

# The Doorway

A Publication of The Gill Corporation

High-Performance Composite Products Since 1945 • [www.thegillcorp.com](http://www.thegillcorp.com)

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GILLINER®





The background of the page is a close-up, vertical view of red curtains. The curtains are dark red with lighter red highlights, creating a textured, draped appearance. The lighting is dramatic, with some areas being brighter than others, emphasizing the folds and ridges of the fabric.

# Cargo Liners That

# Wow

**Greatness can come in many forms. We applaud great actors with Oscars, Emmys, and Tony Awards. We honor great athletes with gold medals, trophies, rings, and wreaths. We celebrate great events with brass bands, parades, and fly-bys. When it comes to excellence in the manufacture of advanced composite materials, the true measure of greatness comes by designing products that provide value solutions to our customers. By that account, The Gill Corporation finishes first.**

Our greatness began with an idea that turned the fledgling commercial airline industry on its ear. Instead of using the usual plywood and aluminum in the cargo hold, why not try a new product?

In the 1950s, The Gill Corporation met with Douglas Aircraft Company and proposed a fiber-reinforced plastic (FRP) cargo liner. This product would be a lower cost, lighter, yet semi-rigid material constructed of multiple layers of woven glass cloth and a polyester resin matrix.

The original Gill cargo liner was relatively lighter-weight, with good mechanical strength, moisture/chemical/heat resistance, *and* it was repairable. Gilliner became an instant star, and it wasn't long before it was the preferred cargo liner for all major commercial airlines.

Fast forward five decades and composites are fundamental to advancing aircraft design. The industry has experienced exponential growth and welcomed hundreds of groundbreaking product developments – and The Gill Corporation has held a major supporting role.



Since our founding, The Gill Corporation has introduced myriad proprietary cargo liners, most of which have become the standard within our industry. Our customers expect exceptional performance from anything with the Gill name, so there is little room for error.

To design and build a winning product, it's necessary to understand the fundamentals.

Cargo liner is a fire protection feature, required by 14 CFR 25.855, which is installed in Class B-E cargo compartment(s) of passenger, combi, and freighter aircraft. Its purpose is to prevent a fire originating in the cargo hold from spreading to areas occupied by crew and passengers before it can be contained by the fire suppression system. It also contributes to the creation of a sealed environment to contain hazardous levels of smoke and to maintain adequate concentration of the extinguishing agent. Accordingly, cargo liner is installed in the sidewalls, ceilings, and partition walls of an aircraft.





While the primary function of cargo liner is fire protection, the in-service conditions associated with a cargo hold also necessitate that certain mechanical and physical properties be met. A cargo liner having puncture damage, hole tear-out at the attach points, or wear-through is not in compliance with 14 CFR 25.855. Recognizing that mechanical strength requirements for cargo liner vary significantly depending on the type of compartment (e.g., bulk or containerized cargo) and its location in the cargo compartment (e.g., ceiling, lower sidewall, partition wall), The Gill Corporation has developed a portfolio of products to meet customers' strength, weight, and cost objectives.

FRP cargo liners offer considerable design flexibility. Generally speaking, the mechanical strength of a liner is driven by the type, style, and amount of fiber reinforcement.

The resin, which surrounds and supports the reinforcement for translation of the fiber properties, primarily influences the fire, smoke and toxicity characteristics. Thus, FRPs can be tailored to meet a specific set of requirements by modifying the type and amount of reinforcement and the resin matrix. Although some OEM cargo liner designs are based on a sandwich panel having FRP facings bonded to a honeycomb, the fundamentals of cargo liner remain the same.





While there are a variety of different reinforcements commercially available today, contemporary Gill cargo liner designs rely exclusively on woven glass cloth, due to its relative low cost, high strength and, most notably, high temperature resistance. Our designs feature E-glass, S-glass, or a combination of both, with either a polyester or phenolic resin matrix. All designs are available in a variety of gauges to address the varying strength requirements within the cargo compartment (for example, a cargo liner installed in a ceiling location will have lower requirements than that which is installed in a lower sidewall of a bulk compartment).

When designing a cargo liner, consideration is given to the following characteristics:

- **Impact/Puncture Resistance**
- **Edge-Bearing Strength**
- **Abrasion Resistance**
- **Flexural Strength (lower sidewall applications)**
- **Flammability, Smoke, and Toxicity (FST)**
- **Weight**
- **Cost**

So, why does all this matter? Original equipment manufacturers tend to specify the lightest or lowest cost cargo liner for use in serial production. Consequently, it is common for operators to replace OEM cargo liners with alternative liner materials to improve in-service durability, achieve commonality across their fleet, save weight, and reduce costs. In order to make an informed decision, it is important to understand how a specific design influences in-service durability.

Throughout our history, The Gill Corporation has had numerous opportunities to work with airline customers to provide optimum cargo liner solutions. It's a process that involves analyzing the in-service environment (including methods used for loading and unloading of cargo), analyzing modes of failure, and relating this information to specific mechanical and physical characteristics of the cargo liner. While it is common for airlines looking to improve the durability of a cargo liner to simply increase to a thicker gauge material, this is not necessarily the best option. If, for example, the increase in cargo liner thickness is achieved simply by increasing the resin content of the FRP, the weight increase will be significant – while the increase to strength may be marginal at best.

The following table illustrates how the type of glass reinforcement used in a cargo liner can influence impact resistance.

CONSTRUCTION	THICKNESS	WEIGHT	IMPACT STRENGTH
E-glass reinforcement	0.030 in	0.30 psf	14 ft-lbs
Hybrid E/S glass reinforcement	0.030 in	0.30 psf	20 ft-lbs
S-glass reinforcement	0.030 in	0.30 psf	27 ft-lbs

Substituting an S-glass reinforcement for an E-glass reinforcement achieves a 43% increase in impact strength with no increase to weight.

For applications where weight is a key consideration, the following table illustrates how substituting S-glass for E-glass can achieve significant weight savings with no sacrifice to impact strength.

CONSTRUCTION	THICKNESS	WEIGHT	IMPACT STRENGTH
E-glass reinforcement	0.060 in	0.600 psf	23 ft-lbs
Hybrid E/S glass reinforcement	0.040 in	0.420 psf	23 ft-lbs
S-glass reinforcement	0.027 in	0.275 psf	23 ft-lbs

While many cargo liner materials may look the same and, in some cases, even be qualified to the same OEM specification; we believe at The Gill Corporation that the true test of cargo liner is its in-service durability. For more than 50 years, we have been designing cargo liners that capitalize on the ability to tailor FRPs to meet even the most stringent strength and weight requirements.





The following product listing provides an overview of the design flexibility offered by FRP cargo liners.

**Gillfab 1076C** is qualified to BMS 8-2, Class 1, Grade A. It is a general purpose polyester cargo liner which offers a good balance between strength and cost.

**Gilliner 1366C** is qualified to BMS 8-2 Class 2 Grade A. It is a high-impact-resistant polyester cargo liner.

**Gillfab 1076D** is qualified to Boeing BMS 8-2 Class 3 Grade A. It is a high-abrasion/wear-resistant polyester cargo liner designed for use in the B737 lower sidewall.

**Gilliner 1366F** is qualified to BMS 8-2 Class 2 Grade B. The construction is identical to 1366C but with a white Tedlar® overlay on one surface.





**Gillfab 1367/A** is qualified to BMS 8-223 Class 2 Grade B. It is a high-impact-resistant phenolic cargo liner that also offers low fire, smoke, and toxicity characteristics.

**Gillfab 1367G** is qualified to BMS 8-223 Class 5 Grade B. It is an ultra-lightweight, high-impact-resistant phenolic cargo liner that offers low FST characteristics.

**Gillfab 1367B** is qualified to BMS 8-223 Class 4 Grade B. It is a lightweight, high-impact-resistant phenolic liner which offers weight savings, as compared to BMS 8-223 Class 2 Grade B, with no sacrifice to mechanical properties.

**Gillfab 4422** is qualified to Airbus Technical Specification 2550 M1M 0008 Types A-N. It is a high-impact-resistant, low-FST sandwich panel consisting of FRP phenolic skins bonded to Nomex® honeycomb core.

Our portfolio of cargo liner solutions is broad and, happily, substantial growth within the industry is projected to continue.

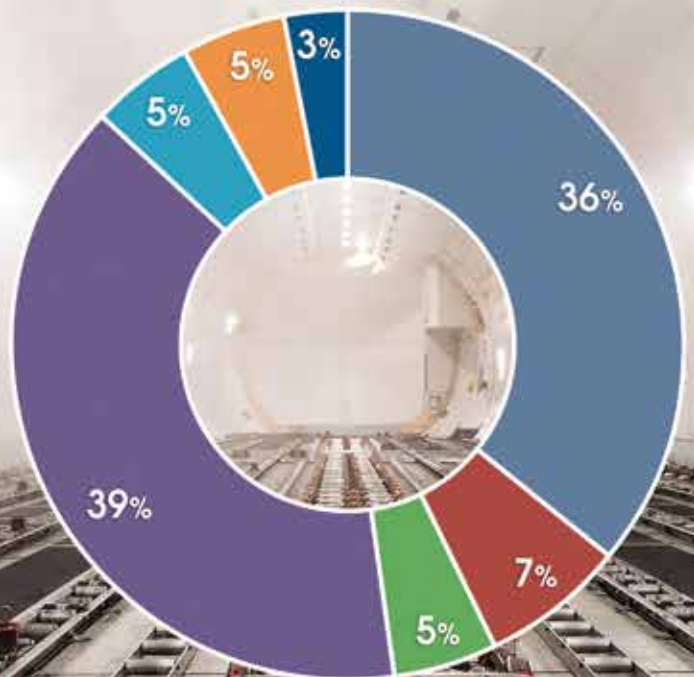
This year's Flightglobal Fleet Forecast predicts delivery of 41,000 new commercial turboprop and jet aircraft over the next 20 years, with Airbus and Boeing accounting for more than 85% of the total deliveries predicted through 2034. Single-aisle aircraft are forecast to account for more than 60% of those deliveries and almost 50% of that value, making it an important sector of the industry today.<sup>1</sup>

This type of projected growth requires serious players, and we are ready to bring the house down. In the last ten years, The Gill Corporation has embarked on an aggressive plan to satisfy future demand with substantial capital investments in new equipment, facility upgrades, new buildings, added personnel, and technologies aimed at achieving operating efficiencies we once only dreamed of. Chairman and CEO Stephen Gill sees it as an investment in the future of the "family business."

Sound planning, in-house expertise, and a personal commitment to our craft means we offer one of the widest selections of qualified cargo liners in the industry.

The star of this issue is cargo liners, but The Gill Corporation is so much more. We are vertically integrated with manufacturing capabilities to provide a vast array of floor panels, laminates, interior structures, honeycomb, and repair patches. We design and fabricate to spec and offer 24-hour turnaround for AOGs. While our aerospace-grade products are manufactured to meet individual customer demand, we have identified "standard" or R stock products that are built, stocked, and consistently monitored to ensure we maintain sufficient inventory levels to address urgent customer requirements. This strategy guarantees we are able to serve the commercial airline industry with a complete portfolio of Airbus, Boeing, and other OEM qualified products.

## Single-Aisle Deliveries 2015-2034



<sup>1</sup> Rob Morris, Flightglobal Fleet Forecast, London, August 6, 2015, [www.flightglobal.com](http://www.flightglobal.com)



The Gill Corporation offers our customers global access to products and services to satisfy their requirements, and a team of sales specialists eager to provide solutions.

This commitment to our customers and the commercial airline industry is what makes us a star.

- 737Max
- 737NG
- A320ceo Family
- A320neo Family
- C919
- CSeries
- MC-21

Source: Rob Morris, Flightglobal Fleet Forecast, London, August 6, 2015, www.flightglobal.com



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# Trivia

## Statistics From 100 Years Ago

Every year, a meme<sup>2</sup> circulates online, purporting to be an accurate comparison to life now vs. a century ago. Turns out, that meme contains inaccurate or misleading information!<sup>3</sup> Here are the true facts about **Life in 1915:**

Fewer than 1 in 10 American adults had a car.

Only 14 percent of American homes had a bathtub with running water.

The maximum speed limit for automobiles in most cities was 10 mph.

The tallest structure in the world was the Eiffel Tower.

The average annual U.S. wage for a man was \$687; for women, *half* that amount.

More than 95 percent of all births took place at home.

A dozen eggs cost the modern equivalent of \$11.

The population of Las Vegas, Nevada was around 2,000.

While the national literacy rate was in the 90 percent range, only about 10 percent of all Americans had graduated from high school.

2. Meme (noun): an idea, behavior, or style that spreads from person to person within a culture

3. Source: [factually.gizmodo.com/this-viral-list-about-1915-is-full-of-lies-1750330886](http://factually.gizmodo.com/this-viral-list-about-1915-is-full-of-lies-1750330886)

# THE FUNNY SIDE

**What are prehistoric monsters called when they sleep?**

A dinosnore!

**What is the fruitiest subject in school?**  
History, because it's full of dates!

**What illness did everyone on the Enterprise catch?**

Chicken Spocks!

**How many balls of string would it take to reach the moon?**

Just one, if it's long enough!

**What cheese is made backwards?**  
Edam!

**What do elves do after school?**  
Gnomework!

**If Ireland sank into the sea, what county wouldn't sink?**

Cork!

**What happens when you throw a green stone in the Red Sea?**

It gets wet!

**What city cheats at exams?**  
Peking!

**Why is Alabama the smartest state in the USA?**  
Because it has 4 As and one B!

