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EDITOR'S COMMENT

“Aeroplane readers are an extremely responsive lot, keen to share their opinions with the editorial team – and we wouldn't have it any other way!”



A VERY BIG THANKYOU to the many, many of you who responded to our reader survey in June's *Aeroplane*. We are still considering the results, and tying them up with the fruits of further research, but a number of conclusions are already clear. You have confirmed that you love our *Database* section and our historic content in general; that you value the quality of our photographs, illustrations and news; and that you generally approve highly of what we provide each month. No surprises there! We will continue to deliver on all counts.

What is also apparent is that many of you have an appetite for detailed information on restoration projects, also aero-engines and the like – and so I am delighted to be able to point you this month in the direction of our cover story *The Devil is in the Detail* on page 44, about SkySport Engineering's recently-completed Hawker Demon; and *Merlin Magician* on page 22, about the challenges of engine overhaul and rebuild.

Watch out for more of what you want over the coming months, let me know what you think, and tell your aviation-minded friends!

Michael Oakey – EDITOR

PS With Christmas coming, if you don't already subscribe you might want to leave the magazine strategically lying around open at pages 38–39; and see page 94 for subscription gift ideas for friends and relatives!



Aeroplane helps you get under the skin of aviation history and preservation... here is Hawker Demon K8203, this month's cover subject, in all its uncovered glory.

IAN FRIMSTON

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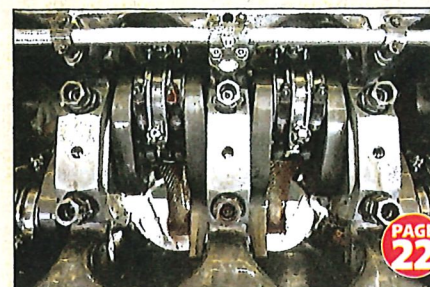
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EDITOR'S CHOICE

AEROPLANE



PAGE 22

Inside the Merlin

Just what is involved in rebuilding and overhauling Roll-Royce's iconic aero-engine? We visit a Merlin guru to find out



PAGE 40

Jammed elevators...

Amazing what *Aeroplane* sparks off – prompted by our Trident *Database* section last month, former test pilot Desmond Penrose recalls a crisis quietly solved



PAGE 14

Hidden history

Did you know that Mexican pilots joined the Royal Canadian Air Force in WW2 so that they could join the Allied war effort in Europe?



The Devil is in the Detail



IN 1976, AT RAF Cardington in Bedfordshire, I began documenting the restoration of aircraft for the RAF Museum. On the nearby storage racks, amongst the thousands of items, was the rear fuselage of a Hawker Demon. At that time no-one could have envisaged that parts of the fuselage would be used in the restoration of an example of this lovely 1930s biplane fighter to flying condition.

Arriving at SkySport Engineering one day in 1991, I was able to inspect its latest project, recently purchased from Aero Vintage by a family



ABOVE The "kit of parts" with which the project began in 1991 – it was first reported in Grapevine in January 1992's *Aeroplane*.

as a retirement project. The technical difficulties resulted in a task that, up to its culmination in June this year, took somewhere in the region of 35,000 man-hours over an 18-year period.

Along with the rear fuselage

of Demon K8203 also came a fin, rudder, tailplane, elevators, centre section, a Hector front end from Ireland, some wing sections and some undercarriage components. Enough of the decking had survived to indicate that the aircraft may have been fitted with a turret; and there were also components from a second Demon.

An essential starting point in any restoration project is the many hours spent undertaking research and where possible acquiring copies of original drawings. Sufficient drawings were eventually obtained to ensure that the project could be completed; SkySport was

IAN FRIMSTON traces the 18-year effort to restore Hawker Demon K8203 to airworthiness – a “modest little project” which turned out to be anything but. With air-to-air photographs by **RICHARD PAVER**



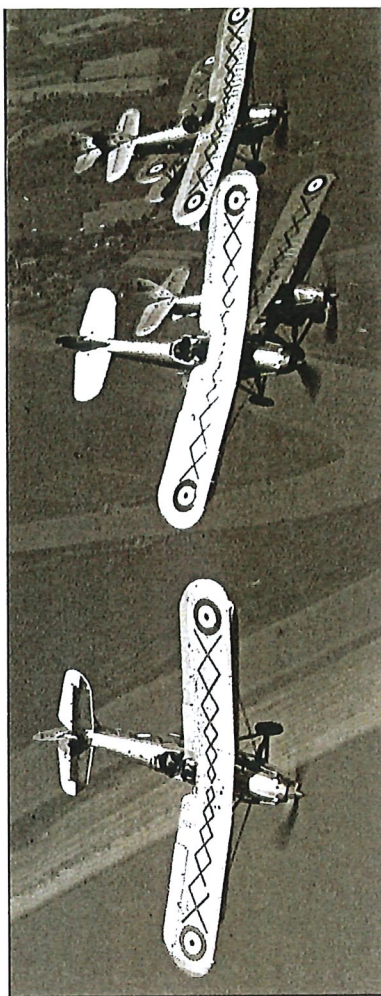
ABOVE Demon Displays' (DD) Hawker Demon K8203/G-BTVE being flown by Stuart Goldspink from Old Warden Aerodrome, Bedfordshire, in mid-August. DD's Howell Davies protrudes from the Scarff ring of the gunner's cockpit.

also fortunate in having a parts list for the Demon, vital for any project. With the Hind at Shuttleworth and the RAF Museum's Hart trainer undergoing a total strip-down and rebuild at Cardington, much valuable information could be recorded from these nearby airframes. Many years were then spent obtaining parts.

The front part of the fuselage is mainly of steel but this was corroded, except for the stainless steel plates, which could be reused after undergoing NDT checks for cracks.

Setting the standard

Once work had begun, a major criterion for the finished aircraft was that it would be historically accurate in every way. To this end, careful checking of components was undertaken, to ensure that they were airworthy and could be included in the restoration. The majority of the rear end, with the exception of the steel longerons, was used. New stainless steel bracing wires were fitted. One of the most time-consuming jobs was the squaring of tube ends: there were some 20 different sections, various companies were tried without success, and eventually the engineers were able to use the tube-squaring machine made by Aero Vintage. Yet another problem to be overcome was the manufacture of hollow rivets: small quantities of original rivets would turn up, but hundreds were needed.



Once the main structure of the fuselage had been completed, attention was then turned to the original engine bulkhead. Although pitted, it was salvageable and was sandwiched with stainless steel to improve its strength and fire protection. Strength was essential, because the radiator tubes go through the bulkhead and the radiator swivels up and down on the tubes, which articulate and are packed with glands. If the glands are too tightly packed, strain is passed directly on to the bulkhead and

Demon descent

THE HART FIGHTER, as it was originally known, was operated only by one flight of 23 (F) Sqn at Kenley, where it proved to be a successful adaptation of the Hart airframe – so much so that it was renamed Demon and a contract for 17 aircraft to Specification 9/32 was issued in 1932. Demon K8203 was built by Boulton Paul to Spec 8/34, and was one of 37 aircraft in the third production batch; the eventual production run for the Demon was 234.

Taken on charge by the RAF on October 27, 1937, K8203 was initially assigned to 64 Sqn at Church Fenton. Following service with 25 Sqn at Hawkinge, the aircraft moved to No 9 Maintenance Unit at Cosford and then to No 9 Air Observers' School at Penrhos. Struck off charge on September 28, 1940, K8203 became a training aid at No 1 Service Flying Training School at Netheravon. After this the history of the airframe becomes tenuous but it is understood to have finally been allotted to No 413 (Aldershot) Sqn of the Air Training Corps, probably during 1943.

LEFT Demons of 64 Sqn, based at Martlesham, demonstrate dive-bombing in June 1937.

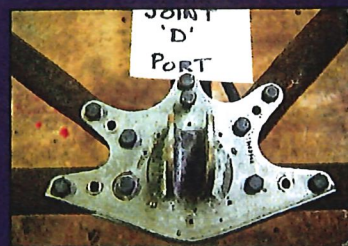
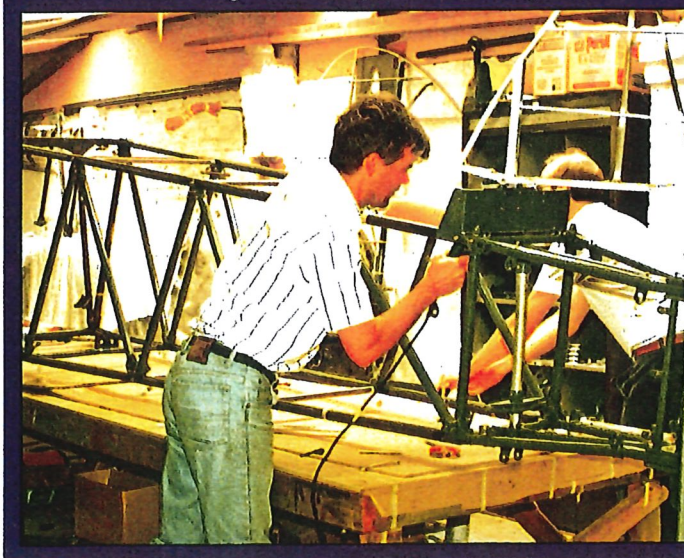
cracking could occur. The engine bearers are new-build.

Tracing a Kestrel V engine has been a priority from the beginning. SkySport already had an incomplete Kestrel upon which Vintech was working. Obviously a complete engine was needed and, as happens, word was received that one was available in Australia. This was a difficult stage in the project as costs were escalating, but an opportunity was seen to recoup some of the outlay on spar development. After a visit to Jack McDonald in Australia, the engine was secured along with some instruments, Fairey fasteners and a radiator. The project again moved forward. During the trip

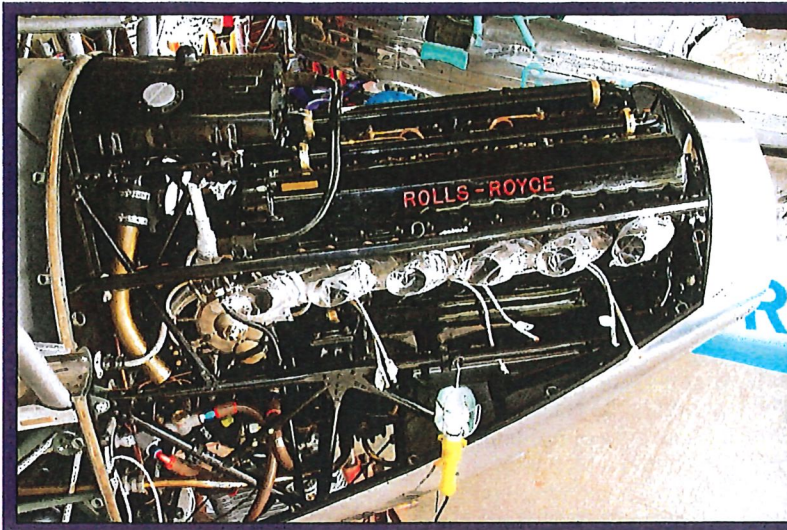
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BELOW SkySport engineers Steve Roberts and Martin Kimm working on the Demon's rebuilt rear-fuselage tubular frame, which utilised new steel longerons but kept most other original parts.



TOP A detail of the port side of the engine bay, showing the unrestored condition. **ABOVE** Although the fuselage's steel tubes had corroded, the stainless-steel fishplates were still in excellent condition. **ABOVE RIGHT** The engine bulkhead before restoration. The surface pitting could not be cured, so it was reinforced with stainless steel.



LEFT A spare engine side panel from Shuttleworth in place on K8203 to act as a pattern. **BELOW** The wooden formers for the new compound-curved cowlings.

LEFT The Demon's Rolls-Royce Kestrel engine, restored by Vintech at Little Gransden. Blackburn B-2 G-AEBJ is in the background.



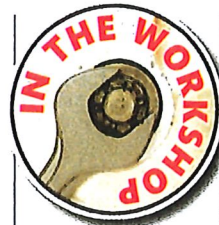
Text continued from page 46 to Australia, additional Demon parts were offered that had, it transpired, come from a scrapyard in England. It was a long shot that any other part would still be there, but an exploratory visit was made. The engineers struck gold, for at the back of the yard, amongst the trees and undergrowth, was a coolant ball valve assembly, which although too far gone to be used, provided all the information necessary for the manufacture of a new one. Also found were the Ferodo pads which mount the feet of the engine on to the engine bearers, and these were also used.

Before the second engine went to Vintech for a rebuild, it was mounted on the airframe, so that development work could proceed with plywood formers in order to

make moulds for the engine cowling. All reference to engine cowlings on Demon drawings, simply refer to "shops jigs". SkySport was fortunate that the Shuttleworth Collection has a spare set of side panels and these were lent to act as patterns for new ones.

Hurry up and wait

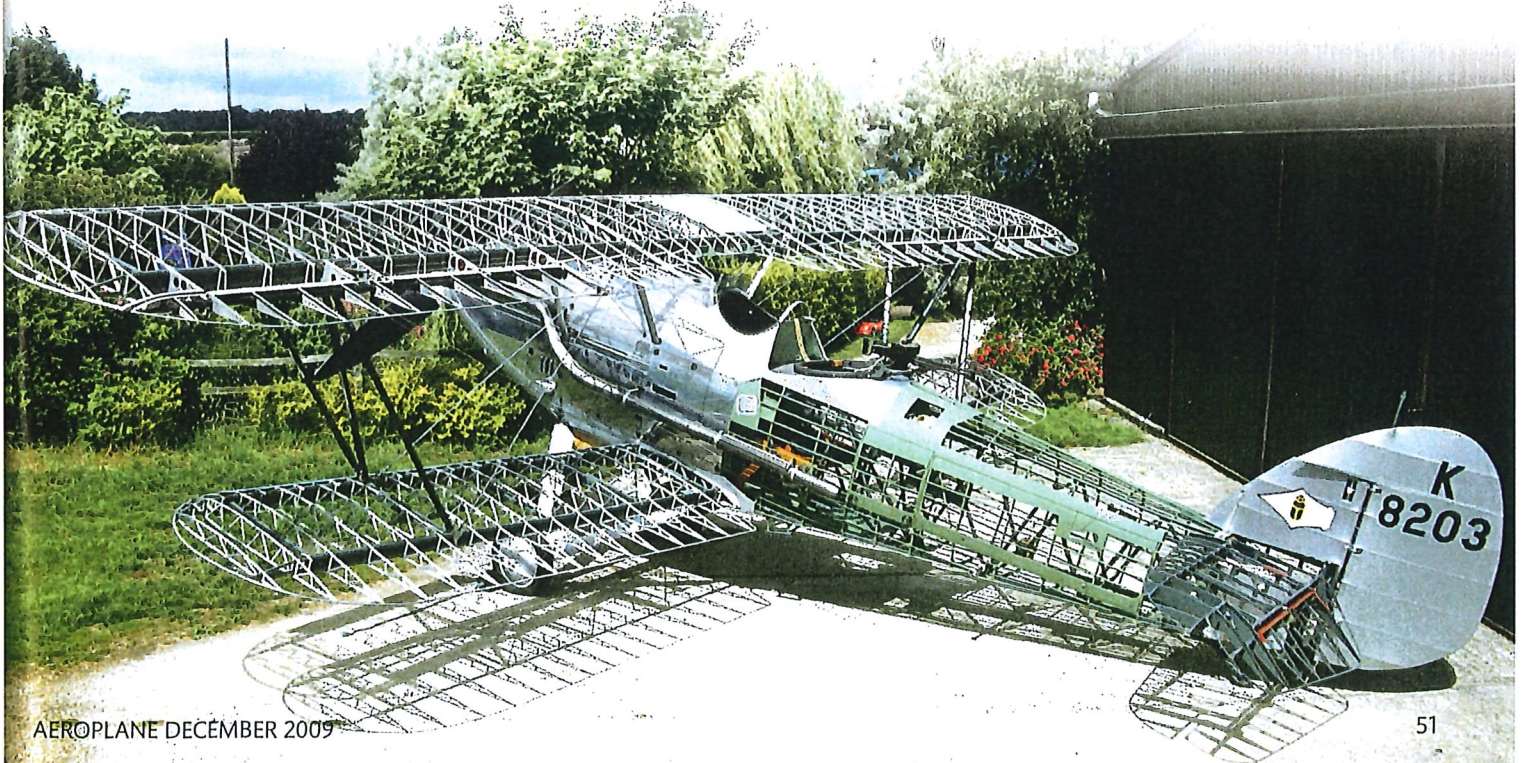
Although the fuselage was progressing, however, there was still a lack of information or drawings on certain areas and the team was reluctant to go too quickly in case, as happened, the drawings did turn up. Not long after the cowling work was completed, a photograph was located showing the production of cowlings at Hawker — and SkySport had used exactly the same procedure!



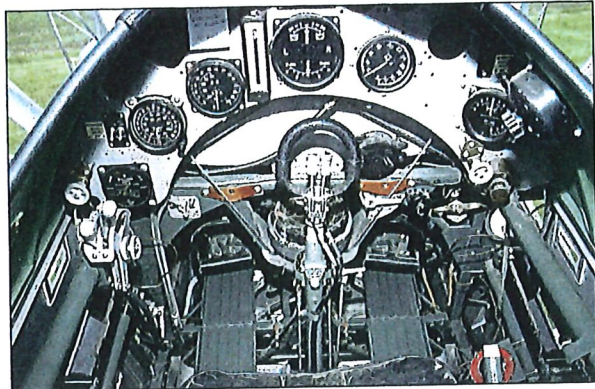
BELOW It's not just aeromodellers that do it: the completed airframe assembled outside SkySport's hangar for photographs and general admiration before fabric-covering (although the fin-and-rudder with its 64 Sqn scarab emblem and serial couldn't wait).

SkySport was adamant that the twin-curved engine cowlings should be made in one piece, as original. Owing to the size of each sheet of aluminium, it was a two-man job to handle during the shaping. The rolling of the cowlings was undertaken by Steve Moon, who also made a second set as part of the engine swap deal.

On completion of the basic fuselage frame, systems and other items were then installed. An original seat, instrument panel and instruments were available. An oil tank was found in Ireland from a Hawker Hector and parts of this were incorporated into the project. SkySport had a propeller from an Audax that came with the project, but the team was reluctant to use it and instead used a newly-built



AIRCRAFT RESTORATION



one from Canada. The gunner's Scarff ring is original and also came with the project; it was stripped, restored and protected before fitting to the airframe. The Constantinesco synchronisation mechanism for the forward-firing Vickers guns has also been fitted. New ammunition boxes and chutes for the guns were made and fitted. One item that has been left out at this stage is the large and heavy (60lb) original radio — a decision made to allow greater flexibility with the c.g. range for flight testing.

Tungam tube, used on the engine coolant system, was extremely difficult to obtain, as was a company capable of bending it; again, the ends had to be swaged or rolled. Wheels were pushed to the back end of the project as they were proving particularly difficult to obtain anywhere in the world. A number

ABOVE The Demon's cockpit displays a typical British layout of the mid-1930s, with little thought given to ergonomics or convenience.

RIGHT A glorious aerial view taken in mid-August 2009, on the same sortie as the other air-to-air pictures in this feature. The interlocking tapered zigzag squadron markings of 64 Sqn make K8203 look highly distinctive.

of Hind wheels made of magnesium alloy were located, but all had corrosion. Dunlop had also made some of the wheels in aluminium, which had a better corrosion resistance, but the only aluminium wheels found belonged to the RAF Museum Bristol Bulldog restored by SkySport, although they clearly were part of the Bulldog and could not be parted from it. Finally, the bullet was bitten and new wheels were manufactured. The last headache on the project was the sourcing of brake units including bags, which was eventually resolved by their purchase from Aero Vintage.

Hawker renaissance

At the time that the project started, no Hurricanes had been rebuilt and the technology to build the spars was only just beginning to be put in place, although at considerable cost. It is important to appreciate that whereas it had originally been a production aircraft, K8203 had, from an engineering point of view, become a prototype in order to return it to the air.

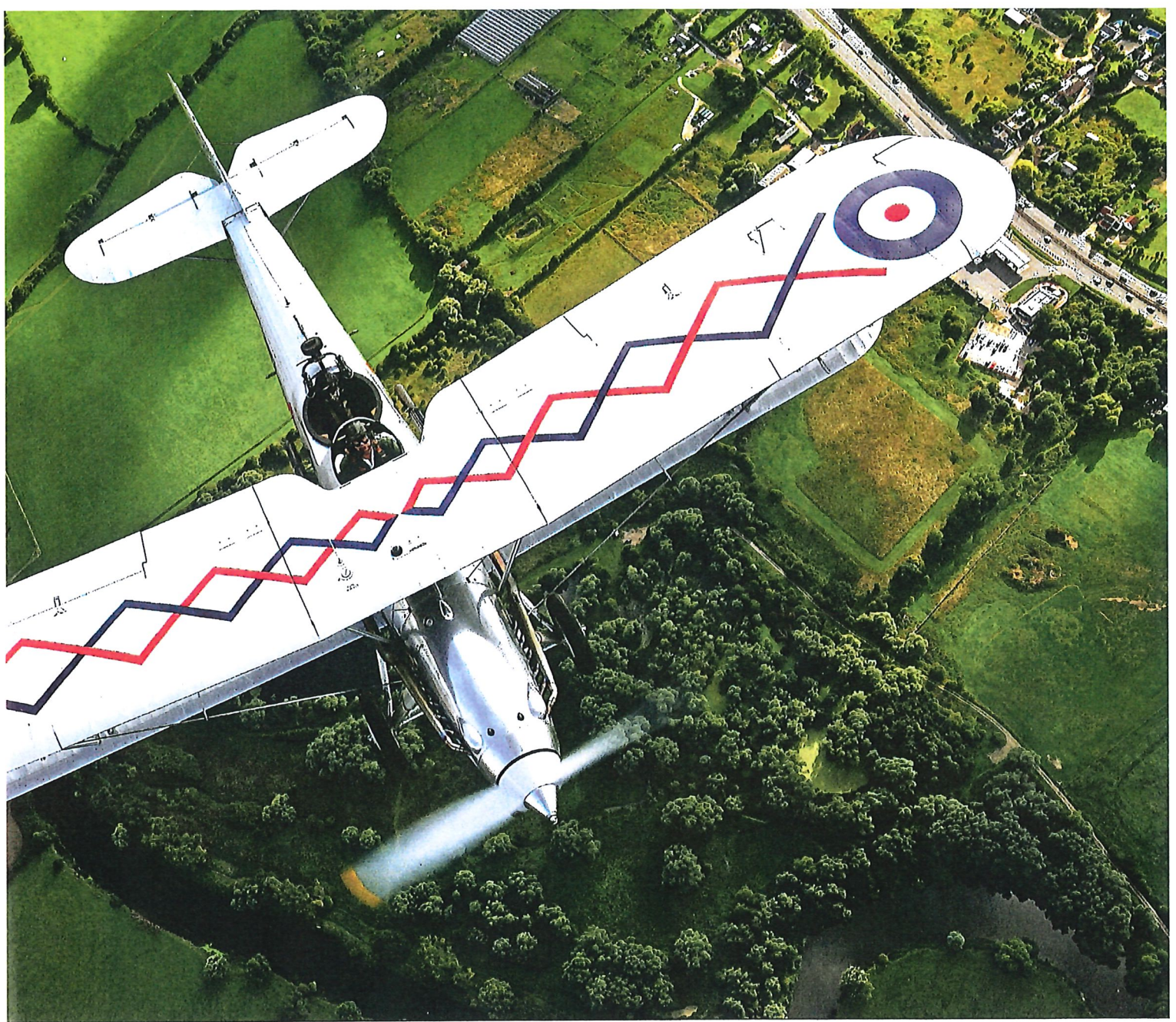
Credit for the spar development and manufacture must go to Aero Vintage and Compound Sections. The ability subsequently to put the Hawker types in the air stemmed from the research and development



"While originally a production aircraft, K8203 had, from an engine

BELOW An original Hucks Starter is employed to fire up the Demon's 695 h.p. Kestrel engine.





ing point of view, become a prototype in order to return it to the air”

undertaken in the earlier days of this Demon project.

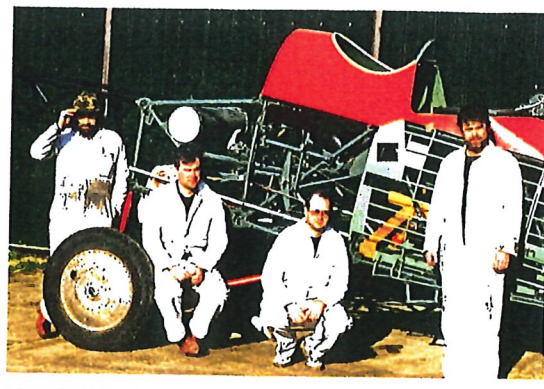
The centre section was an original Boulton Paul example and this was re-sparred, as was the tailplane. The wings are virtually all-new, with many components supplied by Airframe Assemblies, and the whole build was very intensive in development and man-hours. The airframe is covered in Irish linen, which, on the wings, is laid on the bias at 45°, as per the original, so that should a tear occur in the fabric during flight, it would reach only the nearest rib. The aircraft is painted in the colours of 64 Sqn, in which it served.

The final part of the project, after flying the aircraft out of SkySport's base near Sandy on June 23, 2009, was the test flying at RAF Henlow. This proved to be the most rewarding part of the project, both for the engineers

and the owner. After all the tribulations, the world's only airworthy Hawker Demon had proved itself. The Permit to Fly was issued by the CAA on July 29, 2009, and K8203 made its airshow debut at Old Warden a few days later on August 2.

Keeping an eagle eye on the project throughout was Peter Longland. Peter, an ex-ARB and

BELOW SkySport engineers pose with the Demon's fuselage. From left: Colin Day, Steve Roberts, Martin Kimm and Ken Watts.



senior CAA surveyor, was the Demon's inspector and such was his involvement that he delayed his retirement in order to sign off the project for the test flying.

The project reached fruition for three reasons: the willingness of companies to co-operate in what is a highly competitive field, the determination of SkySport engineers not to be beaten by what, on occasions, seemed insurmountable engineering problems, and the support and patience of the owner, Howell Davies, and his family — which led from the initial encouragement by his late wife Mouse to embark upon what was intended to be a “modest little project”. **A**

Thanks and more info

The author would like to thank the team at SkySport (and its leader Tim Moore!) for help in the preparation of this article.

» www.skysportengineering.co.uk



base at Old Warden Aerodrome in Bedfordshire – perfectly encapsulates the inter-war era of the Royal Air Force's silver biplanes. Restored by
fighter is painted in the 1937 markings of No 64 Sqn. It is being flown by Stuart Goldspink, with Demon Displays' Howell Davies in the gunner's seat.

