JUNE/JULY

AIRCORPS AVIATION

Dakota Territory Air Museum's P-47 Update

by Chuck Cravens

This quartering rear view of the P-47 shows the area where the flap will be installed with the skin clecoed in place.

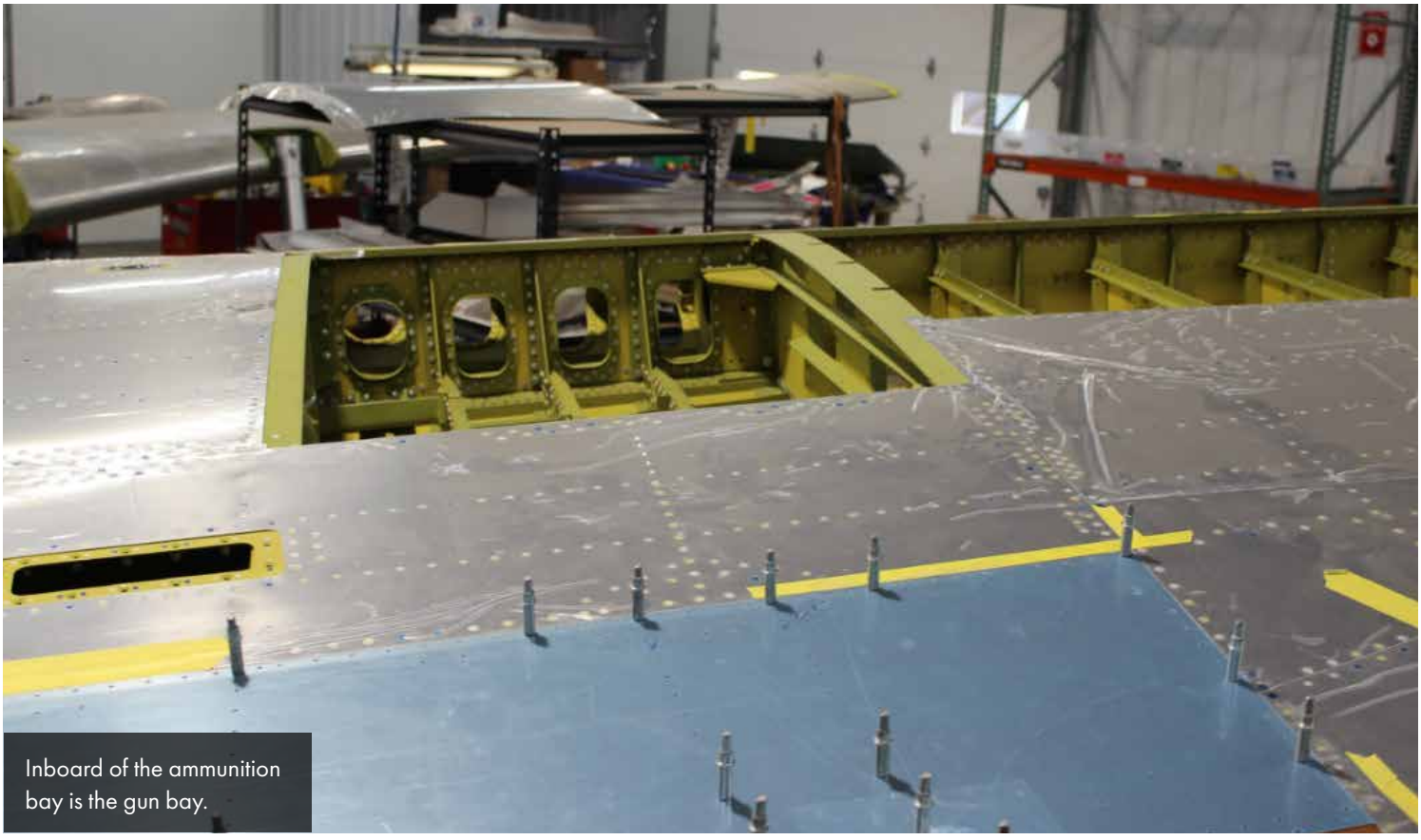
DAKOTA TERRITORY AIR MUSEUM

Update

Much of the work this month doesn't show obvious exterior visual changes in the main airframe. That is because a great deal of effort was expended on systems preparation and installation. In a complex fighter like the P-47, with all its turbo ducting, controls for the engine, turbosupercharger, plumbing, and landing gear hydraulics, the behind the scenes part of the restoration is time consuming.

The oil cooler installation is finished.

A very large ammunition bay is needed to feed the four guns in each wing.



Inboard of the ammunition bay is the gun bay.

The leading edge gun openings will eventually have a skin piece installed with round openings for the gun muzzles.

Turbosupercharger

One of the unusual facets of this restoration is the incorporation of a functional turbosupercharger system. It involves additional effort and resources to make the system functional, but the Dakota Territory Air Museum feels it is worth it.

This "Y" shaped forging is the connection between the incoming air and the turbosupercharger. This is the end that meets the two air ducts.

The single opening mates to the turbosupercharger inlet.

This is the turbosupercharger case that has been inspected and chosen as the one that will be used for the restoration.

Hydraulics

Mark has been restoring and inspecting the complex components of the landing gear and flap hydraulic system.

Here he works on the main hydraulic cylinder that moves the gear up and down.

Like everything else in the Thunderbolt, these hydraulic components are massive.

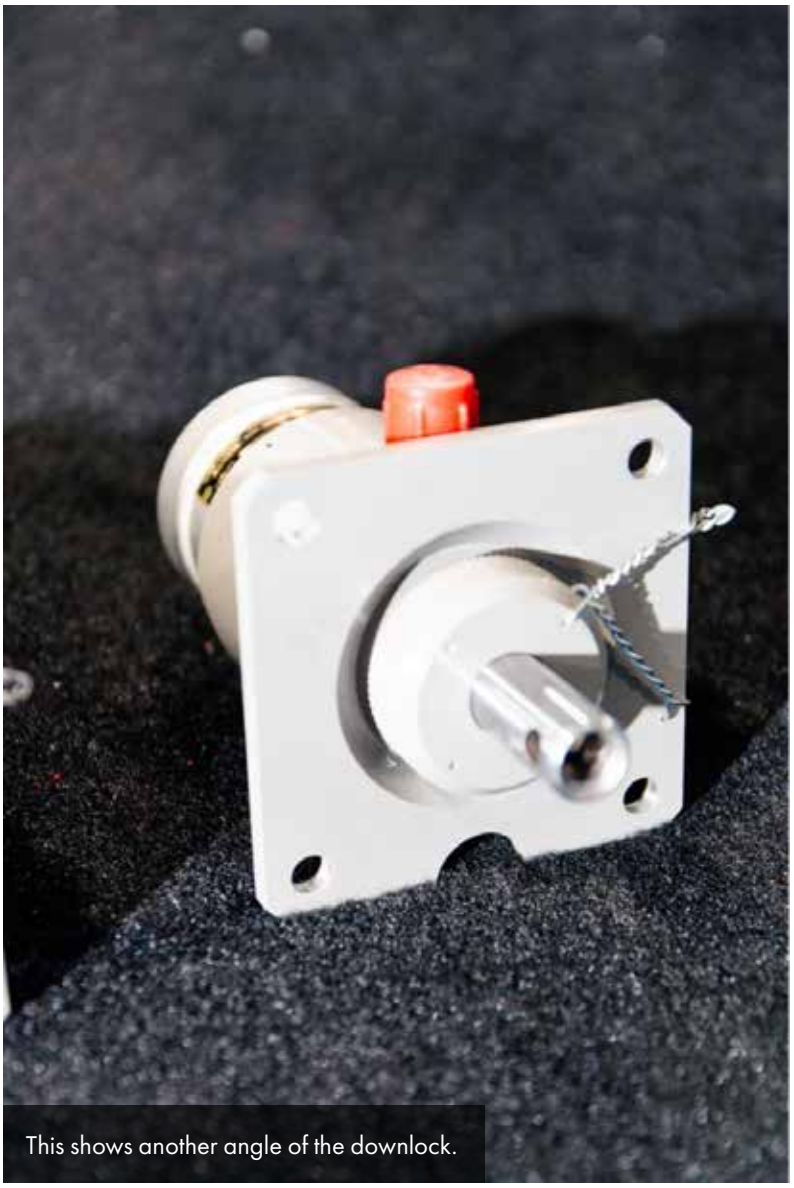
The main landing gear hydraulic cylinders sit on a bench.

Mark has also been working on the aileron trim push rod.

These are the hydraulic cylinders that will operate the landing gear doors.

These are the wing flap operating cylinders.

These are the main landing gear downlocks.



This shows another angle of the downlock.

Downlock cylinder with the hydraulic downlock attached from the side.

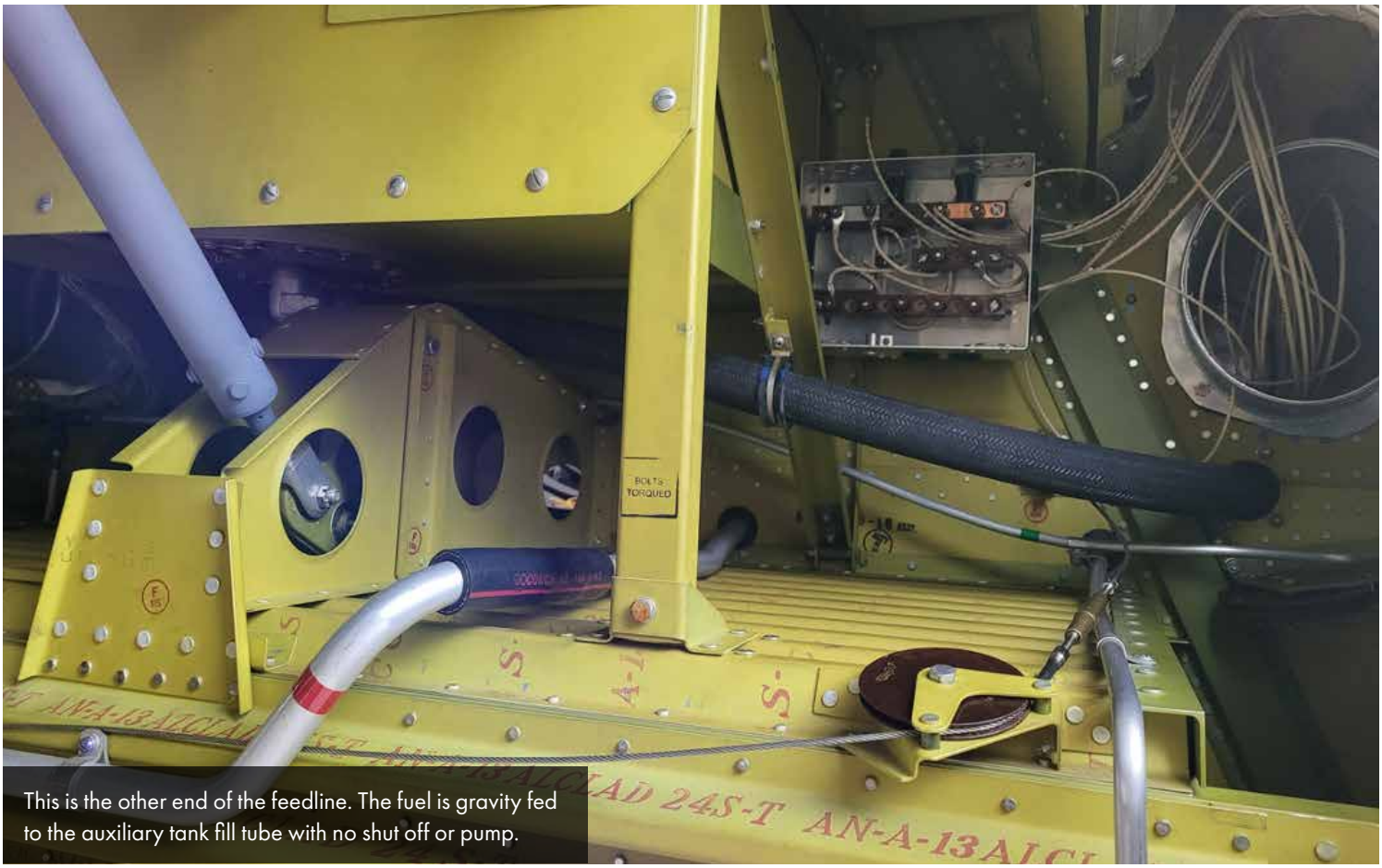
The main landing gear uplock is installed in the wheel well.

Christmas Tree Tank Plumbing

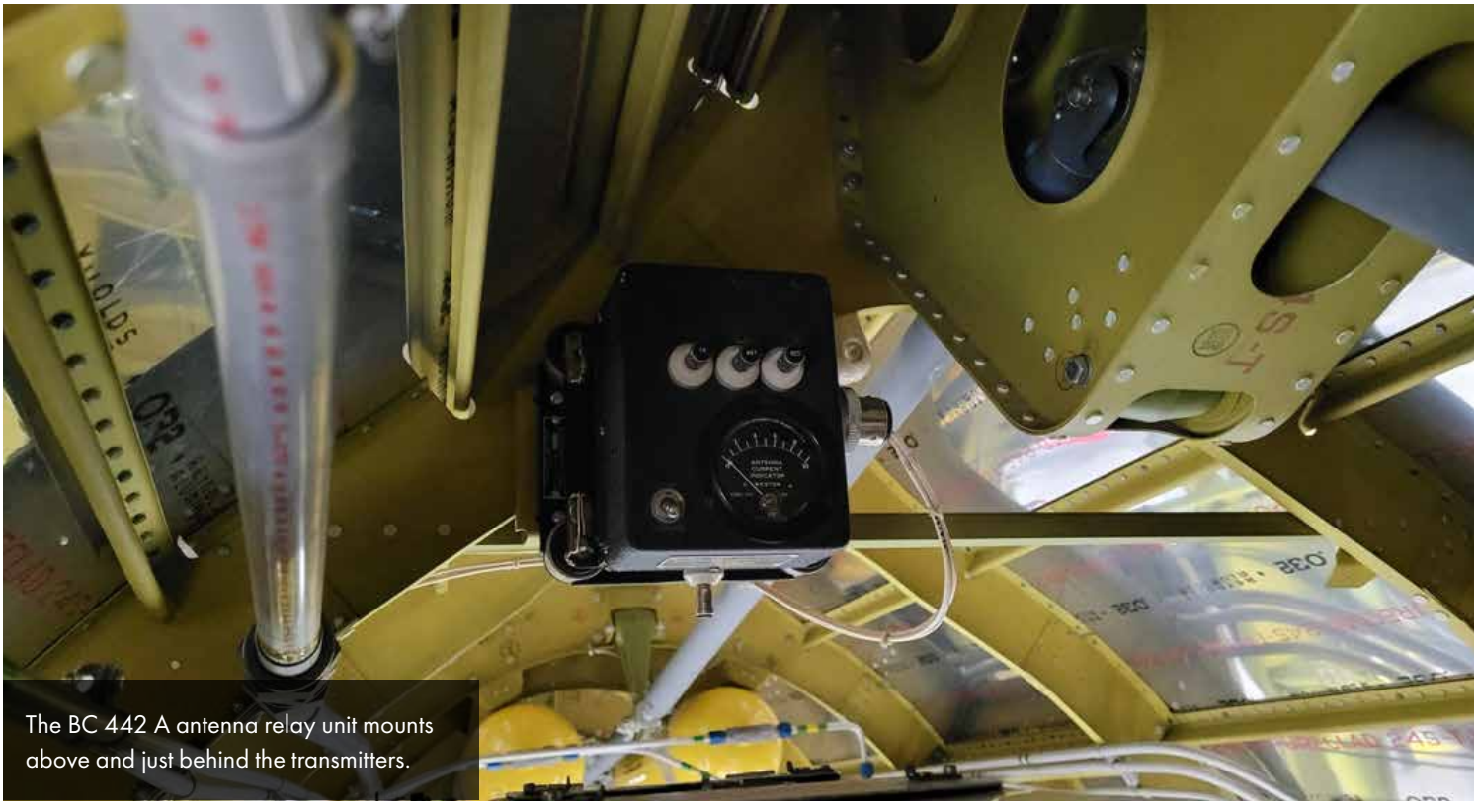
Aaron has completed the final items of the unique Christmas tree tank installation. This was a particularly challenging part of the restoration of 42-27609 because none of the installation is documented on Republic engineering drawings. Field modifications like this normally are not, so Aaron had to follow the way things were done in 1944 by carefully examining and documenting 42-27609's modified fuselage systems as they were disassembled for inspection.

All the radio and oxygen equipment had been moved as part of this field modification; so finding new locations to install them in places not documented on the Republic drawings was part of the process.

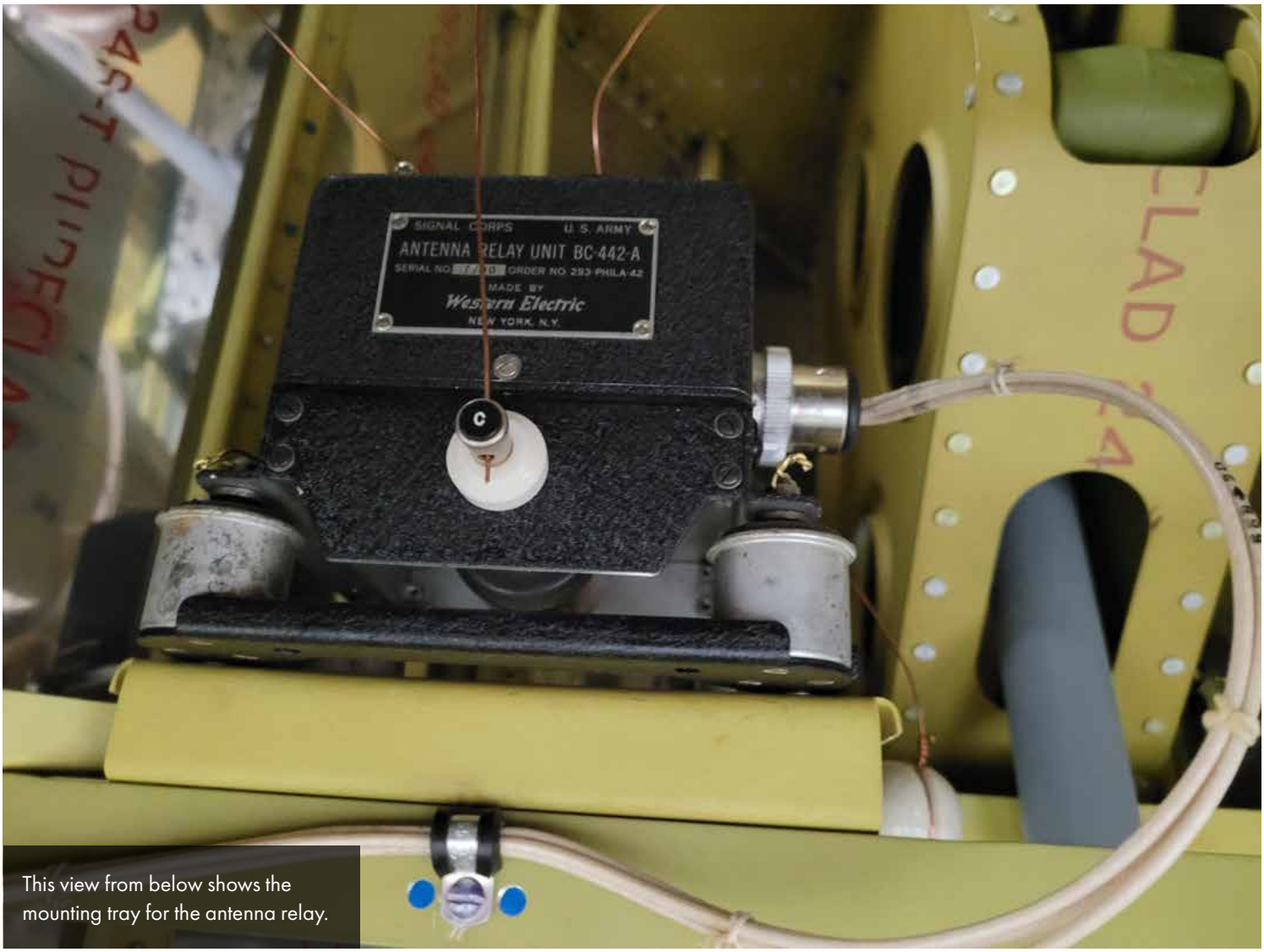
The black tubing is the feed line for the Christmas tree tank. It goes from the Christmas tree tank to the filler neck for the auxiliary tank.



This is the other end of the feedline. The fuel is gravity fed to the auxiliary tank fill tube with no shut off or pump.



The BC 442 A antenna relay unit mounts above and just behind the transmitters.



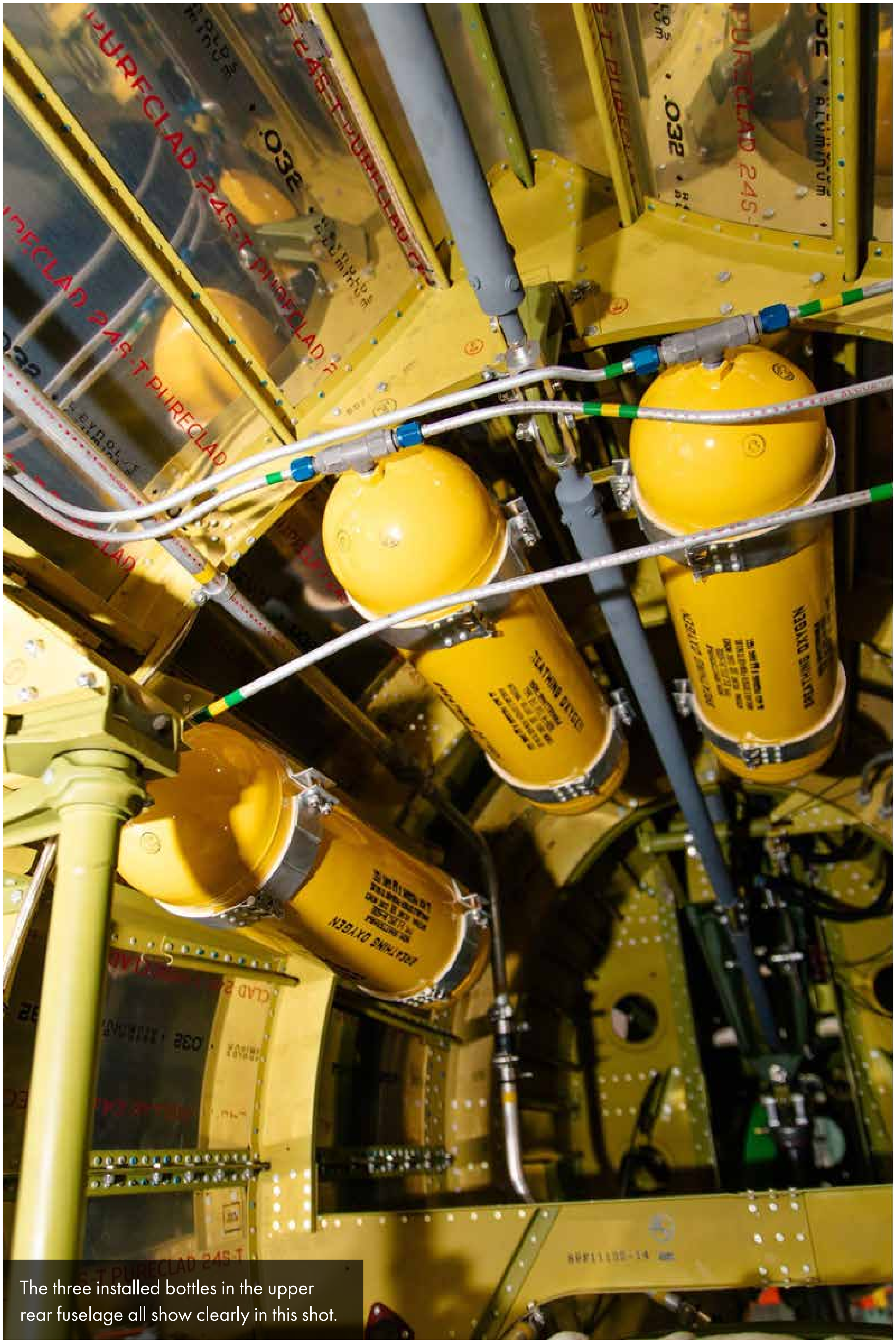
This view from below shows the mounting tray for the antenna relay.

Oxygen

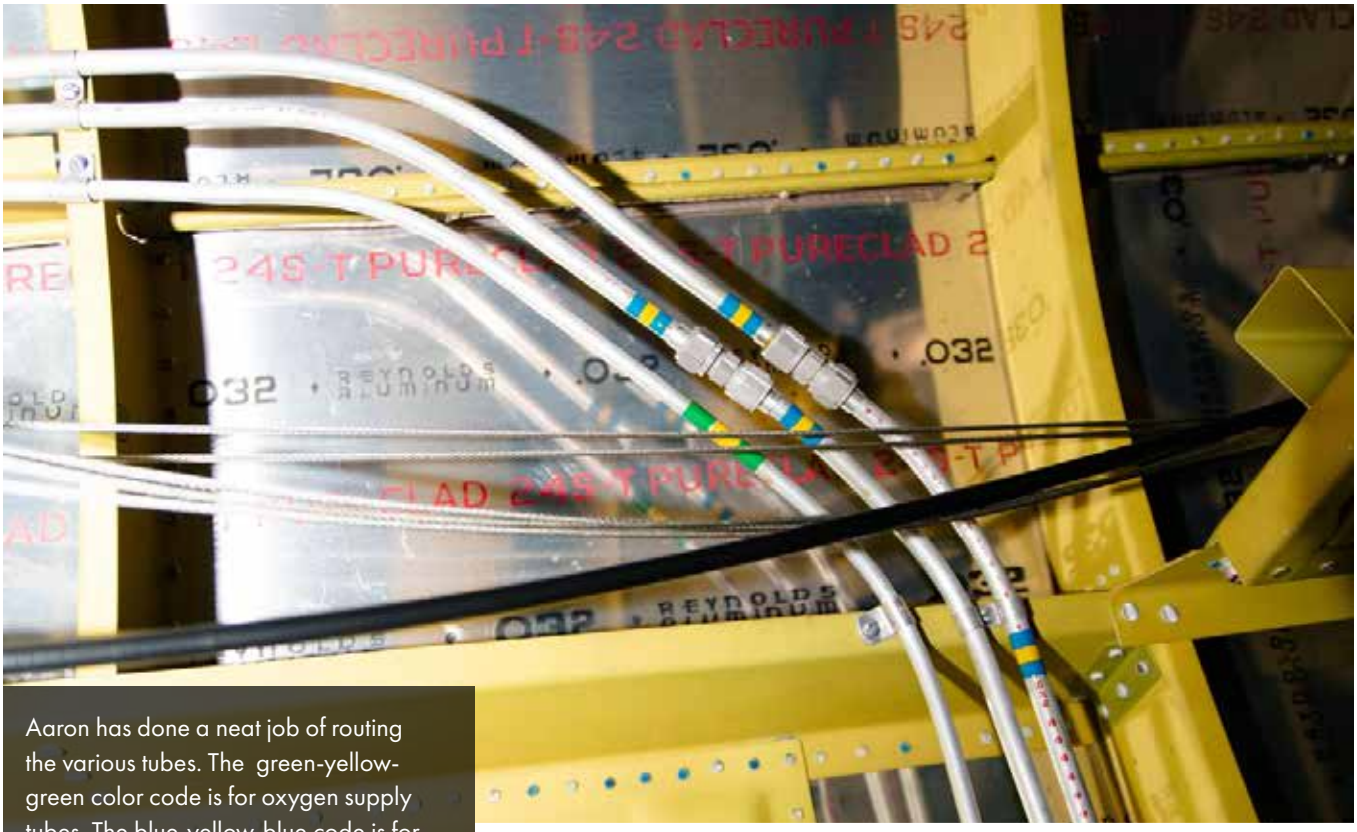
The oxygen tank installation is another non standard part of the restoration because they were moved back to allow space for the Christmas tree tank.

The oxygen supply and feed lines are completed.

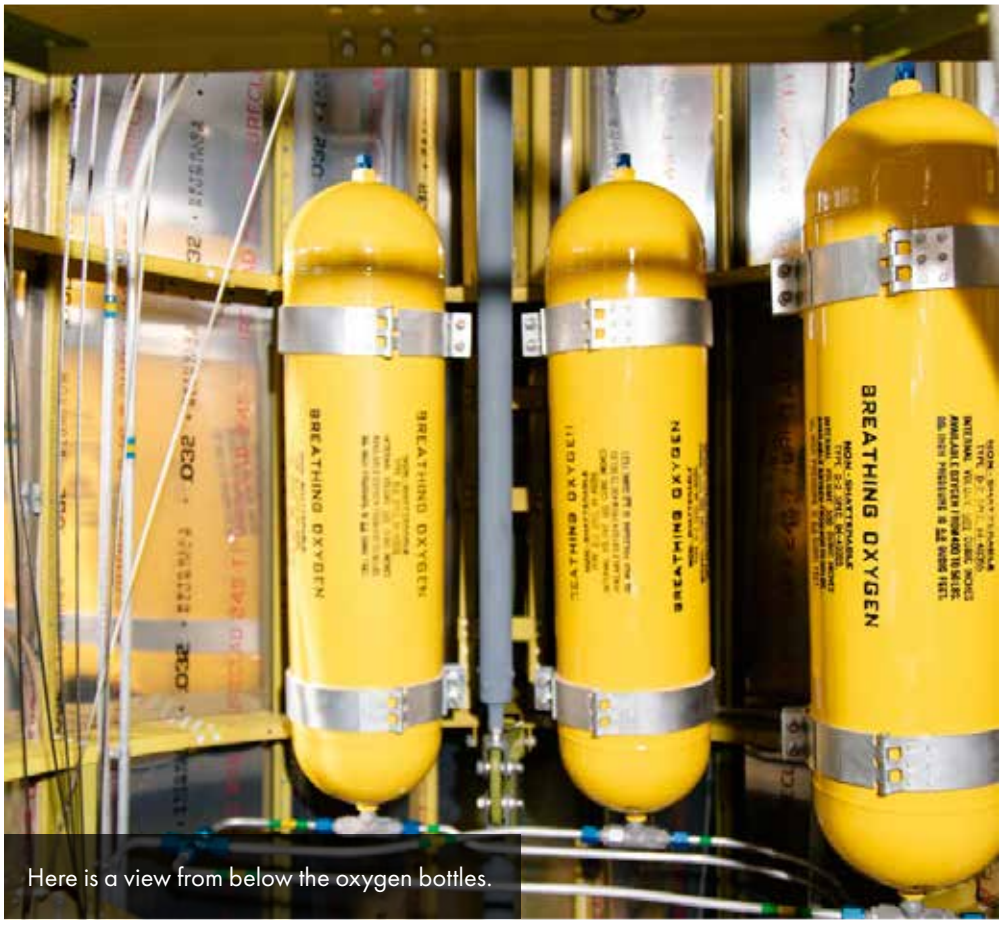
The gray elevator pushrod can be seen running between the oxygen bottles.



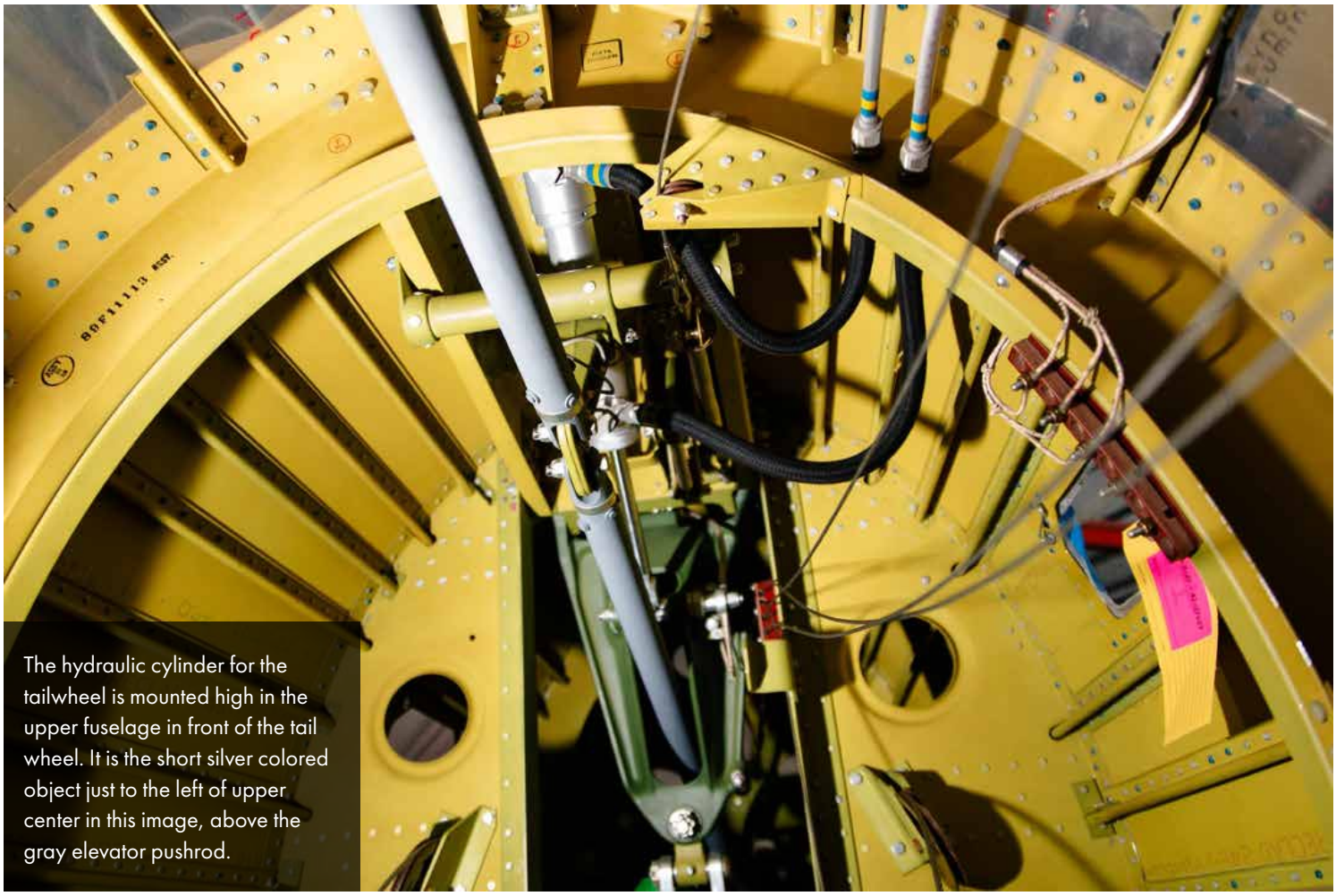
The three installed bottles in the upper rear fuselage all show clearly in this shot.



Aaron has done a neat job of routing the various tubes. The green-yellow-green color code is for oxygen supply tubes. The blue-yellow-blue code is for hydraulic oil under pressure.



Here is a view from below the oxygen bottles.



The hydraulic cylinder for the tailwheel is mounted high in the upper fuselage in front of the tail wheel. It is the short silver colored object just to the left of upper center in this image, above the gray elevator pushrod.

Ailerons

The last major airframe structures to be restored are the control surfaces. Brad has been working on the ailerons.

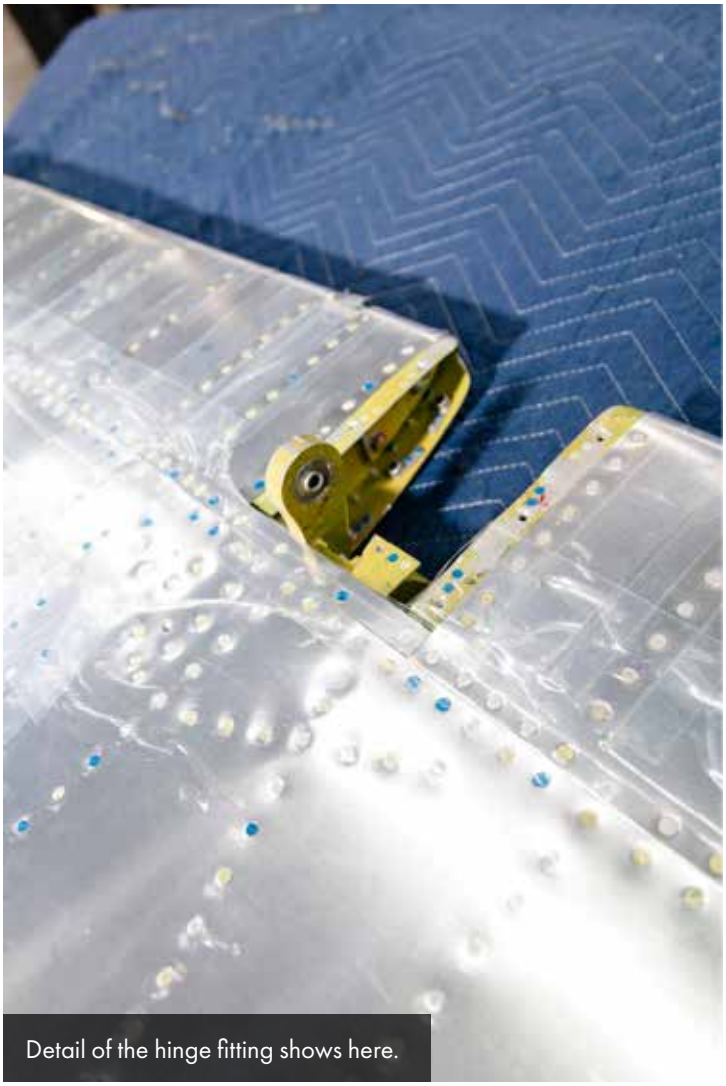
The aileron ribs have been installed to prepare the aileron for mounting in its assembly fixture.

The aileron is now in the fixture.

The leading edge ribs have been installed on the second aileron.

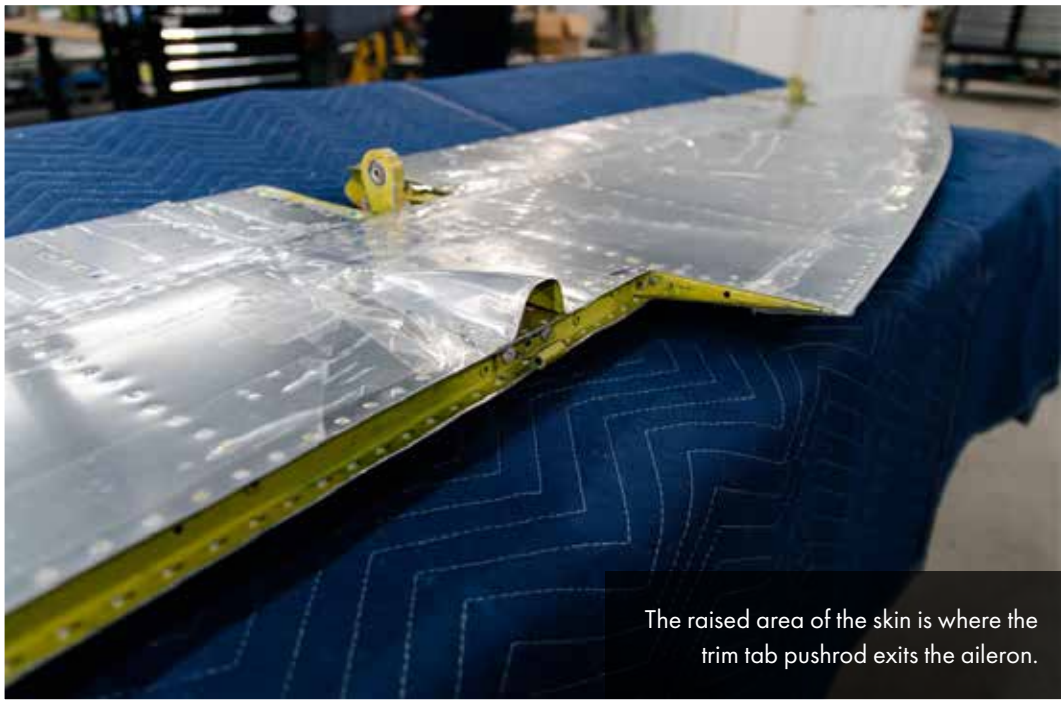
This is an original aileron. The skin was removed and the structure was inspected carefully.

Once the inspection was completed, and the aileron structure was determined to be airworthy, it was painted with zinc chromate and reassembled.



Detail of the hinge fitting shows here.

This is a view of the same aileron from the tip end.



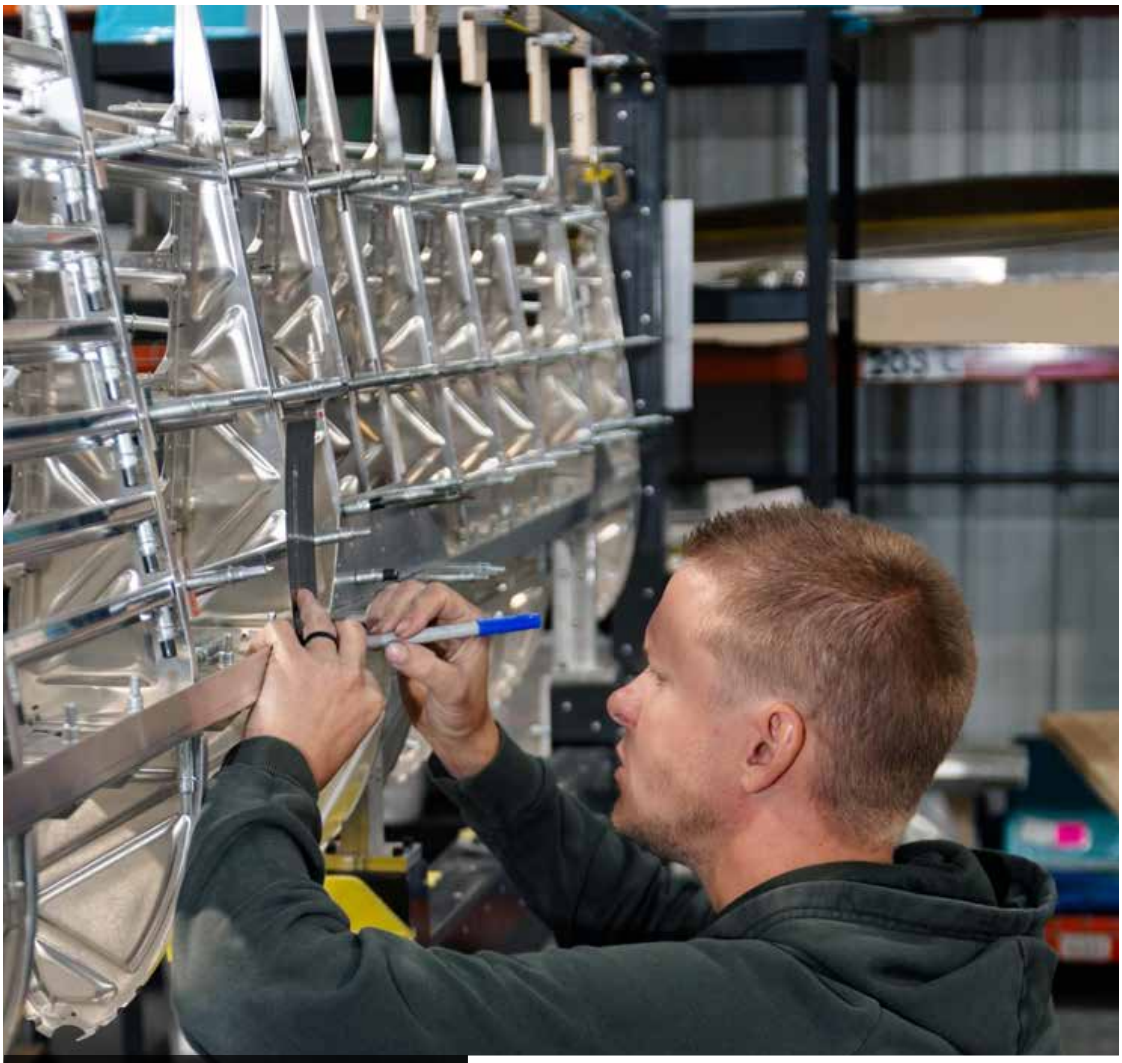
The raised area of the skin is where the trim tab pushrod exits the aileron.

Flaps

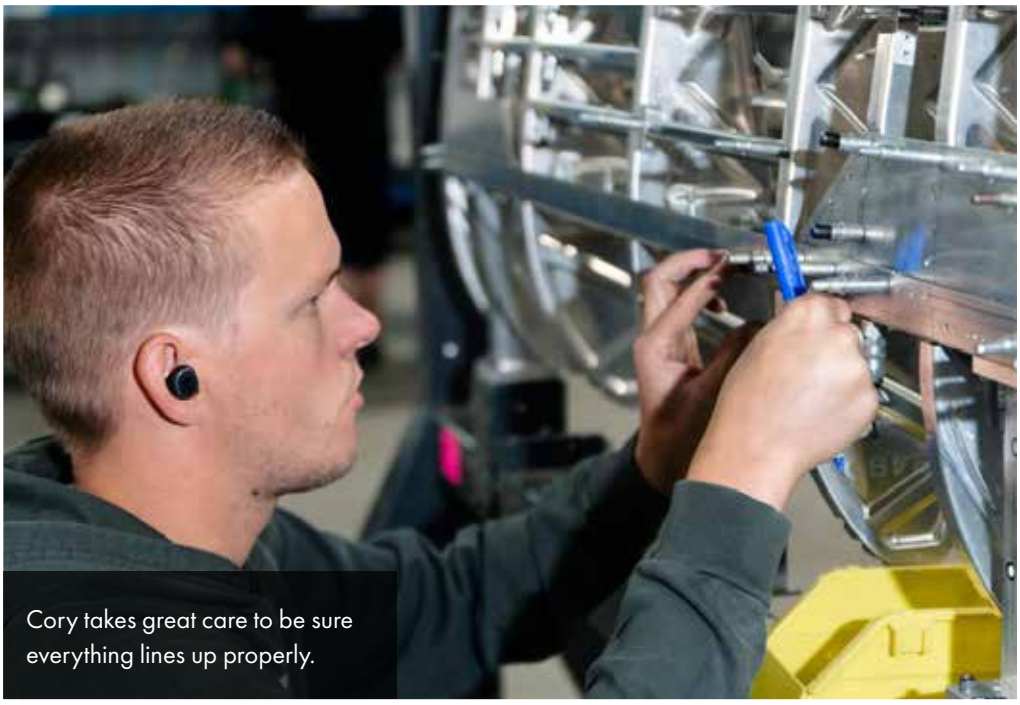
Cory continued working on producing a set of flaps for the P-47 this month.

The flap structure takes shape in the fixture. This is the upper side.

Here is a view of the underside of the flap structure.



Many rivet holes must be located precisely and then drilled and deburred. Here Cory is marking the rivet spacing for the skins on the flap spar.



Cory takes great care to be sure everything lines up properly.

Mock Up Engine

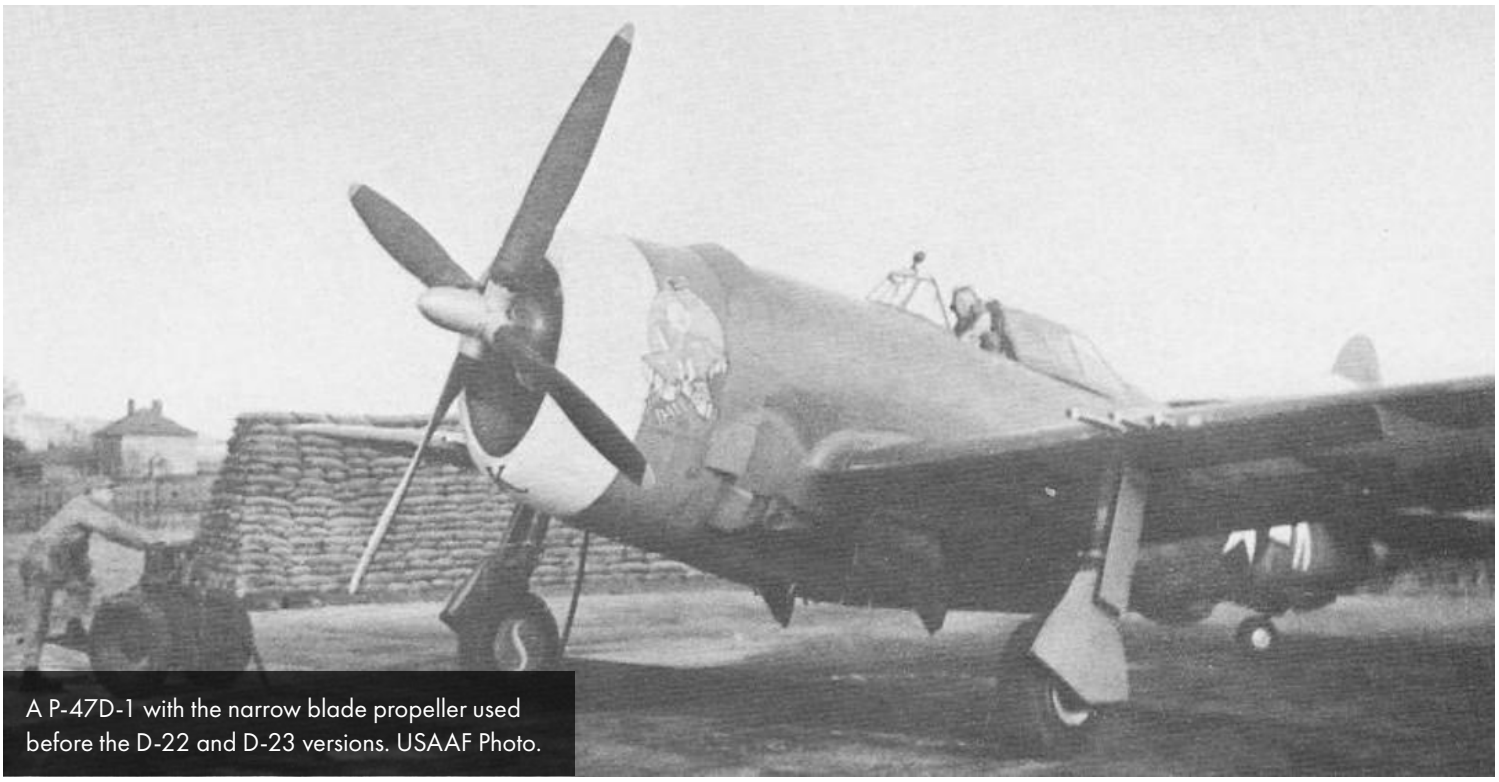
A non-airworthy R-2800 is being used as a placeholder with which to install as many of the engine accessories and connections as possible before the rebuilt engine comes in.

The mockup engine on a stand at the restoration shop.

Here is a view from the front of the twin row radial.

This angle shows the mount behind the engine itself.

The P-47D-22 and 23 Represented the Pinnacle of Razorback Thunderbolt Design



A P-47D-1 with the narrow blade propeller used before the D-22 and D-23 versions. USAAF Photo.

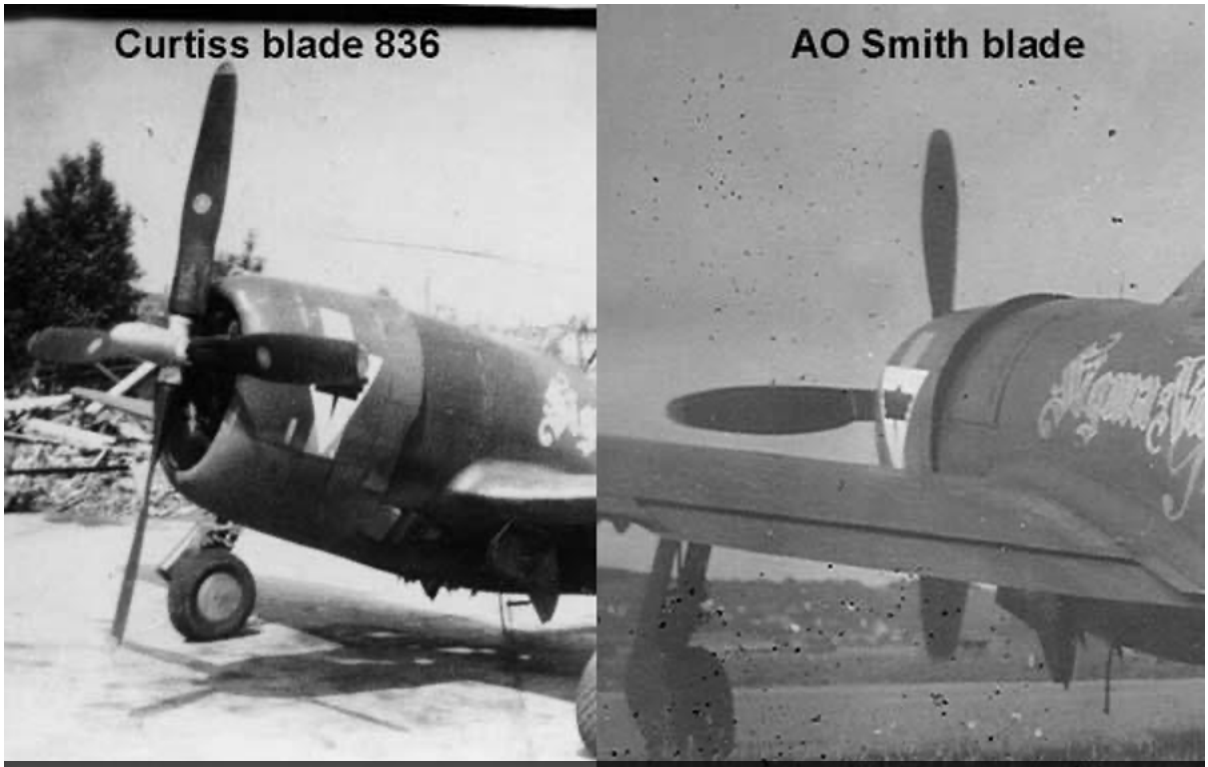
The last two versions of the razorback P-47 were very similar, and they introduced the paddle blade propellers to the Thunderbolt line. They differed from one another primarily in the propeller used and the location where they were manufactured. The P-47D-22 RE was a Farmingdale product, while the -23 was built in Evansville.

The P-47D-22RE used a Hamilton Standard Hydromatic 24E50-65 propeller that was 13 ft 17/8 in diameter. The P-47D-23RA incorporated a Curtiss Electric C542S of 13 ft. 0 inch diameter[1] and used either Curtiss paddle blades or AO Smith blades that were even wider.

These props allowed full use of the increased horsepower available with water injection.

Joe Baugher reports " there was a scant six inches of clearance between blade tips and the ground during take-offs and landings, which must have been hair-raising!"

[1] Roger Freeman, *Thunderbolt, a Documentary History of the Republic P-47,* Charles Scribner's and Sons, New York, 1978, p119



Curtiss Electric props with the two distinct paddle blade shapes used. https://www.britmodeller.com/forums/index.php?/topic/234989098-curtiss-prop-p-47-question/ accessed 8-3-2021

The -22 and -23s both added a jettisonable cockpit canopy. The pilot pulled a ring inside the cockpit, the hood would then be pushed backward, and the slipstream would then finish the job of pulling the canopy free of the aircraft. Other updates included the addition of a bullet-proof windshield, and an increase in the internal fuel capacity.

Both had better climb by about 400 feet per minute than previous versions of the P-47. The D-22 had very slight performance advantages over the D-23, but they were small enough that the individual airframe differences are more significant.

[1] Joe Baugher, *Aerofiles P-47D/G Thunderbolt*, http://www.aerofiles.com/JBrepub-p47dg.html, website accessed August 3, 2021

Below is a War Department, Engineering Department report on testing of P-47D-22 42-26167 at Wright Field in Dayton, Ohio.

ENGINEERING DIVISION MEMORANDUM

REPORT SERIAL NO. ENG-47-1774-A

15 July 1944

FLIGHT TESTS ON THE REPUBLIC

P-47D AIRPLANE, AAF NO. 42-26167

USING 44-1 FUEL

Summary

Preliminary tests were run to clear the airplane for performance with higher powers with and without water injection. Detonation equipment was installed to determine if any flight condition became marginal as to detonation, cooling or improper operation of auxiliary parts. No detonation was observed in level flight up to 65.0" Hg. without water and 70.0" with water. No detonation was observed in climb up to 65" Hg. without water. Detonation occurred at 65.0" with water in climb but was remedied by using a No. 18 water jet. Cylinder head and carburetor air temperatures remained below the limits in level flight. Excessive cylinder head and carburetor air temperatures were encountered in climbs, limiting the duration of any climb to a point where limits are reached.

The airplane and engine handled well at all altitudes at the higher powers. At 70.0" Hg., water injection, a maximum speed of 444 MPH was obtained at 23,200 feet. At 65.0" Hg., with water a high speed of 439 MPH at 25,200 feet and a maximum rate of climb of 3260 ft/min. at 10,000 feet were obtained. At 65.0" Hg., without water a high speed of 430 MPH at 25,400 feet and a maximum rate of climb of 2850 ft/min. at 12,000 feet were obtained. At 56.0" Hg. without water a high speed of 418 MPH at 29,600 feet and a maximum rate of climb of 2330 ft/min. at 12,000 feet were obtained. At 52.0" Hg. without water a high speed of 412 MPH at 31,400 feet and a maximum rate of climb of 2030 ft/min. at 12,000 feet were obtained.