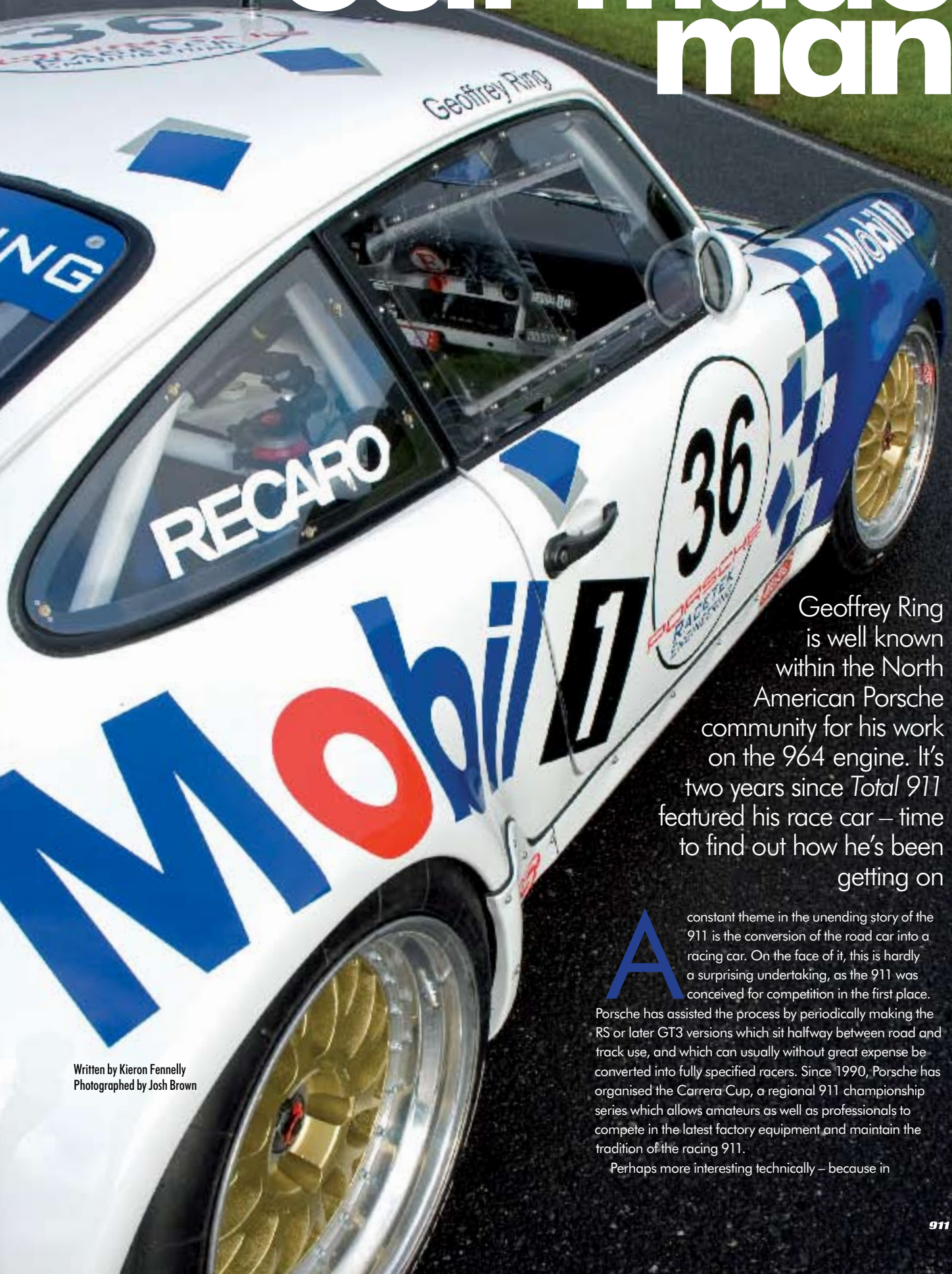


Self-made man

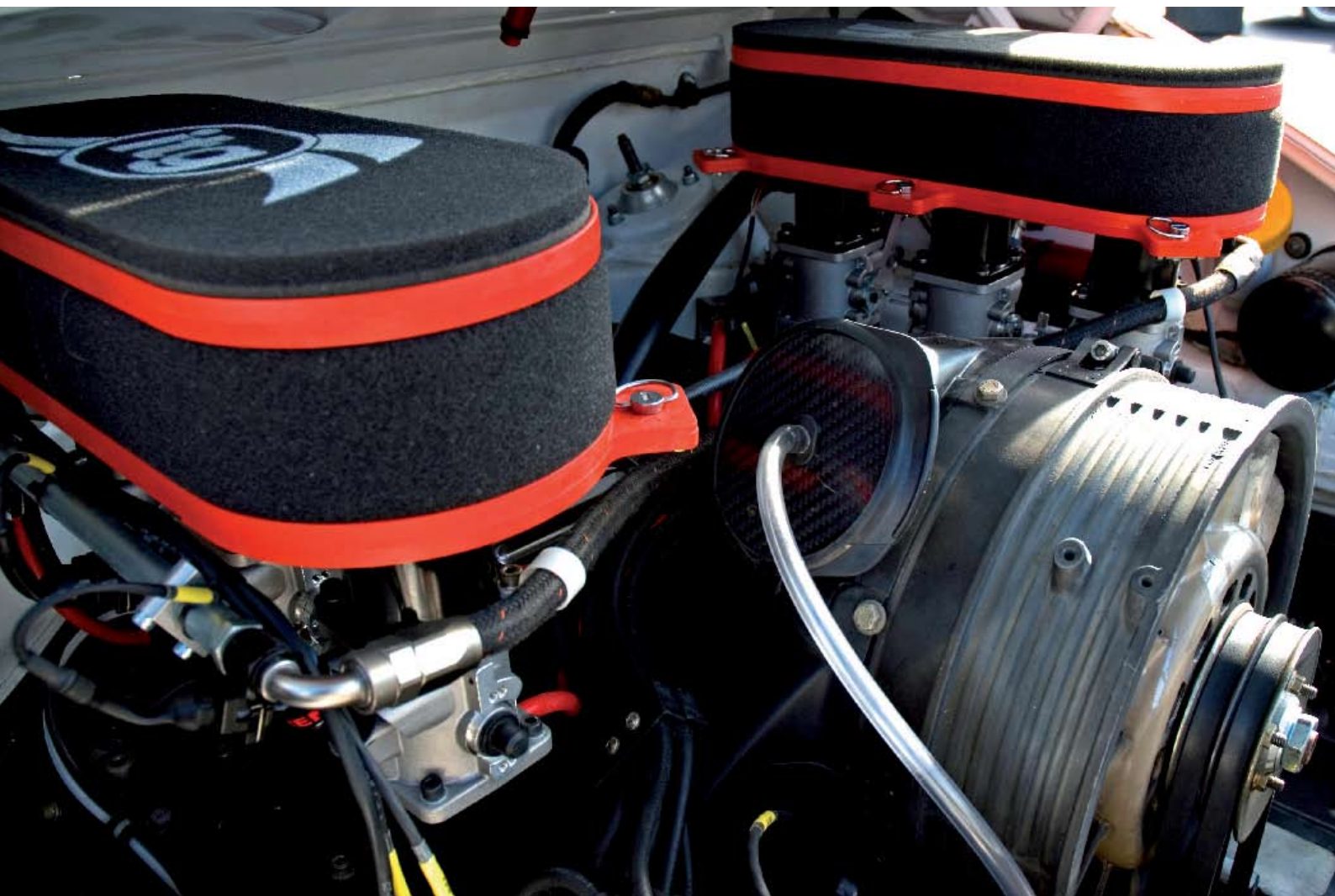


Geoffrey Ring is well known within the North American Porsche community for his work on the 964 engine. It's two years since *Total 911* featured his race car – time to find out how he's been getting on

A constant theme in the unending story of the 911 is the conversion of the road car into a racing car. On the face of it, this is hardly a surprising undertaking, as the 911 was conceived for competition in the first place. Porsche has assisted the process by periodically making the RS or later GT3 versions which sit halfway between road and track use, and which can usually without great expense be converted into fully specified racers. Since 1990, Porsche has organised the Carrera Cup, a regional 911 championship series which allows amateurs as well as professionals to compete in the latest factory equipment and maintain the tradition of the racing 911.

Perhaps more interesting technically – because in

Written by Kieron Fennelly
Photographed by Josh Brown



offering greater variety it is open to a wider range of participants – is the club racing scene. The rules vary, but generally competitors have to respect both the spirit and style of modifications of the period, so the challenge lies in enhancements using modern technology, such as engine management, without radically changing the basic engineering of the original car.

One of the more thoughtful exponents in this field is Geoffrey Ring, who hails from Kingston in New York State. *Total 911* readers will recall the series of detailed articles written by Geoffrey a couple of years ago where he described how he built a replica 964 RSR from a crashed 964 shell. Since then he has enjoyed over 100 hours of virtually trouble-free track work, a tribute to meticulous preparation. Recently, *Total 911* met Ring again to look back over the past three seasons and review the further developments he has carried out on the 911 engine and chassis, in particular.

But first we should recap a little; Geoffrey is a trained engineer and stalwart PCA club trackday enthusiast with a particular interest in engine management. Motorsport has always been his hobby and, while still at school, he worked weekends and evenings as an apprentice mechanic at a local Porsche dealer, mainly with 944s. He also raced motorcycles, though he tired of them after some years, preferring to drive and develop track cars.

Soon after university, he formed his company RaceTek, which specialises in road and racing upgrades using MoTeC brand electronics which perform the dual role of engine

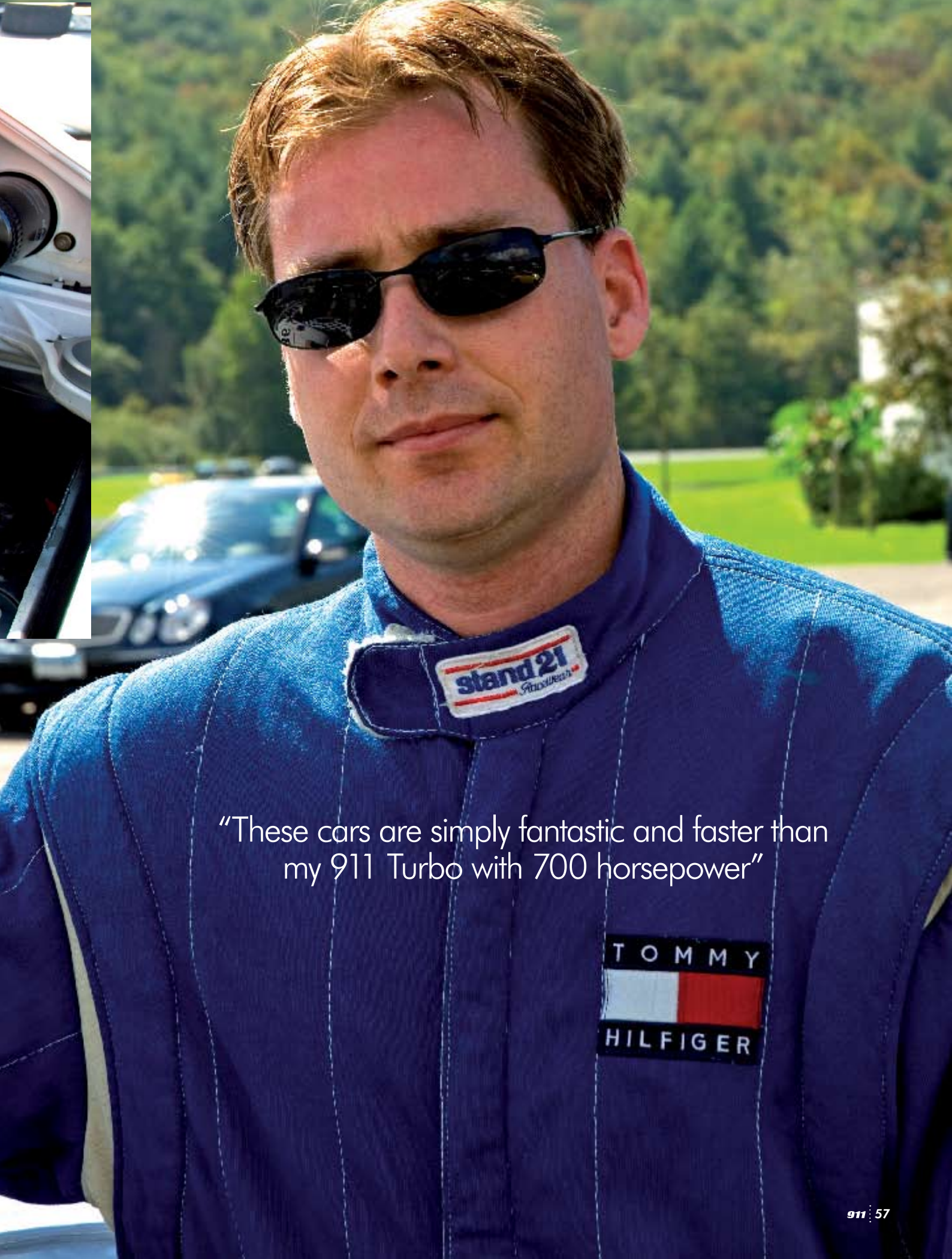
management and data acquisition. His own race car, currently the 964, has always served as both a test bench and promotional tool for his business, as does the E30 BMW M3 track car which RaceTek prepares and sponsors.

Geoffrey contracted the 911 virus despite the logic of an engineering education and theory which suggested that the engine was at the wrong end of the car. However, as many others before him have found, when it comes to the 911, theory does not apply – the 911 is the default sports car.

He first became acquainted with Porsches through the 944, working those aforementioned weekends at a Porsche dealer during his school days in the mid 1980s; but the 911 was what he really impressed him and by 1996 he was campaigning a 1989 911 Turbo; the first car he converted to MoTeC. Over the next few years he improved this car steadily, boring it out to 3.4 litres, for example, until it was producing a heady 700bhp.

It was not until 2004, though, and then entirely by chance, that he had the opportunity of driving a track-orientated non-turbocharged 911, in the shape of a 964RS. Having travelled all the way to Mosport in Canada for a track weekend, his Turbo's transmission failed in the first few minutes and he faced the prospect of three days as a spectator. Happily, though, a couple of his RaceTek clients who were also at Mosport offered him their 911 RSs to try. This 911 was a revelation to Geoffrey, who was stunned: "These cars were simply fantastic. Granted, they are purpose-built racing cars compared with a modified street car, but shouldn't my 911 Turbo with 700 horsepower be faster?"

Who said 911 engines were dull to look at? Geoff's self-built 964 unit (above) not only looks superb, it's also proved very reliable. Geoff himself (right) is remarkably modest about his accomplishments



“These cars are simply fantastic and faster than my 911 Turbo with 700 horsepower”

Well, it turned out that it wasn't and neither was it as much fun or as comfortable to drive. What great fun a 964 Euro Cup is!"

He had simply found out what European 911 track devotees had always known, but which, thanks to US import restrictions, North American fans had been deprived of since the original 2.7 RS was banned in 1973. Porsche never homologated the RS versions or the 959 and the US had to wait for the GT3 MkII; the first 911 in the RS tradition to be officially imported, in 2004. In the interim, US club racers had begun to import 964RSs and 993RSs ten years after their European debut. Geoffrey's eureka moment was in any case well timed: "I had been developing the Turbo for some years for the MoTeC business and it was time to move on to something else." So the 911 Turbo was duly sold to fund Geoffrey's racecar project.

The balance and lightness of the naturally aspirated 911 appealed to him, but as an engineer he sought the challenge of building his own car instead of buying a race-prepared car. Rather than recreate a standard RS or GT3, Geoffrey decided to modify a 964 to RS Cup specification, yet incorporate many of the subsequent improvements of the 993RS. He was particularly taken with the chassis of the 964 – hardly surprising after persevering for so long with the previous torsion bar set-up, but also because he believes that it is the most underrated of all the 911 chassis; its simplicity making it the most cost-effective, too.

So having located a donor car – a damaged narrow-body 964 – he fitted the wider Turbo rear wheel arches obtained from a 1986 930 – he admits he's always been partial to the Turbo body – and was pleased to discover how well they aligned with the mounting points of the later car, showing how little the overall dimensions of the 911 had changed between the 3.2 and 964.

Mechanically, he decided to use the G50 six-speed gearbox driving through a lightweight, 7.5-inch two-plate Titan GT3R clutch and flywheel, and the manual steering rack of the 964RS. As the project took shape, he began to realise that the car he was making was an updated

"The seam welding of the 964RS was never as comprehensive as we tend to believe"

specification of the legendary 964 RSR, a model virtually unknown in North America.

In his quest for lightness – Geoffrey had a target of 950kg which, combined with 380bhp would yield, he estimated, at least equal performance to his 1400kg Turbo – and for authenticity, he set out by examining a Riccardo-modified GT3 RS chassis to see exactly how the seams were welded before he started work on his own donor chassis. "This was the first time a Porsche racing chassis underwent torsional stiffness testing by an outside company who seamwelded every panel," he explains. "It gave me the idea to seam-weld my chassis fully." One of his more interesting discoveries as he worked through the Porsche factory manual was that the seam welding of the 964RS was never as comprehensive as we tend to believe, being largely confined to the rear suspension area. Additional welding, plus a built-in rollcage copying the Matter original linked to the suspension mounts



but with additional bracing, meant that Geoffrey's car would be significantly stiffer than the original RSR.

The car is superbly finished, to the point of wearing an original track RSR livery which, typical of his thoroughness, Geoffrey researched in the 1993 Porsche Sport archive. Entirely rewiring the car with a simplified loom saved weight and also provided an incomparable practical demonstration for his students at the EFI University where he lectures on engine management.

But the crowning glory must be the flat six; a 993RS 3.8 20,000-mile unit which he rebuilt with Ninemeister billet heads and his own MoTeC configuration. Initial bench readings with an 89db silencer showed that the unit was producing 330bhp at the rear wheels (for comparison, an unsilenced GT3 Cup produced 335bhp) and 275ft lb of torque spread over 5500-8000rpm. He was very impressed with the Ninemeister cylinder heads, testing them on his own flow bench: "The results confirmed everything Ninemeister has said regarding flow and velocity and they address many of the production design compromises of the factory heads."

Geoffrey's aim was to complete the project with a budget of \$60,000, a realistic sum for club racing, and within a tight timescale, so the engine did incorporate some compromises. For example, he used the standard Mahle pistons, state of the art in the mid 1990s, but heavy by modern standards; the Ninemeister 102mm pistons combined with special GT3 titanium connecting rods would have reduced reciprocating weight, but required extensive additional engineering to ensure perfect conformity. "I didn't want to spend time resolving all the issues of aftermarket pistons," explains

The 964's pistons (top) after 100 hours of racing. The discolouring is due to the use of low octane fuel. Brakes (above) are suitably uprated for track use

964 racecar

Geoffrey, who was looking for a dependable engine from the outset. He did, though, use the GT3 crankshaft which he feels is better located and a superior design with less flex and more reliable for racing than the 964 or 993 cranks.

On the electronics side, everything is administered by the MoTeC unit, a veritable super-computer delivering and storing readings on virtually every adjustable parameter of the car as well as, for example, switching in and out the gearbox oil cooler – a RaceTek addition to the specification – at preset temperatures (and, incidentally, recalling the electronically-managed engine oil pump with which Porsche has equipped the latest 997).

Geoffrey's methodical development of the car has generated quite a following on the Internet and his contributions to the Rennlist forum have deservedly given him something of a guru status. This is certainly helped by his willingness to acknowledge advances made by other specialists, such as Ninemeister.

Testing by a professional racing driver at Watkins Glen at the end of 2005 suggested that Geoffrey's 964 was faster than the contemporary GT3 Cup car, and he ventured back on to the track after more than a year's absence with more confidence in the car than his driving ability. In fact, the car behaved perfectly, fully justifying the time and method that Geoffrey had invested, and he admits that it took him several outings on the track before his driving had caught up with the capability of the 964.

The car itself required only replacement of leaking dampers during its first season and Geoffrey took the engine out during the winter for a general inspection. He also removed the silencer and remapped the electronics to suit. The only significant problem during the following season was brake bias which Geoffrey eventually resolved by fitting 993RS rear calipers: "These have larger bore pistons than

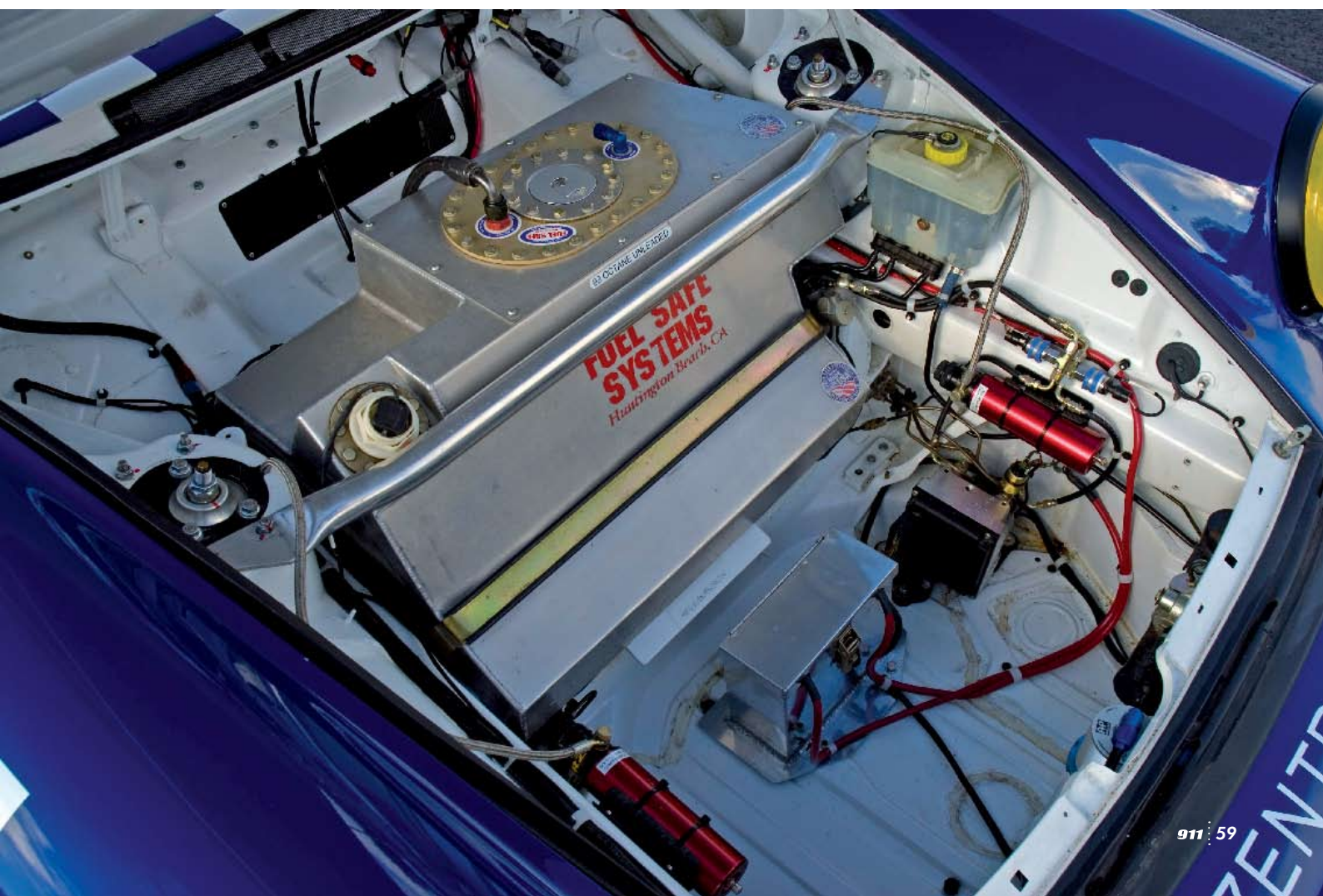
the 993 Turbo calipers," he explains. "Oddly, the 993RSRs used the 993 Turbo pistons rather than the 993RS units." He also enhanced suspension control by fitting position sensors on the dampers. Once again, inspection of the engine during the closed season revealed nothing amiss, but for good measure he opened the transmission which was also in excellent condition, although Geoffrey took the opportunity to replace the early 993 four-plate motorsport differential with a GT3RSR eight-plate item.

It is hardly surprising that Geoffrey found he had once again acquired the taste for competition and in 2008, he began entering race meetings. At this stage with approximately 60 track hours, the engine was functioning perfectly and his main developments were suspension adjustments based on the MoTeC data after the first two races. He lowered the car by 30mm with stiffer springing. A further worthwhile gain came from shortening the intake trumpets by 65mm, which gave a 10bhp increase according to the dyno, which also confirmed engine output within 1bhp of his original reading after 10 hours' use. These early modifications turned out to be worth one second a lap.

More recently Geoffrey installed a front antiroll bar which he can regulate manually from the cockpit as the fuel load diminishes. As fuel weighs anything up to 70kg at full capacity it has a discernable influence on handling, and Geoffrey had taken to qualifying with a full load, but realised that car would obviously lap faster if he could get the same handling characteristics with a light load.

"Again the car was good, but at the beginning of the 2008 season I hadn't raced for 15 years and I found it hard," Geoffrey confesses. Nonetheless, he finished second in class and fourth overall in a combination of sprint (10 laps) and endurance (usually an hour) races, a pretty emphatic return to the circuit. In his final race of the season, in October,

The front luggage compartment is now pure racecar, and its neatness is testament to Geoff's attention to detail throughout





Geoffrey had the leaders in his sights when a young deer stepped in front of his car, which was travelling at 123mph, according to the MoTeC data. The wretched animal was torn in half, but fortunately for the Porsche and its driver, the worst of the impact was confined to the right wing as Geoffrey's post-race picture illustrates. The wing and door in carbonfibre were relatively straightforward to replace and a new front bumper completed the repair.

At this point, having had 100 hours from the engine, Geoffrey now wanted to dismantle it, though it would

“It is amazing that the air-cooled flat six should still be capable of such performance gains”

certainly have performed for a further season. As is his wont, he posted his analysis on Rennlist and we reproduce it here:

“I finished the disassembly and inspection of the engine and am very happy with what I've found. I'm glad that I took the engine apart and didn't run it longer, although it would have run another season (about 30 hours) with little issue.

“When we disassemble a standard 100-hour 964 race engine (Cup for instance) there is considerable wear on the main bearings. We found we had issues with rod bearing failures so we no longer use Porsche rod bearings, but rather an aftermarket race bearing developed for the Carrera 2

engine. We usually see a lot of piston wear due to the weak connecting rod and heavy Mahle piston.

“However, on my engine the main bearings, which are standard Porsche items, looked very good with a little wear on the thrust side of the number-one bearing. There was also some wear on the number-eight nose bearing which I didn't replace from the original core engine – I will replace it this time, though.

“The piston tops had little to no carbon on them, no signs of detonation (even without knock sensors) and no evidence of piston-to-valve contact from an over-revving. The pistons were blackened simply due to the use of 93 octane street fuel.

“The RSR race pistons have a graphite coating on the piston skirt to reduce friction. Normally, due to the rocking, the coating is worn and the pistons are worn through the finish on the piston. Mine, though, looked almost new, which was unexpected. Looking at the ring lands, the rings were still sealing well. Often the piston peens over the wrist pin from being hammered so much. In order to remove the wrist pin, you have to clean up the edge of the piston bore and heat the piston with a heat gun. These wrist pins came out very nicely.

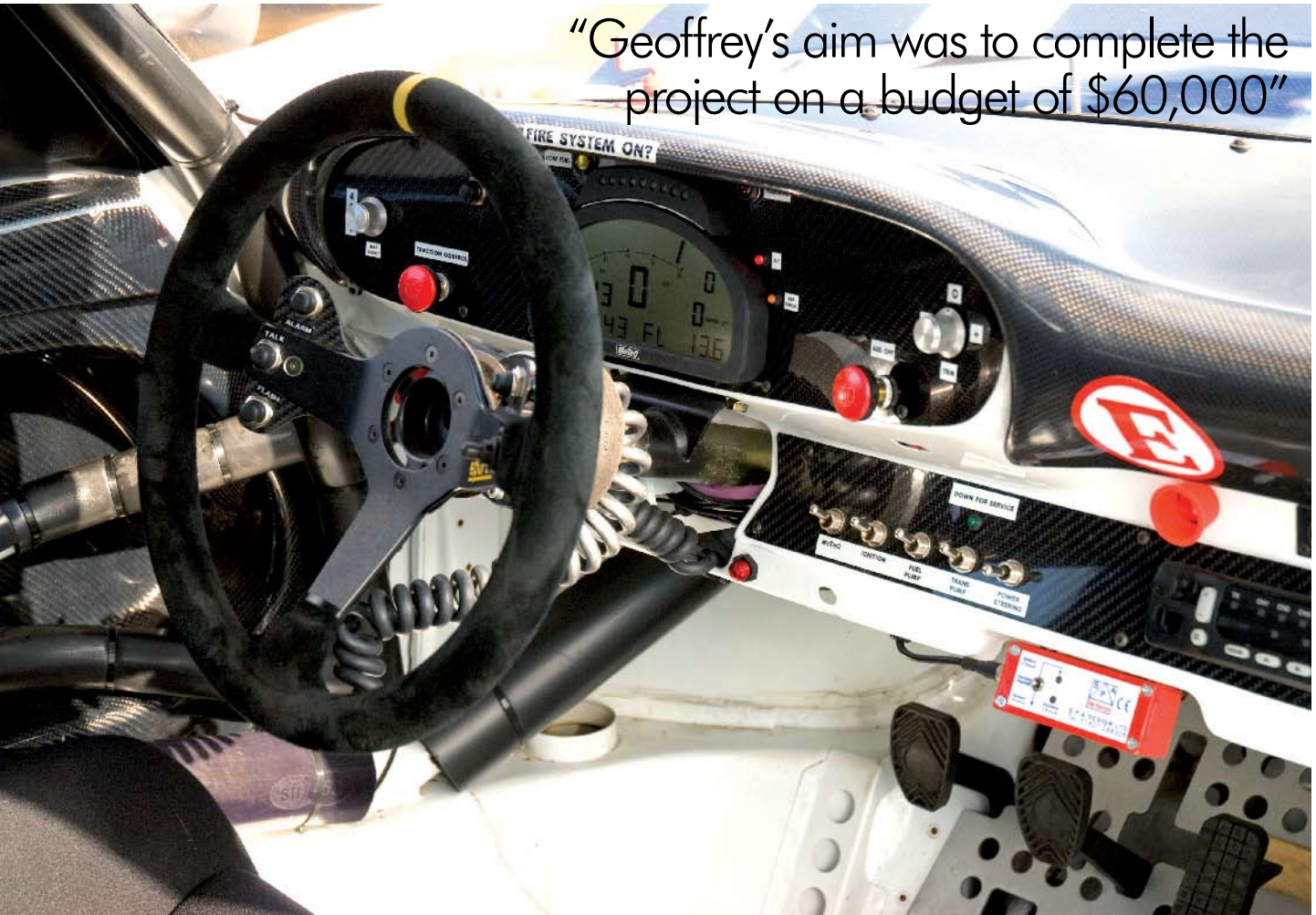
“This engine uses GT3R rod bearings which have a coated racing bearing, not a street bearing. It has a black coating on it and is tougher than a standard bearing. You can see that the rod bearing has begun to wear through the coating in the centre. The GT3R crankshaft has improved oiling over a standard crankshaft. I didn't cross drill the crankshaft, as many people do with the street item.”

Clearly, with so little wear, the engine needed no special maintenance, but after three years of simply adjusting

Geoffrey's modified 911 Turbo, which he raced until he discovered the joys of normally aspirated power

964 racecar

“Geoffrey’s aim was to complete the project on a budget of \$60,000”



valve clearances and retorquing the head bolts, Geoffrey, a man who likes a challenge, was keen to introduce some improvements. During last winter he installed lighter pistons from Ninemeister with titanium connecting rods. He has had a new camshaft of billet steel machined and the valves will be actuated by Ninemeister-designed rocker arms. These are fashioned from alloy and both lighter and stronger than the standard items.

On the face of it a simple mechanical lever, there is more to a rocker arm than meets the untrained eye. Bench testing on a custom rig called a Spintron revealed that a batch of Porsche-supplied rocker arms showed clearance variances up to 0.004 inch whereas the Ninemeister item was consistent at 0.001 inch. Besides having modified oilways, this design also has a larger pad area in contact with the cam lobe which allows a higher peak valve velocity. A characteristic of overhead-valve engines was that maximum revs were often limited by valve bounce, which set in as camshaft velocity became too much for the valves to maintain their timing.

Geoffrey reckons that the combination of the DLC coating on the rocker pads and intensive micro-polishing of the cam lobes will remove a large element of valve train friction and enhance general smoothness. “There’s no way I’d consider using the factory rockers again on a racing engine,” he observes honestly.

It is amazing that the air-cooled flat six, developed over three decades by Porsche, should still be capable of yielding such performance gains. Yet none of the work carried out by RaceTek or Ninemeister is exactly revolutionary – reporting and re-engineering the cylinder heads to enhance

combustion, polishing crankshafts to reduce friction losses, fitting lighter valve componentry and connecting rods to save weight. Some of the materials, titanium for example, may be fairly exotic and certainly the engine management and data measurement technologies are far more effective than what was available 15 years ago when the M64 engine was undergoing its final evolution at Porsche, but clearly this engine was, and still is, far from obsolete.

Geoffrey’s pioneering work shows that the basic engineering is straightforward enough for other enthusiasts to undertake, and with the prospect of a reliable 110bhp/litre, the air-cooled engine is going to be snapping at the heels or even beating the GT3 in mixed races for some seasons to come. His approach exemplifies much of what is worthwhile about the 911 tradition: he has developed his 964 logically and intelligently and readily published his progress for all to appreciate.

On behalf of the 911 community, *Total 911* wishes Geoffrey continued success.

Geoff completely rewired his 911 with a simpler and lighter loom

FURTHER READING

We covered the story of Geoffrey Ring’s 964 racecar build in great detail, over the December 2006 and January, February and March 2007 issues. To order back-issues go to www.total911.com

