ABOUT THE COVER:

Embossing, foil-stamping and die-cutting on the cover of the printed version of this brochure were created using magnesium plates produced by Luxfer’s Revere Graphics business (see page 11).
Luxfer Group (Luxfer Holdings PLC) is a global materials technology company specializing in the design and manufacture of high-performance materials, components and high-pressure gas-containment devices for healthcare, environmental, protection and specialty end-markets. Our customers include both end-users of our products and manufacturers that incorporate Luxfer products into finished goods. Listed on the New York Stock Exchange in October 2012, Luxfer trades under the symbol LXFR.

The Group operates 21 manufacturing plants in the United States, England, France, Germany, Canada, China and the Czech Republic, as well as joint ventures in the United States, Japan and India. Luxfer products shown on the following pages are used in most countries around the world.

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EXPANSIVE GLOBAL FOOTPRINT

MAP KEY

UNITED STATES
1 Riverside, California (2 locations)
2 Brigham City, Utah
3 Madison, Illinois
4 Cincinnati, Ohio
5 Findlay, Ohio
6 Graham, North Carolina
7 Tamaqua, Pennsylvania
8 Flemington, New Jersey
9 Lakehurst, New Jersey
10 Riverhead, New York

CANADA
11 Calgary, Alberta
12 Stoney Creek, Ontario

EUROPE
13 Salford, England (Head Office)
   Swinton, England (2 locations)
   Nottingham, England
   Worcester, England
14 Gerzat, France
15 Ratingen, Germany
16 Louka u Litvínova, Czech Republic
LUXFER is a British company, registered in England, operating 21 manufacturing plants in North America, Europe and China, joint ventures in the United States, Japan and India and a sales office and distribution center in Australia.

INDIA
17 New Delhi, India

CHINA
18 Shanghai, China

JAPAN
19 Shizoka, Japan

AUSTRALIA
20 Sydney, Australia
Luxfer Group (Luxfer Holdings PLC) has two global divisions: the Elektron Division and the Gas Cylinders Division, each of which encompasses two worldwide brands, outlined below (detailed brand profiles follow on pages 7-32).

**ELEKTRON DIVISION**

**MAGNESIUM ELEKTRON**—Under our Magnesium Elektron brand, we develop and manufacture:
- Highly specialized lightweight, corrosion-resistant and flame-resistant magnesium alloys used in aerospace, automotive, defense and healthcare applications.
- Magnesium powders used in countermeasure flares that protect aircraft from heat-seeking missiles.
- Magnesium, copper, zinc and brass photoengraving plates used in the graphic arts industry, as well as a complete line of engraving-related chemicals and equipment.
- Magnesium-based heating pads for self-heating meals used by the military and by emergency relief agencies, as well as an extensive line of self-heating meals, beverages and soups used by military and civilian end-users.
- Chemical agent detection and decontamination kits and seawater desalination kits.

**MEL CHEMICALS**—Under our MEL Chemicals brand, we develop and manufacture:
- Specialty zirconium compounds used in automotive exhaust catalysts and industrial catalysts.
- High-performance zirconium oxides used in electronic and structural ceramics.
- Filters for drinking water purification and wastewater treatment.
- Thermal barrier coatings for aerospace applications.
- Zirconium-based reactive and crosslinking chemicals used in adhesives, antiperspirants, printing inks, paint, pigment coatings, metal treatments and oilfield production.
- Zirconium materials for biomedical applications.

**GAS CYLINDERS DIVISION**

**LUXFER GAS CYLINDERS**—Under our Luxfer Gas Cylinders brand, we develop and manufacture high-pressure aluminum and composite cylinders and accessories used for:
- Breathing air containment and life support for firefighters and other emergency-response personnel.
- Containment of medical oxygen and other medical gases used by patients, healthcare facilities and laboratories.
- Compressed natural gas (CNG) containment for alternative fuel vehicles, as well as CNG transportation and bulk storage; containment of hydrogen for fuel-cell vehicles.
- Containment of high-purity specialty gases for electronics and pharmaceutical manufacturing, environmental monitoring and laboratory applications.
- Inflation of aircraft escape slides and life rafts, as well as other aerospace applications.
- Containment of CO₂ for fire extinguishers and beverage dispensing.
- Containment of air and specialized breathing blends for scuba diving.

**SUPERFORM**—Under our Superform brand, we design and manufacture lightweight aluminum and magnesium panels “superformed” into highly complex shapes for aerospace, automotive, rail, architectural and healthcare components and products.
HEALTHCARE — The medical sector has long been an important growth market for Luxfer, and in both of our divisions we make products that benefit patients and healthcare professionals. These include lightweight aluminum and composite cylinders for containment of medical and laboratory gases; magnesium powders for pharmaceutical products; magnesium materials for lightweight orthopedic devices; specialized magnesium alloys for cardiovascular stents and implants; and zirconium materials for biomedical applications.

ENVIRONMENTAL — This growth market encompasses many Luxfer products that improve and safeguard the environment, including our zirconium-based products that clean up automotive and industrial exhausts, purify drinking water, remove heavy metals from wastewater and capture carbon dioxide; our lightweight magnesium alloys used in fuel-efficient aerospace and automotive designs; our lightweight, high-pressure carbon composite alternative fuel cylinders that not only contain clean-burning compressed natural gas, but also improve fuel efficiency; and our cylinders that contain calibration gases used in environmental monitoring.

PROTECTION — For this growth market, Luxfer offers a number of products that protect people, equipment and property during conflicts and emergencies, including magnesium powders for countermeasure flares that defend aircraft against heat-seeking missile attack, life-support cylinders for firefighters and other emergency-service personnel, inflation cylinders for aircraft escape slides and life rafts, fire extinguisher cylinders, and chemical agent detection and decontamination products.

SPECIALTY — The three strategic growth markets described above have emerged alongside our traditional specialty markets, including a comprehensive range of graphic arts products, petroleum-production products and high-pressure cylinders for containment of high-purity specialty gases used in the manufacture of microprocessors and other high-technology electronic equipment.
Our business strategy is based on the Luxfer Model, which consists of five key themes:

**Strong Customer Relationships**—The customer is at the center of everything we do, and our long-term customers, including many blue-chip companies, often work closely with us as partner-of-choice.

**Manufacturing Excellence**—We have focused for many years on achieving and maintaining world-class manufacturing, including using external auditors to measure our performance against rigorous standards.

**Innovation**—Through the ingenuity of our own people and close collaboration with research universities around the world, Luxfer continues to develop a steady stream of new products.

**Technology**—Our expertise in metallurgy and material science and our commitment to extending the boundaries of our core materials are fundamental to Luxfer’s business.

**High-Performance Products**—Using our technological expertise, we develop advanced materials and manufacture high-performance products for the most demanding requirements and environments.
Magnesium Elektron holds more global patents on specialized magnesium alloys than any other company. Our lightweight, corrosion-resistant and flame-resistant alloys are widely used in demanding aerospace and automotive components such as those shown above.
Magnesium Elektron is a global technology and innovation leader in the use of magnesium, the lightest-weight structural metal: 30% lighter than aluminum and 75% lighter than steel. Founded in Swinton, England, in 1936, we have been involved in every aspect of magnesium, starting with primary production and then moving to ingot, plate, sheet, particulate, billet, extrusions and purpose-built fabricated forms. As years passed, Magnesium Elektron ceased being just another supplier of primary magnesium and began focusing on developing and making unique, high-performance magnesium alloys—many patented or proprietary—for a diverse range of specialized applications that benefit from our innovative materials and ongoing research and development.

Today we serve a global customer base from manufacturing operations in Swinton, England; Lakehurst, New Jersey; Madison, Illinois; Findlay, Ohio; Cincinnati, Ohio; Riverhead, New York; Tamaqua, Pennsylvania; Stoney Creek, Ontario, Canada; and Louka u Litvínova, Czech Republic.

Throughout our history, Magnesium Elektron has pushed metallurgical boundaries of magnesium alloy technology, taking maximum advantage of magnesium’s unique chemical, physical and mechanical properties, including high strength, high specific stiffness (18 times stiffer than steel and double the stiffness of aluminum) and high machinability. Our products and services include:

**HIGH-TEMPERATURE AND HIGH-PROPERTY MAGNESIUM ALLOYS**—Our lightweight structural magnesium alloys are used in critical aerospace, automotive and military applications, including helicopter transmissions, jet engine transmissions and components, generator housings, power-takeoff systems and other types of equipment that run at high temperatures (see page 9).

**CORROSION-RESISTANT AND IGNITION-RESISTANT MAGNESIUM ALLOYS**—Magnesium Elektron has developed high-performance alloys that provide improved resistance to corrosion and ignition in demanding environments to which aircraft and automotive components are frequently exposed (see page 9).

**ULTRA-FINE MAGNESIUM POWDERS**—Magnesium Elektron is the leading producer of magnesium powders used in military flare systems, including both illumination flares and countermeasure flares that protect aircraft from heat-seeking missile attack (see page 10).

**GRAPHIC ARTS PRODUCTS**—Magnesium Elektron photoengraving plate is used to produce high-quality printed media such as greeting cards, premium labels and decorative packaging (for example, for beverage containers and luxury goods). We also supply copper, zinc and brass plates for this application along with a full line of chemicals and ancillary equipment (see page 11).

**MAGNESIUM-BASED HEATING PADS FOR SELF-HEATING MEALS**—Used by both military and civilian end-users, these heating pads and a wide offering of self-heating meals and beverages became part of Luxfer’s product range as a result of a major acquisition in 2014 (see page 12).

**BIOMEDICAL APPLICATIONS**—We make a range of magnesium powders for the pharmaceutical industry, as well as magnesium materials for lightweight orthopedic devices. At a purpose-built facility in Swinton, England, we make our patented Synermag® magnesium alloy for cardiovascular stents and implants (see page 14), as well as for splints and fasteners that support bones during healing and then dissolve once the job is done.

**SEAWATER-ACTIVATED BATTERIES**—Our alloys are used in seawater-activated batteries for demanding military applications, including driving torpedoes and powering sonar buoys that locate and track submarines.

**RECYCLING SERVICES**—Recycling metals is now an essential environmental and economic practice, and Magnesium Elektron has recycling capability at all our production facilities. In 2002, we created Magnesium Elektron CZ, a business unit in the Czech Republic dedicated specifically to recycling magnesium alloys.

**MAGNESIUM ARMOR PLATE**—We make specialized alloys for use in lightweight military armor systems to protect ground personnel vehicles. Magnesium Elektron developed the first military specification for magnesium-alloy armor as part of a U.S. government-funded program.

Magnesium Elektron is not a conventional magnesium company. Our pioneering advances in research and development, technology and production techniques have generated numerous new and unique applications for magnesium—and we continue to push the boundaries of this versatile material.
The aerospace industry has long recognized the benefits of Elektron® high-performance magnesium alloys for reducing weight in fuselage structures and aircraft skins, interior appliances, engine frames and components, helicopter transmissions and wheels. For both commercial and military aircraft, we offer advanced magnesium alloys that resist high temperatures, ignition and corrosion. Our alloys also provide aircraft component designers the ability to produce complex shapes by casting, machining, extruding or forging. Our products are available in many forms, including ingot, plate, sheet, extrusions, billet and powder.

Our Elektron® 43 alloy offers such excellent resistance to both corrosion and ignition that it passed rigorous testing by the United States Federal Aviation Administration, including fire tests shown at the left. In 2013, this led the FAA to certify our magnesium alloys for passenger aircraft cabin applications, including seating, and the current FAA flammability certification test was developed using Elektron 43 as the standard.

Seat manufacturer ZIM Flugsitz (shown at left at an aircraft interiors exhibition) was first to use our alloy, and others are considering it because of significant weight savings offered by magnesium components against traditional aluminum alloys used by the industry.
For more than 70 years, Magnesium Elektron has been a strategic supplier of magnesium-based powders for military applications. The U.S. Department of Defense has designated our Reade Manufacturing and Hart Metals plants as "Critical Suppliers." Magnesium Elektron leads the world in the production of bespoke powders for military flares and other pyrotechnic devices. Our ultra-fine powders are the main constituent of infrared countermeasure decoy flares used to protect aircraft from heat-seeking missile attack. When deployed, flares mimic heat signatures of engines. With the increased use of shoulder-launched weapons, these countermeasure systems have become even more critical to survival of aircraft in combat zones.
Magnesium Elektron and our Revere Graphics business share a long history and proud heritage in metal engraving and etching. Our combined roots date back to Paul Revere (1735-1818), a master engraver and printer.

Metal foil-stamping and embossing dies are used primarily in luxury packaging and labels and greeting cards. Our high-quality magnesium, copper, zinc and brass plates are ideal for these and other graphic applications. We used our premium Revere magnesium dies to create embossing, foil-stamping and die-cutting features on the cover of the printed version of this brochure.
A soldier pours water into a plastic bag to activate our magnesium-based heating pad that will heat a military Meal, Ready-to-Eat (MRE). The photo at the right shows steam rising from the MRE during the heating process.

Luxfer Magtech Inc. (LMI) is a wholly owned subsidiary and stand-alone business of Magnesium Elektron. On July 29, 2014, LMI acquired the assets and businesses of Truetech, Inc. and Innotech Products, Inc.

From locations in Riverhead, New York, and Cincinnati, Ohio, LMI manufactures and markets all former Truetech and Innotech products, including:

- Magnesium-based heating pads for self-heating meals used by the U.S. military with Meals, Ready-to-Eat™ in the field.
- An extensive line of self-heating meals (Heater Meals®) and soups and beverages (Café 2 Go®) used not only by the military, but also by the Federal Emergency Management Agency (FEMA), the Red Cross and other disaster-relief agencies (see page 13), first-responders around the world and campers, hikers and other outdoor enthusiasts.
- Chemical agent detection and decontamination kits (see page 13).
- Seawater desalination kits.
Sailors from the Naval Air Station in Pensacola, Florida, load Heater Meals on a helicopter bound for New Orleans, Louisiana, as part of the disaster-relief effort after Hurricane Katrina.

Heater Meals®, which use the same flameless, magnesium-based self-heating technology as military meals, are a mainstay in disaster-relief activities by the Red Cross and other private and government agencies. Because LMI’s Heater Meals and Café 2 Go® self-heating beverages require no refrigeration, they are often stockpiled to facilitate rapid emergency response.

Military and civilian agencies use Luxfer Magtech detection and decontamination products to identify and clean up chemical agents (right). End-users include military personnel, firefighters, law enforcement, emergency medical teams, hazardous-material teams, disaster-relief agencies and other first-responders.

The soldier at the right uses a LMI chemical agent decontamination mitt during a training exercise.
Global research into bioabsorbable materials has increased significantly over the last decade, particularly in the fields of orthopedic trauma fixation and vascular intervention, where the use of metallic implants is now commonplace.

Magnesium, an essential nutrient for the human body, supports vascular and bone health. Since the chemistry of human tissue will dissolve and absorb solid magnesium pieces over time, magnesium is an ideal material for vascular stents (right) that will open clogged arteries, enable healing and eventually dissolve after passageways are clear.

Magnesium Elektron has been actively involved in research into such magnesium materials, which has led to development of our exclusive SynerMag® magnesium bioabsorbable alloys at our new state-of-the-art SynerMag Technology Centre and manufacturing facility in Swinton, England.

Magnesium Elektron researchers have worked in close collaboration with universities and leading medical device companies in Europe, Japan and North America. Through these programs, our SynerMag® alloy has already undergone a number of in-vitro and in-vivo evaluations, and additional clinical trials are planned.

SynerMag can also be used to make bioabsorbable splints, screws and other fasteners that will repair and reconstruct bones and dissolve when healing is done.

Shown above is specially designed extrusion equipment at our SynerMag Technology Centre that produces wire made from our exclusive SynerMag bioabsorbable alloy. The wire (shown below) is then used to create arterial stents similar to the one shown in the illustration at the left. Stents made from SynerMag alloy are now undergoing in-body trials.
MEL Chemicals has been a leading innovator and manufacturer of zirconium-based chemicals for many years. We offer a broad range of products used in numerous domestic and industrial applications, including water purification (see page 19).
A global producer and supplier of inorganic zirconium-based chemicals, MEL Chemicals has long been at the forefront of technological developments in zirconium chemistry. With research and development and manufacturing operations in England, the United States and Japan, we produce an extensive range of high-quality pure zirconia, doped zirconias, zirconium hydroxides and zirconium salts and solutions. Our versatile zirconium chemicals offer low relative toxicity and high-temperature tolerance for a variety of applications in numerous industries. MEL specializes in tailoring products to specific customer needs. Primary markets and products include:

**Automotive Catalysis**—Catalysis is the modification of the rate of a chemical reaction by adding a substance (catalyst) not consumed during the reaction. MEL supplies a wide range of catalyst-grade zirconium hydroxides and oxides for use in catalytic converters, emissions-control devices that convert toxic pollutants in exhaust gases from internal-combustion engines into less-toxic substances. Our high-quality products are used mainly with gasoline (petrol) engines, as well as with diesel engines (see page 18).

**Chemical Catalysis**—Zirconia-based materials are ideal for controlling pollution from petrochemical plants and other refining and manufacturing operations, especially those involving hydrogenation, oxidation, amination and isomerization. We offer an extensive range of zirconium hydroxide and doped zirconia powders and precursors, including aqueous zirconium salts and organic soluble complexes. We also manufacture an exclusive line of process catalysts.

**Drinking Water Purification**—Using patented technology, we have developed a range of zirconium-based, environmentally safe, highly efficient adsorbent materials for removing heavy metals from drinking water. Our exclusive Isolux® products are particularly effective at removing arsenic, as well as other metals (see page 19).

**Wastewater Treatment**—Our MELsorb® products use tailored chemistry and patented technology to remove arsenic and other heavy metals from wastewater. We have engineered our zirconium adsorbents into a versatile range of amorphous and crystalline forms with a wide selection of particle sizes (see illustration below). Our materials exhibit superior kinetics and performance compared to conventional ion-exchange resins.

**Advanced Ceramics**—Because of their resistance to electrical charges, heat and wear, our MELox™ doped and undoped zirconium oxides are used in a huge range of industrial and domestic ceramic products, including electronic components, engineering ceramics, filters, milling media, fiber optics, oxygen sensors, solid oxide fuel cells, and medical implants and restorative applications. Our versatile products are suitable for tape casting, injection molding and iso-static pressing techniques. Depending on the application, we offer various levels of chemical purity, particle size distribution and surface area, including special ceramic grades for critical laboratory and manufacturing applications.

**Carbon Dioxide Sorption**—Carbon capture is a key factor in environmental protection, and our MELsorb® products are particularly effective for this use. These products are beneficial to many chemical processes and industrial applications that require removal of carbon dioxide.

**Reactive Chemicals**—MEL provides a broad selection of zirconium-based reactive (crosslinking) chemicals used in petroleum production, paper production, adhesives, antiperspirants, printing inks, paint, pigment coatings and metal treatments.

**Nanotechnology**—Nanotechnology (manipulation of matter at an atomic, molecular or supramolecular nanoscale of 1 to 100 nanometers) is driving significant change in chemistry, biology, medicine, physics, materials science, electronics and engineering. MEL offers the highest-quality nano-zirconia and nano-stabilized zirconia materials, including aqueous suspensions used as dispersions. We are committed to ongoing research and development in this exciting, multifaceted field.
At its headquarters facility in Swinton, England, MEL Chemicals produces high-quality, zirconium-based chemicals, including a wide variety of highly specialized powders used in applications illustrated on the pages that follow. The Swinton facility also operates an advanced laboratory dedicated to zirconium research and development.

Quality control is crucial when making zirconium powders. The equipment shown below is heating powder in crucibles to prepare it for analysis by x-ray florescence, a technique for detecting chemical impurities.
Today’s advanced “three-way” catalytic converters for internal-combustion engines help reduce pollution by combining carbon monoxide (CO) with unburned hydrocarbons to produce less-toxic carbon dioxide (CO₂) and water (H₂O), as well as reducing oxides of nitrogen (NOX). MEL supplies high-quality, catalyst-grade zirconium hydroxides and oxides, often doped with rare earths, for use with both gasoline (petrol) and diesel engines. Our materials are also used in automotive oxygen sensors.

MEL Chemicals has developed proprietary technology that enables us to customize and fine-tune our MELcat™ range of zirconium oxides and hydroxides to optimize catalysis and pollution control for specific plant requirements, including enhancing surface-area stability, porosity and phase composition of our materials at high temperatures. We can provide products in whatever form is needed, including slurry, washcoat, extrudate and tablet.
For treating wastewater, we make our MELsorb® products, which effectively remove heavy metals, including arsenic. Both MELsorb and Isolux systems produce non-hazardous waste that is safe for landfills since adsorbed arsenic and other metals remain fixed, even in acidic or alkaline environments.

Our zirconium-based, adsorptive Isolux® water-purification products remove arsenic and other heavy metals from drinking water. Isolux systems are available in a variety of sizes and capacities ranging from small home units to larger central-treatment systems ideal for communities.

The steel industry uses filters based on zirconium oxide to remove slag, dross and other impurities from molten metal during production of high-quality metal castings.
Our MELox™ doped and undoped zirconium oxides are key ingredients in a wide variety of industrial and domestic ceramic products, primarily because of their resistance to heat, wear and electrical charge. Using specialized lab equipment (below), we rigorously control the quality of our materials used for ceramics. We can tailor our MELox products for particular applications, including special ceramic grades that require close control of physical and chemical properties, high-purity oxides with precise chemical compositions and our customized “E Range” for electronic components. Zirconium-based reactive chemicals are also used in printing ink (right), paint and pigments, adhesives, antiperspirants and many other commercial products.

This MEL lab device uses X-ray diffraction to verify the structural integrity of ceramics made with our zirconium oxides.

Our zirconium oxides are used to create ceramic foam filters for thermal insulation, absorption of environmental pollutants, filtration of molten metal alloys and as substrates for catalysts requiring large internal surface areas.
Luxfer Gas Cylinders is the world’s largest manufacturer of high-pressure composite and aluminum cylinders, including a comprehensive line of ultra-lightweight, durable carbon composite breathing-air cylinders for firefighter life support (see page 23).
Luxfer Gas Cylinders, the world’s largest manufacturer of high-pressure aluminum and composite cylinders, operates manufacturing facilities in England, the United States, Canada, France, Germany, China and India (joint venture). More than 50 million Luxfer cylinders in service around the world have an exemplary record for dependable service and safety.

Luxfer has a legacy of innovation in high-pressure gas-containment. In 1941, Luxfer France (then known as Société Métallurgique de Gerzat) invented the hot-extruded aluminum cylinder. In 1958, Luxfer invented the cold-extruded aluminum cylinder in England. Innovations in manufacturing and metallurgy followed, including Luxfer-developed patented and proprietary aluminum alloys that have enabled us to produce lightweight, durable, corrosion-resistant cylinders for a wide range of applications. We added fiberglass-reinforced, hoop-wrapped composite cylinders to our product line in 1976 and thinner-walled, fully wrapped models ten years later. In 1997, we introduced ultra-lightweight composite cylinders wrapped with aerospace-grade carbon fiber, and we have continued to develop and improve these products and the processes we use to make them. Our primary products and markets include:

**LIFE-SUPPORT CYLINDERS**—Luxfer is the world’s largest supplier of carbon composite life-support cylinders for self-contained breathing apparatus (SCBA) equipment used by firefighters and other emergency-response personnel. We make the world’s lightest-weight and highest-pressure carbon composite cylinders. We also manufacture emergency-egress cylinders for miners and others in potentially hazardous environments.

**MEDICAL**—We offer a wide range of aluminum and composite cylinders for containment of oxygen and other medical gases used by patients, healthcare facilities and laboratories, including cylinders made from our exclusive L7X® higher-strength aluminum alloy developed by Luxfer metallurgists. Although L7X cylinders have the same dimensions as conventional medical cylinders, they provide up to 50 percent more gas capacity because they can be filled to higher pressures (4,350 psi or 300 bar).

**SPECIALTY GAS**—Luxfer invented the aluminum specialty gas cylinder in 1974. These cylinders feature Luxfer-exclusive internal surfaces for containment of high-purity specialty gases used in micro-processor manufacturing and other electronics applications, pharmaceutical manufacturing, environmental monitoring and laboratory applications in which gas stability is crucial.

**ALTERNATIVE FUEL (AF)**—Luxfer offers a comprehensive line of large carbon composite cylinders for containment of compressed natural gas (CNG) and other alternative fuels used in buses and trucks, as well as cylinders used for bulk storage and transportation of CNG. We offer both Type 3 (aluminum-lined) and Type 4 (polymer-lined) cylinders and a full line of CNG system accessories. In addition, we make Type 3 cylinders and valves for high-pressure containment of hydrogen for fuel-cell vehicles.

**AEROSPACE**—Luxfer’s lightweight carbon composite cylinders are used to inflate emergency-egress slides in commercial and military aircraft, helicopter floats and life rafts. Our aluminum and composite oxygen cylinders and aluminum fire extinguisher cylinders are standard aerospace equipment, and we also make specialized spun-steel breathing cylinders for aviators and parachutists.

**CARBON DIOXIDE (CO₂)**—Aluminum CO₂ cylinders used to dispense beverages in British pubs were our earliest cylinder products, and we still make them today for use with various beverages. These cylinders are also used for CO₂ fire extinguishers; our customers include well-known fire equipment companies around the world.

**SCUBA**—Luxfer developed the world’s first aluminum scuba cylinder in collaboration with scuba pioneer Jacques-Yves Cousteau, inventor of the original Aqua Lung® equipment that revolutionized underwater sports and exploration. In addition to its all-aluminum products, Luxfer manufactures the world’s only hoop-wrapped composite scuba cylinder, which can be filled to higher pressures than standard tanks.

**PERFORMANCE RACING**—We offer a complete range of aluminum and composite cylinders for professional performance racing applications, including nitrous oxide (N₂O) cylinders for engine performance enhancement, nitrogen cylinders for tire inflation and CO₂ cylinders for fire suppression.
Luxfer has been manufacturing self-contained breathing apparatus (SCBA) life-support cylinders for firefighters since 1972, beginning with aluminum cylinders and then expanding our product line to include hoop-wrapped and full-wrapped cylinders. Today Luxfer’s SCBA cylinders are used by more fire departments and brigades around the world than any other brand, including those serving many of the world’s major cities. Our most popular products are our ultra-lightweight, full-wrapped carbon composite cylinders, which include both the world’s lightest-weight and the world’s highest-pressure models. Our customers include leading global SCBA original equipment manufacturers.
In keeping with the “manufacturing excellence” theme within the Luxfer Model (see page 6), we continue to invest in automation. Shown above and at the left are scenes from the shop floor at our highly automated facility in Riverside, California, which specializes in manufacturing high-pressure cylinders ranging in size from breathing air units that fit on firefighters’ backs to very large compressed natural gas cylinders for buses and trucks. Far more productive and cost-efficient than in the past, our cylinder plants now use a number of proprietary manufacturing processes.

Above is one of many robots at work in our facility in Gerzat, France, which makes both aluminum and composite cylinders for a variety of applications.

This close-up photo shows the spinning process used to make aluminum liners for our Type 3 composite cylinders.
Luxfer has been manufacturing Type 3 carbon composite alternative fuel (AF) cylinders with aluminum liners since 2007. Used both for CNG-powered vehicles and bulk gas transportation and storage, this product line is marketed under the brand name G-Stor Pro®.

Late in 2014, Luxfer expanded its AF product line to include large-diameter carbon composite Type 4 cylinders with polymer liners, marketed under the name G-Stor Go®. Our product range includes 26-inch-diameter cylinders for heavy-duty class 8 trucks powered by compressed natural gas (CNG). Luxfer also markets a line of proprietary AF accessories, including exclusive lightweight, high-flow valves and pressure-relief devices.

In addition to CNG cylinders, Luxfer offers an exclusive line of Dynecell® cylinders and valves for hydrogen fuel-cell vehicles.

Below, left: Luxfer Type 3 (aluminum-lined) composite cylinders are in service atop a large fleet of CNG buses (above) serving the Dallas Area Rapid Transit (DART) authority in Texas.

Our lightweight Type 4 cylinders are used in efficient back-of-cab systems made by Trilogy Engineered Solutions for class 8 heavy-duty trucks.
Luxfer invented the aluminum high-pressure cylinder, and we supply more cylinders to customers around the world than any other company. We manufacture aluminum cylinders in Nottingham, England; Gerzat, France; and Graham, North Carolina. Our products are used in a variety of applications, including (clockwise from above) specialty gas, fire extinguishers, scuba diving, medical cylinders for individual oxygen users and emergency medical services, and beverage dispensing (for more uses, see page 22).
Superform makes complex components for many well-known car manufacturers, including Aston Martin, a long-time customer. Shown above is the Aston Martin Vanquish, for which our Superform facility in England made interior components and rear fenders.
Superform is the world’s leading supplier of complex, superformed components for a variety of industries, including aerospace, automotive, rail transportation, medical and architecture. Superform was founded in Worcester, England, in 1974, and Superform USA was established in Riverside, California, in 1986. We initially made automotive components and soon expanded into other markets. Customers include Airbus, Aston Martin, Bentley, Boeing, Bombardier, BAE Systems, Ferrari, Fiat Chrysler, Ford, Goodrich, Honeywell, Lamborghini, Lockheed, Morgan Cars, Rolls Royce, Siemens, United Technologies and many others around the globe.

Superforming is a process in which a sheet of material—in our case usually aluminum or magnesium—is heated and then molded under air pressure onto a single-surface tool to create a complex, three-dimensional shape from a single sheet. (To learn more about the process, visit our website at www.superform-aluminium.com.) Superformed components often undergo a variety of post-forming operations, including trimming and welding, to create a final part or assembly. Superforming gives designers the freedom to create complex geometric shapes—from subtle to extreme—that conventional forming processes cannot produce. On most projects, the tooling investment for superforming is much less than that associated with standard matched-die tools. Superforming offers significant cost benefits when low-volume, high-variety manufacturing is required. Our primary markets and components include:

**AUTOMOTIVE**—We have used our unique techniques for a number of major luxury and high-performance niche vehicle projects, enabling car manufacturers to introduce new models far faster while minimizing tooling costs. Our Superform staff is particularly expert at prototyping, working closely with designers and car manufacturers to provide a single-source solution to chassis and body development. Using the Superforming process can cut weeks off lead times for production-ready tooling and first-off parts. Our process is often used to produce exterior body panels, chassis structures, door inners, bodysides, door rings, enclosure assemblies, tunnels, structural-support pillars and cantrails, roof structures, bulkheads and footwells. The ability to make such components in one piece saves costly assembly time compared to methods that produce multiple pieces. Superforming can also yield the class A surface quality necessary when manufacturing parts for luxury automobiles and sports cars. Superform facilities also provide precision laser-trimming and other post-forming services to ensure excellent component quality.

**AEROSPACE**—Superform is an established first-tier supplier to original equipment manufacturers that supply lightweight aircraft structures, including jet engine nacelle skins and lip-skins, bulkheads, lamp drums, wingtips, winglets (see page 30), leading-edge ribs for wings, access door inner skins, equipment covers, fascia panels, acoustic panels and other lightweight laminar structures. Our process offers aerospace designers opportunities to reduce part counts by forming components in single pieces rather than fabricating, to increase structural integrity of parts and assemblies, to reduce part weight and to speed up final assembly because of better repeatability. Superform makes components for both civilian and military aircraft. We have also provided components to NASA, including exterior panels for the International Space Station (ISS) and Automated Transfer Vehicles (ATVs) that bring supplies to astronauts living and working in the station (see page 31).

**RAIL**—To railcar designers, key benefits of superforming include reducing overall railcar weight, significantly reducing the number of parts required, reducing assembly time and improving component surface quality and durability. The Superform process is ideal for producing cab structures and skins, interior panels, window and door components, as well as other parts (see page 32).

**MEDICAL**—Superform makes complex-shaped components for a number of high-technology medical devices, including Siemens MRI units and Varian accelerators used in radiotherapy (see page 32).

**ARCHITECTURE**—Superform has worked with leading architects and designers around the world to bring complex design concepts to reality. Typical components include exterior cladding for structures, specialized trim, decorative panels and perforated panels.
Superforming offers automotive designers a high degree of creative freedom, since this versatile process can produce complex shapes and details (for example, sharp corners) that conventional forming methods cannot make from a single sheet. Superform produced the complex rear bootlid inner and outer for the Ferrari California T (above). For Morgan Cars (below), Superform has been manufacturing aluminum exterior body components for many years.
Superform is producing this aluminum component for Boeing Advanced Technology Winglets for the Boeing 737 MAX airliner. The exclusive Boeing design redistributes wing loading, increasing the effective span of the wing, generating more lift, reducing drag and significantly reducing overall fuel consumption.

Superform is used to produce a wide variety of components for commercial and military aircraft. Aerospace designers can reduce the number of parts needed by forming components from single metal sheets rather than fabricating from many separate parts—which not only reduces weight and speeds up final assembly, but also increases structural integrity of components and assemblies.

Superform produced wingroot fairings (see the engineering drawing in the inset below), as well as wingtips for the Piper Mirage.
Superform produced exterior panels both for the International Space Station (ISS) and for Automated Transfer Vehicles (ATVs) that bring air, water, supplies and experiments to astronauts from around the world who live and work in the station.
Superform produced components for London Metro railcars (right).

For more than a decade, Superform has been producing circular end-shields for Siemens Magnet Technology MRI scanners.

Railcar designers specify intricately shaped Superform components for both exterior and interior use. Benefits are similar to those in aerospace applications: lightweight, one-piece parts reduce weight and speed up assembly while providing superior structural strength.