

It's a Bird... It's a Plane...

THE X-HAWK FROM URBAN IS ONE OF THE MORE UNIQUE CONCEPTS IN ROTOR FLIGHT IN A LONG TIME, AND IS CLOSE TO BEING A REALITY.
by Shawn Coyle



Although seen here only as a mock-up, Urban Aeronautics' X-Hawk is closer to reality than it seems.
X-Hawk Photo

In my aviation career, I've seen many concepts appear briefly on the radar. The out-of-the-ordinary ones had extremely brief lives, as they were patently impractical or so outlandish as to be immediately dismissed. Some concepts resurfaced from time to time — a ducted fan-car type device springs to mind. Many are the brainchild of one individual, who, as it turns out, has a fixed view of the way things operate, hence their ideas are often at odds with reality. The remaining ones actually have some serious design principles behind them, and bear a closer look.

A good indication of when an idea has merit is when that closer look is made by a large, established company. Large companies, with all the inherent problems of large organizations, including shareholders to keep happy, don't work with whims unless there is some serious potential.

So, I was a bit surprised on a visit to Bell Helicopter's training center at the Alliance Airport in Fort Worth, Texas, to see a mock-up of the X-Hawk in the hangar. As I was busy with another project, I didn't pay too much attention to it at the time. On reflection, and knowing Bell's engineers, it should have been obvious something was going on.

As luck would have it, I got a chance, quite unexpectedly, to find out more. While at the recent American Helicopter Society forum in Montreal, Que., I had the opportunity to speak with the design team from Urban Aeronautics about this radical concept.

EVERYTHING OLD IS...

The first thing that needs to be said about the X-Hawk is the core idea is not new. Frank Piasecki produced a device called the Aerial Jeep, 50 years ago. Like many of Piasecki's ideas, though, it was too far ahead of the technology at that time to be practical.

Now, with major improvements in materials, engines, computing power and aerodynamics, the idea can be considered anew. Advances in materials mean significantly lighter composites for the structure. Today's engines, meanwhile, have much higher power-to-weight ratios than the early turbine Piasecki used. Computers can now command an automatic flight control system that is custom-made for the idiosyncrasies of this design. Finally, significant advances in aerodynamics mean issues of flow in and around, and over and through the machine can be better understood and harnessed.

The time appears ripe for this concept. A series of models have been built and successfully flown, and larger versions are in the works.

One thing has to be stressed, though, this concept is not going to replace a helicopter in most missions, as the inevitable compromises in design mean it's not as efficient as a helicopter in hovering. Projected forward speeds do match those of a helicopter, but with a much smaller payload. It can, though, do some things helicopters cannot.

THE STRENGTHS

One of the unique capabilities of the X-Hawk design is it can work very close to buildings and obstacles. With the lift producer encased in a ducted fan, there is no worry about hitting a fragile rotor blade against something. And, aside from not having the problem of hitting wires on the fuselage, there are also no control rods to get severed.

In spite of the high average downwash velocities it has compared to helicopters, Urban's tests show most of the high-speed flow is contained in a very narrow (approximately six-foot diameter) tube of air below each fan. The flow also dissipates very quickly and thus avoids the helicopter's self-induced clouds of dust or snow.

The ducted fan also has another secret: the vanes above and below the rotor can provide direct lateral force. In a helicopter, you have to tilt the rotor to generate side force, and this means tilting the fuselage. With Urban's Fancraft technology, the vanes above and below the fans are adjusted to tilt the outgoing air, moving the vehicle sideways without tilting the body.

Imagine being able to bring a vertical-lift vehicle right

next to an opening in a building's wall! Even without having to worry about hitting the rotor blades, this will take some getting used to. As the control system is unique, there will surely be other things it will be able to do that helicopters can't. And, it will definitely require learning another way to fly, or perhaps require unlearning how helicopters fly.

Another asset the X-Hawk has is it can land in areas not much larger than the size of its body — not the rotor diameter, as with a helicopter, but the size of the vehicle itself.

THE DETAILS

As far as engineering details, the human-carrying versions are being designed to meet powered-lift requirements, including Category A performance. Powered lift is a combination of fixed- and rotary-wing transport category requirements, so the level of redundancy and performance is fairly high. What has been revealed is that two turbines with 30-second one-engine-inoperative capabilities are being installed, as well as a ballistic recovery parachute. Details of the power required to hover were not revealed, but given the size of the fans, the engines will be larger than those on an equivalent-weight helicopter.

A smaller, unmanned vehicle, called Mule, is currently in development as a first step toward the eventual manned version. It will be powered by Turbomeca's Arriel 1D1

engine and capable of carrying 484 pounds plus fuel for two hours. Mule's primary role would be to carry equipment and supplies to the battlefield, then fly back two wounded soldiers.

The obvious question for *Vertical 911* readers is what's the possible impact for parapublic use? Urban believes the X-Hawk design can play a significant role in air medical, law enforcement and fire fighting missions, especially in an urban setting. In addition to the strengths mentioned earlier, a machine like this would probably be more acceptable to the public due to lower noise. Secondly, not having rotors slashing around above other workers will make the whole experience less worrisome for many. (In a perfect world, the rescue vehicle would just appear from nowhere and carry all the injured folks away like a magic basket, with no noise and no downwash — but we're a long way from that, at least on this plane of existence...) Finally, not having to pay too much attention to things like wires and poles will reduce stress for the crew as well.

This is just what comes immediately to mind, I'm sure Urban and Bell have a list of other advantages they're saving for future marketing. And, with orders already lined up and 2010 scheduled for the X-Hawk's first flight, the marketing departments and customers must surely be salivating.

