

# The Doorway™

M.C. Gill Corporation Group of Companies

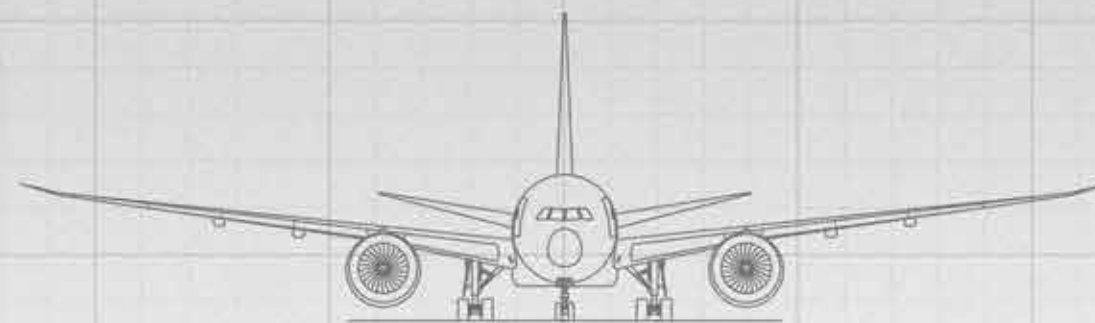
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Volume 48 • Number 3 • Fall 2012

## DESIGNING A SHIP OF DREAMS



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## A Watershed Moment

In the late 1990s, when Jack Dawson brashly declared, “I’m king of the world,” and the movie *Titanic* was setting global box office records, a group of Boeing engineers were imagining their own ship of dreams.

Their watershed moment came when Boeing Corporation embarked on the Yellowstone Project with the 7E7 as the cornerstone. The 7E7 program would be stage one of Boeing’s plan to replace their entire airliner production line. Boeing’s strategy was a decisive move, pioneering the evolution from 20th Century aircraft design archetypes towards the 21st Century’s ultra-efficient, technology-rich, aircraft.



# DREAMLINER

**Naming Contest Finalists:**

- Dreamliner      Stratoclimber
- Global Cruiser      eLiner



The 7E7 was a descendant of an earlier cancelled Boeing design called the Sonic Cruiser. The 7E7 team sought to create the company's most fuel-efficient, long-range, mid-size, wide-body, twin engine jet airliner ever. The project would use sonic cruiser technology in a more conventional configuration and be the world's first major airliner to incorporate advanced composite materials for most of its construction. In 2003, Boeing held a naming contest, with participants from 166 countries casting 478,000 votes. On June 15 (by a mere 2,500 votes), the 7E7 became the Boeing 787 Dreamliner.

A Boeing senior vice president shared his thoughts: "We are using 7E7 concepts similar to how automobile designers use concept cars, to stretch our imaginations, to consider new possibilities and to help us design the best possible product for our customers. Final assembly is targeted to take approximately three days instead of the 13-17 days that today's airplanes take. The reduction in time comes from final assembly receiving fewer, bigger pieces that are easier to join, and the implementation of lean manufacturing techniques. Boeing has decided that the aircraft will be the first commercial jet ever to have a majority of the primary structure – including the wing and fuselage – made of advanced composite materials instead of aluminum.

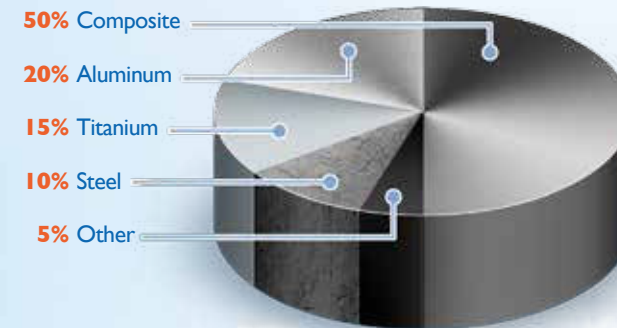


Boeing 787 Roll-Out Ceremony 8 July 2007

Composites offer us a variety of advantages, including better durability, reduced maintenance requirements and increased potential for future developments."<sup>1</sup>

A recent publication gave more exacting details. "The Boeing 787 aircraft is 80% composite by volume. Its materials, listed by weight, are 50% composite, 20% aluminum, 15% titanium, 10% steel and 5% other. Aluminum is used on wing and tail leading edges, titanium used mainly on engines and fasteners, with steel used in various places."<sup>2</sup>

## 50% COMPOSITE BY WEIGHT



Each B787 contains approximately 35 tons of carbon fiber reinforced plastics. High-performance composite materials have increasingly become an essential part of aviation design since their introduction over 50 years ago. Aircraft manufacturers like Boeing are constantly challenging their suppliers to keep pace with advancing technologies and innovative designs.

<sup>1</sup> Mike Blair, Boeing Corporation, [www.boeing.com/news](http://www.boeing.com/news) July 1, 2003  
<sup>2</sup> Wikipedia.com, Boeing 787 Dreamliner, October 17, 2012



M.C. Gill Corporation wrote the book on avant-garde R&D. Our scientists routinely analyze new materials and processes that will result in products with exceptional performance properties previously unseen. It's not unusual for our sales managers to approach a customer with a product that offers features never considered possible but quickly becomes indispensable.

As a manufacturing pioneer in advanced composites, we eagerly embraced the introduction of next generation aircraft like the Boeing 787 Dreamliner. Honoring the philosophy behind Boeing's design team necessitated the research and development of a portfolio of products having unprecedented weight and performance characteristics.

Our relationship with Boeing goes back over 30 years, earning us the Silver Supplier Award four times and being selected Supplier of the Year in 2007.

As trendsetters in the aerospace industry, our scientists embarked on a development program targeted to the Boeing 787 Dreamliner and developed a new honeycomb core floor panel and cargo liner. We manufacture a multitude of products incorporated into every B787 aircraft. One of these products is our second-generation aramid honeycomb: Gillcore™ HK.

The Boeing Company  
 2007 Supplier of the Year Award





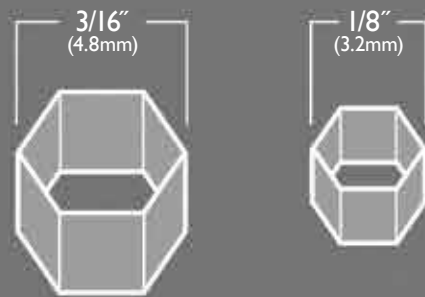
## Gillcore HK Offers Weight Reduction and Design Flexibility

Gillcore HK is a high-performance honeycomb manufactured using DuPont Kevlar® N636 paper with phenolic resin. As a saturable, para-aramid substrate, N636 becomes a true composite when converted to honeycomb, offering exceptional shear strength and modulus, stiffness, durability, fatigue and hot/wet properties. Gillcore HK can offer significant weight savings for applications currently utilizing Nomex® based Gillcore HD. This material is also a lower-cost alternative to bias weave fiberglass reinforced honeycomb and Korex®, (the predecessor to N636 Kevlar).

The general rule of honeycomb is that shear properties are driven by the substrate, compression properties are driven by the resin. The replacement of Nomex honeycomb by lower density N636 honeycomb is based on the higher shear strength and modulus inherent to N636 paper. For applications where shear strength and modulus are the critical properties, it is possible to achieve design allowable values that are equal to or higher than existing Nomex values at a significant reduction in core density.

Because most densities of Gillcore HK can be manufactured using different thicknesses of N636 paper, this product offers a broad range of latitude in design. Within certain parameters, paper thickness can be increased or decreased to achieve the required shear, modulus and compression properties.

Gillcore HK has been developed and commercialized in both hexagonal and over-expanded cell configurations. It is available in cell sizes ranging from 1/8" (3.2mm) to 3/16" (4.8mm) and densities ranging from 2.0 to 10.0pcf (32kg/m3 to 160kg/m3). With typical weight savings potential of 20-40%, Gillcore HK is positioned to become the new standard for composite sandwich structures.



Like other aramid honeycombs, N636 can be shaped, cut and bonded using standard industry methods or heat formed to achieve more complex shapes. As manufacturers around the globe work to reduce their supply chain, there is a growing necessity to partner with suppliers who offer expanded capabilities to support a wide range of value-added services. The combined resources of M.C. Gill Corporation, Alcore, Inc. (USA) and Alcore Brigantine (France) offer customers a complete design solution. Alcore and Alcore Brigantine (subsidiaries of M.C. Gill Corporation) have become the corporation's centers of excellence for the machining, profiling and heat forming of honeycombs. These facilities currently support major OEM programs with aircraft structure sub-assemblies such as flaps, slats, spoilers, rudders, ailerons and engine nacelles.



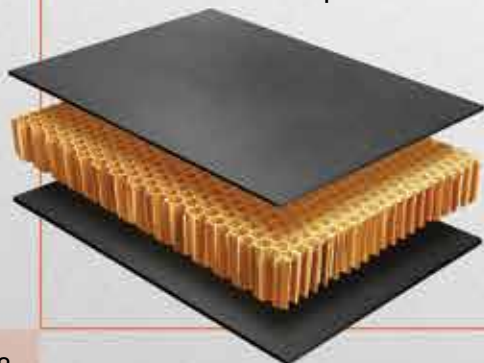


**GILLFAB™ 4809**

## Weight-Saving Floor Panel Translates into Fuel Savings

Another weight-saving floor panel ideal for the B787 is Gillfloor™ 4809. This product provides a 13% to 21% (depending on specification type) weight reduction over Gillfloor 4709. Prior to the introduction of Gillfloor 4809, Gillfloor 4709 had been the lightest and strongest panel qualified to BMS 4-20 and was the exclusive floor panel for the B777.

Gillfloor 4809 is a lightweight floor panel made from unidirectional carbon fiber reinforced epoxy facings bonded to Kevlar® aramid honeycomb core. It offers high impact-resistant facings covered with a thin fiberglass layer to prevent galvanic corrosion. It is a panel with a high strength-to-weight ratio and is qualified to Boeing BMS-4-20, type VI, VII, VIII and IX. Boeing's 787 Dreamliner incorporates Gillfloor 4809 and typifies the weight-saving benefits that composites offer.



Since the B787 attributes much of the structural airframe weight to composite materials, it will burn 20% less fuel than existing jets of a similar size. This translates into fuel savings, a reduction in airport landing fees, lower maintenance costs, increased passenger satisfaction and improved airline profits.



As demonstrated by the qualification testing of Gillfab™ 4809 to Boeing specification BMS 4-20 Types VI-IX, our innovative designs have resulted in weight savings per square foot ranging from 8.7% in low-traffic areas to over 28% in galleys and highly loaded areas, compared to earlier material standards. Our ability to achieve such reductions is directly related to our vertically integrated manufacturing capability, which allows us to tailor the aerial weight of the facings, adhesive and honeycomb to achieve a fully optimized construction. In the example of Gillfab 4809, our use of unidirectional carbon reinforced facings not only supports weight reduction, but also provides higher impact resistance and panel stiffness at a lower cost than woven carbon fiber.

**GILLFAB™ 1367G**

## New Cargo Liner for B787 Saves Weight

M.C. Gill's Corporation's R&D Department routinely explores new resins, hardeners, additives and reinforcements. New resins offered the possibility of faster curing, superior toughness and better visual and mechanical properties derived from unique chemistry. M.C. Gill Corporation's goal for the B787 program was to meet the requirements of BMS 8-223 Class 4 types with considerable weight reductions; Gillfab 1367B served as a baseline.

The R&D Department embraced the challenge and began to systematically evaluate new materials. Unbound by traditional product, schedule and customer requirements, the R&D scientists created products based on science and capability and then determined an application. The result is an addition to our family of cargo liners: Gillfab 1367G.

Gillfab 1367G is a low weight, high impact, low smoke, low flammability and low toxicity, fiberglass reinforced phenolic laminate. Designed as an aircraft cargo compartment liner, it features high mechanical strength, puncture and corrosion resistance with a white Tedlar overlay on the face side for reflectivity. Gillfab 1367G is qualified to Boeing BMS 8-223, Class 5, Grade B and meets FAR Pt. 25, appendix F Parts I & III (burn through). This laminate uses lower areal weight fabrics that reduce the weight and thickness of the liner, while maintaining the properties of thicker, heavier products.

This feature-rich product is ideally suited for today's state-of-the-art aircraft. Consequently, Gillfab 1367G is the preferred cargo compartment liner for Boeing's 787 Dreamliner. Gillfab 1367G may be a new addition to our family of cargo liners, but it will be far from our last.





The Boeing 787 Dreamliner entered commercial service on October 26, 2011 with 32 aircraft now in operation.<sup>3</sup> M.C. Gill Corporation and its subsidiaries are proud participants in the B787 program. This program allows us to showcase our cutting-edge product development skill-set, dedication to the aerospace industry and commitment to our customers.

The products featured on the B787 are robust, performance-rich materials designed to survive the test of time. However, after years of service, the day will come when it's time to replace some of the aircraft cargo liners and floor panels. M.C. Gill Corporation will be there to provide replacement materials with short lead times, since we stock these materials.

We are committed to continue our long history of service and innovation through stringent development criteria, a fierce commitment to quality and unparalleled attention to customer requirements.



<sup>3</sup> www.boeing.com, 787, 10/20/2012



Please visit our website at [www.mcgillcorp.com](http://www.mcgillcorp.com) to learn more about our products and history.



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Alcore does not sell sandwich panels. Contact M.C. Gill for these products.



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## Hmmmm.....

I planted some bird seed. A bird came up. Now I don't know what to feed it.

All I ask is a chance to prove that money can't make me happy.

What is a "free" gift? Aren't all gifts free?

How can there be self-help "groups"?

Teach a child to be polite and courteous in the home and, when he grows up, he'll never be able to merge his car onto the freeway.

Experience is the thing you have left when everything else is gone.

Is it just me – or do Buffalo wings really taste like chicken?



## Quiz for Bright People

This is a quiz for people who know everything!

1. Name the one sport in which neither the spectators nor the participants know the score or the leader until the contest ends.
2. What famous North American landmark is constantly moving backward?
3. Of all vegetables, only two can live to produce on their own for several growing seasons. All other vegetables must be replanted every year. What are the only two perennial vegetables?
4. What fruit has its seeds on the outside?
5. In many liquor stores, you can buy pear brandy, with a real pear inside the bottle. The pear is whole and ripe, and

- the bottle is genuine; it hasn't been cut in any way. How did the pear get inside the bottle?
6. Only three words in standard English begin with the letters "dw" and they are all common words. Name two of them.
7. There are 14 punctuation marks in English grammar. Can you name at least half of them?
8. Name the only vegetable or fruit that is never sold frozen, canned, processed, cooked, or in any other form except fresh.
9. Name six or more things that you can wear on your feet beginning with the letter "S."

left in place for the entire growing season. When the pears are ripe, they are snipped off at the stems.  
6. Dwarf, dwell and dwindle.  
7. Period, comma, colon, semicolon, dash, hyphen, apostrophe, question mark, exclamation point, quotation mark, brackets, parentheses, braces, and ellipses.  
8. Lettuce.  
9. Shoes, socks, sandals, sneakers, slippers, skis, skates, snowshoes, stockings, stils.

1. Boxing.  
2. Niagara Falls. The rim is worn down about two and a half feet each year because of the millions of gallons of water that rush over it every minute.  
3. Asparagus and rhubarb. Actually I believe the artichoke is a vegetable. That would be three.  
4. Strawberry.  
5. It grew inside the bottle. The bottles are placed over pear buds when they are small, and are wired in place on the tree. The bottle is