Re-Build – New From Old

This is an occasional feature showing the possibilities of restoration work and how it is feasible to dramatically cut the cost of owning a motorglider. MIKE WOOLLARD demonstrates in words and photographs the mammoth task he took on in restoring an RF-4D and the sheer satisfaction in getting it to flying condition



Mike, Chairman of the BGA Technical Committee and Engineering Director of Irvin Aerospace Ltd, the parachute company, flying his RF-4D over the Cambridgeshire countryside in the UK. He is a member of the Cambridge Gliding Club and started gliding 18 years ago. Mike has 1130 gliding hours and 570 power, is an advanced aerobatic rated gliding instructor and has two Diamonds.

My first encounter with the RF-4D, November Xray (NX) was in the hangar at Nympsfield, home of the Bristol & Gloucestershire Gliding Club in the UK, when as a rookie student pilot I grabbed the opportunity when no one was looking to slip into her cockpit and "try her on for size!".

Although she was long overdue for a re-cover I was captivated by her beautiful lines - the product of an artist's mind rather than that of an engineer -, the business like functionality of the cockpit and the promise of fun packed flying. Immediately my thoughts were transported to imaginary flights along mountain ridges, swooping around mountainous cloudscapes and the pure unbridled exhilaration of flying her through a barrel roll. I was hooked !

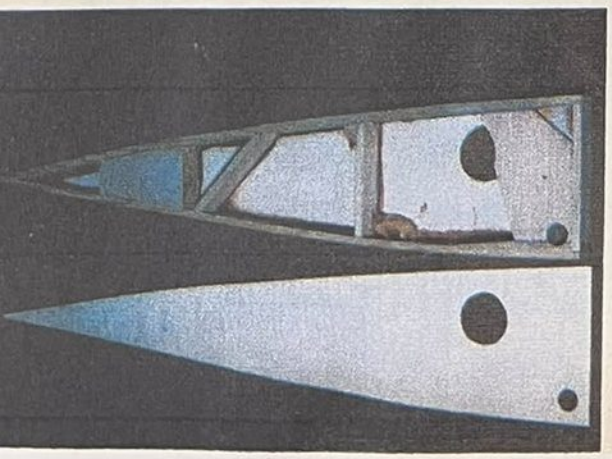
Eight years, a Silver badge and a PPL later my dreams were realised when I had the chance to join NX's nine man syndicate. By this time she had been treated to a much needed professional re-cover by Targett Sailplane Services and now sported a classic Fournier colour scheme in Ford electric Monza blue. She looked magnificent.

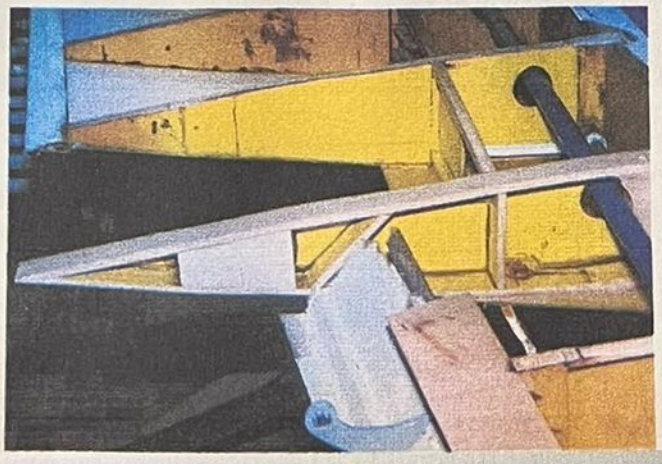
My first flight fulfilled all my hopes and more. Here was an aeroplane designed to be flown just for the pleasure of flying. Immaculate vice free handling which just begged to fly aerobatics and would do exactly what was wanted of her.

Ask her to spin and she will cleanly break away into the desired autorotation which can be stopped on a heading at the blink of an eye. Roll her upside down and she will stay there flying almost as stable as in erect flight for as long as you want.

An absolute delight with classic handling characteristics designed by René Fournier to bring fun affordable flying to the average man on the street. The 1200cc VW Beetle engine up front is reliable, cheap to service and repair and uses less fuel than a Mini at

Left: A new rib is ready for positioning. Centre: Glued into position. Right: Repaired wing ready for covering. Photos by Mike.







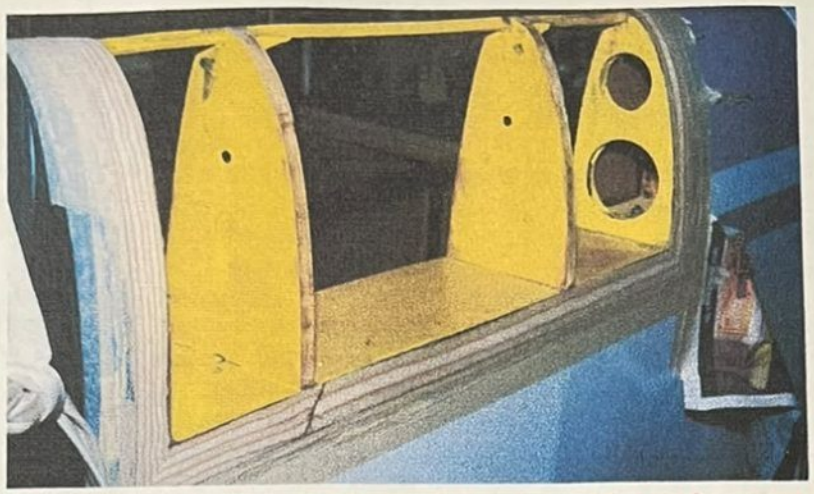
a 100mph cruise - a remarkable performance and the aircraft is fully aerobatic with the exception of flick manoeuvres.

And so began a long and happy relationship, not only with NX but also with the well run Nympsfield syndicate with whom I shared many happy moments worrying about overheating problems, top end overhauls, 50 hour services and the numerous technical challenges which needed to be solved to keep NX operating in a cost efficient way. And with everything paid for, including insurance, hangarage and an annual check, all she cost us was £18/hour and £16/month.

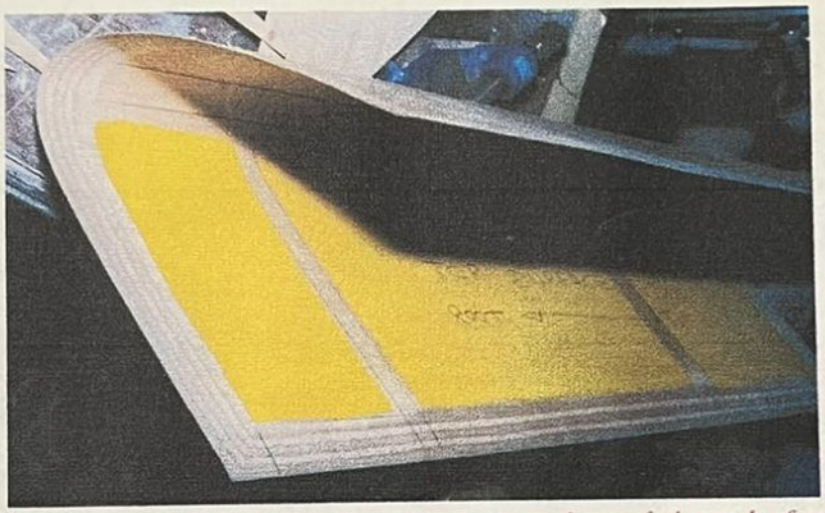
Sadly a change in job caused NX and me to be separated. I found I was missing the flying and aerobatic practice too much, so I resolved to establish a similar syndicate near Cambridge and began negotiations to buy another RF-4. It was then that I heard that NX had come to grief in an overshoot landing in a small field in North Wales.

I was not a little surprised at the effect this news had on me - a sense of loss which transcended the mere material possession, which was insured anyway, to more of the sense of loss one feels when someone in the family or a friend is seriously ill. So it was with a leaden heart that I went to Nympsfield to view the wreckage and discuss with my partners what was to be done .

Dismantled and broken, NX looked a sorry sight. The impact with the end of the field had involved a boulder infested ditch, tearing out the outriggers and supporting wing structure, puncturing the wing D box in two places and smashing the propeller and shock loading the engine. Mercifully the spar had escaped unscathed.



The D box ready to accept the scarfed and moulded replacement plywood.



Steam moulded plywood section cut and scarfed ready for gluing into position.



Plywood glued in position and the D box ready for finishing.

The fuselage initially appeared unaffected but a small 25mm long split in the outer plywood skin near the wing supporting bulkhead was all that indicated a serious problem which took many hours to repair.

Viewing the wreckage with a growing sense of dismay, our fears were confirmed when the underwriters agreed with the repairers' estimates of £18 000 to return her to her former glory - clearly she was a write off. I couldn't accept that this once beautiful aircraft which had provided me with so many of my happiest leisure experiences should be condemned to the scrap heap by economic necessity. She deserved more, so I resolved to fix her myself and negotiated a price for the wreckage.

My 30ft long garage, which when we bought the house was thought ideal to handle all our flying hardware needs, had to be extended 8ft using 16 external grade plywood sheets, some roofing felt and 50mm x 50mm timber. This we did in one frenetic weekend before we could transport NX, with her one-piece 37ft wing, on a T-21 trailer.

With nightmare visions of wiping out pedestrians, cyclists and cars on each of the multitude of roundabouts along the 100 mile cross-country journey, I approached the task with some trepidation, particularly when our best attempts to load NX on to the trailer resulted in a full 8ft overhang of precious valuable RF-4 wing. Somehow a little red flag felt wholly inadequate to protect this vulnerable protrusion, but all went well and NX was soon installed in her new home for the next two and a half years.

NX's airworthiness flight certification had always been an annual permit to fly issued by the Popular Flying Association, an organisation with Civil Aviation Authority delegated powers to approve airworthiness for certain types of aircraft.

The PFA exists to promote and educate its members in the technical and operational intricacies of the aircraft they fly, and to encourage and oversee their maintenance and building of recreational aircraft under the supervision of accredited PFA engineers, termed inspectors.

Clearly this gave an ideal environment for my repair project and it only remained for me to find a suitable inspector. And so it was that I came to know Pat Barker, an immensely experienced officer and senior inspector within the PFA, who soon became a regular visitor to my home workshop.

Pat's first visit was a nerve wracking affair as he sought to evaluate both me and the enormity of the task. After inspecting the damaged wing he looked at me with a quizzical gaze, which spoke volumes, and asked whether I had ever done anything like this before. I admitted that I hadn't, but had undertaken a variety of repairs to wooden gliders during my 18 year gliding career, including some re-covering work.

With a heavy sigh which suggested his expectation that he was committing himself to a lot more than just a few evening visits, he commented that "well it's not the sort of job ➡

I would recommend for a first project, but let's get started and see how we go".

And so began a pattern which would repeat itself month after month. Having cut back the fabric to reveal the underlying damage to the woodwork, I would cut back the damaged material, carefully noting the nature and dimensions of the construction required. Then after consulting with expert friends such as senior BGA inspector David Braham, I would draw up a repair scheme defining what I proposed to do and the materials I would use.

The MoD Air Publication AP119A-0501-16 was an invaluable guide, covering a wide variety of wooden aircraft repairs. It clearly draws its origins from the days of the Avro 504 and Sopwith Camel, but it is a great read and its lessons are no less relevant today. Pat would study the repair scheme, suggest appropriate revisions and then let me continue with the work to be inspected at pre-agreed levels of progress.

Without doubt I spent as much time if not more standing looking at the problem, discussing potential solutions and writing up repair schemes and drawings, as I did doing the work. Once solutions were devised as to how 15:1 scarfs were to be prepared and clamped, the actual work became a relative formality.

Sourcing the wood was an absolute nightmare as the RF-4 is made of pine rather than the more common spruce (which is a weaker form of pine). Eventually by a stroke of luck I learnt that London Sailplanes had a job lot of Baltic pine which had been carefully selected for suitable grain pattern and moisture content for a major repair; and yes they had some left. I bought the lot, just enough for NX's needs.

Thankfully it was easy to find aircraft grade beech plywood and the different thicknesses were soon laid in. I used Aerodux glue for the jointing adhesive as I had good past experience with this brown treacle like mix of two liquid ingredients combined in equal measure.

Repairers tell me that they estimate such a repair job on the basis of one major glue session per day, and I soon saw the wisdom of that approach.

Each evening I would prepare a particular repair site by cutting away damaged material, removing old glue, cutting and shaping replacement wood sections and preparing the interconnecting scarf joints. The new wood was glued and clamped in place. Finally sample joints were made with the residual glue and wood for Pat to test for joint efficiency. This pattern repeated itself day after day after week after month...

I soon found that the secret of success lay in having a good selection of simple but strategic tools and I became quite proud of my collection of clamps in various shapes and sizes, my strange collection of purpose made sanding blocks and strange metal wedges of various taper angles to assist in the carving of scarf joints. Having sharp tools is of paramount importance. An hour spent sharpening a good set of chisels is quickly recouped in the time saved and the quality of the work you achieve.

At the outset the job appeared so immense it was impossible to see it as anything other than an endless series of tasks and challenges to be undertaken as well as possible.



Collecting the salvage.

Strangely this helped to off load the sense of pressure which one might otherwise perceive to exist on such a project.

The RF-4 was "Mike's long term project" as and when he had some spare time and family pressures permitted. Looked at in this way and knowing that the long term result was extremely worthwhile, each task became a fun activity to be enjoyed in isolation and not hurried. This was certainly the case in the first year and a half.

Once the repairs were completed and the wing closed up the urgency to finish increased. Towards the end I was constantly underestimating the time needed to complete the project by factors of four or five. If there is one great truth in such projects it is that finishing takes an age.

I started it in September 1995 but the approaching winter brought its own particular problems. The glue which normally would take three hours to cure, but in practice was left overnight, took much longer as the cold increased the cure times. It was impractical to heat the whole uninsulated garage, so I partitioned off the repair site with blankets and heated it with an oil filled radiator. Leaving the radiator on all day raised the temperature to a just acceptable working environment on even the coldest of days.

The most demanding repair was to the two holes in the plywood D box, one of which had damaged the leading edge spar. This meant a disturbingly massive further cut back of the D box so that I could make a proper scarf repair, leaving an enlarged section of moulded ply to be replaced. The plywood cut back was prepared to accept a rectangular sheet of plywood once bent around the leading edge. The edges were reinforced with dummy riblets and then scarfed back to a width of some 32mms.

The difficulty came in persuading the 2mms thick five ply beech plywood to assume the required profile prior to trimming, scarfing and gluing into position. At the first attempt a shaped and partially scarfed piece of ply was drenched in boiling water and tensioned around the leading edge. Just as it was finally pulled into shape when the tension in the encircling straps was at its greatest, a loud bang signalled the splitting of the plywood along the leading edge and the fruitless end to more than a week's work.

It was at this point that I turned my attention to techniques in steaming wood used by master carpenters in Francis Drake's day to build the Golden Hind.

I bought a wallpaper steamer from the local DIY shop and made a steam box out of a pair of children's moulded plastic sledges and sheets of polythene. The plywood was enshrouded in this steam box and steamed for two hours. Once thoroughly heated through, the hot plywood was draped over the D box in the required position and pulled into position by a number of webbing straps.

In this steamed state the plywood required a constant force to be bent to shape around the D box, assuming the profile with a satisfying lack of protest. After being allowed to cool and dry for a couple of days, the straps were released and the plywood held its shape perfectly. It then remained only to trim to shape and scarf the edges before gluing and stapling into position.

A very satisfied and relieved Pat Barker confessed to me later that when he first saw the job he felt for certain he would end up having to do this D box repair, a task he clearly did not relish. This accomplishment gave me an enormous increase in confidence in my ability to complete the rest of the work.

The cost of the job was not as one might at first think. Certainly in terms of man hours it was very expensive indeed and more than justified the original write off views of the insurers and repair quotations. However, the materials were quite modest at around £1800 including £450 for the engine strip and rebuild.

Far and away the greatest expense was the paint. I used Glasurit 21 line two pack polyurethane bought at a staggering £45/litre, plus hardener, thinners and plasticisers. This was the paint used before on NX, so a good match was assured. It also has a reputation for unsurpassed durability and flexibility and can be sanded and polished back to a high gloss finish - immensely useful when faced with the inevitable paint runs, dust specks and orange peel finish which plague me when I am spraying.

Being a two pack paint it is quite dangerous to spray and needs to be taken very seriously to avoid damaging your health. So I had to invest a further £750 in spraying equipment, including a compressor and closed circuit filtered breathing equipment, with which the spray job went as smoothly as a spray job can go.

I finished all the workshop work in the fall of 1997, just two years after I started. All that remained was to re-assemble the airframe and fit the engine - just a few weeks' work I thought. Wrong again. It was not until January 9, 1998, some four months later, that I was finally ready for the flight test, having had to fit and remove the engine three times and undertake a bewildering array of small jobs not originally anticipated.

Words cannot adequately express the pride I felt as I made the preflight inspection. NX looked better than I had ever seen her in the whole of our 18 year acquaintance.

Her wings shone like mirrors and the cockpit sported a new instrument panel and a totally refurbished carpet lined interior. Instantly forgotten were the long hours spent in a cold workshop and the multitude of technical problems stacked up to be accomplished one by one - all replaced by the warm glow of contentment one feels when rediscovering an old long lost friend.

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