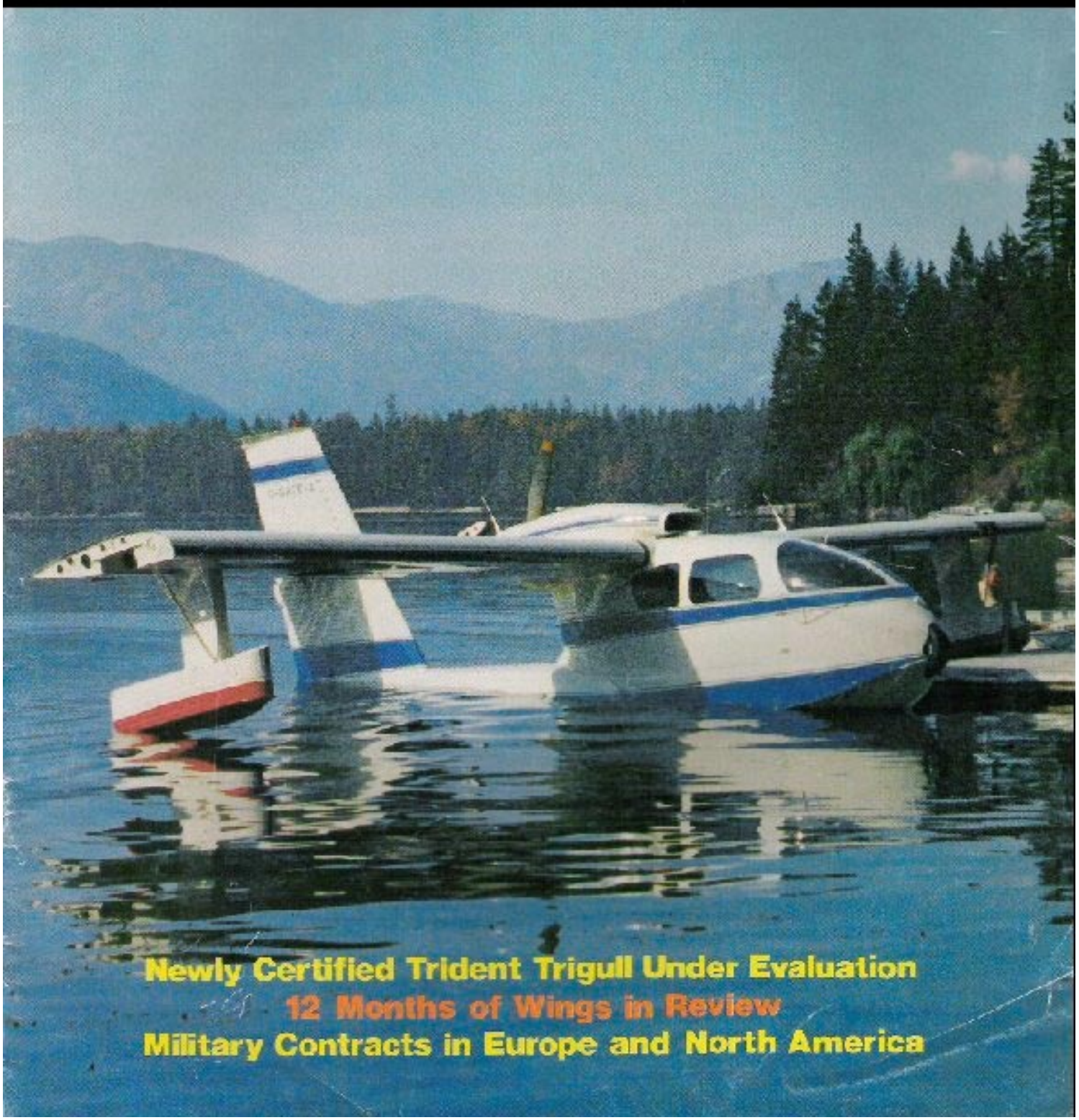
FEBRUARY 1977, $1.00

Wings



Newly Certified Trident Trigull Under Evaluation

12 Months of Wings in Review

Military Contracts in Europe and North America

Wings, February, 1977

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Trident Trigull

a fascinating development from the western shores

by George Westinghouse

"If the Seabee had been allowed to develop normally, there wouldn't be any Cessna 180s on floats today." Coming, as it did, from a Republic employee, this statement can be accused of bias; it also contains a strong element of truth. The 'Bee is tough, easy to fly, very maneuverable on the water and not particularly expensive to buy and operate. It is also slow, heavy, noisy and – especially in the original version – underpowered. The glide angle has been compared to that of a streamlined anvil and the water takeoff run at full gross was described by one pilot as, "the straits of Juan de Fuca". Despite these shortcomings, it is interesting to note that, almost 20 years after the last airplane left Republic, there are a tremendous number of these beasts around, being cared for and flown by people who defend their virtues with almost fanatical zeal.

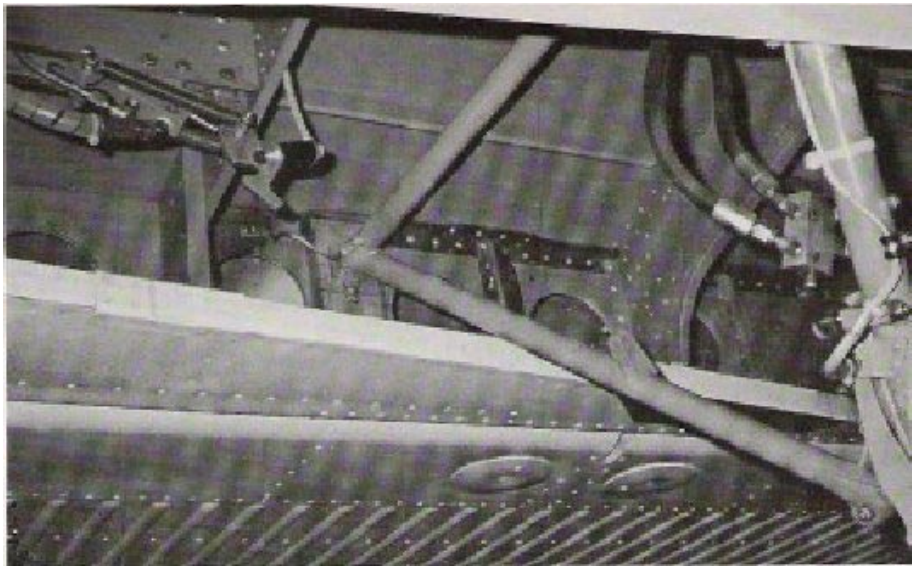
Why all this talk about the Seabee, when the point of this article is a whole new machine? Well, the 'Bee was the first modern design in light single engine flying boats; despite lack of commercial success, it was the right idea. The technology of the time however, made it more practical to adapt land planes to floats – hence the popularity of light floatplanes. What was needed then, was some more evolution in the Seabee design to make it lighter, more powerful, aerodynamically cleaner while remaining in the light single engine class. A tall order Italian designers came up with a partial solution in the form of the "Riviera", which looked rather like a Seabee with two tail beams. The main problem with this plane apparently was a small wing, which gave it undesirable low speed characteristics. The lake amphibian series answered many of the problems but lack the 'Bee's ruggedness and ability to handle rough water and – according to numerous mechanics – are a horror to work on. The latest – and most complete – solution to the problems posed by a small flying boat comes from a small concern in Vancouver, Trident Aircraft's Trigull. The Seabee has evolved.

Nose Gear Detail

The evolution has been such that the Trigull's resemblance to its ancestor is only skin deep. There are 2 reasons for the remarkable outward similarity between the 'Bee and the Trigull: First, there are only a limited number of forms a single engine flying boat can take; Second, the basic design comes from the same Mr. Spencer who designed the Seabee and the Spencer Aircar, a Seabee-like home built. Once you get past the physical appearance however, you're into a whole new machine; the technology of 1946, when the Cessna 120 and Fleet Canuck were new, has yielded to the techniques of the '70s.

Let's have a closer look at this machine. The basic airframe is aluminum alloy, light and very strong, meeting the requirements of F.A.R. 23 up through amendment 13. This includes a structural strength safety factor of 1.5, secondary wing spar capable of supporting some 80% of the main Spar's load, docile stall

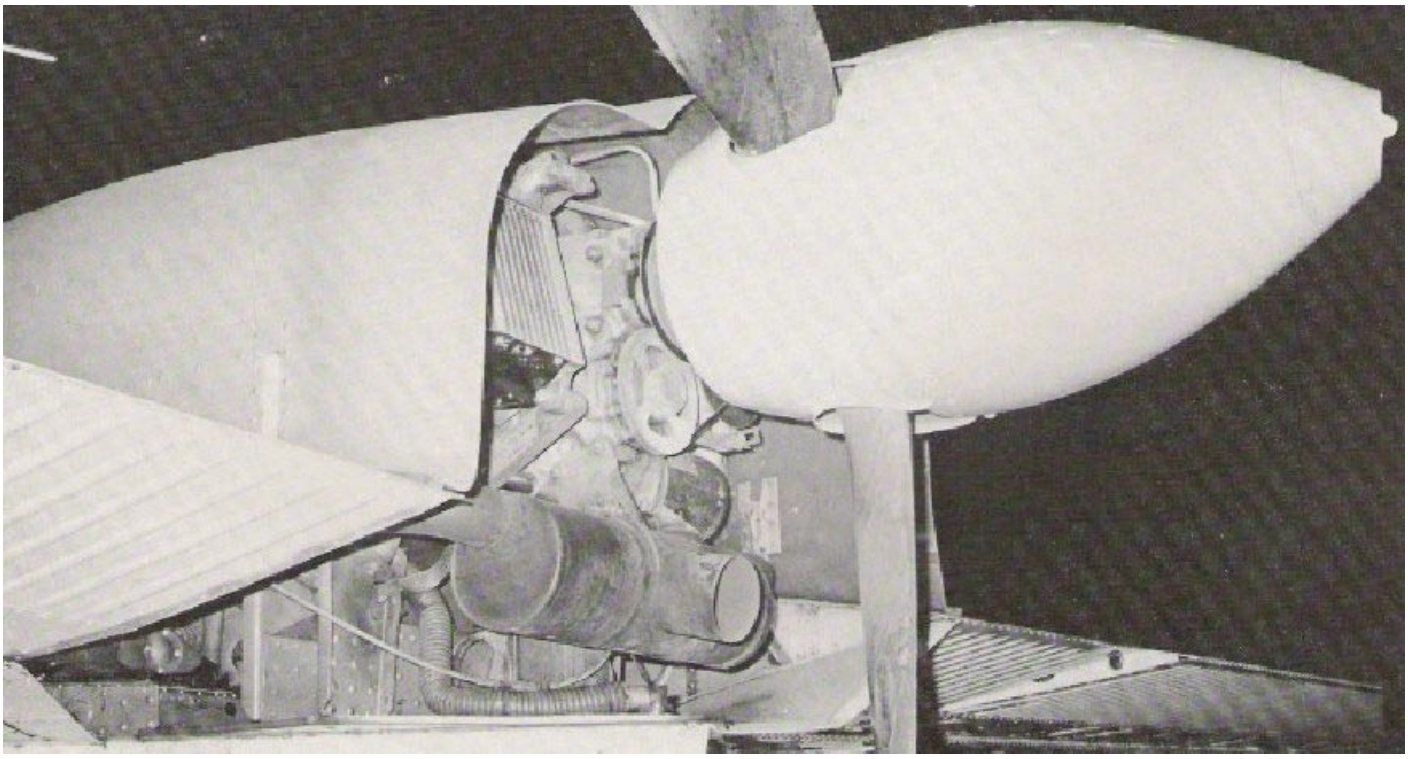
Trident Trigull



characteristics with no tendency to spin, and so on. Each part is heavily primed and rust-proofed prior to assembly. In the cabin assembly aluminum has given way to thick moulded fibreglass; this process is much better suited to the construction of these curved surfaces, doesn't corrode, makes a lighter, cleaner component (no rivets) and loses little – if any – of the original strength. Without going deeply into the hydrodynamics of the hull, the result is conventional, efficient and forgiving – as we shall see a bit later. Basically then, the airframe is conventional and strong.

Aerodynamic streamlining is achieved by retracting everything. The undercarriage, which on the Seabee contents itself with scrabbling up out of the water and hanging there, retracts cleanly into the high wing. This makes for a long, rather gangling appearance when extended but is every bit as strong as any other landing gear arrangement and gives a wide, stable stance on the ground. A further advantage of this design is that the gear mechanism has been moved up out of the cabin, making more room for luggage. The 'Bee's tailwheel has been moved to the nose and retracts forward into a

Above: Main gear up and down lock detail. (Below) Underwing fairing removed.



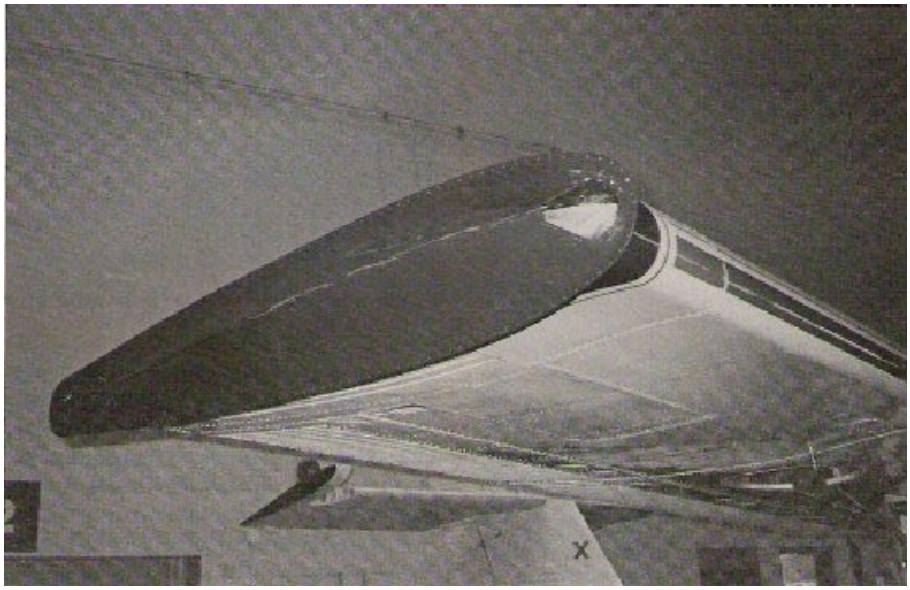
watertight compartment, leaving the tyre exposed to act as a bow bumper for water operations – an outstanding idea. (The aerodynamic wing floats – which are smaller than one might expect but provides more than adequate stability on the water – retract to add a total of 3 feet to the wing span and make a clean wing tip.) The gear is hydraulically operated, held up by mechanical locks and hydraulic pressure ad kept down by hydraulic pressure and over-centre locks. The Fowler flaps are also hydraulically operated and can be set to any position, being held there by trapped hydraulic pressure. The water ruder retracts manually – cable and pulleys – into the rudder. A cantilever wing with no external struts completes he clean picture. The Hydraulic system is self contained and powered by a 28 volt DC motor, with a hand pump for emergency operation.

The flight controls are conventional, with 100% mass balance in the elevator. Pitch trim is achieved by adjusting the horizontal stabilizer on a jack screw arrangement and the rudder is trimmed by a spring arrangement.

Power for the Trigull comes from Teledyne Continental's new Tiara 6 – 320 engine, at present certified only in a de-rated 285 HP version; when the 320 HP version is certified, this will be installed. The main advantage of the Tiara is the Vibrational Torque Control Unit, used in place of counterweights on the crankshaft to dampen torsional vibration in the engine. In layman's terms, what this unit does is it allows the propeller to be driven by a flexible drive shaft which itself is turning at a low enough RPM to avoid any significant torsional vibration.

The result is a very smooth running engine. Another interesting feature of this engine is a heater for the priming fuel to facilitate cold weather starting. The engine develops cruising power at an unusual 4400 RPM and is geared down at 2 to 1 ratio to drive a Hartzell constant sped, reversible propeller, To prevent the surprise of inadvertent reversal in the air, the prop can only be reversed at low (taxi) RPM, when there is a constant supply of oil pressure to the prop (at cruise RPM the governor supplies oil pressure – used to drive the prop to forward and reverse pitch – only momentarily to maintain constant RPM). Further protection is provided by indenting and locking the Beta – reverse – lever. Fuel comes from a single (for easy fuel management) 89 gallon (imperial) tank, located at the back of the cabin shell for convenient refueling and a low C of G.

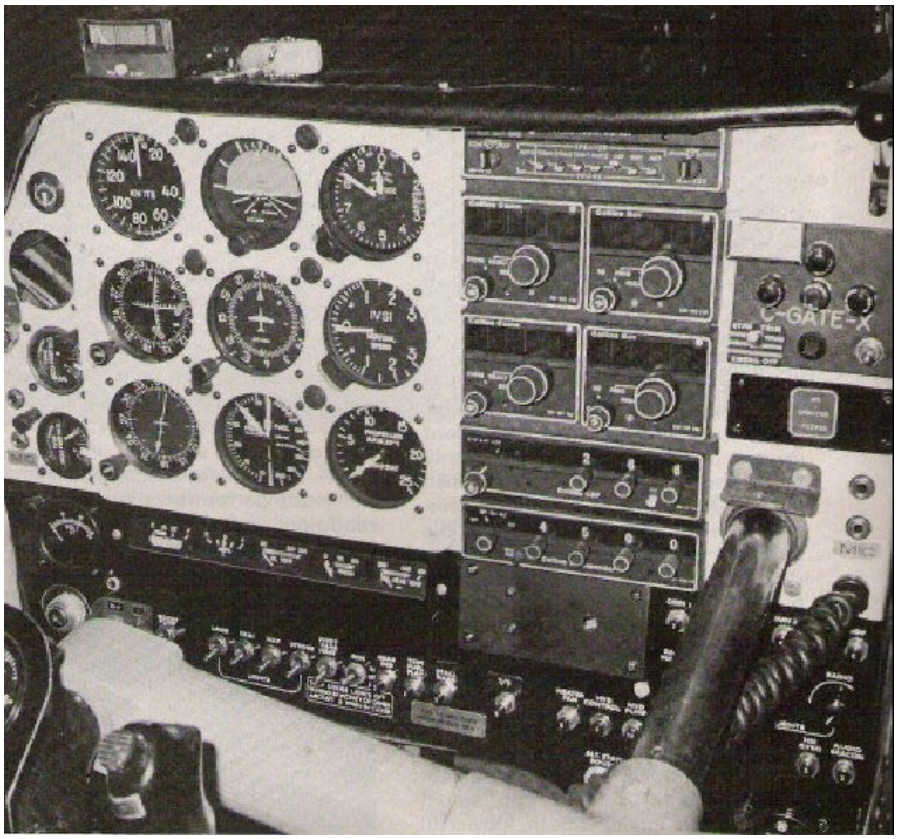
Performance is what you would expect of a modern clean, powerful design – excellent. Basic weight is around 2400 lbs. and allowable gross is advertised as 3800 lbs., leaving some 1460 lbs. for useful load – about the weight of a Cessna 150 with full tanks and 1 person on board. Subtract 600 lbs. for a full gas tank and 23 lbs. for oil and you can still take 4 large men fishing and have room left over for fish. Seating arrangements allow for 6 rather cramped people, 5 comfortably or 4 with lots of room. A land takeoff at sea level, standard conditions and maximum gross weight will use 840 ft. to get airborne and another 860 ft. to get over a 50' obstacle, for a total of 1700 ft. Water takeoffs naturally use a bit more room, requiring 1100 ft. to get airborne and another 900 ft. to clear a 50' obstacle. Very impressive figures indeed. Landing data is just as good: at full gross the Trigull will use about 490 ft. for ground roll or 130 ft. to come in over a 50' obstacle. Water landings require 570 ft. of water and some 1200 ft. to clear an obstacle. Rate of climb is predicted to be 1000 fpm at sea level and +9ºC, falling off to 850 fpm at 2000 ft. and 0ºC; again, the figures are impressive for a 4000 lb. airplane. Cruise speed at 6500 ft. and 75% power is 134 knots true, some 40 knots faster than the original Seabee! At this speed you can expect to burn about 14.5 gallons (all measures are in imperial gallons) per hour, getting about 9.2 miles per gallon. At $0.83 per gallon then, the Trigull costs about 9¢ per mile for gas and range is 716 NM with 45 minutes reserve. Throttling back to 65% power for a more economical cruise yields 129 KTAS at about 13.2 gallons per hour. You now get about 10 NM per gallon and the cost goes down to 8.3¢ per mile. Total range now is 780 NM. Best range is 863 NM at 45% power, but your airspeed is now closer to 100 KTAS.



Wing tip float up

The manual from which I got the above information, like the machine itself, lives up to expectations for a high priced single. The book follows the new

Trident Trigull



Instrument panel – Turn and Bank missing

G.A.M.A. format, being concise, complete and well laid out and tabulated for easy reference. Performance charts, for example, are exactly that – charts from which you can predict exact performance for any given conditions rather than columns of figures through which you have to guess and interpolate as best you can. A well thought out, professional document.

A holiday trip to Victoria, B.C. got me into the general area and let me meet Dave Hazelwood, the driving force of Trident, Norm Ronaason, a highly experienced former Canadian Forces test pilot, now the test pilot for Trident and Peter Masterton of the design team, whose background includes a stint at Canadair working on – amongst other things – the CL 215 flying boat.

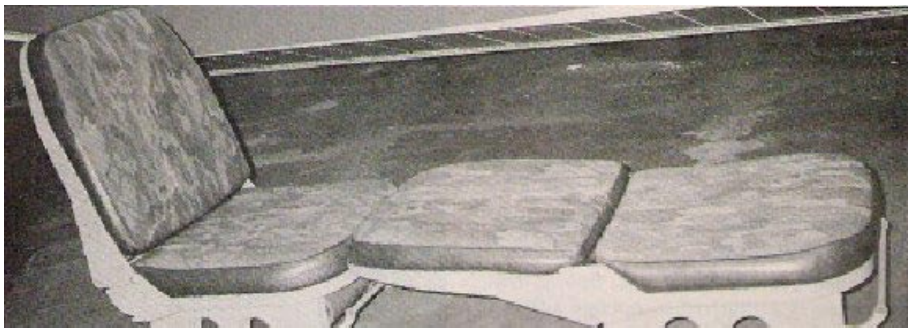
So it came to pass, one unseasonably sunny morning, that I found myself face to face with the world's only flying Trigull, C-GATE-X, newly certified and still in the pre-production stages. Preflight inspection was conventional; the gear is unusually easy to check because of the high wing. The gas cap incorporates a dip stick so you can tell exactly how much fuel is left – a nice touch. The nose wheel lets the cabin sit close to the ground so entry is easy through the large doors on either side – the bow door is used for water operations. Upon strapping in I was immediately impressed with the spaciousness of the cabin – no cramping here at all. The instrument panel ends about half way across the cabin to allow access to the bow door, so space is at a premium and is extremely well used. Flight instruments are straight in front in a modern "T" formation with power instruments below, engine gauge cluster below that and nose trim and flap indicators off to the left. An unusual feature here is a fuel flow meter measuring pounds per hour. All are easy to scan. Navigation aids are conveniently located to the right of the flight instruments and your radio – a very nice set of Collins microline equipment – to the right of the nav. aids. On the far right, still within easy reach, are the float selector and gear indicators. Gear and flap selectors are on a centre pedestal below the instrument panel. The water ruder lever is on the floor beside the pilot. The control column located in the centre of the instrument panel has yokes going to each side, with the right side detachable for access to the bow door; the elevator trim button is on the right side of the pilot's yoke and rudder trim and mike button on the left side. To further facilitate bow access, the right hand rudder pedals also fold down. Moving up to the ceiling, we have the power quadrant mounted up by the top of the windshield, an awkward-looking arrangement but quite common on flying boats and convenient to use. The Beta lever just aft of the power controls completes the list; al controls are conveniently located and no unnecessary stretching is required – an unusual feat.

Starting was easy and the engine idled smoothly at 1000 RPM – that's prop RPM on the tachometer, the engine itself is doing double time. Visibility is excellent for taxiing; like the Seabee, you sit well forward of the wing and there is nothing to interrupt the panorama before you.

I found the rudders quite heavy during taxi and had to use a lot of leg muscle to get around tight corners. Runup and pre-takeoff checks were conventional and we were soon ready to leave.

For this flight we were fully loaded and I was interested to see how the Trigull performed under these conditions in the hands of somebody completely unused to this sort of machine. Acceleration was smooth and quick on the takeoff roll with very little tendency to yaw; firm back pressure at about 60 KIAS lifted us easily off Victoria's pavement. With the gear and flaps up we accelerated immediately to 0 KIAS and passed 1000 ft. at an honest 1000 fpm – slightly less than predicted but the temperature was 5ºC warmer than standard.

Leveling off at 2000 ft., I tried a full speed run and got 138 knots true at 27" of manifold pressure and 160 pounds (22.2 gallons) per hour. Throttling back to 24" of manifold pressure and 1800 RPM yielded 125 KTAS at a much less expensive 115 pounds per hour, which translates to about 8 miles per gallon – very close to book specs for that altitude. Control response at cruise – and indeed in all maneuvering – is delightfully crisp and responsive without being touchy. Comfortable is probably the best description. The ailerons and rudder are interconnected to make life even easier. Visibility is simply outstanding in all directions, probably the best I've ever encountered in a single engine aircraft. The noise level was moderate, comparable perhaps to a 2 year old Cessna 172. Bear in mind however, that as a pre-production machine GATE has no interior insulation. The production aircraft then, should be just as quiet as any new aircraft; as it was, conversation was no problem. Changes in power settings require trim adjustments – nothing dramatic, just a gentle pressure that says it's time to do something. Elevator trim is easily handled by the yoke button and rudder trim is equally convenient; pressing the rudder trim button on the yoke disengages the trim springs while you position the rudder pedals for co-ordinated flight, whereupon releasing the trim button re-engages the trim springs in the correct position. By far the simplest system I've ever seen. A foray into the slow flight range revealed little discernable loss of control response and no tendency to wallow. Stalls required heavy back pressure and were uneventful; a firm buffeting is followed by a very gentle break. Release of the back pressure produced immediate recovery. I was encouraged to try a stall from a climbing turn; the aircraft just falls into a straightforward stall with no tendency to drop a wing. A stall/spin accident in the Trigull is going to take real determination – abuse of the controls just won't do it.



Seats shown fully reclined

The next step was some water work in Cowichan Bay, an exercise I anticipated with mixed emotions as 8 years have elapsed since my last water landing. Even with Norm Ronaason's comforting presence beside me, the possibility of a porpoise was uppermost in my mind. I needn't have worried – the Trigull is docile on the water as it is in the air. The first landing was across a gentle swell – good porpoise potential. Coming in at 70 KIAS, I rechecked gear up, floats and flaps down – a complicated warning system lets you know if you're about to land on the right surface in the wrong configuration and vice versa but does not take the place of a thorough pre-landing check. Despite – rather than because of – my technique, touchdown was gentle and after a couple of gentle pitching movements GATE settled comfortable into the water. Water maneuvering is simplicity itself with that reversible prop; just set the throttle at 1000 RPM and use the Beta lever to go ahead or astern. The Trigull turns easily into or out of the wind, going forward or back. Although we didn't get a chance to try it, step turns are apparently easy and stable – those little wing floats provide all the buoyancy you need. Takeoff across the same light swell, although further complicated by an attempt to get on the step too early, showed only a gentle pitching motion – instead of the full blown porpoise I would have apparently experienced in, say a Goose or a Widgeon. Another splash and dash in calmer water and using slightly better technique produced no discernable pitching tendency; with no way of measuring our takeoff and landing runs I can only say that the Trigull wastes no more time getting up or down from the water than it does from a paved surface. Very impressive, when you remember that we were close to the maximum gross weight.

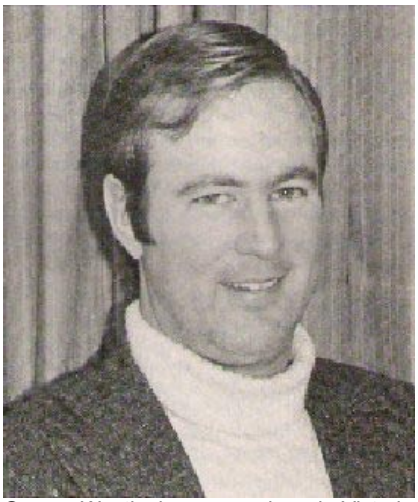
The final step involved a return to Victoria International for some circuits. Circuit maneuvering was easy – that superb visibility is a real asset here – and the checks conventional for a constant – speed retractable. Gear and flaps down, floats up this time, we settled into a stable approach followed by an easy touchdown. Following the touch and go we headed toward Sidney Island to set up an ILS approach on runway 26. Maneuvering through the approach was easy; the convenient instrument and control layout is an asset. Setting up on final at 100 KIAS and half flap we lowered the gear at glide slope

interception to establish an easy 600 fpm descent. The stability at this stage was outstanding and minor power changes kept the needles in lace down to minimums. Lowering full flaps and reducing to minimum approach speed, we crossed the threshold at about 50 ft. and could have turned off at the 1500' point – just like the book says. Rather than use heavy braking however, we added a bit of power and rolled on to the 2000 ft. point before clearing the runway.

In summary, the Trigull is everything the Seabee was and could have been had it continued to evolve. It is tough. It is delightful to fly and highly forgiving when abused. It carried a good load and performs well when loaded. As a flying boat it has been designed for water work, not converted. The potential is amazing.

I would like to finish by having a look at where the Trigull fits into the scheme of things. The price – about $85,000 to $100,000 depending on avionics – is comparable to a Cessna 185 on amphibian floats. Your 185 however, is a land plane design converted for water then further converted to go back to the land – a successful but cumbersome arrangement; the problems of water operations – such as corrosion – were anticipated in the early stages of the Trigull's design and solutions found at that point so that the basic design is inherently suited to both land and water. The next problem is marketing: Although designed for the private owner the Trigull's commercial potential is enormous. The seats are easily removable to allow for cargo or mercy missions – stretchers fit easily through the bow door. Dave Hazelwood suspects that the most difficult market to get into will be the one at his doorstep, simply because of the number of float-equipped Cessnas already providing excellent service on the west coast. There are firm orders from Tasmania and serious inquiries from Fiji, Malaysia and the Philippines. Thus while nobody is likely to sell everything and re-equip, the virtues of the Trigull have caught the attention of those who are starting to buy. Personally, I would recommend that anybody considering buying a seaplane give serious though to the durability, performance and pleasant handling characteristics of Trident's Trigull.

Profile



George Westinghouse was born in Victoria, B.C. in March 1946, and was educated at Trinity College School, Port Hope, Ontario and University of Victoria, Victoria, B.C. graduating from the latter in 1968 with a B.A.

He learned to fly on an Air Cadet Scholarship at Victoria Flying Club in 1964. Obtained a Commercial License in 1966 and Instructor rating the following year. He joined the U.S. Air Force in 1969 – and after pilot training was assigned to Lockheed HC-130s, the Search and Rescue version of the Hercules. After 2 years of covering the United States, Arctic, North Atlantic and Europe was sent to the Philippines for 2 years, flying throughout South East Asia.

He was qualified as a Hercules instructor pilot when he left the USAF in late 1974 and returned to Canada. Mr. Westinghouse holds as Airline Transport License with single and multi-engine land and sea endorsements and a Class II Instructor rating, and has 4,000 hours experience in over 30 different types of aircraft, ranging from a 65 HP Piper Vagabond through supersonic T-38 Talons up to the 18,000 HP Hercules. He lives in Calgary with wife and 3 children, and instructs for Mount Royal College Aviation program.