

The Restoration of ex-Mexicana de Havilland Comet 4C 6424 by the Museum of Flight, Seattle, WA

A compilation by the de Havilland Aeronautical Technical School Association

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INTRODUCTION

The objective of this compilation is provide regular updates on the progress of the restoration of the Comet formerly operated by Mexicana. Our intention is to supplement, but in no way over-ride, the official publications of the Museum of Flight Comet Restoration Team.

Regular progress reports, many written specially for us by Project Manager Emeritus Robert B (Bob) Hood, have appeared in the newsletters of the de Havilland Aeronautical Technical School Association. Modified versions of these reports are given here, also for continuity the 2006 posting on the Comet Team's website www.dhcomet.com.

In September 2012 a video was made by KBTC Public Television of the work of the team. It includes a short history of the Comet airliner. It can be viewed at <http://video.kbtc.org/video/2281445990/>

Brief histories of Mexicana and of the Comet, and an overview of the start of restoration, are on pages 2 and 3.

PROGRESS REPORTS

In Spring 2007, Bob Hood provided us with the first of many updates on progress for inclusion in our newsletters. These reports are archived in this document, with additional items and/or photographs for which there was no space in our newsletters. In some years there was more than one item; for simplicity the links below have been grouped by year.

[2006](#) Page 4. Report posted on Comet Team website.

[2007](#) Pages 4-5. Reports for Spring and Autumn newsletters.

[2008](#) Pages 6-8. Reports for Spring and Autumn newsletters.

[2009](#) Pages 9-12. Report for Spring newsletter, also team message from Jim Goodall and team message to B/E Aerospace.

[2010](#) Pages 13-17. Report for Spring 2010 newsletter.

[2011](#) Page 18. Progress report for the year.

[2012](#) Page 19. Report for Summer newsletter, also appreciation of DHAeTSA fund-raising via Bob Wright.

[2013](#) Pages 20-23. Progress report for the year, compiled using Bob Hood's weekly team reports.

MEXICANA

Mexicana Airlines was founded in 1921 under the name Compañía Mexicana de Transportación Aérea (CMTA). It claims to be the airline with the fourth longest tradition in the world. Mexicana became the first international airline to unite two foreign destinations: Brownsville and Guatemala. The route made stopovers in Veracruz, Minatitlán, Ixtepec and Tapachula, and continued on to the city of Guatemala. There Mexicana linked up with Pan American routes, which at the time flew to Miami, Nicaragua and Panama. In addition to five Ford Trimotors, the airline also had eight Fairchild FC2, three Fokker F10s, one Keystone and two Stearmans, which were mainly used for mail transfer and pilot training. During the 1930s services began to the capital cities of El Salvador, Costa Rica and Cuba, as well as to Los Angeles where Mexicana was the first foreign airline to touch down.

In 1959 five de Havilland Comet 4C airliners were ordered, although in the end delivery was taken of only three. On July 4th 1960, with one of the Comets, Mexicana commenced services between Mexico City and Los Angeles.

THE de HAVILLAND COMET 4C

The Comet 4C was the largest variant of the type. It combined the increased length of the 4B, which had a reduced wingspan, with the original wing of the 4. It was ordered by a number of airlines and by the RAF. Thirty were built; the last two were unsold and were converted into Nimrod development aircraft. Mexicana's three aircraft were 6424 XA-NAR delivered in June 1960, 6425 XA-NAS delivered in January 1960 and 6443 XA-NAT delivered in November 1960. The first two were converted from unsold 4Bs. The certification flight testing for the 4C was done on 6424, with completion to Mexicana standard afterwards, hence it was the second aircraft delivered. The cabin had 22 first class and 59 tourist seats, and this layout is being preserved in the restored aeroplane.

COMET 4C 6424 XA-NAR

Pat Fillingham flew the first Comet 4C, constructor's no. 6424, registration G-AOVU, on October 31st 1959 after its conversion from a Comet 4B. After about 87 hours of certification flights, it was refurbished and delivered to Mexicana registered as XA-NAR. It inaugurated the 'Golden Aztec' service between Mexico City and Los Angeles on July 4th, 1960.

XA-NAR served Mexicana routes from 1960 to 1970. From 1970 to 1972, it was kept in reserve for the occasional charter. In 1972, it was sold to Westernair of Albuquerque, New Mexico, who re-registered it as N888WA. It remained at Mexico City for the following two years, undergoing a complete upgrade, which included a new paint job and a reupholstered interior.

Westernair planned to sell it and its sister ship to a large corporation in Europe. Ironically, the purchase negotiations took place in Geneva, Switzerland at the same time OPEC was having its organizing meetings across town. The OPEC meeting agreements triggered the Arab oil crises of 1974, which led to a five-fold increase in the price of jet fuel. The rest, as they say, is history: the value of many smaller jets, including the relatively thirsty Comets, was slashed and the sale fell apart. The refurbished Comets were left at Mexico City until another buyer could be found.

A subscription-club airline in Redmond, Washington, Redmond Air, bought the Comet in 1978 and had it ferried to Salt Lake City to upgrade its electronics to current US standards. After a year; in July 1979, N888WA was ferried to Everett, Washington. It had accumulated a total of 27,065 hours of flight time.

It was grounded by the FAA at Paine Field with the insistence that all of the maintenance done in the 18 years since leaving the de Havilland factory would have to be re-inspected and signed off. Alternatively, it could be ferried to Dan Air at Lasham in the UK, to be re-certified to like-new standards. Since meeting either of these requirements would cost many times the value of the ship, it was left essentially derelict at Paine Field.

In 1984, title was transferred to the Everett Community College's Aviation Maintenance Technician School. Its exterior, which by that time was in very poor condition, was painted in BOAC livery by Boeing paint shop volunteers.

Unfortunately, nothing was done to protect the interior, and the aircraft was left outside with standing water in the hull for the following years. The climate in Everett has high background moisture and a slight salt content from the adjacent Puget Sound. Sadly, the only attention this historic aircraft received was from Paine Field Firefighters, who occasionally practiced their techniques by blowing high-pressure water through the engines and into the cabin emergency exits.

The Seattle Museum of Flight was given title to the Comet in 1994, and it was towed to the Museum's Restoration Centre at Paine Field/Snohomish County Airport in Everett, Washington in 1995. (For information about the Restoration Centre, see www.museumofflight.org/restoration-center)

RESTORATION OVERVIEW

Restoration began at the end of 1995. The team found an airplane that had been derelict for 17 years, closed up with standing water in the hull and with very advanced corrosion everywhere. The air inside was so foul that they could only stay in it for ten minutes before they had to leave to get a breath of fresh air. Everything was covered with a heavy slime film. This presented a formidable challenge, since they were planning to bring this large aircraft back to museum static display standards.

All seats and upholstery were removed. All floorboards were taken up; almost all of the floorboards and seat rails had such advanced corrosion that they had to be replaced. All of the forward and aft cargo bay liners were removed to gain access to the inner skin and supports. The interior of the aft passenger cabin was stripped out, including two galley bulkheads, two toilet bulkheads and floor support framing. All six emergency exits, which are large magnesium castings, were removed, corrosion treated, and rebuilt.

The team's work has benefited from the generous encouragement of many individuals in the UK. Philip Birtles of the de Havilland Aircraft Museum Trust Ltd. and Nick Newton of the Ministry of Defence at Boscombe Down, plus many of their associates, have given the project vital support. Mexicana Comet Information has been supplied by Capt. Jorge Garcia Bencomo, whose father flew XA-NAS for many hours. Many aircraft suppliers have contributed materials and information. Further, access to British Aerospace archives for accurate historical information on de Havilland and on the aircraft's construction and appearance was kindly given by Ron Hedges and Pamela Guess.

Two trips were made to England to get more parts and information. On the second trip, in the summer of 1997, XV814, (formerly 6407 G-APDF) was bought at auction in collaboration with scrap dealer, Mil-ver Metals of Coventry. XV814 had been a Nimrod development airframe, known colloquially as the 'Comrod', and was the last structurally sound Comet slated to be broken up. With the cooperation of MOD people at Boscombe Down, just about all of the parts needed were removed from this airframe – including two landing gear assemblies, floor support frame members, cockpit seats, cabin seat tracks, replacement toilet bulkheads, and many other items which were all crammed into a 20 foot container. At that point the team had not only North America's only remaining Comet, but also about 10 tons of ex-Mexicana and ex-RAF spares – which probably represented the world's largest remaining stock of Comet parts. More than 17,000 parts were inventoried and stored. The whole XV814 aft floor structure was installed in XA-NAR, so today's museum visitors who walk through the aft passenger compartment can honestly say they have been in two Comets!

The original plan was to shrink-wrap the nose of the aircraft and place the tail in the hangar to be able to work on its control, etc. surfaces. The idea was that because the wing trailing edge was at nearly right angles to the fuselage centerline, whereas the sweptback wing leading edge would leave more of the aircraft outside when the root of the wings was brought right up to the wall of the hangar. Thus, more of the aircraft could be inside the hangar if the entire airframe was backed into its protected space. Later, practical problems in getting an acceptable weather seal for all of the openings in the nose, including the first class passenger windows, the cockpit overhead emergency hatch with its sextant openings and the many windows looking forward, including the movable direct vision panes convinced the team to turn the Comet around and move the nose into the hangar. In the long run, this was a good decision because restoration of the cockpit and forward passenger compartments were much more accessible via the forward crew door. Its disadvantage was that

more of the wing surfaces were left exposed to Puget Sound weather until much later when the shrink-wrap enclosure for the wings was erected in 2011.



Project Manager Jim Goodall removing accumulated moss from the wings.

Posted in 2006 on the Comet website at www.dhcomet.com which includes photos.

From the Desk of Bob Hood & Jim Goodall ~ Comet Progress Update

Regular readers of this report have seen the accelerating pace of completed work. We are pleased to report that this trend continued through the end of 2006.

We are particularly thankful for the gifts and support of many kind and generous people and organizations separate from the Paine Field restoration crew.

On the other side of the Atlantic, volunteer Bob Wright masterfully guided acquisition of a complete set of “timed out” Comet/Nimrod landing gear. Bob shepherded five pallets of gear through a virtual odyssey. The parts were trucked from RAF Kinloss to the Midlands, where they were prepared for air shipment, thence to London, where Sir Richard Branson’s Virgin Atlantic kindly transported them to San Francisco. From San Francisco, FedEx ground shipped them to Paine Field. Words could not adequately describe how grateful we are for all of the support from cooperative friends at the MOD, RAF Kinloss, and the many military and civilian people who made this possible.

Special thanks go out to the United Kingdom's Ministry of Defence, RAF Station Kinloss, BAe Systems, FRAviation Ltd., Virgin Atlantic Cargo and FEDEX. Within these organizations, key players in providing and transporting these, and other parts, were Sir Richard Branson, Warrant Officer Clive Buckland, Jim Carl, Dave Hebbbron, Rab Logan, Sean McCourt, Alex McMurray, Dave Squires and Dave Thorne. The Museum of Flight recently presented commemorative plaques to these people in appreciation of their help.

Our fall issue showed pictures of forward passenger cabin progress. Jim installed the carpets in this area – another great visual advance. Also, we received the first pair of reupholstered tourist section seats, and they look very good. We are able to upholster these seats thanks to the generosity of one of the former owners of our ship, Vera and LeRoy Olsen. LeRoy has continually supported our restoration – having already given us nearly 10 tons of ex-Mexicana Comet spares. We are truly grateful to the Olsens for their earlier contribution of cockpit seats re-upholstering, and now for the cost of upholstering 59 passenger seats!

We have begun to sew curtains for the forward compartment and center bulkhead airconditioning duct covers are being covered in vinyl.

Large (12 foot long) belly skin panels under the aft toilets were painstakingly removed to reveal some of the most advanced corrosion in the entire aircraft. The supporting frames that we could save were cleaned and bead blasted in preparation for paint.

Meanwhile, back in the hangar, we are working on the aft passenger cabin’s two parcel shelves. The first shelf is just about ready for paint, and we removed the second one from its nine-year hangar balcony storage. This adds to the list of assemblies that will be ready for the aft compartment, including many galley units, two toilets, etc. Final galley shelves and switch panel are nearly finished. Seat tracks over the center section will be replaced by tracks now under restoration.

Published in the Spring 2007 DHAeTSA Newsletter

Starting in December 1995 with an essentially derelict aircraft, greater than 150,000 volunteer hours have been spent restoring C/N6424. During much of the 11-year history of the project, our major investment has been in labor, disassembling and cleaning this massively corroded aircraft. This took time and hard effort, but not much in the way of materials and supplies. We were blessed with a large ex-Mexicana spares inventory, and through the cooperation of many English friends, including the MOD at Boscombe Down, were able to add parts from XV814 and many RAF Comet spares.

Now, we are installing assemblies painstakingly restored over the past eleven years. The pace quickens as each component contributes to completion of the eventual display. So far, much of the work in the forward part of the ship is done, with the cockpit, forward galley, forward toilet, and 80% of the forward passenger compartment finished.

While previous work has been manpower intensive, as we move forward a proportionate increase in parts and materials purchasing costs makes the remaining work more financially challenging. We have some tasks that require specialized business suppliers. For instance, we have just given a local shop the contract to upholster 59 tourist class seats, and the hunt is on to find 22 seats for the first class section (which will undoubtedly also need re-upholstering).

Robert B. Hood
Project Manager Emeritus

**Published in the Seattle Museum of Flight newsletter and reproduced in the Autumn
2007 DHAeTSA Newsletter**

From the desk of Bob Hood and Jim Goodall – Comet progress Update

In our last newsletter, we reported on the vigorous and accelerating progress of work. With the acquisition of new landing gear from the Nimrod program facilitated by our friends in England, we are proud to report that this pace has continued, culminating in a major project milestone.

The Comet now stands on its new main gear, which replaces the severely corroded and massively broken gear that had deteriorated due to 28 years of exposure to an atmosphere polluted by industry and traces of salt water from nearby Puget Sound. Just after restoration began in 1995, the trailing radius arm of the right main gear failed, separating the rear axle from the vertical strut. In 2001, temporary bracing was used so the aircraft nose could be towed into the hangar supported on the right by only two remaining main gear wheels. To support the weakened gear and to stabilize the airframe so that there was no risk of movement against the hangar opening, jacks were placed under the aft main spar jack points and the nose gear.

We were surprised some months later when the upper end of the right gear's vertical strut literally exploded – throwing fist-sized clumps of aluminium forging onto the parking area! Close examination of the failure showed progressive material failure, probably due to long-term stress corrosion. Further, a look at the other left main gear also showed cracks in a critical area, which convinced us it too would eventually fail. This set off a long-term search for replacement gear that succeeded (as mentioned in our last progress report) thanks to the support of our many British friends, including the Ministry of Defence and Virgin Atlantic. While we all knew that the Nimrod gear was designed to exactly fit into our much older Comet airframe, there was always a lingering fear that small changes made over years might make its fit in our aircraft problematic. To the relief of the entire team, the Nimrod gear fitted perfectly into the original mounting points. Our appreciation goes out to Bob Wright and all of our supporters across the pond who obtained the gear, and to Jim Goodall and Paine Field volunteers Bob Hood, Steve Belenky, Dale Chapman, Adrian Corson, Bruce Cronk, Allan Harwood, Russ Hoff, Frank King, Rebecca Lynch, Charley Price and Craig Wall who installed it.

With installation of the new landing gear, we now need to address the impact of the load on the tires. Due to the constant pressure placed on the tires by the aircraft's weight and the fact that they are over forty years old, they need frequent inflation. In order to preserve the appearance of fully-inflated tires, and minimize maintenance, we will use the Wright-Patterson National Museum of the United States Air Force process by filling the tires with high-density polyurethane foam. This will remove the requirement to replenish the air in the tires by permanently sealing them, to keep them display worthy for many years. Presently, we are looking for donations of money or services to complete this project.

Concurrently, attention has turned towards removing the four Rolls-Royce Avon turbojets, and applying corrosion treatment to the engine compartment. Once completed volunteers will restore the compartment to static display condition with the corroded engines later salvaged.

Aft of the wings, restoration of over 80% of the major components is complete. Work is currently under way reinstalling the lower belly skin after extensive corrosion repair and treatment of the panels and stringers. Once this task is complete, we will remove the Comet's horizontal and vertical stabilizers in preparation for placing the rear fuselage under cover inside the main restoration hangar where refurbishment will begin on the aft passenger cabin. Our thanks go to David McKee, Ross Michel, Craig Wall and Hank Pucket for assisting in the reskinning of the lower fuselage.

Forward of the wings, interior work is progressing into its final stages. Half of the cabin window curtains have been reinstalled; this is the first time since 1996 that any of the cabin windows have had curtains. Once the reupholstered seats are added, the forward tourist and first class cabin will appear as it did upon entering service with Mexicana.

Since April of 2002, the Comet forward fuselage has been under cover in the restoration hangar at Paine Field, leaving the section aft of the wings open to the elements. This fall, we plan to cocoon the forward fuselage in plastic to protect the restored interior and exterior components from deterioration and turn the aircraft around in order to complete work on the rear section of the aircraft.

As work progresses into the first class passenger cabin we need business class seats from the Avro RJ/BAe 146 series of airliners. These particular seats match the specifications of the original first class Mexicana seats. If you know of any seats available please contact the Museum.

Overall, because of the dedication of our volunteers and donors, the momentum behind this project remains strong. Thanks go out to all for making 2007 a momentous year for the project.

Written for the Spring 2008 DHAeTSA Newsletter by Bob Hood

Now that the weather is improving, we are getting ready to remove the empennage surfaces in preparation for turning the aircraft around to put the aft fuselage into the hangar.

Last week, we purchased scaffolding and jacks to support the horizontal stabilizers while their mounting bolts are removed. It will be challenging, since these bolts have been exposed to the weather almost continuously since 1959.

Before the turnaround, we will completely wrap the forward fuselage in heavy 'shrink wrap' plastic. The wrap will protect the restored forward fuselage from the weather while the aft end is in the hangar. Further, a dehumidifier will keep the cockpit and forward fuselage dry, and should essentially stop further corrosion. The wrap will cost about \$2900, and we are currently trying to raise money for the effort.



Steve Belanke and Mike King repairing elevator corrosion



Bill Bush removing an elevator, supervised from above by Mike King

Of course, this turnaround would not have been possible without the surplus Nimrod landing gear contributed by RAF Kinloss, which we installed last year. (We had it thanks to the efforts of Bob Wright, and his friends at Kinloss. Particular gratitude is owed to Rab Logan of Flight Refuelling Aviation, who are contracted to carry out major Nimrod servicing

at Kinloss, for his continuous support, sage advice, and critically needed used parts.)

Our restoration will return C/N6424 to its original seating configuration, with 59 tourist and 22 first class seats. All of the tourist seats have been restored, with the heavily corroded steel-framed seats we found at the beginning of restoration replaced by modified ones contributed by Alaska Airlines, upholstered with fabric specially loomed to match the original photos in dH archives at Farnborough. (As ours was the first Mk4C, dH made very good photographic records of its factory new appearance.)

For about 10 years the dilemma has been: "Where will we find 22 first class seats to match the appearance of the originals?" We have attempted for about a year to manufacture first class seats by cutting tourist seats in half and adding a patch in their backs and bottoms, but the results were very time consuming and ultimately unsatisfying.

Just last month we got great news! Thanks to the good efforts of Dubai Aerospace (an aircraft leasing firm), B/E Aerospace has promised to manufacture a complete set of 22 seats based on the RJ series pattern. They will be modified to match those shown in dH archive photos, using custom matching fabric loomed by AaBe Textiles back in 1997.

We are off to a good start. Our initial progress in 2008 is truly encouraging, with a large portion of it due to the kind and generous support of our friends in the UK, in particular from dHAeTSA members.

Robert B Hood
Project Manager Emeritus

Written for the Autumn 2008 DHAeTSA Newsletter by Bob Hood

We celebrate satisfying 'first Mk4C' Comet Restoration progress for 2008's first eight months.

EXTERIOR PROGRESS

The great event this year took place 14th August with removal of the second (starboard) horizontal stabilizer. (The port stabilizer had been removed two days earlier.) For those not familiar with Comet construction, the magnitude of this event requires some explanation. The fore and aft main spars of these surfaces are joined by four large (1.5 inch diameter by 5 inch long) pins. Our restoration crew is prepared to swear (legally and pejoratively) that these pins were designed to never be removed. We spent about six weeks trying to get them out.

However, our good friend at RAF Kinloss, Rab Logan, reassured us that they are routinely removed during major Nimrod inspections. He gave us very detailed instructions. Their technique employs a combination of heat, very high torque, careful adjustment of the stabilizer weight load on the pins, hydraulic ram pressure, and a ten-pound slide hammer. We used Rab's advice and were pleased to find that these techniques did break loose three



Jim Goodall with sledge hammer 'persuading' a pin to break loose while John Blum covers his ears.

of the pins from their forty-nine year sojourn (they had not been removed since their 1959 Hatfield installation). However, the fourth and most-difficult-to-reach pin (in the upper forward location) was not as cooperative. At Rab's suggestion, we bored out this hardened steel pin to 0.75 inch diameter (a many hour task), heated it, then poured liquid LN2 into the cavity – hoping that thermal shrinkage would help. It did not. A few days later, we acquired a six point impact socket and enlisted Dave McKee, the Restoration Facility's strongest volunteer, to apply maximum force on the pin using a breaker bar with pipe extension. After carefully fitting himself into the small compartment behind the forward spar, we heard a groan, a grunt, and a "bang" like the firing of a small cannon. THE PIN HAD BROKEN LOOSE. Moral to this story: BRUTE FORCE artfully applied DOES WORK.

With this pin and its fellows air hammered out, Jim Goodall, the Comet crew, and volunteers from the rest of the facility, including Director Tom Cathcart, were able to remove the two stabilizers. They are now at ground level and available for restoration. Concurrently, we removed almost all flight control surfaces: elevators, flaps, ailerons, and speed brakes.

INTERIOR PROGRESS

Meanwhile, there has been substantial progress in the aft passenger compartment. At the beginning of the year, this area was just about void of everything but structural frame members and the skin's inner surface. The only finished items in sight were the emergency exit doors, which had been restored in 2007.

We started by installing the over aisle light / speaker / annunciator bar – a completely new construction with 110 Volt AC lighting. Next, we installed the two long overhead air circulating ducts with their attached Coanda Effect airflow aiming panels.

A note on air handling: Whenever the Restoration Facility is open, blowers mounted in the forward baggage compartment continually feed the fore and aft overhead ducts. This evenly circulates the air, helps stabilize temperature, and keeps down any possibility of condensation. At all times, external dehumidified air from a Munters industrial unit is fed into the aft fuselage. With the structure closed up, an approximate relative humidity of nineteen percent is maintained.

Next, long strips over the windows were cut and installed along with retaining strips for the overhead laminate panels. This was followed by remanufactured laminated window surround strips, and the cutting and trial fitting of the first thin wood window level interior laminate support panels.

At the aft end of the compartment, work on riveting the compound curved underbelly skin panels was coming to completion, with hundreds of modern Hylock fasteners to 'pull in' the badly distorted sheet metal. Next, heavy floor panels were permanently installed. Restored shelf panels were carried into the aircraft and temporarily stored in the forward passenger compartment. After attaching the Wardrobe hangar bar assemblies, the aft toilet bulkheads were put in place, including the pre-restored sinks, mirrors and lights.

All things considered a period of excellent progress!

Robert B Hood
Project Manager Emeritus

Some completed areas:



Flight deck



Galley



Galley

Written for the Spring 2009 DHAeTSA Newsletter by Bob Hood

Jim Goodall and the Comet crew are celebrating a successful fall and winter season. Progress has been good right through Jim's recent departure for knee replacement surgery. Fortunately, he will be returning soon after several months of convalescence.

By the end of last summer, interior restoration forward of the center bulkhead – including the cockpit, galley units, toilet and passenger compartment – was essentially complete. All that is needed to finish restoration of this area is to add the 22 newly manufactured first class seats, which are given thanks to the generosity of Dubai Aerospace Capital and B/E Aerospace. Their delivery and installation in August 2009 will make the compartment ready for display.

This winter our interior work centered on the aft passenger compartment, including galley units, toilets, and wardrobe areas. The original plan was to turn the aircraft around so that the aft fuselage would be in the hangar for warm interior work while the completely restored forward end (including cockpit and forward passenger compartment) would be outside --- unheated, but 'shrink wrapped' in plastic to protect it from the weather. Unfortunately, we were not able to raise funds for the shrink-wrapping, so decided to keep our forward fuselage in the hangar and out of the weather.



Russ Hoff preparing a parcel shelf.

In preparation for the winter, exterior work included removing all tail surfaces, which were then moved

into the hangar for restoration and protection from the elements. The horizontal stabilizers are mounted on the wooden frames originally used to remove them from the aircraft. Inside the hangar work began by separating the horizontal stabilizer leading edges and removing much of the defrosting duct work. An accumulated mess left by generations of nesting birds was flushed out to begin the restoration process. The wing and fuselage surfaces to remain outside were cleaned as well as we could.



Aft passenger compartment, March 2009.

The winter's work concentrated in the often frigid aft fuselage ---we learned there how remarkably cold one can get working in an aluminum tube when the outside temperature hovers around 0 degrees C. We also learned that small

electric heaters are an inadequate counter to that tube's icy rate of heat loss. In spite of this, remarkable progress was made.

Assuming that our present pace continues (augmented by a recovering Jim Goodall back in his usual good form) we should complete the interior by mid – to – late summer 2009.

Robert B Hood
Project Manager Emeritus



Enjoy your flight, Marilyn!



*Forward cabin overview,
with the new seats in place.*

Close-up of new seats.



Messages from Jim Goodall and Bob Hood, September 2009

From Jim Goodall:

To one and all:

Well it's been a ten year trek, not only for me, but for Bob Hood that started the process of trying to find out just how we could get first class seats for our Comet. Our search was helped by friends at de Havilland Employees Association; to BAE Systems; to Mexicana; and almost through desperation to looking into making them ourselves by modifying some Alaska Airline seats that we had extras of.

On Wednesday, 09/09/09 we received what I would call an early Christmas present, twenty two beautifully built replicas of the original de Havilland seats that were in our Comet on the date of delivery. In addition to Bob and so many other very special people that I can't begin to even start naming them, a few stand out: Dave Robichaux of Dubai Aerospace; Pete Morris, Ed Kinner and Mitchell Freeman all of B/E Aerospace; and the best crew of volunteers a project manager could ever ask for.....thanks to all involved!



From Bob Hood to B/E Aerospace:

THANKS TO THE GENEROUS PEOPLE WHO DUPLICATED THE “FIRST JET AIRLINER” FIRST CLASS PASSENGER SEATS

This is written to recognize the support of the talented people at DUBAI AEROSPACE CAPITAL, B/E AEROSPACE, FRANKLIN PRODUCTS, AND TORRINGTON DISTRIBUTORS. Particularly, all of those whose inspiration, time and patience are deeply appreciated: Bob Genise, Dave Robichaux, Ed Kinner, Pete Morris, Mitchell Freeman, Nancy Beck, and their associates.

A short personal comment might give you some idea of the wonderful difference your new seats, which so faithfully duplicate the original ones, have made to our restoration project.

Restoration by its very nature is a long-term process marked by a seemingly endless series of incremental steps. Over the 14 years since the beginning of the project, about 350 volunteers have made many small steps forward – each one concentrated on an individual assembly – a cockpit instrument, or a piece of galley equipment, or the acquisition of fabrics and custom laminates to duplicate original materials.

When each step is done there is a satisfaction in that separate item's quality of restoration, but its relationship to the whole is often hard to see. Over the years, the “sense” of the entire reproduced aircraft appearance gradually emerges, until one final step causes the whole to come together. Then in a flash, the restorer sees with perfect clarity exactly what the original designers had in mind. It is as if the designer's ghosts stepped out of the shadows to say “There it is – that is what we intended”.

It is a moment of complete satisfaction and it justifies all of the investment in time and effort to that point.

We had just such a moment when your seats were installed in the aircraft. The surrounding colors, which combine metallic gold panels and fabrics with white and pale green / gold laminates, together with the dark blue carpet and bright aisle panels are just right; and suddenly we could see what the designers intended.

Your seats tie it all together and Mexicana's “Golden Aztec” interior is now returned to all of its original elegance.

Thank you for doing such a fine job, and for giving us that moment. But, more important, we thank you on behalf of future visitors to the Museum, who will see the last copy of the “world's first jet airliner” with an interior virtually identical to the one it had when it left the factory in Hatfield, England a half century ago.

The entire Comet Restoration Crew joins Jim Goodall and me with our sincere appreciation for your excellent accomplishment.

One item of bad news: The Museum, like many non-profit organizations, has been hard hit by the economic downturn. As part of a long list of financial cutbacks, they were forced last November to lay off Project Manager Jim Goodall. Jim has done great work, and we are very sorry to see him go. On the bright side, he has just been hired as Associate Curator by the Pacific Aviation Museum on Ford Island, Pearl Harbor, Hawaii – an excellent professional promotion after his decade of work on the Comet.

Be assured volunteers are continuing the project and will complete the interior later this year. Also, as this is written, they are fitting a port underwing patch to repair corrosion damage.

Robert B Hood



Center section under carpet floor heating "electric blanket" (important passenger comfort item, as the floor here is a pressure bulkhead and the fuel tanks below would track the -75 degree F OAT at altitude).

Advances in the port aft toilet and passenger door surround finish.



Aft starboard galley and toilet.

Written for the Spring 2010 DHAeTSA Newsletter by Bob Hood

(Note: the photographs were not included in the Newsletter)

First, the good news – our steady progress has now reached the point that almost every added touch to the Comet interior brings us visibly closer to completion. Currently, after installation of new first class seats in the forward passenger cabin, our focus has been on the aft cabin.

One important improvement is less visible. In past years, winter work in the aft compartments has been almost impossible because that part of the aircraft is out in the weather. (After all, the thin aluminum tube of a parked aircraft's fuselage is a very efficient heat (cold!) transfer device.) Vain attempts to warm the interior with portable heaters produced blown circuit breakers and fire hazards, but very little warmth. Volunteers claimed that ice could form in a coffee mug on a cold night.

A local HVAC (Heating, Ventilation and Airconditioning) company and good friend of the Comet generously gave us a residential electric furnace along with custom duct fittings, wall thermostat, and many installation items. Further, an electrical contractor gave us the advice and hardware needed to connect it to electrical power. So, after running many feet of conduit, and many trips to electrical supply houses, we now have a furnace in the cargo bay under the aft passenger compartment that keeps everything at any temperature we desire. In cold weather, the aft passenger compartment may now be the warmest place in the Restoration Center.

So far, we have very closely recreated the appearance of our aircraft's forward half more than half a century ago when those 1959 Hatfield flights took place. The accuracy of reproduction was recently confirmed when we received a 1960 first class section photo from the Mexico City Mexicana museum. It shows an interior almost exactly like ours!

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Aft cabin with trial carpet fitting, more window curtains in place. Note the grill in the center aisle floor.



Reinforcement at corner of emergency exit.

The aft passenger cabin should also reproduce the original appearance. But, in this section, we are going to show visitors a few of the many very creative and technically impressive features of the de Havilland design. Features to be highlighted include the massive reinforcement around the emergency exit. Also, we plan to have a clear panel in the floor over the aileron control bay. Its many features will be spotlighted with explanatory placards drawing visitor's attention to the 'fly by hydraulics' controls and many levels of system redundancy. A small clear panel in the ceiling will also show the very advanced (for the 1940s) use of Coanda effect to direct air-flow from overhead ducts to the space between the outer skin insulation and the interior finish panels.

For advice on further exhibit items, we are looking to readers of this article who were involved in the design and manufacture of Comets. There must be a number of creative features in this part of the ship that stand out in their memories. If you would like to see these features in the Seattle Museum of Flight exhibit, let me know at robthood123@gmail.com and we will look into adding them.

Continued...

Figure 11

Port inboard flap trailing edge – before restoration.



Figure 12

Port inner flap trailing edge – during restoration .

Figure 13
Finished flap trailing edge.



This report concludes with grateful thanks for the dedication of the restoration crew – which continued with unabated progress during the project manager's two-month recovery from injury due to a serious fall from the wing pannier tank.

THE ENTIRE COMET CREW WISHES ITS MANY WORLDWIDE FRIENDS A HEALTHY AND SUCCESSFUL NEW YEAR !!!

Robert B Hood

The major Comet interior event of the year was completion of the Aileron Control Bay exhibit. This compartment, with its clear acrylic floor panels clearly reveals the Comet designer's great care and many redundant features of the Comet's fly-by-hydraulics aileron control. (The aisle center acrylic panel is structurally supported by a carefully made look-alike beam fabricated to duplicate DH practice elsewhere.) Attention was given to reproducing all of the major cables, hydraulic lines and servo piston linkages in this compartment. A track light system using custom designed LED sources to avoid incandescent lamp burnout highlights the compartment's features, including the cabin pressure regulator assembly. Man-months of work beginning more than a decade ago are vindicated by the visually striking final result.



Figure 8 Aileron Control Bay – aft baggage compartment barrier --- before (right) and after (left).

Further work in the hangar concentrated on restoration of two port wing flaps, which were found to be in very poor condition with cracks and corrosion. The inboard flap's trailing edge has a milled aluminum wedge strip which had the advanced corrosion seen in Figure 10, and we did not have the resources to duplicate the part. Then, our Scottish volunteer again came to the rescue! He talked a friend into removing the same strip from a decommissioned Kinloss Nimrod flap and then mailed the part to us. Elsewhere, the flap panel's many cracks and patches required a surprisingly large time commitment. To finish flap restoration, we plan to build temporary flap bead blasting chambers in 2012 to clean up leading edges. After that, the panels will be corrosion protected and stored in the hangar's protected environment.



Figure 9
Aileron Control Bay under restoration.



Figure 10
Aileron Control Bay viewed through its clear acrylic floor panel.

4. Upgrading forward entry passage and galley light fixtures to accept newly designed very low maintenance LED light sources.

5. Partial restoration of the aft passenger cabin wardrobe doors with preliminary alignment and hanging just aft of the passenger compartment.

6. With the help of our Scottish volunteer, we obtained the aft passenger door handle and associated hardware.

7. Took the first steps toward mounting the gray plastic quilted liner covers for the aft passenger and galley supply doors. The covers will be made from a roll of the original DH fabric found in the ex-Mexicana spare parts inventory.

8. Protected all passenger seats with removable plastic covers.

9. Designed and built a clear acrylic cover for the under carpet electric blanket installed over the center section's fuel tanks. (A placard on the adjacent bulkhead explains the blanket's function as an example of the creative design needed to deal with very hostile 7½ mile high environment.)

10. Cut and installed carpet in the aft passenger compartment, with retainer frames for the under-floor furnace vent and aileron control bay acrylic floor panel openings.

11. The last few passenger seats were attached to seat rails, and the final plastic seat track covers were cut and mounted.

12. Comet volunteer Gary Bovey gave us a new 46 inch flat screen monitor to introduce restoration visitors to the Comet project and to familiarize them with the Comet's history and background. The video presentation, which will include many Comet pioneers and former Comet pilot Peter Duffey, is being edited for presentation in a few months.

13. Many wing root fairings have been restored by a volunteer who recently completed his Everett Community College A & P training. They are stored above the Hangar floor workbenches (see Figure 5).

Figure 5 Aft passenger compartment.



Figure 6 Wing root fairings under restoration.



Figure 7 Setting up the new flat screen presentation display.

With this experience behind it us, it now appears that the best step will be to encase the wings in a heavy (nine mil thick) ‘shrink-wrap’ plastic cover to block high winds and be impervious to water. Although this will be more costly than the original plan – which was limited to used materials donated to the Museum by local companies – it will give much better protection from the area’s average 75% relative humidity.

We are currently in fund raising mode to find the funds to complete the shrink-wrap operation.



Figure 2 Pannier Tank Cable Support Beams



Figure 3 Wing Support Cover Cables



Figure 4 Assembling Wing Cover Fabric



Figure 5 First Fabric Over Port Wing Tip

MEANWHILE, PROGRESS CONTINUED ON THE AIRCRAFT INTERIOR AND EXTERNAL PANELS STORED IN THE HANGAR

Viewed objectively, the quality of the ‘FIRST JET AIRLINER’ exhibit will really rest on the cumulative effect of a large number of small details. After all, we are trying to re-create the impressions that a visitor to the world’s first jet airliner would have had when he or she first stepped into the Comet – an exciting moment for the new passenger. The challenge is to impart their perception to modern 21st century Museum visitors.

The validity of that experience rests on the accurate execution of many small details. Although we began the year with much of the passenger cabin and forward galley units restored, many details were needed to closely duplicate the appearance of our aircraft in 1960 when it left Hatfield. This year, three to four volunteers spent their time to good advantage in this area. A partial list of items includes:

1. Design and construction of sheet metal covers for the modern seat leg-to-track’s joints to approximate the original appearance.
2. Completion of the small floor level panels at the center bulkhead pass-through, complete with removable fire extinguisher.
3. Further progress populating the many shelves in the five galley units, including two hot beverage dispensers on galley walls.

Progress Report for 2011, written by Bob Hood

The major 2011 effort focused on completing the previously started wing protection system. Very hard work done by the crew, including John Blum, Jeral Godfrey, Gary Hopper, and others toiled to protect the Comet's wings from corrosion. (By the end of 2010, we had found about 10 through skin corrosion sites in wing bottom skin.). (One example is shown in Figure 1). Our overall plan is to shield as much of the aircraft as possible from Puget Sound's very high humidity environment. To accomplish this, we worked on outside wing protection for most of the year.



Figure 1 Corrosion Damage to wing bottom skin

THE LONG TERM PRESERVATION PLAN

The Comet's present status benefits from many years of preservation:

1. Removal of all external flight control surfaces, including the vertical and horizontal stabilizers, the rudder and elevators, all four flaps, and ailerons with trim tabs. These items are stored out of the weather in the hangar where they are available for year-round restoration. Most of this was done by the beginning of the year.
2. Flooding the rear fuselage and passenger compartment with dry air – continuing a process that has for more than a decade successfully arrested the very advanced aft fuselage corrosion we found at the beginning of restoration.
3. Further, since 2001, when the Comet nose was pulled into the Everett hangar, the fuselage forward of the wing roots has had protection for the forward passenger compartment and all cockpit openings.

Construction of a protective wing cover system was begun in 2011 to keep the wings in a controlled dry air environment using the same Munters dehumidifier that presently protects the Comet aft fuselage and the interior of the first Boeing 727. The whole Comet restoration crew will celebrate when the wing cover is complete because then the last Comet in the Western Hemisphere will be stabilized against further corrosion. Its future permanent preservation will wait until the Museum's planned large aircraft exhibit building has been funded and constructed.

When an assured controlled environment is available in Seattle at the Museum of Flight's main Boeing Field facility, the Everett Comet's wings will be separated from the fuselage, and the whole aircraft moved by flatbed trailer or Puget Sound barge from Paine Field to Boeing Field. There, after rejoining the wings and other external panels to the fuselage, the aircraft will be painted in the original Pan Am/Mexicana livery and put on display in the new building.

That is the general plan. Many time consuming and complex steps are underway to bring all of this about.

In the past year, we rigged a port wing cover support system, which included construction and installation of three major cable support beams roughly parallel with the main axis of the aircraft fuselage – one 36 foot long one over the fuselage centerline, then two 26 foot beams over the pannier tanks. This included special platforms constructed to fit over the pannier tanks to support the associated beam forward ends, and the manufacture of steel locating straps to positively secure the pannier tank beam supports and the side-to-side and lengthwise position of the fuselage top beam. Wing tip panels were removed and replaced by rigid cable mounting points. A portable ladder was built to reach from either port or starboard wing root to ease access to the fuselage top beam when installing the wing cover fabric.

The plastic fabric for wing top-and-bottom cover panels, and the large vertical panels forward and aft of the wings were formed by taking 12.5 foot wide strips of fire retardant plastic reinforced fabric (reclaimed from a construction site) and taping them together with special tape that claimed to form a chemical weld between adjacent sheets. (We were disappointed to later learn that these taped joints would prove to be the weak point in the concept.) A few weeks after mounting, the port wing top cover was torn due to more than 60 mph winds. Subsequently a system of through fabric battens was created to limit movement of the fabric under very high wind conditions. However, a critical look at the overall port wing result left us concerned we would not have a cover with low enough air leakage to make possible the low 35% Relative Humidity needed to stabilize wing internal corrosion.

So, after many hundreds of hours of effort, we returned to the drawing board.

Written for the Summer 2012 DHAeTSA Newsletter by Bob Hood

Rab Logan has just organized shipment of a pair of vitally needed ex-Comet, ex-Nimrod aileron trim tabs to Everett, Washington. They will replace original parts suffering from fatal combination of corrosion and extreme hangar rash. This is another occasion to tell Rab and Linda that we are all grateful for all of their help in making this shipment possible.

I also want to pass on the thanks of the Comet Restoration Crew and the Seattle Museum of Flight for the generous contribution some years ago by DHAeTSA members to cover the cost of this shipment. The same pool of funds, kindly collected by DHAeTSA member Bob Wright, was also used to facilitate the earlier shipment of an entire landing gear set from Kinloss, Scotland to Everett, Washington.

Our gratitude knows no limits, but if anyone is moved to further support the last Western Hemisphere Comet (and the first Mk4C), we are now searching for money to protect its wings from internal corrosion due to our climate's 78% relative humidity.

The plan is to surround both wings with heavy gauge plastic shrink-wrap and pump dry air (at 20% relative humidity) into the space around them. The wrap's support cables are now in place, and we are attempting to defray the cost of the shrink-wrap itself. When done, we will have protected C/N 6424 from corrosion until the planned future controlled environment display hangar is funded and built.

The aircraft is now in the Paine Field Restoration Center hangar and any external parts (other than the wings) are routinely flooded with dry air. After shrink-wrapping the wings, the entire craft will be preserved for the foreseeable future.

With repeated and advance thanks from all of us,

Robert B Hood



The new shrink wrap was in place for the winter of 2012/13, giving the wings their first dry winter since 1979.

DHAeTSA Fundraising

Included in one of Bob Hood's weekly team messages, in February 2013, he included the following appreciation:

Bob Wright, formerly of de Havilland Aircraft and Pilkington Glass, organized a 1990's DHAeTSA (de Havilland Aeronautical Technical School Association) fundraiser, which received funds to cover the shipping and packing cost of many parts sent to us from the UK during the restoration project. Last week he sent a final accounting along with a bank draft for the residual £318.83 (about \$499 USD).

A bit of history: soon after our project began in December 1996, Bob sent an appeal to his former associates for funds to support restoration of the first Comet Mk4C. About 48 individuals made contributions (in equivalent US dollars) ranging from \$313 to about \$40, with a total of about \$2800. Over the past seventeen years, those funds made a critical contribution to the very high cost of sending parts to Paine Field from shipping points as far away as Kinloss, Scotland and London, England. It is truly striking that many employees of a company that ceased to exist as a separate corporate entity in mid 1960 were willing to generously contribute to the restoration of one of its products half a century later. It says volumes about the high quality and *esprit* of the de Havilland organization and its people! Without this help, we would not have been able to get parts for an aircraft exhibit that, I believe, will reflect the best of the great creative and manufacturing contribution de Havilland's first jet airliner made to air travel.

Our warmest gratitude and thanks goes out to Bob and Monica Wright and their many de Havilland friends.

Robert B Hood

Progress during 2013 (Compiled from Bob Hood's weekly team reports)

Repair work has continued on ailerons, flaps and the vertical and horizontal stabilisers. After an extended debate about the best way to manage the awkward and heavy restored horizontal stabilizer discussing the possible, but limited, number of ways to move and store the panel, a call to Scottish volunteer Rab Logan, gave the answer: A threaded nut buried under the panel's top skin near its c.g. was strong enough to provide a needed lift point. The stock of DH bolts from the ex-Mexicana/ex-Redmond Air inventory produced just the right thread for that nut. Rab had warned about possible corrosion at the nut site, but this panel fortunately had no corrosion. The lift point nut and bolt with two elevator hinge connection points was used with the battery driven hangar fork lift to move the panel from its vertical work site into its original storage position on the wheeled dolly.



Horizontal stabiliser before restoration.

Horizontal stabiliser after restoration.



Part of vertical stabiliser under restoration.

Vertical stabiliser after restoration.



Attention has been given to various areas of corrosion and repairs made as practical and necessary. This picture shows what was found when the fuselage belly skin was removed.



The pictures below are before-and-after shots of corrosion found when the skin behind the starboard aft galley was removed.



The passenger cabin aisle between the two aft galleys (main passenger entry) has been refurbished, as shown below. Work has continued on the aft wardrobe area, where there was much rot and mechanical damage to the panel between the wardrobe and the aft baggage compartment.



The major achievement of the last few months of 2013 was the removal of all four engines. Dollies and a hoist had first to be made. A prop to support the tail also had to be made, because engine removal made the c.g. move aft. The first two engines were removed in late December 2013 and the remaining two in January 2014.



Above and left : lowering an engine.

A surprisingly clean engine bay.





Engine on dolly

All four engines have very extensive corrosion damage to the magnesium inlet sections, with large white 'crumbles' lining the lower inlets and corroded see-through windows in parts of the casings.

The engine nameplates were removed and carefully cleaned up. An illustrated plaque is planned with the plates mounted over an outline of the Comet showing the engines' original position in the aircraft.



A very old DC power supply with a 60 ampere output capability, circa 1970s, has been found, which could eventually power an engine DC starter motor. The motor, in spite of 35 years' exposure to the elements, works flawlessly. It is therefore hoped that it might be possible to display a slowly-rotating engine.

Work on a thrust reverser assembly is in hand in the hope it can become a functional demonstration of this 'first commercial airliner thrust reverser'. The reversers are, in a way, the reason that the aircraft landed at Paine field on July 20, 1979. Hans von der Hoven, the Redmond Air pilot landed it in Everett, even though Redmond Air was based in Olympia at that time, to get Paine's longer runway so he didn't have to use the thrust reversers, which he believed were not trustworthy. As disassembly proceeded, many reasons to validate his good judgment were found. Most welds in the flange connecting the reverser to the rest of the exhaust tubing were broken and missing bolts in the reverser's clamshell doors plus generally shoddy maintenance practices showed that the contraptions were downright dangerous to use.

Compiled by Roger de Mercado in February 2014 from recent Team Newsletters issued by Bob Hood.