Built by passion, not by committee!

The “86” Development Story

Two automakers, Toyota and Subaru, formed an alliance, integrating their advanced technologies and instilling their passion in the development of the “86.”
The development keywords, “Built by passion, not by committee!” symbolizes the passion of each and every person involved in the project for creating an ideal sports car.
The passion then led to the birth of a car that responds precisely and intuitively to the driver's intentions.
This brochure describes the development activities conducted based on an unprecedented approach, including the project background and the creation of vehicle concept, as well as the design, engine and chassis features of the “86.”

Contents

The vehicles shown in all photos in this brochure slightly differ in specifications from the models on display.

Family Tree of Toyota Front-engine Rear-wheel Drive Sports Cars

To provide the fun of automobiles and the pure pleasure of driving them,
Toyota created a great number of sports cars in its production history.
The front-engine rear-wheel drive (FR) layout seen in many of Toyota sports cars,
which uses the front wheels for steering and the rear wheels for transmitting drive power to the ground,
is considered as an “ideal” automobile layout by many people who know the fun of driving a sports car.
This layout was adopted by Toyota's first lightweight sports car, Toyota Sports 800, and Japan's first genuine sports car,
Toyota 2000GT, as well as the AE86 that continues to enjoy a growing number of fans and still dominates circuits.
The challenging spirits behind the development of these three FR sports cars
have been passed down to the development team of the “86” and are imbued in that modern-day Toyota vehicle.

Toyota Sports 800 participated in the Fuji 24-Hour Endurance Race held in 1967. Leveraging on its excellent fuel efficiency, the Sports 800 competed head-to-head with rivals with larger engines.

1965

Toyota Sports 800

In Japan, sports cars began to draw interest of people in the early 1960s when motorization advanced and the number of people owning cars increased. In 1963, Japan's first full-fledged car race, the first Japanese Grand Prix, was held in the Suzuka Circuit. In this race, Toyota Corona claimed first, second and third places in Class C5 (engine displacement of 1300 to 1600 cc). In Class C2 (400 to 700 cc), Toyota Publica took all top positions from first place to seventh place, exhibiting unrivaled performance. Moreover, in C6 class (1600 to 2000 cc), Toyota Crown captured the championship. The first Japanese Grand Prix spurred rapid growth of popularity of motorsports that had been steadily rising in Japan before, thereby creating needs for sports cars and desires for owning one. Against this backdrop, Toyota started developing a Publica-based high-performance sports car. With the aim of offering “a sports car for everybody,” Toyota developed an inexpensive, easy-to-drive sports car, Toyota Sports 800, which was affectionately called “Yota-Hachi.”

Toyota Sports 800 was released to the market in March 1965. Although the Sports 800 was based on a bread-and-butter model, Publica, it delivered outstanding performance from its rather small 2-cylinder 790cc engine, without relying on a powerful engine to propel the vehicle forward as in most sports cars in those years. Toyota accomplished it by taking every possible measure to reduce air drag and vehicle weight. With an ordinary horsepower rating of 45 PS, the Toyota Sports 800 boasted the maximum speed of 155 km/h and higher and the 1/4-mile (402.33 m) acceleration time of 18.4 seconds thanks to the light 580-kg vehicle weight, thus outperforming sports cars of one class above. Furthermore, the combination of the horizontally opposed engine with a low center of gravity and the FR layout enabled the Toyota Sports 800 to handle marvelously and also to offer excellent fuel efficiency to reduce the number of pit stops. As a result, the Toyota Sports 800 did extremely well in races. A legendary race that is still talked about today took place between the Toyota Sports 800 piloted by Tojiro Ukiya and its chief rival Honda S600 with Tetsu Ikuzawa behind the wheel in the All Japan Car Club Championship Race Meeting (CCC race). The Toyota Sports 800 driven by Ukiya was behind Ikuzawa's Honda S600 until the middle of the race. In the fifth lap, however, Ukiya's Sports 800 contacted Ikuzawa's Honda S600 and had to return to the pit. After leaving the pit, Ukiya quickly gained upon Ikuzawa, and finally took over the Honda S600 in the 24th lap to claim the leading position. Ukiya remained in that position until he crossed the finish line and became crowned champion.

In 1969, production of Yota-Hachi came to an end. The Toyota Sports 800 was an advanced vehicle that realized more than 40 years ago ideal features and performance of sports car that are desired today, such as light weight, superb aerodynamics and excellent fuel efficiency. The concept of lightweight sports car featuring the world's only unique combination of horizontally opposed engine and FR layout has been adopted again in the “86” after more than 40 years from the birth of Yota-Hachi.

1967

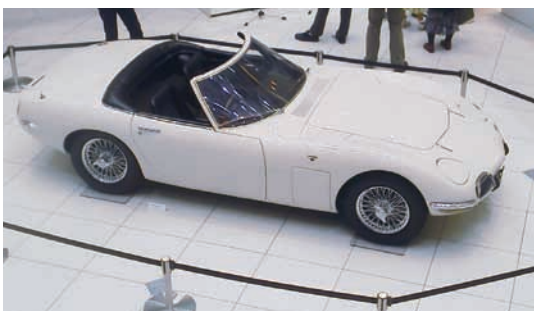
Toyota 2000GT

After the first Japanese Grand Prix was held in 1963, popularity of motorsports such as car races and rallies spread rapidly across Japan. People began expressing their desires for true fast and high-performance sports cars as they sought more than just ordinary passenger cars with performance modifications. To respond to this demand and also to make Toyota's accumulated technological achievements available to the public, Toyota initiated a project to create a genuine luxury GT car, Toyota 2000GT. The Toyota 2000GT was equipped with Toyota's first twin-cam engine, Type 3M, developed by using the Toyota Crown's SOHC 6-cylinder engine as a base and mounting a DOHC head. This engine produced maximum horsepower of 150 PS and achieved maximum speed of 220 km/h and higher. The 2000GT also featured a high-rigidity X-shape backbone frame, a four-wheel independent suspension system, Japan's first four-wheel disc brake system and a limited-slip differential (LSD). All these systems and mechanisms were new to vehicles produced domestically at that time, and on par with those equipped in luxury sports cars produced in other countries.

The Toyota 2000GT was unveiled in the 12th Tokyo Motor Show held in 1965, and attracted a great deal of attention. The following year, in June 1966, Toyota 2000GTs entered Japan's first long-distance car race, Suzuka 1000 km, and captured first and second places. In October, Toyota took on a challenge to break world high-speed endurance record and other international records in the Toyota 2000GT Speed Trial held at the Automobile High-Speed Proving Ground Foundation (presently Japan Automobile Research Institute) in Yatabe-machi, Tsukuba-gun (presently Tsukuba City) in Ibaraki Prefecture. Under harsh weather conditions with wind and rain brought by an approaching typhoon, the Toyota 2000GT traveled day and night at speeds above 200 km/h for a total distance of 10,000 miles and for 72 hours. In this test, the Toyota 2000GT achieved speed records that broke the three world records held by Ford's Comet. In its class, the Toyota 2000GT broke a total of 13 international records held by Porsche, Triumph, AC Cobra and others. Furthermore, in the Fuji 24-Hour Endurance Race held in 1967, Toyota 2000GTs claimed first and second places, demonstrating its outstanding overall performance in the challenging endurance test held under unfavorable conditions.

In May 1967, the much-talked-about Toyota 2000GT with a glorious racing history was introduced to the market. Priced at \2,380,000, the Toyota 2000GT was a “dream car” for most people, considering that the beginning salary of a university graduate was \25,000 per month in those years. Its elegant, flowing form was distinctively prominent among car designs seen in those days, including those of European and American automobiles. The Toyota 2000GT also created a sensation overseas. So much so that the 2000GT appeared in the British James Bond movie, “You Only Live Twice,” as a Bond car in 1967, even before it became available to the public. The 2000GT's graceful side window shape and rear fender line are inherited by the "86."

The Toyota 2000GT was unique because it was developed jointly with Yamaha Motor Co., Ltd., which was achieving spectacular results in motorcycle racing at that time. The joint development project was carried out in a way that was never done before. Toyota established a branch office of its Product Planning Department inside Yamaha Motor. Toyota supplied main parts such as the engine, transmission and steering mechanism, and Yamaha Motor tuned the engine and produced and assembled parts. The development of the “86” is a further “dream collaboration” drawing on the strengths of the two companies after the Toyota 2000GT development project.



Toyota 2000GT Convertible appeared as a Bond car in the British move, “You Only Live Twice.” The elegant convertible body style with beautiful wire spoke wheels was unmistakably distinctive.

AE86 Corolla Levin 3-door hatchback. Also available was a 2-door coupe model.

AE86 Sprinter Trueno 3-door hatchback exhibited in the Tokyo Auto Salon. The Trueno with a black-and-white color scheme, which was driven by the leading character is a well-known comic book, is still popular today.

1983

AE86 (Levin/Trueno)

In 1983, Toyota introduced the fifth-generation Corolla/Sprinter. From this generation on, the four-door sedan and five-door hatchback models adopted the front-engine front-wheel drive (FF) layout, but the two-door coupe and three-door hatchback models of Corolla Levin and Sprinter Trueno succeeded the FR layout from the previous-generation models to deliver sporty performance, thus attracting great interest from sports car enthusiasts as soon as those vehicles were released. Among them, the sporty grade models (GT, GTV, GT-APEX) equipped with the newly developed compact and lightweight 4A-GEU engine are still favored by many car enthusiasts, and they are known as “Hachi-Roku” (meaning “86” in Japanese) due to their “AE86” model code.

For the development of the AE86, Toyota set a number of targets: recording the fastest lap speed at the Tsukuba Circuit, achieving maximum speed of 200 km/h and winning championships in domestic rally races. The newly developed compact and lightweight 4A-GEU engine was a responsive, high-revving engine. It revved smoothly and quickly to 7700 rpm in just 0.95 seconds, at which the rev limiter was activated, when the accelerator pedal was depressed fully. Coupled with the newly adopted rack-and-pinion steering mechanism that delivered quick handling (3 turns for lock to lock), the 4A-GEU engine provided sporty driving pleasure. The AE86 used basically the same suspension system as its predecessor, TE71. The front strut and rear five-link solid axle were rather conventional in those years. However, they turned out to be an advantageous feature of this car. Since many aftermarket parts and components were available for those suspensions at that time, tuned versions of the AE86 were said to have appeared only ten days after the AE86 was released to the market.

The AE86 also actively participated in motorsports including All Japan Touring Car Championship (Group A), rallies and gymkhana races. In the season-opening Group-A race held in 1985, the AE86 made a debut win against rivals with larger engines and those with turbocharged engines (Hartge BMW 635CSi, Skyline RS Turbo, etc.). Keiichi Tsuchiya, a race car driver, played a major role in the increase of AE86 fans. In 1984, he captured six consecutive wins in the Fuji Freshman race series with his “ADVAN Trueno.” Tsuchiya was introduced as a “master driver of Hachi-Roku” in many car magazines in those days. He still demonstrates his drifting techniques with the AE86 on TV.

In the late 1990s, the AE86 regained attention when it was depicted as a car driven by the leading character in the comic book series called “Initial D.” Because of its popularity, an AE86 in good condition still sells at a premium price today. Even after a quarter century from the debut, many car tuning shops are specialized in the AE86, and one-make races are actively held. The AE86 is indeed a car that has been cherished by loyal fans over many years. This car-and-user relationship is what the new “86” aims to create.

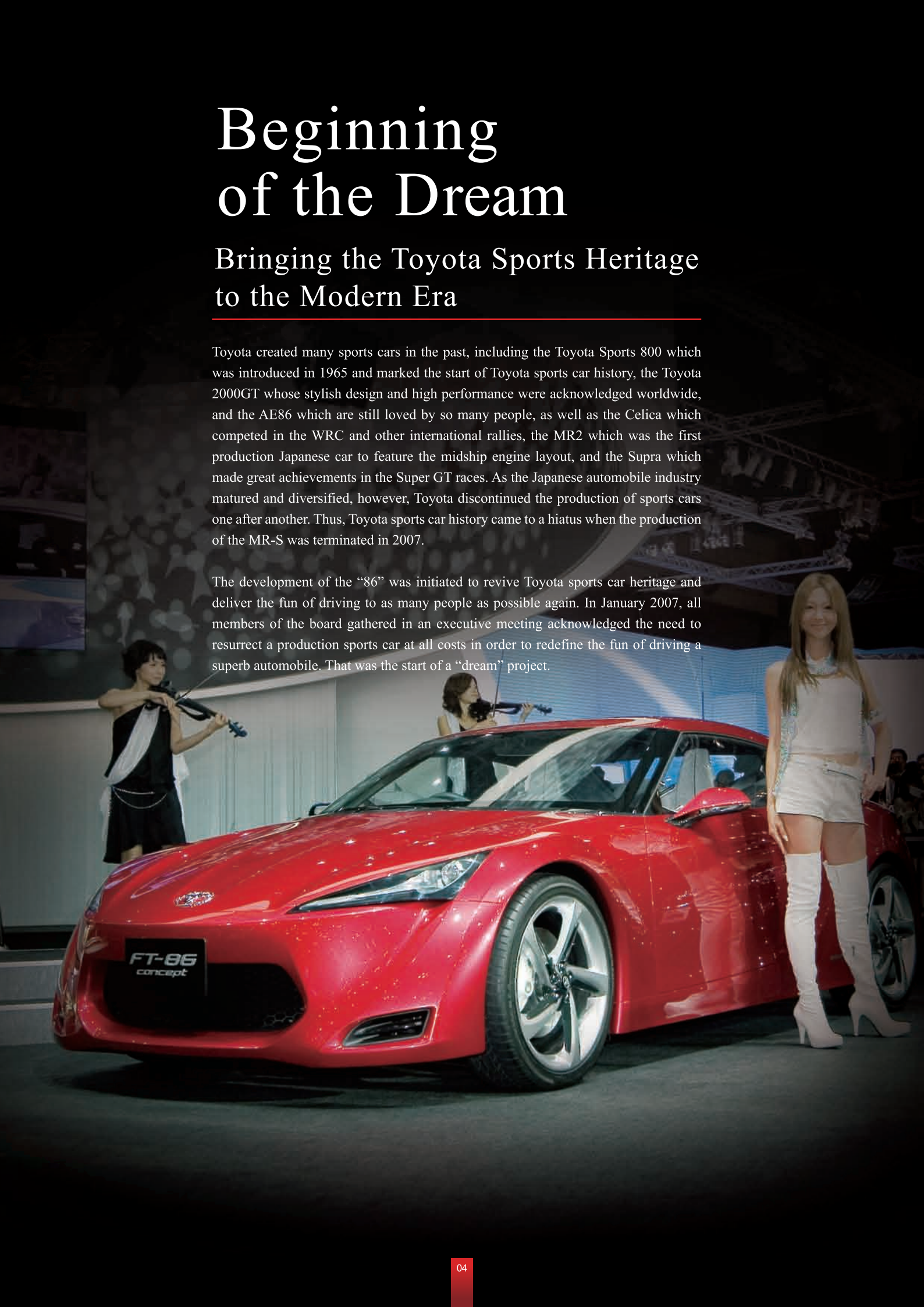
Fan meetings and track events draw crowds of loyal AE86 fans even today. There are many tuning shops specialized in the AE86.

Beginning of the Dream

Bringing the Toyota Sports Heritage to the Modern Era

Toyota created many sports cars in the past, including the Toyota Sports 800 which was introduced in 1965 and marked the start of Toyota sports car history, the Toyota 2000GT whose stylish design and high performance were acknowledged worldwide, and the AE86 which are still loved by so many people, as well as the Celica which competed in the WRC and other international rallies, the MR2 which was the first production Japanese car to feature the midship engine layout, and the Supra which made great achievements in the Super GT races. As the Japanese automobile industry matured and diversified, however, Toyota discontinued the production of sports cars one after another. Thus, Toyota sports car history came to a hiatus when the production of the MR-S was terminated in 2007.

The development of the “86” was initiated to revive Toyota sports car heritage and deliver the fun of driving to as many people as possible again. In January 2007, all members of the board gathered in an executive meeting acknowledged the need to resurrect a production sports car at all costs in order to redefine the fun of driving a superb automobile. That was the start of a “dream” project.



Tetsuya Tada

Development Direction

Chief Engineer, Product Planning
Product Planning Group

A project launched with a steady eye on the future of the automotive industry

Toyota has created many memorable sports cars over the course of its long history. However, as sales of minivans boomed in the 1990s and global competition intensified starting in 2000, consumers began expressing a preference for vehicles capable of accommodating larger numbers of passengers and models emphasizing economy. Against this backdrop, sports cars began disappearing one model at a time. Chief Engineer Tetsuya Tada, who led development of the "86," looked back at conditions at Toyota at the time.

Tada: *"In terms of sports car product management itself, engineering departments continued to propose ideas each year. However, each year those ideas were rejected. The reason had to do with the cost-benefit equation: sports cars were considered to be passé."*

There was a move to put together a joint development project following Toyota's alliance with Subaru in 2005. Futoshi Ito of the Product Planning Division and Atsushi Takada and Kazuo Okino of the Product Management Division aggressively promoted the planning of the "86" concept, which combined a horizontally opposed engine with an FR (front-engine, rear wheel drive) layout.

Ito: *"The possibility of an alliance with Subaru came up, and in 2006 we began considering how we could create a symbol of the two companies' alliance. The idea of an entry-level sports car or a true sports car that would serve as the successor of the Supra was discussed. In the end, if we were going to get involved in a joint development project with Subaru, people asked what could be more natural than to create an FR layout with a horizontally opposed engine. We want sports cars to be loved by ordinary people, rather than being the exclusive preserve of a small base of enthusiasts. We were also confident that there was no substitute for an FR design with a horizontally opposed engine in order to give the car impact. When we sought advice from then-vice president Kazuo Okamoto, who led the engineering department, he described the project as potentially "interesting" and asked us to study the possibilities. I worked out a basic approach for our joint project with Subaru wherein Toyota would be responsible for vehicle planning and design development, and Subaru would be responsible for the actual development work. At the time, our concern was to aggressively lower the center of gravity."*

Okino: *"At that time, I discussed with Takada-san, my supervisor, whether a straight-four FR layout like the old AE86 design would resonate with the public if we were to hypothetically launch such a vehicle. What is required is to ensure that everything is top-grade. If we fail to offer a design that gives people a visceral new understanding of how cool a car can be, then we will not be able to recapture the enthusiasm of customers who have lost interest in cars. This is what we were thinking as we put together the plan."*

Even as the general outlines of the project were officially decided and the start of serious development work was within sight, the partners began to exhibit a slight difference in the tenor of their approach due to a divergence in their respective philosophies concerning the automobile. This difference centered on how the product concept should be approached. Subaru was a manufacturer known for its high-performance 4WD sports cars, which had even established a presence in international motorsports. At the time, the company had complex feelings toward the "86" product concept. Toshio Masuda (Senior General Manager, SUBARU PRODUCT & PORTFOLIO PLANNING DIV & Project General Manager, SUBARU BRZ), who was in charge of Subaru's development operations, speaks candidly about his thoughts at the time.

Masuda: *"At Subaru, we were manufacturing cars with a global appeal by combining added value in the form of turbo engines and 4WD with our dedication to vehicles featuring high-rigidity bodies and a low center of gravity thanks to their use of horizontally opposed engines. We didn't think using a horizontally opposed engine was enough alone to make a good car. From our standpoint, seeing as how we were making 2-liter cars that produced more than 300 horsepower, a 2-liter naturally aspirated sports car sounded like a questionable proposition."*

Hiromi Tamou (Deputy General Manager, BODY DESIGN DEPT, SUBARU ENGINEERING DIV), who was responsible for package and body development at Subaru, felt a variety of dilemmas.

Tamou: *"I wondered whether we'd be able to recoup our investment in this car, and I felt that it would be extremely difficult to evolve the design. Things would get difficult when we tried to create variations on the design. When we submitted a draft package proposal with a layout in which we had quietly saved some space so that we could later have a 4WD model, Toyota's Okamoto-san pointed out the wasted space. The horizontally opposed 4WD layout created by our predecessors was so perfect that it could not be easily changed. However, just like the Grand Shrine of Ise is rebuilt once every 20 years, we felt that in principle we couldn't develop the talent of our engineers without changing the architecture and thereby keeping the requisite skills alive at the company."*

A prototype vehicle manufactured in order to explore the potential of the "horizontally opposed engine + FR layout" design provided an opportunity to move past the impasse. To produce the hand-built vehicle, engineers shortened the wheelbase of an existing sedan and aligned just the height of the center of gravity with the plan's target figure. At test drive events held by both Toyota and Subaru, people reacted with surprise at the extent of the prototype's potential. Shigemi Kanbayashi (at the time, Senior General Manager, SUBARU ENGINEERING DIV), who led the project at Subaru, recalled that he saw new possibilities for the horizontally opposed engine in the prototype's potential.

Kambayashi: *"When we made the design into an actual vehicle, I felt that we had reached a dimension that I had not yet experienced. I felt that Subaru's horizontally opposed engine had the potential to open up new domains. I was extremely happy, and I felt that the project, which had seemed like it might end at any time due to its commercial viability and a variety of other factors, might now be successful."*

Futoshi Ito

Product Planning

General Manager, Strategic Product Management Dept.,
Product Planning Division

Meanwhile, Takada and his colleagues, who had been working on vehicle planning, strived to reconcile the two companies' feelings in the form of a single design. Okino, who was working on the plan under Takada in the Product Management Division, used hand-made materials he had cut and pasted from past Subaru and Toyota accomplishments when he attended meetings.

Okino: *"In the case of both Toyota and Subaru, passionate engineers made cars for the general public during the mid 1950s. With the new project, those engineers' successors—today's engineers—had to make the dreams of young car enthusiasts who lusted after the supercars of the past come true. The 'horizontally opposed FR' layout combines the sports pedigrees of Toyota and Subaru. I worked extremely hard to communicate this fact. Kambayashi-san, who was leading the project at Subaru, was extremely sympathetic to this way of seeing things. Without him, I don't think the project would have made any progress at all."*

In this way, a joint development project bringing together two manufacturers with differing histories and philosophies entered into the true development phase.

There had already been multiple discussions about the future of the automotive industry as a whole and how to halt the trend toward decreased reliance on cars among youths. In the past, Tada had experience working on the first-generation bB, which was introduced as a new concept for young buyers.

Introducing vehicles such as the bB had the momentary effect of increasing interest, but the market would inevitably revert to its pre-launch state with the passage of time. Efforts to hold a variety of events and change dealerships similarly failed to yield promising results. What was the principal cause of these failures? Akio Toyoda, then serving as Toyota's vice president, suggested that sports cars might be losing primacy of place among car enthusiasts. In response, a conference of all Toyota executives was convened at the beginning of 2007. Participants adopted the policy of introducing a sports car designed with a steady eye on the future of the automotive industry, rather than an exclusive focus on whether the vehicle would be profitable.

Following this decision, Tada, who had been serving as chief engineer for the second-generation Wish, was chosen to lead the development of the new sports car in March 2007. The selection came out of the blue, without any warning.

Tada: *"I was summoned to the executive suite during my lunch break and told that I need not concern myself with minivans any longer, and that I was to make a sports car instead. I had no idea what was going on, but I felt a simple sense of happiness. Myself and one other person—we formed a group of just two people, but, obviously, we didn't have a base vehicle to go on. We had started development of a Toyota sports car for a new era from an almost blank slate."*

Behind the "86" development code name

So what kind of sports car would the team build? In the course of considering various ideas, Tada gave voice to what would become the team's desire to build a sports car that would be cultivated by a community of enthusiasts, like the AE86 of the past.

Tada: *"We asked a lot of people for their opinions. Some voiced the view that the new model would have to be a hybrid, while others clamored for a successor to the Supra; still others favored a less expensive car that would sell for around 1.5 million yen. All of this led me to conclude that different people want different things in a sports car. I realized that it would be impossible to create a market-driven car. The only way to do that would be to build a custom vehicle for each customer and sell them for several hundred million yen each. In that case, if we were to make a car such as the AE86, customers would be able to modify the vehicle as they wished. I thought that this approach would be the only way forward. If you take a look at the history of Toyota sports cars, you'll find that it's the AE86 whose drivers are still enjoying the vehicle. It's not that the AE86 itself had spectacular performance when it was introduced, but rather that driers have modified their vehicles to suit their own tastes and now continue to enjoy them. That's the kind of vehicle I want to make. The best possible outcome would be for people to still be enjoying the car 10 or even 20 years after it went on sale. That's the first thing I decided. That's why I was waiting intently for the development codes that Toyota assigns to vehicles to reach the number '86.'"*

The AE86 inspired the idea of a sports car that would be cultivated by a community of enthusiasts. In terms of hardware, it was the Toyota Sports 800, Toyota's first lightweight sports car, which caught Tada's attention.

Tada: *"It was the only vehicle with a horizontally opposed engine and an FR layout; it was lightweight, compact, and fuel-efficient. It was too advanced for its time when it was introduced, but it would be an ideal car for today's times. When I was asked to design this new car, the first vehicle I went to research was the 'Yota-Hachi,' as the Sports 800 is known. When I went to have a look at the blueprints stored at Kanto Auto Works, Ltd., I was struck by a realization of just how good the horizontally opposed engine is. That's when I received information from the planning side about the joint development project with Subaru. I thought that this would be a great opportunity to realize our ideals."*

Atsushi Takada

Product Planning

Project General Manager, Marketing Division,
Toyota Marketing Japan Corporation.

In the old Toyota Sports 800, Tada discovered the ideal of the "horizontally opposed engine + FR layout" package. In addition to providing a low center of gravity, the design helps keep a low hood profile. He had an intuitive sense that the approach would provide exactly the ideal combination that he wanted in a sports car. In this way, the development of the "86" began as a joint development project with Subaru.

Tada: *"Because we were pursuing the development process with an extremely focused plan, we were unable to reach agreement with other departments in a great many areas. Takada-san probably found himself bowing and making requests behind the scenes to smooth things over again and again. He was very active in offering his support all the way up to the executive level with his message that Toyota's dream had to be restored no mater what the cost. Without him and his colleagues, the '86' would never have seen the light of day."*

Designing the Sports Car That We Want to Drive

The spirit instilled in the development keywords, “Built by passion, not by committee!” was so powerful that it revolutionized the decision-making process for vehicle design and resulted in a unique development approach. The designers were determined to create “a sports car that they want to drive.” The “86” is a dream come true for the designers and many other employees who love sports cars.

Takayasu Furukawa

Exterior Design Supervision

Group Manager, Toyota Design Division, Design Group

A design that began with changes to decision-making mechanisms

In the development of the "86" design, designers went beyond their normal domain of activity and became involved with the design engineering as well, sometimes showing strong initiative. Takayasu Furukawa of the Toyota Design Division directed the exterior design effort, joining the project during the package study stage and rendering his vision of the ideal sports car.

Furukawa: *"The Toyota Design Division, which serves not as an advance design department but rather as a commercialization team, joined the project during the package stage. For example, the radiator in the initial package was mounted vertically. But keeping the hood low was a key priority for us, so we issued an order for the radiator to be angled and kept low by whatever means necessary. As that example shows, it all started with a different way of being involved with the design from the start."*

It's fair to say that the exterior design of the "86" would have been completely different if the design team had not been involved from the package stage in this way. Kenji Kido, who oversaw the exterior design under Furukawa's direction, described the objective of the design process and its emphasis on a low center of gravity and a low hood.

Kido: *"I want to build a car that thrills car enthusiasts when they look at it. Because we were focused on giving the design a low center of gravity, we wanted to give the car a cool appearance that starts with its basic frame. What this means, is that when you lower the position of the body, the tires come up higher. This in turn necessitates fenders, and the direction of their flare becomes clear. My design work reflects my desire to express shapes that are not fake, to express authentic beauty. Sexiness and luster are other characteristics. I envision a physical design that you can love over the long term, one that promises new discoveries even after you have bought the vehicle, for example by allowing you to discover new aspects when you wash the car."*

In its drive to express that sense of sexiness and luster, the team drew inspiration from the Toyota 2000GT. By bringing an actual 2000GT to the shop where they were carving clay models of the new vehicle so that they could bring their sense of its presence to bear as they shaped the new design, Kido's team sought to create a sports car design with a timeless appeal, starting with elegant side window graphics.

Kido: *"We've incorporated the slightest hint of the 2000GT's look into parts such as the area where the bottom of the side window graphic tapers up and where the rear fender's character line flows toward the rear corner."*

Toshiaki Noda, who directed development of the new car's body, recalled how the body designers' understanding of design and enthusiasm served as a major impetus in the drive to implement this very specific shape.

Noda: *"The body design process accounts for an extremely large portion of vehicle development. In addition to the need to realize packaging that was unique in the world, we had to overcome the unknowns imposed by the need for two companies with completely different cultures to collaborate on the project, with Toyota handling design and Subaru handling design engineering."*

Subaru's Tamou reflected on the difficulties of implementing the exterior design.

Tamou: *"At first, we grappled with the extreme difficulty of the fact that even when we used the same words, they had different meanings. It was nobody's fault, but there was a time when our teams just didn't mesh together well. Since I had worked for a bit as a design studio engineer, I thought that the role of the design engineering process was to do what the designer wanted. In this project, the workers responsible for design engineering and manufacturing technology were also extremely motivated. There wasn't anybody on the team who replied to suggestions by saying it couldn't be done. It was thanks to this approach that we were able to assimilate that shape."*

Tada: *"The remarkable thing about Tamou-san is that he was able to build in an extraordinary level of body rigidity, which serves as the foundation for ultimate handling, while manifesting a beautiful shape. Even after the official blueprints were completed, we would point out some aspect of the design that was still lacking, and Tamou-san would respond that he would redo all the drawings. When he said that, I felt that we had come to a different place."*

Noda: *"We as team members were products of different histories and cultures, but we shared a desire to create the ultimate sports car. You could say that the design of the '86' is the crystallization of both our companies' passion."*

In terms of the development of the "86" design, Tada had worked to have a different technique adopted than is typically used for the design finalization process. It was a completely new experiment that involved refining the design based on evaluations from "sports car panelists" who actually drove sports cars in their daily lives.

Furukawa: *"Toyota has an internal evaluation system for gaining the approval of executives as well as sales and plant personnel for design proposals. Normally, the most difficult part of the process is getting through this stage. But in the case of the design of a sports car, it all comes down to personal preference. You can't design a sports car by incorporating a mishmash of individual opinions. So for this project, we studied and completed the design with a team composed primarily of the chief engineer and a few designers after asking for authorization to finalize the design with a small number of people while consulting only with President Toyoda. Instead, we asked Human Resources to choose about 200 employees who actually drove sports cars. We showed this group the modeling we were creating and asked them to freely express their views."*

Masaki Tooyama, who directed the vehicle's interior design, reflected on the response to this initiative.

Tooyama: *"We didn't want to make decisions for this car based on majority vote. The process was an experiment in designing a car based on the judgments of people who were deeply invested emotionally in its creation,*

Kenji Kido

Exterior Design

Toyota Creative Studio

Toshiaki Noda

Product Management (Body)

Project Manager, ZR,
Product Planning Division

Sports car panelists evaluate the "86" design, providing a range of detailed observations concerning the vehicle's external appearance and interior.

including Chief Engineer Tada, who was the lead developer, and Toyota's president. As a result, I think we were able to produce what we wanted as-is in a straightforward manner."

Meticulous focus on functional parts: It all comes down to driving

In their evaluation of "86" development, the sports car panelists were presented with the extremely specific question of whether they wanted the car. The panelists looked at the vehicle as if it were the next car they were going to buy and evaluated it in great detail. The team described the many things they learned as a result of this process.

Furukawa: *"People who truly like sports cars will look at a vehicle extremely seriously. For example, people pointed out that the positions of the rear fog lamps and back-up lamps were the opposite of where the white and red lights should be in a true race. I realized that people who really drive in races look closely at those sorts of things."*

Tada: *"One of the views from the panelists' evaluation that I was extremely interested to hear was the request to stop using parts from other vehicles. They wanted us to create dedicated parts specifically for this car, even if that meant spending a little more money. So we approached this car by striving to use 100% dedicated parts. For example, the inside rearview mirror is the world's first dedicated mirror to incorporate special sports car technology. When the design engineering staff explained that it would be extremely expensive to use dedicated designs for such parts, we told them not to say such things until they had actually tried to make the part and to draw on their brainpower to make it work."*

The focus on functional parts such as these is also strikingly apparently in the team's approach to developing the interior design.

Tooyama: *"Typically, interior design starts with a drawing of the instrument panel, and then details such as the steering wheel and meters are decided. But the '86' is a sports car. Functional parts that affect the driving of the vehicle—the steering wheel, meters, and seats—are the starting point and the most important facets of the car as driving tools, so those areas are where we began. We proceeded with the design process by treating parts as the car, rather than starting with the whole."*

One of the people who brought a strong focus on functional parts like these to the design process was Yoshiko Hayashi, who worked on the development of the interior design under the direction of Tooyama.

Hayashi: *"In placing the start switch on the center cluster in the middle of the vehicle, we wanted to ensure that the driver could complete the entire sequence of pushing the start switch, releasing the parking brake, and shifting the transmission with his or her left hand. We wanted to make the instrument panel extremely simple, and otherwise we wanted to use a 'stoic' approach that was willing to get rid of everything else. We were focused on making everything more and more simple, so that nothing extraneous would be reflected in the driver's field of vision."*

To control such reflections, the team used a low-gloss grain for the top of the instrument panel and aggressively eliminated decorative lines and other design elements. On the other hand, they incorporated ideas that had been fed back from racing, for example by placing a small mark in the center of the top of the instrument panel so that the driver could be aware of the center of the vehicle. In determining such characteristics as the driving position, steering wheel shape, and parking brake lever position, the team undertook a countless series of changes and adjustments while repeatedly inviting company development drivers to verify that it had achieved the most naturally feeling design and layout during the design development stage.

The intense focus of the designers is apparent in the way they gave full play to their abilities while communicating closely with the chief engineer and design engineering team and honoring the dreams of the many Toyota employees who possess a heartfelt love of sports cars. The design of the "86," which embodies the sports car that the designers themselves would like to drive, took shape in the context of this unprecedented framework.

Masaki Tooyama

Interior Design Supervision

Group Manager,
Toyota Design Division, Design Group

Yoshiko Hayashi

Interior Design

Toyota Design Division

Combining Toyota and Subaru Technologies

Next-generation D-4S + Horizontally-opposed Engine

Subaru's horizontally opposed engine and Toyota's next-generation D-4S direct-injection technology were combined. The cooperative and uncompromising efforts of the engineers of the two companies with determination to make this unique collaborative project successful gave birth to the 86's powerplant that has low center of gravity performs marvelously and is gentle to the environment. Furthermore, Toyota applied its expertise and the most advanced technologies to create a powertrain that delivers maximum driving pleasure to the driver.

Hirohisa Kishi

Engine Development Direction

General Manager, Engine Management System Development Division, R&D Group 2

Takamitsu Okamoto

Engine Technology Development Advisor

New Engine Development Division, R&D Group 2

The combination of D-4S and a horizontally opposed design, which originated in a determination to achieve 100 PS per liter

When the joint development of the “86” began, Subaru was making steady progress in its development of a 2-liter-class horizontally opposed engine for its next generation of cars. There was a sense among both companies’ engineering groups that this engine would naturally find its way, largely without modification, into the “86.” However, Chief Engineer Tada’s unbending insistence on a particular combination of performance characteristics led to a singular challenge that no one had expected. Those characteristics embodied a low-center-of-gravity, naturally aspirated, high-revving sporty engine capable of developing 100 PS per liter as it leapt stress-free into the high-rpm region. Masayuki Kuwano (Manager, 1ST POWERUNIT RESEARCH & EXPERIMENT DEPT, SUBARU ENGINEERING DIV), who led engine development at Subaru, described his surprise at hearing the objectives put forth by Tada.

Kuwano: *“I had heard at the beginning that the car was to be an entry-level sports car, and I figured that we would only need to lower the center of gravity by using the FB engine that we were developing at the time. So when I heard the goal of 100 PS per liter, that led to a discussion about how on earth we could achieve such high output with the engine. I even suggested that we might as well just increase the displacement.”*

Against this backdrop, Tada sought advice from Takamitsu Okamoto of the New Engine Development Division, who led engine development for the LFA. There was about three years left before the first vehicle was to roll off the production line at the time-impossibly late in the game from the standpoint of the typical engine development timeline.

Okamoto: *“I was asked how the engine could be made to develop 200 PS. But they also wanted good fuel efficiency. To generate 200 PS with a 2-liter, port-injected engine, you’d have to increase redline to at least 7,600 rpm. At the time, Subaru was considering a bore of about 84 for its next-generation horizontally opposed engine; it would be difficult to get a large enough valve diameter to achieve 100 PS per liter with that configuration to begin with, even if you ran it at 7,600 rpm or higher. On the other hand, we had to lower the rpm to some extent to ensure good fuel efficiency, and if they wanted to provide performance at the same time, then our D-4S system was the most obvious choice. I also told them that they would have to increase the bore somewhat.”*

This challenge led to a major discussion involving a range of project workers. Was it acceptable to disclose technology that could be described as the linchpin in Toyota’s engine control regimen to a competitor? Would it even be possible to recreate Subaru’s horizontally opposed engine from the most basic design stage for just one car? At the end of a heated discussion, the engine department leadership made a wise decision to combine Toyota’s D-4S with Subaru’s engine and redesign the engine from its bore and stroke. The decision was extraordinarily unusual insofar as it would require disclosing all Toyota’s technical information related to D-4S to Subaru.

Reacting to this policy, the Toyota Engine Control System Development Division was promptly added to the project. Motoki Ohtani, who was working on the development of the next-generation D-4S system at the time, recalled the situation.

Motoki Ohtani

Engine Development

General Manager, Engine Management System Component Design Deptartment
Engine Management System Development Division, R&D Group 2

Ohtani: *“Senior Managing Director Kobuki, who was in charge of engine development at Toyota at the time, kindly led our consultations with Subaru. It was a major decision that involved both companies sharing their crown jewels. It must have felt like a real leap in the dark. But once the policy had been decided, there was no time. Moreover, the two partners had occasionally failed to understand one another well at the outset. At first, Subaru questioned whether D-4S had quite as much potential as we were making out. I guess you could say that we rose to this challenge. This was something that we were developing ourselves, and we were confident based on our calculations that it could generate 200 PS.”*

The technology that was being tapped for use in the “86” was not the D-4S, which was already commercially available, but rather the next-generation D-4S that Ohtani and his team were developing at the time. And as was expected, the effort involving the simultaneous development by two companies of technology that had not yet been released by Toyota proved to be fraught with difficulty. The resulting joint development truly transcended the manufacturers’ boundaries, with Subaru engineers setting up shop at Toyota at one point, and Toyota engineers setting up shop at Subaru at another.

The prototype engine with the next-generation D-4S, which from Subaru’s point of view had been developed as a sort of shot in the dark, achieved the 200 PS goal on its first bench test. Hirohisa Kishi, the general manager of the Engine Control System Development Division, described how he sensed the technical ability and backbone of the Subaru team.

A technology exchange meeting being held by Toyota and Subaru engineers. The result was a joint development project that transcended both companies' boundaries in pursuit of an engine capable of developing 100 PS per liter.

Kishi: *"When I thought about the difficulty of designing D-4S components and the overall combustion chamber, I realized that it was going to be extremely difficult to have Subaru handle that work. At one point, I told them that the technology posed formidable challenges even for us, that the development process entailed truly demanding work, and that I didn't think even Subaru could get it right on the first try. Later, I heard from the Subaru team that hearing these things only made them more determined to complete the task successfully. As a result, the first prototype easily exceeded the goal of 200 PS. That's when we all breathed a little easier, and I guess you could say it's when we began to trust one another. We began to realize that Subaru was capable of getting it done."*

Kuwano: *"Regardless of how it was to be done, we had to create a high-revving engine. Consequently, we were pursuing research behind the scenes that would allow the engine to exceed 7,000 rpm. When Kishi-san questioned whether such an engine could really develop 200 PS, that only hardened my resolve to prove that it could be done."*

Kenji Watanabe of the Engine Control System Development Division, who oversaw the preparation of the D-4S and horizontally opposed engine combination for mass production, was also impressed with the Subaru team's technical ability.

Watanabe: *"Subaru's past horizontally opposed engines seemed to sort of rumble at low speeds, and they didn't give the impression of being able to rev up smoothly to high rpms. But when they let me drive the prototype vehicle with the new engine, I found that it easily and smoothly revved up to 7,000 rpm. That prompted an immediate transformation of my impression of Subaru's engines. After talking to their engineers, I came to understand that the low, rumbling effect was something that the engines had been tuned by design to produce. Equalizing the intake and exhaust timing and other adjustments yielded an extremely pleasant, smooth-revving sound, and that made me glad that I had worked so hard with the Subaru team."*

Kazuto Nakamura of the Product Planning Group, who supervised the engine development project, reflected on the challenges of creating the engine's unique sound signature, which could be described as the icing on the project's cake.

Nakamura: *"As it happens, it was very difficult to convey the engine's excellent sound to the driver. We had to limit the amount of noise being radiated from the vehicle in order to comply with various country's increasingly strict vehicle exterior noise regulations, making it difficult to increase the exhaust note volume very much. Under these circumstances, the sound reaching the driver wasn't loud enough, and it wasn't enough to satisfy the initial goals we had as far as the prototype's sporty driving characteristics, which had come together quite nicely in a variety of other areas. Upon test-driving the vehicle, Toyota's president pointed out an inability to "converse with the car" due in part to the inadequate volume of its sound. In response, we took a number of steps at a stage of development that would ordinarily be impossible. Specifically, we've brought the sound directly into the interior of the car. This is the first time for a system of this type to be used in a Toyota."*

The combination of Subaru's horizontally opposed engine technology and Toyota's direct-injection technology originated in a determination to achieve 100 PS per liter, and it was implemented by means of the brainpower and tenacity of numerous engineers. The creation of a horizontally opposed engine with D-4S is an accomplishment that symbolizes "Team 86" and its pursuit of development in a manner that transcends the boundaries of individual manufacturers. In retrospect, Okino, who played a key role in product management from the outset, described the development of this engine as the project's greatest difficulty.

Okino: *"To propose that a completely new engine be developed at the point in time that the discussions were being held was an extremely onerous thing. The project had come to a phase in which the direction of those discussions would determine its very future. Ultimately, the process led to the creation of the ideal sports car engine with D-4S and a bore and stroke of 86 × 86. This engine was truly the heart of the project. I think it embodies the backbone and passion of both companies' engineers."*

Kenji Watanabe

Engine Development

Project Manager, Control System Package Development Department, Engine Control System Development Division, R&D Group 2

Kazuto Nakamura

Product Management (Engine)

Project Manager, ZR, Product Planning Division

A Pair of Transmissions Engineered to Spur Dialog between Car and Driver

In the same way that they focused intensely on developing a sporty engine for the new car, the team strived to implement a pair of transmissions that would make possible an intimate conversation between car and driver. Engineers made major changes just one year before production was scheduled to begin in an effort to give the six-speed manual transmission the ideal shift feel. For its part, the six-speed automatic transmission combined the world's fastest shifting control with carefully tuned sensibility. These two transmissions, engineered with an uncompromising focus on how they would make the driver feel, were polished for inclusion in the "86."

Two transmissions developed with a focus on sensibility

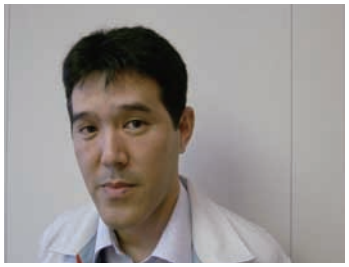
The project was also characterized by a meticulous focus on the transmission, the part of the car most directly linked with the driver. Since Subaru didn't have a vertically oriented transmission suitable for use in an FR-layout vehicle, transmission development began with an effort to shorten the stroke of the 6-speed manual transmission used in the Altezza. Tomohiro Ishikawa, who worked up the requirements for the development effort, understood intuitively that although the only major change was the shortening of the stroke, the task at hand was no simple one.

Ishikawa: *"If you want to shorten the stroke, you're going to need to make major improvements. It was all well and good to make a short stroke the goal, but at one point I confirmed with Chief Engineer Tada the process was going to entail significant changes since the heavy throw usually associated with a short stroke would be undesirable."*

Development work was performed by both Subaru and Aisin AI based on the requirements that had been worked out by Ishikawa. However, the process ran into unexpected difficulties. The team was unable to achieve the ideal feel for the transmission, despite trying a series of improvements. Yuichi Sekiya (Manager, TRANSMISSION DESIGN DEPT, SUBARU ENGINEERING DIV), who led the design engineering effort at Subaru, recounted the difficulties being experienced by the team at the time.

Sekiya: *"The technology had actually been commercialized once in the past, so I figured that it would turn out OK. But when we actually set out to make the transmission, we were unable to improve the weight and control feel. We were able to shorten the shift stroke by minimizing the lever ratio. But this resulted in a heavy feel. Time and time again, it was pointed out to us that the feel we had achieved was not acceptable. As the overall performance of the car was increasing, the requirements being imposed on the transmission itself were growing more stringent."*

With one year to go before the first vehicle was to roll off the production line, the team had still not achieved what they saw as the ideal 6-speed manual transmission feel. At that point, Ishikawa made a major decision to redo the process from the unit design stage.



Tomohiro Ishikawa

Six-speed Manual Transmission Development Direction

Group Manager, Experiment & Analysis Engineering Department, Drivetrain Engineering Division 1, R&D Group 2

Takeshi Kaino

Six-speed Manual Transmission Development

Assistant Manager, Experiment & Analysis Engineering Department, Drivetrain Engineering Division 1, R&D Group 2

Ishikawa: *"Tada-san and our division general manager kindly said that the start of production could be delayed if the alternative was coming up with a half-baked transmission. I was impressed by the strength of their resolve. In the end we made some major changes. We realized that it would be a waste to compromise on something important at that moment just because there was no time. Our only thought at that point was that it was not acceptable to deliver a transmission that we found unsatisfactory."*

At that point, an exceptional initiative was set in motion. It's goal: implementing the ideal 6-speed manual transmission by virtually pouring in engineers from Toyota, Subaru, and Aisin AI. Ishikawa brought Takeshi Kaino, a researcher specializing in shift feel, into the project.

Ishikawa: *"We couldn't compromise on feel, so I asked my supervisor to add Kaino-san to the project. The three companies continued development work, making sure to hold a site meeting at least once a week."*

Kaino: *"My case is a little bit unique in that I've worked on nothing but shift feel since joining the company. I was able to envision what I felt as a waveform and then to identify what to change to fix various issues. So my thought when I was summoned was that this job that I had been hearing about had finally come to me. After that we gathered at Aisin AI's plant in Nishio countless times to investigate how we might resolve the issues. I realized everyone was focused in the right direction."*

After creating five different prototypes and executing a final, daring overall design change, the team finally succeeded in creating the ideal 6-speed manual transmission for a sports car. With a pleasant shift feel that reliably communicates the moment when its gears mesh to the driver, the transmission was truly created for the "86."

Ishikawa: *"Perhaps 80% of the design had changed. More than that, if you look at blueprints for individual parts. Most of the parts were changed I bet."*

Kaino: *"Since the people who buy cars with manual transmissions have high expectations and strong ideas when it comes to shift feel, we naturally worked meticulously to build that in. Executives spurred us on, telling us that shift feel was everything in a manual car, and that the transmission in its present form was completely unacceptable. We knew that was the case. Employees had high expectations, and since this was a sports car that customers had been looking forward to with great eagerness, we knew that we absolutely had to meet those expectations."*

At the same time, another team was developing a 6-speed sport automatic transmission in an effort to combine Toyota's technology with Subaru's sensibility. Hideo Tomomatsu, who had worked on the development of the SPDS transmission for the Lexus IS F, LS 460 Version SZ, and other vehicles, reflected on the project.

Tomomatsu: *"Our sport automatic transmission technology is incredible, if I do say so myself. We've created a very fine-grained mechanism by implementing control algorithms and hardware that operate instantly when the signal is given, thereby achieving the world's fastest shifting speed of 0.2 seconds. Subaru doesn't have that sort of technology. We figured that we could create an extremely good car by combining Subaru's sensibility with our technology, so we took the best of what each partner had to offer. We provided the basics as far as expertise, technology, and control, but we left it to Subaru to give the transmission the right 'flavor.'"*

In fact, Subaru had reason to welcome this proposed arrangement, too. Tadanori Fujii (Assistant Manager, 3RD POWERUNIT RESEARCH SEC, 3RD POWERUNIT RESEARCH & EXPERIMENT DEPT, SUBARU ENGINEERING DIV), who implemented transmission control at Subaru, described the situation.

Fujii: *"We didn't have a vertically oriented automatic transmission for an FR layout vehicle, so we threw open our doors to Toyota's design and were quite happy about the arrangement. For this project, Toyota provided the hardware, and we added control specialized for driving. For example, it's OK to give the driver a bit of a shock, so we sought to convey a sense of gears shifting. Toyota was frankly surprised when they saw what we had done."*

Hideo Tomomatsu

Six-speed Automatic Transmission Development Direction

General Manager, Automatic Transmission System Engineering Department, Drivetrain Engineering Division 2, R&D Group 2

Harmonization: The Indicator That Embodies the Ideal of an FR Sports Car

Once the ideal package consisting of a horizontally opposed engine and the FR layout was chosen as the platform of the “86,” development efforts were focused on improving performance to the highest possible level. To create a true FR sports car that takes advantage of the inherently superb characteristics of this package, Toyota set three goals; “vehicle motion that defies the moment of inertia,” “ground-hugging handling performance” and “smooth suspension stroke for stable and comfortable ride.” Tested on roads around the world and improved toward achieving optimum harmonization of all components and parts, the “86” concretized “intuitive handling” through the passion of Toyota and Subaru's engineers.

Striving to achieve the vision of the ideal FR sports car

The starting point for "86" performance was a single prototype built in order to explore the potential of a design combining a horizontally opposed engine with an FR layout. Engineers built the car by hand, shortening the wheelbase of an existing sedan and giving it one of Subaru's horizontally opposed engines. Subaru's Kazuo Ikeda (Manager, POWERUNIT MOUNTING & OPERATING SYSTEM DESIGN SEC, CHASSIS DESIGN DEPT, SUBARU ENGINEERING DIV) and Tamou described the difficulties they encountered in creating this prototype.

Ikeda: *"I remember how Tamou-san and I sat there looking at CATIA (design data) day after day, just the two of us, pondering how far the engine could be lowered and what the critical concerns were. We held these two-person sessions in an environment where the idea of changing the 4WD layout of our horizontally opposed engine was almost taboo."*

Tamou: *"When we were building the prototype vehicle, then Chief Officer summoned me and told me to do whatever was necessary in order to ensure that the car would have the world's best driving stability. We knew from the specifications that it would perform well, but even so we were out there working on the vehicle on the test course right up to the test driving session."*

Many project workers at Toyota and Subaru describe how they sensed the hidden potential of the car when they gripped the prototype's steering wheel. But—and this goes without saying—what they experienced was separate and distinct from the true driving performance that the "86" was designed to achieve. Minoru Takagi, Toyota's "top gun" when it came to evaluating the dynamic performance of its vehicles, had a specific vision of the ideal FR sports car even as he praised the potential of the prototype.

Takagi: *"I sensed the car's low center of gravity, and the ride wasn't harsh at all—it was very comfortable. However, to be blunt, the vehicle as it was then was a sedan. So then we had a discussion about what should be expected of an FR sports car in an effort to once again set some mutual goals. At that point, I asked the team to achieve three things: vehicle motion that defies the moment of inertia; ground-hugging handling performance; and smooth suspension stroke for stable and comfortable ride. I wanted them to build in the car's potential. It was essential that those three things not be left out. I think that was the real beginning of the car's development."*

To promote a shared understanding of what the team was trying to achieve, it was necessary to communicate in a concrete manner which phenomena should occur in response to which conditions and driver inputs. To that end, Takagi laid down a rule: when evaluating driving performance, team members had to bring along members of Subaru's engineering team.

Takagi: *"I forbid team members from driving the car alone and then communicating their evaluations of its performance. They had to bring Subaru people with them so that they could convey their thoughts about which aspects of the vehicle were lacking and which were good. Even on the test course—even at the Nürburgring—they had to ride in the car together. That was an absolute rule."*

Yoshinori Sasaki, who directed the vehicle's overall driving performance from the standpoint of the Product Planning Group, reflected on the benefits of this policy of requiring engineers to ride in the car together.

Sasaki: *"By having engineers ride with each other, it was possible to communicate concrete observations, for example about a certain phenomenon that might be occurring at a corner entry at a certain speed, to the passenger in a manner conducive to shared understanding."*

Initiatives like this had the effect of creating a sense of unity among project workers as "Team 86," and their efforts gradually came to embody the project's goals. The development phase led to a design fit for the roads of the world.

Driving tests around the world

Akihiro Osaka, who served as chief test driver for the car, worked along with Takagi to perfect the driving performance of the "86." Driving performance tests were conducted on roads around the world, including in Germany, Belgium, Spain, the United States, and Canada, as well as numerous tracks in Japan such as Fuji Speedway. Germany's Nürburgring played a particularly important role as Osaka and his team tweaked and tested the vehicle.

Osaka: *"There's no doubt that the Nürburgring presents the most demanding driving conditions. There's a lot of input from the road surface, which is alternately rough and low-friction. There are corners with a variety of shapes. There isn't a track in Japan with as much vertical motion. There are cars that break down the moment they're driven on the Nürburgring, even though they had performed satisfactorily on a domestic track. That said, if you were to tune the vehicle exclusively at Nürburgring, then you would end up with a car specialized for stability, and it wouldn't be a fun car to drive. Therefore, our approach at Nürburgring was first to drive along various country roads in the surrounding area. Then, once we had made a certain degree of progress in tuning the car, we took it to the Nürburgring and made sure that it wouldn't fail. Over the course of about a week, first we worked the vehicle on normal roads, and then starting on the third day we verified that it wouldn't fail at the track. When we found a weak point, we would take it back to the normal roads. In this way, we undertook a process of trial and error."*

Minoru Takagi

Advance Development Testing Driver

Expert Advisor Reporting to the General Manager,
Vehicle Evaluation & Engineering Division 1

Yoshinori Sasaki

Product Management (Chassis)

Project Manager, ZR, Product Planning Group

The team worked to tune the car's sensibility on tracks worldwide.

Manufacturers often use absolute speed to characterize performance at the Nürburgring, to the point that lap times are even used to advertise vehicles. However, the goal of the "86" development project was somewhat different. Takagi recalled that the vehicle inspired a sort of quiet confidence, even when driven on the track alongside cars with larger engines.

Takagi: *"Until the middle portion of the Nürburgring, the course is made up of a series of flat or descending sections. The '86' is pretty fast up to that point."*

Sasaki: *"Our goal with the '86' is that it be a fun car to drive, and naturally it gets passed by big-power cars on the straightaways. But in the corners, it's absolutely not going to lose. What's even better is that we were able to have the best development drivers in the car at each facility, for example Herwig Daenens in Europe and Richard Woodroffe in the United States, take a look at the car. That was a big benefit."*

Harmonization: An index that allows one plus one to equal three

In one way, the development of the car's driving performance differed decisively from the conventional approach: engineers set individual targets for different performance characteristics, but instead of being content to simply achieve them, they sought to harmonize them overall in an effort to achieve a more sophisticated blend of performance. The keyword in this effort was "harmonization," a concept that was pushed primarily by Hiroshi Watahiki (Deputy General Manager, TOTAL VEHICLE PERFORMANCE INTEGRATION DEPT, SUBARU ENGINEERING DIV), who supervised testing at Subaru.

Watabiki: *"This was a joint development project, so there were lots of specialized departments and a very large number of project workers. That's where the harmonization effort began. First of all, we had to harmonize the driver, the car, and the road in order to make the car fun to drive. Second, we had to strive to optimize the vehicle's overall performance, rather than pursuing a partial optimization approach that focused on the performance of individual functions. And our third objective was to facilitate harmonization between Toyota and Subaru."*

Sasaki: *"Ordinarily, you establish objectives for individual aspects of the vehicle's performance, such as driving stability, ride comfort, etc. But with the '86,' we really emphasized overall harmony. If one aspect of performance stood out from the rest, we worked to raise the others. If that went too far and exceeded our initial objective, then next time we would raise the others to match it. For design engineers, that meant going back and completely redoing their work, so this was a difficult approach to take. If the project was Toyota's alone, the company might not have allowed this approach. But since the spirit of harmonization guided our work, the team quickly developed a shared resolve to make the project succeed."*

Akihiro Osaka

Chief Test Driver

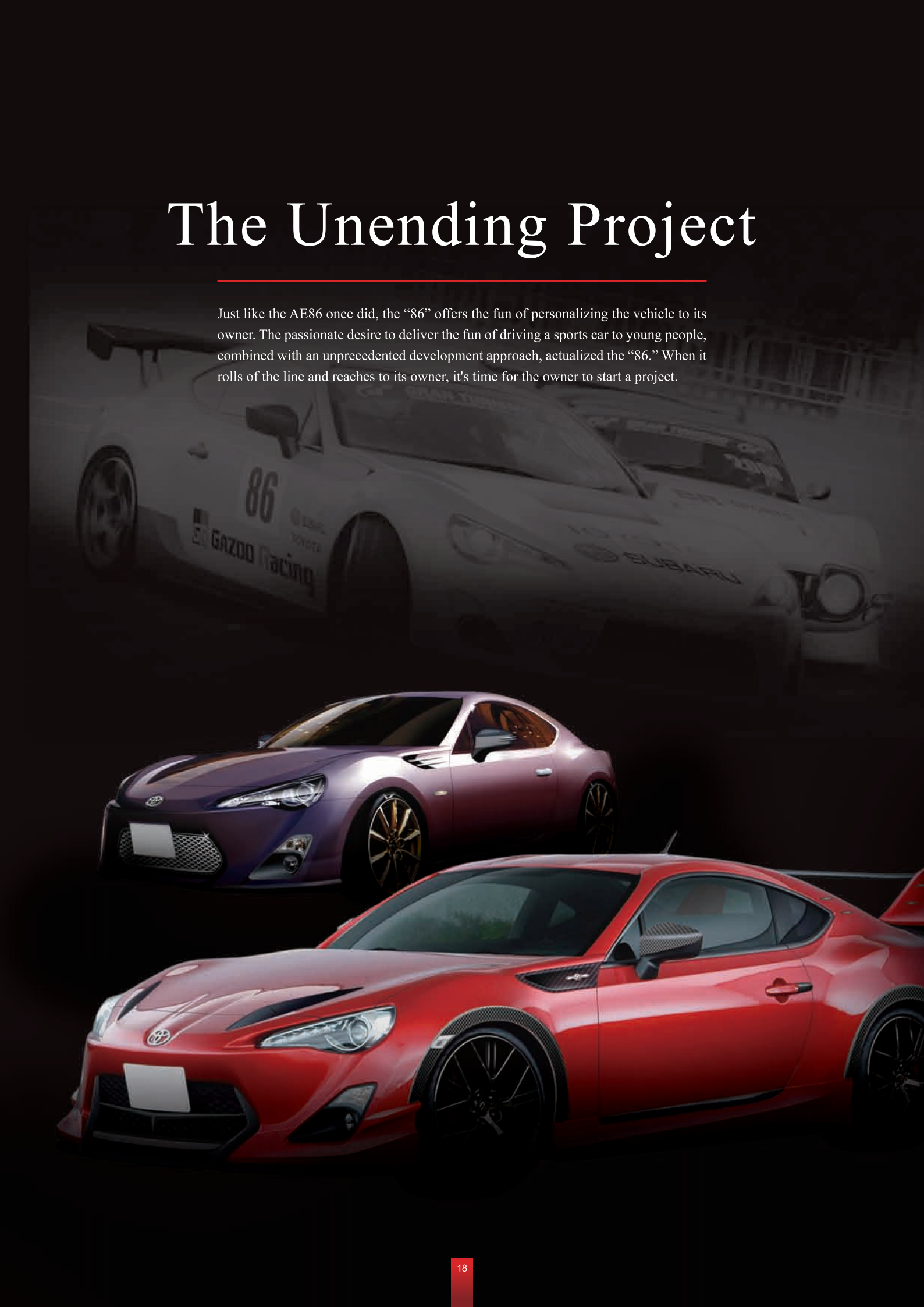
Senior Expert, GR Development Department,
Sports Vehicle Management Division

Takagi: *"People often describe the benefits of synergy by saying '1+1=3,' but the process of getting rid of a contradictory element can have a negative effect on performance. Even simply adding a new element doesn't necessarily yield an answer of two. In order to make one plus one equal three, you can expand the reach of performance by taking advantage of the quality of materials—of potential itself—to produce a complementary effect between functions so that they compensate for one another's negative aspects. I had a strong sense that these things contributed to harmonization."*

Takagi's words are a sign of the sense of accomplishment that derived from Toyota and Subaru's success in contributing all of their resources to the "86" development project.

The Unending Project

Just like the AE86 once did, the “86” offers the fun of personalizing the vehicle to its owner. The passionate desire to deliver the fun of driving a sports car to young people, combined with an unprecedented development approach, actualized the “86.” When it rolls of the line and reaches to its owner, it's time for the owner to start a project.



Hiromitsu Kishi

After-market Product Development

Project Manager, Sports Vehicle Management Division

A car that enthusiasts cultivate, like the AE86

The “86” was named for the AE86, and Chief Engineer Tada’s first vision revolved around the worldview provided by that car.

Tada: *“The reason that the AE86 still has fans today is the incredible ease with which it can be customized and tuned. The owners themselves gave it cult status. I felt that this worldview was a wonderful thing. I wanted the ‘86’ to inherit what you might term the human side of the AE86.”*

Based on this vision provided by Tada, the assumption that owners would take their cars to the track was built into the “86” from the design engineering stage. For example, the inside door handles have been placed slightly to the rear so as not to interfere with installation of a roll cage. There’s also a reason that the team chose a 2+2 seating layout rather than making the car a two-seater.

Tada: *“Our insistence that the car have a 2+2 layout was not founded on a desire to increase the breadth of the target market. In order for amateurs to have fun driving a sports car, there has to be room for tires, tools, and other cargo needed for track driving in the back of the car. Two-seaters obviously don’t have space for that sort of thing, so drivers end up asking their friends to bring it for them or buying a light van to transport it. It’s an enormous amount of trouble. So with the ‘86,’ you can fold the rear seat down and put four spare tires in the back. We made millimeter-scale adjustments to the car’s packaging so that tires would just barely fit into the back.”*

In response to Tada’s vision, Hiromitsu Kishi and Kazuo Okino of the Sports Vehicle Management Division have been actively courting third-party vendors such as manufacturers of custom parts and tuning products. Kishi notes that expectations of third-party vendors will differ somewhat from previous cars.

Kishi: *“With past cars, some tuning was sometimes necessary to compensate for aspects of driving performance that were inadequate, but the ‘86’ provides performance that has been perfected to the point that there’s no room for improvement. So our expectations of third-party vendors involve not tuning, but rather the ‘fitting’ domain, which consists of products designed to improve driving skills and accommodate owner preferences. For example, once you reach a certain level of skill in the sport of golf, the selection of products based on idiosyncrasies or physique and related advice becomes important. My goal is to be able to provide products from the ‘fitting’ domain in response to the increasing driving skills of owners, including at Toyota dealerships.”*

Okino: *“There’s a shop specializing in British cars that has the atmosphere of a barn way out in the English countryside, and when you visit you can lose yourself in that world. That’s the ideal. Sports cars are a hobby, and if you fail to provide an experience of that depth, then it may be impossible to communicate the joy of a lifestyle revolving around sports cars. Since the ‘86’ is this kind of car, we want the staff to talk about it in the proper way. We want them to create a shared worldview. And that’s why I want to cultivate this type of staff.”*

The “86” team is also working to develop functionality for interfacing with game consoles and smartphones using CAN data from the vehicle.

Sasaki: *“For example, you can record driving and status data for the vehicle along with GPS information during a session at the track, just like an F1 team. If you install some companion software on a PlayStation 3, you can then create a video reproducing your driving. You can research how you attack the track by watching that video, and you can even compete against your past performances. We plan to make ‘86’ driving data for Toyota factory drivers available online, and you’ll be able to research where the professionals brake, for example, by following them in a game.”*

This experiment will let users try out actual tuning parts in the game to see their benefits and even order parts online. By mixing the virtual and the real, the “86” will spawn an unprecedented experiment.

Production of the “86,” which was developed as the ideal FR sports car, will soon begin. That milestone marks the start of a new story: the story of how the “86” will evolve and grow along with its owners.

Kazuo Okino

Product Management and
After-market Product Development

Group Manager, Sports Vehicle Management Division