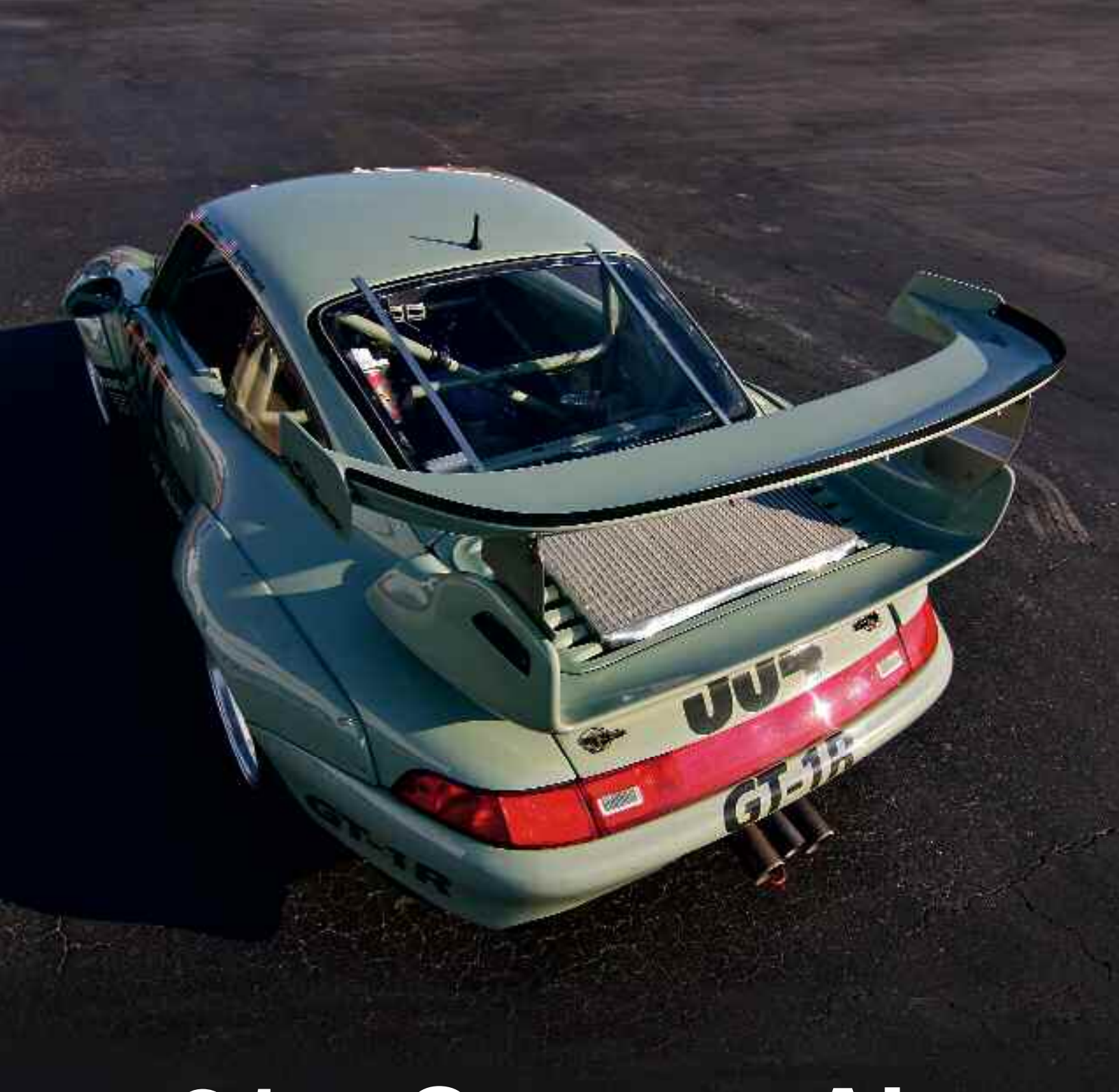

21st Century Air

A turbocharged, air-cooled 911 racer with unconventional thinking

STORY AND **PHOTOS** BY **BRUCE SWEETMAN**

Sharp-eyed readers might recognize that this 911, while it wears 993 RSR bodywork, is no 993. It started life as a 930, but it's pretty hard to call the now twin-turbocharged, 3.4-liter, 645-hp racer a 930. However, for all the modifications that builder Pat Williams performed, one thing he wouldn't change was its source of engine cooling. Mentored by Porsche-engine gurus Jerry Woods and Bruce Anderson in the mid-1980s, Williams has been building, maintaining, and racing air-cooled Porsches ever since.

Porsche hasn't relied on air cooling for more than a decade, and many of today's club racers are buying water-cooled GT3 Cups. Some are even fitting their older air-cooled machines with Cup engines, seeing a water radiator as a fine compromise in the path to more power. But Williams remains resolute in his commitment to air cooling, which begs an obvious question: *Why?*

The answer dates back to the 24 Hours of Daytona in 2000, when Williams, then crew chief for The Racer's Group, leapt over the wall to examine the team's brand-new 911 GT3R. "It was spitting water out of the weep hole," he recalls, "and this older guy in a crisp Porsche shirt climbed over the wall, put his hand on my shoulder, and asked me what was wrong. I pointed to the water pump." The older man was none other than Porsche Motorsport Director Herbert Ampferer. While TRG's GT3R was the first to suffer this failure at Daytona, says Williams, "everyone lost water pumps that year!"

It was an inauspicious beginning for the water-cooled race cars, and while they have more than proven their durability over the intervening years, Williams still likes the older air-cooled engines. While he was still with TRG, Williams was part of the last team to run early 911/930-based cars when everyone else had switched to more modern 993 RSRs. "An IMSA rule allowed us certain advantages," he says. "You could run a 3.6-liter engine without a restrictor and you could be a bit lighter. Besides, we wanted to do a hot rod, not the factory 'because-they-said-so' package."

This mixture of love and racing advantage carried over to Williams' business, Pat Williams Racing in Memphis, Tennessee, and eventually led to this 911. But a couple of other cars came first.

When 3.6-liter water-cooled 996s started showing up in Porsche club racing in the early 2000s, the old air-cooled 3.8s were no match, yet both groups of cars ran in the same GT2 class. "We were getting spanked!" Williams says. "That's when I decided to do a small-displacement turbo car."

The Porsche Club of America rule book contained a turbocharger equivalency formula, which stated that a turbo engine's displacement, multiplied by 1.3, would equal naturally-aspirated displacement for purposes of determining class. "Lots of people thought it was a cool idea to do a small-displacement turbo," says Williams, "but nobody had ever pulled the trigger — because it was hard. And risky."

Still, Williams proposed replacing the 3.8 in one of his client's racers with a smaller twin-turbo mill. The client, Ronnie Randall, gave the green light, and Williams got to work.

Using the equivalency formula, Williams specified a 2.1-liter twin-turbo engine to run against the 2.8-liter naturally aspirated engines in the GT4 class. He chose a 2.4-liter engine case, then destroked

a 2.2-liter crankshaft to 64.95 mm, down from 66 mm. After fitting a pair of Garret turbos, a Manifold Absolute Pressure sensor and a Motec ECU, Williams says the engine made 419 hp and 321 lb-ft of torque at 1.1 bar of boost on the chassis dyno.

The package was an instant success on track. In its first outing, at Brainerd Raceway in August 2003, Randall vied for the overall win with a 996 GT3 RS and left the rest of the field in the dust. In later races, he regularly beat cars in higher classes that were running on track at the same time.

"That was the very first successful small-displacement turbo engine in the country in PCA," says Williams. It would not be the last, however.

In June 2004, another of Williams' clients, Barry Bays, asked him to co-drive an enduro at the inaugural PCA race weekend at Barber Motorsports Park. "That's how it started — with us driving together," says Bays. "Then we started talking about building this 2.6-liter engine."

"Barry wanted to do a GT car," adds Williams, "and he asked me what I would build that would be unique and competitive. I said that I'd do the GT3 version of the GT4 twin turbo we had done for Ronnie Randall." Specifically, Williams

Opposite: Barry Bays' Seamist Green racer wears what might just be the widest rear wheels we've seen on a 911 — 18 inches! Clockwise from top left: Interior features AIM data logger/dash display; massive intercooler conceals view of 645-hp, 3.4-liter, air-cooled engine; twin Garrett turbochargers are visible from underneath; front brake setup consists of 997 World Challenge calipers and 350-mm NASCAR rotors.

Top: Bays' 2.6-liter car is built on a 1976 Targa chassis, and wears most of the same suspension bits as the 3.4. Below: Ronnie Randall's 2.1-liter flat six was Williams' first small-displacement twin turbo.

proposed building a 2.6-liter twin turbo, equivalent to 3.4 liters naturally aspirated. He built the car from the ground up, starting with a 1976 Targa chassis.

"From '74 through '89, all 911 chassis are pretty much the same," says Williams, "though Targas had some extra reinforcements." A 996 body from Getty Design was chosen and painted beige. "My wife picked the color," says Bays. "She said, 'You don't want another red car, blue car, or white car, you want something that's going to stand out!'" And stand out it does — like a Cocker Spaniel in a pack of Dobermans.

But the car is more like a Greyhound at heart. This time, Williams started with a 3.0-liter engine and destroked its crank to 65.5 mm. Custom 92-mm pistons were used to further reduce displacement, and a pair of custom Garrett turbos were fitted. With a MAP sensor and an ECU from EFI Europe, says Williams, the 2.6-liter engine produced 571 hp and 399 lb-ft of torque at 1.2 bar on the chassis dyno. A six-speed 993 transmission was selected to match the engine's torque curve.

Williams and Bays shook down the Porsche at Sebring in 2005. In its next race, at Road Atlanta, Williams scored a class win. Another class win at Mid-Ohio highlighted the '05 season. The pair is still racing the beige car, although its engine has since been enlarged to 2.8 liters following a rules change.

In 2006, Bays decided he wanted to go all-out and compete for overall victories, rather than just class wins. And that brings us back to the 645-hp green machine.

GT1 is the PCA's top air-cooled class. Displacement is unlimited, so Williams drew up plans for a fire-breathing 3.4-liter twin turbo. He could have built a 3.8, but considers those engines more fragile. Besides, he says, "I've never been pulled by a 3.8."

Williams began with a 3.3-liter engine case from a 1986 Turbo, fitting 1-mm oversize Mahle pistons and cylinders, forged Pauter rods, and a stock crankshaft machined to accept Buick Indy turbo racing bearings made by Clevite. Heads from a 3.2-liter Carrera were twin-plugged and then Ni-Resisted for good sealing. "The machine work was all done CNC for accuracy," says Williams. "The head heights are within ridiculously tight tolerances."

Next up were a larger set of custom Garrett ball-bearing turbochargers and a 993 scavenge pump. "The pump is driven straight off the intermediate shaft that's on all the 911 engines," Williams explains, "although the pump was never on anything older than a 1994. I put it on a '78–89 case, and it looks like it belongs there. Why try to develop something yourself? I use OEM Porsche parts whenever possible."

According to Williams, with a MAP sensor and EFI Europe ECU the 3.4-liter flat six pumped out 645 hp and 501 lb-ft at the rear wheels. "It has a flat torque curve and no turbo lag between 4500 and 7800 rpm," he says. "We limit boost to 1.1 bar, it lasts forever, and we can pull most any car at the green flag!"

As you've probably deduced, the heart of these potent air-cooled twin-turbo engines is the combination of a MAP sensor and an aftermarket ECU. "The biggest difference between the 935 days and now is that they didn't have engine management," says Williams. "They had fixed ignition and mechanical fuel injection, which you could ask to either work on boost or off boost. The 935 engine was so detonation-prone and ran such high combustion temperatures that it required a huge flat fan over the engine, and they had to spray-oil the cams and valve springs just so it wouldn't fail. But they made it work!"

Today, he continues, "the MAP sensor is the (key) to the whole deal. We're constantly manipulating the timing based on pressure or lack thereof. When it's off boost, it runs a ton of ignition timing; when it's on boost, timing is pulled back three-dimensionally based on rpm, throttle position, and pressure. Compared to a 935, we're able to make an engine with (fewer) exotic parts and equal or more power that lasts longer. And drivability is much, much better."

In addition, the last 30 years have seen plenty of advances in turbo design. "Back in the day, they had a big turbo, a small turbo, this turbo, that turbo," says Williams. "Now there are a number of variables that you can change — the aspect ratio, the wheel size, and the trim — on both the tur-

bine and the compressor side. Of course, you have to know the engine's volumetric efficiency and you have to do the math before ordering a turbocharger. When you get it right — when you make the turbo match the engine's ability — that's not luck. There's no luck involved whatsoever."

To handle the 3.4-liter engine's massive torque, Williams selected a four-speed transaxle from a 1986 911 Turbo. "It's about the strongest transmission Porsche ever made," he says, "and the car has so much torque it doesn't really need more gears." With just four ratios, first is pretty tall, topping out at 88 mph.

The drivetrain was installed in a 1986 Turbo chassis Williams again built from the ground up. Every metal body panel, including the roof, was replaced with a composite piece. A roll cage was fitted and the driver's compartment was sealed front and rear to keep out water, dirt, and unnecessary heat. Next, the chassis was clothed in 993 RSR bodywork from Getty. Sticking with the previous car's understated hue, this one was painted a 1949 Ford Coupe color called Seamist Green, which Williams had seen at a hot-rod show.

"Nobody runs a car in that kind of color," says Bays. "We wanted something unique, so that when we got to the track everybody would say, 'Here they come!'"

Williams chose aftermarket 935-type front suspension from ERP, along with Moton Motorsport three-way adjustable shocks. The rear utilizes ERP spring plates and Moton coil-overs, while both front and rear wear adjustable Smart Racing anti-roll bars. This setup, which was also used on the earlier 2.1- and 2.6-liter cars, is very similar to that of the TRG 911s which Williams oversaw.

Braking hardware is equally serious. 997 World Challenge Brembo six-piston calipers clamp NASCAR 350-mm rotors with Porsche Green Pagid Cup pads up front, while four-piston IMSA Viper Brembos grab 299-mm rotors with Pagid Orange pads in back. Massive Fikse forged wheels measure 18x11 fore and 18x18 (!) aft, and are wrapped in 280/650R18 and 330/690R18 Yokohama rubber.

Williams and Bays debuted the green car at Sebring in February 2007, and it was competitive from the get-go. "We led the 'Fun Race' the first time we ran the car," says Williams, referring to the practice race that kicks off a PCA race weekend. Over the next few years, #334 took numerous class wins, along with overall victories at Miller Motorsports Park in 2008 and Daytona in 2009 against the fastest water-cooled cars in the GTA and GTC classes.

In mid-March 2010, we got to see the car in action at the Peachstate Region PCA races at Road Atlanta. It was awesomely fast on the back straight and bellowed like a basso profundo opera star as it climbed the hill out of Turn 1. In the Sprint race, Williams drove from tenth to second before retiring with a transmission problem. The only car to pass him on track was a twin-turbo 993 RSR — a car he also built.

By applying modern engine management, turbochargers, and suspension to 911s of yesteryear, Williams has force-fed new life into race cars that were once relegated to the back of the pack. Today, he and Barry Bays continue to challenge for supremacy in the top PCA classes with their air-cooled 3.4-liter twin turbo.

"We wanted to take older technology, update it, slip a new skin on it, and you don't know what we've got," says Bays with a smile. "You just know we're fast, and we're filling up your mirror every lap." ■