MASSACHUSETTS AIR AND SPACE MUSEUM

HORIZONS

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The Massachusetts Air and Space Museum inspires new generations to explore, experience, and pursue interests and opportunities in science and technology

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Spincraft

A Massachusetts Company

Nestled in a half-abandoned industrial park in North Billerica, Massachusetts lies a medium-sized company that is integral to the U.S. space program and the aviation industry. *Spincraft*, a subsidiary of Standex International Corporation based in Salem, New Hampshire, occupies an ever-expanding niche industry that caters to both major aviation and aerospace endeavors. While other companies may be able to spin metal down creating small items, and even shaping the nosecones for small rockets and missiles, *Spincraft* has taken this particular manufacturing process to new dimensions. In a spotlessly-clean factory environment, they manage to *Spinform* up to five-inch thick aluminum plates, weighing up to five tons, down to thicknesses that meet the most demanding specifications of their customers. Those thick plates are soon spun into five-meter wide domes that form the tops and bottoms of tanks employed by modern rocket-launched vehicles.

Boeing's Delta 4 Heavy-Lift Vehicle

NASA's Orion Spacecraft

At first blush, *Spincraft* appears to be just another metal finishing plant, with basic machining and heat-treatment capabilities. But the scale of what they produce is what sets them apart from any would-be competition. *Basic* is hardly the word to describe

their operation.

Business Development Manager for Space Systems, Pete Awad, explained that *Spincraft* has been an integral part of America's space program dating back to the days of the Titan IV Launch Vehicle program in the 90's. As project leaders in that program moved on to leadership positions in other companies, they took with them a special positive relationship that had been developed with *Spincraft*. These relationships, coupled with the technical savvy of *Spincraft's* production team, help produce major components for modern rocket-launched space vehicles that are both lightweight and provide complete structural integrity.

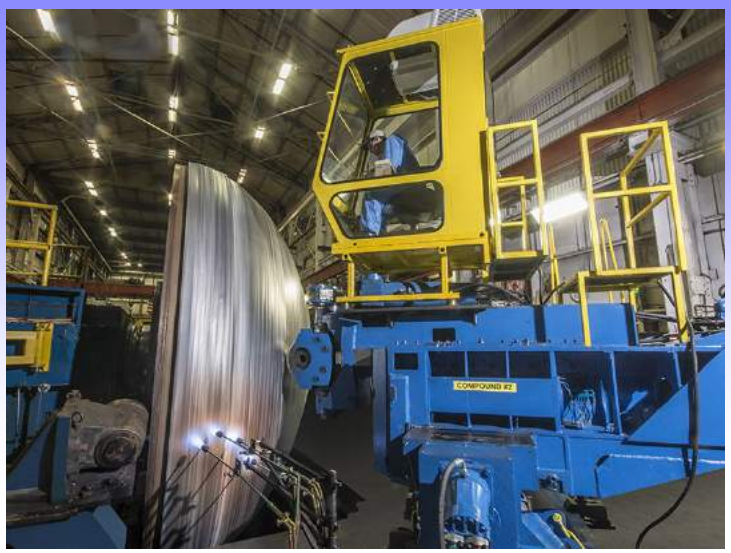
Spincraft manufactures internal bulkheads for United Launch Alliance's (*ULA: a 50/50 joint venture of Lockheed Martin and Boeing*) Delta IV rocket. These bulkheads make up both ends of the enormous fuel cells. Consisting of a single piece of metal that is void of welds, these metal parts are able to withstand the enormous pressures and immense vibrations that accompany the launch of heavy-lift space vehicles.

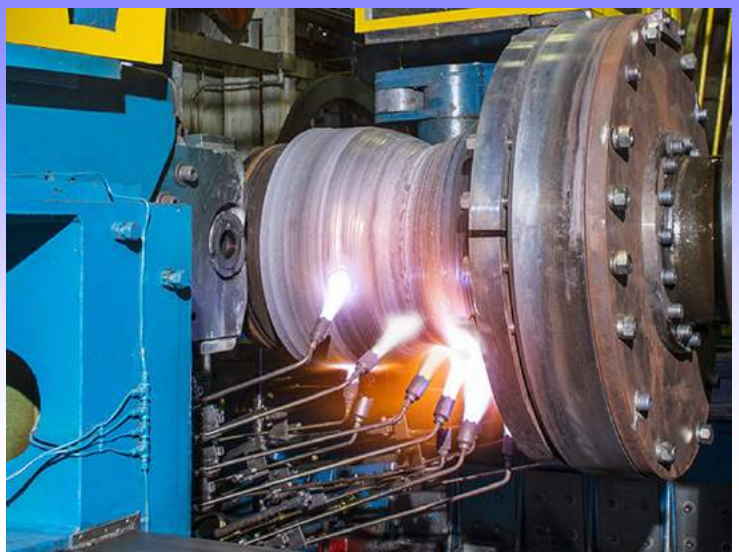
In NASA's *Orion Deep Space Exploration Vehicle*, there is a curved dome of metal that stands between the heat shield and the astronaut's crew quarters. It is sixteen-and-half-feet in diameter and comprises one of the layers that stand between the astronauts and the heat shield. During Orion's re-entry to earth,

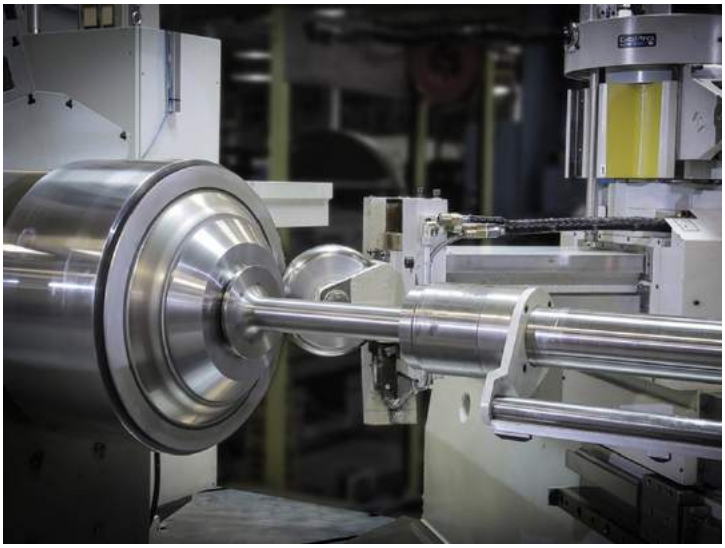
when temperatures reach 27,000 degrees Fahrenheit, the heat shield literally melts away at a predictable rate, with metal bulkheads remaining intact to protect the human occupants inside. Any burrs or flaws in the supporting structures of the shield would cause erratic and irregular melting, hotspots, and ultimate disaster for the astronauts.

The precision needed to create a metal dome for such a craft must meet not only the exact dimensions specified, but must be formed from a single piece of metal being spun down to a small thickness. It must weigh a precise amount, and this kind of precision can be achieved only by employing *Spincraft's* proprietary technologies.

Heavy plates of metal are placed on giant lathes. Utilizing both operator directed and computer-driven equipment,



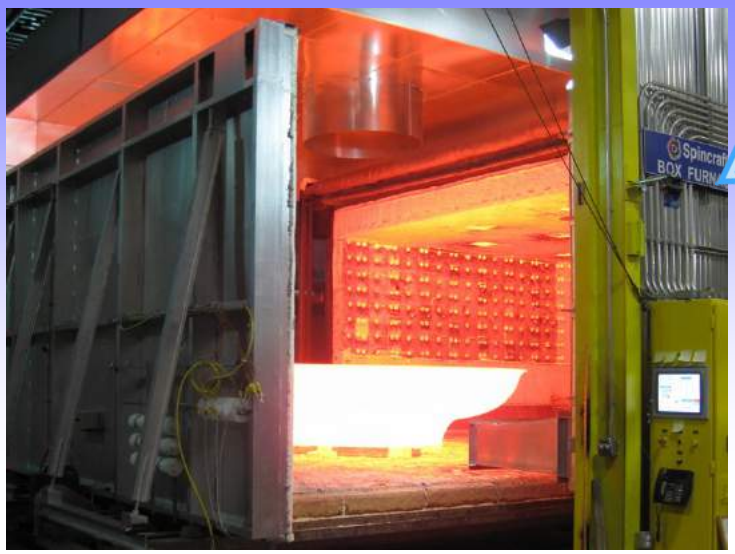




the metal is turned down onto mandrels that help form its ultimate shape. Excess materials are removed and the dome structure takes shape.

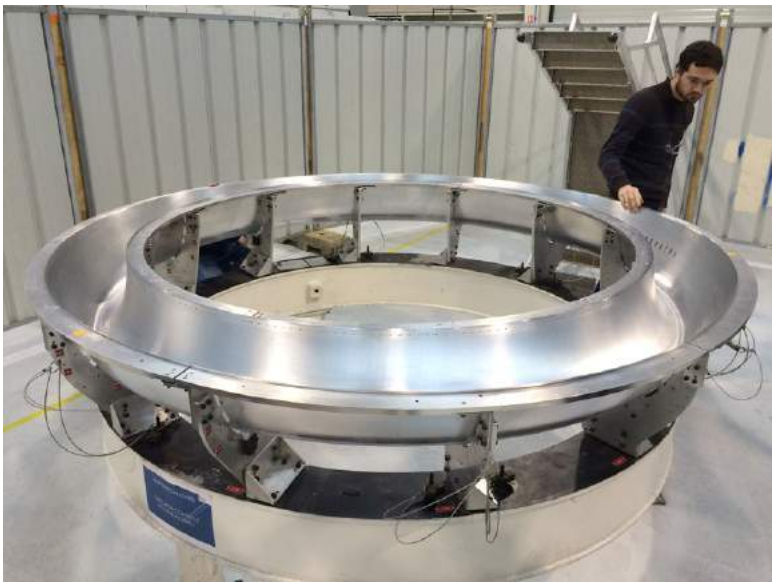
Some of the giant domes used as bulkheads in pressurized fuel and oxidation tanks of rockets require small ports to be situated in specific locations that allow delivery of the fuel and oxidizers to the rocket engine below. These ports must be incorporated into the dome in exacting ways, making certain that the immense pressure within the tank above does not dislodge the conduit used to convey the fuel.

Many of the *Spincraft's* creations require a fine finish; a



2,592 Cubic-foot oven capable of producing 2,300°F

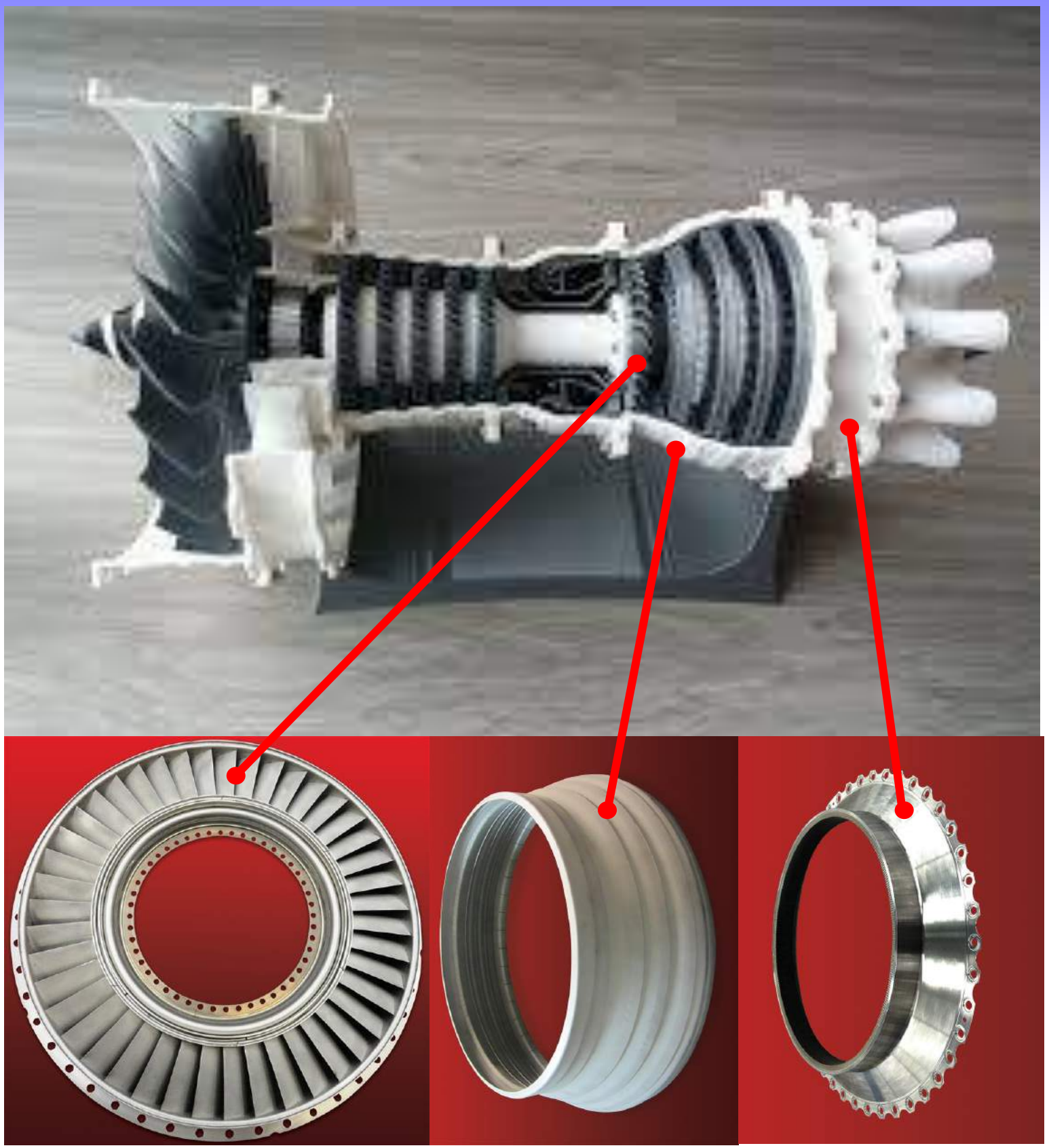
virtual mirror-like shine. Anything used on the outside of an aircraft or spacecraft that would create wind-resistance needs to be as smooth as possible. Such finishes take time and effort in order to make each of them perfect.



NASA's *Orion* spacecraft's bulkhead, and the pressurized tanks for the Delta IV rockets, are not all that *Spincraft* has to offer the space industry. The familiar bell-housing that forms the basic structure of a rocket engine is routinely made from a single piece of metal, spun in two directions to create both the convergence taper and the thrust chamber. The narrow taper of metal between the initial combustion chamber and the thrust chamber is where a river of hot gas passes through. It is this burning gas, moving at high speeds, that produces the thrust of the engine. Each rocket engine has specific dimensions, which is what ultimately determines the amount of thrust it generates.

Rocket engines and spacecraft bulkheads are not the only metal parts that need to be made from single plates of metal. Modern jet engines

Rocket engine thrust nozzle requires metal being turned to exact dimensions in both directions, and to be a specific uniform thickness



Spincraft provides internal parts spun down to specifications from single ingots of metal, heat treated, hardened, then finished into the internal parts of the Pratt & Whitney PW1100G-JM series jet engines used on Airbus A320 aircraft. Each part must endure higher compression ratios and temperatures in order to burn fuel more efficiently and offer one of the greenest jet engines on the market.

have many parts that need to be constructed to close-tolerance specifications. Although created in the same fashion as giant domes used in spacecraft, these smaller parts require the same demanding standards. Internal engine parts need to withstand extremely high temperatures and pressures, while the external *lipskin*, that is the leading edge of a jet engine, must be thin enough to be lightweight, while strong enough to withstand bird strikes, hailstones, and any other debris that it might encounter in flight. The leading edge of the nacelle must be perfectly smooth in order to facilitate efficient air intake, and to allow efficient airflow both inside and outside of that engine.

On the exterior of modern jets, it is possible to discover some of *Spincraft's* most unusual handiwork. What sets their work apart from any potential competition is that the lipskins they produce aren't necessarily perfectly round. The intake profile on many jet engines is actually elliptical, which compounds the manufacturing process. Not only must the part be comprised of a single metal piece, it must be shaped perfectly to align with the engine housing in order to present the minimum amount of surface area so as not to reduce the airspeed of the aircraft.

While the metallurgy involved at *Spincraft* is somewhat commonplace, it is trade secrets that protect the modern alchemy employed there, and the methods that have transformed spinning metal with small lathes onto the giant computer-driven monster machines they use today. What was once a form of hand-craftsmanship, used to fashion lamp bases and other ornamental items, has evolved into a high-tech major industry that furnishes the broader aerospace world with possibilities never before imagined. *Spincraft* is poised to set new standards in both aviation and space technology, while providing their customers safe and reasonably-priced alternatives for ever-increasingly efficiency, and it is another unique Massachusetts company that is contributing enormously to a global aerospace industry.

Revisiting Berlin and Pan Am's IGS

By Mary Lou Bigelow

One of the perquisites of working for an airline was the discounted vacation travel we enjoyed on the airline's dime. On one such trip, my mother Winona Moore, joined me on a whirlwind tour of Europe back in 1963. We both especially looked forward to seeing Berlin.

"Technicolor to black and white" flashed through my mind as mother Winona Moore and I entered East Berlin from West Berlin through the American border crossing known as "Checkpoint Charlie." It was a dismal March day in 1963. Winona later noted in her diary, "*Hardly any cars in sight. People were dressed warmly but poorly. The city had a grey cast with no lights, signs or color.*" Yes, it was a sad contrast to the bright lights and gaiety of West Berlin, but oh how it has changed since my stewardess days in the 1960s with Pan American World Airways!

In May of this year, I traveled back to Berlin for a Pan Am reunion dubbed *IGS 17*, and thrilled as my two hour Spree River boat cruise unveiled the exciting, bustling, modern Berlin of today.

A visit to "*Checkpoint Charlie*" and the Wall Museum brought back so many memories. But as I gazed up *Friedrichstrasse* into the former Eastern sector, what I saw was anything but the once sad, rundown street. It is now a gleaming boulevard with huge modern glass buildings. Gone were the horse drawn buggies of the Cold War era, replaced by Mercedes speeding by in their place.

We were there to celebrate Pan American pilots and crews, who flew the *Internal German Service* (IGS) connecting the then-isolated West Berlin people to the outside world, and providing essential supplies to West Germany. Pan Am's *IGS* was a nuclear cell all its own. It was the airline's, "cash cow," says IGS Captain Don Cooper who chaired the Berlin reunion. The stories abound of the crews who flew these exacting, harrowing flights through the tight American air corridor. Often referred to as the "*Black Sheep*" of the airline. These pilots were actually envied by those who yearned to take part in this

unique *"fly by the seat of your pants"* operation that initially used DC-4s, and later B727/737s from 1950 to 1990.

The late Pan Am Captain Jack O. Bennett flew more than any other pilot during the US-led Berlin Airlift out of Tempelhof 1948-1949. American Overseas Airlines was purchased in 1950 by Pan Am and he continued flying the American air corridor until he retired in 1974. His Pan American uniform, including hat and wings (though described in the display as his air force uniform), is displayed in an enclosed glass case at the Wall Museum.

The opening reunion event featured a welcome by former Mayor of West Berlin Eberhard Diepgen (1984-1989) who continued as mayor for the reunited Berlin (1990 to 2001). This was a fitting surprise for the Pan Am group as the mayor was in office during the last days of the Berlin operation, before Pan Am sold its IGS service to Lufthansa in 1990. The American Chargé d'Affaires Kent Logsdon also spoke to the 450 plus Pan Amers during the opening event.

A highlight of the trip was Ed Trippe, youngest son of Pan Am's founder Juan Terry Trippe, along with wife Bobbie, reading recently discovered love letters between Juan and Betty Trippe. These enlightening letters gave us a totally fresh look into the personality of this brilliant, stubborn, but quiet aviation pioneer who, with the guidance of Charles Lindbergh, opened up Latin American routes, and then the Pacific and Atlantic to long range international air travel. Pan Am flight attendant, author and historian, Becky Sprecher, gave a synopsis of Pan Am's history and final days. There wasn't a dry eye in the room, as the audience reflected on that dismal day Dec 4, 1991 when Pan Am was suddenly forced to shut down its operations.

May history continue to honor Pan Am, the iconic international carrier that opened up so much of the world for so many, proudly carrying the flag of the United States of America.

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*Mary Lou Bigelow was a stewardess-purser from 1962 to 1964 in the Atlantic Division, JFK base and reservations, and CTO 1965-1968 in Miami. She lived in Kabul, Afghanistan from 1968 to 1972, and Kinshasa, Republic of Zaire from 1974 to 1975 on Pan Am's Technical Assistance Programs. Her 11-minute video "*A Pan Am Memoir 1962-1964*" is available on Youtube. See her website and blog at:*

www.maryloubigelow.com/tv

MASM Collection of Artifacts is Growing!

Massachusetts Air and Space Museum

Recent donations to the Massachusetts Air and Space Museum include a Springfield Aircraft Corporation ¾" lapel pin from the estate of Josephine Small, a Springfield resident born in 1885.

The Springfield Aircraft Corporation was organized on September 27, 1917 specifically to manufacture training aircraft for the U.S. Army Signal Corps, Aviation Section. With the cooperation of the Wason Manufacturing Company, builders of railway cars and streetcars, Springfield was able to lease 200,000 square feet of floor space for the wartime production of aircraft for the U.S. Government. During the war the workforce grew to 1,050 employees and production capacity was five to eight aircraft per day. Springfield Aircraft Corporation's principle offices and production center were at Wason Car Shops on Wason and Brightwood Streets, North End, Springfield, MA. Aeroplane flight testing occurred at a leased temporary flying field in West Springfield.

MASM Collectionof Artifacts is Growing!

Another addition to the collection includes 70 Massachusetts aviation slides from the estate of Paul M. Paulsen. Mr. Paulsen was an avid photographer and served as an official photographer with the Massachusetts Air National Guard in East Boston (now Logan Airport) and Otis Air Base in Barnstable County, MA.

The Massachusetts Air and Space Museum welcomes donations of artifacts, memorabilia and objects of significance to Massachusetts aviation and aerospace. We encourage monetary donations of any size as we strive to build the museum.

If you have an item that you would like to donate to the Massachusetts Air and Space Museum, please contact:

Barbara Jagla,
Collections Manager
bjagla@massairspace.org

Massachusetts Air and Space Museum

Mobile Museum Comes to Hanscom

MASM installed its portable museum exhibition case into the lobby of the new Jet Aviation Executive Terminal at Hanscom Airport. MASM Chairman of the Board Joe Dini and President Robert Segal oversaw the installation on October 18th. The display's content consists of the following MASM artifacts:

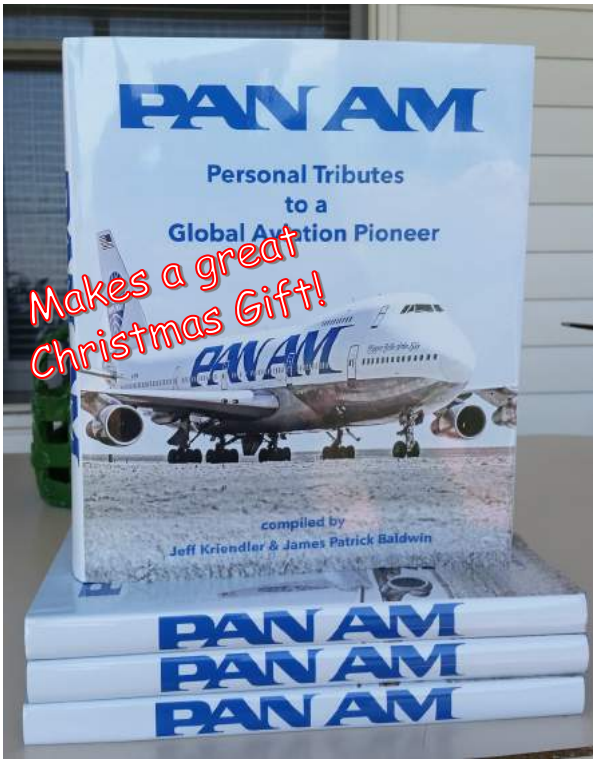
- An F-15 fighter pilots helmet and oxygen system
- A part of the Drop Physics Module, a component of the United States Microgravity Laboratory created by Boston University, that was carried into orbit by the Space Shuttle Columbia in the fall of 1995. Mission Specialists Kathryn C. Thornton and Catherine "Cady" Coleman used the equipment to make sound waves manipulate spinning droplets of silicon oil until they split.
- A BOSE Corporation A20 Aviation Headset
- David Clark Company DC Pro-X Aviation Headset

Additionally there are two wall graphics; one relating the history of Hanscom Field, and the other telling about the MASM Mission. MASM appreciates this opportunity to tell visitors at Jet Aviation about the Museum and its goals.

Pan Am, Personal Tributes …

by Mary Lou Bigelow

Once in a while, a book strikes a chord with commercial aviation enthusiasts. *Pan Am, Personal Tributes to a Global Aviation Pioneer,* compiled this year by Jeffrey Kriendler and James Patrick Baldwin for the Pan Am Historical Foundation, is such a book, commemorating the 90th anniversary of the founding of Pan Am in 1927. It tells the iconic airline's history through the eyes of those who worked it and traveled on it. You will read accounts by Ed Trippe, the youngest son of founder Juan Terry Trippe; Sir Richard Branson, founder of the Virgin Group and Virgin Atlantic Airways; Bill Plante, CBS News Senior White House correspondent; Robert Hager, retired NBC correspondent; Pan Am presidents and CEOs; aviation museum directors; authors; flight crews and ground support. It's all here.



This gorgeous tabletop book, crammed with color photos and reasonable size print, takes you on a fascinating journey of the airline that launched the first scheduled passenger service across the Pacific in 1936 and the Atlantic in 1939.

Enjoy traveling through these pages from the flying boats to the ground breaking aircraft by Lockheed, McDonnell Douglas to the 1960's and 1970's with the extraordinary jet leader *Boeing Company* and its 707, 727, 737 and "Queen of the Skies" 747 to the beginning of the Airbus phenomenon. You will read about World War II, Korean War and Viet Nam support flights, press charters, Berlin Internal German Service, Intercontinental Hotels and Pan Am's Technical Assistance Programs (TAP) to airlines around the world. (*MASM steering committee member Mary Lou Bigelow tells of her experience living in Afghanistan on a TAP assignment from 1968 to 1972.)* You will experience the glory days and disasters days - until Pan Am's unfortunate early demise in 1991.

Cover price is $65. **Take advantage of the special holiday price until Dec. 31, 2017 of $35 each or $30 each for five books or more.**

(For International mailing, add $50 mailing fee)

Mail with check payable to **Pan Am Historical Foundation** or credit card information to:
c/o Jeffrey Kriendler, 5600 Collins Ave #17N, Miami Beach, FL 33140. Email: jkriendler@aol.com

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Editor: Paul D. Bagley, *esq*.— paul@berkshirecottage.com

Join Us Today!

The Massachusetts Air and Space Museum will soon come to life in Bedford, Massachusetts at historic Hanscom Field. Your help is needed to turn this vision into reality. Send your tax-deductible contribution to:

Massachusetts Air and Space Museum 200 Hanscom Drive Bedford, Massachusetts 01730.

Complete the form below and include it with your contribution to get on our mailing list. Your donation of $25.00 or more will automatically enroll you as a Member of MASM with the benefits as outlined on our web site. You will receive our electronic newsletter "Horizons" which will be emailed to friends of the museum free of charge. This publication is informative and interactive, and online you will find links that will connect

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- SR-71 L.A. SPEED STORY
- Conspiracy Theory?
- Spinning Metal Parts
- *Boeing's* Delta IV Rocket launch
- APOLLO ON STEROIDS!
- Patriot's Twin 767s
- MARS 2017
- *Gravity Plane*
- Helicopter Landing in Rough Seas