Amateur Halo - Part I

Richard J. Nelson

Here is how I appear to the other person during a video conference using my Amateur Halo Studio.

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Introduction

I recently participated in a demonstration of the Hewlett-Packard video conference Halo system[1] that was developed in conjunction with DreamWorks Animation. The image quality of Halo is astounding. I was in San Diego California and the Halo R&D Manager, Dr. William Wickes, was in Corvallis Oregon. The Halo system costs about $ 500,000 initially and $ 18,000 per month for 24/7 use. The purpose of the Halo system is to securely and reliably connect two digital video Halo systems together no matter where they are located around the world. HP has sold Halo systems to many US and foreign customers because their use saves a great deal of travel time and expense.

The Halo meeting room consists of a long somewhat narrow table with six chairs on one side and three large video screens on the other side. A fourth video screen is centered higher up for special images. The lighting, color selection, textures, and spatial layout of the room cameras, screens, microphones and speakers are carefully engineered to present a personal presence for up to 12 seated people to meet "face to face" and share information in real time. Image quality is very high and no matter who you are talking to at the distant Halo meeting room you have a virtual presence that is so real that you quickly forget that they are not in the same room with you. The audio quality is just as high as the video quality.

The cameras, microphones, and speakers are unobtrusive and positioned to optimize eye and voice contact so that the personal interaction is as real and natural as possible.

I use Skype, the (can be free) Internet service that allows text, audio, and video communication with other Skype users. The audio quality is excellent if you don't have other applications open on your computer. You will need a microphone and the Skype software tells you if your contact is available to be "called."

If you send a text message it will appear on your friend's computer when he or she "shows up." I was recently Skyped by a friend, Doug Mecham who lives in Waldport Oregon, who said that he had a new toy, and during our conversation his image appeared on my screen. Two days later I bought my own webcam and I soon started testing it with other Skype friends who had webcams.

As I experimented with my webcam I was reminded of my recent Halo experience and I divided my testing and "home video studio" construction into four categories for my own amateur "Halo" Video studio. These are: (1) Webcam Position, (2) Lighting, (3) Background, and (4) Auxiliary Camera(s) usage to show books, circuit boards, and even other rooms of my home.

This article, Part I, will describe the first three of the Halo categories mentioned above. The fourth category, Auxiliary Camera(s), is discussed in part II.

Webcam Position

The images shown in this part illustrate my initial tests. I bought an HP 1.3 Megapixel Webcam for notebook PCs, product No. RD345AA, that connects to my computer with a USB cable. I have four additional powered USB ports added to the left side of my computer LCD screen. Webcams are available from $30 to $120 just about any where. You may buy more expensive models that have additional lens systems for even greater flexibility.

Figure one on the next page shows the general layout of my computer (on the floor on the left) desk and my LCD screen. I have attached (with double sided tape) two black painted blocks of wood to be able to attach the camera which is shown spring clipped to the "B" block on top of the LCD screen. I have two

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1. *See HP's web site at:* http://www.hp.com/halo/introducing.html

24 inch book shelves on the back of my computer desk with a one foot space between them. I mounted a utility power box on the bottom of the paper shelf that sits on these two book shelves. It has an outdoor "security type" lamp socket that may be rotated and tilted. The photo was taken with a frosted 60 watt incandescent bulb installed.

I wish I had SAP (Surprisingly Attractive Person) for these images, but the subject will have to be me. Figure two shows the image that the other person in the conversation sees when the webcam is positioned six inches above and six inches behind the 19 inch LCD screen - shown as mount "A" in figure one below. The lens system used for most webcams is extremely wide angle because the webcam is unusually close to the subject.

The first test image, shown in figure two, is the widest image. The second test image is shown in figure three. You can't see my glasses in the "closer" figure three. Another change from the mount "A" to mount "B" test image is that I am no longer in focus after the webcam was moved even though the webcam has auto focus (within limits which are obviously exceeded here). The images in figures two and three were taken using overhead (and slightly behind) six "100 watt" ceiling compact fluorescent lamps, CFLs.

Two consequences of this seemingly small change may be noticed. The distortion is minimal but you may clearly see it at the edges of the 640 x 480 pixel images. Look at the vertical doors seven feet behind me and notice how curved they look. The HP Halo system uses higher quality lenses that are physically much further from the subject to provide a more natural appearance.

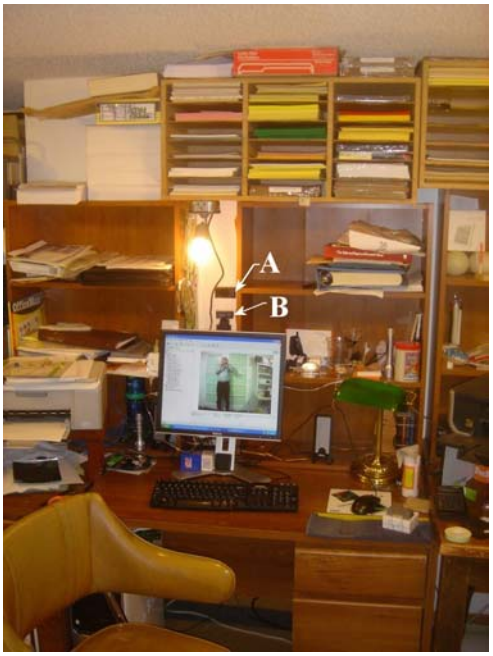

Fig. 1 – My computer desk with light and webcam on the top of the LCD screen.

Fig. 2 – Image with webcam at "A" above and behind the LCD screen. Refer to figure 1 for the two current (black) camera mounts "A" & "B".

Figure four shows the image I would send to a Skype video caller with the webcam on top of the LCD screen, the doors closed, the overhead lights turned on, and the front light turned on with a frosted 60 watt incandescent bulb. I forgot to re-focus the webcam. A focused image is shown as figure five below.

The camera was then moved back to the mount "B" position for figure six. The overhead lights were turned off and the frosted 60 watt incandescent bulb shown in figure one was turned on. The figure six image was taken the following day. Note how bright the light makes my face shine. It is clearly too bright. You may also note my shadow, distorted doors, and general clutter in the background.

Fig. 3 – Webcam positioned on top of the LCD.

Fig. 4 – Doors closed, webcam at "B," & front lighting.

Lighting

Fig. 5 – The same image as figure 4 except focused.

Fig. 6 – Mount "A" with front 60 W incandescent light.

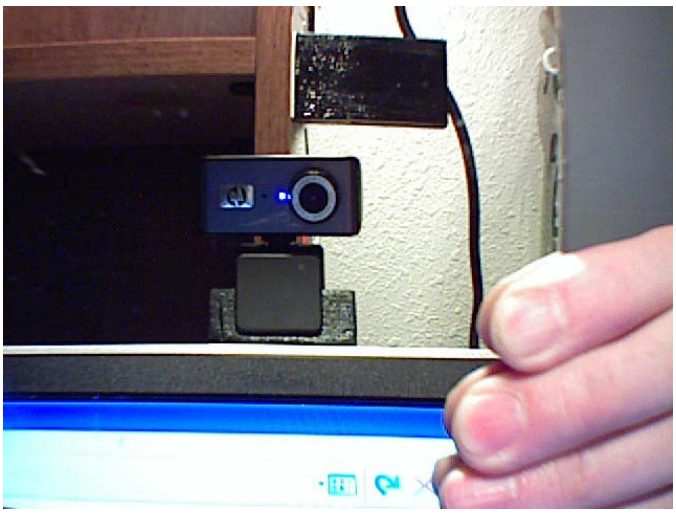

Fig. 7 – Camera shown on mount "B" using a mirror.

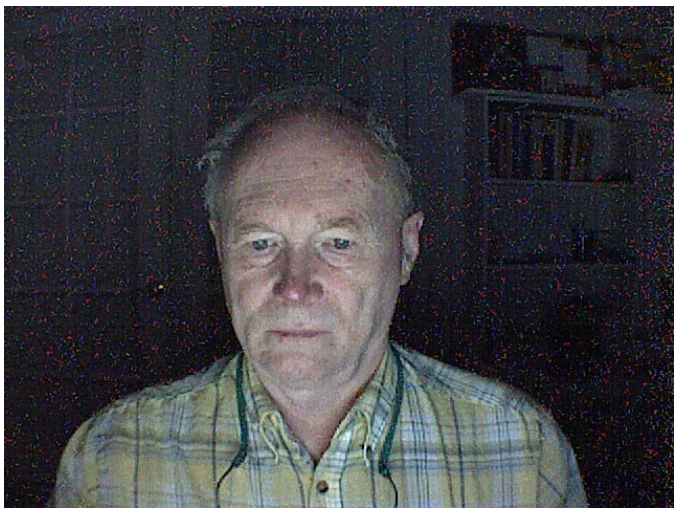

Fig. 8 – Same as fig. 6, 60 W lamp turned off, with noise.

The image in figure seven was taken using a magnifying mirror held up in front of the camera. The image is mirror reversed and you may see the two black painted wood blocks ("A" on top, "B" on the LCD) used to mount the camera. The black cord hanging down is from the light above. The camera mount is

not designed for one handed removal and attachment. Clearly this product was not designed by anyone with either HP well-thought-out functionality, or personal-webcam-use experience. See additional detailed camera observations in part II of this article.

The image shown in figure eight is the same as figure six except that the frosted 60 watt incandescent lamp is turned off. The only light is coming from the 19 inch LCD itself. The colors seem more natural (a major consideration for this exercise) and the background is very dark. The webcam is straining to produce an image and the result is very noisy as indicated by the light 'specks" in the dark portions.

Figures one through eight show the results of a few basic tests of lighting and camera locations. Other camera locations are the sides or below the LCD screen. Several tests were made with the camera mounted below (and centered) the LCD screen. All the people who were asked if they thought it was suitable answered NO! An LCD side mount might be more suitable if you need to present your "best side." The ideal position is the center of the LCD but that is not practical. There are many additional tests that could be made to improve the lighting.

Background and Lighting

The next step towards improving the communication experience is to remove the background clutter. The least expensive and simplest idea I had for doing this is shown in figure nine. This is the image I would send to a Skype caller from my Amateur Halo Studio with the background clutter removed. I used a 53 inch wide by 72 inch long white pull down window shade mounted on the ceiling behind my chair. The frosted 60 watt incandescent lamp is used with the camera mounted on top of the LCD screen. This is similar to the test image shown in figure six. It is too bright and too red, but the background clutter is removed.

Figure ten is an attempt to compensate for the brightness by hanging a sheet of paper in front of the frosted 60 watt bulb to act as an attenuator and filter. This is a nice improvement. Also note the shade horizontal lines.

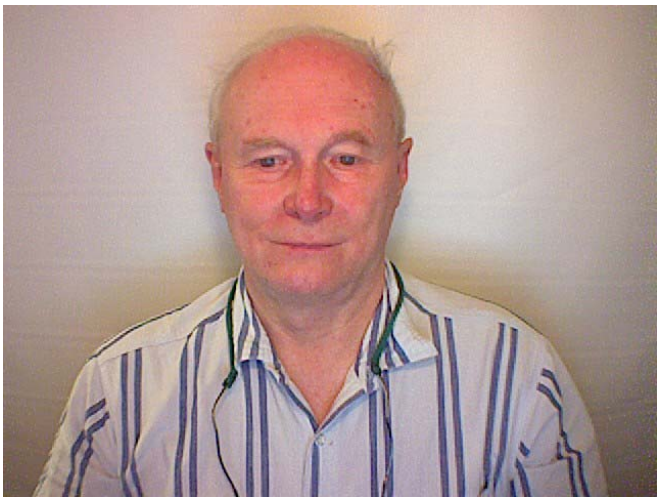

Fig. 9 – A window screen is used for a background.

Fig. 10 – Same as fig. 9 with white paper light filter.

Figure 11 is the same as figure nine except the frosted 60 watt incandescent lamp is replaced by a frosted 15 watt incandescent lamp. Figure 12 is the same set up with the 15 watt frosted lamp turned off. The only lighting for figure 12 is a small amount of natural overhead light from a skylight six feet (on my right) away and the LCD screen. Note that the light level is now too low and webcam noise is visible.

Which of the four images shown in figures nine to 12 seems the most natural? What could be improved? Certainly the shadows are distracting and their elimination would be a step forward.

Figure 13 shows the color effects of a 40 watt clear incandescent bulb. The previously used frosted 60 watt bulb seemed too bright. The lights (overhead and LCD) are influencing the automatic exposure of the camera. Figure 14 is the same as figure 13 except the light is turned off. This was late in the after noon and the sun was setting so any skylight or window light was minimal. Except for the shadows, the image in figure 14 is getting closer to being acceptable.

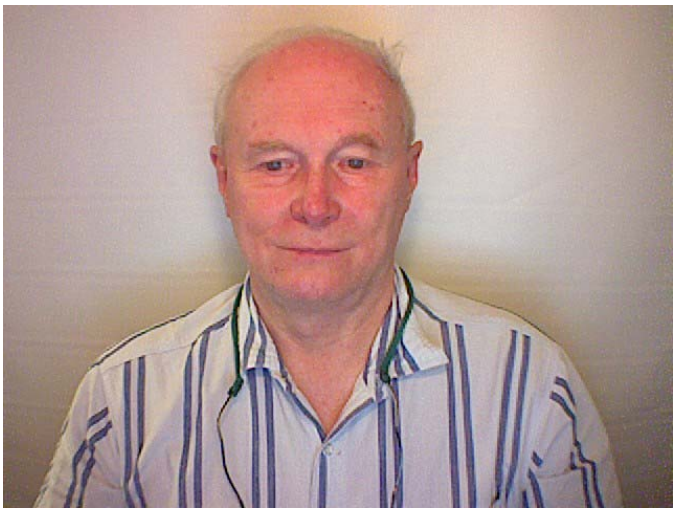

Fig. 11 – Fig. 9 with a 25 watt incandescent lamp.

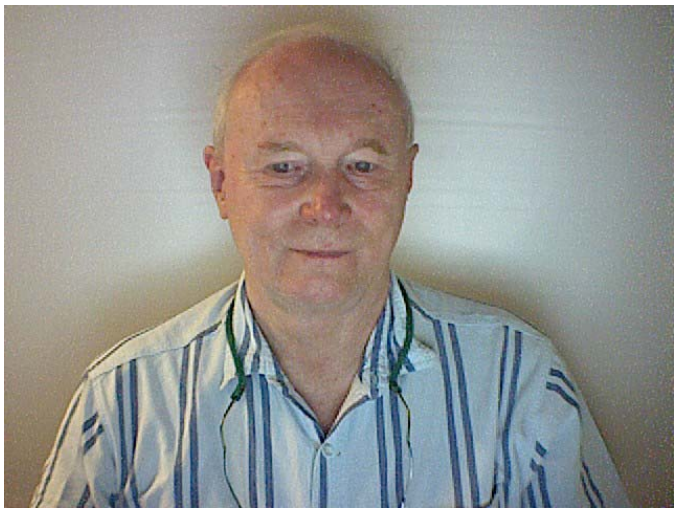

Fig. 12 – Same as Fig. 11 with the 25 W lamp turned off.

This brings up an important point. Lighting considerations for day and night use is also worth thinking about. HP's Halo rooms are totally enclosed so natural lighting is not allowed. I keep the blinds of my office windows closed because of the Arizona desert heat. I haven't made a cover for the two skylights in my office. They have sliding translucent covers and I keep them closed. The light is minimal. One way to see how much this light influences the webcam is to look at the image after dark.

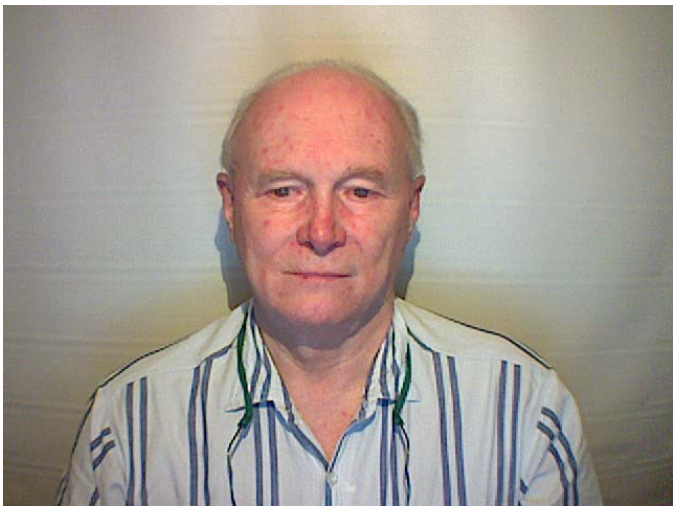

Fig. 13 – Clear incandescent 40 watt bulb in front.

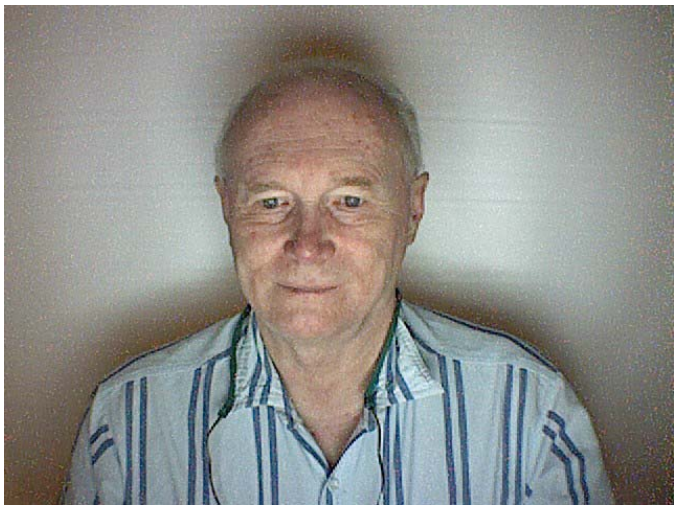

Fig. 14 – Same as fig. 13 with lamp off, note the noise.

Figure 15 shows how a 40 watt compact fluorescent lamp, CFL, front only light, affects the webcam exposure. With this single light there are still strong shadows. One thought for eliminating these shadows is to back light the white background shade.

Figure 16 is a test for shadow reduction. The back of the shade is lit with a 100 watt CFL in an 8.5 inch diameter aluminum reflector 16 inches behind and slightly above me. This additional lighting biases the auto exposure circuitry of the webcam and my face darkened as a result of the back lighting. I tried using a 250 watt bulb a little further back. The whole screen behind me was bright without shadows. I did not take a photo. Solving one problem often introduces another. While the face lighting is a bit weak the

color rendition looks better.

The next series of tests to eliminate the distracting shadows, photos not included, used two clamp-on reflector lamps positioned on each side of the center light. Twenty five watt vanity bulbs were used to see if the face coloring (red reduction) would be improved. The shadows were reduced in intensity but there were more of them. This form of lighting was not a solution to the "reddish" or shadow problems. Let's try another approach to shadow reduction by using a wide more uniform light.

Fig. 15 – Same as fig. 13 except 40 watt CFL.

Fig. 16 – Fig. 15, adding a 100 watt CFL behind me.

Figure 17 shows front and medium high (32 inches above the desk top) lighting using a three foot 30 watt fluorescent light mounted slightly below and four inches in front of the single light shown in figure one. This eliminated the shadows but the image is still too bright and too red. I incorporated another change shown in figures 17 and 18. I painted the window shade a flat gray using two coats. It looks more blue than gray and none of the photos shown in this article were processed to correct color, contrast, etc. The paint eliminated the horizontal lines seen on the shade in the previous photos.

Figure 18 uses the same lighting as figure 17 except three layers of course white cloth were hung down in front of the lamp - eight inches. This reduces the brightness and controls the light on my face. You can still see the slight influence of the skylight over my right shoulder and a cover for it will be made.

Figure 18 is getting very close to being acceptable as my Amateur Halo studio. The lighting with three layers of white cloth acting as an "attenuator/filter" also keeps the light from shining in my eyes. In addition it provides efficient local lighting for most work at the computer desk and I can turn off the 600

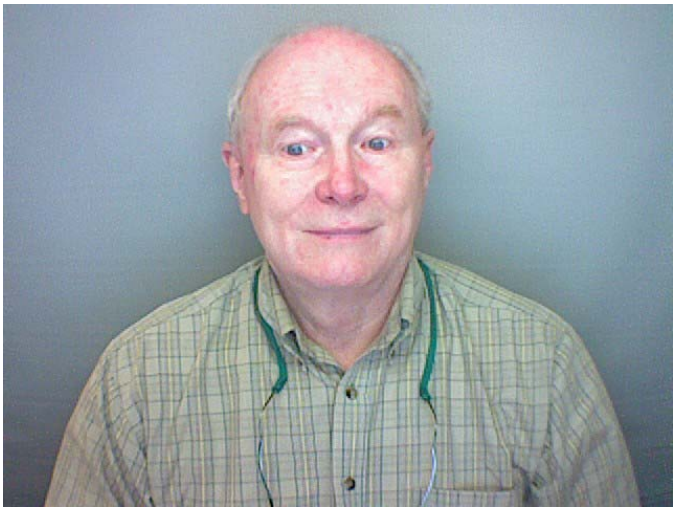

Fig. 17 – No shadows with 3' fluorescent lamp lighting.

Fig. 18 – Fig. 17 with three layers of white cloth.

equivalent watts of overhead lighting in the room. The color of figure 18 is still a little reddish and one more test will be made to see if the color may be easily shifted. I replaced the three layers of white cloth with two layers of green cloth. I bought red, blue, and green cloth to test.

Figure 19 shows a little reduction of red but it is not as bright and as good as figure 18. Another idea to try in the future is to find 36 inch wide colored plastic sheets to use as a filter to reduce the reddish response. Obviously more tests are needed. This may be explored more in part II.

Another useful idea is to use the tubular fluorescent lamp attenuators that are available. They have black dots painted on the tube around the circumference to provide a variable density as you rotate the plastic tube around the fluorescent lamp. I have seen these but I don't have any idea where they may be bought.

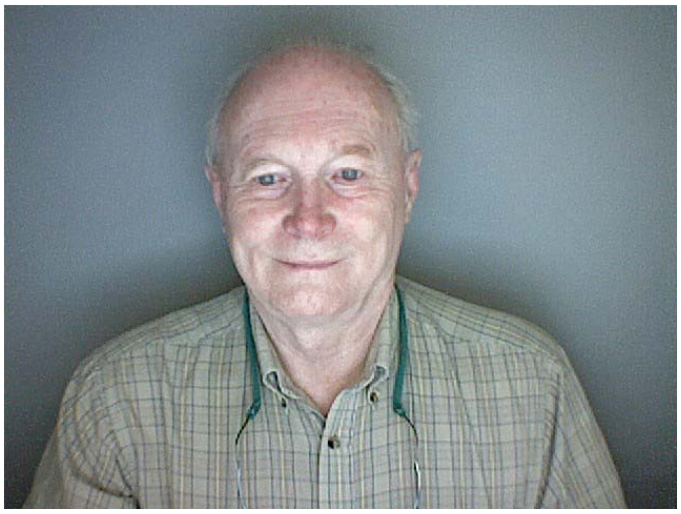

Fig. 19 – Fig. 17 with a two layer filter of green cloth.

All of the examples above were made using informal "props'. Many of the lighting tests were done using spring clamp-on lamp reflectors or cloth attenuator/filters that were held in place with tape. See Appendix A for additional technical details.

This is an on going project and I continually keep an eye open for ways to improve my Amateur Halo Studio.

The final images that follow were made using the finished installation of the previously mentioned test examples. See appendix A for additional photos of my complete Amateur Halo Studio.

Conclusion

The purpose of this article is not to tell the reader how they should be setting up their webcams. It is simply a description of my personal situation and what I did to provide a more professional and flexible use of my webcam. I was strongly influenced by a recent experience using the Hewlett Packard Halo video conference studio. I had several considerations that were important to me. These were low cost - more do-it-yourself time intensive rather than cost intensive – and adaptable to my computer desk.

Each webcam presents its own lighting and background situation and I have not made an attempt to explore situations other than my own.

Video Conferencing will be more popular over the next few years. It really adds a wonderful dimension to communicating with friends and family. Figure 20 is the "final" result and shows how I would appear if I use Skype®, Windows Live™ Messenger, AOL® instant Messenger™ (AIM®), or Yahoo® Messenger.

Fig. 20 – Final results: camera position, lighting, and background.

The question of how "close" you should be to the webcam is one of personal taste. Some people tend to show a very tight view. Figure 21 is the same as figure 20 except the LCD is moved six inches closer. I personally prefer a wider view in order to show things to the other person. It also provides a more realistic view with regards to emulating the HP Halo system. My computer desk has book shelves at the back so I can't move the camera (and LCD screen) any further back as I would prefer. People need to talk with their hands and the other person should see this just as they would if they were there in person.

I attempted to create my own video "studio" by hanging a window shade behind me. I painted it flat gray using two coats. Figure 22 shows the shade partially pulled down. Note the color change because the overhead CFL lamps were turned on for this photo. See additional camera position comments in part II.

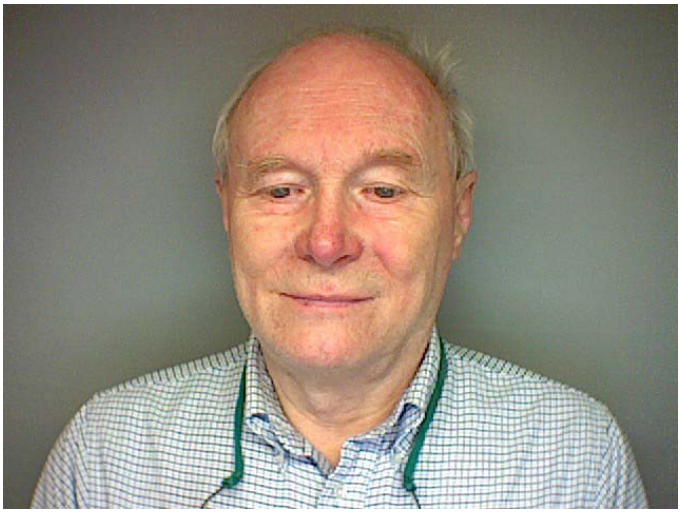

Fig. 21 – Fig. 20 with the LCD moved six inches closer.

Fig. 22 – Fig. 20 with the background shade half way.

This completes the first part of my two part amateur Halo Studio description.

Amateur Halo Lessons

Below are seven lessons I learned from my testing (Part I) for a low cost Amateur Halo Studio.

1. Keep the camera reasonably close (less than seven feet) to the subject to avoid distortion unless it has a suitable lens – usually more expensive.
2. Consider both daylight and after dark room lighting. A close window on one side or behind you will create a shadowed face. Avoid gradient lighting and shadows as much as possible.
3. Use a suitable bulb(s) for the camera and subject – CFL(s); Incandescent (frosted, clear, or natural) bulb(s); or a single tube Fluorescent lamp. Verify that the colors are acceptable by testing.
4. Use a simple gray background that is non-reflective (cover with flat paint if necessary).
5. Choose your camera carefully to be sure that all of your personal needs are met. Perhaps this article will illustrate a few ideas to consider. Refer to part II for additional camera details.
6. Adjust the Camera's zoom feature or physically move the camera (back) to provide a below-the-shoulder view of yourself so you may present a more personal image showing jesters, body language, or other things to the other person.
7. The microphone is usually built into the webcam. If you are having an audio conference and the camera is unplugged the audio will have to come from another microphone. Keep this in mind as you set up your video/audio studio.

Appendix A – Technical Details – Page 1 of 2

The text in the article is fairly technical. Some of the technical details were intentionally omitted and they are included here. See part II for the details of the camera(s) and how they may be used to show technical details of any project that you wish to share by way of video with friends and family. Video conferencing has been the technology dream for 40 or 50 years. Adding video to your conversation is like adding color to a TV or a computer screen. Once you use it there is no going back. Of course you may need to be conscious of how you are dressed (or not dressed). Women may be especially concerned, but like any new technology we will just have to "get used to it."

Figures A1 and A2 show my lighting test equipment. Many of the tests are illustrated in the article. The book shelves on my computer desk made it easy to try different means to achieve a uniform, appropriate, and low cost lighting. Good color correction (for accurate color representation) is a separate challenge that is beyond the scope (and financial resources) of my Amateur Halo Studio.

Fig. A1 – clamp-on light fixtures used for lighting tests.

Fig. A2 – Various lamps (15 – 100 watts) tested.

Figure A3 shows a 20" by 36" four layer folded course white cloth that is used to "adjust" the facial lighting. The window screen is shown partially lowered.

The cloth was wrapped around two 3/8" diameter wood dowels 36 inches long for support. A one pound lead weight holds it in place as shown in this photo. In actuality three of these weights are used.

You may see the shadow just inside the front edge of the desk. The idea is to light the keyboard and provide less light on my face.

The final position of the white cloth filter/attenuator is shown wrapped tightly around the fluorescent lamp in figure A4 on the next page.

Fig. A3 – Computer desk showing four layer course cloth filter/ attenuator to adjust facial lighting.

Here is a view of my Amateur Halo Studio. The lettered items are described below.

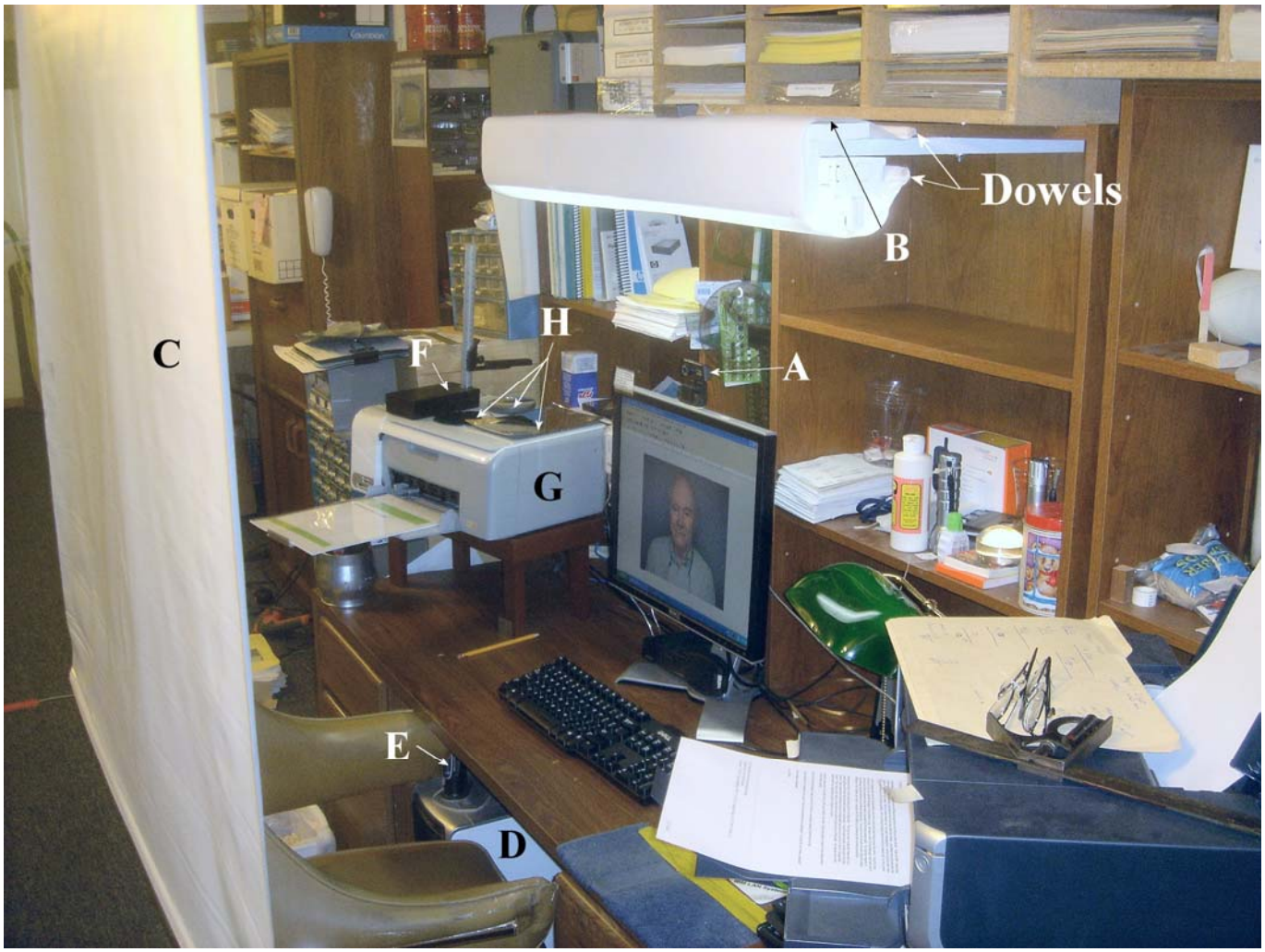

Fig. A4 –Amateur Halo Video Conference Studio. See text for a description of the lettered items.

The Amateur Halo Studio parts are identified with letters in Figure A4. They are described below.

A. Webcam mounted on a piece of ½" thick wood held on the LCD with double sided tape.

B. White course cloth (four layers) filter/attenuator that may be seen hanging down in fig. A3. A binder clip is attached to the bottom wood dowel and the cloth is wrapped around the wood light fixture and held with a wire tie that may be seen just to the right of the lead weight on top. The tie is held by a small nail. Cloth: $ 1/ yd. on bargain table at Wall mart. It is 52 inches wide and 63 threads/inch.

C. Window shade (53-1/2" wide and 72" high uncut, $11 Home depot) mounted on a painted furring strip and screwed to the ceiling. The screen is painted with two coats of flat gray paint on the studio side.

D. Desk computer under the desk connected to the Internet with high speed cable.

E. Universal 12-in-one memory card reader.

F. Camera stand for showing documents and small objects as described in Amateur Halo, Part II.

G. HP Photosmart C4150 all-in-one Printer Scanner Printer.

H. Three mirrors, two magnifying and one flat. See Amateur Halo, part II for their usage.

Appendix B – Video Message Cards – Page 1 of 5

There are times when you can't hear the other person or they can't hear you but your video image is still working. Keep in mind that the video image (and audio) is digital and being sent via many different computers. This means there could be a substantial delay. I have experienced seven, 15, or more seconds between a change on my end and the visible change on the other end.

Below are a few message cards you may print to keep handy to be able to tell the other person what is going on and what you want them to do. They may also be used to tell them what you are going to do.

Hold the following large text "message" cards in front of your camera to communicate with the other end in case there are audio or other problems – and there are always "problems." I printed them on heavy yellow cover card stock and cut the printed pages in half.

The lettering is 42 point New Times Roman. See example in figure B1 and B2 below.

Fig. B1 – Sign printed on yellow card stock. Note how the color is shifted towards the green. See Fig. B2 for the actual card color.

Fig B2 – Actual color of the green card shown in Fig. B1.

NO AUDIO

CHECK MICROPHONE

DO YOU

HEAR ME?

I CAN

HEAR YOU

RE-POSITION

YOUR CAMERA

I WILL HANG UP

AND CALL YOU BACK

PLEASE HANG UP

AND CALL ME BACK

BE SURE YOU

HAVEN'T MUTED

YOUR MICROPHONE