BETTER THAN NEW

172

AIRFRAME ADDITIONS

A cuff and a fence, a tip and a tank

BY THOMAS B. HAINES

WE sometimes feel the need to apologize for our airplanes. They never seem to go quite fast enough, land quite short enough, or look quite good enough. But in truth, we're quite unfair in such thinking. The designs and construction methods of general aviation airplanes really are fairly efficient considering the demand that airframes be light, strong, durable, and easy to maintain. N737QN, our Better Than New 172 project airplane, for example, meets its design require-

PHOTOGRAPHY BY MIKE FIZER

Though N737QN's shiny aluminum leading edge may look like a bleed-air anti-ice system, the wing cuff really is part of the Horton STOL kit. Less obvious are the RMD wingtip recognition lights and the sumps for the Flint Aero auxiliary fuel tanks in the wings.

A typical Horton STOL kit includes wing tips, leading edge cuffs, stall fences, rivets, and, depending on the model, a landing light cover.

ments well. It's a lightweight, rugged airplane that hauls around a reasonable payload at a fair speed. It won't knock your socks off in performance or looks, but the Cessna 172 didn't get to be the most popular winged craft on the planet by falling too short of expectations.

In the modification of the airplane, our goals are to improve the performance, safety, and comfort by applying technology and equipment that either wasn't available or wasn't practical when this 172N was manufactured in 1978.

In the May issue, we wrote about the engine upgrade process that replaced the original Lycoming 160-horsepower O-320 engine with a 180-hp O-360. Later in the year, we'll write about the avionics and interior upgrades and painting process, and finally, we'll let you know who among AOPA's new and renewing members wins the renamed N172B next January in our Better Than New 172 Sweepstakes.

The larger engine obviously improves cruise and climb performance. Because it fits in the same cowling with virtually no changes, the only penalty is increased fuel flow and a slight weight increase. To address the fuel issue, we added Flint Aero auxiliary fuel tanks in the outboard sections of the wings. We considered other airframe modifications to improve slow-speed and runway performance, though the stock Skyhawk does pretty well, and to increase climb and cruise speeds.

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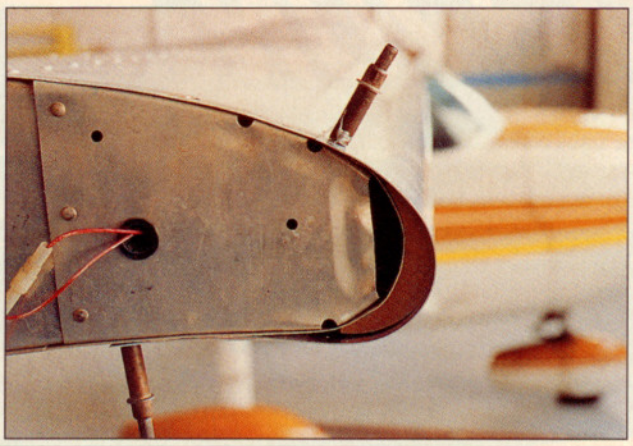
The obvious answer to the runway and slow-speed performance question is a short takeoff and landing (STOL) kit. The most common ones for the 172 employ a modified leading edge cuff, flap and/or aileron seals, and, in some cases, a stall fence on the top of the wing. Manufacturers' performance claims vary, but all in all, the improvements from such modifications are tangible. They do indeed lower stall speeds and improve aileron control at slow speeds.

An end view shows the Horton cuff installed over the stock wing leading edge.



We eventually chose the Horton STOL-Craft kit for a variety of reasons. One factor is Horton's location at the Wellington (Kansas) Munici-

pal Airport. Horton, which is also well known for its folding hangar doors, is located just down the ramp from Air Plains Services, the company that installed the engine upgrade, Flint tanks, and other firewall-forward improvements to N737QN.

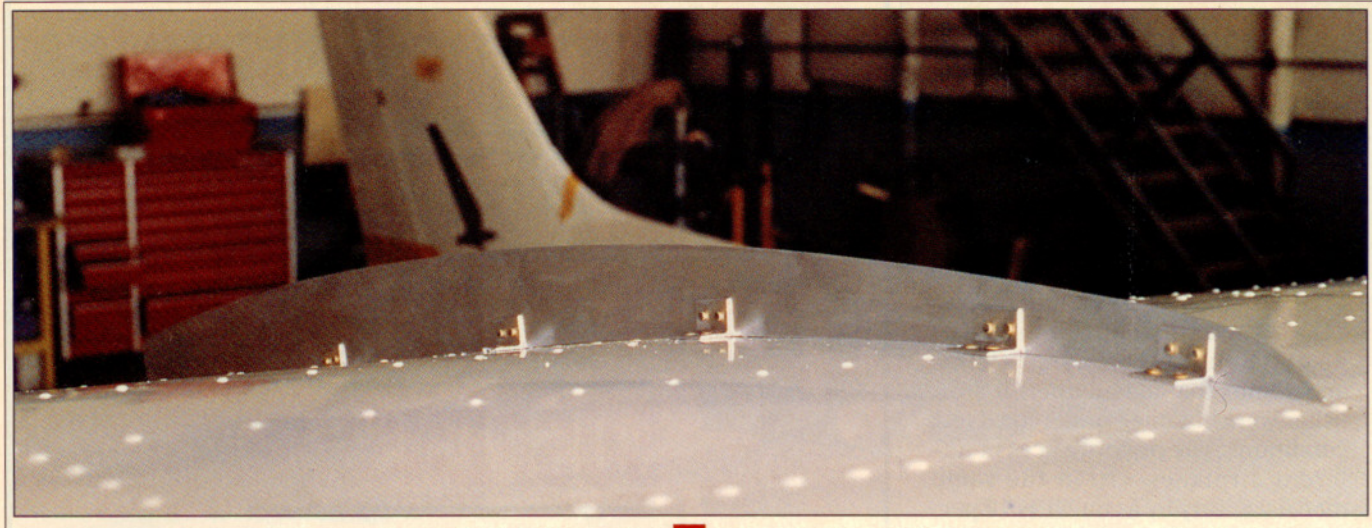
Most impressive about Horton are its down-to-earth claims about its STOL kit, which it prefers to call Safer Take Off and Landing. Horton makes no outlandish performance claims and admits that the numbers it publishes were obtained under ideal test conditions. The performances of different airplanes within the same model can vary by as much as 10 percent based simply on pilot capability, aircraft rigging, and engine and propeller efficiency.

Over the past 18 years, Horton has developed STOL kits for dozens of models of Cessnas and Pipers. The list includes virtually all the Cessna singles and the 337 Skymaster and many of the "Hershey-bar-wing" Piper PA–28s and even the Grumman AA–1.

Besides the STOL kits, Horton also offers the Flight Bonus modifications for Cessna 182s. The components of the kit were developed by Charles Seibel, who proved that his modifications could make a fixed-gear Skylane as fast as a retractable-gear version. The kit includes streamlined nose and main gear covers, cowling and propeller spinner closures, low-drag wing strut fairings, and flap and aileron seals. Since acquiring the mods from Seibel in 1987, Horton has converted them from plastic to more durable fiberglass and made minor changes to improve fitting. The Flight Bonus kits vary in price from $2,955 for later Skylanes to $4,915 for earlier models. Installation adds $1,200 to $1,700.

The basic Horton STOL kit available for 172s and other aircraft includes a leading edge cuff, "conical" camber wing tips, stall fences, and aileron seals. The cuff increases the radius and camber of the wing leading edge, increasing maximum lift and reducing drag. Cessna took a similar tack and, beginning with the 172M in 1973, modified the stock wing to include such a cuff. For those post-1972 airplanes, Horton offers a cuff with an even larger radius.

The fiberglass wing tips are an improvement over the stock plastic ones in materials alone, but their slightly drooped airfoil also is claimed



to reduce wing-tip vortex strength, thus decreasing drag. The tips also increase wing area and decrease stall speed.

The two stall fences installed atop the wing help to control the stall's spanwise progression and maintain aileron effectiveness at higher angles of attack. Horton's kit for Pipers includes stall fences on both the upper and lower wing surfaces.

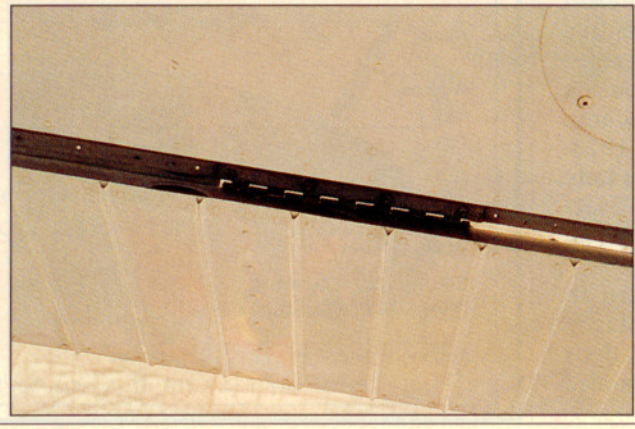
The aileron seals stop the flow of air from the high-pressure area on the underside of the wing to the low-pressure area on top of the wing via the gap between the trailing edge of the wing and leading edge of the aileron. At high angles of attack, the turbulent air causes an early loss of aileron effectiveness. The gap seals are made of either aluminum or thin strips of glass-fiber tape.

Most of the Cessna STOL kits list for $799, but because of the lack of commonality of parts with the rest of the fleet, the Skymaster kit can cost as much as $1,393. Installation costs about equal the parts prices. Horton charges $999 for the Piper kits and $845 for installation. Install time is three days at Horton. Kits can be and often are shipped out for installation.

An option with the kits, and one we took advantage of, are flap well seals. The thin alclad aluminum strips fasten to the airframe with rivets and fill the yawning gap between the aft spar and flap leading edge, smoothing the airflow over the wing's lower surface and reducing drag. Horton claims a 1- to 3-mph increase in cruise speed. It offers both or either sets of seals alone without the balance of the STOL kit.

The two stall fences installed atop the wing help to control the stall's spanwise progression.

Stall fences (top) help lower stall speed. Optional flap seals (above) increase cruise speed. Aileron seals, already installed to the left of the hinge (below), improve roll control at low speed.



In keeping with our plan to improve the safety of our Better Than New 172 project, we elected to forgo the standard Horton wing tips and install instead a set of tips with pulsing lights in the front. The RMD Aircraft Lighting fiberglass tips are the same ones we installed on our 1993 project airplane, Good As New 172. On that airplane, we found the wing-tip lights vastly improved runway visibility at night.

This year, we opted to also include a Precise Flight Pulselite system. Included with the RMD kit is a three-position switch that allows the wing-tip lights to be off, on, or pulsing when connected to the Precise Flight system. In the pulse mode, the lights make excellent recognition lights. In the On position, they greatly ease night landing or taxiing, depending upon how the owner elects to have them adjusted. RMD's list price for 172s is $1,095. The wing tips are also available for about all the four- and six-seat Cessna singles; most of the Piper fleet, including the Seneca twin and the Cheyenne turboprop; the Merlin; the Beech Bonanza; and even the RV–4 and RV–6 kitplanes. The Pulselite system adds another $199 for single-engine aircraft.

The auxiliary fuel tanks are a less obvious airframe modification. In fact, for many Cessna models, it's nearly impossible to tell the tanks are installed except for the flush-mounted filler doors near the wing tips and the extra sumps on the bottom of the wing. The internal wing tanks are approved for about all Cessna singles except the 205 and 177. In the case of

the 172, the tanks add 24 gallons to the stock 40-gallon capacity; about a half-gallon per tank is unusable. With our 180-hp engine, the extra fuel should equate to an extra 2.5 hours, for a total endurance of about 6.5 hours.

Retail price for the 172 tanks is $3,275. Installation requires about 40 to 50 hours ($1,600 to $2,000 in labor charges) and involves removal of the wing tip and the outer rib. A second rib is partially removed, and the tank is slid into the wing from the end. Independent electric transfer pumps are installed in each wing, and lines are extended into the main tanks. With the tanks in place, the outer rib and wing tip are reinstalled. Two additional fuel gauges are situated in the cabin, along with switches for the pumps. The transfer of auxiliary fuel can be initiated when the mains are about half-empty; transfer time is 20 to 30 minutes. The package adds about 17 pounds to the empty weight.

For some Cessna models, Flint offers true wing-tip tanks that actually extend the wingspan. For the 210G through R, the P210R, and the T210R, the tanks add 33 gallons and about 26 inches to the wingspan. Empty weight is increased by about 38 pounds. Similar tanks for some models of 206s and 207s and the 210D through F add from 28 to 30 gallons and about 36 inches to the wingspan.

Because our project airplane has been in the paint, interior, and avionics shops since the STOL and engine installations, we can't report much yet on the performance of our airframe mods. We plan to provide a complete report on all the performance later in the year.

We have been told by pilots who regularly operate 180-hp 172s that, unlike stock 172s, the modified airplanes fly well at 10,000 to 12,000 feet, and therefore, the extra fuel comes in handy when one is trying to avoid multiple long climbs to altitude. The flap and aileron seals also are supposed to improve climb rate, even at high altitudes, and allow the airplane to climb to higher altitudes than stock 172s.

Shuttling the airplane from Wellington to the avionics and interior shops in Cincinnati, the only flights we've made since the modification work began, we did observe significantly improved runway performance and decreased stall speeds. In fact, we found it difficult to land the airplane. It floated far down the runway when we approached at normal 172 speeds. Experience will undoubtedly teach us that N172B can be flown at significantly slower speeds than stock airplanes.

In the end, we believe the airframe enhancements, when combined with the larger engine and the many improvements we're installing inside the airplane, will indeed show that it's possible to provide new levels of safety and comfort to the existing fleet. Look for N172B this summer at Oshkosh and October 21 through 23 at AOPA Expo '94 in Palm Springs, California, and let us know what you think. □

Horton's STOL kit can be made to accommodate the fiberglass RMD Aircraft wing tips. The wing tips accept the aircraft's existing strobes and navigation lights.

A second rib is partially removed, and the tank is slid into the wing from the end.

Flint Aero, Incorporated, 1935 North Marshall Avenue, El Cajon, California 92020; 619/448-1551.

Horton, Incorporated, Wellington Municipal Airport, Wellington, Kansas 67152; 800/835-2051.

Precise Flight, Incorporated, Post Office Box 7168, Bend, Oregon 97708; 800/547-2558.

RMD Aircraft Lighting, Incorporated, 3648 S.E. Roanoke Court, Hillsboro, Oregon 97123; 503/681-0685.

The components of the fiberglass Flint Aero auxiliary tanks add about 17 pounds to the aircraft empty weight and a total of 24 gallons of fuel, 23 usable.