Retractable Gear Article Comments

The following was taken from a letter to me from James Foster (IL)

I was disappointed by the comments regarding J. D. Newman. There is no place for repeating hearsay and conjecture in an article weighing the merits of RG systems (if anywhere). Unsubstantiated statements that undermine the entrepreneurs in our sport do all of us a disservice. We should encourage new designs and then let the market decide if the developer correctly interpreted its desires.

Lets work toward elevating the science, and art of the canard pusher designs. Criticism is fine, but keep it constructive and fair.

Fly Canards

EZ Retractable Main Gear, Another View

In the January issue David Orr's article, EZ Retracts, contained statements that stimulated reply from a CSA member and a non-member. The member's comments are printed in the article on the left. The other letter presents J.D.Newman of Infinity Aerospace views of the situation.

Mr. Newman's very detailed letter stated, "I hope and believe there is space for this letter to be published in its entirety, or it will lose it's informative value and purpose." He further offered to pay to have the 3 page double-sided letter placed in the newsletter.

Among other things, the letter refutes: the reason for the law suit against the Long-EZ owner, time period of the agreement, reason for the crash, negative statement that his retract system is not insurable or held in low esteem by the insurance investigator, safety concerns, and offers history of his company and an update on Infinity progress.

Past newsletter policy has been to make extended articles available to the membership. To obtain such articles members have been directed to send a SASE and request the desired information. It has also been policy to not accept any paid material for publishing.

In light of that policy, and not wishing to paraphrase Mr. Newman's information, I have decided to make the letter available through the usual extended article method.

Long-EZ For Sale

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I SCREWED UP

Looking isn't the same as seeing

BY BUDD DAVISSON

SHOW ME A BUILDER who has never made a mistake, and I'll show you a builder who has never actually built anything. Mistakes are part of life, and in any situation, be it mechanical or social, the very first thing to say or do when something goes wrong is to admit right up front that you really screwed that up. This brings the situation to a close, ready to be worked upon. The second thing is asking how you can fix it. While saying those things to ourselves, we need to do so while asking ourselves what we learned from that mistake. In this Shop Talk I'm doing all three. This is a mea culpa and a discourse on mistakes rolled into one.

The email that prompted all of this came from Todd Tracy, EAA 1272355, of Pompano Beach, Florida. It read, "The June 2019 article Shop Talk 'Confessions of a Knot Nerd' has incorrect photos for Steps 2, 3, 4 and 5!" and he goes on to explain what is wrong. Nice catch, Todd. Thanks! And you're right.

When I received that email, I thought, "What the ...?" and immediately grabbed some rope. Giving it little to no thought, I tied the taut-line hitch as I have done hundreds, maybe thousands, of times in my life. Another "What the ...?" The knot came out just the way Todd described it and the way I thought it should be. So, what did I do in the photos? This is where, when we're building stuff, whether it's the Station 4.1 Fuselage Framus or taking a photo of a knot, we need to actually *see* the part, not just look at it.

There's a profound difference between seeing and looking. The latter means our eyes are the only organ involved while the former has our brain conducting the exercise, not just our eyes. The result is that, when seeing, we're actually analyzing what our eyes are looking at and drawing useful data from the image. When I was shooting those photos, I was doing a lot of looking and very little seeing. I was, as we so often do, seeing what I wanted to see. I was thinking more about exposure, framing, etc. than what the picture said.

What I was looking at and not seeing was that between step one and step two, I must have turned the rope over or something because I misidentified which line was going from the ground to the airplane. The one that's on the left in the first photo is on the right in the second one. Another "What the ...?" I was tying the knot around the wrong piece of rope and going the wrong direction! Fundamentally, the series of half-hitches go around the main rope and put it in a slight bind, and the harder you pull on it, the tighter it gets. I looked at it with my eyes, but my brain was somewhere else and didn't see the mistake.

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That's a pretty basic mistake. How could I not have seen that? I didn't see it the same way a close friend and highly experienced airplane builder didn't when I walked into his shop and found a mistake. He was building a 450-hp replica of a 1930s racer. I immediately pointed out a deep nick, almost through the tubing, in the stabilizer spar from a cut-off saw. It was obvious to me because I was "seeing" but invisible to him because he was so close to it that he was always "looking" and saw only what he expected to see. We all do that. Every one of us. That's why an extra set of eyes going over our work is always needed. It's the same way that our spouses do a better job

Radio Antennas

Dave Black (VA) - In addition to being a Velocity builder I hold Commercial and Amateur Radio licenses. To speed up the building process I had my wings with internal Nav and Com antennas built for me. I *assumed* the antennas were fine until I tested them.

Antennas are as important to radio receivers as propellers are to engines. There is a fair amount of "black magic" in antenna design but the idea is to radiate as much signal as possible. Fortunately that is easy to test. The general health of an antenna may be determined by checking its *Standing Wave Ratio* (SWR) across the frequency band. SWR is the ratio of maximum voltage to minimum voltage on the transmission line, and indicates what portion of the signal is reflecting back instead of radiating. If no signal is reflected back, you have a perfect SWR of 1:1. As an antenna works more poorly, more signal bounces back without radiating and the measured SWR increases. An SWR of 2:1 is often considered the acceptable maximum. It is important to note that a high SWR adversely affects receive just as it affects transmit functions.

I checked my antennas with an SWR analyzer. The results made me sick. I discovered my nav antennas have an SWR ranging from a low of 2:1 to 4:1. My com antennas range from nearly 1:1 to over 8:1, higher than my meter will read! At 8:1 SWR nearly 2/3 of all power reflects right back to damage the transmitter. Not good. If I was grading these antennas, the navs would get D+ while the coms would get D-.

The SWR vs frequency plot for each of my nav and com antennas shows the SWR changes a lot with change in frequency. (see plots on next page) The curves have sharp bottoms and the traces go into the stratosphere! My built in antennas were not even correctly tuned for their band. As installed, my nav antennas would work well only above 116 Mhz. The coms would work acceptably below 122 Mhz, rendering most of the com band useless.

Much better antennas are available. The Sportcraft 008 com antenna is an inexpensive commercially available antenna designed for composite aircraft. Its plot lies relatively flat across the whole com band, never reaching as high as 2:1. This is how an SWR curve should look. That antenna gets an A.

I opened up my winglets to see if I could salvage the installation. It was impractical to fix the many installation errors: failure to use Baluns for matching co-ax to antennas, locating the antenna near a carbon-fiber lay-up, routing co-ax directly along an antenna element, use of cheap co-ax with solid center conductor and open weave braid, antennas cut to wrong length, and failure to verify antenna performance during installation.

As a result of my experiences, I have been asked to evaluate antennas in other canard airplanes.

I have found: a Long-EZ with antennas installed in the usual way (with no balun). It had an SWR ranging from 1.5:1 up to 3:1. The antenna worked reasonably well. A Long-EZ project with antennas supposedly built into the winglets were so poor I could not detect any antennas at all! A Vari-Eze with SWR ranging from 3.5:1 to 6:1. It's SWR was poor and the com antenna was polarized almost horizontally. The owner reported difficulty transmitting and receiving. Another Velocity owner had SWR numbers identical to mine. That was not surprising, since the antennas were installed by the same factory as mine.

In talking with builders I get the sense that most would rather not concern themselves too deeply with antennas. It's much easier to just build it as shown in the manual or as a friend did it. Builders may be lulled into a false sense that their antennas are fine based on nothing more substantial than they seem to work. Builders should remember that *any* piece of wire will work as an antenna. Only if you test the antenna can you determine <u>how well</u> it is working. <u>How well</u> the antenna works makes the difference between a transmit range of 100 miles or only 5 miles.

Antennas must be constructed using proper technique and that it be confirmed by testing prior to glassing them permanently in place. All antennas, whether of good or bad design, are position sensitive. Where you put them and how you install them makes a tremendous difference. Well designed antennas can be installed to work poorly. Poorly designed antennas can be installed to work acceptably. The trouble is you will never know which you have - or how best to position your antennas, unless you test them.

To test them, take the wings outside, well clear of electrically conductive objects and people. Place them as high above the ground as practical. A wooden picnic table could be used for support. Run an SWR sweep, using an SWR analyzer or com transmitter plus SWR meter. Plot SWR values every 1 or 2 Mhz. Reposition the antennas and feed lines as necessary until you achieve the lowest, flattest possible SWR curve within the frequency band of interest. If the SWR curve goes up too high at the low end of the band, as my nav antennas did, the antenna elements should be longer. Conversely, if the SWR curve goes too high at the top end of the band, the elements should be shortened. Make adjustments 1/2" at a time with an effort toward centering the SWR curve on the band of interest.

If you have not built your antennas, take the time to do it properly. The extra time and few dollars spent on a well designed antenna installation will provide superior radio performance for the life of your plane and may well prevent an unexpected trip to the radio repair shop. If antennas are already installed, check them anyway and decide a course of action.

In my case I determined the antennas

Step 1:
Half hitches around the main line. In some versions the second half hitch crosses over the first one but exits in the same place

of finding something we've lost than we do. I don't know how many times I'll be running around the house looking for something, and my wife will point it out sitting right in front of me. Looking not seeing. That's how mistakes are made. And we all make them.

One of the really aggravating aspects of making a mistake while building an airplane is that a big one at the wrong time means taking many steps backward to set it right. That's hard to do psychologically. We always want to be moving forward and hate to take steps back. It's at that point, while sitting in the shop looking at a buggered piece and trying to make up our minds whether we should back up and do it over or not, that we should remember what it is that we're building. If something fails, we can't coast over to the curb and call our spouse to come get us. The call to them may not be from us, and it may not be pleasant. So, if something needs fixing, be 100 percent safe, back up, and do it over.

Looking not seeing. That's how mistakes are made. And we all make them.

One of the few attributes of growing a little older is that our patience seems to increase. I know I'm now perfectly willing to redo a piece two or three times just to get it as right as I can get it. Don't confuse that for the ravings of a perfectionist. I'm anything but. However, I very much value my own hide and the happiness of my loved ones, so cutting corners to save time is something I outgrew decades ago. This is a highly recommended trait for builders.

PHOTOGRAPHY COURTESY OF **BUDD DAVISSON**

Step 2: *In some versions the third half hitch goes over the top of the main line, rather than under, and curls under.*

However, there are mistakes and then there are *mistakes*. Some are cosmetic and visually irritating while others introduce flight safety issues. If a rivet set leaves a string of smiley faces across part of a panel, the airplane's structure is unaffected. Do the same thing with a screwdriver, plowing a deep gouge across the same panel, and it's a different story. The safety is affected and a repair needs to be considered. Undercutting a weld at the end of a cross tube at the rear of the fuselage is less worrisome than the same thing on a landing gear or wing fitting. Then cutting and splicing is sometimes called for.

It is seldom we don't recognize the correct solution for a mistake the instant it is discovered. We almost always automatically know what "should" be done. We know when a panel should be replaced or a weld redone or spliced. Or the paint

PHOTOGRAPHY COURTESY OF **BUDD DAVISSON**

Step 3:
This is the tautline hitch as seen on most knot tying websites. However, there are variations on the tautline theme.

Far too many times we try workarounds that look easier in the short term, but almost never work out in the long run.

stripped and done over. However, it is seldom that we give in and say to ourselves, "We screwed up so let's cut to the bottom line and do it right." Far too many times we try workarounds that look easier in the short term, but almost never work out in the long run. We know that, but we try them anyway and almost always regret it. Most of the time, giving in to what we know deep inside is the correct solution is the right thing to do – regardless of the time involved. And that brings us back to that stupid knot.

Having made the mistake about the knot last time around, the right thing to do is to start over. So, I will. Here are the steps to doing it right. The line going from the ground to the airplane is on the right. Sorry I screwed up! Incidentally, in rectifying my stupidity, I Googled taut-line hitch and found at least four variations on a theme. Most having to do with whether the last half-hitch goes over or under the main line. Todd's version runs the second half-hitch over top of the first one. Try them all and see what works best for you. EAA

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