

# PHANTOM MAKES ITS ENTRANCE

The Phantom Clubmans marque is now being manufactured in Sweden and the latest creation promises to take the category in an intriguing new direction. By John Coxon



THE 'Clubmans' category is more popular now than ever before. And not just in England.

Based on the original concept of front-engined, rear wheel drive, 'home-built' true single-seaters, in the style of the

1985 that the Swedes, seeing when their British cousins were on to a good thing, decided to formally introduce the category to the Scandinavian racing scene.

UK-built Mallocks, Phantoms and Visions – allied to Swedish Bodolas – have served

racer of the front-engined Phantom cars. The duo then formed Phantom Automotive Sweden to manufacture and supply complete cars, kits and spare parts for the steadily increasing number of owners of this attractive looking car.

Although the UK series has now adopted the Rover 1600 'K' Series as a control engine, the Swedes took a different direction and replaced the venerable Ford 1600 Kent engine with an 1800 cc Ford Zetec unit. Mildly tuned to give 155-160 bhp, and with the standard OE fuel injection equipment replaced by trusty and well-understood twin Weber DCOE carburettors, this unit forms the heart of the class today. In its dry sump form it gives reliable power and particularly low running costs.

The first Swedish-built Phantom, designated the S21, was finally completed

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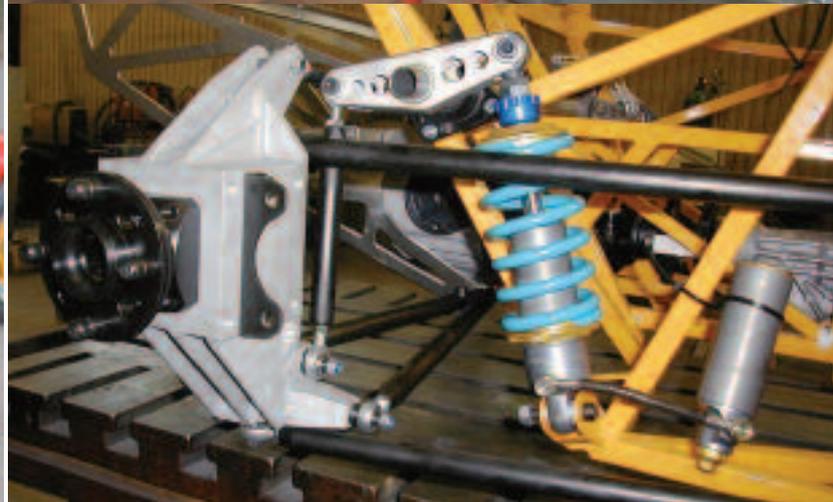
Lotus 7 of the 1960s, the cars provide close and exciting racing on budgets that can be afforded by many.

The concept is in its 41st year in the UK and in its time has spawned many small marques like Mallock, Haggispeed, Vision, Centaur and Phantom. It was not until

the category well but in January 2000 the story took an unexpected turn. Datsun 240Z racer Anders Andréasson and Phantom P91 owner Jan Nordgren purchased manufacturing rights, drawings and body moulds from Chris Greville-Smith, original designer and long-time

**RIGHT** Where the S22 retains Phantom's trademark De-Dion rear suspension, the next generation S240 (below right) replaces it with a fully independent system

**BELOW** The S22 was conceived as an evolution of the existing S21, in time for the Scandinavian season, but incorporates some of the concepts planned for the new S240



in 2002. Differing from the UK-built version, which was last updated in 1994, the chassis featured improvements to the lower front frame as well as a redesigned nose frame and front suspension rocker arms. In addition, the chassis was bolted directly to the back of the engine, making it more of a structural member.

"Many of the older Phantoms suffered from cracking around the rear diff unit, so the opportunity was taken to introduce additional forward bracing between the differential and the end of the gearbox," explains Nordgren. "With the suspension geometry remaining the same, and by careful analysis of the frame, the car still weighs in at around 470-500 kg depending upon specification."

Since Scandinavian regulations demand a minimum weight – including driver – of 580 kg, then in theory the portly shape

of the more 'mature' driver can be accommodated easily without penalty.

"The S21 was to be the mainstay of production for the Clubmans formula," he says, "but Anders and I were looking for new opportunities to compete for outright victories in the Swedish Sportscar Championship and also perhaps a future new direction for the formula."

#### PHANTOM S240 IS BORN

With 2.0 litre Honda S2000 engine units now appearing second-hand in the breakers yards and delivering a useful 240 bhp even in standard form, it was only a matter of time before one appeared – together with its six-speed gearbox – at the premises of Phantom Automotive Sweden in Vittsjö, a small town in southern Sweden. Before long, the design

had begun of what would eventually be known as the Phantom S240.

Having decided on the type of engine and transmission, the first decisions involve the packaging of the major components within the frame. For mid-engined applications, where the engine is installed behind the driver, this presents few problems. For front or, to be technically correct, mid-engined vehicles, where the engine is in front of the driver, consideration has to be given to things like the positioning of intake and exhaust systems and the amount of offset to the centreline of the car, to offset the weight of the driver. A number of other decisions also have to be taken: how far back can the engine come to give an acceptable front to rear weight distribution? And to what degree can the engine be tilted to reduce the frontal area and lower the bonnet line? ▶



“Unlike most clubmans cars, including the previous Phantoms, the S240 is left-hand-drive”

**ABOVE** The original S21 flanked by the frames of the S240 and S22

### CLUBMANS RACING IN SCANDINAVIA

WHILE not actually called Clubmans, Formula 1000 was conceived in 1965 upon English Clubmans regulations to cater for front-engined spaceframe cars using proprietary engine and transmissions.

Three or four Swedish cars were built but the formula didn't take off. It was not until 1972, when the first purpose-built Clubmans cars were imported from the UK, that the class gained a foothold in the sports prototype classes. A rotary Wankel-engined Mallock of Stefan Mumm is remembered for assaulting everyone's eardrums with the shrill note of his unsilenced engine, and he went on to be heavily involved in the introduction of the Clubmans class to Sweden.

In 1985 the Scandinavian Clubmans Register was formed by Swedish and Danish drivers. But it was not until 1990 that the cars were sufficient in number to warrant their own races. Later on the Norwegians also began to show an interest in the category.

Today the Clubmans cars are 20 in number: nine Mallocks, six Phantoms, four Bodola/Bodin (a Swedish manufacturer) and one Vision. They race in the Swedish Sportscar Championship at circuits like Mantorp Park, Knutstorp and Anderstorp.

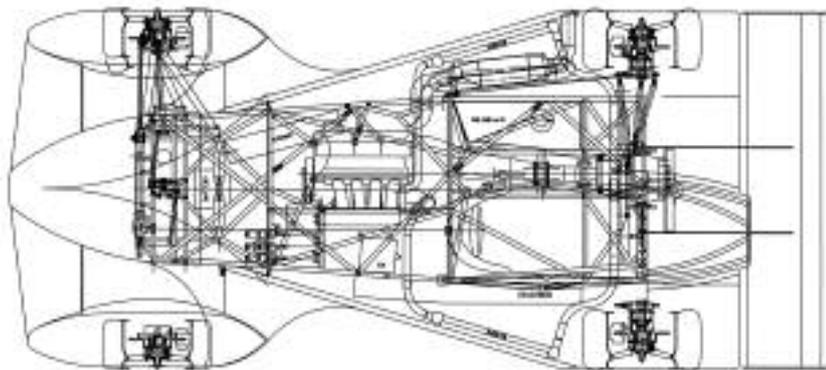
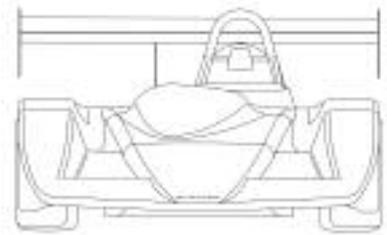
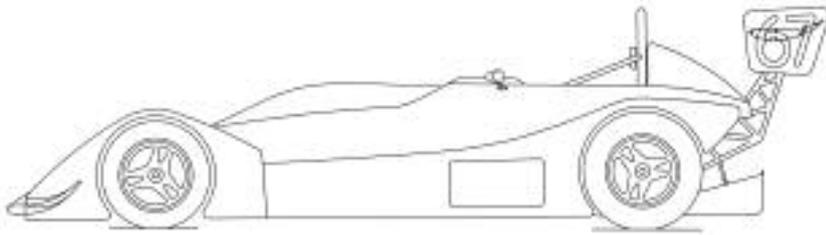
Some drivers also travel from Denmark and Norway and the Clubmans Cup, the championship of the Scandinavian Clubmans Register, is contested over seven rounds throughout May to September.

This last item is a particular problem with overhead cam engines. The extra height, barely noticeable where the engine is behind the driver, causes major issues to aerodynamics and driver visibility when placed in front of him. In addition, the position of the unit can often be limited by the Clubmans technical regulations which state that: 'The engine and gearbox must be located in front of the rear axle line and the centre of the rearmost engine spark plug hole must be not less than 91 cm (35.8 inches) in front of the rear axle line'.

Taking everything into consideration, including the length of the gearbox and its tailshaft, to equalise corner weights, the engine and drivetrain (including the differential) are all mounted 75 mm offset and parallel to the centre line of the car. This compares with the S21, which is mounted askew with the engine at the front offset by 125 mm and the differential by 70 mm. This, of course, means that the driveshafts are of unequal length but this is normal for most cars of this type.

Unlike most Clubmans cars, including the previous Phantoms, the S240 is a left-hand-drive car with the driver changing gear using his right hand. In other words, as per normal on Swedish roads! This configuration was dictated by the position of the exhaust ports on the right hand side of the Honda engine and the undesirability of plumbing the exhaust system around the driver's legs.

When the engine is situated in front of the driver, designers ▶



**LEFT** The S240, offered up here in 2D CAD form, could take the Clubmans-type cars in a different direction. The left-hand-drive configuration was dictated by the positioning of the exhaust ports to the right of the Honda engine

often look at canting the unit over to one side. The advantages of reducing the frontal area and, equally important, lowering the centre of gravity can be significant and sometimes well worth the extra engine engineering which may be necessary. On the Honda, however, which uses the standard intake manifold and throttle assembly, there is little aerodynamic gain. There may be centre of gravity advantages but this would require careful analysis of the oil drain mechanism within the unit and a redesign of the sump assembly.

"In the end," says Nordgren, "we chose to package the engine in its normal Honda S2000 position of 14 degrees to the horizontal to the exhaust side."

Using the standard wet sump would inevitably give oil surge issues on cornering if it wasn't for the installation of an Accusump oil pressure accumulator. This rather large device

chassis is completely re-engineered," says Nordgren. "Made predominantly from 20 mm square mild steel tubing, its torsional rigidity is much greater than our previous version."

Even with reinforcement around the Honda Torsen 4.1:1 differential and the engine/gearbox mounts, the weight has been kept to the same as the S21. The positioning of the engine and gearbox targeting a 40/60 front-rear weight distribution gave no space for a propshaft. Any misalignment therefore has had to be accommodated using a BMW Hardy disc mounted between the gearbox and differential unit. "Later on," he says, "we intend to try a GKN carbon fibre disc – it will save around 0.6 kg but at the time we had many more pressing issues."

The packaging has, of necessity, increased the wheelbase by 45 mm. It's not a lot, but maybe it will help to improve car stability at the higher top speeds of in excess of 260 km/h (160

mph) that are expected.

Suspension geometry at the front is very similar to its predecessor, although with

**"At the rear, the Phantom's trademark De-Dion link has been replaced by a fully independent system to reduce unsprung weight"**

measures 22" by 4.25" diameter (56 x 11 cm), contains six US pints (2.8 litres) of oil and is designed to boost the engine oil pressure should it sag during hard cornering. "Even so," he claims, "there is still a weight saving over the dry sump."

Once the driver position and orientation of the engine and transmission had been determined, and the location of the many components (fuel tank, battery, pedal box, radiators, to name a few) decided, design of the chassis could begin in earnest.

"Although borrowing much from the previous design, the S240

slightly 'tweaked' inboard pick-up points. Unequal length wishbones, top and bottom, fabricated out of elliptical steel section, operate a revised rocker assembly via pushrods to the inboard coil over Nitron three-way dampers.

Anti-roll at the front is catered for by an interesting adjustable blade configuration, weighing 0.1 kg, mounted centrally in the chassis and pushrod operated from the top of the rocker arm. Anti-dive, however, is more of a personal thing. Many drivers can easily cope with the slightly vague feeling that this can

## HONDA S2000 ENGINE

ANYBODY who has looked at the specification of the latest 2-litre sports engine from Honda will appreciate that its 179 kW (120 bhp per litre) output and free revving capability up to 8,800 rpm make it an ideal target for circuit racing.

This compact 4-cylinder engine has a bore/stroke of 87 mm x 84 mm and gives the highest output in the world for a mass produced car engine.

Introduced in 2000, this engine is setting the benchmark against which all other sporting road car engines will be judged. Not only is peak power produced at a refreshingly useful 8,300 rpm but with a torque of 207 Nm (153 lbs ft) at 7,500 rpm this is nothing short of a race engine for the road. A brief glimpse at the design details will tell you why.

Typifying all Honda road engines, the cylinder block is die cast aluminium alloy but

this time with fibre-reinforced cylinder liners. This reduces the temperatures between the bores and enables them to sit closer together, giving a more compact engine. The lower part has a ladder frame structure, also of die-cast aluminium but integrated with cast iron bearing caps, that not only stiffens the overall structure but also provides a more thermally stable bottom end.

With a forged, high carbon, manganese steel crank, carburized and glass peened connecting rods and forged lightweight pistons, the design has obviously benefited from many years of performance engine development.

Following the compact theme, the VTEC cylinder head operates its double overhead cams via a rocker arm system that can be switched to alter the valve lift. In this way, the cylinder head can be narrowed by

moving the cams closer together, saving in both size and weight.

Switching at 5,850 rpm to the full 12 mm lift of the 36 mm diameter intake valve may not appear to be much of an advantage in a circuit racing engine. However, it does make it more responsive when pulling away from the grid or coming out of slow corners.

The intake manifold shape and volume has been carefully optimised, with attention paid to the weight of the flywheel. When allied to its slightly heavy six-speed close ratio box and its slick, precise short-throw change, the package is the closest you'll get to a real racing car without spending large amounts of money.

The fact that these engines can now be obtained second-hand from accident damaged vehicles makes them even more appealing to the enthusiastic racer on a budget.

introduce under braking but it is not the preference of all. For the S240 this was reduced to give better feel. Steering is via a modified Ford Escort rack that is claimed to be actually lighter than the Titan specification on earlier examples of the marque.

At the rear, the Phantom's trademark De-Dion link has been replaced by a fully independent system to reduce unsprung weight. The fabricated and heat treated aluminium hubs to which this tube is normally bolted are retained.

"This new arrangement is considered to be very much a development exercise," says Nordgren. "If the revised system comprising of lower wishbone, upper link and radius arms is not an improvement, then the suspension will revert to the tried and tested De Dion design."

### CHANGE OF PLAN

Rear springs and damping are once again the province of Nitron three-way coil over units while anti-roll can be adjusted side to side using a curious system of links and spring packs operating from the rocker arms. Braking is provided by Wilwood callipers, 4 pot at the front, 2 pot at the rear. They operate on what are described as "wavy" discs – 270 mm diameter front, 260 mm rear – to reduce unsprung weight even further. According to Nordgren, they are borrowed from motorcycle racing technology.

The original choice of Honda engine was perhaps influenced by the need (for 2007 in Sweden at least) for a fully operational catalyst. It was at this point in the decision process in December 2005, when discussing whether to persevere with the Honda PGM fuelling system or opt for the more user-friendly aftermarket equivalent, that Nordgren dropped a bombshell on his colleague: he had an offer on his S21 clubmans racer!

The bid was a good one, but it left the pair without a

clubmans racer for 2006. Enter the S22. Conceived as an evolution of the S21, but with many ideas adapted from the Honda-engined design, work started on this immediately. Retaining the De-Dion rear suspension and with further development of the front pushrod/rocker arm mechanism, the front spaceframe was quickly revised to bolt to the front of the Zetec cylinder head, making the engine even more of a structural part. A new cross member through the passenger side improved the stiffness. To improve braking, the front nosecone was reprofiled to include a separate air duct.

At the rear the wing stay material was changed to carbon fibre honeycomb (weighing only 0.48 kg each) supporting a dual element rear wing also made of carbon fibre. With a minimum weight limit complete with driver of 580 kg, this wasn't strictly necessary but did reduce the height of the centre of gravity at the rear.

With the build going well and all looking set for the start of the Scandinavian season in May, the pair set out to Autosport International in January to select a gearbox, some wheels and a number of proprietary components.

Problems were encountered with the delivery of the wheels, the gearbox and some braking components. It's a frustration we all experience at times but in Sweden, where the racing season is much shorter than most, this was turning into a disaster. Eventually, the sourcing of a second-hand gearbox and a slight redesign of the front brake calliper saved the season.

By the last week in June, the car was finally ready for its first shakedown run and the biggest sports car event in Sweden – the Swedish Sportscar Championship at Knutstorp.

And the future of the S240? Nordgren smiles. "Maybe for 2007. Yes, *definitely* the 2007 season!" It is to be hoped that the S240 concept transpires to be more than a mere phantom. ■