

The de Havilland Aeronautical Technical School Association

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

Progress Reports - last update January 2010



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. Slightly abbreviated and modified versions of these reports are given here, also for continuity the 2006 posting on the Comet Team's website www.dhcomet.com which now appears to be defunct. Many more photographs can be seen in the photo gallery on the DHAeTSA website (go to www.dhaetsa.org.uk if you are not there already)

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 F10 three-engine planes, one Keystone three-engine plane 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.

6424

Pat Fillingham flew the first Comet 4C, constructor's no. 6424, registration 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 and has been under restoration there since late 1995 at the Museum of Flight restoration facility. Although painted some time ago in BOAC colours (although that airline never operated the 4C), it will ultimately be painted in Mexicana colours.

Since 2001 the nose has been sheltered, leaving the rest of the airframe outside.



Project Manager Jim Goodall removing accumulated moss from the wings.



Unique tool technique: Mike King

A wide range of skills has been called upon...



Sewing curtains: Sheree Van Berg



Carpentry:

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 Hebbroon, 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 Spring 2007 in the 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 Mexican 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

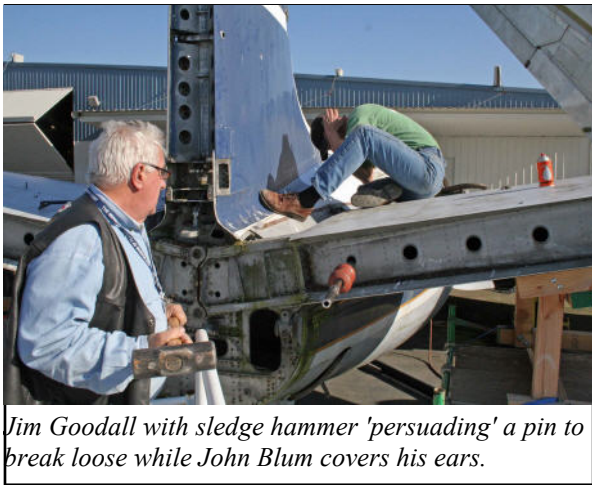
Written for the Autumn 2008 DHAeTSA Newsletter by Bob Hood

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 of the pins from their forty-nine year sojourn (they had not been removed since their 1959 Hatfield installation). However, the fourth



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

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

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.

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.



Russ Hoff preparing a parcel shelf.



Aft passenger compartment, March 2009

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.

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

Some completed areas:



Flight deck



Galley



Galley

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 Kinnear, 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.