VOLUME 27
WINTER 1990
NUMBER 1

THE M.C. GILL DOORWAY

M. C. GILL CORP., 4056 EASY ST., EL MONTE, CALIF. 91731 • PHONE (818) 443-4022 • TELEX 67-7467 • FAX 818-350-5880

CARGO LINERS: *Past, Present, Future.*

The Early Years

The M.C. Gill Corporation's first order for fiberglass cloth reinforced polyester (FRP) cargo liner was placed by Convair in 1946 for the Convair 240/340/440 Series. The company needed 60" wide sheets and the existing competitors' laminating equipment could not accommodate that size, so we received the order and produced it using a wet layup technique. Incidentally, we don't know who conceived, or first used, FRP as a lining for cargo compartments, but it was a real breakthrough and a definite improvement over the then materials of choice such as ABS sheet, aluminum, and plywood.

The Convair order was a one-time sale and it wasn't until the early fifties, when the then Douglas Aircraft Company was looking for 48" wide sheets that M.C. Gill got the order and the company was in the cargo liner business to stay.

In those earliest days the glass cloth used was a square or plain weave with no "finish." The early resins incorporated chlorinated waxes and other additives to obtain the fire self-extinguishing properties necessary for commercial aviation usage.

Although these early FRP products represented a major breakthrough in cargo lining materials, they possessed fewer than half of the desired characteristics common to today's materials. They did have low specific gravity, good corrosion resistance, satisfactory flame resistance, repairability, good aging properties, dent resistance, and good fatigue properties, among others. But they were a far cry from the liners available today. Gillfab 1038 met those early requirements of Lockheed's spec LAC-C-22-939, and although today's version of 1038 has been improved considerably, sales of that product are miniscule because of the superior performance of products developed in recent years.

With the advent of the larger 4 motor piston aircraft such as the DC-6 and DC-7, properties improvements were required. Mechanical properties including rigidity were upgraded by the use of satin weave fabrics and bolt pullout at the edges was increased somewhat. Pigments were added to the resin systems to obtain a uniform white color throughout, wide sizes (48" to 60") became readily available, and much of the surface porosity was reduced so that the sheet possessed greater integrity. Thickness was often the answer to increased puncture resistance and rigidity. Of course, thicker meant heavier, but weight was not as critical as it was to become. The thicker the liner, the better it performed. Gillfab 1018, qualified to Douglas spec 10011 (now obsolete), is a liner that was representative of that era, although sales of that product today is less than one-half of one percent of of total laminate sales.

The Middle Years – The Early Jet Age

The introduction of jet aircraft to commercial aviation focused attention on weight and improved puncture resistance. Puncture test fixtures, called "impact testers," were developed to empirically ascertain comparative values. These values were expressed in foot-pounds for a certain geometrically shaped "point" used on a given type of tester. Unfortunately, each airframe manufacturer designed its own impact tester, creating confusion when attempts were made to correlate data. The liners of the last of the piston aircraft and the early jets were generally upgraded by advances in resin technology, proprietary additives, special cloth weaves, and better processing techniques. These produced *improved puncture resistance, reduced weight, better flame self-extinguishing properties, and resistance to shear at the supporting metallic ribs, which all combined to greatly prolong service life.* Gilliner 1066 made its appearance in this era and has remained the standard by which other polyester liners are measured. Its excellent service performance is the reason it is still used extensively by many of the world's major airlines.

As the trijets, e.g., DC-10 and Boeing 727 became increasingly popular, cargo liner weight became critical. Lighter, thinner, and more rigid material requirements were met by higher performance reinforcing agents. Moreover, manufacturing and quality control techniques continued to improve. The goal was to provide a better liner that weighed less. As a result, the following characteristics were improved: abrasion and shear resistance, rigidity for better appearance when installed, flame resistance, and color uniformity. In addition, surface blemishes, or discoloration, and surface porosity were completely eliminated. Puncture resistance was still considered of prime importance and it was markedly improved in the heavier gauges. Gilliner 1166 and 1266 (Gillcoated 1166), and, a few years later, Gilliner 1366 are prime examples of a proprietary product that met almost all the desirable characteristics of the day and were the culmination of almost 30 years of concerted effort and specialization in the field.

The Here and Now

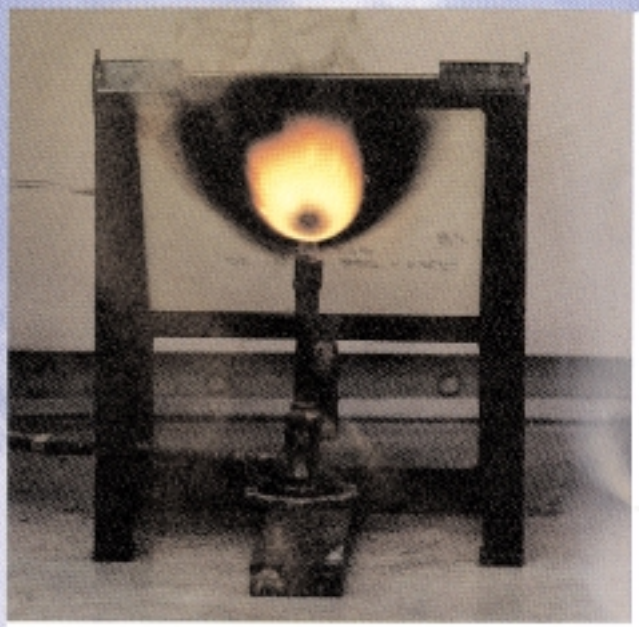
"The cargo liner of the immediate future will probably employ a resin which when burned produces little or no smoke or toxic gasses. The reinforcing material will have a much higher strength to weight ratio when laminated and surface abrasion will be greatly improved." This is a direct quote from a past Doorway article on cargo liner. Given what we know now, the words don't mean much. But, that article appeared in our Summer 1975 issue! Prophetic indeed, because the current state of the art cargo liners use a *phenolic resin*, which when burned produces extremely low emissions of smoke or toxic gasses (see our Summer 1988 Doorway for graphic proof). Moreover, these new cargo liners, typified by Gilliner 1167 and Gilliner 1367, have very high puncture resistance, and good mechanical strength and stiffness.

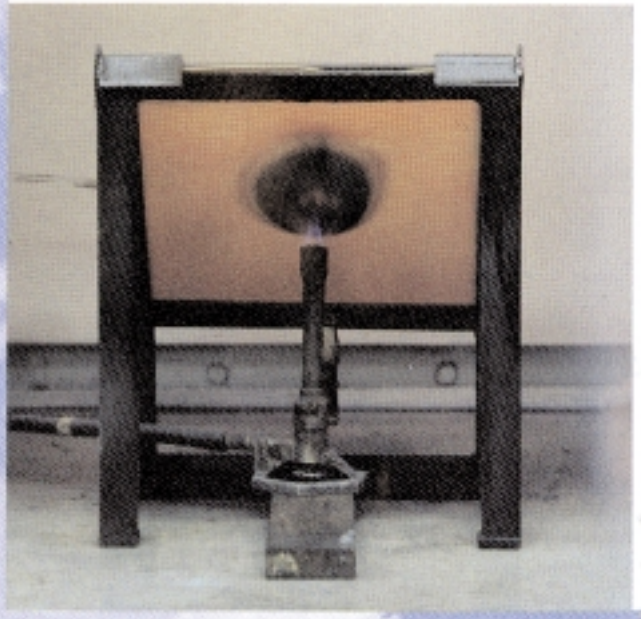
The new phenolic liners meet all the mechanical and physical property requirements imposed by the airframe manufacturers (see page 6 for a discussion of these requirements). *More importantly, they, along with other M.C. Gill Corporation cargo liners pass the FAA's flame and burn-through tests discussed in the following paragraphs.*

The FAA has adopted two Federal Airworthiness Regulations (FAR) that relate to the performance of cargo liners when exposed to fire.

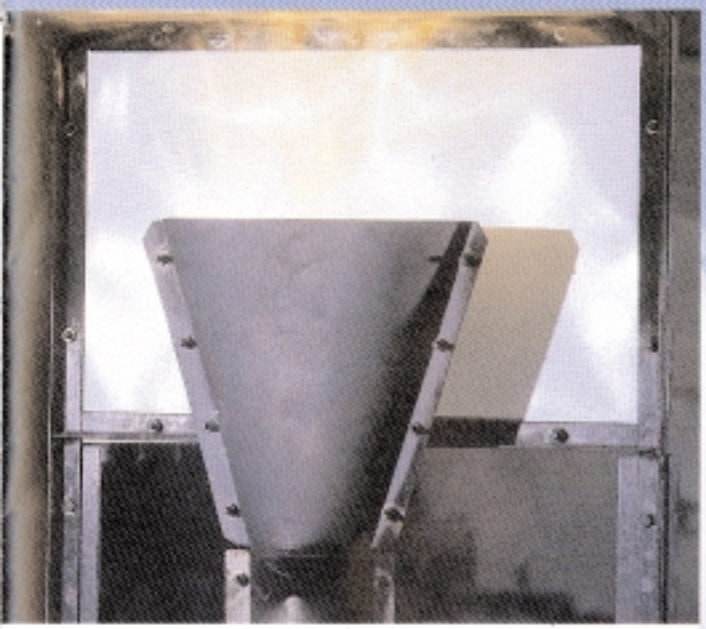
FAR 25.853(b). Called the vertical flame test, a 4½" x 12" sample of the material is exposed in a vertical position to a 1550°F (minimum) flame from a Bunsen burner for 12 seconds. In order to pass, the material must extinguish within a maximum of fifteen seconds after removal of the flame; if there are any drippings from the material, they must self extinguish within a maximum of five seconds; and the length of burn must not exceed 8"

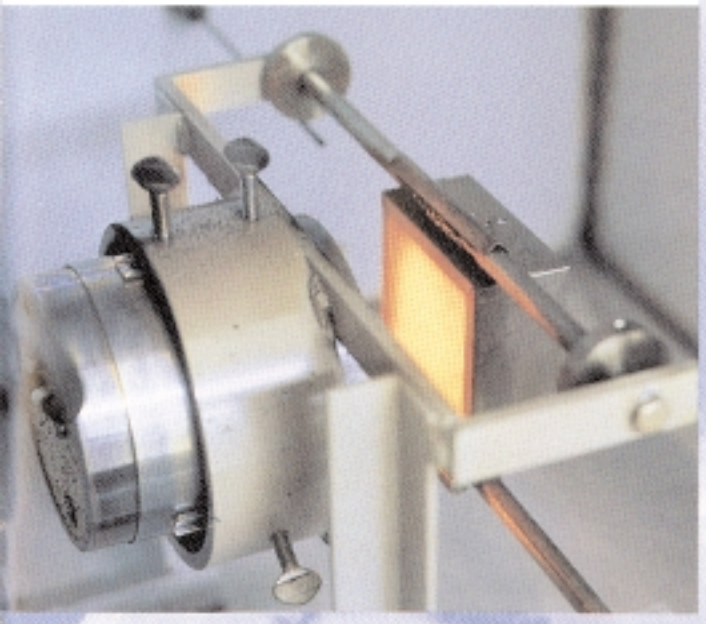
FAR 25.855(a). Called the 45° flame test, an 8" x 8" piece of material is exposed at a 45° angle to a 1550°F (minimum) flame from a Bunsen burner for 30 seconds. In order to pass, the flame must not penetrate the material, the material must self extinguish within a maximum of fifteen seconds after the flame is removed, and the glow time after the material has extinguished can be no longer than ten seconds





The dramatic difference in smoke emissions between polyester material (above) and the phenolic sample (below) is demonstrated here. The M.C. Gill Corporation produces cargo liners using phenolic resins in their construction that qualify to both Boeing and McDonnell Douglas specifications.





The New Oil Burner Burn-through Test (top) which recently became part of the FAA's specification included in FAR 25.855, Appendix F, Part III, Amendment 25-60. Many of M.C. Gill's cargo liners pass this demanding test.

The NBS Smoke Chamber (bottom) tests smoke emitting properties of M.C. Gill products. The smoke chamber measures smoke density and its test results are the commercial aircraft industry's standard for smoke emission requirement.

maximum. Every cargo liner manufactured by the M.C. Gill Corporation meets the standards imposed by FAR 25.853(b) and 25.855(a-1), Appendix F, Part I.

As noted, the two tests above use a laboratory size Bunsen burner to produce the required heat. Based on full-scale fire tests, the FAA has conducted, the agency concluded that new, larger scale test methods were required so that burn-through resistant properties of cargo liner material could be evaluated better. In 1986, the FAA issued a Notice of Proposed Rule Making (NPRM) 84-11, which has now been incorporated into FAR specifications and is included in FAR 25.855, Appendix F, Part III, Amendment 25-60. It identifies new standards and testing apparatus which are considerably more demanding, to say the least.

Whereas the vertical and 45° flame tests utilize a Bunsen burner's ⅜" diameter tapering flame to produce the heat, the new oil burner apparatus' opening is a 6" x 11" oval. The test fixture holds two 16" x 24" samples (either or both of which may be tested), one in a vertical (or sidewall) position, the other in a horizontal (or ceiling) position. Once the flame reaches a temperature of 1700°F (±100°F) it is placed 2 inches from the sidewall panel and 8 inches below the ceiling panel, and allowed to burn for five minutes.

The criteria for passing the test are that *no* flame penetrates either sample and that the temperature measured 4 inches above the horizontal sample not exceed 400°F.

Although the tests are conducted in a controlled laboratory environment and the results may or may not be representative of those experienced in post-crash fire conditions, their severity is a real test of a material's flame and burn-through resistance. *As of this writing, seven M.C. Gill cargo liners have met the requirements of the FAA's new burn-through test; they are Gilliner 1076R, Gilliner 1167, Gilliner 1167B, Gilliner 1266, Gilliner 1366T, Gilliner 1367, and Gilliner 1367A. We know of no other cargo liner manufacturer* who has qualified this many types of material to FAR 25.855 Appendix F!

But, We're Not Done Yet

Efforts are currently underway to qualify additional Gilliners to the oil burner test. For example, Gilliner 1066R has passed all the flammability tests required by the FAA and will be issued a certificate of compliance upon completion of the necessary paperwork.

However...
Passing burn-through and flame resistance tests are essential to compete in today's commercial aviation marketplace. Essential, yes, but successful qualification to those requirements is only part of the story. There are other key properties today's cargo liners must possess if they are to be considered for original equipment by the airframe manufacturers and replacement parts by the airlines. We believe the following properties are critical to provide long-term in service use.

▲ *Impact* — Impact strength addresses two separate but related problems: impact by a slow-moving blunt object such as that simulated by the McDonnell Douglas tester and puncture by a sharp object as simulated by the Boeing tester. Although referred to as impact tests, they are more accurately "resistance to puncture" tests. In this type of test, the shape of the object, i.e., blunt or pointed, is the key factor. Sharper points take less foot-pounds to penetrate a laminate. Each tester has an ambiguous drawing of its specially designed point and the tester must be calibrated with the originator. Failure is normally recorded when the tested sample can be penetrated by a sharp pointed object.

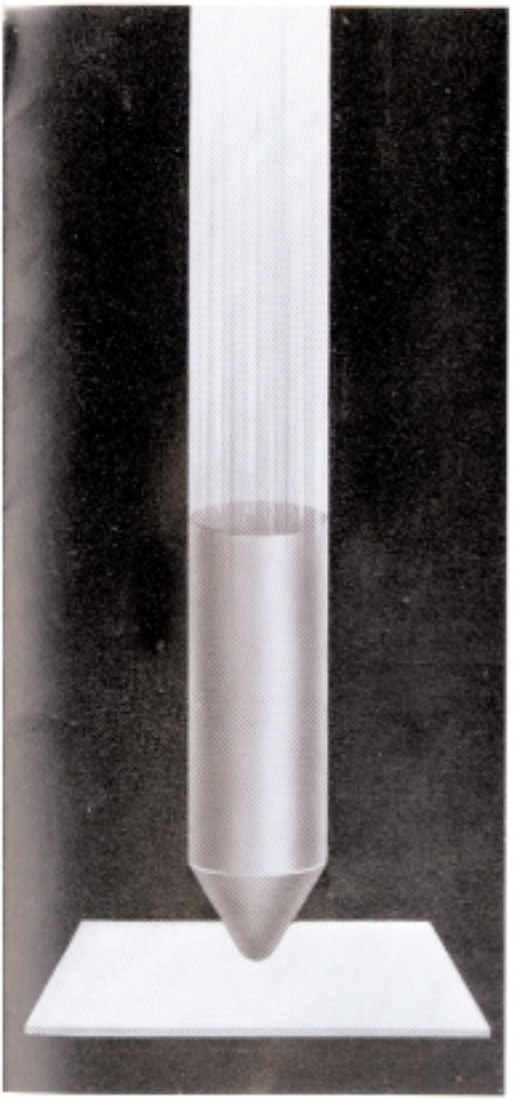
▲ *Hardness* — This test measures indentation hardness using a model GYZJ 934-1 Barcol Impressor. Because each test reading is only accurate to ±20 percent, ten readings must be taken and averaged.

▲ *Flexural Strength and Flexural Modulus* — This test determines the stiffness properties of cargo liners. The sample is tested in flexure as a simple beam supported at two points and loaded at the mid-span. The test material is loaded until rupture occurs. The maximum stress in the outer fibers occurs at mid-span. A deflectometer is placed at the center of the specimen to obtain a load-deflection curve, which is used to calculate modulus (stiffness).

▲ *Edge Pull-out* — This test determines the edge pull-out strength of fasteners in a cargo liner under tension or impact loading. It is intended to apply where rivets or bolts are used to attach the liners to the frame of the aircraft. The test specimen is mounted in the tension loading fixture and is loaded at the prescribed rate of cross-head travel. The maximum load is recorded as the edge pull-out, in pounds. Table I lists some of the specifications and M.C. Gill product properties that meet the requirements of FAA, airframe manufacturers, and airlines.

Implicit throughout this article is that the M.C. Gill Corporation offers the largest selection of cargo liners in the industry. The simple truth is that there are few, if any, current airframe manufacturer or airline specifications to which at least one of our liners will not qualify. Because of this, we still manufacture and sell our first and second generation cargo liners since some of our customers still order them. They were specified as original equipment by the airframe manufacturer and even though they qualified to what are now obsolete specifications they can still be called out on customers' drawings and purchase orders. Often, these early liners are less expensive than their modern day counterparts, and to some buyers' way of thinking, first cost is the only cost. Because we value all our customers we will comply with their requests if we possibly can.

But, we would be remiss if we did not point out that today's cargo liners are far superior to those we developed and introduced back when. For example, Gillfab 1038 was qualified at Lockheed Aircraft



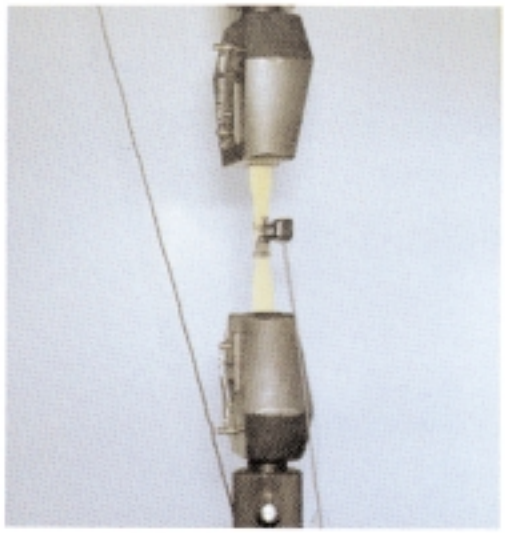


Photo at far left—
The Dart Impact test (symbolically represented here) measures cargo liner resistance to puncture. All M.C. Gill cargo liners must pass this rigorous test before they are shipped.

Photos at left—
A speciman of cargo liner loaded into the test fixture to determine the strength properties of laminates under tension (top). This particular sample passed but it was taken to failure (bottom), as are all our test samples.

The tests shown on this page and on pages 4 and 5 are just five of many such tests to which M.C. Gill products are subjected before they are sold. This constant attention to quality has kept the M.C. Gill Corporation the leader in the cargo liner industry—a position we do not intend to relinquish!

in 1959. Thirty years later, we are still selling that product as replacement cargo liner. We understand that customers continue to buy a product because if they don't receive complaints, they assume all is well. But we wonder if those engineers and buyers that continue to specify 1038 would consider purchasing a new television set today that was built to 30-year-old specifications and using 1959 technology. We doubt it.

We devote roughly 3,000 man-hours annually in our R & D laboratory each and every year on efforts to improve existing cargo liners and develop new ones. These efforts have paid off handsomely and our customers are the beneficiaries of this work.

The Future

The future will see greater improvements in cargo liner properties, e.g., more impact resistance, greater flex strength and flex modulus, stronger edge pull-out, better fatigue resistance, lighter, and higher abrasion resistance coatings. In short, everything that is state-of-the-art now will be even better. Either existing products will be upgraded or new ones will be developed to conform to more exacting requirements. Exotics? Probably not; at least not those that are considered exotic now, including aramid fiber, boron, and graphite. Not only are they expensive, they have shown poor in-service histories in high-abuse applications comparable to those encountered in aircraft cargo compartments.

Surface coatings will be developed that have lower flammability, and smoke and toxic emissions characteristics, and better abrasion resistance than those currently in use. Improvements in automated cargo handling systems will result in longer cargo liner life of existing products, although impact and insert pull-out will continue to be important considerations. While improvements may be possible in reducing the weight of cargo liner, they would result from the use of more expensive materials and it is doubtful that the weight reduction achieved would justify the increased cost of new materials. The M. C. Gill Corp. plans to utilize our in-house expertise in efforts to decrease the weight of our existing products.

One very important property that has to date been considered as important but not essential is smoke and toxic emissions in fires. These emissions are most assuredly fire associated danger in a post-crash environment, but at this writing, the FAA has elected not to establish test procedures and minimum standards for cargo liner as that agency has done with burn-through criteria.

The reasons are that in their full scale fire tests, the FAA found a significant correlation between flammability and a) smoke emissions and b) toxic emissions of the various materials. With regard to smoke emissions, the FAA stated, "Flammability is a more significant factor in survivability than smoke alone. It would, therefore, be inappropriate to establish test

procedures and standards for smoke in lieu of flammability."

Likewise, as to toxic emissions, "...the new flammability standards indirectly address toxicity by requiring the use of cabin interior materials with reduced heat release rates that delay or prevent the onset of flashover (a condition of extremely intense heat where fires suddenly break out much in the manner of spontaneous combustion and one where high levels of toxicity occur). It must also be noted that standards for toxicity would be especially difficult to establish because level of human tolerance to typical post-crash fire toxicants have not been adequately defined."[1]

Requirements for smoke and toxic emissions admittedly can be difficult to define and establish, particularly those of toxic emissions because of the aforementioned varying levels of human tolerance to them. Nevertheless, it is our opinion that in the not too distant future, the FAA will address the issue and adopt a set of standards for heat release, and smoke and toxic emissions for cargo liners. There appears to be a mounting body of evidence that these emissions pose as great a hazard in post-crash conditions as fire and we believe that some sort of limits for both smoke and toxicity will be forthcoming for cargo liners and sandwich panels.

When? We don't know. We are certain of one thing, however. Standards will be adopted and, whatever they are, the M.C. Gill Corporation will have products available that will meet or exceed them. In fact, we are confident that four of the cargo liners discussed in this article will conform to whatever requirements the FAA might impose, for smoke emissions at least. They are 1167, 1167B, 1367, and 1367A. Perhaps in anticipation of future Federal standards, the major U.S. airframe manufacturers have adopted smoke emission requirements for cargo liners that must be met before they are qualified as original equipment. Using ASTM E662-83 as the standard test method and depending on thickness, Gilliner 1167 and Gilliner 1167B are qualified to McDonnell Douglas specification DMS 2226. Likewise, Gilliner 1367 and Gilliner 1367A are qualified to Boeing specification B BMS 8-233, Class 2, Grade B, Ty 13 through Ty 70.

The M.C. Gill Corporation is extremely proud of the accomplishments we have achieved with our products' performance and compliance with the airline industry's safety standards—particularly when our compliance precedes the formal adoption of such standards! The one thing we cannot and will not accept, however, is resting on our laurels. We believe that accounts in great measure for the fact that we are, and fully intend to remain, the leader in the cargo liner industry.

1. Federal Register, Vol. 51, No. 139, pp 26026-26220.

M.C. GILL CARGO LINERS

ORIGINAL EQUIPMENT CARGO LINERS

Gilliner is original equipment in the following aircraft

MANUFACTURER AND AIRCRAFT	M.C. GILL PART NUMBER	MANUFACTURER SPECIFICATION
BOEING		
737	1266	Proprietary
	1366	BMS 8-2, CL 2
737-300	1367	BMS 8-223, CL 2
747	1367	BMS 8-223, CL 2
757	1367	BMS 8-223, CL 2
767	1367	BMS 8-223, CL 2
McDONNELL DOUGLAS		
DC9	1100G	DMS 1946, Ty 2
MD80	1167	DMS 2226, Ty 1
DC10/KC10	1100	DMS 1946, Ty 1
MD11	1167	DMS 2226, Ty 1
BOEING CANADA		
DASH 7	1366	Proprietary
DASH 8	1102	DHS P-1.42
	1367	BMS 8-223, CL 2
CANADAIR		
"H_2O Bomber"	1066	Proprietary
LOCKHEED		
L-1011	1367	LAC-C-22-1249, CL 3
	1138	LAC-C-22-1249, CL 1
	1338	LAC C 22-1347, CL 1*

Note: 1366T is also qualified to Boeing specification BMS 8-2, CL 2, Gr. B for all 700 Series type aircraft.

1167A is also qualified to McDonnell Douglas specification DMS 2226, Ty 2 for MD-80 and MD-11; 1167B is also qualified to McDonnell Douglas specification DMS 2226, Ty 1.

*Proprietary product subsequently adopted by and qualified to specifications shown.

Note: The above is only a partial list of manufacturer specifications to which M.C. Gill products are qualified. Others include Embraer, Fokker, Cessna and Beech.

PROPERTIES OF SELECTED M.C. GILL CARGO LINERS

PROPERTY AT STANDARD CONDITIONS	GILL PRODUCT NUMBER AND SPECIFICATIONS TO WHICH THEY QUALIFY								
	1076R BMS 8-2 CL 1, Gr. A	1066 Proprietary	1100 DMS 1946	1138 LAC-C-22-1249, CL 1	1166 (1266) Proprietary	1102* DMS 2043	1167* DMS 2226	1366* BMS 8-2 CL 2, Gr. B LAC-C-22-1249, CL 3	1367* BMS 8-223 CL 2, Gr. B
Flexural Strength, psi	30,000	18,000	70,000/55,000	32,000	32,000	70,000/45,000	26,000/23,000	35,000	26,000
Flexural Modulus, psi x 10^6	1.5	1.2	3.2/2.3	2.2	2.0	3.2/2.0	1.4/1.0	2.0	1.5
Tensile Strength, psi	42,000	38,000	45,000/40,000	42,000	45,000	**	54,000/50,000	47,000	60,000
Compressive Strength, psi	12,000	9,000	20,000	20,000	16,000	**	**	20,000	N/A
Impact Resistance Douglas pendulum tester #2 (24 lbs.) (.045" laminate), ft.-lbs.	N/A	66	40	40	40	34	34	66	N/A
Boeing dart tester #3 (12 lbs.) (.030" laminate), ft.-lbs.	**	10	5	10	10	12	N/A	18	16
Bolted joint pull-out, per DMS 1946 (.060" lam.), lbs.	365	400	350	420	420	500	350	350	N/A
Edge bearing strength, per BMS 8-262 (.030" lam.), psi	23,000	27,000	35,000	30,000	31,000	37,000	32,000	30,000	33,000
Taber abrader, grams lost, 2000 cycles, CS10 wheel	.035	.075	.026	.028	.040	.053	.060	.0625	N/A
Weight (.060" lam.), lbs./ft.²	0.6	0.6	0.6	0.6	0.6	0.6	0.3 (.030")	0.6	0.3 (.030")
Water Absorption, % maximum	1.0	2.5	0.65	0.5	0.5	0.5	0.5	0.5	
Barcol Hardness, minimum	45	30	60	50	50	60	N/A	N/A	N/A
Resin Content, % average	35	37	33	33	33	33	33	33	32
NBS Smoke Emission Ds @ 4 minutes flaming (thickness)	140/200/475/600 (.013"/.023"/.045"/.059")	150/300/550 (.016"/.030"/.060")	NA NA	NA NA	NA NA	10 (.060")	40/50/60 (.016"/.025"/.030")	NA NA	50/50/50/50/50/50 (.013"/.020"/.030"/.040"/.060"/.070")
Burn through, per FAR 25.855, APP. F, Part III, Amend. 25-60	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
OSU Heat Release, (kw-mins./M² and kw/M²)	NA	NA	NA	NA	NA	NA	36/35 (.030" thick)	52/42 (.030" thick)	25/19 (.030" thick)

*Proprietary product subsequently adopted by and qualified to specifications shown.

**No requirement in specification. N/A — Not Applicable; NA — Not Yet Available.

HELPFUL HINTS

Foremost among the objectives of the M.C. Gill Doorway is to inform and educate our readers about the field of composites as it pertains to our products. We believe we've adhered to that objective on a regular basis. With the dawning of a new decade, we thought it would be helpful to review some of these articles that have appeared in the last ten years. Many of our readers will remember them, but for those of you who have been on our mailing list for a shorter period of time, we hope these references will prove useful. If a particular review(s) provokes interest, please contact our Marketing Services Department, M.C. Gill Corporation, 4056 Easy Street, El Monte, CA 91731, and we will be pleased to provide a copy of that particular issue(s).

New Flooring: Unfazed by Fire, Heels, and Wheels. Fall 1989. Cover article relates history of aircraft flooring; discusses advantages and disadvantages of various flooring materials; includes a table of properties of various flooring panels.

Update on Fabrication of Complex Shapes. Summer 1989. Describes how a contoured part is made, from pattern to finished product; lists various reinforcements, resins, rubbers and processes used to manufacture these parts.

Resin Transfer Molding. Summer 1989. Describes the RTM process; lists advantages and disadvantages of using the technique.

How to Select a Composites Laminator. Spring 1989. Details the major factors to consider in selecting a top advanced composites manufacturer; includes sections on equipment, personnel, quality assurance, research and development, and "the important intangibles."

What It Takes to Get FAA O.K. Spring 1989. Describes the procedure required to obtain an FAA Certificate of Acceptance for a new product.

Facilities Update. Winter 1989. Text and photos depict the various departmental operations of the M.C. Gill Corporation including sections on raw materials, manufacturing equipment, inventory, marketing, R and D, and quality control.

M.C. Gill Cargo Liners and Sandwich Panels Pass the Test. Summer 1988. This article covers the hazards associated with fire in a post-crash environment; new FAA regulations concerning burn-through resistance of various materials on an aircraft; and M.C. Gill products developed to meet and exceed the requirements imposed by those regulations.

Gilliner 1367. Fall 1987. Discusses the factors to consider in selecting cargo liner; pros and cons of the various materials used in the construction of cargo liner, i.e., resins, reinforcements, and interface; important cargo liner properties; the efforts required to develop and manufacture a superior product; and highlights Gilliner 1367.

Gill's Home Study Course on Composites—Part 1. Summer 1986. First of a three-part series deals with the benefits of advanced composites over other materials in certain applications; their construction, and advantages and disadvantages of different component parts.

Gill's Home Study Course on Composites—Part 2. Fall 1986. Second of a three-part series focuses on the resins and processes used to "build" advanced composites, and the advantages and disadvantages associated with them.

Gill's Home Study Course on Composites—Part 3. Winter 1987. Last of the series discusses the applications of advanced composites in various industries including aircraft, aerospace, automotive, ballistics and marine.

A Brief Study on Resins. Spring 1985. The logic in selecting the proper resin system for a specific composite application is explained; types of resins are described, and the pros and cons of each are discussed.

Gill's Home Study Course on Sandwich Panels—Part 1. Summer 1984. First of a three-part series discusses factors to be considered in evaluating sandwich panel construction, including safety, weight, and durability; describes benefits and drawbacks of common sandwich panel configurations.

Gill's Home Study Course on Sandwich Panels—Part 2. Fall 1984. Keys on adhesives, cores, and facing materials used in sandwich panel construction; and sealing sandwich panels.

Gill's Home Study Course on Sandwich Panels—Part 3. Winter 1985. Provides a summary of the calculation techniques used for sandwich panel design with formulas, charts and tables quantifying these techniques.

Versatility of Balsa Core Sandwich Panels. Winter 1983. Describes the many and various uses of sandwich panels constructed from an end grain balsa wood core with either aluminum or fiberglass reinforced polyester facings.

Space limitations preclude a more extensive list than the preceding. Certainly, all the Helpful Hints articles published in the last ten years and before are, by definition, informative and they are listed on page 7 of the index of past Doorway articles included with this issue. All articles are grouped by subject matter and each has a short, one-sentence description. Again, if you will contact our Marketing Services Department, we will be pleased to send you a copy of that particular issue.

Trivia

Camp David, the presidential retreat was originally named Shangra-La by Franklin Roosevelt. President Eisenhower renamed it Camp David after his grandson and that name has endured.

******

Texas is the only state in the Continental U.S. that was once an independent republic.

******

It can be bad luck to.... pass one nun on a street in Austria, or stir food with a knife if you're a Navaho Indian.

******

At the time Dan Marino broke Y. A. Tittle's season record for touchdown passes, Marino had never heard of Y. A. Tittle.

******

Philadelphia's earliest streetcars were powered by 80 huge clock springs.

******

Unborn whales have legs.

******

For each $1 spent on ads the return is.... $1,213.87 for Wal-Mart Stores and $8.00 for Kellogg Co.

******

Narrowest town in the United States is Bingham Canyon, Utah — one street wide and seven miles long.

******

A third of the world's potential water power is in Africa.

******

On the average, there are more births, in the U.S., on Tuesday than any other day in the week.

The Funny Side

Hair transplant: Reseeding for the receding.

******

Root canal: A dental procedure that feels like it is done with the same tools used in Suez and Panama.

******

About the only thing you can do on a shoestring anymore, is trip.

******

An employee who laughs at his boss's jokes may not have a sharp sense of humor, but he does have a keen sense of direction.

******

Husband to wife in a restaurant, "Would you like the filet mignon, the lobster or electricity the rest of the month?"

******

Lost — three-legged dog, blind in one eye, left ear missing, broken tail. Answers to "Lucky."

******

Wife to husband: "It says in the paper that in some parts of India a man does not know his wife until after the marriage." Husband: "Why single out India, were they the first?"

******

The mayor's brother-in-law waved a parking ticket in the desk sergeant's face and cried, "Do you know who I am?" The desk sergeant called the mayor's office and said, "Tell the mayor his brother-in-law is here and cannot remember his name."

******

See no evil, hear no evil, speak no evil and you do the work of three monkeys.

NEWS FLASH

As this issue of the Doorway goes to press, we are pleased to announce that Gillfab 1367, a low smoke cargo liner, is now qualified to Lockheed specifications LAC-C-22-1249 C1 3 and EPS 224154, and applies to all series of L-1011 aircraft.

IMPORTANT TELEPHONE NUMBERS

George Bush (202) 456-1414
President of the U.S.A.

Mikhail Gorbachev 007/095-205 25 11
Secretary, C.C. of the KPdSu
Moscow Red Square 4

Elizabeth II 00441/930-48-32
Queen of the United Kingdom

John Paul II 00396/69 82
The Pope

Dr. Helmut Kohl 0228/561
Federal Chancellor, W. Ger.

Yitzhak Shamir 009722/55 41 11
Prime Minister, Israel

M.C. Gill Corporation
4056 Easy Street, El Monte, CA 91731
818/443-6094 FAX 818/350-5880

M.C. GILL CORPORATION