
MOTOR SPORTS

1 Introduction

In 2016, the automotive industry faced a number of issues, most notably aftershocks from Volkswagen's diesel emissions scandal that was uncovered in 2015, the falsification of fuel economy figures, and a wave of takeovers and tie-ups across the business.

Part supply issues caused by explosions and fires at parts and materials manufacturers, as well as natural disasters such as the Kumamoto earthquakes and heavy rains in the Tohoku region also forced automakers to adjust production and re-evaluate the importance of risk management.

2016 was a stable year for car racing in Japan with few major changes to regulations, resulting in strong competition based on driver skills and team strengths. However, it was a shame that the damage caused to the Autopolis Circuit in Oita Prefecture by the Kumamoto earthquakes resulted in the cancellation of races in the Kyushu region.

One shocking occurrence in car racing outside Japan for fans and non-fans alike was the sight of Toyota's leading car coming to a halt with three minutes to go before its maiden victory in the 24 Hours of Le Mans. Audi also announced its withdrawal from Le Mans and its switch to full-time participation in the FIA Formula E Championship, a sign of the growing importance of environmental considerations to automakers.

In MotoGP, the pinnacle of motorcycle racing, Suzuki won the British Grand Prix in its second season after its return to the MotoGP World Championship. The rise of Suzuki was particularly enjoyable for fans even as Japanese manufacturers led by Honda and Suzuki vied for the title 2017 promises to bring even closer battles between the top teams in MotoGP.

2 Car Racing Trends

2.1. Trends in Japan (Table 1)

Car racing in Japan was to no small extent affected by the Kumamoto earthquakes, which led to the cancellation of races at the Autopolis Circuit close to the affected region.

2.1.1. Super GT (Fig. 1)

Although eight rounds were held in 2016, the same as in the previous year, the scheduled event at the Autopolis Circuit was replaced by a double-header at Twin Ring Motegi. An overseas round was held at the same Buriram United International Circuit in Thailand as 2015.

2016 was the final year of the existing GT500 class regulations. From 2017, the class plans to switch to new vehicle regulations more closely harmonized with the technical regulations of the Deutsche Tourenwagen Masters (DTM: German Touring Car Masters) series. However, the regulations will impose restrictions on vehicle and engine development to limit speeds and enhance safety. The development of aerodynamic specifications has remained frozen since 2015. The engine fuel restrictor flow was also reduced from 100 kg/h to 95 kg/h. In addition, although the 2015 series applied fuel restrictor flow limitations to replace handicap weights when the weight exceeds 50 kg, the 2016 increased the maximum weight handicap to 100 kg. The races were fought by a total of



Fig. 1 Car from Lexus Team SARD⁽¹⁾.

Table 1 Details and results of major car racing categories in 2016.

Category		Outline of races	Outline of vehicles	Participating Japanese manufacturers	2016 champions		Remarks	
					Drivers	Manufacturers		
International series	GT500 class	8 rounds (circuits: Suzuka, Fuji, Motegi, Okayama, Sugo, Thailand)	NRE engine (2.0-liter inline turbocharged engine, fuel flow restrictor fitted) Car body rules harmonized with DTM	Lexus Nissan Honda	Heikki Kovalainen Kohei Hirate			
	Super GT GT300 class							JAT GT or JAF GT "mother chassis" rules based on commercially available vehicles Free choice of engines, displacement, turbocharging, driving wheels, etc., intake restrictor fitted Cars may also be authorized FIA GT3 vehicles
	DTM	18 races in 9 rounds (circuits: Hockenheim, Nürburgring, Moscow, etc.)	Dedicated race cars with the same silhouette as commercially available vehicles (body regulations harmonized with Japan's Super GT), RWD, 4.0-liter V8 naturally aspirated (NA) engines, tires from single supplier	—	Marco Wittmann			
	IndyCar	16 rounds on oval circuits (Indianapolis, Long Beach, Texas, etc.)	Dedicated race cars (formula) 2.2-liter V6 turbocharged engines Blended fuel consisting of 85% ethanol and 15% gasoline	Honda (engine supplier)	Simon Pagenaud			
	FIA Formula E	10 races in 9 rounds (circuits: Beijing, Buenos Aires, Long Beach, London, etc.) Held on specially designed courses in cities	Dedicated race EVs (formula) Power units: battery and motor-generator units (MGUs) (linked to rear axle)		Sebastian Buemi			
Japanese championships	Super FORMULA	7 rounds (circuits: Suzuka, Motegi, Fuji, etc.)	Dedicated race cars (formula) NRE engine (2.0-liter inline turbocharged engine, fuel flow restrictor fitted) * Mostly harmonized with Super GT engine	Toyota Honda	Yuji Kunimoto			
	F3	17 races in 8 rounds (circuits: Fuji, Okayama, etc.)	Dedicated race cars (formula) Max. 2.0-liter inline 4-cylinder NA engines	Toyota Honda	Kenta Yamashita			
	Rally	JN6	9 rounds on general roads (Hokkaido, Chubu, Kyushu, etc.)	Min. 2.5-liter engines (* turbocharged engine displacement calculated by applying a coefficient of 1.7) RN and RJ cars, 4 WD	Subaru Mitsubishi	Norihiko Katsuta		
		JN5		2.0-liter to 2.5-liter engines (turbo coefficient applied) RN, RJ, and RR cars (* RR cars have no displacement categories), 2 WD	Subaru Toyota Honda Daihatsu Mitsubishi	Hiroshi Yanagisawa		
		JN4		Max. 2.5-liter engines (turbo coefficient applied) RN and RJ cars, 2 WD and 4 WD	Subaru Toyota	Takahito Sone		
		JN3		Max. 1.5-liter engines (turbo coefficient applied) RN and RJ cars, 2 WD	Toyota Honda	Tomoyuki Amano		
		JN2		1.6-liter to 2.0-liter engines (turbo coefficient applied) RPN cars, 2 WD	Suzuki Toyota Mazda	Shintaro Meiji		
		JN1		Max. 1.6-liter engines (turbo coefficient applied) RPN cars, 2 WD Some AE cars, 2 WD and 4 WD	Suzuki Daihatsu Mazda Honda	Hisashi Suzuki		
Other series in Japan	F4	14 races in 6 rounds (circuits: Fuji, Okayama, Motegi, etc.)	Dedicated race cars (formula) Max. 2.0-liter inline 4-cylinder NA engines	Toyota Nissan Honda	Ritomo Miyata			



Fig. 2 Super Formula car from the P.mu/cerumo-INGING team⁽¹⁾.

15 cars: 6 from Lexus, 4 from Nissan, and 5 from Honda. The title was won by the pairing of Heikki Kovalainen and Kohei Hirate.

In GT300, cars continued to enter under the unique JAF GT (GT300 and the GT300 “mother chassis” rules) and FIA GT3 vehicle rule books. As a result, GT300 attracted a wide variety of entries, consisting of more than 30 cars from both inside and outside Japan. However, most vehicles in recent years have adopted the FIA GT3 rule book, with fewer entries adopting the JAF GT3 rules.

2. 1. 2. Super Formula (Fig. 2)

Although there were few substantial alterations to vehicle and engine regulations in 2016, one major change was the switch to Yokohama tires. The need for teams and drivers to become accustomed to the grip characteristics of the new tires and different basic tire characteristics during warm up and long runs revitalized Friday practices as important shakedown runs at all events. The canceled race at the Autopolis Circuit was replaced by an event at Okayama, resulting in seven rounds in 2016, the same as the previous year. Yuji Kunimoto won his first drivers’ title.

2. 1. 3. All-Japan Formula Three (F3) Championship

F3 is the gateway to the top categories of racing and is an international race category based on harmonized FIA rules. 2016 saw the entry of a non-Japanese manufacturer, with Volkswagen (VW) participating as an engine supplier. A total of 12 cars participated under rules organized by JAF and 8 cars participated in the F3-N class, which is under the jurisdiction of the Japanese Formula 3 Association. Although many leading drivers have emerged from F3, the recent design in the number of competing cars is an issue that must be resolved. The title was taken by Kenta Yamashita in his third year.



Fig. 3 No. 5 Toyota TS050 Hybrid from Le Mans 2016⁽¹⁾.

2. 1. 4. FIA Formula 4 (F4)

This, the second season of the F4 Japanese Championship, saw entries from 36 cars, roughly the same as the previous year. This season also welcomed the participation of 16 new drivers, establishing F4 as an important entry formula series and a proving ground for drivers wanting to step up into higher categories. Except for the round outside Japan, F4 races are held as support events for the Super GT series, which has boosted interest in the competition. In 2016, the title was won by Ritomo Miyata.

2. 1. 5. Japanese Rally Championship (JRC)

In 2016, the class definitions of the JRC underwent major revisions. The classes were greatly simplified by grouping four-wheel drive (4WD) cars in the top class (JN6) and two-wheel drive (2WD) cars in the second class (JN5). Furthermore, the very definition of a rally car is changing with hybrids, EVs, and fuel cell vehicles taking part as AE cars in the JN1 class

2. 2. Trends outside Japan (Table 2)

Environmentally friendly technology remains on the center stage, mainly through the Formula One World Championship and the World Endurance Championship. Engine fuel usage restrictions have encouraged improvements in thermal efficiency through lean burn combustion, while hybrid vehicle (HV) systems such as brake and exhaust energy regeneration are leading the way to more advanced next-generation powertrain technologies. The EV-based FIA Formula E Championship entered its second season and reflects the growing wave of automotive electrification. In contrast, a number of manufacturers announced that 2016 would be their last year in some of the main series.

2. 2. 1. FIA Formula One World Championship (F1)

Two races were added in 2016, bringing the championship to a total of 21 rounds, the highest ever. Although

Table 2 Details and results of major car racing categories outside Japan in 2016.

Category	Outline of races	Outline of vehicles	Participating Japanese manufacturers	2016 champions		Remarks		
				Drivers	Manufacturers			
World championships	F1	21 rounds (circuits: Melbourne, Shanghai, Sochi, Monte Carlo, Hockenheim, Singapore, Suzuka, America, Abu Dhabi, etc.)	Dedicated race cars (formula) V6 1.6-liter direct-injection turbocharged engines + energy regeneration	Honda	Nico Rosberg	Mercedes		
	Endurance races	LMP1 (hybrid)	9 rounds (circuits: Silverstone, Spa, Le Mans, Nürburgring, Mexico, America, Fuji, Shanghai, Bahrain, etc.)	Dedicated race cars (prototypes) Free engine design + energy regeneration, 4 WD drive allowed	Toyota	Romain Dumas Neel Jani Marc Lieb	Porsche	Works teams
		LMP1 (non-hybrid)		Dedicated race cars (prototypes) Engines: max. 5.5-liter, 2 WD	—	Dominik Kraihamer Alexandre Imperatori Mathéo Tuscher	/	Privateer teams
		LMP2		Dedicated race cars (prototypes) Mass-production engines NA engines: max. 5.0-liter 8 cylinders Turbocharged engines: max. 3.2-liter 6 cylinders Diesel engines prohibited 2 WD	Nissan (engine supplier)	Gustavo Menezes Nicolas Lapierre Stéphane Richelmi	/	
		LM-GTE		Cars based on commercially available vehicles NA engines: max. 5.5-liter Turbocharged engines: max. 4.0-liter 2 WD	—	Nicki Thiim Marco Sørensen	Aston Martin	
	World Touring Car Championship (WTCC)	22 rounds at 11 venues (circuits: Nürburgring, Twin Ring Motegi, Shanghai, etc.)	Cars based on commercially available vehicles 1.6-liter direct-injection turbocharged engines 2 WD	Honda	Jose Maria Lopez	Citroen		
	Rally	WRC	13 rounds on general roads (Monte Carlo, Sweden, Argentina, Finland, Germany, UK, Australia, etc.)	Cars based on commercially available vehicles 1.6-liter direct-injection turbocharged engines 4 WD	—	Sébastien Ogier	VW	
		WRC-2	7 rounds on general roads (same venues as the WRC)	Cars based on commercially available vehicles 1.6-liter direct-injection turbocharged engines 4 WD	—	Esapekka Lappi	/	
		WRC-3	7 rounds on general roads (same venues as the WRC)	1.6-liter turbocharged or 2.0-liter NA engines 2 WD	—	Michel Fabre	/	
		Junior WRC	6 rounds on general roads (same venues as the WRC)	Cars based on commercially available vehicles Max. 1.6-liter NA engines 2 WD	—	Simone Tempestini	/	
Rallycross (WRX)	12 rounds on dirt and paved circuits (Germany, UK, Sweden, Latvia, Argentina, etc.)	Cars based on commercially available vehicles 2.0-liter turbocharged engines 4 WD	—	Mattias Ekström	Audi			
Cross Country Rally (CCR)	9 rounds on general unpaved roads (Russia Abu Dhabi, Morocco, Portugal, etc.)	Dedicated rally cars and cars based on commercially available vehicles Diesel turbocharged engines, gasoline NA engines	Toyota Nissan Mitsubishi	Nasser Al-Attiyah	Toyota			
International series	Dakar Rally	Held in Argentina and Bolivia Total distance of 9,200 km, starting in Buenos Aires, doubling back in Bolivia, and finishing in Rosario	Dedicated rally cars and cars based on commercially available vehicles Diesel turbocharged engines, gasoline NA engines	Toyota Nissan Mitsubishi Hino	Stéphane Peterhansel	Peugeot		
	DTM	9 rounds (circuits: Hockenheim, Nürburgring, Budapest, etc.)	Dedicated race cars (same appearance as commercially available vehicles) 4.0-liter V8 NA engines RWD	—	Marco Wittmann	BMW		
	Indy Racing League (IRL)	16 rounds, mainly on oval circuits (Florida, Long Beach, Indianapolis, Texas, etc.)	Dedicated race cars (formula) 2.2-liter V6 twin-turbocharged engines Fuel: 85 % ethanol blend	Honda	Simon Pagenaud	Chevrolet		

there were no major alterations to the technical regulations from the previous year, several new sporting regulations were introduced, such as changes to the number of tire compounds used in races, minor tweaks to the qualifying system, and further restrictions on driver aids. From a hardware standpoint, F1 also began studying a new safety device designed to lower the risk of drivers being struck by debris at the front of the car.

The Mercedes team again dominated the season, winning 19 out of 21 races and taking 20 pole positions. This was their third Constructors' Championship in succession. Nico Rosberg, who won nine races, took his first Drivers' Championship before announcing his retirement at the end of the season.

2. 2. 2. FIA World Rally Championship (WRC)

In 2016, Citroen pulled out of the WRC as a works team, but continued to supply cars to privateer teams. The Constructors' Championship was competed by VW, Hyundai, and Ford (as the M-Sport World Rally Team). VW dominated the series, winning nine races. Both VW and Sébastien Ogier claimed their fourth consecutive drivers' and manufacturers' championships. Despite this success, VW announced its withdrawal from the WRC after the 2016 season. However, this was offset by Toyota announcing their return to the WRC for the first time in 17 years in 2017.

2. 2. 3. FIA World Endurance Championship (WEC)

Although the top LMP1-H category of the WEC in 2016 was fought over by three teams (Toyota, Porsche, and Audi), each competed using different types of hybrid powertrains and engine performance. For example, whereas Toyota's cars focused on regenerating kinetic energy, Porsche's system regenerated energy from the exhaust. This resulted in the development of cars with widely differing characteristics (Fig. 3). Including the 24 Hours of Le Mans, the season featured nine rounds (all 6-hour races except for Le Mans) and a new round was added in Mexico at an altitude of 2,000 m. This was the first sports car race to be held in Mexico since 1991. Toyota's sudden retirement at Le Mans with three minutes left in the race was a particularly memorable event during the season. The Driver's and Manufacturers' titles both went to Porsche. The entry of a team of Ford GTs in the lowest LM-GTE class also attracted much attention in the 2016 race. Unfortunately, Audi announced its decision to withdraw from the WEC at the end of the 2016 season.

2. 2. 4. FIA World Touring Car Championship (WTCC)

Chevrolet entered the 2016 WTCC as a supplier of privateer teams, joining works teams from Honda, Citroen, Volvo, and Lada. Citroen ran away with the title with 12 wins (including by privateer teams), and the Drivers' Championship was won by José María López. Citroen then announced that 2016 would be its last year in the WTCC, leaving organizers looking for ways to bolster the appeal of the series in the future.

2. 2. 5. FIA World Rallycross Championship (WRX)

2016 was the third year of the WRX as a global championship. WRX races are held in stadiums over relatively short laps (roughly 1 to 1.5 km) on highly undulating courses featuring a mix of tarmac and gravel. The action is clearly visible to the spectators, creating an exciting entertainment-focused event that is rapidly attracting attention. The entrants are 4WD cars with 2.0-liter turbocharged engines. Former WRC drivers are prominent in WRX and the 2016 championship was won by Mattias Ekström.

2. 2. 6. FIA Formula E Championship

This was the second season of the Formula E championship, which runs from October to June the following year. In 2016, more flexible development rules for power units were introduced. Since, the cars cannot run the full race distance without recharging due to the energy density, power density, and weight of the battery, drivers currently switch cars mid-race. In the future, organizers are considering introducing non-contact charging systems capable of charging the cars as they are being driven.

3 Motorcycle Racing Trends (Table 3)

As a result of the efforts and close cooperation between the series organizers, promoters, and manufacturers that develop the bikes and run the teams in the planning and running of each series, 2016 saw exciting races across all motorcycle race categories.

MotoGP, the pinnacle of motorcycle road racing, was the focus of particular attention (Fig. 4). The operation and regulations of MotoGP have been subject to a constant cycle of changes based on trial and error, evolving into a series that has gripped fans around the world.

In addition to a change in tire supplier, 2016 saw the adoption of unified engine control unit (ECU) software to accompany the unified hardware that was introduced in

Table 3 Details and results of major motorcycle racing categories in 2016.

Category		Outline of races	Outline of vehicles	Participating Japanese motorcycle manufacturers	2016 champions		
					Riders	Manufacturers	
World championships	Road races	MotoGP	Dedicated bikes for MotoGP with 4-stroke max. 1,000 cc engines	Honda Yamaha Suzuki	Marc Marquez	Honda	
		Moto2	Same competition style as road racing, but uses a two-heat system of two races in each round.	Dedicated bikes combining a 4-stroke 600 cc commercially available engine and bodies developed by each constructor	Honda (engine supplier)	Johann Zarco	Kalex
		Moto3				Commercially available or dedicated racing bikes with a 4-stroke 250 cc engine	Brad Binder
	Superbikes	Same competition style as road racing, but uses a two-heat system of two races in each round.	Bikes with a commercially available max. 1,000 cc engine (2-cylinder bikes are permitted a max. displacement of 1,200 cc.)	Honda Yamaha Kawasaki	Jonathan Rea	Kawasaki	
	Endurance	Road races in which teams compete for position with two or three riders alternating stints on a single bike over an extended period of time (8 or 24 hours).	Bikes with a commercially available max. 1,000 cc engine (2-cylinder bikes are permitted a max. displacement of 1,200 cc.)	Honda Yamaha Suzuki Kawasaki	Anthony Delhalle Vincent Philippe Étienne Masson	Suzuki	
	Motocross	MXGP	Competition for position on a motocross (unpaved dirt or sand) track that lasts for 30 minutes + 2 laps (two-heat system). Races are held in different countries and the total of points over a year determines the standings.	Dedicated motocross bikes with a 4-stroke max. 450 cc or 2-stroke max. 250 cc engine	Honda Yamaha Suzuki Kawasaki	Tim Gajser	Honda
		MX2				Dedicated motocross bikes with a 4-stroke max. 250 cc or 2-stroke max. 125 cc engine	Jeffrey Herlings
	Trials	Competition to complete set courses within a time limit without a foot touching the ground.	Dedicated trials bikes (no displacement restrictions)	Honda	Toni Bou	Honda	
	Japanese championships	Road races (JSB1000)	Competition for position by racing around a circuit. Races are held at different circuits and the total of points over a year determines the standings.	Bikes with a generally commercially available max. 1,000 cc engine (2-cylinder bikes are permitted a max. displacement of 1,200 cc.)	Honda Yamaha Suzuki Kawasaki	Katsuyuki Nakasuga	Yamaha
IA1 (motocross)		The All Japan Motocross Championship is the pinnacle of the sport and involves competition for position on a motocross track lasting for roughly 30 minutes. Races are held at different tracks and the standings are determined by points obtained over a year.	Dedicated motocross bikes. The IA1 class features dedicated motocross bikes with a 4-stroke 450 cc or 2-stroke 250 cc engine.	Honda Yamaha Suzuki Kawasaki	Akira Narita	Honda	
IA super (trials)		Competition to complete set courses within a time limit without a foot touching the ground.	Dedicated trials bikes (no displacement restrictions)	Honda Yamaha	Tomoyuki Ogawa	Honda	



Fig. 4 2016 MotoGP bike number 93 (RC213V) ridden by Marc Márquez⁽²⁾.

2014. Other examples of the wide-ranging changes to regulations included changes to the number of engines allowed to be used in a year (seven, or in some cases,

nine), a reduction in the minimum weight limit from 158 to 157 kg, and unification of the fuel tank capacity to 22 liters. These modifications were made to help close the gap in performance between the factory and satellite teams, and will hopefully lead to even more exciting racing.

Although some regulatory changes impose a development burden on participating teams, it also provides opportunities to create differences between entrants through innovation. One example in 2016 was the full-scale adoption of winglets by each team. These winglets are due to be banned in 2017 on safety grounds, but this gives the teams even more chance to show their developmental ingenuity.

The final results of the season show that Marc Márquez won his third consecutive MotoGP Riders' Championship, and that the standings were led by factory riders such as Valentino Rossi, Jorge Lorenzo, and Maverick Viñales. However, a look at the overall season shows wins for four different teams (Honda, Yamaha, Ducati, and Suzuki) and individual wins for nine different riders (seven from factory teams and two from satellite teams). The regulation changes appear to have had a major effect, further boosting the appeal of MotoGP. 2017 promises to be a year of further exciting changes as many riders have switched teams.

Johann Zarco won the Moto2 Riders' Championship with seven wins, becoming the first repeat champion. In Moto3, among various exciting occurrences, Brad Binder became the first rider from South Africa to win a title for 36 years.

Moto2 and Moto3 have produced several big names that have gone on to light up MotoGP, including Márquez, Viñales, and Pol Espargaró, and are continuing to act as feeder series for MotoGP, with Zarco and other riders making the step up to the highest class in 2017. In addition to thrilling fans with close title races, Moto2 and Moto3 continue to demonstrate their value as a feeder series for MotoGP.

Looking at the series that are based on commercially available motorcycles, seven manufacturers competed in the 2016 Superbike World Championship (WSB). Despite strong competition from the world's leading riders, Jonathan Rea won his second consecutive world championship. The key happening in the All Japan Road Race Championship was the unprecedented fifth consecutive title (and seventh time in total) for Katsuyuki Nakasuga on a Yamaha factory bike.

The MXGP class of the Motocross World Championship was won by rookie Tim Gajser, the second consecutive year that a rookie took the championship, after Romain Febvre in 2015. This was another thrilling season that was led by a new generation of riders.

Race scheduling of both the Superbike World Championship and the MXGP-class motocross championships included ASEAN countries, where motor sports are continuing to gain in popularity. These series held races in Thailand in 2016 and are steadily looking to break into new markets while expanding their fan bases.

The Endurance World Championship broke new ground from 2015 and the popular European sports tele-

vision channel Eurosports has agreed to present live coverage of the races. The Suzuka 8 Hours is the home endurance race for four motorcycle manufacturers. In 2015, Yamaha brought its current MotoGP riders and took the win in its return as a factory team, creating a stronger global flavor to the event. Yamaha repeated the win again in 2016 as a factory team, taking advantage of its stable of MotoGP and Superbikes riders. It is hoped that this will spur other teams to move in the same direction in the future.

As described above, motorcycle racing both inside and outside Japan worked hard to attract more fans in 2016 by harnessing the efforts of the whole industry, creating opportunities to raise media awareness throughout the season.

4 Motor Sport Tire Trends (Fig. 5)

Throughout motor sports, a recent trend is to switch to sole tire suppliers to reduce costs and create equally competitive conditions. This has occurred in diverse events across four- two-wheel series including F1 and MotoGP.

Running against this trend as a series that is continuing to expand competition, Super GT in Japan is an example of a high-level event that is technically competitive on a global scale and that allows multiple tire suppliers. Other series that allow competition between tire manufacturers include the OK class of the All Japan Karting Championship, the All Japan Road Race Championship, and the 86/BRZ Race series, although this is not an official all-Japan championship. In other words, although many categories of racing require single tire suppliers to reduce cost and provide equally competitive conditions, the series that allow multiple tire suppliers feature even more exciting competition.

Consequently, the trend toward single tire suppliers calmed down in 2016, and it is likely that both types of series will coexist in the future with clear delineations between single- and multiple-manufacturer events.

However, growing calls for more environmentally friendly technology is also being reflected in tires. In 2015, the PN class of the All Japan Gymkhana (JGC) series introduced a rule that limited tires to those labeled by the Japan Automobile Tyre Manufacturers Association (JATMA), which specifies a maximum rolling resistance standard as well as a pattern with continuous grooves around the tire. Despite tight vehicle regulations



Fig. 5 Gymkhana PN class Direzza β 02 tire⁽³⁾.

that allow little room for modification, the number of participants in the PN class has increased to more than half of entrants in the JGC series in 2016.

In addition, since the increasing number of entrants has led to fiercer competition, tire manufacturers are focusing their development on tires in this category. 2016 saw the launch of a second-generation of tires that comply with the JATMA rules with even better grip.

In a more unusual happening, the 2016 24 Hours of Nürburgring endurance race also introduced restrictions on developmental tires to enhance safety and create equally competitive conditions. These restrictions require teams to register their tires in advance and provide sam-

ple tires to the organizers before the race. The organizers have the right to check that these tires are the same as those actually used in the race. The objective and operation of these regulations are difficult for tire manufacturers to understand and this trend must be closely monitored in the future.

In motorcycle races, mainstream rims used to be 16.5 inches due to the performance advantages of this size of tire. However, since this size is not permitted on public roads, 17-inch rims were introduced in MotoGP in 2016 and are planned to be adopted by the All Japan Road Race Championship in 2017.

As this demonstrates, all categories of motor sports spent 2016 looking for a better combination of regulations. The selection and application of improved regulations that reflect up-to-date requirements will continue to be an important feature of motor sports. This will require close cooperation between national sports authorities (ASN) such as the Japan Automobile Federation (JAF), other motor sports associations, organizers, and tire suppliers.

References

- (1) Publicity materials of Toyota Motor
- (2) Publicity materials of Honda Motor
- (3) Publicity materials of Sumitomo Rubber