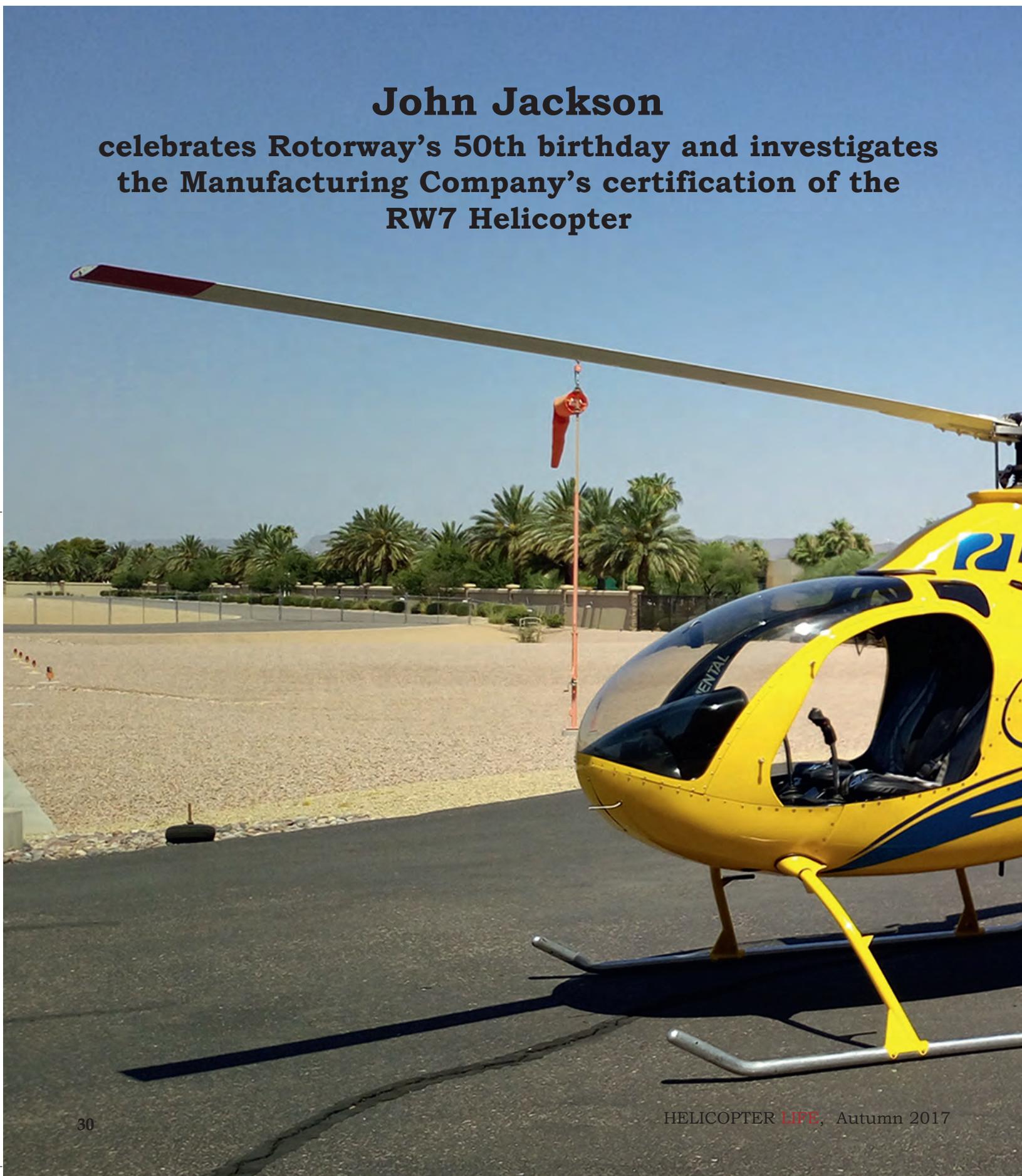




Rotorway Moves Into The

John Jackson

celebrates Rotorway's 50th birthday and investigates the Manufacturing Company's certification of the RW7 Helicopter





Certified Market

HELICOPTER
LIFE
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Photographs by JJ Jackson



Rotorway's 50th Birthday

The aren't many aviation companies that can boast that they are still in business more than 50 years after they were founded. How many household names have fallen by the wayside or been bought out by big business? Rotorway however, despite several peaks and troughs and a few changes of ownership over the decades, continues to slug it out in what must be one of the most difficult of niche markets. Producing a kit helicopter that people want to buy, build and most importantly, fly, is not a simple business model and it is their foresight and simplification (a relative term!) of the build process that has played a large part in their success. Furthermore, producing a 'proper' helicopter that can be born in the garage of a suburban semi' is something quite remarkable. Having been through the process myself, I can tell you that of my 11,000+ flying hours, there isn't a single one that's as memorable or satisfying as the first time I took to the skies in a machine that I'd bolted together myself! Since their first production kit, the Scorpion, left the factory in 1967, they have produced over 4000 kits - that's an average of one and a half kits a week for 50 years! Another key to their undeniable success is continued product development and improvement. Much has been written before about product evolution so I don't intend to repeat that here (if you're interested, there is plenty of background material on-line).

The General Manager, Darron Braymiller, who gave me a 'no holds barred' tour of the factory in Chandler,

just outside Phoenix, is another, in a long line of visionaries. He's passionate about Rotorway and the many new developments in the pipeline. He answered all of my many questions candidly and indeed allowed me to roam the whole factory complex unaccompanied to take photos and speak to the staff (some of whom have been with the company for decades). If that's not the attitude of someone who's got nothing to hide, I don't know what is? He was quite happy to discuss some of the Exec/Talon shortcomings as well as 'selling' the virtues. Many of the historic issues that have befallen Rotorway models have already been addressed - in particular, lack of power has been fixed by the addition of a turbo-charger and the age-old perceived problem of the belt-driven tail rotor was fixed with the introduction of the tail rotor drive shaft in the Talon several years ago.

Darron has the difficult, but nonetheless enviable job of driving Rotorway forward. The Chinese owners of Rotorway have tasked him with improving sales; these have been in the doldrums a little since the economic difficulties of the late-naughties - a problem by no means unique to Rotorway. His two-tier strategy involves numerous performance and build improvements to the current kit model, the A600 Talon. These are being accomplished in parallel to the development of a brand new certified 2-seat trainer model, the RW7 that was announced last year



General Manager Darron Braymiller who inspired John Jackson with his passion for Rotorway



The RW7 being shown in Australia

The RW7 - Rotorway's seventh generation

Everyone knows that the most successful training helicopter of the last 3 decades is the Robinson R22, yet Frank Robinson insists that it was never designed for that role. That the R44 Cadet purpose-built trainer is now, to use the modern parlance, 'a thing', is proof if it were ever needed. The reason the R22 was so successful - low cost. The Enstrom and Schweizer series of helicopters have always been relatively costly to operate and the new wonder kid on the block, the Cabri G2, however brilliant a training helicopter, is eye-wateringly expensive to acquire. So it would appear, there is a bit of a gap in the market for a low-cost, purpose designed, helicopter trainer. Step up, the Rotorway RW7.

In developing the RW7, Rotorway is playing to its strengths that have been developed over decades of kit-helicopter manufacture. The structural design, although pretty much all new, clearly shows its lineage. The

rotor-head assembly for example, in the pre-production model at least, is taken straight from the Exec/Talon series - if it ain't broke, don't fix it. There may however, be a few geometry tweaks required when it comes to test flying and meeting all the stringent certification requirements that have so far been pretty much ignored in the Experimental Category that the Exec/Talon reside. What has always made the Exec/Talon stand out from the crowd are its curvy lines and pretty looks and it is this attractive quality that Rotorway want to carry forward. Outwardly, it is a balancing act of trying to make the RW7 retain the beauty of the Exec/Talon whilst also appearing contemporary and fresh. Only when we see the finished production model in the flesh will we really know if they have pulled it off. The pre-production models' lines are due to be refined slightly but for the moment at least, I think it looks a bit like the Talons' big-

boned, not quite as attractive, elder sister – a bit like Serena and Venus Williams; both from the same family and very capable, but I know which teenagers would rather have pictures of on their bedroom wall. If it's to maximize its chance of sales success, good looks will definitely matter.

In getting the required performance for serious training in the height of the Arizona summer, the RW7 will be equipped with a fuel-injected Lycoming 360 with a combination of electronic ignition and magneto; similar to the system found in the Guimbal Cabri G2. The same basic engine is also fitted in de-rated form in the R22 Beta 2, but unlike the R22 the RW7 will spin at 2700RPM without de-rating - they are hoping for a 2000hr TBO. Also, unlike the R22, the clutch system on the RW7 will be centrifugal (think Gazelle) which has the advantage of being able to keep the engine running with the rotors stopped for rapid and safe crew changes; it also simplifies the mechanics and alignment of the transmission. The drive to the main rotor will be through

an all new 90 degree, bevel main rotor gearbox - the one seen in the photos already has 300 hrs of trouble-free testing under its belt. Further performance will be achieved by a thorough weight saving programme; the fuselage panels are intended to be from aluminum alloy, is a change from the Talon, which is clothed in heavier GRP composite.

In the cockpit, with plenty of room for a couple of 'ample' occupants, there will be inertia-reel seat belts and crashworthy seats. For the smart-phone generation, a glass cockpit display with, no doubt, a multitude of irrelevant features that no-one ever uses in a VFR helicopter, but at least it will keep the marketing men happy and look 'cool' in the glossy brochures. (Am I sounding like a Luddite grumpy old man?). I know glass cockpits are the future, but in terms of information displayed, less is definitely more in a VFR helicopter. Give me a big dual tacho with joined needles, an ASI, VSI, Altimeter and Compass and I'll be happy. As for Ts and Ps, just leave the display blank and let the attention getter warn me

The RW7 is seeking FAA and EASA certification



Above: the RW7 prototype in the factory

Right: Experimental re-profiled tail rotor

Far Right: the instrument panel and new pedals



when I'm approaching an exceedance.

With the RW7 sharing key components with the Talon, I asked Braymiller if there were plans to iron out some of the Talons' less endearing handling qualities. What would be done about the strong flapback tendency in forward flight? He told me that the current 90 degree offset of the cyclic control, to counter phase lag, would be adjusted, probably closer to 60 degrees to fix the problem. I'm not totally convinced, I think the flapback tendency is more due to lack of washout on the main blades but I forgot to press the matter further as I got distracted when talking about aft cyclic authority. How was he going to fix the problem of limited aft cyclic authority? The Talon will run out of aft stick in a wind of more than about 12 knots. He put it down to poor Centre of Gravity management and suggested that pilots shouldn't be taking-off and landing downwind. Not the ideal response when you're designing a training helicopter that has out-of wind manoeuvres as part of the PPL(H) syllabus. Furthermore, us instructors like to have a bit of a buffer to allow the student to make mistakes before we recover the situation - currently, the Talon certainly doesn't have that, and from the sounds of it, neither will the RW7. To his credit however, I could see that Braymiller picked up my concern and from his body language I could tell he was listening to my explanation of possible causes and solutions. But hey, he's employing the aerodynamicists and test pilots - let them work it out!

Having maintained my own Exec for several years, I realise just how important it is to care for it and keep it inside to protect it from the ravages of European winters. Although I forgot to speak to Braymiller about this aspect, as corrosion isn't a serious consideration in Arizona, Rotorway will certainly need to design in some fixes to potential corrosion trouble spots. I'm thinking particularly about the main rotor head that currently has a shallow recess above the swash plate bearing that water sits in after it has rained that leads to corrosion of the retention circlip (snap-ring) and surrounding alloy - ultimately, if left unchecked, this could corrode the bearing itself with seriously undesirable consequences. Also, although the main rotor blade construction is currently anticipated to be almost identical to that of the Talon (again, of it ain't broke....) some form of leading edge, anti-erosion strip will be essential to give the extruded alloy leading edge spars the longevity expected of a certified machine.

Some of you reading this will be thinking that you've heard it all before and that to take a helicopter through certification is just too tall a mountain to climb for a small company without big company backing. And you'd be right. However, Braymiller assured me that they have a sizable, Chinese budget to dip into. Although he disclosed the sum, I don't think it's appropriate that I share such information publicly. To give you some idea though, the appointment of aerodynamicists and process





Far Left: blade manufacturing

Left: Part store

Below: the RW7 will have a Lycoming 360 engine



engineers that used to work at the other side of Phoenix for MD Helicopters, specifically to wade through the certification treacle is a sign of commitment and financial backing. They've already implemented a far more rigorous paperwork trail on the Talon production line to ensure the necessary traceability. Working practices within the factory are experiencing significant refinements to bring things into line with the high standards required for certification. Indeed, a search will be on for new premises, as the factory site at Stellar Air Park just isn't big enough to support future development.

With the Chinese holding the keys to the Rotorway

factory, would production be outsourced to China to cut costs? The answer was a clear 'No' as the company owners realise that an American-built helicopter will have significantly greater worldwide market appeal than a Chinese product. He didn't, however, rule out some of the components being sourced from China.

Braymiller exudes an infectious enthusiasm for the RW7 and he is clearly pushing the development forwards apace. With him at the helm, and Chinese backing, they have every chance of success. If Rotorway can pull this off, the sky's the limit, literally.



Rotorway workshop in Chandler, Arizona USA



A600 Talon Turbo



At Stellar Air Park, Chandler, Arizona at 0700 hrs local time, we carefully lifted into a 3ft hover and it was immediately clear that already at +36C, giving a whisker under 4400ft Density Altitude, any 'ordinary' Rotorway would have been struggling somewhat just to leave the ground. Not so the new Turbo-charged Talon. The neat and tidy addition of a turbo charger to the exhaust system just under the radiator only develops 4lb of boost but makes a world of difference to performance. It was a very pleasant, and unfamiliar experience having some throttle to spare as we taxied out, at about 50lb shy of gross weight, to line up on the immaculately kept runway adjacent to the Rotorway factory. Another subtle modification with the Turbo is a slightly increased diameter engine drive pulley that means the engine now spins at only 3900rpm instead of 4250rpm with the stock version - Rotor RPM remains unchanged. By reducing engine revs, they've got to the peak of the torque curve without a significant drop in power. One by-product of these two changes is a much quieter exhaust note to help keep the neighbours happy. Another is reduced wear and tear on the engine and increased service life, which is always a good thing! What caught me a little by surprise, but shouldn't have when I thought about it in hindsight, was that the throttle was much more responsive in the hover (the Talon is no

longer offered with a governor). I found myself twitching the throttle twist-grip as I have done a million times before on the Exec but ended up with the rotors wanting to over-speed - trust me, that's not something that you get accustomed to in a non-turbo Rotorway due to limited power.

In the cruise, the RRPM on the non-governed Rotorway is usually 'controlled' by sound. Even inexperienced pilots quickly develop the skill of listening for a change in engine tone and almost subconsciously adjust the twist grip to return the soundtrack back to normal - a quick glance at the dual tachometer to confirm. In the Turbo, because of the quiet exhaust note and the reduced engine revs, again, I had to concentrate quite hard initially as my ears weren't tuned-in to the correct frequency. It didn't take long to adapt, but was another thing that, given sufficient forethought, I could have anticipated. Other than sound, the cruise experience was identical to the Exec.

After a couple of approaches at an abandoned airstrip to get my throttle co-ordination back on song, we tried some high hover work. The aircraft was capable of achieving a 30ft hover in the calm wind conditions but ran out of puff when we tried to go higher. My demo pilot for the day, Steve, said that this was the most sluggish the aircraft had been since the turbo had been fitted



and put it down to the high temperatures and hence high Density Altitude. On my drive to the factory, the local radio was broadcasting warnings about the heat wave - so it was uncharacteristically hot, even for Arizona. The MAP gauge topped out at 37" at which point the turbo waste-gate automatically opened to prevent over-boost. It's difficult to say for sure as it's a few years since I last flew one, but I think in Turbo-charged form, the Rotorway now probably out performs the R22 in the hover as well as the cruise.

When we returned to Chandler to shut-down, I found the engine cool-down period the same as the non-turbo. The only difference was the electric oil pump for the turbo charger is left running for about 30 seconds after the engine is stopped to cool the turbo and bearings - an essential precaution carbonization and premature failure (...anyone remember the Mini Metro Turbo?).

Other developments that are in the pipeline are re-profiled tail rotor blades that Braymiller says are more efficient and allow greater authority than the current design. They are designed to spin at a lower RPM too, thus reducing noise (something that will need to be carefully considered in the RW7 certification process). The wiring harness for the kit is being produced as 'plug-and-play' to hugely simplify the electrical installation and reduce man-hours for the builder. The current

undercarriage design, although tried and tested, is becoming increasingly costly to produce as the accurate bending of the 4130 Chromoly steel cross-tubes has to be out-sourced - something Braymiller tries hard to avoid. The new in-house solution is to produce a redesigned alloy undercarriage that is both stronger and lighter than the current version - the configuration is very similar to that of the R22. On the Talon, the radiator cooling-fan is belt-driven from the secondary drive shaft and the assembly is relatively heavy for the job that it's doing; it also soaks up about 8hp. A possible modification that is being mooted is to replace the current fan with a thermostatically controlled electric fan, like the one in your car, that will only need about 2hp to do the same job and will be several pounds lighter to boot - that's almost a 5% performance improvement effectively for 'free'. Extended main rotor blades turning at a reduced RPM with redesigned tip caps are going to be experimented-with as well and redesigned alloy fuel tanks with greater capacity are likely to hit the shelves soon. Last but not least, is the removal of the horizontal stabiliser winglets; apparently they give negligible aerodynamic effect, add complexity to the build, and of course, add all important weight.

For the UK owners desperate to fit a governor to their Exec, please don't hold your breath. The governor that is fitted to G-TALN, and approved by the CAA, is no longer produced. As a consequence, the Italian Rotorway agent has successfully developed their own governor. It is going to be trialed in the RW7 and if fit for purpose, could be offered as a retro-fit to other Talons' and Execs, subject to CAA approval, as always!

It is evident that Rotorway are not standing still, which could have been a criticism after the Exec 162F was introduced - now it seems to be surging forwards. Many of the changes to the Talon are desirable improvements, some are forced due to lack of part supplies and a few more are spin-offs from the RW7 programme. Whilst this is great news for anyone buying a new kit, for owners of legacy aircraft like the Exec, it may present future problems. There is no longer a supplier of the main rotor drive chain for the Exec forcing owners to convert to an expensive, but safer, toothed cog-belt. Also, older 162F Execs equipped with the twin 'FADEC' engine control units can no longer get replacement parts so if these fail, a costly new ECU must be fitted and programmed to the individual engine. Finally, as has been the case for some time, it's no longer possible to get a replacement Exec 90/162F undercarriage, an upgrade to a Talon version is now required should the need arise. So whilst the current pace of improvement of the Talon seems as welcome as it is frenetic, and clearly sales of new parts for older aircraft is good for Rotorway's bottom line, for legacy owners, it's not without a flip side.



Page 38 (far left) A600 console
Left: A600 head
Main picture: John Jackson about to do a
test flight on the A600 Turbo

