

# WENDY CARLOS & MICHAEL FREMER REVEAL THE SECRETS BEHIND

## The Soundtrack of **TRON**

By Robert Moog

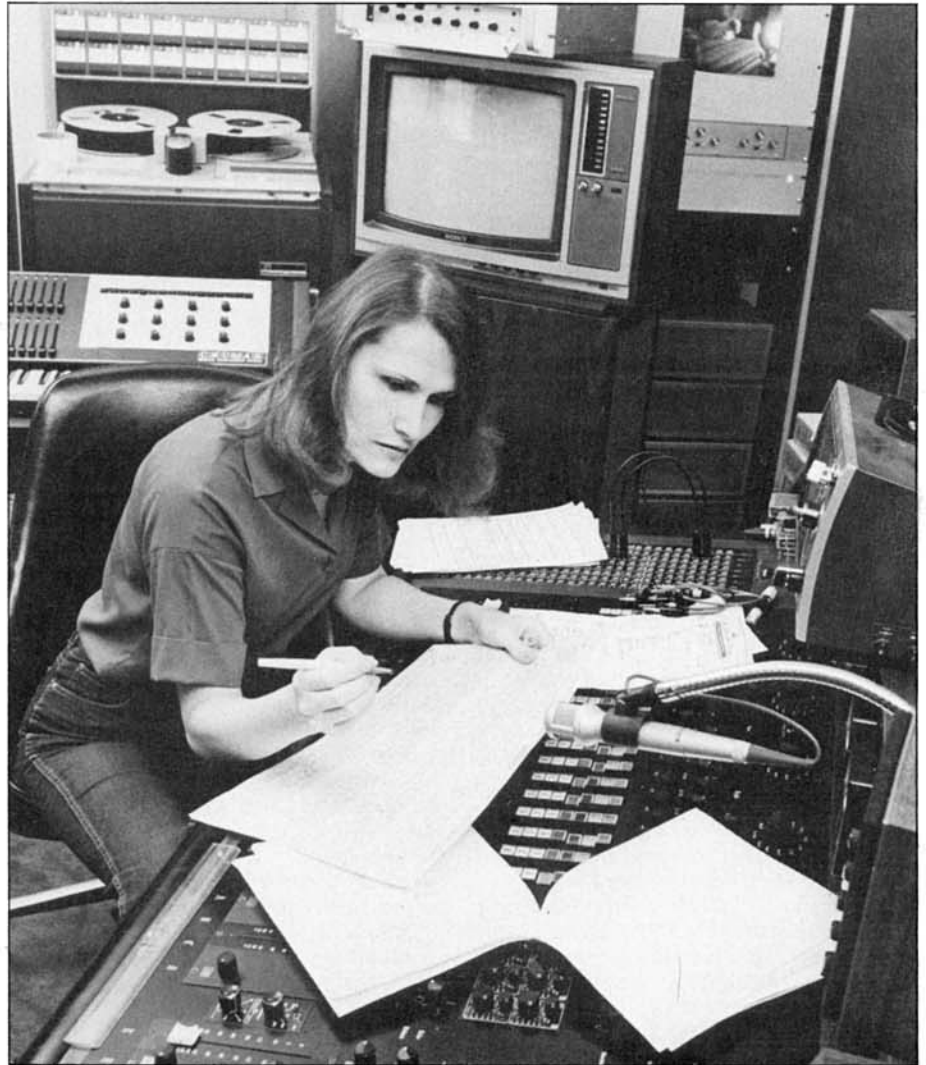
**H**OW NOISY IS THE engine of a Light Cycle? How does its muffler sound? Does it even have an engine? Does it make any noise at all? How does an orchestra sound inside a computer memory? Electronic or romantic? Or both? And how does it reverberate from those computer-graphics walls?

Does a Solar Sailer glide silently, propelled only by music? Does it whoosh like a glider? Or whine like a Mach 3 fighter? Or roar like the interior of a power plant?

For most of us, these questions are the 1982 equivalent of discussing how many angels can dance on the head of a pin. But for the people who created the soundtrack for *Tron*, Disney's fantasy of a superprogrammer who is thrust into a universe of computer software to do battle with the evil Master Program, these and many like them were serious questions. Since nobody (that I know of, at least) has actually heard a light cycle go past his front lawn, or has actually played a gig inside a computer memory, the question of what sounds authentic and realistic takes second place to the question of what is original and exciting, yet appropriate.

In an imaginary environment, all sounds except dialog have to be fabricated, recorded, and cued in, usually one at a time. Footsteps, love themes, explosions, background ambience, and the closings of computer-graphics doors, all have to be synced so they come out at just the right place in the final mix. It's a huge job involving the creation and processing of thousands upon thousands of sound events.

About a year before the completion of *Tron*, Michael Fremer was given overall responsibility for production of the movie's soundtrack. Fremer has some experience in film sound work. He is also a professional stand-up comic and has a degree in industrial and labor relations, two qualifications that stood him in good stead in dealing with the enormous logistical and personality problems that he encountered. Fremer was committed to producing a soundtrack whose artistic and technical quality would be second to none. At the same time, he realized that the amount of work involved in soundtrack production could not be covered by the budget which he was given, if the editing were done in the traditional way. "I knew right away that this picture had to have a fantastic soundtrack if it was going to sell," Fremer said. "I had three choices: produce a mediocre soundtrack, or overspend my budget like crazy until they caught up with me and fired me — or I had to use new technology if I could." Fremer reasoned that



Carlos at her custom-built 24-track board, with (L to R) MTI GDS, master 16-track recorder, Sony Trinitron screen, and Datametrics SMPTE master code generator in background.

if he could record all the sound effects and music on time-coded multi-track tape and synchronize them with the visuals and dialog using the latest digital techniques, he would avoid the large expense of recording and editing the thousands of music and sound effects cues on sprocketed reels of magnetic tape. In doing so, he set a course that led to a unified technique for handling sound material and resulted in rapid completion of a soundtrack of high artistic and technical quality at unusually low cost.

Fremer's contribution to the *Tron* soundtrack goes beyond technical innovation. From the very beginning he saw the necessity of planning music and sound effects together, since they represent complementary aspects of the soundtrack's impact. As Fre-

mer points out, "Sound effects have an impact that is literal, whereas music carries the emotions on a higher plane. Music becomes especially important in small theaters where the soundtracks are on optical format and the sound systems are probably small. In these theaters, big smashes sound like little thuds. But you can play music through a 2" speaker and it will still communicate emotion. In small theaters, a film will degenerate into a cartoon if it doesn't have a powerful score." Fremer also points out that the music is even more important in a film which is set in an imaginary environment. "The music has to guide the audience through emotionally alien territory, to cue the viewer to the desired response."

Fremer initially envisioned a score that

# The Soundtrack of **TRON**

used a traditional orchestra for the real world sequences and electronic music for the computer world. Since he was a Wendy Carlos fan and knew of Wendy's experience in scoring earlier films by Stanley Kubrick and others, Fremer called Carlos in June 1981, explained his concept, and asked her if she would be interested in producing the computer-world portion of the score. Wendy asked to see a copy of the script. She recalls, "The concept of the film and the story itself intrigued me. It looked like a beautiful film from a graphics point of view. I was a little disappointed in the script itself, which seemed written in a somewhat sophomoric, comic-bookish style, but one can overlook things like that if other aspects of the film make it attractive. I had to decide if this was something that I would devote the better part of a year of my life to.

"As I thought about it, it became clear to me that the part of the score for the computer world should be as full of color as possible. I wanted to use a combination of symphony orchestra and synthesizer for the computer world, and just a string orchestra for the real world. I felt that symphony orchestra in combination with synthesizer could be a strong factor in the film. It was a natural, *simpatico* idea that exactly complemented the way the film combined live actors and video graphics.

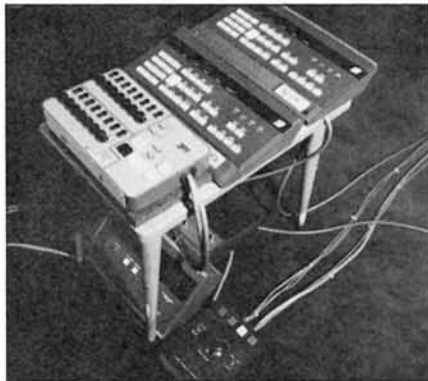
"In addition, this appeared to be an opportunity for me to break out and do a substantial amount of orchestral composition. I heard the score as a blending throughout of electronic and acoustic colors, with no harsh, artificial separation of timbres. I am trained and experienced in orchestration, I enjoy composing for orchestra, and I wanted to enter the project with my competence in orchestral writing acknowledged."

As evidence of this competence, Wendy sent Michael a demo tape containing a sampling of work, including several cues that she had done for Kubrick's *The Shining*. Impressed by the tape and persuaded by Wendy's clear vision of the score, Fremer convinced the director and the producer to hire her to do the entire score for *Tron*. The deal was closed at the end of the summer of 1981.

The original schedule called for the entire film to be edited by November 1981, at which time Wendy was to begin the actual scoring of the film. Throughout the fall, she worked at developing motifs, textures, and complete pieces of music. In September the film's producer brought the "first cut" of the film (with totally unprocessed computer-world footage) to Wendy, and at the same time heard some of the music that had been composed. Later in the fall, Wendy was asked to produce the score for a short "NATO reel" of the film, a ten-minute demo for the benefit of the National Association of Theater Operators. In this work Wendy first encountered one of the problems that would influence her writing throughout the *Tron* project: The film's editors were using a fast, TV style of cutting that didn't lend itself to being scored by long,

sweeping musical lines. Wendy had to redo much of her music to fit the pacing of the NATO footage. The NATO reel, although well received, pointed up the importance of being able to accurately synchronize successions of short music cues.

As a result of their experience in scoring the NATO reel, Fremer suggested that Wendy's studio be equipped with a device called the Shadow synchronizer, manufactured by BTX. The Shadow is designed to synchronize virtually any two remote-controllable recorders through a SMPTE (Society of Motion Picture and Television Engineers) time code.



Control center for sync of music mixes in Wendy Carlos' studio. On bench (L to R): 3M master self-sync remote, BTX Shadow auxiliary 16-track slave to 16-track master, BTX Shadow video slave. On floor (L to R): master remote locator, custom video-as-slave stabilizer & remote control for JVC U-matic.

The SMPTE code is a serial digital representation of time in hours, minutes, seconds, and frames (of film or video) that can be recorded on any track that can accept audio. Thus, for instance, a videotaping in which high quality, multi-channel audio is desired may be made by (a) recording the audio on a professional multi-channel audio recorder, (b) recording the video on a regular video recorder, and (c) recording a SMPTE time code signal simultaneously on what is normally the audio track of the video recorder and on one track of the multi-track audio recorder. On playing back, the audio and video recorders can be held in tight synchronization by a device that compares the time code signals coming from the two machines and applies a correcting signal to one of them if the time codes start to diverge. In principle, either machine can be a master (which determines the timing) or a slave (which follows the master). Or a master recorder may have two or more slaves.

Since the final music mixes for *Tron* would be done on six tracks, Wendy decided to set up her studio so that the final mixes would be recorded on 16-track, 2" tape. Her plan was to deliver two simultaneous mixes to the film studio, which would allow the film mixers to cross-fade from one to the other. This would occupy twelve of the sixteen tape tracks. One of the remaining tracks would be used for SMPTE code. To mix down from a 16-track multi-track recording to the six-track mixdown, while simultaneously watching the film on a video monitor, required two 16-track recorders, a video playback machine, and two synchronizing units to slave the audio playback recorder and the video machine to the audio master recorder.

Wendy's usual studio equipment includes a single 16-track, 2" audio recorder. To set up for the *Tron* score, she rented another 16-track and a remote-controllable video-cassette player, and brought in two BTX synchronizers. Then she and several technicians set about hooking them all together. It turned out to be a monumental effort. Recalls Wendy, "Nobody seemed to know exactly how to get the whole system working. Lots of people told us what couldn't be done. But, by asking impertinent questions that demanded answers, we got the information and the pieces fell in place. The system was cranky at the beginning. The audio recorders had the wrong kind of motors for tight speed synchronization. There was a technical problem with synchronizing the video player: A 'noise bar' would obscure part of the screen when the unit was being synced. And the BTX units were a constant frustration. Although most of their hardware is well made, the internal software of the BTX was inadequate for our job. For instance, even though there is a microprocessor in each of the units, we had to add and subtract music cue times by hand before punching them into the machine. And often the program in the machine would hang up, and nothing would work until we shut the machine off and turned it back on, thereby losing all the data that we had laboriously entered. We got the system working, but it was always cranky. It never worked completely until the end of the project."

While waiting for the final-edited film to be delivered, Wendy continued to compose and develop ideas. Her plan was to first spend two or three months recording synthesizer tracks for the computer world sequences. Then the orchestra recording sessions would come, in which the synthesizer tracks would be played for the musicians, and they would record their orchestral parts while the conductor followed a click track. She would then mix the two. There was much discussion of which orchestra and which hall to use. The film's director requested that organ be used in the score, so Wendy planned to use organ with the orchestra, and wanted to record in a hall with specific acoustic requirements. Her music would be rhythmically complex, and would require a first-rate orchestra that had previous experience with film music. Wendy and Michael decided to record the London Philharmonic in Royal Albert Hall. The orchestra was booked for the third week in March 1982.

During this period, Wendy also spent time with her Hewlett Packard 9825 computer. In order to take advantage of the time-code synchronization capability which was now installed in her studio, she wrote a music cue locator program. To use the program, the musician starts by entering the times (accurate to a hundredth of a second) of the visual events in a sequence of one or two minutes duration, which are gotten from the videotape of the scene. Next the approximate tempo and meter of the accompanying music are entered. The program then calculates the measure and beat on which each cue starts, and is capable of "fitting" the music to the cues by varying the tempo. The



program is interactive, in that the user can compute the fits of several trial tempos, print them out, examine them and try them out, and then recompute at different tempos and starting points until the desired fit is obtained.

Wendy used her music cue locator program extensively when editing her score. As she explains it, "Film composers call this 'cue catching.' If you do it in a obvious way, it tends to give the film a cartoonish quality. But you don't have to be gross about it. You don't have to catch a cue by dropping a chair. My technique is to get the sound and picture to fit like a hand in a glove. Things fit perfectly in the score. It's just as if the film were shot to the music, not the other way around. It's never been done before."

Wendy also wrote a manuscript paper plotting program. Most personal computer users have a printer that produces numbers and letters, like a typewriter. Wendy opted instead for a plotter, a device that draws lines in response to computer commands. The output of her plotting program consists of enough staves to accommodate full orchestra writing, click track markings, treble and bass clefs, and several custom features. The plotter output was turned over to a commercial printer, who printed enough manuscript paper for all of the *Tron* work.

As the end of 1981 approached and the final footage had still not come from Hollywood, Wendy and Michael became worried that there would not be enough time to realize all of the synthesizer tracks before the March orchestra session. Although a lot of material had already been composed and recorded, there was no telling if it would fit the editing of the final footage. The first reels arrived during the second week in February, leaving five weeks until the scheduled orchestra session to plan out, compose, orchestrate, and copy the parts for all of the music. The orchestra session date could not be changed. There was definitely not enough time to both compose the orchestral parts and realize the synthesizer tracks. Wendy and Michael therefore adopted a new plan: record the orchestra first and add synthesizer afterward. "We turned the project on its head from the way we originally planned it," Wendy says.

As soon as the edited film footage (on videotape with SMPTE time code) was delivered, Wendy, her collaborator Annemarie Franklin, and Michael met to plan out the entire score. They viewed the film several times, then compiled a "bible," a film musician's term for a directory of all the places in the film where music is required, the exact location of the cues, and a brief description of the type of music for each cue. The effort took a full week, at the end of which there was a half-inch stack of papers—a list of over seven hundred cues, pinpointed to the exact frame in the film. Four weeks remained to the orchestra session.

Michael then organized a team consisting of arranger George Calendrelli, music editor Jeffrey Gussman, Annemarie, and Wendy. Calendrelli is a well-known orchestrator among New York musicians. He and Wendy worked together on the actual orchestration, Wendy providing the musical direction and George carrying through. A cue would begin

**COMPUTER PRINT-OUT**

```

LIGHT SHILER:
CLICK TRACK CUES
START: 441.150
# 1 445.270
# 2 500.133
# 3 503.060
# 4 508.120
# 5 -517.153
# 6 534.230
# 7 -613.240
      (MSS.FF1)

*****
TEMPO:
1/4 = 120mm
CLICK: 12.0 fr
METER: 6/8

CUE#  MEAS  BEAT
****  ****  ****
0      1      1.0
1      5      1.8
2      19     2.9
3      22     2.4
4      27     2.8
5      37     1.0
6      54     1.9
7      93     1.6

CUE STARTS @:
MSS.FF1 441.150
*****
4-BEAT INTRO @:
MSS.FF1 439.150
*****

LIGHT SHILER:
*****
TEMPO:
1/4 = 120mm
CLICK: 12.0 fr
METER: 6/8

CUE#  MEAS  BEAT
****  ****  ****
0      1      2.0
1      5      2.8
2      20     1.9
3      23     1.4
4      28     1.3
5      37     2.0
6      54     2.9
7      93     2.6

CUE STARTS @:
MSS.FF1 441.150
*****
4-BEAT INTRO @:
MSS.FF1 439.150
*****

OPTIMIZING:
@ START = -0.050
@ CLICK = 0.2
@ Err = 0.0010

LIGHT SHILER:
*****
TEMPO:
1/4 = 118mm
CLICK: 12.2 fr
METER: 6/8

CUE#  MEAS  BEAT
****  ****  ****
0      1      2.0 ✓
1      5      2.9 ✓
2      20     1.4
3      22     2.8
4      28     1.0 ✓
5      36     2.9 ✓
6      54     1.0 ✓
7      92     1.2 ✓

CUE STARTS @:
MSS.FF1 441.100
*****
4-BEAT INTRO @:
MSS.FF1 439.088
*****

```

**#1** The Cues are entered, from:

**#2** Input Desired Approx. Tempo & Meter

**#3** = Resulting Cue Points

**#4** And corresponding Start times

**#5** Automatic Optimizes Routines (Routines within desired or allowed shift of tempo and starting point—these are input at this time.)

**#6** = Final Acceptable List of Cue Points And Start Times (Checked Cues were those considered most desirable to "Hit" exact-on-beat)

**"LIGHT SHILER" 22A** Try: ~12 fr click 6/8

- #0 - 4:41.15 Scene Starts
- #1 - 4:45.27 7 Riss "Elevator"
- #2 - 5:00.13 3 stops
- #3 - 5:03.06 Dialog
- #4 - 5:08.12 Bsm comms thru
- #5 - 5:17.15 Commotion / Fight
- #6 - 5:34.28 Door Opsns "SCHERZO"
- #7 - 6:13.24 Sques to 22B

(SMPTE Cues Gotten from Videotaps of Scns.)

**EX. THE 2.7<sup>TH</sup> BEAT OF A MEAS.:** ~2.7<sup>TH</sup> BEAT =

(6/8)

(f. n. (10.))

**1/4: RESULT:**  
 1/4 = 118mm (12.2 fr click)  
 6/8 Meter  
 4-beat intro starts at  
 SMPTE: 4:39.088  
 4 MIN }  
 39 SEC }  
 8.8 FR. }

*Nested Loop can take between 3 to 15 seconds, depending on Cues Length & Range for desired trial & error search*

Excerpts from the printout of Wendy Carlos' computer cue locator and optimization program, with her own annotations of intended use.

with Jeffrey's setting up the page, then would pass to Wendy, who would write in the main lines and sketch out the rest of the orchestration, and finally to George, who would complete and check the parts. Annemarie coordinated the project and kept track of its progress.

The team worked day and night to meet the deadline. It was a monumental task that demanded unflinching effort. Recalls Wendy, "It was grind followed by more grind. You could almost never allow yourself to have any human weakness at all. The allergy season wiped me out for many days. I felt like I was dying in my chair. And yet I had to continue. I didn't think I had the capacity to do it. It was physically exhausting, the hardest thing

I've ever done in my life."

The team worked until 11 PM of the night before Wendy and Annemarie left for London. The next day they packed, picked up the last of the parts from the copyist, and drove to the airport. In their London hotel the night before the first session, they spent eight hours sorting the parts and checking last-minute arrangements.

Wendy had specified a large orchestra. She stopped short of full symphony size because much of the music was rhythmically complex, and the crispness would be lost with too many players. The material to be recorded ranged from brief textures to extended themes. The forty minutes of music and fifteen minutes of textures were to be

# The Soundtrack of TRON

recorded in four three-hour sessions. Conductor Douglas Gamley was supplied with a large video monitor. Fremer had marked the tape of the film with "streamers" that identified the cues. As is the practice in recording orchestral film music, the musicians had no specific idea of what the action on the screen was at the time they were playing. Their job was to follow the conductor's cues.

Technical arrangements for the sessions were made by John Moseley, who also engineered the actual recording. Moseley, used to recording choral music for records, maintained that the mikes had to be placed far away for ambience. Wendy, on the other hand, counting on being able to separate the sections of the orchestra for further processing in her own studio, demanded that the microphones be placed close in. Moseley insisted that the first session be used exclusively for rehearsal, whereas Wendy wanted everything recorded so she would have a bigger selection of material. Fremer remembers, "There were a hundred musicians, a conductor, and two BBC remote trucks sitting there while Moseley argued with Wendy. Of course it turned out that Wendy was right."

The two sessions the first day were recorded in Royal Albert Hall, at which time the organ parts were also recorded. The second day's sessions were done with a smaller

group of musicians in another hall. At the end, all of the music was recorded. Wendy remembers that the musicians were cooperative and enthusiastic, and strove to give her exactly what she requested. "We had seven percussionists during the first day's sessions, playing everything from timpani to a whip. They were a marvellous group, and produced some wonderful textures."

A few weeks later, choral parts were recorded by the UCLA chorus in Los Angeles. At that time Wendy was deeply immersed in working on the orchestral tapes. Annemarie attended the Los Angeles sessions, which conductor Donn Weiss timed by referring to the same cued videotape that was used during the London Philharmonic recording. Wendy comments, "The UCLA chorus combined top rate musicianship with the enthusiasm and receptiveness to new ideas that you associate with a college group. They did a great job. Also, because they sang to a well-tuned piano, the recordings are in perfect tune with the orchestra. The final mix sounds as if chorus and orchestra performed together."

The mark of a true professional is her ability to turn out a first-rate product from second-rate material. A master violinist can make an inexpensive violin sound like a fine instrument; a master chef can produce a great meal from undistinguished ingredients. Only the professional herself knows, because there is a lot more work involved in using second-rate material than there is in using the best.

So it is also in film music production.

When Wendy and Annemarie first listened to the tapes after returning to New York, they were disappointed. Wendy recalls, "The recording sounded really bad. Many of the tracks were miked too far away, and could not be used. A lot of the tracks were distorted, probably the result of a bad microphone power supply. Many of the sections that I wanted recorded in stereo were recorded in mono. On top of that, there were cues in which all of the takes had performance mistakes in them. Either a player came in at the wrong time, or the timing was off, or there were wrong notes, or parts were left out completely. My music is simply difficult to perform. Good musicians can play it if they are allowed to rehearse. We were only allowed two days of orchestral recording, which for the sheer amount and complexity of music that I had written was inadequate. The orchestra that recorded the *Star Wars* score, for instance, was in session for nearly two weeks.

Carlos then set to work on the tapes, using all the techniques in her arsenal of tricks. Several takes were spliced together to form one usable cue, mistunings were corrected by re-recording at slightly different speed, and whole tracks were eliminated in favor of synthesizer tracks. "I used the synthesizer in three ways," Wendy says. "First, I added tracks where synthesizer colors were needed. Second, I doubled lines that I thought were played poorly. Third, I put in lines that had been missed altogether by the orchestra, totally off-mike, or improperly recorded." Wendy pressed the newly-arrived GDS digit-

Orchestral sketches of cue 29C. Synthesizer was played from these sheets, which were then recopied to large score paper for orchestra.

(13.6 fr. click) © 1982 SERENDIP 29C ELECTRON 3 MUSIC BY WENDY CARLOS Page: 1 of 2

START (0)

105 mm

Cut back to MEP, Thrilling chord (4:42-27) 4 CLIX CUE

SARA ZOMBIE DESTINES AT MEP

WHICH IS STRANGE TO BEH SP-UP P-VIS UP-SPACE TO HAUSUNG

5:10:21 5:11:02

TRON PITCHES DIA AT SPOT DEER GOES INTO SPOT MEP EXPLODES (PEPE) Old Man spinning, slows down

5:11:10 5:11:19 5:11:01 5:11:17

Ant. cump (L.R.) ORANI + MM

REPEAT OVER LOWER V. AT APPROX ALLEGRO

ritard pattern poco a poco

PLAY OVER LOWER LEFT AT POSSIBLE

ritard pattern poco a poco

PLAY OVER LOWER LEFT AT POSSIBLE

ritard pattern poco a poco

PLAY OVER LOWER LEFT AT POSSIBLE

GRADUALLY INTO CUE

4 - highest note playable 5 - play behind the bridge 6 - attack hold as long as possible with diminuendo through to imperceptible ending prior to meas. 18.



al synthesizer into service, using her own modifications of the machine's standard voices to record many of the synthesizer lines.

The orchestra tapes (fifteen audio tracks plus one time code track) were mixed down to five tracks of an intermediate work tape. Chorus and synthesizer were added to this tape. Then the intermediate tape was re-mixed onto six tracks of the "final music mix" tape that was sent to the film mixers in Hollywood. Every final music mix contained the two six-track music recordings, which enabled the film mixers to cross-fade from one to the other. "There was a great deal to correct," Wendy explains. "Just the mixing onto the intermediate tapes took me two weeks to do."

Carlos actually produced two music mixes, one for the soundtrack itself and the other for the *Tron* soundtrack album. The differences have to do mostly with equalization. In theaters, speakers are often placed behind the screen. This tends to attenuate the higher frequencies, so the mix for the actual soundtrack is brighter than that for the record.

Meanwhile, back at the sound effects studio, Fremer contracted Frank Serafine, a West Coast synthesist and sound effects producer, to work on the sound effects for *Tron*. Serafine's equipment included a 16-track, 1" recorder and a BTX Shadow. The two began to develop a library of effects that could be dropped in as required when the film editing was complete.

Since the computer world sounds are totally arbitrary, Fremer and Serafine tapped every conceivable source in their quest for convincing, interesting sounds. No source was out of bounds. "We went for a ride in a Goodyear blimp with our recorder," Fremer reports. "It's got a double propeller drive and that huge reflecting surface. The beats are unreal. We used that for the recognizers and for Sark's aircraft carriers. Also, I went around my house, looking for things that made good sounds. The inside of my frost-free refrigerator provided the sound for the Solar Sailer. We recorded lots of video games, and even got an engineer in here to program those chips for new sounds. We recorded motorcycles, cars, hundreds of different things. We created effects on the Minimoog, the Prophet-5, and the Fairlight [digital synthesizer]. Originally we planned on driving the Fairlight directly from the SMPTE code, but they didn't have their synchronizing software worked out the way we wanted at that time."

As the sounds were recorded, they were transferred to the 16-track. One track was used for SMPTE time code, while all the others were for effects. As the effects were recorded, they were entered on a mailing-list type program on an Atari 800 computer. "Every sound was described by some word like 'bang' or 'whoosh,'" Fremer explains. "We entered the number of the reel, the number of the track, the SMPTE code time, and a brief description of the source. The Atari produced a catalog for us where all the bangs are listed together, and so on. To audition a few bangs, we simply looked them up in the catalog, got out the right reel, dialed in the right tracks and times, and in a few minutes we had it. It was light years faster than



VERNON L. SMITH

At work on the *Tron* score.

the conventional way of cataloguing effects, where each effect or group of effects is on a reel of 1/4" tape. When you want to find something in that system, you often have to spend a half day looking for it and loading it up, and then you can hear only one sound at a time." The thousands of sound effects that Serafine and Fremer collected were stored on just five reels of 16-track tape.

When edited footage first became available, the sound effects editors went to work. They found that Fremer's original plan for assembling effects directly on a multi-track without splicing was too cumbersome for much of the work that had to be done. About two-thirds of the initial work was done by the more traditional cutting and splicing of magnetic film. Their problems closely paralleled Wendy's work in setting up for comprehensive SMPTE synchronization. "The Disney studio had an Ampex 1100 sixteen-track that was not up to the job. It simply wouldn't punch in fast enough," Fremer recalls. "Besides that, the synchronizer was often a problem to use."

The editing work encountered other problems that weren't directly related to equipment shortcomings. The initial edited film footage had incomplete video graphics, so that crucial elements of the picture were missing. Fremer points out that they "were working with black and white shots of actors on a dead black set, pointing to things we couldn't see, pushing buttons we couldn't see. We didn't know what things should sound like, or when they should be heard." Sound effects editing for *Tron* therefore turned out to be just as experimental an effort as the film's video graphics. The big difference was in the budget: Because of the "visual chavinism" of the film industry, the budget for the soundtrack turned out to be a serious constraint.

The sound effects editing was being completed as the computer-generated graphics

became available. The final effects mixes were put on 16-track tape with SMPTE coding, and were delivered to the final mixing stage along with time coded dialog tapes and Wendy's time-coded music tapes. The film mix was handled by three film mixers, each controlling the tracks from one of the tapes.

As often happens, *Tron*'s director put the chief film mixer directly in charge of determining how the soundtrack would be mixed. Mike Minkler, a sound effects mixer by experience, was hired as the chief mixer, and brought in two of his relatives to assist with the mix. During the actual mix, Wendy was still preparing the music tapes, and therefore could not attend the mixing sessions. On the other hand, a crew of twelve or so effects editors were still working, but they were close to the mixing stage, so they would drop in and ooh and aaah every time one of their effects made it to the final mix. Fremer explains, "There was no strong musical spokesman on the dubbing stage. It was a blueprint for disaster. Instead of letting the music carry the emotions, they gave priority to the effects and mixed the music down or out. It's too bad. I believe that the film could have been stronger if the soundtrack had used more music and less effects, if the music were allowed to reach out and grab the emotions."

Of the original soundtrack album, Wendy says, "The record is true to what we want, whereas the film mix is not based on decisions that Annemarie or I made. If you listen hard to the record, you may hear some of the patchwork that is a result of the work we had to do on the orchestra recording. On the whole, however, we are satisfied with the way it turned out."

Of Wendy's work, Michael Fremer says, "The album contains some of the best film music there is. Wendy rescued the score and she sacrificed herself to do it. For me, working with Wendy was a great pleasure. It wasn't easy, but that's okay with me." ■