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ATZ spezial

Driving Tomorrow's Mobility with Aluminum Innovations

ATZ Special Feature
Aluminum Technology 10

SUPPLY CHAINS IN THE U.S.
Continuous Growth of Automobile Production in the U.S.

ALUMINUM VALUE SUPPLIER
UACJ Automotive Whitehall Industries, Inc.

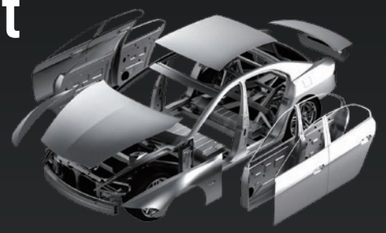
ECO-SUSTAINABILITY
Aluminum's role in achieving a sustainable mobility society

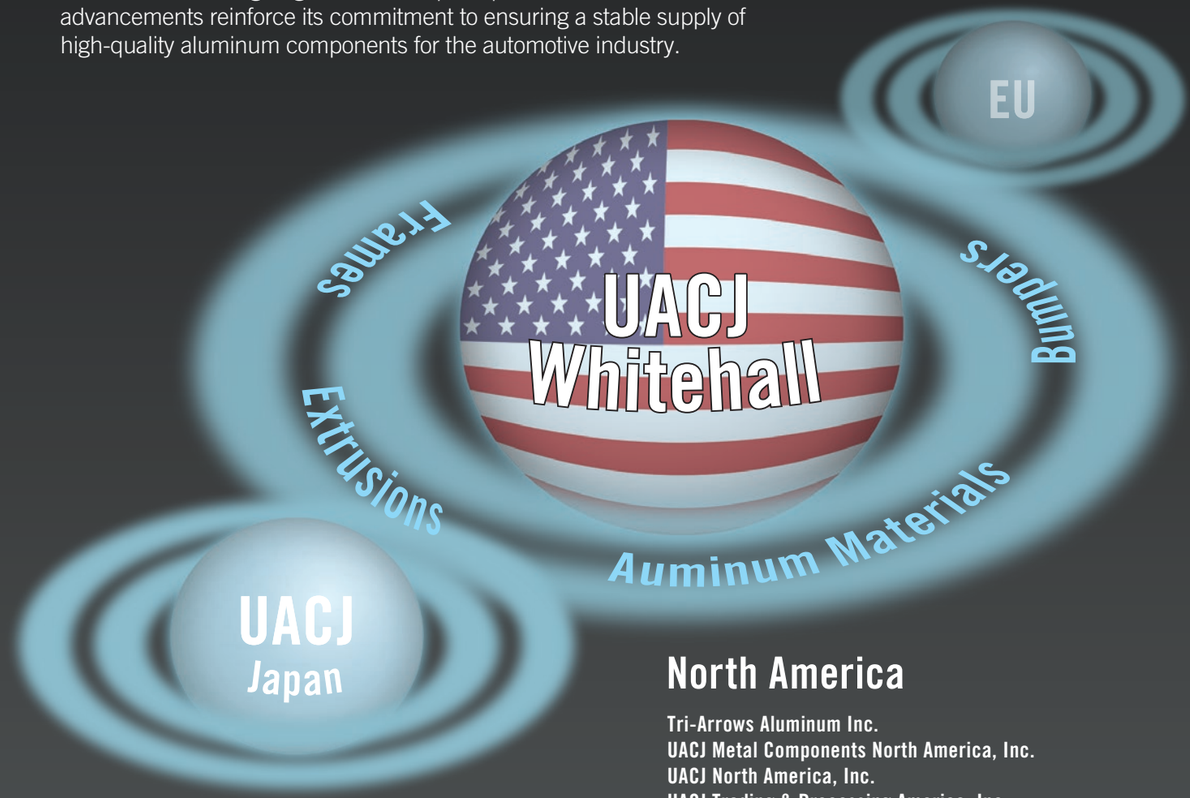
/// **SPECIAL TALK** Akio Niikura Ph.D. [UACJ]

/// **INTRODUCTION** Various Aluminum Automotive Components

Leading Automotive Component Excellence in the U.S.

With a long history of producing and supplying aluminum structural components to U.S. automakers, UACJ Whitehall, the U.S. subsidiary of one of the world's leading comprehensive aluminum manufacturers, has recently expanded its extrusion press capacity at its primary facility in Michigan and established a cutting-edge automotive parts plant in Arizona. These advancements reinforce its commitment to ensuring a stable supply of high-quality aluminum components for the automotive industry.





North America

Tri-Arrows Aluminum Inc.
UACJ Metal Components North America, Inc.
UACJ North America, Inc.
UACJ Trading & Processing America, Inc.
UACJ Metal Components Mexico, S.A. de C.V.

Japan

R&D Division
Mobility Technology Center
UACJ Extrusion Corporation
UACJ Foundry & Forging Corporation

The Automotive Industry Faces Many Challenges

The automotive industry is currently undergoing an unprecedented transformation. At the heart of this change are electrification, autonomous driving, digitalization, and societal demands for sustainability. These forces are driving a paradigm shift in the way vehicles are designed and built. Automakers are rallying their technological expertise to develop new vehicles that not only meet these evolving demands but also exceed consumer expectations.

The push towards electrification is accelerating, driven by stricter environmental regulations and increasingly rigorous fuel efficiency standards. However, this shift comes with its own set of challenges, including the need for more robust charging infrastructure and advancements in battery technology. Full electrification may still be some time away, making hybrid solutions a practical choice for the time being. As both fully electric and hybrid vehicles evolve side by side, they are laying the groundwork for the future of mobility. Sustainability, too, has become a major focus across the automotive industry. The development of recycling ecosystems, the use of recyclable materials, and improvements in energy efficiency are being integrated into the entire manufacturing process, leading to significant reductions in environmental impact. Alongside these efforts, advancements in manufacturing techniques are enabling more efficient and environmentally friendly production methods. Aluminum, in particular, is playing a crucial role in addressing these challenges, contributing to both vehicle performance and quality.

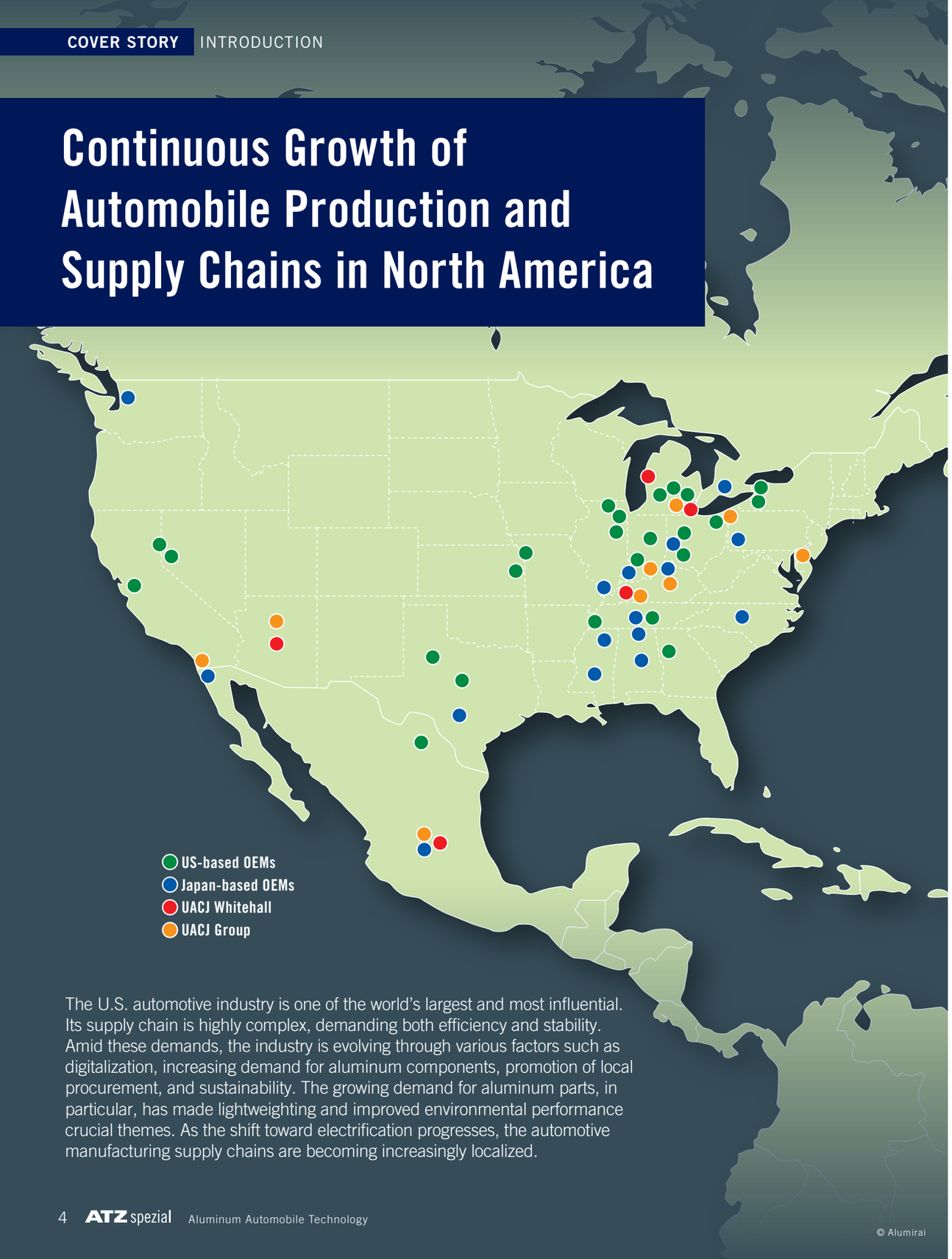
In this era of change, one might wonder how vehicles will continue to evolve and shape the future of mobility. Aluminum, with its lightweight and high-strength properties, is becoming increasingly essential. It extends vehicle range, enhances crash safety, and supports the production of more sustainable vehicles. As we move forward, aluminum will continue to play a vital role in this ongoing transformation.

Fumihiko Sato
Chief Executive,
Automotive Parts Business Division
Managing Executive Officer
UACJ Corporation

P6 UACJ Automotive Whitehall Industries Machining Center of the Main Factory

P12 How Aluminum Contributes to Achieving a Sustainable Mobility Society

Continuous Growth of Automobile Production and Supply Chains in North America



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The U.S. automotive industry is one of the world's largest and most influential. Its supply chain is highly complex, demanding both efficiency and stability. Amid these demands, the industry is evolving through various factors such as digitalization, increasing demand for aluminum components, promotion of local procurement, and sustainability. The growing demand for aluminum parts, in particular, has made lightweighting and improved environmental performance crucial themes. As the shift toward electrification progresses, the automotive manufacturing supply chains are becoming increasingly localized.

Strategies of U.S. Automakers

Three major manufacturers—Ford, GM, and Stellantis (formerly Fiat Chrysler)—dominate the U.S. automotive industry. These companies are actively reforming their supply chains to respond to the trend of electrification and the tightening of environmental regulations. Ford is prioritizing the production of electric vehicles (EVs) and hybrid vehicles, with new models such as the F-150 Lightning and Mustang Mach-E gaining market attention. The company is promoting the digitalization of its supply chain, enhancing real-time inventory management and demand forecasting accuracy, and securing a stable supply through long-term contracts with major suppliers. GM (General Motors) developed its proprietary Ultium EV platform and is expanding its EV lineup. Additionally, it has established a joint battery plant with LG Energy Solution to stabilize battery supply. GM is also promoting the adoption of aluminum as a lightweight material to improve fuel efficiency.


© General Motors

GM Lansing Grand River assembly plant
Main production model:
Cadillac CT4, CT5, and gearing up for upcoming EV production


© Ford Motor

Ford Tennessee Electric Vehicle Center
Planned main production model:
the next-generation electric truck, a successor to the F-Series

Strategies of Japanese Automakers

Japanese automakers, particularly Toyota, Honda, and Mazda, are also increasing their presence in the North American market. These companies are deploying unique supply chain strategies to improve local procurement rates and promote the use of aluminum components. Toyota leverages its hybrid technology, offering models such as the Prius and Camry for the North American market. It is advancing supply chain localization to improve local procurement rates and increase the use of aluminum parts in its North American factories, aiming to enhance lightweighting and fuel efficiency. Honda is introducing hybrid versions of popular models like the CR-V and Accord to improve fuel performance. The company is strengthening its supply chain in North America, expanding local production, and promoting the use of aluminum chassis and engine components to achieve lightweighting and performance improvements. Mazda's CX series SUVs, now equipped with hybrid technology, have received favorable reviews in the North American market. Mazda is increasing the use of aluminum parts to achieve vehicle lightweighting and improved environmental performance while stabilizing its supply chain in the U.S. and enhancing local procurement.

Automotive Manufacturing Supply Chains

The North American automotive supply chains are marked by advancements in digitalization, increasing demand for aluminum, promotion of local procurement, and a focus on sustainability. First, they are becoming increasingly digitalized, enabling real-time inventory management and demand forecasting. The adoption of AI and IoT technologies in smart factories is improving production efficiency, allowing automakers to respond more quickly and flexibly to market changes. Second, the demand for aluminum parts is increasing to achieve lightweighting and improved fuel efficiency. Aluminum is being adopted for critical components such as engines and chassis, reducing overall vehicle weight and enhancing fuel performance. Partnerships with aluminum manufacturers are being strengthened to ensure a stable supply. Additionally, there is a growing movement to increase local procurement rates to mitigate global supply chain risks. Strengthening supplier networks within the U.S. is improving supply stability and reducing costs, enhancing overall manufacturing process efficiency and stringent quality control. Lastly, the importance of sustainability is increasing. To comply with stricter environmental regulations, recyclable materials and energy-efficient production processes are being introduced. Efforts to minimize environmental impact are advancing in EV and hybrid vehicle production. Automakers are working to build sustainable manufacturing systems that minimize environmental impact.

U.S. Automotive Industry

As the U.S. automotive industry continues to evolve, several interconnected trends are significantly reshaping the landscape. Digitalization is enhancing supply chain efficiency and enabling real-time data integration, driving greater responsiveness and flexibility in manufacturing. The growing demand for aluminum parts is vital for achieving lightweighting and meeting stringent environmental standards, reinforcing the industry's commitment to sustainability. Additionally, the shift toward local procurement is not only strengthening supply chain resilience but also fostering closer collaboration with domestic suppliers. These trends, coupled with a strong emphasis on sustainability, are guiding the industry toward a more innovative, eco-friendly, and resilient future.

UACJ Whitehall: Pioneering the Development and Manufacture of High-Quality Aluminum Automotive Parts

A Leader in Aluminum Excellence

UACJ Whitehall began producing aluminum extrusions to support our fabrication and assembly processes, enabling us to maintain tighter control over quality and efficiency. This vertical integration has provided us with the necessary level of precision and oversight to manufacture parts that meet even stricter tolerances and higher quality standards. We currently operate multiple advanced presses in Michigan and Kentucky, including the first HyBrEx Servo extrusion press in North America, which underscores our commitment to innovation. UACJ Whitehall is fundamentally a fabrication company dedicated to excellence. Parts with strict tolerances and intricate machining are challenges that we are not only well-equipped to handle but truly enjoy tackling.We supported the EV startup Tesla in its early days, contributed to the development of its platform, and have now established a supply system as a Tier 1 supplier for this global EV company.

Introduction and Company Overview

Since its inception in 2001, UACJ Whitehall has established itself as a leading supplier of high-quality aluminum automotive parts in the United States. Initially focusing on precision aluminum extruded shapes for various industries, the company quickly recognized the immense potential within the automotive sector and strategically shifted its focus to meet the stringent demands for high-quality components that this industry requires. This pivotal shift was further strengthened by the company's integration with the UACJ Group, a move that significantly enhanced its capabilities in research and development, design, and comprehensive production processes. Over the years, UACJ Whitehall has become synonymous with both innovation and quality, consistently leveraging the global support, extensive expertise, and vast resources of the UACJ Group to remain at the forefront of the highly competitive market. This seamless collaboration has empowered the company to not only meet but consistently exceed client expectations, ensuring that it delivers precision-engineered aluminum automotive parts that adhere to the highest industry standards and continue to set new benchmarks for excellence.

David Cooper
CEO
UACJ Automotive Whitehall Industries

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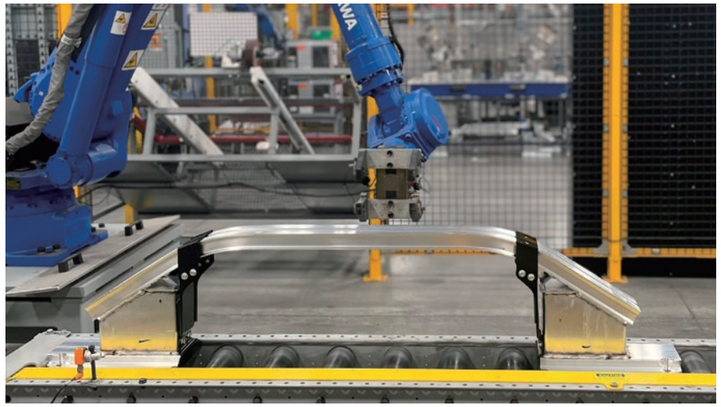

© UACJ Whitehall

Expansive assembly space for various automotive parts
UACJ Automotive Whitehall Industries Assembly Department.

Expertise, Target Audience, and Industry Recognition

The primary target audience for UACJ Whitehall includes key decision-makers at major U.S. OEMs such as GM, Ford, Chrysler, Jeep, and Ram, as well as the leader in electric vehicles, Tesla, and Japanese OEMs such as Honda and Toyota. These companies require components that are not only high in quality but also reliable and precisely engineered to meet their specific needs. UACJ Whitehall's experienced team is dedicated to providing highly engineered products with the agility and precision that these industry leaders demand. The company has earned a reputation for its vertical integration, controlling both extrusion and fabrication processes to maintain stringent quality standards. This approach has positioned UACJ Whitehall as a pioneer in manufacturing structural and crash management systems, with 100% of its products serving the automotive sector. Recognized as one of the top 100 suppliers in North America by Automotive News, UACJ Whitehall's commitment to quality and innovation is widely acknowledged within the industry. The company's expertise is further demonstrated by its comprehensive engineering and design capabilities, which include working with all 3D data formats, custom machine design and maintenance, and internal design and build of fixtures.

Journey, Capabilities, and Standards Commitment

UACJ Whitehall's journey began with the production of aluminum components for copiers, leveraging its ability to meet tight tolerances and high-quality standards. This expertise laid the foundation for the company's entry into the automotive industry. In 2001, UACJ Whitehall installed its first extrusion press, allowing it to control both the extrusion and fabrication processes. This vertical integration created a seamless production flow and enhanced the company's ability to control quality throughout the manufacturing process.
The demand for UACJ Whitehall's automotive sunroof rails quickly grew, leading the company to supply many Tier 1 automotive roof system suppliers. As UACJ Whitehall expanded its capabilities, it adopted advanced technologies such as the HyBrEx Servo extrusion press, which consumes up to 55% less energy while increasing productivity by up to 20%. This technology exemplifies the company's commitment to energy efficiency and productivity, resulting in improved quality and customer satisfaction.
UACJ Whitehall adheres to industry certifications such as IATF 16949 and ISO9001, ensuring that its processes meet the stringent requirements of the automotive industry. The company's internal benchmarks, including a safety OSHA incident rate of 3, a 12-month rolling internal ppm of 50, and a customer ppm of 15, highlight its dedication to safety, quality, and on-time delivery. As active members of the Original Equipment Supplier Association (OESA), UACJ Whitehall stays engaged with industry developments and standards, ensuring that it remains at the forefront of innovation and best practices.

Corporate Name	UACJ Automotive Whitehall Industries: (UWH)
Detroit Sales office	755 West Big Beaver Road, Suite 1119 Troy, MI 48084
Corporate HQ/6th Street Plant	5175 W. 6th Street Ludington, MI 49431
Madison Manufacturing Facility	801 S. Madison Street Ludington, MI 49431
Progress Drive Manufacturing	4960 Progress Drive Ludington, MI 49431
Paducah Manufacturing Facility	5600 Commerce Drive Paducah Paducah, KY 42001
UACJ Flagstaff Plant	2400 Walgreens Blvd Unit 3 Flagstaff AZ 86004
Mexico Manufacturing Facility	Carr. San Miguel a Dr. Mora Km. 1.5 CP 37748 San Miguel de Allende, Guanajato Mexico

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UACJ Automotive Whitehall Industries
Corporate HQ/6th Street Plant

© UACJ Whitehall

UACJ Automotive Whitehall Industries
Progress Drive Manufacturing

© UACJ Whitehall

High-Precision Aluminum Alloy Extrusion Press and Cooling Equipment
UACJ Automotive Whitehall Industries Manufacturing Department

Engineering and Design Excellence

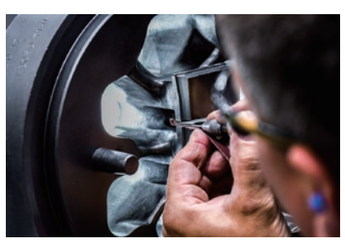
One of UACJ Whitehall's biggest strengths is its engineering and design capabilities. The company's team of engineers specializes in various disciplines, including mechanical, electrical, manufacturing, and quality engineering. This diverse expertise allows UACJ Whitehall to offer comprehensive support to its customers, optimizing the manufacturability and performance of their products. The company's ability to work with all 3D data formats ensures seamless integration with its customers' design processes, facilitating efficient and accurate product development. UACJ Whitehall excels in custom machine design and maintenance, providing bespoke solutions that enhance its manufacturing capabilities. The internal design and build of fixtures further support the company's commitment to delivering high-quality products that meet the exacting standards of the automotive industry. In collaboration with UACJ's R&D team, UACJ Whitehall engages in alloy development and CAE analysis, ensuring that its products are optimized for performance and durability. By leveraging the combined expertise of its engineering team and UACJ's extensive resources, the company can consistently innovate, pushing the boundaries of what's possible in automotive design and production. The company also offers four-phase program management support, providing a structured and systematic approach to project execution, ensuring that every project is completed with precision, on time, and within budget.

Sustainability and Innovation

Sustainability is a core value at UACJ Whitehall, and the company is committed to reducing its environmental impact through innovative practices and technologies. Participation in the Aluminum Stewardship Initiative (ASI) highlights its dedication to responsible sourcing and production of aluminum. Additionally, UACJ Whitehall is actively involved in a solar renewable energy program with Consumers Energy of Michigan, aiming to power its Michigan locations with 100% renewable energy by 2028. The company is also advancing sustainability in product development by creating alloys that incorporate aluminum from post-consumer and post-industrial scrap. By using recycled materials, UACJ Whitehall reduces reliance on virgin aluminum, thereby minimizing its environmental footprint. Furthermore, the company is exploring ways to integrate circular economy principles into its operations, ensuring that every aspect of the production cycle—from sourcing to recycling—contributes to a more sustainable future. Compliance with the Manufacture2030 (M2030) platform ensures accurate CO_2e data reporting for both Scope 1 and Scope 2 emissions, reflecting a commitment to transparency and environmental responsibility. The company's adoption of HyBrEx Servo extrusion press technology exemplifies its dedication to innovation and sustainability. This advanced technology not only improves energy efficiency but also enhances productivity and product quality, ensuring UACJ Whitehall's products meet the highest performance and reliability standards. Through these initiatives, UACJ Whitehall continues to set new benchmarks in sustainability, driving the industry toward a greener and more responsible future.

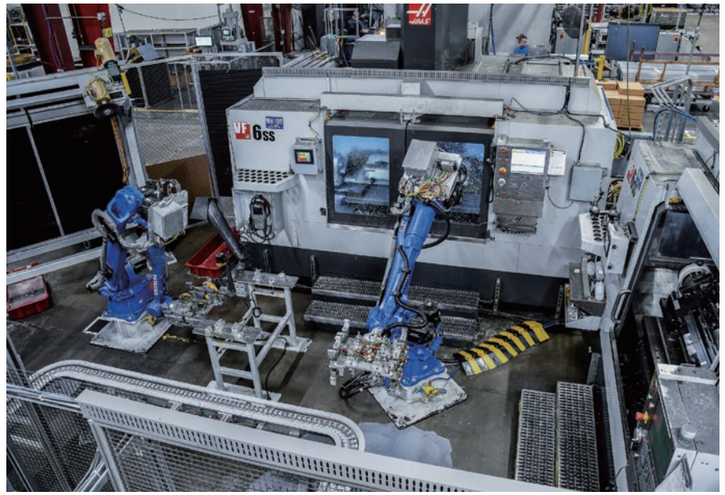
Production and Quality

Quality is a fundamental value at UACJ Whitehall, influencing every aspect of the company's operations. From individual actions by associates to cutting-edge laser-etching traceability technology, quality is prioritized in all endeavors. This commitment to excellence enables the company to consistently deliver high-quality parts that meet stringent customer standards. UACJ Whitehall's production processes are designed for on-time delivery and superior quality. The company employs lean manufacturing principles and continuous improvement initiatives, such as Kaizen, to optimize operations and enhance efficiency. Its state-of-the-art facilities in Michigan and Kentucky are equipped with multiple presses, including the first HyBrEx Servo extrusion press in North America, allowing for the production of superior products with minimal labor. The comprehensive quality management system includes rigorous testing and inspection processes to ensure that all products meet the highest standards of performance and reliability. Advanced technologies like laser-etching traceability monitor and control every stage of production, ensuring the highest quality in UACJ Whitehall's products. The company's commitment to quality extends to customer relationships, working closely with clients to understand their needs and provide tailored solutions. This customer-focused approach is strengthened by ongoing feedback mechanisms, ensuring that UACJ Whitehall continuously adapts to meet evolving client expectations. This dedication is reflected in high customer retention rates and positive client feedback, solidifying UACJ Whitehall's reputation as a trusted partner in the automotive industry.



© UACJ Whitehall

High-quality extruded shapes at UACJ Whitehall are produced using state-of-the-art presses and expertly crafted dies.



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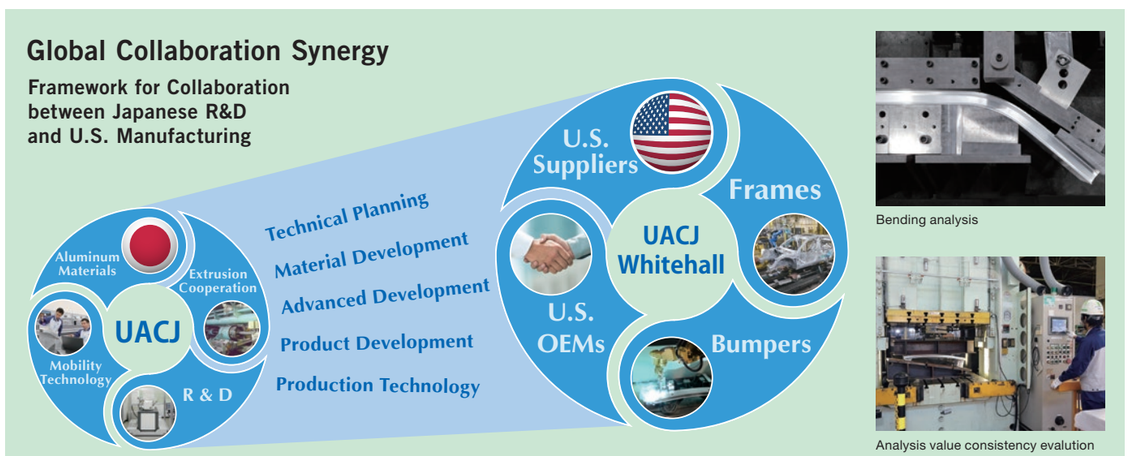
Machining Center for Aluminum Alloy Automotive Parts
UACJ Automotive Whitehall Industries Processing Department

Future Outlook of Aluminum Supply

As the U.S. automotive industry continues to evolve, several interconnected trends—digitalization, growing demand for aluminum parts, a shift toward local procurement, and a focus on sustainability—are reshaping the landscape. Both major U.S. and Japanese automakers are navigating this transformation by refining their supply chains and adopting new strategies to stay competitive. The pace of change shows no signs of slowing, underscoring the need for more advanced and resilient supply chains in the future. UACJ Whitehall's vision is to become the leading aluminum automotive parts supplier in North America by providing innovative solutions and maintaining the highest ethical standards. The company is dedicated to advancing the automotive industry through quality, innovation, and sustainability, ensuring that it remains a trusted partner for its customers. UACJ Whitehall's unwavering commitment to excellence drives it to lead the market, setting new benchmarks and continually striving for perfection. By leveraging advanced capabilities, comprehensive engineering expertise, and a strong commitment to sustainability, UACJ Whitehall is poised to meet the evolving needs of the automotive industry. The company is dedicated to delivering high-quality, reliable products that help its customers achieve their goals and drive the industry forward. With a solid foundation, a forward-looking vision, and a proactive approach to addressing industry challenges, UACJ Whitehall is confident in its ability to lead the market and set new standards for excellence in aluminum automotive parts. The company's focus on continuous improvement and adaptation ensures it remains at the forefront of industry developments.



UACJ Mobility Technology Center

UACJ's Commitment: Collaborating with OEMs for Future Mobility Solutions

Aluminum Components Development in the Field

The development of aluminum automotive components is an ongoing effort to create efficient and safe next-generation components encompassing a wide range of factors, such as weight reduction, electrification, automated driving, safety improvement, digitalization, and sustainability. There is a focus on reducing emissions, utilizing renewable energy, and reducing the recyclability and waste of components. UACJ's automotive component development is based on benchmarking and agile development to flexibly respond to customer requirements.

UACJ Corporation, one of the world's leading aluminum manufacturers, opened the Mobility Technology Center (MTC) in 2020. It features an integrated system that covers technical planning, materials development, product development, and production technology development. The evaluation and elemental technologies are based on the specialized capabilities of materials and the comprehensive capabilities of materials development, in cooperation with UACJ's R&D Center.

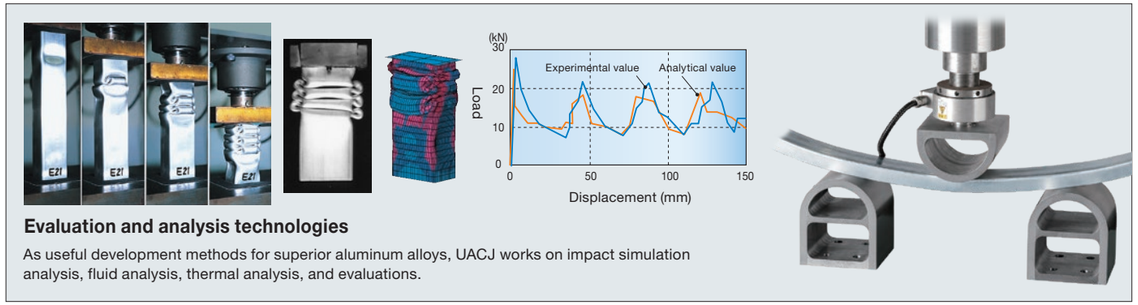
UACJ Mobility Technology Center's Activities

Interviewer (ATZ): How is UACJ's automotive parts business currently performing?
Dr. Niikura: We are pleased to receive high praise from various OEMs for our design, development, and simulation capabilities. In the field of aluminum bumper components, we have supplied parts for over one million vehicles worldwide, reaching the status of a Tier 1 supplier in this sector.

ATZ: What are UACJ's strengths in automotive component technology?
Dr. Niikura: Aluminum bumper materials must be lightweight and high-strength, while also providing impact absorption. However, each component is made up of a minimal number of parts, meaning each part requires advanced alloy design. As a specialized aluminum manufacturer, UACJ has established a wealth of expertise and possesses some of the world's most precise extrusion presses and cooling equipment.

ATZ: What are the dominant material technologies for aluminum bumper components?
Dr. Niikura: In the AA system, alloys are named according to their chemical composition, but in reality, mechanical properties can change significantly with fine-tuned composition control and advanced heat treatment. Our ability to produce high-strength 6000 Series aluminum alloys and manufacture crash boxes that deform into an ideal accordion shape upon impact is a direct result of these material technologies.

Akio Niikura, Ph.D.
Vice-Director of Mobility Technology Center
Marketing & Technology Division
UACJ Corporation



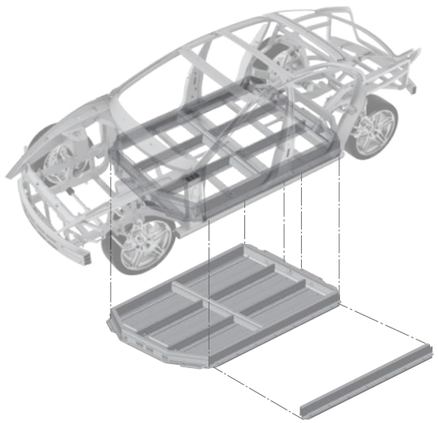
Evaluation and analysis technologies
As useful development methods for superior aluminum alloys, UACJ works on impact simulation analysis, fluid analysis, thermal analysis, and evaluations.

Innovative Strengths in Aluminum Technology

ATZ: I understand that aluminum components are also used in EV battery housings.

Dr. Niikura: Just like in bumpers, aluminum extruded shapes play a crucial role in battery housings as well. The cross-sectional shape of the extrusions absorbs impact energy during a side collision, ensuring the safety of the battery. To meet this requirement, we have established proprietary impact energy absorption simulation technology and are developing aluminum structural components.

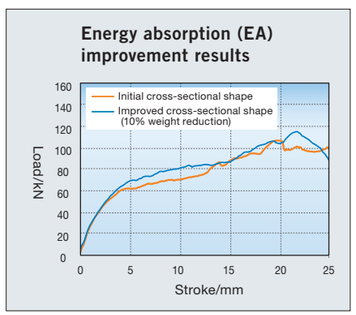
ATZ: Where will MTC's components development go in the future?
Dr. Niikura: UACJ has jointly developed bumper beams, crash boxes, and battery housing side frames, which are typical shock-absorbing components for crushable zones, and has accumulated technical information by manufacturing them at domestic and global manufacturing bases. In the future, we would like to promote the modularization of structural members using aluminum extruded shapes for crushable zones. In parallel, we have also been developing thermal management systems such as cooling channels for battery coolers. We would like to further enhance the manufacturing technology based on UACJ's unique know-how to meet the demand for the development and manufacture of aluminum components for the scalable platforms promoted by automobile manufacturers.



As useful development methods for superior aluminum alloys, UACJ works on impact simulation analysis, fluid analysis, thermal analysis, and evaluations.

UACJ's Global Expansion

Dr. Niikura: ...We would also like to focus on manufacturing processes that reduce the environmental impact of the automotive industry. We've been developing aluminum materials for various automotive parts for quite some time now, and our efforts in this area continue to grow. Our U.S. subsidiary, UACJ Automotive Whitehall Industries, based in Michigan, has been actively involved in developing and supplying a wide range of aluminum structural components to U.S. OEMs, contributing significantly to the automotive industry's shift toward lightweighting and sustainability.



Aluminum's Role in Achieving a Sustainable Mobility Society

Electric vehicles are rapidly appearing around the globe. The total number of electric vehicles worldwide is estimated to be around 10 million, with 4.2 million in China, 3.2 million in Europe, and 1.7 million in the U.S. By 2030, this number is expected to soar to 125 million. As the shift towards electrification accelerates, there is a growing demand for high-performance aluminum, especially for platform and battery housing structural materials. In the context of the global movement toward carbon neutrality, it is particularly noteworthy that aluminum boasts excellent recycling properties, further contributing to a sustainable future.

EV Platform Performance Evolving for the Future

In 2021, the Insurance Institute for Highway Safety (IIHS) updated its side-impact crash test to better assess occupant protection. The new test features a heavier barrier and increased impact speed, making it more stringent and realistic, especially in simulating collisions with modern SUVs and trucks. These enhanced tests have driven significant advancements in vehicle safety design. For frontal crashes, the IIHS continues to refine its tests, focusing on both front and rear occupant protection. These developments underscore the need for improved crash safety structures, particularly to minimize damage to high-voltage components and batteries. Aluminum structural members play a vital role in this context, significantly contributing to the overall body structure. The aluminum shock-absorbing components at the front end prevent wheels and debris from penetrating the vehicle interior, thereby reducing occupant impact. Additionally, the battery housing disperses impact energy and absorbs residual forces, protecting the battery pack. These developments highlight the essential role of aluminum in ensuring both vehicle safety and performance.

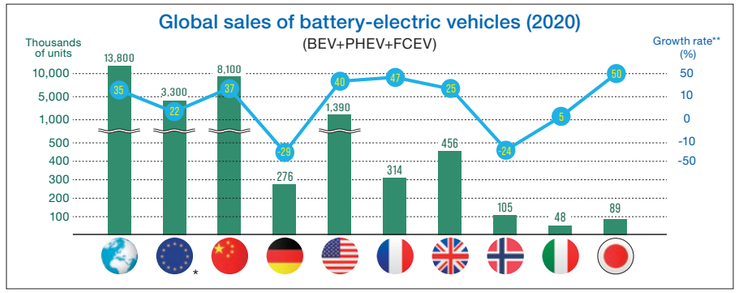
© IIHS

2022 Rivian RiT drive-side small overlap front IIHS crash test

The skateboard platform and body common to Rivian's R1T electric pickup truck is a multi-material construction of aluminum alloy, high-strength steel, and CFRP.

Battery Modules: The Key to Promoting Electrification

Globally, there is increasing momentum toward carbon-neutral initiatives. However, the production of electric vehicles (EVs) emits significantly more greenhouse gases compared to gasoline vehicles, primarily due to battery manufacturing. This process is also associated with environmental challenges, such as the mining of scarce mineral resources and reliance on coal-fired power generation. Batteries are crucial in determining EV performance, influencing factors like range, charging speed, power output, and safety. Automakers are striving to secure raw materials, establish production bases, and implement recycling systems to build a sustainable supply chain. Promoting research and development (R&D) to reduce the use of rare metals and expanding a network of fast-charging stations are also critical. Innovations in battery technology, including solid-state batteries and advancements in lithium-ion technology, focus on increasing energy density, reducing charging times, and minimizing the environmental impact of battery production.



*Europe: EU+EFTA **Growth rate vs. 2022
Source: Global, EU, China, and US data are from IEA's Global EV Outlook 2024; other data are based on national automotive industry associations and others.

Benefits of Aluminum Closed-loop Recycling

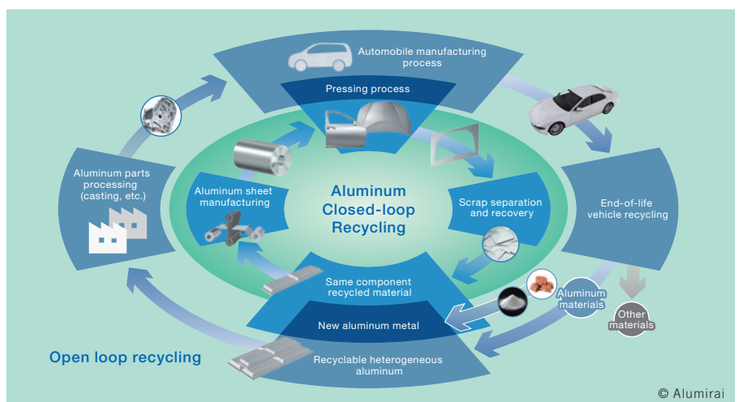
Aluminum plays a crucial role in achieving sustainable mobility by enhancing fuel efficiency and reducing CO_2 emissions. Beyond its use in vehicles, aluminum significantly reduces environmental impact in the manufacturing process through closed-loop recycling. This system, known as the 'aluminum closed loop,' involves returning scrap material from the production of aluminum sheets for body panels to the supplier. The supplier then remanufactures this material into aluminum coil, which is delivered back to the manufacturer. A case in point is at Audi's production site in Germany, where this process has reduced CO_2 emissions by several thousand tons annually. Similar initiatives are being adopted by other automakers. In Japan, UACJ is advancing sustainability throughout the supply chain by supplying aluminum body panel materials to models like the Toyota Land Cruiser and Nissan Rogue. This closed-loop system not only conserves raw materials but also drastically reduces the energy required for aluminum production, as recycling aluminum consumes only 5% of the energy needed to produce new aluminum from ore.

Hydrogen Highlighted as the Next Clean Energy Source

Hydrogen can be produced with virtually no CO_2 emissions, depending on the production method used. 'Green Hydrogen' is produced through electrolysis powered by renewable energy sources, while 'Blue Hydrogen' is generated using natural gas combined with Carbon Capture and Storage (CCS) technology. Although producing hydrogen using renewable energy can be challenging, CCS and Carbon Capture, Utilization, and Storage (CCUS) technologies allow for the production of low-carbon hydrogen even when electricity from fossil fuels is used.
In the automotive sector, hydrogen is already being widely adopted as a primary energy source for fuel cell vehicles (FCVs). This is especially true in public transportation, where buses, as well as trucks in the logistics sector, are increasingly powered by hydrogen fuel cells. Aluminum plays a critical role in this transition, being used extensively in the lightweight construction of hydrogen tanks and vehicle structures. As a result, hydrogen, supported by aluminum, stands alongside EVs as a key component in building a sustainable future for mobility.

An Indispensable Role

Aluminum plays an indispensable role in the transition to sustainable mobility. It enhances the safety and efficiency of electric vehicles, extending their range through lightweighting, while its exceptional recyclability significantly reduces the environmental impact of the entire manufacturing process. By conserving energy and resources, aluminum supports a sustainable closed-loop system. As the automotive industry continues to evolve, aluminum is at the forefront, enabling the future of vehicles to be both eco-friendly and efficient.



Aluminum closed-loop recycling system

Aluminum platforms

The Chevrolet Corvette C8 features an all-aluminum alloy space frame structure, utilizing high-strength aluminum extruded shapes throughout to achieve high rigidity. The C8's design includes a larger center tunnel and a newly engineered structure that emphasizes frame strength. The platform's material composition for the C8 is approximately 40% extruded shapes, 39% sheets, 18% castings, and 3% others. Notably, the C8 E-Ray, a hybrid model, incorporates an aluminum alloy center tunnel designed to house the battery pack. This innovative use of aluminum not only reduces weight but also enhances structural integrity and crash safety, which are crucial factors for maintaining performance and efficiency in high-performance vehicles like the Corvette.

© General Motors

Tailored Blanks, FSW & FSSW

Tailored Blanks technology involves joining multiple materials with different thicknesses and compositions into a single unit, which is then press-formed. By optimally arranging the required plate thickness, this technology allows for significant weight reduction while maintaining structural strength. The most critical aspect of this technology is the joining process, particularly in the use of Friction Stir Welding (FSW) and Friction Stir Spot Welding (FSSW). These advanced joining techniques ensure strong, durable bonds between dissimilar materials, making them essential for modern lightweight construction.

Friction Stir Spot Welding (FSSW)

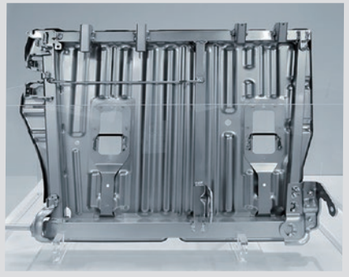
Aluminum alloy cross-car beams

Cross-car beams connect the left and right panels beneath the A-pillars of the vehicle body, supporting key components such as the steering wheel, instrument panel, and airbags. In recent years, the increasing size of navigation system displays has led to heavier components. Aluminum alloy beams not only provide essential structural support but also play a critical role in enhancing the interior by reducing noise and vibration (NVH), thereby improving overall user experience and feedback.

© Volkswagen

Aluminum battery housings

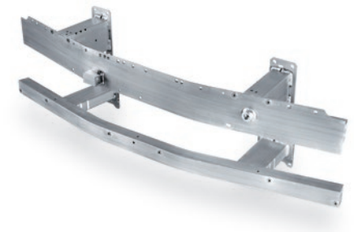
In many battery electric vehicles (BEVs), battery housings are made from aluminum extruded shapes due to its strength-to-weight ratio. Aluminum's lightness reduces overall vehicle weight, while its thermal conductivity efficiently dissipates heat, protecting battery cells. The housing integrates essential components like the crash frame, battery cells, cooling systems, and electrical circuits, ensuring safety, durability, and optimal performance in modern EV designs.



All-aluminum seat frame

This seat frame is constructed by welding 5000 Series aluminum sheets to a 7000 Series aluminum extruded frame. This combination offers the same strength and safety as steel while achieving a 35% reduction in weight. The lightweight design is particularly crucial for second-row seats in SUVs, where versatile seating arrangements and flexible usability are key. Reducing the weight of these seats enhances overall vehicle efficiency, contributing to better fuel economy and handling.

Aluminum bumper beam and perimeter beam



In vehicle body design, a new architecture has been introduced that evolves the multi-load path system. The bumper beam and perimeter beam, made from high-strength aluminum extruded shapes, enhance the overall mass efficiency of the vehicle, achieving both weight reduction and high collision safety performance. The energy absorption characteristics of the aluminum extruded shapes allow the bumper beam to reduce damage during collisions. Furthermore, the perimeter beam reduces vehicle intrusion behavior, minimizing body deformation. The aluminum crash boxes that support these beams work in conjunction with the main and lower load paths to absorb energy and efficiently transfer impact forces.

Aluminum forged brake calipers

As vehicles grow in size and performance, the need for lightweight, high-rigidity forged components has increased. Aluminum forged brake calipers must withstand the extreme temperatures of braking while ensuring top performance. These calipers are made from an aluminum alloy, refined through nano-level metallographic control and aerospace-grade heat treatment, offering superior strength and heat resistance.

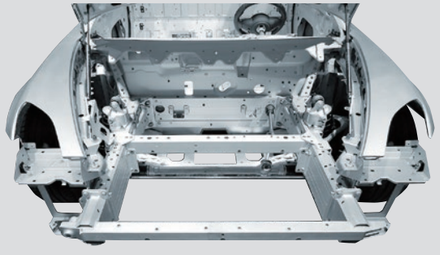
© Cemedine

Structural adhesives

Structural adhesives are applied in a straight line between panels to be joined, increasing "surface contact" and thereby enhancing joint strength and body rigidity. This results in improved handling response, better ride comfort, and reduced vibration and noise. Structural adhesives are widely used in multi-material structures, playing a crucial role in modern automotive design.

Mechanical joining

Hybrid joining techniques, which combine mechanical joining, structural adhesives, and laser welding, are increasingly used for joining dissimilar materials such as aluminum, steel, and CFRP in multi-material vehicle bodies. These methods address the challenges of joining dissimilar materials, including issues like distortion and deformation caused by differences in thermal expansion coefficients, as well as the risk of galvanic corrosion. By integrating multiple joining methods, hybrid techniques provide stronger, more reliable connections that are essential in modern automotive design.



All-aluminum platform with mechanically joined extruded shapes

Self-pierce Riveting (SPR)

Combination of rivets and adhesives

ATZ spezial

Driving Tomorrow's Mobility with Aluminum Innovations

ATZ Special Feature
Aluminum Technology 10
November 2024

Dear Reader,
Aluminum alloys play an important role in the manufacture of automotive components, and their properties are constantly being refined through improvements in material development and manufacturing process technology.
An environmentally friendly metal, aluminum continues to evolve as a more reliable lightweight material that contributes to the realization of a sustainable mobility society.

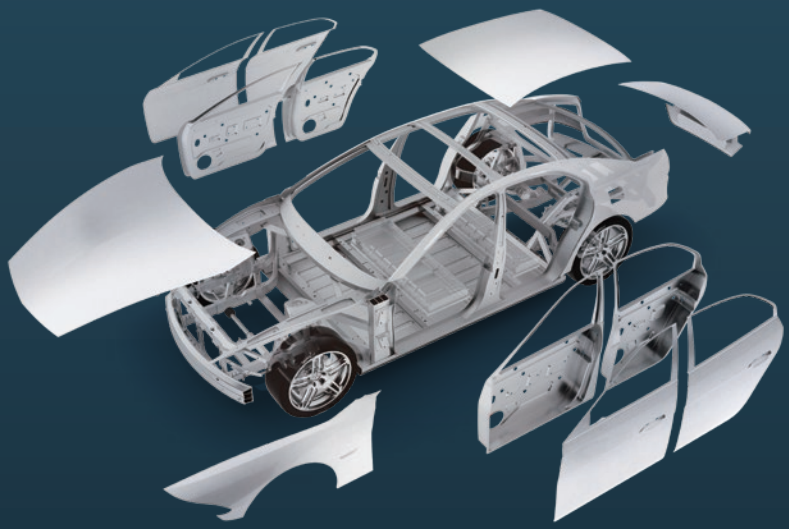
Haruya KATADA
Editor-in-Chief
ATZ MTZ Group
Japan

UACJ

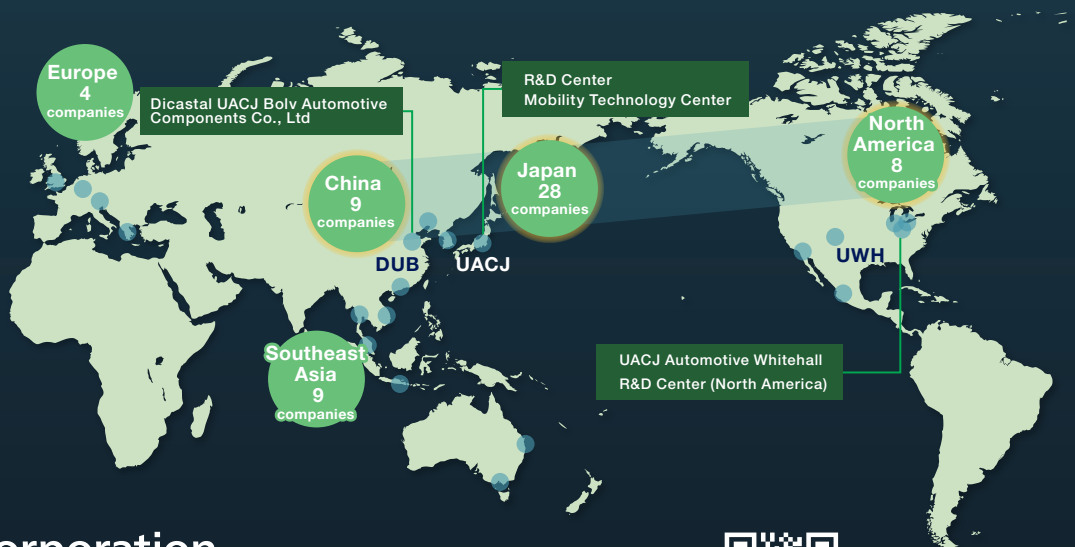
eMobility Technology
Sustainable Aluminum
for Future Mobility

Driving Tomorrow's Mobility with Aluminum Innovations

Under stringent environmental regulations, the automotive industry is accelerating its shift toward lightweighting and electrification. The rise of electric vehicles is only the beginning, as automakers navigate the CASE era, in which Connected, Automated, Shared, and Electric vehicles will surely shape the future of mobility.
As a leading aluminum company, UACJ Corporation is at the forefront of this transformation, leveraging our broad expertise to pioneer advanced materials and structural solutions that drive weight reduction and electrification. Together with leading automakers, we are not only envisioning the future of aluminum, but also closely supporting the future of the automotive industry.



Aluminum Automotive Parts
Aluminum Alloy Sheets & Plates
Aluminum Alloy Extruded Shapes
Aluminum Forged Products
Aluminum for Li-ion Batteries



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