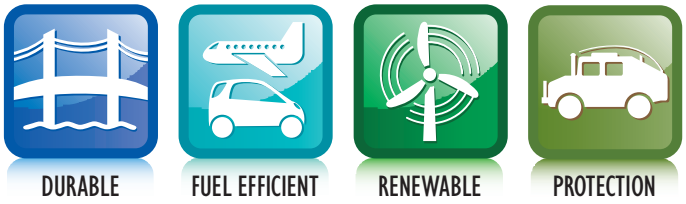
THE COMPOSITE APP CHALLENGE



TOP 10 COMPOSITE APPS

In the mid-1930s, consultants looking for new things to make with glass combined a handful of insulation-like fibers with an early commercial plastic and produced what may have been the world's first fiberglass-reinforced plastic. They had produced a new basic material.

Kilo for kilo, glass fibers are stronger than steel, yet glass is known for being brittle and fragile. Polymers are light and allow designers great freedom of expression, yet the first plastics were also easily broken. The two together, however, transcend the perceptions of either material and make a composite that is strong, light and durable. It can make existing products better and new things possible.

In the 75 years since that first fiberglass-reinforced polymer was made, inventors and engineers around the world have found thousands of ways to put composite materials to work. Applications of composites have transformed some industries, such as boat and shingle making, and enabled others, such a large-diameter pipe and commercial wind energy. From that first glass fiber-reinforced material has sprung a $6 billion global industry employing tens of thousands.

Following is a list of what may be the Top 10 composite applications to date. These applications surely represent milestones along the path of composite development. Most of these application platforms opened the door for other applications in the same field. For example, the Stout-Scarab car was never produced commercially but showed the way for hundreds of composite applications in vehicles today, ranging from truck fenders to parts for the engines of cars.

For this list, "composite" is defined as a fiber-reinforced matrix, typically fiberglass-reinforced polymer but not necessarily limited to that combination because composites today include reinforced concrete and asphalt.

What applications will be included in this list in another 75 years? No one knows for sure but perhaps at least one new transformational application will be discovered during the Owens Corning Composite App Challenge.

STRONG AND LIGHTWEIGHT AIRCRAFT PARTS

STRONG AND LIGHTWEIGHT AIRCRAFT PARTS

As early as 1942, fiberglass and polyester airplane parts were being produced in the U.S. These were low pressure plastic laminates made from fiberglass cloth impregnated with resin. The first structural use of fiberglass in aircraft was in the cockpit of the first attempt at a combat helicopter feasible. These early aviation applications helped the industry experience the strength, light weight and durability of composite materials first hand. Composites continue to be used in today's most advanced commercial aircraft as airlines demand lighter planes for increased payload and reduced fuel use. Composite applications now range from flooring and cargo containers to fuselage and cabin components.

LOW-MAINTENANCE BOAT HULLS

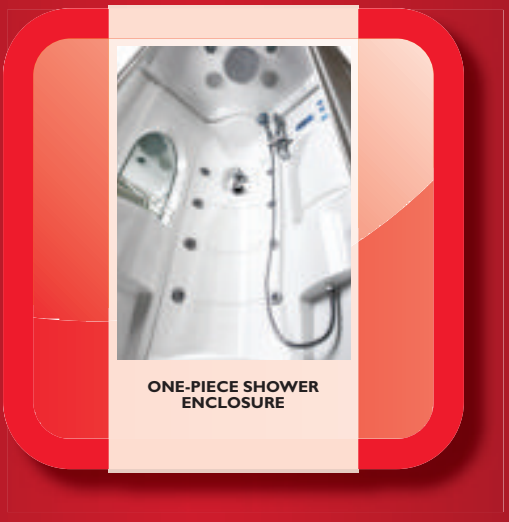
LOW-MAINTENANCE BOAT HULLS

Made with glass cloth cured over a flimsy canoe-type hull, the first composite boat hull sank during its maiden voyage. Despite that setback, development work continued and Ray Greene is credited with making the first composite boats for sale, starting with a small dingy. Composites ultimately revolutionized the marine industry with low-maintenance watercraft that allow owners to enjoy more time on the water and spend less time performing annual maintenance chores.

STYLISH AND RUST-FREE CARS

STYLISH AND RUST-FREE CARS

William Stout developed the first car with an FRP body in 1945. Although the Stout-Scarab never went into commercial production, the vehicle was a breakthrough in thinking that others followed. In 1953, General Motors and the Kaiser-Willys Company both launched production cars with FRP bodies – the Chevrolet Corvette and the Kaiser-Darrin. Corvette is one of the longest-running nameplates in Chevrolet history and GM currently builds as many as 35,000 units a year. The total since 1953 surpassed 1.5 million during the 2007 model year. Composite parts on cars and trucks today range from engine valve covers and rear deck spoilers of sports cars to the cabs and trailers of 18-wheelers.



ONE-PIECE SHOWER ENCLOSURE

ONE-PIECE SHOWER ENCLOSURE

The concept of a one-piece molded shower stall and tub has been around since at least the 1920s when it was a feature of Buckminster Fuller's visionary Dymaxion House. Fiberglass-reinforced plastics hadn't been developed yet so Fuller's design called for stamped copper, which may be why the concept never saw widespread commercial production. We haven't been able to determine who made the first FRP shower enclosure or when, but the application continues to keep fabricators busy today. The shower stall also showed homeowners some of the benefits of FRP – leak-proof construction and easy cleaning without frequent caulking, for example – which has since spawned a myriad of other uses in homes including cast polymer countertops, and the spas and pools.

LIVELY, STRONG AND DURABLE POLES

LIVELY, STRONG AND DURABLE POLES

Invented by Dr. Arthur M. Howald and introduced by The Shakespeare Company in 1947, the composite pole revolutionized the fishing rod market and made bamboo and steel virtually obsolete. The fishing pole's larger cousin, the vaulting pole, soon followed and made a name for composites as vaulting records moved up to new heights. Today, solid and hollow poles come in a variety of lengths and diameters for applications ranging from power distribution to telecommunication, lighting and flag display. Matrix materials have expanded to include both polymers and concrete but one thing remains the same – composite poles are still replacing traditional materials including wood, steel, aluminum and, yes, bamboo.

CORROSION-RESISTANT PIPE AND TANKS

CORROSION-RESISTANT PIPE AND TANKS

Composite pipe and tanks could be considered two separate applications that are similar in their construction and benefits. According to the Fiberglass Tank and Pipe Institute, FRP first became a viable alternative to protected and stainless steel for pipe in 1950 when centrifugal cast fiberglass piping was first used as a solution to corrosion problems in the oil production industry. Development work for underground gasoline storage tanks led to the construction of a pilot plant in 1963, and by 1985 the industry had produced more than 100,000 composite tanks. Composite pipe and tanks are in demand today for oil fields, chemical processing, flue gas desulphurization, desalination facilities, and water and sewage systems.

LIGHTWEIGHT SPALL-RESISTANT BALLISTIC ARMOR

LIGHTWEIGHT SPALL-RESISTANT BALLISTIC ARMOR

One of the first applications of composite armor was on CAV 100 vehicles used by the United Nations High Commissioner for Refugees to protect workers aiding civilians fleeing combat zones. Composite armor was made by high-pressure compression molding multiple layers of high-strength glass in epoxy resin. An important performance benefit was the reduction of spall, the deadly fragments that can come from the back side of metal armor when hit by a projectile. Today, military vehicle manufacturers are exploiting the ability of composites to combine structure and protection in an integrated solution.

STRONG AND DURABLE PROFILES

STRONG AND DURABLE PROFILES

The process of "pulling" resin-rich reinforcements through a heated die to create a continuous composite profile was developed in the 1950s by W. Brant Goldsworthy, the person many consider to be "the father of composites." Profiles in familiar shapes enable engineers to use the material as a basic component replacing metal and wood parts. Corrosion resistance makes composite profiles a popular choice for hostile environments such as chemical processing plants and seaside marinas. Cooling towers are one of the latest structures to capitalize on the durability of composite profiles.

MOISTURE-RESISTANT ROOFING SHINGLES

MOISTURE-RESISTANT ROOFING SHINGLES

Asphalt shingles were a popular choice for American homes in the housing boom that followed World War II. The original substrate was organic felt made from rags, waste paper and wood chips. Fiberglass was seen as a superior reinforcement because it would not absorb moisture, so by the mid-1950s a fiberglass-reinforced asphalt shingle was developed and introduced in the U.S. Despite the best efforts of the fiberglass industry to get the shingle industry to adopt the improved reinforcement, which could enable shingles to achieve a Class A fire rating, shingle manufactures opted to instead stay with organic felt – which they just happened to also produce. That finally changed in the 1970s when Owens Corning bought a nationwide producer of asphalt shingles and led the conversion to fiberglass-reinforced shingles. Homeowners embraced their fire rating and longer warranties and fiberglass reinforcement soon became the leading substrate for residential and commercial shingles. Today, shingles covering more than 13 billion square feet are made annually with a composite of asphalt and fiberglass mat.

STRONG BLADES FOR HARNESSING THE WIND

STRONG BLADES FOR HARNESSING THE WIND

Wooden windmills are picturesque but modern composite materials enabled wind to become the first commercially viable source of renewable energy. New fabrication facilities for blades continue to be built around the world as designs evolve and blades get longer. The most common blade size today – about 2.5 meters in length – uses as much as six metric tons of composite material. Wind blades may also be the fastest growing market for composites ever, having gone from an emerging industry 15 years ago to having more than 120 gigawatts (GW) of installed capacity today. More than 400,000 people are now employed in the wind industry and that number is expected to be in the millions in the near future. The Global Wind Energy Council expects the market for wind turbines to grow by more than 155 GW, from 94 GW in 2007 to 240 GW of total installed capacity by 2012. This success has prompted many in the composites industry to ask, "What is the next wind blade?"