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THE M.C.GILL DOORWAY

New Vistas in Composites

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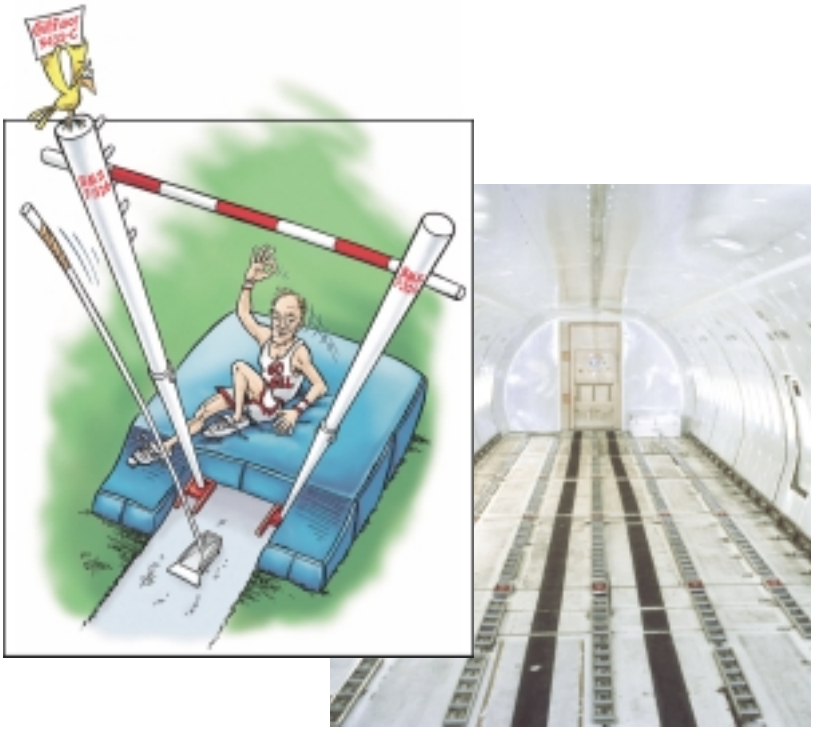
SuperAchiever

A REVIEW OF FLOORINGS FOR



Time To Raise The Bar

Over the years we've devoted a lot of space in the Doorway to flooring panels—a logical decision given that roughly half our sales result from sandwich panels used for aircraft flooring.

However, much of that ink has gone to passenger compartment floor panels, probably because it is a bit more exotic (if a sandwich panel can be thought of as "exotic"). We always talk about light weight, high strength, and so on. Passenger compartment flooring can be thought of as the svelte sports car model and if that is so, then that which covers the cargo compartment floor could be considered as the big 18-wheeler.

Probably the most serious damage that can be done to passenger flooring is that caused by high heeled shoes. Although that damage can be severe, *it does not compare to the chaos that sometimes results from the various types of cargo hauled in the belly baggage bin* – passengers' luggage being one of the tamer examples.

Much depends on the area served. For example, in North America the cargo holds in aircraft serving Texas, Southern Louisiana, Alaska and Western Canada may be filled with oilfield equipment (tubing, casing, derrick sections, and the like); those aircraft floors in the Great Plains states may be loaded with heavy farm equipment; and, the old Flying Tiger freighters used to carry such circus paraphernalia as rigging and animal cages—often with the animals in them!

AIRCRAFT CARGO COMPARTMENTS

Cargo Flooring Takes a Licking, But Gillfloor Keeps on Ticking

We cannot stress strongly enough the beating that cargo flooring receives – particularly that for bulk cargo. It faces the most severe in-service conditions of any floor panel. And not surprisingly it has, by far, the highest replacement rate of any aircraft flooring panel made. The M.C. Gill Corporation has always tried to provide the most durable material for cargo flooring. Our customers, original equipment manufacturers and airlines alike demanded it! And, as always, we've listened.

Cargo flooring has changed radically over the years. Starting with plywood it has evolved to monolithic I-beam panels, to aluminum bonded to hat sections, to aluminum-clad end grain balsa wood, to fiberglass-clad balsa, to honeycomb core panels (both Nomex® and aluminum). In short, the materials used in the construction of cargo flooring have progressed at a rate comparable to any other part on any given aircraft.

Things Change…*Nevertheless, the various air frame manufacturers have their own "favorite" cargo flooring construction. Douglas (now Boeing) has used an aluminum faced end grain balsa core panel for years; Boeing sometimes utilizes .070" aluminum sheeting, while Airbus has chosen a panel with FRP facings and a Nomex honeycomb core. No matter what the construction, the M.C. Gill Corp will make it for you…with the same quality you've come to expect. We assure you that our panels qualify to the specifications called for.*

Ahead of Our Time… Innovations, Not Tag-Alongs

To give our readers a brief example of how our flooring not only has changed with the times, yet in some cases has been many years ahead of its competition, we offer the following excerpt from a previous Doorway. *"The baggage compartment floors…represent a genuine breakthrough in aircraft design – floor panels with the modulus of aluminum and the light weight of magnesium."*

M.C. Gill developed a unique sandwich panel…composed of very thin aluminum skins and a .050" resin impregnated Nomex® or Kevlar® fabric core. The result is a floor panel which incorporates the flexural modulus of aluminum (over 10 million psi) and the light weight of a Nomex or Kevlar cloth FRP center core.

The product is Gillfab 5033, the customer was Lockheed, the aircraft was the L-1011, and the Doorway was the *Summer 1972 issue.*

A REVIEW OF FLOORINGS FOR

Knowing the Flooring Requirements

The requirements for cargo compartment flooring are just like any aircraft component—it should be light weight, strong, durable, and safe…

SAFE

- Won't support combustion

HIGH SPECIFIC STRENGTH

- Low initial weight
- Minimal weight gain when exposed to moisture
- Minimal weight gain from insert installation and edge sealing

STRONG AND DURABLE

- Corrosion resistant
- High impact strength (or resistant to puncture)
- High strength-to-weight ratio
- High shear resistance
- Good pull-out strength at fasteners
- Abrasion and dent resistance
- Not weakened by fabricating for fasteners or installation of roller tracks
- Stiffness (or rigidity)
- Resistant to gouging
- Produces no cutting edges or ridged, jagged protuberances when punctured

GILLFLOOR 5007 SERIES

A STORY IN ITSELF…

No article on cargo compartment flooring would be complete without a few additional comments on the granddaddy of them all – Gillfloor 5007C.

Some Background. When M.C. Gill pioneered the use of end grain balsa wood as a sandwich panel core, Gillloor 5007 was born. It was constructed of resin reinforced fiberglass-laminated facings bonded to an end grain balsa core and was introduced in December 1963.

In June 1970, Gillfloor 5007A made its debut. The main difference was that 5007 required a secondary bonding step whereas 5007A needed only one step "bonding"—actually, the facings and core are fused and results in a less expensive product with actual improved peel quality and service.

AIRCRAFT CARGO COMPARTMENTS

Six Years Later…

Gillfloor 5007B made it's first appearance. 5007A did not meet the values set forth in a newly written Boeing specification. Both United and American airlines had used it extensively as replacement flooring, and even though 5007A was completely satisfactory in service they insisted the M.C. Gill Corp. develop a product that would pass the newly written specification; hence, 5007B was produced.

Gillfloor 5007C was introduced in August 1979 at the request of Federal Express, they wanted a more durable version of 5007B for their use in and around doorway areas—typically the highest wear areas in cargo configured aircraft.

To comply with their request, we incorporated fiberglass mat as the top or wearing surface to protect the fiberglass cloth reinforced polyester laminate (Gillfab 1074) which is the standard top facing skin on 5007A and B.

The Tigers Put It In Their Bellies. The old Flying Tiger Airline used 5007C almost since its introduction. The difference was that Flying Tiger used it as the flooring of choice throughout their aircraft because the nature of their cargo was such that the floors took a substantial amount of abuse. In fact, a maintenance supervisor told M.C., *"My guys on the floor say, 'we put it in and we forget it.'"* High praise, indeed. When FedEx and Flying Tiger merged in 1988, the use of 5007C in their aircraft continued uninterrupted.

TABLE 1 – PHYSICAL AND MECHANICAL PROPERTIES GILLFLOOR 5007C

PROPERTY	TEST METHOD	UNIT	VALUE
Weight	ASTM C29	lb/sq ft (kg/sq m)	1.09 (0.49)
Thickness	ASTM C366	inch (mm)	0.400 (10.2)
Sandwich Peel	MIL-STD 401B	in-lb(N-m)/3 in width	52 (5.9)
Long Beam Flexural Ultimate Load Facing Stress Deflection @ 100 lbs Load	MIL-STD 401B	 lb (N) ksi (MPa) inch (mm)	 431 (1917) 13.2 (91.0) 0.629 (16.0)
Flatwise Compression	MIL-STD 401B	lb/sq in (kPa)	1982 (13665)
Flatwise Tensile	MIL-STD 401B	lb/sq in (kPa)	644 (4440)
Impact Strength	BMS 4-17	lb (N)	1028 (4573)
Insert Shear[1]	ASTM 3029	in-lb (N-m)	84 (114)
Flammability - 60 second vertical Self-extinguishing Time Burn Length Drip Extinguishing Time	FAR 25.853	 second inch (mm) second	 0 0.6 (15.2) 0
Flammability - 45 Degree Self-extinguishing Time Afterglow Penetration	FAR 25.853	 second second —	 0 0 none

1. SHURLOK INSERT 5107-A3 USED IN TEST.

A REVIEW OF FLOORINGS FOR

M.C. Gill Knows Balsa. We have been producing end grain balsa wood core sandwich panels for almost forty years. There is no other previous panel design that we know of that has a better record of consistency and durability. Balsa wood can be difficult to laminate but if done correctly, the resultant panel will have high strength, low cost and outstanding durability.

The advantages of end grain balsa as a sandwich panel core start with lower cost and are many, including high compressive strength (more than 1500 psi); resiliency and high fatigue resistance good core shear strength (more than 200 psi); better thermal insulation than unfilled honeycomb; and a continuous core which gives more bond area and does not take on water when punctured.

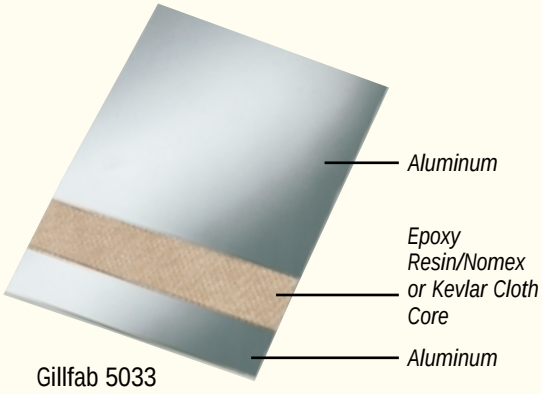
For a long time, flooring panel core material had to be nine pcf (pounds per cubic foot) for a long service life whether it was balsa, aluminum, or Nomex honeycomb and 5007B or C were the least expensive. There are new core materials at six or seven pcf but they are currently more expensive and have presented no challenges, as yet, for durability.

The Old Guy's Been Around for Awhile…And Is Still Going Strong. Ever since 5007C came to market in 1979, it continues to be one of the company's largest selling *replacement* floor panels. For example, in the past six years, 121 customers, including 44 airlines (30 domestic and 14 foreign) and 43 (40 domestic, 3 foreign) maintenance centers have purchased more than 5,600 panels—about 232,000 square feet or enough to cover almost six football or soccer fields!

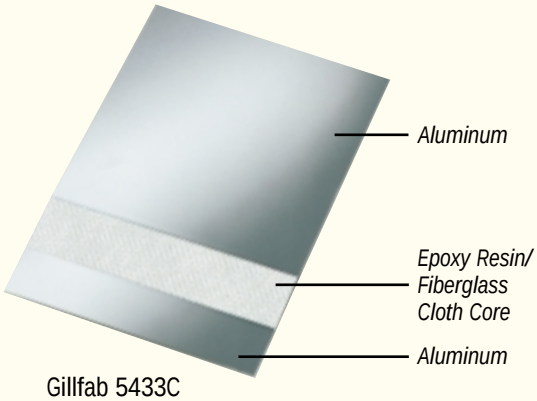
So, when "state-of-the-art" is yesterday's technology and "cutting edge" may not make it through the day, it is refreshing to see the 5007C panel (now, at age 22., old enough to vote)not only continue to survive but remain the product of choice for many of the aircraft of the largest package and cargo carriers in the world!

Fast Forward to Summer 2001

One of our new generation cargo flooring panels, a modification of 5033 previously described attests to our further innovation with the most robust panel available – Gillfab 5433C. As a flooring material, it overcomes shortcomings of all fiberglass panels which are abrasion resistant and flexural modulus in nature. This sandwich panel is made from aluminum facings bonded to a woven fiberglass-reinforced epoxy core. It is used as a cargo compartment flooring panel in areas of hard use and much abuse such as those just inside the cargo compartment door and in bulk cargo areas. It is dent, puncture and abrasion resistant, and has the flexural modulus of aluminum with slightly more weight than a fiberglass laminate. It is qualified to Boeing BMS 7-326, Type VII, Class 2/1.



Gillfab 5033



Gillfab 5433C

If you guessed that the two panels, 5033 and 5433C, are essentially the same, you guessed right – the latter is simply a variation of the former – 29 years later! The point is, M.C. Gill has been making cargo compartment flooring panels since the days of the DC-6…and experience goes hand in hand with our innovative capabilities. *Lockheed, Douglas and Convair discovered this almost 30 years ago…Boeing, Airbus, and the airlines of the world have confirmed it.*

There Is More To Cargo Flooring Than 5433C.

Gillfab 5433C is but one of many “new generation” cargo flooring panels designed to stand up and endure the wear and tear caused by today’s cargo.

Unlike the old days, there is a wide selection of cargo compartment flooring panels from which to choose, depending on the type of aircraft flown and the cargo to be carried. The data are presented with the intent to give the reader an opportunity to draw a reasonable conclusion as to which M.C. Gill flooring is the right one for your purposes where a modification of existing floor panels is desirable.

COMMONLY USED CARGO FLOORING

Aluminum Honeycomb

Compressed Aluminum Honeycomb

End Grain Balsa

Nomex Honeycomb

Compressed Nomex Honeycomb

CORES

End Grain Balsa

Durable and competitive low cost, balsa is widely used as core material for sandwich panels – especially in cargo compartments. It has very few shortcomings and its greatest assets are a solid core, price and proven durability. High compressive strengths – more than 1,500 psi for 9.5 pcf balsa and more than 900 psi for 6.25 pcf balsa. It is resilient, has high fatigue strength and is resistant to point loading. Has good core shear strength – 200 psi for 9.5 pcf balsa and 160 psi for 6.25 pcf balsa. Generally heavier than panels using Nomex or aluminum honeycomb – because of heavier facings necessary for rigidity. Care must be exercised where the panel is exposed to moisture. For more on end grain balsa, see page 5.

Nomex Honeycomb

Aramid fiber (Nomex) honeycomb is the core of choice, proven for high performance applications. Given the cell size and density, it provides a panel with a very good strength-to-weight ratio. It is somewhat more expensive and has low resistance to water absorption, but offers superior fatigue resistance.

Aluminum Honeycomb

This type of honeycomb has good temperature resistance, no water absorption, and is relatively inexpensive. Has low heat and electrical conductance, but if not properly treated it will corrode. It produces a panel with a lower strength-to-weight ratio than one with a Nomex honeycomb core.

Compressed (Crushed) Aluminum Honeycomb

Compressed honeycomb panels can be roll-formed, routed, sawn, drilled, or riveted using standard metal shop practices. It can be treated like solid aluminum, but with significant weight savings. General aviation aircraft use crushed honeycomb panels as flooring and interior sidewalls. In larger commercial aircraft these panels are used as flooring in containerized baggage compartments. It can be substituted for solid aluminum sheet, thickness for thickness, at a weight savings of one-third without sacrificing mechanical properties. However, thin sliced Nomex honeycomb core panels result in even lighter weight/lower cost products and which can be substituted for crushed aluminum core panels in applications where the panels do not have to be formed.

COMPONENTS AND THEIR CHARACTERISTICS

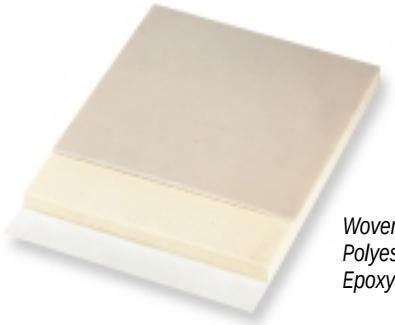
FACINGS

Aluminum has sufficient strength and good stiffness properties. It is heavier than fiberglass and will corrode unless properly treated. It is also subject to denting, tearing, and permanent distortion. Aluminum is non-burning except at very high temperatures and non-smoking but it does have high heat conduction.

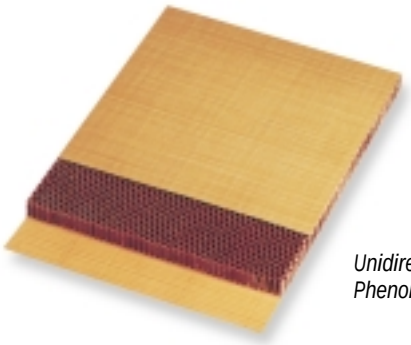
Woven Fiberglass Cloth Reinforced Plastics (FRP) are widely used as facing material. They have lower specific gravity and greater corrosion resistance than aluminum. FRP can be ribbon-like or uni-directional where all fibers run in the same direction to provide high specific strengths, or woven cloth to provide ease of cutting and trimming, and delamination resistance.

S-2 Glass®, E-Glass and Carbon are all possible reinforcements but the first two are almost always the FRP materials of choice for cargo compartment sandwich panel facings.

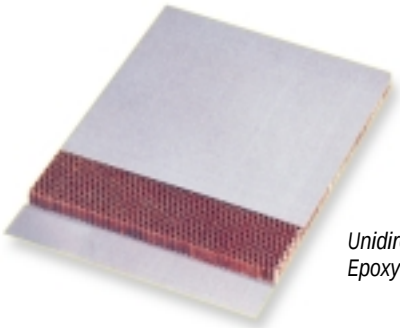
As noted, M.C. Gill predominately uses aluminum and FRP facings, but if our customers request, we can use any suitable material as sandwich panel facings and core, for that matter.



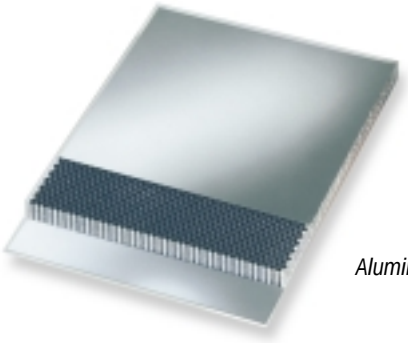
Woven FRP-Polyester Or Epoxy Facings



Unidirectional FRP-Phenolic Facings



Unidirectional FRP-Epoxy Facings



Aluminum Facings

ADHESIVES

For the purposes of this article, four types of high performance adhesives are considered, although only one – modified epoxy – is discussed at length. These adhesives are vinyl-phenolic, durable with good property values but has environmental drawbacks in the pressing phase of the manufacturing process; contact elastomeric, satisfactory in non-structural applications but must be evaluated for cold flow and solvent, moisture, and heat resistance; urethane, normally used in construction but has water resistance problems; and, of course, modified epoxy.

All epoxy adhesives that M.C. Gill uses meet the two most common adhesive specifications: MMM A 132, Type 1, Classes 2 and 3, and Mil A 25463 A. One of the primary advantages of epoxy adhesive is that there are many formulations available for a variety of end uses. Modified epoxies are used with honeycomb and other higher performance cores required by the commercial aircraft and aerospace industries. The M.C. Gill Corporation manufactures seven different adhesives and all but two are epoxies (these two are a phenolic and a contact).

RESINS

Epoxies

The resins of choice for high performance and high strength. They lend themselves to easy molecular modifications and can be formulated to excel in many (not all in one resin) of the following properties: high peel and flexibility, low shrinkage in curing, high mechanical strength, and resistance to chemicals, fire, and abrasion. They do have high smoke and toxic emission in a fire and are somewhat difficult to process (slow to cure and sensitive to moisture).

Phenolics

These resins are first and foremost non-burning with very low smoke or toxic emissions. In addition, they are low cost, have good mechanical strength, and capable of withstanding prolonged high temperatures. Conversely, they are somewhat lower in mechanical strength than epoxies, difficult to modify, and emit 4 to 8% volatiles during cure, producing parts that may have somewhat porous surfaces with micro-voids.

Polyesters

Polyesters were the first resins used in development of FRP. They are relatively low in cost; are easily modified to meet most fire retardant specifications; and are corrosion resistant. They do have high smoke and toxic emissions in a fire; their service temperatures are limited – generally at 180°F; and have high shrinkage during cure (4 to 8%) which can result in internal stresses.

In summary, the materials listed in Table 2 are the components of choice or, the most commonly used, for cargo compartment flooring that will help retain the desired characteristics. There are others, certainly, but these are used in almost all instances.

TABLE 2 – COMPONENTS OF CHOICE FOR CARGO COMPARTMENT FLOORING PANELS

Facings	Resins	Cores	Adhesives
1. Woven reinforced fiberglass cloth	1. Epoxy	1. End grain balsa wood	1. Modified epoxy
2. Unidirectional fiberglass	2. Phenolic	2. Aluminum honeycomb	2. Modified phenolic
3. Aluminum	3. Polyester	3. Nomex honeycomb	3. Contact
		4. Crushed (or compressed) honeycomb	4. Polyester
		5. Fiberglass cloth laminate	
		6. Nomex or Kevlar laminate	

Rather than expound on most of the possible types of components and list their advantages and disadvantages, we chose to consider only those more commonly used components and list their strengths and shortcomings only as they pertain to cargo flooring. Thus, we hope we saved the reader's time and, perhaps, one or two trees in the bargain. For a more complete analysis of sandwich panel components, please see the Winter and Spring 1997 issues of our Sandwich Panel Review (Volume 34, Numbers 1 and 2). If you do not have these issues, please contact us at any of the numbers on the cover masthead and we will be pleased to send them to you promptly.

A FEW GOOD PRODUCTS

The M.C. Gill Corporation does not specialize in a lot of different product lines. Our philosophy is that if we can make a few products and make them well, we can perform a real service for our customers. Cargo compartment flooring is one of those products and the flooring we make today is the result of our years of experience in this facet of the commercial aviation industry. Even if you were to get a derrick, a tractor, or an elephant in the cargo compartment, we are confident Gillfloor in the cargo hold will stand up to such a load better than any flooring conceived to date. Those items, particularly the elephant, would make a good story for the Doorway. So, if you are shipping an unusual (and legal) cargo, please notify us and we will send a photographer for the story.

TABLE 3 – M.C. GILL CARGO COMPARTMENT FLOORINGS

PRODUCT	AIRCRAFT	SPECIFICATION	CONSTRUCTION
		AIRBUS	
4105B	A300, A310, A330, A340	TL53/5000/79 Ty 2	.375" thick; .024"/.024" fiberglass reinforced epoxy facings, 6.0 pcf Nomex, honeycomb core.
4123	All Airbus Freighter Aircraft Main Deck	5360 M1M 0005 00 (MDC2)	.374" thick; .030"/.020" woven glass cloth reinforced phenolic facings, 9.0 pcf Nomex honeycomb core.
4223	All Airbus Aircraft Bulk Cargo	5360 M1M 0005 00 (BCC2)	.496" thick; .050"/.020" woven glass cloth reinforced phenolic facings; 9.0 pcf Nomex honeycomb core.
4322	All Airbus Aircraft Containerized Cargo	5360 M1B 0001 00	.374" thick; .024"/.022" woven glass cloth reinforced phenolic facings; 6.0 pcf Nomex honeycomb core.
4323	All Airbus Aircraft Bulk Cargo	5360 M1B 0001 00	.496" thick; .030"/.020" woven glass cloth reinforced phenolic facings, 6.0 pcf Nomex honeycomb core.
4522	A319, A320, A321 Containerized Cargo	5360 M1M 0005 00 (CCC1)	.374" thick; .020"/.015" woven glass cloth reinforced phenolic facings, 8.0 pcf Nomex honeycomb core.
		BOEING	
4417	747F	BMS 4-17 Ty II	.400" thick; .015"/.015" unidirectional fiberglass reinforced epoxy facings, 9.0 pcf Nomex honeycomb core.
5424	727, 737, 757, 767 Freighters	BMS 4-23	.400" thick; .015"/.015" unidirectional fiberglass reinforced epoxy facings, 8.5 pcf aluminum honeycomb core.
5433C	777	BMS 7-326, Ty VII Cl 2/1	.058" thick; .016"/.020" 2024T3 aluminum facings; woven glass cloth reinforced epoxy laminate core.
		LOCKHEED	
5033	L-1011	LAC-C-22-1356 Ty I	.070" thick; .010"/.010" 2024T3 clad aluminum facings, modified nylon fabric laminate core.
		LAC-C-22-1356 Ty II	.076" thick; .016"/.010" 2024T3 clad aluminum facings, modified nylon fabric laminate core.
		MCDONNELL DOUGLAS	
4017T	DC-10, MD-10, MD-11	BZZ 7002 Ty III	.400" thick; .030"/.015" unidirectional fiberglass reinforced epoxy facings, 9.0 pcf Nomex honeycomb core.
5065	DC-10F, MD-10F, MD-11F	BZZ 7002 Ty IV	.400" thick; .030"/.015" unidirectional fiberglass reinforced epoxy facings, 8.5 pcf aluminum honeycomb core.
		BZZ 7002 Ty V	.300" thick; .030"/.015" unidirectional fiberglass reinforced epoxy facings, 8.5 pcf aluminum honeycomb core.
5242	DC-9, MD-80, MD-90, B717	S00096	.390" thick; .020"/.012" 2024T3 clad aluminum facings with a frp overlay on the face side, end-grain balsa core.
5042B	DC-10F, MD-11F Upper Deck	S3932193	.390" thick; .016"/.010" 7075T6 clad aluminum facings, 9.0 pcf end-grain balsa core.
5042B	DC-10, MD-11 Aft Cargo (Non-Doorway Areas)	S3932195	.390" thick; .020"/.010" 7075T6 clad aluminum facings, 9.0 pcf end-grain balsa core.
4022	DC-10F, MD-11CF Main Deck Cargo –Wet Areas	S3933941	Woven glass cloth reinforced phenolic facings, 8.0 pcf Nomex honeycomb core (facing & panel thickness per dwg).
5142	DC-10, MD-11 Forward & Center Cargo Compartments	S4929905	.390" thick; .016"/.010 7075T6 clad aluminum facings 9.0 pcf end-grain balsa core.
5142A	DC-10 Aft Cargo	S4929962	.390" thick; .020"/.010" 7075T6 clad aluminum facings, 6.5 pcf end-grain balsa core.
5242A	DC-10, MD-11 Aft Bulk Doorway	S4932048	.390" thick; .020"/.012" 2024T3 clad aluminum facings, 9.0 pcf end-grain balsa core.
4004	MD-80, MD-11	7954401	.390" thick; .015"/.015" unidirectional fiberglass reinforced phenolic facings, 9.0 pcf Nomex honeycomb core.
		M.C. GILL PROPRIETARY	
5007C	Per Airline Engineering Order	FAR 25.853 Flammability	FRP polyester facings with a .005" mat overlay, 9.0 pcf end-grain balsa core.
5040	Per Airline Engineering Order	FAR 25.853 Flammability	Aluminum facings, 9.0 pcf end-grain balsa core. Panel thickness and facing call-out per customer specification.

THE FUNNY SIDE

Quotes of questionable wisdom

"Heavier-than-air flying machines are impossible.", Lord Kelvin, president, Royal Society, 1899

★★★

"Airplanes are interesting toys but of no military value.", Marshal Ferdi, professor of strategy, Ecole Superieure de Guerre.

★★★

"The wireless music box has no imaginable commercial value. Who would pay for a message sent to nobody in particular?", David Sarnoff's associates, in his response to his urgings for investment in the radio in the 1920's.

★★★

"Who the hell wants to hear actors talk?", Harry M. Warner, Warner Brothers Motion Picture Studio.

★★★

"There is no reason for any individuals to have a computer in their home.", Ken Olsen, president, chairman, and founder of Digital Equipment Corporation, 1977.

Trivia

90 percent of tennis elbow cases are caused from too small a grip.

★★★

Every year, U.S. farmers raise 45 million turkeys for Thanksgiving.

★★★

According to the Long Island (NY) Professional Voice Care Center, it takes 52 hours of study to lose a Long Island accent.

★★★

On July 9, 1893, Dr. Daniel Hale Williams performed the world's first open heart surgery.

★★★

William Fargo cashed the first American Express traveler's check at the Hotel Haufe in Leipzig on August 5, 1891.

★★★

The editor of the first New York daily newspaper, The American Minerva was Noah Webster.

★★★

F.W. Woolworth started selling 5-cent merchandise in 1878 and added 10-cent items in 1880. It wasn't until 1932 that he added 20-cent items.

★★★

Texas averages 124 tornados a year— more than any other state.

OOPS!!

In the last issue of the Doorway, we informed our readers that the University of Southern California (USC) recognized M.C. Gill's generosity in endowing the former Center for Composite Materials by renaming the Center in his honor. What we neglected to tell our readers was the correct name of the Center. For years, M.C. Gill has been just that—"M.C." and your intrepid reporter assumed that the name of the Center would be the "M.C. Gill …". But, as the man in question is quick to point out (and has, over and over and over), "To assume is to err."

And so, we take this opportunity to correct our error and set the record straight. It is the "Merwyn C. Gill Foundation Composites Center ". Everything else is the same: the facilities, Steve Nutt the Chair holder, the Center's goals and objectives, everything. Except the name and, having written it on the blackboard 500 times, you may rest assured that this mistake will not be repeated.

MERWYN C. GILL FOUNDATION
COMPOSITES CENTER

Also, in last issue's article, space limitations (NOT neglect) dictated that we omit the role our own Research and Development plays in supporting the Center. In addition to supplying much needed materials for testing, our R&D personnel also lend their expertise to assist the USC graduate students and PhDs in their efforts (noted in bold face in the following is a list of current projects the Center and M.C. Gill R&D are jointly involved in).

1. Toughening of Phenolic Foams
2. Long Discontinuous Fibers as a Reinforcement Base for Cellular Materials
3. Experimental and Analytical study of Natural Vibration Modes of Soft-core Sandwich Beams
4. Acoustic Studies on Sandwich Panels
5. Higher-order Vibrations of soft-core Sandwich Beams
6. Experimental and Analytical Study of Nonlinear Bending Response of Soft-core Sandwich Beams
7. Nanocomposite Polymeric Foams
8. Mechanical Behavior of Machine Augmented Composites
9. Deformation of Bulk Nanocrystalline Metals

Now that we corrected the name of the Center, discussed our R&D Department's participation and listed the current projects underway at the Center, we will again congratulate M.C. Gill on this notable honor. Well done, M.C.! Or should that be "Merwyn C."?