

Digital Mastering of the Mercury Living Presence Recordings for Compact Disc Release

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AN AUDIO ENGINEERING SOCIETY PREPRINT

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Abstract:

Music purists believed it was impossible to capture on compact disc the power and ambience of the original Mercury Living Presence lps. A custom analog to digital chain was developed with restoration and use of original tube and film equipment. Topics include production methods employed, tube versus transistor comparisons, and the goal of maintaining the original natural sound while working in the digital domain.

1. INTRODUCTION

As a mastering engineer and audiophile, I was well aware of the legendary Mercury Living Presence Recordings on LP and the sonic attributes they embodied. As Vice President of Studio and Technical Operations at PolyGram U.S.A. at the time that the Mercury project was being planned, I knew that it would pose an exciting challenge to capture the realism and power of these recordings on Compact Disc. Philips Classics wisely enlisted the aid of Wilma Cozart Fine, the original producer, to supervise this project. This paper tells the story of the work and craft that went into the CD releases of the first twenty-six albums in this series.

2. BACKGROUND

In early 1989, we were given the go-ahead to begin work on the project. The first task at hand was to start collecting all of the masters necessary for the first batch of releases. For those not familiar with the Mercury recordings, masters were in three track format either on 112 analog tape or 35 millimeter magnetic film. Using a location recording technique masterminded by the late C. Robert Fine, three precisely placed omni-directional tube microphones were positioned along the frontal plane of the orchestra. These microphones were directly fed to the three channels of a Westrex film recorder or Ampex 350 3 channel, 112 inch tape machine. When these recordings were mastered for LP, the three channels of audio were fed through a Westrex 1524 tube console for 3/2 reduction and then to the cutterhead of the disk lathe. The beauty of this approach was in its simplicity: minimum number of microphones to capture the sound-field, minimal number of line amps to amplify the signal, and only one generation of tape or film. No limiting, compression, or filtering was ever placed in the signal path. It should be noted that during the live mix to disk for mastering, Pultec tube equalizers were sometimes used to compensate for cutterhead variations and deficiencies.

3. MASTER TAPE PREPARATIONS AND EQUIPMENT RESTORATION

Most of the original masters that we needed for this project were in storage in Baarn, The Netherlands. Since it was decided that only first generation, original masters were to be used for the CD transfers, we had to work out a system for safe transport of the masters to the United States where the production work was scheduled to be done. Working with Mr. Marcel Shopman of Phillips Baarn and Mr. Onno Shultz of the Philips engineering team, we worked out a program to back-up all of the masters on Sony 3324 digital multitrack, preserving

their 3 channel integrity, before being shipped to the PolyGram Studios in Edison, New Jersey.

Concurrent with the safety transfers being done in Baarn, restoration work had begun on the Westrex film recorder, console, and Ampex 1/2 inch tape machine that were used for the original Mercury Recordings. Mr. Robert Eberenz, a member of the original Mercury recording team, and Wilma Cozart Fine had fortunately kept this equipment "in the family." In order to restore this equipment to its original condition, Mr. Eberenz replaced tubes, capacitors and wiring as required, and performed all of the necessary mechanical "tune-ups".

4. DEVELOPMENT OF CUSTOM A/D TRANSFER CHAIN

As Mrs. Cozart Fine and I began our evaluation sessions in April 1989, it became very clear to us that the A/D conversion process was a very critical step in our production work. As the producer once described it, the sounds from different converters were all different "bowls of soup". We began auditioning every A/D converter that we could obtain. Our test methodology was simple: while playing an original master as source, we would switch between the direct output of our console and the output of the digital chain. The digital chain consisted of the converter under test feeding a Sony 1630 PCM Processor. The final link in the chain was the Apogee filter modified D/A section of the Sony 1630. At times, we would substitute different D/A converters for listening evaluations, but we always returned to the Sony converters or the D/A's of our Panasonic 3500 DAT machine for reference purposes.

Our monitoring set-up consisted of a Cello Audio Suite feeding balanced lines to Cello Performance Amplifiers, which in turn were driving B & W 808 Monitor Loudspeakers. As we compared the various digital converters to the playback of the actual analog source, we found that the soundstage of the orchestra was always reduced in width when listening to the digital chain. We also found that many A/D converters exhibited a strident string sound, unnatural sounding midrange, and a loss of air or ambience around the instruments.

As a production team, we had a golden rule: In every step of the production process, always compare back to the original source to ensure that it remains true. To further this goal, we also installed an audiophile quality turntable and preamp. Using a VPI TNT Turntable with a Vanden Hull MC-10 cartridge feeding a Cello P-101 Phono Preamp, we were able to simultaneously switch between the original master, the digitally processed signal and an original LP pressing of a particular release. In this way, we were able to define the particular format signatures of each medium and zero-in on maximizing the digital transfer for the most authentic sound quality.

After many listening sessions during which we evaluated A/D converters, we finally selected the DCS-900 as being most true to the original source. Employing 128 times oversampling technology, this converter had a convincing solidity of sound and a better soundstage presentation of the orchestra in comparison to its competition at the time. Using the Liszt Piano Concerto #1 performed by Byron Janis as our master source, we could also hear more of the air around the instruments and the ambience of the recording hall itself.

By late 1989, most of our equipment was installed in the Edison studios. As a matter of interest, we did some experimenting with playback of the 112 inch masters on tube versus transistor tape machines. It was quite evident that the tube playbacks had a warmer, "golden" sound with better harmonic relationships to the musical instruments. The transistorized playback electronics had a slightly

thinner sound, not as rich, with a slightly metallic, “silver” sound. Even though the tube tape machine gave us a slightly higher noise level, it was an easy choice to justify its use for the project. Not only was the recreation of the soundfield superior to the transistor electronics, the tube equipment also gave us the exact reciprocal of the original recording equalization curve for playback.

In January 1990, we added a final improvement to the digital chain which made a substantial improvement. Thanks to Gotham Audio in New York, we were able to demo the prototype Harmonia Mundi BW 102/49 Redithering Module. This unit uses an advanced noise shaping algorithm which significantly increased our low level signal resolution and detail. By outputting the digital signal from the DCS converter in the 24 bit mode, we were then able to redither and noise shape the signal with this unit and reconfigure the bitstream back down to the 16 bit world of the Sony 1630 CD mastering format. Our analog to digital chain was now complete.

5. PRODUCTION METHODOLOGY

In early February 1990, the film and tape masters that we needed for the first ten releases finally arrived in Edison from Baarn. Fortunately, the condition of the masters was very good for their age. The 1/2 inch analog tape was slightly brittle but quite playable. Most masters only needed minimal resplicing and exercise by winding. Initial rewinding, however, had to be done very slowly. Sticky splices could actually pull off the oxide from adjacent layers of tape if rewound too fast. After getting used to working with the large 35 mm film reels, I gained quite a respect for the medium. The low noise level, three dimensional soundfield, and full frequency response were amazing for any format, let alone on masters that were over thirty years old.

As we began actual work on the first batch of releases, we developed a routine that carried us through the project. After several experiments with digital cloning, we decided that all CD's manufactured would be made from first generation digital masters. In order to preserve the depth and width of the soundstage, we found that the less digital processing, the better. In order to accomplish this we would first do the three channel to stereo mixdown through' our digital chain to create the digital master. Simultaneously, we would make DAT reference copies for listening and evaluation on other playback systems. We constantly referenced back to the original master and LP pressings to ensure the integrity of the digital master. In order to avoid digital editing and copying of the music, it was necessary to assemble our musical selections by manually synchronizing and punching in on the Sony DMR-4000 Digital Recorder. Proper pause lengths between the musical selections were determined at this time. Since the producer wished to maintain continuous room tone between all movements and works, we would then sample and loop good, “clean” sections of short room tone and digitally insert this into our 1630 master. In this way, we were able to keep a sense of performance continuity by avoiding fades to digital black and at the same time keep all of the music first generation digital.

Our first completed CD master was the “Balalaika Favorites” by the Osipov State Russian Folk Orchestra, recorded in Moscow in 1962. As an additional quality check, we requested that the CD manufacturing plant send us a test CD before full scale replication was accomplished. This turned out to be an important decision. Once we received the reference CD back from the plant, we carefully set up a listening comparison between it and a 1630 digital clone of the

master. Both of the digital sources were switched at the input of the D/A converter to eliminate any converter-induced differences. To our surprise, the CD was harsher and more “digital” sounding, with less depth in the low frequencies, than the 1630.

Upon further investigation, it turned out that the plant had three different laser beam recorders and that one of them sounded different than the other two. After making a glass master of the “Balalaika Favorites” on all three LBR's and comparing the subsequent CD test discs from each, we were definitely able to identify the “thinner sounding” lathe. From the information given to us by the plant engineers, apparently this lathe was configured with different front end electronics. As they proceeded with standardizing the electronics on all three LBR's, we simply mastered our product on either of the other two lathes. This gave us an excellent sonic match to our original master tape. The producer and I were finally satisfied that the CD medium could capture not only the wide dynamic range, but also the three-dimensional clarity of the original Mercury Living Presence recordings.

6. UNVEILING TO THE PRESS

After completing the masters for the first ten releases on CD, we decided to set up listening sessions for the press at the Edison Studios. This would give them the ability to A/B the manufactured CD's with the original recordings for direct comparison. On June 21, 1990, representatives of the major audio magazines and the audiophile press gathered at the PolyGram Studios in Edison, New Jersey. After two separate sessions of blind A/B comparisons between the CD reissues and the original master tapes, these critical listeners were unable to consistently identify the source. (1-3)

7. CONCLUSIONS

Several important rules in digital remastering were reaffirmed during this time-consuming but rewarding project and many new lessons were learned.

Most important of all, no matter what it takes, find and audition the original analog master for CD transfer. If the master suffers from some sort of deterioration, then equalized copies or safeties must, of course, be examined.

Also, seek out assistance from the original producer and/or engineers of the recording if possible. Their help will add invaluable input and authenticity to the reissue.

Finally, optimize the transfer of the original master by using equivalent playback equipment whenever possible. This reaffirms the need for accurate technical information on the master tape box at the time of recording. In addition to speed, equalization and any applicable noise reduction for analog masters, tape type and tape recorder used should also be indicated. For digital masters, sampling frequency and digital format must also be included.

We were fortunate to have full support on this project from the management of Philips Classics. This gave us the creative freedom to restore the original tube equipment, develop a customized analog to digital transfer chain, and take the time necessary for thorough comparisons back to the original master. Maintaining the natural sound of these analog masters in the digital domain required extreme care and critical listening. As we all strive to improve the quality of digital in order to make better recordings, let us not forget to fully utilize our most important tool of all—the human ear.

8. ACKNOWLEDGMENT

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