

# ***Third party's T-Rex 600N upgrade fan review***

*September 2007 – by Tony Chaveiro aka "tchavei"*

## ***Introduction***

When I began thinking about testing all the aftermarket fans that were available for the new 600N, I thought this would be a fairly easy job to accomplish. There had to be one fan that would do its job better than any other. After my initial tests, I soon discovered this wouldn't be as easy as I thought initially as all fans both have their weaknesses and strengths. The fans that were used in these test are the G-Force HeV2 (High Efficiency), the 3DX Fan from 3Dx, the G-Force SHO (Super High Output) and the new QuickUK fan. I didn't bother testing extensively the stock align fan as the question for most 600N owners isn't if the aftermarket fans are better than the stock one (no question about that) but what third party fan is the best. At the time I started the tests, the metal align fan wasn't available yet.

## ***Test methodology***

To try to be as accurate as possible during testing, all fans were tried out for four flights during three consecutive days to assure ambient conditions would be as close as possible. The best of all four flights was used as comparison and the others discarded to avoid confusing as I was constantly adjusting the engine needles for each particular fan.

As a recording device, I used an Eagletree Systems USB Micrologger which was set to a capture rate of one frame per second to assure there would be enough memory to adequately record all four flights. The data that was to be recorded included: engine rpm, Rx voltage, instant amperage consumption, cumulative amperage and, of course, engine temperature. The idea behind all those sensors was to not only give an idea of the engine performance but to cross reference the data with servo load (instant amperage draw) and engine power (rpms) during a set of maneuvers. This would assure that I didn't cheat and fly softly with one fan and trashed the machine around with another. The servo load during a temperature "high peak" and an rpm "low peak" states that a hard maneuver was performed. Just as an example, imagine a back flip. The servo load is higher during the initial and transitional collective bump and much lower during the disc unload phase (vertical nose up and vertical nose down). The same applies for engine temperature although the engine rpm curve will state the opposite i.e. low servo load equals unloaded rotor disc which should reveal a higher rpm.

The governor used in these tests was a CSM Revlock 20 with the gain setup at maximum without engine hunting. The power was supplied by a 2600mAh Fromeco Pack and Arizona Regulator. The temperature sensor was the standard Eagletree system's one and I made a patch to use the existing rpm sensor on the machine for the logger. At the time, CSM was about to release an electronic unit that would be able to tune the main needle of the engine according to the head's temperature. This device would have probably allowed me to show much more consistently and accurately engine performance but even after contacting CSM, I was unable to acquire a unit as it still was in a "beta-testing" stage. Maybe next time I will get the opportunity of using one of those fantastic devices. The helicopter used was a T-Rex 600N pro with Futaba S9351 servos on collective, a Futaba S9254 on throttle, a Logictech 6100T Gyro/tail servo combo and a Futaba 5114 G3 Receiver in 2048 mode. The engine used was an O.S. Hyper 50 with a Hatori #522 muffler.

### ***Flight Report and Results***

After all the field tests I can say that all fans were a major improvement over the stock align fan. Not only in terms of performance but also in every other aspect like noise level and ease of installation. It's much easier to detect a metal fan rubbing inside the fan shroud than it is with a plastic unit. For clarity purposes I decided to divide the results so instead of comparing directly each fan to the all others, I'll list the data and the pros and cons of each one.



#### ***G-Force HeV2 Fan***

##### **Physical characteristics:**

CNC machined, edges are chamfered and polished, has an outer rim to increase strength and durability. It has two inside pockets to hold most current magnets and an anodized finish. It weighs 23.8gr

##### **Installation:**

This fan has airfoil style type fins to reduce engine load and still provide adequate cooling. It seemed to be quite effective during the tests even though the reader should take notice that needles had to be adjusted

accordingly. Balance was spot on and there was no noticeable run out. I did however notice a slight vibration while I was spinning the fan at high speed on a high point balancer but careful investigation revealed that it was in fact the metal hub that was out and not the fan. The metal fans just magnify the problem by being heavier than the stock plastic fan. This slight vibration was felt with all tested fans. I did have a small issue when I installed the fan as I needed to readjust the governor sensor distance since the HEv2 fan is beefier than stock. This wasn't a big deal but it may be problematic for some types of sensor installations.

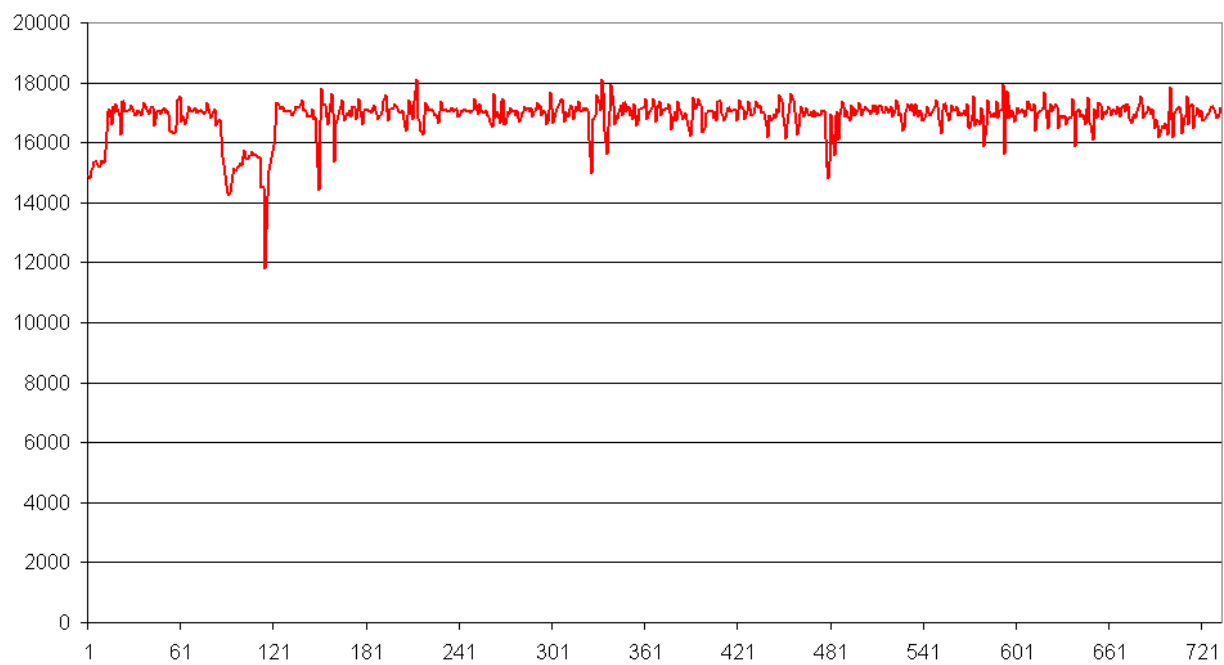
### ***Flight report:***

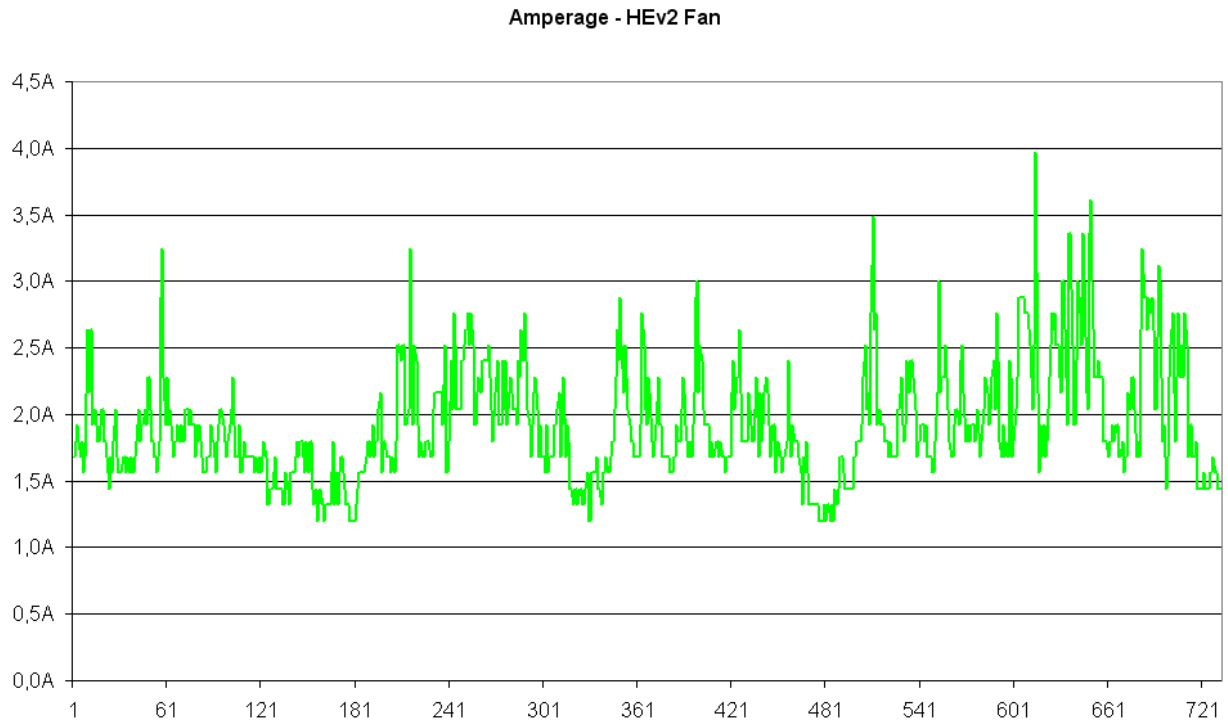
In the following charts you may appreciate the engine performance during a set of tictocs, back flips and other acrobatics. As you may notice the temperature varies quite a lot from maneuver to maneuver. For instance, I noticed that the engine cools a lot while inverted. I couldn't find a reasonable explanation for it but it does happen. I would also like to note that since I'm only using 20% nitro, my engines usually reach peak performance at 239F (115C) and it isn't unusual to hit the 248F (120C) mark during the summer peak. My last Hyper lasted around 320 flights before it needed a piston replacement due to a defective carburetor o-ring which made the engine hit the 394F mark and then die in agony. The rear bearing is still the original that came with the engine so I'm pretty relaxed running those temperatures from past experience. As you can appreciate on the RPM chart, the engine performed consistently with the defined target rpm (17000) and rpm losses are minimal (between 500 and 1000 rpm mostly) which doesn't reveal much when not compared with the 3Dx and SHO charts. The engine tuning required minor adjustments on the main needle (4-6 clicks richer) to keep the temps under control and no significant reduction in mileage was noticed. This fan lets you tune the engine just like almost all fans currently used in rc-helicopters.

Temperature - HEv2 Fan



RPM - HeV2 Fan





### **Pros:**

Nice quality finish, beefier than stock and performed as expected. No flex could be noticed and once the magnets are in it they'll stay there. Engine load seems to be minimal as the governor doesn't work all too hard to keep rpms at the defined target range. The use of the fan doesn't change the way of tuning the engine.

### **Cons:**

Magnet pockets could be 0.1mm deeper to make sure the magnets will flush perfectly with the surface using thicker adhesives. I really wish G-force could make a 1 mm hole in the pockets so one could press out the excess of glue and poke out the magnets if needed. Once they are in, there is no way to get them out without damaging the fan. Make sure your magnets have the correct polarity before installing them. A sensor distance readjustment over the stock fan is needed.



### **3DX Fan**

#### **Physical characteristics:**

CNC machined, raw polished aluminum fan. It's the lightest of all tested fans. Instead of two pockets it has two holes, strategically positioned on opposite sides of the fins giving two support points, one being the fin itself and the other the base of the fan. Its design is simple and physically its external dimensions are exactly those of the stock fan. I would however advise you to use a towel around it if you need to grab the fan hard. During removal of the fan, I managed to strip a screw and after cutting a slot in it with a dremel, I grabbed the fan hard to remove the stripped screw and in the process I cut myself not once but three times on the sharp fins. Excessive force will also bend the fan so go easy on it. Its weight is 19.6gr

#### **Installation:**

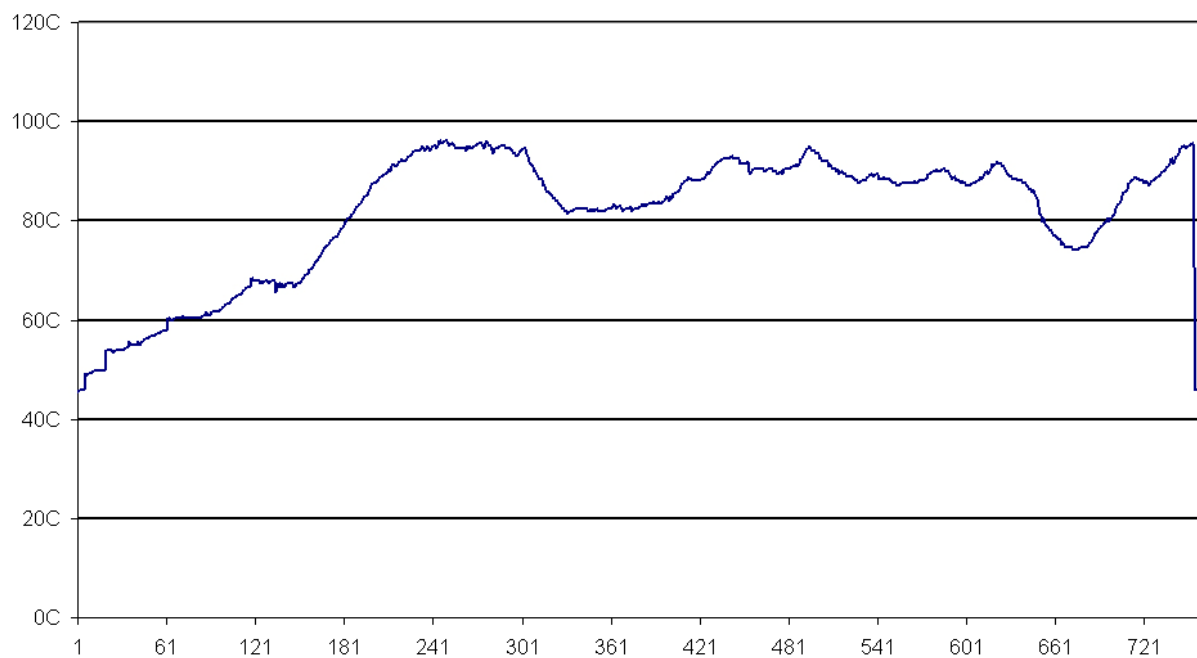
This fan has reversed airfoil style type fins to maximize engine cooling in any condition. Balance was again on spot and there was no noticeable run out. Just as with the HEv2 fan, I also noticed a slight vibration while I was spinning the fan at high speed but like I mentioned before, it's the hub's fault. Installation was plug & play since the 3DX fan has exactly the same outer dimensions as the stock unit. No sensor adjustments are needed when upgrading from the stock fan. Both magnet and counterweight flushed perfectly. I was a little skeptical with the magnets holding tight in the fan since it had so much less area to grab on but, for now, the magnets didn't fall out.

#### ***Flight report:***

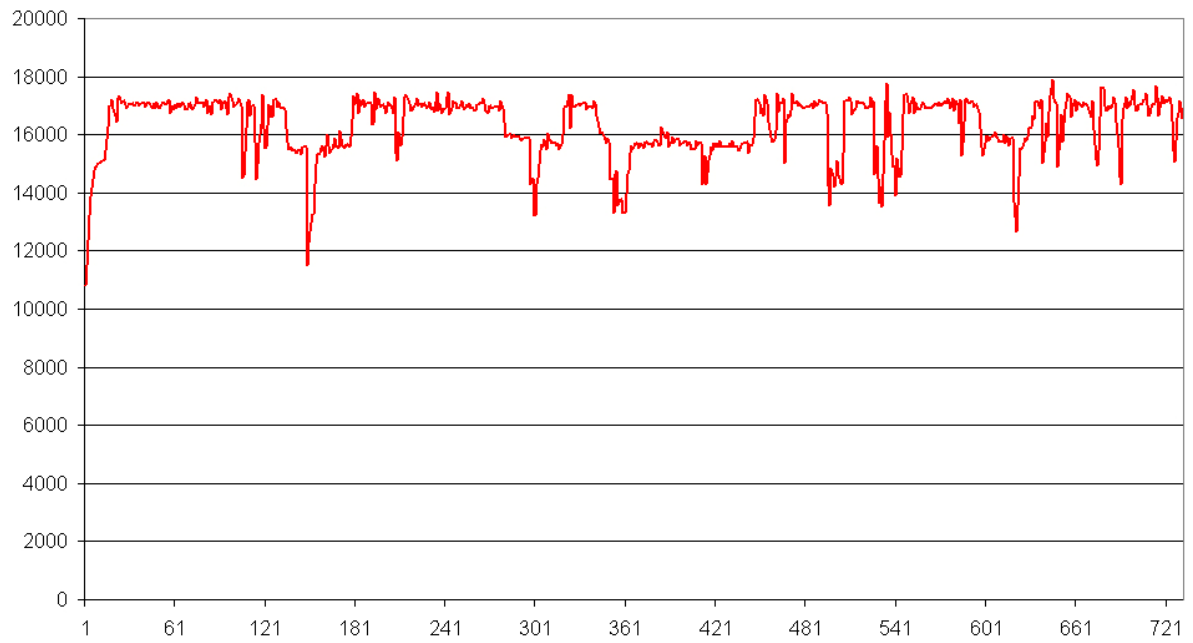
In the following charts you may appreciate the engine performance during a set of tictocs, back flips and other acrobatics. As you may notice the temperature is quite lower than with the HEv2 fan but its amplitude is greater. The fan is so effective at cooling the engine that it manages to cool down the engine in seconds between maneuvers. As you can appreciate on the RPM chart, the governor did have some trouble maintaining the target rpm (17000) as engine power loss was noticeable on some maneuvers (between 2000 and 3000 rpm). The curious thing is that I didn't expect to have these rpm drops as I couldn't notice them during flight but as the chart reveals, the drops are so short they become disguised in the maneuver. The engine tuning required minor adjustments

on the main needle (4-6 clicks leaner) to keep the temps up but I didn't notice a significant increase in mileage. However, please be advised that this fan will change completely the way one is used to tune an engine. Temperature isn't a variable any more with this unit. During the first minutes of the test I used the traditional method of tuning and went leaner and leaner until the engine was starving for fuel and bogging during simple loops but the head temperature never got above 230F. After realizing my mistake, I started to rich the mixture until I was able to do consecutive tail down tictocs without bogging the engine to death.

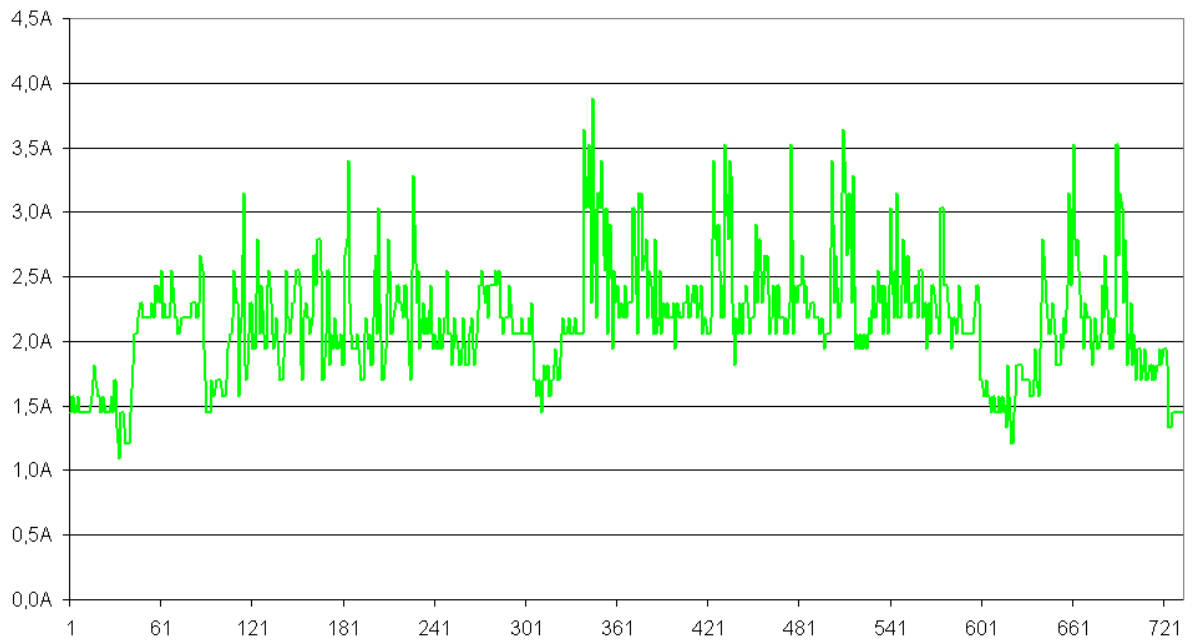
**Temperature - 3Dx Fan**



**RPM - 3Dx Fan**



**Amperage - 3Dx Fan**





**Pros:**

The 3Dx Fan is light and simple. Governor magnets can be removed and refitted if ever needed. It's a simple bolt-on item. No sensor readjustments are necessary. Achieved engine temperatures are very attractive during the heat of the summer as it will provide added power through the cooling and beat any stock fan in terms of performance.

**Cons:**

Engine load up is on top of all other items. 3000 rpm drops during maneuvers are significant even if only during a second or so. Most of the power gain provided by good cooling is lost to the added engine load. Good collective management is required. I managed to bend the fan slightly by applying excessive force with my hand. I managed to straiten it though but I didn't expect that to happen. Engine tuning is completely different so the user has to learn to tune the engine by different terms.

***G-Force SHO Fan*****Physical characteristics:**

CNC machined, edges are chamfered and polished, has an outer rim to increase strength and durability. It has two inside pockets to hold most current magnets and an anodized finish. Its weight is 24.2gr

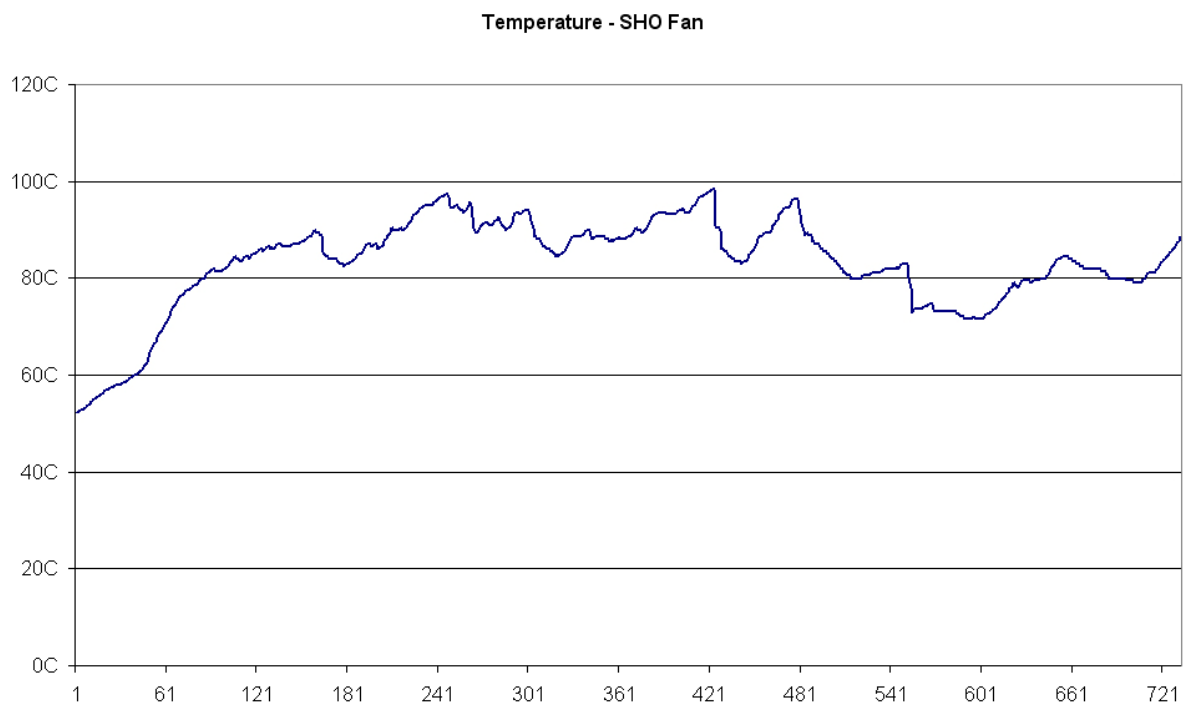
**Installation:**

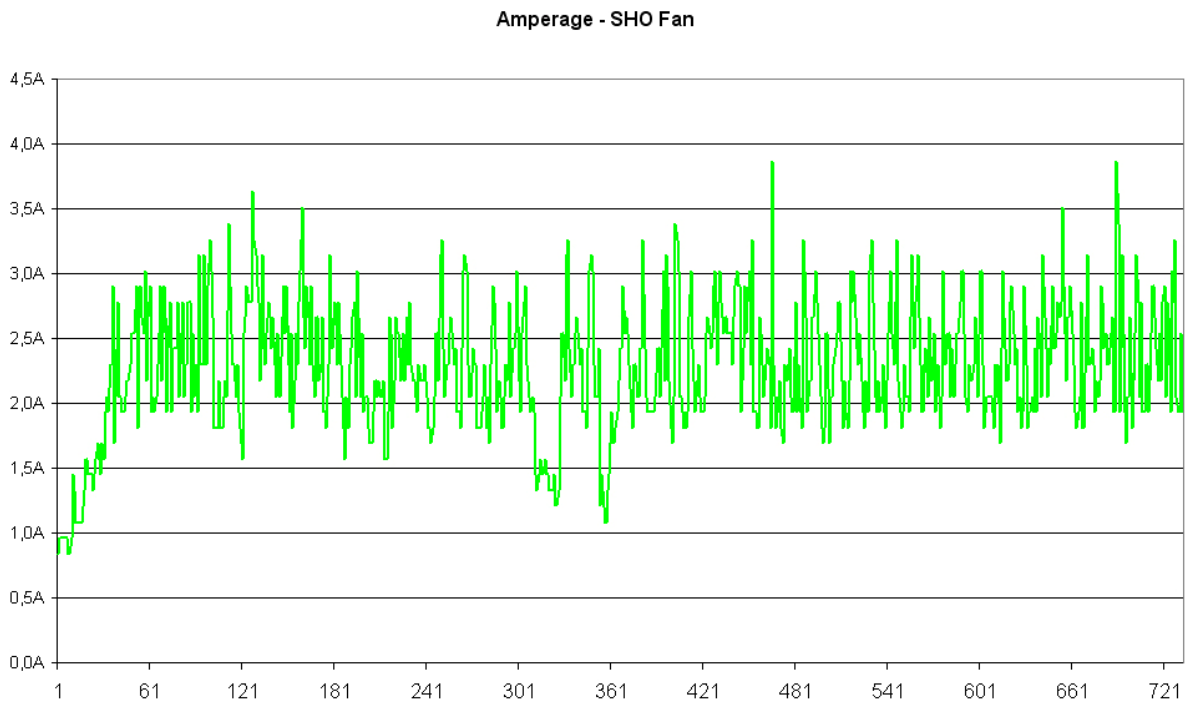
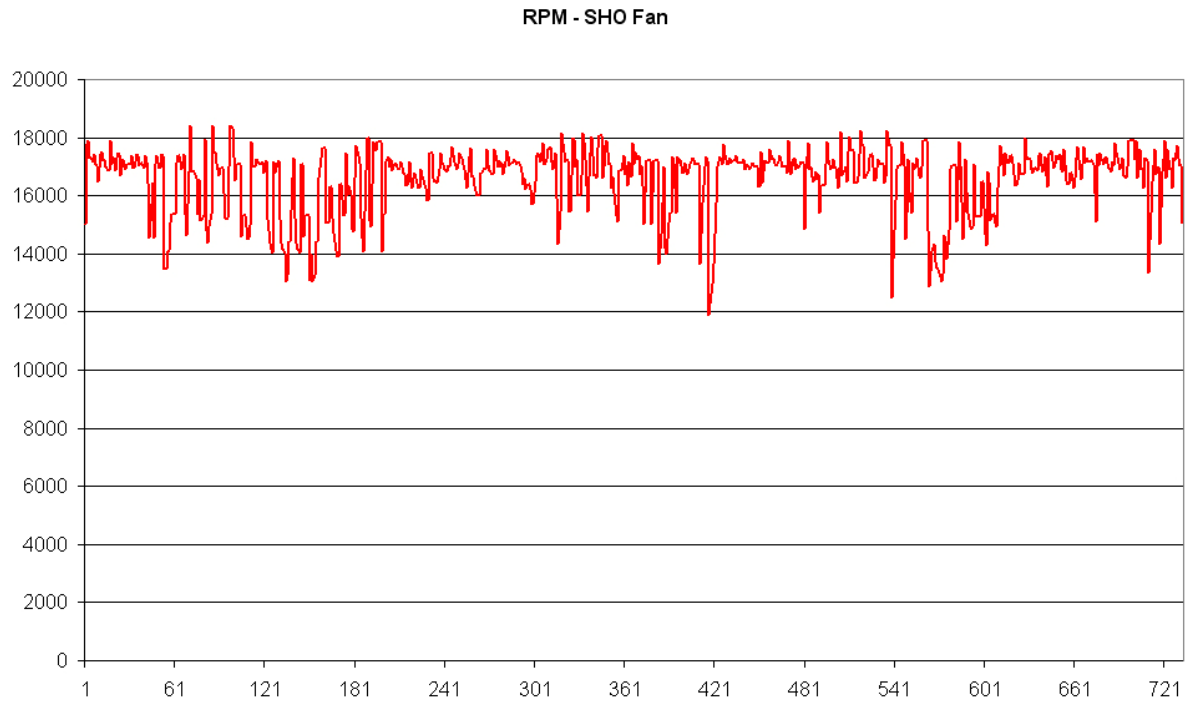
This fan has reversed airfoil style type fins (12 to be exact to maximize engine cooling whereas its name (Super High Output). Balance was, once again, on spot and there was no noticeable run out. Once again, the slight vibration was present just like in all the other tested fans. Since this fan shares the dimensions and features of the HEv2 fan, you also need to readjust the governor sensor distance.

***Flight report:***

In the following charts you may appreciate the engine performance during a set of tictocs, back flips and other acrobatics. As you may notice the temperature is quite low due to the high output that this fan is able to

produce (the air flow is respectable, even at idle just like on the 3Dx fan). As you can appreciate on the RPM chart, the engine had some trouble keeping up with the added load and rpm losses are noticeable (between 2000 and 3000 rpm) which can be only be explained by the design of the fan itself. Just like the 3Dx, the fins shovel the air at high speed outwards which creates added resistance the engine has to bear with. The engine tuning required minor adjustments on the main needle (4-6 clicks leaner) to keep the temps up and no significant increase in mileage was noticed. Please be advised that this fan will, once again, change completely the way one is used to tune an engine. Temperature is a secondary factor being the main concern power and performance.





**Pros:**

Nice quality finish, beefier than stock and performed as expected. No flex could be noticed and once the magnets are in it they'll stay there. This is

the fan that cools the most due to the increased number of fins. If you are a "cooling freak", this fan won't let you down

### **Cons:**

Magnet pockets could be 0.1mm deeper to make sure the magnets will flush perfectly with the surface using thicker adhesives. Just as with the HEv2 fan, a 1 mm hole in the pockets going thru the base of the fan so one can poke out the magnets if needed would be nice. Once they are in, there is no way to get them out without damaging the fan. Make sure your magnets have the correct polarity before installing them. A sensor distance readjustment over the stock fan is needed. Just as with the 3Dx fan, engine load is a factor to be taken account of and good collective management is a plus.



### ***QuickUk 600N Fan***

#### **Physical characteristics:**

CNC machined, high quality anodized finish. Fins have a symmetric airfoil but are angled relative to align's stock fan. It has two inside pockets to hold most current magnets and weights 21.3gr.

### **Installation:**

This fan has symmetrical airfoil style type fins which may appear at first glance to be machined perpendicularly to the center axis but this is not true. If one carefully checks the fins, you will find that QuickUk has angled the blades slightly increasing the air output considerably without altering radically the fan design. This slightly different approach places the fan very high against its other counterparts as it doesn't load up the engine significantly but still provides a high flow of air to cool down the engine. Installation was quite painless as it replaces the stock unit perfectly without needed to adjust sensor distance. Like on the G-force fans I would like to see an 1mm hole in the center of the magnet pockets to allow for the excess glue to come out and also provide a way of removing the magnets if you need one day. Balance was spot on and no after work was needed.

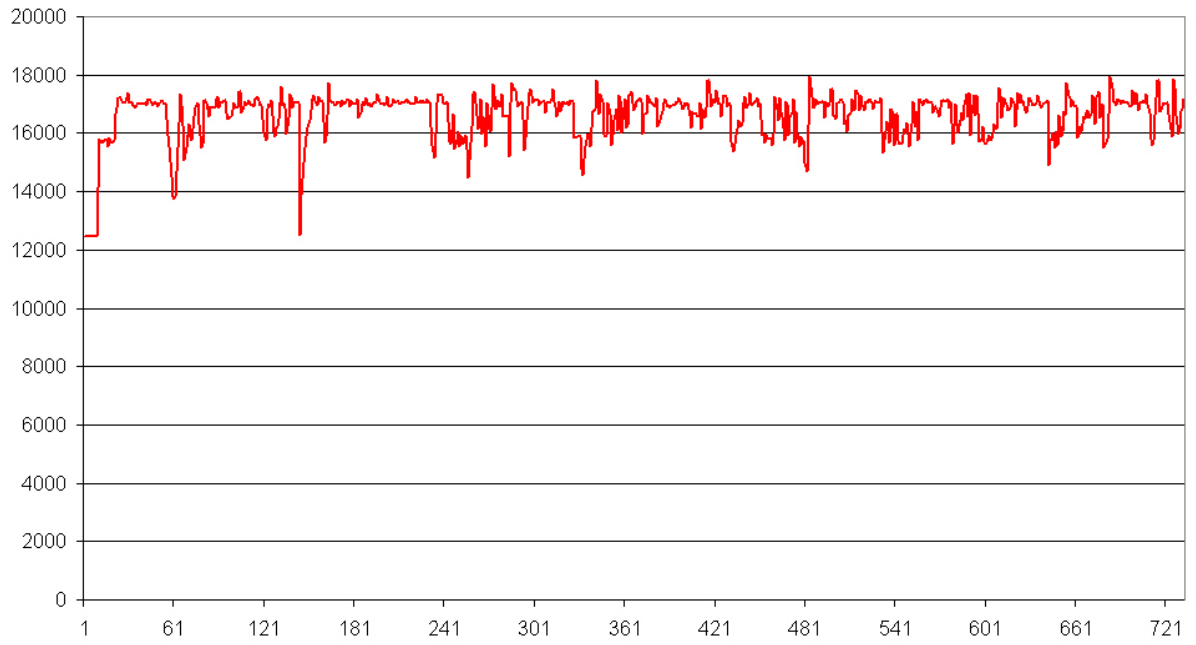
### ***Flight report:***

In the following charts you may appreciate the engine performance during a set of tictocs, back flips and other acrobatics. I was quite impressed with the fan's performance. I would rate it between the 3Dx and the HEv2 fan as it provides added cooling but still doesn't bog the engine near as much as the 3Dx or SHO fan. Temperatures were acceptable during the entire flight and RPM loss was only around 1500 rpm during the most demanding maneuvers which translates to about 176 rpm loss on the head. I also noticed that recovery of the lost rpms was quite fast which could be due to the fan design itself. I needed to lean the engine a couple of clicks as it sounded a little richer than before but all in all no big changes had to be made to make this combo work. I'm not sure how this fan will behave during the winter as it cools the engine quite down and even QuickUK recommends its use in "hot & high environments" so until the cold appears around here, I can't tell for sure but signs are promising that its performance will be acceptable even then.

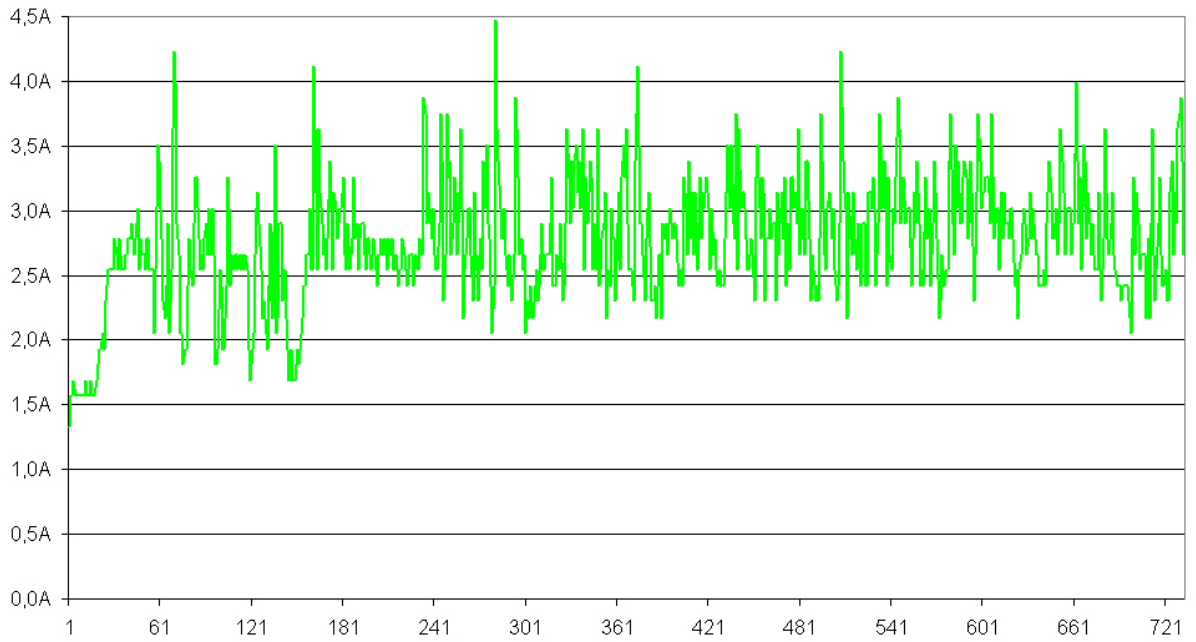
**Temperature - QuickUk Fan**



RPM - QuickUk Fan



Amperage - QuickUk Fan



**Pros:**

Nice quality finish, black anodized finish which is a plus for those running optical rpm sensors. No flex could be noticed and once the magnets are in it they'll stay there. Engine load is somewhat greater than with a high efficiency fan but still in an acceptable range. The governor needs to compensate the added load to keep at the defined target range. The use of the fan changes the way of tuning the engine as you can't just rely on the temperatures anymore and need to tune by feel and sound. It's great for those that want a better fan without having to choose between maximum performance and maximum cooling.

**Cons:**

Same as with the G-force units, a 1 mm hole in the pockets would be nice so one could press out the excess of glue and poke out the magnets if needed. Once they are in, there is no way to get them out without damaging (drilling) the fan. Make sure your magnets have the correct polarity before installing them. The almost traditional design makes this a good day-to-day use fan for the vast majority of flyers out there but the hard core pilot will probably prefer having two fans for each flying ambient condition.

**Conclusion:**

After all the tests my personal opinion is that there isn't a perfect fan. Each fan has its advantages and flaws. You need to consider in what conditions you fly mostly and what factor (power vs. cooling) is more important to you. I believe the majority of the pilots out there don't need to push their machine to its limits but do want reliability through the whole year. In this case, a QuickUk fan will serve you well. If you're part of those who want the maximum performance possible and fly in colder environments, the HeV2 will surely exceed your expectations. In warmer climates where you need to keep the engine lean to get that ultimate drop of power, a 3DX or SHO will do what they advertise. Personally, having two machines, I'm going to keep the QuickUk on one and see how it will hold up through the year and on the other, I'm going to follow the maximum "power route", swapping between the HEv2 and the 3Dx/SHO according to the yearly season.

I way I see it, the 3Dx and G-Force companies have chosen extreme designs to give the best possible power under certain conditions whereas QuickUk kept things traditional, fixed what was wrong with the stock fan and provided an alternative which works better than stock and still

performs well under different conditions. Ultimately, it's up to the pilot to make the right choice for his situation.