



Virtual and Hybrid Studio Set-up and Equipment

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SWEDISH TRANSPORT ADMINISTRATION

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Broadcast studios for webinars, webcasts, and virtual conferences

Introduction

In this memo, we introduce you to a number of affordable broadcast studios for webinars, webcasts, and virtual conferences while discussing possible set-ups and technical solutions. Today, a common broadcast studio setup includes attention to lighting, cameras, video mixer, audio, and sound solutions.

Against the backdrop of the recent pandemic, webinars and other virtual broadcasts have become almost commonplace. Many organizations invest in studios to obtain a better visual and audio quality in their virtual setup. We predict this trend will likely grow as the benefits outlast the pandemic restrictions. Benefits like remote participation, enhanced inclusion, saved time and money, and its contribution to reducing our carbon footprint are becoming the order of the day.

Why do you need a broadcast studio?

A studio for virtual webcasts, webinars, or as a node in a larger virtual conference can increase the energy and quality of your event. The studio can either be permanent (in a dedicated room with preinstalled technology) or portable (a studio setup on the fly). One advantage of a permanent studio is instant access. However, rigging a studio takes time, so a portable studio probably will not always be set up for smaller broadcasts or meetings.

Studios do not need to be big, expensive, and equipped with advanced technology

A studio is a place for broadcasting where you adapt the technology and environment to reach the best possible conditions. Your studio's advanced setup depends on your ambition, purpose, and available budget. Studios do not need to be big, expensive, or equipped with advanced technology. The studio concept we propose below is simple to manage. One technician can often learn how to run simple broadcasts after a brief introduction to the studio.

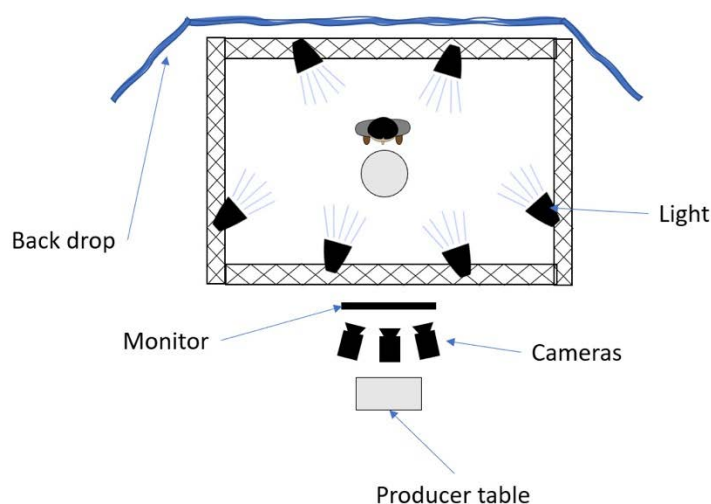


Figure 1: Schematic sketch of a webcast studio

Purpose of your studio

You must determine the primary purpose of your studio, e.g.: recording lectures, conference contributions or production of e-learning material. When contributing material to traditional television, the quality demands are often higher. Focus on the main purpose.

Mini studio concept

*Can be managed
by yourself without
compromising
production quality*

For simpler webinars, you may consider broadcasting from a mini-studio. A setup that you can manage by yourself without compromising production quality. The mini-studio, however, should not be seen as a substitute for a full range studio but as a better option than conducting webinars or participating remotely as a lecturer, using your computer with the built-in camera. A mini-studio where the presenter can present standing up is a powerful way to create energy in your webcast or meeting.



Figure 2: Example of a Mini Studio concept with a simple camera and a calm backdrop.

Camera

What is a suitable camera? You can go with a good-quality webcam or even better, a video camera where you can control exposure, zoom, and focus. However, the positioning of the camera at eye level is all-important.

Lighting

The studio should also offer more and better lighting than the typical office space. The light source should preferably be positioned in front of you and not above. Use a curtain as a calm backdrop. A tail-light or a light directed towards the backdrop will make the presenter stand out from the backdrop.

You can use regular home or office LED lighting in a mini studio setup, but the light sources must be placed right and have a consistent colour temperature. It is essential to test your lighting to not inflict any flickering effects in the video.



Figure 3: LED lighting for regular home or office use can be used if they are placed right and are of good quality.

Microphone

The microphone setup can either be a gooseneck or broadcast microphone placed on the table or a standard USB or Bluetooth headset. Altogether this would cost from a few hundred dollars and up.

The sound and lighting in a studio

Avoid noise

You must consider the surroundings carefully when choosing a broadcasting location. Unwanted noise can occur from within the room and from outside the area. Examples of noise sources are automatic sun protection screens, heating, cooling, ventilation devices, heavy car traffic, and noise propagating in the house's frame. The selected location should be reasonably quiet. If the ambition is to build a studio for sound recording, the requirements are higher. We often have to accept minor sound disturbances, but testing the sound environment with a recording before deciding if it is quite enough is recommended.

The broadcast area must be framed with a curtain along the walls, reducing noise and improving the acoustics in the room. Heavy textiles reduce sound

more. Remember that the textile choice also affects light reflection: a dark blue, black, or grey background generally works well. It is then possible to adapt the set design for a broadcast according to any specific preferences in the studio.

Avoid preinstalled lighting

Avoid using any preinstalled lighting in the room, as ordinary ceiling lighting may cause problems in many ways. The light should not come straight from above in a broadcast, and when using ceiling lights, the colour and the quality of the light cannot be controlled. Ceiling lights with LED or fluorescent lamps can result in a flickering effect in the recordings or webcasts.

A so-called truss is often installed in the ceiling in a permanent studio to make more room on the floor instead of light stands. A truss is an approx. 50 mm round beam to which lighting can be attached. Another option is to build a scaffold (cage) around the stage room and mount the lighting on this if you do not want to install the truss in the room's ceiling.



Figure 4: Example from a webcasting studio. Notice the lighting mounted in the ceiling.

Lights from several directions

Typically, simple three-point lighting is preferred: one head light from the side, fill light from the other side, and tail light from behind (see Figure 5). This type of lighting will lift the person from the background and make the image more three-dimensional. In addition, you can direct a light source towards the background to make it more dynamic. You often want a relatively evenly distributed light from the front in the studio, meaning that the head light and fill light should be equally strong.

Controlled lighting facilitates the broadcast. Controlling the light with a light mixer from one point makes it easier to fine-tune the lighting during the production.

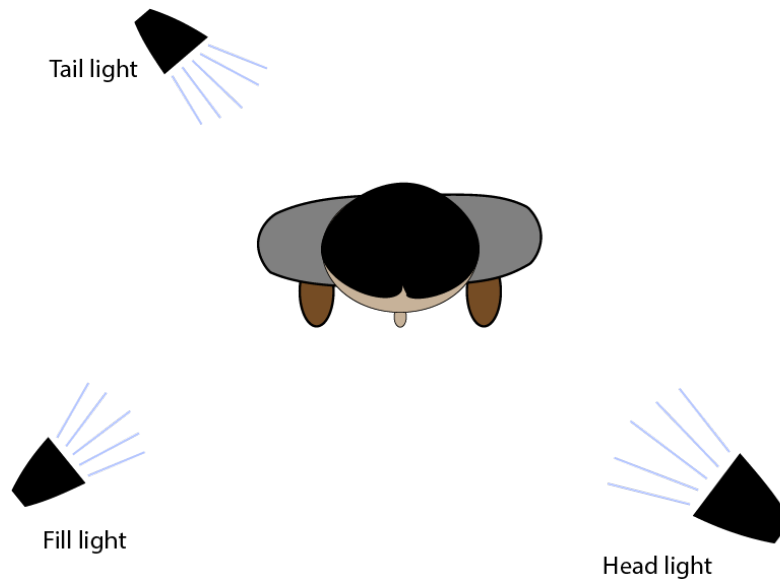


Figure 1: Three-point studio lighting.

Table 1: Example of lighting equipment needed in a studio.

Type	Quantity	Price per unit
Stage Curtain as back drop	The perimeter of the studio	\$20/m (3 m width)
Truss or Light stands		
Light mixer with DMX protocol	1	\$110
LED panels	6-8	\$220

Camera and video mixer

Choice of camera

Your choice of camera depends on the type of production you desire. An inexpensive camera will suffice to stream a video to YouTube. However, you need a more advanced and expensive camera for more professional-looking video productions.

Some cameras are operated manually, and others, so-called PTZ cameras (Pan, Zoom, Tilt), are motorized and managed remotely from the production table. The advantage of motorized PTZ cameras is that fewer people work the broadcast, and the cameras provide greater operational freedom. The disadvantage of PTZ cameras is that they are more expensive compared to the image quality they provide.

The camera should have an optical zoom suitable for the size of the studio, and it should also be simple to control the focus, exposure, and colour temperature on the camera. Each camera also needs a tripod with a video head to control the camera's movements.

You can choose any semi-professional camcorder from leading brands available in the price range between \$1000-2000. Concerning resolution, there are

cameras with 4k resolution and HD 1080p resolution. 4k means 4000 vertical pixels per image. A standard HD image has 1080 pixels. In broadcasting, resolutions up to 1080 most often suffice, and you rarely need the highest resolution.



Figure 6: Pan, zoom and tilt camera (PTZ camera).



Figure 7: Semiprofessional video camera.

Video mixer to change image be- tween cameras

You use a video mixer to manage which camera's image you want to broadcast when. You also use it to insert a video meeting presenter or show a pre-produced video in your webcast.

In recent years, many new inexpensive video mixers with a high production quality have surfaced on the market, with prices starting from \$500 and up. In this example, we assume that the primary use of broadcasting is to stream to own or internal channels and virtual conferences.

The new generation of very competent but simple video mixers often uses signals from the camera via HDMI. One advantage is that less advanced or expensive video cameras also use HDMI for their video output. The mixer is simple to

use, and many functions become available when using the controller software from a computer.



Figure 8: Producer table the videomixer in the middle and the multiview from the mixer on the screen.

Four inputs enough in most cases

When planning what mixer to invest in, you must determine the number of needed inputs. For example, you may need to connect several cameras, one computer with a presentation and another computer with a remote lecturer presenting in a virtual meeting. All of these inputs need to be mixed into your webcast. In addition, one input for pre-recorded videos can be useful. All in all, four inputs are enough in most cases. If more possibilities and more inputs are desired, there are mixers on the market with more inputs and more features. The price will then be a few hundred dollars higher.

Table 2: Example of camera and video equipment.

Type	Price
Videomixer	\$1000
Tripod with videohead	\$100-300
Semi professionell camera	\$1000

Sound

We recommend that you opt for a head microphone. This way, the microphone is closer to the speaker's mouth, and it minimizes ambient sound interference in the studio. An alternative would be a lavalier microphone that is more common in video interviews. In this case, the microphone is placed on the shirt and thereby a bit further from the mouth. In other cases, you can use a gooseneck microphone standing on the table in front of the speaker.

In a small room, the microphones will pick up all the sound. The closer the microphone is to the mouth, the less noise from the surrounding room you will hear in the recording. If you want to reduce the interference from ambient noise, you need a separate control room. In that case, you must set up a communication system between the studio and the control room. The easiest and cheapest way to reduce the disturbing sound is to be as quiet as possible and use head microphones.



Figure 9: A head mic is placed near the speaker's mouth and often used on stage.

In hybrid broadcast, the sound needs to be handled differently

In a broadcasting situation, where some speakers or lecturers attend remotely via a virtual meeting, or if all participants attend online, the sound needs to be handled differently. The participants in the studio need to hear what the remote participants are saying in the virtual meeting without getting their sound reversed or echoed back. At the same time, the sound from both the studio and the virtual meeting feeds into the broadcast. Therefore, we need to divide the sound into groups, a so-called mix-minus.

One way to divide the sound into groups is to connect a USB sound card to the computer hosting the virtual meeting. The sound card gets all the sound from the studio via its in-channel.



Figure 10: Example of USB sound card.

The mixer, in turn, receives the sound from the virtual meeting via the USB sound card's out channel. Together, the sounds from both parties go to the mixer's *main mix*.

This needs to be considered technically in the studio when remote speakers or lecturers participate in a web meeting.

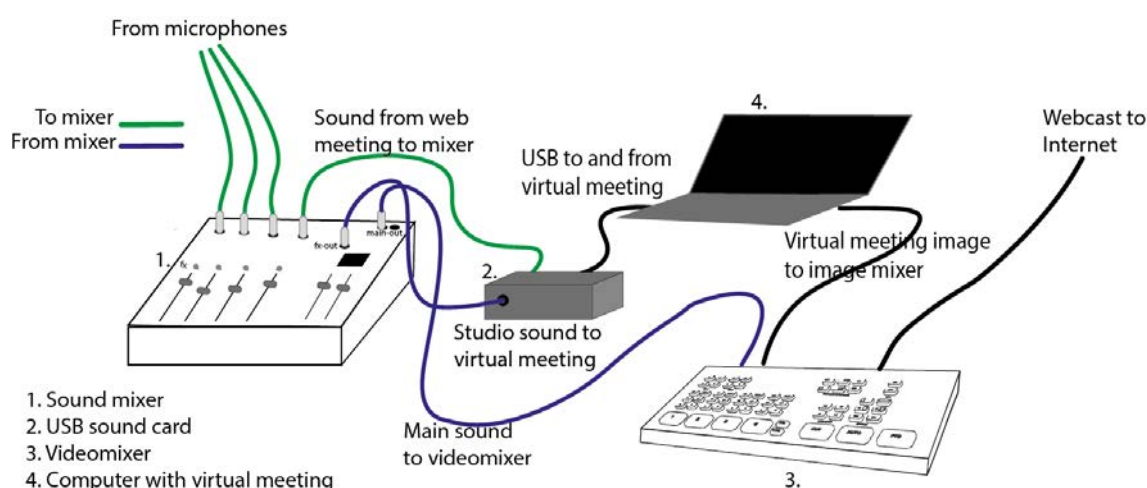


Figure 11: Example of sound set-up and how to connect components.

Table 3: Example of sound equipment.

Type	Number	Price
Sound mixer	1	\$170
USB soundcard	1	\$60
Head microphone wireless system	4	\$200-1000

Staffing and roles

*One or two
persons
– several roles*

One person can manage a studio with this design. If the broadcast is more complex or if speakers, lecturers, moderators, and panelists participate remotely via a virtual meeting, another person is required as it is otherwise difficult to manage all functions.

Virtual meeting manager: This role manages the virtual meeting, keeps track of lecturers, and reassures that the image shared on the image mixer is of good quality. This role should also go through the set-up with the moderators and speakers or lecturers on beforehand, so that they are comfortable with their roles also in the virtual part of the meeting.

Image producer: This role decides which image will be sent and instructs the camera operator(s).

Camera operator: This role manages the camera or the control unit of the PTZ cameras.

Sound manager. This role manages the sound mixer and makes sure that the right sound goes to the broadcast. This role is also responsible for sound checking, turning on the microphones, and placing them on participants in the webcast.

All roles rarely have their own, dedicated person. More often, all technical roles in the studio are managed by one or two persons.

This Guide to Virtual and Hybrid Studio Set-up and Equipment is compiled in by the United Nations Environment Programme in collaboration with the Swedish Environmental Protection Agency and the REMM project (remm.se), run by the Swedish Transport Administration.

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