REVIEW

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The Making of OptiFUEL™ ...your passion

IF YOU HAVE EVER WONDERED WHERE OUR FUEL COMES FROM THEN READ ON. IF NOT, THEN READ ON ANYWAY – YOU MIGHT FIND IT INTERESTING (I HOPE!)

Background

In 2006, Andy Hinton-Lever joined the Cheshire Hell-E-Cats; a Heli Only model flying club based just south of Manchester, UK. Like many of us, he had flown models in his youth but then other things became more important. However, having just built a heli, he thought he ought to learn to fly it. Andy started, as we all do, hopping his heli about and learning to hover. In the process, he was getting through the fuel. One auspicious day he was at Revolution Models, owned by Dave Whitney (one time member and long time supporter of our club), to buy some more. Unfortunately, they didn't have any of the brand Andy was used to buying. Talking to Dave, it turned out that the supply of that brand was a bit of a hit and miss affair – with delivery timescales an unknown. Very frustrating for both Dave and his customers. This got Andy thinking.

Andy is the Owner and Chairman of a company called Process Measurement and Analysis Ltd. They have three divisions, Industrial Analytical Equipment, Field Service and Chemical Manufacture. After some consideration, Andy decided his company was going into the model fuel business. Andy's General Manager's response to this decision was a wry smile – he obviously knows Andy well! Rather than disrupt the general company business, Andy took on the introduction of making fuel as a personal project. It was to be part of the Chemical Manufacture Division, and Andy has been running it ever since.

Development

The first thing that became clear was that Andy hadn't a clue about model fuel. By chance, he was taking flying lessons with the well-known Dave Fisher and they got to talk. It soon became clear that the only way to proceed was to use a full engineering approach. Dave's suggestion was that any investigation could only be done in flight; bench testing just wouldn't be enough. Andy needed to equip some heli's with full monitoring equipment, so they could analyse how different fuel components affected things like Performance, Engine Head Temperature, Exhaust Temperature and Head Speed etc.

Having set up a fleet of heli's with the appropriate equipment, testing started in earnest. Flights covered the whole spectrum of flight: Sport, FC3 and 3D. To help him Andy brought in some of the world's best pilots. You can see there was to be no holding back from the start! All types of fuel were tested. After each flight, the data was dumped into Excel spreadsheets and sent back to the factory for analysis. Included in the report for each flight were the monitoring equipment measurements, the flight conditions for the day (temperature, wind speed and barometric pressure) and observational data, such as whether the exhaust caused eye or skin irritation, smoked too much, or even smelled horrible! Over time, the compiled data was used to weed out the non-contenders. Even if they produced the power, if they exhibited any of these unwanted characteristics then they were out.

Andy Hinton-Lever

As you know model fuel is made up from three components: Methanol, Nitromethane and Lubricating Oil. To establish his own mixture Andy knew three things; the quality of the Methanol and the Nitro must be the highest possible – 99.99% pure for Methanol and 99.8% for Nitro. Therefore, the only real variable is the oil used. Although Klotz was the obvious choice, it's what is used in most model fuels; Andy tried various other brands to see if he could find something different. In the event, none met the required criteria. Finally, Andy turned back to Klotz. Surprisingly the general purpose Klotz Original didn't perform as well as expected. Then Andy did discover something new. He tested a low viscosity Klotz oil and was surprised to find that it ran cooler than Klotz Original and with a better throttle response. Based on these findings a meeting with Klotz was arranged in the States. It was to be very fruitful and ultimately led to a joint development of a 'Super Low Viscosity' oil. Indeed, further development is underway for an even more sophisticated oil blend from Klotz.

Now that a suitable blend had been found, testing of the product was started in earnest. For the first product an incredible 5400 hours of flying was undertaken using heli's equipped with Eagle Tree Systems telemetry equipment. That's flying 6 hours a day, 7 days a week for 6 months! Every flight was logged and the day's weather conditions added (see included example). Also included were the heli set-up; gear ratios, blades and muffler used, needle position (by clicks) and plug life. Finally, the engines were stripped down to check on the wear rate of the piston, cylinder lining and bearings. All initial testing used heli's only. This allowed a consistent configuration using a constant head speed. A constant head speed meant a constant engine speed, which could be set at its most efficient. Later testing was extended to include fixed wing and nitro cars.

Typical Data Log following a flying session

Optifuel R&D Data Date: 12 March 2011

Atmospheric Conditions	**Model: *(T)Rex 600***		
Wind Speed:	10 mph	Engine:	OS 55
Temperature:	9 Degrees C	Control System:	Beast X
Humidity:	92%	Main Blades:	Radix 600 FLB
Pressure:	1000 Mb	Tail Blades:	Align 95 mm
Flights to Date	131	Pipe:	MP5

Bearing change (1) Flight 83 (3 Dec 2010)
Bearing change (2) Flight 122 (12 March 2011)
Fuel tested: OH1518 SLV
Flights to date on plug: 74
Flights on OH1518 SLV 6
Mixture setting clicks per turn of needle = 30

	Session 2	**Session 3**	**Session 4**
Plug	OS no.8		
Max Head Speed	2230	2228	2414
Mixture Main	35	39	41
Mixture Mid	58	55	57
Mixture Idle	5 Degrees clockwise	5 Degrees clockwise	5 Degrees clockwise
Head Shim	0.2 mm	0.2 mm	0.2 mm

Comments/Notes

Ticking noise from engine from last sessions was found to be a loose clutch! The screws had just backed out slightly!
The first flight was very good, but the successive flights 3 and 4 it became scratchy, hence the poor temp results and run away rpm.
I replaced the clunk line and I continued flying the machine. I could only record 4 sessions but I flew 9 flights today. By the time I had finished the engine was performing beautifully as we have come to expect!
I am sure it was a little fussy to tune today also because of small contaminants in the carburettor. Once these had flushed through the engine stabilised!
Providing you do not over pitch the heli, you would not know it was 15% Opti!

Production

Having achieved the quality of product Andy was looking for, production could start. Already having a chemical manufacture plant in operation, adding a new product line wasn't too difficult. Unsurprisingly the manufacture of fuel is considered hazardous; Nitromethane is classified as a Notifiable product. This means the plant must meet specific criteria and be inspected and licensed every year. Because of the nature of the other products the factory produces it already met these criteria. A team of five people runs the manufacturing process, but they also run other product lines as well. The production line consists of an automated filling machine, a mixing tank, and a bottling plant. The mixing tank can hold 2 metric Tons (2000 litres) per batch and can weigh the contents to better than 500 grams. This means the consistency of each batch is reproducible to an accuracy of 0.025% by weight – perhaps just one of the reasons that you don't have to reset your needle between one bottle of fuel and the next! Production runs continuously.

Being an ISO 9000 and ISO 14001 compliant plant, Quality Assurance is a very important part of the manufacturing process. So testing doesn't stop. Test flights are constantly made and monitored. In addition to the Heli flights every day, Fixed wing and car testing is also done. Although no telemetry is added to the planes, they are flown by international level pilots who provide a view on how the fuel is performing. Cars are tested by hiring tracks for 'test days', where track times, head temperature and number of laps per given volume are recorded. If all that wasn't enough, every batch of fuel is monitored for quality; 'Life Monitoring' checks on moisture uptake and colour degradation of the fuel, and samples of the raw material, and fuel, are sent to Huddersfield University for analysis, which includes Flash (i.e. ignition) Point testing.

It's probably worth mentioning a little about the bottling and shipping of the fuel. Every bottle contains 5 litres and is hermetically sealed. The caps are specifically designed and made for OptiFUEL as Andy wanted a cap that was childproof. This required the design of a new cap and the appropriate manufacturing moulds made. Boxes of 2 or 4 bottles are sent to individuals, with pallets of boxes sent to retailers. The 'G4' boxes meet the shipping requirements for hazardous materials. OptiFuel buy in 10,000 bottles at a time – which, as you can imagine, is a storage nightmare!

Marketing

An important aspect of the fuel business is branding and marketing. All the branding is done by Andy's colleague Len Boosey. This includes all the artwork, including the graphic design for the OptiFuel vans. This is an art form in its own right – just take a look at the detail of the graphics on the OptiFuel vans next time you get a chance to see one. As well as advertising, including attendance at the Nuremberg Toy Fair, OptiFUEL sponsor some 20 events per year, providing raffle prizes (which The Cheshire Hell-E-Cats club, for one, is extremely grateful for!) and club banners. They also sponsor some 40 people ranging from international heli and fixed wing flyers to the HPI car team. Rather than me list all the various fuels and other products they supply, and in doing so almost certainly be out of date by the time you read this, I suggest you check out the their website (www.optifuel.co.uk).

The Future...

Having successfully entered the fuel market, what next? Well in Andy's words, "We view Lithium as a fuel." And so the answer is; Lithium Polymer batteries, or LiPo's to you and me.

Here the story starts all over again... "What do we know about Lithium? What makes one battery different from another?" asks Andy, the answer being, once again, "Not a lot" and "We don't know!"

Andy needed an expert. As luck would have it, one of the OptiFUEL sponsored pilots turned out to be a Lithium expert. Discussions led to the realisation that a different development approach was required from methanol fuel. Batteries would need testing to destruction, not something you would want to do in something that is flying around the sky! So a lab-based approach was

Typical R&D data sent to the lab for analysis

This is the Process Measurement and Analysis Ltd Factory

This is the artwork created by Len Boosey for the OptiFuel *van*

Come rain or shine Andy supports many events. This was at the very wet and windy Scottish Model Air Show at Castle Kennedy

adopted, where batteries could be charged and discharged safely in controlled conditions sometimes to destruction. To enable this specialised testing equipment was required.

Most LiPo manufacturers are in China, so they were contacted to provide samples for test. Testing consisted of charging and discharging the batteries at 1C, 5C, 10C, 15C and 25C and tracking their characteristics by computer monitoring temperature, voltage hold and discharge capacity. These readings were used to characterise the cells. Just in case you weren't aware – 1C discharge rating means that a battery is able to deliver its full capacity at a rate that would discharge it in one hour, i.e. a 1000 mAh battery with a 1C rating could theoretically deliver 1000 mA (1 Amp) for one hour. A 1000 mAh battery with a 25C rating can deliver up to 25 A, and at this current it would be totally discharged in 2.4 minutes.

Testing soon showed many cells had less capacity and 'C' rating than designated. Mostly this was due to high internal resistance, and high internal resistance is a bad thing in batteries, as it produces heat rather than electrical energy. As brand name and reputation are extremely important to OptiFuel only one manufacturer's batteries showed the quality required. Its batteries actually 'did what it said on the tin'.

Now a battery of the quality Andy required had been found, flight testing could begin. Seven heli pilots and three fixed wing pilots, all of international level, were engaged. Each was given a Castle ICE speed controller, which have built-in logging capabilities. For charging they were given a CellPro Power Lab 8 Charger, as they also have the ability to provide a data output to a computer. Charging was restricted to 1C at home and 2C when at the flying field. All the data was sent back to the lab for analysis. Monitoring Voltage Hold, Ripple, Current, Internal Resistance and Total Charge capacity of the cell gave a picture of the flight performance of the cells over time.

All this work has led Andy to believe that, by the time you read this, OptiPOWER (the battery side of OptiFuel) will be able to deliver premium batteries at affordable prices. To compliment the batteries sales OptiPower will also be the European Distributors for CellPro chargers. These chargers are one of the few, if only, chargers that use an Active algorithm to charge the batteries, which he believes is critical to battery cell life and safety.

And Finally...

Perhaps it's worth mentioning thatOptiFuel offers a bottle re-cycling scheme. If a club can get together a reasonable number of used bottles, then OptiFuel will take them off your hands. I suggest you contact them via the website.

Thanks to Andy for taking the time to talk to me about the OptiFUEL set-up.

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