

# Symposium Report:

## Taking Motion Pictures on Film or on Videotape

WILTON R. HOLM, *Moderator*

At the Society's 112th Technical Conference held in Los Angeles, the final session, on 27 October 1972, was a Symposium about the prospects for coexistence or conflict for film and videotape.

The discussion of film and tape was presented because of the great interest in a considerable number of claims and counter-claims concerning videotape and photographic film as original recording media both for television and for theatrical motion pictures. The purpose of the program was to evaluate, as objectively as possible, the relative suitability of the film and tape systems of original photography, both for large pictures in the theater and small pictures on television. To do this, identical subject matter was photographed and recorded both on film and on tape.

Original film exposures were made on both 16mm and 35mm color film. Original electronic photography was recorded on 2-in (50.8-mm) highband tape. Tape copies were made from both the film and the tape originals while film copies were also made from both originals. The demonstration material therefore included film-to-film, film-to-tape, tape-to-film, and tape-to-tape transfers. Film prints from negatives exposed via direct photography and tape transfers were projected on a theater-type screen, and tape copies and film transferred to tape were shown on 10 carefully-balanced Conrac monitors placed strategically throughout the meeting room.

Before showing the films and tapes, SMPTE President Wilton R. Holm explained the purpose of the Symposium to the audience of more than three hundred. He then introduced Paul Wittlig of CBS-TV, New York, who described in detail the films and tapes which would be seen and explained how and why they were made.

After the demonstration films and tapes were shown, these panelists spoke:

*Norwood L. Simmons*, General Manager, Eastman Kodak Co., Motion Picture and Educational Materials Div., 343 State St., Rochester, NY 14650.

*Hugh Hole*, Marketing Executive, Vidronics Corp., 855 Cahuenga, Hollywood, CA 90038.

*Sidney P. Solow*, President and General Manager, Consolidated Film Industries, 959 Seward St., Hollywood, CA 90038.

*Charles P. Ginsburg*, Vice-President, Ampex Corp., 401 Broadway, Redwood City, CA 94063.

*Arch C. Luther, Jr.*, Manager, Engineering Broadcasting Systems Dept., RCA Corp. Camden, NJ 08102.

*Jack Cook*, President, Video-Tran Inc., 211 E. Grand, Chicago, IL 60611.

*Joseph A. Flaherty, Jr.*, General Manager, Engineering Development, CBS-TV, 51 W. 52nd St., New York, NY 10019.

## Introduction by WILTON R. HOLM

The title of our Symposium comes from what is happening today. Back in 1955 tape enthusiasts were predicting that tape would replace film; but coexistence, not elimination, of either tape or film was the order of the next 17 years. Now, again, the same question is being asked; and that, to a significant degree, is what motivated this Symposium.

Speaking of motivation, it is not surprising in these competitive times that there is the urge to play one medium off against another, with very little consideration given to the probability, or even the possibility, of coexistence. And so we get comparisons of film vs tape.

But, strangely enough, the question is seldom asked what

film, or what tape? Where? And when? We have all seen superb film on the screen, and most of us have seen superb tape on the TV system. We have also seen some not-so-superb film and tape. We should, therefore, know what we are comparing when we do the comparing.

In a very general way, let me set the stage for this Symposium. We are here considering two different worlds, generally speaking, the small-screen world of the TV tube, and the large-screen world of the theater projection screen. Film is used in both worlds, and used successfully. Tape is used in the TV world very successfully. It is knocking at the door of the theater world. Some of tape's proponents say it is "good enough." Others say it is not. This leaves us with an ever-puzzling question — "How good is good enough?" It also leaves us with an almost unlimited number of subjective answers.

A comparison basis which attempts to quantify objectively the advantages and disadvantages of film and tape is not a simple matter either. The film man deals in line-pairs of resolution and in lines per millimeter. The tape man deals in simple scanning lines and in bandwidth. Both deal in modulation transfer characteristics, but even in this common ground there are complicating differences.

We have, therefore, made no effort to reconcile the mathematics and the applications to which tape or film might be put. We have some film footage and some tape footage to show you and we will let you make your own conclusions subjectively for the time being.

I should let you know that the tape is standard highband, quad-head recording. The film is Eastman color negative to color positive, both the old (regular) Eastman color negative film 5254, 7254, and the new Eastman color negative II film 5247, and 7247. We have film-to-film, tape-to-tape, film-to-tape and tape-to-film. Paul Wittlig, who did all the hard work on this demonstration material, will tell about these recordings.

I should mention, in all fairness, that what we are comparing here is the Cadillac of the tape recording technology — highband, quad-head recording — to the Chevrolet or at least the Pontiac of the film technology — namely 35mm. Perhaps we should be comparing 2-in (50.8-mm) tape with 70mm, or even I-Max (3 × 70mm) film. Or perhaps we should be comparing ½-in (12.7-mm) or ¾-in (19.05-mm), or even 1-in (25.4-mm) helical-scan tape with 16mm and 35mm films. We won't quarrel about this, but it deserves mention.

The tape system we have used for today's demonstration is the 525-line NTSC system. There are other, nonstandard, systems which might be better for a single purpose, such as substituting tape for film negative for the sole purpose of creating film release prints. But in the short time we have today, we are considering standard systems — existing ones — not what might be, or should be, or could be for special-purpose systems.

Long range, it seems that there should be a possible wedding of tape and film, for both TV and theatrical use, in which a film could be made from film and tape, or a tape from film and tape. It would seem, therefore, that standardization should be a concern.

Appreciation was extended by President Holm to the contributors who made the presentation possible. These included:

Eastman Kodak Company  
Columbia Broadcasting System  
The Conrac Company  
Vidronics, Inc.  
CFI Industries  
RCA Corp. and National Broadcasting Co.  
Fernseh GmbH

# Introduction to Demonstration

by PAUL WITTLIG

We are going to give two test-demonstrations this afternoon. The first will be via closed-circuit television on the monitors and the second will be via direct projection on the screen at the front of the room.

The purpose is to show some of the technical differences between 35mm and 16mm film and videotape. To show these most clearly, scenes were shot simultaneously with a 35mm film camera, a 16mm film camera and an electronic camera. Care was taken to keep the cameras close enough together and at sufficient distance from the subjects so that parallax effects were not significantly noticeable. Efforts were also made to match the picture framing. With the actors, action, costumes, makeup, lighting and settings appearing the same to all cameras, differences extraneous to the object of the test, however subtle they might be, were largely eliminated.

If you have not seen this type of test before, it may come as a shock to see the naked technical differences, stripped of their subjective nuances.

The closed-circuit television part of the test is really a repeat of Dr. Theile's (Institut für Rundfunktechnik) test,\* but updated to include in the comparison the new Eastman color negative II film 7247. We believe this test was more comprehensive than Dr. Theile's, but we acknowledge having had the benefit of his previous experience.

For this test, Eastman Kodak Co. provided the film facilities, studio, crew and rawstock and performed all of the film processing. CBS sent videotaping facilities and crew to Rochester and taped the pictures from the electronic camera operating on 525-line NTSC broadcast standards. Fernsch supplied the electronic camera. For the first test appearing on the monitor, the 35mm and 16mm films were transferred to videotape by Eastman Kodak. Each of these tapes had color bars at the head and these together with bars at the head of the electronic camera-tape were carefully matched to the bars of an edited tape to be shown. In this edited tape, 35mm film and 16mm film both transferred to videotape are compared with each other and with the videotape recorded from the electronic camera. As the tape is run, it is suggested that viewers try to get close to one of the monitors — in any case, "zero in" on one of them. There may be some differences in the monitors; but if a viewer concentrates on one, the technical changes will be more apparent.

## *The Demonstration Tape Was Run*

In the next demonstration the same material was shown by direct projection on the screen at the front of the room. For this purpose, prints from negatives exposed via direct photography were intercut with videotapes transferred to film.

### *16mm*

First to be shown was a 10-second clip on Eastman color print film 7381 from Eastman color negative II film 7247 exposed via direct photography. This was followed by the same scene shot with the electronic camera recorded on videotape, transferred via the CBS Laser Recorder to Kodak Ektachrome MS film 7256 (reversal) and finally reprinted on Eastman Ektachrome R print film 7389. This sequence of intercutting was followed for the next few minutes throughout the 16mm demonstration.

### *35mm*

The same material was repeated with direct projection of 35mm film. Eastman color print film 5381 from Eastman color negative film 5254 exposed via direct photography was intercut with videotape transfers by Vidtronics.

\* Richard Theile, Herbert Fix and Karl-Eric Gondesens, "The technical aspects of television program production on film or video tape," *Jour. SMPTE*, 81: 273-276, Apr. 1972.

## *EK/CBS TV/FILM TEST/DEMO*

*Narration to Accompany Electronic System Demonstration†*

	<i>Exterior Scene</i>	
SLATE	This is the test being shot for presentation	3
LS-EXT	here at the SMPTE 112th Technical Conference. We are shooting an exterior and two interiors. The exterior is this entranceway to the Cutler Union Building on the campus of the Eastman School of Music in Rochester. The sky is clear and it is midafternoon in September. We are shooting simultaneously with 35mm and 16mm film cameras and an electronic camera. The rawstocks are Eastman Kodak color negative film 5254 (35mm) and the new 16mm Eastman color negative II film 7247. The electronic camera is a Fernsch KCU-40 Plumbicon™ whose pictures are being recorded on standard 2-in (50.8-mm) videotape. You are looking at the taped pictures now and we're just running through the scenes to familiarize you with picture content. Following this, we will compare the two film formats transferred to videotape with each other and the video-tape recorded from the electronic camera.	1:04
MS-EXT		34
CU GIRLS	This is not an optical effect; the girls are twins. Carol is on the left and Judy is on the right — or is it the other way around?	1:18
CU BOYS	The boys on the outside are also twins. A Wratten 85 filter is being used in the film cameras, stopped down to <i>f</i> /16, and a neutral density 1.0 filter plus a daylight conversion filter are in the electronic camera operating at <i>f</i> /8.	1:38
	<i>Interior — Low-Key</i>	
LS-LOW KEY	This low-key interior is being shot in the Research Laboratories studio at Kodak Park in Rochester. Incident light at the subject positions measured 320 footcandles (3,433 lux) and the color temperature 3100 Kelvin. In order to minimize parallax, all camera optical centers were kept within a circle whose diameter was 24 inches (610 mm) and cameras were operated between 18 and 24 feet (5.5 and 7.3 meters) from the subjects.	2:24
MS-LOW KEY		
CU ERICKA	Ericka is being shot at a distance of approximately 20 feet (6.2 meters) with the same lighting.	
CU DAN	Dan is also being shot at 20 feet.	
	<i>Interior — High-Key</i>	
LS-HIGH KEY	This high-key interior was also shot in the Research Laboratories studio at Kodak Park. Incident light at the subject positions measured 320 footcandles — the same as in the previous scene. Color temperature and shooting distances were also the same. The brightest surface in the scene is the white base of the flower vase on the right, which measured the same as the gray-scale white chip with a reflectance of 60%.	3:08
MS-HIGH KEY		3:24
CU STU & DONNA	As we begin our comparisons, we will refer to the Eastman color print film 5381 from an Eastman color negative film 5254 transferred to videotape as "35" and the Eastman color print film 7381 from the new Eastman color negative II film 7247 transferred to videotape as "16." We will refer to the videotape recorded from the electronic camera as "tape."	

†As used at SMPTE 112th Conference at Los Angeles, 27 October 1972.  
™Plumbicon is a trademark of N. V. Philips Gloeilampenfabrieken of The Netherlands for television camera tubes.



system consisting of the photographic camera, the films (negative and positive), and the projector has better resolution and better contrast — or latitude, if you will — than the system consisting of the electronic camera, magnetic tape and television receiver.

In terms of broadcast image quality, however, there are known equipment limitations and operating procedures which cause the inherent resolution in films and tapes to be degraded and not fully realized in the television display.

In like manner, quality losses in color reproduction and in tone scale reproduction also occur in the television system. At Kodak, we are working not only in film technology and on equipment used to display these results, but also in improving the operating practices so that the user will be better assured of realizing the quality inherent in the film product. Efforts aimed at improving practices include: standardizing the telecine setup with the Inconel test slide, recommending operation of the telecine in "unattended manual black" to improve tone scale contrast, standardizing review room conditions to reduce print color balance variability from laboratories, stressing the importance of monitor setup and viewing conditions, and offering courses to aid cinematographers and TV station personnel in use and display of films.

We, as film manufacturers, intend to have our film compete successfully in this marketplace by introducing innovative products to serve customer needs *and* to help the customer achieve the best results from these products. Increasingly, we believe that the nature of the original show will determine which medium is used, and then depending on the requirements of the television organization actually transmitting the programing, conversions will be made from film-to-tape and from tape-to-film.

## Abridged Comments

by HUGH HOLE

ON BEHALF OF THE Vidronics Company I thank you for letting me stand in for Carl Hanseman who is ill. Those who know Carl know that he would be here if he could. Because of my being in sales and service, I bring from our engineers a message to be given verbatim.

We can discuss in depth the present capabilities and known potentials of film and videotape, the coexistence of the two systems in the generation of television programs and commercials, the future of videotape in the production of theatrical motion pictures, and the shortcomings of the two systems. We can discuss those technological developments which resulted in significant improvements in both systems during the past years. And we can speculate on the impact which future major technological advances in either or both systems would have on the industry. But these discussions will not, in my opinion, affect the future of either film or videotape.

In reality we must regard each system as a tool, used by the creative members of the industry to record events in time for eventual display on a television or motion-picture screen. Viewers are unconcerned about the system used as long as their involvement is not disturbed by poor picture quality. And each individual sets up an arbitrary standard of his own in determining that level of acceptability. Both film and tape are capable of delivering image quality that will satisfy the most discriminating television viewer.

The television producer's choice of a system is determined, therefore, by personal preferences; the specific requirements of a program or commercial; post production requirements; U.S. and foreign distribution or syndication requirements; time factors; the laws of economics; and in the case of commercials, frequently by the specific dictates of the advertising agencies or their clients. The year 1972 is being referred to throughout the entire industry as the year of the videotape explosion. More

programs are being produced on videotape this year than ever before. More programs are being syndicated on videotape and more commercials are being produced and aired on videotape this year than ever before. And more commercials photographed on motion-picture film are being transferred to videotape for both post-production and distribution.

The most controversial area in the film-vs-tape debate lies in their use in the production of theatrical motion pictures. Regardless of what we think of the present capabilities and limitations of electronic photography for the motion-picture screen, we might as well face the facts. The system is being used now, on a limited basis, by pioneering members of the industry's creative and financial groups who share with their engineering counterparts the excitement and enthusiasm of helping this newborn baby grow and mature. And grow and mature it surely will. In spite of its limitations, recognized by knowledgeable members of the industry, electronic photography for the motion-picture screen is here to stay. Soon it will learn how to walk. Tomorrow it will learn how to run. Its present limitations will be reduced in magnitude and number. Its capabilities will be enhanced and expanded. There is a genuine demand within the industry for this beautiful baby— this magnificent, exciting tool. Tomorrow's technology, guided by intelligent and creative electronic image engineering, will give us a new system designed for motion pictures, completely divorced from the restriction of the NTSC television.

## Abridged Comments

by SIDNEY P. SOLOW

We have to distinguish between the origination or storage of the image on the one hand and the reproduction or retrieval of the image on the other. Considering image display first, I think that it is generally agreed that film will continue to be used in the theater for the indefinite future. The film print will continue to be the most likely means of delivering the image to the audience.

There are at least four other important areas where film — especially 16mm and super 8 — is likely to keep or expand its share of the market. The first is in classrooms and minitheaters and places designed for limited public gatherings. The tremendous inventories of films and equipment that are on hand will not wear out all at once. We can anticipate, therefore, that the replacement market will tend to perpetuate the use of film. The next area is the film entertainment provided by airlines. Pilots and navigators are generally opposed to the installation of additional electronic equipment on board, so film is going to remain here also. The salesman's portable, desk-top super-8 projection system will continue to help him make presentations and sales. And there is the individual learning carrell with earphones and a small image display where super 8 has very good prospects for permanent utilization.

Now, considering image origination, it seems most reasonable that both the electronic and photochemical methods of registering images (tape and film photography) will coexist for the foreseeable future.

Regardless of what happens in the big studios where large amounts of money are available for production and regardless of the economics that may be claimed for production on tape, cameras and film have such clear advantages for the individual filmmaker, that this kind of image making seems certain to be perpetuated. The lightweight, portable, economical, self-contained film camera is incomparable as a tool that will help the creative film artist express his ideas.

Finally, I should like to observe that whenever a new technology becomes available, it would seem wiser to consider whether or how it can be adapted to your particular purpose than to allow a purely emotional response to govern your course of action.

## Abridged Comments

by CHARLES P. GINSBURG

MY PERSONAL BELIEF IS THAT significant developments now in the works will result within two or three years at the most in a color TV camera/recorder package that will be pretty competitive with the 16mm film camera in terms of portability. That of course is not what this discussion is about. What this meeting is really about is electronic production and post-production for 35mm theatrical release.

The many participants in the general film-vs-tape debate agree that wide-angle shots taken with television cameras are unquestionably inferior to the same scenes shot on film — although television close-ups done electronically may be quite acceptable. The most obvious shortcoming of the television method is the use of one of the existing standard color television schemes (NTSC, SECAM or PAL), all of which impose very heavy limitations on object definition and color resolution.

At this point we can say that certain technical developments would have to precede the introduction of practical electronic production and post-production of theater motion pictures. First of all, a new color TV system would be needed because even if the cameras and VTRs had infinite bandwidths and noise were reduced to the vanishing point, still the color TV system (NTSC, for example) would limit the performance of the system. Secondly, a color television camera would have to be developed with substantially greater luminance and color bandwidth than is now available. Thirdly, a VTR would be necessary which could accommodate without noticeable degradation even through several generations of video/video dubs (as will occur in the editing process), and it would have to have a luminance bandwidth of at least 10 MHz and a chrominance bandwidth of perhaps 3 MHz. Ancillary equipment would have to be developed which could handle the increased signal bandwidths, and this of course would include devices such as switchers, distribution amplifiers, special-effects devices, editing devices, etc. And not the least of the problems: each of the tape-to-film transfer devices or black boxes would need characteristics good enough to keep up with the rest of the system.

All of these requirements are achievable, but I have no firm opinion yet about whether or not they will be achieved. Certainly, before such an expensive development program could be undertaken, it would be necessary to first examine questions about the size of the market for these systems, then make a detailed economic comparison between tape and film for production and post-production and finally gain a better understanding than we now have of the adequacy of the proposed or hypothetical system in terms of picture quality.

We must note that it is conceivable that suitable modifications to existing TV equipment (mainly but not solely to cameras and VTRs) could produce results sufficiently pleasing that electronic production of motion pictures might become a reality by evolution rather than by revolution.

## Abridged Comments

by ARCH LUTHER

WE HAVE BEEN talking today about two different methods for storing, processing and distributing visual information. These two methods — tape and film — are very different in their essentials (performance characteristics, capabilities, economic structures and even the age and maturity of the concept). On the other hand, artistic demands and practical requirements relative to the two methods also differ widely — again in terms of performance characteristics, capabilities, etc. Under these conditions, where the potentials of the methods and the demands on these potentials both vary widely, there

is no reason to expect that one method would be the optimum choice for all applications. Furthermore, since the technologies behind both methods are developing rapidly, a choice that was correct yesterday may not be correct today or tomorrow.

Today's electronic equipment generally meets very well the needs it was intended to meet; however, we find that, where the needs and applications are not very precisely defined, there are often some shortcomings. Cost of the equipment, its physical size and the skill needed to operate it can be reduced; reliability, flexibility and breadth of applications can be increased. Computer technology, digital circuits, large-scale-integrated (LSI) circuits and new solid-state technologies all will contribute improvements to electronic equipment of the type we are discussing.

Looking at live and telecine cameras and at VTRs, we can say that the equipment operates up to the limits of the NTSC television system; I think this was certainly demonstrated on the monitors here today. However, the results fall substantially short of what is required for theater projection — which means that (as many people have noted) higher line number standards and higher video bandwidths must be considered. We can expect that camera and recording technology will advance in these areas as well as in the areas of portability, light sensitivity, etc.

As I implied at the beginning, I believe that for a long time to come the choice between tape and film will be made by considering what is needed for the particular application and noting what is available technologically at the time.

## Abridged Comments by JACK COOK

I THINK THAT progress in the fields of electronic imagery and videotape recording probably parallels pretty closely progress in the semiconductor industry. The growth of capabilities in these fields over the past five years — dramatic as it is — will be nothing as compared to what we will see over the next five years. These capabilities will be compounded as digital circuitry and LSI circuitry gain wider and wider usage. I anticipate that soon we will be able to repeat the tests we have seen today, and we will see little or no difference in picture quality between the electronic system images and the film system images.

## Comments

by JOSEPH A. FLAHERTY, JR.

AS YOU'VE GATHERED, none of us is coming here to predict the death of either the film or videotape imaging systems. Rather, we are saying that they will work together, and work even closer in the future than they have in the past. What appears to be a great television revolution is, in fact, a maturing of television with the result that it is coming closer to an already mature but still developing film system.

In years past television was technology-limited. This meant that producers and users were not always able to decide by the nature of the program which system to use. They had to use the system which was least technology-limited for whatever it was that they wanted to do. Now that television is evolving and developing at a very rapid rate, these limitations are diminishing. Therefore the two systems can be treated more equally by producers, and creative decisions can determine more often which of the two systems is best for a given application.

We've talked a great deal today about one of the areas where film coexists with television — an area where television is an infant, namely theatrical feature-film production. But I think of at least three other areas where television, which is to say electronic photography, and film coexist. These are televi-

sion program production, commercial production and distribution, and news pickup.

The improvement in television facilities — especially the invention of new and better editing equipment, more stable and smaller cameras — has made possible increasing use of television equipment in these three areas. It's my feeling that television will develop more quickly in these areas of television news, commercials and television programs, before it makes a significant penetration into the realm of feature films for theatrical release.

The NTSC system, which was a grand invention, was designed primarily to conserve spectrum space by fitting color information into an existing monochrome television channel and interleaving the color signal into the black-and-white signal to provide a "compatible" color television service. In so doing, the bandwidth of the color information had to be strictly limited. Those limitations were determined not only by mathematical calculations, but also empirically by a large number of viewers observing television material on picture monitors. The NTSC system still produces a very fine result on such television monitors as do the more recent PAL and SECAM systems. All of these systems, however, are compromises which provide acceptable quality on a television-size monitor. As you saw today, videotape, in its own realm, produces superior results over system. On the other hand, film, in its own realm produces superior results on direct projection. However, we lose quality in each system as we cross over the interface from film-to-tape, or from tape-to-film. We have to pay more attention to the conversion at that interface and much work remains to be done.

Progress is being made in television technology that permits the production of some programs on videotape that were produced on film in the past. This is a natural evolution even though it's so new that in some cases, it makes news. The fact that it's still making news simply means that it hasn't fully developed as yet — and is still considered "unusual."

I have a clipping from today's New York Times, October 27, indicating some of the progress that electronic journalism is making in replacing 16mm film for certain applications. The headline reads: "CBS Wins Network Race on Kissinger Briefing." Quoting from the paper, "In the inevitable television race to cover yesterday's briefing by Henry Kissinger, National Security Advisor to President Nixon, the Columbia Broadcasting System came in first with the help of an electronic partner called the Minicam. CBS News was able to go on the air at 1 PM, 25 minutes after the briefing ended, with a visual recording of Mr. Kissinger's comments, excerpts from the question and answer session immediately following, and a commentary from a CBS reporter. The American Broadcasting Company did not make some film available for viewers until 2:40 PM, when the network interrupted programming with a special report."

When we talk about portability, we seem to think we have a long way to go in television. Let me point out that the present Minicam, which is six years old and already pretty obsolete, is 19 inches long, 3 inches wide and 16 inches high, and weighs 18 pounds. The backpack weighs an additional 20 pounds, but isn't worn unless one is actually moving. The 35mm Mitchell BNC camera, with lenses and magazines, is 32 inches long, 18 inches wide and 30 inches high, and it weighs 100 pounds. The Fernseh camera that was used for this test you saw today is 35 inches long, which is 3 inches longer, 10 inches wide, which is 8 inches narrower; and 14 inches high, which is 16 inches less high, and it weighs 110 pounds. So the evolution continues and the portability of the electronic and of the film cameras are coming closer together.

#### Discussion

*Mr. Solov:* Would you tell us how the prints by the laser recorder were made?

*Mr. Flaherty:* For the purpose of the demonstration today, we decided it would be essential that each system involved have a print from original recording material. In the case of the laser recorder, that was a reversal print from a Kodak Ektachrome MS Film 7256, reversal original, which is the procedure when we have that requirement. That is not normally the way the system is used. May I also remind you that this is an NTSC decoded signal. The laser system is normally used for making originals only on 7256. We have not done any research yet on negative-positive because, quite frankly, we are waiting for the new film, Eastman's color negative II film 7247, to do that. But that stock was not available for this program, so the reversal print from the 16mm reversal original was used. The result is not really an appropriate commercial product.

*Petro Vlahos:* Was the Vidtronics transfer of average daily quality?

*Mr. Hole:* I cannot give you a truly technical answer. I have seen a great many of our transfers, ones I felt to be excellent. In my opinion this one was not up to par with what we have done. I think we rushed it through a little bit. I'm sorry that Carl Hanseman could not be here and comment on the technical side.

*Mr. Holm:* How close are we to all-solid-state TV pickup devices for high quality TV?

*Mr. Luther:* A lot of work is being done to achieve an all-solid-state television pickup device. These types of things are being built experimentally in a number of companies — devices of the line-scan type, that have been used in the Space Program. This kind of technology is being pursued by a number of people for television-type applications, and ultimately for color television.

It would be very risky to predict anything in this area. Certainly a solid-state sensor that produces the kind of quality we saw here today is still pretty far off, but I'm sure it's going to come. It's natural application of the solid-state technologies that have been used in computers and LSI (large scale integration) devices, and I'm sure in a matter of five to ten years we're going to have such a sensor.

## Closing Comments

by Moderator HOLM

WE HAVE HAD the opportunity to view what, in my judgment, is the best demonstration anyone has ever seen of exactly the same subject matter photographed and reproduced by both film and tape. The film projection was very good. So was the tape reproduction. And I have never seen ten TV monitors better adjusted and better balanced. Moreover, our panel members are knowledgeable, and their comments were straightforward and factual.

Again, I want to point out what must now be obvious: We are neither for or against film, nor for or against tape. We are simply trying to present facts. I should also point out that this is just the beginning. The large number of people who have come for this Symposium indicates a significant interest in what the future holds for film and tape. We therefore plan to have other symposia on film and tape, hopefully exploring their strong and weak points in greater depth than was possible in the time we have today.

I would like to see these future programs explore the possibilities not only of standard TV-broadcast type tape recordings, but also what I call nonstandard systems such as the Image Transform system, which is a video recording system developed specifically for yielding film prints, and which has no utility, per se, for television use. Image Transform Inc. declined to show a transfer here today, because all our original tapes were recorded by the NTSC system.

The SMPTE will certainly keep abreast of the developments which were predicted here today by the members of our panel, and I am sure we can look forward to a very exciting future for both film and tape. Unquestionably, as I said earlier, we can look forward to the time when subject-matter recorded on film and subject-matter recorded on videotape can be successfully intercut.