
MOTOR SPORTS

1 Introduction

In 2015, the Japanese automotive industry continued to benefit from the weak yen.

In Japanese car racing, the newly developed 2.0-liter inline 4-cylinder turbocharged engines adopted in the Super GT and Super Formula race series achieved promising results and helped to stimulate a growing number of close battles based on driver skill and team tactics.

Outside Japan, Honda struggled in its return to Formula 1 (F1), underlining the difficulty of achieving results after the recent regulation changes. In the FIA World Endurance Championship (WEC), Toyota also struggled to reproduce its double title-winning success of a year ago. Porsche won the manufacturer's title in its second season as new teams came to the forefront and Japanese marques found success hard to come by.

In a new initiative, the Mazda Women in Motorsport project featuring Keiko Ihara attracted several hundred applicants, highlighting the scale of interest in women's motor sports and giving a boost to women wanting to take part.

In motorcycle racing, Suzuki returned to the pinnacle MotoGP series. 2015 also saw positive signs for the sport with Aprilia joining MotoGP. Yamaha was strong from the start of the season and took both the manufacturer's and individual titles. Overall, 2015 was a very successful year for Yamaha, who also celebrated the 60th anniversary of the founding of the company with a first victory at the Suzuka 8 Hours endurance race.

In contrast, Bridgestone withdrew as a tire supplier for Super Formula and MotoGP at the end of 2015, leaving these series to make a new start with Yokohama Tire and Michelin in 2016. Seeing how teams react to changes like these is one of the compelling parts of motor sports.

2 Car Racing Trends

Table 1 lists the main categories of car races held inside and outside Japan, and the results of each competition.

2.1. Trends in Japan

In 2015, the new entry-level FIA Formula 4 (F4) series got off to a good start with around 40 entrants. However, there were no major changes in either Super GT or Super Formula after the substantial rule changes in 2014.

2.1.1. Super GT (Fig. 1)

2015 was the second year since the vehicle regulations were harmonized with those of the Deutsche Tourenwagen Masters (DTM: German Touring Car Masters) series. These regulations include adopting common parts such as the monocoque, brakes, and gearbox. Each manufacturer competes through development of the 2.0-liter 4-cylinder turbocharged direct injection engine and some aerodynamic parts. The races rightly function under these regulations, creating a tight competition of wafer-thin margins that also includes a development battle between four tire suppliers, quite an unusual situation in global motor sports. Following on from 2014, 8 rounds were held, including one outside Japan in Buriram, Thailand.

Super GT has also studied harmonizing engine regulations with DTM for 2017. However, the administrators of DTM in Germany proposed to postpone the harmonization schedule for two years in October, which was accepted. In the GT300 class, four vehicles entered under the "mother chassis" (MC) rule book (these vehicles are known as "Libre" vehicles under the Formula Libre concept). As a result, this class features performance adjustments between vehicles entered under three different rule books: MC, FIA GT3, and JAF-GT300. From 2016, these MC entrants will use new rules drawn up by the Japan Automobile Federation (JAF).

Table 1 Details and results of major car racing categories in 2015.

Category	Outline of races	Outline of vehicles	Participating Japanese manufacturers	2015 champions		Remarks		
				Driver	Manufacturers			
World championships	F1	19 rounds (circuits: Melbourne, Sepang, Shanghai, Monaco, Austria, Brazil, Suzuka, Russia, Abu Dhabi, etc.)	Dedicated race cars (formula) 2.0-liter inline 4-cylinder turbocharged engine + energy regeneration	Honda	Lewis Hamilton	Mercedes		
	WEC	LMP1	8 rounds (circuits: Silverstone, Spa, Nürburgring Nordschleife, Circuit de la Sarthe in Le Mans, America, Fuji Speedway, Shanghai, Bahrain, etc.)	Dedicated race cars (prototypes) 2 WD (HV may be 4 WD) HV: free engine design + energy regeneration Non-HV: Max. 5.5-liter engine	Toyota Nissan	Mark Webber Timo Bernhard Brendon Hartley	Porsche	
		LMP2		Dedicated race cars (prototypes) NA engines: max. 5.0-liter 8 cylinders Turbocharged engines: max. 3.2-liter 6 cylinders	Nissan, HPD (Honda) (engine supplier)	Roman Rusinov Sam Bird Julien Canal	/	
		LM-GTE		2WD cars based on mass-market vehicles NA engines: max. 5.5-liter Turbocharged engines: max. 4.0-liter	—	Richard Lietz	Porsche	
	Rally	WRC 1 class	13 rounds on general roads (Sweden, Portugal, Germany, UK, etc.)	4WD cars based on mass-market vehicles 1.6-liter direct-injection turbocharged engines		Sebastien Ogier	Volkswagen	
		WRC 2 class	7 rounds on general roads (Sweden, Jordan, Japan, UK, etc.)	4 WD cars based on mass-market vehicles 1.6- or 2.0-liter turbocharged engines	Mitsubishi Subaru	Nasser Al-Attiyah	/	
		WRC 3 class	6 rounds on general roads (Portugal, Finland, Germany, UK, etc.)	FWD cars based on mass-market vehicles 1.6-liter turbocharged or 2.0-liter NA engines		Quentin Gilbert	/	
		Junior WRC class	6 rounds on general roads (Monaco, Poland, France, UK, etc.)	FWD cars based on mass-market vehicles Max. 1.6-liter NA engines		Quentin Gilbert	/	
	Touring cars	24 rounds at 12 venues (Nürburgring Nordschleife, Twin Ring Motegi, Shanghai, etc.)	2WD cars based on mass-market vehicles 1.6-liter direct-injection turbocharged engines	Honda	Jose Maria Lopez	Citroen		
	Rallycross	13 rounds on circuits (paved and dirt) and general roads (Sweden, Portugal, Germany, UK, etc.)	4 WD cars based on mass-market vehicles 2.0-liter turbocharged engines		Petter Solberg	/		
International series	Super GT	GT500 class	Cars based on mass-market vehicles. RWD (Honda: mid-engine) 2.0-liter inline 4-cylinder turbocharged engine Uniform body specifications such as vehicle ground height, width, and wheelbase, and common main components	Toyota Nissan Honda	Tsugio Matsuda Ronnie Quintarelli	/		
		GT300 class	Engine conversion, displacement, turbocharging, and drive wheels are not regulated but cars must be authorized FIA GT3 vehicles based on mass-market models	Toyota Nissan Honda Subaru	André Couto	/		
	DTM	11 rounds (circuits: Hockenheim, Nürburgring Nordschleife, Moscow Raceway, etc.)	RWD cars based on mass-market vehicles, 4.0-liter V8 NA engines	—	Pascal Wehrlein	Mercedes-Benz		
	IRL	17 rounds on oval circuits (Indianapolis, Long Beach, Auto Club Speedway in Fontana, etc.)	Dedicated race cars (formula) 2.2-liter V6 twin-turbocharged engines Ethanol fuel	Honda	Scott Dixon	Chevrolet		

Table 1 Details and results of major car racing categories in 2015 (continued).

Category	Outline of races	Outline of vehicles	Participating Japanese manufacturers	2015 champions		Remarks	
				Driver	Manufacturers		
Japanese championships	Super Formula	7 rounds (circuits: Suzuka, Fuji Speedway, Twin Ring Motegi, etc.)	Dedicated race cars (formula) 2.0-liter inline 4-cylinder direct-injection turbocharged engines	Toyota Honda	Hiroaki Ishiura	Suzuka hosts the JAF Grand Prix	
	F3	17 rounds at 8 venues (circuits: Suzuka, Okayama, Twin Ring Motegi, Sportsland SUGO, Fuji Speedway, etc.)	Dedicated race cars (formula) 2.0-liter inline 4-cylinder direct-injection NA engines 2.0-liter port injection NA engines	Toyota Honda Toda Racing	Nick Cassidy		Five of the rounds are held in conjunction with Super Formula events
	Japanese Rally Championship	9 rounds on general roads (Karatsu, Wakasa, Toya, Tsumagoi, Hokkaido, Shinshiro, etc.)	Mass-market cars Divided into 6 classes from JN1 to JN6 based on displacement, 2 WD, and 4 WD		Toshihiro Arai Co-driver: Naoya Tanaka		
Others	Dakar Rally	Total distance of 9,100 through Argentina and Chile with the start and finish in Buenos Aires	Cars based on mass-market models, dedicated race trucks NA gasoline or turbocharged diesel engines	Mitsubishi Toyota Auto Body Co. Ltd. Hino Nissan	Nasser Al-Attiyah	MINI	



Fig. 1 2015 Super GT: car number 1 (MOTUL AUTECH GT-R)⁽¹⁾



Fig. 3 2015 F1 world championship: car number 22 (McLaren MP4-30 Honda)⁽³⁾



Fig. 2 2015 Super Formula: car number 38 (Cerumo Inging SF14)⁽²⁾

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

Similar to Super GT 2015 was the second year since the Super Formula series adopted newly developed vehicles and the same NRE engine as the GT500 series. There were no major regulation changes in 2015. However, although the engine fuel restrictor flow was reduced from 100 kg/h to 95 kg/h to control rapidly falling lap times due to the performance improvements of the

new chassis and the higher power of the NRE engine, lap times remained virtually unchanged in 2015. Including the final JAF GP event, the 2015 Super Formula series consisted of 7 rounds.

2. 1. 3. Formula 3 (F3)

In 2015, a total of around 20 cars participated in F3, including the same number of “C” class cars and older “N” class entries as 2014. This was the third year since the first participation of these “C” class models using a direct injection 2.0-liter engine introduced in 2013. Lagging a year behind, European cars adopted direct injection engines under the regulations modified in 2014. The performance differences between the teams was underlined in events such as the Macao Grand Prix and further rule harmonization is likely to be an issue for the future.

2. 1. 4. Formula 4 (F4)

In 2015, Japan began hosting an FIA F4 championship as a tournament run by JAF. Since 2015 was the first year of this tournament, a total of 14 rounds were held as a support event for the Super GT series, with two



Fig. 4 2015 WTCC: car number 2
(Honda Civic WTCC)⁽³⁾

races per round. The series has proved to be extremely popular from the start with nearly 40 entries.

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

2015 was the second year since the reorganization of the JRC into six classes, including new RPN categories featuring entries very close to normal road cars. There are around ten cars in each of the JN2 and JN4 RPN categories and the total number of participants has increased by around 50% compared to 2013. The 2013 rule changes seem to have succeeded in achieving the aim of revitalizing the series.

Following on from last year, Rally Hokkaido also served as the Japanese leg of the FIA Asia-Pacific Rally Championship, and a total of nine rounds was held.

2. 2. Trends outside Japan

In 2015, there were a number of major changes to safety and cost regulations. In particular, the safety committee of the International Automobile Federation (FIA) held discussions with all manufacturers about safer seats, seatbelts, and impact mitigation foam, leading to a series of regulation changes. In addition, discussions were held about changing technical regulations in each category from 2017 to make the events more exciting. Likely changes include greater engine power, wider vehicles, and the relaxation of rules covering aerodynamic devices.

2. 2. 1. FIA Formula One World Championship (F1) (Fig. 3)

In 2015, restrictions were placed on team budgets and the number of available engines in an attempt to cap the costs of the sport. The minimum weight of cars was raised to 702 kg and a new virtual safety car (VSC) system was introduced as a safety measure. The dual energy recovery system, which consists of the MGU-K system for kinetic energy recovery and MGU-H for heat energy recovery, was continued on from 2014. However,

the development of updated engines was permitted through the use of the so-called “token” system. 2015 was an exciting season of F1 races marked by the return of Honda as an engine supplier for the first time since 2008.

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

2015 was an even more competitive season than normal with the communication of performance data to and from competing cars banned within special stages (SS) except for safety data. Despite Hyundai joining as the works teams in 2014 and independent teams driving Fords and Citroens, Volkswagen continued its dominance, winning twelve out of the thirteen rounds. Like the World Touring Car Championship (WTCC), the WRC plans to boost the excitement and appeal of races by introducing higher-power engines and a wider range of permitted bodywork modifications.

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

Copying F1, the WEC is also aiming to reduce costs by limiting the number of engines used in a year, tires, team personnel, and testing days. At the same time, measures are in place to harmonize driver weights to ensure safety.

In addition, the LMP1 category was divided into hybrid and non-hybrid cars. Since the WEC permits a relatively high degree of flexibility in its technical regulations, the races feature a wide range of vehicles competing to find the most efficient hybrid system and most aerodynamic body designs.

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

In 2014, revised technical regulations saw the entry of more powerful touring cars. This was a fascinating season with races at the Nürburgring Nordschleife in Germany, France, Thailand, and a debut race in Qatar. In addition to works teams from Citroen, Honda, and Lada, several independent Chevrolet teams also took part. The tires were supplied exclusively by Yokohama Tire. The top four cars in the standings at the end of the season were all Citroens.

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

2015 was the second year of FIA’s new rallycross competition, which features extremely powerful 2-liter turbocharged 4-wheel drive vehicles with a power of at least 600 ps racing over mixed paved/gravel courses over laps of slightly more than 1 km. This series has 16 permanent drivers, and the championship was won by the former

Table 2 Details and results of major motorcycle racing categories in 2015.

Category		Outline of races	Outline of vehicles	Participating Japanese manufacturers	2015 champions		
					Riders	Manufacturers	
World championships	Road races	MotoGP	Competition for position by racing around a circuit (approximately 110 km). Races are held in different countries and the total of points awarded at each race determines the annual standings. MotoGP is the highest class.	Dedicated bikes for MotoGP with 4-stroke max. 1,000 cc engines	Honda Yamaha Suzuki	Jorge Lorenzo	Yamaha
		Moto2		Dedicated bikes combining a 4-stroke 600 cc mass-market engine and bodies developed by each constructor	Honda (engine supplier)	Johann Zarco	Kalex
		Moto3		Mass-market or dedicated racing bikes with a 4-stroke 250 cc engine	Honda	Danny Kent	Honda
	Superbikes	Same competition style as road racing, but uses a two-heat system of two races in each round.	Bikes with a mass-market max. 1,000 cc engine (2-cylinder bikes are permitted a max. displacement of 1,200 cc.)	Honda Suzuki 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 mass-market 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 max. 4-stroke 450 cc or 2-stroke 250 cc engine	Honda Yamaha Suzuki Kawasaki	Romain Febvre	Yamaha
		MX2		Dedicated motocross bikes with a max. 4-stroke 250 cc or 2-stroke 125 cc engine		Tim Gajser	Honda
Trials	Competition to complete set courses within a time limit without touching the ground.	Dedicated trials bikes (no displacement restrictions)	Honda	Toni Bou	Montesa 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 mass-market 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)	Highest class of the All Japan Motocross Championship. Competition for position on a motocross track lasting for roughly 30 minutes. Races are held at different tracks and the total of points over a year determines the standings.	Dedicated motocross bikes. The IA1 class features dedicated motocross bikes with a max. 4-stroke 450 cc or 2-stroke 250 cc engine.	Honda Yamaha Suzuki Kawasaki	Yohei Kojima	Suzuki	
	IA super (trials)	Competition to complete set courses within a time limit without touching the ground. Highest class of the All Japan Trial Championship.	Dedicated trials bikes (no displacement restrictions)	Honda Yamaha	Tomoyuki Ogawa	Honda	



Fig. 5 MotoGP YZR-M1⁽⁴⁾

WRC driver Petter Solberg as his second year in a row. This new form of world championship is much more compact than the WRC and takes place on closed circuits. The cars accelerate from 0 to 100 km/h in between 2 and 3 seconds, creating exciting racing that is likely to

grow more popular in the future.

2.2.6. FIA Formula E Championship

The Formula E Championship runs during the winter season from October to June the following year. The 2015-2016 season was the second since its establishment.

In 2015 greater flexibility have given for power unit design and higher battery power, boosting the performance of the participating cars.

3 Motorcycle Racing Trends

Table 2 lists the main categories of motorcycle races held inside and outside Japan, and the results of each competition.

Following on from 2014, many categories saw races held under transitional regulations with an eye on the future.

This section covers the top categories of motorcycle sports, with the main trends being described based on MotoGP, the Road Racing World Championship Grand Prix (Fig. 5).

In MotoGP, in addition to steps to reduce environmental pollution and restrict the performance of bikes that have been becoming faster and faster in recent years, a continuing theme remains the vitalization of the sport by striking a balance between lower costs and competitiveness.

As part of these trends, the MotoGP class decided to use compulsory common software (ECU hardware is already harmonized) for all bikes in 2016. The 2015 season was a preparatory period for this introduction. Continuing from last year, MotoGP bikes raced under two categories: open entries in which the bikes use both common ECU hardware and software, and factory entries in which the bikes are permitted to use original software. Regulations are highly restrictive. Factory entries are allowed to use up to five engines with engine specifications being frozen after the first race and a fuel tank capacity of 20 liters. Open entries are permitted twelve engines, can change engine specifications during the season, and have a fuel tank capacity of 24 liters.

Although the shared software that is due to be introduced in 2016 has been jointly developed with the ECU among participating bike manufacturers, original software development by each company was frozen part way through the season to prevent the common software development affecting the 2015 races.

Since all bikes use the same software, the open entry category will be abolished in 2016, creating a single harmonized class of MotoGP bikes. (Some regulations will be relaxed for manufacturers in their first year of participation and manufacturers with poor results.)

In addition, MotoGP has used a single tire supplier since 2009. The contract of Bridgestone, which has been a strong supporter of MotoGP as the sole tire supplier since that time, expired at the end of the 2015 season and will be replaced by Michelin from 2016.

In both the Moto2 class, which combines mass-market 600 cc engines from a single supplier with different chassis from various manufacturers, and Moto3, which uses dedicated racing bikes with a 4-stroke 250 cc engine, the performance differences between bikes is small. Each race is closely fought with the lead changing hands very frequently. The riders in these series tend to be younger



Fig. 6 RE-71R tire for 86/BRZ Races⁽⁵⁾

and the races are popular events. One major story in Moto3 in 2015 was Danny Kent, who became Great Britain's first Grand Prix motorcycle world champion for 38 years.

In 2015, the Superbike World Championship (WSB), which features bike categories based on mass-market models, harmonized its regulations to the EVO class, which strictly regulates modifications from mass-market engines to help reduce costs and create more even competition. In addition to the strict restrictions on modifications, the price of components such as ECUs, brakes, and suspensions is capped to make it easier for privateers to take part.

In contrast, since the bikes are based on mass-market models, some are not equipped with ride-by-wire systems in commercially available conditions. Since this results in major differences in performance, modifications to accommodate ride-by-wire systems have been provisionally permitted. (This is provisionally permitted up to 2016. From 2017, no modifications to mass-market parts will be permitted.)

In Japan, GP riders took part in the Suzuka 8 Hours endurance race, drawing large crowds than normal and helping to vitalize the sport.

4 Motorsport Tire Trends

In various categories of motor sports both inside and outside Japan, the trend of adopting sole tire suppliers to reduce costs and create equally competitive conditions is continuing. The pinnacles of both four- and two-wheel motor sports (F1 and MotoGP) have already switched to sole tire suppliers, and the same trend is becoming stronger in races inside Japan.

However, some classes still use multiple competing tire manufacturers. The most well-known of these in four-wheel motor sports is the Japanese Super GT series. Another example is the All Japan Karting Championship. One example in two-wheel motor sports is the FIM En-

durance World Championship (EWC), which includes the Suzuka 8 Hours. Super GT stands out because of the four-way competition among Bridgestone, Dunlop, Yokohama, and Michelin, creating an unusually fierce competition even from a global standpoint.

Outside these top race categories, another recent series of races with fierce tire competition is the popular 86/BRX Races in Japan (Fig. 6). Although this series started in 2013, increasingly heated competition led to the creation of an extra class in 2015. These races now have both professional and amateur Clubman classes. Tire performance has evolved strongly so that the average lap time for the Clubman class in 2015 is around one second faster than the professional drivers in 2013. Lap times of professional class have also dropped by around three seconds (times recorded at Fuji Speedway).

Another key trend in world championship top category race tires is the changes in tire sizes (i.e., rim diameters). Tire sizes have been moving from dedicated race specifications to dimensions closer to normal passenger cars, which is allowing technical feedback to ordinary

tires.

Although F1 still uses 13-inch tires, Formula E, which is in its third season, requires the use of 18-inch tires that are closer to those used by passenger cars (currently, Formula E tires are all supplied by Michelin). Formula E also uses the same grooved tires in both dry and wet conditions.

In motorcycle races, the mainstream rim size used to be 16.5 inches, which is not a normal specification for ordinary tires for public roads. Both the WSB and MotoGP series have recently switched to 17-inch tires, in 2013 and 2016, respectively. The EWC and the Suzuka 8 Hours have also decided to switch to 17-inch tires in 2017.

References

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