

Emergency Measures on dH Comet G-BDIX

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DH Comet 4C “G-BDIX” arrived at the Museum of Flight in Scotland in September 1981. After a flight from Lasham in Hampshire it touched down on the runway of East Fortune Airfield, becoming the last dH 106 Comet to fly in commercial colours.

The National Museum of Flight (NMoF) is surrounded by fields and about four miles (six kilometers) away from the coast.

The museum has three aircraft on outdoor display, a BAC1-11 airliner, an Avro Vulcan bomber and the dH Comet. The two airliners are accessible to the public.

Although once repainted in the 1990s, after more than 30 years the exterior and interior of the Comet has deteriorated considerably due to the harsh Scottish weather and constant use by visitors.

Minor work has been carried out over the years, like corrosion treatment and an exterior clean every spring.

Since 2008 the work of the conservation team at the NMoF is mostly exhibition lead with less time for maintenance of the outside aircraft.

As a result paint is flaking, different types of organic growth are developing, like lichen, algae and moss. Bitumen and aluminium based tape, used to cover openings on the upper surfaces of the wings is partly failing.

Corrosion is present in many areas, from surface corrosion to total exfoliation. Some parts are corroded beyond saving or already lost, like one fuel dump pipe on the trailing edge of the wing. The greatest concern is corrosion of structural components, like main undercarriage hinges and the base of the nose undercarriage, accelerated by galvanic corrosion of the axle stand made of steel.

There was water ingress in different areas which caused a regular puddle around the centre bulkhead, mould growth on the carpet and corrosion in the fuselage. Some windows were taking in water which was standing between the inner and outer pane. Water was standing in the aileron servodyne and hydraulic equipment bay.

The floor panels in the cabin aisle had become tired. They are made of sheet aluminium with strengthening ribs riveted to the underside. Many of the ribs from floor panels in the aisle were broken and rivets had failed because they were constantly walked upon by visitors. In the galley areas the floor also suffered from corrosion.

As a result money was made available to refurbish the worn interior of the Comet after it was closed to the public in 2011.

In March 2012 the conservation department was asked to provide a project plan and costs for short term measures to reopen the aircraft and a long term conservation plan.

It was decided to focus on making the aircraft water tight and replace flooring thus maintaining it as a visitor attraction at NMoF

This work was carried out between September 2012 and March 2013 with a project budget of £11,000.

The original plan was to locate and seal the leaks and replace the floor in the aisle. We suspected that the leaks would originate from the aerial mast and six over-wing emergency exits. At an early stage we decided to empty the entire passenger cabin and re-seal every passenger window. We felt that the project was an opportunity to tackle existing problems and prevent future ones.

After removing seats and some interior trim it transpired that only the six over-wing emergency exits were to blame for the water ingress.

We had to find a cheap and easy solution to cover window apertures while we were working on the windows in the workshop. For the over-wing emergency exits we made blanks from materials which we had in stock already, wooden frames, covered with Irish linen, cellulose nitrate dope and Plastizote foam padding. These blanks formed a good seal even in high winds and heavy rain.

We made two similar but smaller frames for the passenger windows. These proved to be not fit for purpose as they were leaking badly. One of our volunteers suggested a highly technical and specialized solution, retro space hoppers!

Partly inflate, push in, inflate completely, and ready is the bespoke window blank. We purchased ten space hoppers for £10.00 each. That way we were able to work on several windows at a time. Being adult professionals, we resisted bouncing around with the space hoppers.

Most of the 36 windows, each made of two panes of acrylic glass with a rubber spacer in between, were splitting. The components were thoroughly cleaned of dirt and moss and joined with silicone-free acrylic sealant, cheaply available in diy stores. The first intention was to re-grease the rubber seals during reinstallation as specified in the Comet's manual as the grease was cheaply available. By removing windows evidence was found of the old grease and rubber seals failing. The grease, containing graphite, caused galvanic corrosion on the window apertures. Therefore a bead of Windshield and Canopy Sealant between window and aperture was added. Although this sealant costs £32.00 per 100ml cartridge, it has proved its suitability, durability and compatibility with aluminium and acrylic glass in the aviation industry.

The emergency exit hatches, made of cast aluminium alloy were badly corroded. In an earlier attempt to seal the exits, somebody used silicone sealant. The citric acid in the silicone corroded the alloy to a serious extent. Steel screws, used to replace broken handles, had the same effect. The exits were completely stripped off their paint, corrosion ground away and partly coated with primer. The holes and cavities were filled with aluminium putty. The hatches received a coat of zinc chromate primer and two coats of two-pack polyurethane paint before their windows could be refitted.

The seals of the emergency exits were badly deteriorated and needed replacing. A first attempt was made to replace them with off the shelf rubber seals to save costs. As no suitable seals were found, we decided to use so-called fuel tank sealant instead to create bespoke seals. The recess for the original seal was completely filled with fuel tank sealant. Upon installation of the emergency exits another bead of fuel tank sealant was added between hatch and aperture.

The interior was first dry cleaned with a Hazvac, a vacuum cleaner for hazardous materials. Afterwards we wiped all surfaces with a solution of 15% isopropanol in deionised water to remove dirt and mould spores. Vent grills got bathed and brushed in the same solution and thoroughly dried afterwards.

Water that was standing in the aileron servodyne and hydraulic equipment bay was not only coming from the windows but also from other areas we were not able to access. To prevent water collecting in the lower fuselage two drain holes were drilled through the skin in each bay. This will prevent corrosion and the possible development of legionella.

As described before the ribs of the floor panels failed due to constant wear. It would have been possible to repair the panels by attaching new ribs or strengthening the original ones as it has been done while the aircraft was still in service. This would have required a few rivets and some sheet aluminium. Instead we decided to replace all floor panels in the aisle with aluminium honeycomb centred, glass fibre skinned panels, also known as aerolam. With £3400 not the cheaper option, repairing floor panels could not have been achieved within the restricted deadline of the project.

From the beginning of the project it was clear that we had to replace the original carpet in the aisle to preserve it for the future. The first intention was to replace the carpet with lino. This would not have provided enough slip resistance, an important factor for an aircraft displayed outdoors. Instead we used Flotex® flooring, a hard wearing, quick drying carpet. Flotex was also used to replace carpet that was already lost due to mould. Flotex is 50% more expensive than lino, but health and safety took priority.

From time to time we had to throw our conservation ethics over board for the benefit of the long term preservation of the airframe. It was preventive conservation with methods and materials used in the commercial aircraft industry.

An estimate for refurbishing the exterior of the aircraft by a contractor was £120.000. This would include replacing corroded skin and a complete repaint.

As part of a care of collections programme the conservation team produces regular reports on the outside airframes. These are passed onto the Keeper and the senior management team. This in turn helps to form a strategy as part of the National Museum of Flight development programme.

NMS currently has a Heritage Lottery Fund bid in to refurbish two of the WW2 hangars. If successful this will improve the environmental conditions for more of the display collection. The next phase of the NMoF development plan would see all the aircraft

inside with a new super hangar being built off site. This would be the final part of the process for the long term preservation of the collection by creating space to house the outside aircraft, the Comet, BAC 1-11 the Vulcan.