THE TUBE IS MASTER
Restoration of Vintage recorders

A few years ago, I began to miss the nice sound of old vacuum tube mastering machines. The sound of our Studer A80 was quite acceptable, yet it seemed to lack the body and warmth of my old Ampex 300. So I dug a couple of my old Ampex 300 tape recorders out from under the pile of junk in the shop and began to fiddle around with them.

These are remarkable machines, and for many decades were the workhorses in almost every recording studio and radio station. I cleaned one up, plugged it in, threaded a reel of tape and...Magic! What a sound.

Thus began an odyssey of transforming the 300 into a 1/2", 15/30ips machine, changing the speeds, rebuilding the electronics and having John French (JRF Magnetic Sciences) design and build a modern set of heads. I made some of the transports by hand, using some aluminum stock that matched the deck perfectly. The rest is history. This became our primary mastering machine at Sear Sound. Many albums were mastered on this machine, and one major label even went so far as to bring in a mixed album, record it onto the Ampex and the take the output from the playback head and re-record onto a Studer CDR CD recorder, just to add the sound of the Ampex machine on the album.

Just when we thought it was safe to go back into the water, I had the chance to pick up two Studer C-37 recorders. The blueprints are dated 1962, and I found that Gotham Audio (then Studer distributor) had sold six of these machines to RCA alone. Once the primary tape recorder in European studios, few C-37s were sold in the states, as Ampex controlled the market by then. I bought the two recorders instantly.

Each machine is a work of art. The electronics are all modular, which simplifies servicing. The transport hinges up and the front cabinet panel drops, providing total access for maintenance, including a convenient plate to put tools on. The deck has its own internal test meter and switch to measure various voltages throughout the recorder. A regular lightbulb is used as a variable resistor to set the proper startup torque to the motors (shades of my old Westrex film recorder that used the same idea). The wiring, harnesses and overall construction were typically Swiss. There are no VU meters on the machine, which is quite proper. When you align the machine, it should always be to the meters on the console.

The recorders were 1/4", 7.5/15 ips machines, so the first task was to change them into 15/30 ips machines, 1/2". After consulting a variety of knowledgeable people - including David Manley, who owns a slew of them - I got some of the parts that I needed. Then came the critical decisions.

I called Jeff Gilman at MDI Precision Motor Works in Hudson, Mass. He has a proprietary method of building up the capstan shaft size by using a ceramic sleeve. He also machined a series of roller guides for the 1/2" tape configuration. The machine nas no fixed guides - everything turns with the tape. Bill Titus did a lot of measurements for the tape path, and we added brass washer shims of different thicknesses to get all of the guides to the right height to match the head block.

The record and playback electronics were another problem. Beside the usual capacitor and tube replacements, the EQ had to be changed to conform to the various new head characterisitics and tape speeds. This is a "trial and error" situation. When you change the frequency curves to try to eliminate the "head bump" in the bass, the higher frequencies are then affected. After some experimentation, we found the right combination.

The final problems were the logic system and control switching. As machines of that vintage use relay logic, all the relays were cleaned up or replaced. Fortunately, the relays are standard "off the shelf" parts. Modern, microprocessor transport control is far superior, yet the relay system works fine, so we left it intact.

With the restoration completed, we ran wow and flutter tests. The machine came out better than the original manufacturer's specs (at 15ips, 0.04% weighted; and at 30ips 0.022% wow and flutter, 0.0175% weighted). Frequency response was what we expected, with the bass bump at 31Hz, starting at +.6 dB and staying within reason down to 15Hz.

The ultimate test for any piece of recording studio equipment is what the client will accept and will want to use in session. Sear Sound had the privilege of being selected to do the mixing for the Eric Clapton Crossroads II album, consisting of live and studio recordings that were recorded in the mid - 70s. (Jay Mark was the engineer and Bill Levenson produced with Kerry Rappaport for PolyGram Records).

The 2-inch masters for the '70s, mostly 16-track, had to be baked in a convection oven at 125 degrees for a couple of hours. They were then played on our Studer A80 16-track, 2-inch machine and recorded with

timecode onto a beautiful new Studer A827, as well as a 48-track digital machine (rented from Toy Specialists). I don't like the sound of digital, but if I have to record digitally, this would be the machine of choice. It is built with the same care and attention to detail as the old C-37s. As Jay Mark decided to go 1/2", 15ips, Dolby SR, we set up our various 2-track machines. The moment of truth arrived. Which of our 1/2" machines would be best suited to the Clapton project? Using bind testing, it took about one minute for the choice to be made. The C-37 was the preferred machine to everyone. The sound had sparkle, clarity and "air" that other machines lacked.

The album was completed on the Studer C-37. The machine took a year of work, but it turned out well. At 30ips, the Ampex 300 has an "airier" sound, with more second-harmonic distortion, which many people find pleasing. The Studer is more accurate in terms of frequency response, but this is purely a matter of taste. No solid-state machine in our studio is comparable in sound to either of these machines.

I have always felt the deficiency of the sound of transistor equipment. Knowing this, I have always run a studio full of tube gear. Because of my 30 years' prejudice, I go to great lengths to be sure that this does not bleed over into the listening tests that we do. Neither I nor the visiting engineers know which machine or device they are listening to. They simply select button "A", "B", or "C". The differences are clear and apparent. As it often happens, the engineers' decision is the same as that of the producer and studio personnel. There is a clear and distinct difference, and in all the years of testing equipment, I can't recall any situation where vacuum tubes didn't sound superior to transistors.

Walter Sear