



**KNOW YOUR
TOOLS:
HAMMERS**



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#1
SHOP
TESTED**

p.12 **CANADIAN QUOTES:
CHRIS DE
CHAMPLAIN**



ISSUE #134
OCTOBER/NOVEMBER 2021

CANADIAN Woodworking & HOME IMPROVEMENT

**Make a
Fully Adjustable
Tablet
Stand**

TOP 10
**Tips for
Setting Up a
Home Office**
p.10

+ 4 MORE TECH FEATURES

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- **Home Tech Tips to Work Efficiently** p.44
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- **Digital Design Tools: CAD** p.47

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Cover photo by Rob Brown

36 Fully Adjustable Tablet Stand

This tablet stand is not only adjustable over a wide range of positions, but it looks great. BY GORD GRAFF



editor's letter

The past 18 months have forced all of us to make major changes in our lives. Working from home and interacting with friends and family via a screen are now commonplace. Even our kids have participated in distance learning off and on, the piece of straw that almost broke the camel's back. Just two years ago, it's unlikely we would have believed what's possible when necessity takes over.

Even before the pandemic, technology played a huge role in our ability to stay connected with the world. Laptops, tablets and smartphones all take center stage these days whether we like it or not. For everything that they're capable of, they're still far from perfect. I sure can't do much to improve these objects directly, but as a woodworker I can design and build fixtures that allow me to use these screens more comfortably and efficiently.

In this issue we're just scratching the surface of how simple woodworking projects can be merged with the often-complex world of technology to make our lives a bit better. The technology feature in this issue was partially inspired by a simple treadmill desk I made for myself about a year and a half ago. It allowed me to stay active during the workday while still getting my work done. It was an ugly mix of chipped plywood and random pieces of wood, but it worked. In this issue I share the process I used to design a new treadmill desk, and show you how I built my new desk.

Gord Graff has an article on a fully adjustable tablet stand that will make connecting with friends and family, reading recipes in the kitchen, and many other tasks easier and more comfortable. And a passive speaker for your smartphone would be a great way to expand the usefulness of your phone. Steve Der-Garabedian details this project for you. Also, our digital editor Carl Duguay shares tips on how to set up a smart home office and how to keep it running efficiently.

Chris Tucker introduces the topic of computer automated design (CAD) in this issue. Although unrelated to COVID-19, it seemed like the right time to start this multi-article series on how technology can be used to improve your woodworking. If you've already mastered the art of using technology (is this even possible?), we include other woodworking articles for you to read, too.

I'm sure there are more woodworking projects that can help improve our relationship with technology. If you made something in your shop you feel is worth sharing, please send me a photo or two, and tell me a bit about it. I'd love to share some reader projects via social media so we can all benefit from them. — Rob Brown



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CANADIAN Woodworking & HOME IMPROVEMENT

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letters

Canadian Pricing?

Hi Rob,
Good work on the magazine and all of the interesting articles. I was reading the Aug/Sept 2021 issue of *CW&HI* and found the review for the Kreg Portable Crosscut Guide interesting. I'm assuming that the MSRP listed is in USD, correct?

Thanks,
Bruno P.
Port Hope, ON

Hi Bruno,
CW&HI focuses on Canadian content to give readers a better feel for the type of work they're doing, and the tools available at Canadian retailers. We always include prices in Canadian dollars. Well, except for last issue, and that was my mistake. The price of the Kreg Portable Crosscut was accidentally listed in American dollars. The current MSRP for this fantastic Kreg crosscut jig is \$34.99. In my books, this is still a steal. —Rob Brown, CW&HI Editor

Reader Project

This bookcase was built by Troy Chelsberg, from Edmonton, Alberta. The project was made from a discarded pile of survey sticks and wood left outside to rot, along with some maple sheet goods rescued from the garbage.



To view readers' photos, and to submit your own, please visit canadianwoodworking.com/share-photos.

Small Shop Issue: Too Big on Table Saws

Rob,
I tend to agree with the comments of Tony I. (Letters, Aug/Sept) in that there was just too much emphasis on the table saw, of any size, in the June/July issue. On page 47 of the Aug/Sept issue, you included the results of your census for 2021 where it points out that a total of 71 per cent of the readers have a workshop less than 20' × 15'.

So how do I cut up a 4 × 8 sheet of plywood in such a space, or even trim an 8' board? On page 19 of the June/July issue, you show a photo of Karen McBride cutting such a sheet.

Thanks,
Don W.
Toronto, ON

Hi Don,
Thanks for the feedback. It's always good hearing from readers.

CW&HI included an article titled "Working with Sheet Goods in a Small Shop" in our June/July 2013 issue. It covered the characteristics of different types of sheet goods, how to transport them, what machines or power tools to use in order to break them down, how to obtain a nice clean edge, and how to cover or finish that edge once the panel has been cut. I think it's a great article for anyone with a small shop who wants to use sheet goods. Sheet goods aren't the answer to every challenge, but they are the answer to some woodworking challenges. Magazine subscribers have access to all of CW&HI's past articles. — Rob Brown, CW&HI Editor



Recent "From Rob's Bench" Blog Posts

Hi Rob,
I've really enjoyed reading some of your exploits with your son, working together in your shop. What a fantastic dad you are. So many memories and skills being developed. I have an 11-year-old grandson and 13-year-old granddaughter and enjoy when they can spend time in my shop as well. Keep up the good work.

Trent W.
Via email

Hi Trent,
I'm glad you're enjoying my blog posts. Although I often mention whatever I'm up to with my kids in my shop (it's hard not

to, because it's a lot of fun!), over the past few months I've also written about making finishing samples for clients, an internationally known Canadian epoxy / wood turner, how I get some of our magazine covers and the worst customers I ever had. I cover a wide range of topics, and try to keep things pretty relaxed.

You can sign up to receive weekly shop-NEWS emails from our team by going to CanadianWoodworking.com/email-signup. The weekly newsletter includes an intro and link to my most recent column, not to mention popular articles from past issues, lots of woodworking tips and industry insider information. — Rob Brown, CW&HI Editor

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Tool Reviews

Kershaw Taskmaster 2 Saw

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View these reviews and more at:
canadianwoodworking.com/reviews



Events

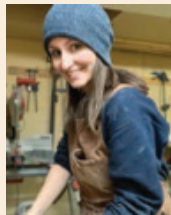
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Product Watch

Custom LeatherCraft Tool Bags

These six moulded-base tool bags and carriers are specifically made for trade professionals. The moulded bottom base is attached with double-stitched tape binding. All bags are constructed with durable 1680D ballistic polyester and include a padded shoulder strap, ergonomic carrying handles, large metal zipper pulls, heavy-duty hardware, and multiple pocket arrangements for tool organization within reach. goclc.com



Video Links

canadianwoodworking.com/videos

Canadian Quotes:
 Chris de Champlain

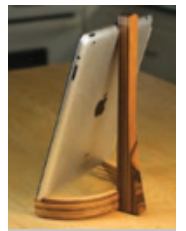


Free Plan

Make a Tablet Stand

If you have a friend or family member who has a tablet, this stand makes a perfect gift. It combines both function and looks, and can be made to suit just about any tablet.

canadianwoodworking.com/free-plans



Forum Thread

Check out these home improvement threads and many others at forum.canadianwoodworking.com

- **Need advice on building this Craftsman fence** – Fences are more expensive than ever, so building it to last, and so it looks great, is critical. From material and hardware selection to construction techniques, learn what the best approach is.
- **Painting Oak Cabinets** – A DIY kitchen reno can save you a lot of money, as long as it's done properly. A forum member wants to update their oak cabinets, but isn't sure about filling the grain, application techniques or what the right tools for the job are.

Got a question? Join our forum so you can ask our skilled and experienced members any home improvement question you like. It's free, and is just a click away.

Micro Mystery

Can you guess this object commonly found in most shops?

Follow us on Instagram to see regular "Micro Mystery" challenges.

We will post the answer to this one in our Dec/Jan issue.



Previous issue:
 Kreg pocket
 hole jig

Best Build

Check out the **Woodworking** section of our forum for our latest "Best Build" thread – a Morris chair. This month's winner, Ed Miller, wins a **Veritas Dual Marking Gauge** from Lee Valley.



To find out more about this project, go to: forum.canadianwoodworking.com or simply go to CanadianWoodworking.com and click **FORUM**.

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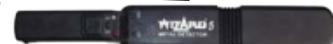
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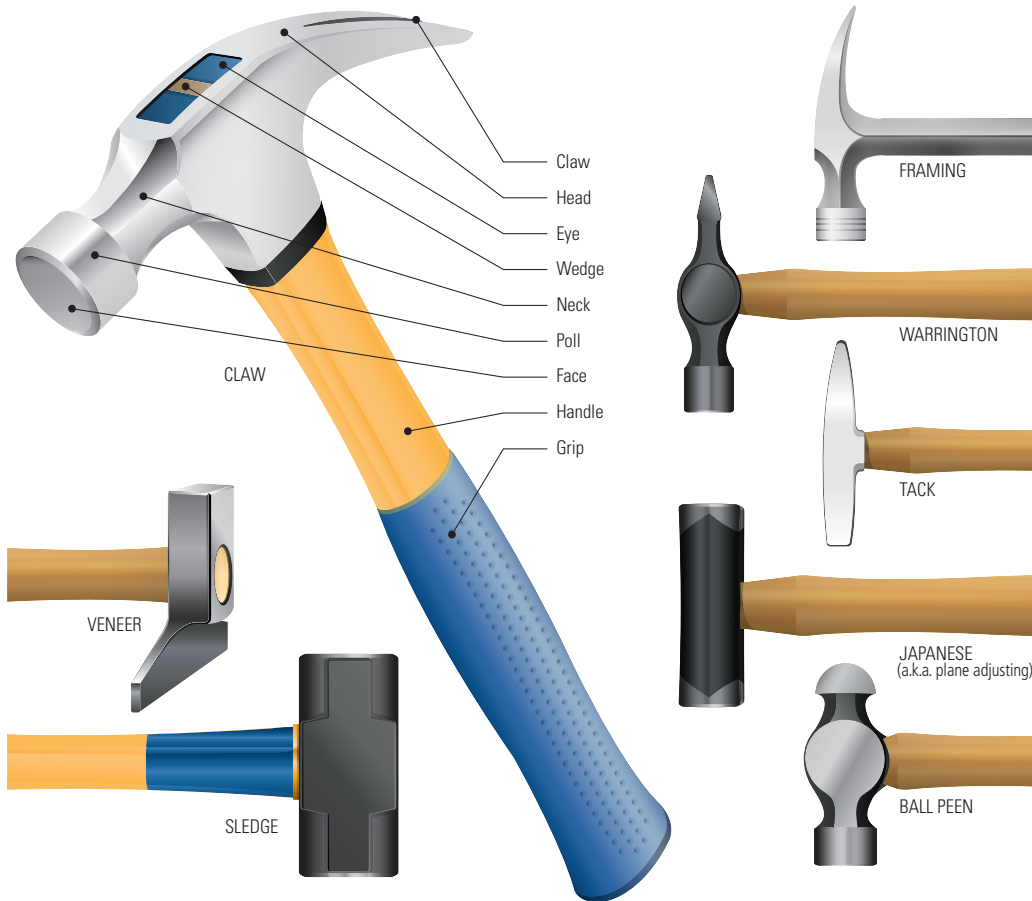
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Hammers



While hammers and mallets perform similar functions, the major difference between the two is that a hammer has a metal head while a mallet has a wooden or synthetic head. There are a range of styles specific to most trades. Within each is a multitude of variations. For example, claw and framing hammers, used for driving and extracting nails and spikes, can have milled or smooth faces with or without an integrated magnetic nail holder; short or long claws with or without a built-in nail puller; and wood, steel, titanium or fibre-glass handles that can be straight, curved or hatchet styled. Buying the right hammer depends on the type of work you'll do with it, how you'll use the hammer and how often you'll use it. Warrington hammers are for starting finish nails with the cross peen head and then using the round head to drive the nails home without marring the wood surface. Choose a tack hammer for driving small nails and tacks. Japanese hammers have one flat and one slightly convex striking face and are widely used for light chisel work and adjusting hand plane blades. For working on your shop machinery and for any kind of metal work, choose a ball-peen. Veneer hammers aren't used for pounding at all – after glue is applied to veneer, they're used like a squeegee to press out excess glue and air. The sledge is a heavy-duty hammer used for demolition work and driving large spikes.

Common types: claw, framing, Warrington, tack, Japanese, ball-peen, veneer, sledge
Head composition: steel, titanium
Handle composition: wood, steel, titanium, fibreglass

Get the Most Out of Your Hammer

Don't "make-do"

One style of hammer won't suffice for all your striking work. Make life easier by using the appropriate type of hammer for the striking job at hand.

Watch the weight

If doing a lot of overhead work, or carrying a hammer on a tool belt for long periods of time, choose a lightweight model.

Love the wood

Wood handles are the lightest, transmit the least vibration and can be easily replaced or customized. Leave the hammers with metal and titanium handles to the pros.

Be weather wise

If you'll be using a hammer primarily outdoors and likely to occasionally "park it" there, choose one with a fibreglass or composite anti-slip handle.

Cover your eyes

Nails, splinters of wood and pieces of concrete can inadvertently break off and get deflected towards your face.

DON'T
JUST

Finish
IT.

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IT.



SINCE 1958

Top 10 Tips for Setting Up a Smart Home Office

Many of us are continuing to adjust to working from home - or just learning how to. Setting up a home office doesn't need to be overly difficult or expensive. There are also a variety of ways you can harness technology to help you work more effectively from home.

BY CARL DUGUAY

1 Get enough bandwidth – Working from home will put a greater strain on your internet bandwidth - especially if there are other bandwidth-hungry users in the home. If you don't have enough bandwidth, web pages can take longer to load and video calls can freeze or drop off. Consider upgrading to a Dual-Band Router that uses a faster 5GHz frequency for your work devices, with the rest of your home devices running on a 2.4GHz frequency. Or, if your office area is far away from your router, consider a Mesh Wi-Fi Network to extend your Wi-Fi signal.

2 Be seen – The telephone is *passée* - you need to be seen as well as heard. Sign up to a video conferencing service and make sure you know how it works before you attend your first video conference. Top-rated apps include Zoom, Webex Meetings, Google Meet and Microsoft Teams.

3 See more – Regardless of the computing device you use, get yourself a large high-definition monitor. Your eyes will thank you at the end of the day and you'll be more productive. A large screen enables you to view more content with less scrolling, peruse multiple documents with greater ease and participate in audiovisual calls with panache.

4 Hear and be heard – Having a good-quality noise-cancelling headset and microphone enables you to stay focused on your work (and politely zone out other people in your home). Get a set that allows you to make and receive hands-free phone and video calls.

5 Off your butt – Sitting for long periods of time is a strain on your health, especially if you have back issues. At the very least you want a comfortable, ergonomic chair with good lumbar support. You



could also consider a motorized standing desk which makes it a breeze to switch between sitting in that comfy chair for short periods of time and assuming a standing position for even longer periods of time.

6 Light up – The best light is natural light and you should try to get as much as you can. If you can't position your standing desk next to a window, opt for dimmable daylight LED lighting. According to lighting experts, LED bulbs are closer to natural sunlight, produce better visual comfort and generally help us put on a happy face.

7 Store it in the cloud – Cloud storage for your data makes it very convenient to share data with people anywhere and have access to data when you're not in your home office. It's much safer than you might think and it's fairly inexpensive. Some services, like Google Drive and iCloud, offer free storage up to about 15GB.

8 Stay safe – If you'll be having a lot of deliveries or visitors to your home office, invest in an outdoor Wi-Fi security camera so you can keep an eye on what's outside for better protection of what's inside. You can also control entry into your home (even when you're not there) with a smart doorbell. They're equipped with an integrated camera so you can see and record who's at the door and two-way audio so you can talk to whomever is there. Optionally, you can open the door to give them access.

9 Don't be a patsy – What happens if someone trips over Fido in your home office? Or inadvertently knocks over your precious 17th-century porcelain urinal collection? Check to see whether your homeowners' insurance covers costs related to a home business. And if not, get covered.

10 Take 5 – Use a timer on your smartphone or computer to remind you to take breaks throughout the workday. If you have a digital assistant (e.g., Alexa, Siri or Google Assistant), set it to turn the lights off, switch off your monitor, play some dance music – anything to get your head out of your work.

CARL DUGUAY

cduguay@canadianwoodworking.com



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 **RUST-OLEUM**

Chris de Champlain

...on design, joinery and staying away from the “flavour of the month.”

BY ROB BROWN



Curly Maple Desk – This desk, with hand carved circular patterns on its front, includes 108 hand-cut dovetails. The legs and rails were hand-shaped with spokeshaves and rasps before being tenoned into the underside of the top.

How long have you been building furniture?
10 years; professionally for five.

What sort of furniture do you specialize in?
I don't consider myself to have a particular style that I adhere to. I work based on customer specifications and add my personal flair to each piece.

If you were not a furniture maker what would you be?
I would have gravitated towards stock broker.

In order, what are the three most important items in your shop apron?
6" square, Lie Nielsen block plane, 0.9mm mechanical pencil

Do you prefer hand tools or power tools?
Healthy mix of both in every project. I enjoy both for what they offer each project and workflow.

Solid wood or veneer?
I love the challenges and options that come with both.

Figured wood or straight grain?
I love both equally.

Inherited Vintage Stanley Sweetheart or fresh-out-of-the-box Veritas?
Neither. Lie-Nielsen! I have their entire lineup.

Flowing curves or geometric shapes?
Flowing curves.

Favourite wood?
Quartersawn white oak and walnut.

Least favourite wood?
Pine.



Chris de Champlain, 34, Custom Creation Woodworking

Location & size of studio – Val-des-Monts, Quebec

My temporary studio is the size of a two-car garage

Education – Graduated with honours from Algonquin College Cabinetmaking and Furniture Techniques program in Ottawa, Ontario



Paper Cord Bench – This black walnut bench was joined with angled mortise and tenon joints, and features laced paper cord and Danish L-nails. De Champlain made this bench as a wedding gift for his friend.

quotes

Despite a size that would make some professional woodworkers question my choice, my studio is fully functional with everything I need for custom work. In 2019 I closed down my larger rental shop when I moved to a new house. The original plan was to add an extra 1400 sq. ft. as a separate shop space on my new property, but then the pandemic hit and with it, steep prices on building materials. For the time being I've put my new shop plans on hold.



I'm definitely not a morning person. My average work day will start around 9 or 10 a.m., depending on how late I worked the night before. I'll often be in the shop until 2 or 3 a.m. When I'm in my shop, I am always on the go. My workdays are spent working, my rest days are spent resting. I'm straightforward like that.



I love to window shop for inspiration by walking in different neighbourhoods, both new and old, both locally and internationally.



What's interesting to me is different forms and elements that important woodworkers' and artisans have incorporated into their work, rather than the entire piece itself.



I tend to stay away from anything that is "the flavour of the month" in furniture design.

If a client asks to me to build something that can be found all over the internet, I will work with them on their design so that it is built to last and has an heirloom quality to it so it not only will stay together for many generations but will also look good in the space for just as many generations.



Always design first and figure out how you're going to build it second. There are always 10 solutions for every problem.



To me, cutting a proper, perfectly fitting joint is a rite of passage as a woodworker that connects us as craftspeople. Traditional wood joinery connects us to our past as a profession and to overlook that is to take depth, creativity and tradition from the profession as a whole.



As time progresses, I'm hoping to take on more challenging projects. I don't want to get comfortable. When you're comfortable, creativity stagnates.



I think social media has done a great job at promoting makers, whether that's with wood, metal, cord or code. I see a bright future for making. But getting into the profession of woodworking? That's going to be more difficult in the future. A lot of makers spend more time recording videos than they do making sawdust.

Using proper joinery for the task at hand is misunderstood by many woodworkers.



Some of my favourite Canadian and international makers are Hans J. Wagner, Craig Thibodeau, Peter Galbert, Michael Fortune, Silas Kopf, Theo Cook, Adrian Ferrazzutti and Karen McBride



Overcoming and adapting is part of woodworking.



Try not to repeat the exact same design twice, even if someone wants something similar.



Integration of different materials in projects will likely change over the coming years.



People are thinking outside of the box more than they ever have.



Some want the Eiffel Tower but have a budget for a woodshed.

ROB BROWN

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Reviews

Our experts review new tools and products on the market that are ideally suited to the woodworker and DIYer.



Bevel-Up – The bevel-up configuration of this plane allows Der-Garabedian to use it comfortably. He found other #1 planes difficult to grasp, but the Veritas fits his hands nicely.

Veritas Bevel-Up No.1 Plane Great Plane in a Small Package

BY STEVE DER-GARABEDIAN

I like working on smaller projects such as boxes or small cabinets because they involve more detail and require more attention.

However, smaller work is better achieved with suitably sized tools. I'm not talking about the miniature tool line that Veritas has, but rather their Bevel-Up #1 plane.

I've looked at getting a #1 in the past but it would have been more for just "having it" rather than having a working plane. Both Stanley and Lie-Nielsen have had similar products, but they were the more traditional bevel-down configuration. While I don't have large hands,

it was hard to hold such a small plane because the blade assembly gets in the way of a decent grip. The Veritas version lowers the blade, allowing either a one- or two-handed grip.

The plane comes with all the features found on other planes in Veritas's bevel-up line. There is no compromise when it comes to the adjustability of this plane. It has a Norris-type adjuster along with an adjustable mouth complete with the locking knob. It also includes the toe-stop screw that halts the toe piece from crashing into a freshly sharpened blade. Since this screw is rather small, accommodation has been made for the use of a small hex wrench for setting it. Like its larger

siblings, it comes with a pair of set screws that center the blade at the mouth. The plane's sole is just under 2" wide and just shy of 6" long. The bed angle is 15° and, along with the 25° blade, has a cutting angle of 40°. Speaking of blades, it can be bought with an O1 blade at \$249 or for an additional \$10 the PM-V11 blade. Both blades are 1-7/32" wide.

Out-of-the-box fit and finish are what you would expect from Veritas. It took very little effort to have the blade cut whisper-thin shavings with water stones. If you have hands as large as Arnold Schwarzenegger, this is not the plane for you. It may seem obvious, but you don't want this plane as a substitute for a jack



One Hand Only – While the plane is comfortable to grasp with two hands, it can also be used single-handedly.

or a 4-1/2 smoother unless you're looking for a workout.

I've found it useful on small boxes or even localized smoothing on larger surfaces. It's easy to hold your work with one hand and use the plane with your other. I'm surprised at how many times I've reached for it over my small bevel-up smoother, also from Veritas. I've also found it different from the cutting action of a block plane. The vertical handle and front knob give it a (pardon the pun) smoother action. It's easy to work small parts or solid trim on veneered pieces. Even small end grain work on a shooting board



Fully Adjustable – The Veritas #1 is well-equipped. A Norris-type adjuster, along with an adjustable mouth and side set screws to keep the blade centered on the opening, will have this plane working smoothly for a long time.

feels good. I haven't tried it on inlay yet, but it is light enough to have a feather-like touch on delicate work.

The plane is comfortable to use and the words light and nimble come to mind when describing it. The smaller sole allows it to be better balanced on smaller pieces. As the saying goes, good things come in small packages. This plane and I agree.

Veritas Bevel-Up #1 Plane

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Make a PASSIVE SMARTPHONE SPEAKER



Photos by Steven Der-Garabedian Illustration by Len Churchill

Amp up your music listening experience by making a sleek speaker for your smartphone.

I love bending wood. In fact, veneering and bending wood was the favourite part of my formal education.

Bending wood seems magical, but there are several ways to make this happen, and we'll use one of these ways to create a smart-looking smartphone speaker.

Built-in speakers have come a long way since Apple introduced the iPhone. We're going to enhance this sound in a stylish manner by making a passive speaker. Sure, you could order a Bluetooth speaker, but aren't we woodworkers? Let's make our own.

High school horn

A few years back, I made a crude version to test how well this would work. To my surprise, it worked quite well. But the time has come to up the ante and make one that I can be proud to put on a shelf and use to listen to music, podcasts or audiobooks with a bit more oomph. When I started thinking about Version 2.0, thoughts of high school and those bellowing announcements from loud-speakers on high posts came to mind.

As mentioned before, there are several ways to bend wood. You could cut a curve out of solid wood, but this usually leads to a lot of waste. Steam bending is another option, but I find this has as many cons as it does pros. One of my favourite ways is to make a form and use a flexible plywood like wiggle wood and veneer to create a shape. In the end I settled for bent lamination as I had just the right piece of walnut.

It's all in the form

Before making the form, I made a drawing on a piece of graph paper to give me a close approximation of both the shape and size of the speaker. Once I was happy with the sketch, I cut up five pieces of MDF. With a few modifications this form can be used in a vacuum bag to bend wood.

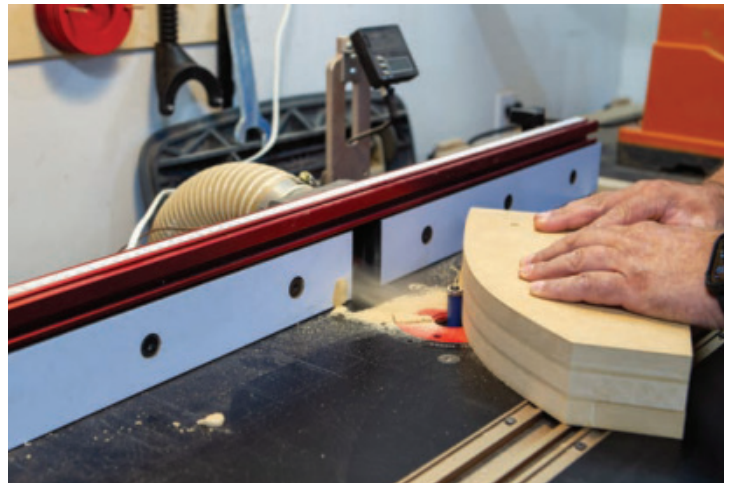
Start off by driving a pair of screws along the curve's path part-way into one of the MDF pieces. I used a cut-off piece of 1/8" thick MDF to create my curve between the two screws. Most any clear piece of wood around the same thickness will do the trick, as well as store-bought options like a French curve. Play with the shape until you're happy and then pencil it in. Next, cut this on a bandsaw and refine it with sanding. Take your time with this step to make a smooth curve because this will become the pattern.

It's simple to create identical pieces by using a combination of a bandsaw and router fitted with a flush trim bit. First, create a 90° corner jig using a pair of MDF pieces, glue and screws. Seat one of the blank MDF pieces in the jig, then place the curved template on top. Using a countersink and three #8 × 1" screws, attach the two pieces together. Keep the screws close to the outer edges, as you'll need to drill holes for clamps in the middle. Head over to the bandsaw and cut the curve, leaving approximately 1/8" of waste. Take your time and don't cut into the template.

At the router table, place a flush trim bit with a bearing on its tip in the router and adjust the height so the bearing rides on the template. Route the assembly to give yourself two perfectly matched pieces. Head back to your bench and place a blank into the 90° jig. Next, put three or four drops of medium Instant Bond CA adhesive on the assembly and spray accelerant on the blank. Lay the assembly on top of the blank and let it set for a few seconds. Turn



A Curved Form – The exact radius for the form isn't important, so Der-Garabedian uses a thin piece of material to give him an even curve to trace.



Flush the Joints – Once the first piece is shaped and smoothed, Der-Garabedian adds a layer to either face of the initial piece and flush trims those pieces on his router table.

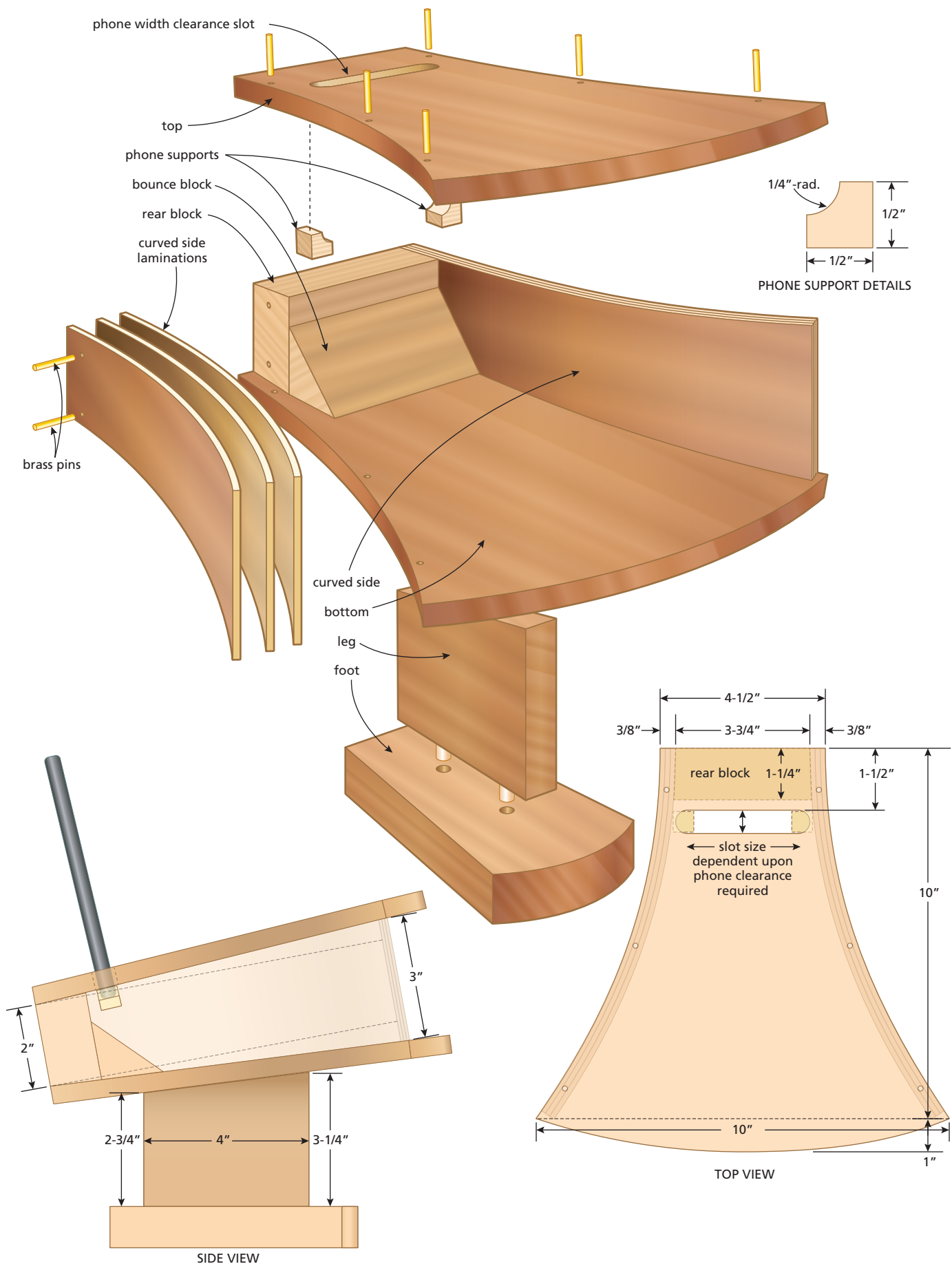
the new assembly over and drive in three screws, once more keeping them close to the edges.

A few more touches

Keep repeating the steps with each blank and in short order you'll have a form that is 3-3/4" wide. Sand any sharp edges and apply packing tape to the form so your lamination doesn't stick to it. I drilled four 1-1/2" holes completely through the form to accommodate the pads on my F-clamps. Adjust the position and hole size to work with the clamps you have in your shop. To find the positions of the holes, place the clamps perpendicular to the curve. Remember to avoid the screws holding the form together. One other addition is to place two small blocks on one side of the form to help align the laminations during the gluing process. These blocks are roughly 3/4" thick by 1" wide by 4" long. Cover these with packing tape before screwing them to the form between the clamps. Make sure they are at least 1" above the curved surface as four pieces of 1/8" hardboard will be used as clamping cauls.

Slice and dice

I wanted to make the curved sides of the speaker 3/8" thick to make it light yet easy to join to the top and bottom. This will



Materials List

Part	Qty	T	W	L	Material
Curved Sides	2	3/8	3 to 2 tapered	10	Three plies of solid walnut
Rear Block	1	1-1/4	2	3-3/4	Walnut
Top and Bottom	2	7/16	Between 4-1/2 and 10	11	Walnut
Bounce Block	1	1-1/2	1-1/2	3-3/4	Hardwood
Phone Supports	2	1/2	1/2	1/2	Hardwood
Foot	1	1	2-1/2 to 3-1/2 tapered	6	Walnut
Leg	1	3/4	2-3/4 to 3-1/4 tapered	4	Walnut
Brass Pins	16	1/8 diameter		7/8	Brass



Clamp Holes – Holes to accept the clamp jaws can be added to the form. This allows the user to add clamping pressure perpendicular to the joint over the entire curve.

require three 1/8" thick pieces for each side. When laminating wood, the thinner the individual slices, the easier they are to bend. While our bend is not too radical, it is made easier with thinner slices. Thinner slices mean less spring-back when the lamination comes off the form.

Start off by milling a piece of walnut or wood of your choice 1-1/2" thick by 3-1/2" wide and 15" long. Longer and wider allows some wiggle room to clean up the laminations after the bend is formed. It also lets you select the part of the curve that suits you best. Set the bandsaw up to re-saw 3/16" thick laminations. Depending on how well your bandsaw is tuned up, you might need to take the last lamination from another

section of the plank. Whenever I make laminations, I mark up one edge with a woodworker's triangle to keep the laminations in the same order in which they came off the plank. By gluing up the laminations in this same order and using white glue, which dries translucent, it makes the lamination look as if it grew in this particular shape. Even though the edges of this project will be covered, it's a good practice to follow.

The process is to re-saw a piece and set it aside. Next, run the rough side of the remaining plank through the thickness planer and re-saw once more. Keep repeating the process until you end up with six pieces. Now run these pieces through a thickness planer until they're 1/8" thick.



Thin Layers – Der-Garabedian resaws thicker stock to obtain six laminations 1/8" thick. Notice the cabinetmaker's triangle on the upper edge of the stock so he can glue the layers up how they were cut from the board, ensuring even grain and colour.



Cabinetmaker's Triangle – Used to keep track of multiple parts, a cabinetmaker's triangle is helpful in many situations. These parts are cut from one piece of wood and will be glued up as they were cut from the board.

Around the bend

Almost every time I use clamps, I'm also using cauls. In this case, to accommodate the bend, I'll use four pieces of 1/8" thick hardboard to help spread clamping pressure and mitigate against flat spots on the lamination. Cover one of the four cauls with packing tape so it doesn't become a permanent part of the lamination. Complete a dry run of the clamping process to see if there are any spots along the bend that need more pressure in the way



Time for Glue – Apply glue to the laminations and get them onto the curved form. Thankfully, with only three laminations there's no need to rush.



Grain Matching – Because the grain on the board Der-Garabedian started with ran on a slight angle to its edge, once the board was resawn in half and bookmatched, a slight fan pattern is visible on the top and bottom panels.



One Straight Edge – A jointer will make quick work of the curved laminations, giving you one straight edge to work with.



Rip It to Width – A bandsaw will give you the width you're after.

of more clamps. If you need to add another clamp, offset the hole in the form a little lower than the others. In my case, I found that the ends could use some help. For the top of the curve, a clamp and caul worked great. For the bottom I needed to add a 45° block allowing pressure to be applied inline without slipping. Add this block using glue, and either brads or pins.

Cover your bench with newsprint and gather your laminations, glue and clamps. Spread glue on the joint faces of the three laminations and stack them on the form. Add the cauls, making sure the taped one is facing the lamination, and start clamping. Check to make sure the pieces are lining up and, if necessary, tap them back towards the side blocks. While there is some wiggle room, it's better to take care of misalignment before the glue sets.

I like to leave bent laminations pressing for at least 24 hours. When you remove the clamps, chances are you'll see some spring-back, especially if you used a PVA glue such as white glue. PVA glues don't dry rigid and have what is called cold creep. On our curve this means there will be a spring-back of approximately 1/8" from each end. With this in mind, it's good practice to make the curved parts of a project first and match the remaining parts to it. Repeat the steps above for the second set of laminations.

Top and bottom

To make the top and bottom of the speaker I re-sawn a part of the plank that had the grain running off at a slight angle to the edge. Bookmatching the two halves created a fan pattern that complements the shape of the speaker. I started with a piece long enough to get both the top and bottom, as well as trim off any snipe. However, a few passes with a hand plane could easily remove it just as well. Having the top and bottom slightly thicker helps with the joinery and also better accommodates the base. With this in mind, mill the pieces to 7/16" thick. After jointing and bookmatching, I ended up with a width of 11-1/2" and a length of 24".

Squared and tapered

At this stage, it's time to clean up the bent laminations before tapering their widths. Do several test fittings to see the overall shape of the speaker. Position your phone at the rear and get a rough shape and length of the speaker. Mark this on one curve and trim to your marks on both ends. Stabilize the lamination on a crosscut sled by using clamps and a wedge to support the curve. To



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FESTOOL



Consistent Results – Der-Garabedian uses his table saw crosscut sled to obtain consistent results when crosscutting the laminations.

Not Too Cramped – Though you don't want the inside of the speaker cavernous, you don't want it too tight, either. A bit of room at the end of the speaker for your phone is all you need.

transfer the length to the other curve, stand it on top of the other, as opposed to placing them side by side, and make your marks. Cut this curve as before.

Head back to the bench and place your phone once more between the curves to see if you're happy with the shape. Trim some more if you'd like. I wanted to flare the curve out a bit more and this was easily accomplished by cutting angles on the ends of the rear block. Be sure to stay within the size limits of the panel for the top and bottom. I used a sliding bevel and ended up happy with a 5° angle. Mill up the rear block and cut this angle on both ends using a table saw or bandsaw.

To make the template for the taper, I used some wiggle wood the same length as the inside of my curved pieces. The taper that seemed pleasing was a 2" width at the back to 3" up front. Cut this on the bandsaw and refine it with a jack or block plane. A bird's mouth holding jig like the one in the June/July 2021 issue does an excellent job of holding the curves while you plane them. Keep comparing the two curves to each other, making them as close to



How Wide? – Der-Garabedian sets the ends of the sides at a right angle, then measures how wide the top and bottom panels need to be.



Taper the Sides – A template makes it easy to mark the two sides evenly.

identical as possible because they will eventually sit in the speaker. However, being off a little won't really hurt the sound.

Start assembling

Once you're happy with the curves, glue the rear block in place. Sit the block on your bench and clamp the curves to it. Transfer the width of the curve to the block. Leave this width to the larger portion of the curve instead of trying to make a compound cut. I find it much easier to flush it up after the glue has cured with a block plane rather than try to hit the angles at the table saw.

I had a few 1/8" brass rods left over from a previous project and since brass and walnut look good together I thought I could not only add some support to the joints but some pizzazz, too. Lay out and drill 1/8" holes 3/4" deep, centered on the rear block and equidistant from the centerline of the sides. Using a small hack saw, cut the brass rod approximately 7/8" long. Cut 16 pieces in total.

Use regular white glue for the wood-to-wood contact and mix up a small batch of epoxy for the brass. I had five-minute epoxy on hand, but longer-setting epoxy will work perfectly well. Use cauls and clamps to complete the assembly.

Flush, flush, flush

Once the assembly has fully cured, clamp it in your vise and file the brass rods flush. I started off with a rougher, 2nd cut file and switched to a finer file as I got close to the surface. There will be some final sanding later so don't worry too much about a few errant file marks.

Use a block plane to flush the rear block to match the taper on the side pieces. The back will be somewhat uneven, but this will be smoothed out later.

Blue tape to the rescue

Lay down some blue tape on the center of the panel for the top and bottom. Use blue tape to also define the center of the rear and front of the assembly you have so far. Mark these clearly with either a sharp pencil or fine black marker.

Set the assembly on top of the panel to determine its position. This will be done several times to determine the length of the top and bottom as well as to transfer the shape of the sides. I thought it



Two Adhesives – White glue works well on wood, but it won't hold the brass pins well. Der-Garabedian mixes up some two-part epoxy to secure the pins once the joint is together.

would be visually pleasing to add a bit of a bow to the front edges of the top and bottom so I cut these approximately 1" longer. Cut the top and bottom to length, then place the assembly back on top of each piece and pencil in a curve at the front as was done before, using a thin piece of wood and clamps to hold it in place. Using an offset wheel gauge or a small washer, trace the outside of the sides onto the top and bottom. Cut this out on a bandsaw and only refine the shape of the front by sanding. In fact, it's easier to tape the



Block Plane to the Rescue – A block plane will smooth out any unevenness in the joints and allow the top and bottom panels to sit flush on the sides.

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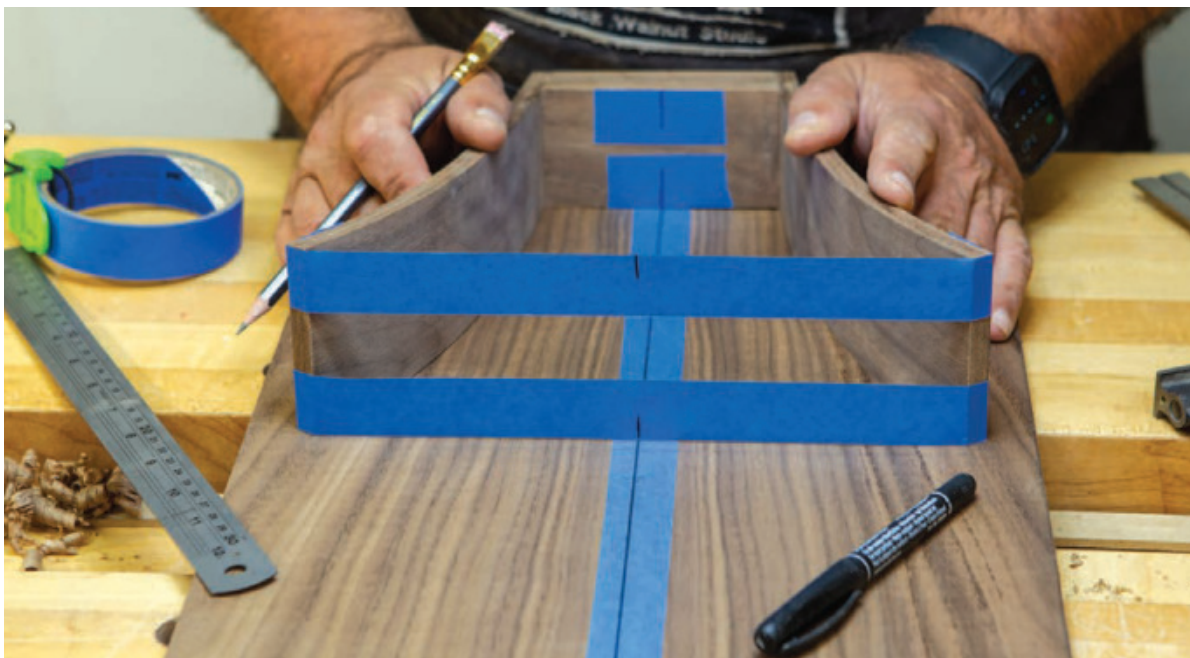
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Strong Visual Effect – Wanting to make the most of the fan pattern on the top and bottom panels, Der-Garabedian does everything he can to ensure the top and bottom are centered.

top and bottom together and sand their fronts as one piece. Leave the sides rough and proud for now. They'll be flushed in much the same manner as when the form was made.

Pins, but not needles

With the top and bottom shaped closer to final size, it's possible to more accurately locate the brass pins. Mark the top and bottom pieces to make sure they will always be properly oriented. The brass pins are placed 1" in from the front and back of the speaker. Another pin will be located in between these two on both edges. A cloth measuring tape made for tailors is a perfect way to follow an odd shape such as this one. Using a cordless drill fitted with a 1/8" brad point drill bit, drill these holes, making sure to hit the centre of the sides. I found the centre by measuring the overhang and adding 3/16". Mark the spot using an awl and repeat for the rest, as well as for the six on the bottom.

Since the rear block is 1-1/4" thick I started the slot for my phone 1-1/2" from the back. My mortise ended up being 9/16" wide as I wanted to use the speaker while keeping the protective case on my

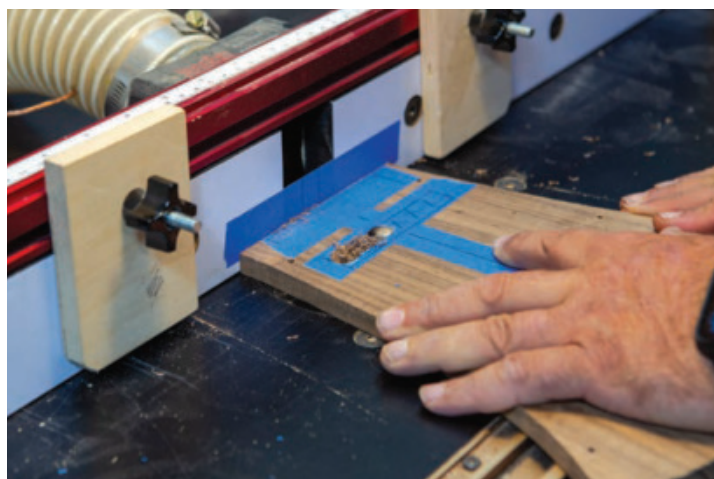
iPhone. Centre this mortise on the top according to the size of your phone with some clearance to let it slip in and out. While routing this groove make sure the flat, rear edge of the workpiece stays in contact with the router table fence. It's easy for it to shift, causing the groove to be unsightly or something worse. You could also rout this groove before or after using a straightedge clamped to the workpiece while moving the plunge router.

Some additional parts

To make sure the phone doesn't drop through and come to rest on the bottom, make supports that are small enough to hold the corners of the phone yet not block the speaker. Once more, this is dependent on the make and model of your phone. Supports can easily be made by taking a small, square piece of wood 1/2" thick and 1-1/2" square. Drill a 1" hole through the center and cut it into four pieces. You'll need two pieces which will eventually be glued to the underside of the top. With the top dry-fit



Another Arc – With the top and bottom located on the sides with brass pins, Der-Garabedian draws an arc on the top and bottom panels.

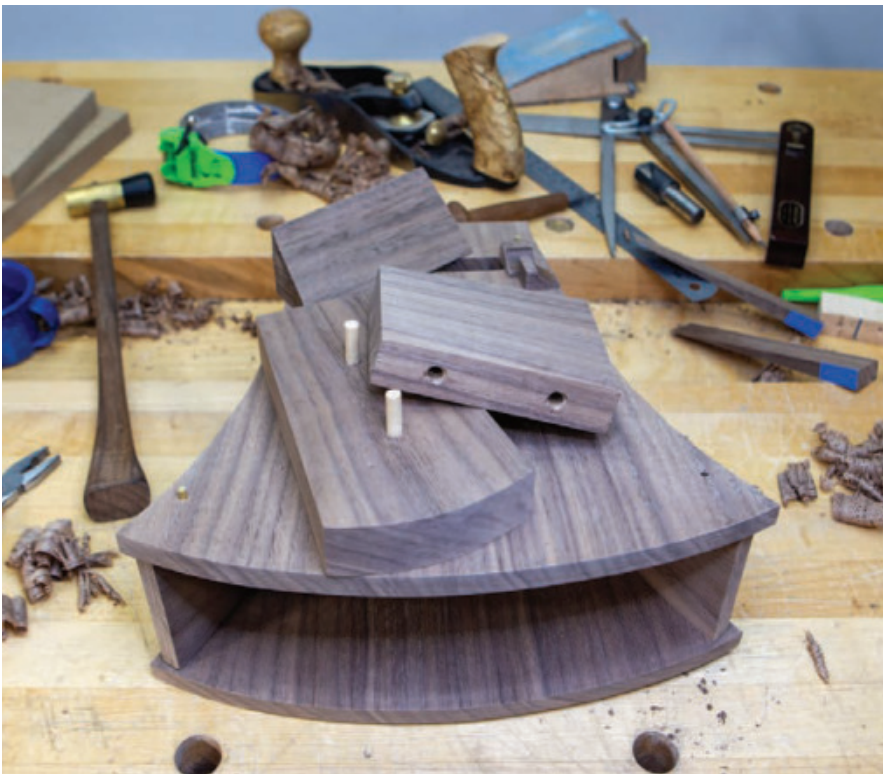


Phone Groove – Der-Garabedian routs the phone groove on his router table, but an alternative method would be to clamp a straightedge on the top panel and use a plunge router to plow the groove.



Little Supports – Small blocks are machined and attached at either side of where the phone will sit, immediately below the groove. Larger blocks may stand the test of time better if kids are going to be using this speaker.

speaker will bounce the sound waves straight into the bottom. In practical use, this worked well, but while experimenting I found that placing a piece of walnut cut at 45° against the rear block improved the output. With the curves and tapers of the speaker, fit this bounce block as close as you can. It doesn't need to be a perfect fit for it to work.



Ready for Assembly – With the parts machined, it's time to bring them all together. Der-Garabedian chose to apply a finish to the parts first, as getting inside the assembled speaker might be a bit tight.

into place, adjust the supports as necessary. If you know you're rougher with things, make these supports a bit larger. You don't want them to break down later.

I'm not a sound engineer, but I imagine that sound waves bounce similarly to billiard balls. With the phone sitting perpendicular in the top's slot, the

The base

The base is made from two pieces of walnut. The foot has a similar shape to the speaker, but with a straight taper from front to back rather than curved. The top of the leg is angled backwards at approximately 7° to project the sound into the air, should the speaker be sitting

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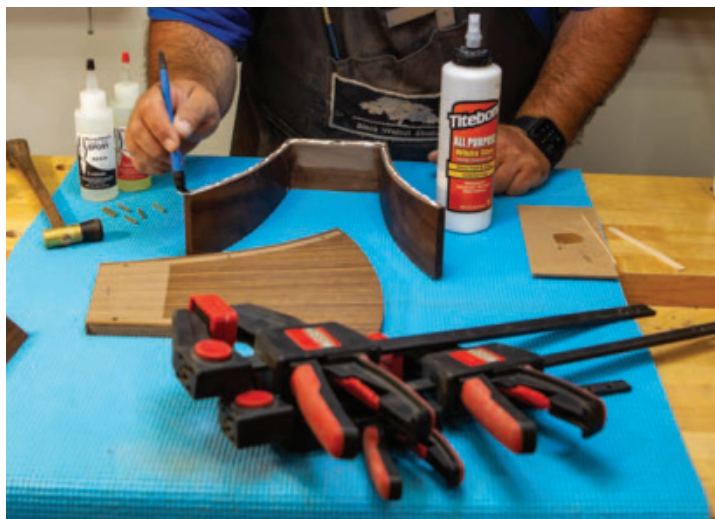
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Finishing Time – Der-Garabedian applies a few coats of finish to the inside and outside of the parts. Blue tape protects the glue joints from getting any finish on them.



Careful Application – So glue doesn't squeeze out everywhere, apply it sparingly and with a small brush.



Small Phone Supports – CA adhesive does a great job at fixing the small phone supports to the sides.



Flush the Pins – Once the epoxy has cured, use a file to smooth the brass pins.

on a desk or shelf. Centre the leg on the foot with a pair of 1/4" dowels 1" in from each end. Drill for 1/4" dowels at the top of the leg with the same positioning, keeping in mind this surface is angled. Add a clamp and clean up as needed.

Start the finish

While I could fit my hands into the assembled speaker, I thought it wise to add the finish before final assembly. I opted for Osmo

Polyx-Oil, but any finish will do. Sand all parts inside and out. Mask off any areas that will get glued. For the top and bottom to the sides, I placed masking tape along the inside edges of the top. I dry assembled the top to the sides with a pair of pins and then, using a scalpel style of knife, I carefully cut away the exposed tape. Do the same for the bottom and don't forget to tape the sides. I applied two coats of finish to the inside and one to the outside, knowing that touchups would be needed along with an outer second coat.

shopnotes

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Flush the Top and Bottom – With the speaker glued up, use a flush trim router bit to even out the joints at both sides.

Once the finish has cured, dry assemble the top to the sides, and using both regular woodworking glue and Instant Bond CA adhesive, glue the phone supports to the inside of the top. Leave a paper-thickness amount of space between the back of the supports and the sides to prevent hindering assembly of the speaker. Later, epoxy will be added to fully lock these in place.

Next, glue the bottom to the sides using glue on the contact points and epoxy in the holes for the brass pins. After dry fitting two pins and locating the bottom to the sides, apply epoxy to the remaining four holes for the pins. Drive these in and then remove the first two. Add epoxy and drive the last two pins into place. Add clamps and let the assembly cure. After removing the clamps, glue the 45° bounce block to the bottom.

To find the mounting point on the speaker's bottom for the base, place a piece of folded sandpaper on the top of the leg and place the speaker on top. Place your phone in its slot and move the whole assembly back and forth until you find a good position that's balanced. Center this left to right and if you bookmatched as I did you will already have a center line. Drill the two 1/4" holes in the bottom about 3/8" deep.

Last little touches

Glue the top to the assembly using the same steps as you used for the bottom. Don't forget to add a small amount of epoxy to the phone supports where they face the sides.

Once the assembly is out of the clamps, use files as you did before to flush the brass pins to their respective surfaces. Next, head back to the router table with the flush trim bit and flush the top and bottom to the sides. Since the top and bottom extend past the front of the sides, pay attention to where you start and stop the cuts. Use sandpaper to round over those points and flush them to the sides. Use a block plane to flush the back of the speaker. Glue the base to the speaker using cauls and a deep-reaching clamp to apply pressure while it cures. Clean up any scratches and apply the final coat of finish followed by a fine furniture wax.

I'm looking forward to listening to my new audiobook while working around the house or the shop. You can add a charger cable to the speaker by drilling a hole in the bottom and feeding the cable through. You can also add a support for your phone behind it, should you feel it is not held securely.

If you've never tried bent lamination, this is a great project to get



Bring It All Together – One clamp will provide enough force to bring the speaker, leg and foot together for good.

you started. If you have, try your hand bending with a vacuum bag, some wiggle wood and veneer. I've already started to make another smartphone speaker as I've caught my girlfriend eyeing this one.

STEVEN DER-GARABEDIAN
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MAKE A TREADMILL LAPTOP DESK



If you work on a laptop for much of the day, you'll feel better if you're able to move while working. A laptop treadmill desk is the perfect project to improve your health and get more work done.

BY ROB BROWN

I have two jobs, and in many ways they're opposite from each other. When I'm building custom furniture I'm usually standing and moving. When I'm taking care of my magazine tasks I'm almost always doing one thing: sitting. I think a mix of standing and sitting is good, but the problem I usually have is when I stand for most of

one day and sit for most of the next day. My back is usually sorer after sitting all day than standing. That is, until I made my first treadmill desk for my laptop.

Take care of yourself

I find that after sitting for long periods of time my back aches and I generally feel worse. Getting up regularly, even for a minute or two, will help me feel a bit better, but the most

Photocomposite by Rob Brown/ Shutterstock

helpful thing for me to do is to simply not sit for much of each day.

I do all of my editing work on a laptop. A few years ago, I made a very rudimentary (ugly) stand that fit on the display panel of my treadmill to hold my laptop while I used it. It looked awful, but it did the trick. I was able to break up all the sitting on my magazine days, and I always felt better at the end of the day. Then my treadmill broke, and the ugly treadmill desk didn't fit on my new treadmill. The solution was simple; make a new treadmill desk, this time taking care to make something more visually appealing.

Are we just creating different problems?

If you do too much of anything your body will rebel. The purpose of this treadmill desk isn't so you can walk for eight hours every day while working on your laptop. The aim of this treadmill desk is to give you another option for how your body is positioned while going through your workday. Like sitting, if you spent too much time using a treadmill desk, you would probably quickly develop wrist and forearm troubles, not to mention other potential upper body, and maybe even lower body, injuries. I'm certainly not trying to scare you away, as this treadmill desk has worked wonders for me. But as my doctor says, everything in moderation, and I find this treadmill desk is great for breaking up long sitting periods and allows me to burn some extra calories while working. A half hour here and there is enough to have me feeling much better by the end of the day.

Laptop position is critical

Before you go too far down the design path, seriously consider three things when positioning a laptop on your treadmill. If your laptop keypad isn't positioned properly, your upper body, and maybe your back or lower body, will be sore after using the desk for even a short period of time. This is the opposite of what we're trying to accomplish.

The first consideration is laptop height. While walking, the keypad and tracking pad should be at a comfortable height. In a perfect world you wouldn't feel the need to lift your shoulders towards your ears to better position your hands. I'm no ergonomic expert, but I think a 90° angle at your elbows would be great, though I doubt the geometry of most treadmills would allow for this. I found that if I position my elbows slightly in front of my body while using the treadmill desk, my elbows are somewhat close to 90°. My shoulders are relaxed during use, mainly because my wrists are supported in front of my laptop, taking the weight off my shoulders.

The second consideration is the distance of the laptop from the user. The keypad should be close enough so you don't need to reach too far to use it. If the laptop is too far forward, you have to reach for the keypad, causing upper body stress. Also, when considering this dimension keep in mind where your feet are landing on the treadmill with each step during use. If your wood treadmill desk is positioned too far forward, you'll have to walk more towards the front of your treadmill and your toes might come into contact with the plastic guard at the very front of the walking belt with each step. This would be frustrating as well as maybe unsafe.

The third consideration is keypad angle. If the front of your laptop is positioned too low, the upper portion of your forearms will have to constantly flex to keep your fingers high enough to type. Although I'll get to the details shortly, incorporating a wrist support into the piece of wood that supports the laptop helps. This takes the



Learn from the Past – My first treadmill desk was ugly, but it worked. A plywood base with a laptop support and a pair of cleats to fix the treadmill desk to the treadmill are all you really need.

weight of your arms off your shoulders and positions your hands over the keyboard comfortably. As long as the wrist support is at the right height, your hands and wrists should feel fine after typing for an hour or so.

Form follows function

Making the desk fit the treadmill and hold a laptop at the correct position was important. First on my list was to design with the above three main points in mind to ensure it worked well and fit me comfortably. Making the treadmill desk look attractive was easy.

Every treadmill is different, though they almost all have some sort of cavities, ledges or rails near the display area. Although you'll need to figure out how to design your treadmill desk so it stays on your own treadmill display and holds your laptop, I'll take you through the process I used and give you some tips on how to ensure your treadmill desk functions flawlessly.

Make a rough model

The simplest thing to do is to make a quick and dirty model with some rough material. I started by cutting a rough piece of plywood (particleboard or MDF would also work) to the size I thought would work. For me, this was 19" x 16". I would suggest cutting your piece on the large side now, as you can always trim it down after positioning it on your treadmill. Remember, this first step is just rough, so don't worry about precision or beauty at this stage. You could probably even use a fairly rigid piece of cardboard if you had some. I placed the piece of plywood over the display area to see what my next step would be.

Add some arms or cleats

When considering how to support the main surface of your treadmill desk, a good rule of thumb is to ensure the four corners of the desk are either supported or at least come into contact with the treadmill. This will ensure the desk stays put during use. This isn't always possible, but the closer the contact points are to the corners of the display, the more stable the desk will be with a laptop on it.

In order to keep the desk in place you'll need to add some bits and pieces. The first treadmill desk I made had a wide horizontal



Start Rough – In order to get a good idea of how large to make your treadmill desk, and whether it will be comfortable and stay in place, it's a good idea to make a very rough model. Brown started with an old piece of plywood and screwed an arm to either side. He could then put it in place and start to get an idea of how it would work.

handrail towards the user, so I made two short arms with curved ends to fit over the rail on either side of the plywood base. This kept the desk from falling. The side of the desk that was away from me was positioned so it just rested on a wide horizontal rail on the display. This meant the four corners were supported and wouldn't go anywhere while in use.

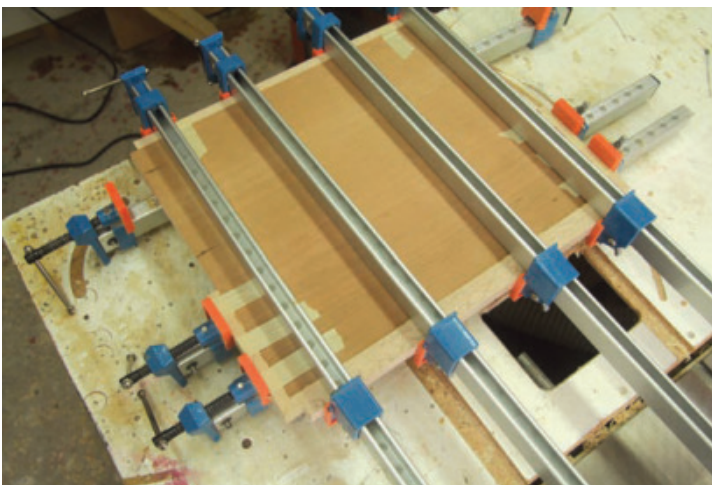
My new treadmill had a number of cavities and protrusions to work with. The largest and simplest were the two holders on either side of the main display for a water bottle or accessories. I made two simple arms that could be attached to the sides of the base and protrude into the cavities. After returning to the treadmill, I screwed the arms to the sides of the base and tested it out for stability. The only other things I needed to keep the desk from moving during use were small spacers that would support the user-side of the desk on a pair of small handrails, but I'd wait to sort out this detail until I had a chance to put the nearly completed desk on the treadmill and see how it fit. With these general measurements and details, I was ready to start making the real thing.



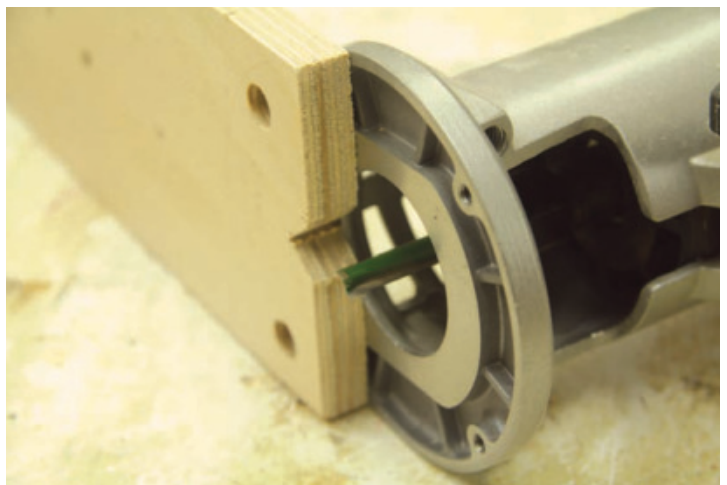
Matching Grain – Brown cut the two pieces of side edging from one length of wood so the grain and colour would be continuous and even across the edge of the treadmill desk.



Trim the Arms – With the arms glued in place, trim them flush with the upper surface of the desk. Brown used a Japanese flush trim saw.



Glue on the Edges – Once the position of the two arms was determined, Brown added two short pieces of mitred side edging to either side of the base. He then added a mitred piece of edging to one long edge.



Flush Bit and Base – With a small piece of plywood attached to the base, adjust the height of the base so the underside of the plywood is perfectly flush with the end of a straight router bit.



Trim the Edging – As the plywood runs on the treadmill desk base, the router bit trims the edging flush. Take your time, as multiple passes are needed, especially if you're using a narrow router bit.

Basic dimensions

Everyone's treadmill desk will likely differ, but to give you an idea of some of the dimensions I landed on, here's a quick list. The base is 18" x 15" and the edging is 5/8" thick. The arms are 1-1/8" wide. The laptop support is about 3-1/2" high, 13" wide and 7/8" thick.

The real deal – the base

After seeing my model sit on the treadmill, I decided to shrink it a little in both directions to help the arms fit into the cavities a bit better, plus the extra depth wasn't needed. The location of the arms on the model worked great, and with a pair of small supports on the underside of the base it would be supported near all four corners.

For the base you can either use a piece of pre-veneered 3/4" thick plywood or apply some figured veneer to a piece of plywood. With it cut to size, I milled up enough lengths of edging to cover the four sides with a bit left over for the two arms.

Mitred corners make for a very clean look. I cut the mitred corners on my table saw with a sled, then glued them in place. I started with the long edge away from the user side of the desk. When that was dry, I added two side pieces that extended part way across the sides. They stopped to make room for the arms, which were next to be cut and glued in place. Because the arms extend away from the base, and they're only fixed to the base with a small amount of surface area, I made sure to butt the arms into the ends of the first two pieces of edging on the side of the base. And by applying pressure



Round Over – Ease the edges with a round over bit. It's tricky working around the arms on the underside of the base, but do your best to keep the router steady and moving or you may have to deal with gouges and burn marks. A small round over bit is much more forgiving than a large bit.

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Some Hand Tools – Brown uses a flush cut saw to trim the edging where the router wouldn't reach. To further fine tune the joint, a sharp block plane and chisels are the answer.



Track Pad Clearance – The track pad on Brown's laptop is close to the front edge of his laptop, so he had to relieve the center section of the laptop support. A stopped cut on the table saw, followed by a 45° saw cut, allowed Brown to use a chisel, file and sanding block to adjust the opening so it was functional and comfortable.



Laptop Support – Determining the height of the laptop support needs to be done at the treadmill with the desk in place. While you're in the shop, make the laptop support higher than needed, then test it for comfort on your treadmill and adjust it later.



Attach from the Underside – Once the best location is determined, the laptop support gets fixed in place with a few screws. Brown didn't use any glue, as he knew a new laptop would likely need to have a new laptop support made. He plugged the holes, but didn't use glue while installing the plugs. A friction fit keeps them in place and a few coats of finish also help.



Check the Fit – Brown placed the desk on his treadmill to check it for fit and comfort. Not only does it need to stay put on the treadmill and be steady, but it has to be comfortable. Here, Brown measures for the small support blocks on the underside of the desk. These will stop the desk from tilting and shifting when the desk is in use.

to the next two pieces of side edging strips, the arms would be locked into place even more solidly. Hopefully, an errant bump down the road wouldn't cause the arms to get knocked off.

Once the arms were glued in place, I took the desk back to the treadmill to double-check its dimensions. At this point I realized the arms didn't need to be 3" long. The extra length only made them more of a target and would provide more leverage if a knock did happen. I trimmed them down so they extended only about 1-1/2" beyond the base.

Trim and round over the edging

Next, I had to trim and round over the solid wood edging. I did both of these steps with my router. It was tricky around the arm, because I couldn't trim the edging flush with the underside of the base, but a flush cut hand saw and a chisel worked just fine.



Multi-Purpose Supports – These small blocks give some strength to the arms so they are less likely to break. They are also dimensioned and positioned to come into contact with the treadmill to ensure the desk is stable while in use.



No-Slip Tabs – Although you should never transport your laptop in the treadmill desk, Brown often forgets the rules of common sense. He sometimes lifts the desk with his laptop on it to adjust the speed or inclination of the treadmill. Though he hasn't dropped his laptop on the ground yet, these tabs will help keep the laptop from falling off the desk.

I started by rounding over the edges even though the edging wasn't flush. This just removed material that I didn't need to deal with while flushing up the edges. I used a router attached to a simple base jig to trim the edging. The jig was a flat, rectangular piece of 1/2" plywood, but it was attached to the router's base so it only covered about 40% of the base. A straight router bit protruded from the router so it was perfectly flush with the underside of the rectangular jig. The plywood jig ran on the plywood base of the treadmill, and I moved the router so the bit trimmed the edging flush with the plywood. I could only get within a couple of inches of the protruding arms, so I eventually used a flush cut saw, some hand tools and a sanding block to flush the edging in that area. When the edging was flush, I ran the round over bit around the edging and the arm once again.

Laptop support

I machined the laptop support on the tall side, then tested it in place before ripping it to final height. I also added a 1/4" groove close to the top of the support to hold the front edge of my laptop. I headed to the treadmill with the main section, the laptop support and my laptop to check out the ergonomics. The laptop support wasn't attached to the main section yet. To my surprise, the height of the laptop support was pretty much perfect at about 3-1/4" wide.

Every treadmill is different, though, and every person is different, so how high yours should be may be completely different. I ended up with the base of the treadmill desk sitting at about 30° off level, while the keyboard of my laptop sitting at about 10° once it's in position on the treadmill desk. The overall height of the front edge of your laptop relative to your body is an important consideration. If I were to just stand on my treadmill, the front edge of my laptop is at elbow height.

If you have multiple laptops in your house, you could make the laptop support edge removable to accommodate other laptops. The thickness of the leading edge of a laptop keyboard differs between brands, and the groove might have to be different. The front edge of my laptop is quite thin. Also, the height of different users may require a laptop support to be specific to each person. Some simple knock-down fasteners and maybe even some jig hardware could be used to make laptop support changeovers quick and tool-free.

Comfort counts

While in use, my wrists rest on the top edge of the laptop support so the edges and surface need to be smooth and comfortable. I bevelled the top edge at about 15°, then heavily eased

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all the corners. I also removed some material near the center of the laptop support so I could more easily access my track pad. Even though my laptop support edge was only 1/4" higher than my track pad, it interfered with its use.

With my last treadmill desk I would lift the desk while my laptop was on it so I could adjust the speed or incline. It wasn't a smart thing to do as my laptop could slide off, but I know I will try that trick again with my new desk. To help keep the laptop from sliding off while the treadmill desk is being held for a moment, I added a small tab on either side of the slot that holds the front edge of the keypad. When complete, the laptop support gets screwed to the base from the underside.

Balancing act

It's important the treadmill desk is stable while in use on the treadmill. Supporting the four corners makes it super solid, but might not be easily done. Any touch points create a more stable desk.

The far edge of my treadmill desk was supported across most of its width. At the edge closest to me, the desk was supported in the center. The base was pretty stable, but it didn't take much to cause it to shift a bit. I added a short strip on the underside of the base, directly beside the arm. This supported the left and right side of the desk, while also providing the arm with some structural integrity, as I glued it to both the base and arm.

If you want to go that extra mile, you could drill a hole in the desk so you could hang it on a wall or maybe a hook attached to the treadmill. I find that when something has a specific home it

usually makes it back there, otherwise it gets kicked around and damaged.

Finish it off

Pretty much any finish will do. Extreme durability isn't needed. This treadmill desk isn't going to see any rain or direct sunlight. The only real considerations are ease of application and the look of the wood; both of these differ from woodworker to woodworker.

I chose a urethane aerosol spray from Varathane. I like the look of it on cherry and maple, and I had some in the shop. An aerosol spray can also make it easy to get into all the nooks and crannies of a small project like this.

At this point it was time to grab my walking shoes and cancel my next chiropractor appointment. A bit of movement is the best medicine for my aching back.

Rob thinks it's not a surprise this is the first article he's written with his new treadmill desk. His back is feeling better already.



ROB BROWN

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MAKE A FULLY ADJUSTABLE TABLET STAND

Finally, a tablet stand that
isn't a pain in the neck.

Photos by Gord Graff
Illustration by Len Churchill

Despite the popularity of tablet computers, especially as a way to stay connected with family and friends during Coronavirus restrictions, tablets have one thing in common: using them can be a real pain in the neck... literally. Using a tablet when it's resting on a table at a slight angle or on a countertop creates uncomfortable neck strain. Even the available folding tablet stands and cases fail to raise the tablet high enough for prolonged, comfortable use while you're sitting or standing.

The solution is simple: raise and tilt the tablet to a comfortable viewing height. Because of its adjustable height and adjustable viewing angle, this tablet stand makes it much more comfortable to use a tablet for prolonged periods of time. Whether you're sitting at a desk or table, or standing at a kitchen counter or a workshop workbench, your tablet viewing from now on will no longer be a pain in the neck.

The building process

I chose hard maple for this project, but the design lends itself to any species you may choose. All of the 3/4" thick parts can be easily obtained from a single board 7-1/2" wide x 6' long. The 1-1/2" and 1-1/4" parts can be acquired from a piece of stock 1-1/2" x 4" x 18" long. Both of these measurements leave plenty of room to avoid a few defects.

With the material jointed and planed to the required thicknesses, it's time to cut the stock needed for the 11" diameter circular foot glue-up.

First, the foot

Consider using boards with a pleasing grain pattern for the foot for maximum visual effect. After all, this panel will end up being the largest piece of the project so you'd like it to be visually appealing. I've glued up this panel oversized at 12" x 15".

Optional templates

Except for the 11" diameter foot, I've taken the time to make templates out of 1/4" plywood or MDF for each of the parts of this tablet stand. This part of the project is optional but working from templates makes building several tablet stands easy and I expect to make several more. It's also an easy way to determine the best use of a board.

Before starting, measure your tablet and make the appropriate dimensional changes to suit your tablet's size. When using the part templates, it's fast and easy to trace out the parts required on your material.

The upper and lower supports are traced out along the edges of the material to accommodate the router's fence used to rout a 3/8" wide x 3/8" deep groove using a 3/8" up-cut spiral bit.

With the groove routed in the upper and lower supports, and the other parts cut out on the bandsaw, you can now cut out the upper and lower supports to 1-1/2" wide using your table saw.

If you were to place the lower arm's template flush to the bottom of a board, the size of the board required would be 7-1/2" x 14-1/2", but you can use narrower boards. Here, I've used a 6-3/4" wide board and traced the lower arms on the material at an angle to gain the use of this narrower board and to take advantage of the



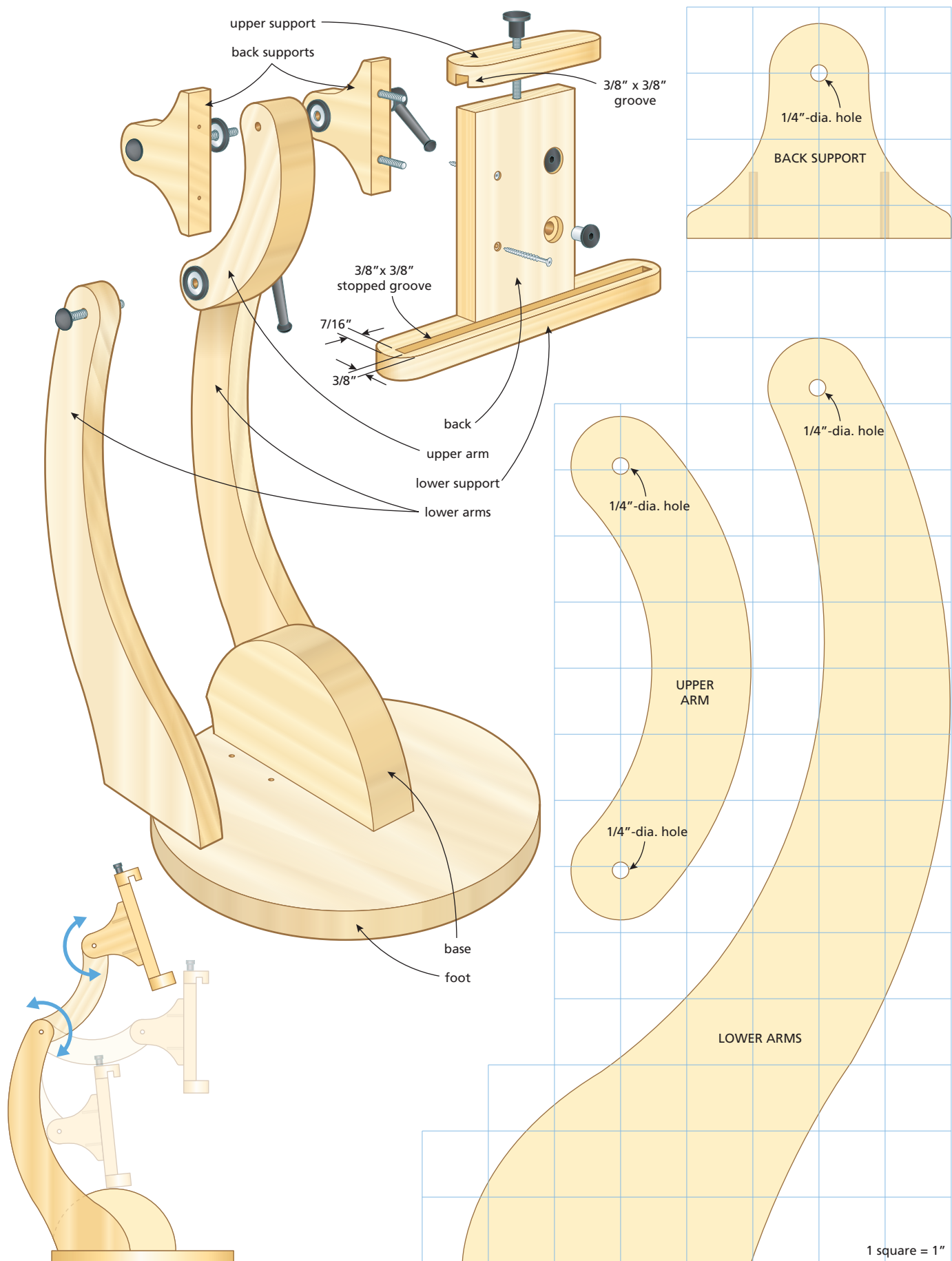
Laying Out Curved Parts – Though not required to complete the project, Graff made templates of the parts in order to best use the material he had. Curved parts are sometimes tricky to work with, so the templates made that aspect easier.



Joinery, Then Breakout – Graff routed grooves in a few of the parts before breaking the parts out of the large piece of lumber. Small parts are hard to rout, while a larger workpiece is easier and safer to machine.



Rip to Width – With the tablet groove in them, you can now rip the parts to final width before trimming their curved ends on the bandsaw.



Materials List

Part	Qty	T	W	L	Material
Foot	1	3/4	11	11	Maple
Base	1	1-1/2	7-1/2	3-3/4	Maple
Lower Arms	2	3/4	7-1/2	14-1/2	Maple
Back Supports	2	3/4	4	3-3/4	Maple
Back	1	3/4	4	5-7/8	Maple
Lower Support	1	3/4	1-1/2	10-7/8	Maple
Upper Support	1	3/4	1-1/2	5-1/2	Maple
Upper Arm	1	1-1/4	3	7-5/8	Maple

NOTE: All 3/4" thick parts can be derived from a maple board 7-1/2" wide x 6' long.

NOTE: All 1-1/2" & 1-1/4" thick parts can be derived from a maple board 1-1/2" x 4" x 18" long.

Hardware List

Name	Qty	Size	Details	Supplier
1/4" x 20 Carriage Bolts	2	3-1/2		Home Depot
1/4" Lock Washers	2			Home Depot
1/4" Flat Washers	2			Home Depot
1/4" x 20 Knob Handles	2			Home Depot
5/16" Flat Washers	4			Home Depot
Hose "O" Rings	4			Home Depot
1/4" x 20 Knob	1			Home Depot
1/4" x 20 Threaded Rod	1	3		Home Depot
#8 x 1-1/8" Wood Screws	2			Home Depot
#8 x 1-1/2" Wood Screws	6			Home Depot
1-1/2" Diameter Rubber Feet	4			Home Depot
1/4"-20 x 14mm Connector Caps	2			Home Depot



Angled Ends – Before breaking the lower arm ends from the blank, Graff trims their ends at the necessary angle. This would be hard to do once they're cut from the blank because there would be no straight edges to reference.

grain pattern. The result is the lower arm's bottom edges are not perpendicular to the edge of the board, but that's not a problem.

Using a digital angle finder, you can easily measure the angle of the base of the lower arm and transfer that angle to the table saw's mitre gauge and cut that exact angle.

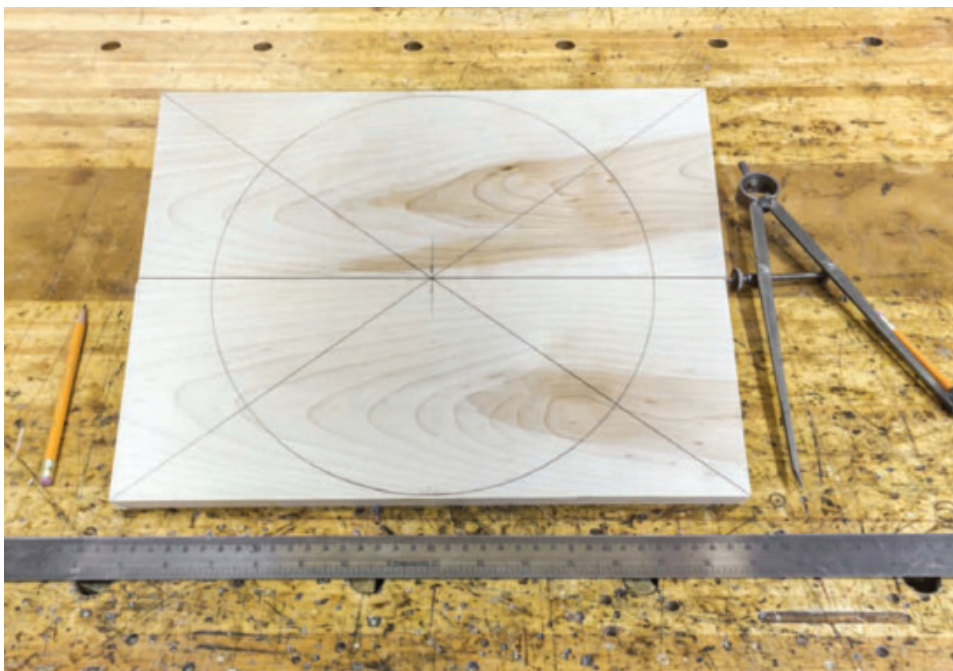
It's now time to take the foot out of the clamps, sand it and draw an 11" diameter circle onto the bottom side of the foot. Using a compass, pencil and ruler, place a center line and diagonal lines on the foot not only to find the center of the board but also to aid you in locating the position of the four rubber feet to be installed on the underside of the foot when the project is complete.

Before heading off to the bandsaw, there is one important step that needs to be done now; the installation of the two hanger bolts into one of the back supports. These 1" long hanger bolts have a wood screw on one end and 1/4" x 20 machine threads on the other. These hanger bolts and the 1/4-20 x 14mm connector caps can be purchased at any big box store.

Depending on your choice of material, the pilot hole required for the wood-threaded portion of the hanger bolt will vary. Typically, a pilot hole from 17/64" to 9/32" in diameter works nicely, but it's best to experiment on a scrap piece first. The hanger bolts are centered 2" center to center on the 4" wide back support. Drill the pilot holes in the end of the back support securely mounted on the drill press and then clamp it into a vise.



The Benefit of Templates – Graff used the lower arm template to carefully lay out the two parts on the blank. Without the template, much more material would have been wasted. Notice the angled lower arm ends marked in pencil.



A Round Foot – Some simple layout will give you the center point of the foot, along with the location of the four feet that will be installed later.

Using two 1/4" × 20 nuts tightened against each other, carefully thread the hanger bolt into the end of the back support by using a wrench or socket and a ratchet. When done, you can remove the hanger bolts and cut the piece out on the bandsaw. Doing this operation now, as opposed to after the wood part is cut out, reduces the chance of splitting.

Cutting out the parts on the bandsaw is next. Cut as close to the line as you feel comfortable, remembering that you'll need to sand to the line to get pairs of parts to match each other or to match the templates. During the sanding process, it's a good idea to check your progress against the template, slowly sneaking up on the finished shape.

At this point you should have cut out all the 3/4" thick parts and the 1-1/2" thick upper arm and the semicircular base. The next step is to resaw the 1-1/2" thick upper arm to an exact

thickness of 1-1/4". This thickness is critical. Check your bandsaw setup carefully by cutting a piece of scrap wood before cutting the project piece.

Once all parts are cut out, sand them to their final shape using an oscillating spindle sander or a sanding drum on a drill press to sneak up on the final shape using the template as a guide.

Drill some holes

It's now time to drill the 1/4" diameter holes in the upper and lower arms where indicated using a drill press. The upper and lower arms are 1-1/2" wide at their ends and the 1/4" hole needs to be centered on that width and 3/4" from the end. Drill the hole in one arm and use that arm as a template to mark the other arm or stack the first arm onto the second arm and, using the hole in the first arm as a drill guide, guide the drill bit into the second



Hanger Bolts – Before cutting the back support to size, drill holes for the hanger bolts and install the bolts into their ends. Doing this now reduces the likelihood of the parts splitting.



Cut Them Free – With the ends of the lower arms cut at the proper angle, it's time to bandsaw the arms from the blank.



Upper Arm – Graff rips the upper arm to final thickness on his bandsaw. This part is too short to be dressed with a thickness planer.



Smooth Curves – A spindle sander makes quick work of smoothing the curves on many of these curved parts.



A Small Trim – With the parts positioned in place, Graff marks where the base protrudes beyond the two lower arms so he can trim that portion off with a bandsaw.

The foot assembly

Using the center line on the underside of the foot, drill and screw the semicircular base to the foot, centered on that line so its edge is approximately 1/4" from the edge of the foot. Clamp the lower arms to the

base leaving approximately 3/8" of the base exposed. Following the profile of the lower arm, trace the lower arm's profile onto the base, disassemble it and cut that piece off on the bandsaw creating a flush base and lower leg connection.

Friction joints

The joint between the upper and lower arms (the elbow joint) carries the heaviest load. Simply tightening that wood-against-wood joint will eventually wear and slip with repeated use. The solution is to employ some type of friction between the wooden pieces of the joint and that friction can be accomplished by using rubber "O" rings. Yes, the same rubber "O" rings used in your garden hose are ideal for creating non-abrasive friction within this tablet stand.

The outside diameter of a 5/16" steel washer is perfectly sized for holding the rubber "O" ring while in use. Slip the "O" ring over the washer and they are ready to be installed in the joint.

With the lower arms securely clamped to the base, try fitting the "O" rings with the 5/16" washers and the upper and lower arm

Garden Hose "O" Rings

– To make a great friction joint between the upper and lower arms, Graff added an "O" ring to a standard 5/16" steel washer. When the joint is tightened the tablet will be fixed in place.



arm. The result is two arms with perfectly matched hole locations. Use one of the lower arms in the same manner to drill the hole in the upper arms and back supports.



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Start to Assemble

– Once they're machined to size, the lower arms, base and foot all get permanently secured together.

Threaded Rod –

Graff bores a hole to accept a threaded rod in the top of the back. The threaded rod will allow the user to tighten the hardware to provide downward pressure on the upper support to keep the tablet in place.



assembly together. You'll find with just a little sideward pressure against the upper arms, you'll easily manage to slide the "O" rings into place and the 1/4" × 20 carriage bolt holds everything in place.

Sand, then initial assembly

Now that you're confident the elbow joint will work well, it's time to glue and screw the lower arms and the base to the foot. Before doing that, take the time to break this assembly apart and sand each part thoroughly. Sanding these parts after assembly would be difficult. Now screw and glue the base to the foot. It's important to slide a 1/4" × 20 carriage bolt through the elbow joint in the lower legs to keep the arms parallel during the glue-up procedure. Glue and clamp the lower legs to the base and make sure the carriage bolt slides freely through the two holes in the lower legs. Beware of misalignment here and correct if needed.

Turn the assembly over and screw two 1-1/2" × #8 wood screws through the foot, into the bottom of each lower leg, through the pre-drilled holes and put it aside to dry.

Tricky Spot – A bit of careful placement will allow you to position the "O" rings and washers in place and bring that joint together.

shopnotes

Festool Cordless Track Saw

Sponsored: Festool recently introduced its new, cordless track saw featuring innovative technology and custom-designed blades for an incredibly efficient work environment. The TSC 55 K's first-of-its-kind Kickback Stop Technology protects the workpiece and improves user safety. Festool created an array of new blades with thinner kerfs and new teeth geometries to enhance overall performance with fast, precision cuts. Combined with its cordless design and seamless integration with Festool's family of dust extractors, the TSC 55 K offers exceptional portability, power and performance for a virtually dust-free workspace. To learn more, visit FestoolCanada.com.





Epoxy to the Rescue – Epoxy will keep the threaded rod in place for years to come.

Head assembly

The head assembly is next, which includes the tablet's upper and lower support, the back, and the two back supports. Depending on the size of your tablet, the upper and lower support, their routed groove, and the height of the back may differ from what you see here.

Re-install the hanger bolts into the back support. Remember those hanger bolts are exactly 2" apart on center so you need to drill two, 3/4" deep, 1/8" pilot holes, center to center, on the other back support, perfectly mirroring the hanger bolt holes. With that done, assemble the back supports to the upper arm with a 1/4" carriage bolt, flat washer, lock washer and knob handle. Don't forget the "O" rings.

The 4" wide back is next. Secure the back against the drill press fence and drill a 1" deep, 1/4" hole at the 2" center mark of the back, making sure the hole is centered on the back's 3/4" thickness.



Almost Done – The assembled back support joint showing how the back will fit onto the threaded rods and get fixed in place. The two black handles control the position of the tablet and lock it in place.

Now you'll need to drill the holes in the face of the back for securing it to the two back supports. The holes in the two back supports are 2" center to center so you'll need to drill 4, 1/8" pilot holes 2" center to center and exactly 2-1/4" apart. The left side holes are countersunk using a 3/8" countersink bit for #8 x 1-1/8" screws and the connector cap holes require a 3/8" through hole with a 3/4" counter bore, 3/16" deep to recess the head of the connector caps.

With the previous 1" deep hole drilled in the top edge of the back, you'll now need to calculate the total length of the 1/4" x 20 threaded rod required for your tablet. Use a long enough threaded rod to accommodate the upper support and knob and any different-sized tablets you may have at home. For my application, a total length of 2-3/8" worked fine. Mix a small batch of two-part epoxy and adhere the threaded rod into the hole.

Temporarily screw the back onto the back support using the #8 wood screws. Now slide the carriage bolt into the back support's hole and slip the rubber "O" ring and washer onto the carriage bolt. Place the other back support into the holes for the connector caps. Feed the carriage bolt into the upper arm and slip the next "O" ring and washer onto it. Then slide the carriage bolt through the second back support. Carefully and slowly tighten the knob handle until the hanger bolts are centered in their holes and install the connector caps.

Install the lower support onto the bottom of the back using the same countersinking method you just used on the back-to-back support. Drill the 1/4" hole in the upper support required for the threaded rod.

With everything assembled you're ready to try it out. Notice how the washers secure the joints with very little effort. Adjust the elbow joint and the tablet support joint, making sure everything works smoothly.

Sand, then final assembly

Now you can sand all the remaining parts, glue and screw the back support to the back, and plug all screw holes with shop-cut tapered plugs or store-bought plugs and sand them flush.

I finished this project with three coats of oil-based polyurethane and spray painted the heads of the carriage bolts and the connector caps with black paint to match the rest of the hardware.

From its lowest position, the bottom of the tablet is 4-1/2" off the foot and at its highest position the bottom of the tablet is 17" off the foot. The head assembly rotates 180° giving you almost infinite adjustability. Whether you're using a tablet as a student taking online courses, a budding chef tackling a new recipe in the kitchen, staying connected with family or friends, or just surfing the net, using your tablet now won't be a real pain in the neck.



GORD GRAFF
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Working Out of Your Home? WORK SMART

Maintain your productivity and efficiency when working at home by integrating all your smart devices and boosting your network bandwidth.

BY CARL DUGUAY

According to Statistics Canada, the COVID-19 pandemic has led to a significant increase in the number of Canadians working from home - an increase from 4% in 2016 to 32% in early 2021. Once COVID restrictions are eliminated some people will return to their offices, others will continue to work from home, and others will work in the office some days and at home for others.

Many homes have products that can be controlled through a desktop or mobile device, such as a smartphone or tablet. These smart devices include door locks and viewers, security cameras, garage door openers, thermostats, smoke and carbon monoxide detectors, air conditioners, speakers, televisions, lights, and even kitchen appliances. Each device has its own app that you use to control the device, though not all devices communicate with each other. To integrate all the smart devices in your home (and office) so they can be controlled by a single mobile

app, you'll need a **smart hub** such as Aeotec (formerly Samsung SmartThings Hub) or Wink Hub 2, or a **smart speaker** such as Amazon Echo or Google Nest. The advantage of a smart speaker is that you can control any devices connected to the speaker with your voice.

Bandwidth

Working out of your home puts a strain on your internet bandwidth (the volume of data sent and received over your internet connection) and it can cause your internet service to crawl to a snail's pace, especially if other people in your home are using the internet at the same time. High-capacity activities (such as video streaming, video conferencing and virtual learning) demand a lot of bandwidth. For example, streaming 4K content requires at least 25 Mbps (megabits per second).

There are a few things you can do to increase bandwidth. Connect the computers and laptops in your home to your router with an Ethernet cable, rather than connecting them wirelessly.



Aeotech Smart Hub – A smart hub, like this one from Aeotech, can help the user control all their smart devices in the home. There are many brands of smart hubs on the market. They can also ease network congestion by diverting traffic off Wi-Fi or Bluetooth.

A wired connection will give you better speed, shorter data transfer delays and better security. Use Category 7 or higher cables and keep them as short as possible.

If you'll be uploading and downloading a lot of data to the cloud or frequently engaged in video conferencing, consider upgrading to a higher Mbps plan from your ISP (internet service provider). Get the highest speed you can afford – for around \$100 per month you should be able to get download and upload speeds up to about 750 Mbps. ISPs offer both shared connections through the more common cable modem and the newer dedicated fibre optic connections.



Smart Speakers – The benefit of using a smart speaker, like the Amazon Echo (above) or the Google Nest Wi-Fi (right), is that it can help the user control all the devices connected to the speaker with your voice. They also make mundane tasks like making a phone call simpler.

Generally speaking, a dedicated fibre connection delivers faster and more reliable internet service.



Routers – the non-woodworking ones

It's good practice to set up your home office as close to your router as possible. If you need to boost internet coverage to other



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Ethernet Cables

— Although often overlooked, Ethernet cables can assist in giving the user a faster and more consistent internet connection.

devices and the internet. Having an effective router running your network traffic is important to ensure you're getting optimal network speed and security. If your router is more than a few years old it may only operate on the 2.4GHz Wi-Fi frequency, which is fine for low bandwidth activities like checking email and browsing the internet. Upgrade to a dual band router that supports both 2.4GHz and 5GHz if you want to get the most from high-bandwidth devices.

Large home?

For large homes with multiple computer users and a variety of smart devices, a **mesh network** might be more appropriate. These consist of a main router and one or more nodes (a.k.a. satellites) placed in different areas of your home. These deliver better signal strength and wider coverage. Popular mesh systems include Google Nest Wi-Fi, Samsung SmartThings Wi-Fi and TP-Link Deco M9 Plus.



CARL DUGUAY

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areas of your home, there are a couple of options to consider. The easiest and less costly is to install a **Wi-Fi range extender** (a.k.a. booster, repeater or amplifier). However, they do reduce Wi-Fi speed, which makes them more suitable for browsing the web and checking email, but less so for high-capacity activities.

Your router manages the movement of data between devices and between

Mesh Networks — Mesh networks, like this TP-Link Wi-Fi Extender, don't require additional routers. In some situations mesh networks can be complex to set up.



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How computer aided design (CAD) tools can help you in the workshop.

Digital Design Tools



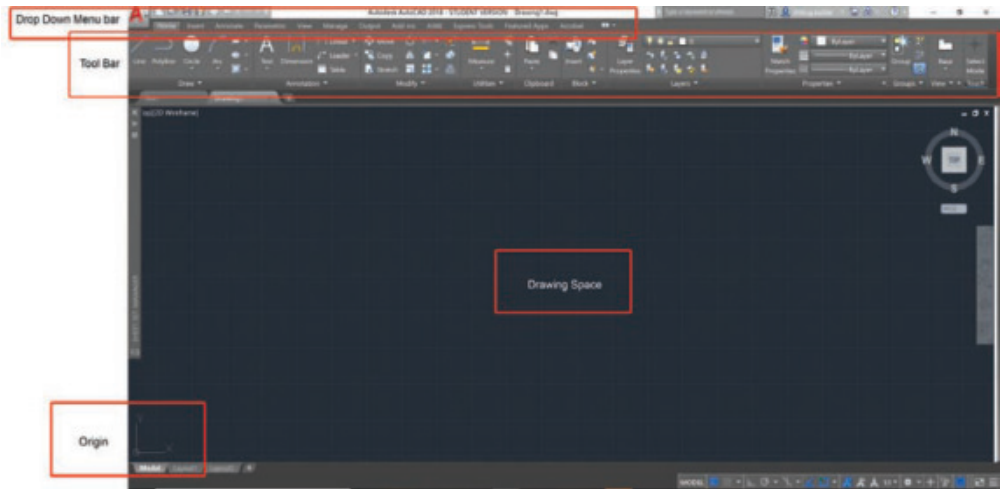
BY CHRIS TUCKER

Computers and digital technologies have advanced rapidly in the past 50 years, and they now infiltrate almost every aspect of our lives. So, also in woodworking, computers have taken root in the design and planning stages of our projects. Computer aided design (CAD) software packages are the digital tools most designers have adopted. It's with these types of software that we will begin to explore how the digital revolution

has begun to change how we spend time in the shop. In two future articles we will explore additional forms of advanced technology in the shop: lasers and 3D printing.

As a construction technology teacher, I have instructed more than 1,000 youth and adults in woodworking techniques over the years. It has been my experience that one of the most underappreciated phases of a project is the planning phase. We are so anxious to get into the shop and see our visions become reality that we may not afford the planning stage the necessary time it deserves. Early

CAD programs didn't help this issue. They required huge investments of time to learn and significant costs to license and upgrade hardware to properly run them. Today's CAD systems have made huge gains in these areas. The reason for these gains could be due to several factors: an increase in computer literacy; more user-friendly software programs; incredible advances in hardware; and, most significantly, with the development of the web, we have new ways of accessing technology and sharing resources. Regardless of the reasons, as woodworkers we get to reap the benefits.



What is a CAD software package?

Essentially, CAD software programs replace traditional drafting tools, and some would even argue sketching (although I still feel there is something magical about the process of putting pen to paper that can't be replaced, but maybe I'm just a romantic). Those images from the '50s of men wearing ties labouring in rows of drafting desks have been replaced with computers, servers and advanced human interface devices such as tablets and trackballs.

The term CAD refers to a broad range of software that can be used in any design profession: architectural, engineering, custom cabinetry or machining. Traditionally, you produce plans, elevations, sections, details, etc. of your design, which then get printed or "plotted" on a large-format printer. You simply conform to the drafting convention that's appropriate for your industry. Using CAD tools, you can design your project using the traditional two-dimensional (2D) projections or, more commonly now, model your design virtually in three dimensions (3D).

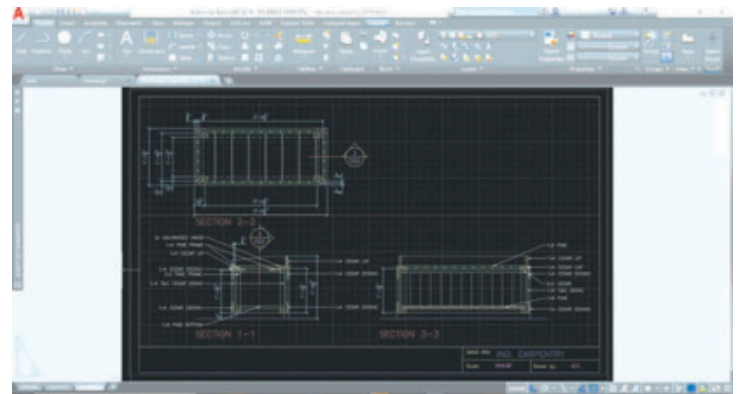
Once designed, these models can be exported into another category of software called Computer Aided Machining (CAM). CAM tools are different because their primary function is to produce machining instructions as a "code" file that will be uploaded to a Computer Numeric Controlled (CNC) machine to be fabricated. In essence, a CAD program will produce a drawing or model, while CAM is the next step to have your part manufactured or "machined." We're going to leave further discussion of CAM and CNC machines for now and continue to explore the nuances of CAD programs.

Common CAD characteristics

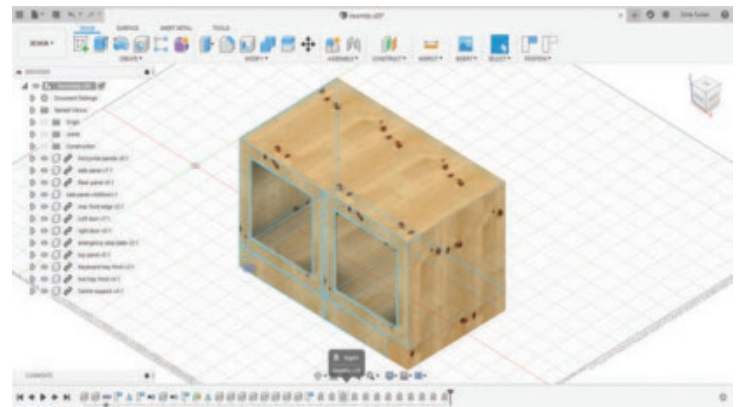
Most CAD programs have several common characteristics. They all use a Cartesian coordinate system, describing any point in space with an "x," "y" and "z" value measured from an origin point. (Are you having math class flashbacks?) They also have similar basic elements, such as a drawing area, an origin, toolbars and dropdown menus. Program functionality can be generally divided into three main areas: drawing tools (line, circle, ellipse, arc, etc.); editing tools (erase, move, copy, etc.); and management tools (layer controls, output parameters, etc.). Users generally find that once they have learned the basics of one program, it's relatively easy to learn other programs.

There are generally two different approaches to CAD design. There is the traditional 2D drafting method used in the building

Typical CAD Display Elements – All CAD programs utilize similar program structures. They feature a drawing pane, an origin, toolbars and dropdown menus. AutoCAD model display is shown here.



AutoCAD Screenshot – This screenshot of a cedar and pine storage bench in AutoCAD currently has all the dimension and drawing layers turned on.

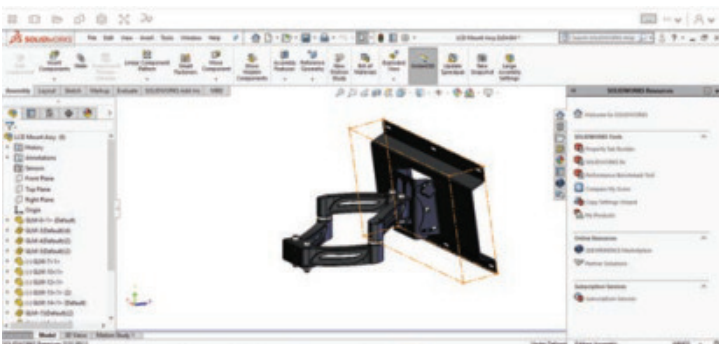


Fusion 360 Screenshot – A pine cabinet with all the components of the project are shown here in Fusion 360.

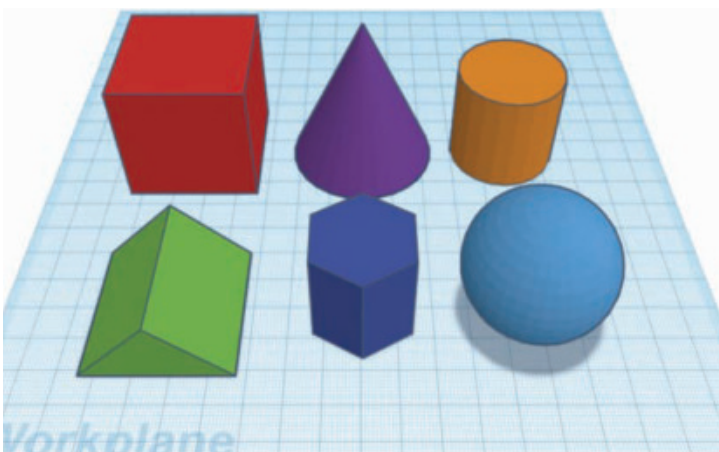
industries and 3D modelling which is a more visualized approach to design. 2D CAD programs approach the technology as a substitute for a pencil or pen. The viewer must be able to read the drawing and imagine what the design will look like. One of the most commonly known software packages utilized for 2D design is AutoCAD, which is produced by Autodesk.



SketchUp Screenshot – In this screenshot, SketchUp is being used to draw a small building.



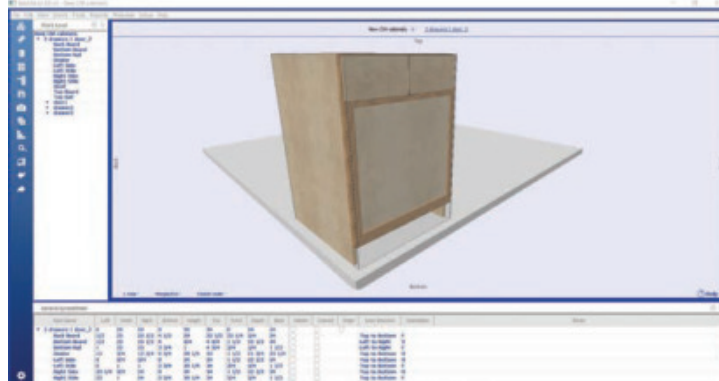
Solidworks Screenshot – Here, an LCD monitor is being drawn in Solidworks.



Basic Geometric Shapes. A few of the basic 3D shapes that are utilized in “dumb” 3D modelling. A screenshot of Tinkercad desktop is shown here.

Three types of 3D modelling

Programs for 3D modelling have been available for quite a while, however, they require enhanced hardware to run and more advanced training in order to operate. Today there are three commonly used forms of 3D modelling that offer multiple entry points for users. The first and most rudimentary form of these tools is classified as “static” or “dumb” solid modelling. These utilize pre-defined 3D geometric solids (remember all of those wooden blocks from elementary math class?) combined and altered to achieve a design. These packages tend to require less hardware to run and



SketchList 3D Screenshot – SketchList 3D offers a database of designs that can be altered to fit user specifications and generate material lists, cutting diagrams and shop drawings.

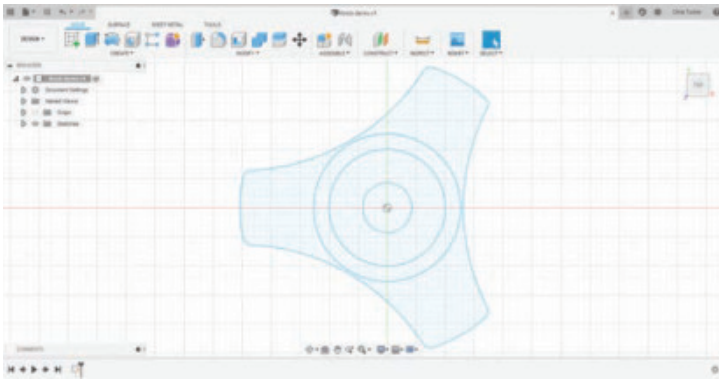
are commonly hosted online, and feature databases of sample projects and material palettes. A common and free online version of this type is Tinkercad. This is perhaps the best entry point for a novice, or if you wanted to get kids engaged in designing their own woodworking projects. A good way to describe it to younger generations is as “Minecraft with more shapes.” (For those of you who don’t play Minecraft, it’s an online virtual building game / environment where everything is built from a single cubic unit.)

While most static solid modelling software packages offer an easy entry point into 3D modelling, there are also some highly specialized packages that take advantage of databases or “galleries” of models and allow users to specify set parameters. SketchList 3D is an example of one of these titles. Through an interface similar to other CAD software, you can design furniture and millwork from base designs modified to fit your specifications, such as dimensions and number of drawers, shelves, doors, etc. There is also an option to build your project from scratch using a palette of materials with predefined properties. Additionally, SketchList 3D also generates supporting documents like cutting diagrams, and parts lists and purchase lists.

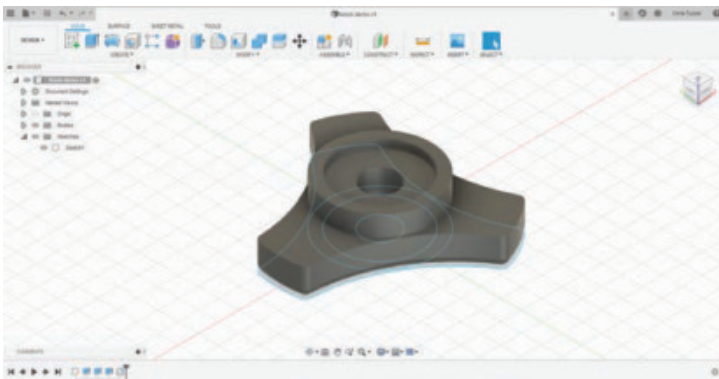
The second type of 3D modelling is a hybrid of 2D and 3D modelling and is perhaps the most powerful of all the options. It has become commonplace in multiple industries. In essence, a designer begins with a 2D profile or “sketch” and then extrudes or sculpts the model to create the final form. One approach in solid modelling is called parametric modelling. Using this technique, a running history of the development of a design is tracked, enabling you to go back and revisit an earlier stage of the process to make changes. Once completed, the remainder of your workflow will automatically update to reflect that revision. This feature is immensely powerful, because it permits a designer to revise or consider variants quickly and efficiently.

The third technique for solid modelling is called “explicit” or “direct” modelling. It’s very similar to parametric modelling, except that it doesn’t track the design history of an object. This approach is commonly used for developing models with complex curvatures and forms. Most mid- to high-end software programs offer both methods and allow the user to select between the two modelling methods or integrate both into a single design.

Another feature of most mid- to high-end 3D modelling programs is the ability to automatically generate traditional 2D drawings of your model. The program may allow you to set your views or will have a series of pre-set viewing windows that



Sketch of a T-Nut Knob – Most parametric models start with a 2D sketch, such as this sketch of a knob for a 1/4-20 thread T-nut done in Fusion 360.



Application of 3D Characteristics – Once a sketch has been developed, 3D characteristics are applied by adding or subtracting: thickness to a profile; fillets; chamfers; lines of symmetry; etc. With this T-nut knob, thicknesses and fillets have been added in Fusion 360.

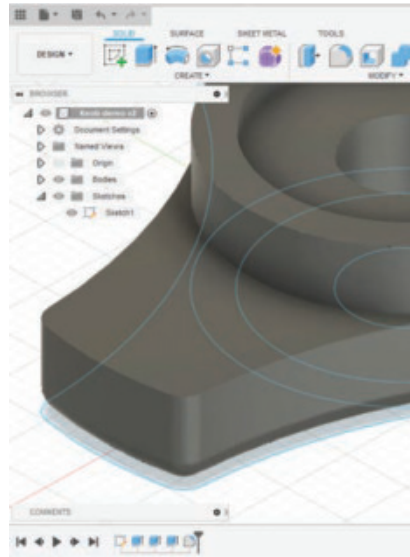
automatically display your model. This leaves you to set the scale, dimension and annotate your drawing as necessary. In addition, your 2D drawings will update as you refine your model. With the development of these types of powerful applications, designers are increasingly beginning their creative process with a model, versus a traditional drawing.

There are several software programs that support the 3D modeling approach. Most are required to be installed on your computer; others are hosted in the cloud, while some are a hybrid of the two. Common titles include:

- SketchUp
- SketchList 3D
- Onshape
- Solidworks
- AutoCAD
- Fusion 360
- Rhinoceros

Printing drawings

Regardless of the type of software you use, at some point you will want to bring your design into the shop. Traditionally, that meant printing it out yourself on letter- or legal-size paper or sending it out to a professional printer for a larger format, which increased the cost of a project. Regardless of the selected print method, one of the key tenets of drafting is the use of line weight to convey depth. For example, architectural convention has been that a floor plan is the rough



Parametric Modelling Timeline – One of the key features of parametric modelling is the ability to track a model's progress and "roll back" to an earlier stage to edit details. An example of a parametric timeline is shown here for a T-nut knob project, shown in Fusion 360.

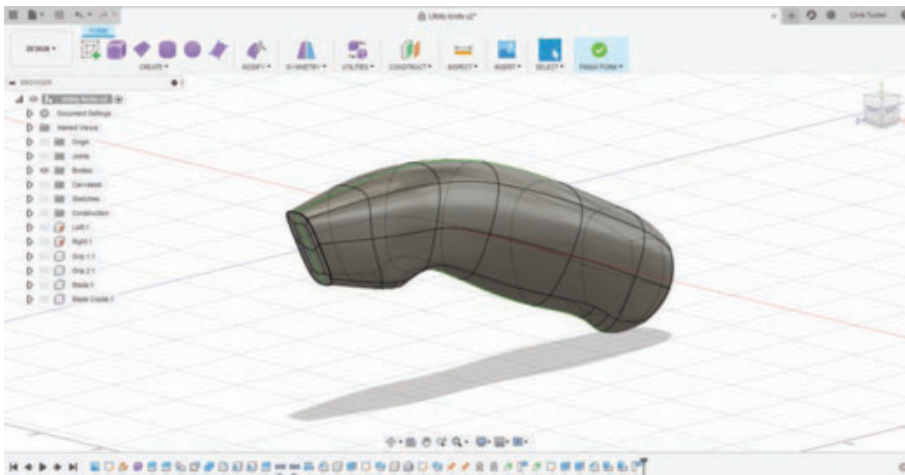
equivalent to a section through the "x-y" plane, approximately 4' -0" off the floor. Any material cut by that plane would be represented by a thicker line than an object that was located below that plane. In a 2D CAD environment, this is commonly achieved by assigning colour to specific drawing layers, placing the various elements of the drawing on the relevant layers (exterior walls, stairs, doors, fixtures, hatching, etc.). For efficiency, standard practice is to have a default layer configuration with the line type and colour included on a title block that you develop. This title block then becomes part of the initial setup of your drawing. Then when you go to print, you assign a pen weight to a colour. General practice is that you would create a standard list of pen weights and then save it as a file and simply open it when you want to apply it to a drawing. If you are sending out for printing, you simply include this list of pen weights with your print order and your printer will be able to set those values for you.

With the development of smartphones and tablets the need for printed drawings has been reduced. Unfortunately, you still need them to apply for a building permit if that's what your drawings are for. All programs offer you the functionality to print or save your designs in a format that can be visible on any smart device. Some of the programs even have dedicated apps that allow you to not only view designs, but also annotate or even edit them remotely. This can be a tremendous advantage when you're in the shop and need to make a revision on the fly, or are visiting a site and need to record an as-built condition.

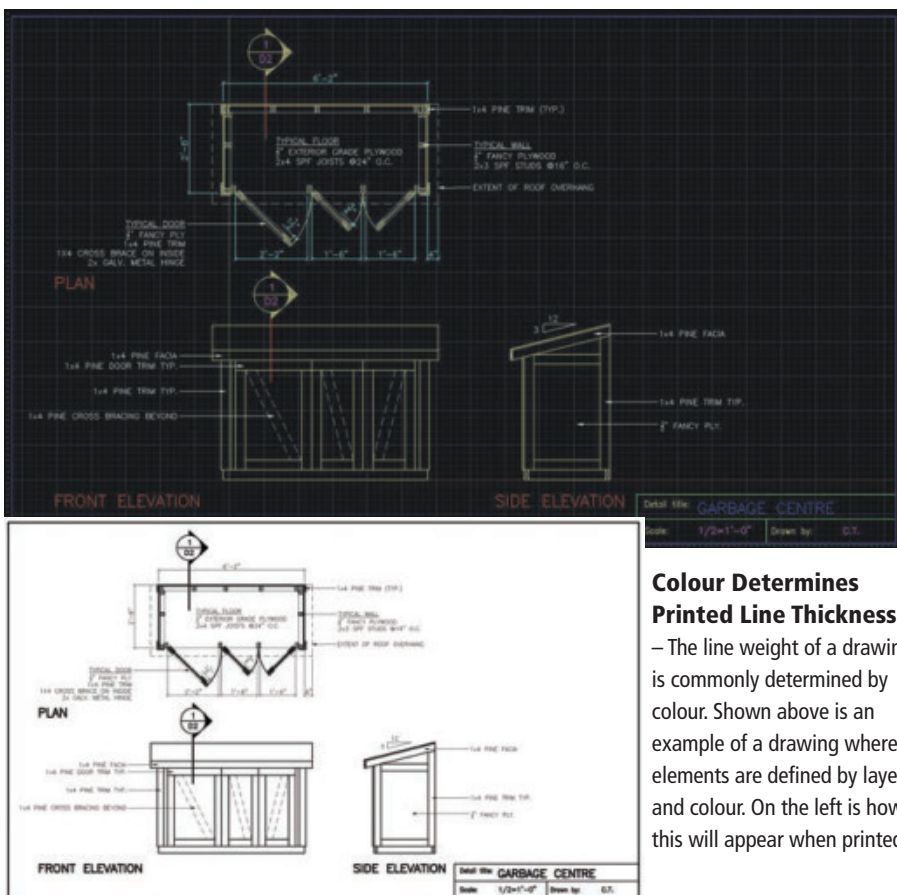
Licensing software has a variety of options. Some are 100% free (Onshape), while others offer free use with reduced functionality (SketchUp) and a purchase option for a full version. Some offer free trial periods, with full access (Solidworks), and some offer free use for certain user groups like hobbyists, educators or students (AutoCAD and Fusion 360). Even the price structures vary. Some offer a one-time licensing fee, or the most recent trend is to offer an annual or monthly subscription fee. Regardless of the fee structure, a single, non-commercial license ranges from hundreds of dollars into the thousands.

Why even bother with CAD?

So, why bother with all of this? Efficiency. If you invest the time to work out all of the details of your project virtually, it will provide you with a better understanding of the intricacies of your



Mesh Body 3D Model – 3D modelling programs allow you to sculpt complete curves using mesh bodies. This technique has some similar techniques as conventional modelling, however, it also has unique commands that allow it the flexibility to create complex curves and planes. A Fusion 360 sample file is shown here.



Colour Determines Printed Line Thickness

– The line weight of a drawing is commonly determined by colour. Shown above is an example of a drawing where elements are defined by layer and colour. On the left is how this will appear when printed.

design and help you to determine potential problems and workflow. To aid you in this, CAD software can allow you the opportunity to:

- provide standardization across projects
- easily revise your project
- test out different materials for aesthetic qualities

- produce animated simulations of projects (joint conditions or walk throughs)
- run engineering analyses such as resistance, curvature or sectional analysis
- access manufacturers' databases of materials and fixtures (plumbing fixtures windows, millwork profiles)

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The wood manufacturing and building industries have all moved to using these design tools in their operations. While you as a hobbyist may not have the same scope of work, there are distinct advantages to being able to leverage these tools in the pursuit of your passion.

Learning the programs

The next question is, how do I develop these skills? Depending on your preference, there are multiple ways to learn how to use these tools. For example, there are printed resources you can purchase and work through at your own pace. The downside to these is that they tend to be pricey and quickly become outdated as newer versions or updates are released.

Alternatively, there are in-person and online courses offered through local colleges. These typically run \$200 to \$500 for a course, and may offer you the opportunity to earn formal recognition.

There are industrial training providers as well that offer industry-recognized certifications or “micro-credentials.” These are typically self-directed and online with a licensing exam. These tend to be more costly because they feature proprietary curriculum and the opportunity for industry recognition.

The last, and perhaps the easiest, option is to search the software

producer’s website for free online training material. Most vendors recognize the need to support users through the initial learning curve and provide resources to do so. However, once you get past the initial acquisition of skills, no-charge training materials for the more advanced features tend to be harder to find. This is where the online community really demonstrates the power of social networking. A quick internet search will generally result in a multitude of online content supporting your needs. These could take the form of social media groups, user forums, videos, instructional blogs or product reviews. As you can imagine, not all resources are created equal but, bearing that in mind, a good deal of my learning around new titles has been self-directed and has resulted in many successful projects.

There is a definite place for CAD tools in woodworking. As these technologies develop, the skill level needed to be successful is decreasing and the hardware is becoming less expensive. There are opportunities for all woodworkers to utilize some form of CAD system in their work. The biggest requirement is the desire to acquire a new set of skills.

Chris is a curriculum consultant with a background as a technology education teacher, an architectural technologist and a contractor. He is a CNC enthusiast, using both additive and subtractive tools in his projects.



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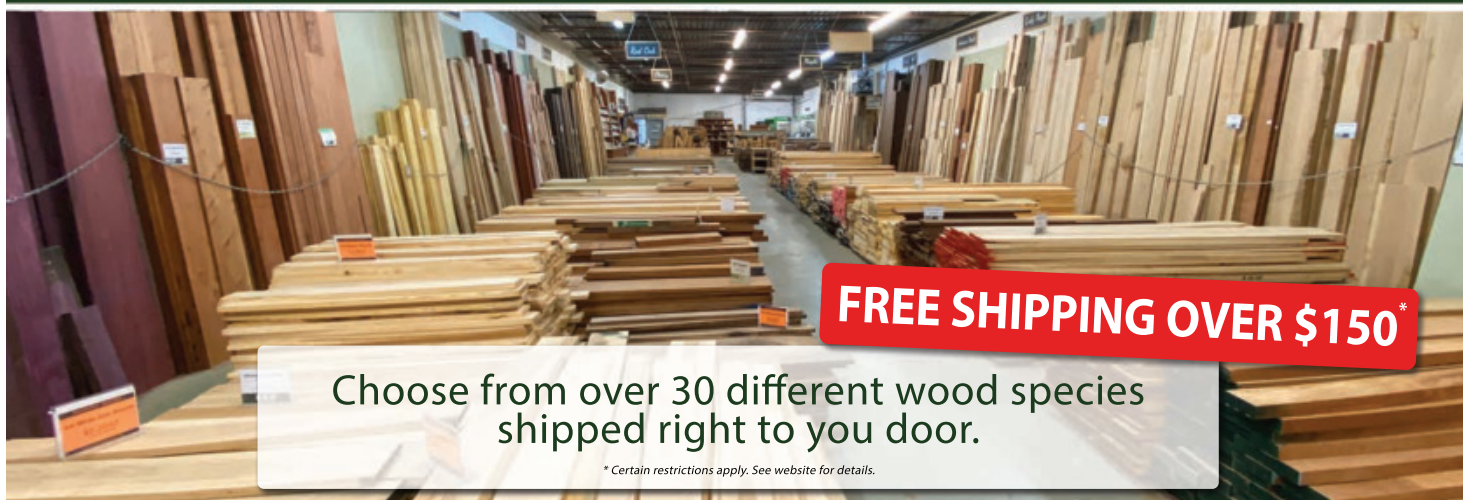
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Stairway to Headache

Sometimes the best home renovation is the one you never do.

BY JAMES JACKSON

Every visitor to our little wartime home in Waterloo Region in Ontario always has the same reaction when they go down the basement stairs for the first time. They grip the railing for dear life and act as if the floor is giving out below them.

It's a natural first instinct given how unnaturally steep the stairs are, and how disorienting they can be for first-timers.

Built in the early 1950s, our one-and-a-half storey home is about 950 square feet, and it's cozy and cute, but those stairs. Wow. I walked down sideways just to make myself feel a little safer during the house tour with my realtor nine years ago when we bought the place.

The stair treads are plenty deep – about 9-1/2" – so there's actually lots of room for your feet to maneuver. They're not dangerous. The steep angle just catches you off guard the first time you use them. And the second time. And the third time. Luckily, there's a sturdy handrail to guide you down.

Plus, going up and down is great exercise for your calf muscles.

Nearly a decade later, I can take them two at a time while carrying a basket of clean laundry in one hand and talking to someone on my cell phone with the other.

But these stairs have also caused us some major headaches over the past few months when it came to a planned basement renovation. We had a few contractors come by last fall to discuss finishing the basement to make a little more living space for our two young girls, but they all pointed to the stairs as a major sticking point.

The steep incline was necessary back in the day to physically fit the stairs into the footprint of the small house, and there's only about two feet of clearance at the bottom landing.

There just isn't enough clearance at the bottom for insulation and drywall, meaning the stairs would need to be physically pushed back at the top to reduce the incline. That would involve cutting a few feet out of the floor and extending the stairs out into the living room.

Not ideal.

Or the contractor would need to add a second landing and cut through some of the overhead joists to change the actual angle of the stairs and pivot the bottom landing out into more open space.

Also not ideal.

For a simple basement renovation, this all sounded like way too much work. Plus, we don't have the budget (or the stomach) for that type of demolition and reconstruction of our old home. The neighbours on either side of us live in virtually the same house and they both have finished basements, though theirs were done a few decades ago when building codes may have been a little less restrictive.

Another option we were offered was to just leave the stair portion unfinished and complete the rest of the basement, but that wasn't a great fit either since we didn't want the basement to have a choppy feel to it.

In the end our solution to the problem is to just continue living with it the way it is. We wanted the additional living space, especially with two small girls who are growing up very quickly, but it wasn't worth the risk, the added cost, or the unknowns of tearing into floor joists and extending stairways into other areas of the home.

You hear horror stories about renovation projects that quickly spiral out of control when the homeowner demands too much of the contractor, or doesn't understand the limitations of the space. Maybe the best home reno we ever did was the one that never even got started.

JAMES JACKSON
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Illustration by Mike Del Rizzo



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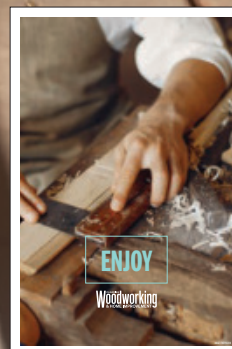
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Turn to page 12 for more quotes.
(Photo by Chris de Champlain)