

Boeing 747-300 Cockpit Restoration Project Timeline & Development

For end use as a home flight simulator



Pictured above is the actual aircraft the cockpit was removed from in 2009

Boeing 747-3H6, Serial number 23600, Total aircraft hours: 64141, Total cycles 13470, Last registration: B-KAC Dragonair Cargo, (Cathay Pacific) Hong Kong

The decision to go commercial

After working over 10 years on my fighter jet simulator, it was time for a change. During the years the fighter simulator was being rebuilt many times over, the real world commercial airlines were having major financial problems. More and more older aircraft from the 70s and 80s were being retired early, parted out and scrapped. Businesses that bought the “as removed” components from the retired airliners soon found themselves with thousands of items in stock that simply would not sell. As the storage of these parts got more expensive, liquidating them at auctions at absurdly low prices became necessary. This flooded the network of eBay sellers with cheap airliner instrumentation that just a few years earlier would be priced way out of reach of the novice home simulator builder. At the same time, the government was clamping down hard on eBay sellers who were selling military avionics to the general public and eventually classified almost all surplus aircraft instrumentation, no matter how harmless and old, as “Demil” items, meaning they would be destroyed rather than being sold to the open market. The time was right to take on the challenge of building an airliner simulator.

What others had done

Two friends of mine had been actively working on real 737 cockpits removed from retired aircraft and I had provided parts to them in the past to support their development. In turn, they helped me greatly with software development for my fighter simulator. Another friend was working on an Airbus simulator in Canada. All of their projects utilized the newer advanced “glass cockpit” flight displays, which greatly simplified simulator cockpit integration when compared to the old analog instruments of the 70s and 80s. Over time, the simulated LCD displays, and flight management systems, in their 737 cockpits became realistic to the point where only physical motion separated them from flight simulators used for training by the airlines.

Deciding on the 747

I had to decide which aircraft, and of what era, I wanted to take on for my new airliner simulator project. I had already cut the cockpit off of a DC-10 and restored it for the company I work for, so I knew the dimensions of that nose section in great detail. I also knew it could be transported on a flatbed trailer without a “wide load” escort. However, the slope of the nose of a DC-10 is very acute and by the time it reached the cockpit door, it was already 10 feet high or more. Flight controls under the flight deck floor required it be cut below that floor by several feet as well, further adding to the height problem. McDonnell Douglas also used “tri-wing” screws extensively, which meant special screwdrivers were required. The 737 cockpit is, of course, smaller than a DC-10 and also could be transported on a flatbed truck without an escort. However, the 737’s height at the cockpit entrance was still an issue and the cockpits were cramped with little space behind the main front panels. There were also a great many other people around the world using 737 cockpits for their home simulators and parts acquisition from easy sources, such as eBay, made buying even worn control heads very expensive.

The solution for me turned out to be the 747-300, which was the last of the 747 series that had analog cockpits and a flight engineer station. The slope of the 747 nose from radome to the bottom of the windshields was the most acute angle and the slope above the windshields going rearward was the least acute of any other airliner I studied. The problem of flight controls extending far beneath the 747’s flight deck floor was non-existent since the lower deck passenger compartment was normally under it. This made the cut-off cockpit section only 9 feet high at the rear entrance. The 747 cockpit, without the seats installed, was roomy and everything was easy to get to. Depth behind the main control panels and flight engineer station was extensive. Wiring and ductwork was routed everywhere but typically easy to get to. No special fasteners, like tri-wing screws, were used and common aerospace screws and bolts held everything together. The only issue was its immense size. Even this seemingly small part of the 747 was 17 feet wide at the bottom rear end. This cockpit required not only a flatbed truck, but a “wide load” escort as well.

Acquiring the cockpit

Working with Jim Doyle at Desert Air Spares got me access to the boneyard and tours of potential 747 cockpits I could have cut off and shipped to me. My specific requirements for the cockpit purchase were intact windows, flight controls, crew seats, wiring, glareshield, and all interior walls, carpet and trim. Avionics were not needed or included as I knew there was a flood of them on eBay and I could pick individual instruments and panels that were in the best condition over time. That proved to be the best move since accepting a fully populated cockpit would have financially locked me into whatever avionics was installed for that carrier, in whatever condition they were in. It was cheaper, and far more flexible, to get the control heads and instruments piece by piece.

The restoration goal

Aside from its ultimate end-use as a home simulator, I wanted to restore the cockpit to like-new condition as much as possible. Like all airliners, this 747 saw tens of thousands of hours of use since its birth in 1986. Dirt, coffee spills, bad touchup paint jobs, sloppy repairs, glued Velcro and all kinds of wear came with the cockpit. I was determined to restore every removable, and stationary, piece individually and without shortcuts. If there was no overspray of paint on a panel, I made sure the restored panel also showed no signs of overspray. Any gauges showing signs of yellowing dials were replaced with others that had crisp, white lettering. No instrument was allowed to have faded warning flags, cracked glass, or dented cases. All toggle switches with white rubber boot tips had to be completely white, with no rips, cracks or yellowing of any kind. All toggle guards had to be new, aerospace quality, with no off-color fading or worn areas. All black gauge clamp screws had to be replaced with fresh replacement screws. All annunciator message lights had to be of equal brightness and clarity, which required many identical panels in some cases to accomplish. It was not uncommon to encounter a message light that looked fine on the outside, but had the diffuser plastic layer above the bulbs burned dark brown in the light caps, thus darkening and discoloring the lettering when lit. All worn knobs had to be replaced with new ones, edge-lit panels restored or replaced, and every captive screw on the light plates had to be painstakingly sanded and repainted. Almost all several hundred circuit breakers had to be replaced with new ones since they were dirty or corroded beyond restoration. All this effort, and more, was done to ensure this would be the best preserved 300 series cockpit anywhere and suitable for museum display in the future. Every museum that had a 747 cockpit I could find that had pictures showed their cockpits all in shambles, filthy, missing parts, or just plain beat to hell. The classic analog 747 cockpit was a masterpiece of man-machine interfacing for its time. I felt it deserved to be preserved for future generations to appreciate its complexity in today’s world of computer displays and completely automated aircraft systems. You really had to know every minute aircraft system in the analog 747s and be prepared to deal with them if something went wrong.

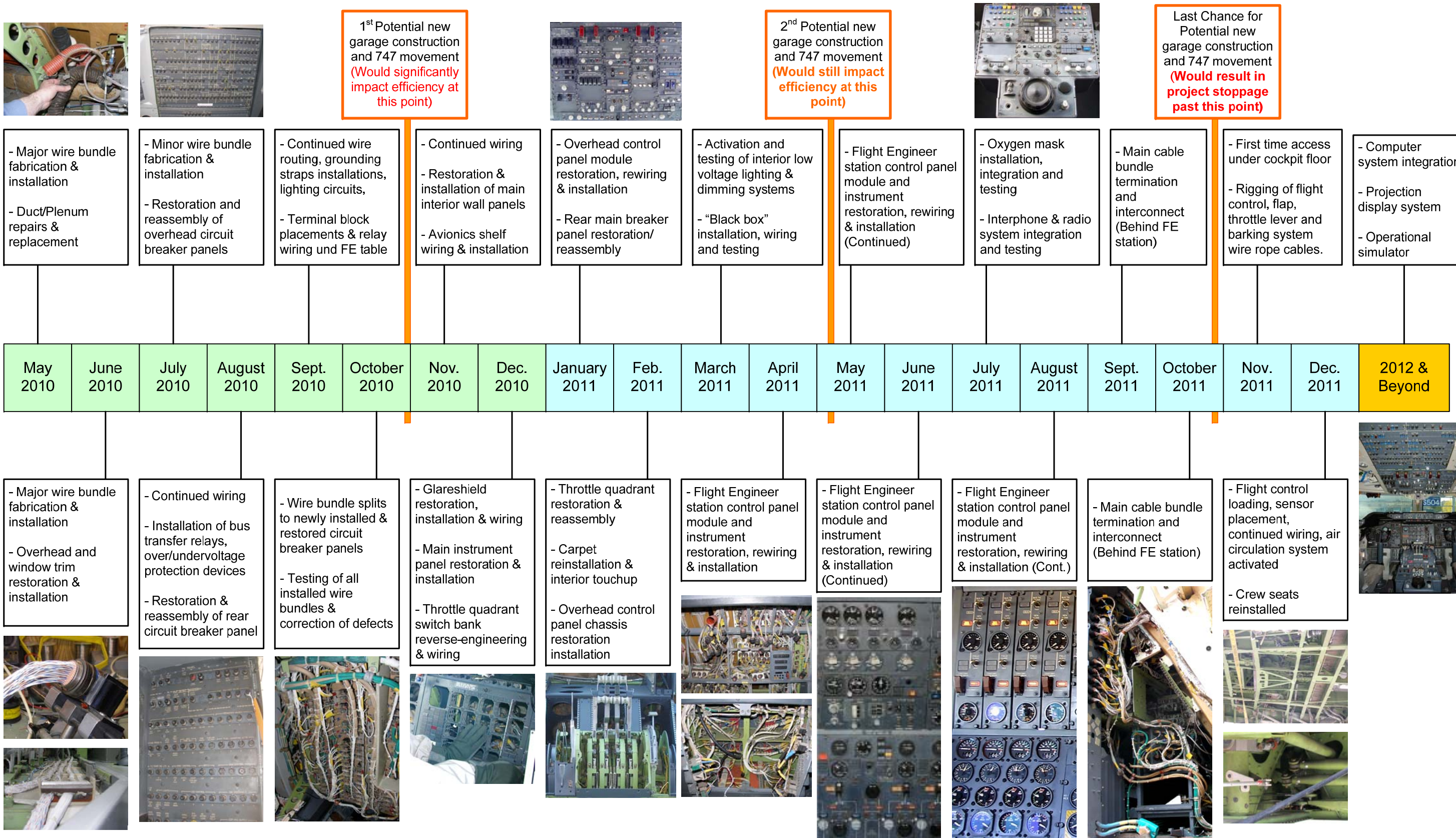
The simulator goal

As was accomplished with the fighter simulator, the flight controls will be interfaced to a computer and all analog instrumentation will be operational. Outside visuals, interior climate control, and Internet connection will be accomplished. This is simply the same process that was successfully accomplished with the fighter simulator, only on a much larger scale and expected to take years to accomplish, as the timeline on the following page depicts. The goal is to never finish... just keep improving.

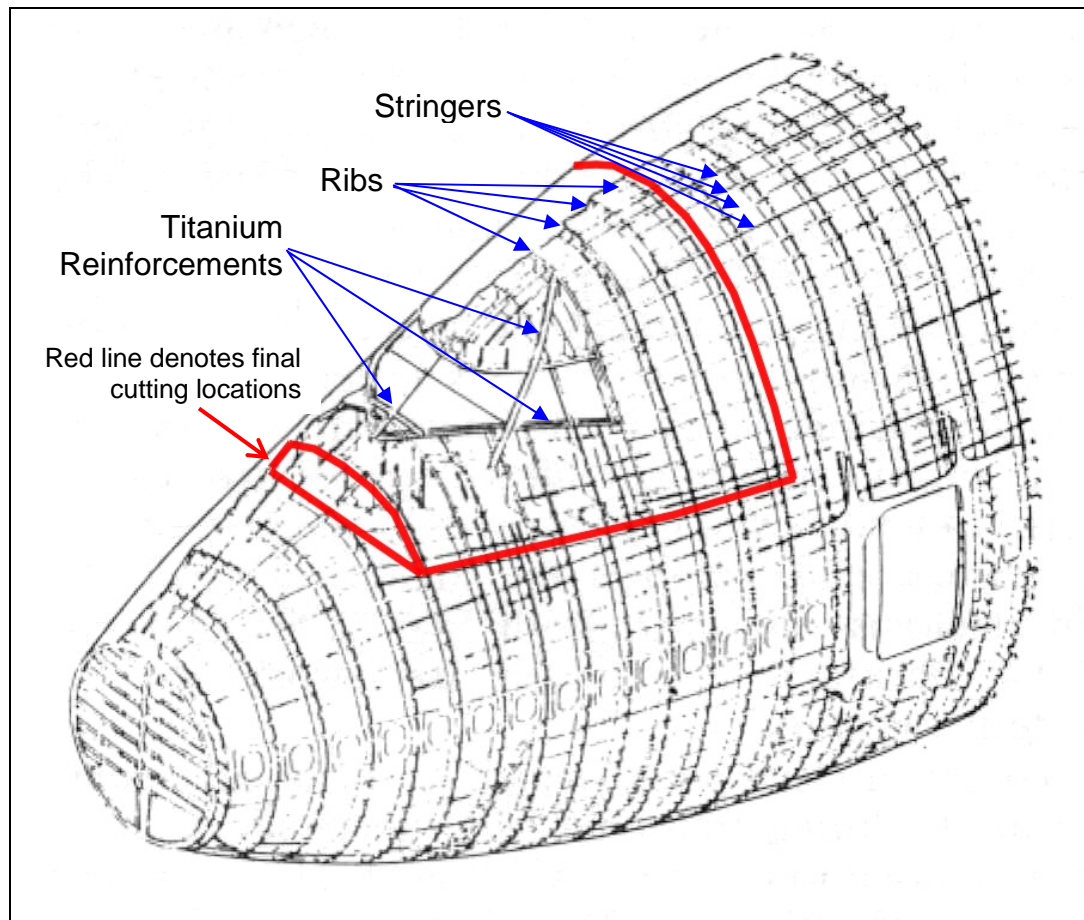


Boeing 747 Cockpit Restoration, Rewiring and Reassembly Timeline*

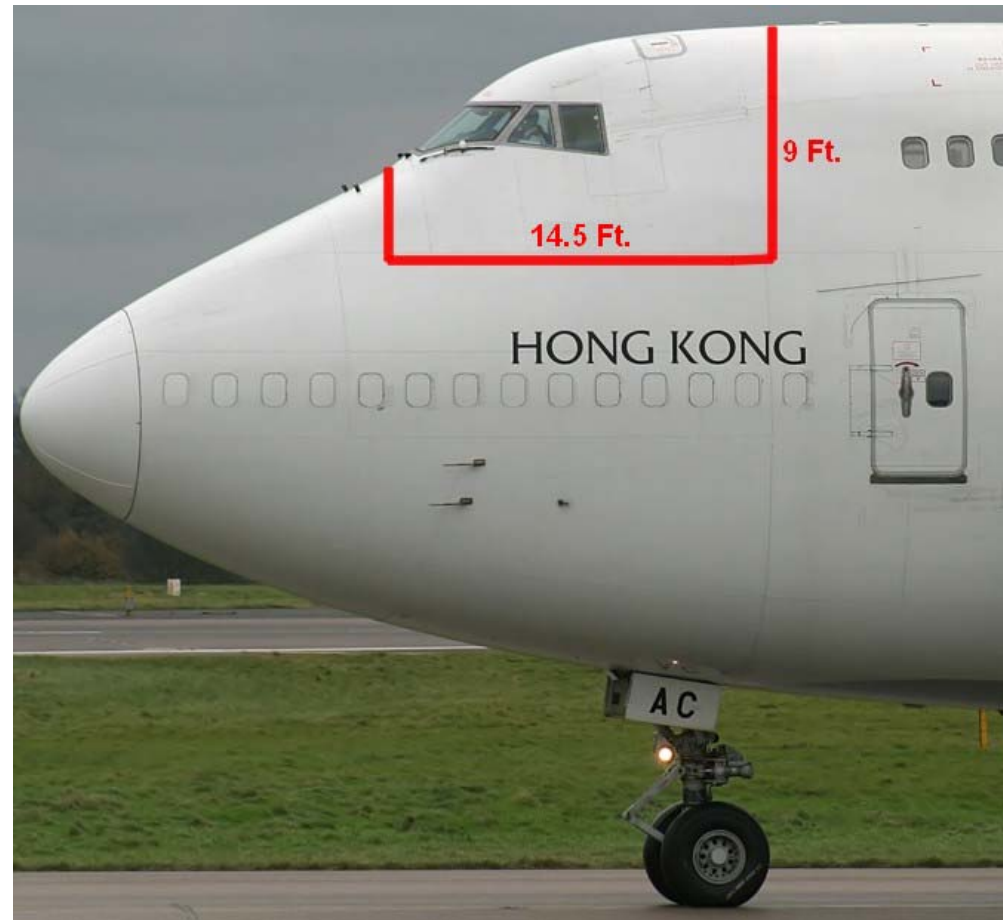
* Assumes work by a single person on weeknights, weekends and holidays (Real job consumes 8-10 hours per weekday)



Boeing 747 Cockpit Structural Characteristics & Dimensions



Boeing 747 interior structure in the vicinity of the cockpit
(Red lines delineate where cutting took place)



Actual aircraft depicting where the cuts on the structural diagram (left) appear on the exterior fuselage and the approximate length/height



Same aircraft with the cockpit removed. Was cut further forward than necessary for easy removal, then trimmed further on ground

Original 747 Construction

Like any other aircraft of the era, the 747 is constructed in multiple sections that are joined together during final assembly. The cockpit section is referenced as "Section 41" by Boeing. The nose section is created by itself and joined to the rest of the fuselage about $\frac{3}{4}$ way through the aircraft's production process. The cockpit by itself is a structurally-independent compartment built of heavy aluminum cross-members under the floor attached to ribs that arch over the walls and under the ceiling to the opposite side. Stringers span between these ribs at regular intervals and the exterior skin is riveted to these ribs and stringers. The structure is made exclusively of aluminum alloys, titanium, and stainless steel high-shear rivets. The end result cockpit structure demonstrates the following characteristics:

- 5500 lbs of Extremely rigid independent structure with very little flexing, bending, or settling characteristics
- Cockpit exterior skin is the thickest than on any other part of the 747 due to the almost flat wall surfaces having to withstand maximum lateral cabin pressure loads
- Built of non-flammable materials, including wall/ceiling insulation, wiring, wall panels and composite flooring
- All aluminum structure is electrically bonded (i.e. all metal parts share the same ground)
- Being designed to be air-tight, water cannot enter through window frames or skin
- All metal components are painted with corrosion-resistant zinc chromate primer (Green or yellow in color)
- Due to its rigidity, the cockpit does not noticeably flex or bend even when only one corner is jacked up

Final cut and trimming of the cockpit resulted in the final outside dimensions of:
Nose to back cut of 12ft. Height at rear center of 9ft. Width at the rear bottom of 17ft. 14.5' x 9' x 17'

Pictured on the right is a 747 Cockpit (Section 41) being carefully attached to the rest of the fuselage during final assembly at Boeing.

It's amazing that such large sections of the 747 are made in other locations around the country, yet still manage to fit together perfectly when the whole aircraft is assembled section by section.



Boeing 747 Cockpit Removal & Transportation to Cedar Rapids, IA



Cockpit at the boneyard after removal from the fuselage



Wide load escorted delivery from Victorville, CA to Cedar Rapids, IA



Crane removal from flatbed truck



The cockpit was lowered onto wood planks to avoid the sharp Cut edges from digging into the ground and making difficult to Place straps beneath it for its final delivery to the house



As the cockpit was to be stored at the wrecker's yard for several weeks, all control panels, flight controls, seats, carpet and interior Trim was removed to ensure nothing was left that could be stolen



An all-encompassing heavy duty tarp was wrapped around the cockpit to protect it from the environment and scavengers

Boeing 747 Cockpit Delivery to Home Residence



The cockpit was placed on a smaller flatbed truck for final delivery



Due to its width, the cockpit had to be escorted from the wrecker's Yard to its final resting place behind my house



As it was moved down my residential street, the sheer size of just this small part of a 747 can be appreciated compared to a nearby car



Lifted by crane, it was placed on four industrial strength dollies on the driveway



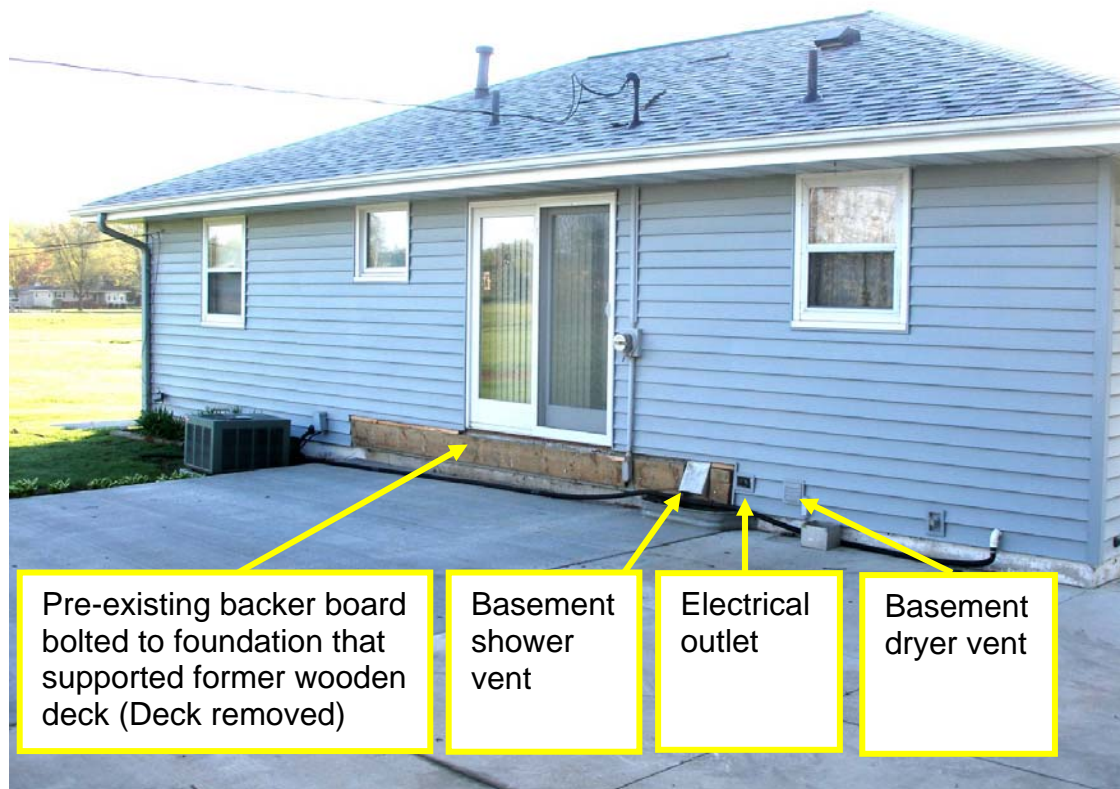
With a forklift used to push the cockpit up the inclined driveway, a workman steered the front of the fuselage to keep it on the concrete



When the cockpit was put into place, a car jack was used to lift the corners to remove the dollies and the cockpit rested on wood blocks.

Boeing 747 Cockpit – Temporary Attachment to House

It was necessary to back the cockpit against the rear of my home so I could gain access to my home's electrical and air conditioning systems. Also to easily gain access to it via the kitchen sliding glass doors.



Pre-existing backer board bolted to foundation that supported former wooden deck (Deck removed)

Basement shower vent

Electrical outlet

Basement dryer vent

Rear of house before 747 cockpit placement

- The wooden deck was disassembled and all wood recycled
- The large deck support board bolted to the house's foundation was left in place
- The basement shower vent and electrical outlet was obscured by the bridge between house and cockpit floor
 - The shower vent was simply routed to the outside of the bridge structure
- The electrical outlet was left undisturbed and unused
- The dryer vent was left undisturbed
- Multiple new ducts were cut through the wall connecting the flight deck's complex original air circulation system to the home's heating and air conditioning system. Two large air ducts existed at the rear of the cockpit that accepted the main flow from the aircraft's air conditioning system and distributed that air throughout the cockpit. A third large duct was routed downward behind the flight engineer's station that was used exclusively for equipment cooling.



Rib structure setting points

Cockpit placed slightly ahead of the gutter

- The cockpit was lowered onto the ground with ribs resting on ½" plywood sheets with a top layer of laminated plastic
- The cockpit floor is even with kitchen floor behind the sliding glass doors
- Several 2x4s with ¼" aluminum plates on top were placed under additional fuselage ribs to provide evenly distributed weight and insurance against any settling. (Aluminum plates prevented the sharp cut rib structure from piercing through wooden 2x4s)
- The gap between cockpit floor and house was three feet
- The entire aluminum airframe was grounded to earth ground via a copper rod driven deep into the soil wired to a heavy cross-member floor spar. Luckily, no lightning strikes hit this very large conductive target while it was exposed outdoors.



Bridge built to between cockpit and house

- Nine 2x4 cross-members spaced 18" apart between cockpit and old deck backer board
- Three 2x4 spans screwed to top of the 9 cross-members
- 2x4s placed on top of each cross-member between the spans
- House side attached via same type of board support metal cradle hardware as the former deck used.
- Cockpit side uses the same support cradles attached to rearmost under-floor support spar.
- All attachments used screws exclusively to enable easy disassembly & maximum strength (No screws went through siding!)
- Intentionally over-built to exceed any expected loads

Boeing 747 Cockpit – Temporary Attachment to House – Cont.



NORTH SIDE

- 1st. layer of ½” particle board was screwed to the top of the 2x4 structure
 - Additional layer of ½” plywood with bonded plastic top layer added later for additional strength and protection from any potential water leaks
- Aluminum sheet metal was added to extend the fuselage from the airframe to the house. Weight of this metal is supported exclusively by the 747. No screws penetrated the vinyl siding
 - UV resistant foam pipe insulation closed the gap between the sheet metal and vinyl siding
- All sheet metal was screwed into the airframe for easy removal when the cockpit was relocated into a new garage
- Sheet metal was caulked to prevent water intrusion



SOUTH SIDE

- To provide continued access to the electric meter, a wall was created with 1” plywood and 2x4s primarily affixed to the 747 fuselage and bottom platform
- Only ONE screw was required to be driven through the roof overhang as an anchor point for the upper right hand corner of the wall. The rest was screwed in via multiple L brackets
 - UV resistant foam pipe insulation was used to close the gap between the wall and siding – no screws through the siding were required
 - Strips of rubber were used to close the gap between the roof overhang and wall. No screws were required.
- Aluminum sheet metal closed the gap between the cut fuselage skin and new rear wall.
- Plastic sheets are retained by metal strips that are pre-caulked and screwed in to provide a water-tight seal in this area



- A plastic “skirt” was placed over the cut skin under the cockpit with UV-resistant foam rubber pipe insulation between the concrete and plastic. This provided the following:
 - Covers all sharp cut edges on the fuselage
 - Prevents small animals from getting under the cockpit and nesting
 - The skirt does not prevent insect and water intrusion on concrete, nor was it intended to
- A plywood bulkhead was added to the cut front end section to cover any sharp edges and prevent animal entry beneath the cockpit
- Extensive use of caulk was employed to seal all seams and joints at every area that had a gap
 - This excludes the home’s siding as caulk would be very difficult to remove from the vinyl. Caulk was used in the gutter area

Boeing 747 Cockpit – Temporary Attachment to House – Cont.



Masking & painting prep

- The cockpit was masked and repainted the same color as the house to prevent the blinding contrast of the original all-white paint and the house
- When the cockpit is relocated into a garage, this paint will be removed and the fuselage repainted with a proper glossy finish



Completed exterior preservation work

- The primary way into the cockpit is through the sliding glass patio doors in the kitchen
- An emergency exit hatch, which is fully operational, is located on the cockpit roof
- None of the cockpit windows can be opened
- All windows are thick, multi-layered panels with several layers used for window heating, which is typically unnecessary where it stands now
 - During extremely cold weather over a period of a week or more, some windows sections will fog internally, thus requiring temporary activation of integral window heating to clear them up. Window heating required 115VAC @ 15 amps for each of the pilot windows. 115V @ 7.5 amps was required for each side window. The side windows had pre-existing heat sensing switches that regulated the glass temperature. The main windshields had a complex heat sensing system that was bypassed and glass temperature was monitored by touching the glass.



All-weather tolerance

- While only temporary, the structure has proven to be extremely solid in the following ways:
 - No settling has occurred resulting in cracks or leaks
 - Internal insulation was adequate enough to allow climate control through simply using a fan placed at the kitchen entrance
 - Have only encountered leaks in heavy rains through the seal in the emergency escape hatch and one time near where the VHF antenna is mounted to the roof
- Electrical power and furnace duct re-routing into the cockpit proved very effective
- Was easily removed from house as it was all attached via screws

Boeing 747 Cockpit – Essential Easy Kitchen Access



Temporarily backing the cockpit against the kitchen sliding glass doors was an essential element of the restoration process. There was no way to get the cockpit into the existing garage and even if it were large enough, climate control would not be possible because of the lack of sufficient electrical power in the garage. Essentially, having the cockpit as a “home addition” made it easy to remove and store parts temporarily in the guest bedroom while other parts could quickly be brought to the basement for reworking. Walking between the house and garage in the extreme Iowa winters would be extremely inconvenient and the spring and summer rain would also be a hassle to walk through. With this solution, it was just a matter of opening a sliding glass door to gain access to the flight deck.

It was a little surrealistic to walk out of the world of a traditional kitchen into the completely different world of a jumbo jet flight deck, but over time, it seemed as normal as walking onto the wooden deck that existed there prior to the cockpit placement.

Since the cockpit was designed to be air tight, no water leaks were encountered and heating and cooling from the house easily handled the addition of this new room.

Security was not an issue since the windows do not open on a 747 and the crew escape hatch at the top of the cockpit was too far up for someone to climb up externally and unlatch the release handle to enter the cockpit. The windows were so thick that getting through them with a baseball bat would be impossible and even using a full size axe would require extreme time and effort to break a hole large enough to climb through. A testament to the strength of the glass used on the 747 would be the nose section photos of PAN AM 103 where the cockpit free-fell 10s of thousands of feet before impacting a grassy field in Scotland. The windshield layers cracked severely, but the windows did not disintegrate.



Boeing 747 Cockpit – Restoration Starting Point

This 747-300 was built in 1986 and delivered to Singapore Airlines as a passenger aircraft. Several years into its passenger service life, it was converted to a freighter which was based at Hong Kong. It typically served routes to Europe and the middle-east. It had been fitted with the required upgrades such as TCAS, mode S transponders, updated radios, AOC data-link equipment, replacement glass ADI and HSI displays, and triple FMS systems in place of the legacy inertial navigation systems and control heads.

As all airliner cockpits endure a lot of wear & tear, there was a tremendous amount of restoration work to be done. The entire interior had to be removed, along with all of the wiring. Luckily, since it lived most of its life as a cargo aircraft, there was no evidence of nicotine stains covering every surface. The air circulation system in passenger aircraft before smoking was banned, would spread a thick film of nicotine on just about every surface of the cockpit, especially behind control panels.

Its freighter status did not exempt it from coffee spillage, though. At every crew position, a large amount of dried coffee had to be cleaned up behind wall trim, under panels, and even out of wiring bundles, relay cases and power transformers.

Sloppy paint touch-ups, patches and crack repairs all had to be cleaned up and redone properly. The “finger cheese” coating on every lever, switch and knob had to be cleaned with Formula 409 and a toothbrush, all air duct tubing had to be removed and replaced with fresh aerospace ducting, air gaspers had to be disassembled and cleaned, Velcro strips attached with aggressive glue had to be removed from cockpit surfaces without damaging the material beneath. All decals had to be carefully removed and cleaned for eventual re-use, or replaced altogether. Strong solvents such as Acetone, Naptha and alcohol were required to clean many surfaces in preparation of repainting. Every single part removed had to be carefully cleaned/repainted, replaced or stored for eventual reinstallation. Luckily the cockpit windows were in perfect condition with no scratches, delamination or cracks.



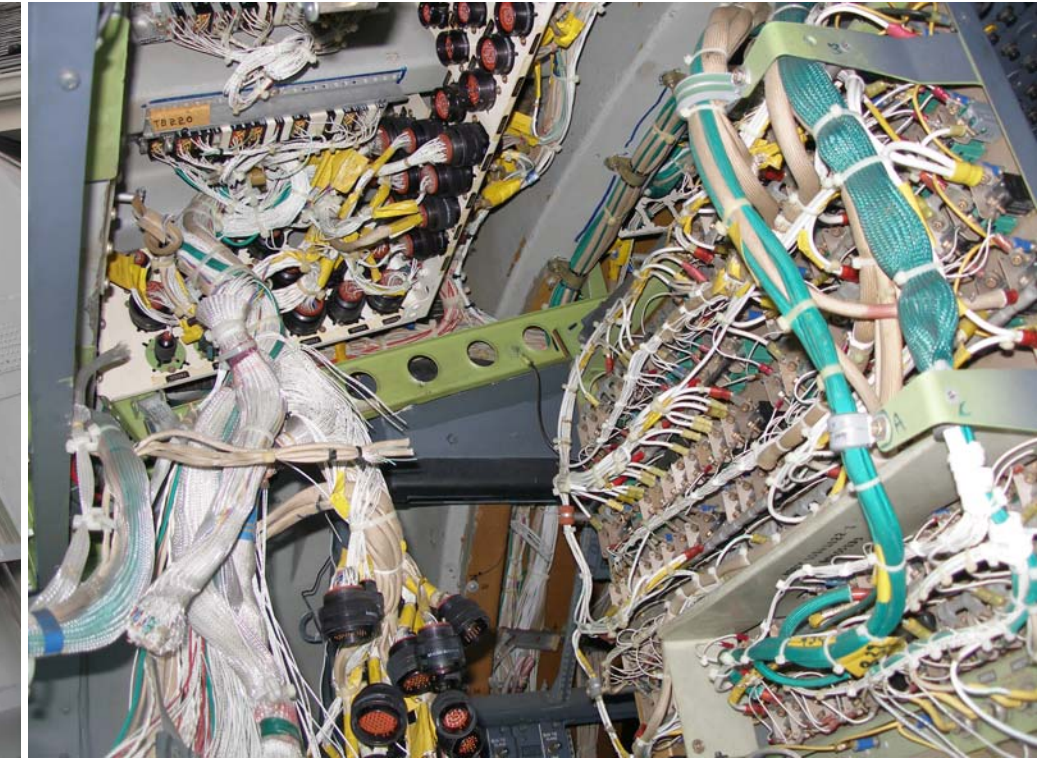
Boeing 747 Cockpit – Restoration Efforts



Three regenerative high capacity blowers were mounted to the Ceiling and drew air from the house's air conditioning ductwork out to The flight deck's original complex ductwork and plenum system inputs



Very little restoration was required on the exterior before painting except the polishing the grime off of the aluminum side window frames



Behind every panel lied thousands of wires that had to be removed and connectors de-pinned and cleaned for eventual reinstallation



With glareshield and all wiring removed, access to the aeroduct tubing Could be gained and replaced and deep cleaning could finally begin



The removal of all the overhead wiring can be seen here now that the pilot's overhead panel and circuit breaker panels are removed.



The Flight Engineer's station was especially time-consuming to de-wire

Boeing 747 Cockpit – Restoration Efforts – Cont.

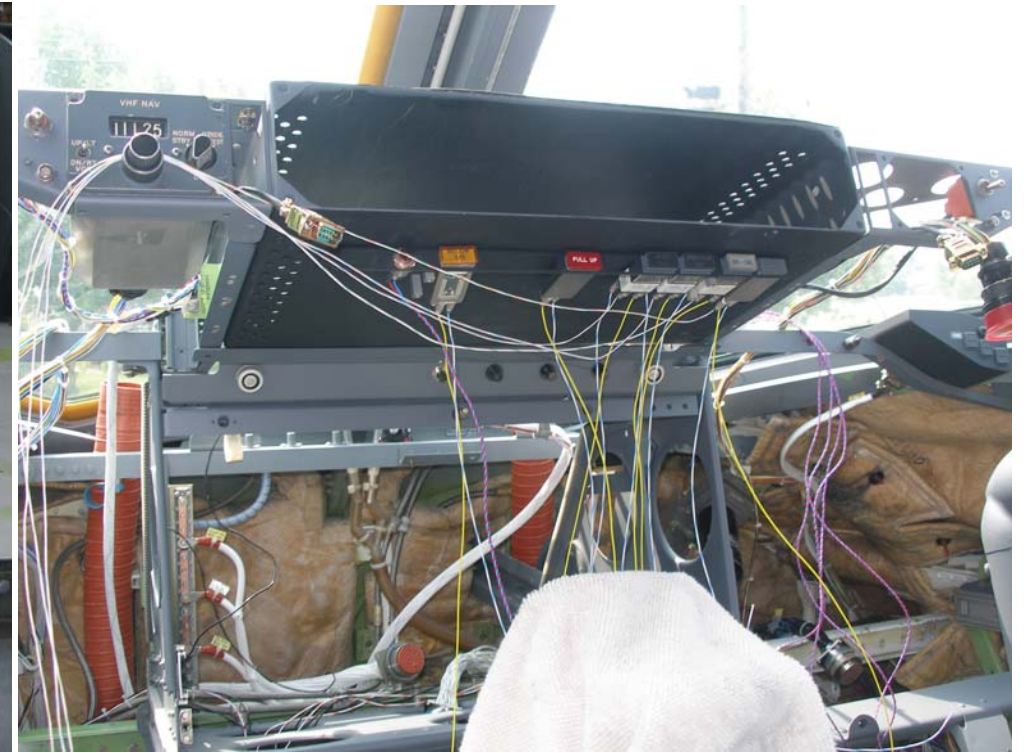
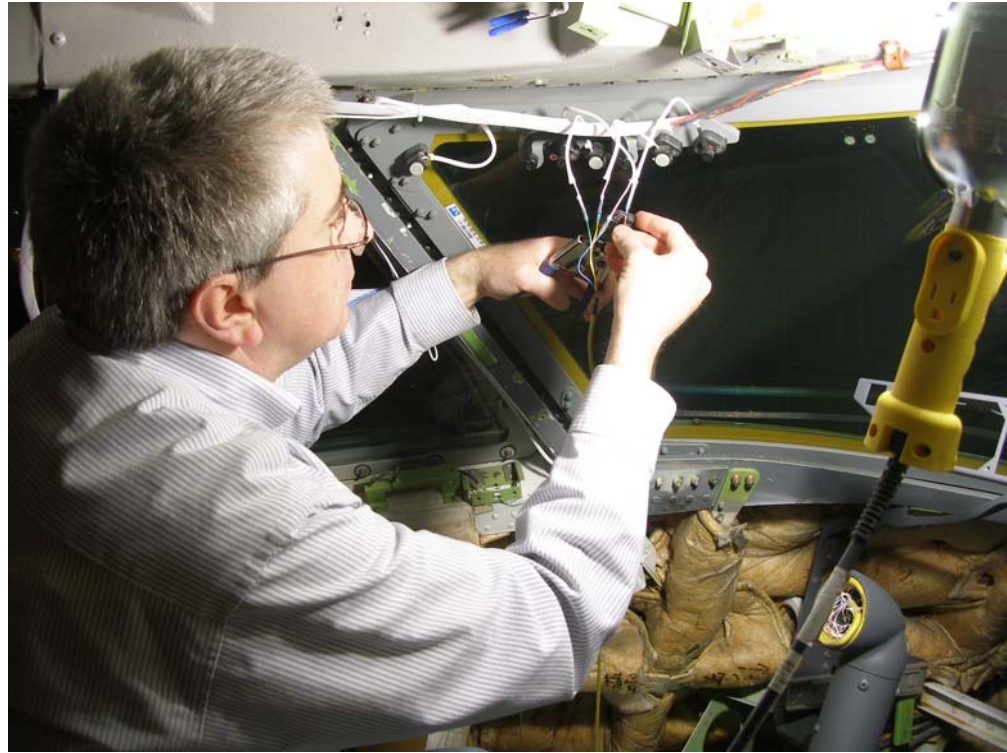


Precise masking was applied to every surface to be painted. No overspray was allowed into any area that did not already have factory gray paint. The spray paint used was custom-matched to Boeing gray



Masking and painting also included color-matched light gray spray paint, components of the cockpit. All removed interior walls and trim were restored and painted in the garage. Zinc chromate primer was used where sanding revealed bare metal. Black paint was applied in the few places where that color was required. Multiple coats of paint were patiently applied to ensure a drip-free, thick overall coat. In the case of circuit breaker panels, all breakers were removed and replaced with new aerospace circuit breakers. This made it easier to repaint the breaker panels and ensured the new panels were not populated with filthily and worn breaker buttons where the amperage reading could barely be seen.

Boeing 747 Cockpit – Restoration Efforts – Cont.

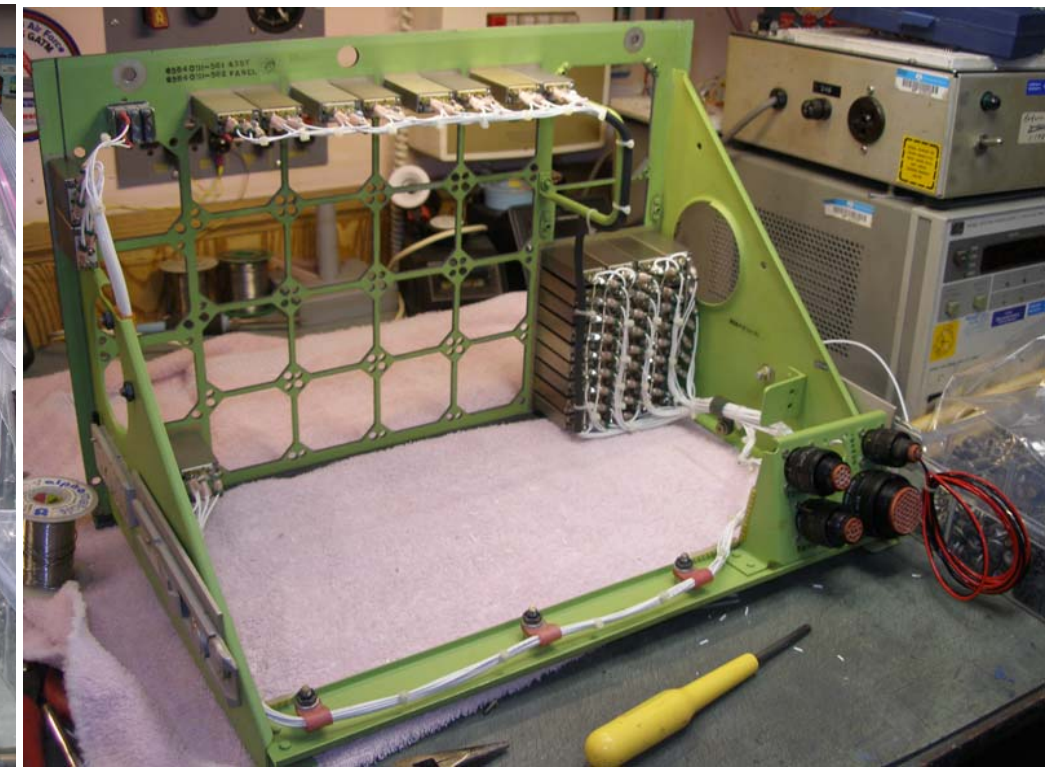
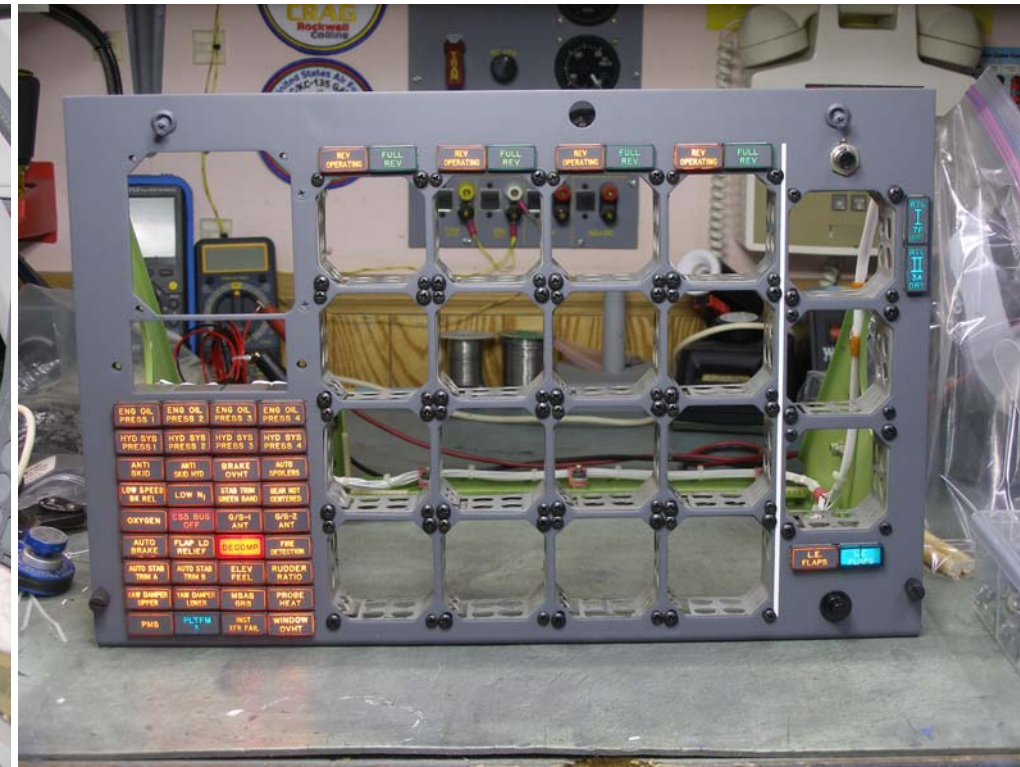


With all cleaning and painting finished, new wiring and air conditioning ductwork could be installed. Only aerospace wire and connectors were used for the refurbishment. All vent tubing was high temperature silicone covered fiberglass Aeroduct tubing. The original Boeing vent tubing was made of a black substance that dried out and created breaches for air leaks and allowed sediment to travel through the ducts and plenums. The silicone-based replacement tubing will not disintegrate into powder over the decades and is smoother on the outside, thus making it easier to slip through tight spaces. .

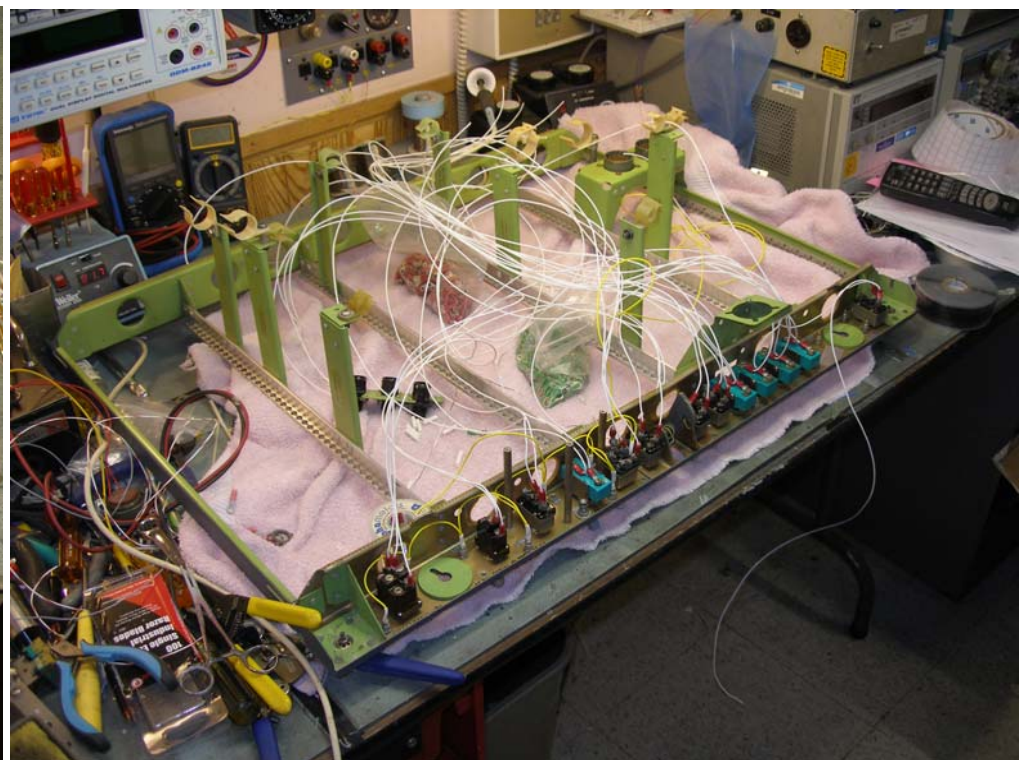


With the new main wire bundles created that lead from the front instrument panel to the rear of the flight deck, smaller wiring requirements were addressed. This included interior lighting, control yoke, windshield washer pump, windshield wiper motors, window heating, speakers and various switches on the throttle pedestal. Tightening of ductwork was performed and the wall panels were gradually reinstalled.

Boeing 747 Cockpit – Restoration Efforts – Cont.



With the glareshield completely repainted, rewired and installed, the long process of refurbishing all of the flight deck's control panels was the next step. As with the cockpit itself, all panels were precision-masked after sanding and chemical treatments to prevent overspray into areas that should only show primer. The original panel cylindrical connectors were re-pinned with aerospace wire to aviation grade spade lug terminals that connect to the various lights and switches on each panel. Even the gauge clamps went through my dishwasher before being reattached to a panel with brand new black screws. Constant improvements are ongoing.



In many cases, multiples of the same panels and control heads had to be acquired to make one good panel. Edge-lit panel condition, white-tip toggle discolorations and any other faults had to be corrected.

Boeing 747 Cockpit – Restoration Efforts – Cont.

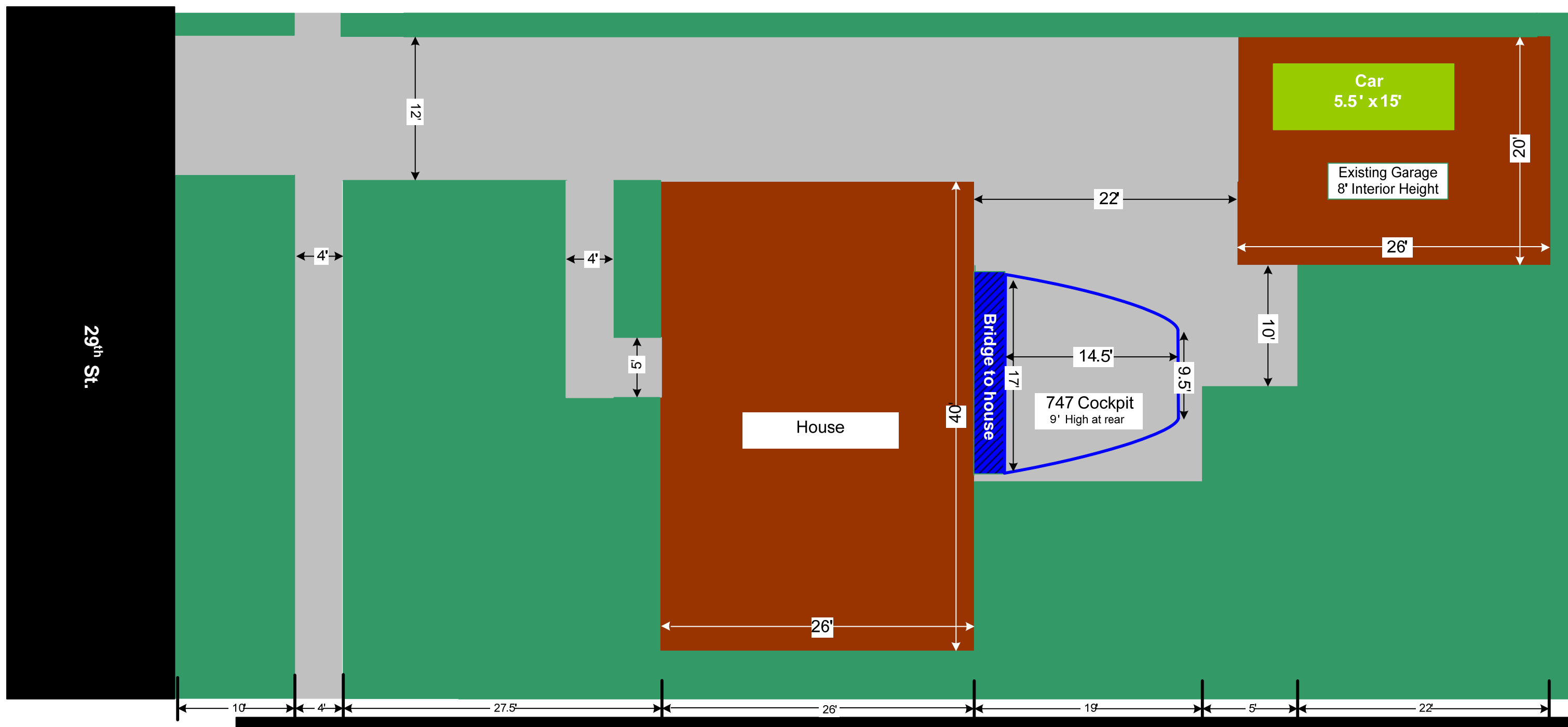


As each panel was restored, it was installed into its appropriate location. Again, multiple identical panels were required to assemble single panels that showed minimal wear. This process is ongoing.



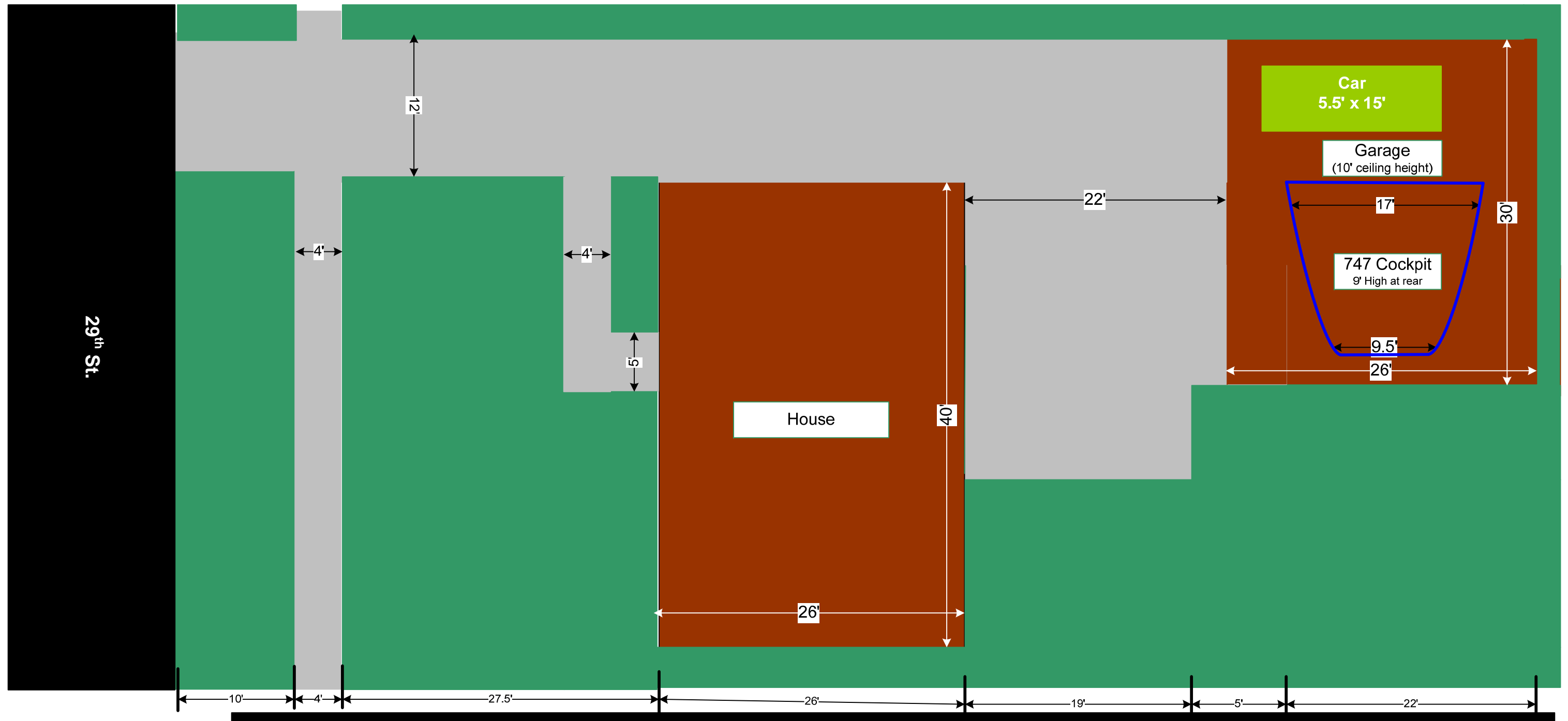
Instruments were temporarily installed before the cockpit was separated from the house destined for its new home in a large garage. I had a garage built as large as the city would allow to give me plenty of room to move the cockpit around. As before, industrial strength dollies made moving the 5500 lb cockpit super easy. Now it resides out of the elements and also stops my house from being a tourist attraction. Restoration, wiring, and spare parts acquisition is ongoing.

Former Property Layout (To scale)



- The un-insulated existing 8' interior garage ceiling height did not meet the height requirements of the cockpit. The Interior ceiling must be 10'-12' high and wide enough to contain the cockpit and one small SUV.
- There was seriously inadequate electrical service to existing garage. To power the 747 simulator, computers and climate control system, 100 amp electrical service will have to be supplied to the garage via underground cables.

Property Layout With New Garage (To scale)



- The new garage accommodates the entire cockpit, plus leaves room for a single car to be parked beside it behind it
- A single, double-wide garage door opening was utilized and the door's hanging tracks do not conflict with the height of the cockpit.

This picture, taken 5/29/12, shows the current state of the cockpit which still has a lot of restoration left to be accomplished. Oxygen masks, decals, original carpeting, crew seats, headsets, and a myriad of other small components remain to be installed.

The front instrument panel depicts mostly a Collins Avionics suite of primary instruments. Collins uses a moving tape in its ADIs to display the pitch portion of attitude while other avionics manufacturers, such as Sperry, use a physical sphere within the instrument. Luckily, the indicators are virtually pin-for-pin compatible and exchangeable without changing electrical connectors. I prefer the Sperry sphere type attitude representation, seen below, and will most likely install that model of ADI.



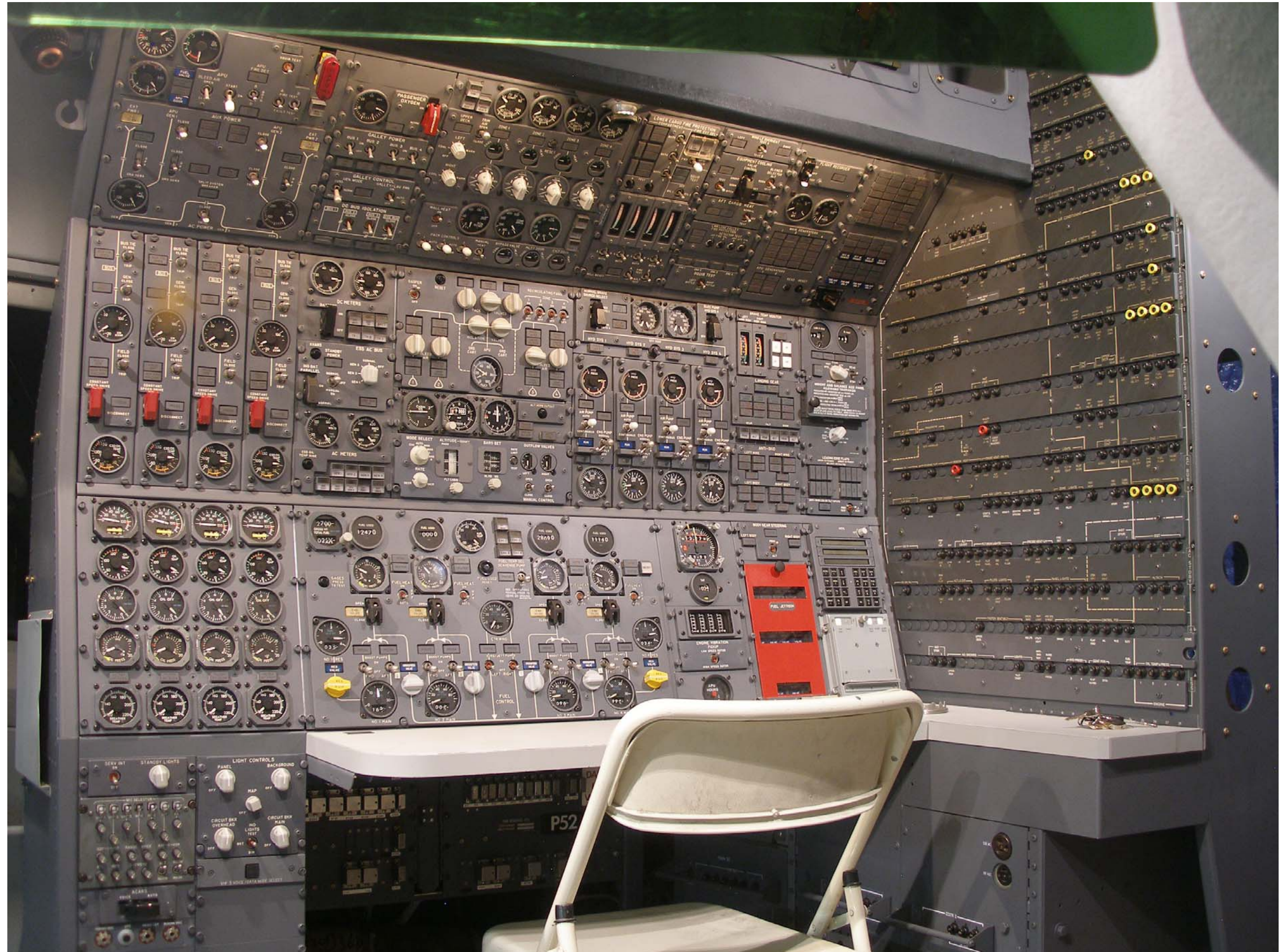
Sperry type ADI

Plain and shielded cabling has already been put in place behind the panels and walls to accommodate versions of the 747-300 that have been upgraded since 1986 to present. Traditional Litton INU CDUs can be installed or replaced with modern full FMS CDUs with six line color displays. The ADI and HSI can be replaced with LCD replacements and a display control panel to support their different modes. This enables the cockpit to be configured as it was originally delivered in 1986 or updated to current regulations requiring TCAS, Mode S transponders, EGPWS, etc. Multiples of each type of each manufacturer's instruments and control panels have already been acquired to enable support of the simulator for years to come. Reconfiguration of the cockpit as a whole is fairly easy since Boeing used standard dzus rail panels just about everywhere.



The 747 Flight Engineer's station layout varies between different airlines depending on the options they chose when they bought the aircraft. Some fuel panels are far less instrumented, the engine gauge grouping on the lower left can vary to exclude the engine breather indicators and, of course, many other panels change depending on if the aircraft will be a passenger or cargo jet. Many panels are standard, such as the APU panel, generator panels, etc., but there is a lot of room for carrier-specific equipment such as ACARS panels and printers. Some carriers choose not to include a brake temperature monitoring panel, or other panels that may appear on other jets. No doubt I will change the panels at the FE station many times, but as with the main front panels, cabling will be in place to accommodate updates such as digital fuel indicators and data link equipment.

During restoration, even the smallest unseen components, such as relays, static inverters, transformers, logic modules, etc., were removed, cleaned and await reinstallation. Every single of the hundreds of electrical connectors were removed, de-pinned, cleaned and await fresh pins to be reinserted. The spider web of air ducts, plenums and hoses behind the panels were either cleaned or replaced and air is already being forced through some of them. As much as practical, circuit breakers will be wired to their appropriate loads. As most of the breakers connected to equipment outside of the cockpit, they will simply remain disconnected.



Shot through a dusty exterior window (Geez, I could have just wiped it off with a rag!) the overhead panel can be seen. Most of the control heads for the overhead have been restored, but you can still see the wires leading out of the forward part of the panel indicating I have not installed dimming potentiometers and knobs at those locations. Right now, all of the interior lighting is set to full bright.

You can also see the mode select panel, which if you did not notice earlier, is a Category II panel since it does not have a third engage lever. The autopilot, flight director and autothrottle mode indicators are also for a CAT II system, but if you have a keen eye, you can see the center engine instrument panel has flag indicators for a CAT III autoland system. The mode select panel and associated mode select indicators can be exchanged with CAT III versions, but as most airlines simply found the analog CAT III system too hard to maintain, they usually taped over the third autopilot lever and marked it as "INOP". I have the parts to change over to a CAT III system, but prefer the pilot of this simulator to manually flare out and land the plane. As the human interface to this old analog world is the most attractive aspect to me, I hope to keep as much of the analog systems running as possible. However, it is always nice to have the ability to upgrade to modern displays and flight management systems.

I've been asked why those yellow stickers are on the window heating wires and the answer is that they exist on the real aircraft and these wire/cable marking identification labels are on every cable bundle behind the connectors. They are made of self-extinguishing Tedlar material and I use the exact same labels on the wiring in this restoration.

Can you say "anal retentive"?

