



Verticopter™ : A new breed of STOVL aircraft

Verticopter™ Newsletter from Garrow Aircraft

(3rd Quarter 2008 issue by Oliver Garrow)

PDF version attached for people with non-HTML compliant email.

Dear Verticopter™ Newsletter subscribers and Verticopter™ X-Plane pilots,

Thank you for contributing to the wide-range and spontaneous support that came after the successful launch of the Verticopter™ family of reference designs a couple of weeks ago and that was first disclosed at the 9th annual Vertical Challenge helicopter air show of San Carlos, CA on June 21, 2008.

This is our first quarterly update on the developments surrounding the Verticopter™ technology, so you will receive no more than 4 scheduled updates per year. You can of course ask at any time to be removed from this distribution list, just open your browser at <http://www.verticopter.com/mailling.php> , enter your email address and click unsubscribe.

Here is the agenda of this newsletter :

- Cover page and introduction
- Verticopter™ concept summary
- Targeted markets
- Development roadmap
- Marketing communications activity
- Engineering and simulator update
- Funding and sponsor activity
- Team composition
- Upcoming developments and next Newsletter

Verticopter™ concept summary

You are amongst 150 people approximately who approached this new concept with an open mind, and I deeply thank you for this, but we also heard several skeptical voices that sounded like “yeah right, just another VTOL company, must be a paperware exercise”. I don’t blame skeptics because there are, indeed, out there many virtual companies with a virtual design. Our project however is real.

Garrow aircraft, being today a 5-week-old startup, departed right away from this virtual activity as soon as it had paying customers, several aircraft designs to support and to enhance, pending patents, a development roadmap, actual marcom and engineering activities and finally a voice (me) and an actual team behind it.

We claim that the Verticopter™, labeled appropriately as a “vertical (flying) wing”, is genuinely a new product that can operate either as STOL or VTOL and that is a good compromise to operate in some relevant missions, that I will document in the next chapters.

The product that was launched last month went through numerous design iterations, and is the result of many months of brainstorming, computation and simulation, by two designers, myself and Dan Klaue.

This original project launch came about the last quarter of 2002. After reviewing all the VTOL material presented on the Discovery Wings cable channel, I challenged myself to come up with a practical airframe solution. Since 2002, no less than 100+ configuration and iterations have been drafted and analyzed to eventually mature into the current design of the Verticopter™. Most of this effort has been continuously evaluated and monitored with the help of a professional flight simulator, X-Plane, going back to version 5/6, this engineering approach has set us apart from “paperware companies”.

Targeted markets

Since the Verticopter™ is a convertiplane, it is natural to think it would address the markets normally addressed by other convertiplanes. But what are these convertiplanes and their respective markets ? here is a nutshell :

- **Harrier** family (AV-8B) => subsonic military single-seater fighter
 - **Osprey** (V22) => military troop transport
 - **JSF** (F-35B) => supersonic single seater fighter
 - **Tilt rotor BA609** => civilian transport (not yet in service)
- And that is.... it ! (a **Yak-38** that went into production doesn't seem to fly anymore)

Needless to say that as of this year (2008) there is not a single convertiplane in commercial operation.

The Verticopter™ is, in essence, closer to the JSF and the AV-8B than it is to the V22 and BA609 Tiltrotors. It has to do with the relative placement of the thrust vectors in relation to the plane's center of gravity.

So let's face it, there is no preset market for a convertiplane, and it is intended to share some niche applications with the helicopter and with turboprop planes. Here is how the positioning would go :

The Verticopter™ would replace an helicopter or a turboprop when they are not performing very well in a given mission. However the Verticopter™ could not compete in the market where helos and turboprops are already doing the best possible job.

The way to justify the use of a Verticopter™ is quite simple : How does one get from point A to point B in the shortest time, and not knowing where point A or point B are precisely located or whether either location offers a runway.

With this understood, potential applications immediately springs to mind:

- **oil rig helipad commute**
- **medical evac**
- **door-to-door taxi service**
- **border, patrol, police surveillance applications.**
- etc...

Another way to justify the need of a Verticopter™ :

- Do you feel that your helicopter is one of the slowest vehicle in the sky?
- Do you wish your turboprop plane could land on any helipad throughout the country ?

These are the 2 main incentives of our new convertiplane.

Another large pool of applications is the one for UAVs (Unmanned Aerial Vehicles). A remote controlled Verticopter™ UAV or an autonomous Verticopter™ UAV could provide very tangible benefits to ground troops, military operations and even aero-lifted troops, such as an helicopter pilot.

We demonstrated that a compact UAV, typically 12-foot in wingspan, would be able to keep up with any existing production helicopters (up to 200 knots) and operate as a wingman to an helo pilot. In the last 4 weeks, we received pilot feedback going in that direction.

Verticopter™ UAVs are mostly destined to support surveillance missions, and would provide two great assets :

- Get to the site of interest very fast, what we call the "fast cruise" mode.
- Then slow down to very fuel-efficient speeds, called "loiter speed", to survey at low speed given areas.

This special operating mode is what I refer to as "selective air surveillance". The UAV operator can pre-select and pre-program several surveillance areas that can be fairly spread apart.

Finally a Verticopter™ UAV is able to perform scheduled stops for refueling and land vertically at any refueling station wherever they may be.

Another key asset of a convertiplane, is that it can take off vertically in the absence of heavy ground infra-structures.

Here is quick quiz for you, find the two missing items in this picture:



- Well, this solution is not very mobile unless it comes with a truck that will haul around that bulky launching ramp. The ramp probably takes some time to install and to prep, to align with the ground wind etc...
- Probably a lot of spare props, looking at that unprotected pusher prop that will likely bite the dust on a very single landing despite that negative dihedral in the wings.

This nice UAV (by Boeing) is useful, but belongs to the previous generation of UAVs. Every take-off is lengthy and costly, same for every landing. It also won't offer any refueling capability half-way into a mission.

Garrow Aircraft has been investigating other applications for its Verticopter™ licenses, including in the R/C hobby market and the toy model market. We are currently supporting a business model relying on licensing and will consider any valid application.

Development roadmap

The Verticopter™ as a generic architecture has sprung the release of 5 reference designs :
(a reference design being a typical implementation for a given wingspan and a given payload)

A 2-seater plane, hosting a pilot and a mission specialist, it has a wingspan of 25 feet and serve as the 100% reference size. The 7-seater plane has a 50 feet wingspan, and is called the 2:1 scale of 200%.
Scaling down, we have a large UAV (12-feet), a small UAV (8-feet, not released), a large R/C model (5 feet), a small R/C model (2.5 feet) and even room for a tiny R/C version (1.25 feet). Those correspond respectively to the 50%, 33%, 20%, 10% and 5% scales. Note that every scale will not yield systematically a reference design.

We also are considering a 10-seater version, with a 240% scale or 60 feet in wingspan.

The way our Verticopters™ are being designed involved two design databases, one created with Blender 2.46, one created with the design tools from X-Plane 900.

The Blender design takes care of all the 3D constraints, mechanical constraints, motions and paintjob, livery design, whereas the X-Plane tool helps create a functional flight model. Eventually the 2 models (3D mechanical one and the flight model one) are being blended in a single flight simulator package.

Of course those 2 designs are faithful to one another and are being updated in parallel.

The combination of Blender and XPlane has been a very powerful combination of tools to design the aircraft structure from a 3D point of view, from a mechanical point of view and from an aero-dynamical point of view.

Another value of those 3D tools is that they allowed a very quick migration from one reference design to the next and allowed quick scaling, up and down from the 100% reference design (2-seater version).

We intend to validate in the next couple of months, two new opposite ends of the scaling range :

- a foam size model, to weigh 150 grams and with a 15-inch wingspan, and
- a large transport plane, with 1+9 passenger capacity, 60 feet in wingspan and 2 x 2,000 HP turbines.

If you are interested in comparing the 2 models (mechanical and flight model), launch the PlaneMaker module and click on the Expert mode and show all visible parts.

More details on our design methodology can be found in our new [Verticopter™ User Manual](http://www.verticopter.com/media/pictures/Verticopter_User_Guide.pdf) at http://www.verticopter.com/media/pictures/Verticopter_User_Guide.pdf

Marketing Communications activity

The last five weeks have been fairly busy, as you can imagine, like for any emerging startup.

Here is our recent milestones :

- June 17 : release of the [Verticopter.com](http://www.verticopter.com) web site and posting of the 5 reference design in our [front-store](#)
- June 21 : participation to our first tradeshow during the Vertical Challenge air show
- July 16 : new release of the 2-seater and 7-seater, provided various fixes and enhancements
- July 29 : release of our first newsletter

In the last month or so, the verticopter.com website has received more than 4,000 unique visitors, that is an average of approximately 1 new visitor every 10 minutes !

So the website has served its purpose to inform people and deliver the simulator package.

Most of this web traffic has been generated by only 3 Press Releases and a couple of posting on the XPlane forum.

Please Google the word verticopter to obtain the exhaustive list of PR postings.

We now have an up and running Blog: <http://verticopter.blogspot.com/>

Verticopter™ news updates will be delivered via two different formats.

1. Fully detailed Verticopter™ Newsletters, much like this one, will be delivered to you quarterly in PDF format via e-mail.
2. Shorter and more frequent Verticopter™ updates will be delivered to you via our Verticopter™ Blog e-mail. Please follow this link [to subscribe to these more frequent Blog updates](#).

Our first tradeshow attendance happened on June 21 during the 9th annual helicopter air show meeting, Vertical Challenge, of San Carlos, CA at the Hiller Museum. The doors open from 9am to 5pm to more than 5,000 visitors, a bit less frequentation than last year, due to a heat wave on that day.

The Garrow Aircraft booth had a high-performance graphic workstation showing off the performance of the full simulator with a Bose audio system and the 2-piece X52 flight control system from Saitek.

Our booth and products intrigued quite many visitors who had to line up at times.

We had a solid attendance despite little-to-no advertising and record high temperatures.

Close to 500 pieces of marketing collateral and brochures were distributed.

Thanks to our readers who came by the booth and ended up purchasing one of the simulator planes.

Here is how our booth looked like at one of the busiest times:



Also on display was our 3D model for the 2-seater that was printed in 3D by our 3D color printer sponsor, [Peak Solutions LLC](#) and their Zcorp Z510 printer, the plane was “printed” from the original Blender 3D database :



Other Marcom activity has been fueled by the Market Survey company **Frost and Sullivan** whose European branch will be sending out a technical alert to their subscribing members at the beginning of August. The Verticopter™ will be featured as an optimized UAV platform.

Another technology news team had expressed its interest to broadcast about the Verticopter™, The **Discovery Channel** in Canada is planning to send a TV crew to Mountain View, CA and to record a short TV segment on our activity and on the upcoming test flight campaign scheduled in late October, early November.

Engineering and Simulator updates

After the 5 reference design went out and could be tested via the X-Plane 900 simulator package, a couple of bugs were reported by our payware customers.

A couple of incorrect definitions and configurations fell into the cracks, mostly related to the 2 Roll-Royce's turbines modeling (model 250 and CTS850).

This power plant was actually quite challenging to model into X-Plane since the only work documents we could download from the Roll-Royce's website are engine characterization plots that are highly non-linear and quite difficult to model in X-Plane. Helicopter turbine engine power depends on several factors but mostly on the altitude and air density but also the air temperature.

As part of several fixes in version 1.1 and 1.2, the 2 Verticopter™ engines (2-seater and 7-seater) were more accurately modeled with newly revised critical altitude and fuel flow coefficients (SFC data).

As an expected consequence, those turbines could develop quite less power at altitude, which yielded slower top speed and cruise speeds, but also showing now accurate fuel flow (FF).

Current un-pressurized Verticopters™ can operate all the way to 25,000 ft but for a given speed, the higher the better for the fuel consumption. The 2 Verticopters™ more or less behave like a Turboprop at altitude.

Engine power is not affected below 2,600 feet for the 2-seater (and 3,000 ft for the 7-seater).

All speeds in knots.

7-seater version	Top speed at 2K	Cruise speed at 20K	Top speed at 20K
Version 1.0	376	391	416
Version 1.1	376	354	390

All speeds in knots.

2-seater version	Top speed at 2K	Cruise speed at 20K	Top speed at 20K
Version 1.0/1.1	330	342	365
Version 1.2	330	304	331

Several other things were fixed, besides power and fuel flow, like roll rates, rate fading etc..

New features were added like the artificial stabilization system, a GPS and an autopilot.

In order for X-Plane pilots to benefit from all these last enhancements, please upgrade to the last latest revisions.

The interior cabin and the front fuselage have been revisited in depth, seats have now a two-tone grey leather covering, the instrument panel is completely new, 3D button were added, prop rotation modeling, cabin brightness, window design, landing gear well etc...

Here is how the new front fuselage and the new instrument panel look like:



Funding and Sponsor activity

I am glad to report that we have two new sponsor and distributor.

Wilson Aircraft, famous for its high-quality aircraft, will be advertising on their site at :

<http://forjets.netfirms.com/>

Wilson Aircraft also has posted one new livery scheme on the forum which can be found at :

<http://forums.x-plane.org/index.php?autocom=downloads&showfile=5772>

We also decided to rely on www.X-plane.org to become our exclusive distributor on the Verticopter™ payware.

X-plane.org has a very reliable server and can reach more potential customers than our original front-end store.

Still use the same link to access the simulator package : <http://www.verticopter.com/simulator/simulator.php>

But the checkout menu will take you to the **x-plane.org** front-store. Nicolas T. will be promoting our package thru his regular communication channels.

Garrow Aircraft being privately funded would benefit from both external investments and external support.

Our current business is thru licensing but we are very limited manufacturing capabilities.

For example we made some good progress toward a licensing agreement with a large R/C airplane company based in Hong Kong and will help them prototype a small version of the Verticopter™ (at the 5% scale)

Similar projects can be opened at this time with full-size R/C model manufacturer and UAV manufacturers as well.

We also got contacted by a small charter aviation company based in Washington Dulles and who would like to represent the full-size 7-seater plane for charter applications in the USA.

Our mission is to enable the deployment of this new technology, so we would like to invite manufacturers and manufacturer's reps to contact us via our web site.

Soon we will be able to accept donations, no questions asked, thru our web site and as a Paypal wiring.

Please visit this location for donations : <http://www.verticopter.com/sponsors/sponsors.php>

We will be relying on the growing community to support this aerial platform, so don't hesitate to email us your suggestions and business proposals.

Team composition

Several of you inquired about who is actually behind **Garrow Aircraft**.

Like any new startup, we're starting with a small core of people with various expertise and availability.

Most of our team members are part-time paid employees and contractors :

Dan : main designer, mechanical and airframe, media production, test pilot,

Ela : Website designer, server and database support, media production, student pilot,

Aaron : International Patent attorney, aviation specialist, private pilot,

Mark : professional UAV pilot and test flight program manager,

Jackie : Legal and Marketing, press release,

John : embedded video and embedded systems,

Oliver : Manager, inventor, engineering and test pilot.

Time to time, we are calling on industry experts and external consultants for advise and inputs.

There are a couple of email address you could use to interface with our team (so without going thru the web site dialog page which is at : <http://www.verticopter.com/contactus.php>) :

Technical support : support@verticopter.com

Sales support : sales@verticopter.com

Inquiries : inquiries@verticopter.com

Web support : webmaster@verticopter.com

Myself : oliver@verticopter.com

Upcoming developments and next newsletter

Beside the design and engineering activity, we are continuing our prototyping activity.

After the successful flight of the prototype #1 last year, during the month of November 2007, it was decided to manufacture a 2nd prototype UAV, still at the 1:5 scale but with various new enhancements :

- the propeller dimension would increase for larger static thrust
- the overall wingspan will be increase for added lift.
- all 3 landing gears will be air retractable
- all the electronics will be overhauled
- new power speed controller
- new power distribution and regulation
- complete conversion to 2.4Ghz wireless technology
- latest flight data recorder from Eagle Tree Systems
- new GPS receiver and logger (5 Hz model replacing old 1Hz model)
- dual MPEG4 video recording system, facing forward and facing aft.
- re-designed airfoils, improved lift and drag numbers
- weight reduction by up to 20%, extensive use of Kevlar only, no more Carbon+Kevlar composites.

The flight test campaign will resume in October and borrow the same runway access at the local NASA base (AMES). This time, flight program and piloting will be under the good care of Mark, our talented local pilot.



As a sneak preview, here is the V-tail assembly that was recently completed that only weighs 363 gr (9.7 oz).

The next Newsletter will be scheduled around end of November, early December, and should be quite shorter than this first newsletter release.

Thank for your kind support, keep on sending your good suggestions and stay tuned.

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