ITALIAN PUSH

Glider-type views and lightweight construction make this fully-certified pusher hard to beat

By Bob Grimstead

I envy the Italians. They have the sexiest women, the fastest cars, the sleekest suits, the tastiest food. They even have the best aeroplanes.

Take their Sky Arrow. It outperforms most other conventional certified two-seaters while costing less to buy and run and it has sleek and stylish (if, admittedly, slightly unconventional) looks.

From its unusual appearance, at first glance many folk assume the Sky Arrow is an ultralight, but it is not. This is a properly engineered, tested and certified two-seat light aeroplane, just like a Cessna 152 or Piper Tomahawk but better, and slightly bigger. More importantly, being a more modern design than those old tin tubs, it is also available in the LSA (Light Sport Aircraft) category or for homebuilders in ten-module kit form.

The motor is a fully certified, 100hp, four-stroke Rotax 912S driving a two-blade, fixed pitch, wooden Hoffmann pusher propeller through its standard reduction gearbox.

A single fuel tank is located in the very rear of the fuselage, with its gascolator concealed behind a flap in the pylon. Both engine and fuel tank attachments have been statically tested for impact loads up to 18g. Since the example I investigated was a certified Sky Arrow approved for day and night VFR, it had twin alternators. The primary 20 amp-hour one is a standard, directly engine-driven Rotax example, while a second, similar, but belt driven unit is the 20 amp-hour standby.

The front wheel is free-castoring. There is no direct steering, but the main wheels have hand-operated differential hydraulic disc brakes.

A neat trick is the ability to tilt the entire airframe backwards to stand on its tail, making the coolant and oil level check easy and facilitating inspection of the engine, propeller and the whole tail. The conventional tailplane and pushrod-actuated elevator includes an electric trim actuator embedded in the elevator. The rudder is mostly cable operated. Rudder and ailerons have fixed, ground-adjustable tabs.

ACCOMMODATION

After swinging open the canopy, the pilot sits on the left sill, grips the fuselage sides, lowers his backside down into the seat and then swings in his legs. The passenger boards similarly, but since the rear sill is higher, the

"This is no ultralight, but a fully certified aeroplane like a C152 or Tomahawk"

Bob says the roll rate is much better than any Piper or Cessna... though not quite in the same league as Pitts Specials!

fuselage incorporates a kick-in step.

The ease of boarding makes this aeroplane ideal for disabled people, and a hand-controlled paraplegic version is among many variants, including an ultralight and one with floats for water operations.

Either occupant can fly the aeroplane, for the rear seat has all the primary controls, including brakes, although only the front rudder pedals are adjustable, glider-style, by pulling a toggle and pushing forward against the sprung cable tension. Thanks to his eight-inch higher seat, the rear occupant has surprisingly good forward visibility. That single-piece, glider-style canopy has near optically perfect transparency, and provides exceptional vision for both pilots. Hinging up and to the right, it is heavy enough to stay open safely in all but the strongest winds. The rear cockpit's side windows can be completely removed for fresh-air fiends or in-flight photography.

This little aeroplane has a surprising number of useful stowage areas. Behind the rear seat is a baggage compartment, and small bags or clothes can be stuffed beneath either seat, while there are other under-floor stowage places with proper latched covers ahead of each pilot. The baggage box under the rear seat holds 30kg, and can be removed. Charts can be slipped into a vertical slot along the right of the instrument coaming, and a six-inch square glove compartment is standard in the panel's centre, although this example had an ILS/OBS indicator in its place. I make that six stowage places altogether.

Both seats are comfortable, slightly reclined, and sparsely but adequately padded, with volumes of headroom, thanks to the Italian requirement for ultralight occupants to wear crash helmets. Fixed (ie, not inertia-reel) five-point harnesses add security, and there's a fire extinguisher immediately ahead of the front seat.

"The rear cockpit side windows can be removed"

The Sky Arrow's front cockpit is particularly well thought out, with most secondary controls grouped along the sidewalls. Progressing forwards from your left elbow are the canopy latch and ELT button, carburettor heat slider and a red, soft-wire locked engine shut off lever (actually the emergency fuel shut-off – since there is only one tank, there is no conventional fuel selector). Inboard of this is the throttle and choke quadrant, exactly where it comes neatly to hand with an adjustable friction knob. Immediately ahead of that is the key-operated starter. At the very front is a generous air vent.

Working backwards along the right side console are the twin manual brake levers with the parking brake knob (you lift and rotate it). Inboard of this is the sidestick, positioned for your right hand, with your forearm resting on the flat sidewall. There are fore and aft trim buttons on the stick. Behind the stick are the cabin heater and defroster slides, the engine baffle control and the canopy jettison lever.

The panel itself is divided into four easily assimilated areas. Most flight instruments, light and flap switches are on the left, with the compass, a handful of warning lights, the master switch, turn and slip and avionics stacked in the centre. Dual lock-toggle ignition and fuel pump switches are over on the top right hand side, with the engine gauges and controls and but a single fuel gauge below them. Finally, the intercom controls and a neat cluster of electrical circuit breakers are grouped at the very bottom of the centre column. The panel is fitted with quick-detach couplings, for ease of maintenance.

This version's 432kg empty weight allowed my demo pilot, the genial Geoff Hill and myself to carry full fuel with eight kilos to spare for bags or other equipment within its 650kg maximum take-off weight.

FLYING

Engine starting is standard Rotax (standard Bing carburettor, actually) and requires the throttle to be closed when the choke is pulled for a cold start. For us, the engine was warm, so it instantly wound up to its 2,000rpm idle. Checking the generators and lights and turning on the avionics was the work of moments, and we were soon ready to taxi.

Although there is no conventional nose-wheel steering, being directly in the pusher prop's slipstream, the rudder has some turning effect even when taxiing downwind, and a

CONSTRUCTION

Design experience shows...

Easy access to the engine and propeller and tail surfaces for preflight checks is one of many features of this clever, lightly constructed design

As you would expect for an aircraft from the drawing board of that prolific Italian aeronautical engineer, Luigi Pascale (he who designed the Partenavia twin and all those delightful Tecnams among others), not only does the Sky Arrow handle nicely, but it has peerless visibility and excellent short field performance.

The Sky Arrow's brilliance derives from a combination of light weight (just 432kg empty, or just three-quarters of a typical Cessna 152's or PA-38's 540-560kg – a remarkable achievement) and clean aerodynamics. The high, untapered, 'plank' wing's rather archaic and empirical 1906 Göttingen 398 aerofoil (slightly modified to improve its low speed handling) is surprisingly at odds with this modern construction, but the combination works remarkably well.

Its primary structure is predominantly composite (mostly a carbon fibre/epoxy sandwich) and modular, to simplify both assembly and disassembly for maintenance. The manufacturer – alternatively known as 3i, III, or Iniziative Industriali Italiane (Meteor) SpA – says the wings, tailplane, electrical system, instrument panel and engine can all be removed quite quickly as individual units.

The flying surfaces and controls are also made from carbon fibre. Each wing has dual C-section spars and is attached to the fuselage with three bolts (two on the root rib and one at the strut), each secured by castle nuts and safety pins, making disassembly comparatively easy. The big, differential Frise ailerons are operated via aluminium rods and bellcranks to minimise circuit friction and backlash, while the plain flaps are actuated electrically with deflections of 0, 10, 20 and 30 degrees.

The fuselage mostly utilises a carbon fibre sandwich in an epoxy resin matrix, but incorporates Kevlar in some areas for additional crashworthiness. The two fuselage sides are bonded together, its shape formed by eight bulkheads, one of which supports both the main landing gear and the steel tube engine mounts.

The deep panel has loads of space for screens, dials and switches. Note sidestick

dab of differential brake soon executes a tighter turn. Despite a hearty fifteen-knot breeze, with a little power (around 2,500rpm is usually enough) and some assertiveness we were easily able to describe figure eights on the small apron. Apart from the routine instrument checks, there is only one taxi check – once the coolant temperature has climbed to 100°C, the cooling fans are selected on (off for flight).

After we had finished our simple run up and brief pre take-off checks, Geoff talked me through the normal lift-off procedure. This involves setting ten degrees of flap and opening the throttle with the sidestick held forward (with aileron to taste) until forty knots. Then you allow it to drift backwards about one third of its travel under aerodynamic pressure. At fifty knots you ease it another inch rearwards to the mid position to raise the nosewheel, after which the aeroplane should lift off cleanly to stabilise in the climb at sixty knots. And so it transpired.

Just a tiny constant right rudder pressure was needed to centre the slip ball in the full-throttle climb. At 200 feet, we retracted the flaps and switched off the landing light, maintaining the same climb attitude to 500 feet, when we were able to turn off the fuel boost pump. Those few tasks completed, we were on our way.

Only gliders and pusher engines give a view like this

Climbing from 500 to 900 feet on a warm, 25°C day took us just thirty seconds at seventy knots, giving us a good climb rate of 800 feet per minute, which tallied well with the manufacturer's quoted 840fpm in ISA at the best-rate climb speed of 65 knots (the best climb angle speed is 57 knots).

I made three flights in this delightful aeroplane, sampling both front and rear seats, and while the panorama visible from the front is peerless, even the back seat occupant gets a great view, thanks to his raised position. For

me, as I looked out and over him, the top of Geoff's head was well below the horizon, even in the climb, meaning it didn't get in the way at all when looking forwards. The rear seat occupant's view all around, below and to the rear is much better than you would think, while the chap in the front seat's is superior in every direction to that from almost any other powered aeroplane.

Levelling at 2,000 feet and reducing power to 5,200rpm gave us a high cruise speed of 93kt IAS (97kt TAS), while a lower power of 5,000rpm still gave us a useful 87kt (91kt TAS). This gives plenty of margin from the 132kt Vne. At 3,500 feet the same rpm gave us 83kt, but our TAS was now a useful 89kt, which accords well with 3i's quoted 75 per cent cruise speed of 90kt with the Rotax's usual frugal fuel consumption of around 18 litres per hour (using cheaper Mogas for preference, of course). There is little trim variation between speeds, and indeed I barely needed to touch the elevator trim switches throughout any of our flights.

A 'kick-in' step facilitates entry to the rear cockpit. This is an easy aeroplane to mount

Making a gentle rate-one turn at this height and speed gives a perfect view of the ground directly beneath – what a superb sightseeing aeroplane this is! Pulling the power right back to 4,300rpm drops the speed to a tad below 80kt, but this is a good loiter setting, extending endurance to a whopping four-and-a-half hours. Alternatively, dropping ten degrees of flap with 4,500 rpm enables you to circle tightly at 60kt in great safety.

A squeeze of rudder was needed to balance all turns, but this is an ideal attribute in a trainer, and no imposition in any aeroplane. The Sky Arrow's roll rate is noticeably better than any Cessna's or Piper's, although of course not quite in the RV-6 or Pitts league. In straight, cruising flight, the aeroplane is stable in all axes and will fly hands-off for long periods, although it does have one unusual, but by no means unpleasant characteristic: the ailerons' initial break-out force is very low, so the stick bounces from side to side very slightly in turbulence.

The 90kt maximum manoeuvring speed gave us plenty of margin for our formation photography at 70kt. At this speed the Sky Arrow is a point-and-shoot aeroplane. Its light and effective controls allied with the superlative visibility made our sortie a total pleasure.

Without flaps and with idle power, the Sky ➲

Cruise speed at 75% power is 90kt for 3hr 20min endurance

SPECIFICATION

SKY ARROW 650TCNS

DIMENSIONS

Wingspan	31ft 10in
Length	24ft 11in
Height	8ft 5in

WEIGHTS & LOADING

Equipped empty	952lb
Max take-off weight	1,433lb
Max baggage	66lb
Standard fuel	16 imp gal
Max wing loading	9.8 lb/sq ft

MANUFACTURER PERFORMANCE

Vne	132kt
75% cruise	90kt
Stall, full flap	40kt
Takeoff run	580 ft
Landing run	425 ft
Initial climb	840fpm
Service ceiling	13,500 ft
Max range (75% power)	330nm
Max endurance (75% power)	3hr 20min

ENGINE & PROPELLER

Four-cylinder, four-stroke, horizontally-opposed Rotax 912 S producing 98 hp at 5,800 rpm. TBO 1,500 hrs. Propeller: Hoffmann two-bladed wood, fixed-pitch propeller.

MANUFACTURER:

Iniziative Industriali Italiane SpA (3I)

UK DISTRIBUTOR

Raymond Proost, Hangar 3,Old Sarum Airfield,Salisbury,Wiltshire, UK,SP4 6DZ Tel 01722 336686
www.skyarrow.co.uk

PRICE

£68,000 for UK certified public category C of A model. Kit price around £40,000. (EASA LSA price likely to be around £50,000.)

Arrow decelerates gently. At 50kt the stall warning horn sounds, followed by gentle buffet at 46kt. The true stall break comes at 43-44kt, with some slight wing-rocking if you hold the stick aft and keep the aeroplane in the stall. This is easily corrected with rudder, while unloading the stick immediately gets her flying again. Height loss is minimal.

The flap switch is lightly spring detented and there is a green LED to indicate each of the four positions. With 10° degrees of flap there is little difference in trim, stalling speed or behaviour, but there is a slight nose-down pitch change when extending 20° or 30°. Thirty degrees lowers the warning speed to 46kt and the stall proper to just 40kt, with plenty of true warning buffet beforehand. These figures are identical to the company's published numbers.

There is little variation in yaw with change of power, although the nose does slew slightly to the right if you abruptly snap the throttle shut at 80kt, so you need a little left rudder in the glide. As you would expect with such a high thrust line, reducing power does initially cause the nose to pitch up, but this is gentle, and it soon nods downwards again as speed reduces, settling in trim at around ten knots slower than you started. In other words, despite its unusual configuration, this is a viceless aeroplane. Indeed, it also glides well, although rather more rudder in needed for gliding turns with no slipstream over the tail.

> "You can land on the numbers every time"

AND SO TO LAND...

Back in the circuit, the Sky Arrow is easy to position and to fly, while its superlative visibility makes it very safe among other traffic. The approach is flown with thirty degrees of flap at 55kt (or sixty if it's gusty as it was for us, but beware the 67-knot flap speed limit), reducing to 50-55kt over the fence.

Control in all axes is so good it is easy to position this aeroplane very accurately, and land it gently, nose-high, right on the numbers every time. That excellent glide angle can catch you out though; unless you make your approaches quite flat, you might easily need to sideslip to get yourself down towards the end (as I did nearly every time!) The makers quote a glider-like 13:1 glide angle, and I fully believe it. Sideslipping doubles the descent angle, so being too high is redeemable.

There is plenty of residual elevator capability to hold off the nosewheel for most of the landing run, although I only realised when seeing the resulting photos that I had been fooled by the sloping sills, just as I once was in the BAe Hawk, into believing our nose was lower than it actually was. From that nose-high attitude there is quite a big pitch decrease to get the nose-wheel safely back on to the ground without damaging it. Using the brakes, and in a ten-knot headwind, we easily stopped in 100 metres. Even without the brakes we rarely ran more than 200 metres. The makers claim that both take-off and landing distances are less than 500 metres, making this a true STOL aeroplane, among its many other excellent attributes.

Ex-glider pilots like me who've been frustrated by the poor views from powered aircraft will love the Sky Arrow. For training, it beats the Tomahawk and Cessna's 150/152 family. And of course, it has been tested, evaluated and certified to a higher standard than the 162 Skydancer, since that is only an LSA, whereas the Sky Arrow is a fully certified, normal category aeroplane.

As you would expect from its rear-engined, pusher configuration, internal noise levels are very low. Neither is it noisy outside, although spectators will soon come to recognise that pusher propeller's pleasant, distinguishing thrum.

Distinctive in all respects, the Italian Sky Arrow is a pilot's delight. ■