TRUCKS

Overall Trends

1 Introduction

Propped up by Abenomics, the Japanese economy in 2015 showed modest signs of recovery on the road to escape from prolonged deflation and reinvigorate itself as the gross domestic product (GDP) for the 2015 calendar year (January to December) rose by 0.5% over the previous year, its first positive growth in two years[(1)].

The agreement in principle on the TPP and the hosting of the Tokyo Olympic and Paralympic Games in 2020 are expected to further stimulate economic recovery.

At the same time, while the economies of China and emerging nations in Asia are slowing down or facing reduced prices for their resources, U.S. economic measures are coming back on track. In that context the uncertainty affecting the global economy due to factors such as the risk of a downturn in the economies of China and emerging nations in Asia, or the fluctuations in international financial markets, remains unchanged.

Against this backdrop, construction demand supported higher sales of dump trucks and other vehicles in the Japanese truck market for the first half of 2015 (January to June). The April to June period for 2014 was affected by the backlash from the consumption tax hike, but the same period in 2015 exhibited growths as that backlash faded away. In the latter half of the year, rising demand in logistics spurred sales of cargo vehicles such as vans with cargo beds.[(2)]

The export truck market benefitted from a higher number of exported units thanks to the recovery of the U.S. economy. In contrast, the economic slowdown in Southeast Asian markets such as Thailand and Indonesia in 2015 led to a drop in demand.

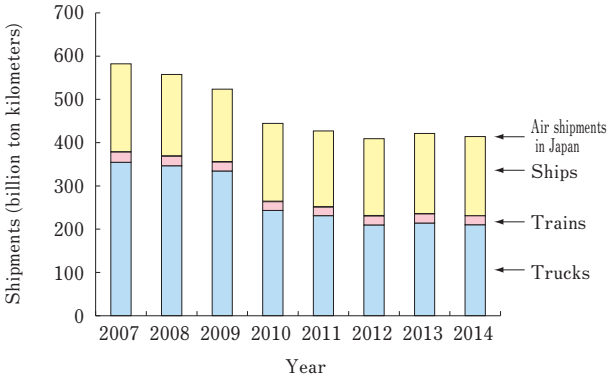
With the COP 21 agreement at the end of 2015, participating countries officially committed to greenhouse emissions reduction targets, an event that is expected to further intensify the need for environmentally friendly trucks.

2 Recent Truck Market Trends

2. 1. Freight shipments in Japan

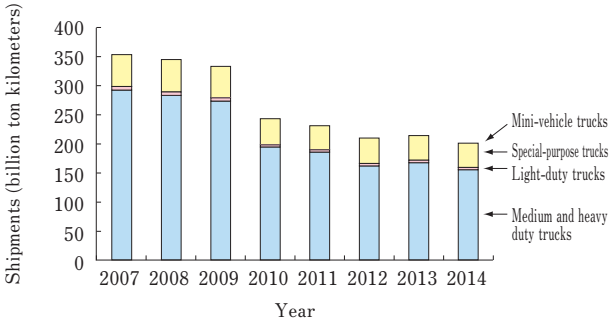
Although freight shipments in Japan in 2014 amounted to 415.2 billion ton kilometers, a 1.4% reduction from 2013, the ongoing decrease observed since 2007 is becoming less pronounced. These shipments break down into 210 billion ton kilometers shipped by trucks, 21.0 billion ton kilometers shipped by trains, 183.1 billion ton kilometers shipped by ships, and 1.1 billion ton kilometers shipped by air. In terms of share, trucks accounted for 50.6%, trains for 5.1%, ships for 44.1%, and air shipping for 0.3% (Fig. 1).

If the amount of freight shipped by motor vehicles is



* Since 2010, private mini-vehicle trucks were excluded from

Fig. 1 Freight shipments in Japan[(3)]



* Since 2010, private mini-vehicle trucks were excluded from

Fig. 2 Freight shipments by vehicle type[(3)]

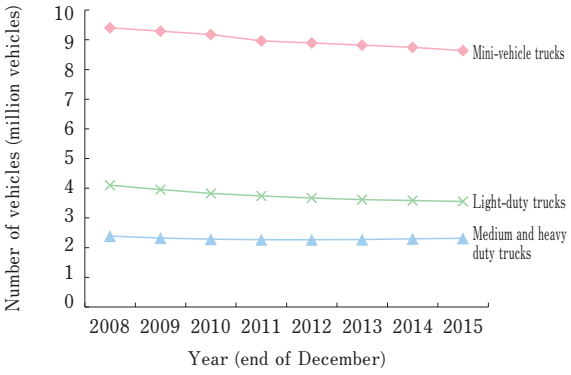


Fig. 3 Number of trucks in Japan according to vehicle type[4]

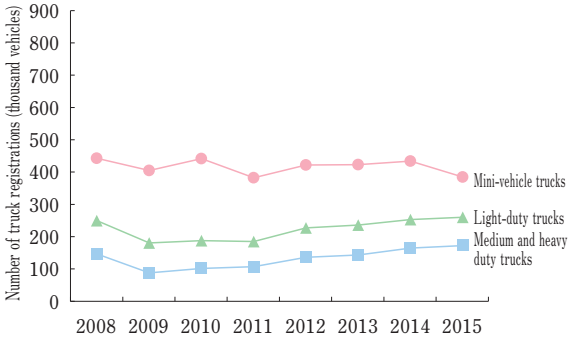


Fig. 4 Number of truck registrations in Japan according to truck type[4]

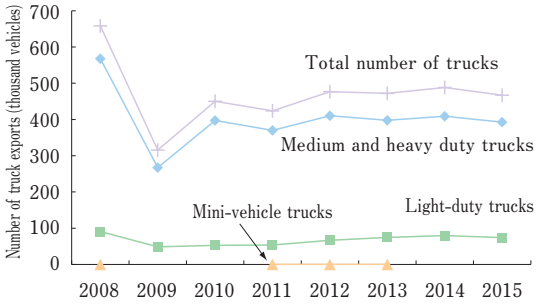


Fig. 5 Number of truck exports according to truck type[4]

further broken down by the types of truck used, medium and heavy duty trucks account for 77.1%, small trucks account for 2.0%, special-purpose trucks account for 20.7%, and mini-vehicle trucks for 0.2%, representing a 1% decrease for medium and heavy duty trucks, and a 0.9% increase for special purpose trucks (Fig. 2).

2. 2. Number of trucks in Japan

The number of trucks owned is Japan has continued to decline, reaching 14.51 million at the end of December 2015, a decrease of approximately 120,000 vehicles, or 0.8%, relative to the previous year. Broken down by type of truck, the number of medium and heavy duty trucks

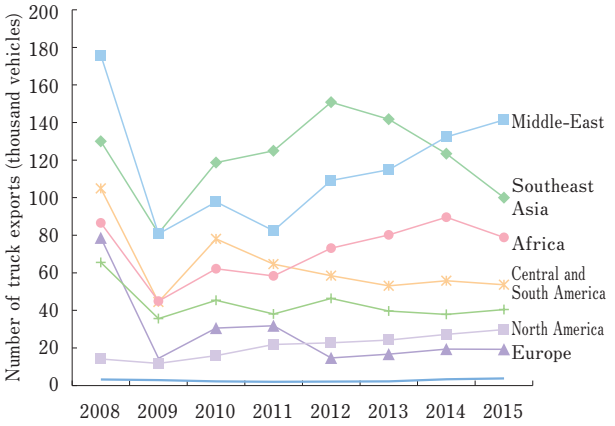


Fig. 6 Number of truck exports according to destination[4]

Fig. 7 Completely redesigned Isuzu Giga[5]

grew slightly, by 0.9% while small and mini-vehicle trucks dropped slightly, by 0.8% and 1.3% respectively (Fig. 3).

2. 3. Number of truck registrations in Japan

The number of truck registrations in Japan in 2015 was approximately 820,000, an increase of 4%, or 34,000 vehicles, compared to the previous year. By truck type, there was a 4.7% increase for medium and heavy duty trucks rose and a 2.8% increase for small trucks, but a considerable drop of 11.3% for mini-vehicle trucks (Fig. 4).

2. 4. Truck exports

Approximately 470,000 trucks were exported in 2015, a decrease of 22,000 units, or 4.4%, compared to the previous year. Exports declined by 4% and 6.7%, respectively, for medium and heavy duty trucks (Fig. 5). By destination, the number of exported trucks increased in the Middle-East, North America, and Oceania, but declined in Southeast Asia, Central and South America, and Africa. The highest exports were to the Middle-East, rising for a fourth consecutive year, by 6.9% over the previous year. Southeast Asia had the second highest number of exports, which nevertheless declined for a third consecutive year, falling to 19% less than in 2014 (Fig. 6).

Fig. 8 Mitsubishi Fuso Super Great V[5]

Fig. 9 UD Trucks Quon[5]

Fig. 10 Hino Ranger[5]

Fig. 11 Isuzu Forward[5]

3 2015 Model Year Trucks and Special Characteristics

3. 1. Trucks manufactured in Japan

Some manufacturers carried out complete redesigns in 2015, and the lest carried on from 2014 in adding or expanding model lineups with improved fuel efficiency and safety performance.

3. 1. 1. Heavy-duty trucks

Isuzu Motors completely redesigned its Giga heavy-duty truck, improving performance in the five areas of comfortable driving environment, enhancing fuel-efficiency, pursuing total safety, securing a high load capacity, and providing remote assistance via information and communication technologies (Fig. 7).

Main enhancements

3. 1. 1. 1. Exterior

Ease of use and economic performance are achieved though improvements such as a new aerodynamic cab that reduces drag, and efficient layout for the steps and grab handles to climb in and out of the vehicle.

3. 1. 1. 2. Interior

A semi-round instrument panel has been adopted to ease driving operations. A functional layout groups the switches by frequency of use around the gauges and instrument panel, making them easier to identify and operate while driving and achieving more efficient operation.

3. 1. 1. 3. Engine

The 6UZ1 engine was upgraded. The specifications of the turbocharger were modified, the intercooler and radiator were enlarged, the EGR cooler was made more efficient, the supply pump was modified, new injectors were adopted, and an ultra-high pressure common rail system was adopted to increase the low- to mid-range torque and improve fuel efficiency. The Eco-stop system that automatically stops and restarts the engine during normal driving operation has been made standard equipment on cargo and dump truck models, reducing the amount of fuel consumed while idling.

3. 1. 1. 4. Transmission

The enhanced Smoother-Gx automated manual transmission reduces shift shock to provide smoother start offs. An engine retarder was also added to improve the braking force of the auxiliary brakes. The Smart Glide system has been installed on models equipped with the 6UZ1-TCS engine and 12-speed Smoother-Gx transmission, which automatically disengages the clutch when the accelerator is lightly pressed in constant cruising such as on a downhill, achieving more fuel-efficient driving by effectively utilizing the inertial force of the vehicle.

3. 1. 1. 5. Safety

The collision mitigation braking function in the pre-collision braking system was supplemented with a collision avoidance support function to cope with moving obstacles. It uses a duel system consisting of both a millimeter wave radar and a camera for improved detection of objects ahead.

Mitsubishi Fuso Truck and Bus Corporation estab-

Fig. 12 Hino Dutro[5]

Fig. 13 2-ton series Toyota Dyna[5]

Fig. 14 Isuzu Elf Hybrid[5]

Fig. 15 UD Trucks Kazet RK[5]

Fig. 16 Nissan NT450 Atlas[5]

Fig. 17 Nissan Atlas F24[5]

lished a new Eco-drive package with improved actual fuel efficiency as standard equipment on the Super Great V heavy-duty trucks equipped with the 12-speed INOMAT-12 mainly designed for high speed driving (Fig. 8). Also, a new dump trucks with a gross vehicle weight (GVW) of 20 tons equipped 13-liter engine was established as the first vehicle in its class to exceed the heavy-duty vehicle fuel economy standards by 5%, which adopts a stop-start system as standard equipment to achieve fuel efficient and environmentally friendly performance. In addition, driver alertness monitor and lane departure warning systems were made standard on all semi-truck systems, improving safety performance during high speed cruising.

UD Trucks has been enhancing the fuel efficiency of the Quon heavy-duty line. The four 2014 tractor models were followed up this year with modified engine characteristics to increase torque at low speeds by shifting the maximum torque lower in the speed range, expanding its range of models exceeding the heavy-duty vehicle fuel economy standards by 5% to a total of 17 models, including cargo, dump, and tanker trucks (Fig. 9).

3. 1. 2. Medium-duty trucks

Hino equipped its Ranger medium-duty truck lineup with a new downsized engine that achieves lower fuel consumption and added a new model featuring a vehicle stability control (VSC) system as standard equipment (Fig. 10). On vehicles in the 8-ton GVW class equipped with a 117 kW (240 PS), the heavy-duty vehicle fuel economy standards were exceeded by 5% by reducing engine speed and modifying the activation conditions for the stop-start system.

Seeking expanded safety performance, Isuzu upgraded part of its Forward medium-duty truck series, offering a pre-collision braking system and millimeter wave vehicle distance warning systems as new options in some models to supplement the lane departure warning and electronic stability control systems (Fig. 11).

3. 1. 3. Light-duty trucks

Hino enhanced the safety of its Dutro light-duty truck

Fig. 18 Suzuki Carry[5]

Fig. 19 UD Trucks Quester[5]

with the addition of VSC and an electric parking brake as standard equipment. At the same time, the hybrid model exceeded the heavy-duty vehicle fuel economy standards by 15% (Fig. 12).

Toyota upgraded the Dyna and Toyoace light-duty trucks (Fig. 13). The 1-ton series received a partial upgrade, with a read end cross member set at the end of the frame (excluding the root van) to prevent sliding under the bottom of the deck when the vehicle is hit from behind. In the 2-ton series, in conjunction with making VSC standard equipment on diesel models, improved safety was addressed by installing electric parking brakes, which allow braking with a minimum effort, on more models and making them standard on aerial work platforms and garbage trucks, which frequently work from a stopped position, as well as offering them as an option on diesel (single cab) models.

Isuzu upgraded its Elf light-duty truck hybrid model (Fig. 14). An EV mode allowing quiet driving when the vehicle is only powered by the motor was added to address noise concerns. In addition to refinements to the engine, the original range covered by the Smart Glide +e control, which provides support for fuel-efficient driving, has been expanded to enable the use of the hybrid function. As a result, the vehicle now exceeds the heavy-duty vehicle fuel economy standards by 15% and has obtained the low-emission vehicle certification.

UD Trucks has launched the Kazet RK light-duty

Fig. 20 Hino New 500 series[5]

Fig. 21 Mitsubishi Fuso Truck and Bus Corporation FJ[5]

truck (Fig. 15). It maintains the cost-efficiency and operability of the light-duty Kazet while offering the carrying capacity of a medium-duty truck.

Nissan strengthened its product lineup with the addition of a new 4WD model with a maximum carrying capacity of 3 tons to the flatbed body, chassis, dump truck, dump truck custom chassis, and tanker truck custom chassis models in its NT450 Atlas light-duty truck series (Fig. 16). The driver's seat armrest that had only been standard for some specifications was made standard on all models, and a hill start assist system was added as a manufacture option on manual transmission (MT) models. A partially upgraded version of the Atlas F24 light-duty truck was also launched (Fig. 17). This partial upgrade improves fuel efficiency by modifying the engine specifications and tire size, and the 1.5-ton series 4WD diesel model now meets the 2015 fuel economy standards, and achieves the 2009 emissions standards 10% reduction level for the low-emission vehicle certification criteria. The rear underrun protection device already standard on diesel models were also made standard on gasoline models to increase safety.

3. 1. 4. Mini-vehicle trucks

Suzuki modified some of the specifications of its Carry mini-vehicle truck, improving fuel efficiency, and also improved its practicability through measures such as add-

ing a second gear start mode to its 5-speed automatic transmission (5AGS) models and using anti-corrosion steel sheets for the entire body surface area (Fig. 18). Engine control modifications added 1.2 km/L to the fuel efficiency rating of 5-speed MT models (JC08 test cycle fuel consumption rates), bringing 2WD models to 19.8 km/L and 4WD models to 19.6 km/L. Similarly, 3-speed automatic transmission model received a 0.4 km/L improvement, resulting in 17.2 km/L for 2WD models and 17.0 km/L for 4WD models.

The same changes were also concurrently applied to the Mazda Scrum Truck, Nissan NT100 Clipper, and Mitsubishi Minicab Truck OEM supply models.

Honda launched a partially upgraded model of its Acty mini-vehicle truck featuring improved fuel efficiency.

3. 2. Trucks manufactured outside Japan

UD Trucks introduced the Quester heavy-duty truck, which was launched in emerging countries in 2013, to South Africa (Fig. 19). Parts for this vehicle are shipped from factories in Thailand and assembled locally. This model achieves the high carrying capacity, flexible customization, ease of maintenance and robust off-road performance required by emerging countries and offers a set of specifications that make it readily adaptable to diverse short- to medium-distance transportation.

Hino launched the new Hino 500 medium-duty truck in Indonesia and Thailand (Fig. 20). This vehicle uses modularization to conform to the market.

Mitsubishi Fuso Truck and Bus Corporation expanded it's exports markets and started selling the Fuso brand FA and FI medium-duty trucks with a GVW of 9 to 16 tons, the FJ and FO heavy-duty trucks with a GVW of 25 tons or higher, as well as the FZ heavy-duty truck with a gross tractor-trailer weight of 49 tons in Asia, the Middle-East, South Africa, and Central and South America. These vehicles are produced at the Oragadam plant of Daimler India Commercial Vehicles Pvt. Ltd. a 100% subsidiary of the German corporation Daimler (Fig. 21).

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(1) Cabinet Office, Statistics
(2) NIKKAN KOGYO SHIMBUN (April 15, 2016)
(3) Road Transport Statistics, MLIT
(4) Yearly, Monthly Report of Automobile Statistics, JAMA
(5) PR Materials and Website of each company

Design Trends

1 Trends in Japanese Truck Design

Japanese commercial vehicles are often used entirely as production goods, and user demand for highly efficient products with fewer running costs rises year after year. In addition, the post post-new long-term regulations gradually start coming into effect on a vehicle weight basis in 2016. Commercial vehicle manufactures are charting various courses to respond to such increasingly stringent demands and regulations.

Design-related solutions include highly aerodynamic vehicle shapes that improve fuel efficiency, and graphics for human machine interfaces (HMIs) that assist the driver in performing fuel efficient driving.

In terms of design trends, manufacturers usually adopt exteriors that emphasize their unique appeal, with typical approaches involving the use of larger front grilles and distinctive graphics.

Truck vehicle heights have generally been rising due to the extra space taken up by the engine, and at the same time some designs are taking an approach that emphasizes continuity from the front lid to the bumper to project an imposing impression of dignify with taller promotion.

The new Isuzu Giga featuring its first complete redesign in 21 years and announced at the 2015 Tokyo Motor Show (Fig. 1) is an example of this approach.

1. 1. Exterior design

Isuzu had already been sharing the cab between some medium-duty Forward (Fig. 2) and light-duty Elf models, and this complete redesign also brings it to the heavy-duty Giga, expanding the commonization of cab parts to its entire lineup, from light- to heavy-duty vehicles.

That cab, which is part of the exterior, has been given a narrower front face that takes aerodynamic performance into consideration and rectifies the flow of air on the vehicle corners. Another difference from the previous model is how the lower edge of the door extends to cover the steps and improve vehicle aerodynamics.

The 2010 facelift applied to the previous Giga model had updated its design characteristic to the horizontal and vertical six-hole continental grille and vertical head-

lamps shared by the entire lineup. That grille subsequently modified to a new generation in the Forward and the Elf.

This involved changing from the traditional horizontal and vertical character lines do diagonal ones bringing out a sense of dynamism, and the new Giga features thick, bold horizontal and diagonal lines in a grille that follows the trend of connecting the front lid to the bumper to more clearly promote a new brand image.

1. 2. Interior design

The design theme for the interior of the new Giga (Fig. 3) was unified with that used in the Elf and the Forward, bringing out the family relationship, with an exclusive design used everywhere except the passenger side dash panel.

The middle part of the dash panel on the driver's side has been slanted toward the driver. The center dash panel gathers the switches near the meter cluster, grouping them by function for better operability. The center of the instrument panel features a 4.2-inch multi-information display that, for the first time in a Japanese truck, can be controlled from switches in the steering wheel, marking an improvement in HMI over previous models.

The seats were also revamped, with the top part of the seat backs made wider to fully support the driver. The fabric is colored in a combination of grey and blue and uses mesh mesh type fabric for better air permeability, providing better comfort to the driver.

Fig. 1 Exterior of new Isuzu Giga

Fig. 2 Isuzu Forward (left) and Elf (right).

Fig. 3 Interior of new Isuzu Giga

2 Trends in Truck Design outside Japan

In Europe, 2015 saw little activity as the various manufacturers had finished releasing their new models compliant with the latest Euro VI emissions regulations by the previous year.

One recent approach in exterior design involves daytime lights whose graphics typify the merging of functionality and the expression of a distinct identity. In terms of the interior, appearance quality is being enhanced in all vehicle grades.

Against this backdrop, Iveco launched the Eurocargo (Fig. 5), a new medium-duty truck that uses the new generation design theme first seen in the Daily light-duty truck (Fig. 4).

2. 1. Exterior design

The front grille of the Eurocargo incorporates the V-shaped theme from the Daily, and continues from the lid to the corner panels which act as an integrated deflector to achieve both functionality and a dynamic design. At the same time, the bumper sports an inverse V-shaped character line mirroring that of the grille to present a distinctive front face.

The headlamps in the bumper are commonized parts taken from the company's heavy-duty models. The exterior shape of the lamp parts has been retained from the previous model, but the daytime light graphics and the shaping of the bumper to wrap around the headlamps provide a sense of novelty through graphic variation.

2. 2. Interior design

Very little change was made to the dash panel of the previous model for the interior of the new Eurocargo (Fig. 6), but the quality of the steering wheel was raised through the use of the same design as in the heavy-duty models.

Functionality was greatly enhanced with the addition of storage space to the central part of the dash panel, a revamped center console, a folding work table, and a large PET bottle holder.

Fig. 4 Exterior of new Iveco Daily

Fig. 5 Exterior of Iveco Eurocargo

Fig. 6 Interior of Iveco Eurocargo

3 Concept Truck Design

3. 1. Concept trucks from Japan

The Hino Profia Hybrid unveiled at the Tokyo Motor Show (Fig. 7), built around the concept of achieving fuel economy in heavy-duty truck driving over long distances, does not limit itself to the hybrid system, but rather incorporates various elements that reduce drag to improve fuel efficiency. Enhanced aerodynamics are realized through design attentive to details, including shutters in the grille, the shape of the outer portion of the side mirrors, and the side skirts.

Also presented at the Tokyo Motor Show, the Quon Vision (Fig. 8) concept truck embodies the UD Trucks vision of achieving smart logistics. While promoting brand identity through the large front hexagonal grille, it also focuses on functional aspects such as a front shape presenting a unified form from cab to bumper, the installation of side skirts, and the use of small side mirror cameras, which amendments to the legislation have made a real possibility, to offer a design that reduces aerodynamic drag.

3. 2. Concept trucks from outside Japan

The Freightliner SuperTruck (Fig. 9) is a concept truck focused on aerodynamics. It incorporates many proposed functions to improve aerodynamic performance, including a function that adjusts the height of the vehicle according to its speed and grille shutters to reduce drag, and a roof with a carefully selected angle that is unified with the windshield.

Freightliner also presented its Inspiration automated driving concept truck. The Inspiration achieves enhanced fuel economy through an exterior shaped for aerodynamic performance while also offering an interior designed with automated driving in mind (Fig. 11). The display set in the center of the dashboard recedes into the dash panel when the driver is at the wheel, and during automated driving, the driver can use it as a tablet. This approach was also seen in the FT 2025 announced the previous year by Mercedes-Benz, another member of the Daimler group (Fig. 12), and represents a proposed next-generation HMIs for autonomous trucks.

Limited use automated driving functions have been commercialized in some passenger cars, and are also starting to make their way into trucks. The transition toward automated driving will undoubtedly change how drivers work and behave in the cabin, a situation that is anticipated to lead to a stronger focus on appropriate HMIs and suitable information and entertainment systems that helps provide a change of pace and reduce fatigue. Multifaceted approaches will become necessary to devise unique cabin environments for commercial vehicles.

References

(1) Website of each company
(2) PR Materials of each company
(3) Product Catalogue of each company

Fig. 7 Exterior of Hino Profia Hybrid

Fig. 8 Exterior UD Trucks Quon Vision.

Fig. 9 Exterior of Freightliner SuperTruck

Fig. 10 Exterior of Freightliner Inspiration

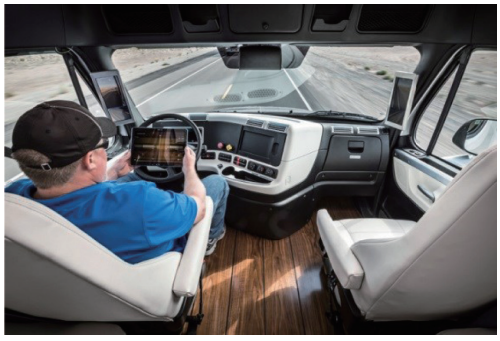

Fig. 11 Interior of Freightliner Inspiration

Fig. 12 Interior of Mercedes-Benz FT 2025

Body Structures

1 Cab and Chassis

1. 1. Product trends

1. 1. 1. Heavy-duty trucks

Table 1 shows the Heavy-duty trucks announced in Japan in 2015, and the main product technology trends. This class features a greater range of vehicles that exceed the 2015 fuel economy standards by 5%, with extensive efforts applied to functions that improve fuel efficiency or safety performance.

The Giga single vehicle series was completely redesigned. The cab frame and component parts were commonized with the Forward and the Elf, and in addition to a modified front face design that reduces drag, it also offers better cooling performance thanks to the adoption of a large front grille and a large intercooler. It also uses a semi-round instrument panel for greater ease of operation while driving. Furthermore, safety was enhanced by making a pre-collision braking system (involving adding a collision avoidance support function to the collision mitigation braking function) standard equipment.

For the Quon, modifications to engine characteristics and other changes were made to expand the range of vehicles configured to exceed the 2015 fuel economy

Table 1 Main product technology trends for heavy-duty trucks in 2015.

Month of launch	Truck model name	Main characteristics
April	Quon	Partially refined •Vehicle configured to achieve the 2015 fuel efficiency standard +5 % threshold.
October	Super Great V	Partially refined •Vehicle configured to achieve the 2015 fuel efficiency standard +5 % threshold.
	Giga	Completely redesigned

Table 2 Main product technology trends for medium-duty trucks in 2015.

Month of launch	Truck model name	Main characteristics
October	Ranger	Partially refined •Vehicle configured to achieve the 2015 fuel efficiency standard +5 % threshold.
November	Forward	Partially refined • Safety systems installed

standards by 5%. At the same time, improvements to the 12-speed electronically controlled transmission and the installation of a function to disengage the engine brake when cruising on inertial force in situations such as going downhill reduce fuel consumption.

The Super Great V became the first model to introduce a stop-start system as standard equipment in dump trucks to offer a configuration that exceeds the 2015 fuel economy standards by 5%. For users who primarily drive at high speeds, an additional Eco-drive package that incorporates fuel efficiency improvement functions such as an automatic control system to disengage drive force, automatic cruising, or economy control has been made available.

1. 1. 2. Medium-duty trucks

Table 2 shows the medium-duty trucks announced in Japan in 2015, and the main product technology trends. As with heavy-duty trucks, this class offers a greater range of vehicles that exceed the 2015 fuel economy standards by 5%, as well as the addition of functions aimed at improving safety performance.

By reducing engine speed and modifying the activation conditions for the stop-start system, the Ranger introduced a vehicle that exceeds the 2015 fuel economy standards by 5% in the 8-ton GVW class.

To offer even more extensive safety performance, the Forward added a collision avoidance function based on warnings and automatic braking, as well as a millimeter wave distance warning system that alerts the driver when the distance with the preceding vehicle closes by more than a preset amount, as options. Both systems combine the use of a millimeter wave radar and a camera, providing high accuracy detection for improved safety.

Table 3 Main product technology trends for light-duty trucks in 2015.

Month of launch	Truck model name	Main characteristics
January	Kazet	Partially refined •Medium-duty truck loading capacity with a light-duty truck base
April	Elf	Hybrid model partially refined •Achieved the 2015 fuel efficiency standard +15 % threshold. •EV mode added
May	Dutro	Partially refined •Safety systems made standard equipment

Table 4 Main product technology trends for mini-vehicle trucks in 2015.

Month of launch	Truck model name	Main characteristics
August	Carry	Partially refined •Engine control modified •Anti-rust steel sheets applied to 100 % of the body surface area
September	Minicab Truck	Partially refined (OEM procurement from Suzuki Motor Corporation) •Engine control modified •Anti-rust steel sheets applied to 100 % of the body surface area

1. 1. 3. Light-duty trucks

Table 3 shows the light-duty trucks announced in Japan in 2015, and the main product technology trends. This class was characterized by the expanded installation of safety systems and the introduction of hybrid vehicles made eligible for the new fuel-efficient vehicle tax reduction category represented by the 2015 fuel economy standards+15% threshold.

The Dutro broadened the scope of its safety systems by making a vehicle stability control system that assists the driver in maneuvering to avoid danger, as well as an electric parking brake that automatically controls braking force according to vehicle conditions, standard equipment.

Among hybrid vehicles, the Elf added an EV mode enabling driving powered only by the motors. In addition, refinements to the engine, along with an expansion of the original range of support for fuel efficient driving, has made all models meet the 2015 fuel economy standards+15% threshold.

In response to growing need for higher carrying capacity in short-distance transportation within an area or for deliveries within a city, the Kazet features a medium-duty truck body mounted on a light-duty truck chassis base, establishing a new category of vehicles that offer

increased carrying capacity while maintaining high fuel efficiency and operability.

1. 1. 4. Mini-vehicle trucks

Table 4 shows the mini-vehicle trucks announced in Japan in 2015, and the main product technology trends. Some models in this class benefited from improvements in fuel efficiency and practicality.

In the Carry, modifications to the engine control improved fuel efficiency, while the addition of a second gear start mode to the 5-speed automatic transmission models enables smoother starts when the vehicle is empty or only carrying a light load. At the same time, anti-corrosion performance has been strengthened by adopting anti-rust steel sheets for the roof panels as well as for the entire body surface area.

The Minicab Truck is an OEM procurement from Suzuki, and the Pixis Truck is an OEM procurement from Daihatsu.

1. 1. 5. Trucks from the U.S. and Europe

No major initiatives concerning U.S. or European vehicles in Japan stood out in 2015. The Volvo FH, recipient of the previous year's (2014) International Truck of the Year Award, was exhibited at the Tokyo Motor Show following its launch in Japan after its first complete redesign in about 20 years. The Secondary Information Display was made standard equipment to provide extensive safety functionality in response to the needs of Japanese customers who prioritize safety.

1. 2. Interior comfort

For truck drivers who spend the majority of the day in the truck cabin, the coziness and comfort of the cabin are important elements. In contrast, the demand for efficient transport is leading to development aimed and making efficient use of limited cabin space while securing carrying capacity.

The shape of the cabin is subjected to the conflicting requirements of reducing drag and ensuring cabin space, and is determined by deriving an optimum solution from analyses and wind tunnel tests, while also taking the balance with the design into account. Some vehicles offer a high roof specification that allows movement within the cabin and enables the driver to change while standing. Furthermore, in short cab vehicles striving for greater carrying capacity, a rest space is installed in the roof to provide sufficient comfort.

1. 3. Operability

In Japan, the declining birthrate and aging of the population is leading to higher number of older drivers and women drivers, making it even more necessary to consider ways to reduce driving fatigue.

More and more trucks are now being equipped with features such as automatic transmissions, manual transmissions with no clutch pedal, and devices that aid the driver when starting on a hill. Switch layouts are facilitating operations by turning the operated face toward the driver and grouping switches by frequency of use or importance to reduce driver fatigue.

Also, multi-information displays that present vehicle and warning information simultaneously in the instrument panel are proving useful in making the management of information more efficient while driving and during servicing. In addition, switches in the steering wheel, which are gradually becoming mainstream in passenger cars, are also starting to be adopted in trucks.

1. 4. Noise and vibration

At the vehicle level, improvements are being made to absorb vibrations through upgraded engine mounts and the setting of chassis air suspensions, and at the cabin level, ride comfort improvements are being made through upgraded cab air suspensions and seat suspensions as part of efforts to improve the quality of product transportation as well as reduce driver fatigue due to prolonged driving. Noise reducing measures also involve installing soundproof covers around the engine compartment and adding sound-absorbing material to the cabin. Wind noise is reduced through optimized cab exterior shapes that decrease drag, as well as by reducing audible intake sounds at the back of the cab. Low frequency cavity resonance is also being analyzed in efforts directed at reducing booming noise as well.

1. 5. Safety

Safety can be broadly categorized as active or passive.

The adoption of active safety systems, which proactively prevent accidents, has been vigorously promoted by manufacturers. Increasingly common systems include collision avoidance and mitigation systems, which use millimeter wave radar to detect proximity to the vehicle ahead with a high degree of accuracy, emit a warning, and activate the brakes, lane departure warning systems which identify the while line of the driving lane and prevent deviations, and electronic stability control systems that control vehicle skids and rollovers.

In terms of passive safety, which minimizes damage in the event of an accident, all manufacturers got an early

start in the structural development of cabs that absorb impact energy while increasing the strength of the body near the occupants through optimized cab strength balance to ensure a safe space. Driver SRS airbag systems, seatbelts with pretensioners, and impact absorbing steering wheels are standard equipment. In addition, a feature unique to trucks is the adoption of front and rear underrun protection to restrict sliding under the cab in the event of a collision with a passenger car.

1.6. Aerodynamic characteristics

Improved aerodynamic characteristics not only contribute to fuel efficiency, but also reduce noise in the cabin (wind noise) and dirt accumulation on the vehicle body, as well as contribute to steering stability. Approaches such as narrowing cab fronts and innovations to the corners, and the use of flush surfaces (eliminate differences in evenness from body protrusions or gaps to get as close as possible to achieving a single surface) for air flow rectification being optimized by applying analysis techniques to the shapes of all components to minimize their impact on comfort or cooling performance. Medium and heavy-duty vehicles also adopt a full complement of aerodynamic parts including roof deflectors, seals to reduce the gap between the cab and the cargo trailer, and side skirts.

1.7. Corrosion prevention

In terms of corrosion prevention, each upgrade to a model involves adopting anti-rust steel sheets at effective locations, as well as the growing use of plastics, which simultaneously meet needs such as better styling design and weight reduction. Better corrosion resistance is also required of mini-vehicle trucks, and anti-corrosion measures such as applying anti-rust steel sheets to the entire body surface area, three-layer painting, and the use of anti-rust steel sheets in the frame are being applied.

2 Rear Body

As logistics become more and more diversified, constant efforts are being made to reduce weight and increase carrying capacity amidst calls to further improve freight handling and transport efficiency. Structures are being reviewed as aluminum and plastic are increasingly adopted to reduce weight. For refrigerator trucks, antibacterial and odor eliminating interior materials or devices are used since they are frequently used to transport foods.

References

(1) PR Materials and Catalogues of each company