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F2CN Shutoff—Dave "McSlow" Hull
(All photos by the author)

In 2011 I brought a nearly completed F2CN to the NATS but never flew it. It was missing a few pieces of hardware, of which the most perplexing was the shutoff. I had decided that I would use a push-to-shut-off mechanism that was driven directly from the bellcrank. This gets rid of the extra hardware and avoids the lack of stiffness that the "horn on the elevator" systems have. On a F2CN, the engine needs to be kept close to the wing to avoid having to add tail weight, so I estimated that if I left 3/8" between the wing and the engine I could make something fit. In the end, I was thrown off a bit by the lower wing position relative to the engine. I wanted a fairly direct run for the fuel line. And above all, I was not going to tolerate a Mickey Mouse setup on a diesel engine where a shutoff failure would lead to an engine burndown—that might junk the engine. So without a shutoff solution, I put the plane back in the truck and looked toward future contests.

After the NATS I had other things that needed doing and so I set the shutoff problem aside. But I recently resolved to have the plane to fly at our October SCAR contest. So picking up where I left off, my eventual approach was to invert the trip wire location of a standard shutoff, and move the pinch location to the middle instead of the bottom. A sample made from 1" square tubing was too big, so I shrank it down until all the parts could be lined up: the trip wire with the bellcrank; the pincher with the fuel tank line; and, the push to reset button with the pitman's thumb, situated above other obstructions.

The photos show what I came up with. A J-bar type shutoff with the crosspiece moved from the bottom up to the middle of the shaft by adding a soldered-on piece. One feature that I really like is the separately adjustable spring tension collar. You can put the thumb button collar where it needs to be for best access, and still adjust spring force independently. This is especially important in F2CN, where the fuel tubing tends to be much stiffer than the silicone tubing used with glow fuels. (The fuel tubing shown in the photos was obtained from Melvin Schuette, and is more flexible than most. Jed Kusik and Dale Long also sell tubing that is suitable.) With this arrangement, you can keep increasing spring tension until it seals, and not have the pitman trying to press on the bare end of the wire. (Pitmen are people, too!)

I hope the photos and explanations are helpful if you find that your F2CN project needs a shutoff and you decide to try a similar configuration. Tight Lines!

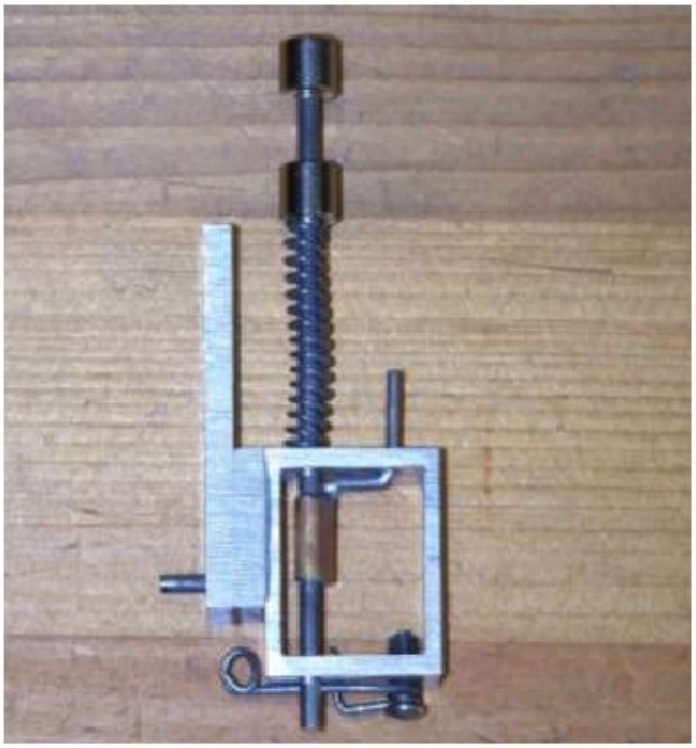

Figure 1. Rear view of the assembled F2CN shutoff in the "off" position. The frame is made from 3⁄4" square aluminum extrusion. Trip wire located on the bottom, and the pushrod loop located very close to the fuselage. Spacer block and mount to suit the installation held together with JB Weld.

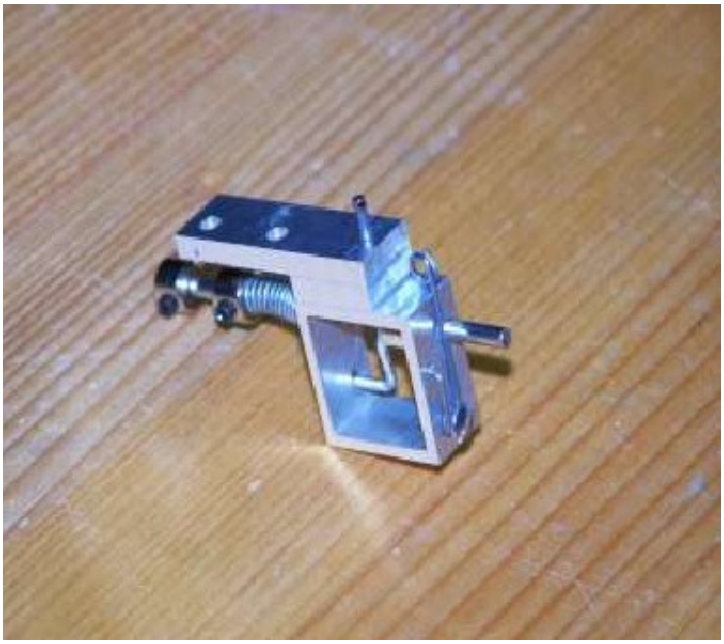

Figure 2. Bottom/Front isometric view of the shutoff shown in the armed, or run position. This trip wire geometry worked the best of those tried. The wire is . 039” diameter (?) and is coiled 1-1/2 turns around the screw. The screw is left snug, not tight, and kept together with a 2-56 UNC locknut. The fixed end of the spring is in a loose hole through the frame. The cleanest notch can be cut in the 3/32” shaft with the smaller Dremel cutting disk. These are not fiber reinforced like the larger ones, so wear your face shield.

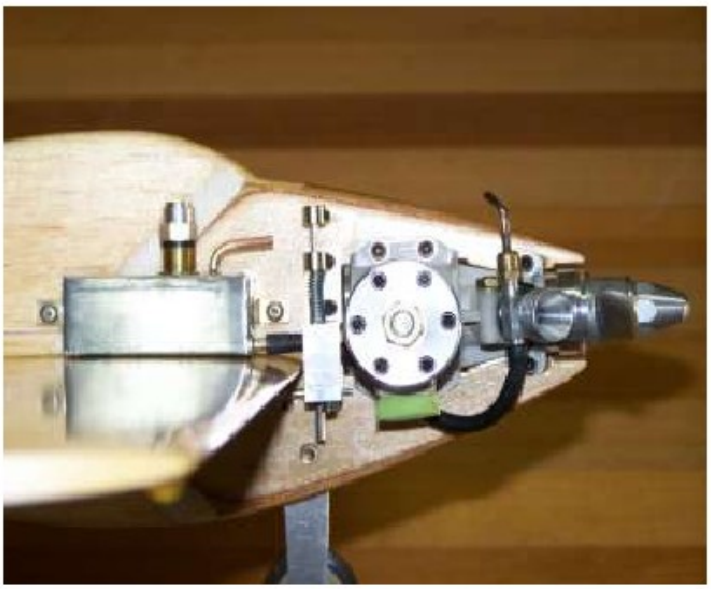

Figure 3. Installed shutoff as fitted to the airplane. Note that the position of the mounting screws in the bonded mounting plate allows assembly access. To avoid slipping of the mount on the fuselage with the offset screws, there is a 1/16” shear pin at about the level of the wing. A hole was drilled into the fuselage, which is hardwood at that location, for a press fit.
The fuselage has threaded brass inserts for the screws.

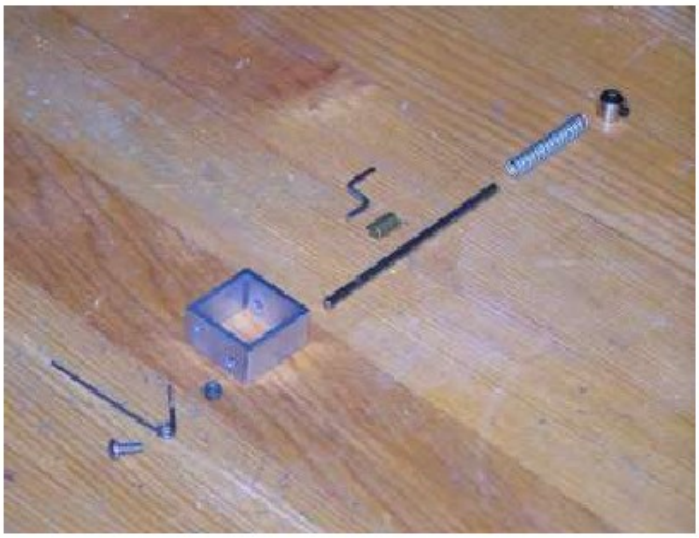

Figure 4. The major pieces before assembly. The S-shaped pinch wire is 1/16” diameter. The solder ferrule is made from ??? OD K&S brass tubing, flattened over the shaft in a vise. The length of the splice is the maximum that allows full shaft travel. Clean everything before assembly, then fit and tune before soldering the pinch wire onto the shaft. With this much surface area, 60/40 solder is plenty strong. Note that one collar is missing, and that the loop on the trip wire still needs to be formed. The last step is to make the spacer, mount, and drill for the mounting pin before bonding it all together.

Figure 5. Using an outboard bellcrank mounted under the wing requires the pushrod linkage to look something like this. The collar is used to adjust the trip position relative to the elevator for the sensitivity your pilot likes. A washer soldered to a bit of tubing makes up the “pusher” that contacts the trip wire. The collar is a bit too big to fit in the small space between the shutoff and the fuselage. The wire is trimmed so it just clears the engine case at full down elevator.

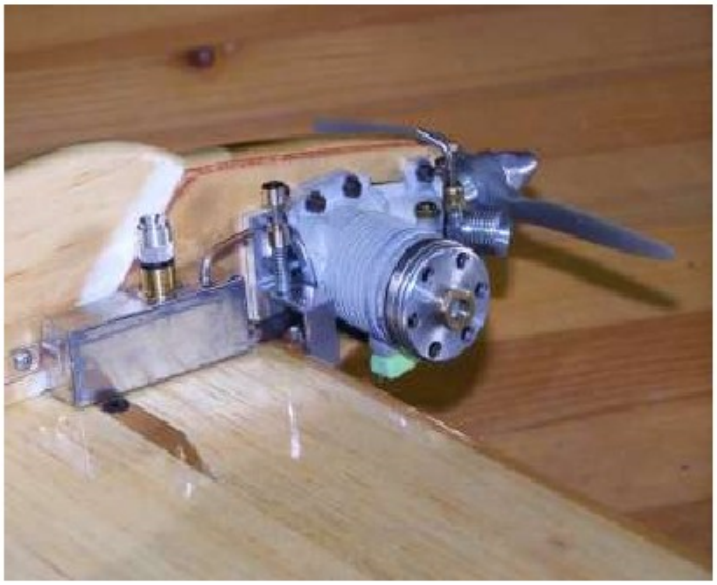

Figure 6. What your pitman sees, when he casts a suspicious eye over things before the test flight. Does it rub anywhere? Can I get my thumb on the button without being double-jointed? Does it hang up or bind when the goofy pilot-guy wiggles the handle? And, if does actually trip, does it seal off the tubing, or is Mr. Nelson going to keep running? (Pitmen have to worry a lot.)

Figure 7. It is always a blast to have a new plane ready to test fly. This one was highly anticipated since it took over a year to get the finishing touches on it! Despite this being my first wing, it turned out to have an exceptional groove and the shutoff works great. Now I just need to paint the fuselage and add the pilot!