



Gallery view. Four boxes across top left show remote members who have clicked “raise hand” on Zoom’s “reactions” tab. Fifth box shows meeting moderator in room on USB webcam. Box at top right shows members in the meeting room; everyone else has joined in remotely.

Club setup for hybrid meetings using Zoom

by John Kelsey, Lancaster Area Woodturners

Our woodturning club has 60 members, 40 of them local to our rather large and semi-rural Pennsylvania county, and 20 from away. During the pandemic we have relied on Zoom to hold a monthly club meeting (first Tuesdays at 7pm) plus a weekly Coffee Hour (Thursdays at 10am). Last fall, six months into the pandemic, we began recording our Zoom meetings so members who couldn’t attend in real time could watch our videos posted on YouTube and on our club website, lancasterareawoodturners.org.

Our meeting space, above Kauffman Kitchens in New Holland, is large and well-ventilated. As the pandemic recedes we’re able to resume socially distant in-person meetings there. But with the aid of Zoom we’d like to continue serving all of our members, not only those living too far away to travel to the meeting site, but also those who can’t make a meeting time because of work, weather, pandemic concerns, or whatever.

Our club’s perspective

We wanted to resume the kind of meetings we have always enjoyed: chat together, club business, show-and-tell, and woodturning demo, usually by a club member but sometimes by a visiting teacher. A hybrid meeting would have some members present in the room and some present on Zoom. We wanted to provide a quality experience and an equal experience for all. That meant every member could see and be seen, and every member could speak and be heard, whether they are in the room or on the Zoom call.

Our needs as a club may differ from the needs of professional turner-teachers who offer Live Interactive Remote Demos. A sole practitioner can use equipment and software tailored to his task, and can handle the learning curve that might come with camera-switching software such as vMix or hardware such as the Atem Mini. The sole practitioner only needs one microphone, whereas we would need at least two. A club like ours must keep it simple so many members can become adept, not only to share the workload but also for continuity as we age out or move on. We needed to rely on ordinary workaday computer capabilities with shallow and short learning curves, not uber-geek expertise.

Early in the pandemic we started a weekly Coffee Hour to check in with our members and help them get up on Zoom. Our hour together every Thursday morning became a lifeline for many of us. It wasn't long before we added shop tours, demo videos, slideshows, and live interviews. The weekly schedule gave us a wealth of Zoom experience with many opportunities to experiment. We learned that we could do almost everything we needed within Zoom. We decided to rely on Zoom as our primary software for managing all cameras and microphones. And so far this has worked out rather well.

Budget

After considerable research and experimentation by several interested members, our club voted to spend \$2,600 to purchase and build the equipment we needed for hybrid meetings. We already owned \$500 worth of gear, in the form of one older camcorder and a shop-made camera boom; besides audio-video equipment we needed an electrical upgrade, a Lexan safety screen, and a heavy cabinet to support a big TV. So a club starting from scratch could expect to spend about \$3,000 for a setup that resembles ours.

We are lucky to have a large and well-ventilated meeting space that has a wired Ethernet connection to the Internet, as well as good WiFi. While WiFi-only or a phone-generated hotspot could work, multiple WiFi devices soon overwhelm any all-wireless setup. Our wired connection avoids a lot of problems and helps ensure a clean, stable, and low-latency Zoom transmission.

It's worthwhile to note that even if we had decided not to set up for hybrid meetings, we would have spent about half of the total budget just for the big TV with its stand and cables, to work with with our pre-existing camcorder and camera boom. We were well past the in-person limit of circling around the demo lathe, plus we wanted to show slides and videos.

Here's roughly where the money goes:

Desktop PC, used	\$300
75" TV	\$900
Stand for TV	\$100
New camcorder	\$260
Refurb camcorder	\$160
Tripods/booms	\$400
HDMI-to-USB cards	\$ 80
Microphone system	\$175
Cables	\$150

Subtotal \$2,425

Plus in our particular situation:

Electrical upgrade	\$300
Lexan safety screen	\$100
Cabinet materials	\$150

Subtotal \$550

Note also that we have begun to use old iPhones and iPads on WiFi as secondary cameras and video monitors; these are loaned by members so they are not part of our setup budget.

Finally, note that our club setup makes a very good demo studio where members could shoot and edit their own YouTube videos.

Computer

Many demonstrators purchase a gamer-quality laptop PC, \$1,500, as the heart of their systems for its speed, graphics, and portability. We decided that a desktop PC would serve our needs better and would be much less likely to walk away or suffer a drop to the floor. We were able to purchase for a mere \$300 a 2017 Lenovo machine running Windows 10 on a fast i7 processor, 16 GB RAM, 2 TB storage, NVidia graphics card, sturdy HP-Compaq monitor, and 8 (!) USB ports. So far it has been perfect for our needs.

Big TV

There's a sweet spot in the big-screen TV market around \$500 for 65-inch models, and \$900 for 75-inch models. We decided to buy one big TV instead of two smaller ones, thinking we could always add more

screens later. The TV shows whatever is on the computer monitor -- it can be the Zoom gallery or speaker view of remote members, the in-room view of the assembled members, slides and videos, or the view through any available camera(s). It also receives the Zoom sound from the remote members, so they can be heard as well as seen.

Primary video camera(s): Canon Vixia

The club already owned a 10-year-old Canon Vixia camcorder; we purchased a second Vixia model R800 new for \$260. The same camera occasionally can be had refurbished from Canon USA for \$160. These cameras are sharp with a big range from wide angle to telephoto, and they output clean HDMI with no tech info cluttering the screen. Although they will run on battery, they do need a wired connection to the computer via an HDMI-to-USB video capture card, \$40. The more expensive Canon R80 version has WiFi capability, but our experiments had demonstrated that relying on WiFi for primary cameras introduced unwanted latency, instability, and yet another layer of software problems.

So in our setup one camcorder mounts on the boom, it typically shows the turner's eye view at our demo lathe, or an overall view of the members in the room. The other camcorder is on a regular tripod, it can look at the demonstrator or the speaker in the room, or at a member asking questions. We usually add a third USB camera, a regular inexpensive webcam, mounted on the main computer to look at the lead tech when he also serves as moderator.

Zoom switches very quickly among the cameras. The "advanced" tab on the "share screen" menu activates Alt+N, which steps around a wheel of available USB cameras. They also may be selected from a menu under the ^caret alongside the video icon, lower left of the Zoom screen.



Lead tech manages cameras and Zoom from our used desktop PC, which connects to the Internet router via wired Ethernet. Zoom image on computer monitor, plus Zoom audio, flow directly to the big TV via 50-foot HDMI cable.



Tripod camcorder on USB looks at the demo lathe and big TV on sturdy cabinet-stand. WiFi iPhone clamped to yellow safety screen, right rear, sees members in the room. Mixing USB and WiFi cameras is versatile as both can be displayed at the same time.



Doug works the camera boom that usually looks down on the demo lathe. It's wired into the main computer through an HDMI-USB video card. Shopmade boom follows plans published by AAW.

Microphones

After considerable research and the experience of a member who had purchased a similar system, we bought the Movo WMX-1 Duo. It consists of a receiver that plugs into the PC, plus two wireless transmitters with remote lapel microphones. The mics transmit to the receiver at 2.4 GHz, not WiFi. We pin one mic on the moderator or main speaker for the meeting, with the second mic taped to a talking stick -- actually a blunt scraper -- for members in the room. Both mics are always on; the Movo software eliminates feedback squeals and, not incidentally, the need for an audio mixing board. A third active mic would be nice but so far we haven't found a way to make it work without feedback.

At \$175 Movo is a budget brand that uses AAA batteries. A pro-level and more durable brand with rechargeable batteries would be Rode, where a two-mic GoTo system might cost \$300.

Secondary cameras: smartphones

In addition to cameras on the USB bus, we can join the Zoom call with one or more additional cameras in the form of smart phones and ipads. Their WiFi advantage is no wires, plus no position on the rotating USB bus.

Having cameras that are not on USB turns out to be quite useful, because the output of each appears as a window in Zoom's gallery view. Zoom will only show one USB camera at a time, but it can spotlight any number of WiFi and remote cameras along with (or without) the main USB view. This feature allows us to show the overhead view of the lathe alongside the demonstrator's talking head: picture-beside-picture.

A secondary WiFi device also may be used as the active microphone, so long as only one is ON at a time. Otherwise, to avoid feedback echoes and raucous squeals it's critical to isolate the mics and speakers of phonecams and ipads from the main audio feed.



Video capture cards convert camcorder HDMI output to USB computer input. \$40 cards also have an HDMI-out port for another monitor.



Movo receiver has a "line out" jack to the computer. The tech monitors mics by plugging earbuds into the headphone jack.



Movo receiver connects to computer via a TRS plug into the standard mic jack.

Secondary video screen

When the demonstrator or speaker can't see the big TV we clamp a small iPad onto the lathe or safety screen so they can monitor the Zoom feed. This WiFi device also can serve as a wireless camera on the demonstrator, though it cannot be used as an additional microphone.

Manpower

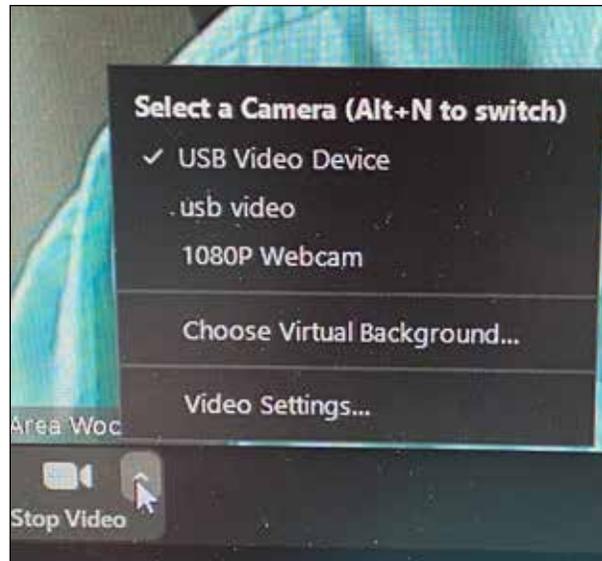
Three members usually work together to run our setup, though two can do it in a pinch. The lead tech operates the computer, one operates the cameras, and one manages our two microphones. Typically one camera looks at the lathe from overhead while the other can be aimed as needed -- the demonstrator speaking, the end view at the lathe, members asking questions or making comments, show-n-tell, whatever.

Summing up

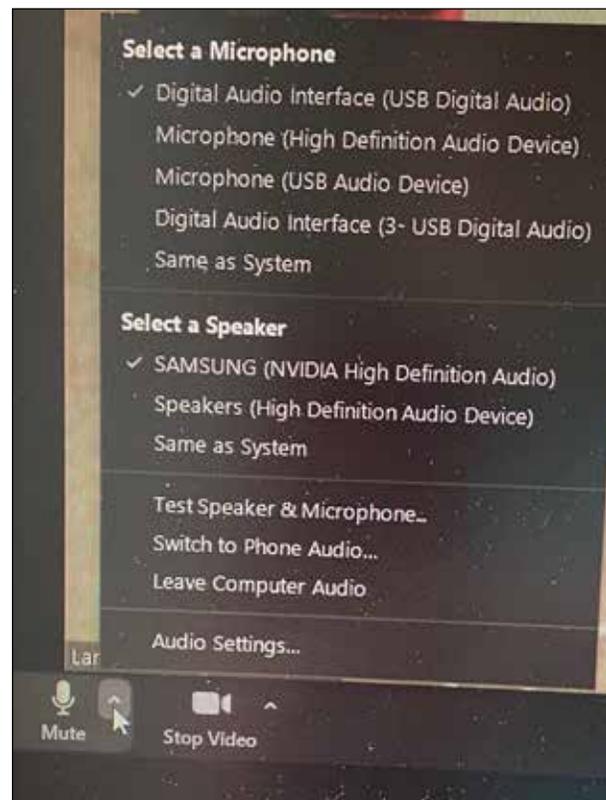
It's all new and we continue to experiment. But with this system we have the ability to show full-screen the action from anywhere in the meeting room -- demonstrator, speaker, show-n-tell, discussion. It's also no problem to present remote LIRD video feeds, pre-recorded videos, and live slideshows.

Our setup delivered an unexpected but welcome symmetry. Members on Zoom must "raise hand" to speak, so the lead tech can spotlight them. Members in the room must raise an actual hand, so they can be given the talking stick while the tripod camera zooms in. When a three-way discussion occurs we can spotlight all three members, whether they are present in the room or virtual on the Zoom feed. It's all very equal, and that's very satisfying.

And at times the meeting feels hushed and on edge like a downtown broadcast studio. It's important to remember that we're not CBS, we're just a gang of woodturners. Take our time, ask for help, laugh at screw-ups, and enjoy meeting together again!



Camera-selection menu appears on the ^caret beside "Stop Video," lower left of screen. "Alt+N" also switches cameras.



Microphone- and speaker-selection menu appears on the ^caret beside "Mute," lower left of screen. Two-mic Movo system shows up as "Digital Audio Interface (USB digital audio)."



Equal access. Remote member Mike explains the gizmo he's building, though his computer webcam and Zoom's "Spotlight" function.



Equal access. Don, member in room, holds his segmented bowl and the mic talking stick. He's seen by the roving camcorder on tripod.



Picture-beside-picture. Alan, joining Zoom from his home computer, uses "share screen" to show photos of toolrests he made. "Side-by-side speaker view" brings up his talking head.



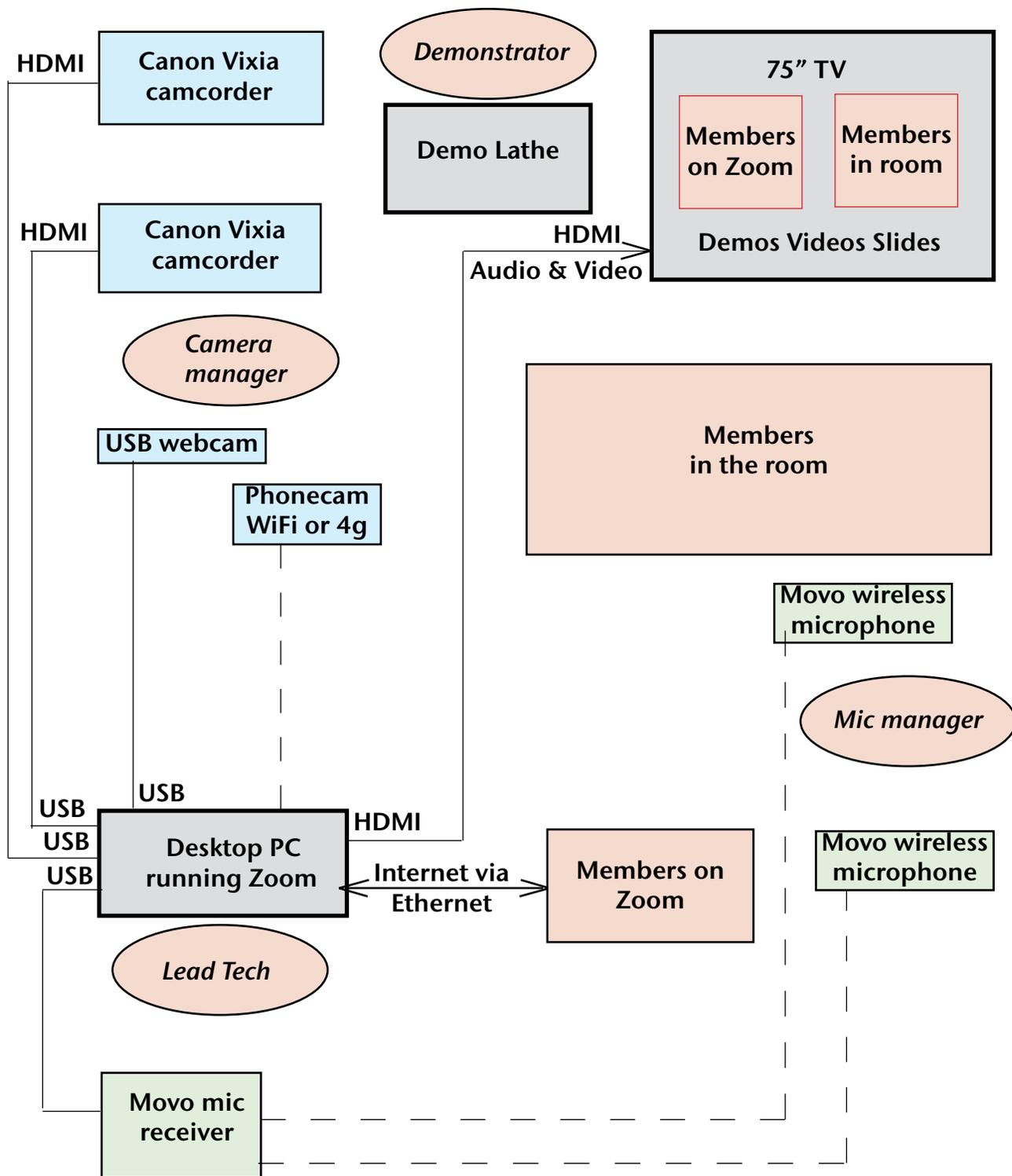
Picture-beside-picture. Doug live-demos on two screens. His face joins Zoom wirelessly through an iPhone on WiFi, while the USB camcorder simultaneously shows his hands at the lathe.



It's all about fellowship on the common ground of woodturning. John, top left, is on a webcam in the Lancaster meeting room. He's discussing with Kai, top right, who joins the Zoom meeting from

Frankfurt, Germany, and Jim, who's joining through his home computer in Delaware. Zoom enables featuring all three faces by selecting "spotlight for everyone," then "add spotlight."

Lancaster Area Woodturners Hybrid Meeting Setup lancasterareawoodturners.org



————— Wired connection
- - - - - Wireless connection

Hybrid Meeting Protocols

Before every meeting

Be sure all systems are switched ON and tested: computer, cameras, mics, big TV.

Be sure Zoom is set to record on our club computer.

Remind everyone - on Zoom and in the room - to silence their phones. And remind the Zoomists to mute themselves if they must take a phone call or talk to their partners.

During the meeting

When you want to talk or ask a question on Zoom, click “raise hand,” we’ll spotlight your video. In the room, raise your actual hand, we’ll pass you the talking stick and aim a camera at you.

Lead tech: Remember to remove all spotlights and return to gallery view whenever the meeting moves on. From there, reframe for the new situation.

Camera operator: Frame your subject, then stop. Fiddling around makes us seasick.

After the meeting

Wait for the computer to convert the recording, and save it.

Before leaving be sure the room lights, HVAC, and all electronics have been switched OFF.



We see you, you see us. Handful of dudes in the room, with empty chairs for the oncoming wave, look into the Zoom feed though an iPhone on WiFi. This puts them into the Gallery View along with the remote members.

Report prepared for American Association of Woodturners panel discussion, July 2021, on how to set up and manage hybrid meetings using Zoom. Hey, this is all new stuff and we’re all still learning. Please direct questions, comments, corrections, and advice to the author:

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