

# «Ray» - new life for Vertical Takeoff Aircraft

The idea of an airplane with the capability to takeoff and land without being dependent on runways isn't new. Numerous prototypes with different concepts were built and tested. With the exception of two, none made it to serial production. Now a small, independent team of young Swiss engineers has revived the idea of a VTOL aircraft with a new, convincing concept. In a few years such an aircraft should be available for door to door flights for the civilian market.

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Text: Hansjürg Moser

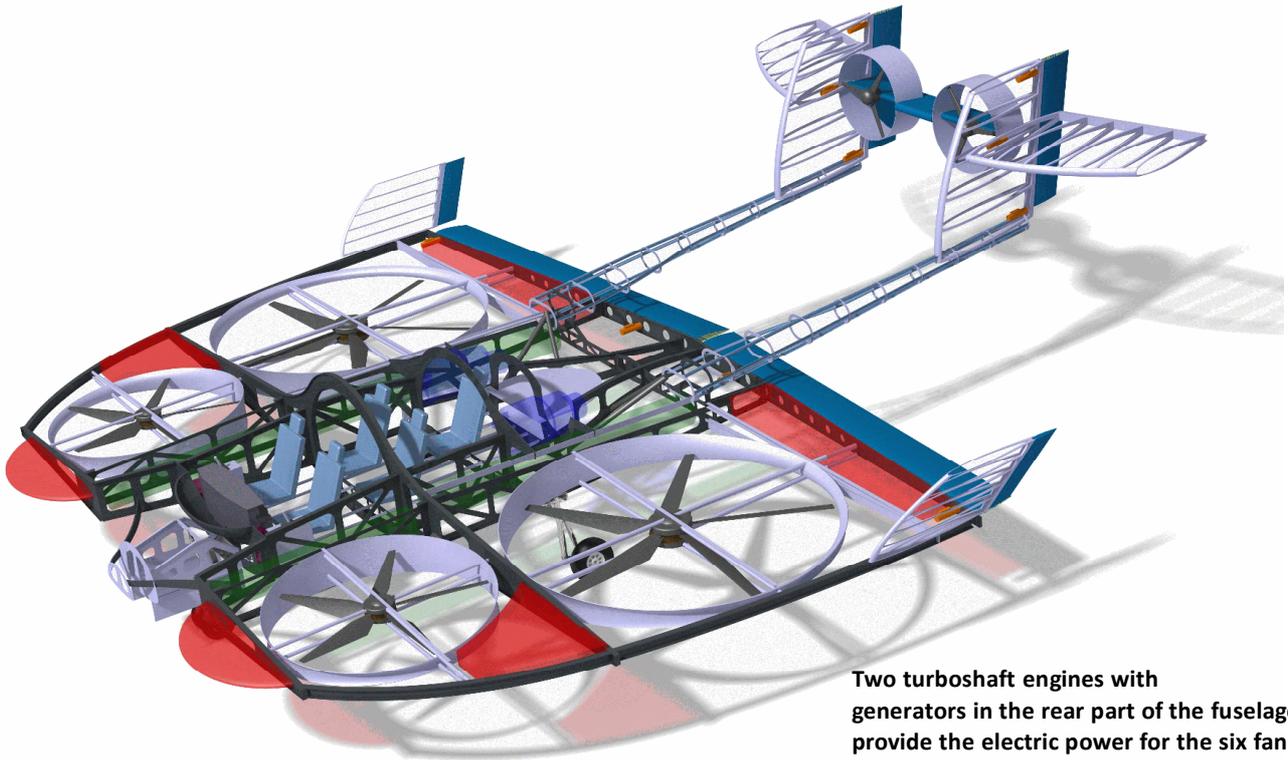
The large styrofoam model looks quite unusual: It has the wingform of a ray, six propellers, four of them are in the wings, two are at the tail and special, adjustable fins on the bottom side of the wing. In the premises of Ray Research Ltd. in Basel, David Posva explains to me that this will become a civilian, 5-seater VTOL aircraft, thus suitable for vertical takeoff and landing.

I look at him in amazement. "I'll explain to you how it works and show you some pictures", says David Posva. I'm excited. "Seven years ago I started to study intensively the idea of an aircraft which combines the characteristics of a helicopter, i.e. takeoff and landing outside of runways, with the

advantages of fixed wing aircraft, i.e. much higher flight speed and greater range", he begins to explain. "This concept is already quite old, these machines have been flying for some time now, and everyone knows the British Harrier and the American Osprey" I interject. David nods. "Those were immensely expensive, militarily oriented and financed projects with different approaches. We target other markets and approach the realization in a new way."

I sit down in a modern office chair and ask: "Who are we?" On the large computer screen David presents four portrait photos. The Ray Research Ltd. consists of engineers, which are specialized in





Two turboshaft engines with generators in the rear part of the fuselage provide the electric power for the six fans.

different areas and specifically interested in aerodynamics and aerospace. Beside David Posva as founder and director, Andreas Füglistaler, Pierre Wilhelm and Raphael Neuhaus form the core team of Ray Research Ltd.

### Novel VTOL concept

David Posva knows that the project is certainly challenging. "But we are convinced that our already patented concept of the Ray VTOL can be successfully implemented. In addition, our business model is focused on our capacities. We are not aircraft manufacturers. We see ourselves as researchers and developers that bring the Ray concept to maturity, develop an unmanned proof of concept model at half the original size and provide a production partner with all documentation and 1:1 plans." I look curiously at the computer screen and ask: "What exactly are the novel aspects of your concept?" David Posva presents me numerous pictures of different experimental VTOL aircraft of the past 50 years. So far none has been successfully developed for series production. "We have analyzed all these VTOL aircraft, assessed the pros and cons and realized that we had to look for a new solution." He displays more pictures on the screen and adds: "Many ideas and sketches as well as many complex computer based fluid dynamics calculations (CFD) then led to our concept, which has already been successfully tested with various models. Currently we have our 4th version up in the sky doing test flights. This has confirmed our ideas and inspired us a lot." With model sketches, plans and computer

calculations he now presents me the future Ray: innovative are the wing fans, which are positioned behind one another.

This influences the wing airfoil, surface and aspect ratio. The pitch-up moment around the transverse axis generated by this arrangement is compensated by both tail fans, which are located far behind the center of gravity. With a total power of 1,000 kW, the wing fans generate enough vertical thrust for takeoff and landing. In the transition phase to horizontal flight, the two ducted fans at the tail are successively turned in a vertical position. This guarantees maximum stability and flight control. In horizontal flight, the wing fans are covered: on the lower side of the wing with closable fins and on the upper side with roller blinds, which extend from the fuselage. Computer generated images impressively show the streamlines of air when the wing fans are open and closed. The tail fans of the Ray allow a cruising speed of 360 km/h (200 kts) and a range of 1'800 km (~1000 NM). With these values, the Ray's flight performance is considerably higher than that of a helicopter.

### Innovative drive system

"It looks convincing so far, but an important issue isn't explained yet," I interject. David nods and points to the construction drawing. "You surely want to know how the fans are driven." He points to the two blue symbols in the rear part of the fuselage. "The two turbine engines with the generators provide the power for the six electric motors that drive the propellers. The entire drive

system is redundant." It is not yet decided which type of turbine will be installed. Two Pratt & Whitney 210 with a power capacity of 599 kW each would fit well. Thus there is enough electric power available, which means the Ray doesn't need a hydraulic system. Everything is driven electrically. A fly-by-wire system and four flight computers will take over control functions and relieve the pilot as much as possible thanks to advanced avionics. Now I learn that for the important structural elements of the VTOL aircraft, carbon and Kevlar materials will be used. The paneling will be made of a honeycomb sandwich.

### **Ambitious project plan**

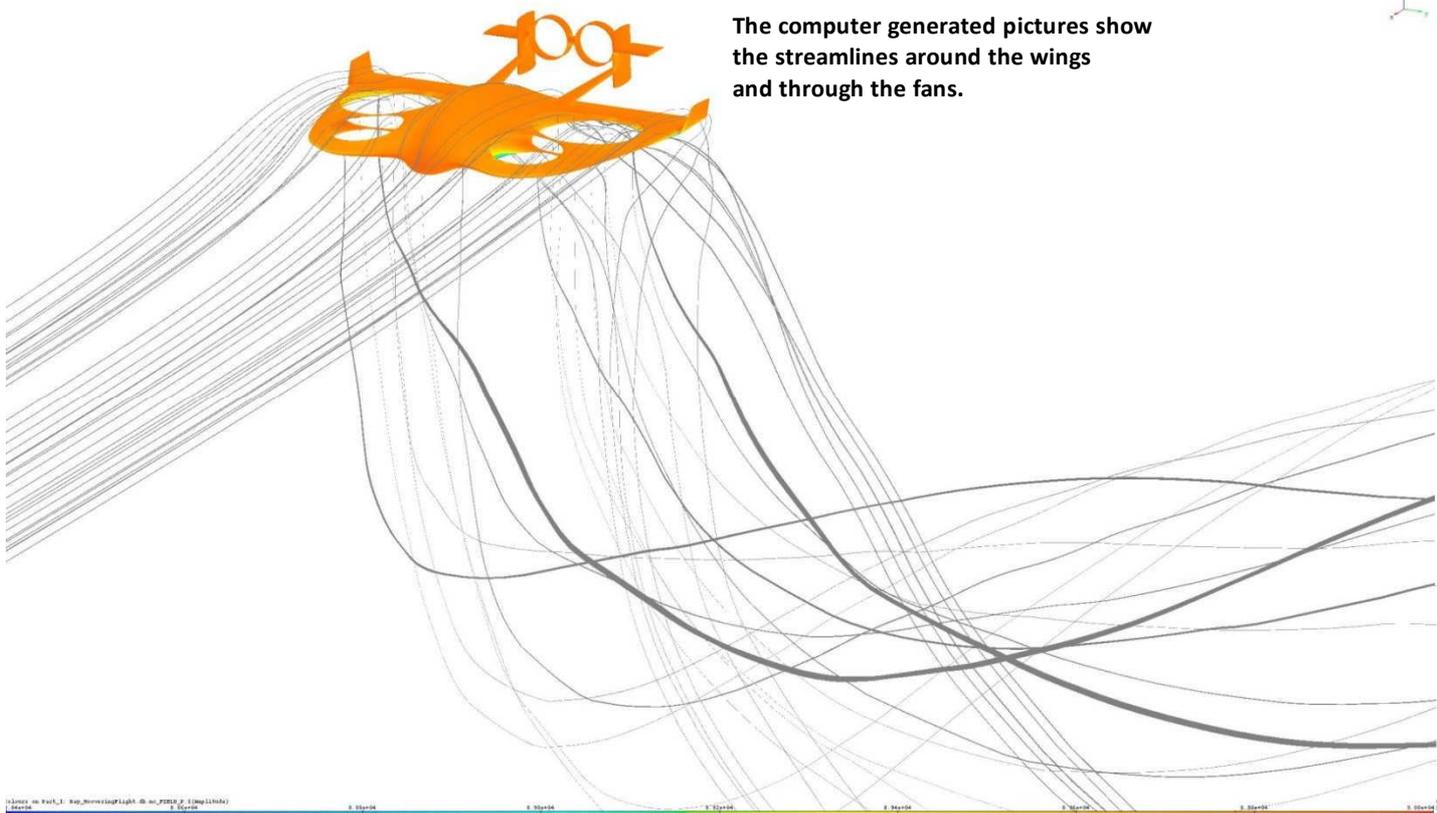
Numerous detailed questions are still unanswered, but the team is working hard to realize their vision. Therefore the small company requires additional investors. In the next two years, the unmanned proof-of-concept aircraft should be completed and tested. The year after that a manned 1:1 prototype should be build with the help of a production partner followed by test flights for certification. "Who could be that partner and what market are you targeting at?" are my last questions after two hours of intense conversation with an enthusiastic and highly motivated David Posva. "We hope to inspire one of the best known aircraft manufacturers for our idea and thus start production" he explains. "There are numerous market segments with potential for the Ray" he continues. "Numerous tasks, for which expensive



**David Posva, CEO of Ray Research Ltd.**

helicopters are used today, can definitely be performed faster and cheaper with the Ray. And because the Ray can be used independently of airfields, it is also suitable for rapid passenger transport to more distant destinations. "

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The computer generated pictures show the streamlines around the wings and through the fans.