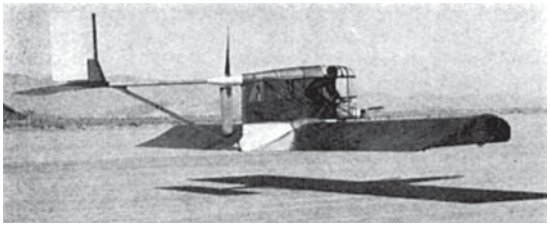
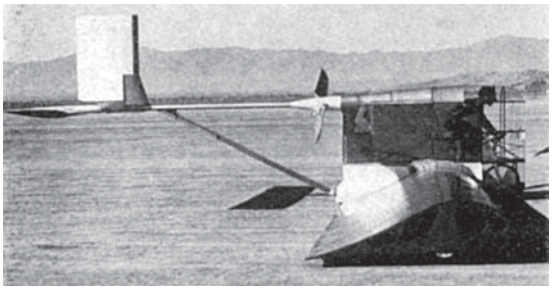
Progress with Man Powered Flight

Up-to-date survey by RON MOULTON



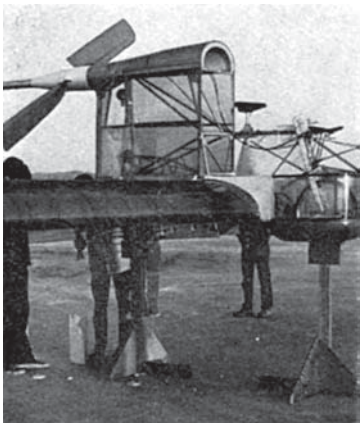
Icarus on tow with Dave Saks at the controls as the machine skims along at 33 km/hr. Note the novel aerofoil which only has an inch ground clearance when at rest



Unusual side elevation of Icarus emphasises the strange aerofoil contour and concentric propeller boss on the upper fuselage boom. Covering is of Solarfilm There are no ailerons

IT SEEMS incredible but true that for the umpteenth year we can say that the prize of £50.000 so generously donated by Henry Kremer to the Royal Aeronautical Society remains unclaimed. Equally that the additional prizes totalling £5,000 for a "Slalom" flight, or the more recently announced £1,000 for the first to fly for 3 minutes are still apparently beyond reach.

Though there is little to report in the way of British flight progress since the reviews in March '76 or May '75 issues and in Keith Sherwin's book Man Powered Aircraft (Argus Books £2.95) the picture in Japan and the USA is much more progressive. A golden summer was wasted here, but the Belgian team of the Maascheleim brothers and Eric Verstraete have been flying their fifth machine at Calais. Sponsored and named after 'Superia' it is distinguished by a pod and boom fuselage with tall power pylon for a pusher prop over a high wing. While the rudder is huge, the elevator which is all-moving, is tiny. It has certainty flown well. One photo shows it at shoulder height ground clearance but no statistics have been released. Strangely, the very similar concept ‘Dragonfly’ by R. J. Hardy (May '75 for 3 view)



Like a microfilm indoor model on its stand, Icarus being assembled in El Mirage dry lake, California Prop stands are needed for wing assembly, with one person at each tip All fairings arc from foam sheet. Photos by Joel Rieman.

Roger Hardy at work on Dragon-fly at Prestwick. This machine is now taken over by Ron Frost and has required modification to overcome its reluctance to rotate nose-up for take-off

failed to take off due to high thrust-line and small tail volume.

In the USA Joe Zinno's ZB-1 was officially observed to fly for 5 seconds at between 12 and 14 inches for a distance between 50 and 60 feet on 21st April 1976 at Quonset Pt, Rhode Island. The event was widely reported as the first man powered flight in the USA, and became the subject of an entertaining account in the New Yorker. Subsequently called ‘Olympian’. Zinno's machine flew once more on tow in September and was damaged beyond repair when the right wing failed - a fate common to others! The design had many interesting features, notably a ‘dual’ aerofoil wing with MS 150-B high lift on the inboard panels and the popular Wortmann FX 63-137 on the outer 25ft of the 78ft span. This gave a peculiar 'step' in the wing - which also had rotating tip ailerons over the last 5ft of span. Power was by levers rather than rotary Power was by levers rather than rotary pedals (as a Kiddy car or some invalid carriages) and the fuselage was of very thin claim has been contested from California where Taras Kiceniuk of hang glider fame has had his 'Icarus' flown by two pilots, wall alloy tubing. Zinno's 'first to fly in USA Dave Saks and Bill Watson. Dave made an unassisted flight of a few seconds on 19th September at El Mirage Dry Lake (see cover) which the Californians maintain was the first official unassisted flight in the United States. Icarus is also unconventional with its ground hugging low wing using a thick Liebeck type aerofoil, worked out on a computer by Taras Kiceniuk. It has an alloy tube fuselage, plus a boom mounted pusher prop. The wing is constructed from hot wire shaped Styrofoam blocks on a single spar of Douglas Fir, 1 in x 1/2 in tapered to 1/8 in at the tip! Covering is Solarfilm which provides colour, unlike the usual transparent Melinex which has been universal since the Puffin.

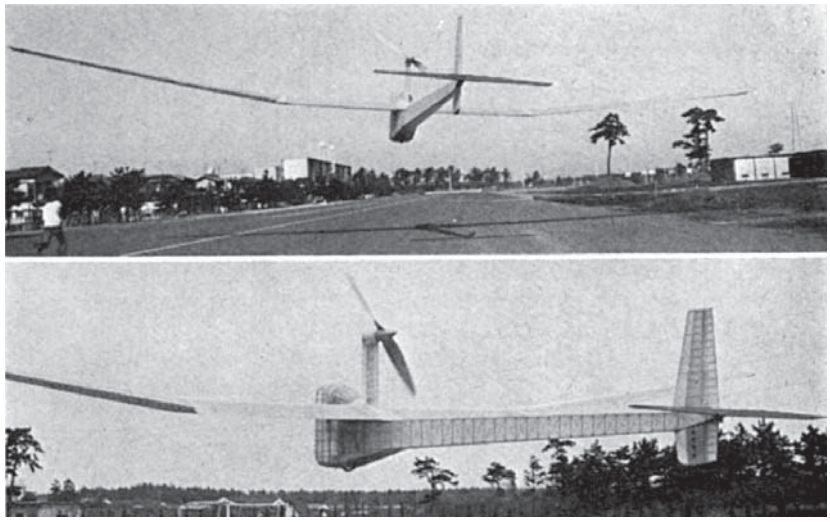
Meanwhile, seemingly unknown to both parties, Wayne Bliesner flew his huge 12ft chord, 74ft span flying wing at Bellingham Airfield, Washington on 18th August 1976. Wayne uses a 12ft diameter prop which is on

a tall pylon over the centre pod. He flew to 12ft height for a 'hundred yards'. Progress had been set back by having a hangar collapse on the machine and the ultimate weight of 220 lbs which is obviously at least 801bs too heavy. Still he's keen, as a second 100ft span 8ft chord wing is on his design board!

Elsewhere, Gerry Ritz, once the world champion in A2 gliders, is working on a project at his farm in Northern Wisconsin. and the MIT Canard biplane is nearing tests. These are two well considered projects which will be watched with interest.

Other prospects in the UK range from M. N. Collis's propeller attached 'powered' Tweetie hang glider which is about the nearest one can get to a man-carrying AMA Cub or BBC Hawk model. It uses a treadle drive, from stirrups, and has been flown many times from hillsides. Peter Lock who lives in Belgium, has a fascinating tandem wing idea, where the airflow is sucked through to provide thrust and Admiral Goodhart is constructing his two man 138ft (42m) span machine at Newbury with the aid of the local model club. To all practical purposes, a flying wing with separated power nacelles, it calls for co-ordination of the two pilots and use of twisting wing to obtain lateral control. At Edmonton, N. London, M. R. Knight, name-sake of a modelling pioneer, is working on a 76ft, 320 sq.ft machine with FX 63-137 section and a 10ft prop. The RAeS register is full of such concepts, plus ornithopters, deltas and pneumatic blow-up airframes to add variety. But it is to the long programme of Linnet, Egret and Stork designs in Japan that we must look for real progress.

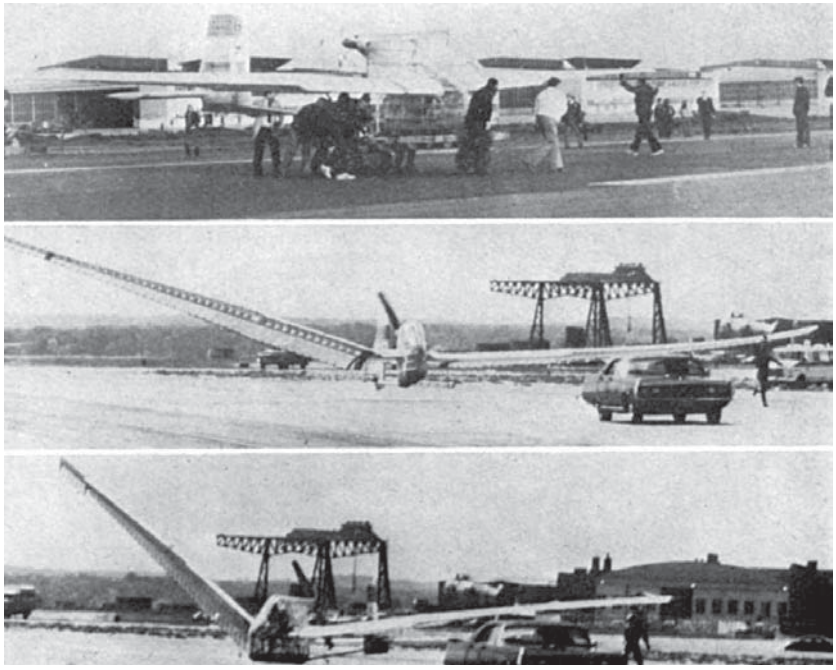
The idea of developing man-powered aircraft by students at Nihon University originated in 1961 soon after the news of successful flights of Britain's "Sumpac" and "Puffin" was received. April 1963 marked the beginning of their first year of research, when a device was made to measure the power generated by man. The second year was devoted to operations research to determine the optimum airframe dimensions, weight, aerodynamic characteristics and other factors to make man-powered flight possible. The basic form of the airframe was defined on the basis of the research. The third year marked a transition to detail design and manufacturing. The long-awaited first 'Linnet' was rolled out in February 1966. Airframe assembly and test flights were carried out at Chofu Airfield with first flight on 25th February 1966, with Munetaka Okamiya at the controls. The 'Linnet thus achieved the distinction of the world's fourth man-powered aircraft, following the ‘Sumpac’, ‘Puffin I’ and ’’Puffin II’.



Stork in flight over Narashima, drifting with yaw but with steady altitude over the narrow single runway with hazzards either side.

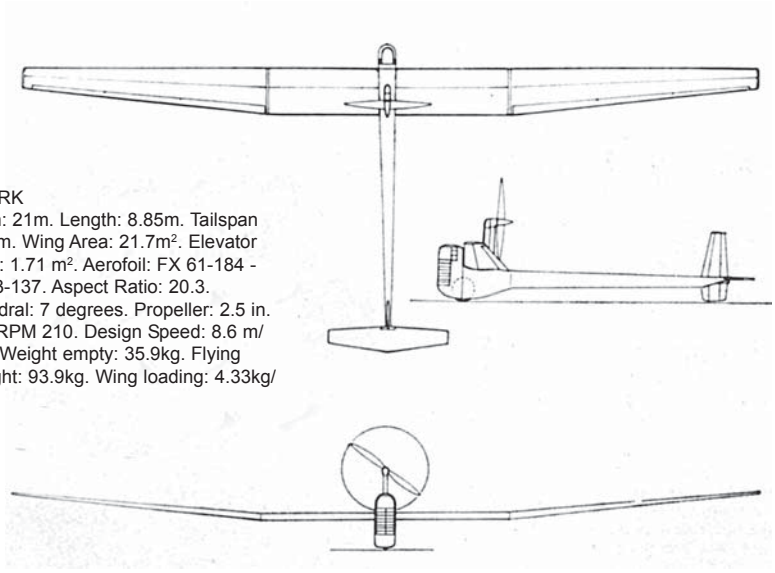
Subsequently, machines continued at a pace of one design almost every year, except for the period during which the university was embroiled in student disputes. The ‘Linnet’ series was built up to the fifth model, using more or less the same basic form, the longest flight being 91 meters by the 'Linnet II'. The last model, 'Linnet V', however, remained unfinished. The key to success of every flight of the 'Linnet' series was in the weight reduction. Styrene-paper was used as covering and this proved to be a particularly effective contributing factor. Made by rolling

Disaterous sequance shows the end of Joe Zenno's Olyimpian when being towed in september 1976.Previous flight attempts ended in heavy landings on the spar mounted outrigger, which wweakend the spar with resultant fracture at the starboard root. Photos by David Gustafason.

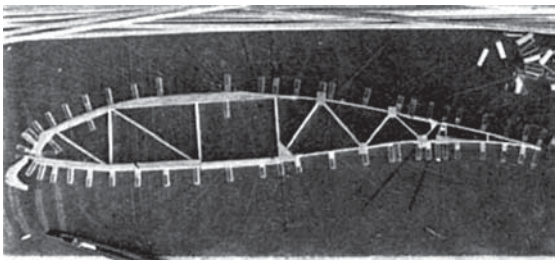


styrol-resins to a thickness of about 0.5mm, the material is light, and effective in enhancing the airframe rigidity. It is also smooth in outer surface finish.

What was wrong with the 'Linnet' series was that a torque shaft measuring about 12ft long was needed to transmit power to the tail end propeller. Vibration of the shaft was resolved by increasing its diameter was resolved by increasing its diameter. The shaft, however, could not be elongated beyond reasonable limits and this made it impossible to lengthen the tail moment arm. Such structural deficiency brought on insufficient longitudinal stability. This demanded too much attention by the pilot, while pedalling at full power. There were many cases in which the Linnets prematurely hit the ground. In 1972, a well-equipped runway, 620m long and 30m wide, was completed along with a hangar in the precincts of the Narashina School of Nihon University's Science and Engineering Department. This provided ideal local facilities and a new series named the 'Egret' was developed.



STORK
Span: 21m. Length: 8.85m. Tailspan 3.44m. Wing Area: 21.7m^2. Elevator Area: 1.71 m^2. Aerofoil: FX 61-184 - FX63-137. Aspect Ratio: 20.3. Dihedral: 7 degrees. Propeller: 2.5 in. dia. RPM 210. Design Speed: 8.6 m/ sec. Weight empty: 35.9kg. Flying Weight: 93.9kg. Wing loading: 4.33kg/



Typical of the many ribs for Stork, the Wortmann aerofoil is jig assembled using magnetic stops on a metal base plate. Radian lines permit rearrangement for wing taper.

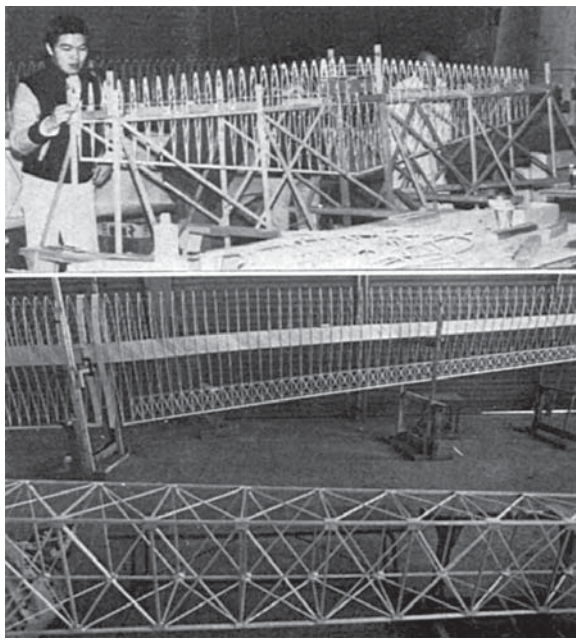
Best yet

Takashi Kata flew 'Stork' over a distance of 2093.9 meters for 4 minutes 27 seconds on

Major improvements featured introduction of belt drive to shorten the power transmission system in a pylon for the propeller behind the cockpit (as in the 'Sumpac' and 'Jupiter'.) The rear fuselage was elongated and the moment arm increased for greater longitudinal stability. Unfortunately, the ‘Linnet I’ was destroyed by wind gusts but the II and III models of the 'Egret' series demonstrated much more stabilized flight characteristics and

Kazuhiko Churei (23) pilot of the Stork for the majority of flights to date. His weight is 58kg. Propulsion set up is similar to Puffin and Jupiter demanding challenge for designers.

Two views of the Stork under construction, tell a story without words for all aero-modellers. It incorporates every desirable modelling feature for maximum strength and rigidity at minimum weight and is a great credit to the team of Junji Ishii, Susumu Ohara, Yasuhiko Katsuki and Noboru Ozeki who first saw British Man Powered aircraft during their Farnborough '74 visit, plus their other colleagues at Narashina College of Science and Technology under the guidance of Prof. Hidemasa Kimura.



came out with far better records than the 'Linnet series, the best flight being for 203 meters. The 1975 student team was composed wholly of enthusiasts who had been helping their seniors with the manufacture of man-powered aircraft since their freshman days. The team had an expert designer as its leader named Junji Ishii, and he was entrusted by Professor Hidemasa Kimura, the guiding light of Japanese Man Powered Flight research, with a new design to be called the 'Stork'.

Compared with 'Egret', the main object of the 'Stork' was directed at further weight reduction and greater airframe engineering precision. Wing panels were made detachable to facilitate transport which resulted in a weight penalty of about 2kg as compared a weight penalty of about 2kg as compared with the conventional one-piece wing, but an overall weight reduction was successfully achieved in terms of an empty weight of only 36.0 kg (79.3 lbs) - an incredible of only 36.0 kg (79.31bs) - an incredible figure. It is worth noting that in addition to the hitherto used foam plastic covering "gan hishi" (a sort of Japanese paper) was used for the outer covering of the various parts of the airframe. Most important of all this truly outstanding achievement is entirely due to Mr Ishii's design policy. Every inch of the airframe was controlled not to allow a single gram of excess weight. Modelling experience was influential. The 'Stork' featured a longer moment arm than the 'Egret' series, use of the chain drive for power transmission and for the first time, remarkably, a system for driving the wheel. Kazuhiko Churei made the first long flight on 14th March 1976 over 446m (1,462.8 ft) for a duration of 57secs. Over the previous two days he had made 5 tests of up to 450ft and over the four day period, 12-15th March, he made eleven flights, and the only limiting factor appeared to be the length of the University runway.

A new student team took over the 'Stork' and a move was made to the Maritime Air base at Shimofusa where the runway length is 2,450m. Two flight trial sessions in May and June included the encouraging flight of 650m (2,132ft) on 18th May, but this was not officially observed as no one predicted so long a flight and in consequence, there was no person at the landing point.

Churei made a deliberate 180 degree turn on the 4th June and this was to be followed by a complete 360 degree circle. Unfortunately, at the 90 degree point, while turning right. the left wing broke. Damage was not serious, and further tests were started in October/ November. A second pilot, Takashi Kato, who had made just two flights in June, 577m and 595m respectively, has since made flights of 816m (December 26th), 855m (December 28th) and the momentous 2,093.9 m record on January 2nd. Man-powered flight remains the most demanding challenge for designers. Sadly, the architect of the prize awards, and guiding light of the RAeS Man Powered Committee, Bob Graham, died on 14th December. A man of staunch character, with a long background of aero-engineering which included test flights of the first British helicopter in the '20's, Bob's influence will be greatly missed in the Man Powered scene. One of his last tasks was to set up the 2nd MPA Symposium which will be at the Royal Aeronautical Society on 7th February, starting with registration at 09.30, through to 1800hrs. Speakers include Professors Lilley of University of Southampton, Covert of MIT (USA), Wortmann of University of Stuttgart, and Wilkie of University College, as well as Frank Irving of Imperial College, Martyn Pressnell of Hatfield Polytechnic, Rear Admiral Goodhart and a film miscellany. Registration details are available from RAeS, 4 Hamilton Place, London W1V OBO.

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