DIY Bond Studs

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A legacy process for securing wire bundles and tubes in airplanes calls for capturing the component in a rubber lined clamp secured to the airplane with a nut and screw. This generally calls for the drilling of holes in the airplane. There is a natural reluctance to drilling holes in the skin of an airplane. Perhaps the ideal location for a hole does not offer ready access to both sides of the mounting surface.

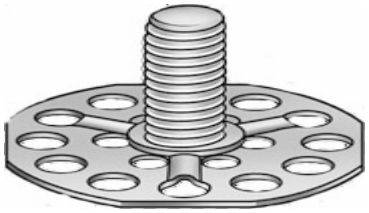
More than 20 years ago, the Click Bond Company pioneered a host of products for installing non-structural fasteners that do not require mounting holes. These products exploited the performance of advanced adhesives for bonding the device to a surface. An example of this company's offerings can be seen at http://tinyurl.com/a8vpun8 During my tenure at Beech I observed their application many times and marveled at the clever installation fixtures and relatively rapid cure times.

While browsing through a manufacturer's salvage outlet store some years back I discovered a part that consisted of a 10-32 stud welded to a perforated flange about 1" in diameter. With the Click Bond products in mind I purchased a handful and conducted some tests with a variety of off-the-shelf adhesives. The first experiment with JB Weld on thick aluminum produced a very strong bond. Repeating the experiment on thin material (like an aircraft's skin) produced a bond that seemed at-risk for peel-failure on the relatively flexible surface.

The next experiment used Eclectic's E6000 adhesive. A 50-pound side load at 160F would not unseat the stud. E6000

adhesive was resilient and resistant to peel failure.

I revisited the salvage store to purchase their entire inventory of several thousand parts. I offered them on my website as the ‘poor builder’s alterative’ to the sophisticated Click Bond product. The bonded studs were very popular with builders of plastic airplanes. E6000 achieves a tenacious grip on any surface but particularly well on composites. In the 10 or so years since I’ve had no reports of failure from any of more than 50 customers.



Based on that experience I’ve been attentive to the need for low cost alternatives to the commercial bonded-stud products. I discovered this product in the McMaster-Carr catalog at http://tinyurl.com/be696px where you will find a variety of threaded studs attached to perforated bases. The stainless steel versions are attractive for their resistance to corrosion.

Consider DIY bonded studs fabricated from hardware store fender washers, truss headed screws and nuts. The screw head will create a lump on the underside of your bond-stud; you may be tempted to consider use of countersunk flat head screws. I considered that also but discarded the idea. Forces that tighten the grip on the stud are loosening forces on the stud’s interface to the washer. After your bonded stud is glued to the airplane there is risk for the utterance of unseemly words if the stud twists free of the washer while you’re trying to cinch down the locknut.

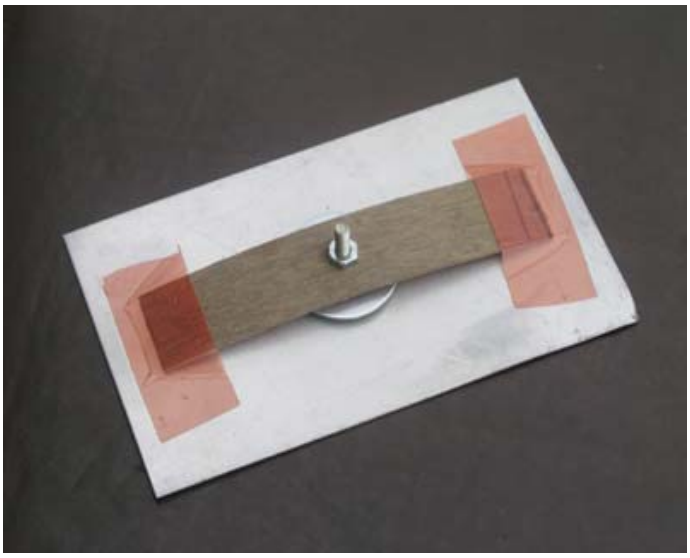
I considered and tried silver-solder which produced a robust stud. However, the high soldering temperatures cooked the plating off the parts making them prone to corrosion.

For the next experiment, I assembled the screw to the washer using J-B Weld under the head of the screw with additional dabs on the screw threads and underside of the nut. Truss heads have a larger than normal diameter which offers a superior bonding to the work piece. Permanence of the stud’s grip on the washer is enhanced with a combination of surface-to-surface bonding of the head, nut and locking of the threads with JB Weld.

E6000 is a solvent based adhesive that becomes fully cured

only when all the solvents have evaporated. Using the McMaster-Carr perforated stud offers a lot of exposed surface area for egress of solvents. Rather than drilling lots of holes in the base of your DIY bond-stud, elevating it off the surface by the thickness of the truss head increases the surface area through which E6000 solvents will escape.

The down-side to an E6000 bonded device is the extended cure time compared to the commercial bond-studs. For this I recommend that you fabricate a strip of scrap perhaps an inch wide, 3-4” long and drill a hole in the center that will slip over the stud. Put a nut down on top of the scrap.



Butter the bottom of the bond-stud with E6000 then use masking tape at the ends of the fixture to hold it in place. It will take a little practice determine how much adhesive required to achieve a little ‘squeeze out’ of adhesive around the periphery of the washer. The width of this fixture holds the stud nicely perpendicular to the surface.

Then go off and leave it for awhile. No doubt there are many other things you can do to push your project along while your bond studs establish enduring squatter’s rights on your airplane’s real estate. A couple of days of cure time insures bond integrity.

The technique can be used to install some

accessories. Here's an exemplar bonded stud installation for a small electro-whizzy.

This process should not be used for securing any critical component of the airframe. Use of bond-studs should be limited to situations that are failure tolerant. I.e. do the failure mode effects analysis. FEMA is a fancy name for a process by which you answer this question, "If the bond-stud comes loose in flight will it cause me to break a sweat?"

Variations on a theme: For very light loads, you can go down in size for the fender washer and screw. A 1-inch washer and 6-32 screw would do just fine for securing wires to the tail strobe and white position light. If you plan to hang coax cables on the stud the larger, 1.5" washers reduce risks for detachment.

When it's necessary to space a bundle or tube off the surface you can fabricate bonded 'spacer-studs'. One end of an internally threaded stud is attached to the washer and bonded with JB Weld. The components to be suspended are attached to the other end. Consider this process for installing a nut plate where riveting directly to the composite sandwich is problematic.

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Bob Nuckolls retired from Beech Aircraft in 2007 after 45+ years of work in certificated aviation and 25+ years of support for the owner built and maintained aircraft industry. Bob publishes the AeroElectric Connection from his website at http://aeroelectric.com

Bob hosts the AeroElectric-List on Matronics.com. This special interest forum serves approximately 1600

participants.