EAA Chapter 648

Longmont, Colorado 80503

Our next meeting, July 8th will be at our usual venue, at Leyner's at our usual 7pm time.

Thanks to all of you for reading our newsletter and I will keep on working to increase our readership and don't forget to patronize our advertisers if an aviation purchase is in your future.
Remember, ***"Nothing happens until somebody sells something"***

Chuckle of the Month:

Instrument flying is an unnatural act probably punishable by God.

The President's Message:

Submitted by President Rick
"Puddles, Swirls, and Knots" excerpted from *Not Gonna Build Itself*, by Ken Bickers

A score and more years ago, Budd Davisson wrote a short piece for the Experimental Aircraft Association magazine *The Experimenter* on oxy-acetylene welding, a piece that deservedly has

become legendary among aviation welders. Part of the brilliance of the piece was that Davisson cut out all the extraneous stuff about welding, focusing instead on the one thing that matters most: the puddle, the small pool of molten metal that must lie at the crease between two distinct pieces of metal, transforming a small amount of the solidity of each into fluid form, if they are to be joined successfully into one single piece of metal. He explained how to produce it; how to see it; how to regulate its distempers with welding rod; and how to draw it along the crease. There is much more to welding, of course. But if the puddle doesn't flow, nothing else matters.

Another part of Davisson's article that has powered its endurance is that he intentionally wrapped the discussion of the puddle into one of the key ideas in the pop culture iconic book, *Zen and the Art of Motorcycle Maintenance*. I read this book the first time when I was a teenager, which, among other things, means I read it a long time ago. What I remember from that first reading is that there was a lot about Greek philosophy that seemed to clutter up the story of how the narrator and his son took a long cross country from their home in the upper Midwest to the West Coast and back on the dad's motorcycle. That kind of cross country trip excited my imagination. It was something I wanted to experience myself. Still living at home, counting the days and minutes until I would leave for college, I was ready for adventure. How much better could life get than making a trip like that on an old motorcycle that I would keep running with my own hands and small bag of tools?

As it happened, college did hold a few such occasions, but not on motorcycles and not the sort of grand adventures that I, or anyone, could conjure into a full-sized book. My main rides during my higher education years were a gas guzzling Mercury Montego that I could no longer afford when OPEC decided that American gas prices were too low, followed later by a beat up, though miserly, Datsun 510, and later still by, of all things, a Chevy Vega that combined few good points but did excel in mildew and mold. There's not much romantic adventure about cross countries in any of these, though there was the constant suspense of wondering whether I would make it to any intended destination.

Many years later, when my first-born son, Steven, was eight, he and I would make a trip perhaps worthy of the *Zen* book. Setting out together in our 1957 Piper Pacer, we followed the Oregon Trail from its jumping off point in Independence, Missouri, to Corvallis, Oregon, in the Willamette Valley. I don't recall now whether at the time I had any thoughts of *Zen and the Art of Motorcycle Maintenance*. The proximate influences were Stephen Ambrose's history of Lewis and Clark, *Undaunted Courage*, which I had recently completed, and Steven's favorite interactive video game at the time, *Oregon Trail*. For many of the same reasons that families heading west chose the more gradually ascending and descending Oregon Trail over the Lewis and Clark Trail, it seemed prudent to opt for the one equally fit for wagon trains and emergency off-field landings.

Somehow, we convinced my wife, Steven's mother, that this was a trip that we could do safely and that would be a boost to his education. We planned for a trip of approximately two-weeks,

though with no particular schedule. Using a book of county plat maps of the Oregon Trail, which I had purchased from the Trails Museum in Independence, I transferred the route onto aviation sectionals. We flew from our home airport in Bloomington, Indiana, sleeping the first night in a tent under the wing of the airplane not far from Independence, then set out for Oregon following each twist and turn of the trail where it still exists and making straighter lines in areas where it lies below highways, lakes, and towns. It is remarkable how much of that trail is still visible, especially when flying 500 to 1000 feet above the ground.

It is also remarkable how much turbulence kicks up by midday the farther west one travels. After an encounter with a bit too much as we flew over western Nebraska the second afternoon of our trip and some time cleaning up stray vomit deposited round the passenger seat, we agreed that we would fly only until noon each day, with occasional evening flights if we wanted to clock additional miles. Steven is now a grown man. That trip is something that we still have in common. He still doesn't care for turbulence.

A few years ago, prompted by reasons now faded beyond recall, I decided to re-read the *Zen* book. On this second reading what struck me most was the centrality of the philosophical debate in the book. The discussion of classical Greek and eastern philosophies needed the motorcycle trip to carry the ultimate thesis. The trip itself could have been anything, which of course was a point I had failed to see on my first reading. But what struck me most on the re-reading was the boldness of the author in turning Plato's basic notion of reality and appearance on its head.

My last year in college and for the seven months between college graduation and graduate school, I worked at a lawn care firm as the mechanic, keeping several dozen lawn mowers, edgers, and weed whackers in good enough repair to make it through another day of use and abuse. The mowing crews were paid not by the hour but by the number of yards they mowed each day. They had no incentive to take care of the equipment. That was my job. After six weeks on that job, I knew pretty much everything that I would ever need to know about the job. Change oil. Clean air filters. Sharpen blades. Clean and gap sparkplugs. Start over. There was not much glamour in the job. I could see why assembly line workers might abuse alcohol and drugs. Why not? The boredom was deadening.

The tedium wasn't so bad that last year of school, but was stultifying once I no longer had classes to attend. I tried to scrub it from my thoughts, or perhaps more accurately to give myself some thoughts, by reading Plato and, after him, Aristotle. I would go to the shop early in the morning to make sure that all the equipment was ready for the crews. I'd make quick fixes to anything that the crews flagged as they were loading up. I'd be back to the apartment by mid-morning. My real work day didn't start until late in the afternoon when the crews began trickling back to the shop. That was when the servicing would begin. Each crew of two needed to have three serviced mowers ready for the next day, a working edger, and a weed whacker ready to whack. In between the brief morning shift and the longer evening hours, I would sit beside the pool at my Fort Worth apartment reading. Those midday months were devoted to Plato's *Dialogues*, *Republic*, and *Laws*, followed by Aristotle's *Politics* and *Ethics*. Read slowly, sometimes while sipping an ice-cold beer even more slowly, the boredom that was my job faded into the background.

Reality for Plato is not what we see around us. The tangible corporeal world encountered through our senses is at best an imitation of what is real. Summed up by the allegory of the cave, what we think is reality is actually akin to shadows cast upon the wall of a cave to which we are chained. Reality is immutable, timeless, and unchanging. In the *Republic*, Plato likens reality to mathematics with its perfect order, logic, and deducibility. In the *Laws*, his favorite analogy for reality is music that is perfectly pitched and harmonious. He was searching for metaphors that could carry the idea of a perfectly ordered reality whose existence transcends time and space. From the components of one's individual personality to individuals in political communities, everything and everyone should be arranged in perfect fealty to this immutable, timeless, and unchanging reality. Each part – or person – finds purpose and happiness when located within an order based on its inherent fitness and capabilities.

The narrator in *Zen and the Art of Motorcycle Maintenance* rejects this view. In so doing, he throws out much of the western philosophical tradition. For the narrator, reality is to be found through doing, an idea familiar in many Eastern religious and philosophical traditions but relatively rare in Western thought, at least outside the walls of many Catholic monasteries and convents. For him, the repetition of a task offers an opportunity to strive for perfection. Hence the metaphor of a journey. But what is more important is the maintenance of the motorcycle along the journey. Each task, no matter how small or seemingly trivial, is to be performed with purpose and care. With time and repetition, one loses oneself in the task – or perhaps more accurately, one becomes the task. One's life becomes meaningful through the discipline of repetition. This is the *Zen* of the book's title. It was an idea lost on me during my period as a mechanic working on lawn mowers.

Yet it is an apt description of what Budd Davisson is trying to convey in his article. With time and practice – and a pair of good reading glasses – a puddle of molten metal takes on an existence that defines the welder's purpose. Everything else disappears. The welder brings the puddle to life. It is mutual. The puddle is what transforms a person into a welder. Puddle and welder owe their existences to one another. A person exists as welder by keeping a puddle alive, by willing it to move. If the welder slows or stops, the puddle begins to boil, shooting off slags of burning steel, dying in an explosive cataclysm. If the welder pushes the puddle too fast, it grows thin and cold, depositing thin ribbons of useless metal atop a seam, rather than drawing metal from each side of the seam and leaving behind a single fusion of metal. This takes practice, lots of it.

Much of the practice involves careful attention to details well outside the puddle. The torch must be set up with a tip that is the correct size for the particular thicknesses of the metal pieces and any heat sinks present to draw heat away from the puddle. Welding hoses must be laid where they are supported and will not be tugging against the torch or knocking into the pieces to be welded. Pieces must be prepared so that gaps are neither too small nor too large. They must be jigged firmly so that they will not collapse or shift while being welded. Welding rods must be laid out where they can be picked up easily without having to remove heavy leather gloves. Diligence must also be paid to how the welder will support his or her torso and arms to remain relaxed and steady during the brief period of the weld itself. Acetylene and oxygen regulators must be adjusted and set.

Safety and reading glasses positioned. Gloves donned. Spark snapped at the tip. First acetylene, then oxygen, tuned until the flame is just right. The flame adjusted until it has just the right inner core and outer sheathing. No yellow. Hues of blue. The flame is not sharply pointed, but not ragged either. Rounded, like a pencil that has been used to draw lines on plywood. The sound is just right, without any ugly hissing. The sound sooths. Time to bring the flame to the metal, never touching but never far away.

This is the moment, who knows how long it will last, that the puddle readies to birth itself. The welder – for at this point the title is almost warranted – waits torch in hand, the tip of the flame positioned exactly 1/8 of an inch from the weldment at an angle of 45 degree, as the metal to which the flame points slowly brightens into a color of shiny, glistening orange. No rushing now. There is calm as the puddle emerges. As it does, the puddle and the welder begin to move together, punctuated by the touch of welding rod, slowing or speeding, paced by the size and shape of the molten steel traveling at the intersection where two pieces of steel become one. Sometimes it all works; many times it doesn't. When it does, the feeling of satisfaction is unsurpassed. *Zen*.

Building an airplane such as a Pietenpol offers many occasions for these unsurpassed feelings of satisfaction. The key is to be willing to let it happen. A Pietenpol Air Camper built with a three-piece wing has 31 ribs. Each rib is comprised of two long wooden sticks that form its upper and lower surfaces. The shape and strength of the rib comes from the 10 vertical and diagonal truss pieces of wood (four ribs have 12 truss pieces), and 30 plywood gussets (four have 38 gussets) holding it together. Do the math. That's 62 long pieces, 318 short pieces, and 962 gussets. All of these must be cut to length and size. Glue must be mixed in countless small batches. On my ribs, the gussets are held in place during the gluing process with small permanent brads, typically four to six per gusset. Each of these was hammered in place one at a time, about 5000 times. Builders obsess over the best way to assemble jigs, mix glues, and prevent glue from sticking rib parts to places they don't belong. These things matter, of course. But in the end, the only thing that really matters is doing it, over and over, day after day, week after week. There's plenty of *Zen* territory here.

The leading edge of the wing on my Pietenpol is made from pieces of Western Hemlock laminated into two planks almost fourteen feet long and another, for the center section, two feet long. As a rough first approximation these planks were fed through my table saw to give them a trapezoidal cross-section. With a template of the desired cross-section cut on the scroll saw from a small piece of plywood, the shaping begins.

As I move slowly from one end to the other, sluices of wood curl around the handplane, forming swirls that drape to the hangar floor. Hour after hour, the swirls of wood shavings mound at my feet, the only sounds a soft abrasive hum as narrow bands of wood are dismembered by the blade of the handplane and the crush of thin ribbons of Hemlock under my feet as I pace the plank. The smell of fresh cut Hemlock fill my nostrils. On each long pass down a plank, the goal is for the shavings swirling out of the handplane to be exactly uniform in width and unbroken the full length of the leading edge. This doesn't happen at first, not often at least. Slowly the swirls become more uniform and longer. As they do, leading edges reveal themselves from the sharp corners of laminated planks. *Zen*.

Like many homebuilt airplanes, the Pietenpol is covered in fabric. In the old days, this was cotton. These days, most builders use Ceconite, which is a type of polyester and a wonderful material. It shrinks predictably at different temperatures to taughten it over the fuselage and flying surfaces. Whether cotton or Ceconite, some things haven't changed. The fabric must be attached to the flying surfaces just as was done a hundred years ago, with needle and thread.

Many builders attach the fabric to the wings and tail surfaces by tying a version of a seine knot. I opted to go with the more modern Staggerwing knot, which was used by the Beech Aircraft Company beginning in 1932. Somehow that seemed appropriate for my version of the Pietenpol, which is built to the "New, Improved" plans of 1934. Plus I never could quite get the hang of the seine knot, finding the Staggerwing knot somewhat easier to tie. A fabric covered airplane offers abundant opportunities to master whichever knot is employed.

Holes are marked with long straight-edges and pre-punched. Reinforcing tape is laid in place. The wing is positioned on its rotator stands to allow the long needle to pass easily from one side to the other. A length of waxed flat cord is measured in sections of arm-to-nose lengths. The long needle made from welding rod is threaded. A starter knot is tied. Cord is pulled through opposite holes and passed back to the front. A knot is tied. A knot is pulled inside the wing. With practice, thinking ceases. Muscle memory takes over. Tension on the thread becomes more uniform. Rhythm emerges. Time is measured not by clocks. It stretches and compresses as knots move down a rib and onto the next. *Zen*.

There is *Zen*. There is also Plato. It would be a mistake, a dangerous one, to reject the basic fundamental insight that was Plato's. The narrator of the *Zen and the Art of Motorcycle Maintenance* has it only half right. When summoning an airplane out of raw materials, a builder must be committed to the notion that there is a reality that is immutable, timeless, and unchanging that gives purpose and order to the building process. That reality is embodied in the plans. Every component that is welded on a jig, glued and nailed together with brads, fashioned on a workbench with a handplane, or knotted to a flying surface is given meaning by the plans.

Plans bring order out of chaos. Without the plans, there would be no reason for the various parts and components that are created in the course of building an airplane. The plans are immutable, timeless, unchanging. Any change from the plans, however well-intended or even necessary given availability of materials, current building standards or preferences of a particular builder, represents a deviation. Every builder must decide for himself or herself how much leeway to tolerate when making a part. Is $1/16^{th}$ of an inch acceptable? Maybe sometimes. Other times tolerances may need to be measured in thousands of an inch.

Such tolerances are our ways of describing what Plato described as shadows playing on the walls of caves to which we are chained. What appears to our eyes as we look upon the components that we have fashioned is as close as we can come to making perfect components. Each part we make is imperfect. Perfection lies outside the cave. The cave is our workshop. I wonder what kind of an airplane Plato would have built. I suspect it would have been pretty good. It wouldn't have been perfect.

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