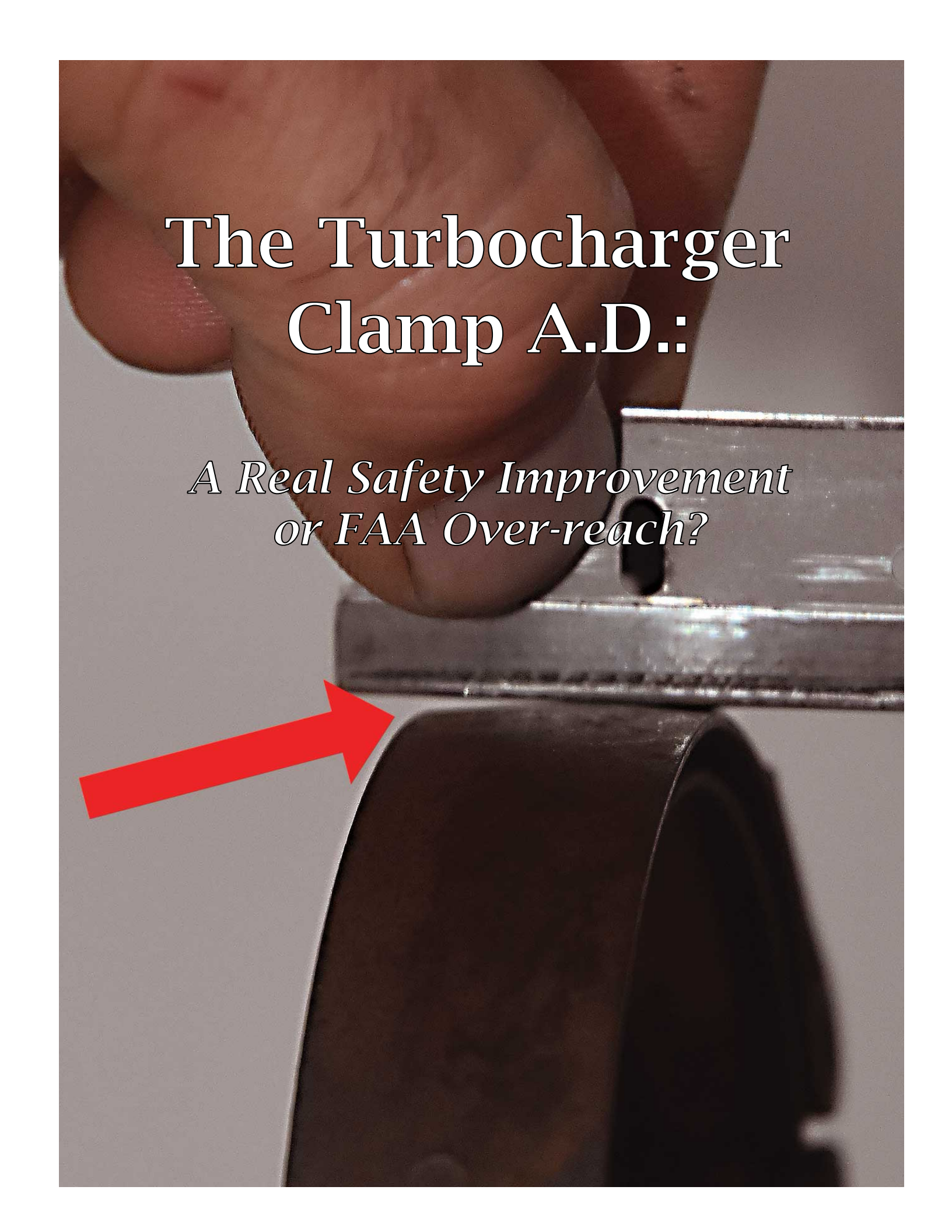




The Turbocharger Clamp A.D.:

*A Real Safety Improvement
or FAA Over-reach?*

The Turbocharger Clamp A.D.: A Real Safety Improvement or FAA Over-reach?

By Mike Jones

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Some people were born under a lucky star. They win at bingo. Their horse leads the pack. If they drop their toast it lands butter-side up. My sister is one of these rare people. When she and I visited Las Vegas once, many years ago, she came home with an enormous bag of quarters. All I brought home was a hangover.

My bad luck bit me again last month when my Centurion was due for its annual inspection. I entrusted my baby to Pinehurst Aviation Services at the Moore County Airport here in North Carolina, the maintenance team at my home 'drome. The plane was flying great, making book speeds, running smooth and cool. How bad could it be? As it turned out, "very bad."

Brandon Smith, a superb A&P, did his usual thorough and splendid job: swinging the gear, sampling the oil, checking hydraulics, replacing tires, all the usual tasks. In and out in two weeks, with a free plane wash thrown in for good measure. I love these guys.

But Smith also scanned the FAA's Airworthiness Directives database. To our mutual surprise he discovered a shiny new airworthiness directive (an

“A.D.” in the parlance of the FAA) regarding the turbocharger; specifically pertaining to the V-band clamp attaching the exhaust pipe to the turbocharger. This A.D. was so new it wasn’t even in effect yet, but once he found the A.D., my plane was grounded.

Unhappily, the bad news wasn’t over. The inspection of the exhaust V-band clamp discovered excessive wear, along with a tiny crack along one edge. Clearly, flying with a damaged exhaust system is a bad idea and the clamp needed replacement. But Smith’s favorite parts supplier was sold out: their waiting list had 107 airplanes ahead of me. It felt like a Lady Luck was planning a game of “whack a mole,” and I was the whackee.

The Weakest Link

Exhaust systems are the least glamorous but hardest working parts of our airplanes. The smart folks at Knisely Welding, who make many of our aircraft exhaust systems, report exhaust gasses average 1,300 degrees Fahrenheit. Like relatives who stay too long, a lot can go wrong.

When those gasses escape from the confines of the exhaust system “they become a torch,” according to Paul New, one of Cessna Pilot’s Association maintenance experts and the owner of one of the industry’s premier aircraft repair shops, Tennessee Aircraft Services. Depending upon what failed and how it failed, those flames could be pointed anywhere: at thin aluminum firewalls, rubber hoses, fuel lines, or electrical wiring. Nothing under the cowlings (except the exhaust system) is designed to withstand raw exhaust gasses. It’s going to be an unhappy ending.

Which brings me back to this tiny, insignificant clamp. The exhaust V-band clamp is a humble stamping of high-temperature steel. It tucks in tight next to the turbocharger and clamps the exhaust pipe to the turbo by grabbing heavy flanges that protrude from the perimeter of the turbo and the exhaust pipe. It’s

strong, fire-proof, reliable, simple, and relatively inexpensive; a perfect answer to a tricky question.

It's also a slick design because using a clamp (instead of steel bolts, for example) allows the A&P a little flexibility to pivot and twist the exhaust pipe so it extends out from the airplane without touching the cowl.

This design is used on about 41,000 turbocharged single- and twin-engine piston airplanes. But our friends at the FAA have found this clamp, if improperly installed or excessively worn, can be a killer. The potential to breach



Brandon Smith is a brilliant A&P at Pinehurst Aviation Services at the Pinehurst (Moore County) Airport in North Carolina (KSOP). The V-band clamp in his hand just came off the turbocharger on my T210 behind him. Smith performed the seven inspections required by the new airworthiness directive and found the clamp failed three of the tests. This particular part may have had as many as 1,700 hours in service.

the firewall is high. Over the last thirty years, the FAA has documented 39 instances of the exhaust clamp failing in flight, with dozens of deaths. A hull loss is one of the *best* outcomes.

Years ago, diagnosing this rare but dangerous condition was challenging because

so few of the aircraft survived the incident. Bob Ripley is a hyper-energetic super-star with the American Bonanza Society. He's a holder of the Wright Brothers award for maintenance and has been working on G.A. aircraft for almost sixty years.

“We were involved in one of the first [known incidents],” he told me. “A clamp came off and the exhaust burned through the fire wall and the rudder pedals. But the clamp didn’t fall out the airplane; it jammed. The NTSB came and looked because it was the first [plane with the problem] that didn’t crash.”

The good news is that many problematic installations already have been resolved by earlier A.D. activity. In a 2018 report, a Working Group of the FAA’s General Aviation Joint Steering Committee documented twenty earlier airworthiness directives on exhaust clamps. It also found eleven Service Bulletins from different manufacturers on the same topic.

Jake Clemens, of Daytona Aircraft Services in Florida, feels, “This A.D. is not an issue. Anybody with any experience in the industry is familiar with the problem.” Bonanza’s Ripley concurs, saying “This new A.D. doesn’t add anything new... they [the FAA] just don’t want the spot-welded clamps.”

So, while it's fair to say the issue is well-known, many A&P technicians are not alert for the problem. As Ripley noted, “We’ve seen a lot of V-band clamps that were cracked.”

Which is in exact alignment with Tom Teplik, FAA’s point man on this particular A.D.

“This A.D. has been in the works for a long time,” Teplik told me. “The purpose is mainly to get all the other airplanes that were not covered by earlier directives.” Like my Centurion.

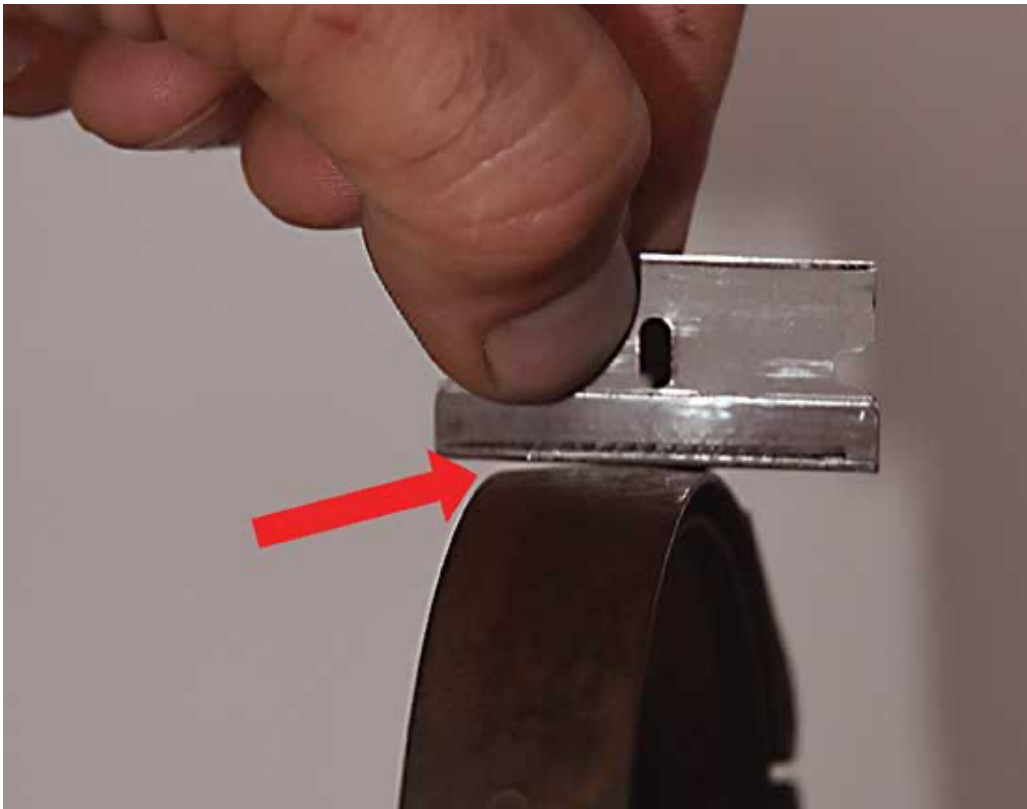
The Source of the Problem

Allow me to get way down in the weeds for one moment. This A.D. only applies to (a) turbocharged airplanes using (b) V-band clamps on the exhaust pipe with a (c) multi-segment design which is (d) spot welded. Most G.A. airplanes aren’t turbocharged, so for them this whole discussion is moot. Many

turbo-exhaust systems use single-piece V-band clamps. Some use multi-part clamps which are riveted. All of those airplanes dodged this bullet.

Unfamiliar with “spot welding” technology, I asked New about the problem.

“This is a very serious issue. I’ve never liked spot welding as a method of attachment,” New explained. “When I weld something, I create a little puddle of molten liquid. That creates a small gap or a dip when it cools, so you add a tiny bit of material to fill in the gap which makes the weld stronger. But with spot welding, no material is added, so the weld is always the weakest point.”



The V-band clamp is supposed to be flat, but years of heat and vibration have warped this example. The red arrow is pointing at a gap between the flat straight-edge tool and the worn surface of the clamp. This failure was relatively easy to find, as was the second inspection, which was to test for corrosion.

Installing the V-band clamp also is a bit of an art. Techs incorrectly expect the clamp to force the flanges together tightly, just as a bolt squeezes two pieces of metal together. But that is not the function of a V-band clamp.

Instead, New explains, the clamp merely holds the flanges in whatever position the tech puts them.

“Unlike a bolt, a V-band clamp is not designed to correct alignment problems,” he said. “The flanges have to be perfectly aligned by the technician. The clamp simply holds them where the tech positioned them.”

Ripley agrees. “Over-tightening, especially over-tightening to bring the flanges into alignment, is the main thing which will cause a V-band to crack,” he said. “If you install it right, install it to spec, you won’t have a problem.”

Importantly, because the clamp is not bolted tightly in place, vibration and heat can cause it to shift after it has flown a few times. A&Ps should check the clamp after the first couple of flights, tapping it with a mallet and confirming the torque has not changed.

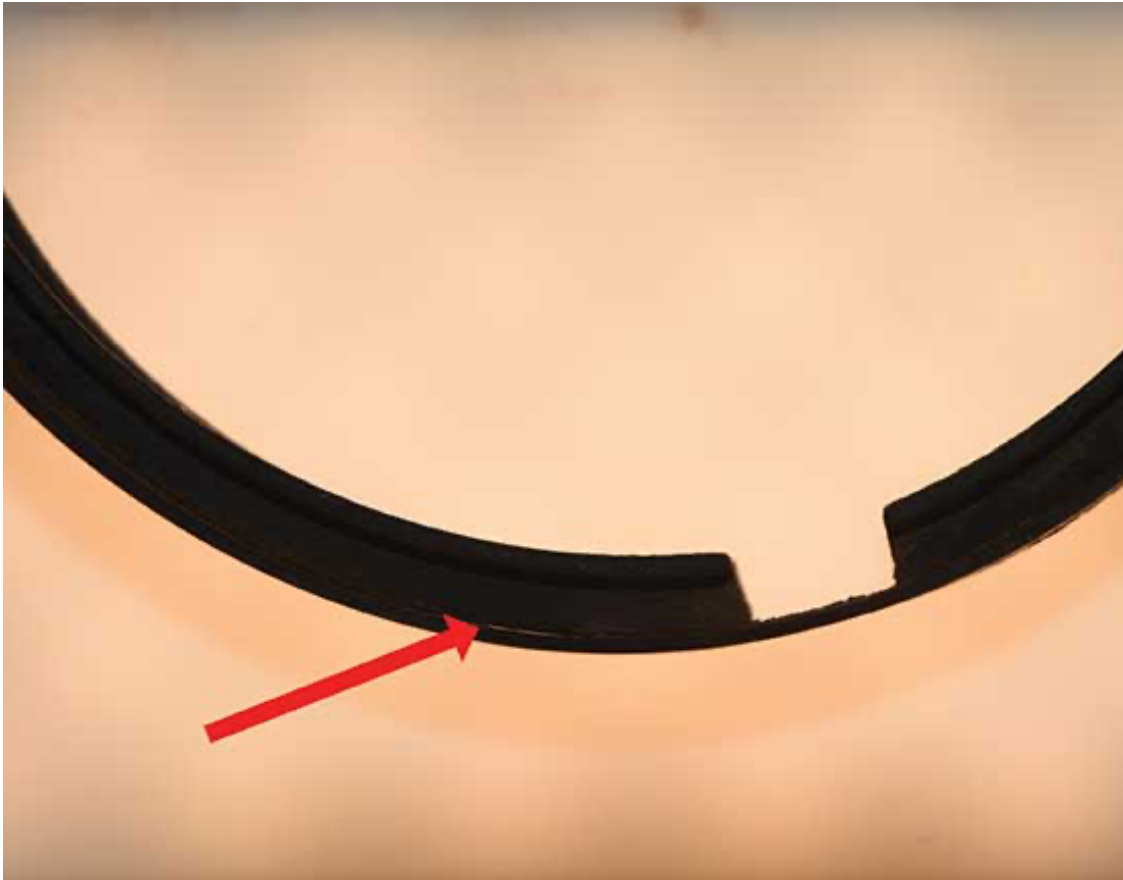
“It takes two or three flights for the clamp to settle down,” Ripley explained.

Supply Chain Issues

I chatted with Tony Saxton, who may be the world’s leading expert on twin Cessnas. He works at TAS Aviation in Ohio, he was the 1993 Maintenance Tech of the Year and is an Aviation Safety Counselor. Saxton knows his way around Cessna twins.

“This A.D. is not over-reach on the part of the FAA,” Saxton answered, in response to my question. “People are buying cheap, heavily worn, legacy airframes. Some are pretty shabby. People are not prepared for the maintenance and all the costs. This inspection, and putting time-limits on the parts, is a reasonable response to protect people.”

That said., Saxton is concerned about the timing of this A.D. He feels, “...they just sort of dropped this A.D. out of the clear blue sky.” This lack of a pre-announcement means clamp shortages are inevitable.



This is the third test the V-band clamp failed; years of wear and tear have caused spot welds to weaken, allowing the inner band of the clamp to separate from the outer band. Although the gap is very small, it is visible by the red arrow and indicates the band has lost its structural integrity. Good catch, Brandon Smith!

My experience supports Saxton’s position. It was impossible to find a replacement Cessna S1921-1 V-band clamp. As I mentioned earlier, my A&P called Textron (the owner of Cessna today) and other vendors and they were all out-of-stock. He found one vendor with a waiting list of 107 airplanes. I also spent hours on the phone, contacting at least ten shops.

I finally found help at Tornado Alley Turbo in Ada, Oklahoma. Their part, #11-1100035, was not made by Textron but is functionally equivalent, in-stock,

reasonably priced, and widely used on turbocharged Bonanzas and other aircraft using Garret turbochargers like mine.

I spoke with the amazingly well-informed Beka Kallberg at Tornado Alley. She confirmed nobody has been able to get OEM-provided V-band clamps for months, maybe years.

“We had a whole batch on order since last year some time, and they never showed up,” she said. “I finally just cancelled the order.”

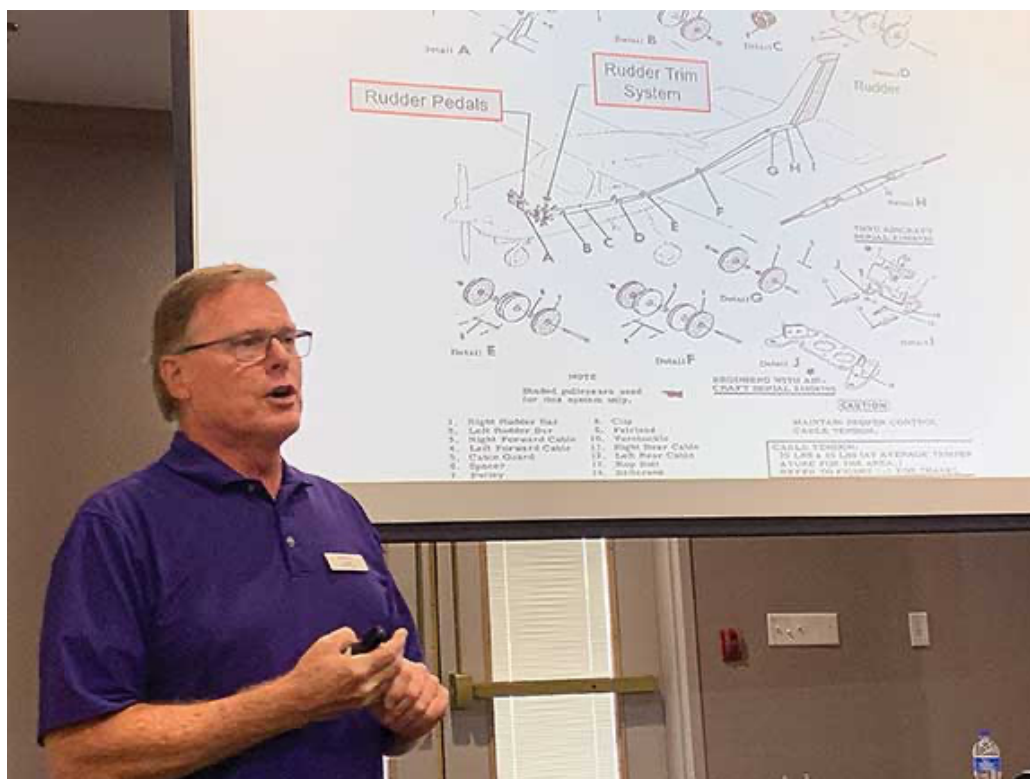
Three huge thank-you's are appropriate. First, a round of applause for Beka, who ran out to the warehouse and got my order picked, packed and shipped, even though it was past closing time. The second thank-you is for the unnamed UPS driver who delayed his route, allowing Beka to get the package into his hands. Lastly, the third is to Brandon Smith who was able to finish my annual, install the clamp, run it up, and make the required logbook entries before dashing out the door for a romantic weekend in Baltimore. Because of these three people I will be at Oshkosh this year. Group hug!

Three Issues the FAA Got Wrong

While no sensible person will argue with the need to fly airworthy airplanes, from my perspective, there are three problems with the A.D. — the timing, the scope, and the cost.

In terms of the timing, this A.D. was released on June 23rd and became effective on July 17th. Any turbocharged airplane going into inspection in the next few months has the potential to get trapped by this A.D. and, without a sufficient supply of spare parts from Cessna or others may be grounded for weeks or months. To my way of thinking, they ought to have allowed an inspection and continued use (say, not to exceed 100 hours?) until more clamps became available.

My second concern is that the A.D. covers 41,000 airplanes, far more than earlier versions, which is going to make supplies tighter than they are already. But perhaps the supply-chain worry is unjustified. For example, Paul New told me the A.D. generally will not apply to turbocharged Cirrus airplanes because they almost exclusively use riveted V-band clamps. Mooneys and Bonanzas also were included in earlier A.D. releases. Saxton thinks most of his twin-Cessna customers dodged the bullet as well.



Paul New is everything one could hope for in an A&P: he knows his airplanes, he knows the technologies and he knows the regulations. New has been teaching at the Cessna Pilot's Association type-seminars for decades. "None of the twin Cessnas have multi-segment clamps anymore, they've all been migrated to single-piece clamps," Saxton said. So maybe we won't have hundreds of planes grounded. But maybe we will.

The third problem with this A.D. is that it is far more expensive than the FAA suggests. The FAA estimated replacement V-band clamps will cost \$170 and it will take two hours to remove, inspect, and then replace the offending pieces, for a total of \$570. Nobody I would trust is billing out their A&P team at \$85 an hour anymore. Plus, when we finally found a V-band clamp the price was \$485 including freight, triple the FAA's estimates.

Paul New agrees with my skepticism of the FAA costing. “You don’t know who they called, when they called, or exactly what they asked,” he told me. “Their hourly rate is low, and their time estimates [to perform the repair] are low. Remember, nobody at the FAA has ever done this repair.”

The Bottom Line?

Is this all a tempest in a teapot? After all, I was able to get the replacement I needed. I will be flying next week. Yes, it cost money, but everything in aviation is pricey. Isn’t safety worth this degree of caution?

I’m vaguely unconvinced. The FAA should have been coordinating with Textron or other suppliers. The cost of the repair is going to be far higher than expected. The entire process feels a bit heavy-handed.

I would suggest the FAA should do their job with more finesse. They could pre-announce these decisions with a six-month lead time. Perhaps they could check with better experts on the time and cost of the repairs. Perhaps they could synch their plans with vendors to make sure parts will be available when they are needed.

These aren’t burdensome chores. They would go a long way to ameliorate the burden placed on owners and A&Ps when the FAA acts imperiously. After all, the FAA holds all the cards. Can’t they play their hand a bit more gracefully?

Sidebar: How to Install a V-band Clamp

All of the experts with whom I spoke agreed that problems with the V-band clamps usually stemmed from improper installation techniques. While spot-welding is a problematic assembly technique and multi-part clamp designs are inferior to single-part designs, the fact remains that thousands of them have provided years of trouble-free service. The one on my Cessna lasted seventeen years. It doesn't owe me any money.

The problem comes from the intersection of two phenomenon. First, a quick visual inspection can't reveal if the clamp was installed properly or not. Second, when the clamp fails it almost always is catastrophic. A better mousetrap clearly is needed.

Paul New coached me through the proper technique to install a V-band clamp. The A&P who keeps my bird flying better than it ever has, Brandon Smith, agreed with this method, calling it "very standard clampology." The FAA has published a "best practices" procedure (see attached QR code) which is extremely clear and helpful. Here's the gist of the process:



Point the camera on your cell phone at this QR code and it will jump to the FAA's 2018 report on the "best practices" for the health and safety of the exhaust systems on turbocharged general aviation aircraft.

Tools: Always use a torque wrench, set to 40 inch/pounds, and a soft mallet. Never use power tools when tightening clamps because it can cause thread damage and an incorrect final torque.

Pre-Placement: Ensure the alignment of the tailpipe flange to the turbo exhaust exit flange are perfectly flat. The maximum allowable gap is 0.005 inch, which is pretty tight (a sheet of standard copier paper averages 0.004 inches thick).

Fitting: Don't over-stretch the clamp to get it over the pipes and flanges. Once in place, use the torque wrench to tighten the locking nut slowly. Use no more than a half turn, and do it five to ten times until you reach the 40 pound limit. Between each turn, gently tap the V-band clamp with the mallet to have it settle into place. Tap lightly!

Post-Installation: Check the clamp after the first couple of flights. Tap it with the soft mallet to help it settle into place. Do a final check of the torque on the locking nut.

Special Warning: Never exceed the specified torque limits! Paul New has seen people crank the torque wrench up to 100 pounds and then slowly reduce the pressure to the proper level. They feel smug when they're done because the nut is tightened to 40 pounds and they did it quickly. They don't realize this abuse will over-stress the locking nut, the threads, and the spot welds but you'll never see the damage until it fails. Over-torquing creates stress the clamp was not designed to handle.

About the Author

Dr. Mike Jones is an entrepreneur who uses his business expertise to help G.A. airports across the country improve their governance and operations, speeding them on their way to more revenues, grants, and community support. He also helps protect them from avaricious developers and reverse the damage caused by ineffectual politicians. He's been writing for this magazine for nearly a decade, flown 800 Young Eagle missions, and put 4,000 hours in his logbook. He's always accessible at PilotMike2012@gmail.com.

