



CONTRAILS



Volume 9 Issue 4

“Information for and about Volunteers”

Winter 2006

FROM THE EXECUTIVE DIRECTOR

Daniel J. Ryan

Like many of you in the volunteer corps, I have had the opportunity to visit most of the large Air & Space Museums in the United States. During these “audits” I pay very close attention to many details including how the buildings, aircraft, and exhibits are maintained. I also look for signage, outdoor advertising, pricing, special features, retail operations, and the overall cleanliness of the facility. I also spend extra time in observing the friendliness, professionalism, and quality of customer service provided by the staff.



These are all very important factors in how visitors perceive the individual museum. They also influence each visitor’s first and last impressions upon their departure. This weighs heavily into the potential for positive word-of-mouth feedback from departing visitors to their friends, family, and others. You can feature a National Historic Landmark like the Titan Missile Museum, provide a bus tour as DOD Contractor to AMARC, highlight a one hour tram tour of PASM, or have a great collection of aircraft, exhibits, and artifacts. But, none of this guarantees excellence, success, or growth for the organization.

What separates our Museums and the Challenger Learning Center of the Southwest from so many other institutions not only locally, but also across the country, is the visitor experience provided by our volunteer corps. I have entered other museums and been greeted by volunteers whose backs were turned to arriving visitors. I have departed other museums where I’ve passed volunteers who were too engaged in their own conversation to acknowledge me or thank me for visiting.

I am proud to say that we have one of the finest volunteer corps that I have experienced in the museum world. As we approach this holiday season, allow me to tell you all how much I appreciate what you do for this Foundation today, but also thank you for the lasting impression that your efforts will leave on our Museums for future growth and expansion. Have a happy and healthy holiday season and I’ll see you on the grounds.

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**B-36 Pictures
by Stan Miller**

TMM DIRECTOR'S CORNER

By Yvonne Morris



Greetings from Down Under—down under at the Titan Missile Museum, that is.

NEW VOLUNTEERS AT TITAN

Please join me in welcoming **Bill Beauvais, Bill Crossley, Dave Druml, and Chuck Winkenwerder** to the Titan volunteer corps. **Bill Beauvias, Dave and Chuck** are training as Docents. **Bill Crossley** is training as a Briefer. Please take a moment to introduce yourselves and welcome them to Titan when you see them.

TITAN MISSILE MUSEUM VOLUNTEERS OF THE MONTH

The Volunteers of the Month for September, October and November of 2006 at TMM are as follows:

September: Harry Synovetz. Harry is one of our Sunday afternoon Docents. He's still working full time, so many of us never see him unless we're here on Sunday afternoons. But he gives a great tour, and he also worked very hard to get some spare parts for us for the TV camera in the entrapment area. It didn't pan out, but it wasn't for lack of effort. Thanks for everything you do Harry, and congratulations!

October: Jim Schultz. Jim is an Instructor Docent who gives a lot of his time to the museum. This summer when he went on vacation, Jim not only found someone to fill all of his shifts while he was gone, he signed up for extra shifts when he got back. Jim epitomizes the team spirit that defines our volunteer corps. Thanks Jim, and congratulations!

November: Merle Jones. Merle Jones has been a Docent at Titan since October of 1987.

Part of Carl Immel's original Thursday morning gang, Merle has contributed more than 3,700 hours to the Foundation. Merle is a quiet guy and in a crowded room he might not stand out. But that all changes when he's giving a tour. Merle uses his wry sense of humor to put his visitors at ease and make them feel like they are getting a special tour. All in all, Merle gives a great tour, and he is a fan favorite of our visitors. Thanks Merle, and congratulations!

MILESTONES

Denny Mart:	250 Hours
Bill Naskoviak:	500 Hours
Woody Woods:	500 Hours
Robert Flemming:	500 Hours
Don Bush:	500 Hours
Calvin Tidwell:	750 Hours
Tim Brown:	1000 Hours
Ed Smith:	1000 Hours
George Birch:	1500 Hours
Jim Schultz:	1500 Hours
Jim McMillan:	3000 hours
Bob Williams:	4000 Hours
Ralph Hoemke	5000 hours

Congratulations! (Note: I think many of you are aware by now that the Foundation web site was attacked by hackers. When this happened, some volunteers and volunteer hours disappeared from the data base. Please bear with us for the next 30 days as Brook Sims works to correct this problem. If your name is not on the volunteer sign-in sheet, please add it at the end of the list. Brook will make sure that you get added back into the system. Also, if you have given your social security number to the Foundation for any reason, rest assured that these numbers were not put at risk by the hackers. None of your social security numbers are part of the volunteer data base.)

WHITE ELEPHANT PARADE COMMITTEE

Len Defendorf and the **White Elephant Parade Committee** members did just an

outstanding job on the parade float. Please take a moment to thank Len for chairing the committee, and to thank **Len, Jim McMillan, Larry Kistler, Dave Weeks, Sue Hein and Sandy Johnson** for their great work. They did a marvelous job representing the museum. Thanks for a job well done!



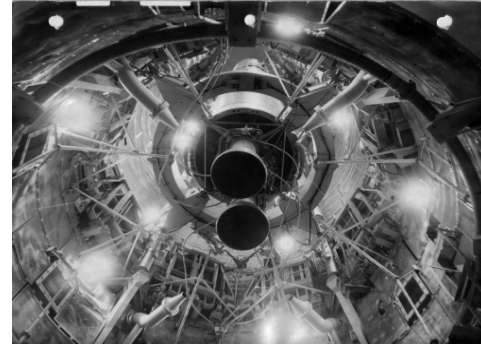
ARCHIVE REVEALS HIDDEN SECRETS

Thanks in large part to a gift from the Charles Simonyi Fund for Arts and Sciences, the Museum was able to hire a part-time Archivist this year, and we are already reaping the benefits. Assistant Archivist **Chuck Penson** is uncovering hidden gems on a weekly basis, including one-of-a-kind photographs like this one,



which is the only known photograph of the pitch rockets in place on the Titan II's Re-entry Vehicle (located over the shoulder of the man on the far right).

This “up the kilt” shot shows an active Titan II from the bottom, up.



It was taken from the deflector at the bottom of the launch duct. To date, Chuck has catalogued more than 3000 items in the archive, including more than 2500 photographs. He has much more work to do, though, since the museum houses the largest collection of Titan II documents and artifacts in the world.

MUSEUM GETS NEW HANDICAPPED ACCESS RAMP AND OTHER SITE IMPROVEMENTS

November was an exciting month at Titan. By now you should have all seen the new monument sign on Duval Mine Road.



It's really striking, and we're getting some great compliments from the public.

You'll also see that we covered the area in front of the museum with gravel and river rock to address some erosion problems we have out there. The rock was donated by Green Valley Decorative Rock. They gave us 9 cubic yards of Apache Red gravel and 6 cubic yards of river rock. Including delivery, this translates into a donation of close to \$650. Acquiring the rock was just part of the project, though. I want to thank the volunteers who worked so hard to help our maintenance staff complete the task of spreading the rock in just 3 days: **Lathan**

Varnado, Calvin Tidwell, Dave Druml, Jim McMillan, Norm Goetz, Cliff Sonberg and Chuck Smith.



You all did a fantastic job, as we can see by the end result.



I also want to give a special thank you to Lathan. He identified the erosion problems, and then designed a solution, including getting cost estimates and determining how much rock we'd need. He created a master rock deployment plan, and then supervised the deployment.

Great job everyone!

Finally, we're addressing a challenge that's been with the museum since it opened in 1986. Our visitors who are confined to wheelchairs have long missed one of the most thrilling sites at the museum—the view of the missile from above on the silo viewing platform. No longer will this be true! Construction of a handicapped access ramp to the silo viewing platform is almost complete.



The ramp includes a raised platform that will place our wheelchair visitors at just the right height to get a spectacular look at the missile in the launch duct. Thanks for your patience while the platform was under construction.

DOCENT TRAINING

Our next Docent training session will take place in December. The theme of this training is "Good facts plus good presentation make a good tour." The training is divided into three parts, and it is mandatory for all Docents. Part I, the classroom session, will be offered 4 times, so everyone should be able to pick a session that they can attend. **The dates are: December 4 at 2pm; December 7 at 10am; December 12 at 2pm; and December 15 at 10am. Signup sheets are on the board in the volunteer lounge.** Please sign up for your session. If you're one of the Docents who commutes from the Phoenix area, we'll work with you individually to get this training on one of your regular days at the museum. If anyone else has a problem with making one of these dates, you must see Yvonne by December 4.

Depending on the number of questions and the discussions that develop, Part I will last 90 minutes to 2 hours. The focus of the classroom session will be on communicating with our visitors. It will include some tips on how different age groups hear, perceive, and learn. Additionally, it will include some interesting results from a survey conducted by museum staff of what people remember most about the tour. These results may really surprise you.

Part II of the training requires that each Docent observe another Docent (that you don't usually

work with) giving the tour, and you'll have until January 30, 2007 to complete this part of the training. There are some really great tours being given by our Docents. All of you have your strengths, and this part of the training is designed to spread these strengths around. There is something we can learn from every Docent who volunteers here, and that is the object of this part of the training. In the future, this will be a regular yearly requirement just like the annual certification.

Part III of the training will be ongoing, and it will address the bad facts/habits that have crept into our tours. The Academic Review Panel has developed a list of "bad facts" that we hear most often. Periodically, a few of these bad facts will be posted on the bulletin board. We'll give you the "bad fact" and the reason it's "bad," and then the "good fact" that you should be using instead.

If you have any questions about this training session, please see Yvonne.

DOCENTS NEEDED

Some things never change. We're still recruiting Docents. Only now, we're recruiting Tour Docents and Education Docents. If you know anyone who might be interested in volunteering at Titan, please let Yvonne know. We are facing a critical docent shortage, as many of you are discovering on your shifts. Also, as many of you are discovering, it's no fun to be short handed. I appreciate all you've done to fill the empty slots, and I know you'll continue to do everything you can to assist your fellow volunteers in the busy times ahead.

VOLUNTEER MEETING

The next Volunteer Meeting at Titan will be January 9, 2007, at 0800 hours in the classroom. There will be door prizes, so you don't want to miss this meeting!!!

PASM COORDINATOR'S CORNER

By Brook Sims



Holiday Party –

Our annual Staff/Volunteer Holiday Party is being held in H4 on Wednesday, December 6th from (5:30 to 9:00 p.m.). The museum will be handling the drinks, main dishes, and music. We are asking those who attend to bring a dish to share, if your last name starts with (A-G) that you bring a dessert, (H-O) bring a salad, and (P-Z) bring a side dish or vegetable. For those of you who may be bringing a hot dish we have aluminum pans to give to you so that they may be placed in our chaffing dishes to keep warm. Please check with Brook as she has them in the Blue Trailer. Also, please check in with Brook if you are planning on bringing your own crock pot or heating device, as we will need to make sure there is enough power. We will be enjoying the music of Shadz Swing Band, who have donated their time and services to us for the evening. So please be sure to bring your dancing shoes, so you can fully enjoy the music. We are accepting RSVP's up until Wednesday, November 29th, so be sure to get your name on a list. You may sign up with either Yvonne at TMM, John Lundquist at PASM's Administration Office, or Brook in the Volunteer Trailer. **See you there!**

Thank you for our Sidewalk –

We owe Cemex a big thank you for donating their time, hard work, and cement for our Volunteer Area sidewalks. Reed Bearbower, our Facilities Manager, is also responsible as he was the one who inquired about the cement with Cemex and got it donated. And we can't forget to thank the employees of Avent/Kimberly Clark and Tucson Newspapers who put in a hard day's work for this project as part of United Way's Days of Caring. Thank you to everyone who was involved and please stop by and take a look at our new sidewalks.

Volunteer Presentation Series –

The schedule is as follows:

December 16th, Bud Daniel presents
“Experiences of the South
Pacific along with a Tribute to
a Fallen Hero”

January 20, Gail Halvorsen presents “Candy
Bombing in the C-54 Skymaster”

February 24, John Miller presents “Advanced
Tactical Fighter Competition &
the F-22’s Selection”

March 17, Tom Howard & Larry Monroe
present “P-3 Orion Aircraft and Anti
Submarine Warfare”

April 21, Rick Laws presents “The EF-111”

May 19th, Bill Earle presents “What is a DE?”

We are still in need of presenters for 2007. We would enjoy hosting our own volunteers and their experiences, but we also invite friends or family members of volunteers to present as well. Please contact Brook Sims at 618-4819 if you are interested or available. Brook is available to assist with minor audiovisual issues, as well as PowerPoint presentations.

Meet Our NEW PASM Volunteers

Welcome the new volunteers who have joined the PASM family since the last Contrails issue.

**Adam Bridges, Bob Brunson, Heather Elftman,
Donna & Gary Gardner, George Hackstadt,
Pat Johnson, Shane Jones, Daniel Shay**

PASM SERVICE AWARDS

Congratulations to the following volunteers who have earned milestone badge awards since the last *Contrails*:

250 Hours

**Pam Asbury-Smith, Brigitte Howells,
Art Kidder, Royal Heemeier,
Randy Scott**

500 Hours

**George Nicholls, Dave Jester,
Al Mosher, John Edris, Jim Dahl**

750 Hours

**Ken Moyes, Dick Casey, Ray Hovis,
Richard Cary, Al Horne**

1,000 Hours

**Glenn Carlson, Les Powell,
Frank Fuqua, Steve Holt**

1,500 Hours

**Fred Hudson, John Moffitt,
M. Stuart Anderson, Charles Hubbard,
Richard Peterson**

2,000 Hours

Dick Brown

3,000 Hours

Bill Earle

4,000 Hours

Ed Cullen, Ted Memmel

5,000 Hours

Ed Grant

6,000 Hours

Tom Bohan

11,000 Hours

Bill McGuire

Active at Both Museums

Wes Whitman – 1,420

Rex Eaton – 691.5

Dave Cook – 1,889.5

Bill Luikart - 165

PASM Calendar:

The following meetings and events are scheduled for the coming months. Call the Museum Scheduler (618-4800) or the Volunteer Coordinator (618-4819) for information or details. *Dates and times are subject to change.*

PASM Calendar:

- 12/06 Volunteer Holiday Party (PASM) 5:30 to 9:00
- 12/09 New Volunteer Orientation (9:00 a.m., Stitt)
- 12/16 Hanukkah
- 12/16 Volunteer Presentation Series (10:00 a.m., Stitt)
- 12/18 Team Leaders Meeting (9:00 a.m., Stitt) – change in date due to Holiday
- 12/25 Christmas
Museums are CLOSED
- 12/31 New Year’s Eve

- 1/01 New Year’s Day
- 1/10 All Hands Mtg. (10:00 a.m. Stitt)
- 1/13 New Volunteer Orientation (9:00 a.m., Stitt)
- 1/15 Martin Luther King, Jr. Day (Admin. Closed)
- 1/20 Volunteer Presentation Series (10:00 a.m., Stitt)
- 1/29 Team Leaders Meeting (9:00 a.m., Stitt)

- 2/10 New Volunteer Orientation (9:00 a.m., Stitt)
- 2/14 Valentine’s Day
All Hands Mtg. (10:00 a.m. Stitt)
- 2/19 Presidents’ Day (Admin Closed)
- 2/24 Volunteer Presentation Series (10:00 a.m., Stitt) – Note change of date
- 2/26 Team Leaders Meeting (9:00 a.m., Stitt)

- 3/10 New Volunteer Orientation (9:00 a.m., Stitt)
- 3/14 All Hands Mtg.

- (10:00 a.m. Stitt)
- 3/17 Volunteer Presentation Series (10:00 a.m., Stitt)
- 3/26 Team Leaders Meeting (9:00 a.m., Stitt)

Volunteers of the Month...

September—Marty Kalish

October—Richard Peterson

November—Dave Jester

December—Dick Lockart

Need for Donations:

- **Golf Cart for (8-10)**
- **Poster Frames**
- **Plant Hanger**



Volunteer Orientation Statistics –

This table shows the statistics on the attendance of New Volunteer Orientation for both the Titan Missile Museum and Pima Air and Space Museum (combined) from January 2005 until November 2006 (the vertical axis of the table). The column marked **Attended** is the total number of people who attended the orientation. The column marked **Completed** is the number of attendees who finished the requirements of orientation and returned to join the Foundation as a volunteer. The column marked **Vol. Today** represents those who attended orientation, finished the requirements of orientation, returned to join the Foundation as a volunteer, and were still volunteering as of November 2006. The column marked **% Return** represents the percentage associated with those who attended orientation, finished the requirements of orientation and returned to join the Foundation as a volunteer. The final column marked **% Still Vols.** represents the percentage of the volunteers who attended orientation, finished the requirements of orientation, returned to join the Foundation as a volunteer and are still volunteering for one of the museums today.

If you have any questions regarding this data, please feel free to stop by and talk with Brook.

Month	Attended	Completed	Vol. Today	% Return	% Still Vols.
Jan 2005	13	8	4	61.5	50.0
Feb 2005	11	6	4	54.5	66.7
Mar 2005	No data	No data	No data	No data	No data
Apr 2005	9	5	3	55.6	60.0
May 2005	9	6	5	66.7	83.3
Jun 2005	No data	No data	No data	No data	No data
Jul 2005	11	5	2	45.5	40.0
Aug 2005	7	4	2	57.1	50.0
Sep 2005	12	6	5	50.0	83.3
Oct 2005	7	3	3	42.9	100.0
Nov 2005	8	5	5	62.5	100.0
Dec 2005	7	3	3	42.9	100.0
Jan 2006	18	11	8	61.1	72.7
Feb 2006	12	6	6	50.0	100.0
Mar 2006	10	4	4	40.0	100.0
Apr 2006	7	4	3	57.1	75.0
May 2006	10	3	3	30.0	100.0
Jun 2006	6	2	2	33.3	100.0
Jul 2006	16	9	9	56.3	100.0
Aug 2006	9	3	3	33.3	100.0
Sep 2006	10	4	4	40.0	100.0
Oct 2006	8	3	3	37.5	100.0
Nov 2006	4	3	3	75.0	100.0



.Sir Frank Whittle: The Jet Age Arrives

By Joe Pacholec

The Whittle Unit (WU) test engine which first ran on April 12, 1937 was damaged beyond repair by a turbine failure on Feb. 22, 1941. During this time it was rebuilt several times as new innovations came along to address the many problems encountered. The single combustion chamber was replaced with multiple chambers having interconnecting tubes which would light off from its neighbor and this required only one chamber to have an ignition source. Combustion problems ceased to be an obstacle to development in 1940 with the introduction of a system designed by Shell engineers where fuel was injected in a fine mist of liquid droplets through a controllable atomizing burner. New materials were developed which would be more capable of withstanding the high temperatures and stresses imposed by the engine. Perhaps the most significant contribution that the WU test engine runs had was to convince many skeptics that this was the aircraft engine of the future.

With the outbreak of war in Sept. 1939, the project got a new lease on life. The Air Ministry commissioned a more powerful W-2 engine from Power Jets, and asked the Gloster Aircraft Company for an experimental airplane, specified as the E 28/39. Vague references began to materialize that the Germans had several jet engine projects under development. In fact, the world's first turbojet powered aircraft had flown on Aug. 27, 1939. It was the Heinkel He-178 powered by the HeS-3b engine designed by Hans von Ohain.

With finances more secure, Whittle turned his attention to the W.1 and W.2 engines. The W.1 was a refinement of the WU and the W.2 was to be a 2nd generation turbojet, significantly more advanced than the W.1. Relations with BTH deteriorated as the company took the view that the jet engine would not compare favorably with conventional power plants. The future of Power Jets became uncertain and the politics of possible participation by the Rover motor car company became a reality. In early 1940, the government bypassed Power Jets and offered shared production and development contracts direct to BTH and Rover. Power Jets was demoted to the level of a research organization. Matters worsened when the air ministry, eager to obtain an operational jet fighter, side stepped Whittle, ignoring the E 28/39 and authorized Gloster to go ahead with a twin engine jet interceptor specified as F 9/40. This was to become the Meteor. In addition, in 1941 the ministry's director of engine production was to agree to Rover alterations to Whittle's design with out him being aware.

Fortunately, on July 9 1941, Lord Beaverbrook, Minister of Aircraft Production, personally assured Whittle that the jet fighter would go ahead. Whittle was relieved by the reprieve, but agonized over the difficulties of getting his engine ready for flight. He smoked and drank heavily and was subject to bouts of depression. He had developed an explosive temper; he suffered from eczema, boils, insomnia, and palpitations; his weight had dropped to 126 pounds and he looked decades older than his 34 years. To drive himself through 16 hour workdays, he sniffed Benzedrine from a nasal inhaler. Then he took tranquilizers and sleeping pills so he could sleep through the night and rise the next morning and start again.

On May 15, 1941, Whittle saw his E 28/39 aircraft lift off the ground at Cranwell on its first flight powered by his W.1 engine. The first flight had lasted 17 minutes. When, Johnson, who had encouraged Whittle for so long, patted him on the back and said, "Frank, it flies," he replied, " well, that was what it was bloody well designed to do,

wasn't it?". The W.1 was cleared for short duration running at 17,000 rpm which produced 1000 lb of thrust and this allowed the aircraft to achieve a speed of 370 mph at 25,000 ft.

Details of Whittle's inventions were made available both in Britain and America. Rolls-Royce, de Havilland and Metropolitan-Vickers became involved. GE had been given some drawings and a complete W.1X engine so that they could build it under license in America. One year later, with help from Whittle, GE delivered the W.2 engines that powered Bell Aircraft's experimental XP-59A Airacomet, which first flew on Oct 2, 1942, beating the Meteor into the skies by five months.

In 1943, Rolls-Royce stepped in and took over work on the W.2B engine, which cleared the way for Whittle to plan improvements which would evolve as later mark numbers. Fearing that private industry would harvest the pioneering discoveries of Power Jets for nothing, Whittle suggested that it should be nationalized. He was taken up on it by Sir Stafford Cripps, the Minister of Aircraft Production, who imposed a price of 135,563 British Pounds and renamed the company Power Jets (Research & Development). Whittle received nothing, having earlier handed over his shares worth 47,000 British Pounds to the ministry.

The Meteor was the only allied jet to see operational service in WW 2 and was never involved in a jet versus jet battle. It saw service against V.1 flying bombs and carried out patrols and air to ground strafing, and proved to be a very reliable machine with good handling characteristics. In Oct. 1945, Whittle had flights in a Meteor I powered by W.2/700 engines designed and made by Power Jets, and a Meteor III with Rolls Royce Derwent I engines. He achieved a maximum speed of 450 mph in the Meteor III. When he told his son, his son said that he must be out of practice because Meteors were doing 600 mph. In fact, the 600 mph Meteors had much more powerful Derwent III engines. Later in life, he would fly much faster as a passenger in the Concorde, at over 1300 mph.

Whittle's poor health had him in and out of hospitals and during this time, Power Jets roll in jet engine design and development began to diminish. He stayed on at Power Jets until his resignation on Jan. 24, 1946. He accepted a post as Technical Adviser on engine Production and Design (Air) to the Controller (Air) at the Ministry of Supply. He again became ill, during an American lecture tour, and in 1948 retired from the RAF on medical grounds as an air commodore (equivalent to a U.S. brigadier general). Shortly afterwards he was awarded an ex-gratia sum of 100,000 British Pounds (\$400,000) by the Royal Commission on Awards to Inventors and was knighted.

After his retirement from the RAF, some people at that time regarded him as a spent man who had burnt himself out and would probably vanish from the scene content to spend the rest of his life in gentlemanly retirement, but this was far from the case. He became a technical advisor to many companies. He was also an author, consultant and lecturer. He traveled extensively and received many honors. He settled in America in 1976 and was a member of the Faculty of the Naval Academy, Annapolis Maryland. He passed away at the age of 89. For more information on this remarkable man, I would suggest reading, "Genesis of the Jet", by John Golley, which I used as a reference for this series of articles.

Materials Technology

By Earl Larsen

In the last issue of Contrails we presented our approach for detailed descriptions of each of the nine individual exhibits currently displayed in the Space Exploratorium. In the Fall issue we addressed the acquisition of the Moon Rock and its supporting historical documentation. We'll continue our coverage of the current Exhibitory with a very diverse display of model aircraft and space systems contained in an area entitled Materials Technology.

This exhibit can best be described as a half-century long opportunity to study and test materials best suited for unique flight regimes. As you glance around the display area in the far rear of the gallery, you will see 22 very high fidelity models of military and advanced national aerospace planes, 4 guided missile/ spacecraft systems, and a vast array of electrical/electronic systems. The common denominator for all these craft is the material from which all of these are comprised. For example, the history of material development for aircraft and spacecraft can be traced from the use of wood, to stainless steel, to aluminum often coated with gold, to titanium, to carbon composites. Without falling victim to the use of a "laundry list", a few interesting examples of materials well-suited for aircraft and spacecraft of their time are:

- 1) Application of aluminum honeycomb panels for the B – 58 Hustler, giving it maximum strength without adding weight.
- 2) The nickel alloy skin of the X-15, offering the best resistance to extremely high temperatures.
- 3) 94% titanium by weight for the SR-71, providing half the weight of steel, excellent anti-corrosion properties, and an extremely high melting point, 3240 degrees F. The fuselage, wings, and tail of the X-36 are carbon composites, as are the wings and leading edges of the Space Shuttle.

Insulating materials play an extremely important role in today's aerospace applications. Included are nylon cloth, glass fiber, phenolic resin (ballistic reentry capsules), graphite and beryllium shingles, and the very important silica fiber used in producing the tiles for the nose and underside of the Space Shuttle in order to withstand reentry temperatures as high as 2300 degrees F. An interesting newcomer to our exhibit is the aerogel display. It is a highly porous solid with the lowest density of any solid known, 99.8% air and 0.2% silica. It is the material used for the thermal insulation around the Mars rover and the Sojourner. I could go on describing many more modern

materials in our display but I believe you'd be more impressed by seeing them for yourselves. The accompanying signage is very detailed and presented in a manner which will hold your attention. Please stop by between tram rides or when your visitor traffic may be light, I think you'll enjoy your visit.

AMARC Team Report

By Bill McGuire

As of 1 November 2006, AMARC has a new team leader and that will be Tom Bohan and he will have 2 assistants who are Bill McGuire and Chuck Osborn.

Our present docents are: Al Frizelle, Bob Ratledge, Al Mosher, Stan Miller, Wayne Butler, Tom Howard, Ed Grant, Tom Bohan, Chuck Osborn, Bill McGuire, Frank Davidson and Keith Connelly. Our new additions are John Miller, Bob Robuck, Scott Anderson and Harvey Diesner.

This past summer (slow season) saw attendance rise about 20 %. October really picked up and starting October 30th we went to 3 tours per day. On 1 December we will go back to 2 tours per day (11:30 and 1:30) thru 20 December. On 21 & 22 December we will return to 3 per day (10:00-noon and 2:00). Starting 26 December we will run 4 tours per day at 10:00-11:30-1:30 and 3:00 and continuing 4 per day as long as attendance requires it.

We want to thank Brook Sims for handling the AMARC Team Leader position for the past year. With all her other jobs, she did wonderful filling in this position.



Report from Restoration

By Bob Strand

The Hawker Hurricane, WWII Fighter Workhorse of the R.A.F.

The Hawker Hurricane on display in Hangar 3 represents the first line of fighter air defense for England in the early years of World War II. Throughout the 1930s, the RAF was equipped with biplane fighters such as the Gloster Gladiator and the forerunner of the Hurricane, the Hawker Fury. These biplane fighters were easily out classed by the monoplane fighters emerging in the German air arsenal, the Messerschmitt Bf 109 and Bf 110.

The Hawker designer, Sidney Cam, developed the Hawker Fury biplane in 1931. It was the RAF's first fighter to exceed 200 mph. The Hurricane became a design extension of the Fury by basically removing the top wing and incorporating retractable landing gear and an enclosed cockpit. The Hurricane also retained the earlier fuselage tube construction known as the Warren truss. The fuselage, wings and tail surfaces were fabric covered. Contrast this with the Spitfire construction which used stressed metal skin throughout.

The engine that powered the Hurricane was the inverted V-12 Rolls-Royce liquid cooled model that had powered racing planes in the early 1930s. The following table illustrates the evolution of the Rolls-Royce V-12 engine through its use in RAF fighter planes and compares performance with the Messerschmitt Bf 109.

Year	Aircraft	Engine h.p.	Max. (mph)
1931	Fury I, biplane	Kestrel V 1640	223
1935	Hurricane Mk I	Merlin III 1030	318
1936	Spitfire	Merlin 45 1478	369
1935	Bf 109	Daimler Benz 1200	358

The Hurricanes equipped the first RAF squadron in early 1938. Extensive pilot training was started in April to familiarize the pilot with formation flying, attack practices and quick

take offs known as scrambles. As the outstanding fighter performance of the Hurricane became known, several other European nations, such as France and Belgium, became interested in the Hurricane and export orders were received. This set a pattern of exporting Hurricanes to a number of nations who soon would become allies in the approaching war.

With the start of commercial production, extensive performance trials were initiated to establish areas where improvements in the Hurricane would be desirable. The first item to be looked at was the propeller. The first Hurricanes were equipped with a Watts two bladed wooden propeller. By mid 1939 it was apparent that a variable pitch, constant speed metal propeller was needed. Since pitch settings were related to engine speeds, the Merlin engine had to be modified with a new mounting shaft. By 1940 Merlin engine production was geared to equip both the Hurricane and the Spitfire with a common engine. The result was the Merlin III engine. Rotol propellers or "air screws" also became the standard propeller. Combat experience showed that still more power was needed from the Merlin engine. Heavier armament carried for evolving combat needs, such as anti-ship and anti-tank missions, required larger caliber guns than the .303 machine guns. A number of trials were made with the Merlin engine that culminated in the Merlin XX with a two speed -single stage supercharger. This engine enabled the Hurricane to carry twelve .303 machine guns in place of the standard eight or four 20 mm cannon or two under wing mounted 40 mm cannon.

The additional power of the Merlin XX also allowed a bomber role for the Hurricane. Attachment points under each wing enabled the Hurricane to carry a 250 lb. bomb under each wing. Targets included railways, roads, bridges and canal barges.

Hurricanes were also used in the Naval or "at sea" role. The need for improved air defense of merchant ship convoys led to the development of the sea Hurricane. There were two concurrent

modifications of Hurricane Is. The first was the installation of an arresting hook for aircraft carrier deck landings. The second was a modification to permit catapult launching from a merchant ship. The catapult launching from merchant ships was a sign of the desperate need to defend these ships against Nazi U-boats who were decimating convoys in the North Atlantic Ocean. The merchant ships were called CAMs {Catapult Aircraft Merchantmen} of which 35 ships were modified. The launching of these Hurricanes was accomplished by mounting banks of two inch diameter rockets to the rear face of the rear center section wing spar [flaps down]. These were fired in stages to raise the airspeed to a flying speed of 60 knots in a distance of 80 feet. Since the aircraft could not be recovered, the pilot was to fly to the nearest land even if it meant internment in a neutral country or capture by Nazi Germany. If the launch was too far from land, the pilot had to ditch at sea and hope for a prompt rescue. This was extremely hazardous because of the cold water temperatures but also for the tendency of the Hurricane to flip over onto its back in water landings. With the deployment of more escort aircraft carriers in early 1942, the CAM ship idea was abandoned by mid 1942.

The advent of improved fighters such as the Spitfire, the Hawker Typhoon and the Hawker Tempest brought the withdrawal of the Hurricane from European front line service. It soldiered on, however, in all combat theatres in diminished or specialized roles because it was available in large numbers. At the end of hostilities in 1945, large numbers of Hurricanes were quickly removed from inventory. Thus, the career of the Hurricane ran from 1935 to 1945, but it was the right fighter at the right time when England sorely needed a good warrior.



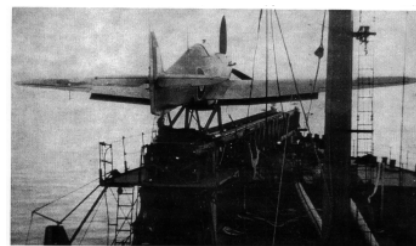
HAWKER FURY II



FIRST PRODUCTION HURRICANE



HURRICANE IV WITH 40mm GUNS



SEA HURRICANE IA ON CAM SHIP

MEET YOUR PASM VOLUNTEERS



Howard D. Fox

Howard was born June 26, 1939 in Portland, Oregon and attended Milwaukie High School. He began his career with Clackamas County, Oregon, as a reserve deputy in 1961 and became a full time deputy in 1964. He served his community in that capacity and in a variety of assignments for thirty years before retiring in 1994. Vacations, including the first trip to Pima, were spent touring on a Honda Goldwing.

In 1995, Howard had a major heart attack, but continued with contract work performing

background investigations for the Sheriff's Department, as well as marine patrol in a local lake community. By the fall of 1998, severe congestive heart failure made it necessary to be hospitalized until he received a heart transplant in January 1999. Within six months, he and his wife were pursuing their hobby of traveling throughout the United States and began spending winters in the Tucson area.

Howard began his volunteer service with Pima Air & Space Museum in 2002 on the Challenger Resource Center and Membership teams. In 2003 he also began working as a greeter and working evening functions. He enjoys working at the museum which gives him the opportunity to talk with people from all over the world.

When not traveling, Howard and his wife Susan live in Oregon City, Oregon. They have four sons, eight grandchildren and five great grandchildren.



Joseph P. Pacholec

Joe was born July 29, 1936 in Scranton, Pennsylvania. At the age of six his family moved to Bridgeport, Connecticut and two years later, they moved to Hamtramck, Michigan, a city within the city of Detroit. At the time it had a predominantly Polish population, and Joe grew up experiencing the heritage of his ethnic background. The nuns at St. Florian Roman Catholic Church and Jesuits at the University of Detroit tried their best to make a good person out of him; at best, the results were mixed.

Joe began his engineering career as a co-op

student in 1955 with Continental Aviation & Engineering (CAE) in Detroit and joined them full time when he graduated in 1958 from the University of Detroit with a Bachelors Degree in Mechanical Engineering. CAE was the military R&D facility for its parent company, Continental Motors, and was heavily involved in the development of reciprocating engines for tanks and other military ground vehicles, as well as small gas turbine engines for various military helicopters, trainers, drones, and missiles.

In 1970, the turbine engine operations were consolidated at the company facilities in Toledo, Ohio and Joe moved along with the rest of the turbine engine engineering staff to Toledo. The company name became Teledyne CAE and concentrated on developing gas turbine engines for advanced trainers, missiles, and remotely piloted vehicles. During his career at CAE and TCAE, he held the positions of Department Head and Principal Engineer.

In 1989, Joe followed his wife Gwen into retirement; he was smart enough to have married a school teacher with a good pension plan. They bought a motor home and became full time RVers, winding up in an RV park in Benson AZ, where they lived from 1990 to 2001. They moved to Tucson in June 2001, where they currently reside year around.

Joe began his volunteer service with Pima Air & Space in 2002 as a member of the Archive Team. He has been involved as Team Leader/Captain for Archives, Library, and Administration; and as Team Captain for Membership and Restoration. He held positions on the Volunteer Resources Committee and the Volunteer Resources Team. He assisted in new volunteer orientation/ training, and was a member of the PASM Off-Site Presentation Team. He is currently working in hangar 2 and the library. As of Sept 2006, he has accumulated over 3600 hrs of volunteer service.

Joe and his wife have 2 children and 1 grandchild.



Tom Bohan

Born in New York City on August of 1937, Tom's family was mostly Irish Police Officers. After a year and a half of Civil Engineering at Manhattan College in New York, Tom joined the Air Force in December, 1957 as an Aviation Cadet and graduated from Pilot Training in April, 1959. After extensive crew training, he arrived at Davis Monthan AFB AZ, in 1960, as a B-47 Copilot. Four years of Strategic Air Command Alert Duty included many visits to scenic Alaska. Somehow, Tom had time to find and marry Diane Austin, but she had to learn to live "on the road". Next came B-52 training and three years at sunny Dow AFB, Maine.

Tom was then sent to the University of Arizona [AFIT] for two years and four months to complete the four-year B.S. in Aeronautical Engineering Program, and he finished in January, 1970.

Next, came OV-10 training in Florida, as a Forward Air Controller. He was sent to NKP Airbase, Thailand to intercept the North Vietnam trucks going down the Ho Chi Minh Trail, in southern Laos, off the DMZ. This was exciting and scary as you flew sideways and up and down, as 23mm, 37mm, 57mm shells went close by, as you tried to keep your voice tone down and direct and control fighter/bombers on hidden targets below you. Tom left Vietnam with over 200 combat missions, over 800 hours of flying time, a Silver Star, 3 Distinguished Flying Crosses and 17 Air Medals and a strong dislike for Vietnamese food.

Returning to the States in 1971, Tom became a Maintenance Squadron Commander at Kirtland AFB NM after which he was assigned as a Squadron Officer [AOC] for a Cadet Squadron at the Air Force Academy, CO. In 1976, Tom attended Logistics School and then was sent to Tinker AFB,

OK. At Tinker he went on Logistics Trips to bases supported by the Tinker Depot and was also in charge of the Tinker Command Post. Next, he was assigned as the Chief of Safety, in charge of a 24-man Tinker safety office and responsible for a 24,000-person Tinker work force, and all aircraft supported by Tinker. Tom also found time in his busy schedule to complete an MBA Degree Program at Oklahoma City University.

After retiring from the USAF Tom worked at Hughes Aircraft Co., Tucson, as a Quality Engineer, for 6 years, then entered Real Estate and Property Management for over 10 years.

Tom joined the Pima Air Museum in 1997, he has done the TRAM, AMARC, Walking Tour and the Volunteer Presentation Series Program. Tom and Diane enjoy their kids and grandkids when they visit.

Last Flight

Since the last Issue of Contraails we have discovered that another of our Museum family has passed.

Arnie Bader

Born October 31, 1925; passed away on November 6, 2006. He was 81 years old and lived in Green Valley for 16 years. He is survived by 3 children and 2 grandchildren.

Arnie completed the course for B-29 Combat Crews at the Army Airfield, Clovis, NM in March 1945. He and his crew flew missions from Guam to Japan in a B-29 named the City of Maywood. After the war the crew went their own way and Arnie was instrumental in bringing them back together after 53 years.

He visited PASM and started as a volunteer in Hangar 4 in July of 1998, talking about the B-29, taking other docents on tours inside the airplane and answering questions from volunteers and visitors until 2003 when he had to retire due to illness.