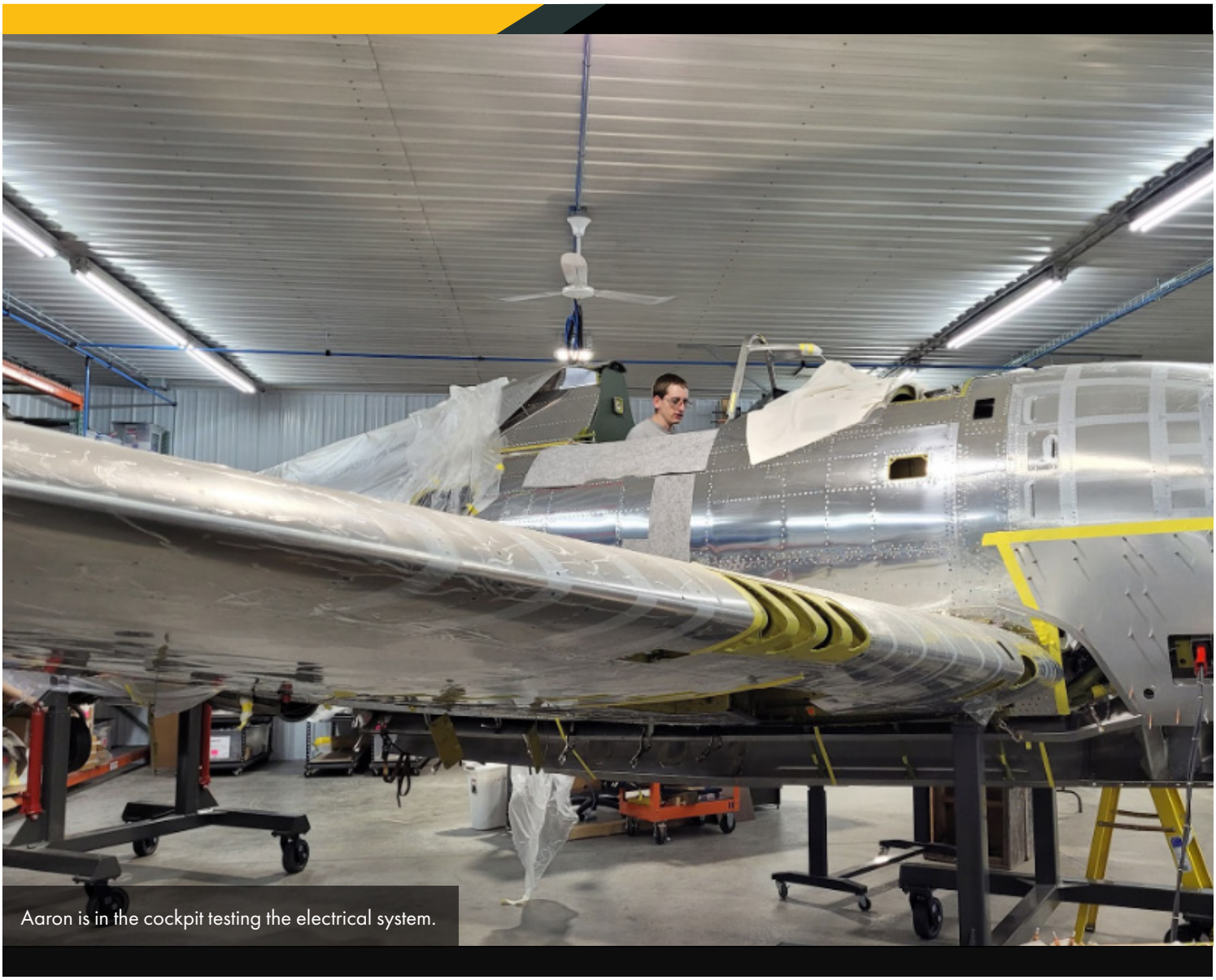
AUGUST/SEPT

AIRCORPS AVIATION

Dakota Territory Air Museum's P-47 Update

by Chuck Cravens



Aaron is in the cockpit testing the electrical system.

DAKOTA TERRITORY AIR MUSEUM

www.dakotaterritoryairmuseum.com

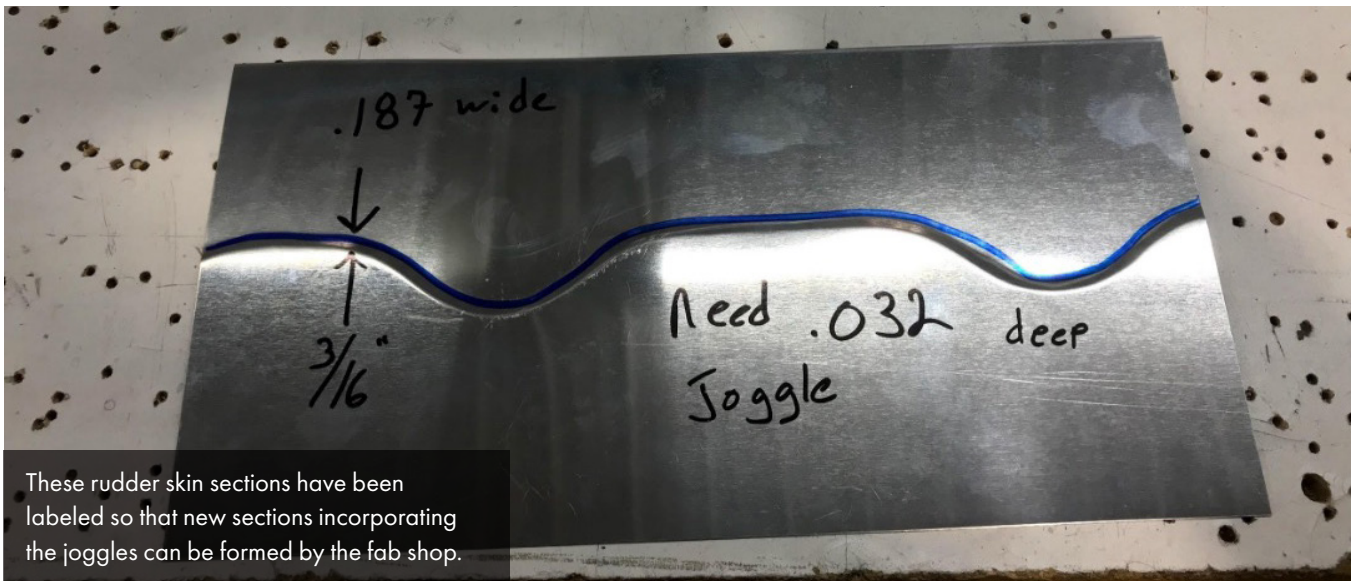
Update

Some of the more complex skin sections on the control surfaces and the wing fillets were focused on this month. The electrical system and radios also received their share of attention.

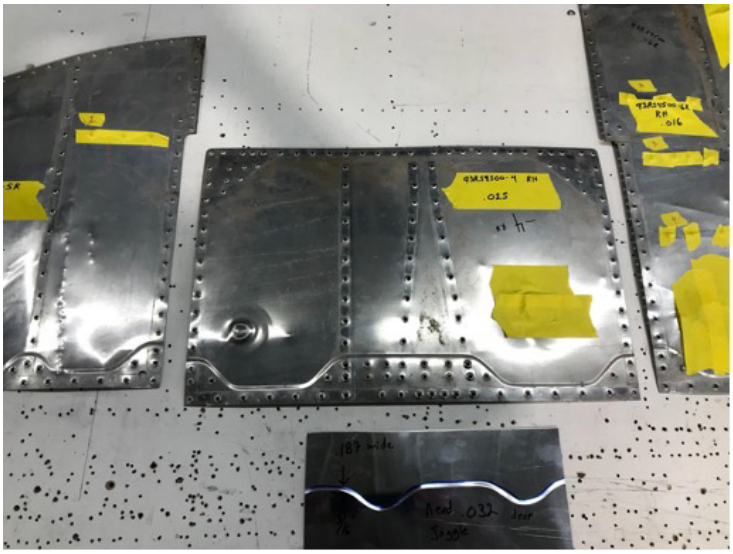
Complex Skin Forming

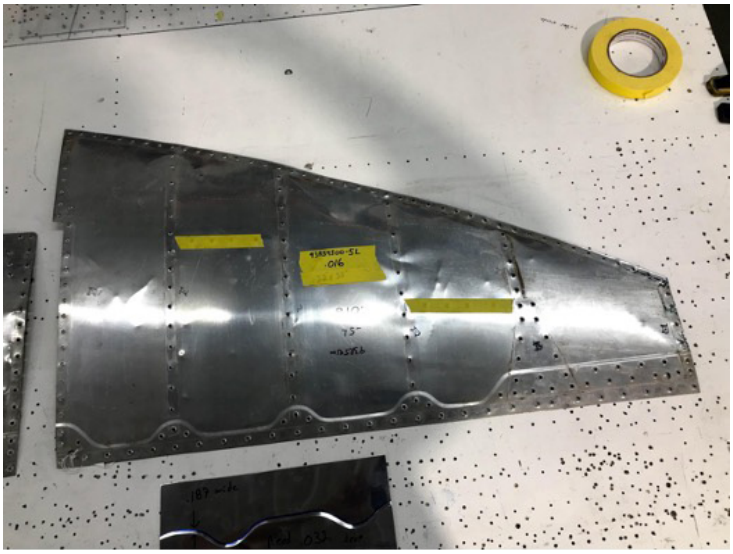
The P-47 has some unusually formed skin sections that join with a seam that has numerous curved indentations. Where the skins overlap in those areas, joggles must be created so that the skin surface remains smooth.

Where the skin overlaps on the P-47's rudder, there are a complex series of joggles that must be replicated on new skin.



These rudder skin sections have been labeled so that new sections incorporating the joggles can be formed by the fab shop.





There are several rudder skin sections that require this process. These are original skins used for templates.

Wing Fillets

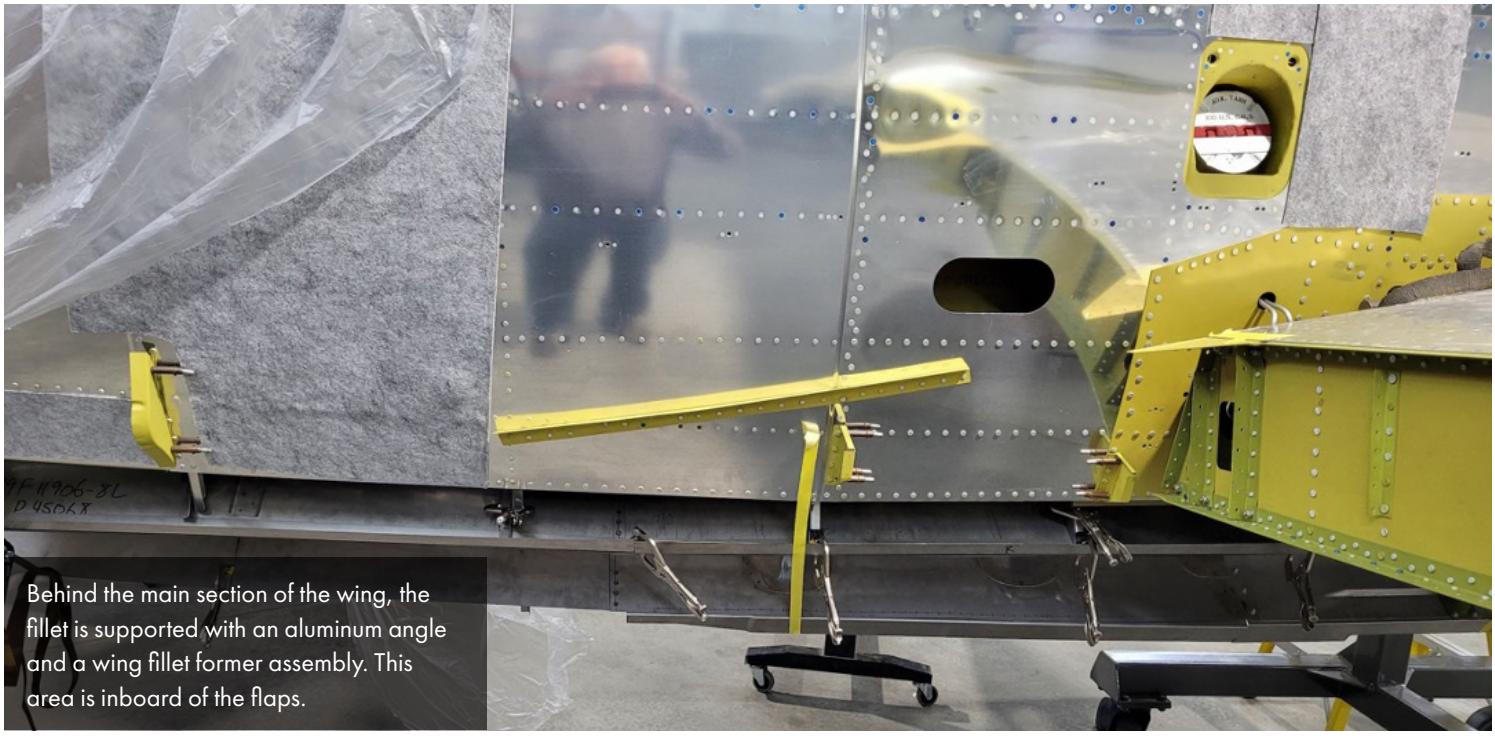
The wing fillets are always an exercise in intricate forming of complex curves in the aluminum skin. Randy Carlson came over from his shop, Carlson Metal Shaping in Fargo, to take care of this specialized work.

Randy Carlson works to form the wing root fillets.

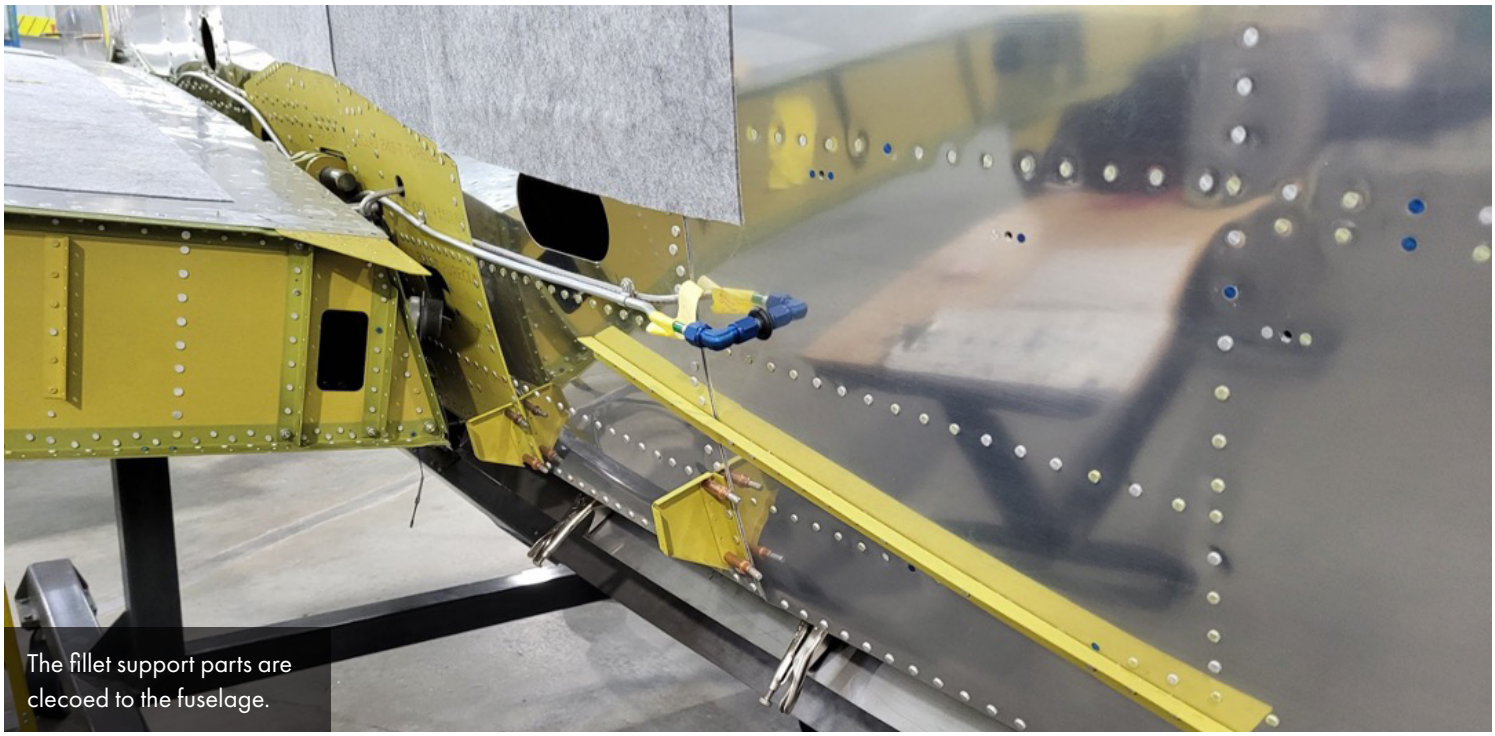
Every piece requires very precise trimming. Here Randy works with a lower leading edge section.

This upper leading edge section will mate to the lower section. It is a process of trim, fit, and retrim in small increments until the part matches perfectly.

Randy works on getting the fit between the upper and lower pieces perfect.



Behind the main section of the wing, the fillet is supported with an aluminum angle and a wing fillet former assembly. This area is inboard of the flaps.



The fillet support parts are clecoed to the fuselage.

Instruments and Radio

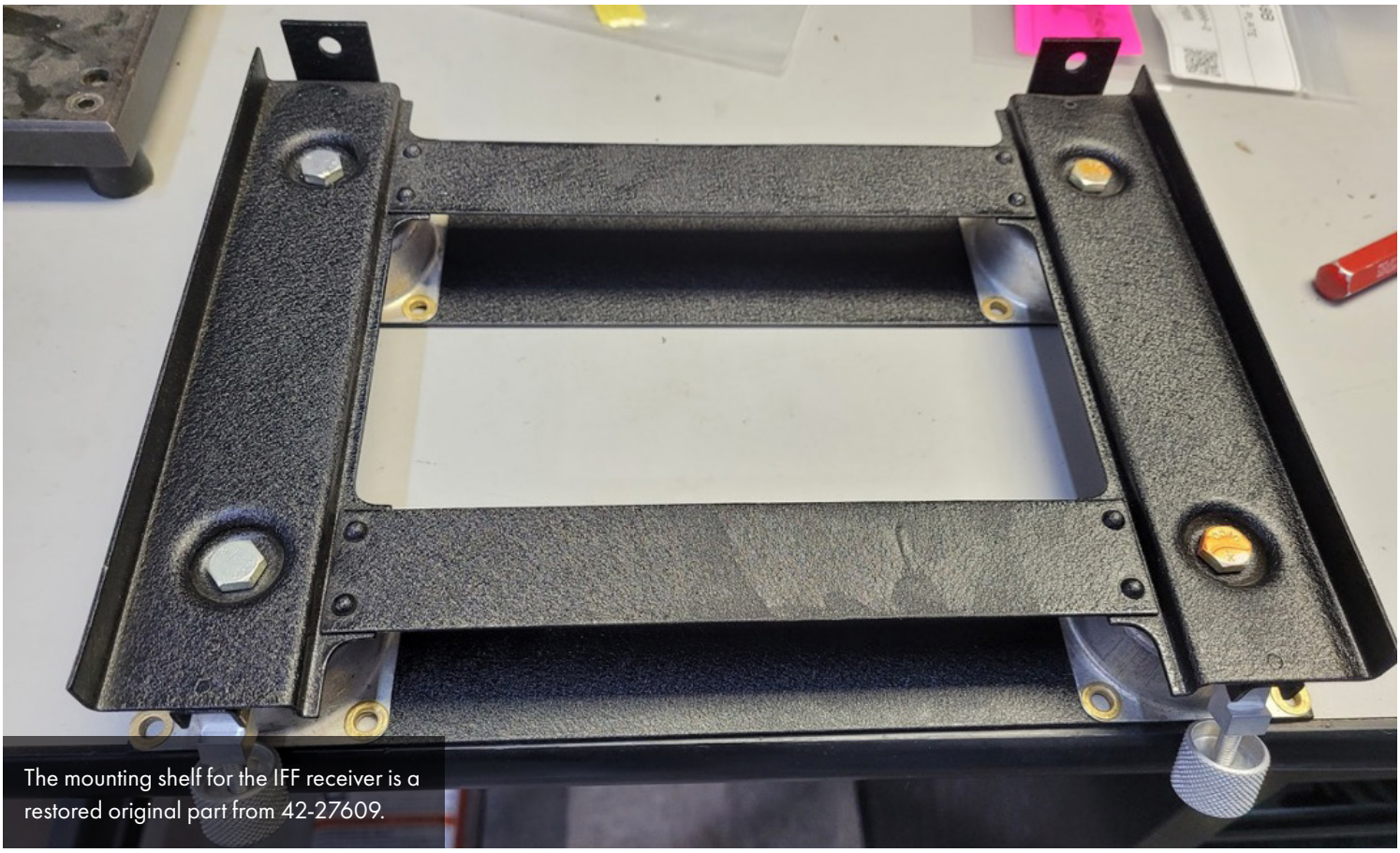
Aaron continues to complete the restoration of the aircraft systems, including the radios and instruments, as the P-47's completion date gets closer.

Aaron has the IFF (Identification Friend or Foe) power control box ready for installation.

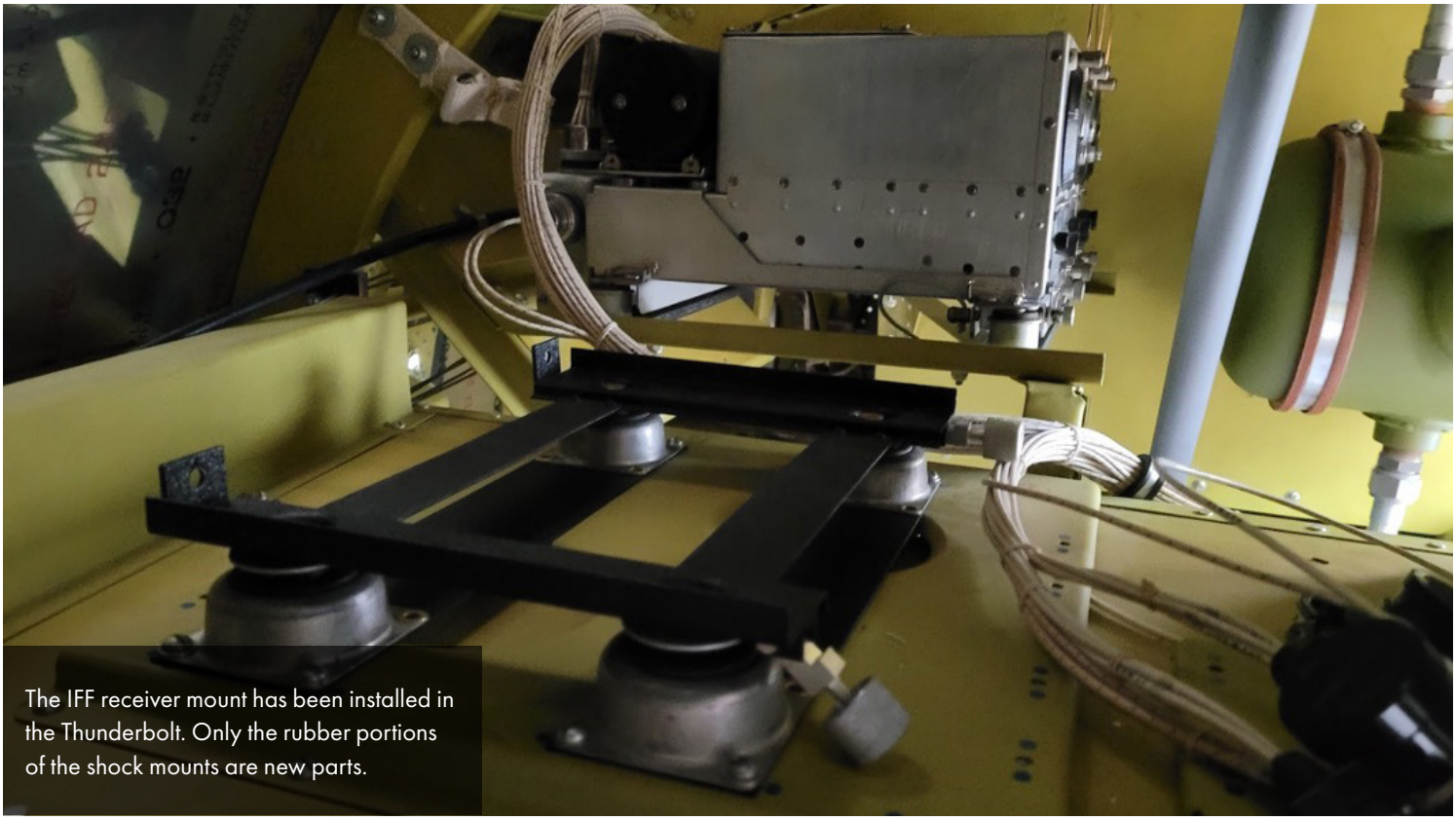
This is the main IFF receiver, which proved to be a very difficult component to find in restorable condition.

The IFF receiver from another angle.

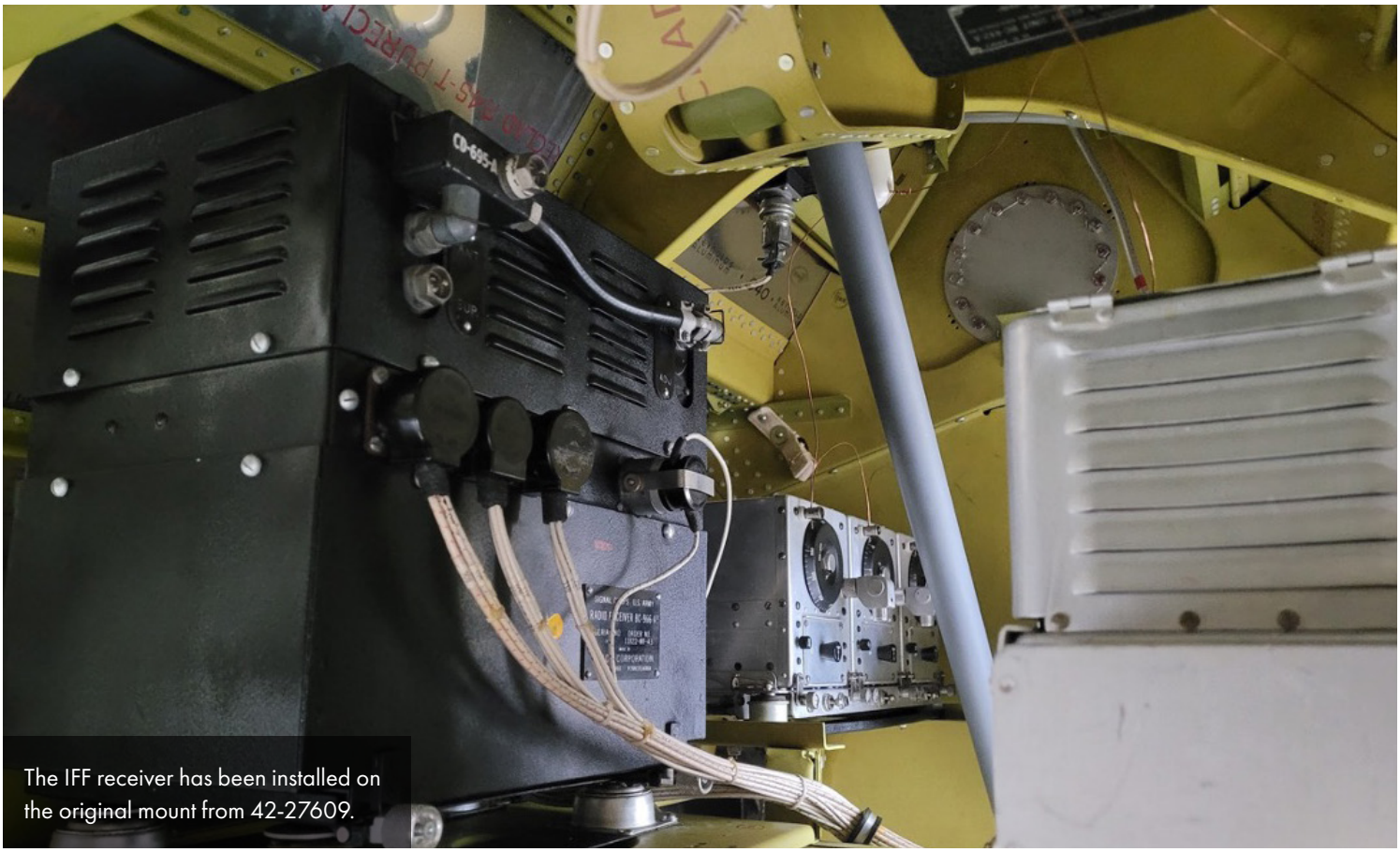
Another IFF system component is the selector switch.



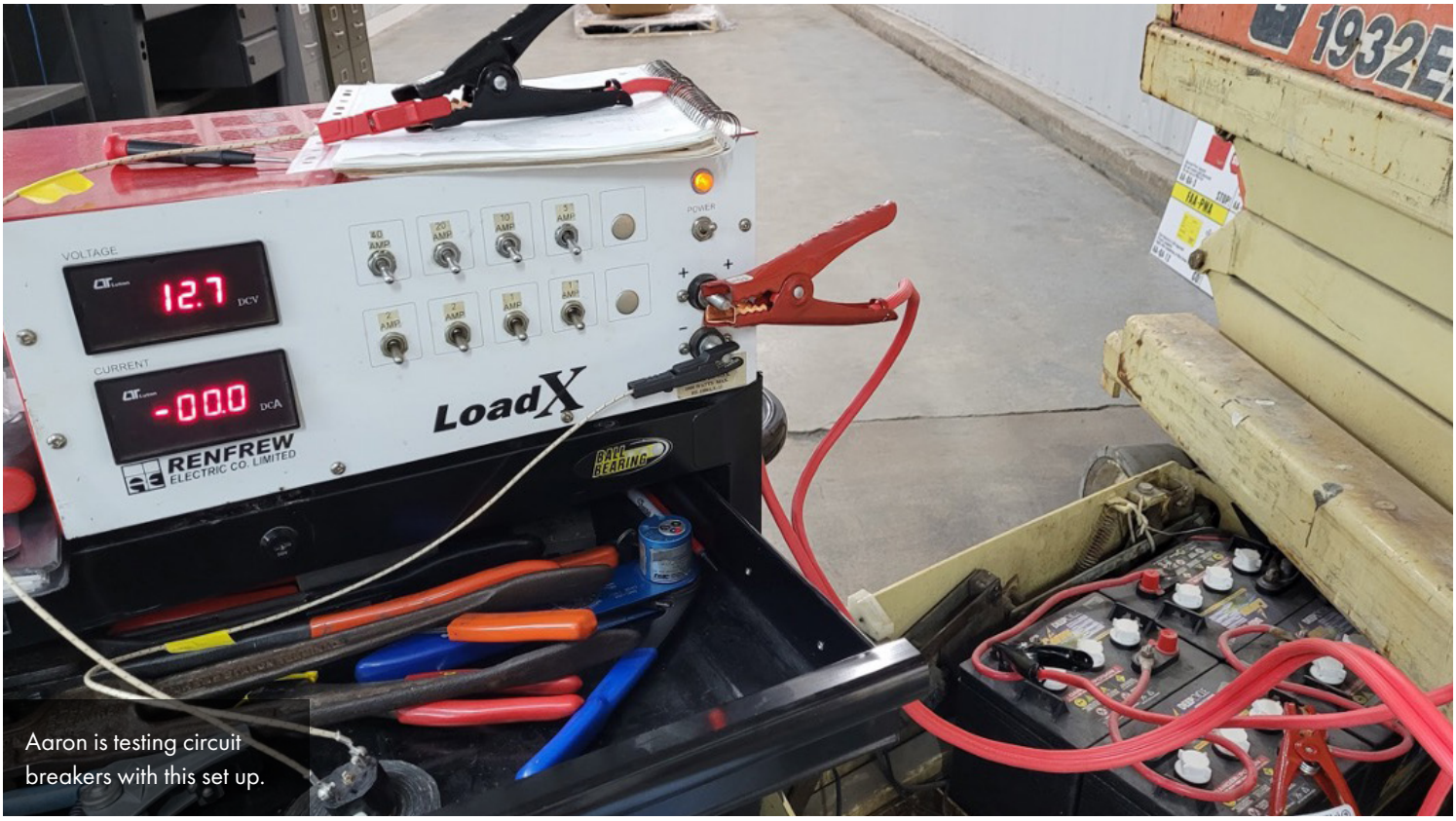
The mounting shelf for the IFF receiver is a restored original part from 42-27609.



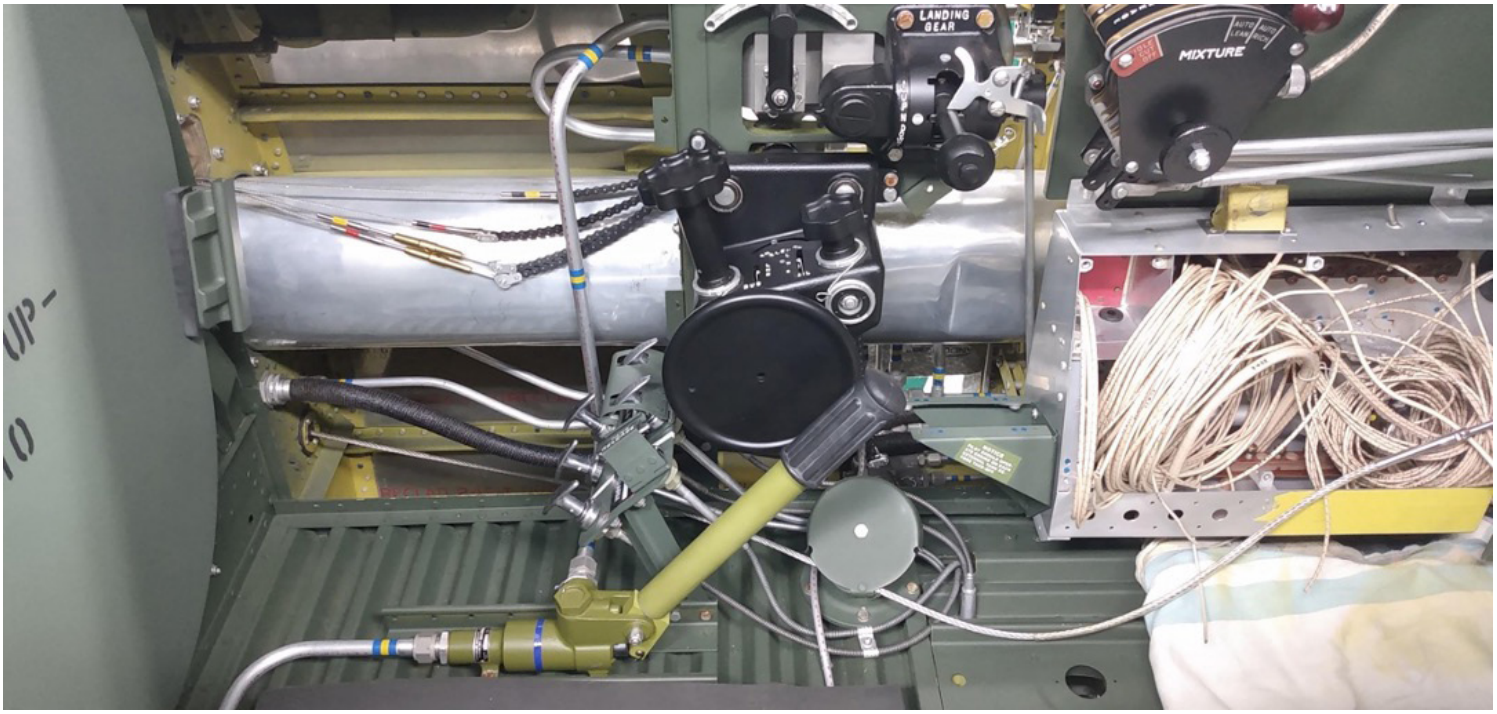
The IFF receiver mount has been installed in the Thunderbolt. Only the rubber portions of the shock mounts are new parts.

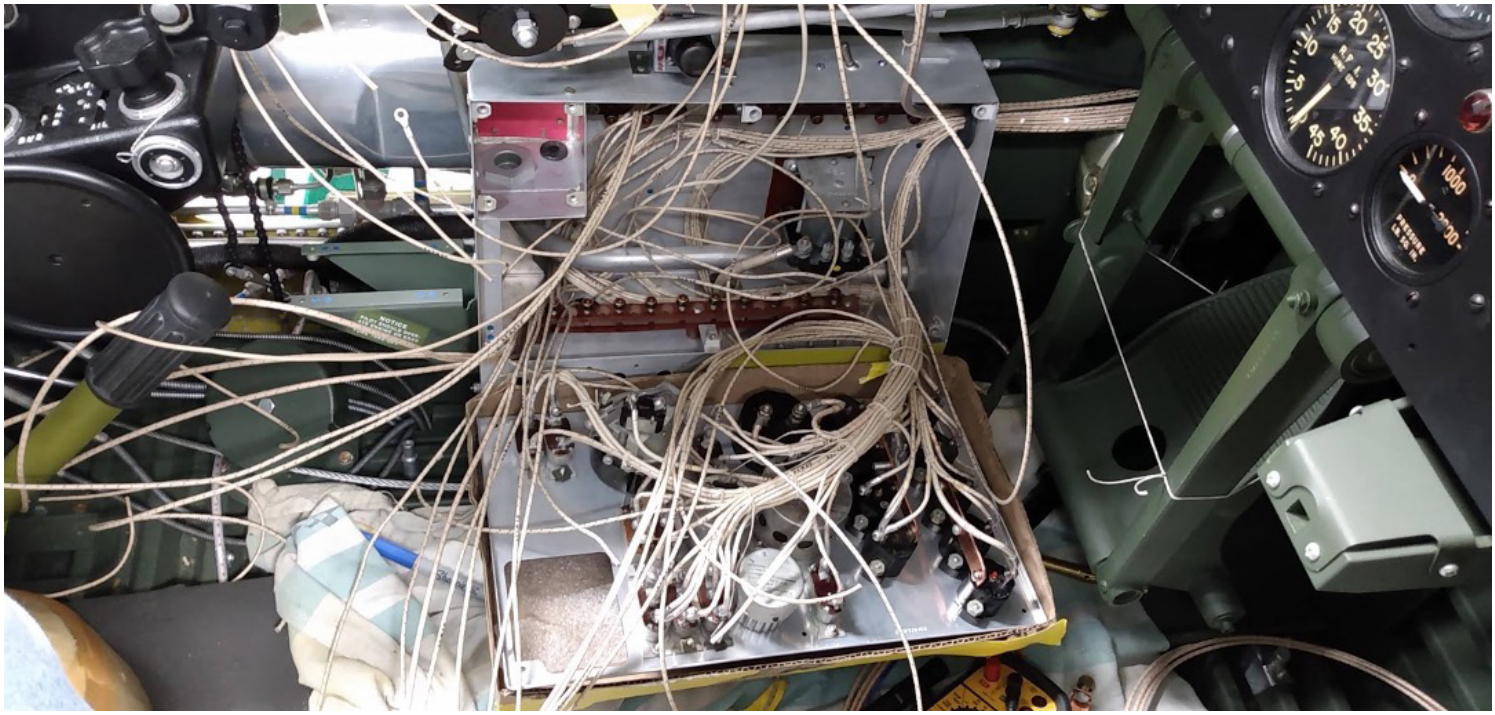


The IFF receiver has been installed on the original mount from 42-27609.



Aaron is testing circuit breakers with this set up.



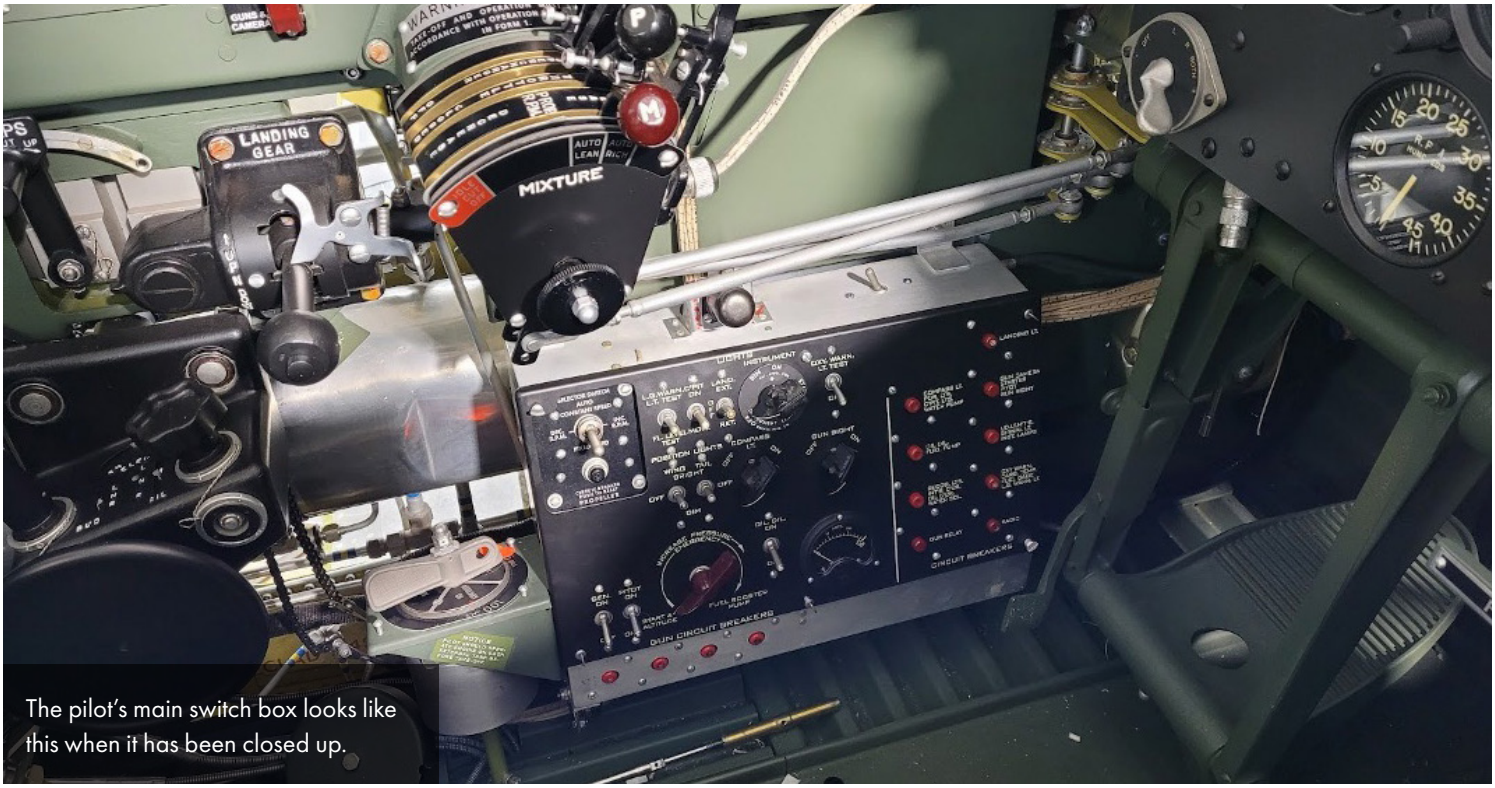


These two photos show how the process of wiring the pilot's main switch box progressed from wires coiled in preparation through the connections inside the box.

There is so much wiring inside the pilot's main switch box that it took Aaron quite a while to route everything properly to create an orderly and neat assembly. The wiring harnesses have been bound, routed, and connected outside the box

Electrical System

A restoration milestone arrived as Aaron powered up the Thunderbolt's electrical system for the first time this month.



The pilot's main switch box looks like this when it has been closed up.

A closer view shows the detailed silk screened and etched labels.

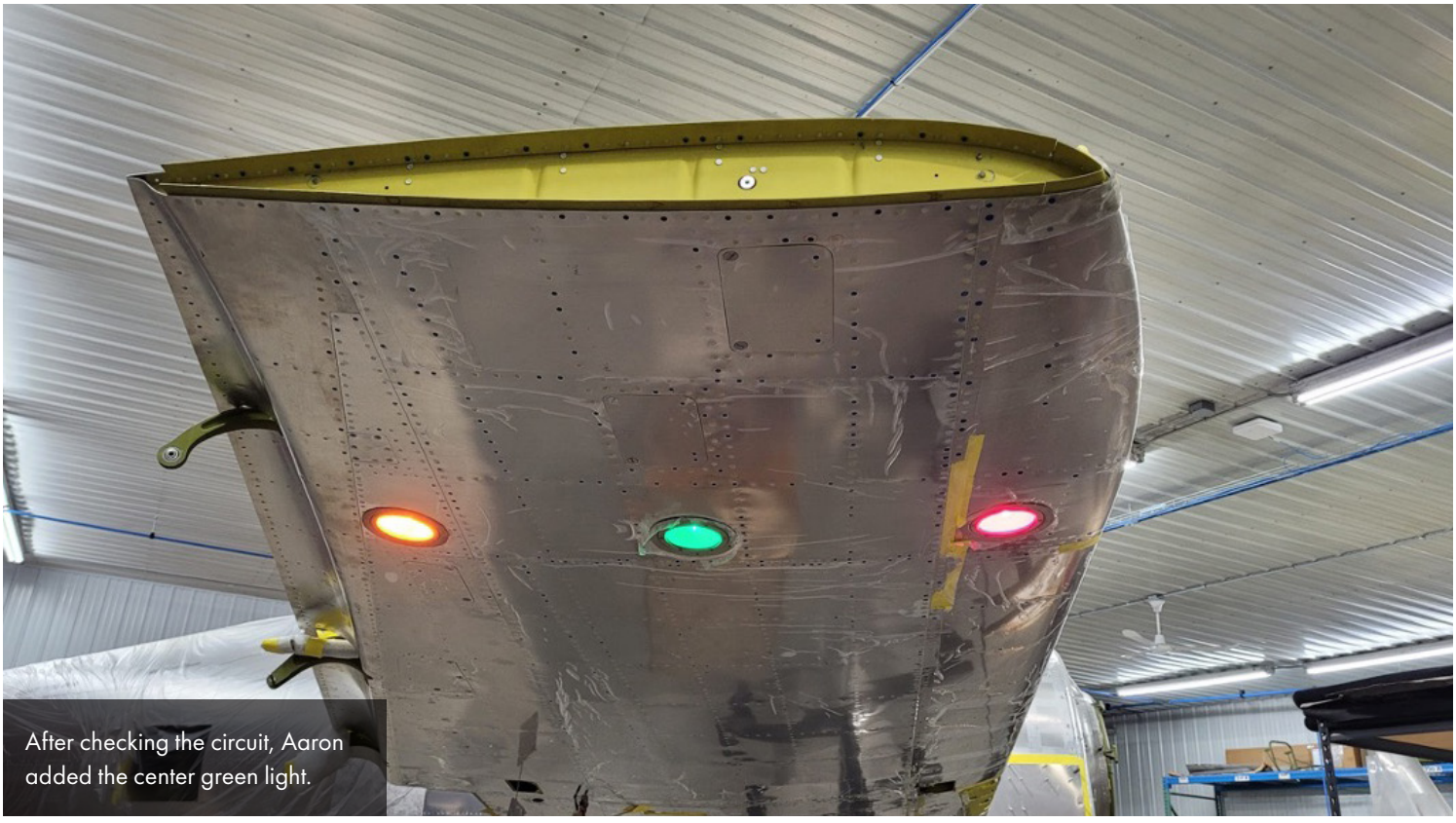
Finally, after many hours of painstaking work, the time to test the wiring circuits has come, so the auxiliary power is connected (red connector).

Aaron is in the cockpit ready to power up the circuits.

The first good sign that the system is working properly is that the white upper position light works (upper right in the photo).

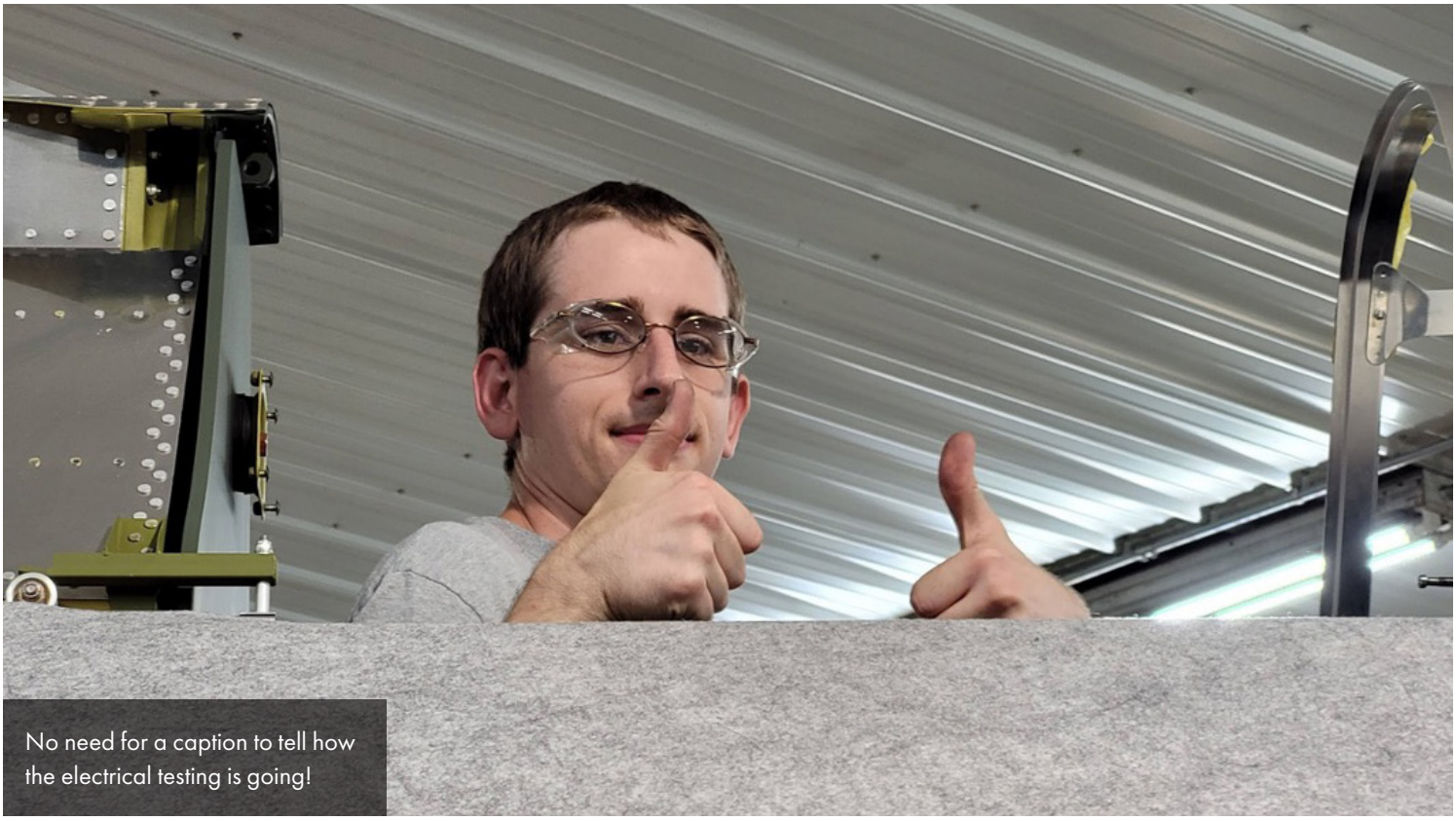
Aaron turns on the switch for the identification lights under the right wing.

The forward red and rear amber lights work.

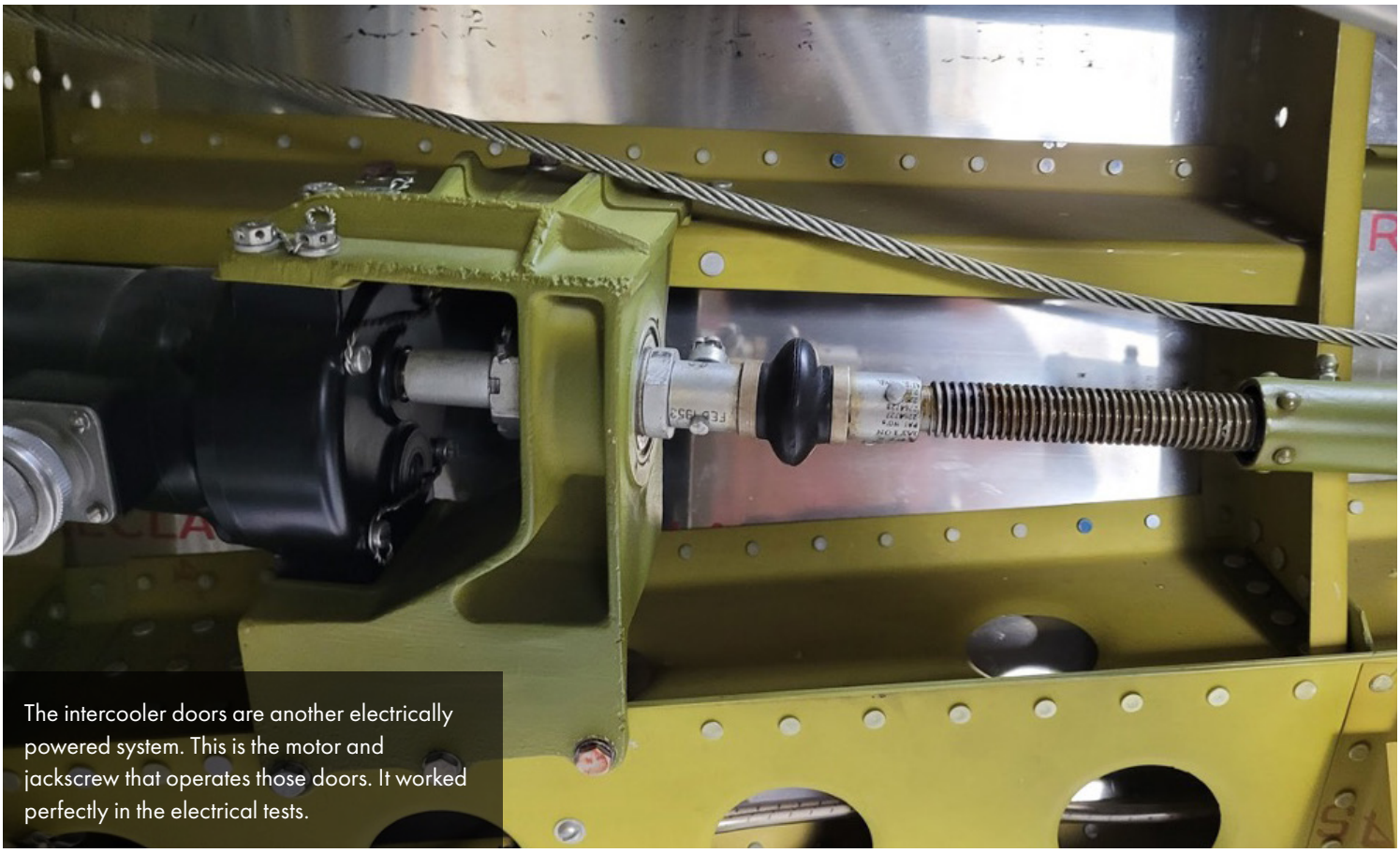


After checking the circuit, Aaron added the center green light.

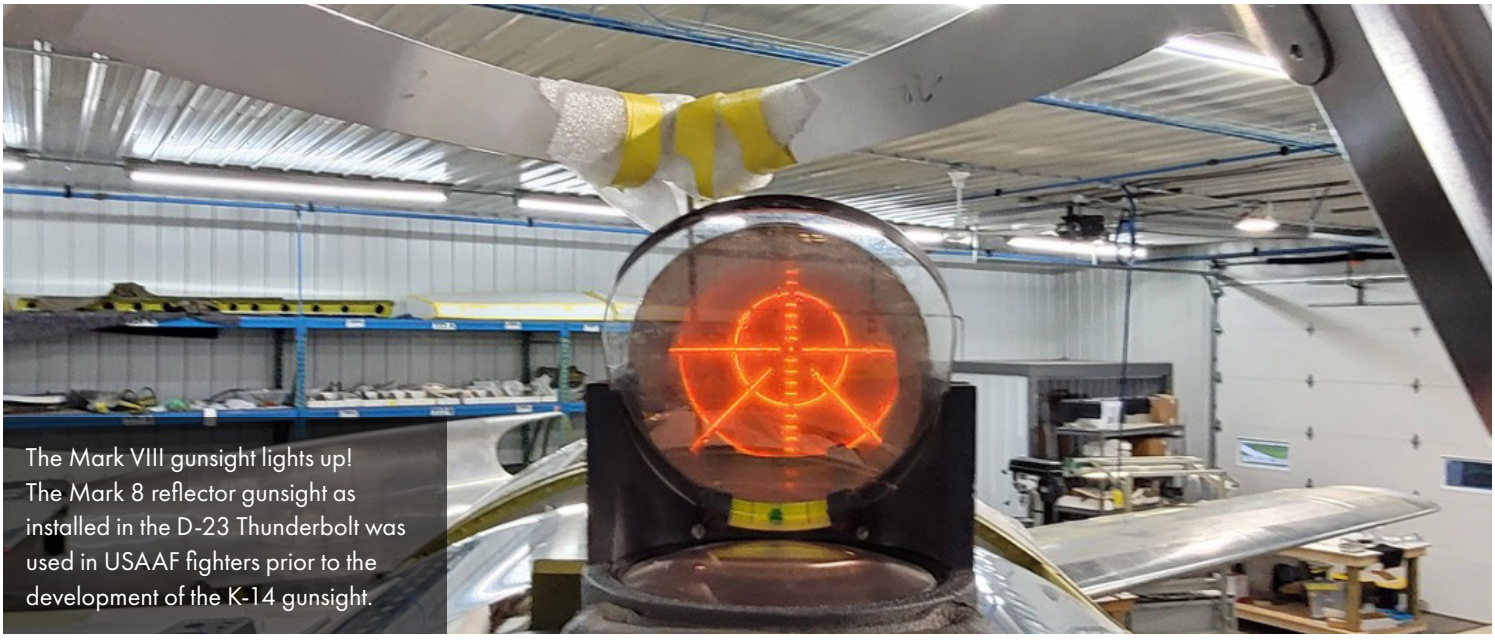
The identification lights can be operated by an intermittent switch to send Morse code messages.



No need for a caption to tell how the electrical testing is going!



The intercooler doors are another electrically powered system. This is the motor and jackscrew that operates those doors. It worked perfectly in the electrical tests.



The Mark VIII gunsight lights up! The Mark 8 reflector gunsight as installed in the D-23 Thunderbolt was used in USAAF fighters prior to the development of the K-14 gunsight.

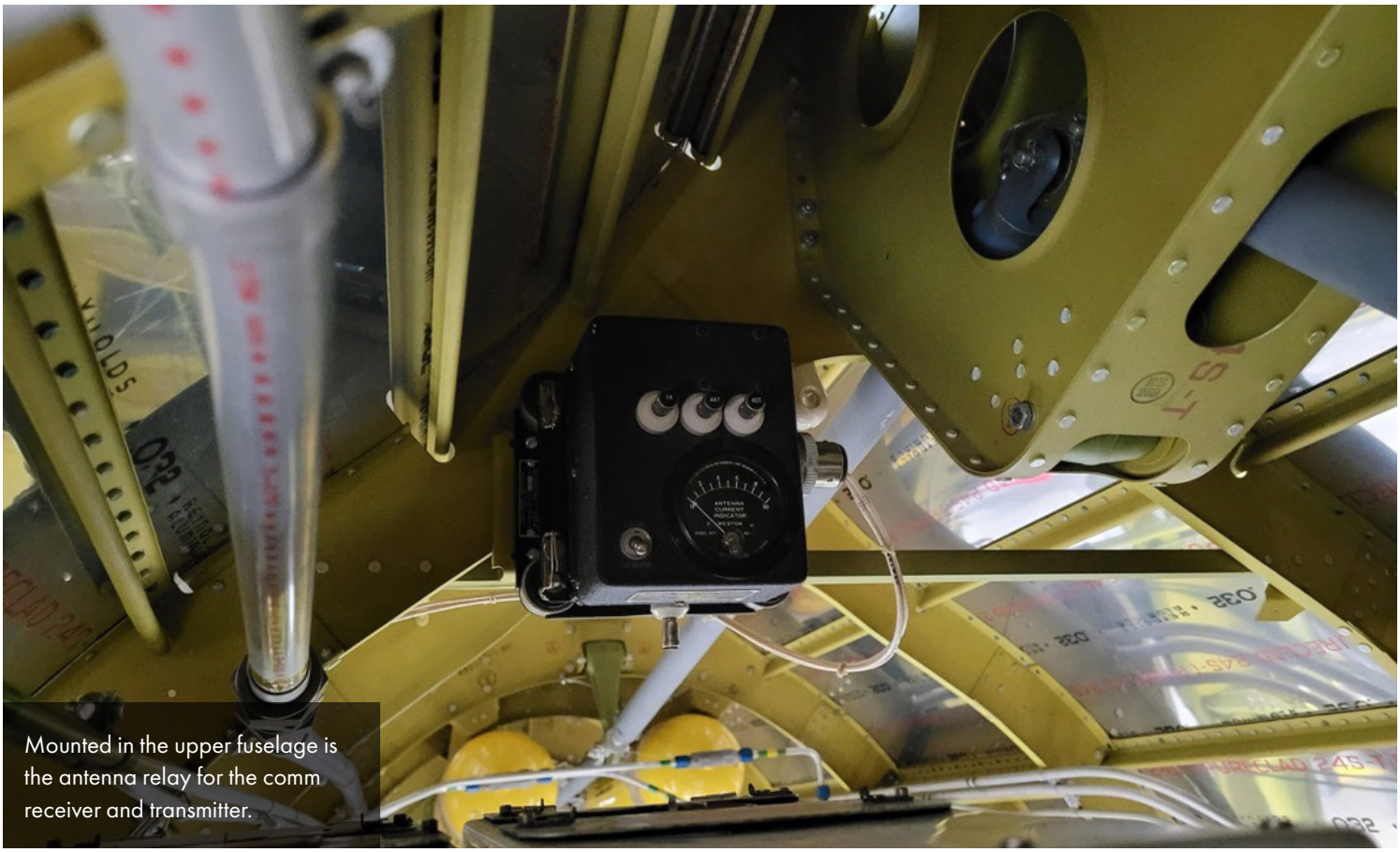
Originally developed by the U.S. Navy, who used it in aircraft such as the F4U Corsair, F6F, and F8F. The Mark VIII reflector gunsight was also used in the P-47D Thunderbolt. Reflector gun sights worked by projecting a "reticle" (also called a "pipper") onto a slanted piece of glass through which the pilot aimed. (U.S. Air Force photo)

The light for the pilot's main switch box is working.

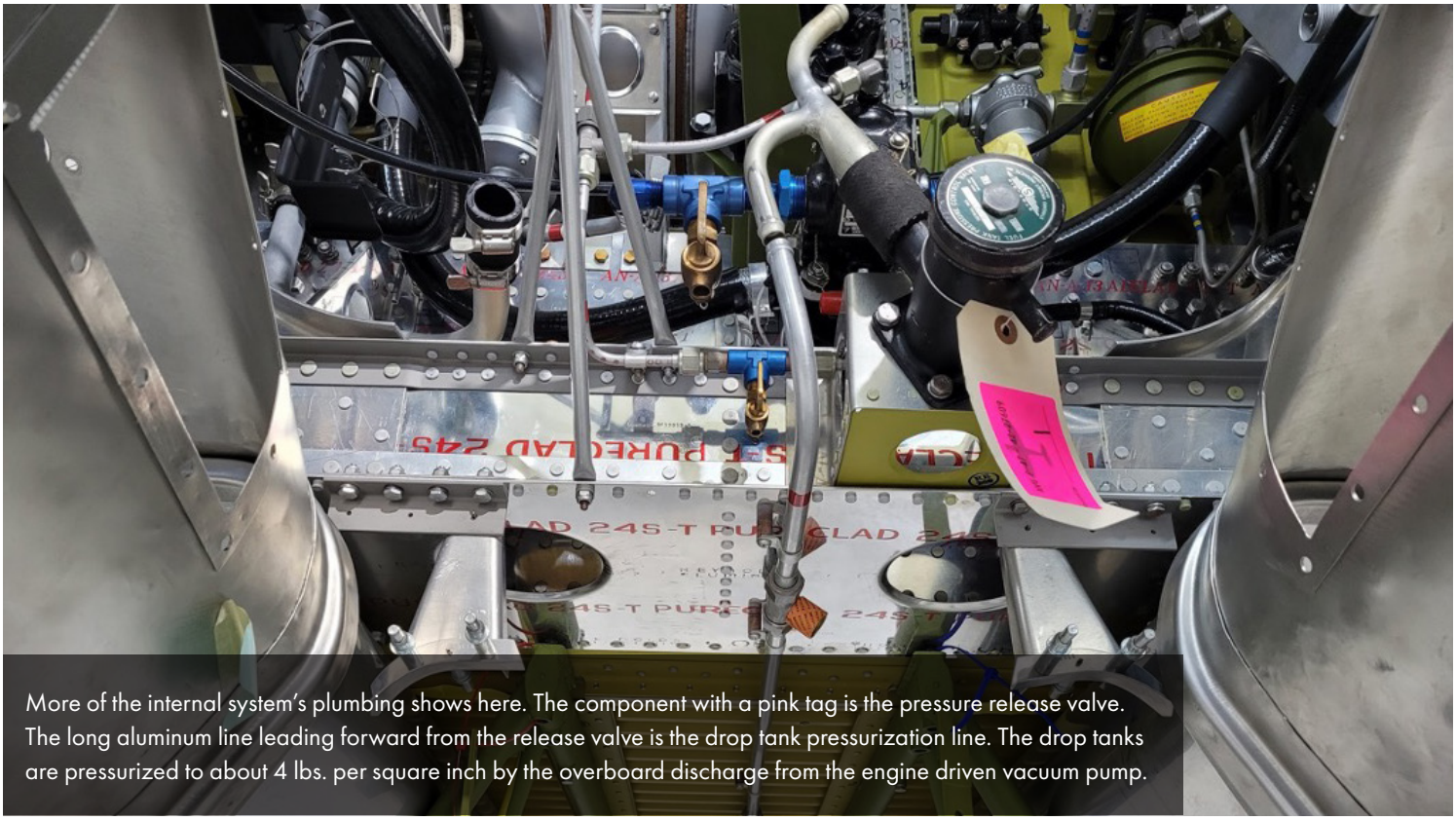
Internal Fuselage Systems

The electrical circuits weren't the only system to receive attention this month. The fuel system plumbing and antenna relay were installed in the upper rear fuselage.

Some of the fuel system plumbing is visible here. The main fuel selector is at the upper center and just to the left of it is the fuel strainer, both with blue fittings on their upper end in the picture. The black component in the lower left center of the image is the auxiliary tank fuel pump which connects to the auxiliary tank fuel sump, the darker green rectangular shaped part.



Mounted in the upper fuselage is the antenna relay for the comm receiver and transmitter.



More of the internal system's plumbing shows here. The component with a pink tag is the pressure release valve. The long aluminum line leading forward from the release valve is the drop tank pressurization line. The drop tanks are pressurized to about 4 lbs. per square inch by the overboard discharge from the engine driven vacuum pump.

Pratt & Whitney Double Wasp R-2800

The P-47 was a versatile and very successful WWII fighter. The Thunderbolt was effective operating both at high-altitude as a long-range bomber escort and down low as a fighter bomber. Much of that success and versatility can be attributed to the Pratt & Whitney R-2800 radial engine that powered the Thunderbolt.

The Pratt & Whitney R-2800-59 that will power the P-47 awaits installation.

Graham White, in his important book *"Allied Aircraft Piston Engines"* called the R-2800 "the most significant aircraft engine built in the United States during WWII".[1] Also called the "Double Wasp", others have named the R-2800 the best radial engine ever built.

Those superlatives are opinions and are open to disagreement, but what isn't debatable is that a great variety of significant WWII aircraft fighters and medium bombers were powered by the R-2800. In fact, it powered more different US aircraft types in WWII than any other engine.

Among the most well known are the F4U Corsair, Martin B-26 Marauder and PBM Mariner, Grumman F6F Hellcat and F7F Tigercat, Curtis C-46 Commando, Northrop P-61 Black Widow, Lockheed PV-1 Ventura and PV-2 Harpoon, Douglas A-26 Invader, and, of course, the P-47 Thunderbolt.

A total of 125,334 R-2800 engines were produced between 1939 and 1960 with 114,073 of those completed between 1941 and 1945 during the war.[2]

Production of the big double row radial continued after 1945. The Martin 404, Convair CV 240 and 340, C-123 Provider, and the Douglas DC-6 all used the R-2800.

Design of what became the Double Wasp began in 1936. The original design displaced 2600 cubic inches, but upon learning that Wright Aeronautical was developing a double row radial of 2600 cubic inch displacement, Pratt & Whitney increased the displacement to 2804 cubic inches by adding just over 11 cubic inches to each cylinder's displacement.

One major challenge to the success of this first US double row, 18 cylinder engine was heat dissipation. The problem was solved by using aluminum cooling muffs with very thin and numerous cooling fins shrunk around the chrome molybdenum cylinder forgings.

A prime example of the collective commitment of American industry to support the Allied war effort was that Ford, Chevrolet, General Motors, and other US companies built R-2800s as subcontractors to Pratt & Whitney.

[1] Graham White, *Allied Aircraft Piston Engines*, Society of Automotive Engineers, Inc, 1995, page 222
[2] Graham White, *Allied Aircraft Piston Engines*, Society of Automotive Engineers, Inc, 1995, page 260

Chevrolet WWII advertisement mentioning the R-2800, photo from The Truth About Cars website, https://www.thetruthaboutcars.com/2011/05/for-memorial-day-the-arsenal-of-democracy-the-independents/, accessed 9/30/2021

Cooling fins on a R-2800 cylinder were thin and precisely designed to maximize airflow over the two banks of 9 cylinders each.

The R-2800 was turned out in over 40 variants, but the version used in the P-47D-23RA was the R-2800-59. Supplied with an improved General Electric C-23 turbosupercharger, the dash 59 could supply 2,000 hp at takeoff and 2,300 hp War Emergency Power in combat, with the use of water injection.

Later versions, the C series engines, attained 2500 hp and were used in the M and N model P-47s.

The R-2800-59 used General Electric magnetos; they are the black painted assemblies in this image. Many of these magnetos were also built by Briggs & Stratton during WWII, just another example of the US industrial commitment to the "Arsenal of Democracy".

The single stage supercharger mounts on the rear of the crankcase and, in conjunction with the C-23 turbosupercharger, provides excellent high altitude performance.

During WWII, R-2800s became renowned for surviving damage that would have stopped any other engine. P-47 pilots came back from missions knowing their R-2800 was down on power but still running. It wasn't until they landed that they found out that one or even two cylinders had been shot out, but the trusty Pratt & Whitney had brought them safely home anyway.