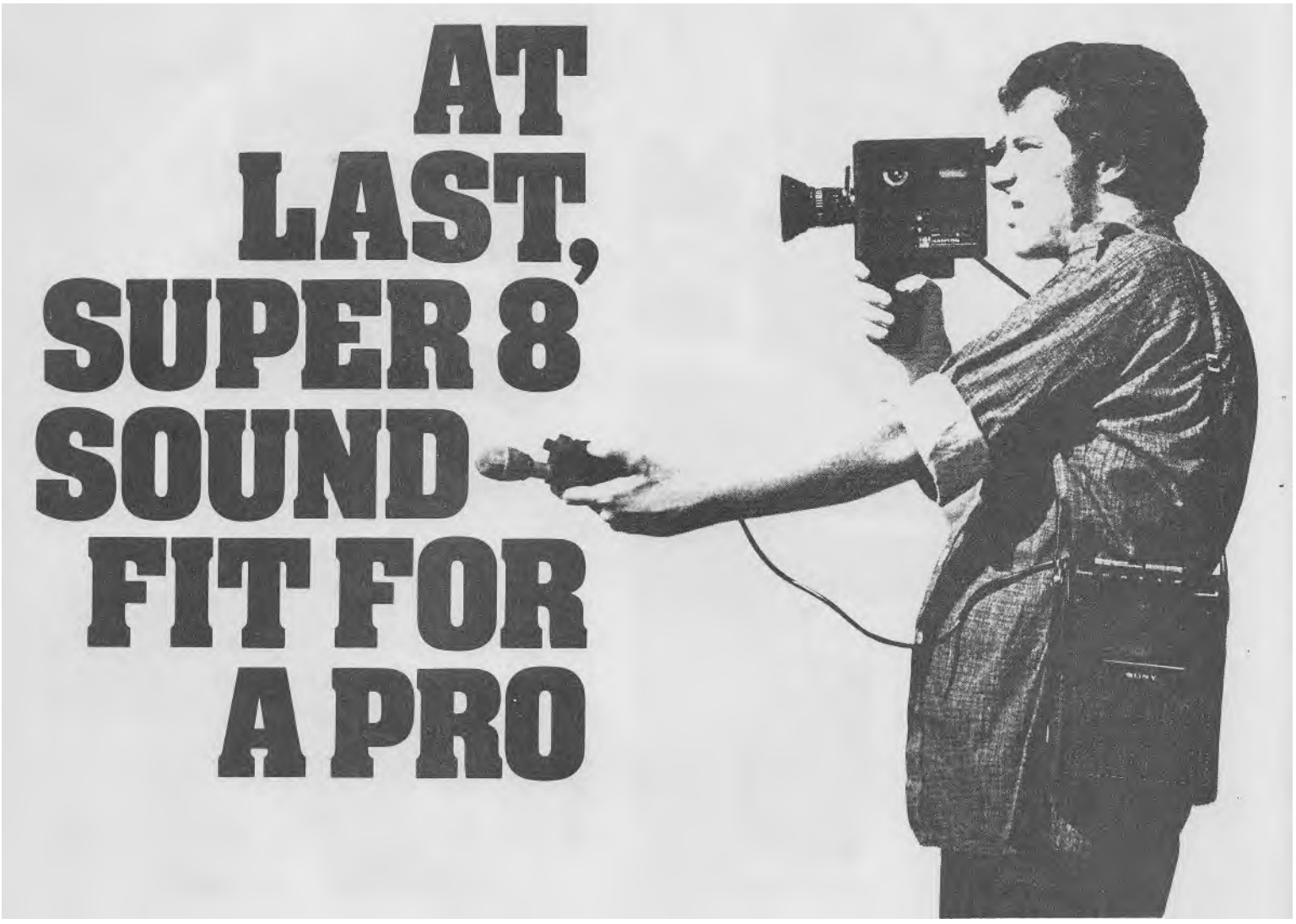
M.I.T./Leacock: Wireless

Camera is a modified sound-blimped Nizo S56 with crystal speed control for wireless synched operation with Sony TC124 cassette recorder, also adapted with crystal speed governor.

AT LAST, SUPER 8 SOUND FIT FOR A PRO



Suddenly, three systems have burst onto the scene; each combines lip-synch with editing provision, but has its own advantages

BY DON SUTHERLAND

After it first appeared in 1965, super 8 rumbled along like a giant carpet sweeper and picked up all manner of particles from the nap of the motion-picture market. The first plucked from the market's warp and woof were the amateurs for whom the plastic package of film was intended. But the cameras began to offer technical capabilities and creative potentials that made their 16-mm and 35-mm counterparts seem antediluvian; the word got around and precipitated a sprinkling of new particles into the market's fabric. Industrial film makers envisioned incredible cost savings. Television broadcasters also had visions of fat wallets dancing in their heads, accompanied by pictures of convenience and efficiency that's unique to compact gear. Film schools imagined being able to supply their students greater numbers of equipment, and quivered with excitement at the thought of better-prac-Jiced, better-learned alumni. And producers who'd been forced to settle for cheaper presentations—slide shows, for example—felt their hearts pound with the prospect of movie shows at about the same cost. But all of them had to sit stilled, quieted, their enthusiasm entrenched and contained as snug as a bug in a rug. Their dreams could not be fulfilled without movies in sound; lip-synch sound that could be edited with precision. There was no such thing in super 8, so they all lay pinned under the heel of 16-mm cost and bulk. Until now.

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Super 8 Sound: Camera paces

Compatible with number of super 8 cameras, modified Sony TC-800B reel recorder takes super 8 magnetic film. Connected by cord, camera's pulse-per-frame signal controls tape speed.

Optasound: Recorder controls

Cassette recorder adapts, connects to any super 8 camera. It scans super-8-perforated tape with lamp and photocell. Each perforation signals camera to pass one film frame.

Suddenly, almost spontaneously, the deadlock has been broken. There are now three distinct systems that permit editing, all novel, all imaginative in concept. All three can completely satisfy professional requirements, while one can suit the quality-conscious amateur as well.

True to super 8 form, innovation underlies them all. The films that can be made with these systems can be just as elaborate as the most complex 16-mm productions, and their technical quality can be just about as good; but while their hardware and modus operandi is reminiscent of the 16-mm standard, each super 8 system has differences that amount to improvements in simplicity and effectiveness as well as economy. Anybody who knows 16-mm procedure can easily adapt his knowledge for working in super 8; anybody who learns film production on this super 8 equipment can quickly translate his education to 16-mm gear. The necessity to do so may be questionable, since it's not beyond possibility that some of the time-saving and operations-condensing characteristics of the super 8 systems could become standards throughout the industry, regardless of the size of the film in use.

But the real beauty of the super 8 systems is that, although they overlap in their capabilities, there are significant differences among them in the specific types of equipment they use, and in the technology that makes them go. Each has some thing or things that the others don't. The systems are named the M.I.T./Leacock System, the Super 8 Sound System, and the Optasound System; their costs vary widely, as do their areas of specific superiority, big or small, in relation to one another. What it amounts to is that the film maker has a selection to draw from, and he can make his choice on the basis of both economics and the particular production ideas he has in mind; all three systems will serve him well, but one will serve him best.

In a general way, all three systems were born under the same circumstances: somebody had a good idea, his idea became the center of an organization assembled to develop it, and then began the struggle to get finances, engineers and facilities for manufacture, and public confidence for sales. Without huge corporate backing to get these things done, it was uphill all the way. The first customers often bought prototypes that might not always do everything they were supposed to; and sometimes additional equipment or services required for the completion of a film were slow in coming, or even temporarily nonexistent—many a tooth was gnashed. But now it looks like all three systems are ready for the market, even if one or two of them make some parenthetical statement about six-week-or-so delivery dates.

Richard Leacock's name as a film maker was established years

ago. He speaks with the strongest affection of the films he did for the "Omnibus" TV series that came and went in the 1950s, although the general public would most likely identify him as part of the Leacock-Pennebaker association of a few years back, or with his work with the Maysles.

Leacock's contempt for established motion-picture equipment and procedure is hardly subtle. "You know, there are all sorts of improvements one could make to the whole film-making process, it's absolutely crazy," he said. "It's a benighted industry; it's never done any research, and Hollywood is still shooting with wild old cameras that were designed about 1928 . . . you know that professional cameramen still load their film magazines in *black bags? In 1973?* I've spent half my life in *black bags*. Every time I do it I lose a day of my life, it makes me so angry. It's a grotesque industry." Changing bags and other grotesqueries are unnecessary in super 8, so when he agreed to organize a film department at M.I.T., it was with the understanding that the school would fund the development of a professional-caliber super 8 sound system for the use of students. When the M.I.T. funds expired, the ball was picked up by Hamton Engineering in Norwood, Ma., with Hy Shaffer at the helm of the project. Starting with the basic concepts and equipment developed by Leacock and M.I.T., Hamton's engineers made improvements while Shaffer aimed to broaden the market from students to anybody who could benefit from a professional super 8 sound rig.

Despite Leacock's distaste for established motion-picture equipment, his system bears the closest similarity to the traditional stuff, probably because of its original intention as a training medium for students of film. Its mechanics and electronics are different in many specifications; in many cases they're unique. But from an operational standpoint, the philosophy behind them comes much closer to the 16-mm norm than do the Super 8 Sound and Optasound systems.

The system in its entirety consists of camera, recorder, resolver/dubber, editor, and projector. The units can be bought individually, but their per-item price is lower when the entire package is ordered. "Cost of the complete system is higher than we hoped—about $7,500," said Leacock, "but the 16-mm equivalent would be between $20-$30,000." It is by far the most expensive of the three super 8 sound systems, but it brings its share of features and capabilities that, in this field, are radical.

The camera is a modified Nizo S56; its intervalometer, power zoom, and variable running speeds are removed. It is blimped—fitted with sound-deadening components and covers to keep camera noise from the microphone—without much noticeable increase in size or weight. It is crystal-controlled at 24 frames per sec; that is, an internal crystal oscillator precisely governs the motor to run at an even, constant 24 fps with practically no variation in speed at any time. The audio recorder—a modified Sony TC124 cassette recorder—has an identical crystal governing its speed. Since both camera and recorder operate at constant, identical relative speeds, they are effectively in synchronization without any synch cable running between them. The recorder puts a synch pulse on the tape, which is used as a running-speed reference during the resolving process.

The recorder can be operated from the microphone, including gain control. It also has a small lamp which, when pointed toward the camera lens, adds a visual start mark or "slate" on the film for initial scene synchronization. All shots must be slated this way; the microphone also transmits an electronic start pulse to the tape.

Resolving means transferring the synch sound from the cassette tape to super 8 magnetic film, or fullcoat as it's often called; this is a material that is identical to super 8 camera film, but instead of being coated with a photographic emulsion it has the same magnetic oxide of recording tape. The resolver is a modified Tandberg recorder that receives the synch pulses from the cassette tape and, while the sound track is being transferred to its fullcoat, conforms its running speed to the frequency of the pulses so that each fullcoat perforation will correspond to a specific frame of the picture film.

Picture and fullcoat now can be threaded on the editing table, a four-plate horizontal console that we hope to describe in detail in the next installment in. this series on super 8 sound. Once picture and track are edited, sound can be transferred to a magnetic stripe on the film. The Tandberg now becomes a dubber (or transfer machine) that conforms to a Bauer T40 super 8 sound projector modified to synchronize with the 60-Hz electrical frequency that comes out of any standard wall outlet; with its running speed thus made constant, and with the dubber running to match, extremely stable synch-sound transfers can be made to sound-on-film.

The T40 projector has interchangeable shutters, according to Hy Shaffer; this is one of the reasons for its selection. A two-bladed shutter is used for normal projection; a five-bladed shutter is necessary for projection into television film chains, and with it the T40 can be used by TV stations. However, the use of a TV projector was motivated for other reasons, straight from the vision of Richard Leacock. "You can edit according to what I call the old-fashioned way, in which you make the print of the original film, have it edge-numbered, edit the print, conform the original to the print, making A&B rolls and so on. Now I find this so tedious as to make me want to give up making films. So what I like to do is edit the original with care, then go straight to video tape. We're hoping to construct a video-tape chain with two projectors, where you make your films up into A&B rolls, and in the process of going to video tape you make all your color corrections, your exposure corrections, your special effects, and go straight to a ¾-in. video cassette." This would mean that the film would always have to be viewed on TV monitors, but this is Leacock's personal preference, shared by many others as a matter of taste or practicality, as witnessed by the advent of the Kodak film video player and a number of similar devices that appeared even more recently.

Whether editing is done physically on an editing bench, or electronically through video tape, the system's use of crystal synch, a pulse on the original audio recording, and a transfer to magnetic film makes it operationally similar to traditional methods. It makes the M.I.T./Leacock system unlike the other super 8 sound rigs; or, more accurately, the other rigs represent a bigger departure from tradition.

The Super 8 Sound System (note caps) is predominantly the concept of Robert 0. Doyle who, like Leacock, operates out of Cambridge. Doyle was an astronomer and lecturer on astronomy at Harvard. "The American Physical Society, and a number of astronomers and others, were talking about super 8 as a very inexpensive way for a lecturer to turn his lectures into educational films," said Doyle, "so about three years ago I decided to make some astronomy films. I went out and bought the then-current super 8 systems, but I was never able to get an easily workable system that could be edited." Confounded by the limitations of the time, he and his associates set out to develop their own system. The result was the Super 8 Sound recorder.

It is a modified Sony TC-800B reel-to-reel recorder that makes its original recordings on super 8 fullcoat. Connected by a synch cable to a camera with a one-pulse-per-frame contact (a flash synchronization) the modified recorder conforms its recording speed to the speed of the camera; if the camera speeds up, the recorder does likewise, and the reverse holds true if the camera slows down. The system is designed to operate at 24 fps only.

Obviously, synchronization as well as recording quality—in terms of wow—are completely dependent on the stability of the camera motor. "One of the problems of working with super 8 amateur cameras is that they weren't designed to run at a steady 24 frames," said Doyle. But by using a feedback circuit between the servo-controlled recorder and the camera, "the system compares the magnetic film with the picture film once every frame. It takes that and integrates it over 24 frames or so before making any decisions about speed changes. If speed changes must be made, they're made very slowly so that there's a long time constant." What it amounts to is that the recorder does not respond immediately to camera-speed changes. If the camera speeds up momentarily and then

returns to normal, the recorder speeds up slowly and makes its compensation over a longer period. It means there may be a displacement of a frame or two between picture and track at the exact point of the camera fluctuation, but this will be gradually evened out so that, possibly 24 or 48 frames later, there will be a frame-for-frame match between the two again. Only under unusual circumstances would the slow recovery to the frame-for-frame match interfere with editing; and in the meantime, it enables the recorder to make speed corrections so slowly that they cannot be detected as audio distortion.

Since the original recording matches the film and is on super 8 fullcoat to begin with, the original soundtrack can be edited in synch with the film without further transfers. However, the prospect of cutting the original turns many film makers' blood to ice; if you make a cut in the wrong place, you've very likely destroyed your track. Doyle suggests making a safety copy of the original on standard tape—a process that effectively amounts to "de-resolving" the track. "Our recorder can send out a synch pulse as well as receiving one. All you have to do is connect our recorder to any standard 1/2-in. stereo tape recorder. You take your original audio and plug it into, let's say, the left channel of the stereo recorder; on the right channel goes the synch pulse. Now, if you want to transfer back to fullcoat from the 1/2-in. tape, you transfer the recording from the stereo recorder to our fullcoat recorder. Our recorder locks onto the synch signal, tracks the pulses, and makes a synch recording on fullcoat."

The second fullcoat recording becomes a third-generation transfer, however. If you want to transfer straight from one fullcoat recording to another, you need a second Super 8 Sound recorder at $695. Making a synch transfer from the fullcoat the sound-on-film requires a modification to a standard super 8 sound projector—a $30 operation according to Doyle. The modification permits the projector to generate a synch pulse, just as compatible cameras do, enabling the recorder to synchronize. Once synch is established between projector and recorder, the track is fed directly to a magnetic stripe on the film through the projector's line input.

The basic Sony TC-800B from which the Super 8 Sound recorder is derived is a large, heavy machine. It has many interesting capabilities, but they are obtained with the sacrifice of maximum compactness and portability, characteristics that can accompany only the cassette recorders of the Leacock system, and of the third system, Optasound.

The Optasound system has its roots in Britain, its basic concept being the invention of Peter Lawson who marketed the original versions under the brand name of Filmin, short for Films in Miniature, Ltd. It was the first of the super 8 sound systems with editing capability to appear in this country. I first spotted it in a tiny booth at the Photo Expo in 1969. It was crude compared to what it is now, and cumbersome in operation. But its basic concept was ingenious, if not brilliant, and I became excited over its obvious potential. I've kept close tabs on its development through several generations of improvements, and have reported on it regularly as it retained its professional capability, but simultaneously came closer and closer to something that could satisfy the convenience-minded amateur.

The Optasound Corp. under the direction of its president, A. Frederick Greenberg, has refined Lawson's basic principles into an eminently simple-to-use, high-quality and versatile system. Original thinking and innovation pervaded Greenberg's approach, just as it did Leacock's and Doyle's in their systems. Entirely new, even radical, approaches to synch-sound editing are emerging from the company; more about that in another installment of this series. For the time being, let's examine how the shooting system works.

The cassette tape is perforated, one perforation corresponding to one frame of film, just as fullcoat matches the film. However, during shooting, the tape is the "master" and the film is the "slave" that conforms to it. The tape runs between a lamp and a photocell; light strikes the photocell each time a tape perforation goes by. The photocell issues a pulse that is transmitted to the camera through a synch cable. The pulse becomes a command to the camera, telling it to expose one frame of film; the camera does so, and returns a signal to the recorder notifying it of that fact. The continual feedback between recorder-camera-recorder is what maintains synch: if the camera tries to speed up, the recorder will slow it down. If 24 tape perforations pass between lamp and photocell in one sec, the recorder will force the camera to expose 24 frames of film. Unlike the above Leacock and Doyle systems, Optasound can operate at 18 fps as well as 24 with the same recorder and tape, just as long as the camera has both speeds.

The significance of the system is that, with the recorder running the show, audio quality is always the maximum that the recorder is capable of. In this sense, the Optasound system does the opposite of all other synch-sound systems. Normally, the camera generates the synch pulse so that the tape will ultimately fluctuate to suit.

Optasound is now packaging Scotch 208 Mastering Tape (a long-time standard of the recording industry) in their cassettes. The cassette recorder is available either with or without an automatic level control, both versions priced at $149.50. The ALC will prove a convenience to the amateur. but all ALC's reduce sound quality somewhat; professionals and advanced amateurs will be willing to "ride the gain" for the sake of maximum audio quality.

For the amateur market, Optasound of-

fers complete developing and transfer services. You send your exposed film and recorded tape to Optasound; they have the film processed, and then they have a sound stripe applied. They transfer the sound to the film, erase the cassette, and return it for reuse along with the finished film. Cost of the operation is $6.50 per 50 ft. For those who wish to edit and/or do their own transfers, Optasound is producing appropriate equipment. Recognizing that cutting and splicing the tiny cassette tapes is not exactly the easiest thing in the world, the company has devised a new kind of editing system whose electronics make it unnecessary to edit the track physically. Again, we hope to go into the details in the next installment.

Any electrically driven camera can be used with the system. While most require a modification—average cost about $40—many are ready for synchronization off the shelf. These include Cinemax C-1000 cameras, and the Sankyo CME-1100. Eumig cameras are being manufactured with the Optasound circuitry built in at the customer's request. Canon offers its DS8 camera with the circuit built in on request, without additional charge. The Optasound people themselves will perform the modification to all cameras; however, Eumig will modify cameras of that make that were bought prior to the advent of the factory installation, and Leitz has modified Leicina RT-1 cameras for their customers.

Of the three super 8 sound systems, Optasound is the easiest to operate. Camera and recorder start simultaneously when the camera trigger is pressed; synchronization is maintained from one scene to the next, eliminating the need to make start marks (or synch marks) with each shot. With the Leacock system, as well as with the Doyle system, it is assumed that the soundman will be physically separated from the cameraman. In both cases, camera and recorder are started independently and the soundman aims a lamp at the camera lens to produce a visual start mark, while a beep is simultaneously recorded on tape for matching the two during transfer and editing. If the shot is arranged in such a way that the soundman cannot be seen by the camera, a hand clap must be used, or synch must be established by touch-and-go matching at the editing table.

Each of the three systems has additional features and capabilities, and all three manufacturers have new equipment up their sleeves that will be introduced before long. But for straightforward shooting, the fundamental capabilities of the system have been described in the context of the products their respective manufacturers are now marketing. All fulfill their primary purpose of providing synch sound that can be edited. But the way in which they do it permits each system to do something the others cannot.

The Leacock system, because it employs wireless synch, enables the soundman to be in one place while the cameraman is in another. Because the camera is blimped, camera and microphone can be quite close to each other without the soundtrack being contaminated by camera noise; but it is an expensive system. The Doyle system can work with 13 different cameras without camera modification. The recorder can synchronize with a variety of other sources—for example, it can be used for transferring Bell & Howell Filmosound 8 tapes—and the original synch recording can be edited as is, assuming you have the courage to do so; but it is a comparatively bulky system.

The Optasound system is the fastest operating, and sound-on-film transfers can be second generation for optimum quality. It is the simplest and possibly the most reliable of the three; but with a few exceptions, camera modifications are necessary, meaning you must survive without your camera for a couple of weeks.

Regardless of the system you choose, one thing is for certain: you will have the potential for complete professional editing, mixing, dubbing, and the creation of music and effects tracks—in short, everything that kept 16-mm in the professional's favor all these years. I've seen original super 8 footage projected on screens that were 20 ft. wide—footage shot on the grainy Ektachrome 160, no less—and the quality was excellent.

For those who want to get in touch with the firms mentioned, their addresses—in order of their appearance here—are as follows: Hamton Engineering Assoc., Inc., 735 Providence Highway, Norwood, Ma. 02062; Super 8 Sound, 77 Huron Ave., Cambridge, Ma. 02138; and Optasound Corp., 116 John St., New York, N.Y. 10038.

In the near future we hope to deal with the editing equipment and see how super 8 blows the lid right off its professional capabilities. It has finally gotten up off the floor and has become the convenient, accurate, inexpensive, high-quality medium it promised it could be.