eagle or pelican will splay their feathers at the tips to reduce vortices. Another contributor to the overall configuration efficiency is the "C-Wings". If you look at the latest configuration photo, the C-Wings are the horizontal aft sweeping surfaces atop the winglets.



**Atlantica prototype undergoing trailer preparation (original configuration).**



The C-Wing is the brainchild of Dr. Ilan Kroo and his students at Stanford University. Some of you may not recognize the name, but Dr. Kroo is the father of the Swift - the high performance, foot-launched glider. The C-wings came about as Dr. Kroo challenged his aero students to design a wing with greater efficiency than a given start point, which was a Long-Eze wing. Through computer design iterations, the C-Wing was born, and what they do is quite amazing; your current wing with slight dihedral has a span efficiency of 1.03. C-Wings increases the span efficiency to 1.45. One of the original concept applications of the C-Wing was to apply them to an existing airliner configuration on top of large winglets to eliminate the entire tailplane.



While this configuration has not gone any farther than artist's conception, C-Wings have been applied to a few R/C aircraft and to Team Atlantica's 1/7<sup>th</sup> electric model of the Atlantica, and the static

model pictured above. Alan notes in the Atlantica e-mail list that the addition of the C-Wing to 1/7<sup>th</sup> scale model had a dramatically positive effect on the landing characteristics and that it will now spoil you in how well it lands. When Atlantica's C-Wing configuration is added to the Atlantica prototype, not only will it be the first man-carrying craft with C-Wings, but its C-Wings will also utilize trim tabs to assist in the landing configuration (another first).

So where is the program at this time and where is it heading? After the taxi (inadvertent flight), the program has come under some financial strain. Current goals are to proceed with a 1/6<sup>th</sup> scale model, a 1/3<sup>rd</sup> scale model, as well as to resume work on the full sized prototype as soon as feasible. A few Atlantica enthusiasts have pledged funds to assist Team Atlantica to get the plane flying. While much headway has been made in reaching the funding goal, it has not yet been achieved. The prototype will be repaired and the new wings, with the new elevon and C-Wings configurations, installed. The landing gear will be relocated forward since its original aft mounted location was a contributing factor to the original incident. A flight test program and a test pilot will be utilized to keep a fresh perspective on flying the aircraft vs. having the designer fly it (which makes a lot of sense).

The Atlantica prototype will fly at some point, and its performance may well surprise the critics. What is being attempted here are a number of firsts, including: proprietary construction technique, the first general aviation BWB, custom airfoils, C-Wing utilization, unique elevon

configuration, and less cambered inverted airfoil section(s) at the tip. The combination of all these aerodynamic features may well in fact lower the drag and increase the fuel economy of Atlantica to springboard it light years ahead of even the slickest homebuilt. In light of current and potential future fuel prices and the cost associated with burning these fuels, it has definitely shown up on many a pilot's radar screen. At some point we may all be looking for alternatives to high GPH fuel consumption figures. This configuration may be a "disruptive technology" to general aviation since it will be hard to say no to the potential fuel savings this configuration may offer. If this is not enough of a change, consider a slightly larger wing span cousin powered by a small turbofan such as the Williams FJ-33. The calculated performance of such an aircraft, as noted on Wingco's website, is eye catching to say the least. With the "very light jet market" just on the horizon, perhaps a turbofan Atlantica will be a player in this arena.

America has always been a country of visionaries that have been willing to take risks, dream big, and reach for their goals. Success or failure, men like Burt Rutan and Sam Williams have followed their passions and have laid it on the line. In the process they have not only changed the way we fly, but in many cases the way we live. In many ways the contributions of such innovators are inspirations for others to dream and reach for the stars. It is truly a testament to these individuals as well as to the American entrepreneurial spirit. In an Oshkosh forum, I once heard one of the Rutan brothers say that if we were not willing to take risks we still would be looking at the backside of an ox. With a little luck and help from visionaries such as Alan Shaw and Company, we will be looking at oxen from "Flight Levels" as small dots as we pass them at an amazing speed.

**Anthony J. Liberatore**  
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Alan Shaw, ready for taxi testing before the unfortunate incident.

- **Engine Conversions**
- **Airplane Profiles**
- **Builder Reports**

Since its inception in 1990 *CONTACT! Magazine* has provided experimenters, designers and builders the unique opportunity to have their work published. Unlike newsstand publications which rely on professional writers to fill their pages, we provide the space and editorial help to those individuals who are willing to share their endeavors with others, and in so doing, help advance the state of the art in aeronautics.

*CONTACT! Magazine* is sometimes confused with type newsletters. These association publications support the building, flying and varied social aspects of a specific type aircraft or type families. Some also carry advertising as an additional means of support. Efforts of their editors are vital to the growth of the amateur built aircraft movement. We recommend anyone beginning a project to join up with the appropriate type group.

*CONTACT! Magazine* crosses over the entire spectrum of home-building. For example, principles of auto engine conversions found in specific articles are applicable to many experimental aircraft. We rely on the integrity and insight of contributors to provide factual and comprehensive information. In our typical twenty four page bimonthly publication we present details of construction, performance, materials, costs and other elements important to individual projects. In the case of commercial offerings, readers can expect that the information provided will exceed that found in respective brochures, and has been thoroughly checked for accuracy in the claims being made. Thus, *CONTACT!* readers can expect quality, easily understood and organized information that is rarely found elsewhere.

Patrick (Pat) Panzera, editor and publisher.



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