

Experimental Aircraft Association



TALESPINNERS

Chapter 174

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Builders' Logbook

CNC In the Home Shop: Part 3 – A CNC Project From Concept to Cut by Kevin Kinney

In this final installment of my CNC article, I will document a simple project I used to teach myself the basics of CNC milling.

My homebuilding project is a Zenith 601XL, largely built of aluminum. Metalworking isn't difficult provided you follow some simple rules. One of the rules is that any holes you drill must be a minimum distance from the edge of the metal.

To mark the edge distance, you can create a gauge by drilling a hole in an L angle, putting a felt tip pen in the hole and running the L angle along the edge of the metal. This works particularly well on curved edges like wing roots and wingtips.

A more sophisticated design incorporates a single gauge with holes at different distances. I chose this as my first project on the CNC mill. After some thinking, I realized that manually writing the Gcode would be the simplest way to do this.

This took a few hours to research & code. The box on the next page shows an example of the code.

During coding, I continually tested my Gcode on the CNC simulator. The picture shows what the final simulation looked like.

Now for the actual cut. I mounted an L angle extrusion on the mill with the one flange pointing back and the other down. The horizontal part of the angle will be the part drilled, but we have to position the cutting bit relative to the inside edge of the vertical flange.

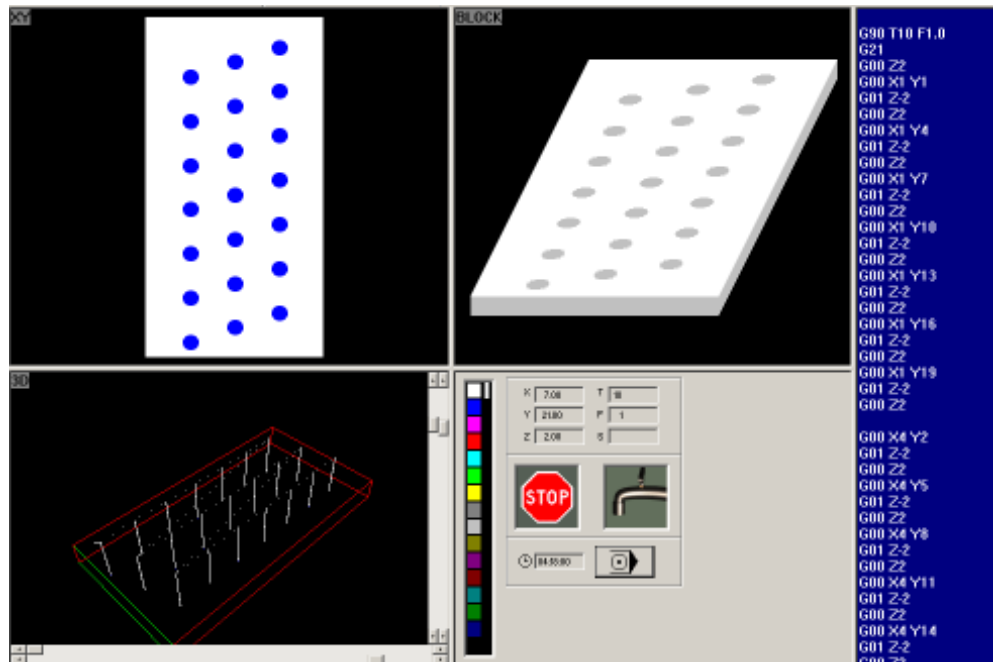


Figure 1. Sample Code

```
G90 T20 F1.0 ;Set absolute distance mode, use tool 20, speed 1 inch/min
G21 ;Use metric measurements
G00 Z2 ;Rapidly move the bit up 2mm
G00 X1 Y1 ;Rapidly move bit to 1,1 (Position over first cut)
G01 Z-2 ;Slowly move bit down 4mm (Drill)
G00 Z2 ;Move the bit up (Retract)
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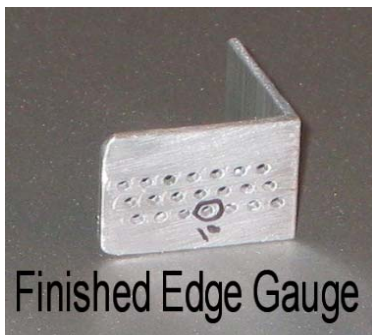
The program assumes the bit is centered directly over the inside edge of the vertical flange. To do this takes some calculation. Stand by for some math.

I snugged the bit up against the leading edge of the L angle. The L angle is 1/8" thick and the cutting bit is .050" in diameter. By adding .125" to half the diameter of the bit, .025", I know the center of the bit is now located at -.15" from the rear edge of the vertical flange. (Which is where the metal edge will be when used.)

By moving the bit .15" to the rear, the bit is centered directly over the rear edge. This ensures the 1mm hole would be centered 1mm from the inside edge of the L angle.

At this point, I power up my system & load the Gcode into TurboCNC. I tell TurboCNC to start after putting on some safety glasses. There have been too many unexpected things flying off my mill to do this without glasses.

With luck, the motors wind up, starting the part & cutter moving. Soon aluminum shavings start accumulating. If all goes well, when the program stops, you end up with a part that looks like the simulation.



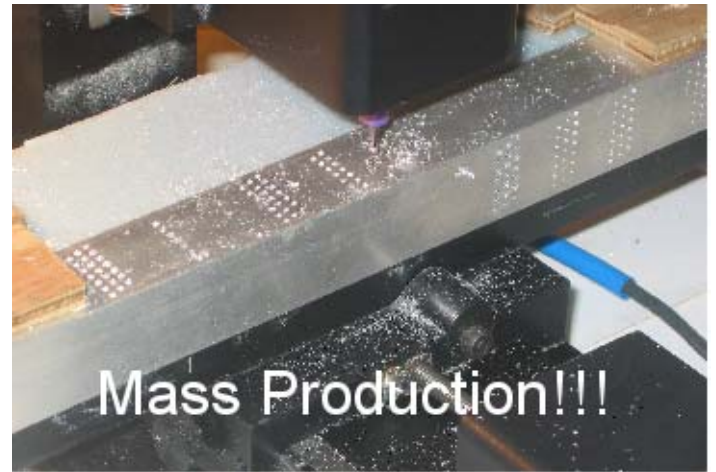
Now that you have a single part, it takes very little to make several more. While these parts are usable, to use the edge gauge you sometimes have to measure to find the hole you need. If I

were to refine this, I would also engrave each hole with the distance it measures. But at the moment, this is beyond my talents.

In this series of articles, I have introduced mills, basic milling techniques and computer control of

mills. The second article expanded on ideas from the first article and outlined possible uses for CNC in the homebuilding area. This last version of the article is an overview of the a simple CNC project.

I hope these articles have been informative. If you have suggestions or questions on hobby CNC, I would be glad to hear them.



EAA's Aviation Services

EAA members are one call, email or letter away from a wide range of technical aviation services available from the Aviation Services Department at EAA. First and foremost, the Aviation Services Team is responsible for answering member technical inquiries relating to pilot and aircraft issues. This one-on-one consulting covers everything from "How do I register my homebuilt?" to "What's involved in the A&P exam" to "How do I convert my ultralight for the new sport pilot rule?" and more.

Experienced pilots, aircraft owners, homebuilders, ultralighters and sport pilot specialists staff the department. Their personal and professional experience enable them to field just about any technical aviation question that comes their way. And if they can't answer your question right away,

they'll do the research needed to help guide you to the right resource or solution. EAA's in-house library is an additional resource the Aviation Services team counts on for information and the library is also available to members visiting the Oshkosh headquarters offices.

The Aviation Services Department supplies a great deal of the technical information found on the Members Only portion of EAA's website at www.eaa.org. The Homebuilders Headquarters section on the site provides a wealth of information on building, maintaining and flying an experimental amateur built aircraft. A significant amount of the content on EAA's Sport Pilot website page is also developed by the Aviation Services team.

Two of the most popular "hands on" offerings from the Aviation Services Department are the Technical Counselor and Flight Advisor programs. There's a network of over 1,000 EAA members across the US who are registered EAA Technical Counselors that will come to your homebuilding location to provide in-progress inspection of your project. The Flight Advisor program has several hundred EAA members who will provide advice and assistance on taking that first flight in your new homebuilt aircraft.

FAA Medical assistance is one of the individual offerings also available from the department. If a member needs assistance receiving a special issuance from the FAA, Aviation Services personnel will track the application all the through the process until approval to ensure that nothing derails your application. In addition, we have a network of doctors that are AMEs and EAA members who volunteer their services to help other members retain or regain their medical.

For more information on your EAA Technical Services offerings please call 1-800 –EAA-INFO. They're ready for your questions!

– EAA Chapter Administration

January Board Meeting Minutes (1/04/05)

Attendees included Todd Winemiller, Pete Eide, Phil Cady, Howard Wells, Norm Beaudette, Lee Jewell, Doug Auxier, Kathy Doyle and Kevin Kinney.

Todd called to order at 6:45, began by introducing transition meeting, covering officer duties & bylaws.

Norm mentioned EAA Chapter handbooks were out of date. Kevin will look into getting 9 new copies.

Norm sent the status report to National and covered it's contents.

Todd raised the topic of outstanding dues. Doug motioned we send a reminder letter, Phil seconded.

Discussion was raised regarding future dues. Tabled.

Norm covered chapter roster as well as insurance requirements. Kevin will send National a list of chapter events requiring insurance.

Meeting adjourned at 10:11.

Kevin Kinney, Chapter 174 Secretary

January Chapter Meeting Minutes (1/16/05)

Chapter President Todd Winemiller called the meeting to order at 2:15 pm and gave a brief financial statement in the treasurer's absence. Todd noted that the Chapter is expected to receive \$950.00 from the Ford Tri-Motor rally.

Social Activities Committee chair Kathy Doyle announced that the Chapter would have a booth at this year's Blue Ash Airport Days – an opportunity to sell more of our T-shirt stock. We also have an opportunity to share a booth with the Moraine EAA at the Dayton Air Show.

Kathy also mentioned that new wing sections have been made from a prop donated by Hal. They are polished on one face and ready for engraving. During the move to the Hawk building, a batch of the old wing sections was found, so we now have a good overall supply. The new prop sections will be sent to our more recent previous guest speakers.

Plans for at least 2 Young Eagles rallies were mentioned briefly.

Howard Wells mentioned that he and Gary had done an informal inspection of George Armstrong's just-purchased partially assembled Sky Bolt project.

Don Reasoner wanted the members to know that all are welcome to attend the Wednesday evening Young Builders meetings.

Doug Auxier noted that the Warbird Museum was hoping to open around Memorial Day. Kathy Doyle mentioned that she intended to donate a historic A1-1 jacket to the museum. The museum is expected to house a B-25, Corsair, T-6, P-51, a Foche-Wulf 190 and others. The museum has so far raised over \$3 Million.

Norm Beaudette mentioned that he had put together a reminder, in the form of an invoice, to be sent to all last year's members who had not yet paid their dues for 2005.

Meeting adjourned at 10:11.

Norm Beaudette for Kevin Kinney, Chapter 174 Secretary

Congratulations!

At the last meeting Neil Hulin announced that he and his wife Janelle are the proud parents of a new baby girl, Anja Hulin, born Jan 10th, 2252 Zulu time. Mom has been doing well, but dad wasted no time showing Anja how to use a bucking bar and how to set Clecos. Neil estimates that with Anja's help, they should finish their Zodiac 601XL project a couple months earlier than they had originally planned!

MERFI Volunteers Needed

Virgil Phillips has taken on the chairmanship of the Mid-Eastern Regional Fly-In (MERFI), with the hope of reviving this classic fly-in this year. He is starting a new board and has been looking for dedicated individuals interested in joining it. Apparently Chapter 174 was once a significant supporter of MERFI – about 30 years ago. If interested, contact Virgil at 419-***-**** or Todd.

Project For Sale

RV-9A Tail, Wing and Fuselage kits including Van's RV-9 wiring kit, and 2 Duckworks leading edge landing/taxi lights. The tail, flaps and ailerons are finished. Both wings have the ribs attached.

Located in Verona, Kentucky, about 30 minutes south of Cincinnati, OH.

Will NOT separate these parts. \$13,500.

Also available: Whelen combo strobe and position lights \$700, PSS AOA Sport \$850, and a Aero Instruments Heated Pitot/static tube \$500.

tel: 859-***-****, email: scottspencer@fuse.net



EAA's Homebuilder Headquarters Web Site

Here's an Internet web site you won't want to miss, and it's brought to you courtesy of (drum roll...) EAA. Take a look at the following EAA link: <http://members.eaa.org/home/homebuilders>. (Note that there's no www in the address.)

This section of the EAA website is designed, in part, to "Present the homebuilder with a wealth of information that will help in the completion of his/her project". Check out the links just above the big "Homebuilders" title, especially the "Building / Articles" link. Here, you'll find all kinds of articles on topics like:

- Basic Construction Practices
- Canopy / Windshields
- Cockpit – Cabin – Interior
- Control Systems
- Cowlings
- Electrical
- Firewall
- Fuel Systems
- Landing Gear / Wheels / Brakes
- Metal
- Painting / Finishing
- Weight and Balance

Read about airfoil design under the "Designing" link, or airspeed calibration under the "Testing" link.

Most of the articles are by homebuilder greats like Tony Bengelis, and, not surprisingly, most are "reprints" of past articles from Sport Aviation.

You can also select articles by a particular author. For example, Budd Davisson's 9-part series of articles from 1987-1988 appears under his name in the "Articles by Author" link.

Click on Selecting, then Kits & Plans for a list of kit manufacturers. Then click on a name to get a list of articles that appeared in EAA publications on that particular manufacturer.

The site also provides a good assortment of books that are available for pursuing your particular interests in greater detail. Many can be purchased through EAA. *Norm Beaudette – Newsletter Editor*

Hangar Flying

with Stu Faber

Feb, 2005

stuartlfaber@msn.com



BOOK. *Flight of the Gin Fizz* by Henry Kisor. A middle aged writer gets a Private Pilot license and as he is interested in the history of Cal Roberts' 1911 coast to coast flight in a Wright Flyer, decides to follow Roberts' course trying to stop at all the same stops. It took Roberts over 80 days and many many rebuilds, causing him to miss a \$50,000 prize. Roberts was underwritten by a grape drink called Vin Fizz for the advertising. Flying an old Cessna 150, and being a low time pilot, and deaf since his youth, Kisor was cautious and usually kept his daily flights fairly short. He describes the many interesting people he met at mostly small airports. The book has many pages of more or less technical information for the non-pilot and is somewhat boring for those with some experience. However it is an interesting story.

At one stop he met a couple who had just returned from flying their own plane to Point Barrow at the top of Alaska. They told him that the recommended survival ration was a bag of dog food since it was nourishing but not so tasty that it was eaten up before the emergency.

ANOTHER BOOK. In *The World's Strangest Aircraft* by Michael Taylor are articles on a number of very strange aircraft including a section on flying wings which have always interested me. To build a stable airplane the tail is usually designed to produce down pressure to balance a forward center of gravity. This produces drag which degrades performance. This is true of gliders although they need to reduce drag as far as possible. During WW II the Horten Brothers in Germany did a lot of experimentation with flying wings. Most of their designs had about the proportions of a residential door. Some years ago I attended a convention of the Sailplane Homebuilders Assn. One of the presenters was a man who was offering plans for a rectangular wing tailless glider. It had a large rudder immediately behind the pilot's pod but no horizontal stabilizer. He claimed great performance. I asked a pilot who flew a similar glider about his C.G. and he said it changed if you nodded your head. Phil Eid, who used to come up to Dayton with me was a friend of the crew chief on Northrop's N-9-N when it was first tested at Edwards AFB. It has been restored to flying status by the same man for Planes of Fame Museum. I saw it when it was nearly restored. It had two Terraplane auto

transmissions driving the pusher props from two Franklin engines inside the wing.

FLYING JEEP. A recent TV program on the history of the Jeep showed a brief shot of a Jeep with an added aircraft tail and a gyro-copter type rotor on top. It showed the contraption about ten feet above a runway. It appeared to be attached to a tow line, which was sloped upward, although there was no sign of what was pulling it. The tow vehicle must have been a plane as a ground vehicle would not make much sense. The program pointed out that the experiment was short lived. Sure would make a sensation at Oshkosh.

BLIMPS AGAIN. Or at least LTAs (Lighter Than Air) again. When the last *Hangar Flying* circulated it was read by Jim Shock who gave a program on blimps to the Huffmann Prairie Chapter a while back. He called me and after a short conversation he said he was making available several of the books he has written on the subject. I have just started to read U.S. Army Airships 1908-1942. I never knew the Army had anything other than observation and barrage balloons. However it appears that the Army had quite an extensive program over those years. It does not appear to have been a high priority program of the higher command and bases were established and changed with some frequency. Of course there were the usual Army-Navy turf controversies. That was settled by agreeing that the Army covered the land and the Navy the seas. As WW II approached the Army decided airplanes were more effective and turned LTAs over to the Navy.

VIEWPOINT. Quoted in the book *Wings of Madness*, "In 1912, Santos-Dumont, sequestered in Benerville, had a rare visitor who described the stunt flying in America, which was also being done in France but not as extensively. The world's first aerial showman was horrified. 'I flew tight circles and steep turns because birds make them,' Santos-Dumont told the visitor. 'But show me the bird that makes loop-the-loops and flies upside down. It's not natural.'"

Santos-Dumont was the pioneer airman who designed and flew powered balloons (blimps) and designed the Demoiselle plane which was widely copied.

Upcoming Events of Interest to Chapter Members

- **Feb 19, Sat. Chili Fly-In at Lebanon – Warren County**. OSU Wright Flyer on display. \$5 charge. Lebanon-Warren County Airport (I68), Lebanon, OH, 11:00 am - 1:00 pm. Call 513-934-3100 for information.
- **174 Feb 20, Sun. Chapter 174 Meeting**. Hawk Building, Clermont County Airport, 2:00 pm.
- **Apr 12-18, Tue-Mon. Sun 'n Fun 2005**, Lakeland, FL.
- **Apr 23, Sat. 2nd Annual Mike's Hangar Spring Pork Loin Burn and Fly-In**. Breakfast - pancakes,

- eggs and coffee - starts at 6:00 am. Lunch - gourmet pork loin sandwiches. Airplane rides and "Concours d'Elegance" for the cleanest airplane. (Judges can and should be bribed). Expect a gathering of Swift's, Tiger Moth's, Waco's, Pitts, RV's, and most other Antique and Classic aircraft. For overnigher's, camping is OK, or a motel. Evening activities are planned. Aircraft parking on the west end of the ramp. Rain date, April 24th. Columbus Municipal Airport (BAK), Columbus, IN.
- **Jun 4, Sat. Chapter 174 Young Eagles Rally**. Clermont County Airport.



Next Chapter Meeting

Sunday, February 20th, 2005, 2:00 PM

Sport Pilot Update

*Presented by Martha Lunken
Safety Program Manager, CVG FSDO*

*Hawk Building
Clermont County Airport
Batavia, OH*
