Tony Nijhuis

Lancaster at LARGE

HE JUST CAN'T RESIST 'EM - TONY NIJHUIS DISCUSSES HIS LATEST LANC' BUILD - THE BIGGEST YET!

6th in line, Tony's latest Avro rests at the pinnacle of his Lancaster building career... thus far!

Thoughts of a winter building project start to take a grip when the weather turns colder - it's an overwhelming urge, a bit like animals needing to hibernate or birds flying south for the winter. For me it's the most sensible time to build, with little distraction in the form of gardening or DIY. So, around November it's time to put the thinking cap on. It may not have escaped your notice that the subject of this article continues what seems to be a trend of mine - building progressively larger Lancasters!

You may think, therefore, that not a lot of thought has gone into this project, but in reality that couldn't be further from the truth.

There was no immediate decision to build another Lanc', indeed before contemplating the project I began by laying down certain criteria: the model had to be big, multi-engine... and electric. Why electric? Two reasons: a.) the pure challenge of pushing the electric flight limits with this size of model, and b.) the cleanliness and operational ease of electric power compared to glow or petrol. Don't get me wrong, I'm not averse to i.c.-powered models - indeed there are

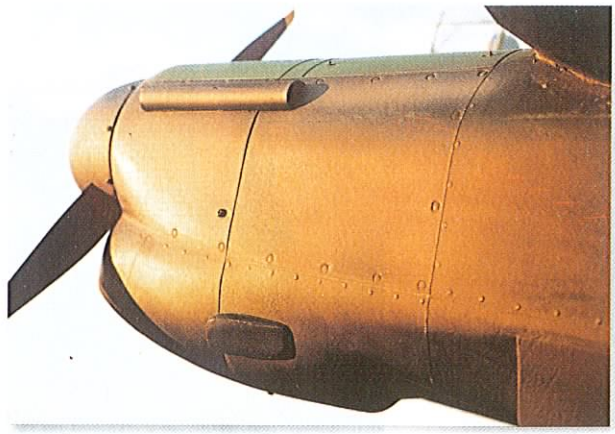
quite a few lining my workshop walls, including an 11' span B-17. However, every time the model is flown and cleaned, a little more paint becomes sticky and a little more balsa becomes fuel-soaked... you know the sort of thing. It can be quite disheartening to see your best paint job dulled by adding fuel proofer, and even worse when you find that the 'proofer isn't doing what it says on the tin!

On reflection though, the success of the small 11' electric Lancaster and last year's 15' Spruce Goose were the incentives for keeping the electric theme going. With both aircraft the secret to success was in keeping them as light as possible. This allowed the use of cheap brushed motors, 8 of which provided the Spruce Goose with a superb thrust to weight ratio.

country through well-publicised shows. I've only been a member for a few months now, but that's been long enough to find out that they're a great bunch of guys (and girls) aided by an excellent and dedicated committee and chairman.

Although the aim was to achieve a weight of less than 20kg I couldn't be certain of achieving this, so it seemed sensible to join the LMA and in the process register the proposed model within the '20kg Scheme'. This meant the design would have to be checked and the airframe inspected during construction.

Having made all the right moves I still hadn't decided on a subject. Initially I was extremely tempted to built a B-24 Liberator, similar in size to John Deacon's petrol version, which has been doing the show circuit for some years now.



popping up. I wanted this project to be nothing other than a success, and my previous Lanc' experience gave reassurance that the new model would perform on a minimal amount of power. So, the seeds were sown

As the sun goes down and the shadows lengthen, these atmospheric shots of the Lancaster are truly reminiscent of a bomber prepped and ready for a night-time raid over Germany.

Having been so impressed with the flying characteristics of the two aircraft (their size being a major factor here), the next logical step was to go larger.

FEASIBILITY

So, what size was it to be? Approaching 17' wingspan and weighing less than 44 lb (20kg) were my initial thoughts. My assumption for this was that the 11' Lancaster weighed 23 lb and the 15' Spruce Goose, 32 lb. In theory, therefore, it should be possible to build a 17-footer at under 44 lb!

You may be asking why specifically under 44 lb? Well, this is the weight where models come under the scrutiny of the Civil Aviation Authority (CAA) and the Large Model Association (LMA). Those familiar with the LMA will know that the association provides an invaluable service in raising the profile of aeromodelling in this

On closer inspection though the sheer bulk of the model persuaded me I couldn't make a 17' Liberator at less than 44 lb, given that John's version weighed well over 100!

So, what could realistically be achieved? Each time I asked myself that question, the Lancaster kept on

for yet another Avro to emerge from the Nijhuis workshops... Mind you, building another Lancaster is no real hardship for me, I really do love the aircraft and, having completed so many, I'm beginning to know it's quirks and construction peculiarities quite intimately.

At 17ft span Tony was unsure whether his Lanc' would weigh enough to qualify for the LMA's 20kg scheme. In the end he took the sensible option, joined the Association, and registered the model for inspection.

LARGE MODELS - PART 1

Tony Nijhuis

Whilst some large models seem to lack suitable scale detail, Tony has gone to great lengths to make the aeroplane totally convincing.

broken down into manageable sections for building and transportation. I finally decided on nine parts in total - wing in four bits, fuselage in two and tailplane in three, the latter with detachable fins. Once that had been figured out and the plan finalised, I generated a CAD template drawing and e-mailed it to SLEC for them to cut the wooden components using their very handy CNC machine.

The CAD data on its own wasn't sufficient to build the model - I still needed a paper copy, and this was no mean feat in itself. Arranging the plan to achieve the best use of space still required a 20 metre long x 1 metre wide roll of paper!

specification and numbering system. Confused and bewildered I decided to speak to someone with good experience of brushless set-ups and, unfortunately for him, John Emms of Puffin Models got his ear well and truly bent.

Puffin are the UK distributor for AXI motors, which have a reputation for delivering excellence in both quality and performance but without breaking the bank. My original plan was to use 16 cells per motor, the AXI 4120-14 seeming to fit the bill based on an input power of 650W.

When selecting speed controllers I was advised to go for a unit that has a higher current handling capacity than the motor will pull, the current

Just look at all those rivets! Tune in next month and find out how they were applied.

In exactly the same way as the full-size, Tony's bouncing bomb is spun backwards before release.

LANCASTER NUMBER 6

No, it's not a printing error - this latest effort represents the 6th Lancaster that I've built, so you really could say I'm a bit of a Lancaster nut! In reality it's yet another scale-up of the (very successful) 72" span *RCM&E* plan which was originally drawn using CAD. This being the case, it wasn't too difficult to scale it up to the required size, although I had to consider how the airframe could be

Lancaster nut and his latest creation. Could this be Tony's last model of the type?

400 hours in the making, and that's before it was covered and detailed!

MOTOR MATTERS

During the design stage I held discussions with various suppliers of electric motors, indeed the information fed back proved invaluable. With this in hand it soon became apparent that conventional brushed units weren't going to be suitable due to their efficiency (or rather lack of it) and the relative size of project. The alternative to brushed motors is, of course, brushless, these having an improved efficiency of anywhere between 80 and 95%, depending on the load. When you consider that a brushed motor does well to achieve 60%, this is clearly quite significant. At the time this particular area of electric flight was a bit of a mystery to me and I found myself trying to compare sizes of brushless motor with that of brushed units (i.e. 400, 600 etc.) which, unsurprisingly, proved fruitless as there's no relationship between the technologies. Even more confusing is the fact that each brushless motor manufacturer has its own

draw therefore being well within the handling capacity of the controller, reducing the chance of failure through overload. I eventually chose the Jeti 75NC, a quality speed controller, again supplied by Puffin.

IN WITH THE NEW

With the power system sorted it was time to get on with building.

Work began on the 2nd January and after 10 weeks, working approximately 40 hours per week, the model was ready to test fly. I like to try all my electric aircraft prior to covering and painting to be sure that all's well and that the chosen power train works successfully. For an electric model of this size both John Emms and myself were entering uncharted territory!

Being reasonably confident that the model was well under weight I only thought about sitting the Lanc' on the scales the day before the test flight, and I was in for a bit of a shock... nearly 43 lb! I was mortified. 2 lb of lead was needed in the nose heading towards 50 lb, reducing my target power to weight of 50W/lb. Not good news.

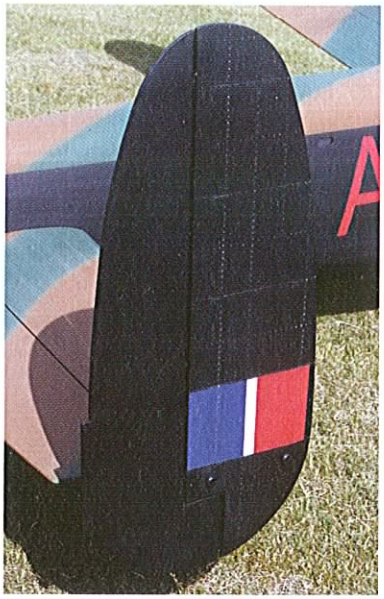
The only positive point was that in its naked form the model just crept under the 20kg limit, so I could go and test fly it without the exemption paperwork in place. With the weather set fair for the following day, the Lanc' was put on charge ready for an early start...

BIG UP

Belonging to the Hastings MFC means I have access to a first class flying site, all safely set out, not a single tree within the fling zone and a 150-metre grass runway.

for achieving C of G; nothing to worry about on a model of this size, but what did concern me was the power requirement. I'd originally calculated that a power to weight ratio of 50W/lb had to be achieved for the Lancaster to work successfully, which equated to 2.2kW of input power based on 44 lb weight. This rule of thumb has worked well to date, but as models get larger the wing loading obviously increases and similarly the power needed to fly the thing. The finished model, it appeared, would be

The Lancaster took about an hour to put together and even though the model was unfinished it still looked pretty impressive. Powering up for the first time and taxiing out revealed the same excellent ground handling characteristics as the smaller 11' version. Although the power seemed fine on the ground it was very noticeable that the props, although being a pretty substantial 14" in diameter, only just cleared the bottom of the cowls. I wasn't happy with this, bigger props would have looked so much better and been more efficient.



The Lanc' breaks down into nine parts for transportation and storage - three of these comprise the tailplane which has detachable fins.

Nevertheless, this wasn't going to delay the moment of truth, and after all the final pre-flight checks were made we were ready to go. The Lancaster was lined up into the gentle 5-knot wind and the throttle progressively opened. She slowly began to roll forward and after 10 metres or so the tail was off the ground, the aircraft balancing perfectly on her main wheels with no elevator correction. Being electric the power is uniform across the motors, so there was no tendency for her to swing or do anything other than track straight down the runway. Truth is, no correction was needed at all. Maximum ground speed seemed to be reached 50 metres or so into the take-off run, at which point I started to progressively feed in 'up' elevator. After some 70 metres she was airborne and climbing out in a very scale-like manner.

So, how did she fare from there? Tune in next month and I'll tell you.

Sensibly, Tony likes to fly all his new designs in their pre-covered state so that any tweaks and alterations can be made while there's still a chance to hide the evidence.

When building a model of this size you really have to think big in every respect. Take the plan, which came on a 20 x 1 metre roll of paper.

LARGE MODELS - PART 2

Tony Nijhuis

Lancaster at LARGE

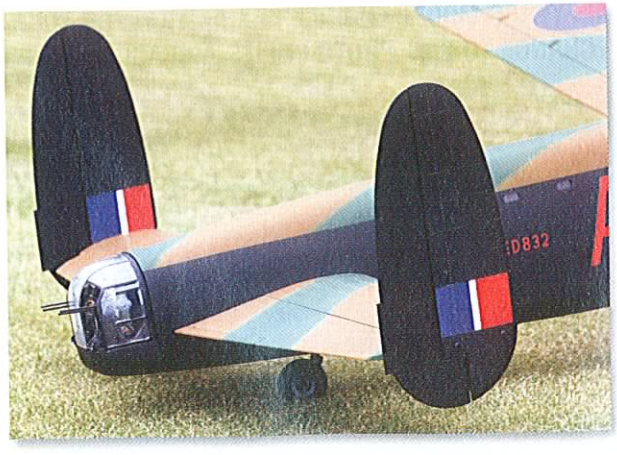
TONY NIJHUIS CHECKS OUT THE LANC'S FLIGHT ENVELOPE BEFORE DETAILING AND PAINTING

Although successful in aerodynamic terms the first flight proved that the motors would be marginal with a fully loaded airframe.

Of course, the problem with large models is that if they're to look right they need a greater level of surface detail. With a Lancaster this size that can only mean one thing... rivets!

Last month I described the design and construction of my 17' span Avro Lancaster, to the point where I'd wheeled her out in an uncovered and unpainted state, ready for some proving flights. If you remember the aircraft reached the point of no return some 70 metres down the Hastings MFC runway and I broke the story with the lumbering aircraft climbing-out over the Pevensey marshes. What happened next? Well, as the wheels were retracted the nose immediately rose and the Lancaster picked up speed. The climb-out continued through a right-hand turn, achieving around 150' altitude by the time she'd completed one circuit. All the controls felt fine, though I needed to hold in quite a lot of up elevator to maintain level flight, indeed neutralising the elevator resulted in the nose pitching down quite suddenly. Adding full up trim permitted level flight with neutral stick position, all the other main control surfaces required only the smallest of adjustments before the model was flying 'hands off' and at a very scale speed. The second circuit was far more comfortable, and I knew the model was everything I'd hoped for.

After some six minutes of gentle circuit flying I called a landing and lined her up on finals. The aircraft doesn't have (or need) flaps, and power has to be applied all the way to the ground. Backing off to about half, the Lancaster descended slowly and gracefully to about 3 metres above the threshold. As I cut the motors she slowed quite noticeably and began to drift to the right.

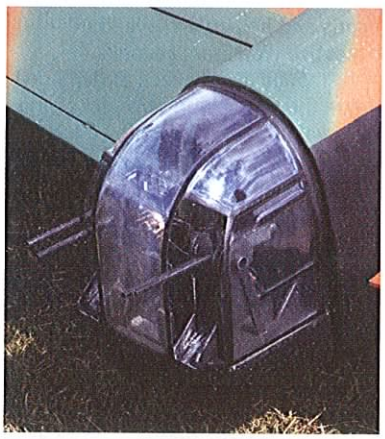


This caught me by surprise somewhat, and I had to power up again to drive her on to the runway. The final touchdown was a bit out of shape and as a result one of the undercarriage legs broke away, the model unceremoniously grounding

to a halt 'wun wing low'. Nevertheless I was absolutely delighted with this first outing, and it was now full speed ahead so as to finish the model ready for Sandown.

POST FLIGHT PONDERINGS

I always like to analyse the test flight of a new design, and the Lanc' was no exception. My immediate concern was the power system. Although power seemed adequate, there were a number of things niggling me. First consideration was the size of the props which, if larger, would be more effective. Second, the painting and finishing process was destined to add another 10 lb, begging the question: could the power system cope? Third, the nose weight would probably rise to 4 lb by the time the finish was applied to the tail, and I don't like giving ballast weight a free trip round the sky.



First thing the next morning I contacted John Emms to ask whether it was possible to increase the prop diameter and squeeze 10% additional power. The answer wasn't favourable, and it soon became clear that the only option was to re-motor and go for AXI 4130-16 motors (the largest AXI currently available); as a result the cell count would have to increase from 16 to 20 per motor. Fortunately the battery compartments in the inner nacelles are cavernous and could easily accommodate the extra cells.

In short, each new motor using a 16 x 10" prop on 20 cells would give an additional 200W in power (800W in total over the four motors), equating to a whopping 30% power increase at the same current draw. This would give the Lancaster an incredible input power of 3.5kW. Once again, John Emms again came to the rescue and replaced the motors after first checking that the original Jeti speed controllers were up to the job (which they were, fortunately).

Believe it or not the model disassembles into five parts and fits neatly into Tony's trusty Volvo estate.

POLISHING OFF

Feeling more confident about the modified power system spurred me into action to get the model finished. Needing to keep the finishing weight as light as possible tempted me to film cover, adding detail and paint similar in standard to that of the 11' Lancaster. But then ed. Graham made a passing comment: "The smaller Lancaster was nicely finished, but what it really needed was a bit more detail, you know, a bit of turret gubbins and maybe some rivets... what do you reckon?" I hate to admit it, but he was right. The bigger the model, the more detailing required. Fortunately, I've amassed a good collection of Lancaster books and pictures over many years so researching the detail wasn't a problem, it was just the

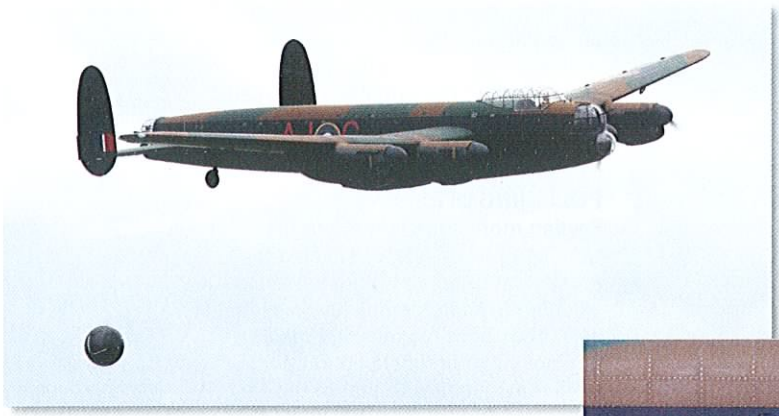
Instead of Tony's usual Solarfilm covering solution, he opted for a more durable glass cloth finish, thus guarding against the inevitable transport and hangar rash.

An entire week was spent kitting out the turrets and the observer dome but it was well worth the effort.

Finished and flying. Tony's Lanc' really does raise the hackles with its awesome presence.

LARGE MODELS - PART 2

Tony Nijhuis



Although you cant see them in this shot, Tony has installed working bomb aiming lights whose beams converge at 10', i.e. a 1/6th scale drop height.

length of time that might be required to complete the job.

The model had been test flown without canopies or turrets - these, along with their respective vac-form patterns, still needed to be made. This took about a week or so to do, at which point the cockpit detailing was started.

Contrary to popular belief early Lancaster's had windows along each side, though they were often painted out.

Because the Lanc' needed more extensive detailing, a Solarfilm-based finish wasn't really an option. As such I decided to use lightweight glass cloth (17g / sq. m) applied with a 2-pack flooring varnish (Sadolin PV67), which dries in about 30 minutes. One of the main benefits of glass cloth is that it gives the model protection against hangar rash which, when manoeuvring a model of this size around the workshop, is very likely indeed!

Prior to applying the covering the model was given a coat of sanding sealer so the varnish didn't sink into the wood. The glass cloth was then applied dry and smoothed out over the airframe before applying the varnish using a 4" foam roller. This method is really quick, and because of the short drying time you can re-work the model after just an hour or so.

Remarkably, the cost of the Lancaster's electric powertrain is somewhat cheaper than an equivalent i.c. set-up.

After three long evenings the covering was complete, whereupon, to give the finish that extra surface hardness, I applied a thinned coat of epoxy over the cloth / varnish. When this was dry I cut the windows into the side of the fuselage; contrary to popular belief the early Lancaster did have windows along each side but they were often painted out as night flying operations rendered them pointless (research on the dambuster Lancaster shows these were unpainted, however). Prior to any further detailing the model was then given a light coating of grey primer to pick out any anomalies with the covering.

RIVETTING STUFF

The simplest way to apply dome rivets is by using slightly (water) thinned PVA glue, but the thought of individually forming some 100,000 rivets filled me with dread, sending me off on a mental quest to find an easier way of

completing the task. My solution was to take a piece of hardwood about 1/2" square x 12" long and drill small holes at 1/2" intervals along its length. A 1" long panel pin and was then epoxy glued into each hole. With this, the sharp end of the pins were linished to a flat end and... hey presto... a multi-rivet tool. To make a suitable glue tray I simply cut a length of 22mm plastic pipe down the centre and glued a piece of plastic to each end of one half.

A line of rivets could then be made by dipping the rivet 'comb' into the trough of glue by no more than a few millimetres, applying it to the surface of the model and carefully rocking the comb from one end to the other before lifting vertically away. And the result? 30 plus rivets instantly. Because the glue grips the comb pins the comb could be used another couple of times before being recharged with PVA.

Applying at a reasonable pace this method can yield 200 rivets a minute, 12,000 in an hour. It took me only two evenings (about 8 hours in total) to complete the rivet detail, and by the time I'd finished it was clear that the time spent was going to make the single biggest visual impact on this model.

WRAPPING UP

Bomb-aiming lights were then added, angled to achieve convergence at 10' (1/6 scale drop height of the full-size). A working bomb rotation and drop mechanism was fabricated, installation of navigation lights and retractable landing lights being the last detailing required before painting.

Applying the final colour scheme was straightforward using spray-applied Flair Spectrum paints, thinned to a 50/50 mix using cellulose thinners. To finish off, the paint was given a light rub down using 1200 grade wet 'n' dry, which revealed the tops of the rivet heads and helped achieve that evocative workmanlike look.

To reduce the chances of damage I made the turrets and observer dome removable, which also allowed me complete the detailing of said items last of all. Since the turrets are such a noticeable feature on the Lancaster this detail had to be utterly convincing. Armed with all sorts of bits and pieces I spent an entire week just kitting out the front and rear turrets and the observer dome.

Endeavouring to keep the aeroplane as light as possible I managed to source a pair of lightweight 9" wheels from Len Gardner. The wheel covers were vac-formed, oleo legs are J. Perkins and the retract units are Ripmax 'Giant'

spring / air. These retracts are designed for models up to 15kg, so with the Lanc' approaching 30kg (60 lb) they needed strengthening somewhat! This was done by making a saddle plate from 2mm thick aluminium to the profile of the retract housing which supported the rather vulnerable plastic.

At time of writing (late June 2004) the Lancaster has achieved 8 flights, amounting to just over an hour of flying - enough to achieve exception and be ready for public display. Although that hour seems onerous when starting out, it allows those teething problems to get sorted, and believe me, the larger they are the more teething there is involved.

Although the size of Lanc' has entered uncharted territory and is the first electric model to come under the auspices of the LMA 20kg scheme, I don't see this an an end to the matter and fully intend to continue pushing the boundaries of electric flight with new and more exciting projects.

SHOW TIME

When displaying the model at Sandown I had a hard job convincing one or two enthusiasts that it was indeed electric. A question often asked was: "What's the cost difference between an electric package and an i.c.?" Strangely, if you bought four O.S. 120 four-strokes or equivalent petrol engines, you may well have to find another £100 or so. Surprised? I was.

When going to large or giant scale one of the great benefits of electric power is that the batteries become useful ballast. Putting 5 lb of lead in a 100" model isn't uncommon. Even Richard Rawle, one of the UK's best and lightest builders, had to concede and put 10 lb of lead in his beautiful 1:3 scale Spitfire. So the weight of conventional NiCads for large format models must be considered an advantage. The Lancaster carries over 12 lb of batteries and no ballast. I think that says enough.

So, an electric model of this size can (and often will) be lighter than its i.c. counterpart. The only slight drawback with the Lanc' is flight times, which are currently around the 7-minute mark. Although for display flying this fits nicely into the usual 10-minute slot, to increase duration I'll either have to increase the number of cells to increase the voltage, wait for a higher capacity (which is seeming less likely with the advent of Lithium technology), or go in the direction of the lithium cell itself - but we're talking serious money there!

A whole selection of household items were used to fit out the turrets. The bullet belt, for example, is made using cut down cocktail sticks and self-adhesive tape.