FEB/MAR

Dakota Territory Air Museum's P-47 Update

by Chuck Cravens

AIRCORPS AVIATION

The gunsight light is operational!

DAKOTA TERRITORY AIR MUSEUM

www.dakotaterritoryairmuseum.com

Update

This month, the pilot's seat, tailwheel uplock, cockpit enclosure, and ADI injection kit were major areas of restoration work for the fuselage. On the wings and empennage, doors for the gun and ammo bays saw attention. The inner landing gear doors were precisely fitted, and work on the elevators and flaps continued to show good progress.

Tailwheel Uplock

One of the issues that came up in the restoration was getting the tail wheel to firmly lock in the up position. Several things contributed to the problem. Speaking to folks who currently operate razorback P-47s, we found this to be a fairly common problem. One thing that exacerbates the issue is conflicting methods of adjusting the tail wheel locks. Some manuals say to adjust in the locked-up position and others say to do so in a neutral position instead of a locked position.

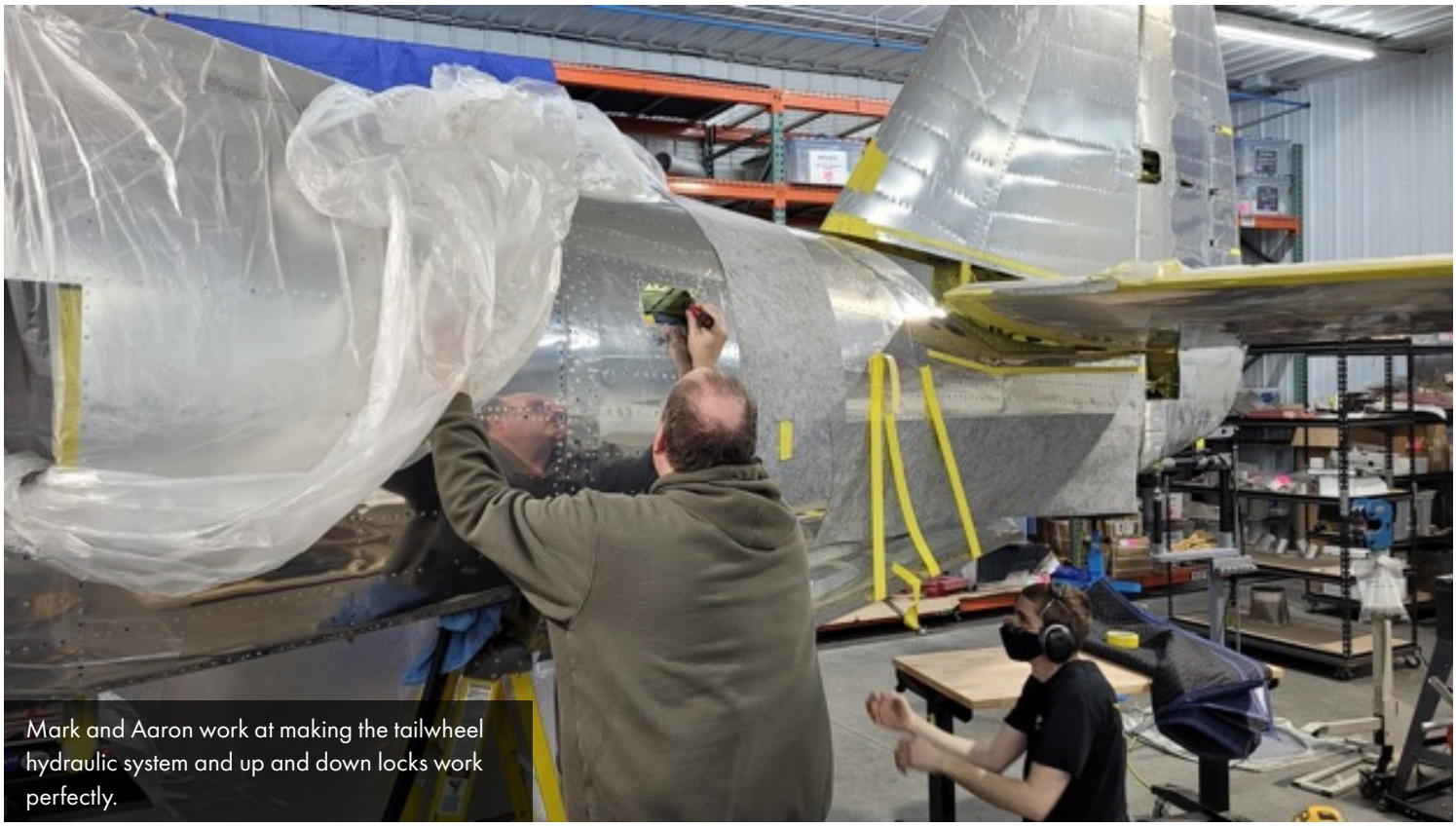
Once both methods were experimented with, it became clear that adjusting in the neutral position was the effective way to do this task.

The original 1944 uplock hooks were found to be too worn to be usable. So new parts were fabricated.

New uplock hooks before assembly.

Mark works on the new hooks.

This is what the completed uplock hook looks like.

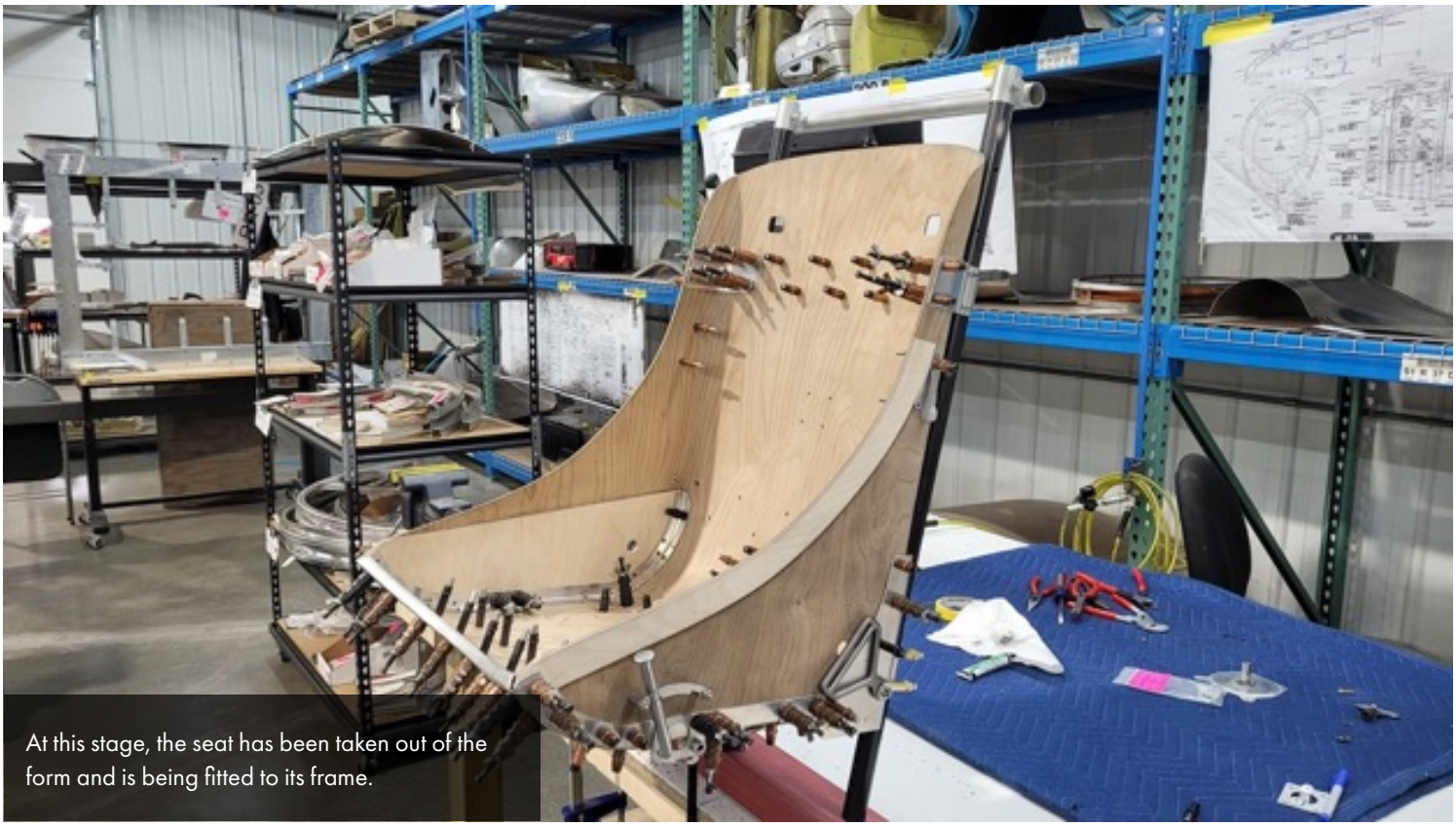


Mark and Aaron work at making the tailwheel hydraulic system and up and down locks work perfectly.

Seat

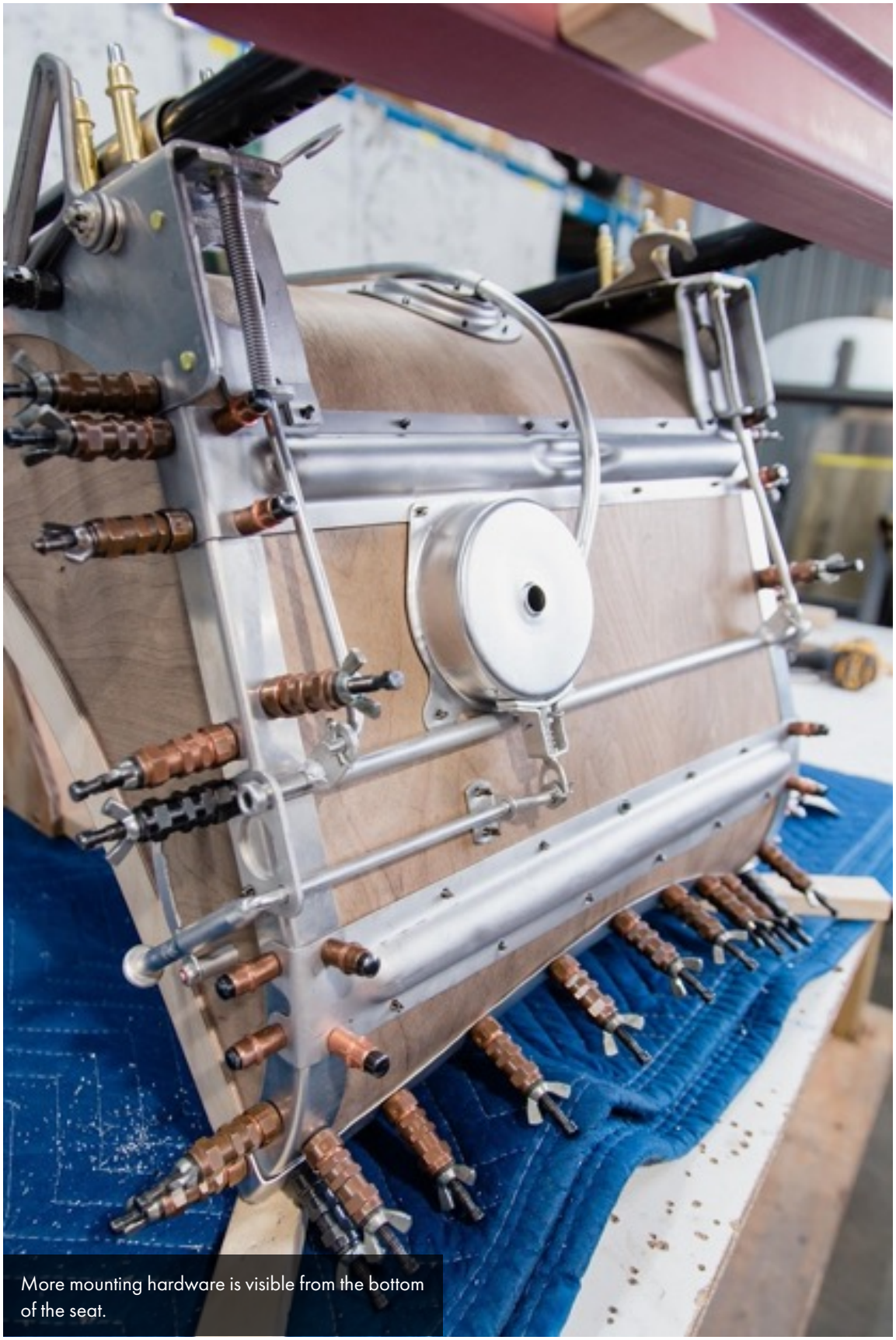
The seat in the P-47 is made primarily of wood. Fabricating the seat required steaming and forming the wood to get the required curved shapes.

A form was built to bend and shape the plywood seat to the original Republic drawing specifications.



At this stage, the seat has been taken out of the form and is being fitted to its frame.

The back view of the seat shows some of the mounting hardware.



More mounting hardware is visible from the bottom of the seat.

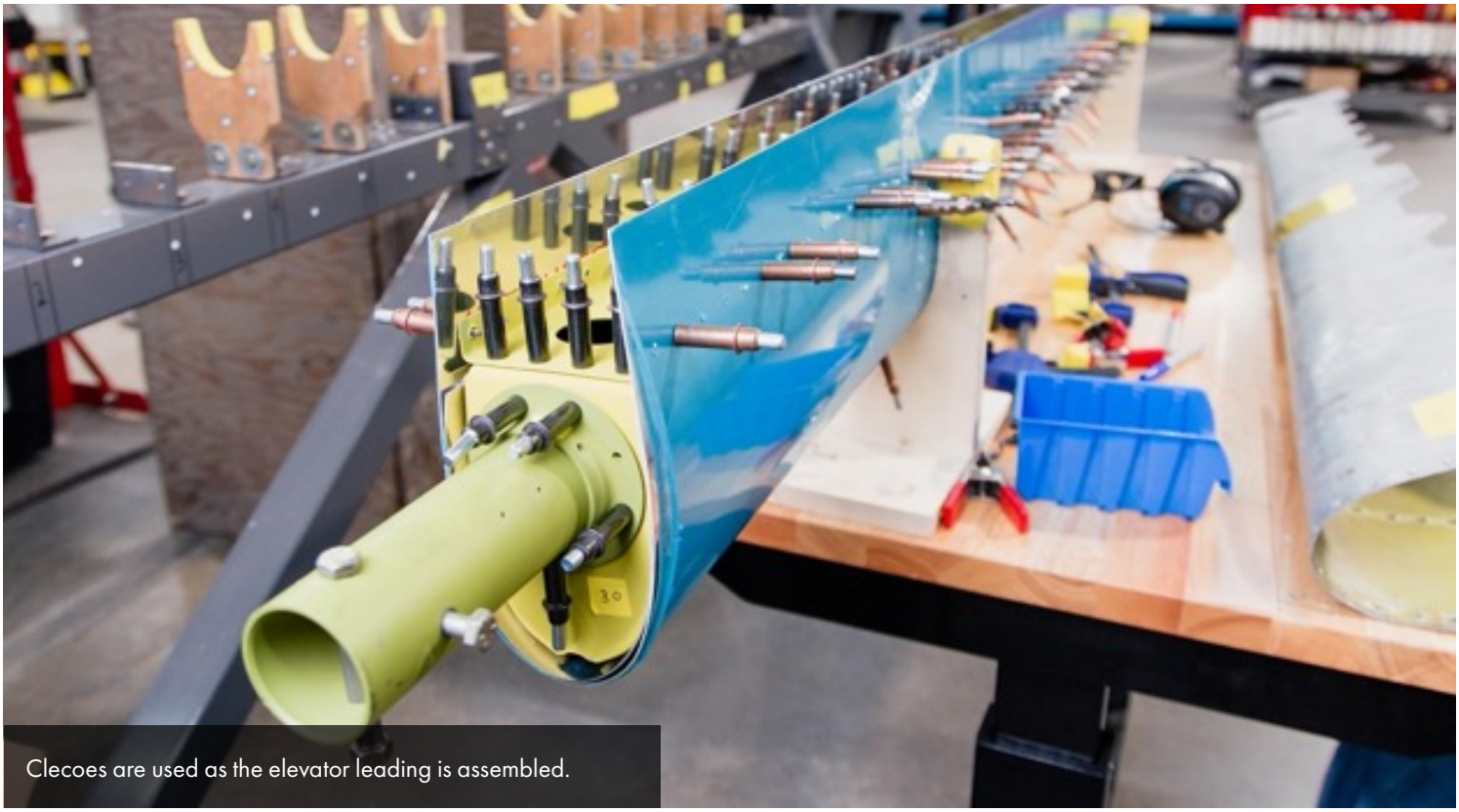
The metal parts of the seat have now been painted. The cable housing running up the back of the seat is for the seat belt tensioner.

The seat belt tensioner cable runs down to a spring contained in the circular housing under the seat.

Control Surfaces and Doors

This is a skin for the elevator leading edge.

Brad is working on the elevator leading edge.



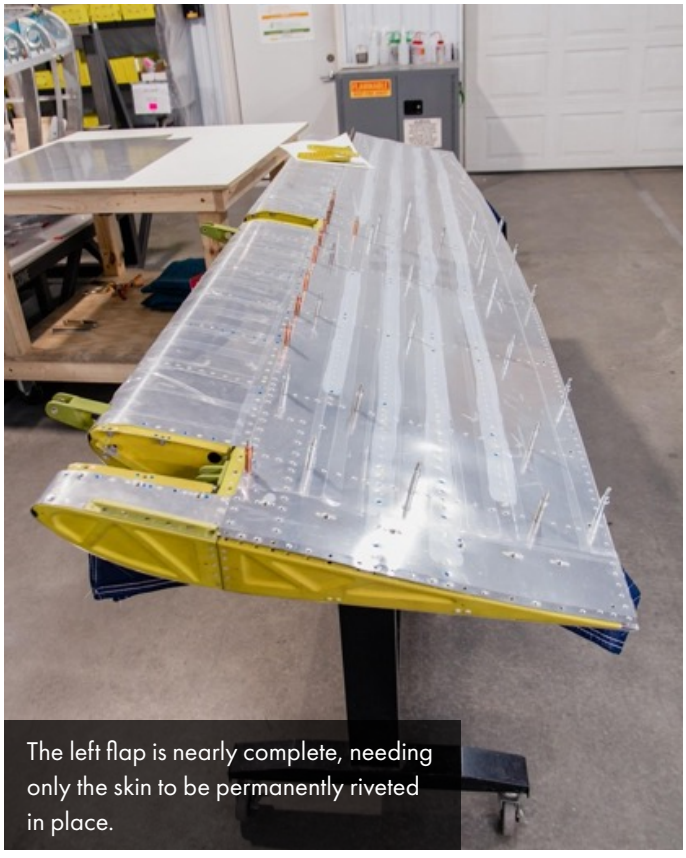
Clecoes are used as the elevator leading is assembled.

These are elevator ribs awaiting their moment to be riveted on.

A flap takes shape in the fixture.

Gussets for the flap are ready to be installed.

These ribs are for the root end of the left flap.



The left flap is nearly complete, needing only the skin to be permanently riveted in place.

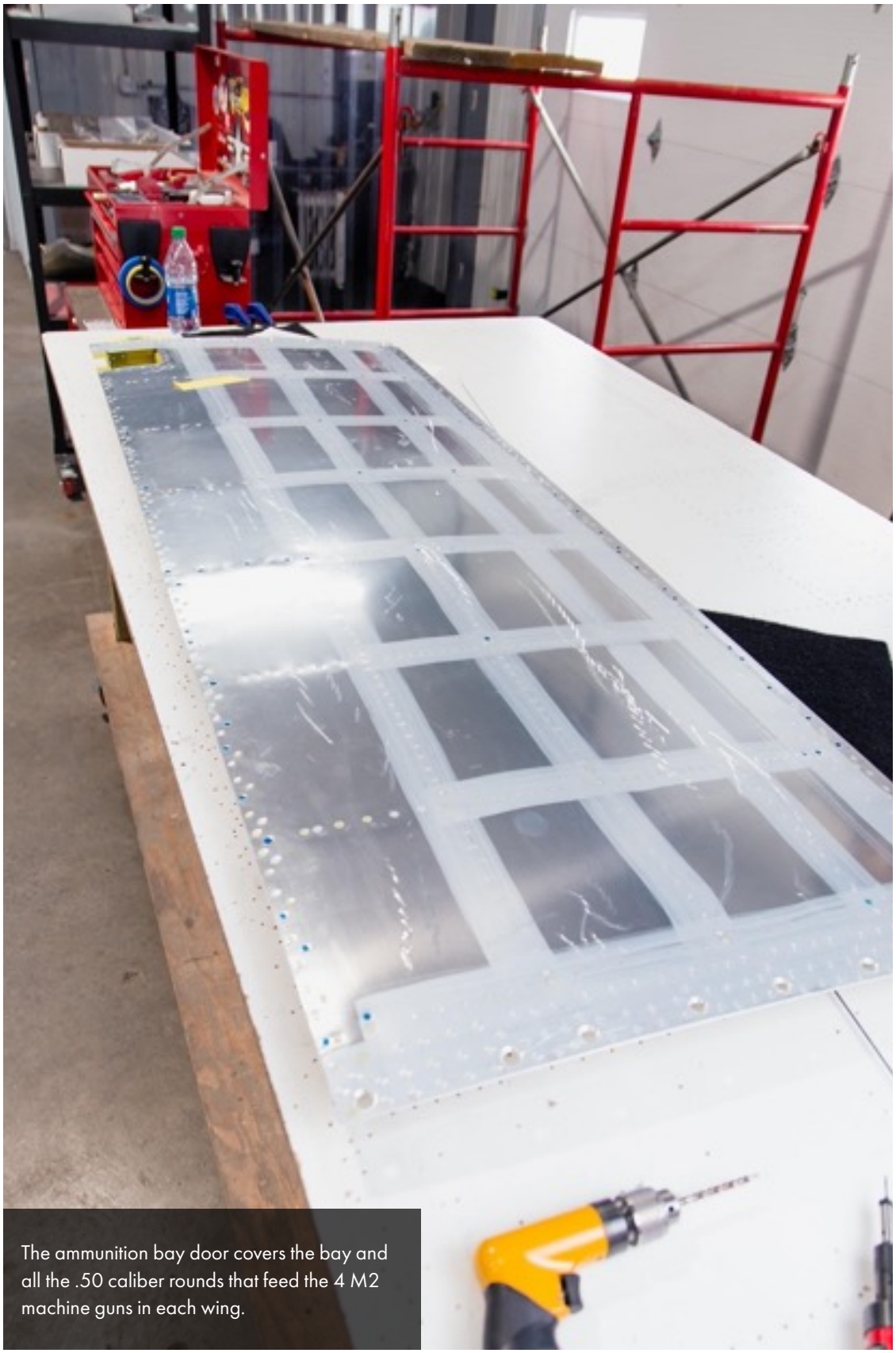
Wings and Gear Doors

Landing gear, gun, and ammunition bay doors were the main focus of the work completed on the wing this month.

Both wings are in fixtures as they near completion.

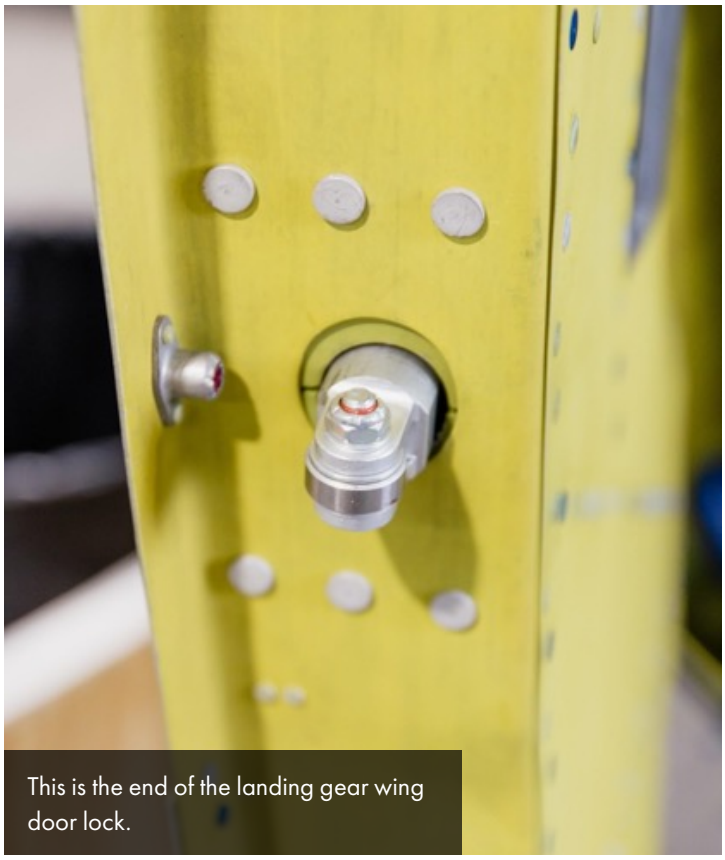
This is the ammunition bay.

The gun mounts are positioned at different distances from the leading edge. Staggering the guns this way allows the ammunition belts to feed into each gun's receiver.



The ammunition bay door covers the bay and all the .50 caliber rounds that feed the 4 M2 machine guns in each wing.

The inner main gear door (called the wing door by Republic) has been fitted.



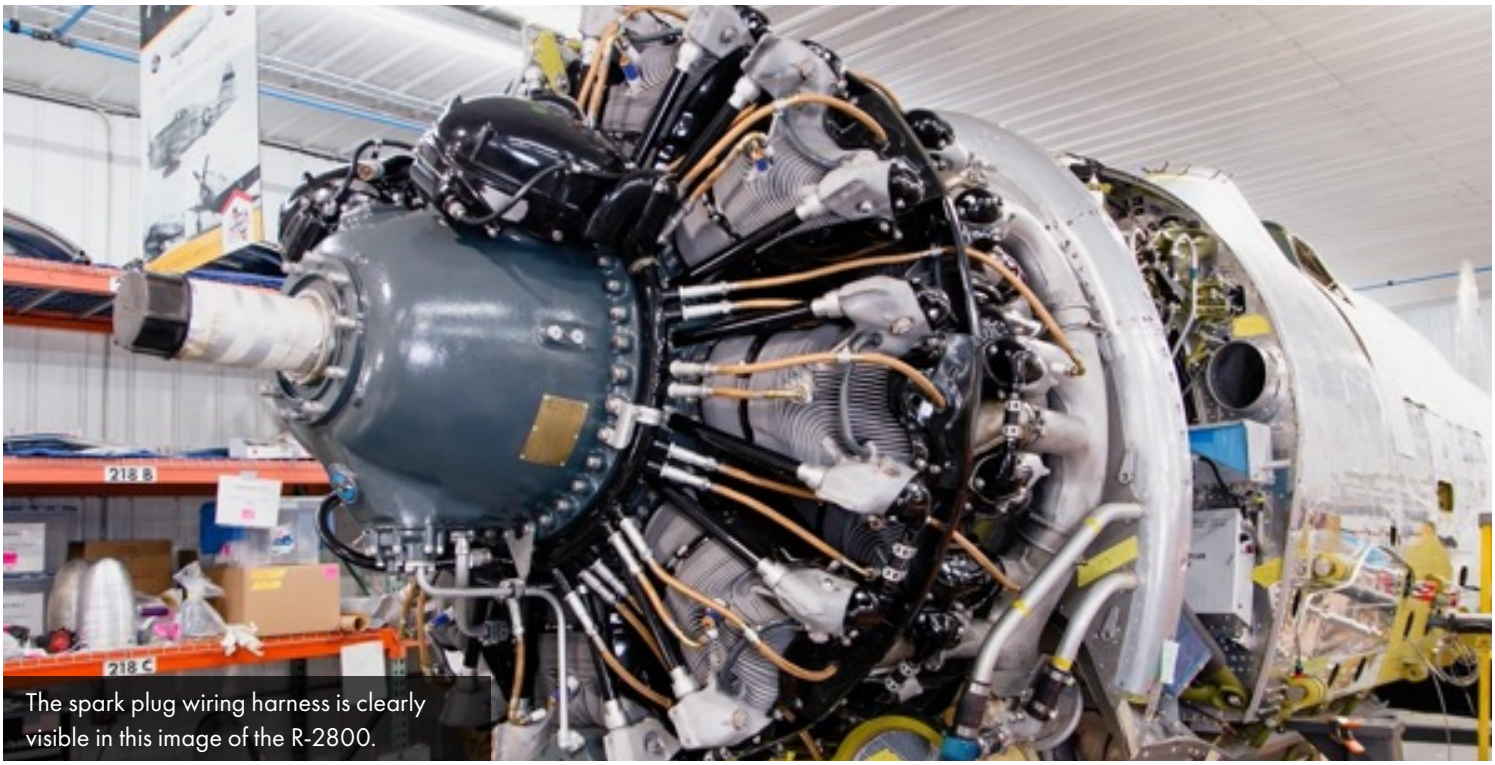
This is the end of the landing gear wing door lock.

Here is a closer look at the wing gear door in the down position.

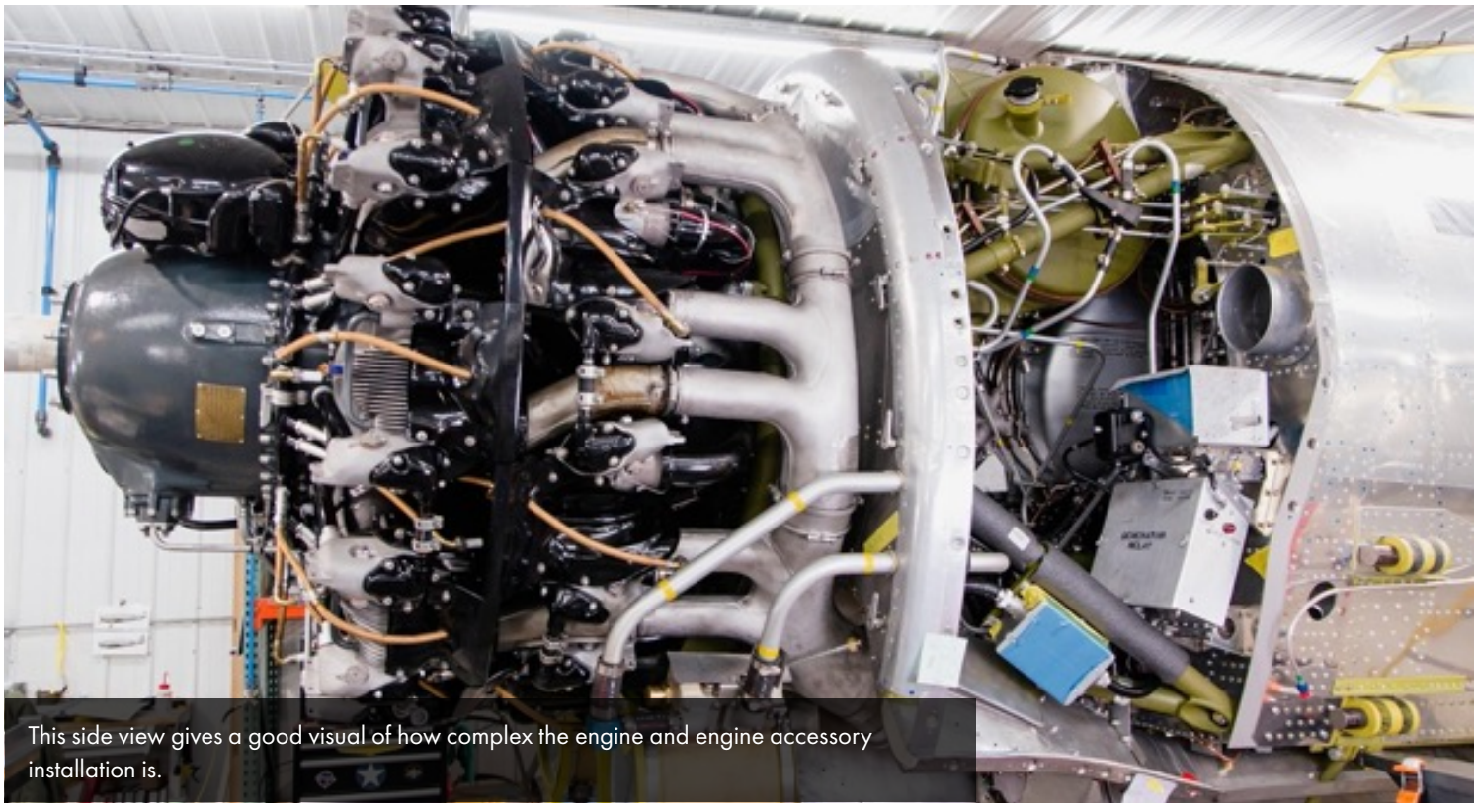
The inner door fits nicely in the up position.

Firewall Forward

Many details of systems and connections on the engine and accessories installation were completed this month.

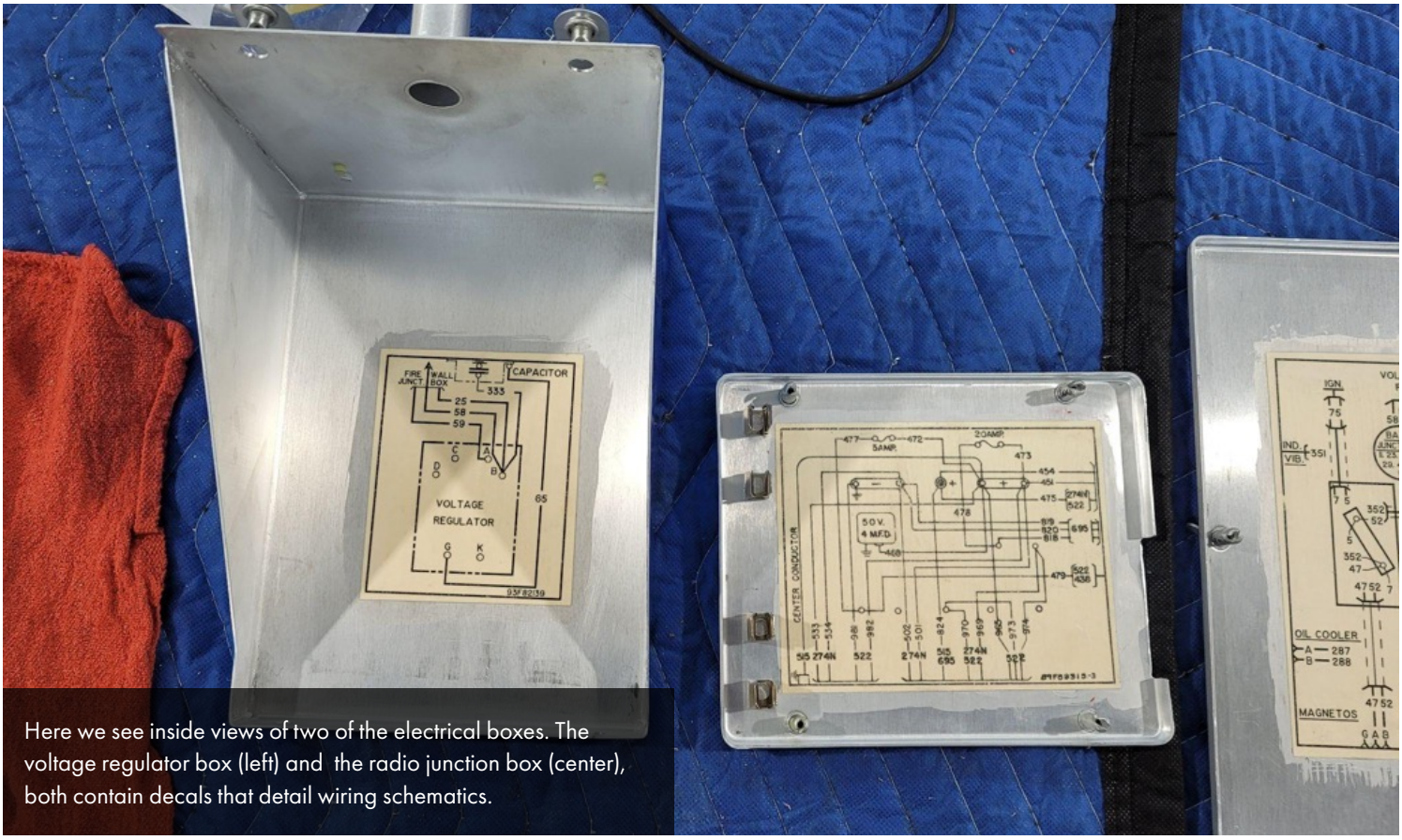


The spark plug wiring harness is clearly visible in this image of the R-2800.



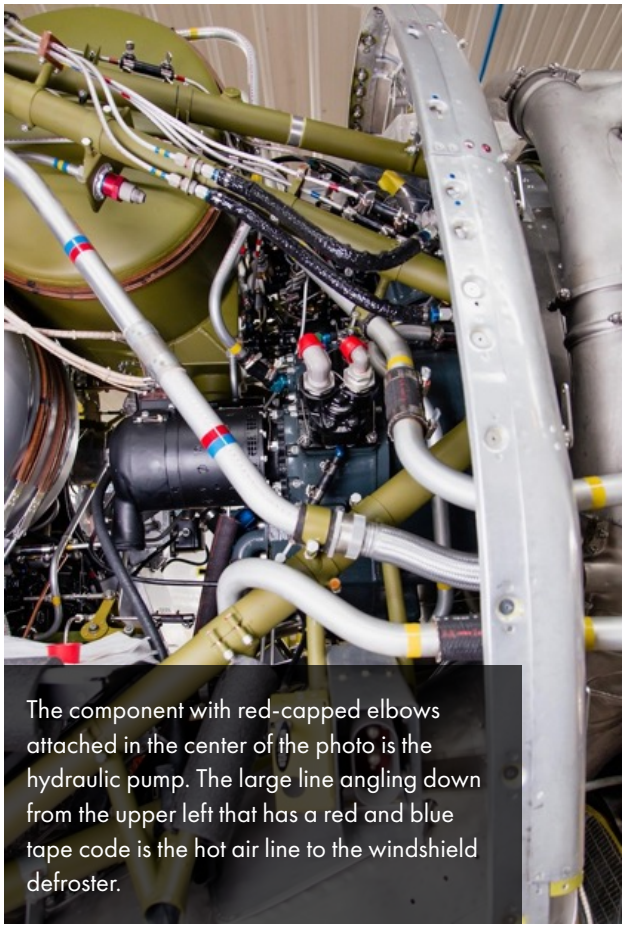
This side view gives a good visual of how complex the engine and engine accessory installation is.

The flexible hose is what connects a horn in the front of the cowl to the defroster system, bringing in outside air to be heated by the exhaust muff.



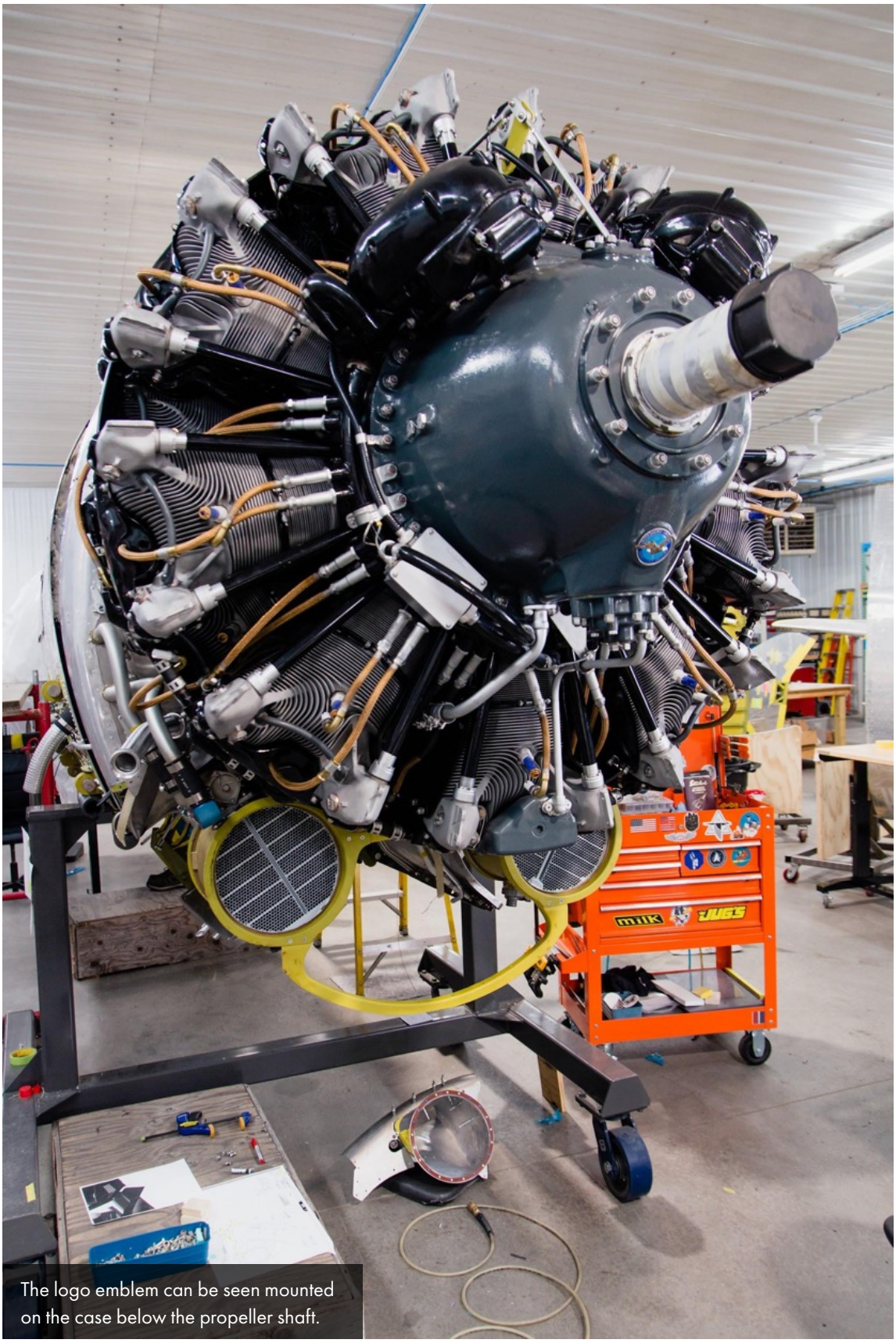
Here we see inside views of two of the electrical boxes. The voltage regulator box (left) and the radio junction box (center), both contain decals that detail wiring schematics.

This is the radio junction box with the cover in place. Its position was changed as part of the field modification for the installation of the Christmas tree tank.



The component with red-capped elbows attached in the center of the photo is the hydraulic pump. The large line angling down from the upper left that has a red and blue tape code is the hot air line to the windshield defroster.

The Pratt & Whitney logo emblem on the front of the big R-2800 double-row radial engine.

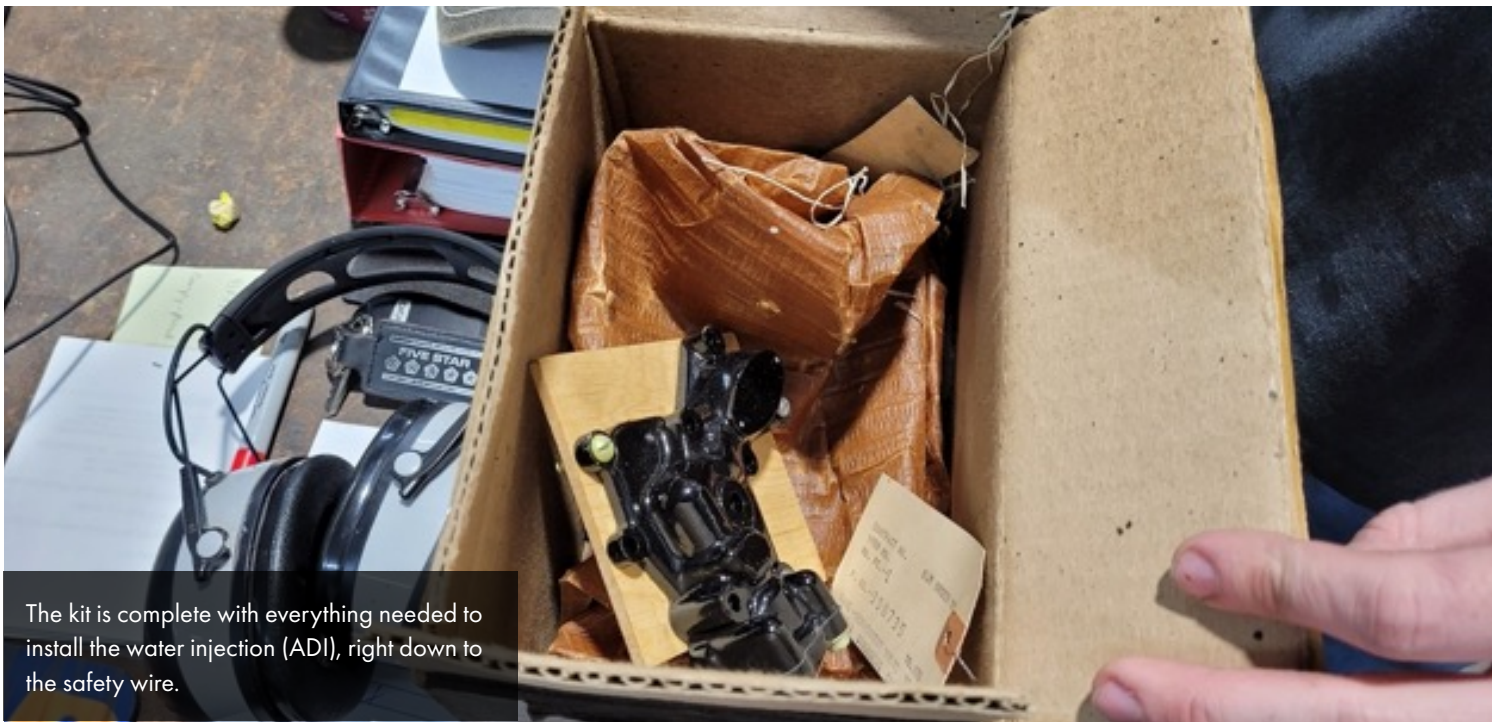


The logo emblem can be seen mounted on the case below the propeller shaft.

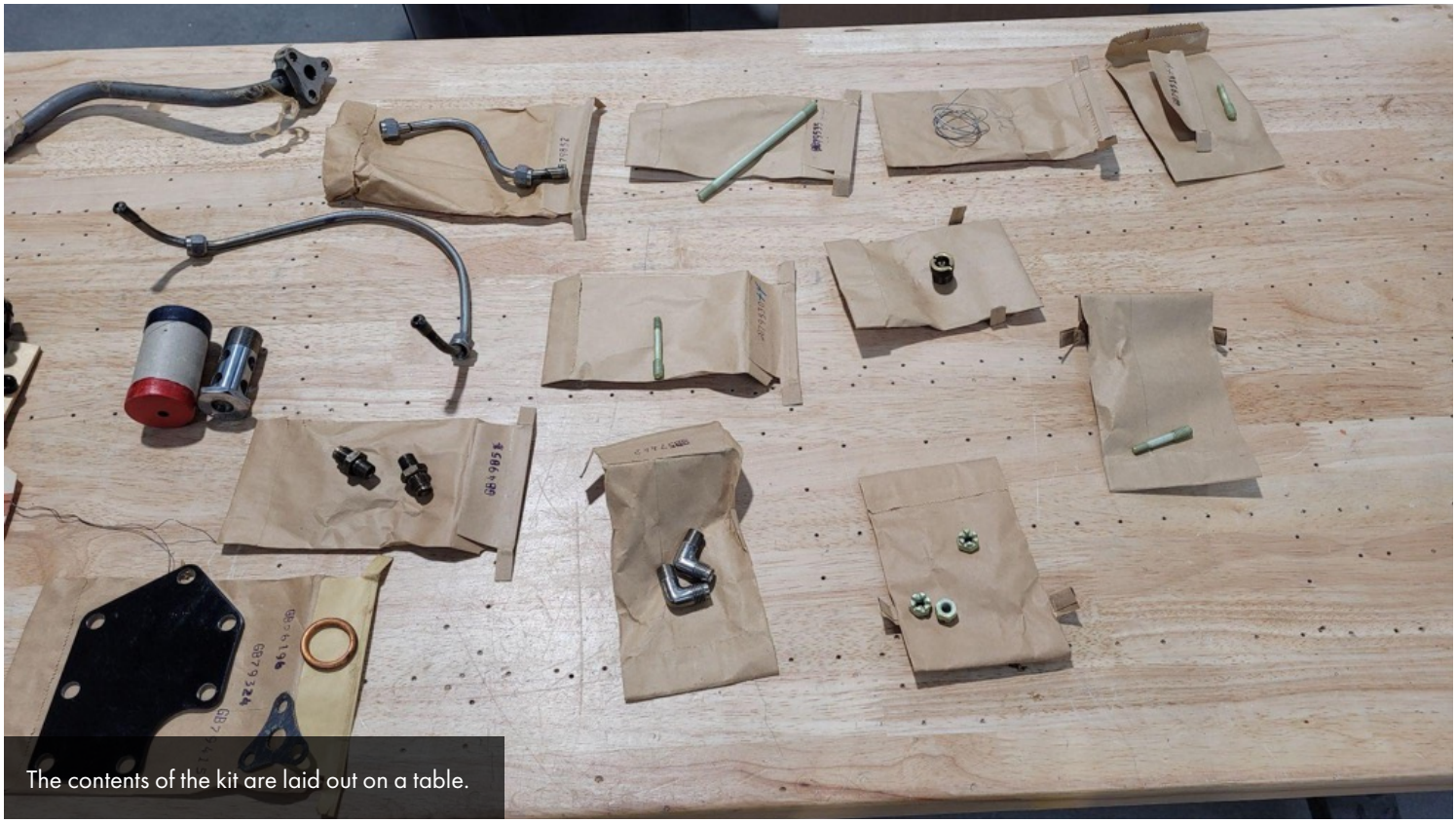
ADI Injection Kit

One of the systems for the engine installation is the Anti-Detonation water Injection system (or ADI). A new old stock ADI kit, dated 9/5/44 on the box, is an exciting find.

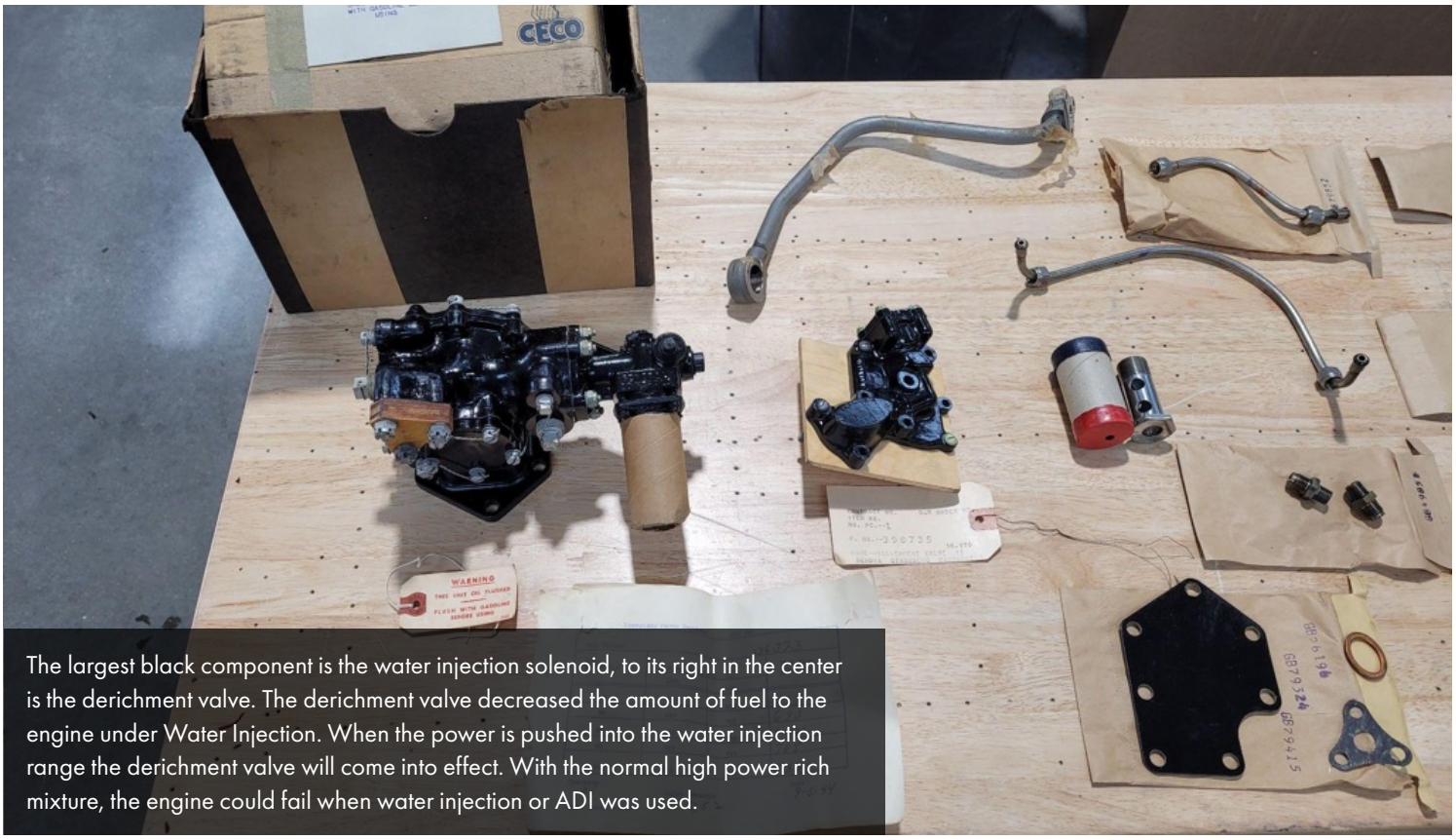
Here is the shipping box, unopened since 1944.



The kit is complete with everything needed to install the water injection (ADI), right down to the safety wire.



The contents of the kit are laid out on a table.

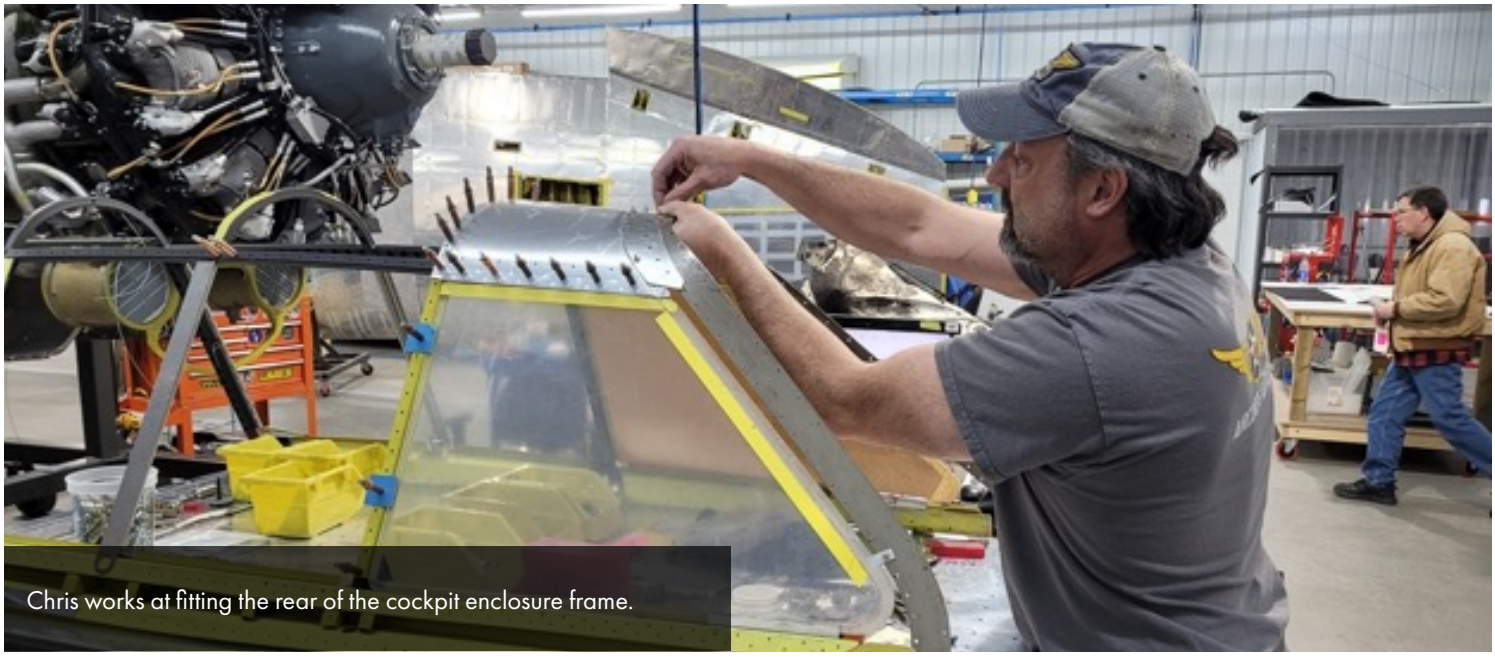


The largest black component is the water injection solenoid, to its right in the center is the derichment valve. The derichment valve decreased the amount of fuel to the engine under Water Injection. When the power is pushed into the water injection range the derichment valve will come into effect. With the normal high power rich mixture, the engine could fail when water injection or ADI was used.

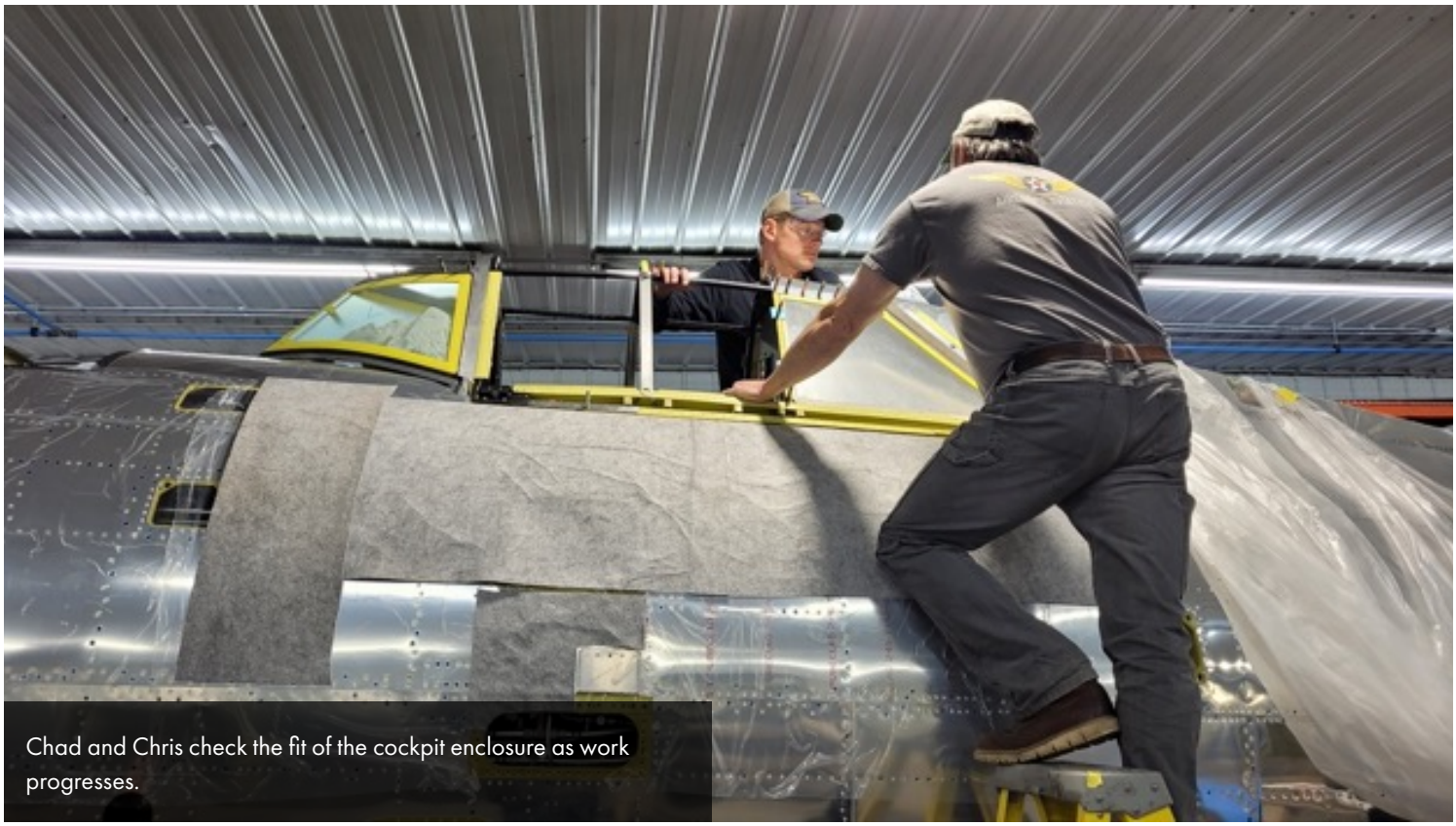
Close up of one of the original tags. It was attached to the derichment valve in the last photo, and says "DERICHMENT VALVE 13 BENDIX STROMBERG CARBURETOR ".

Cockpit Enclosure

Chad and Chris worked hard on restoring the cockpit enclosure and test mounting to adjust the fit.



Chris works at fitting the rear of the cockpit enclosure frame.



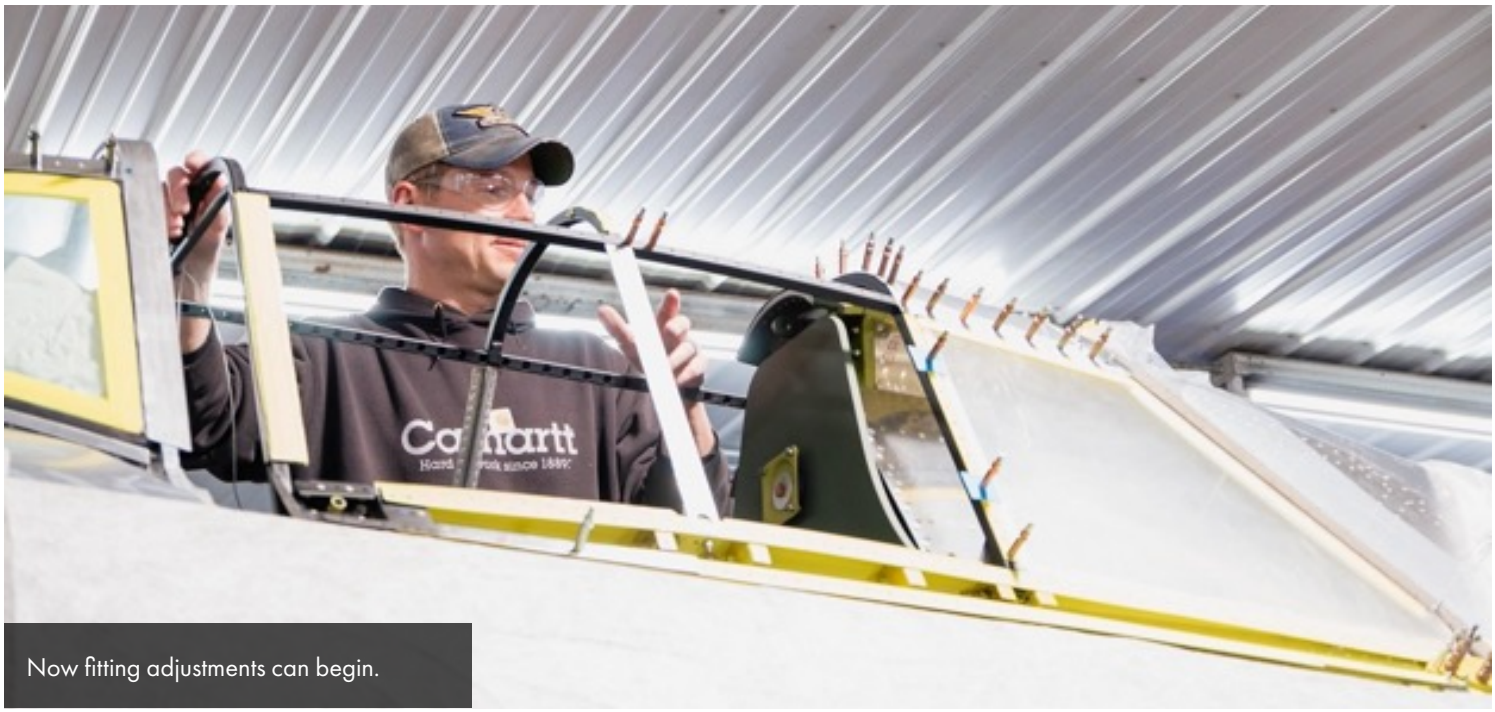
Chad and Chris check the fit of the cockpit enclosure as work progresses.

Randy hands the cockpit enclosure to Chad.

Chad lifts the cockpit enclosure out of Randy's hands.

Chad places the cockpit enclosure on the fuselage.

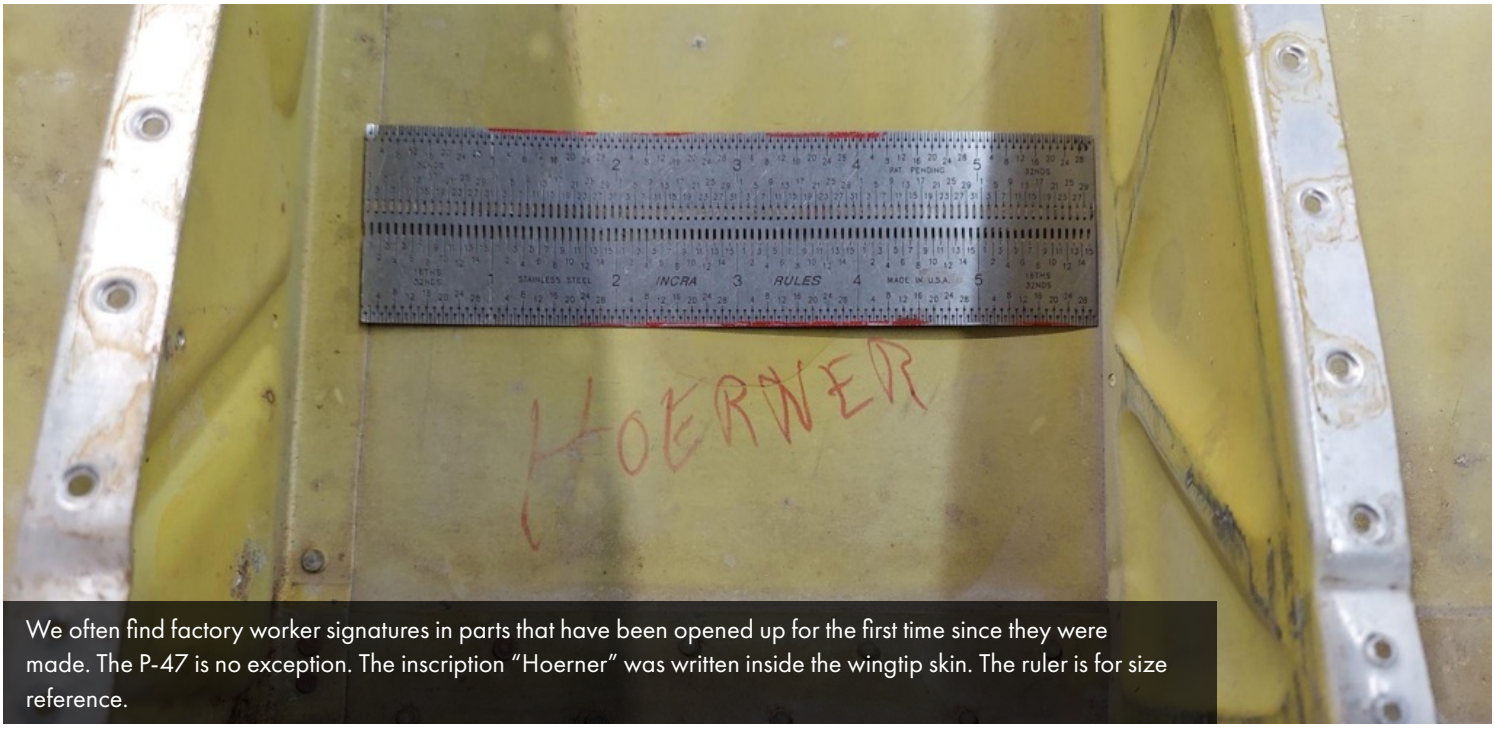
Chad checks to see how well the enclosure slides.



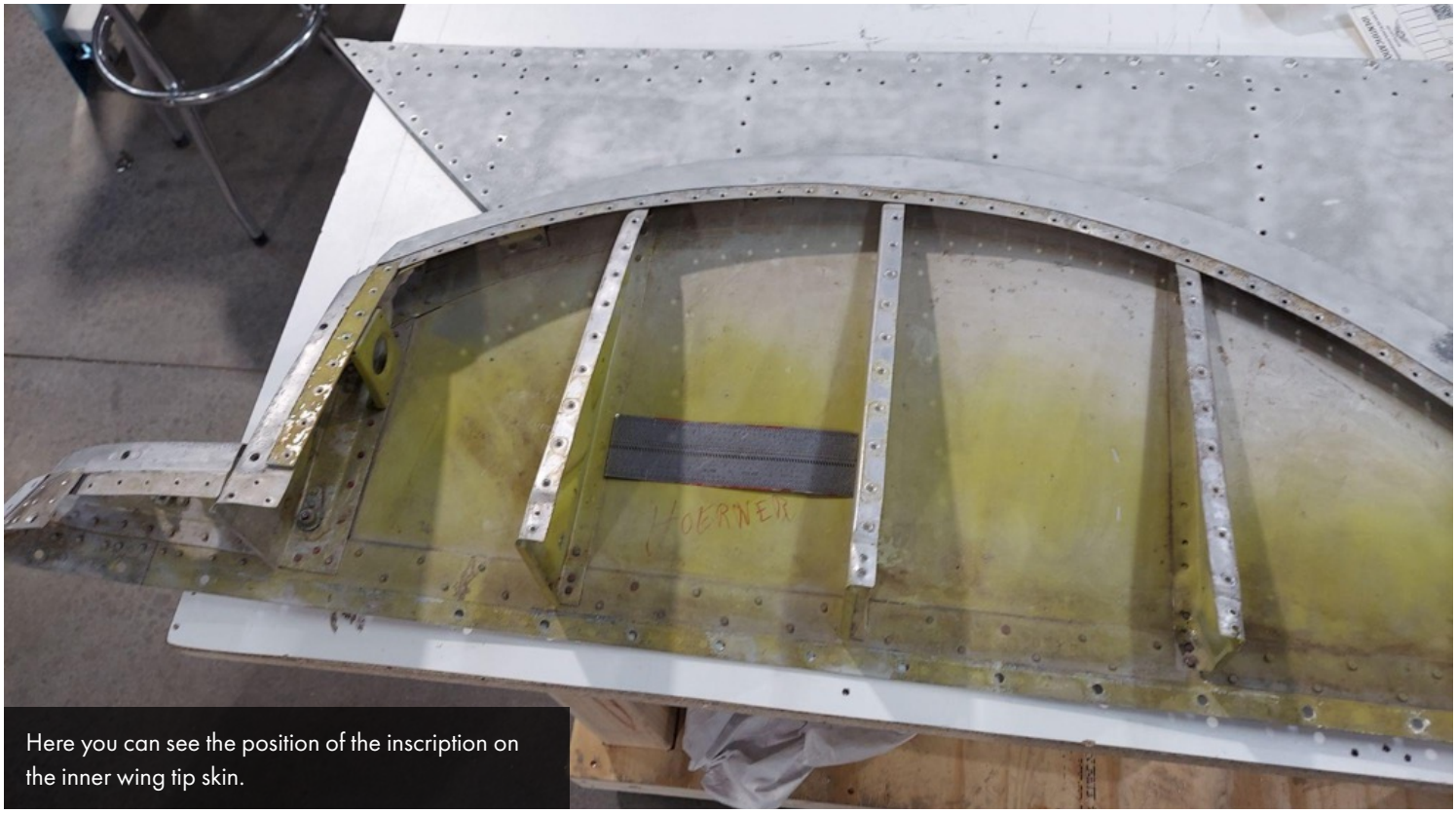
Now fitting adjustments can begin.

Wingtips

Curved wingtips like the P-47s are more difficult to restore than more squared-off tips like on a P-51.



We often find factory worker signatures in parts that have been opened up for the first time since they were made. The P-47 is no exception. The inscription "Hoerner" was written inside the wingtip skin. The ruler is for size reference.

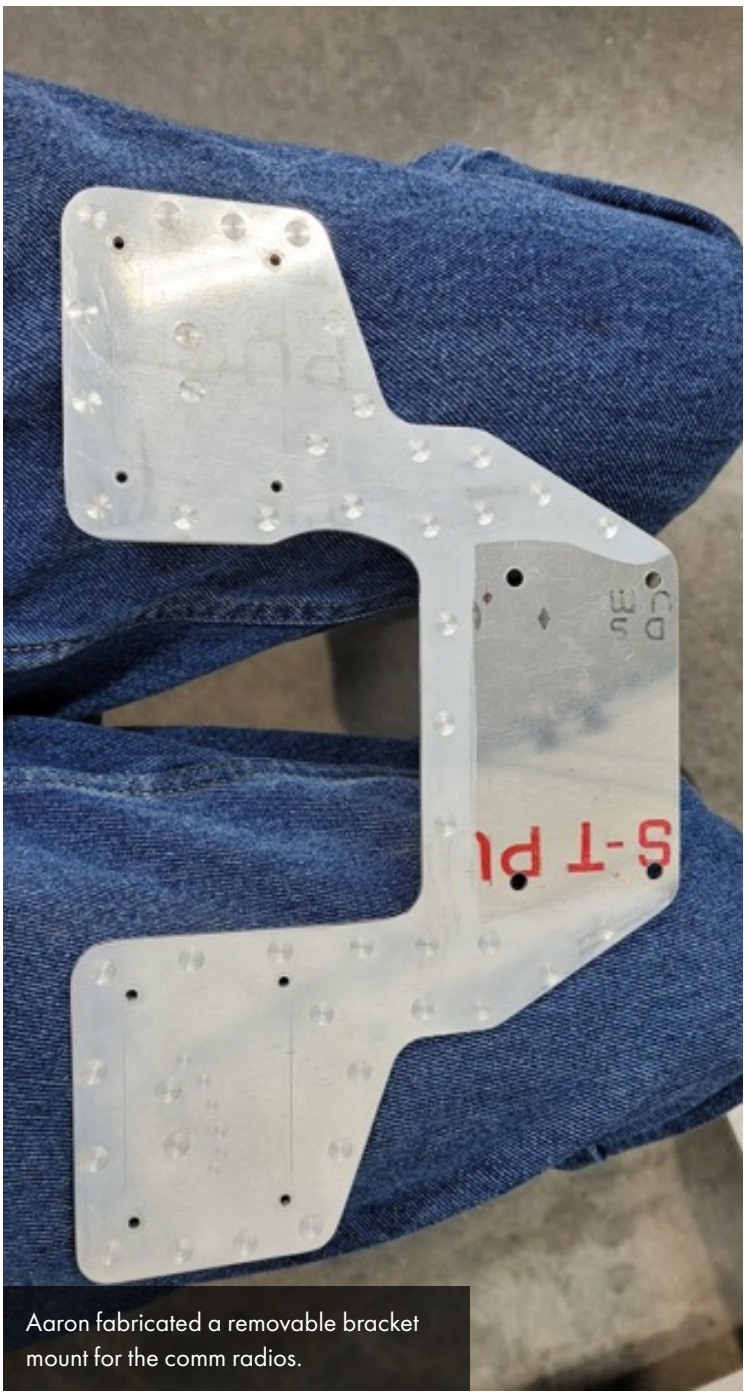


Here you can see the position of the inscription on the inner wing tip skin.

Jacob works on assembling the wingtips.

Cockpit

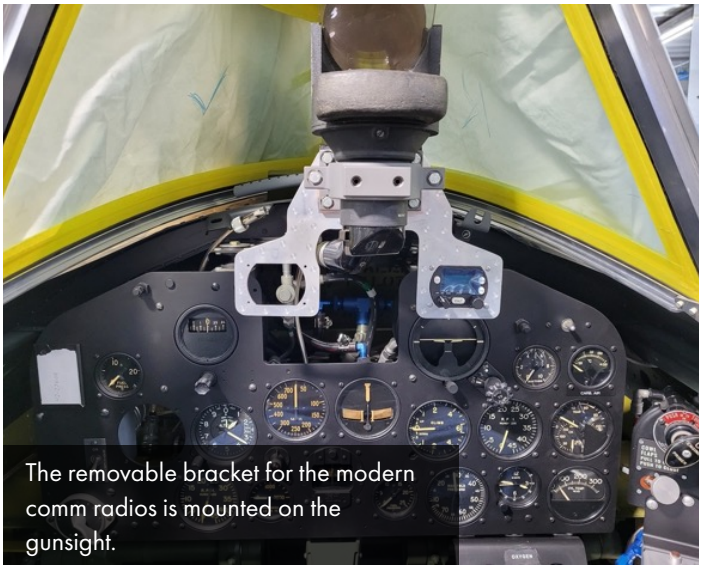
The last items inside the cockpit are being completed. Warbirds flying in the environment of modern airspace almost always incorporate modern avionics as a safety concession. Often, these avionics are installed in a way that retains the original appearance of the cockpit. Original appearance combined with modern safety and technological advantages were the goals for the P-47.



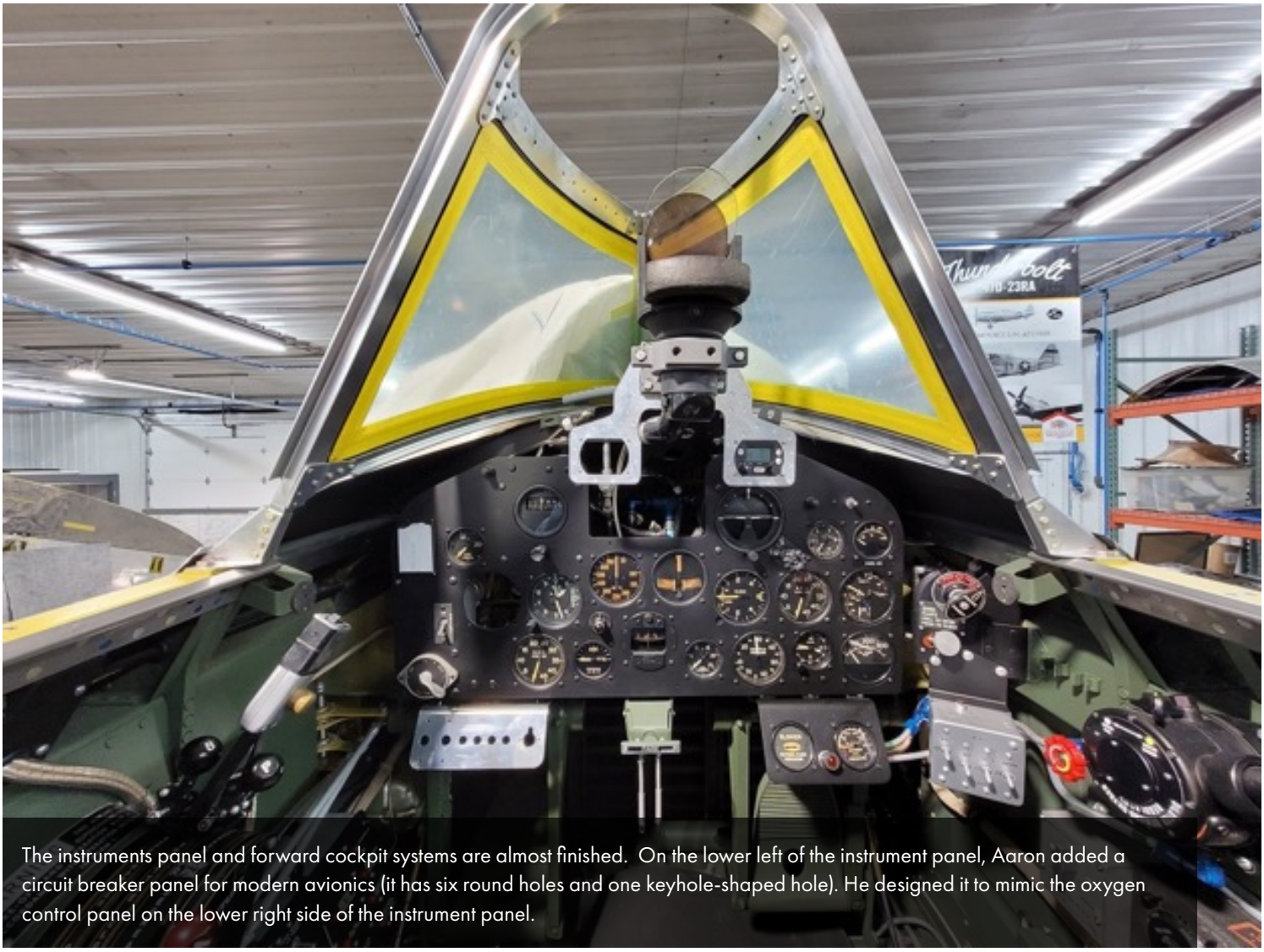
Aaron fabricated a removable bracket mount for the comm radios.

Aaron also modified an original data case to carry some of the connections to modern avionics. The enclosed area on the left inside of the case will hold the avionics connections, while still leaving the space to the right for a Pilot's manual or other documentation.

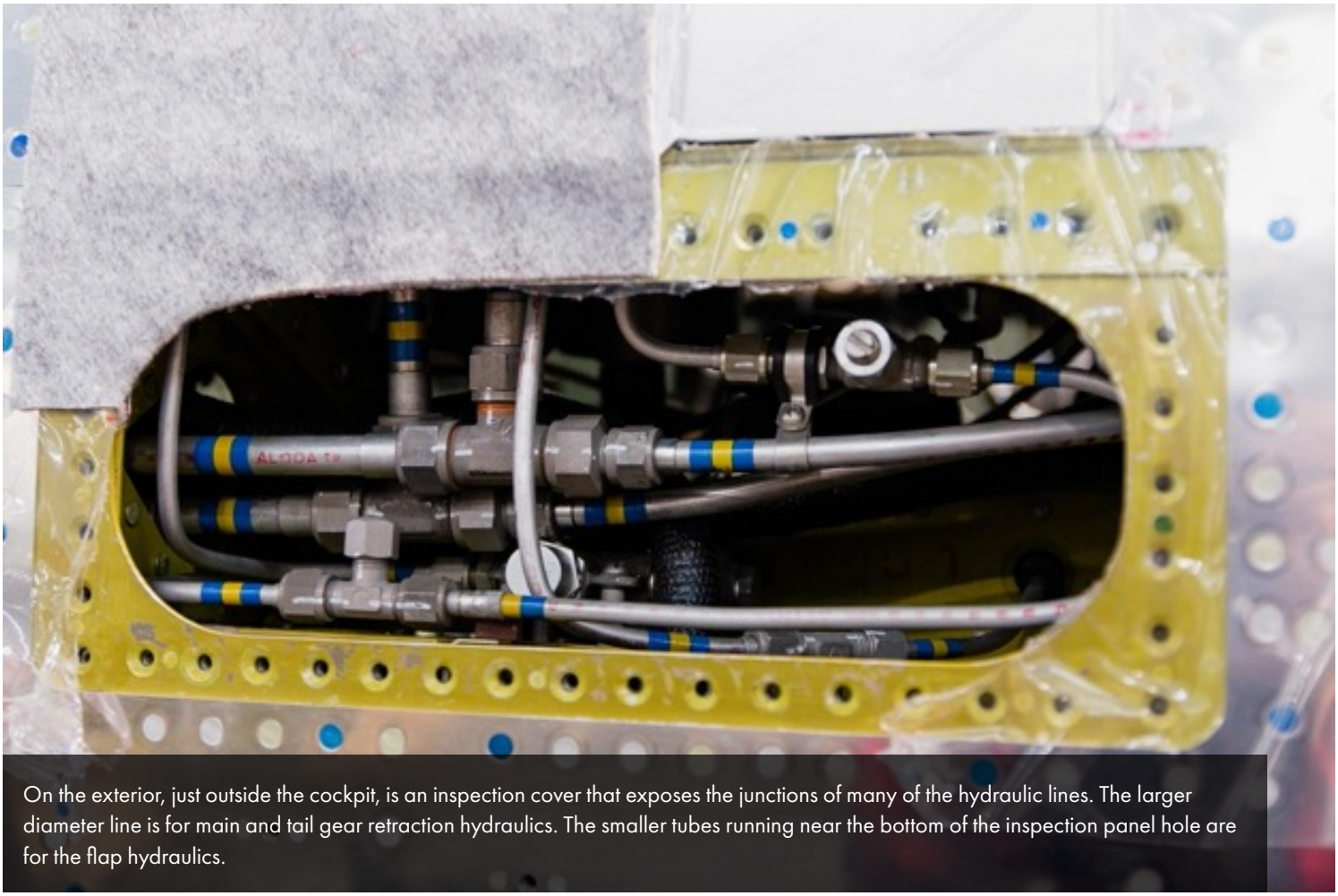
The map case is wired for modern headphone jacks, USB power, and will even have Bluetooth. Placing the connections in this hidden location helps keep these modern accessories unobtrusive.



The removable bracket for the modern comm radios is mounted on the gunsight.



The instruments panel and forward cockpit systems are almost finished. On the lower left of the instrument panel, Aaron added a circuit breaker panel for modern avionics (it has six round holes and one keyhole-shaped hole). He designed it to mimic the oxygen control panel on the lower right side of the instrument panel.



On the exterior, just outside the cockpit, is an inspection cover that exposes the junctions of many of the hydraulic lines. The larger diameter line is for main and tail gear retraction hydraulics. The smaller tubes running near the bottom of the inspection panel hole are for the flap hydraulics.

Early Flight Testing of the P-47

The test version of the P-47B shows the unusual car door-like cockpit door Photo from Britmodeller.com: https://www.britmodeller.com/forums/index.php?/topic/235064236-unusual-p-47d-photo/

As is the case with most new fighters and indeed any new aircraft design, there were some teething problems during the initial testing of the XP-47B.

First, an explanation of why the first P-47 to fly was the XP-47B. Customarily the "B" designation is for a model version of an aircraft built and flown after the "A" model. In the case of Republic's XP-47 series, the original XP-47 was a completely different design, a lightweight fighter powered by an 1150 hp Allison V-1710-39 liquid-cooled in-line engine. It was designed to carry only 2 .50 caliber guns while the P-47A was a version of this design without guns or military equipment intended to speed a prototype into testing.

However, combat experience showed two guns to be entirely inadequate. So the original lightweight Allison-powered P-47 project was canceled. Remarkably, and contrary to common practice, the Army Air Corps issued a new contract that retained the P-47 designation for the next fighter project as well.

The original lightweight XP-47 model during wind tunnel testing (the P-47A was a version of this design without military equipment intended to speed a prototype into testing) neither was ever built. Photo Wikipedia via NASA, https://airscapemag.files.wordpress.com/2019/07/xp-47a-wind-tunnel-model.jpg

The new P-47 project was more closely based on past Republic fighters like the P-43. The availability of the new Pratt & Whitney R-2800 made great leaps in performance possible if it could be incorporated into an evolutionary design. This design was to be the XP-44. However, before a prototype was built, the Experimental Aircraft Division of the USAAC canceled the XP-44. It was at this time that the XP-47 lightweight fighter contract was also officially canceled. War experience information from the European theater showed that the USAAC needed a fighter with much greater range and firepower than the two experimental projects could ever offer.

A new set of requirements was drawn up and a contract was authorized to build a fighter to meet them. That fighter was to be designated the XP-47B. The new USAAC requirements were as follows:

1. The aircraft must attain at least 400 mph at 25,000 feet.
2. It must be equipped with at least six .50 caliber machine guns, with eight being preferred.
3. Armor plate must be fitted to protect the pilot.
4. Self-sealing fuel tanks must be fitted.
5. Fuel capacity was to be a minimum of 315 gallons.

The new fighter was ready to test fly on May 6, 1941. Republic's chief test pilot Lowery Brabham lifted the big new fighter off Republic's sod field. Brabham was immediately pleased with the takeoff and control performance. But one factor he wasn't aware of was to shape the rest of his flight. A large amount of oil had accumulated on the exhaust manifold and stainless steel exhaust ducts leading back to the turbosupercharger during the long check out period before the test flight.

As soon as the waste gates closed and hot exhaust ran back through those pipes, the oil heated up and started turning to smoke. Smoke filled the cockpit and Brabham thought of getting out. He tried to get rid of the smoke by opening a small sliding panel in the cockpit enclosure but that only made things worse.

Fortunately, Brabham was an experienced test pilot with many hours of test flight experience that included dealing with in-flight problems. He knew losing the prototype of a fighter would set back the war effort by months. Not seeing any flames, Brabham made the decision to stay with the XP-47 and land at Mitchel field as had been planned all along due to the soggy grass field at Republic's Farmingdale factory.

In the few minutes he had been in the air, Brabham was already convinced that the new P-47 had great potential. In fact some sources quote him as saying "I think we've hit the jackpot!" after the flight.

The first landing of the XP-47 went smoothly despite the cockpit smoke. Flaps, landing gear, and brakes all worked as designed. The big fighter met the AAC requirements with two exceptions. It carried 298 gallons of internal fuel instead of the specified 315, and it weighed 900 pounds more than specified. But the AAC was willing to overlook these minor issues since the performance was unprecedented and met the specifications.

There were more issues to be solved as testing continued. The P-47 was flight tested at operational altitudes that hadn't been customarily reached before, and the ignition was failing at these high altitudes. Oil pressure couldn't be maintained because the oil was boiling in the low pressure, high altitude environment. Fortunately, pressurizing the entire ignition system and bleeding turbo pressure into the oil tank solved these two issues.

[1]Aviation Darwinism - The Republic P-47 Thunderbolt (author unlisted), https://www.cradleofaviation.org/history/history/aircraft/p-47_thunderbolt_aviation_darwinism.html, downloaded 3-29/2022

[2]Lowery 'Brab' Brabham,P-47 Pilots Association website, downloaded 3-2-30 2022, http://p47pilots.com/P47-Pilots.cfm?c=incP47BiographyHome.cfm&vm=BIO&pilotid=47&p=Lowery%20%27Brab%27%20Brabham

Republic XP-47B 40-3051 prototype in flight. (Republic Aircraft Corporation)

Lowery Brabham's flight test issues weren't over with the first XP-47 flight. Another design problem related to turbosupercharger gases eventually caused the loss of the XP-47 in 1942. The tailwheel failed to retract and caught fire because of the very hot gases expelled by the turbosupercharger. Those gases exit directly in front of the extended tailwheel. That fire burned through the fabric on the elevators.

Brabham successfully bailed out, but the prototype XP-47 was lost. The elevators and all control surfaces were subsequently changed to all-metal construction.