

One-Piece Combination Bungee Installation Tool

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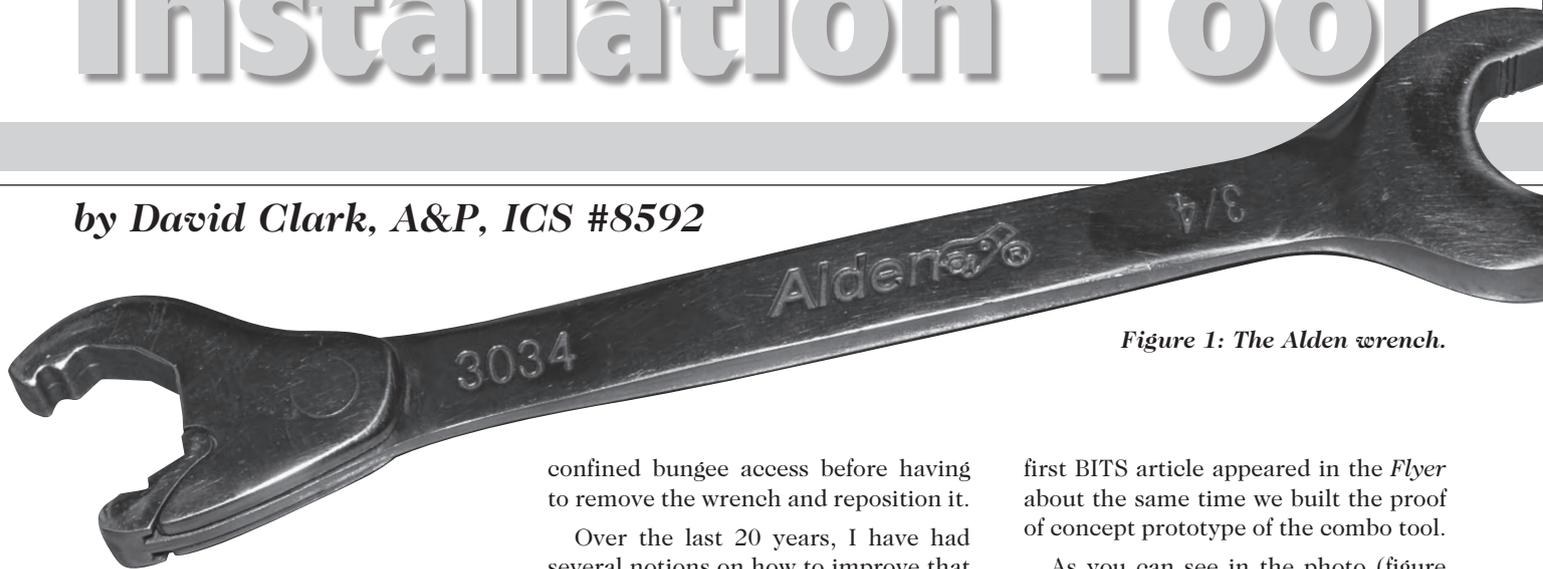


Figure 1: The Alden wrench.

In the development process of the two-piece Bungee Installation Tool System (BITS) that was reported in the June 2010 edition of the *Flyer*, I had initially entertained the idea of a one-piece combination installer-stretcher tool. The very first bungee tool I used many years ago was such a device that had been fabricated by a local mechanic based on a design he had seen in the *Flyer*. This tool employed some threaded rod and a couple of nuts to make it expand and contract. It was very tedious to use when lying on your back with your arms outstretched above you. Furthermore you could twist the nut only about 1/8 of a turn at a time in the

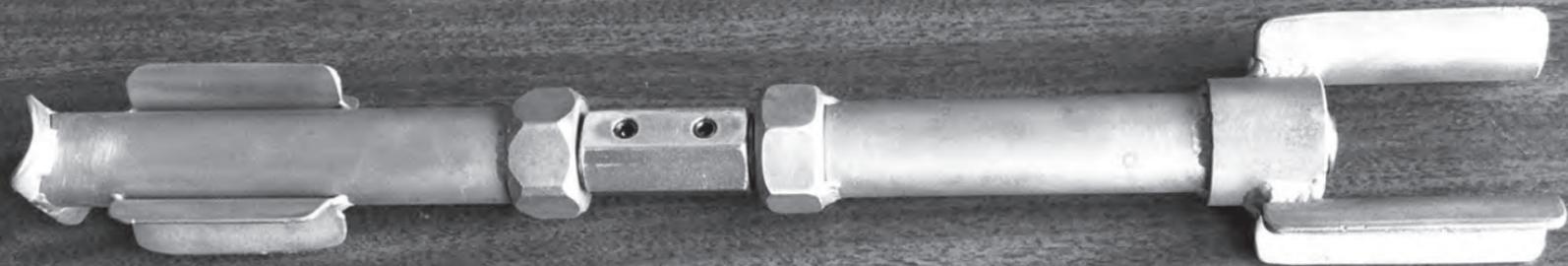
confined bungee access before having to remove the wrench and reposition it.

Over the last 20 years, I have had several notions on how to improve that tool. My hangar neighbor, Bob Lakey, and I have had more than a few discussions about ways to employ a small bicycle chain and a sprocket, how to install a 90-degree “T” drive gear box in the middle of the tool, or even how to build into the tool a small two-way ratchet wrench. While from an engineering standpoint some of these methods might have worked, they were either cost prohibitive, impractical, or too complicated. Then about a year ago, the first part of the solution came to me when I saw an advertisement on the internet for an Alden open-end ratchet wrench (see figure 1). I quickly purchased one of these, and Bob and I designed a one-piece combination bungee tool. Because of the lag period from submission to publication time, the

first BITS article appeared in the *Flyer* about the same time we built the proof of concept prototype of the combo tool.

As you can see in the photo (figure 2), the one-piece combo tool employs two opposing jackscrews in the form of both a right-handed and left-handed Acme threaded rod. This gives you twice as much extension or contraction for each turn of the hex drive in the middle of the tool. The first time I used this combo tool, I was eager to see how the Alden wrench would work up inside the wing. I had collapsed the tool to its shortest length as I planned to use the tool to remove the old bungee (see figure 3). I found that in the shorter configuration it was very easy to place the combo tool between the two bungee “halves.” Just out of curiosity to see how the hex drive would turn by hand, I gave it a try, and to my great surprise, I could expand the tool to its full length without the wrench.

Figure 2: One-piece combo bungee tool.



That is to say, I did not need the Alden wrench at all to remove the old bungee. The mechanical advantage of those two jackscrews was enough to greatly reduce the torque required on the hex drive to expand the tool. Keep in mind that, at this point, the two pulleys are supporting the full load of the bungee, and the tool is just slipping in between them. In previous single-piece, fixed-length “installer” tools, it is usually quite difficult to insert the tool between the bungees when removing an old one. In addition, it is almost as difficult to remove the tool after installing a new bungee.

want to push on the wrench to keep it engaged. In reality, it seems to work better if you consciously pull back ever so slightly as you employ the ratcheting mechanism and re-engage another facet of the hex drive.

As it turns out, the “heavy lifting” of the combo tool takes place outside the aircraft wing. That is because after the rather easy procedure for removing the old bungee from the tool, it is then necessary to stretch a brand new bungee onto the tool for insertion in the airplane (see figure 4). After you place the outboard pulley on a new bungee, it does not require much time with the

propelling it where it might harm the mechanic or the aircraft.

The real test of the tool, however, was going to be the insertion of a new bungee in the wing of a Comanche. With a bungee-loaded and properly expanded combo tool (see figure 5), the initial part of the insertion is very much like using the installer tool of the two-piece system, i.e., you screw in the outboard pulley attachment bolt and then place the inboard portion of the tool over the inboard pulley. You then partially lower the landing gear to engage the bungee onto that inboard pulley. Whereas with the two-piece

Figure 3: Combo tool fully contracted.



Once you have removed the tool from the aircraft, then you will definitely need the Alden wrench because the tool is now “loaded” with a fully stretched bungee. However, the process of removing the old bungee from the combo tool and replacing it with a new one took little effort. The ratcheting mechanism is a great help. This is in contrast to the old combination bungee tools that employed a simple open-end wrench and would require inserting and removing it countless times to reposition the wrench on a new facet of the nut.

The Alden wrench works pretty much as advertised, but there is a mild learning curve in getting the feel for how much “back pressure” to use on the wrench. Your initial tendency is to

special wrench to expand the tool to its proper length. Here again, the mechanical advantage of the two jackscrews kicks in. You can use a yardstick to tell you when it has gotten to the prescribed 19½ inches in length, but in case you forget and keep turning it, we have cut a safety groove into both Acme threaded rods which prevent them from screwing all the way out of each end of the tool. This failsafe mechanism engages the Acme nuts when the tool has expanded to just over 20½ inches in length, and it will not permit further expansion. Since safety has always been a primary concern of ours, we wanted to eliminate the possibility of the tool coming apart with the full force of the stretched bungee

system, at this point, you would remove the detent ring pin and collapse the installer tool, in the one-piece combo tool, you use the Alden wrench to collapse the tool to a length short enough to easily remove it from between the stretched bungee halves. I found that I needed the Alden wrench for the first half of the process until the bungee is engaged by the inboard pulley and the saddles of the tool are pulling away from the tautest part of the bungee halves. After that I could finish turning it by hand.

In comparison to the two-piece tool system, I think the one-piece combo tool takes perhaps a minute or so longer in the wing, but they are about even on the workbench when removing the



old bungee and replacing it with a new one on the tool itself. The combo tool is slightly easier to remove from between the halves of the bungee once you have installed it in the wing. This is due to the fact that the combo tool collapses to a shorter length than the other tool. An advantage of both devices is the ability of the inboard portion of the tool to rotate along its axis and thus slip in and out of the stretched bungee far easier than a rigid tool. Using either system, I can change a bungee in one wing in about 20 minutes from start to finish.

Hopefully we can make both these tool systems available to Comanche owners in the near future. Our two-piece system has been used by 10 different mechanics, and we have received back glowing reports. Because both systems are somewhat labor-intensive to make, we are currently talking to tool manufacturers who seem seriously interested in making both bungee installation tool systems. Now that most of us are replacing our bungees more often than in the past, it is desirable to have a quicker, easier, and safer way to perform that formerly long and tedious chore. For more information or an update on the status of these tools, email me at dave5201@att.net. 

Figure 4: Tool in action (left).

Figure 5: Bungee loaded on tool (below).

