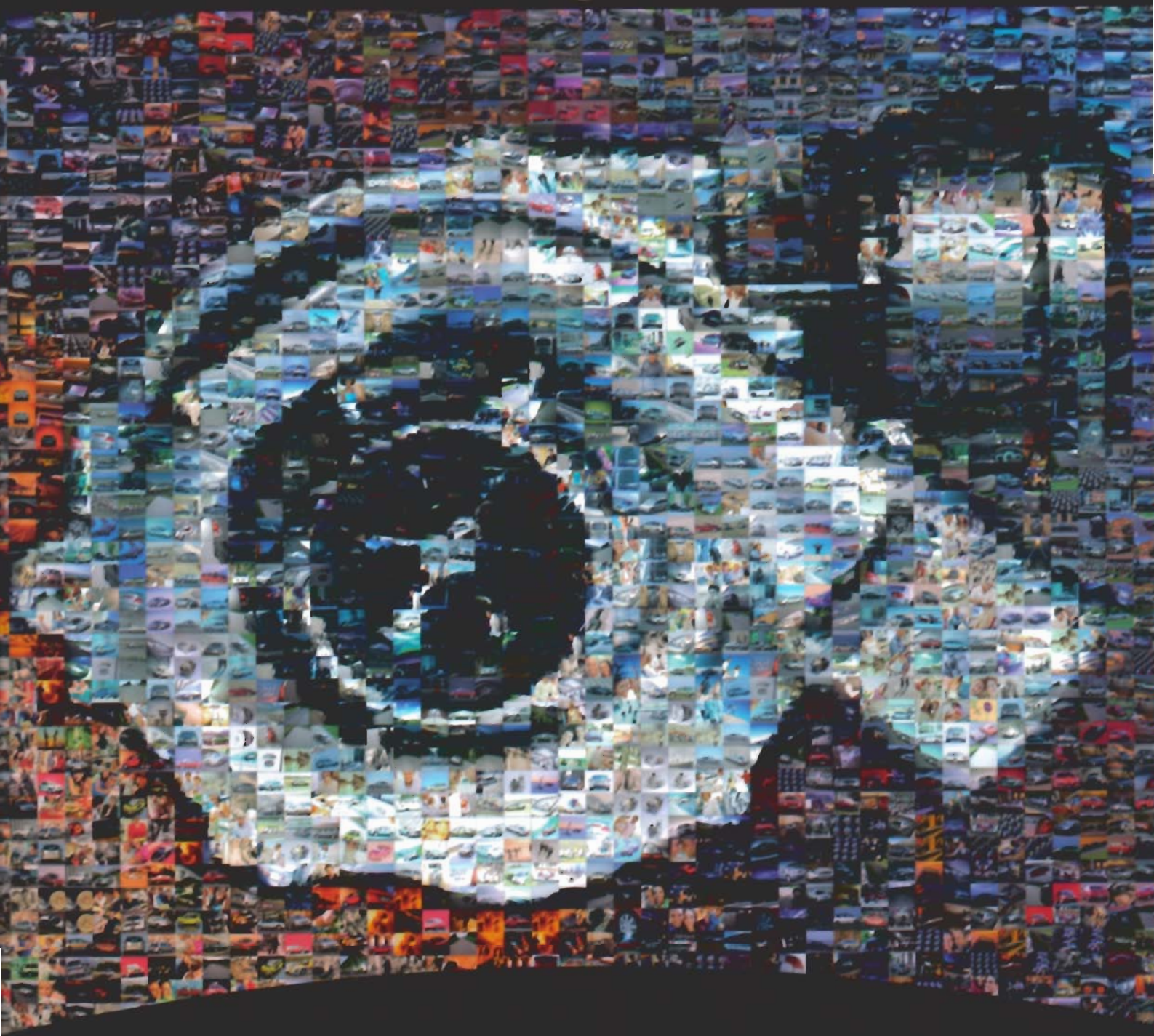
boostermagazine

MARCH 2005



Celebrating 100 Years of Technology and Innovation

1905
2005

Honeywell

On Track

- Adriane Brown has been appointed President and CEO of Honeywell Transportation Systems. Serving also as President of Honeywell Turbo Technologies, she looks forward to developing successful customer partnerships founded on quality and best technologies.

- It's 100 years since the birth of turbo – what is it that makes the technology more relevant today than at any time in its history?

- The aerospace heritage of Garrett Corporation spawned an automotive turbo business that grew from four engineers to 6000 people. John Cazier, the head of the Garrett turbo business from 1967- 1985, charts the company's remarkable progress.

- By highlighting landmark vehicles fitted with Garrett® turbos, we celebrate the partnerships that have created the turbocharged vehicles that defined their time.

- From F1 to World Rally Championship – turbo power claims its place in the honour roll of racing.

- As the spotlight falls on Geneva Motor Show in its 100th year, Mr. Carlo Lamprecht, State Councilor and Minister of the Department of Economy, Labour and Foreign Affairs of the Republic and Canton of Geneva, outlines why the event is such a key date in the automotive calendar.

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Listening and Learning

COVER: CELEBRATING 100 YEA OF TECHNOLOGY AND INNOVATION

Dear Readers,

In this issue of Booster magazine, we celebrate 100 years of turbo history. At such significant moments in time, we reflect on past achievements and acknowledge the work of those pioneers whose foresight and innovation bring us to where we are today.

Through the work of John 'Cliff' Garrett, those of us at Honeywell Turbo Technologies can feel proud of our association with his legacy – but for me what's really important about our heritage is how it shapes the future of our business.

As a new arrival in Transportation Systems, I feel this sense of new opportunity very strongly. I bring my own experiences, both in aerospace and in the automotive industry, to this enterprise, with a strong determination to continue a strong business that has technology, quality and customer support at its core.

The story of turbo is one of technological innovation. For me, though, technology alone is never enough. Technology is only relevant when it provides a solution to our customers.

The goal must be to deliver solutions born of technology – in this way we deliver true value for our customers and we, in turn, share in their success.

I hope you enjoy this journey through the story of turbo. We look forward to working with our partners on its next chapter.

Adriane M. Brown

Adriane M. Brown
President & CEO
Honeywell Transportation Systems

100 Years

1905 Dr Alfred J Büchi (Swiss Engineer) files the first turbocharger patent and so begins the turbo era.

1920 
The LePere bi-plane with turbocharger sets new altitude record of 33,113 feet.

1925 Two German ships are fitted with 2,000hp turbo-charged diesel engines. Dr Büchi patents the first turbocharger application with his pulse turbocharging system.

Adriane Brown was appointed President and CEO of Honeywell Transportation Systems and President of Honeywell Turbo Technologies in January this year. Ms. Brown joined the business from Honeywell Aerospace where she managed Aircraft Landing Systems and then the Engine Systems & Accessories business. Prior to that, she was Vice President and General Manager of the Environmental Products Division for Corning Inc. Ms Brown earned her Bachelor's degree in Environmental Health from Old Dominion University and Master's degree in Management, as a Sloan Fellow, from Massachusetts Institute of Technology.

In this interview, Adriane Brown underlines her determination to develop successful customer partnerships founded on quality and best technology solutions that serve customer needs.

One to One

with Adriane Brown

The best is yet to come...

1936 
John Clifford Garrett establishes the Garrett Corporation in California, US.

1940 
Turbo technology spreads across marine, industrial and locomotive applications.

1951 Garrett engineer Ted von der Nuell advocates the controlled variable nozzle as best concept for a turbocharged earthmover.

Prior to joining Honeywell's aerospace business, you spent more than five years working in the automotive business at Corning. How do you think that will help you in your new position?

As a result of my automotive background, I'm very familiar with the needs of our customers and the issues they face every day – specifically in the powertrain area, which was my focus at Corning. My work there centered around emissions aftertreatment which, of course, is very relevant as we work to help our customers meet emissions rules without compromising consumers' demand for better performance.

What about the five years you've spent in Honeywell Aerospace?

What those five years did was to reinforce that it is all about the customer and their customers. The way we become successful is by helping our customers become successful – if we can't find solutions to their problems, then there are other suppliers more than happy to try.

True partnerships in business can be very powerful. In my last position I saw the enormous benefits as a result of our engineering and product teams working much more closely with our customers.

Going forward, I'd also like to build on the synergies between aerospace and turbocharger technologies – for example, by ensuring that the Turbo business fully takes advantage of expertise in Aerospace, particularly in gas turbine engines. The competency in aerodynamics we have in our jet engine business is unmatched by any other automotive supplier.

What about quality and reliability?

Quality is something that I am passionate about and it's another area where my experience in aerospace is beneficial. There is no margin for error in the aerospace world – I'd like to bring that same edge on quality to the automotive business… and really take it to the next level.

What are your thoughts on technology?

Honeywell Turbo Technologies has a long and solid record of technology leadership, which I plan to continue and – in fact – enhance. I'd like to take our ability to innovate and expand it to how we interact with our customers to enable them to achieve their goals. I'd like us to move from providing our customers with the best technologies to providing our customers with the best technology solutions.

You've been in the job for two months now. What have you learned and what are your priorities for the rest of the year?

I've learned that Honeywell Turbo Technologies is a great business with more than 6000 dedicated employees. I've also learned that our customers are putting more of a premium on quality than ever before. We will meet their quality challenge… this is an area that we can, and will, do better.

For the near future, I plan on continuing to meet as many of our customers as possible – to learn first hand what they want, how we can improve, and how we can better align ourselves to help our customers win. I'll also continue on the path of innovation, not only in the area of technology, but also in collaboration, manufacturing and servicing. I'm confident that the best is yet to come.

1954 Garrett opens its first turbo manufacturing shop located at East 55th Street, Los Angeles.

1953 Caterpillar tests the first Garrett-developed turbocharger. Garrett® T15 began production in 1954.

Innovation and

THE POWER OF TURBO

It's the technology that helped to change the driving habits of millions of people around the world, that put the "hot" into hot rods, lit up Formula One for 12 glorious years and spawned a global industry. Turbocharging is 100 years young in 2005 - but the dream of its earliest pioneer, Dr Alfred Büchi, has even more resonance in the 21st century than when he first conceived the concept at Winterthur in Switzerland in 1905. Dr Büchi had the vision, aerospace engineers recognized the potential, but automotive manufacturers brought relevance to the technology to millions of car owners and truck users around the globe.

Today the agenda remains performance based, but in 2005 there is a new environment imperative. Here too, turbo has a major role to play in engine downsizing, emissions control and CO_2 reduction. It may be 100 years old, but turbocharging truly is a technology fit for the 21st century.

SCHWEIZERISCHE EIDGENOSSENSCHAFT

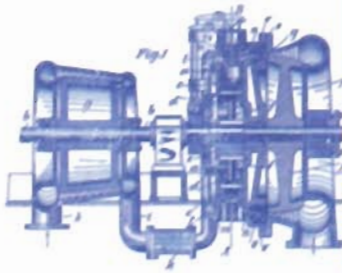
EIDGEN. AMT FÜR GEISTIGES EIGENTUM

PATENTSCHRIFT

Patent Nr. 35259 — Klasse 95

Alfred BÜCHI, in Winterthur (Schweiz).

Kohlenwasserstoff-Kraftmaschine.



First Turbo of 1905

The early days of turbo

In 1905, the chief engineer at Sulzer Brothers Research and Development, Dr Alfred Büchi, patented a power unit comprising an axial compressor, radial piston engine and axial turbine on a common shaft. It was a design innovation that would eventually change the face of performance engine manufacturing forever.

An experimental turbocharger plant was opened at Winterthur in Switzerland in 1911 and, although there was scepticism about Dr Büchi's designs, in 1915 he produced a prototype that demonstrated how the energy generated by the exhaust gases of aircraft could be used to counter the negative effects of diminishing air density at high altitude. While such an innovative design would prove to be highly successful in the future, the initial Dr Büchi prototype failed during testing, unable to maintain adequate boost pressure.

John Clifford Garrett

1955

The Caterpillar D9 crawler tractor, fitted with Garrett® T15, becomes the first American production turbocharged diesel vehicle.

The Caterpillar DW-21 wheel scraper uses the Garrett® T15 together with a pressure-ratio controlled wastegate – regarded as the first wastegate on a land vehicle.

1960

Turbo operatio
opens in Japa

ingenuity

However, in 1919, significant progress was made when General Electric successfully installed a turbocharger in a LePere bi-plane's Liberty engine, which powered the aircraft to an altitude record of 33,113 feet.

Even so, the engineering world did not fully recognize the potential of Dr Büchi's modified development of a separately manifolded 'pulse system' until the Second World War, when thousands of GE units were installed into high-altitude allied aircraft like the B-17 Flying Fortress. The Garrett Corporation, a fledgling company established in 1936 by J.C. Garrett in a small Los Angeles office, supplied all-aluminium intercoolers for these aircraft, a commission that laid the foundations for the development of a global enterprise committed to technology and innovation.

Automotive turbos

The idea of turbocharging engines became common knowledge worldwide during the 1930s partly as a result of compressor race-cars and it was towards the end of this decade, in 1938, that the first turbocharged truck engine was built by the Swiss manufacturer Saurer. Then, in 1953, in what was literally a ground-breaking move, Caterpillar Tractor Co. approached Garrett to help them manufacture higher-horsepower, heavy-duty earthmoving equipment - and the TO2 turbocharger was tested to enormous success. It fulfilled CAT's need explicitly and they commissioned 5000 units for the D9 tractor.

This success prompted the Garrett Corporation to launch the AiResearch Development Division in 1954 – a business dedicated solely to the design and manufacture of turbochargers. It was a significant milestone in the modern automotive turbo era.

AiResearch executives with a component for the Caterpillar D9

THE GARRETT HERITAGE

The name John Clifford Garrett is inextricably linked to the story of turbocharging.

Garrett's passion for engineering and aviation was evident from an early age and in 1928 he became Lockheed's 29th employee. However, he harbored an ambition to run his own aviation corporation and on May 21, 1936, he created the Aircraft Tool and Supply Company (later the Garrett Supply Company) in a one-roomed office in Los Angeles. One year later, with customers totalling 130, the entrepreneur moved his growing business to a new location and by the end of the 1930s, the company's first product, an all-aluminum aircraft intercooler, had been built.

Although only four years old at the outset of WWII, the fledgling company made an impact when Boeing's B-17 bombers were outfitted with Garrett® intercoolers. By the end of the 1940s, post-war planning had paid off with a listing on the NYSE.

The 50s were marked by Garrett's diversification and expansion. The company's aerospace design experience and knowledge supported the development of the firm's land-based business – and soon Garrett became the name synonymous with engine boosting in the automotive sector.

Today, at Honeywell Turbo Technologies, these synergies remain as strong as ever in developing the Garrett® turbochargers of the future. Automotive and aerospace engineers share technical expertise and experience in areas such as aerodynamics and high temperature materials to meet the needs of passenger car and commercial diesel manufacturers in Europe, the US and across Asia.

1962

Oldsmobile Jetfire Turbo Rocket, fitted with Garrett® T05 with integrated wastegate, is the first turbocharged production passenger car.

1964

The merger of Signal Oil and Gas Company and Garrett forms the Signal Companies.

Pressing the accelerator

The Duke of Kent was a high profile visitor at turbo plant in the UK

Turbo goes mass market

If Dr Büchi was the 'father' of turbocharging, Cliff Garrett was the ambitious 'heir' who used his entrepreneurial flair to create mass-market automotive appeal for the technology.

His business was a pioneer in the application of the technology to the production car market. In 1961, the automotive industry took its first tentative steps into the world of passenger vehicle turbocharging when the Garrett® T05 was developed for the Oldsmobile F85, which made its appearance in 1962 alongside the Chevy Corvair (TRW turbo).

The appropriately named Oldsmobile Jetfire had a 3.5 liter aluminum V-8 engine that used a highly complex air and fuel system. Significantly, the engine was high compression, carbureted and contained a complex water-injection that utilized 'Rocket Fluid' – a 50-50 mixture of water and alcohol that was injected between the carburetor and turbo at times of high engine load.

In the commercial diesel arena, turbochargers were soon to be adopted by Deere farm tractors. The Garrett® T04 model found its way into more and more commercial diesel applications as engine manufacturers recognized the mutual benefits of better performance, greater torque and improved fuel efficiency. By the mid 1970s the mass-market turbo era for trucks was well underway – 30 years on and just about every commercial diesel vehicle is equipped with more and more sophisticated turbochargers.

For passenger cars, the 1970s proved to be a turning point for the turbo industry. The Porsche 911 Turbo (KKK turbo with Garrett® wastegate) was unveiled in 1975, but it was in 1977 that the Saab 99 brought the benefits of turbo technology to a wider audience with a 2 liter turbocharged gasoline car that achieved the same level of performance as a normally-aspirated 3 liter engine. This was soon followed by the Mercedes 300 Turbo Diesel, which offered car drivers fuel efficiency and impressive driveability. Buick then announced that the 1978 Buick Regal and Le Sabre sports coupes would be turbocharged.

Over the next 20 years, manufacturers launched model after model of increasingly sophisticated turbocharged passenger cars. Ironically, although the technology was given impetus in the US, the turbo was to have its greatest impact on passenger cars in Europe, where more than 50% of passenger cars are now turbocharged.

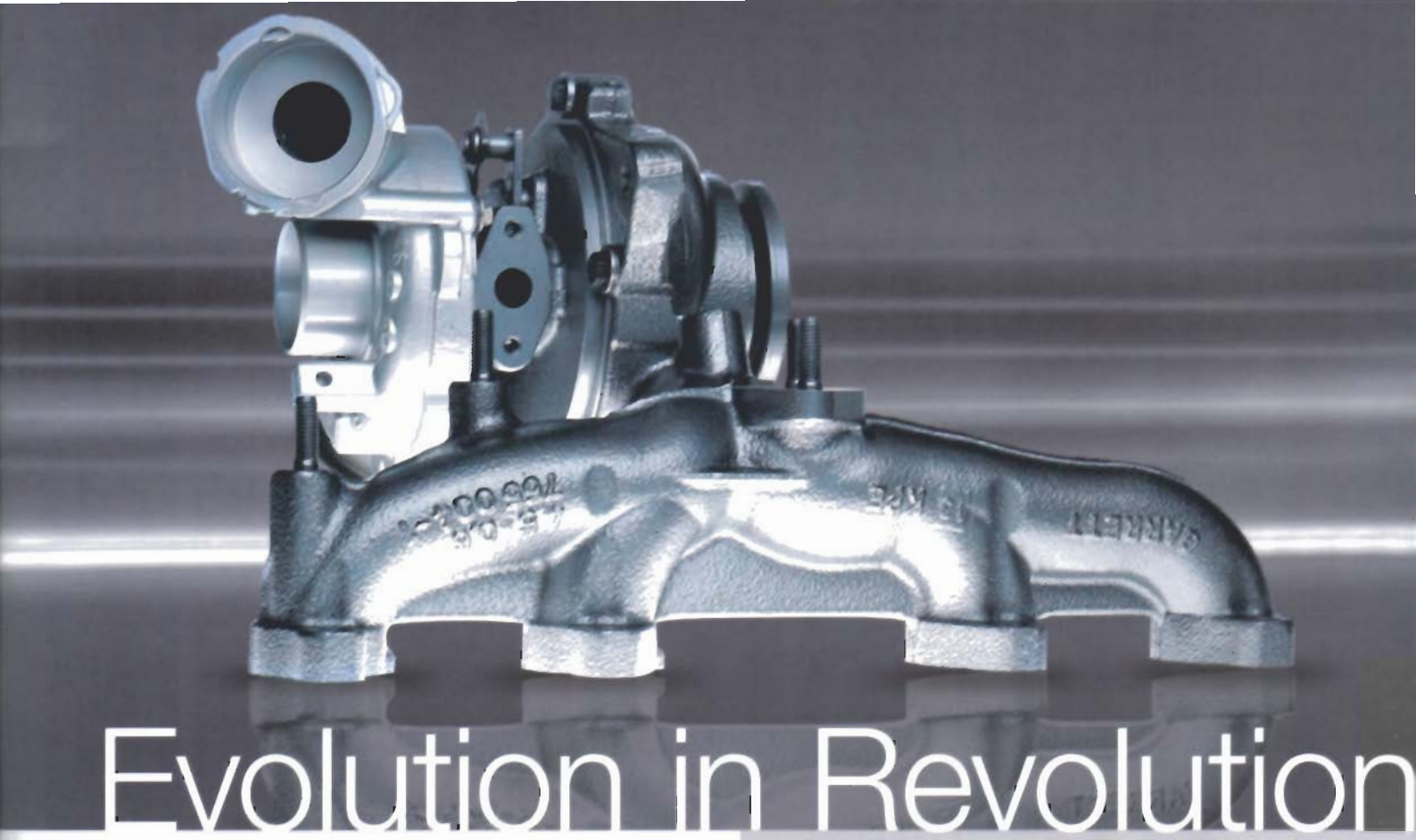
Today, manufacturers around the world look to the technology to help deliver fuel efficiency and to meet the increasingly demanding emissions standards being applied in the US, Europe and Asia.

1966 Turbochargers are first introduced on spark ignition engines at the Indianapolis 500.

1967 

Deere farm tractors select Garrett® T04 turbochargers – the entire tractor industry soon follows suit.

1968



Evolution in Revolution

Smaller, faster, more efficient

Today's automotive turbochargers may have their roots in the aerospace industry – but, in many ways, the engine boosting technologies employed in passenger cars and commercial vehicles actually out-perform their air industry counterparts. For example, the rotating parts of a turbocharger will deliver reliable performance at up to 280,000rpm – speeds much higher than within a jet engine's moving core. Early turbochargers were matched mainly to gasoline powered sports cars with the primary objective of delivering power. Today the focus is fuel efficiency, performance and emissions control in gasoline and diesel engines through advances in aerodynamics, high temperature materials, balancing technologies and bearing systems.

Modern turbos have fewer parts, are smaller, spin faster, offer variable flow solutions, work at pressure ratios of around 2-2.5:1 for gasoline and 4-6:1 in diesel engines and are fully interconnected with the engine management system through the latest sensing technology and electronic actuation. Boreless and threaded bore compressor wheels produce high and ultra-high boost pressure, while high capacity, low loss thrust bearings enhance performance and durability.

Turbo technology has had a huge impact on the torque curve of a modern 1.9 or 2.0 liter diesel engine, to the point where massive amounts of torque are available from very low engine rpm, making for a relaxed, responsive, but fuel efficient, passenger car driving experience.

Forty years on – how do they compare?

Turbocharging took its first steps into mainstream motoring with the 1962 Oldsmobile F85 Jetfire Turbo Rocket. So how does the original Garrett® T05 compare with a modern turbo such as the Garrett® GT2560 found in the Ford RS Focus?

Modern turbochargers help engines to provide much higher specific output – 107hp/liter for the Ford RS Focus compared to 61hp/liter for the Oldsmobile Jetfire. Today's turbos are lighter in weight, benefit from better aerodynamic design (which optimizes flow pressure ratio and efficiency), operate at higher temperatures and provide better integration into the powertrain system. As a result, while the turbocharged Oldsmobile Jetfire provided 16% performance enhancement compared to its non-turbo version, the boosted Ford RS Focus delivers an impressive 50% increase.

	1962	2002
Turbo model	**T05**	**GT2560**
Car model	Oldsmobile Jetfire	Ford RS Focus
Engine cylinder	V8	4
Engine size	3.5L	2L
HP	215	215
Peak compressor efficiency	58% at 1.5:1 and 12lb/min	>78% at 2.0:1 and 20lb/
Maximum speed	90,000rpm	146,000rpm
Weight	25lb	15lb

1970 The first European Turbo production center opens in the UK.

1973 "Oil Shock" plays a major role in accelerating the adoption of turbocharging in the US and Europe.

Bobby Unser is the first winner of the Indianapolis 500 in a turbocharged car – the Garrett® TE06 boosted 2.75 liter Offenhauser.

John Clifford Garrett

New Garrett Supply, Phoenix, AZ, 1955

Garrett workers with a turbo turbine wheel (1950s)

CREATING A CULTURE OF SUCCESS THROUGH TECHNOLOGY

The Garrett

John Cazier embodies the spirit that has made Garrett® one of the most famous names in turbocharging history.

When he joined the Garrett Corporation at the age of 25 in 1950, the company was firmly established in the aircraft industry. The young Cazier intended to stay a couple of years as an engineer before moving into the oil tool business… but he ended up presiding over the global expansion of a company that became synonymous with automotive turbo technology.

Says Mr. Cazier: "Even in those early years, Garrett Corporation was an extremely exciting place to be – we were working on gas turbine technology that was world leading. You had the sense that this was a special company."

Garrett Corporation's – and John Cazier's - first steps into the automotive arena came in 1952 when, as one of just four engineers, he was assigned to collaborative research with Caterpillar on turbocharging their earth-moving vehicles. Out of this program came the Garrett® T02 prototype, later to sell in the thousands as the T15. Its success prompted Garrett Corporation to launch the AiResearch Industrial Division – a business unit dedicated to turbocharging systems.

What stood out for John Cazier about the company, even in these early days, was its culture and entrepreneurial spirit.

"Every manager was an engineer, which meant that customers dealt directly with people who understood the technical issues and delivered solutions. This, together with the entrepreneurial spirit engendered by Cliff Garrett, made for a really exciting environment. People were encouraged to make things happen."

In 1967, Cazier assumed overall responsibility for US operations and helped with the opening of the company's first European production center in Skelmersdale, UK.

The upward curve for Garrett Corporation's automotive business coincided with changes in the economic climate in the 1970s. The 'Oil Shock' and the resulting fuel standards in US led to considerable enthusiasm for turbocharing in the US and Asia.

"We realized, however, that it was in Europe, where fuel was relatively expensive, that future growth would be significant.

And so it proved to be. By the mid 1970s, the turbo evolution was underway in the

1974 Turbo operation opens in Brazil. T04B marks the beginning of the mass market turbo era in Europe for trucks and commercial engines.

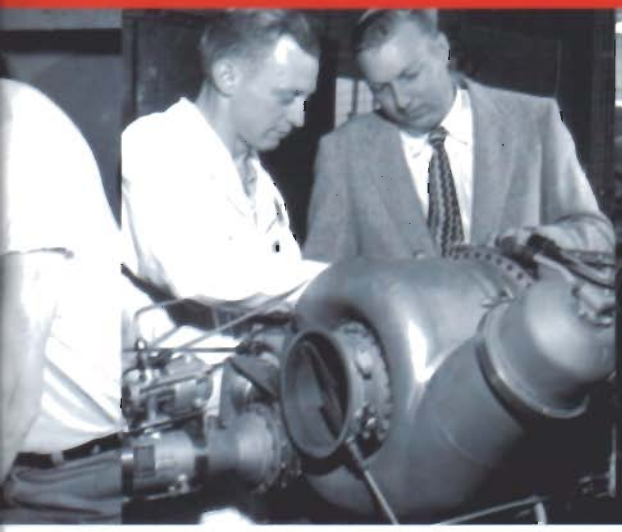
1977

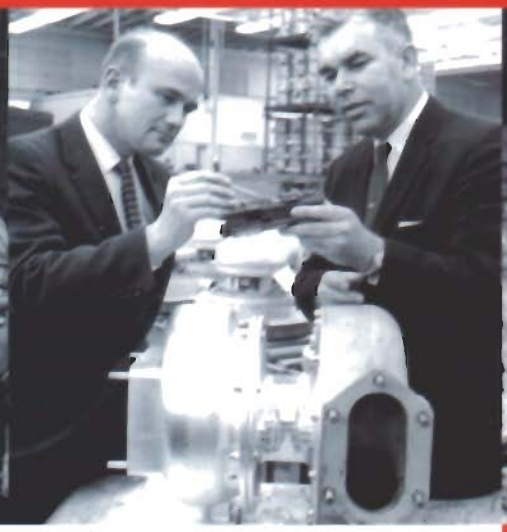
Saab unveils a 2 liter ga… line turbocharged engin… featuring the Garrett® T…

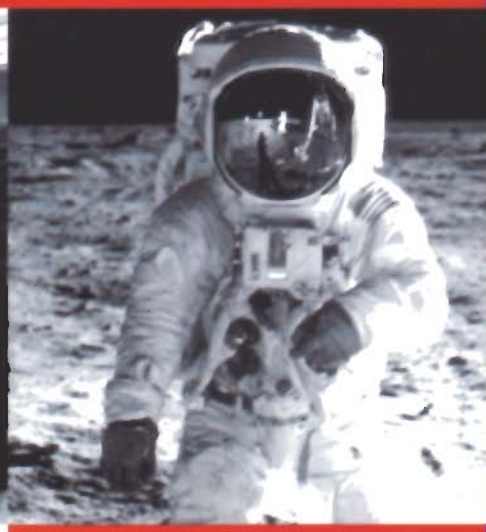
The new 120hp GTCP85-1 lightweight gas turbine APU (1953)

Union Pacific diesel locomotives use Garrett® turbochargers.

AiResearch gimbal drive actuator helped change landing spot on moon surface.







Legacy

commercial diesel sector and soon it was followed by dramatic turbo growth in passenger cars. Turbo was still associated with upmarket gasoline passenger cars, but all that changed in 1978 when Mercedes selected Garrett® turbo for its 300 Turbo Diesel.

"We knew that turbocharging would be a key enabler of the diesel passenger car – it was obvious. As a company, we were ideally placed because we had the reputation, the technology and the critical mass to maximize the opportunities. Our aerospace heritage and expertise enhanced customer confidence in our capability."

Garrett Corporation continued its worldwide push with new centers in Brazil, Japan, France, Ireland while continuing its US expansion. The rest, as they say, is history. Today, as part of Honeywell, the Turbo Technologies business employs more than 6,000 people… a remarkable success story that started with just four engineers assigned to work on turbocharging.

For John Cazier, there was no single breakthrough that made 'the difference' for the turbo business at Garrett Corporation. Rather, progress was continuous. From achieving high component efficiencies to the development of wastegate and then variable nozzle control technologies; from development of pulse turbines to multi-staging for diesels; from metallurgical advances to system innovations… all delivered benefits at critical moments and all contributed to the company's success.

"Above all else, I suppose I'd put our success down to our technology and business culture. From the outset in 1952 we were ahead in crucial technologies… but we also had a vision for the future and worked harder to find solutions that were best for the job and cost effective for our customers."

GARRETT & TURBOCHARGERS.

The 1950s marked Garrett Corporation's diversification and expansion into the automotive sector. The T15 turbocharger was developed for the Caterpillar Company and was followed by an order for 5,000 units - leading to the formation of the AiResearch Development Division.

In 1963, Garrett merged with Signal Oil and Gas Company. In 1985, the Allied Corporation and the Signal Companies merged to form AlliedSignal.

In the 90's, Garrett Engine Boosting Systems, a division of AlliedSignal, experienced continued growth in its turbo business, and in 1999 it became part of Honeywell after the merger of AlliedSignal and Honeywell.

In 2004, recognizing the synergies between Turbo and other Honeywell divisions, the business formally became Honeywell Turbo Technologies, with the Garrett® name applied to the turbocharger product range.

1978

The Daimler Benz Mercedes 300 Turbo Diesel is launched with the Garrett® T03 wastegate turbo.

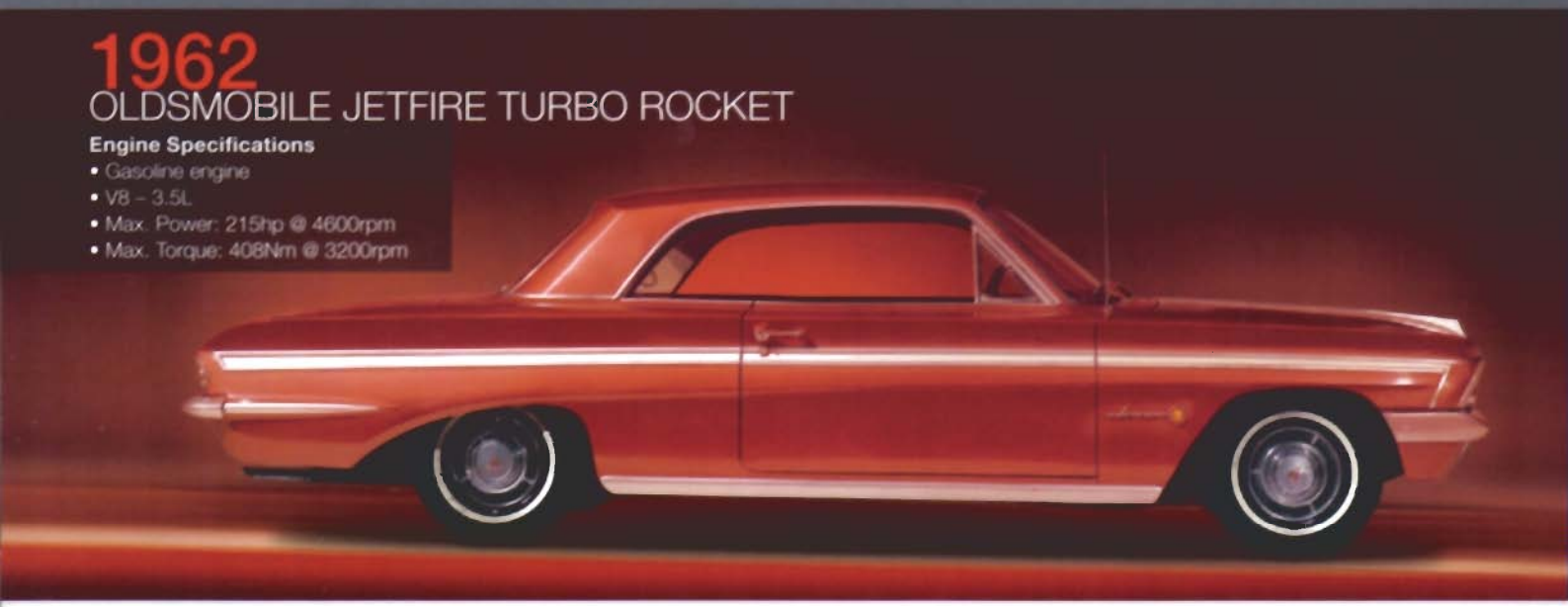
The Renault 2.0 liter Alpine is the first Garrett® boosted car to win the 24 Hours of Le Mans classic auto race.

Renault ushers in the turbo era of Formula One, being the first to race a turbocharged 1.5 liter engine boosted by Garrett® turbo.

Landmark Vehicles

1962
OLDSMOBILE JETFIRE TURBO ROCKET

Engine Specifications
- Gasoline engine
- V8 – 3.5L
- Max. Power: 215hp @ 4600rpm
- Max. Torque: 408Nm @ 3200rpm



What a fitting name for the world's first turbocharged production car. Developed in conjunction with Garrett, Oldsmobile revised its 3.5 liter V8 platform to create the Jetfire Rocket, matched to the Garrett® T05 turbo. Responsive performance, particularly in the midrange, was a prime objective, so Oldsmobile used a static compression ratio that was (and still is) remarkably high. In order to avoid detonation, a 50:50 mix of distilled water and methyl alcohol had to be injected between the carburetor and turbo at times of high engine load.

Turbo Fact File
The Garrett® T05 was the first turbocharger developed for a production passenger car. Features of the turbocharger included a turbine wheel that had a deeply scalloped back disc for minimum rotational inertia and a compressor housing with a water jacket to receive heated engine water that enabled better fuel vaporization and quicker warm-ups. The compressor output was controlled by an exhaust wastegate set for a maximum 5psi (0.34bar) boost.

1955
CATERPILLAR D9

The collaboration of Garrett on the 56,000lb (25,401kg) Caterpillar D9 crawler tractor in 1954 is widely regarded as marking the beginning of the turbocharged era for the automotive industry. The D9, with 474hp of gross power and an operating weight of 49 tons, was one of the most popular large track-type tractors in the world, as a result of its size, durability, reliability, and low operating costs.

Turbo Fact File
The very first Garrett® production turbo – the T15 – conformed to the basic aerodynamic and operating principles of the T02, the first Garrett® experimental unit. However, the T15 featured a much simplified design by omitting such T02 features as the elaborate labyrinth step seals and the shims. The T15 set the standard and provided the template for further developments in turbocharger design and metallurgy.

1967
JOHN DEERE TRACTOR

In the spring of 1965, John Deere made a major commitment to turbocharge its first 6.6 liter, 6 cylinder diesel engine to deliver the performance being sought by agricultural customers. Diesel tractors were commonplace, but John Deere recognised the superior power that turbo technology would deliver and worked with Garrett in the expectation of driving sales volumes.

Turbo Fact File
The Garrett® T04 introduced Garrett's innovative, superior meridionally divided pulse turbine. The turbo was also the first to use a "slip fit" compressor wheel, whereas previously all compressor wheels were an interference fit and had to be heated for assembly onto the stub shaft. Maximum mechanical efficiency was obtained in the T04 by holding frictional losses to a minimum through a balanced design. In 1970, the unit was superseded for new applications by the T04B.

1978

Turbo foundry and part machining facility opens in Waterford, Ireland.

Renault unveils the famous gasoline turbocharged R5 – the first of a long era of gasoline turbo engines.

Buick begins production of world's first V6 turbocharged car, boosted by Garrett® T03 wastegate turbo.

1979

The story of turbo is one of technological innovation and of partnership with automotive manufacturers. So how better to demonstrate the role that turbocharging has played in the development of passenger cars and trucks than by showcasing some of the vehicles that have made their mark on the world over the last 50 years.

1977
SAAB 99 TURBO

Engine Specifications

- Gasoline engine
- 4 cyl - 2.0L
- Power - 145hp @ 5000rpm
- Torque - 236Nm @ 3000rpm

The Saab 99 Turbo ushered in a new dimension in passenger vehicle motoring. Turbocharging was no longer just for sports cars – here was a vehicle that brought the advantages of the technology to a much wider audience. The original Saab 99, introduced in the 70s, was a comfortable, cruising saloon car but the 99 Turbo, with its Garrett® T03 turbocharger, increased power by 23 per cent and torque by a significant 41 per cent compared to the injected 2-liter model. Saab was the first passenger vehicle manufacturer to embrace turbocharging as a mainstream technology.

Turbo Fact File

The Garrett® T03 turbo was free floating with a separate wastegate, controlled by turbine inlet pressure. The backward curved compressor wheel blades increased the operating range, while the turbine wheel blade shape was based on the wheel that powered the first vehicle on the moon! The advanced aerodynamics gave improved low speed torque and increased rated power.

1977
MERCEDES 300TD

In 1977, the Mercedes 300TD brought the benefits of turbo diesel engines to Europe and beyond. The performance of the 300TD played a significant role in winning consumer acceptance of turbo as a technology of the future. The turbo extended the use of diesel engines to the S Class, the high-end car segment.

Turbo Fact File

The Garrett® TA03 was the first mass production turbo for diesel engines in Europe. The turbo used an internal wastegate valve and benefited from the first application of D5S Niresist high temperature alloy turbine housing material.

1980

Pontiac Firebird Trans Am begins production of V8 car with Garrett® T03 wastegate turbo.

The gasoline Volvo 240GL is introduced with Garrett® T03 wastegate turbo.

Peugeot launches the 604 diesel turbo, driving the broad adoption of diesel turbo engines by a major diesel technology pioneer.

Turbo production facility opens in Thaon-Les-Vosges, France.

A Garrett® turbocharged Saab 99, driving by Stig Blomqvist, is the first turbocharged car to win a world rally event.

Landmark Vehicles

1979
PEUGEOT 604 TURBO D

Engine Specifications
- Diesel engine
- 4 cyl - 2,3L
- Power : 80hp @ 4150rpm
- Torque : 184Nm @2000rpm

The Peugeot 604 set the scene for the rapid penetration of turbo diesel technology into mainstream mass market motoring. In fact, such was the impact of the Peugeot 604 and its sister, the 505, in terms of fuel efficiency and performance, that the vehicles were extremely popular in Europe. For many people, the 604 became the first experience of just how responsive a 'modern' turbo diesel could be.

Turbo Fact File
The 604 turbodiesel engine was fitted with a swing valve T03 turbo with integral wastegate on 2.3 liter diesel engine. The turbo was developed with lower cost SiMo turbine housing material and helped to establish turbo diesel as the base technology for high volume production engines.

1978
RENAULT 5 TURBO

The Renault 5, unveiled in 1978, acquired cult status with the arrival of the turbo model. The car featured aluminium body parts and was widely viewed as the first small sports car. It certainly lived up to its turbo 'tag' with its tremendous output via the Garrett® T03 turbo, and led the way in winning numerous race titles.

This application led to the broad adoption of gasoline turbo engines at Renault and created the pathway to the popular Renault R5 Alpine (aspirated carburetor) and later the Renault 18, Renault Fuego, Renault R5 GT turbo, Renault 25, Renault 21and many other later turbo gasoline applications.

Turbo Fact File
The Garrett® T03 turbo was optimized to provide the first high output small engine (1.4L) with the high boost required to achieve 160hp at 6000rpm and torque of 214Nm at 3250rpm.

1982

The Garrett® T2 is developed for passenger car engines generally less than 2.5 liter.

Rolls Royce launches the first Bentley Mulsanne Turbo – a 6.75 liter gasoline engine using a single Garrett® T04B turbocharger together with a Normalair-Garrett® separate wastegate.

1984

Peugeot launches its groundbreaking 2[illegible] T16 at World Rally boosted with a Garre[illegible] turbo with an air-to-air intercooler.

1980
PONTIAC FIREBIRD TRANS AM

Engine Specifications

- Gasoline engine
- V8 – 4.9L
- Power – 210hp @ 4000rpm
- Torque – 468Nm @ 2000rpm

With fuel economy a primary concern, Pontiac turned to turbocharging for Trans Am and formula power during the 1980 model year. Pontiac selected the Garrett® T03 to help power the V8 turbocharged production car in 1980 – a vehicle in which drivers could experience the acceleration available through turbo technology. The net output of the turbocharged engine was 210hp at 4000rpm, with torque of 468Nm at 2000rpm.

Turbo Fact File

Pontiac, for its 301 engine, selected Garrett® TB305, similar to T03 used in the Buick and Ford engines. As in Buick and Ford carbureted engines, a "draw-through" design turbo installation compressed an air-fuel mixture between the carburetor and the intake manifold.

1987
BUICK REGAL GRAND NATIONAL GNX

The 1987 Buick Grand Nationals, the last of Buick Grand Nationals, have become quite collectible since only 547 of them were reportedly produced. One of the modifications made to the engine was the inclusion of a more efficient Garrett® air-to-air intercooler. The engine produced more than 275hp and 488Nm of torque, representing a highlight in the history of Buick V6 engines.

Turbo Fact File

The Garrett® T03 featured a very lightweight ceramic turbine wheel, which allowed for faster response during acceleration of the engine. For additional efficiency, the ceramic turbine wheel T03 incorporates low-drag, dynamic turbine shat seals and a built-in contamination trap. The turbocharger also used an electronic wastegate with maximum boost set at 15psi (1.02bar).

1985 Aftermarket turbo production facility opens in Cheadle, UK. The turbocharged 1.6 liter VW Golf TD takes the automotive market by storm. Allied Corporation and the Signal Companies merge to form AlliedSignal, Inc.

Ford, Chrysler, Dodge, Plymouth and Pontiac launch cars featuring the first turbocharged systems combined with electronic sequential multi-point fuel injection.

1986 Turbo production facility opens in Kodama, Japan.

Landmark Vehicles

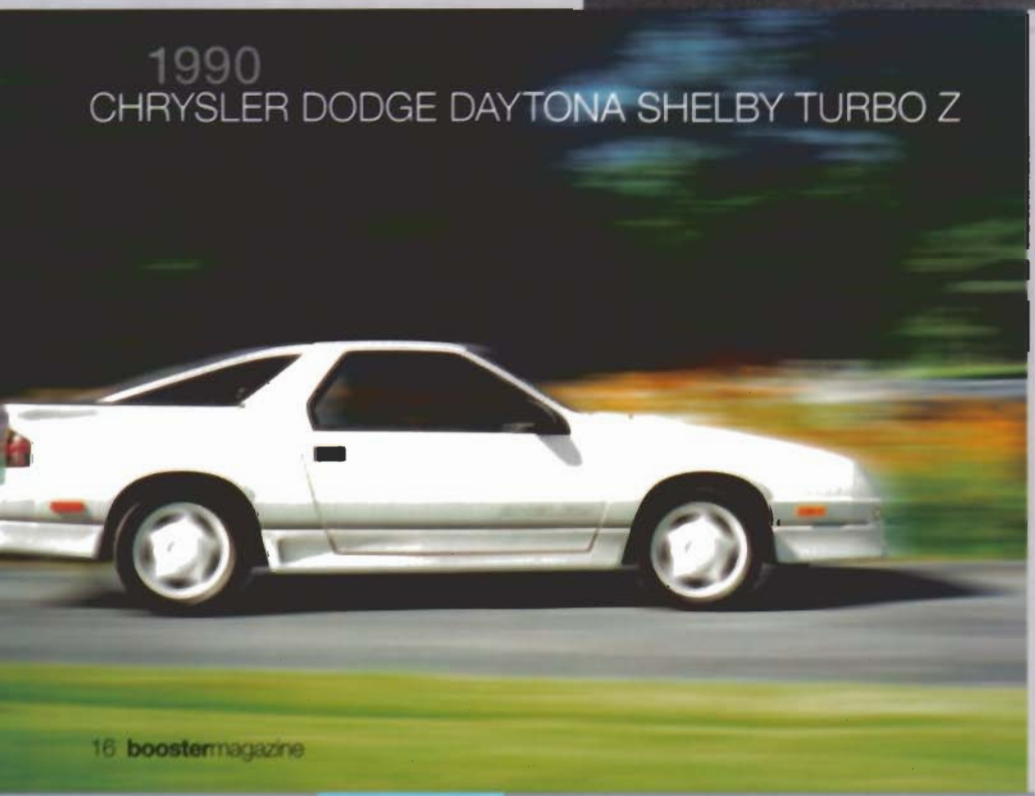
1991
FIAT CROMA

Engine Specifications
- Direct injection diesel engine
- 1.9 L – 4 cylinders
- Power : 90hp @ 4200rpm
- Torque : 190Nm @ 2500rpm

A true landmark vehicle in every sense of the word – the Croma witnessed the introduction of an entirely new concept in automotive turbocharging… the Variable Geometry Turbine (VGT). Garrett® Variable Nozzle Turbine (VNT™) technology was quickly adopted by many car manufacturers and heralded a new era in the story of turbo. This FIAT application matched high pressure direct diesel injection with VGT to enhance performance of the 1.9 DI engine – a combination that has become an industry standard.

Turbo Fact File
The Garrett® VNT™ technology created an automotive industry breakthrough of the 1990s, making it easier for car manufacturers to fully deploy the torque and fuel economy advantages of direct injection diesel engines. The system was unique in that it involved the use of a turbine housing that changed its internal configuration to adapt to variations in the engine's air boost requirements. VNT™ technology enabled the turbocharger to supply greater engine boost at lower speeds than a smaller unit, while matching the performance of a larger turbo at higher speeds.

1990
CHRYSLER DODGE DAYTONA SHELBY TURBO Z



Since its inception in 1984, the Daytona Turbo Z was Dodge's performance flagship. For the 87 model year, performance fans were pleased by the introduction of the new model: the Daytona Shelby Z. In 1990, Shelby Turbo-Z introduced Garrett® VNT™ technology with its Turbo IV engine. The production of Turbo IV engine ended in 1992.

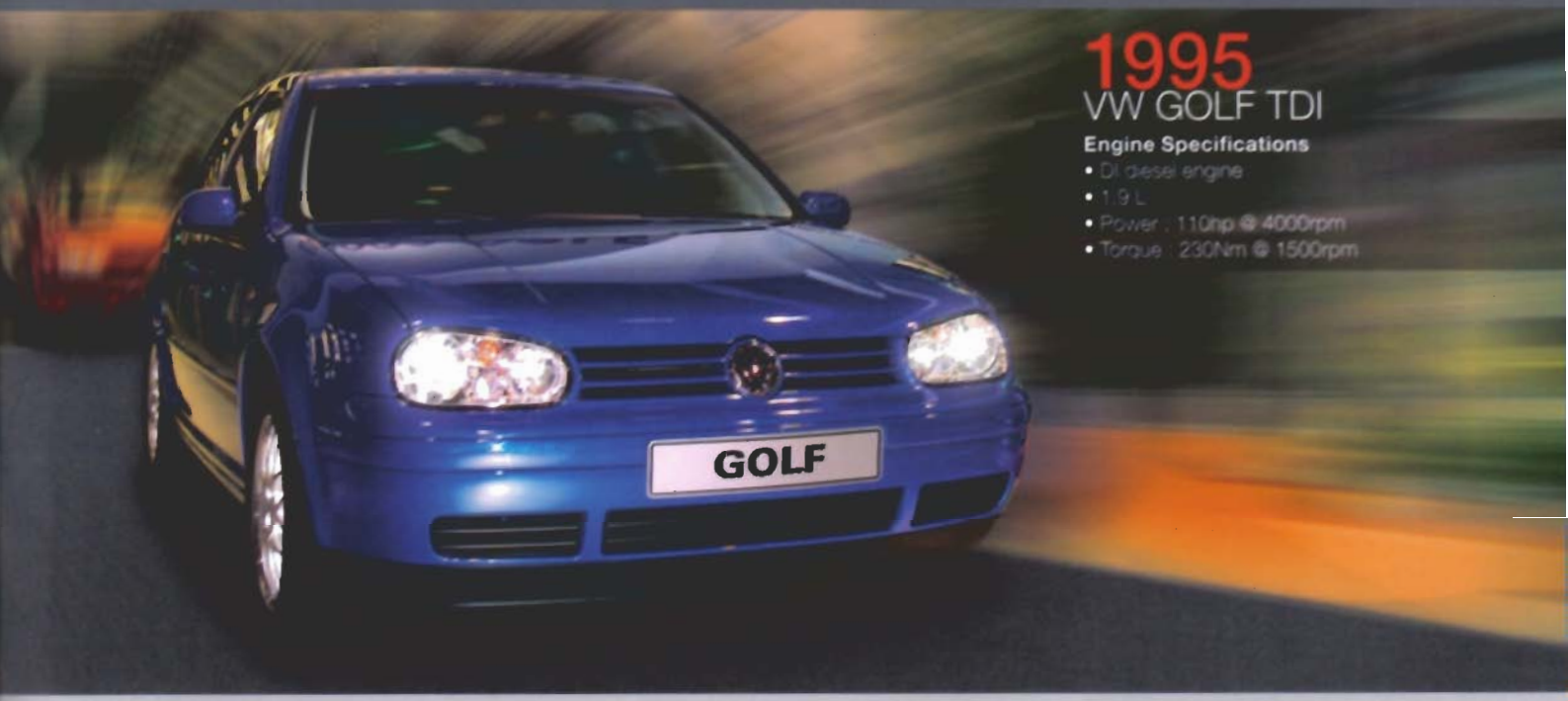
Turbo Fact File
This is the world's first VNT™ turbo on a production car. While the 2.2L Turbo IV engine made the same 174hp as the Turbo II engine, the revolutionary Garrett® VNT™ technology decreased the turbo spool-up time, and helped eliminate "turbo lag."

1987

Buick introduces Regal Grand National GNX using Garrett® Ceramic Turbine Wheel T3/T4 wastegate and intercooler.

Lancia wins the first of a record six consecutive World Rally Manufacturers' Championships, all boosted by Garrett® turbos. The first was a Lancia Delta HF 4WD.

1988



1995
VW GOLF TDI

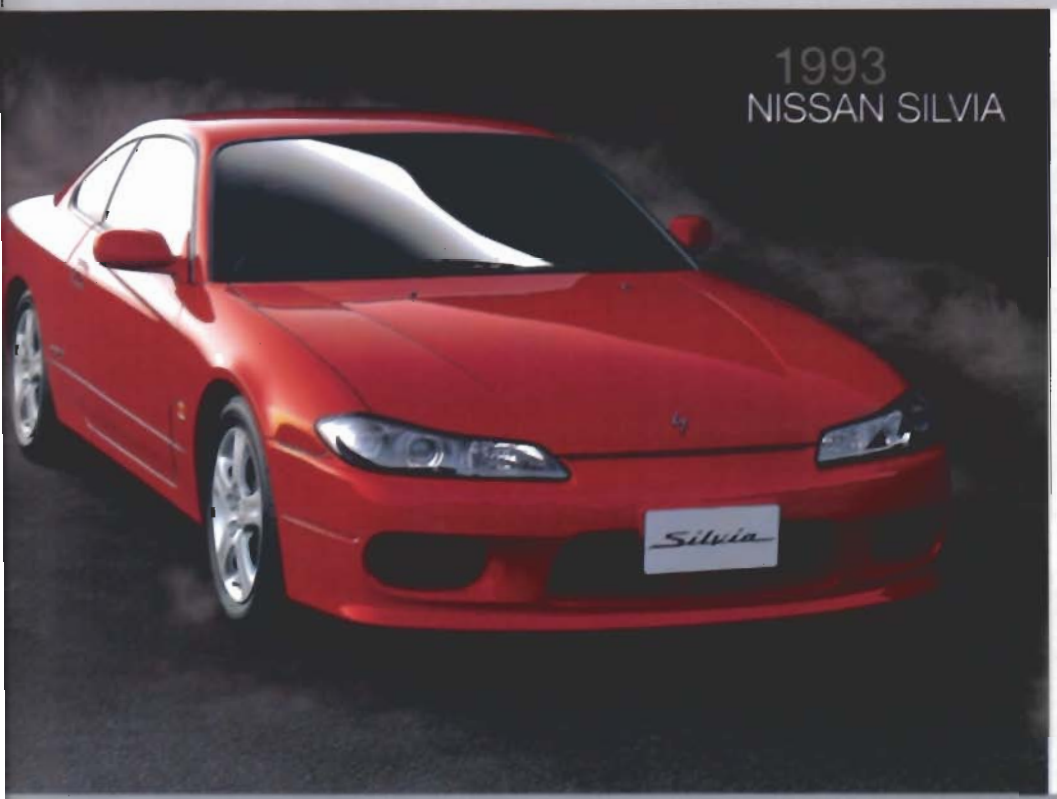
Engine Specifications

- DI diesel engine
- 1.9 L
- Power : 110hp @ 4000rpm
- Torque : 230Nm @ 1500rpm

This vehicle heralded the arrival of the famous TDI era and revealed the huge potential of matching a Garrett® VNT™ turbocharger with a direct injection diesel engine. In 1995, the Volkswagen-Audi 1.9 liter direct injection diesel engine, complete with Garrett® VNT™ Multivane™ turbo, was unveiled at the Frankfurt Motor Show. The Golf TDI went on to play a significant role in the dieselization of Europe. VNT™ technology, by improving engine back pressure, was delivering major gains in torque and power - and the major automotive manufacturers immediately recognized the huge significance.

Turbo Fact File

The GT15S was the first example of a small turbo platform with monobloc bearing concept.The VGT technology, matched to the direct injection diesel engine, succeeded in uprating the power output from 100hp to 110hp whilst lifting the torque from 170Nm to 230Nm.



1993
NISSAN SILVIA

In 1993, Nissan launched the first Garrett® ball bearing turbocharger on the Silvia S14 2.0L engine. The ball bearing turbocharger delivered improved response and proved itself highly durable both in this model and in the later S15. In fact, the Silvia became the most popular import vehicle on the Australian performance scene. The ball bearing technology was also applied to later performance flagship vehicles, including the Nissan Skyline GTR.

Turbo Fact File

Garrett® ball bearing turbochargers are frequently used in the high performance aftermarket and are much in demand in race cars. The technology provides a significant reduction in friction by replacing the rubbing with a rolling mechanism, which results in a faster response during the rev-up of the engine. A ball bearing turbo requires less than half the oil flow of a normal turbo, helps emissions reduction while offering greater thrust capacity.

1989

Turbo production facility opens in Ansan, Korea.

Nissan Diesel adopted Garrett® TD 4501 turbo as the world's first VNT™ volume production turbo on its 12.6-liter for heavy-duty trucks.

Nissan Motors introduces the Garrett® Ball Bearing T2 on its gasoline engine for its Silvia model.

Nissan adopts Garrett® ball bearing technology with a T04S turbocharger in the IMSA (International MotorSport Association) GTP Championship. Nissan won the championship from 1988 to 1991.

Landmark Vehicles

2004
BMW 1 SERIES

Engine Specifications
- Diesel engine
- 4 cyl – 2.0L
- Power: 163hp @ 4000rpm
- Torque: 340Nm @ 2000rpm

In 2004 the BMW 120d set new standards in delivering more power, more torque, higher maximum speed, greater acceleration and better fuel economy in its segment with the introduction of third generation VNT™.

Turbo Fact File
The third generation Garrett® VNT™ uses a cartridge that it fixes the VNT™ mechanism onto the bearing housing through an 'elastic' shroud. This new design spawned several high performance innovations - a new vane shape, a new generation turbine wheel and better controllability... all combining to deliver 130% of second generation VNT™ boost levels at just 90% of back pressure. In addition, because the VNT™ cartridge doesn't use the turbine housing as a mechanism holder, this housing can now be made out of sheet metal, which is lighter in weight and provides a faster catalytic light-off.

1999
BMW 7 SERIES

In 1999, the BMW 7 Series included the first bi-turbo V8 diesel engine to target the luxury car segment, with performance that fulfilled the powertrain expectations of this market and created closer alignment at the high end between gasoline and diesel engines.

Turbo Fact File
High performance was delivered by twin Garrett® VNT™ turbochargers with Rotary Electric Actuator (REA). The REA provided fast and accurate position control of the vane mechanism, to ensure balanced boost and optimum backpressure settings.

1989

Nissan Skyline GT-R 2.6 liter 6 cylinder inline engine is equipped with twin Garrett® TE 2701 turbos with ceramic turbine wheels.

1990

The intercooled Chrysler Dodge Daytona Shel Turbo-Z is the first car to utilize Garrett®'s VNT turbocharger with electronic boost control.

2002
FORD F 250/F 350

Engine Specifications

- Diesel engine
- 6-L V8 (7.3L before 2002)
- Power: 325hp @ 3300rpm
- Torque: 773Nm @ 2000rpm

The popular Ford F250 and F350 super duty trucks are equipped with Power Stroke diesel engines. The Power Stroke engine incorporates advanced diesel air and fuel system technologies from International Truck and Engine Corporation to increase performance and provide an improved driving experience for Ford F-Series pickup trucks and Excursion SUV owners.

Turbo Fact File

Due to more demanding performance and emissions requirements, the GTP38 wastegate turbocharger replaced the TP38, a free-floating turbo, on the Power Stroke engine. The design, together with charge-air cooler, provided improved torque, which resulted in better driveability. Beginning in 2002, Honeywell Turbo Technologies introduced its GT37 AVNT™ turbo for the Power Stroke engine, featuring a fully self-contained actuation system, and successfully adapted Garrett® VNT™ technology for the light-duty truck application.

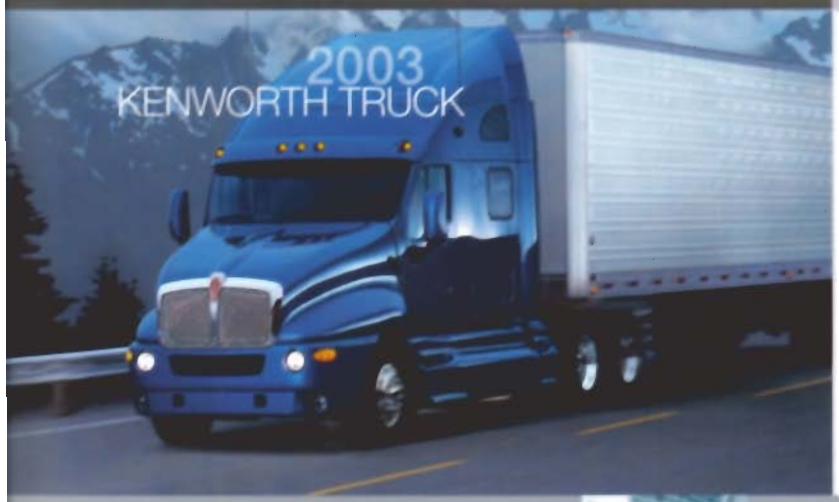
2000
NABI BUS

The NABI bus is powered by the Detroit Diesel Corporation (DDC) Series 50 engine, which was designed with emissions control as a major objective and was launched in 2000. The power unit featured both exhaust gas recirculation (EGR), which minimizes NOx emissions, and double axle VNT™ technology, which helps to optimize fuel efficiency.

Turbo Fact File

Garrett® GT40V double axle VNT™, specially designed for heavy-duty diesel applications, uses 15 turbine nozzle vanes that are supported by twin axles. The patented pressure balancing is a key feature that minimizes vane side loading during operation. The nozzle vanes are positioned via a high pressure pneumatic actuator controlled by an electropneumatic regulator, which continuously meters high pressure air from the vehicle air brake system.The GT40V was also fitted with a high pressure-ratio boreless compressor set and a speed sensor for control purposes.

2003
KENWORTH TRUCK



In 2003, Kenworth T2000 set new standards in aerodynamics and performance. The truck featured Caterpillar's Advanced Combustion Emissions Reduction Technology (ACERT) - a system's approach to reducing NOx and particulate matter that included Garrett® dual-stage series turbocharging.

Turbo Fact File

In dual stage turbocharging, fresh air is drawn into the first stage compressor, where its pressure is raised about 2 to 2.5 times. It is then drawn into the second stage compressor, where air pressure is further raised 2 to 2.5 times. The air is then cooled and the resulting charge air at the engine's intake manifold is typically 4 to 6 times that of atmospheric pressure.

1991 Turbo production facility opens in Atessa, Italy.

FIAT puts a VGT turbocharger in the Croma, matching it to a 1.9 liter direct-injection diesel engine.

1992 Caterpillar is the first adopter of Garrett® boreless compressor technology for its 3406 on-highway truck engine.

Podiu

TURBOCHARGING TAKES THE CHECKERED FLAG

The potential of turbocharging in the racing environment was recognized as early as the 1920s and 30s when compressor cars, which used supercharger technology, competed against each other.

Today, turbo helps to turn power into podium positions, puts the heat into hot rods and delivers enduring success at some of the most famous race events in the world. Rev up and enjoy the ride...

Formula One

It's recognized as one of the most exciting eras in racing – and it was Renault that sparked the 'Turbo Revolution' in Formula One. In 1966, the Formula One rules were amended to allow an increase in allowable displacement of naturally aspirated engines from 2.5 to 3.0 liters. A provision was implemented for supercharged engines with a maximum displacement of 1.5 liters. But it took another 11 years before Renault developed the potential of turbocharging. Having seen the success of the Garrett® turbocharged 2.0 liter Gordini V6 in the European F2 Championship, the company raced it at the 24 Hours of Le Mans in 1977.

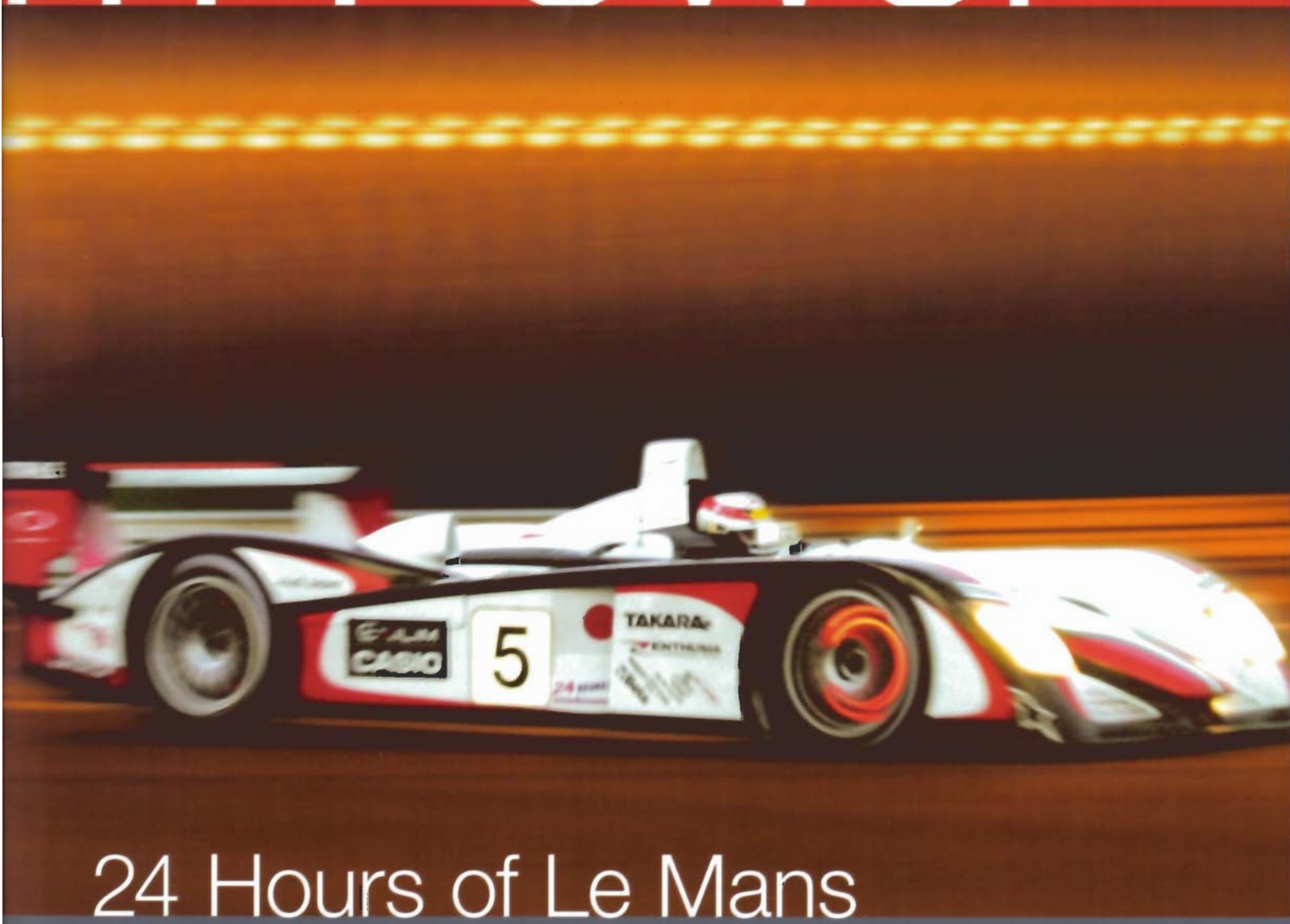
Renault won the Le Mans classic in 1978 at their second attempt with Jean-Pierre Jabouille and Didier Pironi at the wheel. Gaining from this experience, Renault reduced the stroke of the Le Mans engine to bring the displacement to 1.5 liters as required by F1 rules, added a single Garrett® turbocharger... and the rest is history as the company ushered in the 'Turbo Revolution'. Renault won its first F1 race in 1979 with Jean-Pierre Jabouille, the 1978 LeMans winner, piloting. Following Renault's success, Ferrari, BMW, Porsche, Honda, Ford, Alfa Romeo and others developed turbocharged engines for F1 in the 1980s. At the end of the turbo era in Formula 1, the power of engines was exceeding 1000hp, which meant more than 670hp/liter.

1994 Toyota sets the overall record at the Pike's Peak International Hillclimb, finishing the 12 mile (22km) course that rises from 2900 meters to 4300 meters of elevation in 10 minutes 4.06 seconds in a Garrett® ball bearing T04S boosted Celica driven by Rod Millen.

1995 Turbo production facility opens in Pudong, Shanghai.

The VNT™ Multivane™ is developed for the Volkswagen Audi 1.9-liter direct injection diesel engine. This engine configuration revolutionizes the TDI reputation.

m Power



24 Hours of Le Mans

It's the classic event where performance meets endurance – and it's been made all the more compelling as a result of turbocharging. Porsche and Renault were the first teams to achieve success with turbocharged engines at the 24 Hours of Le Mans classic auto race. While Porsche was first to place a turbocharged car in the top ten, finishing second in 1974 with their KKK boosted 2.1 liter engine, Renault had a three year program culminating in an overall race win in 1978 with the Garrett® boosted 2.0 liter V6 Alpine. The Porsche turbo went on to dominate the 24 Hours of Le Mans event, winning an incredible ten times in twelve years from 1976 through 1987. This demonstrated that turbocharged engines were viable in endurance racing not only in terms of performance, but also for reliability and fuel efficiency. Porsche won four more times between 1994 and 1998. But 1999 ushered in the "The Audi Years", finishing 3rd and 4th at their first attempt. The Volkswagen Automotive Group went on to take all the podium positions at Le Mans from 2000 through 2004. All placements were with the Audi 3.6 liter twin Garrett® boosted V8 other than the Bentley 4.0 liter twin Garrett® boosted V8 (built by sister company Audi Sport), which finished 1-2 in 2003.

1997 The first Garrett® ball bearing turbo for commercial diesel makes its debut on Nissan Diesel PF6T engine.

1998 International adopts Garrett® GTP38 wastegate on its 7.3L Power Stroke engine, which is installed in Ford F250 and F350.

Turbo productions facility opens in Bucharest, Romania.

Podium Power

Twenty years after winning the 1979 Indianapolis 500 in a Penske PC8 with a Garrett® T06 turbocharged Cosworth engine, Rick Mears drove the same car at a historic race car parade at the 1999 Marlboro 500 at California Speedway in Fontana, California.

Indy Car

In 1968, Bobby Unser became the first driver to win the Indianapolis 500 with a turbocharged spark ignition engine, setting in train an era that would see 'turbo' dominate for the next 28 years. Although the first turbocharged spark ignition engines qualified for the Indy 500 in 1966, when three 2.75 liter 4-cylinder Offenhauser engines with Garrett® TE06 turbochargers made the starting line-up, Unser's success blazed a trail that would span four decades. Fourteen of the 29 turbocharged wins in the Indy 500 were with Garrett® turbochargers, when some of the most famous names in the history of the event rode Garrett® boosted machines to victory. In 1996, new technical regulations were implemented that did not allow turbocharging. From 1966 through 1978 the cars that raced at Indianapolis competed in a full series under USAC (United States Auto Club) sanction. Garrett® boosted cars won six USAC National Championships between 1968 and 1978. From 1979 through 1996 "Indy Cars" were under CART (Championship Auto Racing Teams) sanction. Garrett® boosted drivers won seven CART Championships between 1979 and 1996.

1998  VW Golf and Audi A4 are the launch cars for the second generation Garrett® VNT™ technology.

2000 Garrett® Double Axle VNT turbos are introduced on DDC Series 50 bus engin

1999 BMW incorporates Garrett® REA technology in its diesel turbo V8 engine for the 7 Series. Honeywell and AlliedSignal merge to form Honeywell.

200

FIA World Rally

Turbochargers appeared at World Rally events in the late 1970s. The first win by a turbo was the Garrett® T03 boosted Saab 99 of Stig Blomqvist at the Swedish Rally in 1979. During the entire turbo era from 1979 to present, Garrett® boosted cars have won 14 Manufacturers' Championships and 9 Drivers' Championships through 2004.

Group B Period: 1982-1986

In 1981 Audi won three events with its four wheel drive Quattro (KKK turbo), and in 1982 the Audi Quattro became the first turbo to win the World Rally Manufacturers' Championship. Turbocharged cars have won every World Rally Manufacturers' and Drivers' Championship since. It was Lancia that interrupted the Audi streak by winning the Manufacturers' Championship in 1983. Then Peugeot leapfrogged them both with its revolutionary Garrett® T03 boosted Peugeot 205 T16 which won Manufacturers' and Drivers' Championships in 1985 and 1986. 1986 would be the last year for the powerful Group B Rally cars, which were retired because of safety concerns. At the end of the Group B Rallycar era in 1986, the cars achieved a maximum of 500hp.

Group A Period: 1987-1996

The Group A cars approved from 1987 were closer to 300hp and much safer for drivers and spectators alike. Lancia made the transition the best and the quickest, winning six consecutive Manufacturers' Championships, all with Garrett® T3 turbos. As a result of Group A rules, some European manufacturers departed and Japanese marques, first Toyota, followed by Subaru and Mitsubishi, had their turns winning championships until the Group A period ended in 1996.

World Rally Car Period: 1997 - present

In 1997 "World Rally Cars", which were allowed to depart from production specifications, replaced Group A. In response, the rally-specific Garrett® TR30R , a very lightweight, air-cooled ball bearing racing turbo, was developed. The Garrett® TR30R has dominated the World Rally scene since 2000 when Marcus Gronholm and Peugeot won the Drivers' and Manufacturers' Championships. Over the last five years, Garrett® TR30R boosted cars have won 52 of 72 rallies, five Manufacturers' Championships (3 Peugeot and 2 Citroën) and three Drivers' Championships (2 Marcus Gronholm and 1 Sébastien Loeb).

Audi finishes 1-2-3 to sweep the podium for the first time at Le Mans with their twin Garrett® turbocharged 2.6 liter V8 engine.

Smart introduces diesel and gasoline turbo engines from 0.6 liter – the Garrett® GT12 micro turbo with patented integral bearing design is featured on the gasoline engine.

Audi launches the A8 TDI 2.5 liter and 3.3 liter V8.

International selects Garrett® AVNT™ turbochargers (GT37 and GT40 AVNT™)for its engines that go into International trucks.

2002

International adopts Garrett® GT37 AVNT™ for Power Stroke engines that go into Ford F250 and F350.

Geneva

Mr. Carlo Lamprecht, State Councilor and Minister of the Department of Economy, Labour and Foreign Affairs of the Republic and Canton of Geneva, talks about what makes Geneva Motor Show a focal point for car manufacturers and thousands of visitors.

What is it that makes Geneva Motor Show such a significant event in the automotive calendar?

Geneva is regarded as a key event in the automotive calendar. It is the first major Motor Show of the year – that's why so many car and component manufacturers choose Geneva to launch new models and products. As a result, the Show is the focus of enormous international attention – both from the media and from the many thousands of visitors from Europe and beyond.

Switzerland's position as a 'neutral' country in terms of automotive manufacturing is also very important. There are no major passenger car plants in Switzerland and we therefore retain complete objectivity in how we structure the Geneva show. There is no inherent bias either by the organizers or by the media in terms of profile given to any particular manufacturer – it is a true 'showcase' for the automotive world.

I think that the Show also benefits from the considerable reputation gained by Switzerland as a place where engineering and innovation can flourish. Swiss engineers have been major contributors to automotive technology, among them Ernest Henry (Peugeot racing engine), Frederic Dufaux (first true 8 cylinder engine), Louis Chevrolet (founder of the brand) and the 'father' of turbocharging Dr Alfred Büchi. This heritage continues to this day, with numerous technology-based companies choosing to locate their businesses in our country.

What in particular attracts the major automotive manufacturers to Geneva?

Aside from its heritage, Geneva also creates an environment conducive to success for the manufacturers that exhibit here. This begins with Switzerland's location literally at the center of Europe, which makes access convenient, but extends to the excellent facilities at the Geneva Palexpo that enable the latest cars and products to be displayed in a way that excites the media and the visiting public.

At another level, the Show is renowned for the opportunities it actively promotes for industry networking and dialogue, particularly in focusing attention on new and emerging technologies within the industry.

We should also remember that Switzerland possesses a population with a strong heritage of technological innovation and interest in automotive engineering. For them, this is a show that brings out a true passion for motoring.

What will drive success for the show in the future?

First and foremost, Geneva must remain relevant to the needs of the automotive industry. In particular this means engaging with the major topics of the day – for example the Motor Show was the first to bring together automotive manufacturers and equipment suppliers with representatives from national and European governments to discuss key issues surrounding environmental impact.

It is by maintaining this relevance to the industry and continuing to appeal to the population at large (the Show is the most visited exhibition in Switzerland) that Geneva Motor Show will go from strength to strength.

There is also considerable backing at government level for the event. For example the President of the Confederation is opening this year's event, and there are plans to increase the exhibition space to accommodate the future requirements of the exhibitors. So we look forward to the next 100 years with considerable confidence.

2003

Bentley finishes 1-2 at the Le Mans classic auto race, and Audi finishes 3-4, for the fourth consecutive 1-2-3 finish for the VW group.

Ford brings the gasoline turbocharged RS Focus to the marketplace.

2004

Garrett Engine Boosting Systems chang its name to Honeywell Turbo Technolog

Motor Show

100 YEARS OF MOTORING PROGRESS

In this year of anniversaries, Geneva Motor Show celebrates two notable milestones – 100 years since its creation and 75 years as an international showcase for the automotive industry.

The last century has witnessed the rise of the automobile from a transport mode for the few to the dominant means of moving people and goods around the world. And, it seems this potential was recognized even at the very first 'National Car and Cycle Exhibition' at Geneva in 1905 when, on the opening day, Federal Councillor Charles Forrer, representing the government, declared that "eventually, the automobile will become… indispensable. It will give the traveller independence and free him from timetables."*

*100 Years of Motoring Progress, Editions Slatkine, Geneve (2004)

That first event attracted 17,514 visitors to the Electoral Building in Geneva – a major success at the time but some distance from the 729,629 people who last year attended the Geneva Motor Show at the Palexpo.

Over the years, Geneva has maintained an important position in the automotive calendar as a place for 'firsts'. From the Clement in 1905 to the Fiat 502 in 1924; from the Jaguar XK 120 in 1951 to the Peugeot 604 in 1975; from the Audi A8 in 1994 to the Ford Fiesta ST last year, Geneva has attracted its fair share of 'premieres'. And in 2005, the trend continues. This year, Geneva will see the unveiling of many new models - augmenting the Show's reputation as both a landmark industry event and a showcase for the latest advances in automotive engineering.

terpillar adopts Garrett® series turbos for its.
CERT on-highway truck engines. Kenworth truck
one of the trucks fitted with ACERT engines.

PSA group wins its third consecutive FIA World Rally Manufacturers' Championship with the help of Garrett® turbochargers (Peugeot in 2002 and Citroen in 2003 and 2004).

Audi sweeps the podium at the Le Mans again for the 5th consecutive year for the VW group.

Torque Back

A technology is only as good as its application... and so Booster Magazine asked some key customer representatives to add their own perspective on the power and potential of turbocharging.

"The Garrett® VNT™ turbocharger, coupled to the Ford strategy of transient overboost, has provided customers with continuous improvement in diesel engine benefits. One such example is our twin turbo V6 diesel engine in the Jaguar S-Type, which sets the benchmark for transient response, NVH (Noise, Vibration and Harshness) and overall refinement.

Turbochargers look set to remain a key component of modern diesel engines and will make an important contribution to the overall emissions reduction road map. Future advanced turbocharging systems will support new combustion systems with significantly reduced particulate and NO_x emissions by delivering higher boost at increased EGR rates.

Flexible bi- turbocharger systems, combined with increased engine speed range, will enhance performance still further. This will establish the diesel engine as a power source with the best fuel economy, lowest emissions and greatest fun to drive."

Dr Norbert Schorn, Staff Technical Specialist, Diesel Research and Advanced Engineering, Ford Research Centre

"Turbocharging has helped to transform robust diesel cars into vehicles that are fun to drive. Turbos help to deliver massive improvements in performance, particularly torque, while maintaining fuel economy.

For Daimler Chrysler, our OM613 project is a good example of best use of the technology. This inline 6-cylinder engine used the advantages of VNT™ technology in a very impressive way to create a strong, harmonic, performance. It was launched in 1999 and became a benchmark in the 6-cylinder class.

Looking ahead, turbocharging will eliminate today's weak points in diesel, particularly at low speed. Turbocharging will also enable OEMs to decrease their number of base engines, while maintaining the performance variants for the market."

Peter Knauel, Manager, Engine Charging, DaimlerChrysler

2004

The BMW Series 1 is unveiled with the third generation Garrett® VNT™ technology.

Honeywell opens turbo operation in Pune, India.

2005

Honeywell celebrates 50 years of turbo production.

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