

DESIGN-BUILD



Leveraging CAD as a Craftsman

How one carpenter has unleashed “his most powerful tool”

BY PHILIP ARMAND

“I can’t take the stress, I didn’t sign up for all this responsibility.” Nearly in tears, my only employee quit.

Three weeks before this meltdown, we were installing a custom home office—the largest project yet of my fledgling business. After 12 months of rapid growth, I needed to subcontract a larger shop to build the cabinets for this luxe waterfront home. The design work was left to us. I conceptualized and he measured and drafted our project—old-school style, with pencil and paper.

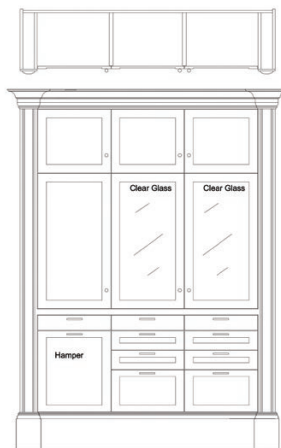
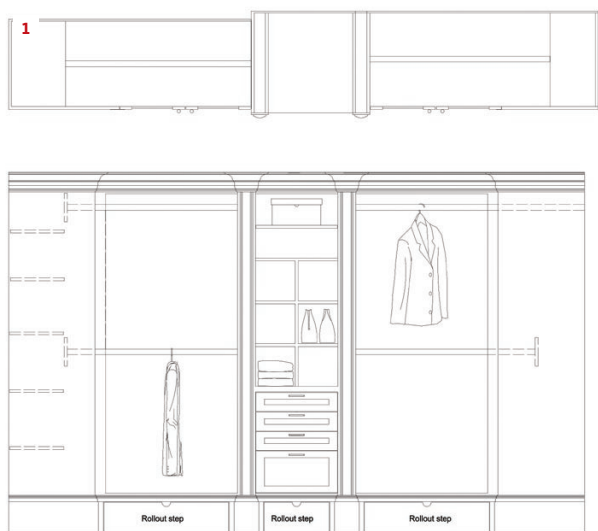
My mid-20s pride was turbocharged as we unloaded the truck; the smell of freshly sprayed lacquer and wood infusing the ocean air. I led the charge in what I was certain would be a massively successful outcome. The morning passed with ease. The base cabinets, a wood desk top, and a custom couch were set. Admiring our work before lunch was a visual appetizer. Next up, the first upper cabinet

(a massive, glass-paned storage unit) was carefully hauled into the office. Hmm, it seemed too large for the allotted space. I pulled out a tape measure and sure enough, there was a 12-inch discrepancy in height! In the garage, that same pesky tape measure affirmed that all the upper components were exactly 1 foot taller than the room. The casualties added up: Profit was lost, pride was deflated, my employee quit, and an annoyed client needed to exert patience for another month.

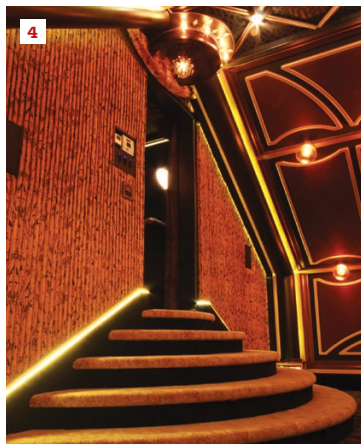
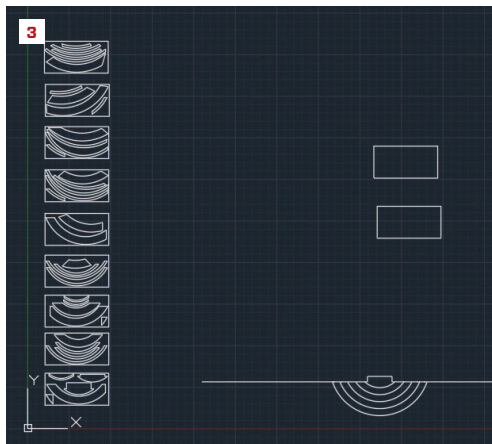
Weeks later, I was sitting in a college classroom learning Auto-Cad, a computer automated design (CAD) software by Autodesk. That night, I steadfastly practiced, typing commands and attempting to draw something ... anything. By week 10, I could use the program proficiently. I had more to learn, but with the basics, I was able to do 90% of the job. As a Luddite with most technology, I needed the pain of

Photos by Philip Armand

LEVERAGING CAD AS A CRAFTSMAN



For this closet design (1), the clothes and accessories on the shelves were taken from CAD blocks. The author inserted his millwork supplier's molding details into the drawing by downloading the files from the supplier's website, then cut and pasted them into the drawing. The ability to do that allows him to “shop” for trim in a virtual space before a build begins. The client loved the finished closet (2), which was executed exactly as drawn.



The entry stairs to a home cinema the author was commissioned to design and build are elliptical. After developing them in CAD (3), he broke the stairs into components that fit into 4-by-8-foot rectangles. Each of those files were saved separately and loaded into the CNC machine, then cut out of shop-grade birch plywood. The parts were assembled in a few hours on site. The completed stairs were wrapped in carpet (4).

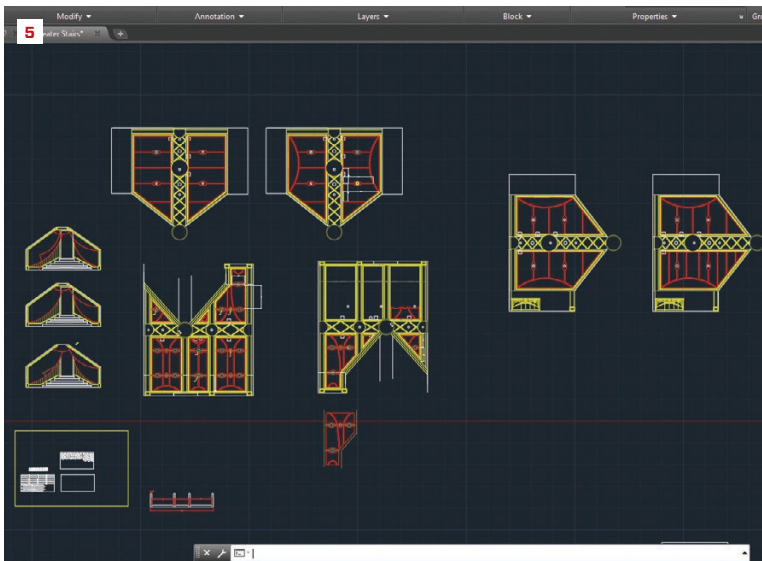
that waterfront mishap to push me toward a technological evolution.

“Learning and innovation go hand in hand. The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow,” wrote American physicist William Pollard. That has become my anthem. Writing this 23 years after that pride-busting afternoon, I am grateful for the silver lining: CAD has been the single most powerful tool that I’ve learned to use. With it, I’ve been able to easily work with clients on their designs, present work to staff and subcontractors, easily make edits, and use CNC (computer numerically controlled) cutting technology.

The details of which design program is best for you can be found elsewhere; there are many software options available along with

dozens of online forums to learn about them. In this article, I describe only how a workflow assisted by CAD has impacted my business. I mostly work on residential renovations and my design work is mainly focused on interiors; however, CAD can be used by any trade.

I use AutoCad by Autodesk, which many architects use and most large cabinet and millwork fabricators are familiar with. For the novice, AutoCad may be daunting because there are seemingly endless tools and ways to configure it. The learning curve can be steep if you want to dive deep into the program. I know the basics and stopped my training at the boundaries of my needs—2D line drawings and the occasional 2D isometric (adding depth to a 2D image to represent a 3D look). This still took time, but the investment I made



The author's CAD workspace (5) for the home cinema allowed a big canvas that was easy to navigate and manipulate. He mapped the geometry of the room into flat planes inside the CAD workspace, allowing accurate design and panel placement (6, 7). Small components like the decorative light panel (8) were hand-designed, and one quadrant was cut out with a jigsaw. Once he had a pattern he liked, he scanned it and sent the file to a graphic designer, who made a properly scaled file in Adobe Illustrator. The author then CNC-cut the panels from 1/4-inch MDF.

in learning how to use CAD changed the direction of my business. Many of the high-end jobs I have executed could not have been done (or done as easily and impeccably) without automation in design and component cutting.

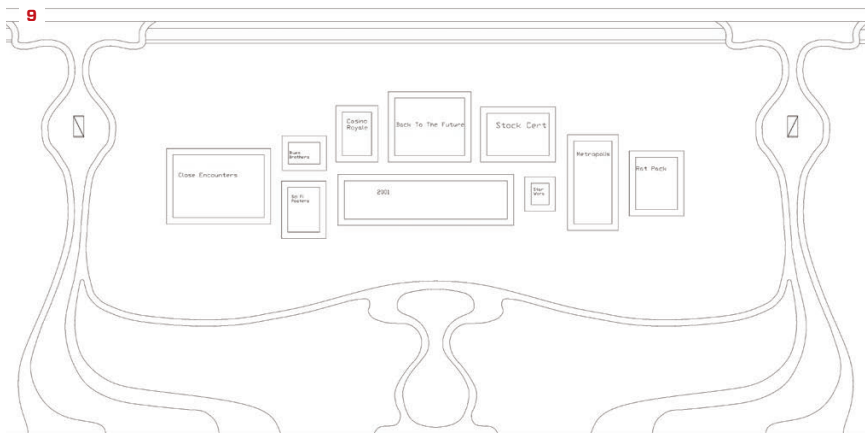
WORKING WITH CLIENTS

A majority of my business has been interior custom cabinetry, millwork, and room design. I no longer have my own shop; I sub out all the cabinet components and handle the design and field-work with my team. I visit the site, interview the clients, gather any inspirational images and samples, measure, and take pictures of the space. Depending on the scale of the work, it can take a few hours to several days to make a drawing. On complex projects, I

bring my laptop on site to help more accurately map complicated room geometry or design as I go.

Designs can get very complex, and I may not have the skill or time to handle all of the design work (my ability stops at 2D line drawings). In those cases, I work with graphic designers who are proficient with Adobe Illustrator. Properly scaled CNC files can be created by most design software, including Adobe Illustrator. I also work with a 3D modeling designer if a client wants to see how the completed work will integrate into the space. Most of the time, my clients accept 2D line drawings. However, if I need to present more, I can easily find pros on sites like [freelancer.com](https://www.freelancer.com) or [fiverr.com](https://www.fiverr.com) to fill the gaps in my skills or schedule.

On several occasions, clients have sat with me to design their



The author used the virtual design-space (9) to organize artwork outside the home cinema—a key step to avoid damage to the hand-screened wallpaper. All the delicate wall components were CNC-cut from lightweight MDF (10).

projects. The most recent example involved an extensive master suite closet. The client couldn't easily explain what she wanted. In about 10 hours, I made a basic drawing; then we sat together with a laptop for two hours and completed a final draft she loved. Before the end of that day, my cabinet shop had the files open in AutoCad and was working on pricing.

My millwork suppliers have CAD files for their products, which makes for a smooth workflow in selecting trim and other architectural details for a project. Most large product manufacturers also provide CAD files, so when I am designing a bath vanity or kitchen, I can often insert accurate representations of faucets and appliances into my drawings. If the exact appliance selection has not been made or a file is not readily available, I use "CAD Blocks," files that can be purchased or often downloaded free that provide generic items in endless categories.

Half my time is now spent designing and consulting on residential build/remodel projects. CAD has been critical for visually explaining how a detail could be executed. I often pass along hand-drawn doodles but usually find this insufficient and follow up with CAD drawings. Granular visual explanations often need a crispness and formality to make them acceptable to clients.

WORKING WITH CREW AND SUBCONTRACTORS

My busiest period saw me managing six finish carpenters on a massive interior trim project. I set up a laptop and printer on site. Every morning, I made shop drawings for my staff. I easily assigned teams to different aspects of the project by handing out drawings and having short conversations. This saved me from the concentration and distraction of constant supervision, allowing me to put my toolbelt on and get dirty.

Drawings were leveraged to CNC-cut components. There were several elliptical arches and complex oval trim details. My CNC

vendor cut components, and my millwork vendor CNC-carved oval and arched window trims to match the selected molding profiles.

It has been easy to work with my preferred cabinet shop and steel fabricator, as both work with AutoCad and can open my files. This carries over into expediency of quoting, editing, and finalizing a project. CAD has saved me hundreds of trips to their shops and increased accuracy dramatically.

Structural aspects of a project are often not fully detailed in the blueprints—there is always some bracket or component that needs to be figured out and fabricated. CAD has been a great way to render and send a component design to an architect or engineer for review. On a recent renovation, a cluster of four large, steel I-beams converged in the middle of an open floor plan. The prints had no spec for that detail, the fabricator did not want to engineer the connection, and the engineer was not responsive. In two hours, I made a sketch of what I assumed (from experience) would work and sent it to the beam vendor's engineer for review. He made revisions and production began shortly after; the engineering logjam just needed a lever.

MAKING EDITS

The power of CAD is the ability to make quick edits. In a file, I can create several versions of a concept, copy and paste sections, and do alterations all within view of the original idea. Then I can easily share my idea with a client, vendor, or collaborator. On a home cinema, I worked with a design collaborator who was also proficient in CAD. All my details were up to snuff until I designed the hallway. My first draft was my favorite—she disagreed. I attempted several variations until she took my file and made several alterations. We ping-ponged the file back and forth, finally settling on the original drawing with a few adjustments.

Sometimes a design is not clear or not possible to fabricate as drawn. My cabinet vendor always makes shop drawings before a



On this job (11), the author produced shop drawings every morning for his staff. He assigned teams to different aspects of the project by handing out detailed drawings and having short conversations. His time in CAD sped up the process, front-loading decision-making in a virtual space, speeding up production, and removing decision fatigue from the carpenters. There were several elliptical arches and complex oval trim details. The CAD drawing (inset) is the CNC file used to cut the arched panel and arched framing.

build begins and sends me revised files for approval. This is a quick way to fail-safe a possible installation debacle and has made our installation process nearly flawless.

My personal strength is in the edit. The first drafts are just a way to gain momentum and get ideas out of my head. I then Frankenstein aspects of my early drafts into a final drawing (without unsightly stitches). Confirming and adjusting the technical feasibility of a building component, architectural detail, or component with a vendor or expert has been easier with CAD. If CAD isn't available at the other end, I make a PDF file or print a copy. Visually asking questions has removed ambiguity and costly re-dos.

LEVERAGING CNC TECHNOLOGY

A close relationship with a cabinet shop has made the process of cutting components simple. The shop's owner trained me in programming and basic operation of his CNC machine, and now charges me \$150 per hour to use it. I need occasional assistance, but once running, I can upload and run my files through the machine to fully cut components. I use other local vendors for plasma and waterjet CNC cutting if I need metal or stone components cut. The technology is widespread and most medium to large cabinet shops have a CNC machine. In my area, there are also several CNC service providers that strictly cut components for clients. Hourly fees vary.

Making CNC-ready files has its own parameters. The shop I use gave me a 10-minute lesson on cleaning up any duplicate lines (newer versions of CAD have a "Delete Duplicate Objects" tool) and making all my objects into "Polylines," where each item I want cut is one contiguous object to the software. I save my files in a CAD version compatible with the shop's current CAD software. This is simply done in the "Save As" menu, where I can select from 16 different versions of CAD. I save the files on a USB drive, then upload

them at the shop to its CAD software for review and output to the CNC software for processing. The software checks the file for errors, and then we program the cutting direction, start point of each cut, how fast the machine will cut, and in how many passes.

CNC technology was invented more 60 years ago; today, it's easily accessible and reasonably priced and even a hand-held CNC router is available. Using this technology to up-level a business seems inevitable. The next generation will easily embrace automation—the young ones are cable-ready, 3D-printing technophiles; my exact opposite. As Stewart Brand wrote: "Once a new technology rolls over you, if you're not part of the steamroller, you're part of the road."

I have distinguished my business from other designers and millwork installers by implementing technology to publish my imagination into reality. CAD has also given me courage to attempt complex and large-scale work, knowing I can fabricate complex geometric parts and scale them with ease. If I can imagine it, I can draw it and make it real. It has made my presentation and work look grander to clients than the reality of my being a guy who operates his small business from a Ford pickup and a home office.

Coming full circle, my infamous 12-inch discrepancy has been forgiven and, hopefully, forgotten. The client was eventually satisfied with properly sized cabinets in his home office. Since then, I have designed nearly a dozen rooms, a cabana, and several architectural details for him and his brother. Knowing how to use CAD wouldn't have prevented that debacle; I still need to be impeccable at field measuring and documentation. But CAD virtualizes a project, making a space and idea portable and allowing me to communicate and collaborate with ease. Simply put, CAD is a tool to bridge creativity and reality.

Philip Armand is a craftsman, designer, and general contractor serving Eastern Long Island, N.Y.