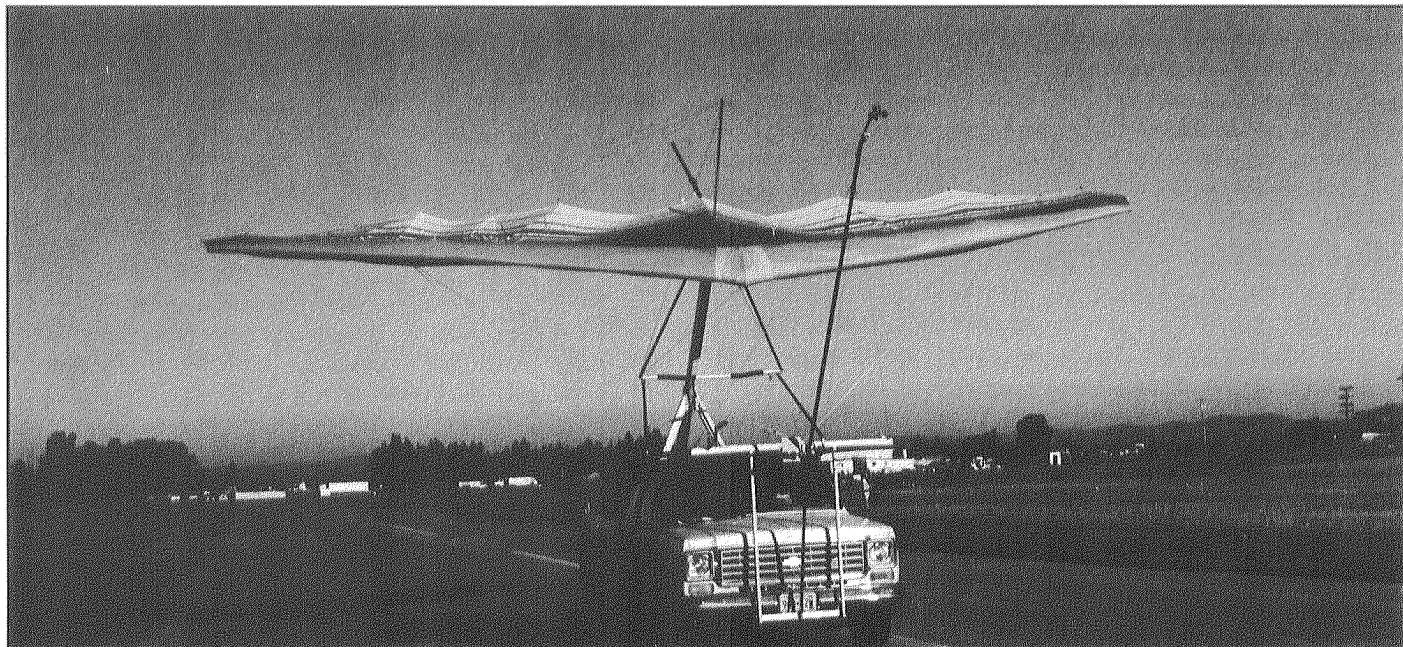


Pilot Report



The Formula undergoes the -30° load test on the Pacific Airwave test vehicle.

Pacific Airwave Formula

by Peter Cheney

The opportunity to fly and evaluate Pacific Airwave's Magic Formula came as an unexpected bonus to a February flying trip to Southern California, that Mecca of all hang gliding Meccas.

As an inveterate aeronautical junkie I'm always keen to try something new, and the Formula was one of the few gliders now on the market that I hadn't flown.

I was intrigued by what I'd heard about the Formula, which seems to have earned a soft spot in the hearts of a wide range of pilots: Advanced pilots speak highly of its superb handling, while less experienced fliers moving up from gliders like Airwave's Vision Mark IV apparently find the Formula an exhilarating introduction to the world of high performance.

OVERVIEW

At first glance the Formula looks like a true high-performance wing. With an aspect ratio of 7.2, a nose angle of 132° and an area of 154 square feet (a 145-square-foot version is available as well), the glider has the sort of specifications you'd expect to find on the current racing wings.

Which is to be expected, given the Formula's heritage. The glider was developed from Airwave's Magic Kiss, which has now evolved into the K2, one of the most popular gliders in the supership class. The Formula is, you might say, the K2's kissing cousin (with apologies to the punaphobic reader).

The Formula's basic planform is virtually identical to the K2, and the casual observer could easily mistake them. But look closely and

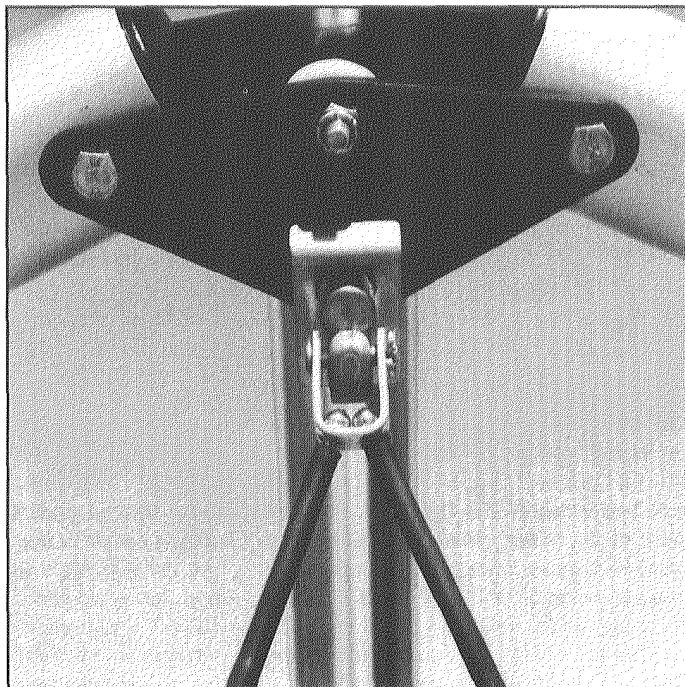
you'll find some key differences between the two. The Formula dispenses with the K2's variable geometry system, it has fewer battens, different leading edge construction, a thinner airfoil shape, less crossbar tension and a looser sail cut.

These strategic changes, along with a great deal of careful tuning, result in a glider with very good performance, but with a different character and feel than its higher-performance sibling, the K2.

The Formula is optimized not for the pilot trying to set world records, but for the recreational pilot who wants to have a lot of fun in a glider that's slick yet relatively simple. Pacific Airwave president and designer Jean-Michel Bernasconi says he wanted the Formula to be "an anxiety-free tool" that would inspire confi-



Formula control frame assembly including PacAir speednut.



The nose latch assembly with spring-loaded catch pin

dence and help the advancing pilot look good. "The specialty of this wing is providing maximum fun along with state-of-the-art performance," he says.

The question, of course, is whether this goal has been achieved, and whether, by extension, the Formula is a good bet for pilots looking for a sweet-handling, dependable wing with the performance to carry them to the top of the stack.

FLYING CHARACTERISTICS

So let's cut to the chase by breaking with a tradition I have always despised—the ritual of forcing the reader to plow through at least two pages of the most detailed analysis of the glider's technical specifications, bolt by bolt, before actually telling the impatient reader how the Unit in Question actually FLEW.

My flights on the Formula took place in Southern California, where I accumulated about eight hours of soaring time on the wing in a variety of conditions. Though some gliders demand a certain amount of transition, the Formula isn't one of them. From the moment my feet left the ground the Formula struck me as an extremely easy-to-fly wing with very straightforward characteristics and a solid yet maneuverable feel.

Which was a good thing. Since my first flights were in soarable conditions on the 60-foot dune at Marina Beach, California, I had no choice but to acquaint myself with the Formula's turning characteristics in short order. Cranking and banking to stay in the narrow ridge band, I found myself marvelling at the glider's beautiful control harmony and roll response. Turning was almost effortless, and unlike many higher-performance wings, the Formula displayed virtually no tendency to overbank.

This lack of "spiralingness" is, in my opinion, one of many characteristics that make the Formula an excellent choice for the pilot who wants a glider with excellent performance, but doesn't have either the airtime or the inclination to put up with the more demanding characteristics of the more high-strung racing wings, which often display marked spiral instability.

The Formula's pitch characteristics are equally well-suited to the intermediate pilot. Pitch feel was light, yet had a slight "notchiness" that clearly indicates the trim position and gives good feel for airspeed when turning. This adds up to pleasant turn performance. Despite the light bar pressure, you can tell right away whether you've applied the correct amount of pitch to coordinate the turn.

Push out a little too much in a turn and the

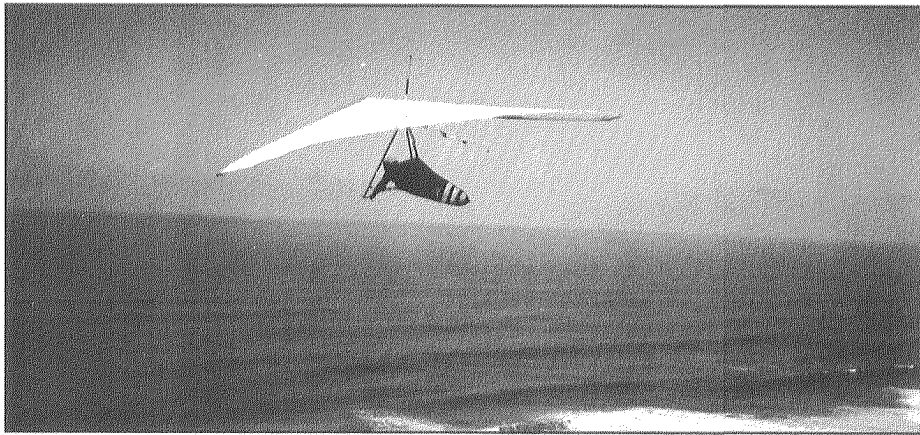
Formula will mush without stalling or dropping a tip. The glider's exceptional turn coordination and positive feel will inspire confidence in even the low-time intermediate pilot; this is a glider that lets you concentrate on your flying instead of its aerodynamic idiosyncrasies.

Later, as I accumulated more airtime on the glider at other sites, this pleasant initial impression was confirmed—the Formula is probably the best-handling modern glider I've flown. If you like to sport around, playing in the lift like a dolphin surfing a wave, this is the kind of glider for you.

PERFORMANCE

There is, of course, a price for everything, and the Formula's wonderful handling is gained at the expense of high-end performance and effortless speed. If you like to race, or if you're trying to break the world distance record, the Formula isn't the best choice. While the Formula has a sink rate that approaches the top performance wings, and an entirely respectable glide, its performance deteriorates markedly at airspeeds above 35 mph or so.

Pull in the Formula's bar hard and you'll notice sharply increased pitch pressure compared to the K2 and its high-performance competitors. You'll also notice a marked fall-off in



The author soars the Formula at Marina, CA.

glide performance. The Formula won't penetrate strong winds with the aplomb of the higher-performance wings, and flying fast will drop you below your buddies who have their VG strings pulled tight.

But to criticize the Formula for reduced high-end performance compared to the competition wings is to miss the point. The Formula wasn't designed as a flat-out racer. And within the speed for which its performance has been optimized—from stall speed up to 35 mph or so—the Formula is an absolute blast. Reduced top-end glide is a tradeoff the designers made in exchange for the Formula's exemplary flying qualities in the speed range where most pilots actually spend the majority of their time flying.

The Formula's performance should rightly be compared with others in its class, such as the Wills Wing Sport, another sweet-handling glider that has endeared itself to a great many pilots. And in comparison to the Sport and other gliders in the class, the Formula's performance is second to none.

Which brings up the thorny and ever-contentious issue of hang glider performance comparisons. While glide ratio and sink rate comparisons are extremely difficult to make, due to wide variations in (among other things) pilot skill, wing loading, glider tuning and air conditions, I feel safe in making a few general observations about the Formula's performance.

In smooth coastal ridge lift at Torrey Pines, the Formula took me to the top of the stack—or very close to it—on a sunny Saturday that featured heavy glider traffic that ranged from ancient single surface ships to the latest competition gliders, many with their VG's cranked full on.

The Formula is clearly a giant step above

Hang II-rated ships like the Vision Mark IV. After a couple of hours of cruising the ridge, I felt the Formula's sink rate was competitive with nearly anything, although Axis's, K2's, HP AT's and late-model Sensors seemed to have somewhat of an edge, as you might expect.

Glide ratio seemed very good. The Formula felt much like a competition-class glider until I accelerated to airspeeds over 30 mph, at which time the glider's added washout (when compared to racing wings) made its presence

"Intermediates will find [the Formula] an exhilarating introduction to the world of high performance, and advanced pilots will find the Formula a fine all-around glider that's more pleasant to fly in a wide variety of conditions than the highest-performance wings."

known with increased bar pressure and reduced glide performance. But, bearing in mind what I've already said about fair comparisons, the Formula's performance at speed is probably among the best in its class.

MORE FLYING

Stall behavior was ideal for a glider in this class—a slow, firm pushout resulted in a gentle mush. A full stall break required a sharp final

push, and recovery was rapid; as soon as I relaxed my outward pressure on the bar, the glider smoothly lowered its nose and recovered with minimum altitude loss.

Entering a stall by pushing out more rapidly from trim speed or slightly faster resulted in a sharper stall with no wing drop, and a quick, uneventful recovery. The relatively low-time pilot will have no unpleasant surprises awaiting him (or her, of course) as he explores the all-important low-speed regime in the course of developing his soaring skills.

Cruising with good altitude above the cliffs at Torrey, I checked the Formula's yaw stability, and found that in the middle speed range, abrupt control inputs can cause the Formula to enter a mild yaw cycle which makes the wings swing gently back and forth. This oscillation usually lasted for a cycle or two before damping itself out, and was easily controlled by reducing airspeed slightly. Smooth control inputs eliminated the characteristic entirely.

Overall, I rated the Formula's stability in all three axes as very good. I should note, however, that some pilots who have transitioned to the Formula from more docile ships have expressed some initial anxiety over the glider's occasional tendency to oscillate in yaw. But a brief familiarization with the glider will quickly eliminate any apprehension.

This mild yawing tendency has also been reduced in the latest versions of the Formula by a subtle reshaping of the sail toward the tips and a slight reduction in overall sail tension, according to Airwave spokesman Kenny Brown.

Landing the Formula was straightforward. The glider's rapid roll response and light pitch pressure made shooting a top landing approach in windy conditions at Torrey Pines a breeze, and flare timing was quite intuitive. Landing in low-wind conditions proved equally simple. The Formula seemed to have a fairly wide flare window, and won't give the average pilot much to sweat about.

NUTS AND BOLTS

Back on the ground, I examined the Formula carefully to judge the quality of its sail, hardware and overall workmanship and design.

The Formula's airframe is built almost entirely of 7075-T6 aluminum tubing. This lightweight, thin-wall tubing is quickly becoming the alloy of choice in the hang gliding industry.

This alloy yields a light, strong and very stiff airframe when used correctly, as it clearly

is in the case of the Magic Formula, which weighs just 63 pounds (the 144-square-foot version weighs 59 pounds), yet managed to sustain over 2,200 pounds of lifting force during positive load testing performed for HGMA certification. (That equates to about 11 G's for a pilot with a hook-in weight of 200 pounds, a figure that speaks volumes about the glider's strength.)

If you're an engineering and hardware buff, you'll no doubt like the way the Formula is constructed. The hardware is elegantly designed and well executed, with a number of inspired design touches.

Among these is the clever, spring-loaded catch at the rear of the keel that the crossbar restraint cables clip into. Unlike some other designs, this system makes it virtually impossible to launch the glider without connecting the crossbar: if you don't clip in the restraint cables the glider will just flop when you try to pick it up.

Lest you think this design nicety unimportant, be advised that top pilots have managed to launch with their crossbars unattached on gliders that use a separate system to haul the crossbar back before it is pinned in place. Sailplane manufacturers, by the way, have for the past several years concentrated on setup systems that eliminate the possibility of negligence by automatically connecting elevator, aileron and other flight-control hookups when wings and horizontal stabilizers are set in place.

Another nice touch that has become an Airwave trademark is the use of swiveling washout tubes that are totally enclosed within the double surface of the wing, cleaning up the tip area both aerodynamically and aesthetically.

The washout tubes are loaded with a short length of bungee, and pop into place quickly. The tubes swivel up and down within a slot machined into the leading edge.

Take a look at the Formula's pilot suspension and you'll notice that there's no kingpost hang system. Suspending the pilot from the kingpost to increase control authority has become commonplace, but the Formula achieves exceptionally quick roll response and light pitch pressures without it. This eliminates a fair bit of unnecessary hardware and the hole through the sail required to route a kingpost hang system.

Any performance gains that would derive from this bit of detail refinement would of course be tiny, but those who appreciate elegant design will no doubt prefer this system—and what's wrong with drag and weight saving, no

matter how small?

The Formula has a medium-sized control frame and fairly tight rigging. The relative tightness of the rigging is partly due to the Formula's lack of a variable-geometry system, and gives the wing a good, connected feel on launch.

The control bar is hinged at the top, and the wing can be quickly dropped flat in high winds by detaching the nose wires from their spring-loaded catch, a feature much appreciated by pilots who fly in windy conditions.

The Formula comes standard with airfoil-shaped downtubes with rubberized trailing edges. (These "Safedge" tubes seemed fine to me, although I must confess that I am somewhat partial to fatter faired downtubes, perhaps because I have hands the size of a gorilla's, even though I'm not a particularly large person. But here we enter into the area of personal fetishes, an area best left untouched in this august journal.)

Assembling or breaking down the Formula reveals a virtue that has become all too rare in the modern sport of hang gliding—rapid, simple setup. Many gliders can be real beasts to set up or break down, with a wearying litany of things that have to be fastened and unfastened, along with a mighty quiver of battens that must each be inserted and tensioned... you know the drill.

The Formula's relatively low number of battens (25 in total, counting the nose rib), and clever mechanical design make setup and breakdown as simple as possible. Though pilots who've practiced could no doubt beat this figure, I managed to take the Formula from its fully assembled state to car-top ready in less than seven minutes on the one occasion when I thought to time the breakdown. Considering that I'd only flown the glider a few times, I thought this spoke well for the glider's design.

Sail quality appeared good. The glider I flew had a leading edge made of mylar-coated ripstop nylon with a mylar insert, and a main body of 4.4-ounce dacron. Other sailcloth options are available. The Formula's cover bag was well made, with padded covers for key components sewn into it so they can't be lost.

CONCLUSION

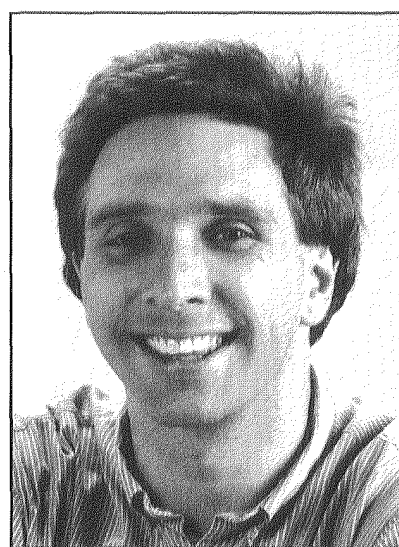
Overall, I thought the Formula was an excellent glider, and I have not hesitated to recommend it to a number of pilots who have asked me about it. The Formula is an excellent choice for pilots from the intermediate level on up. Intermedi-

ates will find it an exhilarating introduction to the world of high performance, and advanced pilots will find the Formula a fine all-round glider that's more pleasant to fly in a wide variety of conditions than the highest-performance wings.

Though it's clearly a notch below the top racing wings when it comes to flat-out speed and effortless pitch pressures, the Formula is a very good performer—and it has the kind of handling that makes you feel as though you've grown wings on your back. ■

FORMULA SPECIFICATIONS

Model	154	144
Sail Area (sq. ft.)	154	145
Glider Weight	63 lbs.	59 lbs.
Wing Span	33.91 ft.	32.83 ft.
Weight Range (lbs.)	130-230	120-200
VNE	50 mph	50 mph



Peter Cheney is a Canadian journalist and the author of Hang Gliding for Beginner Pilots, the official manual of the United States Hang Gliding Association. Peter is an Advanced-rated pilot, and has flown a wide variety of gliders, including almost every glider currently on the market.

Peter is 36 years old and lives with his wife Marian and daughter Catie in Toronto, Canada, where he is a feature writer for The Toronto Star.