

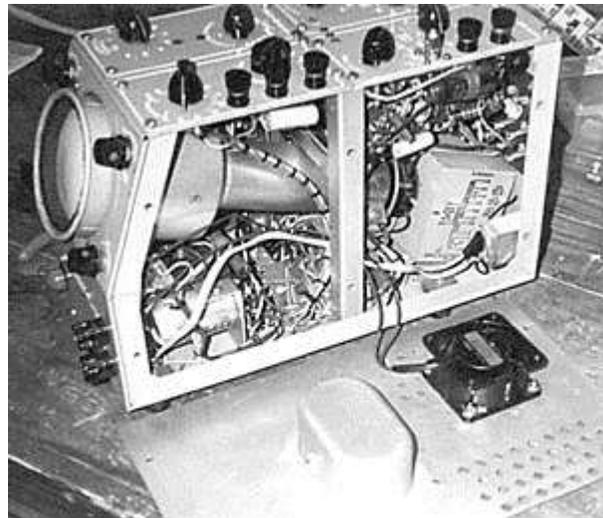
## Putting the Navy OS-8 to Work

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The U.S. Navy OS-8 series of oscilloscopes was manufactured from the 1950s to the early 1960s; it is the military version of the civilian "Pocket Scope." It features a 3-inch CRT with tube circuitry that was very compact for its time. It does not have calibrated gain, nor is the sweep circuitry very sophisticated. But it works well and has been found to be very useful in applications where continuous monitoring of signals is needed, such as checking the modulation envelope of a transmitter or monitoring received signals. It's also useful for some troubleshooting. My main use for it is in physics experiments monitoring electrical fluctuations in semiconductors. It is compact and fits well permanently on the ham shack table or electronics bench where more sophisticated 'scopes are excessively tall or wide and always too long.

There are many viewpoints in collecting antique equipment and I subscribe to more than one. Some equipment is worth having because of its historical importance and that spends most of its time on the shelf and gets a few ohs and ahs and a dusting once in a while. But my greatest enjoyment comes from actually using antique equipment in my everyday exploration of radio, electronics, and physics. And this is where the OS-8 fits, in use as well as in space, on my bench. I take the attitude that if you really have to have both history and usefulness, buy two, keep one for history, and modify the hell out of the other one. I bought my OS-8 many years ago. Today, several are often available on Ebay at any time ([www.ebay.com](http://www.ebay.com), usually under "Navy Oscilloscope"). Fair Radio ([www.fairradio.com](http://www.fairradio.com)) also has them in stock at various times. The main thing to be aware of in purchasing one is to make sure that there are no serious phosphor burns on the CRT.



The OS-8 with its side removed to show location of computer cooling fan.

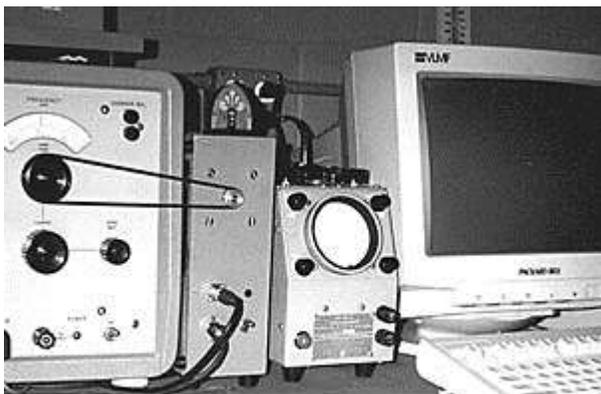
At the time that these scopes were made there was no protection from this problem as on modern scopes. The burns are easily seen as discontinuities in the normally white phosphor. A little irregularity in the phosphor caused by usage is OK (after all it is used equipment), but the phosphor should not be burned to the extent that small areas are either brown or missing. These can be seen without operating the scope, but if you are able to test the unit before purchase, defocus the beam and raise the intensity to flood the phosphor.

A replacement for the CRT, which is a 3RP1, is hard to find so make sure yours is good before buying. New 3RP1's can be ordered from Richardson Electronics, ([www.rel.com](http://www.rel.com)), but are not cheap. At times, some can be found selling on Ebay at times. Phosphor burns come about through carelessness and are easily avoided by not operating the 'scope at high intensity and with no sweep for lengthy periods of time. Over the years my 'scope has had considerable operation and has not developed any such burns. After lengthy use, I found that some of the 12AT7's would fail by becoming gassy, although the emission and transconductance checked OK. I believe that this was due to excessive envelope temperature. Also, the phenolic boards on which the tube sockets were mounted showed some darkening, which is a sign of charring.

Probably the original specs did not allow for extended operation, since the chief function of the scope was for troubleshooting. The major sign of tube gas is that the trace will not hold its centering when rotating the gain control in the d.c. input position of either the H or V selector switch. In fact, it might be impossible to center the trace at all. Another sign is that the internal 5 Meg screwdriver adjustment pots for d.c. input compensation cannot be set and/or that the warm up time of the 'scope becomes excessive.

Although I do not like to modify antique equipment unnecessarily, I decided to make some much-needed changes. I installed a 120V computer fan by first cutting a round hole 2 1/8" in diameter on the removable panel on the right back side just under the tubes. I used a metal coping saw and then trimmed the opening with a file. The fan is positioned so that there is enough clearance on the inside.

The fan I used is a TRW A24-B12A-15W3-3-000 (Allied 965-0100) with an Allied 609-5590 finger guard. Order from [www.allied.avnet.com](http://www.allied.avnet.com) on the web. Caution: before doing this modification, operate your fan in its intended position to make sure that its magnetic field will not affect the CRT. Most computer fans will not, but it should be checked. The OS-8 does have some kind of magnetic shield around the CRT but is somewhat subject to external magnetic fields.



My setup for measuring electrical fluctuation in semiconductors. From left to right: HP 302A wave analyzer, step motor unit, the OS-8, and the controlling computer.

After this modification the Scope ran much cooler and the case no longer made a good hand warmer (somewhat to my regret). Now it is just a little warm. If your fan is too noisy, which mine was not, speed may be reduced by trying different values of wirewound resistors in series with the motor.

The line cord for the OS-8 was a problem. It was armored with a metallic mesh and had a strange retractable ground prong on the wall plug, with a metal shell. I considered this arrangement a hazard since the insulation

inside had hardened and, if it cracked, the wires might short against the armor. I also did not

like the idea of being in contact with the metal of the cord and plug when I plugged it into the wall socket.

I removed this cord and mounted a conventional filter-type line cord socket for a 3 wire line cord (Cor-Com 3EF1 or Allied 657-01-005) on the back of the instrument. If you want a socket without the EMI filter use Allied 689-3495. Also, finding that the pilot light was annoyingly bright, I placed a 22 ohm 1W resistor in series with it.

The vertical plates of the scope are driven by two 6AH6s, which may not be balanced. This is easy to check with the front panel controls. With no signal input and the vertical amp in the x100 position, lock the trace to 60Hz. Then move the trace up and down with the vertical positioning control. There will be a very slight vertical deflection, just barely noticeable, caused by 120 Hertz hum in the power supply. At the center of the screen this slight deflection should vanish and an exactly straight trace should be seen. If it is not the case, either the 6AH6's or the 12AT7 vertical amplifier tubes are not balanced.

There is no way of adjusting for this in the circuitry, so the tubes may have to be replaced. But first check R116, R117, R123, and R124 to make sure they have not changed value (they should all be 3.6K). All tubes except the CRT can be ordered on the internet from either Fair Radio or Antique Electronic Supply ([www.tubesandmore.com](http://www.tubesandmore.com)). Individual tube types are often available on Ebay at various times.

To access these tubes the four screws on the top plate of the vertical amplifier have to be removed and the entire amplifier lifted out. Some of the other tubes in the OS-8 are difficult to remove since you cannot always get your fingers around them. In order to remove the 6J6 Sweep Generator, I had to make a handle by slipping a piece of 5/8 inch ID radiator hose over it. Then it came out very easily. Hint: keep a piece of radiator hose with your tube pin-straighteners!

Although the response of the vertical amplifier is just 2 MHz, the back plates are easily accessible and can be connected to a tuned circuit for vertical deflection with a transmitter at any frequency. But be careful, there is high voltage on some of those terminals under the back plate!

Due to its small size, the OS-8 is always ready on the bench for troubleshooting and has proven very useful as a monitor. It is also a pleasure to see that old Navy equipment in operation again. I've included a picture showing my OS-8 in use monitoring electrical fluctuation in semiconductors. The HP 302A Wave Analyzer next to it is operated by stepping motors that are controlled by the computer. The computer also collects and processes the data automatically.

My most recently published work using this equipment appeared in The Journal of Physics CM, Mar 20, 2000. Reprints are available upon request. An article on how I built my electronics benches appeared in the June 2000 issue of 73 magazine.