

American Cinematographer

International Journal of Motion Picture Photography and Production Techniques

JULY 1977/ONE DOLLAR

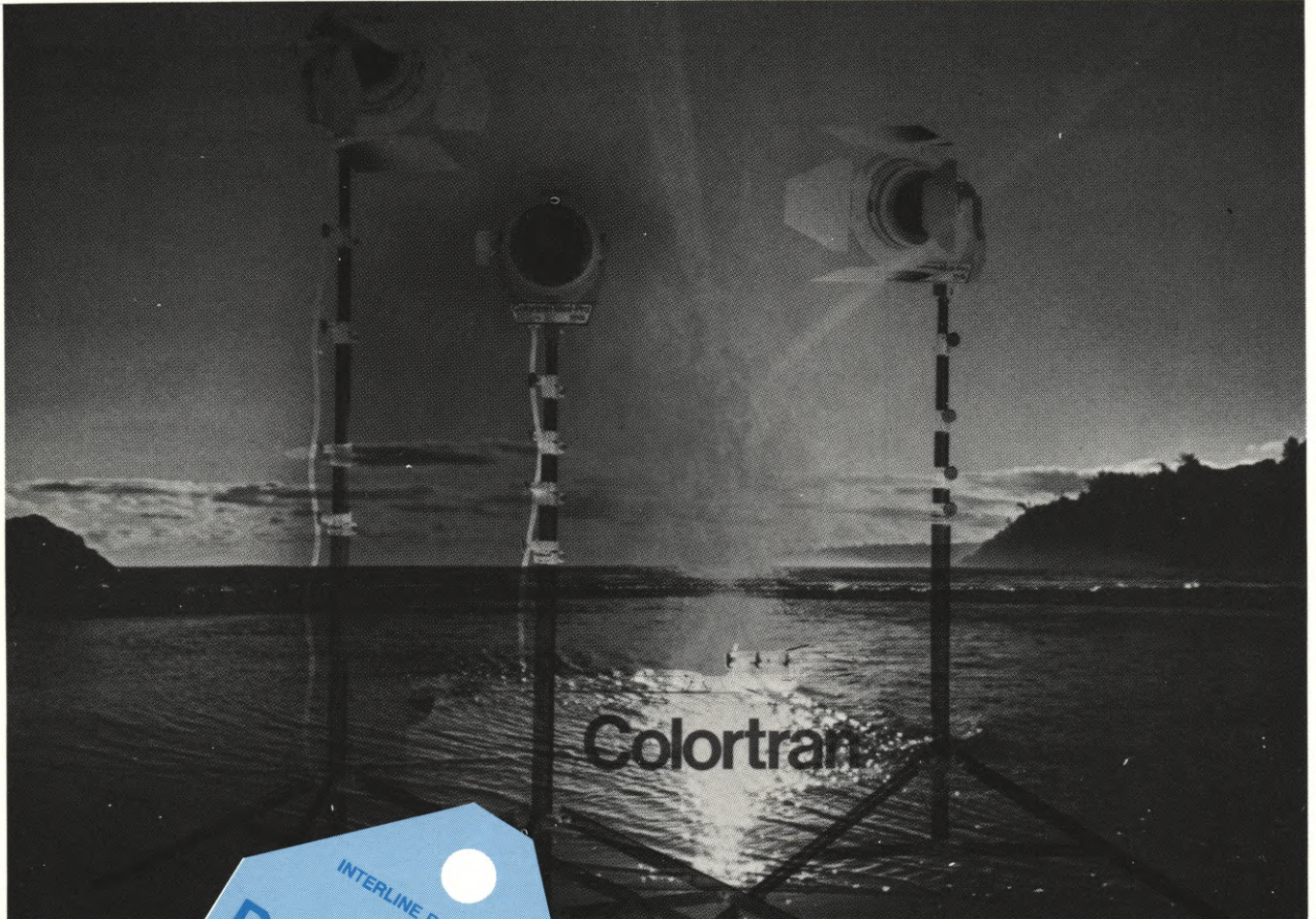


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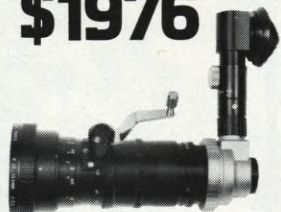
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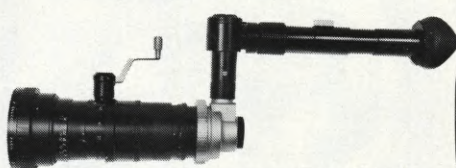


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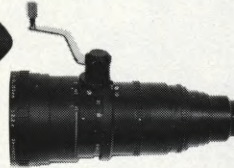
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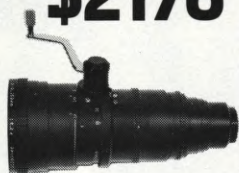
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American Cinematographer

International Journal of Motion Picture Photography and Production Techniques

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JULY, 1977

VOL. 58, NO. 6⁷

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ON THE COVER: Against the ominous Death Star looming in the background, a Rebel X-wing fighter directs a laser blast at an Imperial T.I.E. fighter in a scene from the George Lucas/20th Century-Fox production of "STAR WARS". This dramatic composite rendering, utilizing elements generated from the film, was created exclusively for American Cinematographer by RON LARSON.

AMERICAN CINEMATOGRAPHER, established 1920, in 58th year of publication, is published monthly in Hollywood by ASC Holding Corp., 1782 North Orange Drive, Hollywood, California 90028, U.S.A. **SUBSCRIPTIONS:** U.S. \$9.00; Canada, foreign, including Pan-American Union, \$10.00 a year (remit International Money Order or other exchange payable in U.S.). **ADVERTISING:** rate card on request to Hollywood office. **CHANGE OF ADDRESS:** notify Hollywood office promptly. Copyright 1977 ASC Holding Corp. Second-class postage paid at Los Angeles, California.

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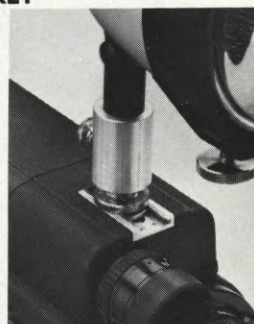
3 400' MAGAZINE ADAPTER

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IN MEMORY OF SOL HALPRIN

"HOLLYWOOD — May 4 — Sol Halprin, noted Academy Award-winning cinematographer whose Hollywood career spanned more than 50 years died today at the age of 75."

That was the succinct method used to present the passing of a truly fine gentleman who did, indeed, start a long and rewarding Hollywood career at the Fox Film Corporation in March of 1918. Over the years he carved out an impressive career by beginning his education in the film industry in the laboratory. Later, he became assistant cameraman to George Schneiderman on the Shirley Mason and Al Ray pictures.

He next moved to the Buck Jones pictures first as an operator and then as an Akeley camera specialist. With the Akeley, he did many other Fox pictures and worked with John Ford on "THE IRON HORSE" and "THE BIG TRAIL". The Akeley was used especially for photographing fast action and Panoramic-type scenes.

His first opportunity as a Director of Photography came through a dear friend, Slim Summerville, on Sunshine Comedy pictures.

When sound changed the industry, it became necessary to find a whole new group of stars and personalities and Sol was sent to New York for three months to photograph new people. This assignment became a 22-month stint and the beginning of the Fox Film Library with background scenes of New York shot

by him in his spare time in New York as the basis.

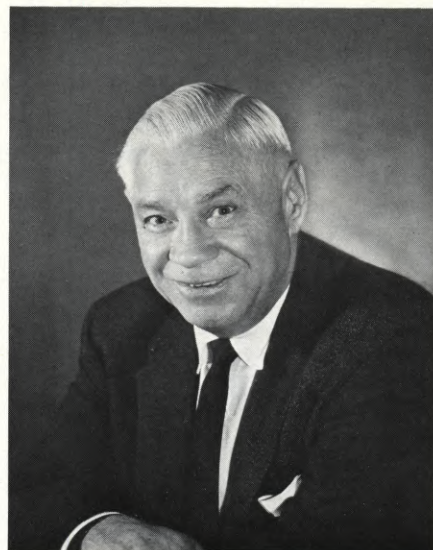
In 1937, Halprin went to Africa to help photograph a second unit exposition with Osa Johnson for 20th Century-Fox for the Stanley and Livingston picture, and in 1938 was put in charge of the background projection department.

World War II saw Solly in a special Naval Reserve unit under Admiral John Ford as a lieutenant when war was declared on December 7, 1941. Called to Washington on December 11, he was assigned to the office of War Information and built a complete motion picture laboratory as that office was to be the eyes and ears of President Roosevelt. During the war Halprin also went to India and Ceylon.

At the end of the war, a full Commander, he returned to 20th where Darryl Zanuck put him in charge of the camera department, background projection department and projection, machine shop for camera repair, film-loading room and the film library.

During the many years he spent in this capacity, he earned a well-deserved reputation of fairness, honesty and compassion. In other words, he was a good boss. This warm feeling was exemplified when he celebrated his 50th Anniversary with Fox in 1967.

The event was originally planned for the Sun Porch of the studio's Cafe de Paris, but soon moved into the main



dining room because of the throng of people who came out to this event.

Many were active employees but many more emerged from retirement and still others were associates from ASC and throughout the industry who wished to pay tribute.

In 1953, Halprin received an Academy Award as one of the co-inventors of CinemaScope.

Upon retiring from 20th Century-Fox after 53½ years in all phases of photography and laboratory work, he took a job as Consultant for Hollywood Film Company and was working in that capacity when he passed on.

Sol Halprin joined the ASC in 1933 and has been an active and supportive member throughout the years. He served as President of the Club for eight years, once for a four-year term beginning in 1966 and again for four years in 1970. He had served continuously on the Board of Governors since 1947 and had taken an active part in the Research and Educational Committee, worked as Membership Chairman on numerous occasions and had been largely responsible for the ASC monthly dinner programs for many years.

He was a member of the Society of Motion Picture and Television Engineers and served on the main Board of the Academy of Motion Picture Arts and Sciences as well as on numerous technical committees.

The motion picture industry has lost a true and dedicated worker but, more importantly, a good and dear friend to many will be sadly missed. ■

Sol Halprin receives gavel of office from Ray Rennahan and presents Rennahan with outgoing President's plaque at the 1966 installation meeting prior to Halprin's serving one of his two four-year terms of office. Leon Shamroy was also seated at the speaker's table.



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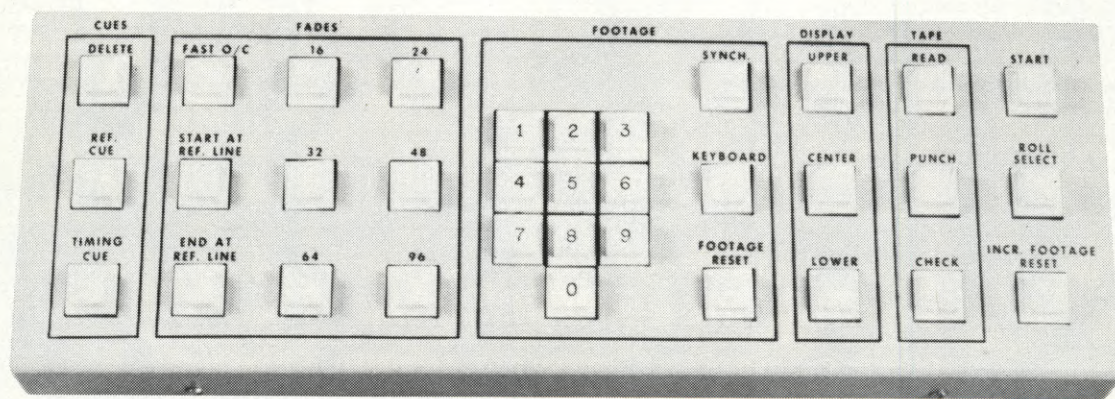
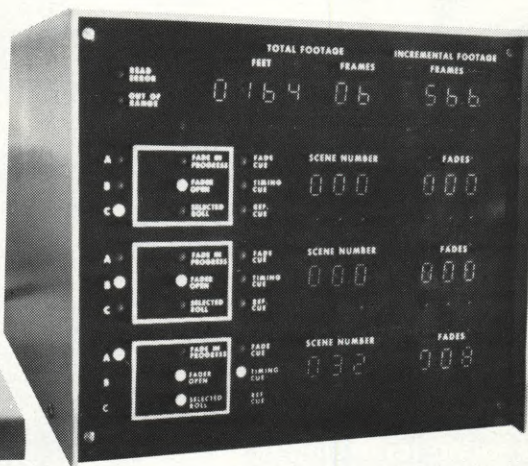
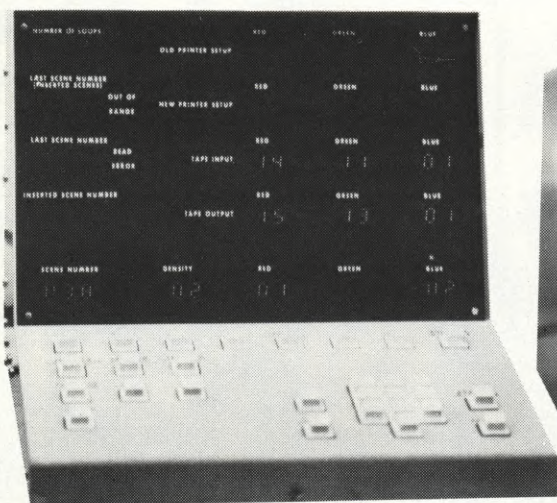
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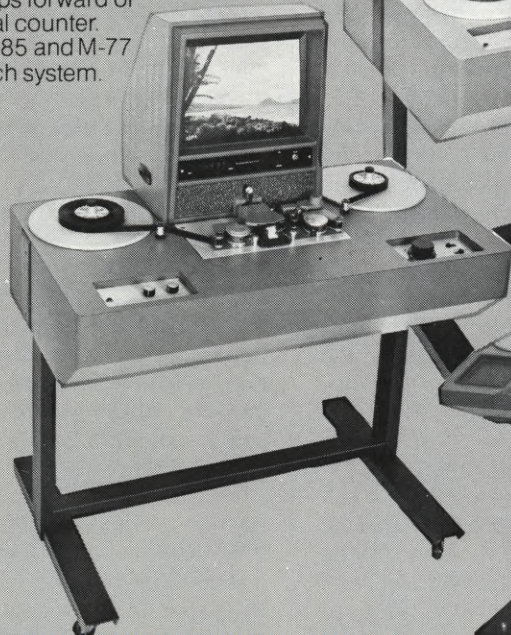
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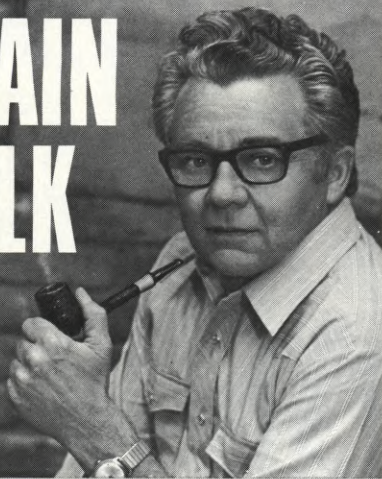
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PLAIN TALK



by *J. Carl Treise*

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fine... if everything
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In other words, whenever a processor manufacturer changes the number or arrangement of modules, he has to change the support system itself to provide the proper base. If his system is flexible and designed so that parts can be added or removed without losing efficiency, you're in clover.

Otherwise, you'll pay through the nose for a good concept, but a lousy operating unit.

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QUESTIONS & ANSWERS

Conducted by CHARLES G. CLARKE, ASC.
and WINTON HOCH, ASC.

(Inquiries are invited relating to cinematographic problems. Address:
Q. & A., AMERICAN CINEMATOGRAPHER, P.O. Box 2230, Holly-
wood, Calif. 90028.)



Q What color-temperature meter is used most often in the motion picture industry, particularly where the color temperature of mixed lighting cannot be controlled and corrective filters must be used on the camera lens? Is a color-temperature meter completely reliable in a situation of this kind?

A There are a number of color-temperature meters now on the market and it is difficult to determine which one is used most in motion picture studios. I personally have been using a Spectra Color Temperature meter with very good results.

Over the years I have exposed a lot of color film in all kinds of mixed-light situations where color correction could only be effected with filters on the camera lens, and I have had fine results using filters as indicated by the color-temperature meter.

Q (1) I have observed that some cinematographers use a flat-cell incident light meter and translate the foot candle readings directly into f/stops, ignoring the effect of anything other than the key light. Whereas others set the key to a certain intensity as dictated by the film speed and then after adding the kickers, backlights, fill lights, clothes lights, etc., switch to the hemispherical light collector on the meter for reading overall exposure. Which method is the most accurate?

(2) In order to establish an accurate key-to-fill ratio, should one read the key alone and then the fill alone, or the key alone then, the key plus the fill?

A (1) The procedure outlined in this question is correct; that is, to use the flat disk on the meter for light contrast readings; then, after getting the kickers, backlights and fill lights properly balanced, the exposure should be determined by using the hemispherical collector on the meter.

(2) To establish proper key-to-fill ratios, the flat disc should be used on the meter when taking readings. Since the Spectra meter is also supplied with a grid, it is possible also to measure scene brightness to determine the proper balance suitable for the particular negative to be used.

It is assumed that this inquiry relates to the use of black-and-white film. Where color film is to be used the procedures mentioned above are the same except that the color quality of the different light sources used should also be measured with a color temperature meter to insure correct color rendition in all scenes.

Q We were having an argument about the number of frames separation between sound and picture on 16mm film and couldn't find the answer in the Manual. Can you answer this question?

A The Manual has the answer on page 396, the separation for magnetic track is 28 and for optical track is 26. Your local film lab could have answered the question much more rapidly for you.

Q Can you give us some details about using the traveling matte process in the production of a training film which we are shooting for a local manufacturer? Is equipment for this work available on the market?

A Traveling matte work is a highly technical undertaking for which only the major studios and some large film labs are equipped. Unless you have a great deal of this work to do, it would be advisable to “farm it out” or change your script to eliminate the need for traveling matte shots entirely.

We do not have available a list of laboratories equipped to offer such service and suggest you inquire of the nearest available film processing laboratory.

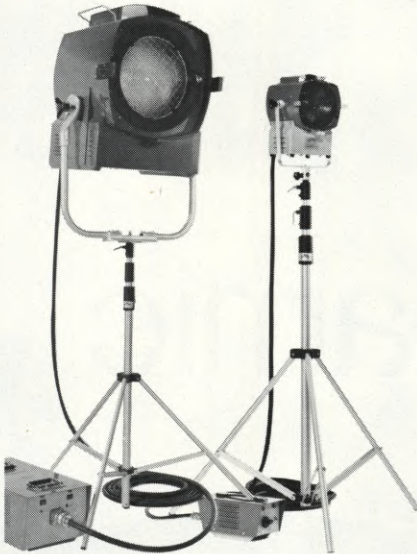
Q I have a Filmo 70-DA camera having a single-frame exposure release. What f/stop should be used for single-frame exposures with this camera, where normal exposure for same subject is 24 fps is f/8 with the same lighting?

A According to Bell & Howell, the exposure interval for single frames shot with the 70-DA camera is the same as when shooting at normal camera speeds. Therefore, in the instance described, you would set your lens at f/8. ■

LTM casts new light on the subject!

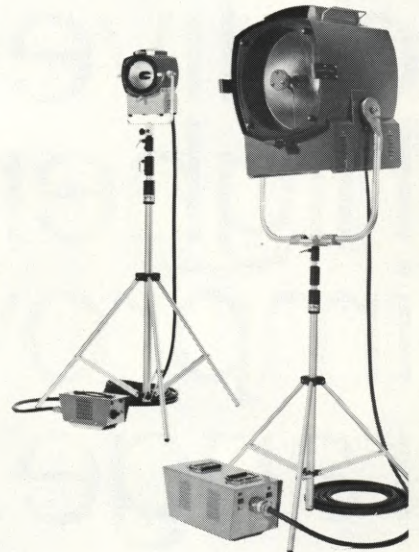
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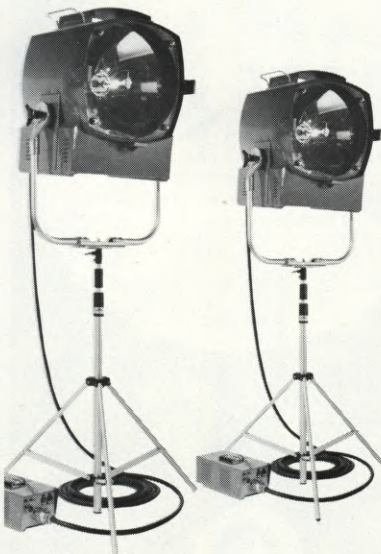
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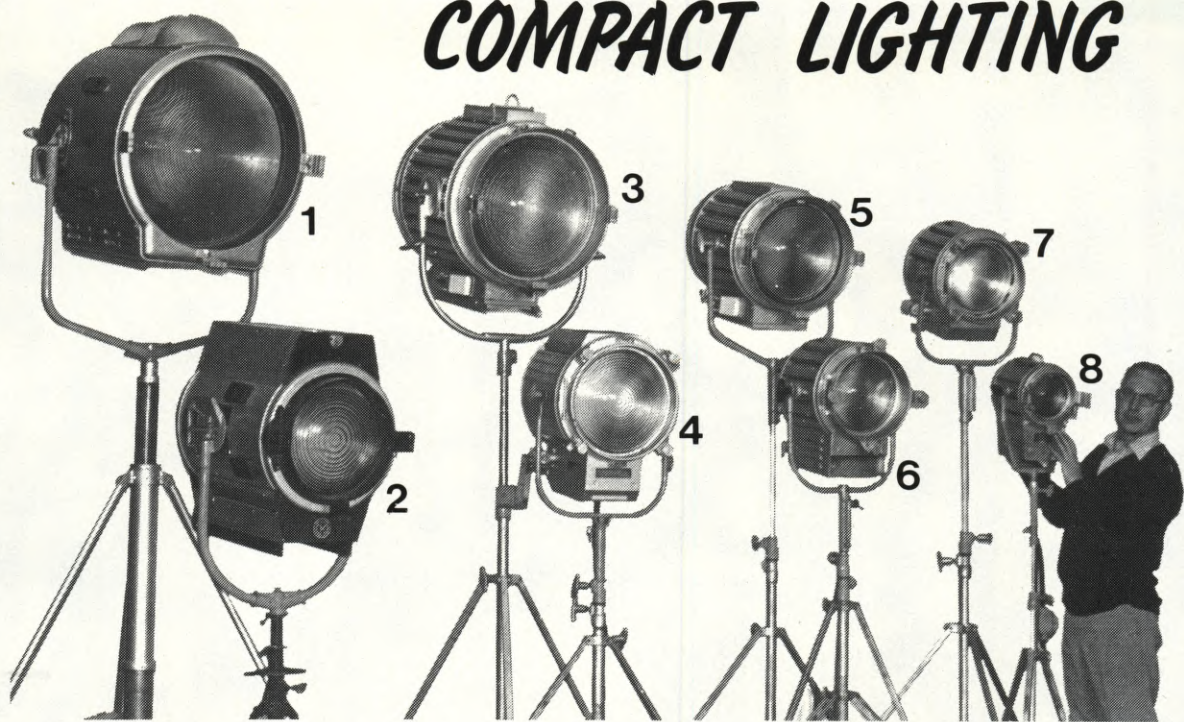


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We're open 6 a.m. to 10 p.m. Monday to Friday, 6 a.m. to 2 p.m. on Saturdays, other times as necessary, and beyond that Geoff's or Graham's bedside phone numbers are (01) 864 7437 and (01) 340 7089

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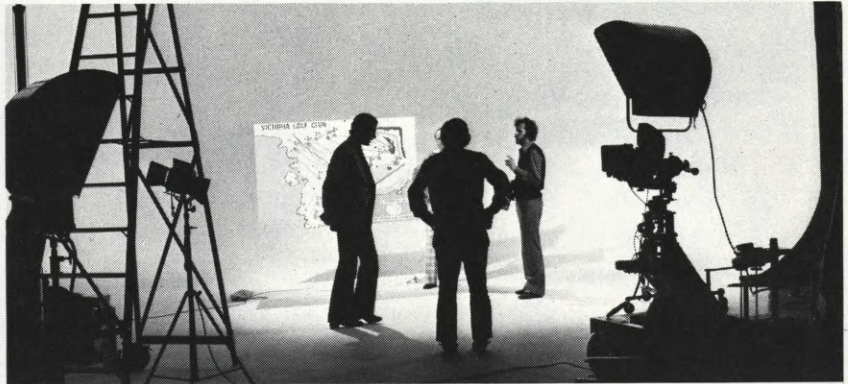
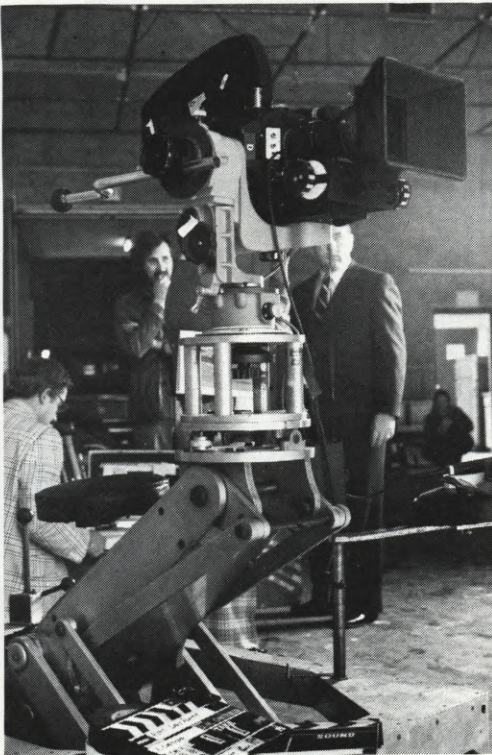
The super-silent, rugged and versatile CP-16R is ideal for filming 16mm feature productions, theatrical documentaries, industrial/scientific films, as well as television specials and commercials.

Precision engineered and manufactured under the strictest quality controls, *all* CP-16R reflex cameras leaving the factory are rated at 30dB max. And, if equipped with Studio Rig, at 28dB max!

But don't just take our word for it. Judge for yourself.

Before embarking on your next 16mm studio-type production, run some sound tests and compare our CP-16R with its famed European rivals: the Arri 16SR, the Eclair NPR, etc.

You'll find that, *with or without Studio Rig*, our CP-16R "out-silences" them all!



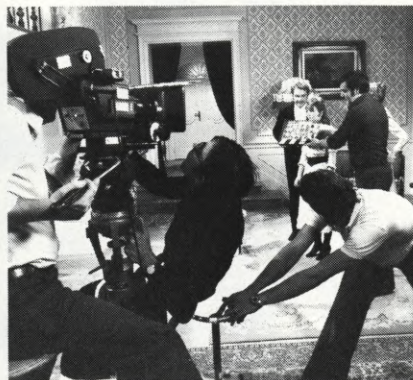
Canadian cinematographer David M. Ostriker (at right) shooting a television commercial with his own CP-16R and Studio Rig.

Equipped with Studio Rig, the CP-16R is rated at 28dB max. when measured on the weighted "A" scale at 3 feet from the optical flat in the matte box.

The optional J-4 zoom control motor is coupled to the lens through a belt drive system for maximum sound isolation.



Our CP-16R (with Studio Rig) checks in at a remarkable 28dB max.



The CP-16R with Studio Rig on a soundstage in Vienna, during the filming of a musical comedy feature for television.

Television features and specials in Austria, West Germany, and indeed all over Europe, are shot in 16mm, and the CP-16R is rapidly becoming the preferred camera (even in the heart of "Arriland") for filming such productions because of its outstanding quiet operation.

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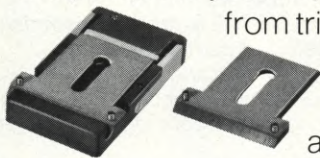
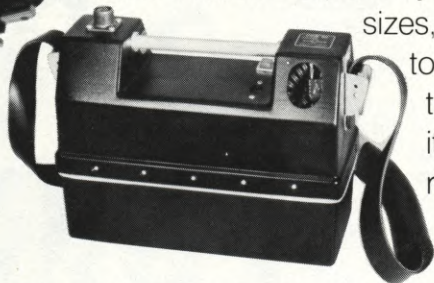
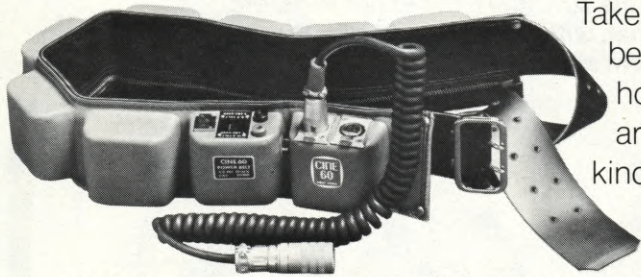
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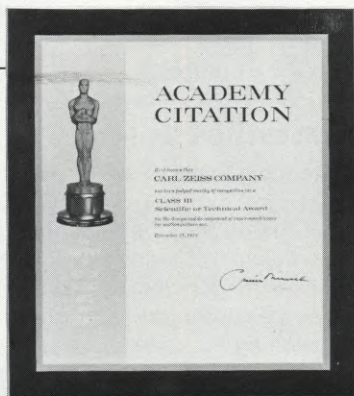
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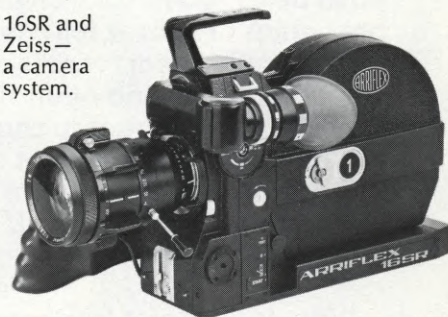
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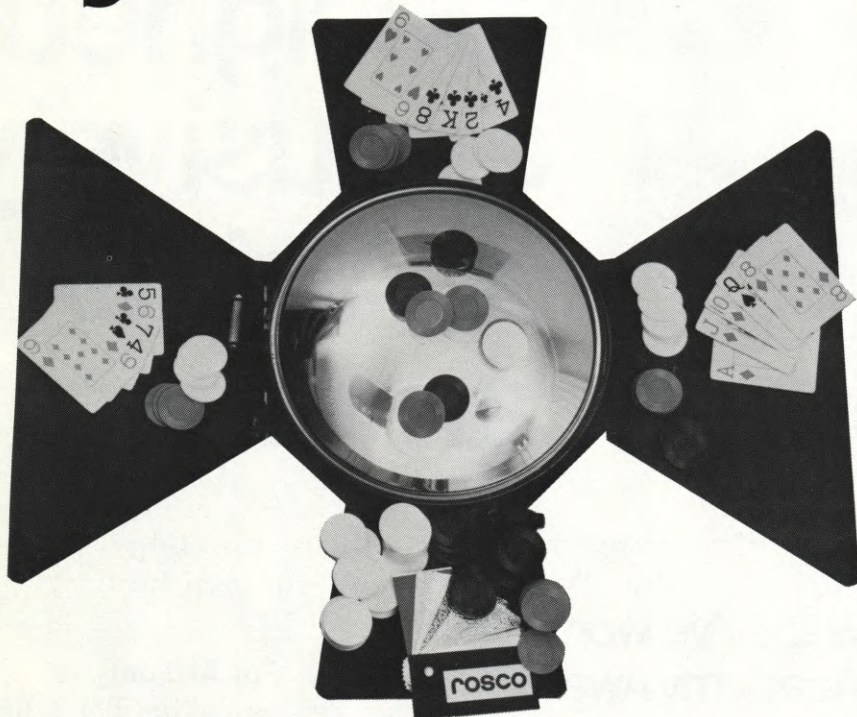


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By GEORGE L. GEORGE

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A practical and compact manual by cinematographer David W. Samuelson, **MOTION PICTURE CAMERA AND LIGHTING EQUIPMENT** provides comprehensive and detailed data for the selection and use of relevant hardware. A clearly written and extensively illustrated text. (Hastings House \$8.95)

Brian G. D. Salt's **BASIC ANIMATION STAND TECHNIQUES** is an informative and functional guide to the methods and calculations required for correct utilization of the equipment by both artists and technicians. (Pergamon Press \$12.50)

A concise Unesco brochure by animator John Halas, **FILM ANIMATION: A SIMPLIFIED APPROACH** is an expert presentation of basic techniques for professionals and advanced non-pros. (Unipub \$3.30)

* * *

THE TELEVISION WORLD

Contending that TV commercials are a contemporary popular art form, Bruce Kurtz, in **SPOTS**, finds their format a reflection of today's predilection for a visual imagery that is of short duration, aggressively attention-grabbing, and provoking audio-tactile-visual sensory responses. A stimulating book that quotes leading TV commercials makers. (Art Communications \$9.95)

The revolution in videotaping due to the expanding use of the portable minicam is discussed at length by R. C. Robert Paulson and his colleagues in **ENG/FIELD PRODUCTION HANDBOOK**, a comprehensive survey of the equipment and its utilization for Electronic News Gathering. (BM/E \$9.95)

A stimulating array of unorthodox opinions voiced by artists, critics, scholars and video producers, **THE NEW TELEVISION** reflects deep concern for TV's present condition and submits proposals for reviving a young and already emasculated medium. (M.I.T. \$14.95)

In **TELEVISION: ETHICS FOR HIRE?**, Robert S. Alley's realistic criticism of video fare based on interviews with TV executives and creative personnel aims for a more aware and better informed viewing public. (Abingdon \$4.95)

The manipulation of public opinion in the U.S. through the use of polls (Nielsen, Harris, Yankelovich and others) is vigorously dissected in *LIES, DAMN LIES, AND STATISTICS* by Michael Wheeler, a stimulating exposé based on well researched facts. (Dell \$2.50)

* * *

THE REFERENCE SHELF

A documented and insightful panoramic history of the last 30 years of film and television unfolds in *THE FLICKS, OR WHATEVER BECAME OF ANDY HARDY?* by Charles Champlin, film critic of the L. A. Times. The evolution of the medium is underlined by Champlin's witty and documented running commentary. (Ward Ritchie \$12.95)

Alan G. Barbour's *CLIFFHANGER* is an engaging pictorial history of the serial. Exceptionally well illustrated, it evokes vividly and informatively a genre that thrilled yesterday's filmgoers. (A&W Publications \$14.95)

The warrior hero of innumerable Japanese movies is the subject of *THE SAMURAI FILM* by Alain Silver, an exciting, well illustrated study of the personage and its many facets, as seen in Kurosawa's, Ito's and Mizoguchi's memorable pictures. (Barnes \$12.50)

A complete record of movies and television shows pertaining to Jews and Judaism that were made or released in this country through 1970, *JEWISH FILMS IN THE UNITED STATES* is a unique source of information indispensable to scholars and researchers. Expertly compiled by Stuart Fox, this substantial volume's more than 4000 separate entries includes basic production and distribution data, and synopses. (G. K. Hall \$40.)

In *FILM IN SWEDEN: THE NEW DIRECTORS* by Stig Björkman, fresh talent that emerged as a result of the establishment of the Swedish Film Institute (Bo Widerberg, Vilgot Sjöman, Jan Troll) is discussed in its historic and creative aspects. (Barnes \$6.95)

John G. Nachbar has organized, in *WESTERN FILM: AN ANNOTATED CRITICAL BIBLIOGRAPHY*, a master list of some 500 books and articles in the English language devoted to that genre, adding notably to already existing material on the subject. (Garland \$15.)

In *CINEMA BOOKLIST: SUPPLEMENT TWO*, Prof. George Rehrauer expands his thoroughgoing and reliable film book bibliography. Over 1000 titles, mostly 1973-75, are included, each

offering publication data and a critical summary, plus an index of film scripts and interviews with prominent film makers. (Scarecrow \$15.)

Film production in Nazi Germany is a well documented entry in *ENCYCLOPEDIA OF THE THIRD REICH* by Louis L. Snyder. It lists significant events, leading personalities and important films of that period, with additional data on specific items. (McGraw-Hill \$24.95)

The 1977-78 edition of *GUIDE TO LOCATION INFORMATION*, aptly edited by John M. Pavlik, provides abundant and detailed instructions necessary for shooting in 46 states and 16 cities, with emphasis on California locales. (AMPTP \$15.)

Each year, some 4000 recurring festivals, fairs and community celebrations are held in the U.S. and Canada. In *FESTIVALS SOURCEBOOK*, editor Paul Wasserman includes among its 18 categories some 50 periodic film events, with specifics as to their location, date, purpose and other useful details. (Gale \$45.)

* * *

THOSE WERE THE DAYS

Bob Thomas, in *BUD AND LOU*, traces the rise of the comedy team of Abbott and Costello from burlesque to screen stardom, a career marred by personal tragedy and bitter professional competitiveness. (Lippincott \$10.)

In the Pyramid Illustrated History of the Movies series, two new volumes, *MYRNA LOY* by Karyn Kay and *JACK LEMMON* by Will Holtzman recap the performers' careers in well researched and factually informative texts. (\$1.95 ea.)

Ex-Mouseketeer Paul Petersen evokes the carefree and magic days of the 50's in *WALT, MICKEY AND ME*, bringing up to date the lives of his former partners of the Mickey Mouse Club. (Dell \$1.50)

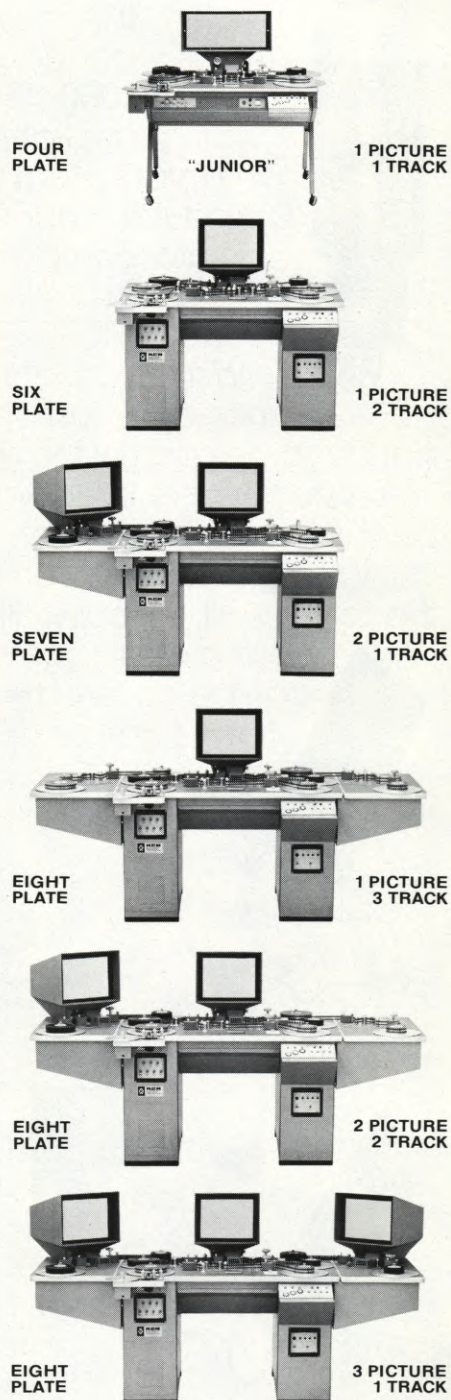
Jean-Pierre Aumont's autobiography, *SUN AND SHADOW*, contains engaging insights into the French star's light-hearted approach to filmmaking, his more serious theatrical work, and his courageous war record. (Norton \$9.95)

A story of Presley's life and career, *THE ILLUSTRATED ELVIS* by W. A. Harbinson has all the elements of country-boy-makes-it-big that will appeal to his innumerable fans. (Grosset & Dunlap \$4.95) ■

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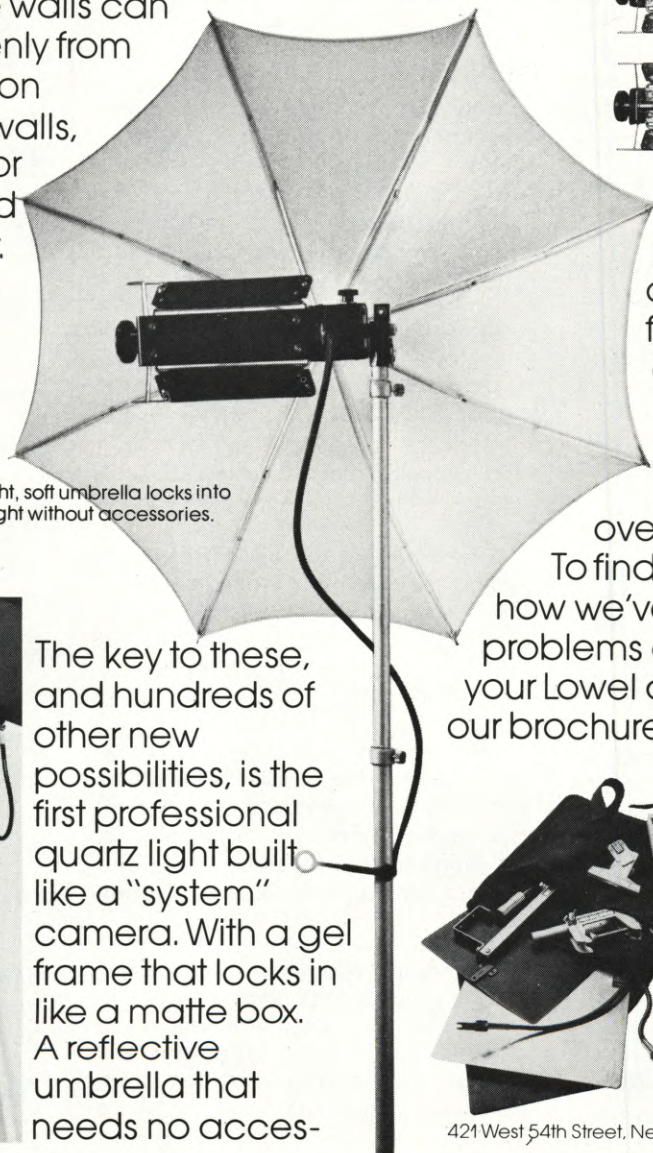


Snap-together flags and reflectors snap onto flexible arms.



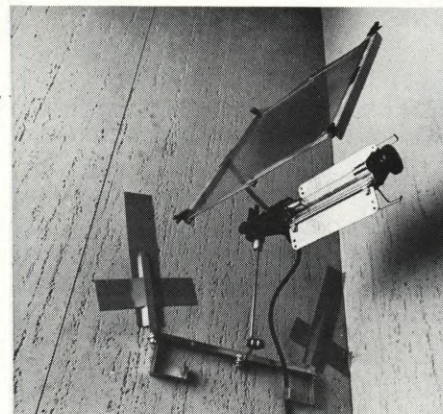
Locks atop doors, open or closed: flags control light precisely.

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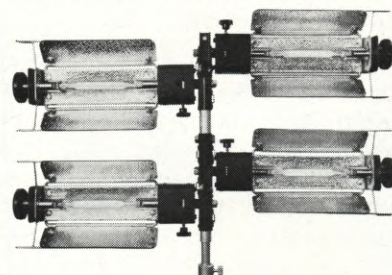


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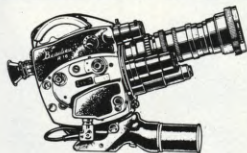
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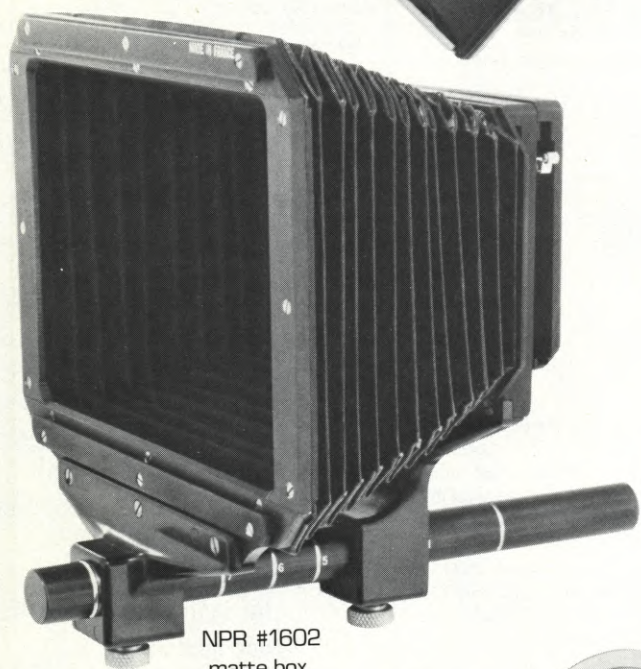
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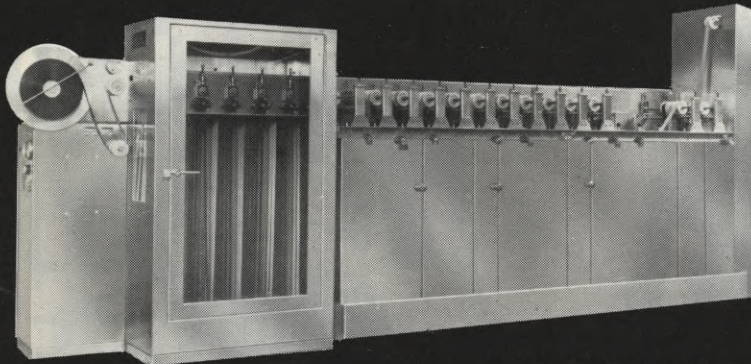
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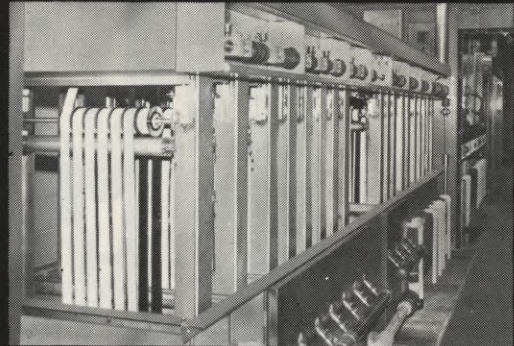
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*The train sequence from "Bound for Glory".
Director of Photography: Haskell Wexler, A.S.C.
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*"To match the daylight I used Tough Blue Frost
on the fill lights in the train sequence..."*



Haskell Wexler, A.S.C.

Lighting for "Glory"

"To match the daylight I used Tough Blue Frost on the fill lights in the train sequence," says Haskell Wexler, A.S.C., when talking about his use of Rosco color media in the award-winning "Bound for Glory".

The problem was the difficult one of lighting a man atop a moving train without losing the mood of the vast expanse of the landscape. The combination of the diffusion and daylight correction in Tough Blue Frost matched the light of the hazy blue-white skies and yet kept the attention on the guitar-playing star.

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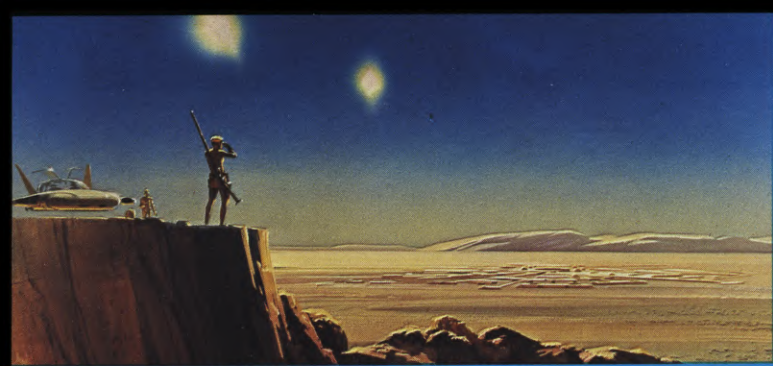
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BEHIND THE SCENES OF **STAR WARS**

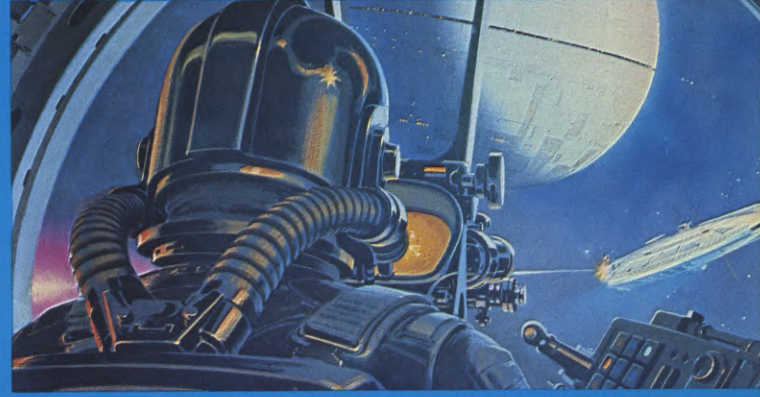
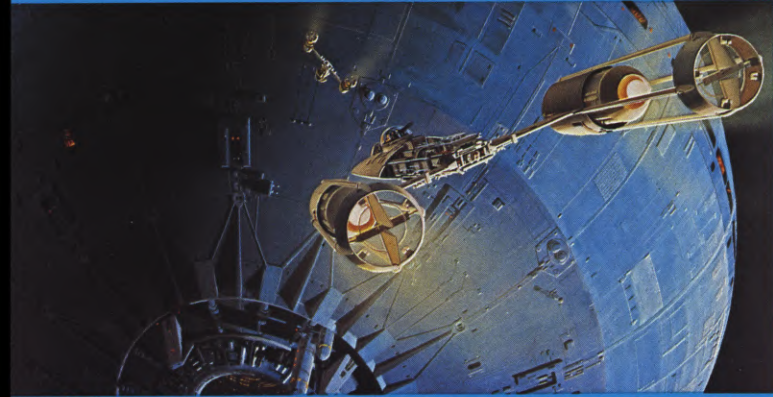


A young, enthusiastic crew employs far-out technology to put a rollicking intergalactic fantasy onto the screen

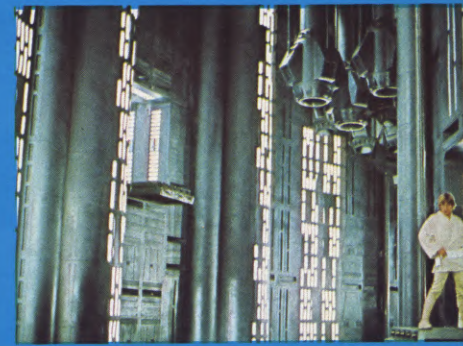
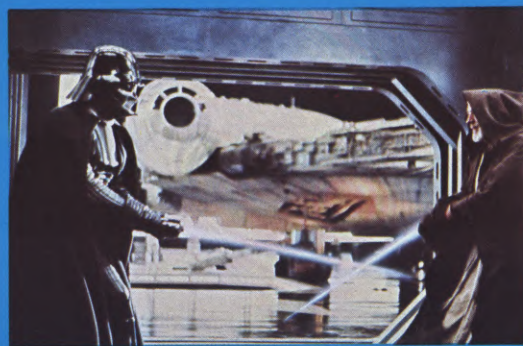
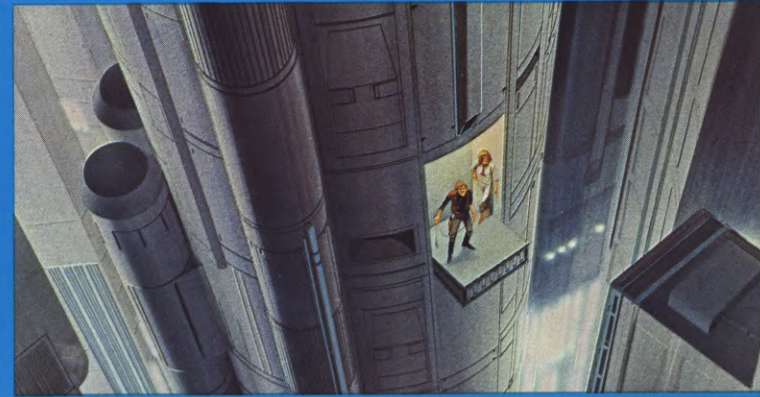
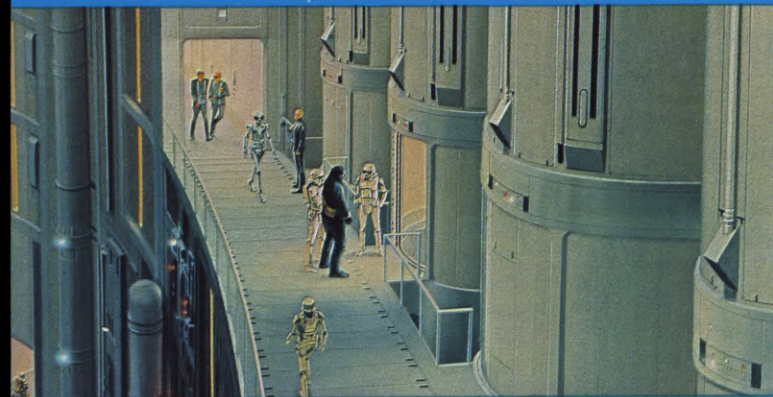
To paraphrase a statement attributed to Orson Welles during the filming of "CITIZEN KANE", the most magnificent toy ever invented for grown men to play with and express their fantasies, to project their nightmares and dreams, and to indulge their whimsies and secret desires is the motion picture medium. Taking full advantage of the technical wizardry of modern filmmaking, writer-director George Lucas has conceived of his film, "STAR WARS", as an expression of his boyhood fantasy life — his love for "Flash Gordon" and all the great mysteries and adventures in books and movies. "STAR WARS" is a distillation of the joys Lucas experienced in the hours he spent watching television and movies, and reading comic books and comic strips. It is also the most ambitious space film since Kubrick's "2001: A SPACE ODYSSEY", as well as being quite possibly the



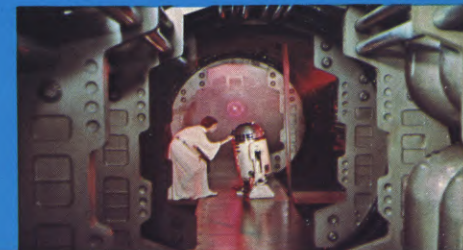
These magnificent renderings by production illustrator Ralph McQuarrie served as a sophisticated storyboard in early production stages. (LEFT) The arid planet Tatooine, with its twin suns. (RIGHT) Dreaded Tusken Raiders on Tatooine.

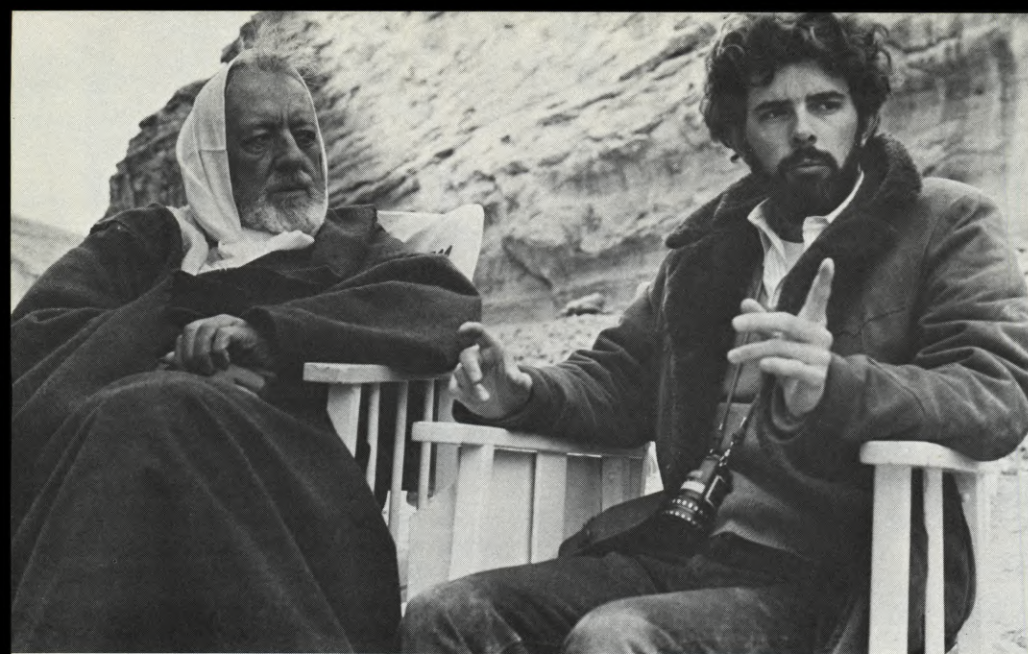


(LEFT) A Y-wing fighter approaches the Death Star. (RIGHT) An enemy gunner zeroes in to blast the Pirate Ship. (BELOW LEFT) White-shelled storm troopers patrol Death Star. (RIGHT) Luke Skywalker and Princess Leia reach a dead end.



(LEFT) Alec Guinness, portraying aged former Jedi knight, Obi Wan (Ben) Kenobi, readies his laser sword for combat. (CENTER) Arch-villain Darth Vader and Kenobi clash with laser swords in a battle to the death. (RIGHT) Luke and Leia, trapped at a dead end in their flight (see illustration above), ponder what to do next. (BELOW LEFT) A storm trooper storms down a corridor on the Death Star. (CENTER) Storm troopers stand guard over spacecraft aboard the man-made satellite. (RIGHT) Leia hides secret plans in innards of robot, Artoo-Detoo.





Famed international star Alec Guinness discusses his role with 33-year-old writer-director George Lucas on location for "STAR WARS". Guinness plays a shabby old desert rat who was once a "Jedi knight" and one of the most respected warriors in the galaxy. Of his latest cinematic creation, Lucas says: "'STAR WARS' is a movie for the kid in all of us."

most spectacular display of intricate special effects ever to sweep across the screen.

"STAR WARS", produced by Gary Kurtz, stars Alec Guinness, Mark Hamill, Harrison Ford, Carrie Fisher and Peter Cushing. It is being released by Twentieth Century-Fox. It's a high-energy action movie, uniting the hardware of contemporary space adventure with the romantic fantasies of sword and sorcery, plus a dash of wish fulfillment. Lucas' goal has been to make an imaginative entertainment experience that would transport audiences out of the theatre and into an unknown galaxy thousands of light years from earth.

As early as 1971, Lucas had wanted to film a space fantasy. "Originally, I wanted to make a 'Flash Gordon' movie, with all the trimmings, but I couldn't obtain the rights to the characters. So I began researching and went right back and found where Alex Raymond (who had done the original 'Flash Gordon' comic strips in newspapers) had got his idea from. I discovered that he'd got his inspiration from the works of Edgar Rice Burroughs (author of 'Tarzan') and especially from his 'John Carter of Mars' series of books. I read through that series, then found that what had sparked Burroughs off was a science-fiction fantasy called 'Gulliver on Mars', written by Edwin Arnold and published in 1905. That was the first story in this genre that I have been able to trace. Jules Verne had got pretty close, I suppose, but he never had a hero battling against space creatures or having adventures on another planet. A whole new genre developed from that idea.

"I had the 'STAR WARS' project in mind even before I started shooting my last picture, 'AMERICAN GRAFFITI', and as soon as I finished I began writing 'STAR WARS' in January, 1973 — eight hours a day, five days a week, from then until March, 1976, when we began shooting. Even then I was busy doing various rewrites in the evenings after the day's work. In fact, I wrote four entirely different screenplays for 'STAR WARS', searching for just the right ingredients, characters and storyline. It's always been what you might call a good idea in search of a story.

"What finally emerged through the many drafts of the script has obviously been influenced by science-fiction and action-adventure I've read and seen. And I've seen a lot of it. I'm trying to make a classic sort of *genre* picture, a classic space fantasy in which all the influences are working together. There are certain traditional aspects of the genre I wanted to keep and help perpetuate in 'STAR WARS'."

"STAR WARS" follows a young man, Luke Skywalker, through exotic worlds uniquely different from our own. Leaving the small arid planet of Tatooine, Luke plunges into an extraordinary intergalactic search for the kidnapped Rebel Princess Leia from the planet Alderaan. Luke is joined in this adventure by Ben Kenobi, the last of the Jedi Knights who were the guardians of peace and justice in the old days before the "dark times" came to the galaxy; Han Solo, the dashing, cynical captain of the *Millenium Falcon*, a Corellian pirateship; Chewbacca, a Wookiee, one of a race of tall anthropoids with quasi-monkey faces and large blue eyes; and the robots, See-

Threepio (C-3PO) and Artoo-Detoo (R2-D2). This odd band of adventurers battle Grand Moff Tarkin, the evil Governor of the Imperial Outland regions, and Darth Vader, the malevolent Dark Lord of the Sith, who employs his extra-sensory powers to aid Governor Tarkin in the destruction of the rebellion against the Galactic Empire. In the battle of Yavin, Luke engages in a terrifying climactic space battle over the huge man-made planet destroyer, Death Star.

Understandably, conceiving the visuals for such a film would be no small task. Lucas initially gathered around him the talents of Colin Cantwell, who had worked on "2001," to design the initial spacecraft models; Alex Tavoularis to do preliminary story board sketches of the early scripts; production illustrator Ralph McQuarrie to visualize the basic ideas for characters, costumes, props and scenery. Over a period of time Ralph went from simple sketches and line drawings to a handsome series of production paintings which set a visual tone for the production.

"The trouble with the future in most futurist movies is that it always looks new and clean and shiny," comments George Lucas. "What is required for true credibility is a *used* future. The Apollo capsules were instructive in that regard. By the time the Astronauts returned from the moon, you had the impression the capsules were littered with weightless candy wrappers and old Tang jars, no more exotic than the family station wagon. And although 'STAR WARS' has no points of reference to Earth time or space, with which we are familiar, and it is not about the future but some galactic past or some extra-temporal present, it is a decidedly inhabited and used place where the hardware is taken for granted.

"We were trying to get a cohesive reality. But since the film is a fairy tale, I still wanted it to have an ethereal quality, yet be well composed and, also, have an alien look. I visualized an extremely bizarre, Gregg Toland-like, surreal look with strange over-exposed colors, a lot of shadows, a lot of hot areas. I wanted the seeming contradiction of strange graphics of fantasy combined with the feel of a documentary."

Best summed up by "STAR WARS" production designer, John Barry, "George wants to make it look like it's shot on location on your average-everyday Death Star or Mos Eisley Spaceport or local cantina."

Realizing his needs, George Lucas

searched for a more-than-capable director of photography. After considering a number of people, he hired Gil Taylor, basing his choice on Taylor's cinematography for "DR. STRANGE-LOVE" and "A HARD DAY'S NIGHT". "I thought they were good, eccentrically photographed pictures with a strong documentary flavor," says Lucas.

Meanwhile, at Elstree, production designer John Barry and his crew began designing the myriad number of props and sets. Instead of the shiny new-looking architecture and rockets one usually associates with space fantasy motion pictures, the sets and props for "STAR WARS" were designed to look inhabited and used.

The film features more than a dozen robots, but the two major ones are C-3PO, known as "Threepio", and R2-D2, called "Artoo". Threepio was the one robot designed by production illustrator Ralph McQuarrie, art director Norman Reynolds and sculptress Liz Moore. The job of making the other robots work fell to John Stears, who devised the production and mechanical special effects. Besides the dozen robots he built for "STAR WARS", he also came up with light sabers, land vehicles and a myriad of explosions.

In the meantime, producer Gary Kurtz worked out a budget and logistical plan for the complex job of filming on three continents. For the desert planet, Tatooine, all American, North African and Middle Eastern deserts were researched and explored. In Southern Tunisia, on the edge of the Sahara desert, the ideal locations were found: a dry, arid landscape with limitless horizons filled with bizarre but real architecture.

It was decided the interiors would be photographed in London, England, because of the close proximity to North Africa and also because of the availa-

bility of a pool of top technical people at the EMI Elstree Studios, Borehamwood. It was the only studio in England or America that could provide nine large stages simultaneously and allow the company complete freedom to handpick its own personnel.

In March, 1976, a film production unit and cast descended on Tozeur, a sleepy little oasis town in Southern Tunisia, where North Africa and Arabia meet and the Sahara Desert begins. The construction crew worked for eight weeks to turn the desert and towns into another planet. Filming began on the Chotte el Djerid, not too far from Tozeur. Chotte means "salt lake" in Arabic. It was an arid, dried-up wasteland dotted with an occasional palm tree; a bare smooth desert reflecting the sun's rays from its myriad streaks of white salt. It's a place of mirages, where it is difficult to distinguish the real from the unreal. In other words, an ideal setting for a film like "STAR WARS".

The first sequences of "STAR WARS" take place on Tatooine, a planet in another galaxy. The homestead where the young hero, Luke Skywalker (Mark Hamill), lives is a huge hole in the ground leading to a series of caves.

Other locations included the sand dunes of the Tunisian desert a few miles outside Nefta. The scene called for the skeleton of a monster creature to lie in the background as robots Artoo-Detoo and See-Threepio made their slow way across the sands. As the sinister Imperial stormtroopers searched for the robots, one of the stormtroopers rode a mammoth beast which looks like a half-dinosaur, half-elephant.

After several sequences were filmed against the rocky grandeur of a volcanic canyon outside Tozeur, the cast and crew moved to Matmata, one of the most unusual towns in the world.

Matmata is largely inhabited by troglodytes, people who make their homes in caves cut from the sides of the crater-like holes in the ground. These craters dot the landscape, much like craters on the Moon. The underground homes evolved not so much in defense against possible enemies many years ago, but as a means of protection from the weather, which is scorching hot in summer and bitterly cold in winter.

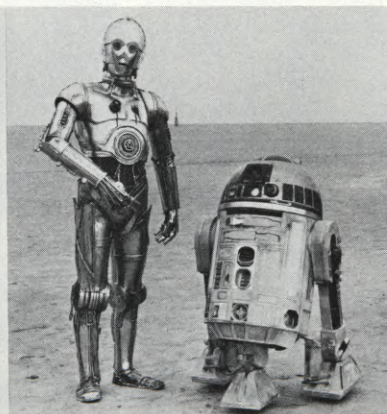
The average Matmata home consists of an open central hole, 25 feet in diameter. Often the hole is surrounded by parapets. In this way, there is shade from the sun and protection from the wind. The only entrance is by a gently sloping ramp which leads through a tunnel with recesses on either side for the storage of fodder and produce. The recesses are also used for stabling animals. The courtyard is 20 to 30 feet square and contains cisterns fed by channels from saucer-like depressions designed to catch the rain. There are usually two rooms on each side of the square, gouged from the earth. Inside the rooms — or caves — niches and recesses act as shelves, seats and beds.

In Matmata, George Lucas filmed sequences in the depths of the Hotel Sidi Driss, which is larger than, but still typical of, the local troglodytes' dwellings. In "STAR WARS", the hotel is seen as the interior of Luke Skywalker's homestead.

Following two-and-a-half weeks filming in Tunisia, the STAR WARS cast and crew moved to EMI Elstree Studios. It took all nine sound stages to house production designer John Barry's thirty sets of other planets, starships, caves, control rooms, cantinas, and the vast network of sinister corridors on the evil, man-made Death Star. For the enormous rebel hangar se-

Continued on Page 747

Some of the "Good Guys" in "STAR WARS". (LEFT) Luke Skywalker, a starry-eyed 20-year-old space rustic, comes on like an intergalactic Boy Scout. (CENTER) A Laurel and Hardy team of robots. See-Threepio (C-3PO) is a fussy British-accented pessimist. His pint-size buddy, Artoo-Detoo (R2-D2), built like a hand grenade, is a spunky little computerized scrapper. They almost steal the picture from the human characters. (RIGHT) Han Solo, starts out as a mercenary blockade runner (skipper of a Corellian pirate starship), but ends up on the side of the Goodies.



MINIATURE AND MECHANICAL SPECIAL EFFECTS FOR STAR WARS

By **JOHN DYKSTRA**

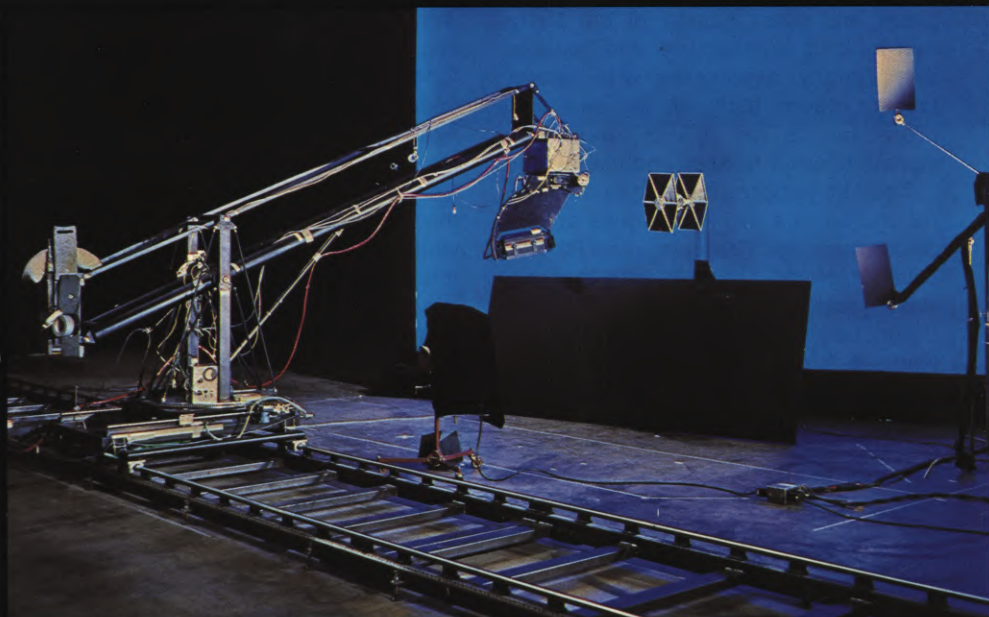
Special Photographic Effects Supervisor

How far-out electronics, computers and lasers, combined with human skill and determination, brought an intergalactic fantasy to life on the screen

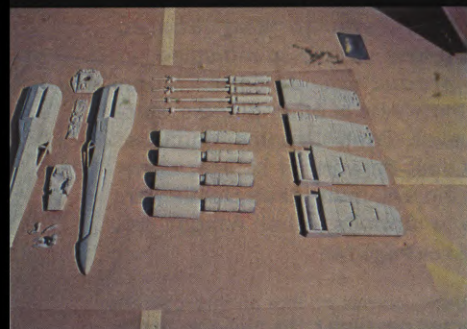
In June of 1975, I was contacted by George Lucas and Gary Kurtz with regard to my supervising the photographic special effects for STAR WARS. These first meetings with George and Gary outlined effects scenes that involved spacecraft engaged in acrobatics that any stunt pilot would be proud of: three or four ships performing rolls or loops while firing lasers at each other in the classic "dog fight" tradition. All this was to occur while being viewed from a camera platform that itself needed the fluidity and freedom of motion of a camera plane. This visual concept was a far cry from the locked-off camera approach to spacecraft miniature photography seen in the space classics of the past. This was a challenge, to say the least.

As the meetings and story breakdown continued, it became clear that this film would not showcase 20 or 30 special photographic effects shots, but would use spaceships, miniatures and

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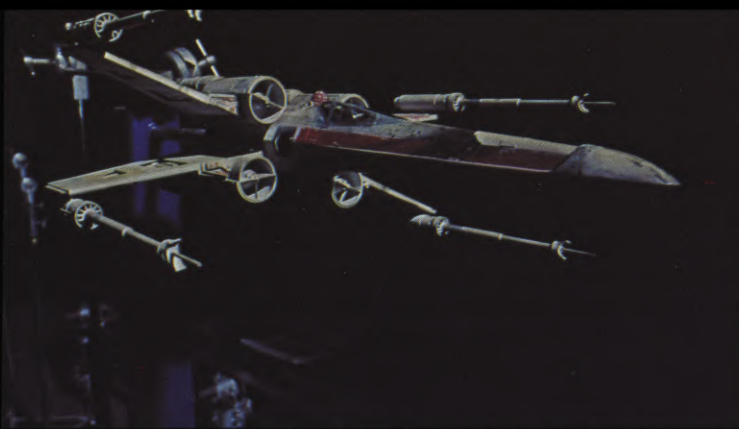
The "DYKSTRAFLEX" is a system using stepping motors for control of any motion in the camera/subject positional relationship. These motors drive a track boom system with seven axes of motion and very precise tolerances. It is shown here set up to film model of a T.I.E. enemy spacecraft against a blue screen.



(LEFT) The basic moulded components that will be assembled as model of an X-wing fighter. (CENTER) The fabricated acrylic structure of the rebel blockade runner, prior to application of surface detail and paint. (RIGHT) The rebel blockade runner receiving its detail and paint. The production of duplicate models involved vacuum forming, injection moulding and silastic glove moulds.

(LEFT) Photographing the laser hit explosion on the completed rebel blockade runner for the opening sequence. The ship was mounted in the inverted position to give the explosion a zero gravity character. (CENTER) Grant McCune masks an X-wing fighter before applying graphics. (RIGHT) The miniature duplicate of the laser guns used by Han Solo and Luke Skywalker during their escape from the Death Star. The detail of the miniatures had to be very complete, as each miniature was seen not only in flight, but also at rest.





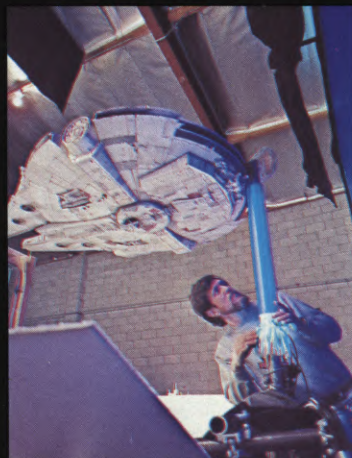
(LEFT) Model of an X-wing fighter mounted on a blue pylon against a blue screen. The size of each specific miniature model was determined by finding a scale that would satisfy depth of field, detail and size relationship to other miniatures that had to appear with it in any given shot. (RIGHT) In the finished scene, two X-wing fighters maneuver aerobically against a star-field background.



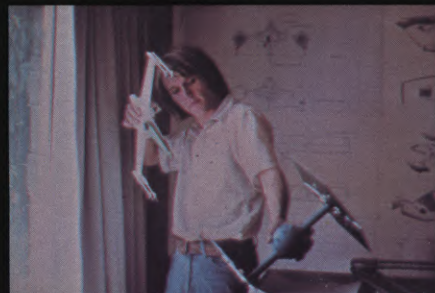
(LEFT) Joe Johnston details a forced perspective illustration to be used at the end of the Death Star "trench" miniature to provide a visual continuation to infinity from the taking camera's point of view. (RIGHT) The Dykstraflex camera suspended in the trench, looking toward the forced-perspective illustration used to carry the trench to infinity for the final chase sequence on the Death Star.



(LEFT) The Pirate Ship miniature incorporated many materials. Acrylic domes sandwiched a laminated plywood ring that was keyed to a metal armature which provided the mounting points for the ship. (CENTER) Scaffold pipe and clamps were used extensively to provide temporary structure for various miniature support rigs. Seen here is a rig that allowed the Pirate Ship miniature to pitch and yaw about its physical center. (RIGHT) John Dykstra checks out lighting for a shot involving the completed Pirate Ship miniature.



(LEFT) Special Effects Director of Photography Richard Edlund checks the balance of brightness between the pylon and the blue screen. (CENTER) Dykstra checks the move and position of the camera relative to the Pirate Ship and docking bay. The miniature piece supported by the "C stand" on the right is used to give some additional foreground material to the shot to help scale. (RIGHT) Joe Johnston interpreted many black and white World War II scenes into storyboards that depicted the same actions which the miniatures were required to perform in "STAR WARS".





"STAR WARS" Special Photographic Special Effects Supervisor, John Dykstra, one of the new generation of young special effects wizards which Hollywood has developed in the last several years. Dykstra got his basic training working with Doug Trumbull on "THE ANDROMEDA STRAIN" and "SILENT RUNNING", later working on Graphic Films' "VOYAGE TO THE OUTER PLANETS". "STAR WARS" vastly extended his responsibility and, with the aid of Space-age electronics and computers, he came through brilliantly.

all manner of photographic effects, as you would use automobiles in a film of contemporary time setting. In the entire film there are some 365 miniature and photographic effects shots. The challenge, therefore, became a task of mammoth proportions.

In order to produce the quantity and quality of special photographic effects shots called for in STAR WARS, a complete in-house system would have to be developed. This system would include miniature design and construction facilities; the design and fabrication of a camera motion control system; electronics and mechanical facets, and a complete optical house and animation department. I felt that the in-house system would be the only way that consistency of quality and control over each of the separate operations could be maintained.

First I sought out the personnel that I felt were necessary to carry out the special requirements of this project. This included conceptualization, design, and execution of the visuals and of the equipment used to produce those visuals. The electronics portion of the system would be handled by Al Miller Electronics. Al Miller and I had worked together in the past and already had a basic design for the electronics/camera system worked out,

and now we had an application for this system. For the mechanical aspects of this project, I contacted Don Trumbull, Richard Alexander and Bill Shourt. All three had talents in design and manufacture of one or two off-types of machines this project would require. In order to make certain that the people who would have to use the equipment had a hand in its design, I brought in Richard Edlund to be the Director of Photography. Grant McCune was given the responsibility of producing our miniatures. A production shop was set up by Bob Shepard, and all scheduling and co-ordination of special effects shots was done by George Mather.

In eight months we brought the facility in Van Nuys, California, from an empty warehouse to an incredibly versatile system. The talent and integrity of these people, plus our ability to communicate with each other, provided the key to the success of the system.

As the equipment began to evolve, the basic in-house departments began to form. Robbie Blalack (Praxis) began setting up an optical department. Adam Beckett began designing lasers and other animation which would be used in STAR WARS. Mary Lind set up a film control room to handle each shot, as it traveled from camera on stage through

rotoscope, and optical.

Because the photographic effects were to be done in the United States, and the live-action filming was to be done in England, some rather severe communication problems had to be overcome. George Lucas, Joe Johnston and myself described each shot in one or more storyboards, and its requirements were established, right to the frame count. Most of this information came from a cut BATTLE SEQUENCE, made up of excerpts from war movies. This established the size and speed of the fighters and their positions in frame. With this first set of storyboards in hand, we set about finalizing our miniatures, and photographic systems.

The format of the system was first to be considered. STAR WARS was to be released in the wide (2.35-to-1) format. The problems presented by trying to produce the incredibly complex photographic effects in this anamorphic format were staggering. There were problems of depth of field and image quality after numerous optical steps, hyperfocal distance of the anamorphic lenses, and complex articulate rotoscope work in a squeezed format. To eliminate the majority of these difficulties, it was decided that a spherical optic was necessary for our effects work. But we still had the problem of image degradation due to optical dupe steps. Once we had filmed the foreground elements and matched move backgrounds, these elements would then have to be combined in composite. The logical solution was to increase the negative size. Rather than use 65mm with its inherent processing and emulsion availability problems, we chose to use the horizontal 8-perf 35mm format similar to Vistavision. This not only gave us additional negative area, but also all of the advantages of high-quality spherical optics produced for conventional SLR still cameras with their incredible lens variety. One of the problems that the 8-perf format presented was optical combination. I decided that in-house opticals were a must in order to maintain our approach. We acquired an 8-perf printer (non-operative) and converted it to our electronics control approach. A second printer was made available to us. It was also converted to electronic control, and 4/8 perf operation. Due to the 8-perf horizontal format, we had to have lenses designed and constructed for the aerial position of our two-head printers, optimizing the image quality from the aerial head and making the printer considerably more flexible. With this choice, we had all the emulsions and processing available to

conventional 4-perf production and a larger negative area.

Concurrent with the assembly of the optical department and model facilities we continued the development of the photographic and motion control systems. Having completed the design in July of 1975, we began construction of the "DYKSTRAFLEX" described as follows:

A system using stepping motors for control of any motion in the camera/subject positional relationship. These motors drive a track boom system with seven axes of motion and very precise tolerances. By using the camera frame rate and count as a time base, we can record camera/subject positional changes at 24 frames-per-second. The positional change is viewed through the taking lens and is controlled by a joy stick for multi-axes moves or by an individual potentiometer for single-axis moves.

If one axis, or more, of the move requires modification, we then go back and rerecord that individual axis, while still playing back all the axes that are good. Once we have described the camera move, including follow-focus, and viewed it real time, we can then change the operational time base from frames-per-second to seconds-per-frame, and repeat the move precisely at the much slower rate used for the actual photography.

This allows complex matched-move, multi-element matte shots by shooting the foreground against the blue screen and then taking that program of motions to a twin camera system. A separate background element can then be photographed with matching motions. When the two elements are combined, the appearance is that of real time photography — allowing pans, tilts, rolls, and accelerations on shots having a multitude of elements which were shot at different times, on separate cameras.

Due to the complexity of the matte shots on STAR WARS we chose to use blue screen for our matting system. Thanks to the help of several experienced blue screen people, particularly Bill Rineholt, we worked out an expedient and versatile method of shooting and compositing each of the proposed shots. This required tight control of both the original photography that Richard Edlund produced on stage, and the system that Robbie Blalack was developing in optical for our blue screen composites.

After some consideration of conventional blue screen systems, we decided to innovate a little. First, we determined that we wanted a transmission screen, Steward (T matte). We

used daylight-corrected, fluorescent tubes to facilitate movement of the screen and to optimize the screen's efficiency. We converted their operation from AC to DC to eliminate possible flicker problems with real time or high speed photography. This provided us with a portable backlit blue screen, easily moved by two men to cover the format on extreme camera moves. This screen has approximately twice the output of a conventionally lit transmission blue screen of the same size, draws the same amperage and is virtually "hot spot" free.

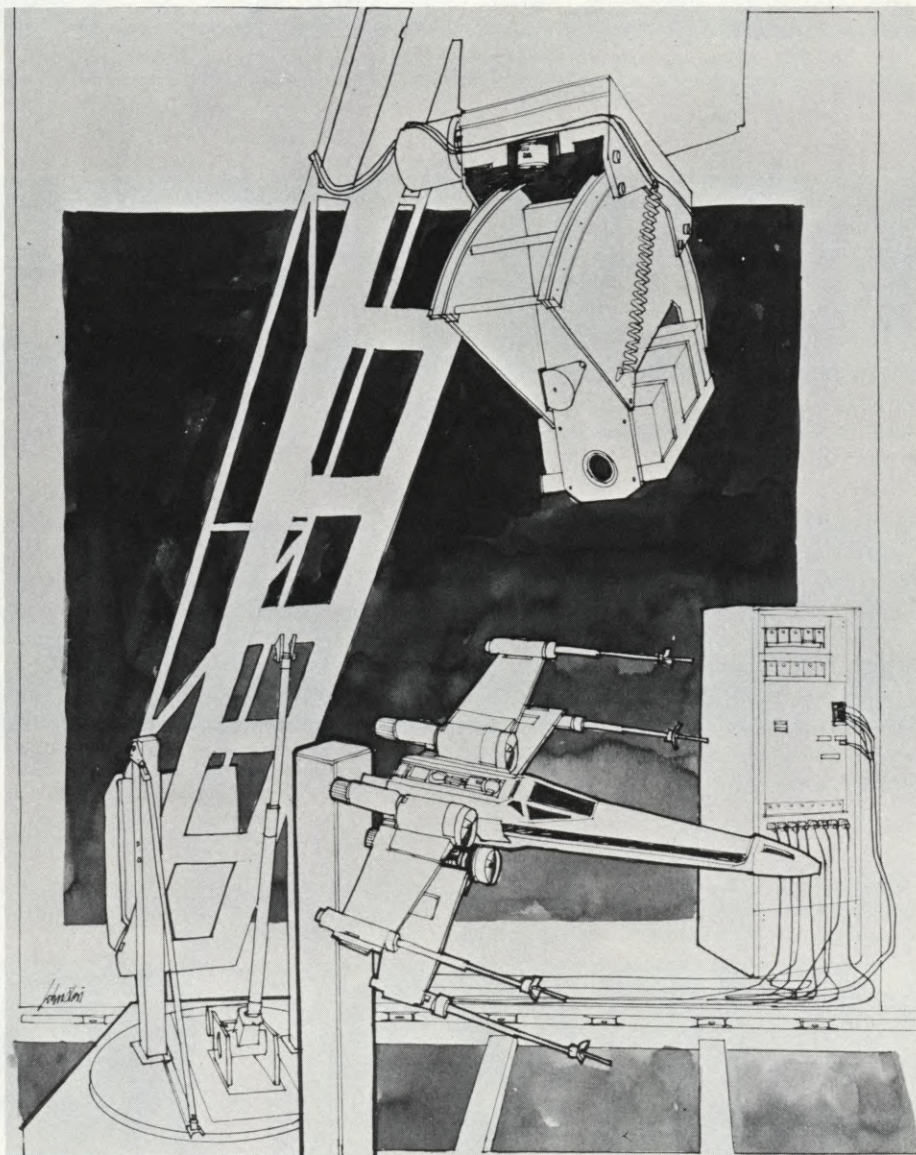
In addition, a rotoscope department was developed to work in conjunction with the optical department. Again we found it necessary to construct the equipment ourselves. The rotoscope

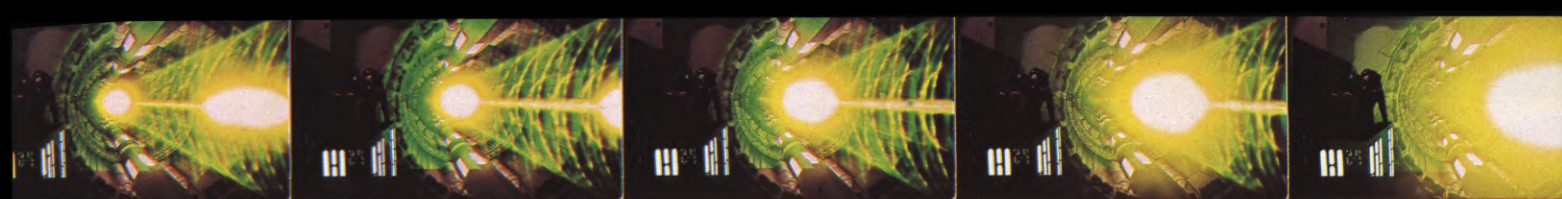
department not only provided garbage mattes and articulate rotoscope blob mattes, but also generated original images to be used for explosion enhancement, laser and flack effects.

With the blue screen matting system, we still had to deal with the question of how to support the miniatures. Articulate rotoscope matting of the streaked images to remove a support proved incredibly difficult. To solve this problem, we constructed what we call a "blue pylon". It consists of a central support tube containing electrical and cooling air umbilical for the model. It is then wrapped with mercury vapor neon which, in turn, is wrapped with acrylic plastic and coated with blue screen material. The miniature is supported by

Continued on Page 732

Illustration showing the Dykstraflex camera, head, boom-arm, track and control electronics, plus the X-wing fighter on pylon. By using the camera frame rate and count as a time base, camera/subject positional changes can be recorded at 24 frames-per-second. The positional change is viewed through the taking lens and is controlled by a joy stick for multi-axis moves, or by an individual potentiometer for single axis moves.





Composite of the interior of the Death Star laser gun. Composite consists of a miniature background that is the laser tunnel, a blue screen component (which includes the actors), a hand-drawn platform (the white patches) and Adam Beckett's sophisticated multiple-pass animated laser effect.



An X-wing ship racing across the surface of the Death Star. Here is illustrated one level of composite difficulty, where the ship, which was shot against a blue screen, is composited against a light background. No place to hide the matte line here!



Composite of an exploding X-wing against the Death Star surface. This represents perhaps the peak level of blue screen composite difficulty. The ship explosion consists of tiny particles and smoke, which must be matted in so that it is transparent, without blue fringing or matte lines.

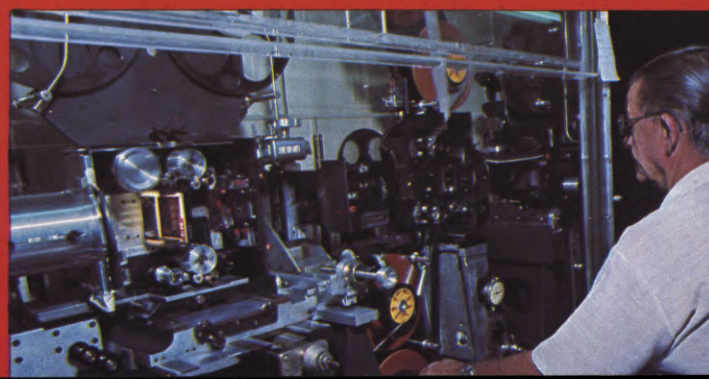


Darth Vader's wingman is destroyed by a laser bolt from Han Solo's Pirate Ship. This shot occurs at the peak of the battle, and consists of: stars, a trench background, the two ships, the explosion, the laser bolts (which are not in these frames). Ship elements and explosion were shot blue screen.



The Rebel ships approach the Death Star, preparing for attack. The shot consists of two X-wing ships, one Y-wing ship, the Death Star, the planet Yavin, and the stars. All elements except the planet and stars were shot blue screen.

(LEFT) Praxis optical printer functioning in Vistavision to conventional 35mm. This printer produced all the final negatives from Vistavision separations through a Panavision anamorphic copy lens. Note that the optical camera is laid on its side. (RIGHT) The Vistavision optical printer was purchased from Howard Anderson and rebuilt to function from stepping motors.



COMPOSITE OPTICAL AND PHOTOGRAPHIC EFFECTS FOR STAR WARS

Combining thousands of images — full-size and miniature — to create the stunning wall-to-wall special effects for this intergalactic fantasy

By **ROBERT BLALACK**
and **PAUL ROTH**

At this time, the ultimate image quality, least apparent grain, highest resolution and accutance, and best tone range and color saturation are produced in first-generation, or camera-original negative. Copies or generations of film derived from an original exhibit the familiar degradation of each of these qualities. In special effect matte photography, the most difficult and rewarding results are obtained when all components in a shot are composited "in camera." This method, also called the "held take" technique, places all the difficulties of color balance, exposure, film shrinkage and matte size/fit in the hands of the miniature stage photographers. Many shots in 2001: A SPACE ODYSSEY were produced in this manner. However, in a film such as STAR WARS, where the shots pose difficulties in miniature photography which have not been attempted in such quantity (see John Dykstra's article on these problems), the held take method would preclude a realistic production schedule. Our approach was to transfer the difficulties of composite matte photography from the miniature photographers to the optical cameramen. This achieved an effective balance between capturing the images on film, and finishing them into composites; it also gave the optical cameramen the challenge of maintaining maximum second generation quality in the optical composite negative.

It was decided to use black and white three-color separations for all primary images in the composites. The emulsion of 5235 color separation stock has a wide contrast latitude and grain definition which is superior to 5243 color Interpositive: it is the best choice for quality.

Any emulsion on standard celluloid shrinks and expands during developing. With a regular four-perforation image size, the shrinkage difficulties are largely controllable. In the double frame format (eight-perforation Vista-vision), the shrinkage is a definite problem. Kodak Estar base was used to overcome this problem, as it is about three times more stable dimensionally than celluloid base. By using Estar we

were able to have better stability over eight perforations than acetate would provide for a conventional 35mm frame.

High resolution over large image areas in one-to-one reproduction is a classic optics problem. A lens capable of resolving 160 lines/mm over a Vista-vision format is roughly four times as difficult to construct as a lens for conventional 35mm. We researched all stock lenses and found that the 100mm f/2.8 RepNikor (lens #1) met our requirements. But this lens was only

suitable for transferring an image from one projector into a printer camera. On an aerial image optical printer, or a printer with two projector heads, the transfer of an image from the film plane most distant from the optical camera necessitates both a second conventional copy lens ("lens #2"), and a "field lens." Positioned behind the first projector film plane, the field lens is required to bend the diverging light rays coming from the furthest film plane, through lens #2, into the Nikor (lens #1). Introducing a field lens cuts the perfor-

Whirling through space against a brilliant star field, a T.I.E. fighter (of the evil Empire forces) zaps a rebel X-wing fighter with laser blasts. To achieve such a result on screen required an incredible number of passes through the optical printer — and there were 364 separate composites that had to be created in this way. The 8-perforation (horizontal) Vista-vision frame was used to minimize blowup to the anamorphic format.





(LEFT) Composite Optical Photography specialists Robert Blalack and Paul Roth, with assistant Masaaki Norihoro in foreground, discuss an effect at the ILM "magic factory" set up in the San Fernando Valley to create the intricate illusions for "STAR WARS". On the board in background can be seen numerous storyboard drawings. Such precise renderings were necessary in order to assemble the complex composites. **(RIGHT)** Blalack looks on, while Norihoro threads optical printer.

mance of any lens dramatically, and to solve this problem, we designed a special lens which required no field lens, while reproducing an exceptional 180 lines/mm resolution, with no distortion. This meant that a blue screen shot could be placed in the first projector, and its matte in the second projector, so that as far as the camera was concerned, the two images were essentially the same. Result: improved matte fit.

Having now attended to the problems of film quality, lens resolution and distortion, and film shrinkage, using the best solutions available to us, we were confronted with constructing optical printer projectors and cameras which were able to work in the largely obsolete double-frame Vistavision format. The essential mechanical problem in the Vistavision format is film weave across the short side of the frame. In conventional 35mm, the weave is only half as noticeable. Fortunately, we were able to draw on the experience of Jack Cauldwell and Paul Lerpae, who strug-

gled with producing Vistavision composites at Paramount for such classics as THE TEN COMMANDMENTS. It was decided to use a third register pin, nine or more perforations from the standard two register pins to eliminate the weave. Even with the third pin, the printer movements required continual adjustment to keep this problem within bounds.

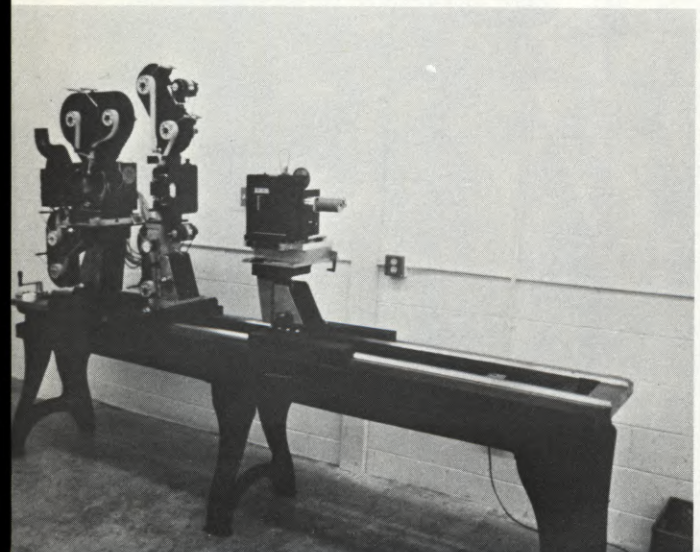
Laying this foundation allowed us to tackle the larger task of the optical department: to produce 360 multiple element composites, with 560 separate blue screen elements, and about 900 other elements (planets, stars, lasers, flak, etc.). We were required to develop techniques for matting fast-moving miniatures with streaked edges and matte them against planet backgrounds without generating matte lines, blue fringes, or double exposures — and do this in 32 weeks of production.

Basically, our task was to create a continuous tone matting system that could be controlled very accurately. Bill Reinhold, one of the most experienced

Industry printer operators, provided invaluable support in approaching this problem. We began an intensive testing program to set standards for sensitometric control of separation and matte exposure. We sought advice from the labs and were greatly assisted by Wes Shanks at MGM and Ted Wilson at Deluxe General. We had to maintain a close relationship with the labs because the result is a function of the relationship between exposure and processing of the mattes. We found that we needed eight or nine separate black and white film elements to produce a blue screen composite. Some of our shots involve as many as eight separate blue screen elements. That makes sixty-four separate B&W elements crossed over each other and the background. As the first ship streaked across frame, the second ship it is in front of must be seen through the streak of the first, and so on down the line of criss-crossing elements.

Often we had to integrate animated
Continued on Page 772

(LEFT) The two-head, eight-perforation optical printer in its early stages of construction. **(RIGHT)** Eldon Rickman operating the completed two-head, eight-perforation optical printer. The control board on the right houses a micro-computer which independently controls each projector head and camera. The projector heads are enclosed in a laminar flow cabinet in order to reduce danger of dirt contamination.



THE DOLBY SOUND SYSTEM FOR RECORDING

STAR WARS

A new technique assures that — for the first time ever — the sound heard in the theater is identical to that heard by the director during the mix

By IOAN ALLEN

Dolby Laboratories is best known to the general public as a result of the B-type noise reduction system, manufactured under license by most high fidelity companies, and incorporated in the majority of cassette recorders, and an increasing number of receivers and tuners. The Dolby A-type (professional) system, manufactured by the company itself, is found in most music recording studios, many broadcast organizations, and in connection with motion picture sound tracks.

Dolby first became involved in film sound in 1971 when "A CLOCKWORK ORANGE" was dubbed in London. Kubrick's film used the Dolby system throughout the magnetic generations (up to five in some cases, depending on premixes), and there was a significant improvement in noise level even on the optical-track, which had been conventionally recorded without noise reduction.

What's Wrong with Motion Picture Sound

The hiss that comes from magnetic recording generations, though, is only one of the problems that beset conventional film sound quality. High distortion, limited frequency response, optical noise, and — to the moviegoer's constant annoyance — a lack of intelligibility, are all major quality constraints. A conventional optical track, heard in the theatre, will have a high frequency response little better than 4kHz (about the same as a telephone receiver), compared with the 12kHz or more expected from a home high fidelity system. No single problem in the recording and playback chain is responsible for the high frequency losses, but rather a *series* of effects, including filters during recording and playback, printer resolution in the

laboratory and loudspeaker and screen limitations in the theatre creates a cumulative loss. Despite the fact that the frequency response seems inadequate today, it is worth remembering that in the late twenties and early thirties, when many of the standards for film sound were established, the quality of sound in the motion picture was better than could be heard in the home; it is only the development of consumer high fidelity equipment that by comparison reveals the inadequacies of movie sound.

In 1972, Dolby started an in-depth investigation into how film sound could be improved. Central to this was the idea that the noise reduction could be used as a tool to effect other changes. If the playback frequency response were to be improved in the theatre, the noise (hiss and sparkle) from the sound track would sound much worse, as if the treble control had been raised on a hi-fi set when playing an old record. Use of noise reduction on the optical track, though, allows the response to be im-

proved without the noise build-up that would otherwise occur. An associated benefit is that the distortion goes down, since the mixers making the sound track do not need to boost the highs so much if they know that the playback response will be extended, and this in turn leads to lower distortion.

These ideas have been utilized on nearly a dozen monaural optical releases between 1973 and today, including such films as "STEPPENWOLF" and "STARDUST". These films exhibited a significant improvement in sound quality over conventional optical tracks, when played back in theatres which had installed the suitable decoding equipment. The quality improvements seem equally useful to dialogue, music and effects; the general subjective response is typically that the track has a greater reality, much in the way that a picture seems more real in color than black and white.

Stereophonic Sound

Despite the improvements achieved with Dolby encoded monaural optical sound tracks, stereophonic sound represents a further quantum jump on subjective sound reality. Until recently, stereophonic sound in the theatre could only be achieved by the use of magnetic striping on the release print, with three, four, or (on 70mm film) six tracks. The fidelity constraints described above, relating to optical tracks in the areas of frequency response, noise and distortion, apply also to the magnetic release print, though perhaps to a lesser extent. A few films have been released using the same Dolby techniques as applied to the mono optical track on magnetic stereo release prints, including "THE LITTLE PRINCE" and "NASHVILLE".

Magnetic tracks have other problems, though, in addition to those mentioned above. **Continued on Page 748**

Steve Katz, Dolby Sound Consultant, works with the Dolby equipment during the "STAR WARS" stereo mix. Basically a noise reduction system, the Dolby technology also minimizes such quality constraints as: high distortion, limited frequency response and a lack of intelligibility in sound tracks. First used for film in 1971 on Kubrick's "A CLOCKWORK ORANGE", it is now widely accepted.



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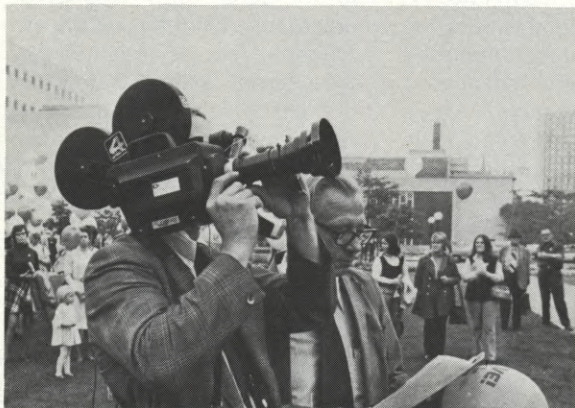
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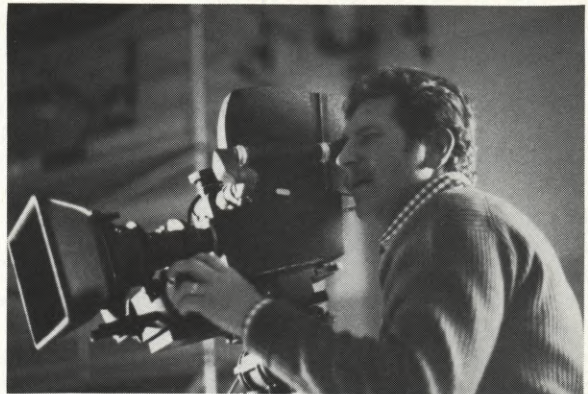
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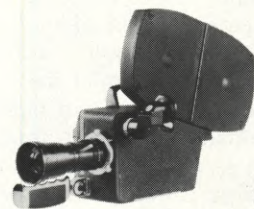
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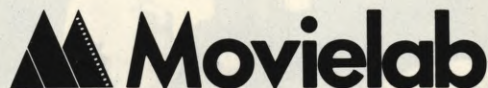
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THE ACADEMY OF MOTION PICTURE ARTS AND SCIENCES CELEBRATES ITS 50th ANNIVERSARY

On the occasion of its Golden Anniversary, the Academy returns to celebrate in the Crystal Ballroom of the Biltmore Hotel, where it began 50 years ago

The Academy of Motion Picture Arts and Sciences observed its 50th anniversary with a golden anniversary luncheon on May 11, held in the same ballroom where the internationally-

known motion picture honorary organization was founded — fifty years earlier to the day. The luncheon was one of a continuing series of events commemorating the organization's half-

century of service to the motion picture industry. The year-long celebration will culminate in the 50th Annual Awards Presentation next spring.

Bob Hope was the master of ceremonies and Academy President Walter Mirisch delivered the keynote address. Another highlight was the showing of a special film tracing the history of the Academy. Los Angeles Mayor Tom Bradley and other national and local governmental figures were on hand to present appropriate commendations and awards to the Academy.

A surprise guest, who flew in from Washington to extend his father's congratulations to the Academy, was Chip Carter, personable young son of President Jimmy Carter.

The Academy's Board of Governors, film industry leaders, civic and governmental dignitaries and members of the press attended the affair, which honored the 16 film professionals who have been members of the Academy for 50 years. Four of the sixteen — Henry King, Mary Pickford, Raoul Walsh and Jack L. Warner — are the only survivors of the Academy's original 36 founding members.

The others who joined the Academy in 1927 and are still members are: J.J. Cohn, George J. Folsey (ASC), Lee D. Garmes (ASC), H.W. Grieve, Mervyn



(ABOVE) On May 11, 1977, 50 years to the day after the founding of the Academy of Motion Picture Arts and Sciences, members and guests returned for luncheon in the same room where that historic event occurred, the Crystal Ballroom of Los Angeles' Biltmore Hotel. (BELOW) The first organizational meeting of the Academy, held in the Biltmore Crystal Ballroom on May 11, 1927. Some of the Hollywood pioneers in this photograph are Mary Pickford, Douglas Fairbanks (the Academy's first president), Louis B. Mayer, Jack L. Warner and Darryl F. Zanuck.



LeRoy, Lewis Milestone, Norma Shearer, John Seitz (ASC), Karl Struss (ASC), Norman Taurog, King Vidor and Darryl F. Zanuck. It is interesting to note that cinematographers comprise 25% of this group.

On May 11, 1927, an organizational banquet for 275 film industry leaders was held in the Crystal Ballroom of the Biltmore Hotel in Los Angeles. It was at that meeting, chaired by the late Douglas Fairbanks, that the Academy came into being.

Mary Pickford, one of the speakers, said: "Tonight should prove a memorable one in the history of motion pictures if the plans we all entertain for the Academy are realized. This mass meeting will be the first great progressive step toward the further development and protection of the splendid industry that has dealt with us all so generously. With our interest, enthusiasm and support, the Academy of Motion Picture Arts and Sciences should become a very great institution second only to the motion picture industry itself. The possibilities are beyond our present comprehension."

The Academy's 50th anniversary

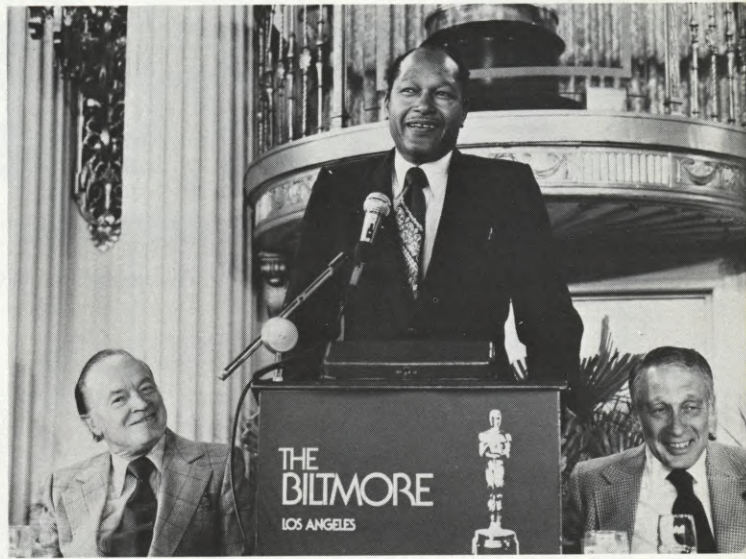
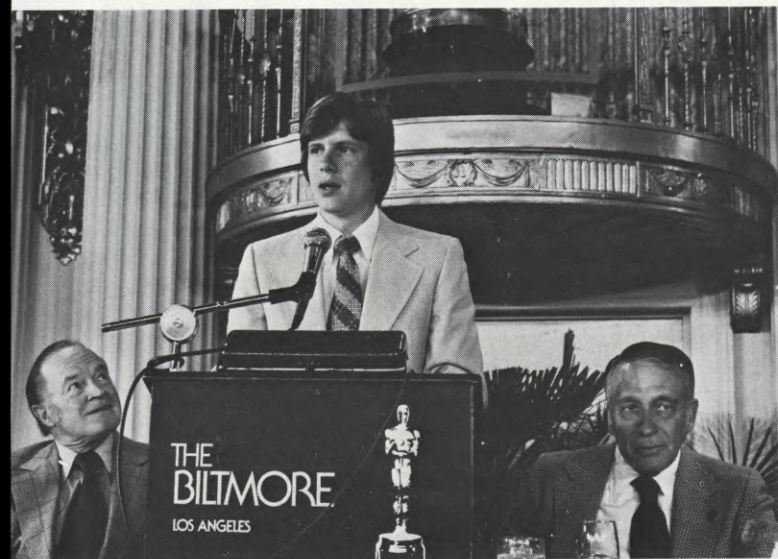


Among the 16 surviving original Academy members, distinguished cinematographers attending the Anniversary luncheon included (left to right) Karl Struss, ASC; George Folsay, ASC; Stanley Cortez, ASC, and Lee Garmes, ASC (not pictured).

activities are under the auspices of a special committee appointed by President Mirisch, chairman. Members include Ted Ashley, David Begelman, Candice Bergen, Michael Blankfort, Leo Chaloukian, Barry Diller, Hal Elias, Verna Fields, John C. Flinn, J. J. Frankovich, William Friedkin and Sidney Ganis.

Others are Samuel Goldwyn, Jr.,

John Green, Conrad Hall, Marvin Hamlisch, Charlton Heston, Bob Hope, Marvin Josephson, Howard W. Koch, Jack Lemmon, Henry Mancini, Gregory Peck, Eric Pleskow, Charles M. Powell, Frank E. Rosenfelt, George Seaton, Sidney J. Sheinberg, Dennis Stanfill, Daniel Taradash, Cicely Tyson, E. Cardon Walker, Robert Wise and Richard D. Zanuck. ■



(LEFT) Flanked by Bob Hope and producer Howard Koch, Chip Carter, personable young son of President Jimmy Carter, relays his father's congratulations to the Academy on its 50th Anniversary, remarking that the First Family's favorite form of relaxation is watching movies. (RIGHT) Los Angeles mayor Tom Bradley pays the city's respects to the Academy. (BELOW LEFT) Bob Hope, long a fixture of the Academy Awards, served as Master of Ceremonies. (RIGHT) Hope looks on, as Academy president Walter Mirisch cuts the Hollywood-style birthday cake.



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A NEW PORTABLE FOLEY (SYNC SOUND EFFECTS) RECORDING STAGE

By **HAL LANDAKER**

Production Sound Director, The Burbank Studios

A backyard swimming tank, a videotape monitoring system and a special audio trailer formed a movable facility for recording "THE DEEP" sound effects

Before the film version of "THE DEEP" went into production, I was contacted by Peter Guber, Producer of the film, and asked to concentrate on developing a way to record the underwater sound effects for the picture. The fact that there would be 45 minutes of underwater effects to be created made it important that we be very realistic and true-to-life in what we were to record.

Since the sound effects themselves would be unique, it became obvious that a unique system would have to be devised in order to record them. The sound effects editors selected to handle effects for "THE DEEP" were Fred Brown and Ross Taylor, whose previous credits had been numerous — including "THE EXORCIST", on which we had collaborated.

The initial problem posed required that we develop a *portable* Foley (synchronized sound effects) system that could conceivably be moved to a location site in order to record the underwater effects. As it turned out, this requirement proved valid, since the final decision was made to do the underwater sounds in a 12-by-3-foot portable tank of the backyard pool variety.

The weight of this tank placed such stress on the floor of the existing Foley stage that the safety of the structure was questioned. On the basis of our previous experience and planning for this project, we then decided to use the portable system (originally scheduled for location recording) on Stage 25 at The Burbank Studios. Stage commitments subsequently forced us to move it to another location — all of this attesting to the extreme portability of the system.

Much research was done in order to create the basic sounds that we were

looking for. Very shortly after the operation was set up, some initial experimentation was carried on, based on our past research, and the approval was given for the methods which would be used to create many of the underwater sound effects that would be needed. We had initially planned to use the portable Foley system for creating only the underwater effects, but the system turned out to be so efficient that we decided to use it for the Foley work on the entire picture. The time saving made possible by the versatility and speed of the system allowed us to create almost all of the effects required in time allotted for the underwater effects only.

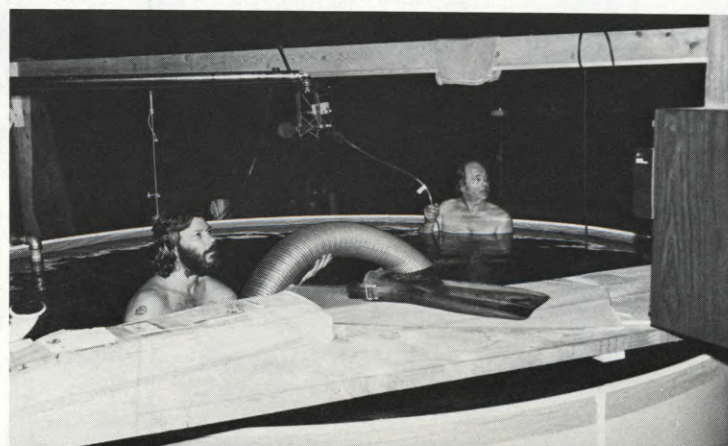
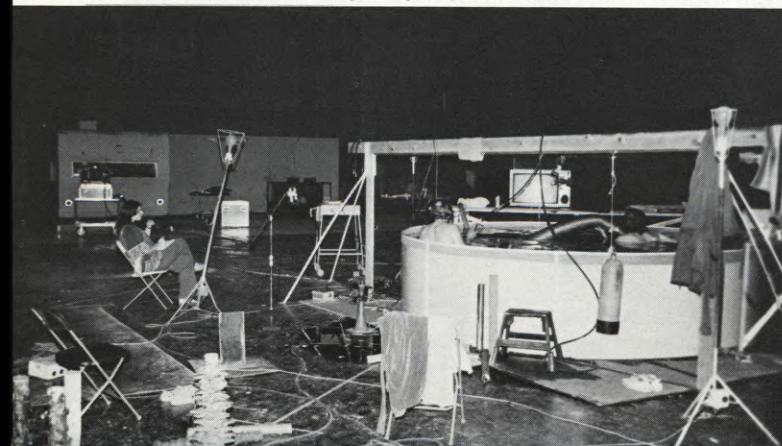
The application of a video system, utilized as it was in this particular instance, marks the first time, to my knowledge, that such a system has been used on a picture of such extensive scope and budget. Foley work is usually done on a large theatre-

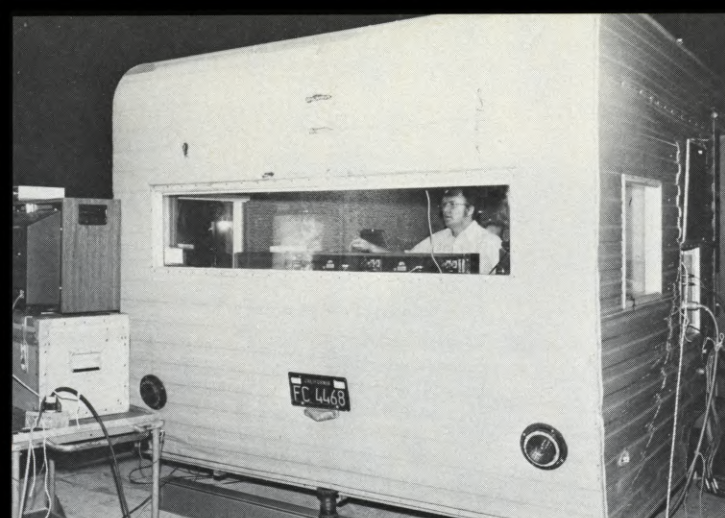
type screen. However, after in-depth consultations involving Fred Brown, Ross Taylor and myself, it was decided to opt for a 25-inch video monitor, rather than a large-screen picture.

The actual fine-tuning of the sync and other technical elements is done on a 4-by-5-inch Moviola screen, or on a KEM editing machine — the screen of the KEM still not being as large as that of the 25-inch monitors used with the portable Foley system. Our assumptions in favor of these monitors proved correct, since they make it possible for sound effects personnel to zero in on a particular action or effect without being distracted by the wide peripheral action taking place on a large screen. The speed of the special video tape unit selected for this work allows us an almost six-times-normal fast-forward and rewind, while still providing a frame readout and retaining an image on the screen to identify where we may be. As a result, it is possible to run down a



(ABOVE RIGHT) Hal Landaker, Production Sound Director for The Burbank Studios, who, in conjunction with his associates, developed the unique effects recording system for "THE DEEP". **(BELOW LEFT)** The movable equipment, including backyard-type swimming tank, set up on Stage 25 at Burbank Studios. **(RIGHT)** Slightly marinated, Fred Brown and Ross Taylor create sound effects for the underwater sequences in "THE DEEP". Bruel & Kjaer hydrophones were used, in conjunction with the Department's special adaptation of other devices.





(LEFT) Exterior view of the special audio trailer, which is a key element in the portable system. Originally designed for recording audio on live video shoots, it provided complete audio processing and playback capabilities to drive reinforcement systems. (RIGHT) Sound Mixer Dana Wood, shown at the console of the sound system housed in the 14-foot, totally soundproofed trailer. The trailer includes a complete patch panel, which allows for insertion of various sound processing devices.

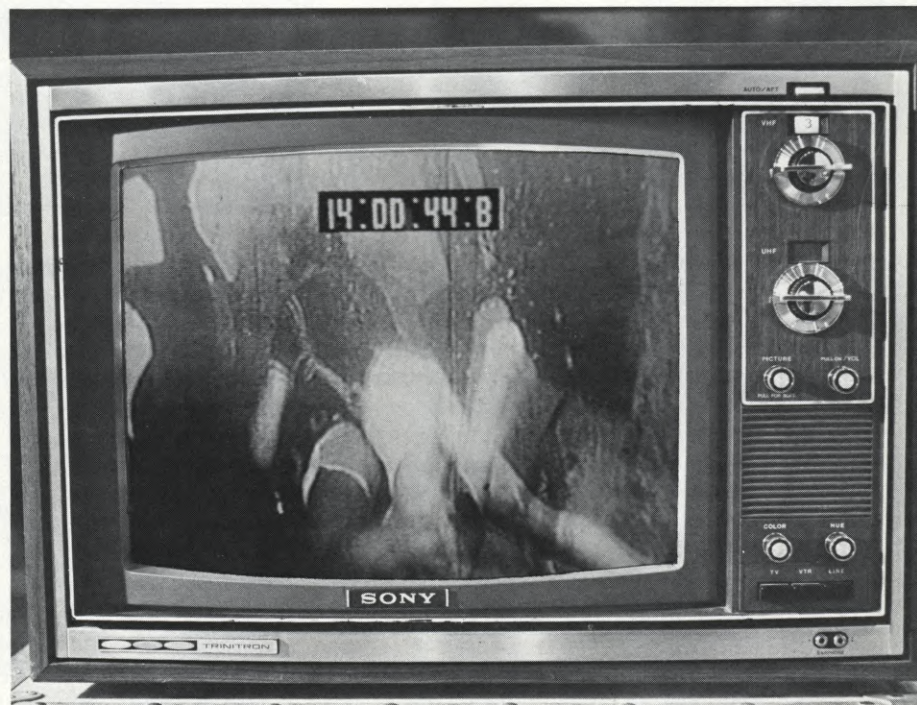
particular image with a minimum loss of time.

The video unit allows us yet another extra capability in that, at all times, we have a stop-frame readout setting on the monitor, so that all personnel involved constantly know at which point we are in the work being done. In addition to this stop-frame capability, the machine can run in slow-motion at approximately one-frame-per-second. This makes it possible to run through a scene and preview it for any fast-action effects that might be overlooked when using a conventional system.

The frame readout is character-generated and appears in the upper portion of the screen. This is the result of our deduction that the great majority of Foley effects occur in the lower portion of the screen. Putting the readout high in the frame, therefore, permits a minimum of interference with the effective area that we are interested in.

The frame count begins on the Academy start and also coincides with a sync pop placed at the start of the sound track on the video tapes. By following this procedure, we end up with an entire reel of sound effects on an individual track, complete with sync mark and coinciding with the Academy start mark. This reel can now be taken directly to the dubbing room, with little or no editing having to be done on it.

The video tape machine is capable of laying down two individual tracks of sound effects, as well as being capable of insert editing, allowing pick-up recording with an absolutely silent changeover. The process that we used allowed us to lay down one series of effects on one track, plus a second series of effects on another track at the end of the recording done on the video tape. We then transferred to 1/4-inch



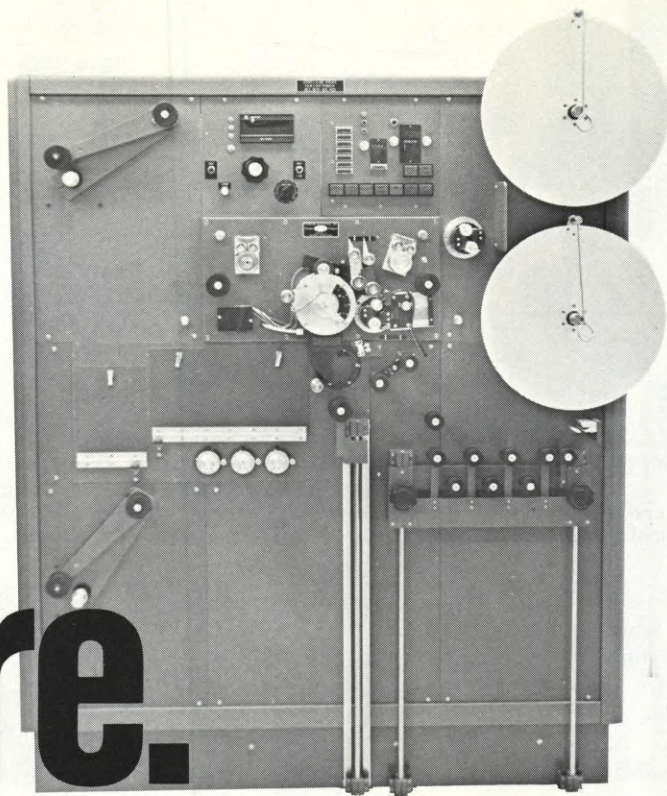
(ABOVE) A "first" in the recording of a major motion picture, this 25-inch screen served as a monitor for synchronizing sound effects. The character-generated readout near the top of the screen allows for precise, to-the-frame pinpointing of any effect. The special videotape unit has an almost six-times-normal fast-forward and rewind capability — a must for synchronized sound effects recording. (BELOW) Hal Landaker (center left) with the crew used to record sound effects for "THE DEEP".



Continued on Page 758

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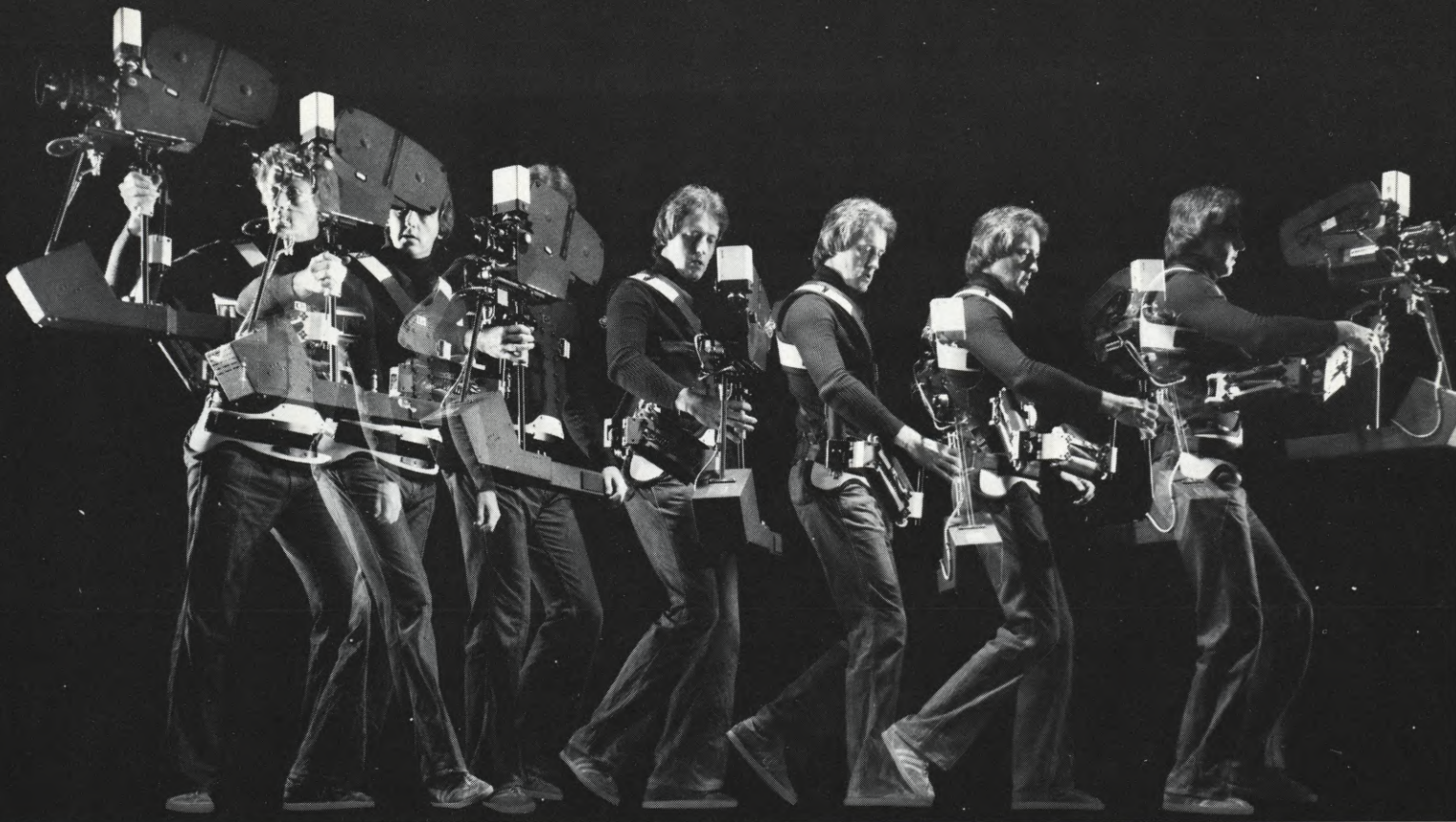
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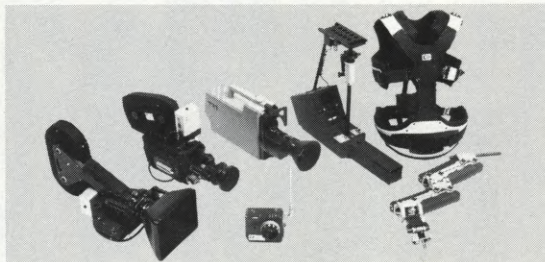
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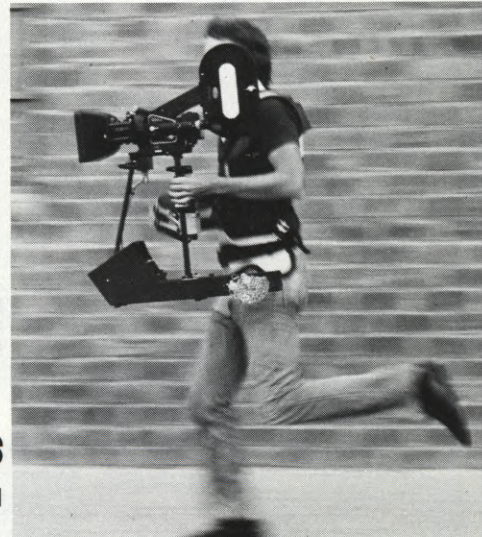
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THE CAMERA ASSISTANT TRAINING PROGRAM IN HOLLYWOOD-1977

By PHILLIP GONZALES

Progress report on a significant program set up to train apprentice camera assistants under completely professional working conditions

The concept of a camera assistant training program goes back to 1968, when a handful of industry visionaries attempted to put a program together. There were some very enthusiastic and dedicated people who focused a lot of energy on the project, and by late 1969 it was almost ready to fly. A detailed schedule of instruction hours had been formulated, whereby the trainee would be sure to get some classroom time as well as practical on-the-job training. Unfortunately, this comprehensive training program never saw the light of day, as a minority hiring agreement with the Justice Department took precedence and precluded the aforementioned regimen.

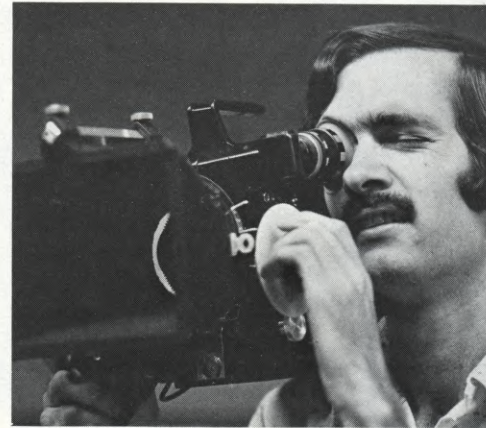
1975: With the formal minority hiring program completed, the industry once again turned to a camera assistant training program, which would encompass some of the original 1969 program's features. The training would be 40 weeks long, or a minimum of 1600 hours, would include some time in the loading room, observing in the laboratory (including optical printing), handling hardware at rental houses and attending seminars. The bulk of the training would, of course, be on-the-job experience on actual productions. Upon completion of the program, the trainees would be graduated and allowed to enter the IATSE camera local as second camera assistants, with a Group 1 classification, giving them attractive seniority status.

How would these trainees be selected and who would provide the financial support for the program? The selection process consisted of two main parts: the first was taking a

battery of written tests lasting eight hours; the second part was a personal interview/oral exam, followed by motor dexterity and color balance tests. The written exam is based on a model derived from testing more than 100 working camera local members who possessed a common range of skills. The Association of Motion Picture and Television Producers, in concert with the IATSE Local 659, contracted the testing bureau of the University of Southern California, under Mr. Bob Jones, to design these written tests.

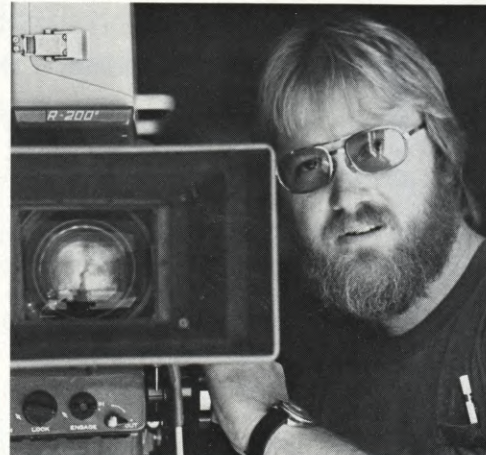
Announcements of the training program were placed in selected publications in May, 1975, and the resultant applicants, numbering almost 900, took the written tests on the U.S.C. campus. Some weeks later, approximately seventy top-scoring finalists were selected to continue testing in the next phase, the personal interview/oral exam. Here, applicants were queried as to their background, asked why they should be selected, and examined orally on specific points of photography. This first group was also asked to critique a still photo they had taken. After considerable deliberations, the training committee selected ten candidates for the training program. This figure was based on available capital, and statistics on attrition of camera local members. AMPTP says the cost is approximately \$10,000 per person, 60% of which is salary. In May 1976, the first group of ten were graduated and entered the industry as second camera assistants. Many of these 1976 graduates have distinguished themselves as excellent assistants, having worked on big features as well as television series.

The second group of ten, which was graduated in May, 1977, experienced essentially the same training as its predecessors, except that, due to the withdrawal of Paramount and Universal from the AMPTP, this new group couldn't work on those lots as part of



DOUGLAS KLOTZ

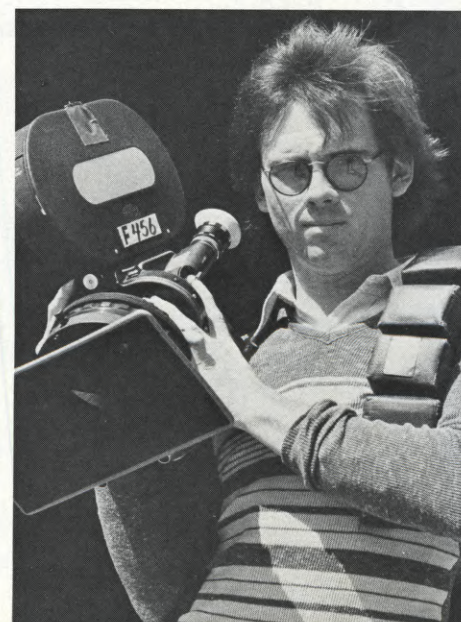
ROLF MENDEZ



CHRISTOPHER SQUIRES

WILLIAM "ERIC" ENGLER

PHILLIP GONZALES



their training.

Here's how it went for us, the second group: The first weeks of training put four of us under Walter Egger's wing at the MGM lab, where we gained knowledge of the art of timing prints. Observing head timer Bob McMillan's crew at work, we learned about printer lights versus f-stops, YCM versus RGB, etc. The timer's trained eye is a premium commodity which, to date, hasn't been replaced by an electronic black box, although such devices help timers to make color decisions in some labs. We then saw the film developing chain, with its myriad of tanks, rollers, drying cabinets, automatic alarm systems, etc. To see how the correlation between film chemistry and sensitometry is controlled, we were guests of Wes Shank's control room, where we learned of "patch runs", film strips exposed at the lab and run through the chemistry, then analyzed on a digital readout densitometer, to keep constant checks on the film stock/chemistry as a system. This department played a very important role in recent times, during the transition from 5254 to the first 5247, followed by a later series. The characteristics of these three stocks were quite different, as regards spectral response, contrast, and forced processing, and Wes was enthusiastic in his depiction of the problems the lab had during the transition stages; he showed us curves on the relative responses of the three color sensitive layers and exhibited comprehensive knowledge of his craft. We then went next door to the negative and dupe room, where all incoming exposed camera stock is checked in, and here we learned the importance of neat, accurate and complete camera reports. Those things we fill out under the pressure of production actually have to be read by someone after the exposed stock

leaves the sound stage! We checked out the tape punch room, where timer's notes are turned into digital instructions for the printing machines. We then observed Bill Lile's optical printing operations, to see how routine effects, such as title supers, wipes, mattes, flips, and other effects, are accomplished. This is very exacting and painstaking work, which requires a special kind of individual, who is, incidentally, a specialized cameraman, and is, therefore, a camera local member.

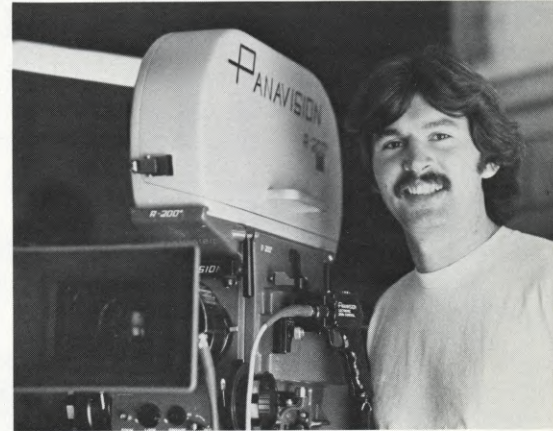
While four of us were learning to speak "lab-ese," the rest of our group was spread out over four rental houses learning the nuts and bolts side of cameras, while others were at the Burbank Studios getting our feet wet as on-the-job trainees on an actual production. TBS is one of a diminishing number of studios which still maintains a camera department that is responsible for loading and unloading the film magazines from all productions shooting on the lot, plus dispatching the right set of camera equipment to the right stage. Although we, as trainees, could not load and unload actual production film magazines, we did have ample opportunity to use dummy stock in familiarizing ourselves with the features of each magazine type.

Possibly due to the relationship between Panavision and TBS (Warner Communications is the parent company of Panavision), we were able to get some "hands on" experience with Panavision equipment — setting it up and practicing threading it. We found you just can't spend too much time getting "hands on" hardware experience. Even early in the program, our experience in the camera rental houses was helping us in production, where we occasionally had the opportunity to set up a second camera for a special shot.



ROBERT COLLINS

ROGER GEBHARD



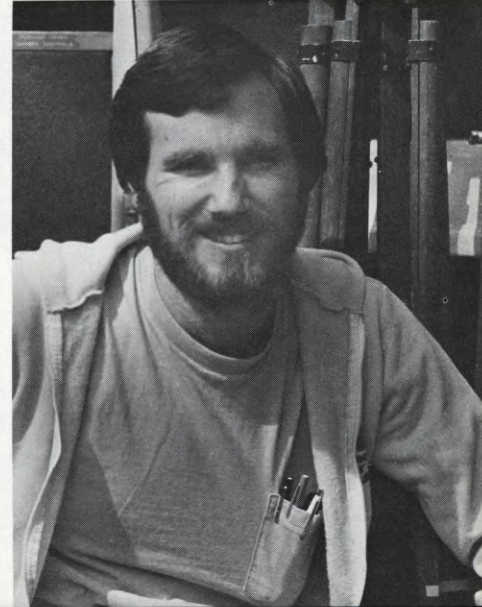
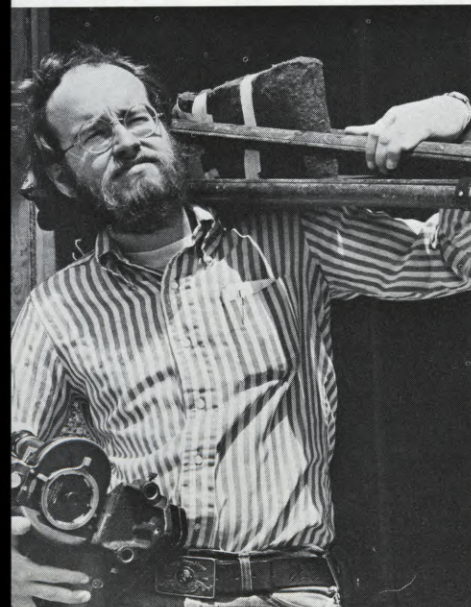
At TBS we were spoiled, of course, by not having to load magazines, as the camera department had already done that.

However, when we worked on an independent production at a studio with no camera department, we often assisted the regular second camera assistant in loading magazines and, in some cases, assumed the total responsibility if the assistant felt we could handle it. Also, on location, we were often called on to load magazines, which the assistants generally appreciated a great deal. I think all of us felt very good if, after a long, arduous day in the field, **Continued on Page 759**

JOHN ANDERSON

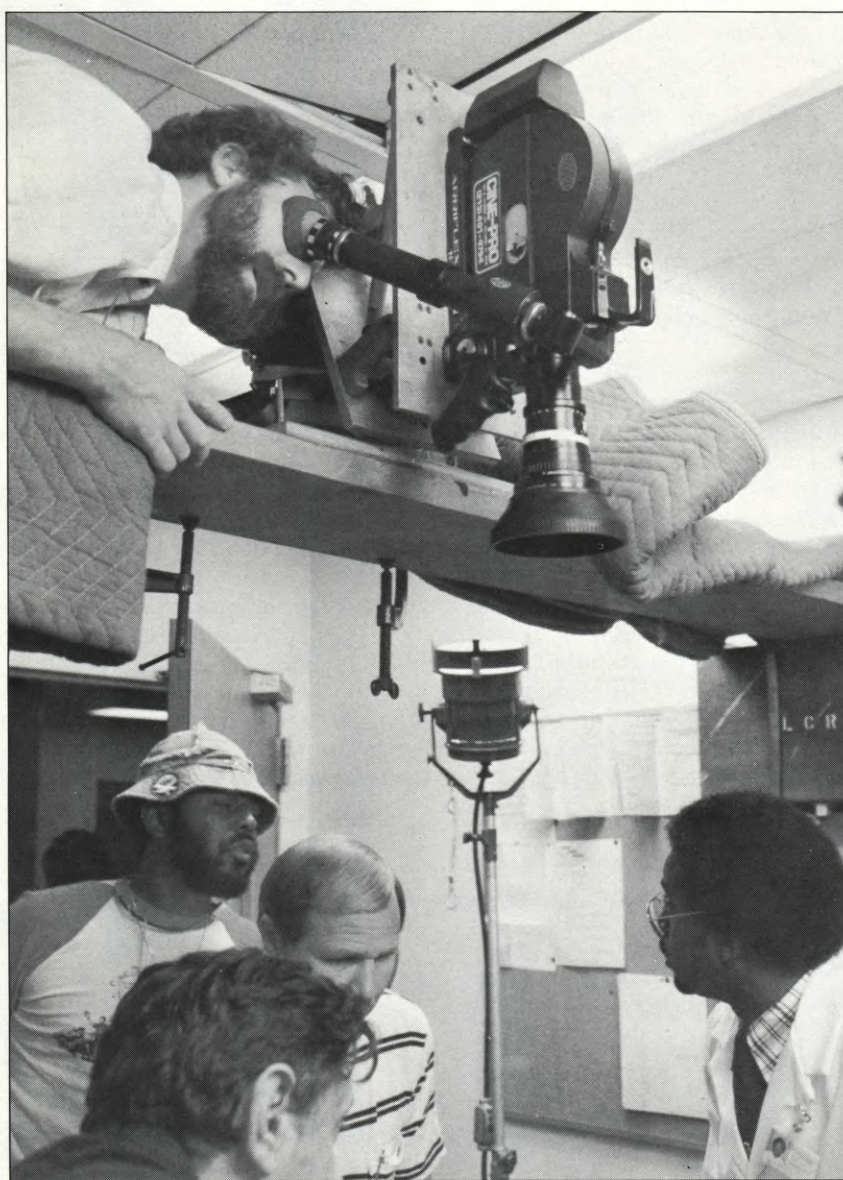
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Arri 16SR on location in tight quarters: flexible unobtrusive and fast.

“Producers like quality,” says Jack Cooperman,
“But most of them like speed even more.
With the 16SR, I found it a lot easier than before
to get good production quality fast.”



“10mm focal length on this one,” says Mr. Cooperman.
“I had to keep my body up high, out of the shot. The
camera’s small size, light weight and adaptable finder
let me rig the whole thing with *one* plank, and get right
up against the ceiling. A fast setup, and *compact*.”

Until he shot this segment of a
March of Dimes documentary Spe-
cial, Jack Cooperman had never
used an Arri 16SR. Here are some of
his comments:

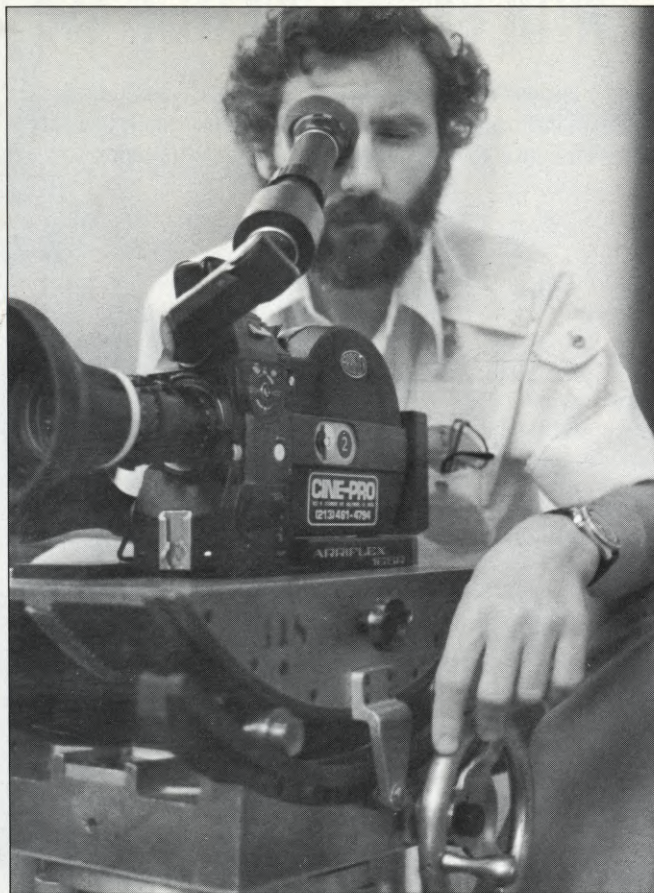
“We were shooting medical staff
and patients at a hospital. To catch
the action while it was spontaneous,
and to keep out of everyone’s way,
we had to be fast and flexible.”

“I found it *pleasurable* to work
with that camera,” says Mr. Cooper-
man. “It’s a studio-quality tool; and
it does everything you expect, plus
quite a few *new* things.”

Produced by March of Dimes Foundation; Ed
Franck, Director; Jack Cooperman, Director of
Photography; Jack Green, Camera Operator.

“Shooting in the crowded Oper-
ating Room, we had to keep out
of everyone’s way. No tripods.”



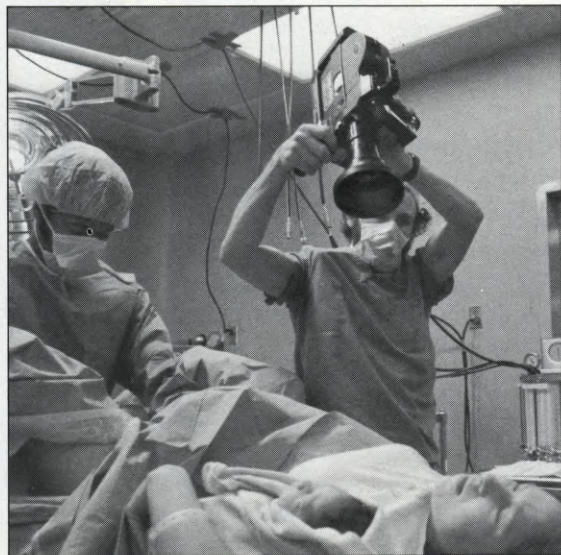


"For one move, I needed to start next to the wall," says Mr. Cooperman. "With the SR's amazing viewfinder, I could put the Worrall head *against* the wall, and still see what I was doing without mashing *my* head."

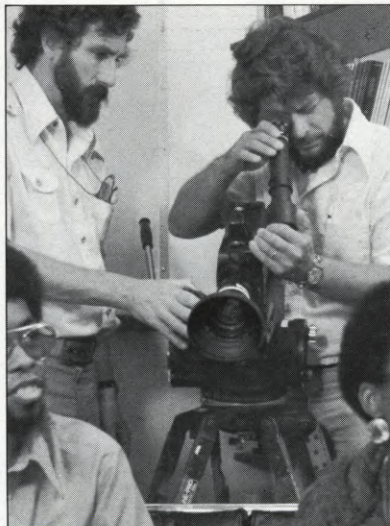


"What was important to me about this camera was the ability to keep the creative flow going at a *steady pace*. The fast setups and reloads were ideal for unscripted, spontaneous action."

"I'd lock it off, swing the finder over for the Director, swing it back, and we'd roll. *Instantly!*"



"The birth sequence required unobtrusive shooting. The cable-free battery on the camera's back helped a lot."



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AN AMERICAN FILM INSTITUTE SEMINAR WITH HASKELL WEXLER, ASC

Conclusion of a discussion with the winner of this year's golden Oscar for "Best Cinematography" (and one other before that), in which he talks about directors, timing, gaffers and photographic styles

PART 2

QUESTION: How much work does the cinematographer do in post-production, as regards getting involved with timing, etc.?

WEXLER: You should get Gordon Willis here to answer that, because what nobody realizes is that he is about the most thorough door-to-door cameraman that there is — that I know of, anyway. I mean, from the day that they decide on him to do the picture, he's testing lenses, camera equipment, screens. When he goes to see dailies he takes along a spot meter to test the reflectance of the screen. He's on the lab's tail all the time; he can tell by his workprint when they switched printers. He does the timing on all his films. He has a regular routine; he has a system. He's made enough films now to have a very thorough routine for pre-shooting and post-shooting work.

QUESTION: Do a lot of studios let the Director of Photography get involved in timing, printing, etc.?

WEXLER: Well, usually, from the economic standpoint, it's not possible for the Director of Photography to get that involved. Secondly, many Directors of Photography just don't have the muscle to involve themselves like that. You come around to the editor and he'll say, "Who is that joker?" That's because a lot of time has elapsed between the period when the Director of Photog-

Director of Photography Haskell Wexler, ASC, supervises filming of an over-the-shoulder shot of David Carradine for "BOUND FOR GLORY", the film biography of the late Woody Guthrie, for which he won this year's Academy Award for "Best Achievement in Cinematography". Heavily diffused, with the color desaturated, the photography of this picture captured the hopelessness of the Depression/Dust Bowl era.

raphy was important and when the film comes out. But a smart director, when he has a good cameraman who wants to volunteer in that way, should accept the offer I think.

QUESTION: In a lot of pictures, when they shoot day-for-night, they shoot on cloudless days and get a very hard edge to everything, but I've noticed that your pictures have much more of a true nighttime feel — that they're softer. How do you do that?

WEXLER: In approaching day-for-night photography, you have to look at night and analyze it. You have to ask yourself, "What are the general characteristics of night?" One thing is that moonlight is like sunlight in the respect that it is a one-source light. But it is different from sunlight in that it's softer. Another consideration in shooting day-for-night is the fact that the sky is brighter than it actually is at night, so if you can control the harshness of the sun and the intensity of the sky — and also the ground that's under the sky — you can make pretty damned good day-for-night shots. Where a lot of cameramen fall down is in forgetting the softness aspect of night. Even in a gutsy picture, night is soft; things are not seen sharply. Changing the subject, on BOUND FOR GLORY I used the new STEADICAM, working with the cameraman who invented it, Garrett Brown. It's a breakthrough camera that

completely smooths out hand-holding. There's one shot in the film that was done from a Chapman crane high over a migrant camp. The camera cranes down, hits the ground, and picks up Woody Guthrie (David Carradine), who then walks through the migrant camp about 100 yards, through hundreds of people, underneath tents, through very narrow areas, in amongst people, into a dialogue scene with Randy Quaid — then it comes back. It's a fantastic shot — not because I did it, but because this device allowed me to do it.

QUESTION: Do you have any preference as to filming format — the rectangular frame versus the square frame, that is?

WEXLER: Well, it took me a long time to accommodate myself to 1.85, because I like the old, more square screen. I just recently shot some tests with the STEADICAM unit, using the anamorphic format. I shot the Super Bowl stuff for BLACK SUNDAY in anamorphic. I think your preference stems from what you think you're good at, so the answer is to try to be good at all of them. If I would work more on trying to be good in all aspect ratios, I think I'd prefer them all.

QUESTION: When you're working with a director and you feel that a scene can be improved by shooting it a little differently, is there any accepted line which designates the director's purview on one side and the cinematographer's on the other — or do you work it out with each director as to how much he wants to hear of your ideas?

WEXLER: There's no accepted line, except that the director is the boss. We can talk about cooperative film-making and whether you should intrude or not intrude, but the fact is that it's like a ship to the extent that there's a chain of command. I mean, I've been on films where everybody does everything, and there's chaos. The bottom line is that the director is the boss. If the director says, "I want it done this way," you do it that way or you get off the picture. Now, he may be the kind of person to whom, because of your knowledge of him or relationship with him, you could say, "Would you consider it this way?" But if he says, "I considered that and ruled it



out," then shut up. It's just that way. Many of those decisions are made when every minute is costing thousands of dollars, so you can't get into any long theoretical discussions. Before shooting begins, or in the morning, or at dailies, you can get more theoretical.

QUESTION: In communicating with a director before a film starts shooting, do you know of any better way than seeing films with him or talking about films that perhaps you both have seen? You might not be talking about the same thing. You might interpret a scene one way and he might be interpreting it another way.

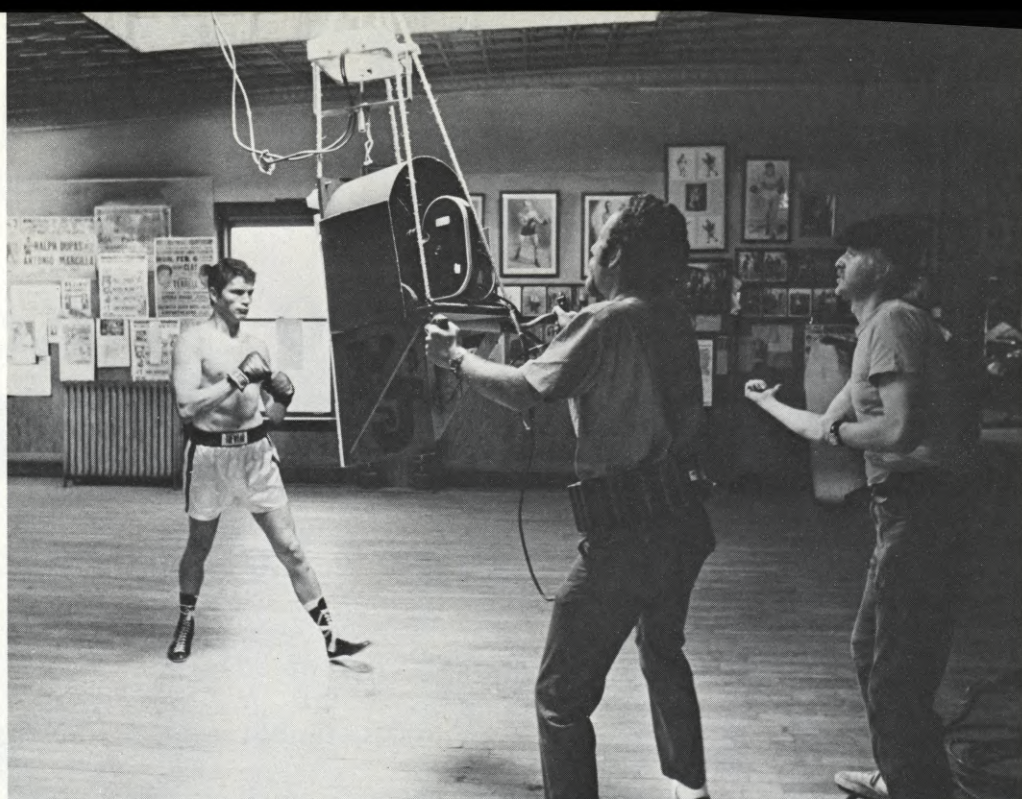
WEXLER: I was just thinking that I'm not really the best expert on how to get along with directors. Actually, you find your own way. Connie Hall and I were talking about that just yesterday. He fights with Schlesinger all the time, but it's beautiful fighting. If you visited the set and you didn't know the two people, you would say, "How the hell can those two guys work together on two pictures and really like one another. Look at them fight!" Well, that's the way that the two of them have worked out their creative commingling.

QUESTION: What I meant was the use of still pictures or anything other than just talking about a scene that goes by in a second and doesn't give you any concrete frame of reference. Do you know what I mean?

HOWARD SCHWARTZ: I think that storyboards are what you're talking about. Bob Wise always uses storyboards. I don't know whether you read the article by Bob Surtees in American Cinematographer on *THE HINDENBURG*, but every frame of that film was from a storyboard. Particularly on a big picture, it gives you a frame of reference and saves a lot of time in avoiding over-shooting.

QUESTION: The actual look of the film, though — the style of photography; that must be very difficult to communicate.

WEXLER: A lot of the time nobody knows. A lot of times I'll be talking bull and the director will be talking bull, and maybe three weeks into the picture there will be certain things that you'll start to like, that seem to be working, and you'll sort of dive in and say, "There, that's working. That's what we're going to do. Let's keep it that way."



In this punching-bag-eye's-view of Robert Forster for a scene in "MEDIUM COOL", the camera is swung from a cradle, with illumination provided by an umbrella light above. Wexler is an experimentalist in unusual techniques, but keeps them unobtrusive. He is especially fond of umbrella lights because of their ability to "eat around" into the shadow areas.

QUESTION: In regard to *AMERICAN GRAFFITI*, I remember hearing you talk about lighting from the dashboards — some of the lights you used inside the cars . . .

WEXLER: Oh, yes. That whole film was like a jukebox. George Lucas and I talked about that. What I used inside the cars were recreational vehicle lights. I had a camper at that time and I noticed that the dome light was really nice. It was a 12-volt light, rectangular, with a glass surface that breaks up the

light — so it's a soft light to begin with. Because it's 12-volt, you can just hook it right into the battery. It was just a fast way of getting light on the faces of the people while the cars were running all over the place. The color temperature of it was a little warm, but I just let it go. A couple of times I boosted it up to about 14 volts. There are a lot of ways of doing that now. Those little mushroom-shaped lights they use on airplanes for reading lights can be used. I have a bunch of those. You get

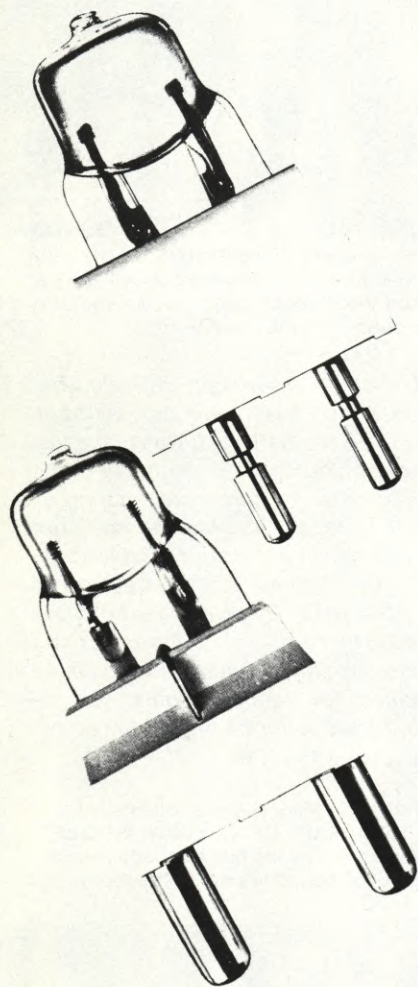
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Wexler views composition through the viewfinder, as Director Mike Nichols rehearses Elizabeth Taylor and Richard Burton in a scene from "WHO'S AFRAID OF VIRGINIA WOOLF?", which garnered multiple Oscars, including one for Wexler. It was the last statuette awarded specifically for black-and-white cinematography, but it established Wexler in the top rank of contemporary cinematographers.



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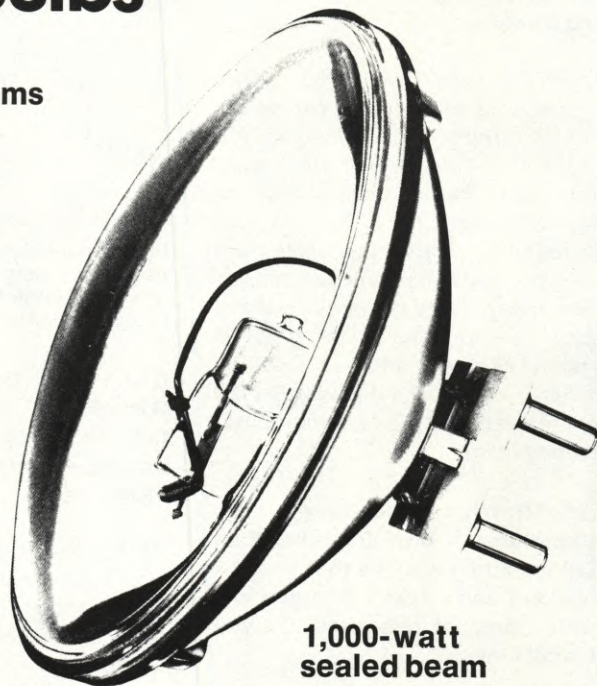
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THE TENTH MOTION PICTURE SEMINAR OF THE NORTHWEST

Completing its first decade, this important forum for the exchange of ideas and techniques of film production is just about the best ever

By HERB A. LIGHTMAN

SEATTLE, Washington

In my ceaseless wanderings about the globe, I have come to think of certain places as "homes away from home". It is not so much that they are physically or geographically interesting (although they are); it is more the fact that the warmth and friendliness of the local people create a "coming home" kind of rapport each time one revisits. For me such places include London, Tehran, Moorea (Tahiti), Sydney, Marrakech — and Seattle (unique, in that respect, among American cities, as far as I'm concerned).

Seattle, serene in a setting of spectacular seaways and majestic mountains, is populated by a rare breed of people — warm, friendly, down-to-earth, *real* people. There is sophistication aplenty, but minus the brittleness I so often find in the sophisticates of my home town, Hollywood. Almost all of the people I know here are engaged in the film industry, and they are turned on to it with an almost adolescent kind of enthusiasm, which is a lovely thing to behold.

That is why I am happy to be back here for the Tenth Motion Picture Seminar of the Northwest. Last year (and also four years ago) I was the Moderator of this prestigious event, but this time I am here simply to enjoy it as a guest and to report on it for *American Cinematographer* readers.

The Seminar kicks off, as is the custom, with an evening cruise across Puget Sound to the atmospheric Kiana Lodge for their famous Potlatch Salmon Barbecue. This is more than simply an extremely pleasant social outing, because it affords those attending a chance to get acquainted with,

and talk to, the Seminar speakers in a relaxed, informal atmosphere aboard ship.

The next morning, eager crowds mill about, enjoying coffee and pastries in the atrium of the Seattle Center Playhouse. For me it is reunion time with such old friends as Les Davis, affable President of the Seminar, and Laszlo Pal, one of its founding fathers and most energetic supporters. These are two of my favorite people and it's a joy to see them once again.

There is a moment of crisis when it is learned that the designated Moderator of the Seminar has been taken ill and will be unable to attend. Rather reluctantly, the Seminar's own Art Coburn moves into the breach and does a beautiful job of introducing the speakers.

Here it should be explained that the Motion Picture Seminar of the Northwest was initiated a decade ago to provide a forum of the most advanced motion picture techniques and technology for film-makers of the northwestern United States (including Alaska) and our Good Neighbors to the North, the Canadians — especially those from nearby British Columbia. The first Seminar attracted only 40 to 50 people. Now 900 avid attendees pack the attractive Playhouse to capacity. Publicity is currently being played down, because, as Laszlo Pal explains, "We don't want it to get any bigger. If it did, our next move would have to be to an auditorium seating 4,000 — in which case we would lose the intimacy and the personal give and take with the speakers which is such an important part of the Seminar."

The event begins right on schedule

with a paper entitled "A NEW HIGH-SPEED CAMERA FILM 7250 AND VNF PRINT FILM 7399", presented by Jack Teahan, Pacific Northwest sales and engineering representative for the Eastman Kodak Company. Mr. Teahan explains that 7250 is a new high-speed color reversal film with a rating of ASA 400 (Tungsten) and ASA 250 (Daylight, with 85B filter). Developed primarily for newsgathering purposes, it should also enjoy wide application to documentary and industrial subjects — especially since it can be force-processed to ASA 800, ASA 1600 and ASA 3200.

Mr. Teahan shows us clips of the new film exposed at each of these ratings. At ASA 400 the image is of excellent quality, and incredibly little is lost when processing is pushed to ASA 800. At ASA 1600 the quality begins to break down noticeably, and at ASA 3200 the grain is very apparent. However, even so, there is a good deal of valuable information on the film, a consideration that might well override quality in the reporting of a "hot" (but low-light) story.

The new 7399 is a low-contrast reversal color print film designed for making prints from high-contrast originals, such as 7240, 7239, 7250, 7242 and 7241. It is also useful for mastering from ECO. Film clips again provide the proof of the pudding, and the new 7399 exhibits fine grain characteristics and superior color reproduction qualities — in addition to which, there is virtually no build-up in contrast, when compared with the original.

Space limitations preclude my going into detail on every one of the papers presented over the two-day Seminar, so I shall confine my comment to those

(LEFT) Early on the morning of the first day, those attending the Seminar begin to arrive in the courtyard of the Seattle Center Playhouse to partake of coffee and pastries. The Playhouse is part of the cultural complex built originally for the Seattle World Fair and dominated by the spectacular Space Needle. (RIGHT) Registration is handled quickly and efficiently by a conscientious staff.



which I personally find most interesting. Among these is a presentation by Ed Winkle, of Vic-Winkle Productions (Hollywood), entitled "THE NEW MICRO-PHOTOGRAPHY: TODAY'S ODDITY OR TOMORROW'S TOOL?", and it is a mind-boggler. It seems that Mr. Winkle and his associates have taken a tiny rod lens telescope (of the type previously limited to endoscope photography inside the human body) and adapted it for "out-of-body" cinematography. This miniature multi-element lens is an extreme wide-angle (though not fisheye) instrument with infinite depth of field — as evidenced by an astounding film clip in which the camera starts on a screen-filling grain of rice and pulls back through a hole in Swiss cheese to reveal practically the whole world. It's a stunning effect and the device should make possible many dramatic applications.

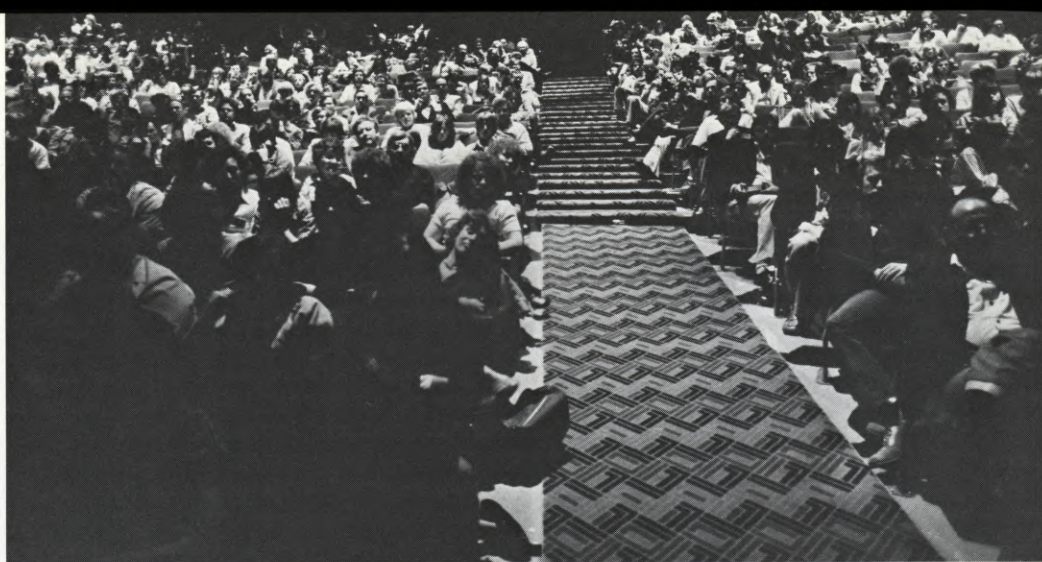
In his presentation, "THE CREATIVE PRODUCER IN THE HOLLYWOOD MARKET", Robert Lovenheim uses examples from his own recent career to explain how the role of the producer in professional motion picture production has changed, especially with the growth of filming features for television.

Expounding on "GRANTS FROM A TO B", a genial and slightly flaky gentleman, Mitch Block, provides considerable useful information on tracking down grants for film production — besides adding a welcome touch of hilarity to the program.

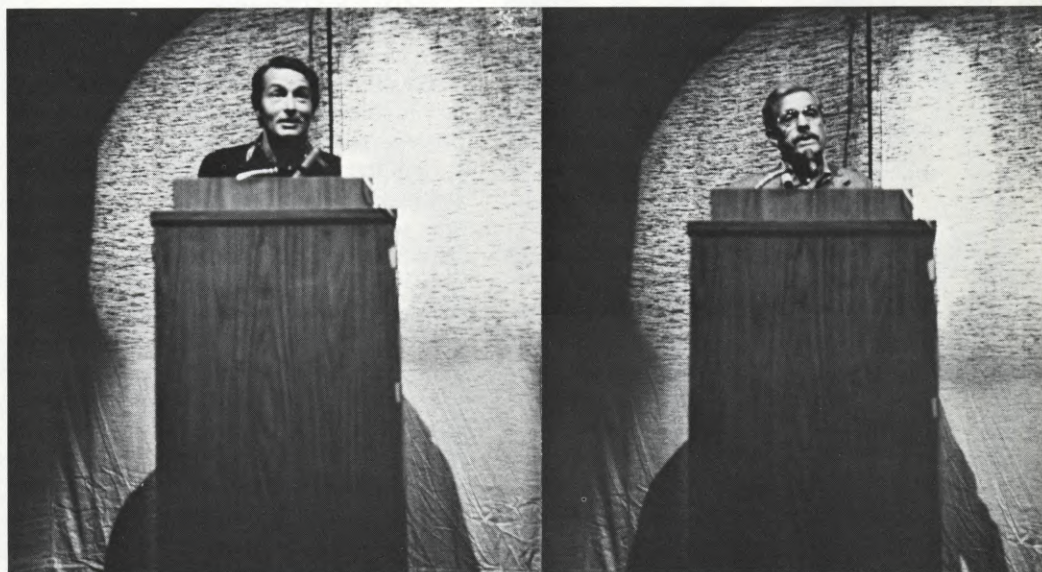
As part of "CREATING A MOOD WITH MUSIC", Arnold Schwarzwald, composer/music editor at MCA/Universal Studios, gives a fascinating demonstration of how variations in musical score can completely change the psychological undercurrents of what appears on the screen. Running the same silent sequence nine times with widely differing musical themes, he causes the identical footage to run a complete gamut of emotional content.

No less fascinating is "CREATING THE ILLUSION WITH SOUND EFFECTS", presented by Academy Award-winning sound technician Peter Berkos, also of MCA/Universal Studios. He shows a sequence from "THE HINDENBURG" (for which he won his Oscar), with only the dialogue originally recorded, and then demonstrates how a sound effects track is built up, bit by bit, to fully complement the action.

In the evening, the Seminar sponsors a three-hour program of the Best in Northwest Produced Films. The capacity audience is treated to a three-hour display of marvelous film-making,



The comfortable 900-seat Playhouse auditorium is filled for many of the presentations, with turnaway crowds for both evening screening programs. Seminar sponsors do not wish the event to get any bigger, fearing that a spillover to a larger facility would mean a loss of intimacy and valuable give and take between audience and speakers.



Because of its relative closeness to Hollywood, the Seattle Seminar draws heavily on the top professional talents of the Film Capitol. (LEFT) James Crabe, ASC, Director of Photography on "ROCKY", the "sleeper hit of the year", talks about his work on that film and also "SEX-TETTE", starring Mae West. (RIGHT) Two-time Academy Award-winning wizard of special effects, Albert Whitlock, spellbinds the crowd with film clips of his cinematic magic wrought in a score of features.

Producer/cinematographer Laszlo Pal, one of the Seminar's founding fathers and most avid supporters, presents a handsome trophy plaque to Seminar President Les Davis, in recognition of his decade of devoted dedication to the event. When the Seminar was initiated ten years ago, it drew scarcely 50 people, but has grown steadily to the peak of success which it now enjoys — thanks to the concern and efforts of local film people.





The foyer of the Playhouse is crowded with interested visitors to the exhibits of scores of the top manufacturers and distributors of motion picture equipment — a popular plus.

which ranges from Marv Newland's Academy Award-winning "BAMBI MEETS GODZILLA" to the extraordinary clay-animation featurette, "MARTIN THE COBBLER", by Will Vinton, who won an Academy Award for his "CLOSED MONDAY". The audience is asked to vote on their favorite, so that it may be awarded a cash prize. It comes as no surprise when "MARTIN THE COBBLER" receives the award.

Bright and early the next morning, the Seminar resumes with "HOW TO SHOOT 16mm FOR 35mm BLOWUP", presented by Clive Tobin, of Seattle's Alpha Cine Laboratories. It is one of the most technically detailed and informative discussions on the subject that I've ever heard.

In "THE ONCE-A-MONTH COMMUTE", James Miller, screenwriter of the recently telecast "mini-series", "THE TESTIMONY OF TWO MEN", traces his career through 12 years of post-production experience to pre-eminence as a scenarist, and explains how he manages to live in Washington and work in Hollywood.

"FOUR-WALLING: DRY HOLE OR BLACK GOLD", turns out to be an extremely interesting behind-the-scenes look at the highly specialized type of distribution in which the producers of films lease their own theaters. Ron Olson, an expert in the field, gets a laugh when he tells the audience that, in this type of promotion, the trailers and advertising campaign are often designed first, and then a feature is pro-

duced to back them up. He is completely serious when he says it.

At the "gala" luncheon we really luck out, because the Keynote Speaker is Academy Award-winning screenwriter Walter Reisch, author of such screenplays as "TITANIC", "COMRADE X", "GASLIGHT", "THAT HAMILTON WOMAN", "THE GREAT WALTZ", "JOURNEY TO THE CENTER OF THE EARTH" and "NIAGARA", which starred the late Marilyn Monroe. His announced topic is "50 Years of Film Experience on Two Continents". A charming gentleman, possessed of a devastating wit, Mr. Reisch captivates the crowd with his stories about the Golden Age of Hollywood.

If anything could be called the "hit of the show", it would have to be "MATTE PAINTINGS AND SPECIAL EFFECTS", presented by the "Wizard of MCA/Universal", Al Whitlock. Winner of two Academy Awards (for "EARTHQUAKE" and "THE HINDENBURG"), Al is an old friend of mine and I'm delighted to see him on the program. He holds the crowd absolutely spellbound with two reels of his cinematic magic garnered from a dozen or so of the hundreds of films he's worked on.

Another old friend whom I'm very happy to see in Seattle is James Crabe, ASC, Director of Photography on "ROCKY", the "sleeper" hit of the year. Jim talks about photographing that film and others, including Mae West's new feature, "SEXTETTE".

The papers program of the Seminar closes with "POST-PRODUCTION — THE THIRD CREATIVE DYNAMIC", by Thomas Stanford, Academy Award-winning Editor of "WEST SIDE STORY". Mr. Stanford gives a very graphic demonstration of what can be done with editing and other post-

production techniques to ultimately "make or break" a film. For example, he shows the raw "print" takes for a sequence of a television feature, and then shows how the sequence plays when these scenes are properly cut together.

At the close of the session, Laszlo Pal presents a beautiful trophy to Les Davis in recognition of his decade of devotion to making the Seminar the grand success that it is today.

In the evening, there is a screening of selected films by Seminar speakers. The "star" of this show is the stunning feature documentary, "GREENPEACE: VOYAGES TO SAVE THE WHALES", presented by Cinematographer Ron Precious. At the opposite end of the scale is "F' FOR FAKE". It lives up to its name. A rip-off of a film, it was obviously cobbled together from a couple of

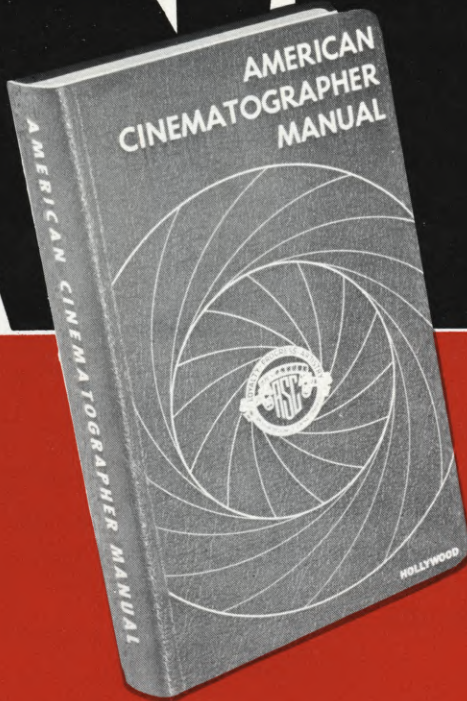
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(ABOVE RIGHT) Luncheon Keynote Speaker Walter Reisch, Academy Award-winning screenwriter of such masterpieces as "NINOTCHKA", "GASLIGHT" and "THE GREAT WALTZ", charms the audience with his nostalgic and hilarious recollections of the Golden Age of Hollywood. (BELOW) The near-capacity crowd attending the luncheon listens to Mr. Reisch recalling highlights of his 50 years in the film industries of two continents.



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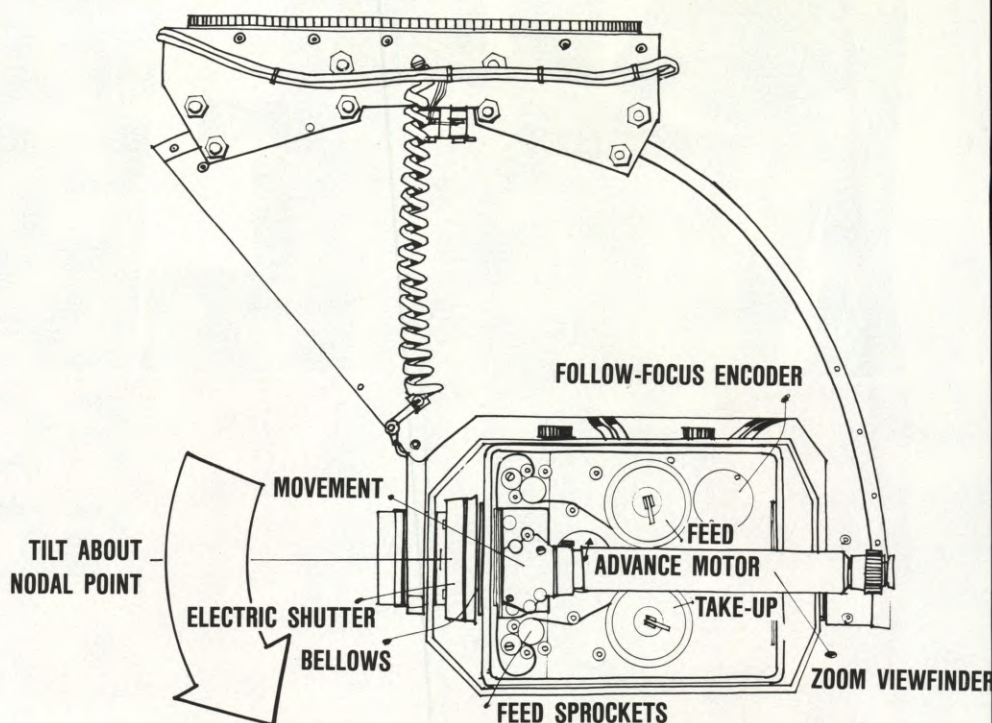
MINIATURES AND MECHANICALS
Continued from Page 705

this blue pylon. When the blue record is pulled to create the matte, the pylon completely matches the blue backing and eliminates the need for articulate rotscope.

The department called "Control" has the responsibility of vaulting and routing each piece of film generated for this project. Control catalogues each piece of negative, and print, and their relationship to the 2 to 12 other pieces with which they will be combined in composite. Control has the responsibility of keeping infinitely accurate records and making film elements and information available on a moment's notice, a tremendous task considering the some 3838 elements required for the 365 projected individual shots.

While all of the mechanical and electronic portions of the facility were being designed and constructed, one of the most important portions of the film was getting under way: the miniatures. Designs provided by Colin Cantwell were being modified to suit our photographic system and new designs for additional ships were being created. Joe Johnston had a major hand in providing the configurations that the final miniatures would incorporate. Grant McCune was assembling the people and facility needed to provide 75 models. Each of these models appear in several shots from a variety of camera angles. To accommodate this requirement, each specific design incorporated the ability to mount the miniature from the front, rear, top, bottom, and both sides. Each of the models included complex practical lighting for engine effects, laser weapon effects, and cockpit lighting. Some of the models had articulated details: wings that moved, rotating antennas, etc. All of the electrical leads for their motors and lights also had to be available at each of the mounting points. Because special high-wattage quartz bulbs were used in much of the practical lighting, cooling air was routed through the armatures of the miniatures.

The great number of miniatures which we would have to construct ranged from 1600 square feet of highly detailed surface architecture of a mechanical planet called the "Death Star", to tiny one-inch-high duplicates of the robots in the film, R2-D2 and C3P0. The scales of the miniatures had to suit the photographic methods used to record them. Edge detail had to be sharp but not too spindly because of the blue screen matting system. The size of each of the specific miniatures



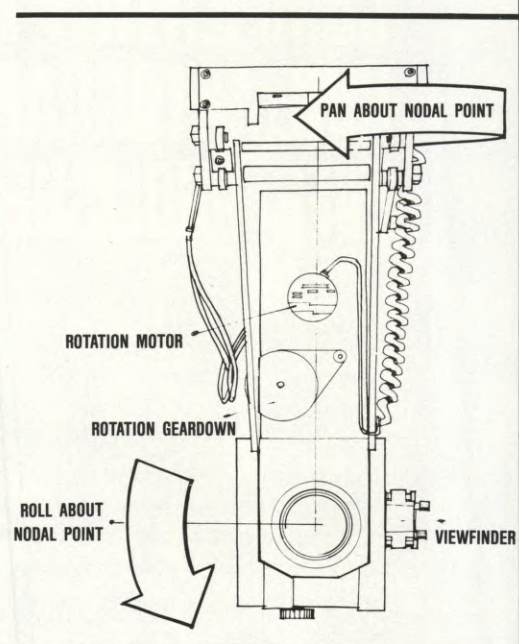
(ABOVE) ORTHOGRAPHIC I — Cutaway side-view diagram of Dykstraflex camera. Once the camera move has been described and viewed in real time, the operational time base can be changed from frames-per-second to seconds-per-frame, and the move can be repeated precisely at the much slower rate used for the actual photography. (BELOW) ORTHOGRAPHIC II — Front aspect of Dykstraflex camera.

was determined by analyzing each shot projected for that miniature to appear in, and finding a scale that would satisfy depth of field, detail, and size relative to other miniatures that had to appear with it in any given shot.

The color and paint detailing was given the same analysis and laid out with regard to the planets or other ships that a particular model was to appear over or with in a specific projected shot.

Many of the individual model designs needed to be duplicated several times for use in separate camera set-ups or shots showing tight formation. Also, duplicate ships were needed in shots which required a miniature to explode.

In view of the duplication necessary, we set about determining what methods would be best used to produce the individual pieces. We considered vacuum forming, injection moulding, and silastic glove molds. Eventually we used all of these methods to speed miniature production. The parts for each duplicate ship were also produced in a variety of materials; foam with a surface coat was chosen for those ships which were to be exploded. Foam was chosen for this application because it is low-density and shatters easily. These characteristics were needed to make our explosion shots more realistic. The shattering nature of the foam allowed



us to use much smaller, slower-burning explosive charges, and the low density of the pieces caused them to move more slowly, both contributing to the scale of the explosion.

With this brief and generalized description of each of our main areas, perhaps their interaction could most understandably be outlined by following an individual shot from conception to completion.

Continued on Page 742

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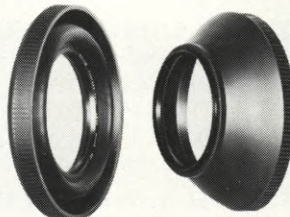
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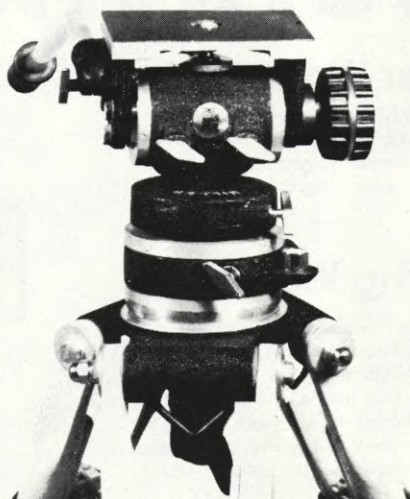
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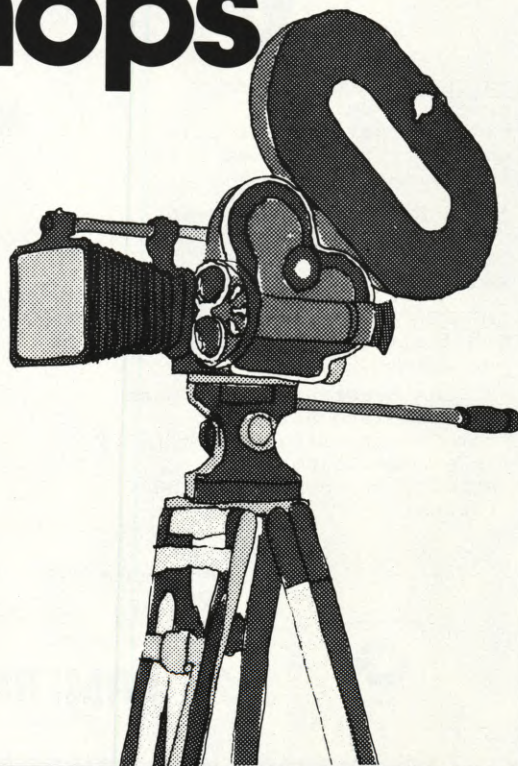
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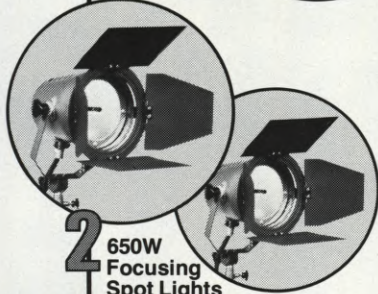
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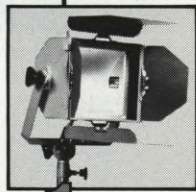
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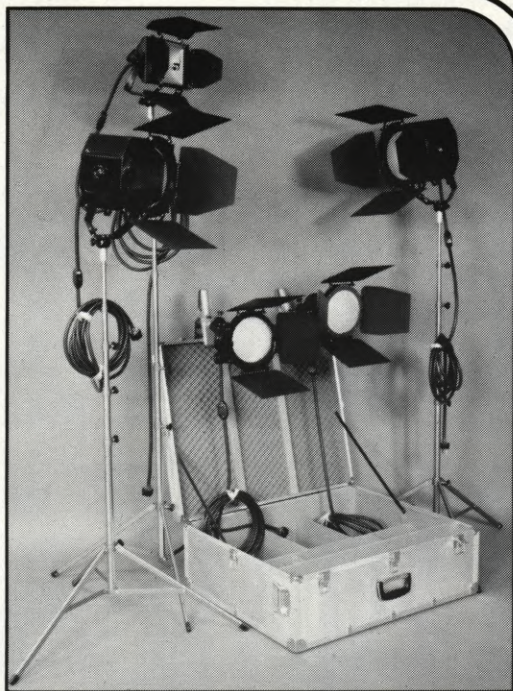
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**AN A.F.I. SEMINAR WITH
HASKELL WEXLER, ASC**
Continued from Page 725

sockets for them and over-voltage them a little bit and you can hide them in various places in cars. The big problem in lighting the inside of a car at night is to not get the steering wheel shadow on the face or too spooky a light. If you're going to shoot night stuff in a car and you can't get a convertible, you might try to find a car with a sunroof — there's lots of them nowadays — and use it to let a little ambient light inside the car.

QUESTION: Have you ever tried putting lights outside the windows and, if so, does that work any better?

WEXLER: It does. If you don't have to show the whole car you can do a great job that way. Oftentimes I'll take tracing paper and put it out by the windshield for side angles, so that, again, it's "invisible" soft light coming in. In general, you can make people look better inside a car if you don't have to light them from inside the car, because nowadays the dashboard lights are not really strong enough to motivate a light source like that.

QUESTION: Could you describe the working relationship you prefer to have with your gaffer?

WEXLER: For me, working with the gaffer really is the most sensual part of film-making, because when I work with my gaffer I feel like we're the only two guys who sort of know what's going on. When I try something and he likes it, I am really pleased, and if he has an idea which I like and use, I'm pleased for him. It's something that's really pleasurable, on a day-to-day basis, working with the gaffer. It's like a community of interests, like being able to say, "Gee, we're doing something together." And that's really the excitement of film-making.

QUESTION: Do you tell the gaffer that you want something lit in a certain way. In other words, how much freedom does the gaffer have?

WEXLER: With me, the gaffer has no freedom, but then I do allow him some liberty. It's a struggle for me, personally, because I like to be a good guy. I like for people to feel free around me and I like to be liked, and if you're authoritarian it's difficult to be liked. But I have found that, in a practical sense, I have to lay the law down. I don't



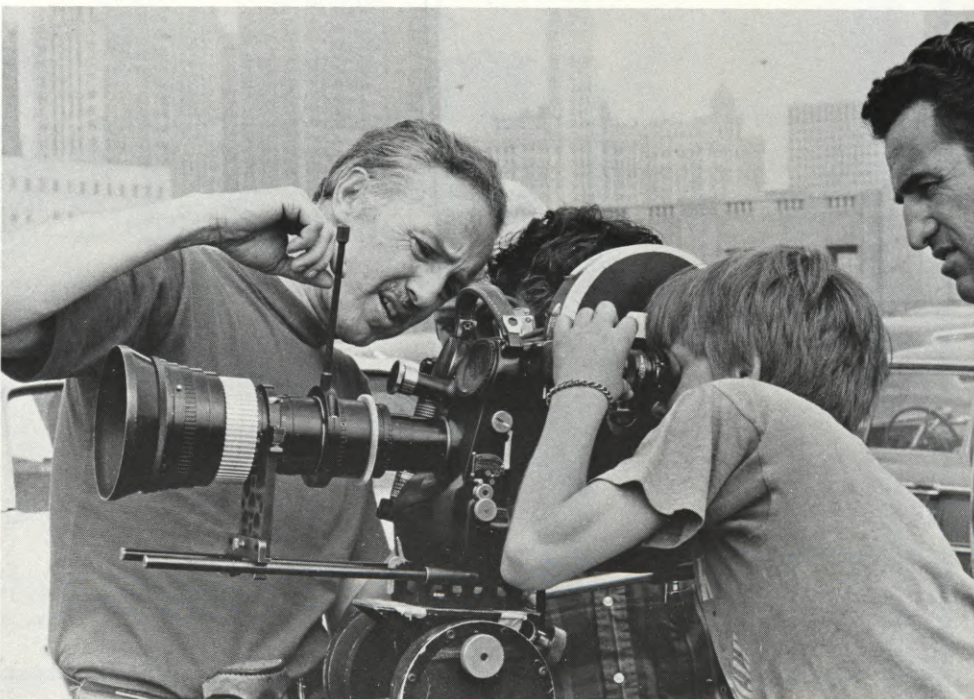
On the set of "MEDIUM COOL", on which he did triple duty as writer, director and cinematographer, Wexler shouts an order. He is wired for sound in order to more clearly listen to the dialogue. Far from being overburdened by his multiple chores on this feature, Wexler loved it. "I'd like to do it every other week," says he. Present plans call for him to do more directing, less photographing.

even have to say it; it's understood that I'm lighting the picture. It's like saying, "I don't want to turn off your creative juices, but I'm first." I learned that the hard way.

QUESTION: In what direction do you see motion picture equipment and techniques heading?

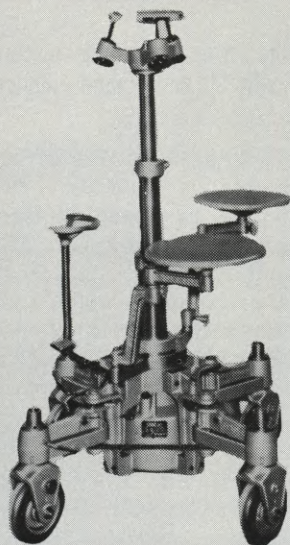
With help from a couple of young assistant's, Wexler lines up the Eclair CM-3 camera. Like director Claude Lelouch, no mean cameraman himself, Wexler has a special fondness for this camera, which hand-holds relatively easily (minus the long zoom). Wexler prefers to own his own equipment, complete with all the latest gadgets and modifications to make the results more satisfying.

WEXLER: Well, everyone has been talking for a long time about television taking over. I remember sitting with a bunch of people like this ten years ago and everybody saying, "Film is going to be out of business. We ought to call it the American Tape Institute instead of the American Film Institute." But it
Continued on Page 763



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THE CHALLENGES OF PHOTOGRAPHING **MacARTHUR**

How a \$16,000,000 epic, almost all the action of which takes place overseas, was actually shot "authentically" in and around Hollywood



Director of Photography Mario Tosi, ASC and Operator Joe King (wearing STEADICAM camera stabilization rig) prepare to shoot combat sequence for the Zanuck-Brown (Universal) production of "MacARTHUR", a cinematic tribute to the controversial soldier-hero. (BELOW) Cameramen (far right) are positioned in the thick of the fray, as cinematic battle rages around them. Tosi, who actually had a powder charge go off under his foot, was happy to see more combat action staged and fewer stock shots included in the picture.



Universal's "MacARTHUR," a Richard D. Zanuck/David Brown Production directed by Joseph Sargent and photographed by Mario Tosi, ASC, begins when the General, at age 60, his position in the Philippines made hopeless by Japan's destruction of more than half the planes in his Far East Command, leaves Corregidor pledging, "I shall return." It ends, in the screenplay by Hal Barwood and Matthew Robbins, when MacArthur visits West Point two decades later to deliver his famous "Duty — Honor — Country" speech, striking a dramatic contrast between himself, the Old Soldier, and the young cadets.

Determined to make the film totally accurate pictorially as well as editorially, producer Frank McCarthy and key members of the production staff embarked on a Pacific and Far East scouting tour to scrutinize the locations where many events actually occurred. After researching the Philippines, Korea and Japan, they returned to Universal with one all-encompassing evaluation — none of the overseas sites existed as they did when history was originally made. The sea wall at Inchon in Korea, which MacArthur's troops scaled to cut enemy supply lines, was situated next to the city when the attack was made. Now the city was a full mile away. Malinta Tunnel on Corregidor and the Leyte beach in the Philippines where MacArthur waded ashore on his return were both totally different, the latter filled with vacationers playing volleyball. And Tokyo, 1976, was a far cry from the way that city looked in 1945.

It was immediately obvious that production designer John Lloyd was going to have to recreate each and every site. This being the case, it made no sense to spend the time and money to travel 8,000 miles to do it. That money was better spent in other areas; thus, the decision was made to film "MacARTHUR" entirely in the U.S.

Following the authentic re-creation of the Japanese surrender aboard the U.S.S. Missouri, the company moved to Universal Studios for a brief period before beginning an extensive shooting



Battle and beach-landing sequences were staged at the U.S. Marine Corps base at Camp Pendleton, California and other nearby beach areas. The decision to film the entire picture in the United States came as the result of a location survey which revealed that all of the authentic locations in the Philippines and Far East had changed drastically since the 1942-45 period of the picture. If sets had to be built anyway, it was reasoned, why not build them "at home" instead of 8,000 miles away?



(LEFT) American prisoners of war are marched out of their tunnel barricade by their Japanese captors, as Corregidor is overrun. (CENTER) A ticker tape parade welcomes General MacArthur back to America after his long stint overseas. The scenes staged for this sequence were skillfully intercut with documentary footage of the actual parade. (RIGHT) Tosi, his Operator and the Panavision camera get in out of the rain while shooting.

(LEFT) Sequence portraying the Japanese surrender aboard the U.S.S. Missouri in Tokyo Bay was staged aboard that same actual vessel — but in San Diego Bay. Matte painting expert Albert Whitlock matted out the background shown here and substituted a flotilla of escorting warships. (CENTER) General MacArthur meets with Japanese dignitaries in Tokyo, following the surrender. (RIGHT) MacArthur addresses Congress in half-million-dollar House of Representatives set originally built for "BILLY JACK GOES TO WASHINGTON".



(LEFT) This dramatic shot of Gregory Peck aboard ship illustrates Tosi's preference for the use of colored light, where appropriate. (CENTER) Sequence in which the aging General MacArthur addresses cadets at the U.S. Military Academy at West Point posed enormous potential lighting problems. The Mess Hall was so enormous that a "fisheye" lens had to be sent for. (RIGHT) Tosi originally felt he could light the Mess Hall with one arc for each window, but found, when he got there, that it would take ten. He decided to go with mostly available light instead.





Tosi checks a camera angle aboard the U.S.S. Missouri. Born in Italy and educated at the School of Fine Arts, Rome, he became a collaborator of artist Francesco Zonghi-Lotti, Director of the Regia Accademia Raffaello d'Urbino. He exhibited by invitation in many regional, national and international art exhibitions and was awarded the Silver Medal of Rome Goddess prize for extemporary painting. In America, he was a student of American Cinematographer Editor Herb Lightman, when the latter taught at Columbia College.

schedule at other locations, including Fort MacArthur, Camp Pendleton, the U.S. Naval Amphibious Base at San Diego, the Catalina Isthmus and the U.S. Military Academy at West Point. Battle sequences were filmed at all these sites, except the latter, with still others being re-created at spots in and around Los Angeles.

In the following interview for *American Cinematographer*, Director of Photography Mario Tosi, ASC, talks about the problems and pleasures of photographing "MacARTHUR":

QUESTION: Can you describe the photographic style used in filming "MacARTHUR" and how you arrived at it?

TOSI: I discussed it with the director, Joe Sargent, and we both agreed that we should make, first of all, a very "moving" picture — one in which the

camera would never stop, but would always be going someplace. This would include dolly shots, hand-held shots, STEADICAM shots and very smooth zoom shots. The reason for all this movement is that the story is about a man who is always talking with somebody — with the President, with a general, with a friend, with his wife. He was always talking and we were afraid that it might become very static, so we made it move and, I think, very well.

QUESTION: Aside from camera movement, what about the visual texture of the photography?

TOSI: Before shooting began, I was told that this movie was going to be crammed full of stock shots. Because of that, I was asked to make some tests to see how I could accommodate the stock shots and reach a visual compromise with them. Now, stock shots do

not all have the same photographic character. Because they are shot in different locations and different years they may all look totally different. I decided that I couldn't worry about that. I said, "I am going to do this film in my own way and the way I feel it is going to look best. I don't care about stock or anything else." So I decided to give it a realistic, but classic look. I felt that everything should look like a painting and, at the same time, real. It should not have a documentary feel, but something different, more classic. This was the opinion of Joe Sargent, as well. He gave me the go-ahead. He said, "Make it as good-looking as you can make it."

QUESTION: And how was that decision received by the top executives in the MCA/Universal "Tower"?

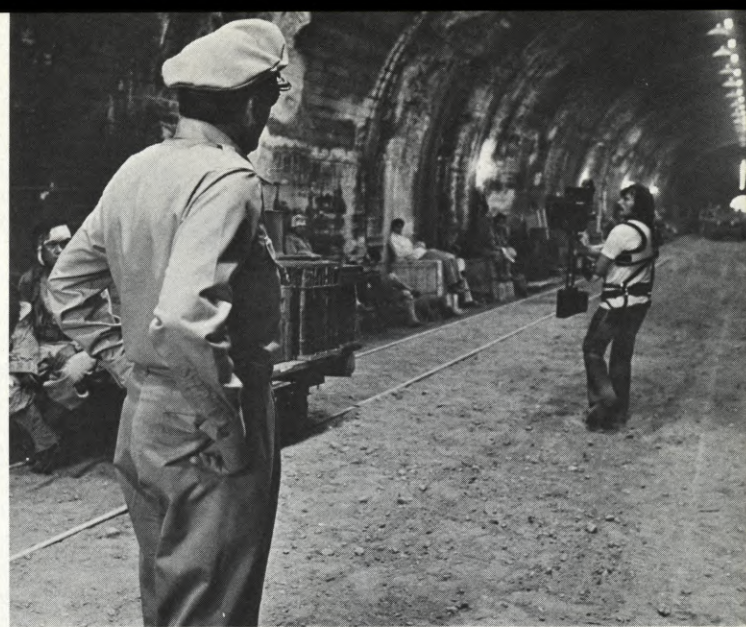
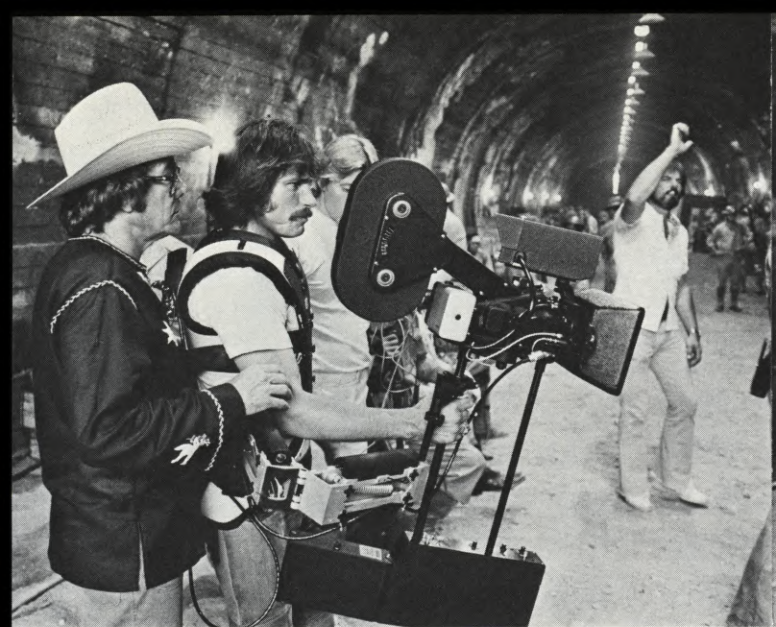
TOSI: After less than a week of work on the interiors, I had people from the Tower coming down and telling me how beautiful it was. They called it "great, fantastic, different". And so, the studio decided to put more money into the picture, which, fortunately, gave us the opportunity to shoot many more combat sequences than had been originally scheduled. As a result, in the final cut, the stock shots are very minimal — about 10 or 15. I am very happy about this, very relieved, because stock shots, as real as they can be, always create a jolt in the continuity of the photography.

QUESTION: What kind of filtering did you use on "MacARTHUR"?

TOSI: Well, I'm a lover of light fog filters — unless it's a special effects sequence. For example, on a dream sequence in "CARRIE" I used a #5 fog, plus another fog filter. But in this case, I used only a very light #1 or #2 fog filter — just enough to cut the glossy look that the straight lens produces. I

(LEFT) Tosi takes a meter reading of the light falling on Gregory Peck. The lighting style he used for "MacARTHUR" depended almost totally upon the use of bounce light. He used white cards or foam core to bounce the light and sometimes, when shooting for a daylight effect, he painted the foam core with a Booster Blue paint in order to raise the color temperature and get a whiter skin tone. (RIGHT) He rides the boom in preparation for shooting winter exterior ambush sequence inside the sound stage.





(LEFT) Director Joseph Sargent observes Operator Joe King using the STEADICAM for shooting sequence inside long tunnel, supposedly on Corregidor. The tunnel used was actually in downtown Los Angeles. Because it had been abandoned and sealed up for some time, it required extraordinary clean-up measures to get rid of the horrible smell. **(RIGHT)** With Gregory Peck in foreground, King executes a tricky shot with the STEADICAM. Light inside the tunnel came mostly from practicals, augmented by a few hidden units.

remember that when I first started in the motion picture industry, each camera had its own set of matched lenses and these were never switched from that camera. But for quite a few years now, in the rental houses, they have been switching lenses from one camera to another and there has been a big mix-up of color correction and resolution. One lens might be very sharp and the other less sharp. One might have a yellow cast and the other a blue cast. A zoom lens — even if you do not use it to zoom, but as a variable focal length lens — has a continuity of resolution and color and is usually not quite as sharp as a prime lens, so it does not need as much filtering. On “MacARTHUR” I shot with the zoom lens most of the time, using just light fog filters, but when I switched to the STEADICAM (with its prime lens), I had to increase the degree of fog filtering.

QUESTION: In recent years there has been a vogue for heavy filtration. How do you feel about that?

TOSI: Yes, it is true that everyone has been trying to cut the sharpness down. They have been using every kind of gimmick, including the ones that were used 50 years ago. They are using stockings and coral filters and fog filters and low-contrast filters and anything they can think of to break down the sharpness. As for myself, I don't like too much sharpness, the kind you get with a prime lens. I prefer to use the Angenieux 20mm-to-120mm zoom lens. It has a nice mellow portrait quality which, to me, is much more effective for a movie than the postcard sharpness you get with a straight lens. Probably some stories can use that sharpness,

but not a mood picture or a love story. Sometimes I put so much stuff in front of the lens that I get frightened. I say, “Well, that's probably too much. I can't see what's going on.” But instead, on the film, it comes through looking beautiful. You have to have a lot of guts to use filters, because what you see through the lens is not really what you get on the film. But filtering in photography is very important on the artistic level. It requires a lot of experimentation and experience. The final effect depends upon the focal length you use, the front lights, the cross lights and the backlights. You can go wrong so easily if you don't have enough testing time.

QUESTION: “MacARTHUR” has a wonderful feeling of authentic foreign locales, even though it was filmed entirely in and around Los Angeles and San Diego. The tunnel sequences are especially impressive. Can you tell me

where they were shot?

TOSI: The big tunnel, where we shot exterior and interior sequences, is located in downtown Los Angeles. It had been closed for many years and they had to do a fantastic clean-up job on it because of the unbearable smell, but it worked out very nicely. The small tunnel, the connecting tunnel, was built on the sound stage. Another interesting set we used was the House of Representatives originally built at a cost of half-a-million dollars for “BILLY JACK GOES TO WASHINGTON”. The Oval Office was a set built on the sound stage and so were all the other offices, but we tried to make them look realistic enough to have been shot on location.

QUESTION: Can you tell me a bit about the shooting of the combat sequences?

Continued on Page 766

Tosi with Director Joe Sargent, whom he greatly admires, and Gregory Peck. In addition to “MacARTHUR”, his theatrical feature credits include: “CARRIE”, “HEARTS OF THE WEST”, “REPORT TO THE COMMISSIONER”, “BUSTER AND BILLIE”, “FROGS” and “SOME CALL IT LOVING”. In addition, he has shot many major productions for television, including “SYBIL”, starring Sally Field and Joanne Woodward. He is currently assigned as Director of Photography on “THE BETSY”.



MINIATURES AND MECHANICALS Continued from Page 732

A TYPICAL SHOT

First the motion, size, position in frame, and frame counts are determined by examining the black and white WWII DOG FIGHT footage. Our example will be a Mustang moving from left to right and away while we pan with him as he rolls and begins to dive. A Zero enters frame lower right in pursuit, firing its guns at the Mustang. Our camera position tracks with them as they both cross the horizon and move down toward the surface with the camera, platform/viewers point of view on their tails. This black and white footage is now translated into a storyboard drawing describing the actions of the WWII aircraft in terms of our miniatures. The Mustang will be replaced by an X-wing fighter, and the Zero will be replaced with a T.I.E. fighter, firing lasers instead of bullets. The light sky in the black and white will become stars against black and the grey horizon in the black and white will become the Death Star surface.

The X-wing miniature is mounted from the nose mount so that it can roll about its own axis, yaw about its own axis, and crab to the side — in an axis perpendicular to the camera track motion. The camera, with its eyepiece mounted, is placed so that the ship is in the position indicated for the head of the shot.

Now the camera/subject motion programming begins. The dominant axis of motion is programmed first. In this case, the ship's motion away from camera and down in frame is established. With this portion of the program running, the "following pan" is put in. In this case, rotation of the ship on its vertical central axis will give the viewer a perspective change indicative of a pan, although the camera itself may not pan at all. With the crab and yaw motions on the ship running, and the track and tilt motions on the camera running, the ship's roll motion can be programmed to give the camera platform a feeling of motion.

All of the other motions of both camera and ship will be run while adding some roll to the camera, thereby giving the viewer the feeling that the camera platform is banking in order to follow the ship being photographed. These programming functions are being performed with the motion control system operating at approximately one-half real time — meaning that the motions seen through the eyepiece are at one-half the speed that those same motions will appear on the screen. The system can operate in a real time mode for programming, but for rapid subject motion the drive systems simply cannot move the camera at the speeds necessary for real time. I might add that even if the drive systems could operate that fast, it would be particularly dangerous, since if this shot were programmed in

real time, it would require that the camera dolly and boom move 40 feet from a standing start and come to a stop in just under six seconds.

Now that we have our move complete, the digital information (that is, the map of distances, accelerations, and speeds for that move), is transferred to a cassette for future use. We use frames-per-second as our increment of measure in the control system.

Example: The system running half real time is running on a 12-frame-per-second time base. We next reduce our time base from 12-frames-per-second to one-frame-per-second. This is really an exposure time of one-second-per-frame, but because pulldown of film in this system is independent of exposure, the calculator automatically figures in the time required for pulldown, and compensates motion speed appropriately.

Because of this isolation of exposure and film advance and the long exposure times we are using to allow depth of field control, we have available shutter durations as long as 340°. This long-duration shutter, though ideal for eliminating strobing in extreme subject or camera displacement, must be used judiciously.

With our system, motion of camera and subject continues during exposure, just as in live-action photography. This is where the 300° shutter creates a problem. When the ship being photographed becomes small and its



(LEFT) Richard Edlund programming prologue for "STAR WARS". Tilting lens board on the Dykstraflex made possible holding of depth of field in any plane necessary. Without such unique equipment, this particularly difficult shot would have been practically impossible. (CENTER) The Death Star with only its backlit "practical" lighting. (RIGHT) The Death Star with its backlit practical lighting, plus front lighting. The backlight portion was photographed on a separate pass to balance its brightness against the front light exposure without changing aperture.

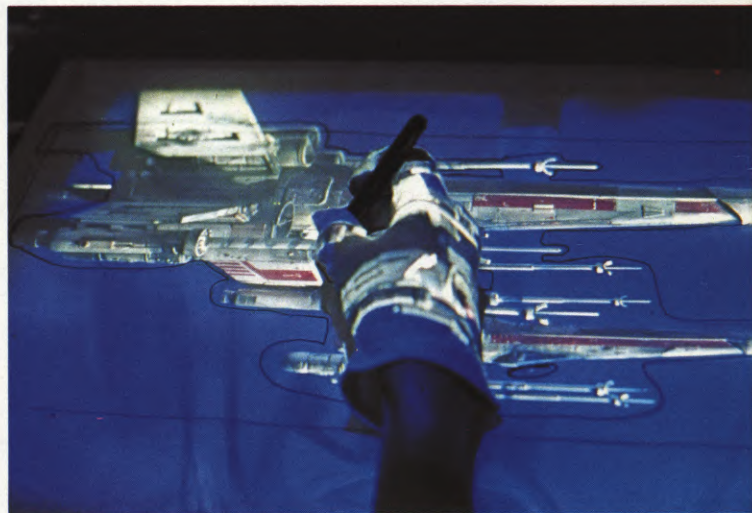


(LEFT) Doug Smith reads the illumination level on the Star Destroyer, while Grant McCune attaches the electrical and air umbilical used to provide practical lighting. (CENTER) The Dykstraflex camera making a "matched move" pass on a scaled-down version of the Death Star surface. This element, when combined with the foreground ship for which the move was generated, will provide a feeling of camera platform motion. (RIGHT) The Dykstraflex camera suspended in the "trench", looking toward the forced perspective illustration used to carry the trench to infinity.

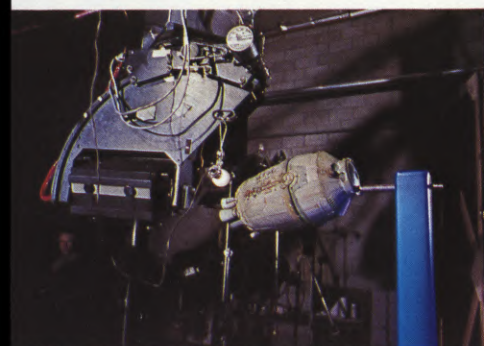




(LEFT) For filming of the explosions on the surface of the Death Star, the operation was often moved outside into the parking lot. This provided perfect single-source illumination, with plenty of brightness for high-speed photography. (RIGHT) Photographing motorized miniature of the Sand Crawler on a dry lake. This ungainly vehicle, used by the "Jawas" to scavenge junk robots on the planet Tatooine, loom enormous on the screen. The illusion is enhanced by cutting to a full-scale construction of the lower part.

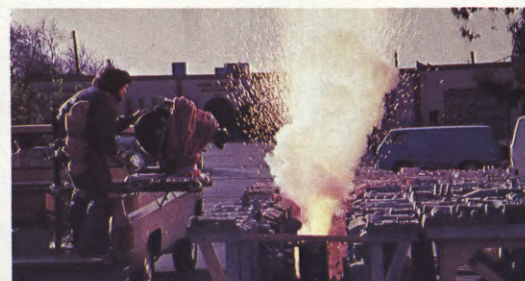


(LEFT) Some of the 75 miniatures constructed for use in "STAR WARS". Many of the individual model designs needed to be duplicated several times for use in separate camera set-ups or shots showing tight formation. Also, duplicate ships were needed in shots which required a miniature to explode. (RIGHT) Artist outlines the X-wing fighters projected through rolescope camera. The area outside this outline will then be opaqued to provide one cell of the series that will become the "garbage" matte for this element.



(LEFT) Set used to photograph escape pod tumbling down toward planet Tatooine in the opening sequence. The rod which mounts the escape pod is supported in bearings inside the pylon and is driven in a rotational axis via chain through center of the pylon. (CENTER) Vistavision high-speed camera is mounted facing straight down to photograph the escape pod being jettisoned from the rebel blockade runner. (RIGHT) Camera set-up used to photograph the Pirate Ship entering and exiting the docking bay on the Death Star. The camera moved on the large track, and the miniature on the small track.

(LEFT) The high-speed Vistavision camera mounted on the 42-foot track is pushed toward the exploding miniature to produce apparent motion of the miniature in the final composite. (CENTER) The sun is the gaffer for this high-speed explosion shot filmed in the ILM parking lot. (RIGHT) The foam parts from which the Death Star surface was constructed were nearly indestructible. The section seen here had weathered seven explosions with little deterioration.



motion-per-frame is greater than a quarter of its overall size, it becomes a smear. In this situation, there is a happy medium of shutter-angle setting which makes the ship image apparently sharp and reduces strobing to the minimum possible. Once our shutter angle is chosen, we can deal with focus. The follow-focus device is built into the camera, and includes a tilting lens board for tailoring depth of field on tight shots. It runs off the same time base as the motion control motors. It can be initialized (establishing base point for focus calculations) and will change directly with the camera moves on the track. Or it can be individually programmed in cases where the camera subject distance is determined by something other than the camera track (if the camera boom is used or the subject is mounted on another track which moves it nearer to or farther from the camera during the shot).

The blue backing is now covered to expose just the area around the X-wing. This is done to minimize blue reflections on the miniature. This leaves a lot of extraneous equipment in the shot; lamp-stands, gobos, etc. These will be eliminated later by garbage mattes made in our rotoscope department.

With the lighting set, focus and move programmed, we shoot this X-wing element on black and white negative material and process it in our black and white lab. This serves several purposes, it can be viewed immediately to check move, lighting, focus, etc. Its other purposes will be apparent later.

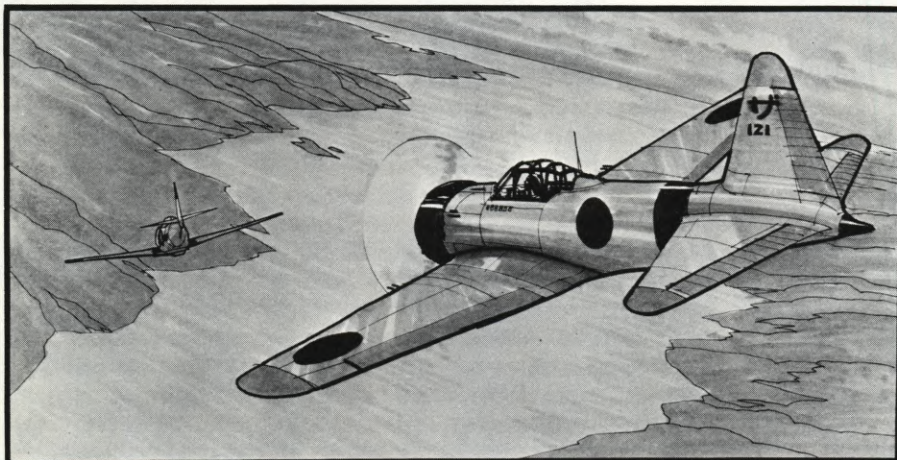
Because the X-wing is seen from the rear in this element, the photography on final color negative will be made in two passes — one to record the X-wing miniature with its key/fill light, and blue backing, and a second pass on a separate piece of negative to record the X-wing's engine light effect. The reason for this double pass is twofold. The built-in practical lighting, in this case the engines, is not bright enough to balance in exposure against the X-wing body and wings. The second pass allows us to increase the exposure and add some filtration to enhance the color and the flare of the engine light effect. Also, when using the blue screen matting system, it is very difficult to process a good fitting matte for the engine flare when the element must be matted over a grey value background. This double-pass approach on a complex move such as this is only possible because of our system's unique electronic and

mechanical precision repetition of camera/subject position on a frame-to-frame basis.

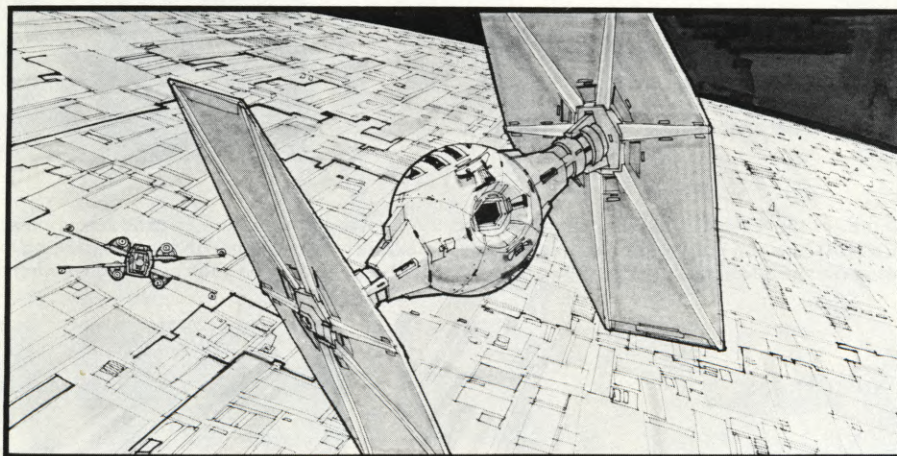
We have now generated three pieces of film which exactly duplicate the motion of the X-wing miniature and its engine effects frame-by-frame. The black and white negative, which we have already processed, gives us a black X-wing image on a clear cell background. The color negative shows the X-wing and blue backing, and the third negative has the X-wing engine against a black field. A camera report is then made up for the processing of the color negative elements and set aside for delivery to the laboratory.

We now prepare the T.I.E. ship miniature for photography. Normally, when one of the ships in a shot is firing lasers, the miniature has a laser emanation point provided in original photography. This point is usually a small light at the tip of the ship's laser cannon which lasts for one frame when a laser fires. In this case, however, the lasers are fired as the T.I.E. ship is going away from camera. Hence, no laser emanation point will be required on this shot. The T.I.E. ship is mounted and we begin programming the second element of this shot. Because our camera platform, or viewer's frame of reference, is required to make some moves in this shot, we will use a portion of the program that we used to photograph the X-wing. We load the digital information off the storage cassette into solid state memory in the control device, and we are ready to proceed. We are describing with the T.I.E. ship basically the same move that the X-wing performed, but it will enter frame later in the shot than the X-wing because it is to appear that the T.I.E. ship is pursuing the X-wing. The only axes of motion that we must use from the previous program are the camera nodal point, roll, pitch, and yaw. This is necessary to maintain the camera platform/viewer frame of reference integrity. This motion will match the camera motion of the X-wing element on a frame-for-frame basis, so that no matter what position or independent motion we give the ship, the two shots will have the same angular displacement (nodal point camera motions) and, therefore, give the appearance that the camera platform/viewer frame of reference rotates and pans independent of the individual ship motions.

We will change the track motion, the crab motion, and the boom vertical motion slightly to give the T.I.E. ship's move a subtly different character. We will move the track position in tighter to make the T.I.E. ship larger. We will reposition the crab move to the left to have the T.I.E. ship stay behind the X-wing,



Information for staging the "STAR WARS" space battles came from a reel of excerpts from World War II movies. This established the size and speed of the fighters and their positions in frame. (ABOVE) This is what the World War II shot (black and white) looked like. (BELOW) This was how the final shot, with the "STAR WARS" miniatures, had to look.

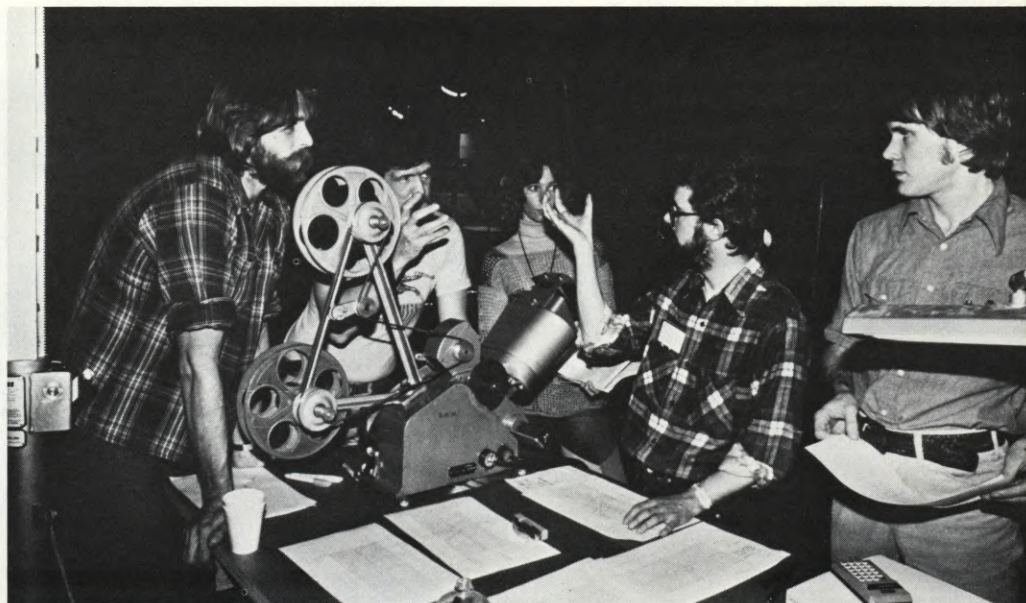


and we will boom down to position the T.I.E. ship higher in frame. The model crab, rotation, and yaw will remain the same to give the appearance of tracking the same moves that the X-wing is making. We now generate the same film elements on this T.I.E. ship that we generated on the X-wing with the exception of the engine element. The T.I.E. engine effect is provided by L.E.D.'s (Light Emitting Diodes), which record in the original key, and blue backing element photography.

First we photograph the T.I.E. ship move on the black and white negative material and process it. At this point we have another use for the black and white negative element which we made of the X-wing's move. We can "bi-pack" (lay together), the black and white negatives of the X-wing and the T.I.E. ship in a registration viewer. Because the images of the ships are black, and the backgrounds are clear, we can see the motions of the ships relative to each other and the composition of the shot at projection speed. Having viewed this test, we can now modify the T.I.E. ship move if necessary, or go ahead and photograph the T.I.E. ship move on color film.

Once the T.I.E. ship is photographed on color negative, we move on to the background — in this case, stars and black sky — and the surface of our mechanical planet, the "Death Star". This shot requires us to dive on the surface from high altitude in pursuit of the X-wing and T.I.E. ship and pull out just above the surface. We have four scales of Death Star miniature to work with and, because of the extreme perspective change we have to go through to follow the X-wing and T.I.E. ship realistically, we must use the second largest scale. This scale has the relief necessary to look realistic in the move, and is small enough in scale to provide the high-altitude to low-altitude diving portion of the shot without requiring a very great subject-to-camera distance in order to achieve the proper size change.

We can use the same camera nodal point, roll, pitch, and yaw that we used on the T.I.E. and X-wing to provide that viewer frame of reference motion, but because this miniature is in a different scale than that of the X-wing and T.I.E. ships, our linear track, crab, and boom moves will have to be reduced, not only in length, but in speed, as well. The linear moves will have to be programmed from scratch, so in order to make this program, we refer to the "bi-pack" black and white negatives of the X-wing, and T.I.E. ship, that we used earlier to test the composition and speed of the two ships. By studying this representation of the shot, we can then get an idea of what the



(Left to right) John Dykstra, Richard Edlund, Rose Duignan, writer-director George Lucas and Joe Johnston discuss the storyboard layout for an intricate sequence. "STAR WARS" was made by what was probably the youngest crew ever assembled to work on a film of such magnitude. The final stunning result reflects their dedication and flagless vitality.

background should look like. We program this move into the control system and shoot another black and white negative and process it. We can now tri-pack (triple thickness) the X-wing black and white negative, the T.I.E. ship black and white negative, and the newly generated Death Star surface negative. Looking at this combination in the viewer tells us if the independent moves recorded on each of these pieces of film will sync together in a realistic-looking way. When we have a good-looking move, we then commit it to color negative. The Death Star surface we are using for this shot is too large to be placed in front of the blue screen. In order to make a matte to be used in optical to hold out the stars, we now make yet another digitally controlled move on the Death Star surface. But this time we front light the Death Star and overexpose the color negative a minimum of three stops. This provides us with a matte of the Death Star surface as a white, or clear cell, image against black. After the proper optical steps, the negative of that print will provide the optical element used to hold out the stars in our final composite. We now set aside the normally exposed image of the Death Star surface, and the overexposed image of the Death Star surface for delivery to the laboratory.

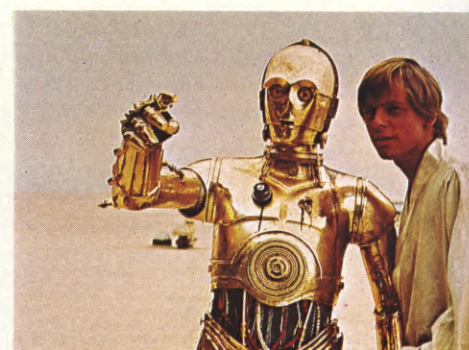
Finally, we prepare to photograph the stars for this composite shot on yet another piece of film. The Dykstraflex camera could be used to photograph the stars, but the star photography does not require the complexity of the ship and surface moves. Instead we will take the tape record of the camera nodal point roll, pitch and yaw to the Dykstraflex's sister camera and control system. This second system does not have the versa-

tility of the Dykstraflex but exactly matches the motor speed per degree of angular motion of the Dykstraflex so that, by loading the digital information from the tape of the nodal point angular moves used on the surface, we can photograph the stars with an exactly matching set of angular moves. No track moves are necessary on the stars, as they are at an infinite distance and traveling toward them or away from them will not noticeably change their position in frame. Because no program changes were necessary in any of the axes, the star move is photographed directly onto color negative and set aside for laboratory delivery.

The processed black and white negative of the X-wing, T.I.E. ship and the Death Star surface, along with the tape of the digital information comprising those moves, are appropriately catalogued for future reference. The black and white negative will be used later for synchronization of all these elements, and the tape is held so that any element can be duplicated again should any harm befall the negative in its future travels, or should another shot require a similar move on a different miniature.

The negative with its latent images now becomes the responsibility of "Control". Control shepherds the film from that stage through all the steps that it must take from this point on to become a final composite. Control now sends the negative to the laboratory, ordering the appropriate prints for later use. In this case, each of the elements will be printed twice, with the exception of the X-wing engine effect, which will have a third, low contrast print made. This print will be used later in optical composite.

Continued on Page 750

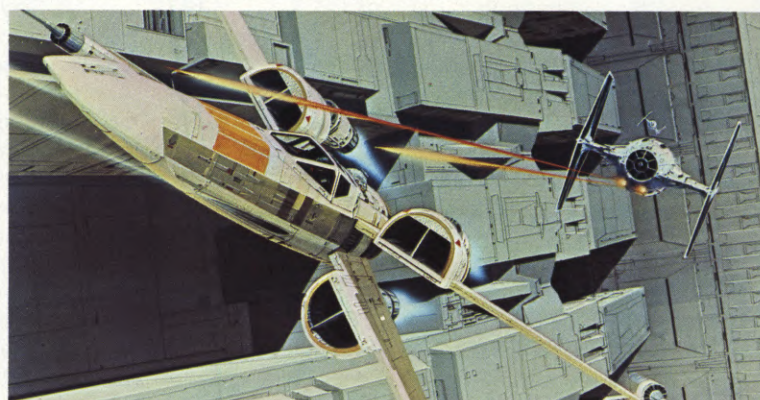
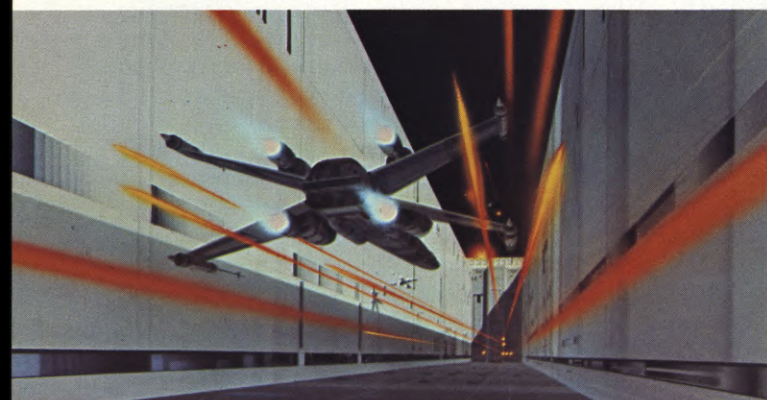


(LEFT) Han Solo fights off the Baddies, backed up by his co-pilot, Chewbacca, a hundred-year-old giant Wookiee. The 8-foot, blue-eyed Simian, a cross between King Kong and the Cowardly Lion, is amiable enough — except when someone beats him at chess. (CENTER) A storm trooper rides a beastie that resembles somebody's mother-in-law. (RIGHT) Luke Skywalker hatches a plot with gold-plated See-Threepio. The fuss-budget robot is George Lucas' homage to the Tin Woodsman of "Wizard of Oz" fame.

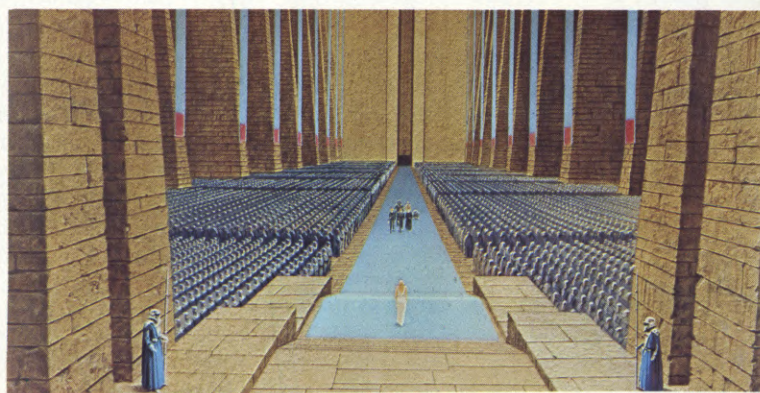


(LEFT) The Jawas, meter-high junk scavengers of Tatooine, bear a stunned Artoo-Detoo toward their Sand Crawler. (CENTER) Luke barter with Jawas for red-striped, slightly used "droid" (robot), but finally takes Artoo-Detoo instead. A felicitous encounter for both. (RIGHT) The Tusken Raiders, also known as Sandpeople, wear abundant clothing to protect themselves from Tatooine's twin suns. These large, strong creatures pursue a nomadic existence. Vicious desert bandits, they are not to be trifled with.

More of production illustrator Ralph McQuarrie's magnificent renderings. (LEFT) Rebel X-wing fighters roar down the trench of Death Star, intent on destroying the evil satellite. (RIGHT) An enemy T.I.E. fighter on Luke's tail tries to blast him out of the trench.



(LEFT) The verdant surface of one of the moons of the planet Yaven, site of the secret Rebel base. (RIGHT) In an imposing ceremony on Yaven, Luke and Han Solo are honored by Princess Leia for their heroic efforts in destroying the evil Death Star.



BEHIND THE SCENES

Continued from Page 701

quence filled with a squadron of X-wing and Y-wing fighters, the set was so huge that it had to be filmed on the largest sound stage in Europe, located at Shepperton Studios, in Middlesex, some twenty miles away. The scenes with the actors took 14½ weeks to film in England.

The script called for a large number of miniature and optical effects. In June of 1975, George and Gary contacted John Dykstra with regard to his supervising the photographic special effects. No commercial facility had the equipment or the time to accomplish what "STAR WARS" required, so John worked out the plans for a complete in-house effects shop. Appropriately named "Industrial Light & Magic Corporation," the shop was set up in a warehouse in the San Fernando Valley.

Employing as many as seventy-five people and, in post-production, working on two full shifts, ILM executed the three hundred and sixty separate special effects shots in the film. Altogether film enhancement and special effects are visible for half of the running time of "STAR WARS".

The various departments at ILM included a carpentry shop and a machine shop, which had to build or modify the special camera, editing, animating and projecting equipment required for the special effects. A horizontal 35mm double-frame format was utilized on all the special effects filming in order to get a larger negative that could sustain the quality of the images filmed in live action. A model shop was built to execute the prototype models of the various space and land vehicles.

Other departments included optical printing for putting multiple images together on film, and a rotoscope department, which provided matte work and

also generated original images to be used in explosion enhancement. The electronics shop devised special cameras for a self-contained camera and motion control system. There was also a film control department for filing and co-ordinating all of the special effects and other film elements.

Additional second unit Tatooine desert material was photographed in Death Valley and Yavin Jungle material was photographed in the Mayan ruins of Tikal National Park, Guatemala.

Noted composer John Williams spent a year preparing his ideas for the score. During March, 1977, he conducted the 87-piece London Symphony Orchestra in a series of 14 sessions in order to record the 90 minutes of original music.

Original sound effects for the galactic languages, vehicles, robots and weapons were collected and created by Ben Burt. The final elaborate stereo soundtrack was mixed at the Samuel Goldwyn Studios, using the Dolby system of noise reduction for the ultimate motion picture high fidelity in the theatre.

ABOUT THE FILMMAKER . . .

During the last few years, there has emerged within the motion picture industry a whole new generation of talented filmmakers. These young directors were brought up on motion pictures and television. They extended their childhood passions for the film medium by attending film schools. They studied theory, explored the technical demands of motion pictures by making their own short films, and endlessly viewed past works in an endeavor to rediscover those visual and narrative elements that made movie-going a weekly habit around the world. Their own work has exhibited a sense of craft, intelligence, youthful enthusiasm and a willing capacity to entertain

audiences.

In the forefront of this new generation of filmmakers is 33-year-old George Lucas, who directed and co-wrote the enormously successful and critically acclaimed "AMERICAN GRAFFITI". It was hailed as the quintessential movie about American teenage life and rituals when it was released in 1973. In direct contrast to that subject matter, Lucas has now written and directed "STAR WARS", an action-filled space fantasy.

George Lucas attended the University of Southern California Film School, where he quickly turned out eight films. He subsequently became a teaching assistant at USC for a class training U.S. Navy cameramen. With half the class assisting him, he made a science-fiction short entitled "THX 1138:4EB". The film won top honors at the Third National Student Film Festival in 1967-68 and many other awards.

In 1967, Lucas was one of four students selected to make short films about the making of Carl Foreman's "MCKENNA'S GOLD". Lucas' short was Foreman's favorite, although it told more about the mysteries of the desert than about Foreman's film. He then won a scholarship to Warner Bros. to observe the making of "FINIAN'S RAINBOW" under the direction of Francis Ford Coppola. While working as Coppola's assistant on "THE RAIN PEOPLE", he made a forty-minute documentary about the making of the movie, entitled "FILMMAKER," which has been recognized as one of the best films on moviemaking.

George Lucas' first professional feature motion picture was "THX-1138", (see *American Cinematographer*, October 1971), which was an expanded version of his prize-winning student film. Francis Ford Coppola acted as executive producer on the

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(LEFT) The strong-willed Princess Leia Organa holds her ground against the two top Baddies in the film, Grand Moff Tarkin (Governor of the Imperial Outland regions) and the sinister Darth Vader, metal-shrouded Dark Lord of the Sith. (CENTER) Leia is escorted to her cell, and is scheduled to be "terminated", but you might know she'll survive. (RIGHT) A "storm trooper" of the Empire blasts with his laser gun. All the villains of this piece look and act vaguely Nazified.





(LEFT) The rerecording mixers on "STAR WARS" (left to right): Bob Minkler, Don MacDougal, Steve Katz and Ray West. (RIGHT) The special peripheral equipment used to achieve the extraordinary sound track on "STAR WARS". The 70mm showcase releases of the picture employ a new technique Dolby has developed for an extended base response, using loudspeakers 2 and 4 (with five speakers behind the screen). In order to achieve the superior result, significant changes had to be made in the original recording of sound on location stages.

DOLBY SOUND SYSTEM FOR RECORDING "STAR WARS"

Continued from Page 709

tioned. Significant among these are the price (magnetic striping and recording can add as much as 50% to the cost of a release print), and maintenance problems caused by excessive playback head wear in the projector. So, despite the fact that magnetic stripe can have a frequency response flat to 12kHz, this is rarely replayable in the theatre.

Stereo Optical Sound Tracks

In 1973, Eastman Kodak and RCA collaborated on the design and development of a two-channel stereophonic optical system, based loosely on earlier proposals from as far back as the late thirties. Stereo optical tracks have advantages over magnetic tracks, since prints cost no more than conventional optical releases, and none of the maintenance problems associated with magnetic stripe are present. The Kodak/RCA proposal was to have two tracks side-by-side in the area normally occupied by the single optical track, with the additional advantage that in this way an unconverted projector can play the track and get a mono compatible signal, in the same way as a stereo phonograph record played in mono.

Dolby Laboratories joined this project in 1973, in an effort to apply the techniques they had previously used on monaural optical tracks, in upgrading the fidelity of the stereo optical system. Current specifications call for a signal-to-noise ratio in excess of 62dB, and a frequency response to approximately 12kHz.

While Dolby does not feel uniquely attached to the two-track stereo optical format, it does seem to have several salient advantages when compared

with some other proposals. First, the laboratory problems are greatly eased by the variable area tracks, which are no different in terms of processing from conventional optical sound-tracks. Second, two tracks are superior to three or more tracks on the film when compatibility to monaural is required. Third, two tracks will have a better signal-to-noise ratio than three or four tracks, and make for much cheaper and easier to install projector modifications and optical recorders. Finally, two tracks, and no more, minimize problems caused by printer misalignment and projector weave, and illumination non-uniformity during playback.

Two Loudspeakers or Three

While two loudspeakers (left and right) may be sufficient for domestic music playback, and perhaps in theatres that are long and very narrow, in wide theatres a member of the audience sitting near the front and on the side of the theatre has the disturbing effect of a center front signal appearing to come from the nearer loudspeaker, a particularly bothersome effect when the sound should be coming from a center screen actor. Dolby developed a logic circuit for use during playback of the two-track film. The circuit constantly analyzes the differences between the left and right track signals and redevelops a center signal, which is sent to a center screen loudspeaker. In this way, three loudspeakers are in use, L, C and R, and the resultant sound is normally indistinguishable from a conventional three-track signal intended for magnetic stripe three track discrete playback.

Several films have now been released with Dolby encoded twin-track SVA (stereophonic variable area) sound tracks. In Europe, "TOMMY" was released this way, and in the U.S.A.

recently "MR. BILLION" and "A STAR IS BORN".

Stereo Optical Surround Track

In addition to a large number of technical improvements to the stereo optical format over the last few years, Dolby has recently developed a method of adding surround information to the optical track. In order not to reduce the advantages of having only two tracks on the film, the surround information is Sansui matrix (QS) encoded onto the two-track signal; new techniques are used along with the matrix circuitry to reduce any residual cross-talk signals turning up on the surround speakers during what should be front-only signal conditions.

Dolby and "STAR WARS"

Gary Kurtz and George Lucas, the producer and director of "STAR WARS", approached Dolby Laboratories in 1975 to discuss the sound track of the film. They felt that a film of this type warranted a sound track of a quality better than could be achieved from using conventional techniques, and from Dolby's point of view the subject matter would allow them to show their wares in a way more demonstrative than was common. It was decided early on by all involved that magnetic striping of 35mm release prints should be avoided, because of the quality problems previously mentioned. Dolby-encoded stereo optical with a surround track seemed ideally suited for the 35mm prints, and Dolby encoding would also be applied to the 70mm releases, which would also employ a new technique Dolby had developed for an extended base response using loud-speakers 2 and 4 (with five speakers behind the screen).

Many changes in technique are called for during the preparation of the

Continued on Page 761



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MINIATURES AND MECHANICALS

Continued from Page 745

All of our prints are made at our specified printer light, and the laboratory graciously consented to run sensitometric color strips generated by us in order to allow control of the blue screen, and subject color. These strips were all shot at the same time and stored under ideal conditions until sent with our exposed negative.

This method allowed us to determine whether or not subtle color variations seen in daily projections were due to slight laboratory fluctuations or to some change in our system, such as aging lights or aberrations in the camera mechanics or electronics. We also ordered a quantity of print stock with a camera 1866 pitch and shape perforation. When contact-printed on a machine used for making internegatives, the print we received could be used for making rotoscope garbage mattes, and in some cases this print would actually be used in the optical printer as a printing element.

The morning following the photography on stage, we select takes in dailies. The individual takes may be different by design. One longer than another or perhaps a filtration variation. Shooting this variety helps expedite the completion of the shot should the pacing or visual nature of the shot require modification later.

The selected takes then appear via "control" at the viewer for synchronization. The viewer which we designed and built for our next step incorporates a pin-registered movement capable of projecting three thicknesses of our special 1866 printer stock, or six thicknesses of the mylar-base black and white negative stock. Because of the negative pitch stock and the pin-registration, this device can give a very accurate indication of matte fit and steadiness, even though the print we are viewing was continuous printed. The only variation that we generally find is a very slight bit of image weave. Using this machine, we now bi-pack the color print of the Death Star surface and its second-pass matte to make sure it fits. Now the color print of the stars is run against the matte of the Death Star to verify that the motions of the stars and surface match appropriately. We now check the X-wing color print against its second-pass engine effect to be certain of its matching up.

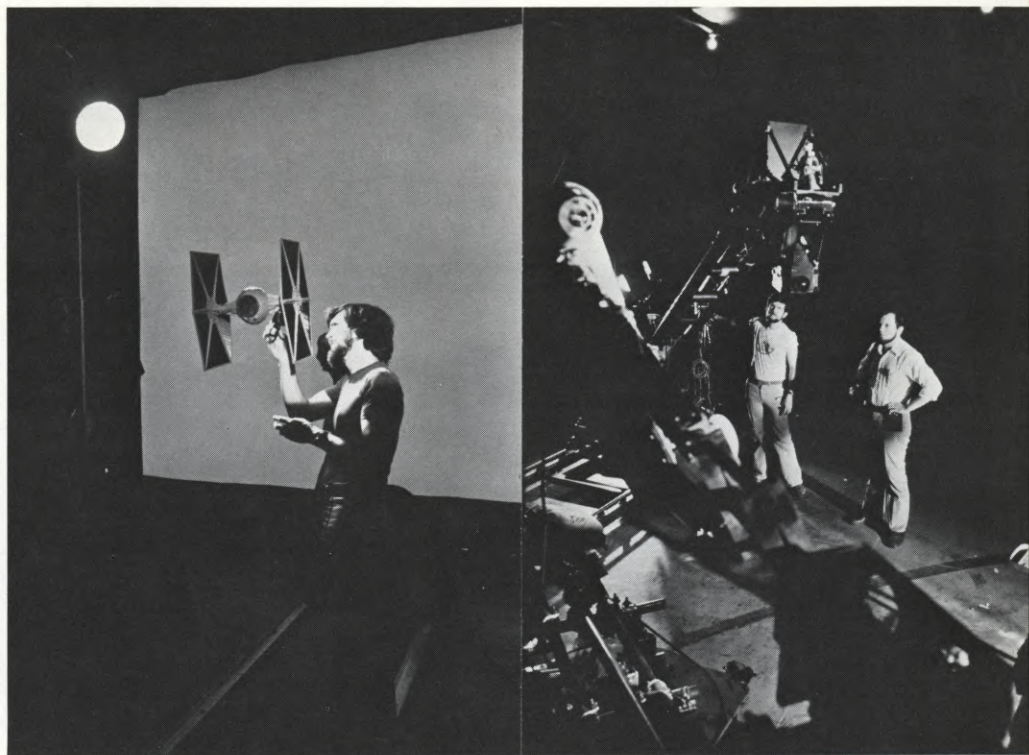
The black and white negatives of the X-wing, the T.I.E. ship, and the surface that we generated during programming are now bi-packed with each of their color print counterparts to make sure that they are exactly the same. The reason for this last step is that the

synchronization of each of these elements can be varied slightly (two or three frames) from what the original match up was at the time of photography. This slipping of synchronization can improve the feeling of the shot. The color print is a white or clear image of a ship against a black or dark blue background. When bi-packed, it is very difficult to see the ship, which falls behind or in front of the heavy density of the blue or black areas of the print. The black and white negative, with its black ship image on clear cell background, allows you to see all the ships, or surface relative to each other easily.

Once it has been determined that the black and white negative and the color print duplicate each other exactly, we set aside the color print, and run black and white elements in Bi-, Tri-, or Quadrapack. When the composition, position, and speed of each element relative to each other element seems right, the elements are punched with a holepunch on a common frame. This sync punch is then transferred to the matching six color elements and sent back to control with specific instructions for "Optical", or "Rotoscope" regarding its optical combination.

The next step involves returning the color print elements to control with their sync marks and the instruction card. Control then records the key numbers from each piece of print and sends the prints with their instruction card to the optical department. The optical department attaches their own optical sync mark to color print elements and deter-

The Dykstraflex camera simultaneously tilts up, booms up and dollies forward to provide a point-of-view shot from a spacecraft zooming up out of the trench on the Death Star.



(LEFT) The miniature T.I.E. ship to be exploded is suspended by fine wire in front of the blue screen. **(RIGHT)** Producer Gary Kurtz (right) looks on, as Director of Photography Richard Edlund swings the camera boom into position next to the Pirate Ship miniature. In "STAR WARS" these effects are so well done that there is never an awareness of watching miniatures.

mines what pieces of film will have to be provided by rotoscope. In this shot, lasers firing from the T.I.E. ship at the X-wing will have to be generated. The lasers will cause reflections on both the T.I.E. ship that fires them and the X-wing which they will pass by. Because of the precision artwork this requires, optical may choose to make a registration print of these two elements. This print will more exactly match the position of the X-wing or the T.I.E. ship on the original negative, than the continuous print. The blue screen elements of this shot will also need garbage mattes. With these requirements determined, the appropriate elements will be sent to "roto-scope".

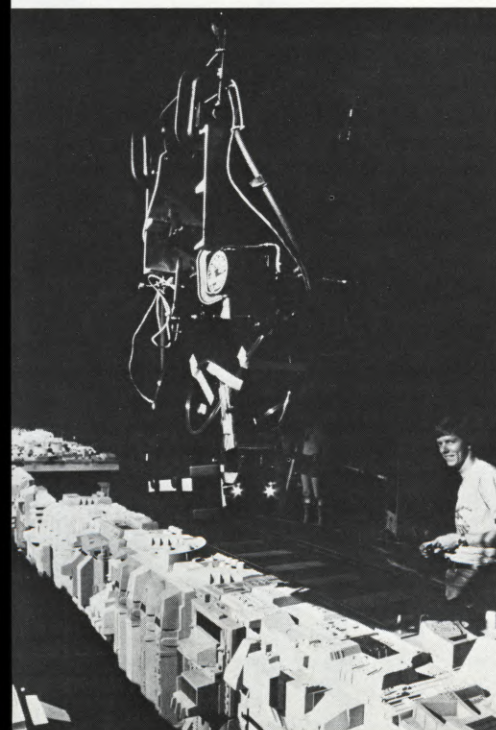
First, rotoscope will generate the garbage mattes. The T.I.E. ship and the X-wing are the two elements that require garbage mattes for this particular shot. As you may remember, these two ships were shot against blue backing. To help reduce the blue-light reflections on the miniatures, we covered the majority of the blue screen. This left a small patch of blue around the miniature and a large black area that may have lampstands or other equipment included in it. This black area with its attendant "garbage" is the reason for these garbage mattes. The rotoscope department will now put the color print of the X-wing in a device called a rotoscope camera which is capable of projection and photography through the same lens with the pre-

cision of a camera movement. The print will be projected frame-by-frame onto a surface with animation registration pegs. A cell is placed on this surface and a drawing is made which outlines all of the areas that we will not want seen in the final composite image. These drawings are blacked out in the areas to be eliminated. The drawings are then returned to the rotoscope camera where they are re-photographed off the same surface and animation pegs they were originally drawn on. This gives us a piece of film which will be used in conjunction with the X-wing element in the optical composite step to keep from printing the unwanted portion of the frame. A similar garbage matte is then generated for the T.I.E. ship element.

With the garbage mattes complete, we will now move on to the laser beams and reflections. With the frame-by-frame drawings of each of the two ships, we can now establish their position relative to each other in any frame of the shot.

We discuss the choreography of the lasers and establish their speed and position. We also determine their number.

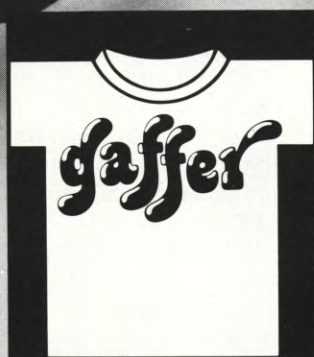
In this shot the T.I.E. ship pursuing the X-wing fires a volley of lasers, starting on the 12th frame from the sync frame. These lasers miss, but some pass behind the X-wing, and some pass in front of the X-wing. To achieve this effect, two sets of lasers will have to be





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created — one set that passes over the X-wing and one set that passes behind the X-wing. The two sets are necessary so that when the optical department composites this shot, the set of lasers behind the X-wing can be covered up by the X-wing hold-out matte. Lasers typically last between three, and six frames. In this shot the volley which we mentioned will include seven lasers. These lasers will come from the T.I.E. ship in a rapid fire fashion. The first laser fired will appear on frame 12, and the second on frame 14. The remaining five lasers will appear in two-to-four-frame intervals.

The interval and duration of the lasers provide us with the frames that we will have to be concerned with. In the same fashion that we generated the cells for the garbage mattes, we now generate a new set of frame-by-frame drawings. This set of drawings will include the positions of both the X-wing and the T.I.E. ship on one cell. There is a cell for each of the frames which will include lasers. The first cell contains accurate drawings of the X-wing, and the T.I.E. ship, as they will appear in frame 12 of the final composite.

The artwork for the laser is now created. This cell will have only the beginning of the first laser on it. The second cell contains the ships as they appear in the following frame (frame 13). The move that the ships make between this frame and the last is inspected and the artist creating the second frame of laser must compensate the position of this second frame of the first laser to allow for our apparent camera move.

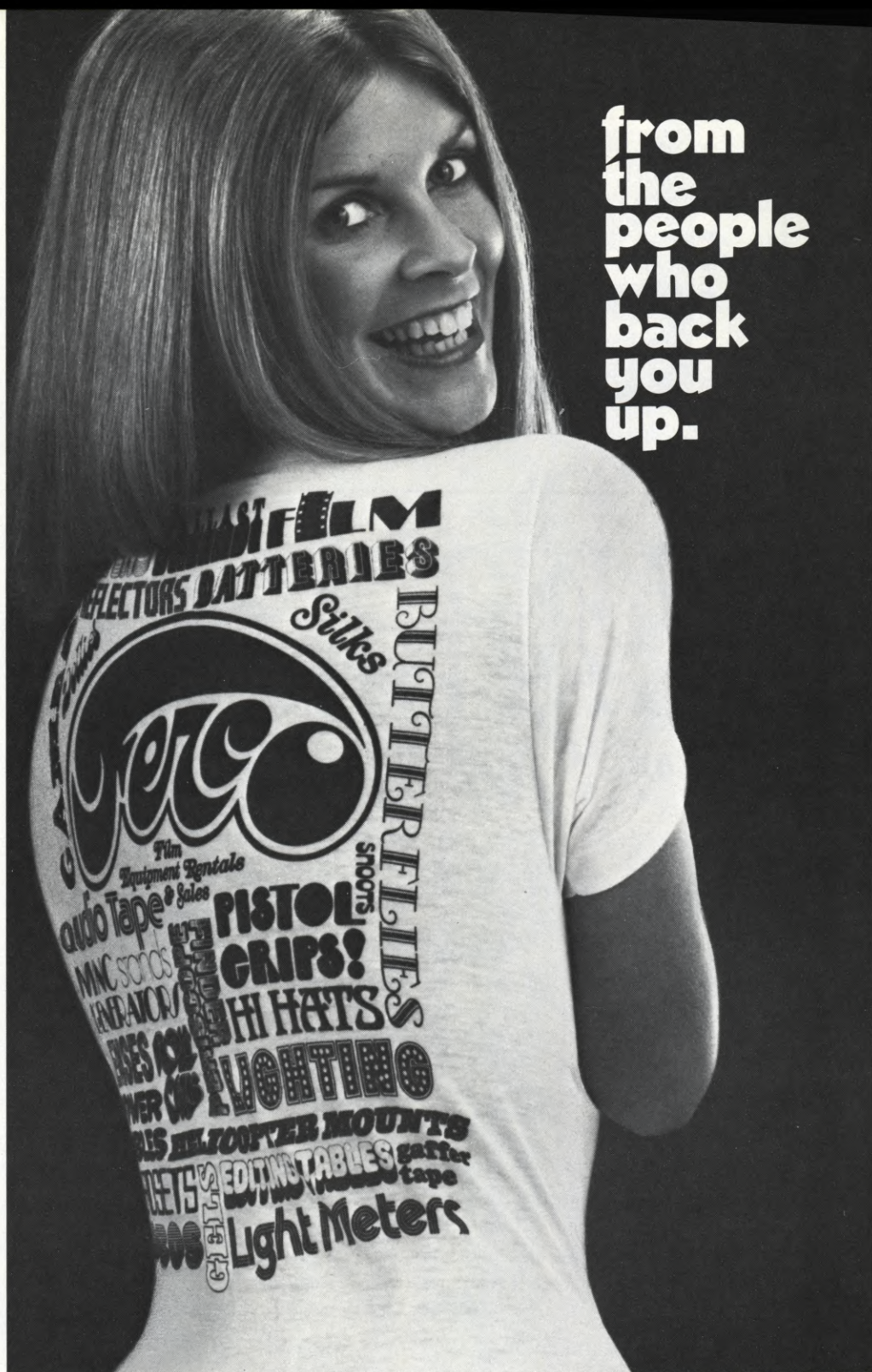
Once the motion of the first laser is worked out, each of the successive lasers must be animated with regard to the laser that precedes it, and whether or not it passes in front of or behind the X-wing. With the laser portion of the animation complete, the reflections that those lasers create on the T.I.E. ship which is firing them, and the X-wing which they are narrowly missing must be created. The laser beams are incredibly bright light sources. They illuminate those surfaces facing them, and cast shadows where their light is blocked from those facing surfaces. The artwork for these reflections take into consideration how many lasers appear in each frame and their distance and position relative to the ships.

We now have the artwork for the lasers, and reflections. This artwork will be photographed on five pieces of film: the color laser element which prints over the X-wing, and its matte, the color laser element which prints behind the X-wing, and its matte, and the color reflections which print over both the X-wing, and T.I.E. ship. The front, and behind color

laser elements are generated by photographing back-lit, hi-contrast laser artwork in two passes. The first pass is photographed with yellow filtration, and normal exposure. This provides the hot core of the laser. The film is rewound and a second exposure of the same artwork adds the green surrounding glow. This second exposure is made through a green filter, and a diffusion filter. The diffusion provides the soft transparency of the laser's surrounding glow. Variations in exposure are also used to help make the lasers move away with a tracer-like character. This gives us the color laser elements to go in front of and behind the X-wing. Because of the lasers' transparency and because they must be printed over the X-wing and Death Star surface, mattes must be made to keep the Death Star and the X-wing from exposing the negative in the areas in which the lasers appear in the final composite. This matte is made by photographing the laser artwork in exactly the same sequence on another piece of film which will be used to eliminate exposure in the areas on the negative where the lasers must expose. This gives us the lasers in front of the X-wing, the lasers behind the X-wing and their respective mattes. The last animation element to be generated consists of the reflections of the lasers on the ship. This element is photographed on color negative through a green filter and is to be double-exposed or "burned in" during the optical composite step. It doesn't need to be seen in those areas of the ship which are lit by the key light so it needs no matte.

These elements are processed and printed for viewing the following day. Two prints are made from this color negative — one is our normal print and one is preflashed and slightly underexposed to reduce contrast. This second print will be used in the optical printer to produce the laser and reflection effects. It has this contrast reduction to compensate for the contrast increase inherent in the optical composite step. After viewing the normal print, and checking its synchronization against the rest of the elements in the shot, this material returns to optical via Control.

While rotoscope has been generating the lasers, reflections, and garbage mattes, optical has to be assembling the rest of the elements into one of their "optical blocks". A block consists of a group of shots that have similar printing requirements. This organization of material is incredibly complex. Paul Roth has the responsibility of overseeing the assembly of these elements in workprint form and then making certain that the original



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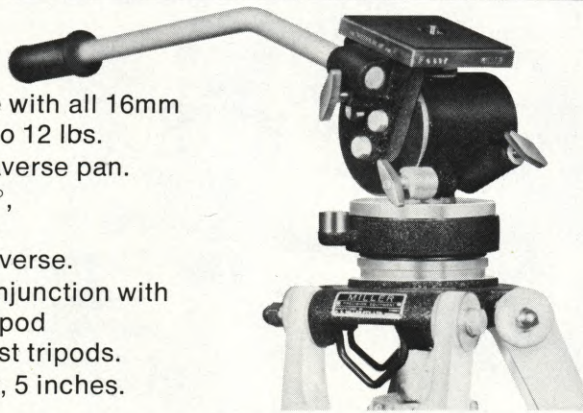
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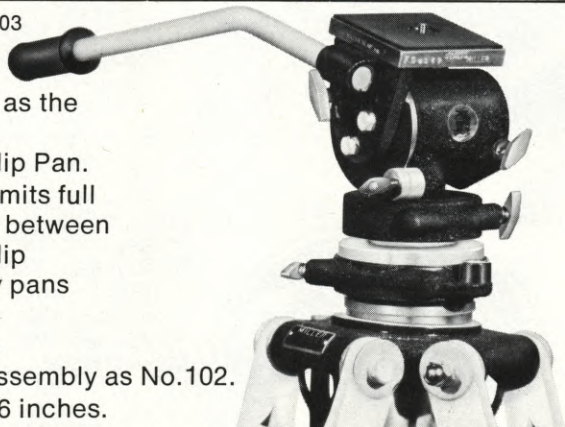
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negative which was conformed (cut to match) to the workprint is accurate.

This assembly of the elements is called "line-up". In our optical process there are two phases of line-up. The first phase orients the workprints of each of the pieces of film to one another by lining up their synchronization marks. These marks are the punches that we put on the film originally at the viewer.

We now have all the elements that we have generated for this shot parallel to one another with their sync frames in a row. If we wind this film through a synchronizer we can see all of the images that must appear in each frame of the final composite lined up in a row.

With the shot lined up in this fashion it is spliced in sync onto rolls that include elements in parallel sync for another shot of similar complexity. When several shots have been assembled onto these rolls in this fashion, these rolls become an optical block.

This block will move through all the optical composite steps as a unit. The first place that the completed workprint optical block goes is to the negative cutter via Control. The negative cutter conforms original eight-perforation horizontal negative to the eight-perforation workprint. We now have the optical block rolls in eight-perf workprint, and eight-perf negative. Each roll of negative is now run against each roll of workprint to insure that they match to the frame.

Each of these rolls of negative is now used to generate the optical elements that will be used to composite the shot in its final form. The blue screen elements of the T.I.E. ship and X-wing that we shot earlier will have separations made from them. The system we are using to make the mattes that isolate the ships from the background is called color difference.

Color difference is used because it is less time-consuming than blue screen composites made by conventional, three-color separations and its matte techniques. The T.I.E. ship and the X-wing separations are then used to create the hold-out matte and the window matte. These mattes will be used in the final composite step. Similar elements are generated on the Death Star surface and appropriate printing elements are made for the stars, all laser elements, the laser reflections, and the X-wing engines.

At this point, we have all the pieces of film that will have to pass through the printer to make the final composite. There are 28 pieces, not counting special garbage mattes, articulate rotoscope mattes, or the original negative from which these 28 printing elements

were made.

The individual elements are distributed as follows: the T.I.E. ship and the X-wing have four color printing elements, and four mattes each. The Death Star surface has five elements: three color printing elements and two mattes. The lasers over the X-wing, and under the X-wing have two elements each: one color, and one holdout matte. The X-wing engines, and the laser reflections are single color print pieces to be double-exposed and need no matte. And lastly, the stars do not print over any other image, which means that their color printing element needs no matte of its own.

Each of the color printing elements is used to produce an exposure on the final composite negative and each of the mattes is used to keep the composite negative from being exposed in an area that will receive exposure from another element.

The matte elements are usually used in pairs. The holdout matte is a black image of the subject to be matted in on that particular frame. This black image is surrounded by clear cell. This holdout matte is used to keep the light used to expose the final composite negative from printing any information in the area that the subject of this holdout matte will occupy in the final composite. The other element of the pair is called the window matte. This matte is used to keep the material which is in the frame with the subject of the matte from printing. In our system this matte is usually a composite of the blue screen matte with its edge gradation and the garbage matte generated in rotoSCOPE.

This composite matte gives us a totally black frame with a hole (or window) for the subject to print through. At this point we have matte pairs for the T.I.E. ship, and X-wing, the surface, and each of the laser elements in the shot. The composite goes together much in the manner of a three dimensional jigsaw puzzle. When we applied the sync marks to the elements at the viewer we also described which element crosses over which other element. The description which optical has for this shot is as follows:

The T.I.E. ship crosses over both sets of lasers, the X-wing, the Planet, and the Stars.

The reflection element crosses over the T.I.E. ship.

The "over the X-wing lasers" cross over the X-wing, the Planet, and the Stars.

The X-wing crosses over the "Under the X-wing lasers", the



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Planet and the Stars.

The reflection element crosses over the X-wing.

The "Under the X-wing lasers" cross over the Planet and Stars.

The Planet crosses over the Stars.

This description determines the order in which the printing elements must be used.

Our optical printers are basically two projectors and a camera. In order to maintain the quality of our original negative through the various printing steps we combine all of our eight-perf horizontal elements through an anamorphic squeeze printing lens onto a four-perf vertical format (standard 2.35-to-1 Panavision release format). In this way, our image is only one dupe generation from the original photography.

I will describe the optical combination of this shot as simply as possible.

First we determine which image has the most other information matted over it. By starting with this piece we will use all of the holdouts of the images to be combined in this shot and remove each holdout as we prepare to insert the subject of that holdout. The holdout was providing an unexposed place on the composite negative. This will, hopefully, help to simplify the explanation, even though it may not exactly describe the way this shot will be composited. In this shot the element that has the greatest number of elements matted over it is the stars.

The stars must appear everywhere in the scene that there is no other subject. To achieve this we project the star element, (stars completely filling the negative area) onto the raw stock upon which the final composite will appear. In order to keep the stars from exposing in those areas of the composite negative where other images are to appear, we use the holdout mattes of all other elements in the shot. These mattes are put in registration with the star field we are projecting. (The holdout matte being clear cell with a dense black image of the subject of that matte on it). The mattes of the surface, the lasers, the X-wing, and the T.I.E. ship keep the star image from exposing the composite negative by blocking the light in the exact shape and position of these subjects. We now have the latent image of a star field with perfect holes for each of the other images to print into.

We next select the element that has the next greatest number of the remaining elements printed over it. In this

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case, that is the surface of the Death Star. That color printing element is now projected onto the composite negative just as the stars were. Before we expose the Death Star surface onto the four-perf composite negative, the hold-out matte of the Death Star surface is removed, and the window matte of the Death Star surface is combined with the holdouts of the lasers, the X-wing, and the T.I.E. ship. The purpose of the Death Star window matte is to eliminate everything in the Death Star color printing element that we do not want to see (lights, stands, etc.). We print this combination, and we now have on the composite negative the latent image of the stars and the Death Star surface, both with perfect holes for the remaining images to print into. Before continuing, we remove the window matte of the element we just printed, allowing additional images to be printed into those areas.

The step that we just performed is repeated on the laser element, the X-wing element, and the T.I.E. ship element — each time removing the hold-out matte for the color printing element that we are exposing, and inserting the window matte for that color printing element. Having completed the exposure of all the color printing elements with their appropriate matte pairs, we now have a single four-perf anamorphic negative with all of the elements of our shot printed on it — each element occupying only the space allowed for it by its mattes, and each element printed over, and under its appropriate fellow elements to achieve the proper perspective.

The print back of our composite is viewed and corrections, if any, are made. Once the composite is accepted, a print goes to editorial, the negative goes to the negative cutter via the Control department.

That is the history of one of our shots, with an average level of complexity and difficulty. There are 364 more to be completed. ■

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(ABOUT THE AUTHOR: John Dykstra has worked on a variety of projects. He was a special effects cameraman and designer at Trumbull Film Effects on "THE ANDROMEDA STRAIN" and "SILENT RUNNING". Later, he worked on "VOYAGE TO THE OUTER PLANETS" for Graphic Films. The film was released in "IMAX" and was exhibited at the Reuben H. Fleet Space Theatre in San Diego. He has since worked on commercials and several projects for Future General, including a presentation film for a future feature film project, "JOURNEY OF THE OCEANAUTS". He also made a demonstration film for the Show Ride Project, an aircraft simulation presentation for an amusement park ride.)

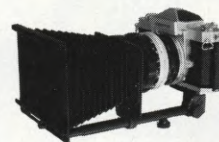
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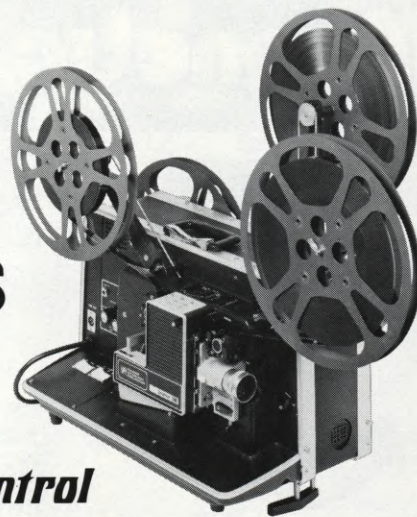
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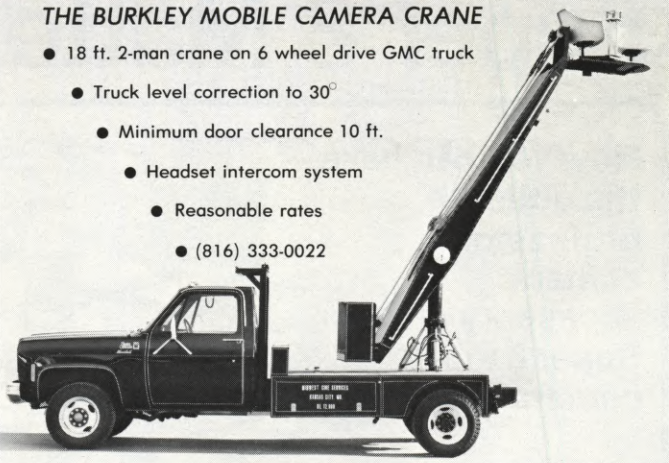
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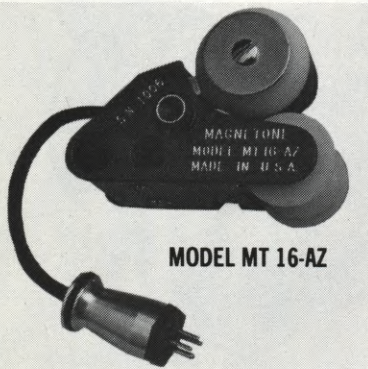
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Continued from Page 717

tape and this became our ultimate master that could be transferred in any conventional transfer room.

While the video tape machine is certainly one of the keys to the system, the other prime element is the special audio trailer used. I originally designed this trailer to record the audio on live video tape shoots. As such, it allowed us complete audio processing capabilities, as well as playback capabilities, to drive reinforcement systems. The interior of the trailer is totally soundproofed. Two JBL 4310 speakers are used for monitoring. The mixing console is a 12-input, 4-channel board, allowing us complete EQ on all inputs. There are also four reverb busses which utilize AKJ-BX10 reverb units for this function.

The trailer also has a complete patch panel, which allows us to insert various sound processing devices — such as dip equalizers, graphic equalizers, high-low pass filters, noise gates, tape repeaters, noise reduction systems, and 2-channel playback capabilities for driving reinforcements in its normal function in live video-audio recording.

This playback system was utilized to feed our underwater speakers. In order to create and record special underwater effects, we utilized the same underwater speakers and recorded the sound on Bruel & Kjaer hydrophones, as well as our own special adaptation of other devices.

All of this equipment is housed in a 14-foot soundproofed trailer, allowing us complete portability. The flexibility of this trailer made it possible for Peter Yates, our Director, to hear the effects as they would sound after they had been equalized. Much time was saved, by utilizing the full capabilities of the trailer, due to the fact that we could deliver to the dubbing room a product that was very close to the final sound. At the most, it would require only slight trimming as it was being dubbed.

In creating the sound effects in the way that we did for "THE DEEP", we feel that we pioneered in two ways. In the first instance, we have introduced a completely portable stage for normal Foley work. In the second instance, with the use of this system, Fred Brown and his most competent crew have created the first complete set of underwater effects ever used on a major motion picture. The result is similar to that of adding an entirely new and different dimension to the film medium. In the past most motion pictures used musical scoring for their underwater se-

quences in order to carry the action. In this case, the viewer becomes an extra person underwater, listening to the sounds that are being generated, without being distracted by his own bubbles — as he would be if he were actually diving.

The policy of The Burbank Studios is very graphically illustrated in the solving of the unique sound effects problems encountered on "THE DEEP". The system was developed to satisfy the requirements of Peter Guber and Peter Yates, Producer and Director, respectively, of "THE DEEP". The future of this system remains to be decided. Time will prove its potential. The system is not meant to be a replacement for all Foley rooms, but merely a supplement — as was the case in this unique situation — but we feel that the concept will prove to have added a very thrilling extra dimension to "THE DEEP". ■

CAMERA ASSISTANT PROGRAM
Continued from Page 721

one of the camera crew came up to us and said simply, "Thanks a lot for your help." That's all we needed to make our day. It was difficult for all of us at the end of the day if no one acknowledged our existence on the set with a simple "Thanks. See you tomorrow."

After twelve weeks, we had all been exposed to the lab, rental houses, optical and animation departments, so the bulk of the time left went into actual on-the-job production experience.

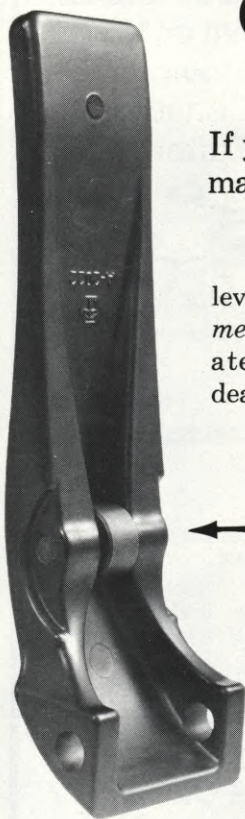
Production encompassed a vast scope of cerebral and physical activity, such as: intimate knowledge of all camera heads, lenses, motors, magazines, cables, accessories, camera mounts, etc., and not only *how* to effect the use of this expensive precision machinery most efficiently, but also *when* to do certain things, such as sensing the right moment to move in and set marks for the actor's stage blocking. Stage protocol was something that couldn't be learned from a book, but only by being there in the actual production environment — the relationship between camera crew and other departments, dynamics among the camera crew members, established no-no's, anticipating the next setup, or the next camera reload, proper slating, efficiently completing all necessary paperwork, keeping "tuned in" to the commands given by camera crew members — at the same time being bombarded with the cacaphony attendant to a complex production, with air conditioning, sometimes dozens of extras, principals, producer guests, other crew members, possibly some

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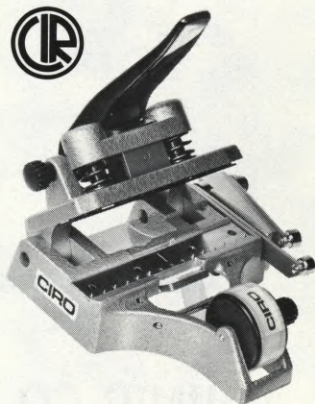
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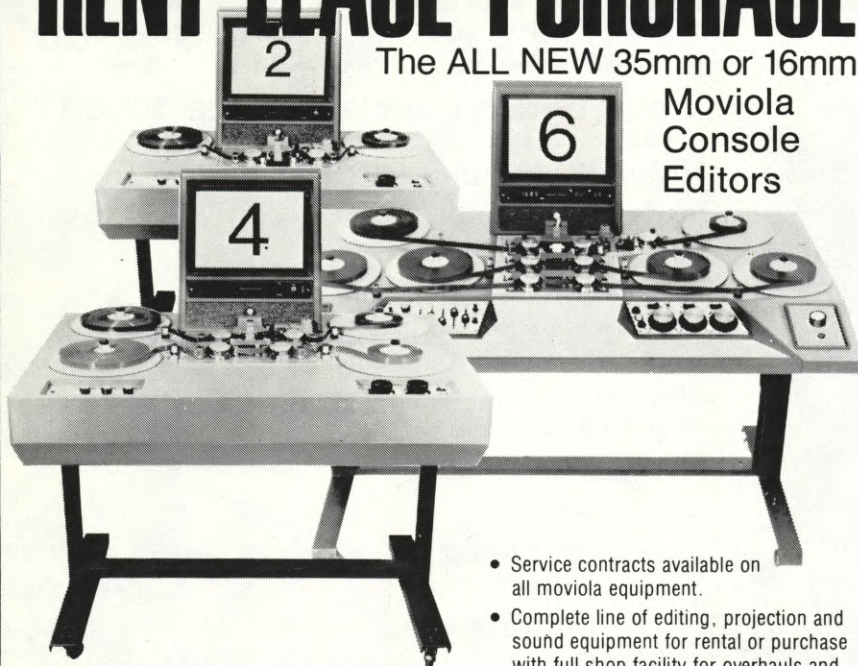
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animals, and God knows what other distracting sounds.

Besides The Burbank Studios, the ten of us worked on various television series, movies of the week, and features, both studio productions and independents, at Twentieth Century-Fox, MGM, Disney, CBS Studio Center, Samuel Goldwyn and Culver City Studios. Each lot has its unique geography, procedures, and traditions, and it was a great experience to have gotten a taste of all of them.

As the weeks passed, we were able to take bits and pieces of the many things we had learned and apply them to our current assignment, trying them "on for size." We found everyone doesn't do the same thing exactly the same way; there is some room for individuality, but work methods must be considered carefully lest we pick up some bad habits.

Although the original 1968 plan called for a certain amount of classroom instruction, our program had none of this, but did include a series of very interesting seminars, held once a month at the American Film Institute. We are grateful to AFI and Howard Schwartz, ASC, for arranging our attendance along with the regular AFI fellows. These seminars consisted of a feature film screening, followed by a session with the cameraman. This was a very popular event, as we had the chance to pick the brains of contemporary cinematographers, as well as those of some fascinating old-timers.

Speculation about a continuing training program includes the possibility of training optical printing and animation personnel, in addition to the production types produced thus far, but at this writing, it is uncertain what the future holds for a continuing yearly training program. If you want to know the latest on this, call Mr. Jack Carlson's office at AMPTP in Hollywood.

As one of the graduates in the '76-'77 group, I'm sure I speak for all of us in saying that this program has been a supremely gratifying educational experience, and we are all very grateful to the AMPTP, the IATSE Local 659, the training committee members and all the participating labs, rental houses, optical houses, animation facilities production companies and the many assistant cameramen from whom we learned so much. For this we have great difficulty in expressing our gratitude, humility, affection and respect.

Perhaps the best way to express our feelings is to resolve to make an industry-wide reputation of excellence for ourselves and to perpetuate this tutorial tradition bestowed upon us. ■

DOLBY SOUND SYSTEM FOR RECORDING "STAR WARS"
Continued from Page 748

sound track, if the full advantages of the better release prints are to be fully utilized. These started right back at the location stages of sound recording, when Dolby engineers met with the location and floor mixer in London prior to the commencement of shooting. Wherever possible, the quarter-inch location and floor tape were Dolby encoded, but more importantly, the minimum possible use of limiting was made, and no equalization was allowed. Conventionally, the sound recordist, knowing that his recordings will ultimately be played back on a theatre system with a poor high-frequency characteristic, may boost the highs on the tape. While this may make for better intelligibility on the dailies, it leads to much higher distortion, and would obviously sound excessively bright when played back in a wide-range Dolby-equipped playback situation.

All dailies (35mm transfers), effects, ADR and Foley were also Dolby-encoded. Looping and premixing were carried out in London at De Lane Lea and in Hollywood at Producers Sound Services, The Burbank Studios, Goldwyn and Glen Glenn. The music was recorded at Anvil Studios in England.

Final mixing took place at Goldwyn Studios in April of this year. Because of the dual release requirements, six-track 70mm and stereo optical, a four-track master was prepared, carrying left, center, right and surround information. At the end of the mix, the four-track was used to prepare a two-track running master for stereo optical use, and the same four-track was also taken to Todd-AO where it was used to make a six-track running master for 70mm. Optical printing was carried out at Deluxe Labs, and the 70mm recording at Todd-AO.

More than 50% of the first-wave release theatres for "STAR WARS" will be equipped with Dolby theatre playback packages, containing the necessary noise-reduction decoders and equalizers that exactly tailor the loudspeaker responses to match those of the dubbing theatre where the film was mixed. In this way, *for the first time ever*, the sound heard in the theatre should to all intents be identical to that heard by the director during the mix.

The Dolby participation on "STAR WARS" marks another step toward bringing motion picture sound reproduction and theatre playback to the high quality level that the audience expects and appreciates. ■

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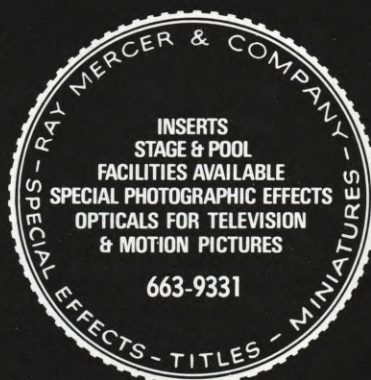
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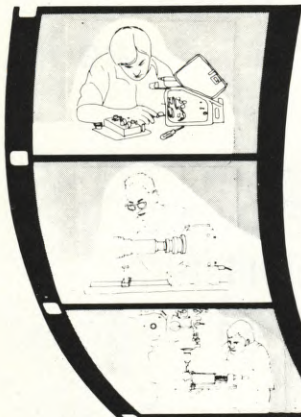
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BEHIND THE SCENES OF "STAR WARS"

Continued from Page 747

film. Starring Robert Duvall and Donald Pleasence, "THX-1138" was enthusiastically received by critics when it was first released and has since become a cult favorite among audiences.

In 1973, Lucas co-wrote, with Gloria Katz and Willard Huyck, and directed "AMERICAN GRAFFITI". Gary Kurtz and Francis Ford Coppola co-produced. The movie was nominated for five Academy Awards, including Best Picture, Best Director and Best Screenplay. It won the Golden Globe Award for Best Motion Picture — Comedy, and both the New York Film Critics and the National Society of Film Critics Awards for Best Screenplay.

George Lucas was born on May 14, 1944. The son of a retail merchant, he was raised on a walnut ranch in Modesto, California. His two passions as a teenager were cars and art. Determined to become a champion race car driver, he worked at rebuilding cars at a foreign car garage. He also worked in pit crews at races throughout the country. Following a serious automobile accident a few weeks before his high school graduation, he gave up any hopes of becoming a race car driver.

He attended Modesto Junior College for two years and majored in social sciences. By chance, he met cinematographer Haskell Wexler, who encouraged him to study filmmaking and helped pave the way for his admittance to the University of Southern California Film School.

George Lucas met his wife, Marcia, when she was hired to assist him on editing a documentary under the supervision of Verna Fields. They live in San Anselmo, California. Marcia Lucas was one of the editors on "STAR WARS" and was nominated for the Academy Award for Best Editing with Verna Fields for "AMERICAN GRAFFITI". She has also edited "ALICE DOESN'T LIVE HERE ANYMORE" and "TAXI DRIVER."

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Continued from Page 736

hasn't happened yet. I think what's going to be happening is more of a wedding of the two. Like this **STEADICAM** that I've been working with — because it takes a certain physical ability to operate, it uses television for its viewing system. I think that a lot of the special effects that are done with **Chroma-Key** in television will be used in film more, just for economic reasons. A matte shot that would cost \$2,000 on film can be made rapidly and cheaply with video. Outside of that, with the newer film emulsions, the potentials of 16mm are really developing. I didn't see Bergman's film of **THE MAGIC FLUTE**, but I understand that it really is beautiful. It's in 16mm.

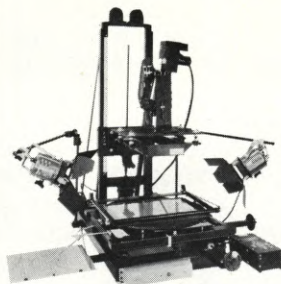
**RESPONSE: So are SCENES FROM
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WEXLER: Of course. So anyway, I think that the possibilities of working in 16mm and having it theatrically acceptable are good.

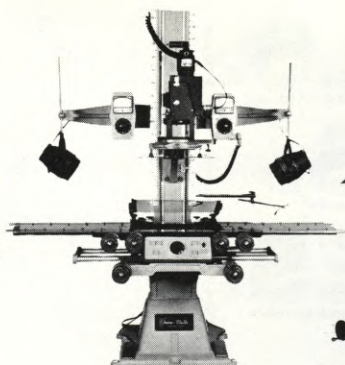
QUESTION: Do you think that the television viewing system would help on the set — especially in regard to cutting down the time required for the director to look through the camera during rehearsal and so forth?

WEXLER: Well, it's been tried, you know, and usually, so far, they've found that it doesn't save time; it takes more time. I did a film called **THE CATONSVILLE NINE** and we used the video thing on that. It was just a pain in the ass, because you'd do a take and then there would be a conference around the TV monitor. It just didn't work out. Now, there are certain conditions under which it could be quite useful. For example, when I do helicopter shots I usually try to get it set up so that when I come down the director can look at a videotape and see the shot I made. With this new device, the **STEADICAM**, we have a radio transmitter which transmits to a **Porta-Pak** a video image of the scene which the **STEADICAM** has filmed, and that's certainly valuable. I mean, there are times when a director is completely blind — like when you're using a car mount and nobody sees the shot, and it can be expensive if you have to go back and set it up again after you've seen the dailies. For example, an actor may do something that he didn't do during rehearsal, like leaning way forward into the windshield, and be completely out of the shot. You would never know it if

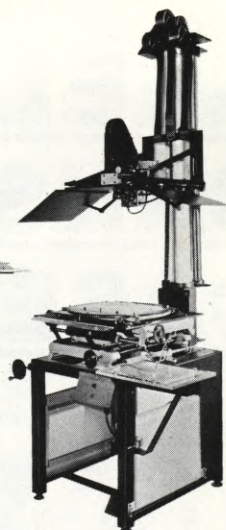
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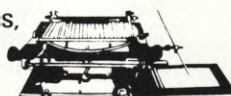
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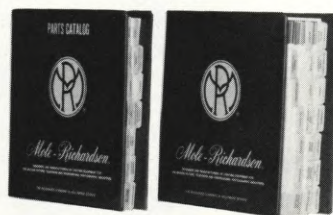
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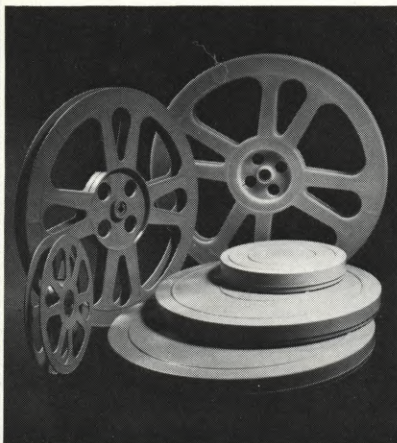
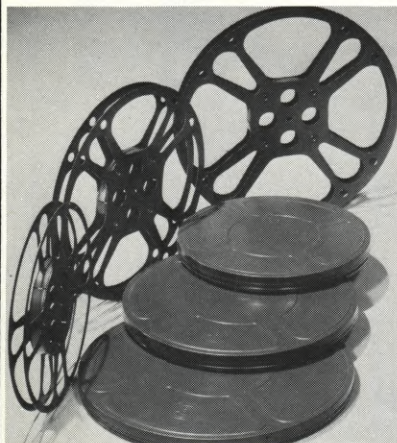
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the camera was just locked off on the rig. So television can be useful in that way.

QUESTION: When shooting night-for-night, do you go with a blue light correction?

WEXLER: No, I don't. I don't like that blue arc look. They used to do it all the time and I think I did it in some scenes for *IN THE HEAT OF THE NIGHT*, where we just used a naked arc with a Y1 on it. Somehow, the assumption was that night light was blue; I don't think it necessarily is. No, I generally try to light night only very slightly blue, with maybe a Quarter Booster Blue or something like that, a slight bluing filter.

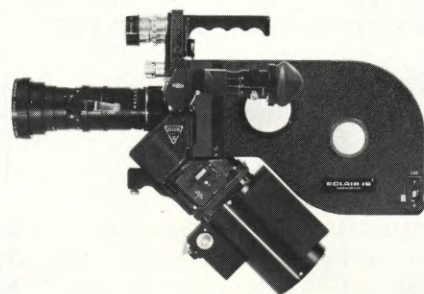
HOWARD SCHWARTZ: I think there was one sequence in *AMERICAN GRAFFITI* out by the lake, where you used the blue in order to tie it into the day-for-night which you printed blue into.

WEXLER: I'm trying to remember. The lake thing. That was day-for-night. Well, sometimes, depending on my mood — there's no logic to it — I'll shoot day-for-night without the 85 filter. Generally, I'll do that if the flesh tones aren't really prominent in the scene. Then, if they don't print it right, they might leave too much of that blue in. For example, Kubrick doesn't shoot anything with the 85. A number of British cameramen shoot complete pictures with no 85 filter, always shooting with the naked lens. Then they'll just make a note to the lab: "No 85 used." When you shoot still pictures using negative film, you can just tell the lab: "Print for the 85." Then they'll correct with a filter pack. The advantage of that is that you can get another half-stop of speed out of the film.

QUESTION: I was wondering if you've had any experience with the available light processing for 5247 that they do at CFI or Moviellab now?

WEXLER: Well, the term "available light" is a crock — because, available for what? Available can be good and available can be bad — and it may not be available for the four hours when you're shooting, also, but it's a term that you hear a lot. All they're talking about is a faster development process that pushes the film speed to ASA 200 or ASA 400. I'm chicken about pushing. I figure that 200 is fast enough for me. I have very fast lenses. I have an f/0.95 lens, T/1.4s, T/1.2s. You can shoot about anything you can see with those lenses.

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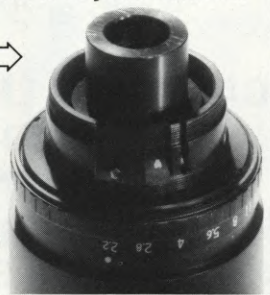
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QUESTION: I'm in the directing part of this program and I'm wondering if there are certain areas that you think directors should know more about — areas that some of them don't know about?

WEXLER: What seems to be happening with directors (that's different from other aspects of film-making) is that directors can be directors and know less than any other person on the set. I'm really being serious. You can be a lousy cameraman — or a cameraman who can't light well — but you still have to know certain things. You have to know lenses; you have to know how to read a light meter; you have to know emulsions. There is a certain body of technical knowledge you have to have. If you're going to be a makeup man, there's a certain body of technical knowledge. If you're going to be a script clerk, there's a big body of technical knowledge. But it is possible to be called a director in modern-day film-making and not know anything — except maybe the producer. I'm not making a general statement about directors, but it is true that you can start at the top faster in this business — and the top here is pretty high in respect to the economic level of the country — easier than you can start at the bottom.

QUESTION: As a film-maker, how much of your attention should be devoted to technique and how much to content, relatively speaking?

WEXLER: Film is an artistic, human expression and, as such, I believe that film-makers — and particularly students — should give serious thought to what they want to express, what their art is, what their ideas are about life, about people, about humanity, about why we're here and what we're doing. But if you want to be comfortable — if you want to think only about Series II Cooke lenses and f-stops and zoom ranges and two-frame pulldowns or full-frame 35mm — you can get quite involved with that and forget what it's all about. So I would suggest that perhaps, as artists and as film-makers, a great deal of thought and conversation with one another should go into some of those aspects of film-making — thinking about why you are making films, what kinds of films you want to make and why you want to make those particular films. When you go to see a film, look at it and ask yourself, "What does that film say to me? What does it mean to me? How does it reflect what's in the air, what people want to know, what I want to know? Is it truth, or just a segment of truth — or is it a lie?"



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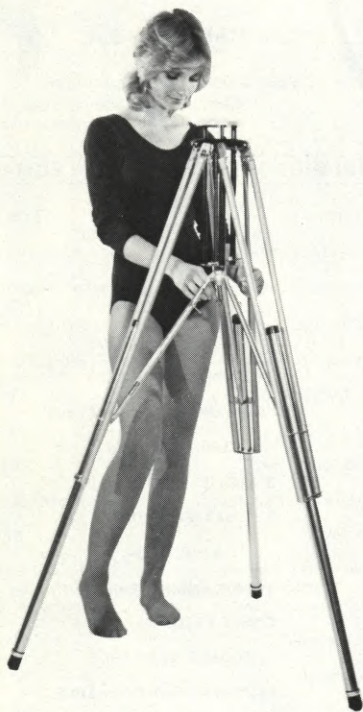
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THE CHALLENGES OF PHOTOGRAPHING "MacARTHUR" Continued from Page 741

TOSI: I'm really proud of how those combat sequences came out, because we really had to struggle to get them. I think we spent only about two days on all the combat scenes for the movie. In San Diego we shot four cameras — with two of them on the crane in a fixed position and Joe King (who is a terrific operator with the STEADICAM) and myself hand-holding. The special effects people almost blew me up, because I stepped on a bomb just as it was going off. That was really an experience, being blown up. They almost had my blood in the film. But I think we turned out some very realistic combat scenes, with all the fire and smoke.

QUESTION: You've mentioned the STEADICAM. Would you care to elaborate on its use in this picture?

TOSI: The STEADICAM, I think, is a fantastic piece of equipment. Garrett Brown and Ed DiGiulio have come out with something that is representative of the future of cinematography, something that can do what Lelouch could do with his "magic hand". I love what can be done with the STEADICAM, the possibilities for creative use in the hands of a skilled operator — but I think it should be applied only to certain shots. There is a time for the fixed camera, a time for the dolly shot and a time for the STEADICAM. The STEADICAM should be used when you really want to build up excitement in a shot. I think you should study very well your approach to using this beautiful piece of equipment. There are some fantastic things that can be done with it, but it requires the strength and skill and artistry of a good operator. Unfortunately, many of the beautiful shots we took with the STEADICAM for "MacARTHUR" were chopped out to reduce the running time.

QUESTION: Can you tell me about the lighting used in the picture?

TOSI: Lighting is my favorite subject, because lighting, to me, is what photography is all about. The lighting style of this picture depended almost totally on bounce light. I use white cards or foam core to bounce the light and sometimes, when I shoot for a day-light effect, I paint the foam core with a Booster Blue paint to raise the color temperature and get a whiter skin tone. I hate typical red faces — and we have a few of them in this movie — but when-

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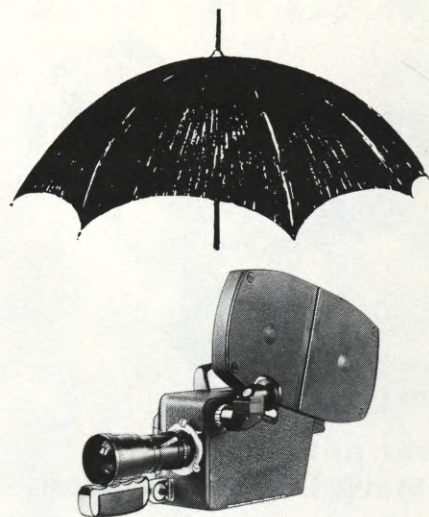
ever I can I love to get a light, pastel skin tone, even though it is always very difficult to get. So all the lighting was bounce light that seemed to come from the sky or from the ceiling. There is nothing that can replace bounce lighting or the kind of look it creates. We haven't discovered anything so far to make it better. They have developed soft lights and all sorts of other things, but nothing is as good as bounce lighting. Of course, it is very difficult to control. It's very difficult especially to achieve a low-key mood for a dramatic show. It takes more time and requires a lot more concentration. You need big flags and teasers and not too many people have the strength to cope with it. For comedy it is easy, because you let light spill all over the place, but when you want softness on the subject and want to leave several parts of your set dark, then you really start asking for trouble. If you don't have sufficient time, it can be tough — but I think that bounce light, especially for color, is irreplaceable.

QUESTION: What kind of light levels do you use when working with bounce light?

TOSI: With bounce light you don't need very much when you are shooting in low key. For example, several years ago I was already shooting with five footcandles — something that most of the people are doing now. But with bounce light, because of its basic softness, you need intensity on one side to build up the modeling of a face, or whatever the subject is. So, now that we have faster film and faster lenses, I have started going in the opposite direction, building up the light. I think I shot everything with the zoom wide open at 35 footcandles.

QUESTION: In "MacARTHUR" the sequence shot at West Point is especially atmospheric. Can you tell me about that shoot?

TOSI: The location shooting at West Point was historically very interesting. I had never been there and had always wanted to see it. I was very lucky photographically, when shooting outdoors, because we had a day with nice high clouds, dark and very dramatic. Outside I used three cameras. I shot a hand-held camera lying on the ground in the middle of all those marching people. They don't look; they just go straight and step all over you; they just go like a tank. But it was a lot of fun, shooting outside. Inside it was extraordinary. The Mess Hall is so big that I



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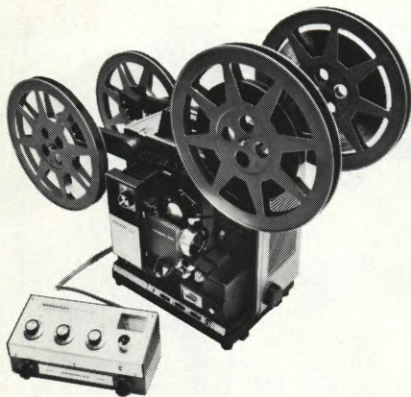
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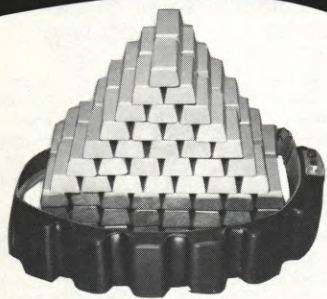


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had to send to Los Angeles for fish-eyes, which are not often used. Each of the aisles in the Hall is as big as St. Peter's Cathedral — and there are six of them. Five thousand people come in, and they sit on one order, they eat on another order, and they get up and leave on another order — everything in half-an-hour. It's incredible! But photographically, the expanse and beauty of the place was just something to record. That's why I wanted to shoot it with a fisheye.

QUESTION: What about lighting that Mess Hall?

TOSI: While I was busy with pre-production, I sent my gaffer to West Point to get an estimate of the lighting that would be needed. They had showed me a photograph of the Mess Hall, but I didn't realize how big the windows were. I told the gaffer that I wanted to put an arc through each window on three of the aisles. He did what I told him to do and made a list of all the stuff that would be needed, including booster lights for the inside. He came back and said that in order to light the place, we would need something like 55 arcs. When they heard that, the production executives came roaring down from the Tower and said that I'd better go to West Point and check it out. So we flew up and stayed there for three days, and only then did I realize how big the place is. The windows are so enormous that it would take ten arcs on each one to get the effect I wanted of shafts of light coming in. I tried to accurately estimate the amount of light coming through the windows, but one day would be sunny and the next very cloudy, so dark you couldn't see anything but the candelabra hanging in there. I told them, "Look, I can shoot this with the available light; we'll just boost the light for Gregory Peck and it will be wonderful. But if we get a dark day, we'll be out of luck; we won't be able to shoot." We had only two hours to shoot the speech, because they couldn't change the rules for us, but I had to take a chance. It worked out, and it was an impressive day. I enjoyed it.

QUESTION: Did you push the film for that West Point interior sequence?

TOSI: Yes, but for interiors I always push one stop anyway, even if I have enough lights. I do that because it strains the negative a little bit and you don't get that sharp "Technicolor 1945" look from the Kodak negative. You have to work on it to tone down the per-

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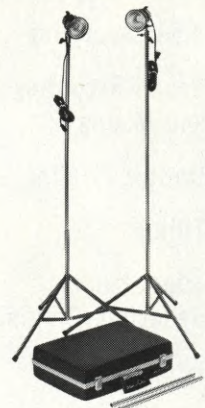
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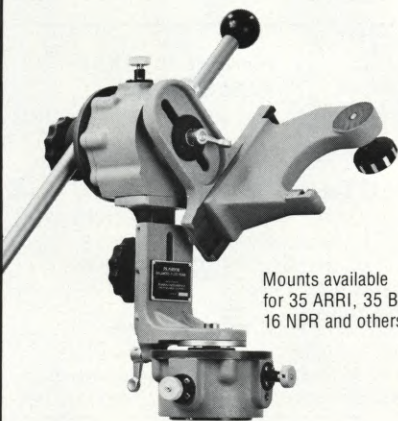
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fect color, perfect saturation, perfect sharpness. We don't want it perfect; we want it moody; we want it like a painting that expresses the mood of the script, not like a picture postcard. Also, pushing gives you a lot of freedom in the timing. If the light level is limited and I am shooting with a zoom lens, I know that I can get down to 10 foot-candles (two stops underexposed) and, by pushing, have a negative that is printable. That is the kind of freedom that lets you shoot just about anywhere. However, we very seldom get down that far. As I said before, on interiors I operate at just about 35 foot-candles — with a push.

QUESTION: Aside from the West Point situation, what would you say was your most difficult sequence to photograph in "MacARTHUR"?

TOSI: The sequences were almost equally challenging, in order to make them look right. All of the sets were big and they required a lot of work, but perhaps the most difficult was the tunnel sequence, because of the way the lighting had to be rigged. Everything in that sequence was shot with the STEADICAM and it followed Gregory Peck all over the place, which meant that the only way it could be lighted was with the practicals you see on the screen. We would cut now and then to make a shadow fall in the right place or to point up a mood with shadows and I put an enormous 10K at the very end of the tunnel as an extreme light source, just to create a very odd effect. In the main tunnel downtown, we had double lighting — lighting that showed and a different set of lights that were flagged off. That was the most complicated sequence to shoot, but it was more of a mechanical than creative problem.

QUESTION: Is there anything else you'd like to say about the filming of "MacARTHUR"?

TOSI: Only that I really wanted to make this movie classic-looking, but also gutsy and real, and I hope that I achieved that. I'm amazed that there have been so many compliments, and I have to thank my whole crew for that. Sometimes I scream and holler, but they are all good boys; they all grew up with me. For example, my operator, Joe King, started out as my loader and went up through all the ranks. All the people on the crew really work; they give everything. But best of all was the chance to work again with Joe Sargent, who is a great human being and a fantastic director.

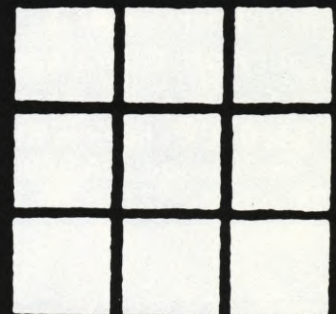
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Continued from Page 730

failed documentaries, with Orson Welles thrown in as a kind of glue. Despite his undoubted adhesive qualities, the picture comes unstuck, and it will hardly go down in cinematic history as a high point of Welles' career.

When it is over, everyone seems to agree that this year's Seminar is just about the best ever. There may have been so-called "bigger" names in the past — but never more interesting speakers. Every one of them has done his homework and, almost without exception, they have used film and/or slides to illustrate their talks. Moreover, they have covered a wide variety of interesting topics having to do with film technology, production and distribution. Heartening, too, is the fact that this intricate event has gone off without a hitch — a model of quietly efficient organization. The dedicated people who have worked so long to bring the Seminar to its present peak of excellence are to be congratulated.

Few things get better with time. Good wine is one of them. The Motion Picture Seminar of the Northwest — in its tenth year — is another. Long may it continue to flourish! ■

TENTH MOTION PICTURE SEMINAR OF THE NORTHWEST PROGRAM FRIDAY, MAY 20, 1977

8:00 AM 9:00 AM
Registration

9:00 AM 9:10 AM
Introduction

9:10 AM 9:25 AM
A High Speed Camera Film 7250 and VN
Print Film 7399 — Jack Teahan

9:25 AM 9:45 AM
The New Micro-Photography: Today's
Oddity or Tomorrow's Tool? — Ed Winkle

9:45 AM 10:15 AM
What is The Animograph System and Video
Animation: A New Approach For Animation
— Jean D'Joux

10:15 AM 10:35 AM
Break

10:35 AM 10:55 AM
A New Eastman Color Intermediate Film
5243 — Joseph Semmelmeier

10:55 AM 11:20 AM
The Creative Producer In The Hollywood
Market — Robert Lovenheim

11:20 AM 11:50 AM
Conception, Birth, And Growth Of A T.V.
Series — Lin Ephraim

11:50 AM 1:10 PM
Lunch

1:10 PM 1:35 PM
What's New in Wireless Microphones —
Frank Kelly

1:35 PM 2:00 PM
The Computer and Animation — Dr. Alfred
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2:00 PM 2:25 PM
Grants From A To B — Mitch Block

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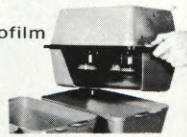
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Vision and Vision — Fr. Leo Remington

2:45 PM 3:05 PM
Break

3:05 PM 3:25 PM
Entertainment Aspects of Copyright Law —
Ed Bulchis

3:25 PM 3:50 PM
Notes On Animating Thurber — William T.
Hurtz

3:50 PM 4:25 PM
Creating The Illusion With Sound Effects —
Peter Berkos

4:25 PM 5:00 PM
Creating A Mood With Music — Arnold
Schwarzwald

8:00 PM 11:00 PM
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MAY 21, 1977**

8:30 AM 9:00 AM
Registration

9:00 AM 9:10 AM
Introduction

9:10 AM 9:30 AM
How To Shoot 16mm For 35mm Blowup —
Clive Tobin

9:30 AM 9:50 AM
The Making Of A No-Budget Feature — Jeff
Meyer

9:50 AM 10:15 AM
The Once-A-Month Commute — James
Miller

10:15 AM 10:35 AM
Break

10:35 AM 11:00 AM
Four-Walling: Dry Hole or Black Gold? —
Ron Olson

11:00 AM 11:20 AM
Film Distribution In The Art Market — Pat
Finley

11:20 AM 11:45 AM
Production Managing And Stunt Co-
Ordinating — Nate Long

11:45 AM 11:55 AM
Film Presentation Award

11:55 AM 2:00 PM
Luncheon — Exhibition Hall, Seattle Center
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2:00 PM 2:10 PM
The Life Expectancy Of The Modern Cartoon
Industry — Marv Newland

2:10 PM 2:30 PM
First Feature — Bruce Wilson

2:30 PM 2:55 PM
Verite among the Harpoon Boats on the
North Pacific — Ron Precious

2:55 PM 3:40 PM
Matte Paintings and Special Effects — Al
Whitlock

3:40 PM 4:25 PM
Photographing ROCKY, the "sleeper" hit of
the year — James Crabe, ASC

4:25 PM 5:10 PM
Post Production — The Third Creative
Dynamic — Thomas Sanford

8:00 PM 12:00 PM
Selected films by Seminar speakers with
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COMPOSITE OPTICAL EFFECTS

Continued from Page 708

Lasers and Glows between the ships. The next level of difficulty came when, with all this going on, the ships being matted suddenly exploded. We used combinations of exploding miniatures, animation, and superimposed explosions. In any case, it is very difficult to matte the delicate smoke and tiny particles produced by explosions without defects. (Another complication was the 150 or so shots that had all this going on and included a live action foreground previously photographed in England. A large number of these shots had reflections of the blue screen in the foreground, which required precise hand-drawn mattes on a frame-by-frame basis.) By far the largest matte difficulty was maintaining the integrity of the miniatures when they were small in frame; the smaller the image, the less quantity of grain defines the image, and the more likely it is that the image will disintegrate in composite.

Over ten thousand B&W film elements had to be prepared for printing ("lined up"), logged, cleaned, and expedited through the jungle of complications, mistakes, and directorial changes. Out of the problems of this project, a line-up system was developed by Paul Roth to rapidly mass-produce composites. All exposures and problems were logged as the work progressed. Some elements were used in a number of different shots. Some were flopped upside down and others needed their directions reversed. Often combinations of these, including added alterations to the original stage photography, occurred in the same composite. All of this had to be accurately recorded and accessed quickly to facilitate use of the elements.

At last, after months of running the printers 24 hours a day, the 365 shots lost their numbers, designations and individuality, and merged with the rest of STAR WARS as a completed film. ■

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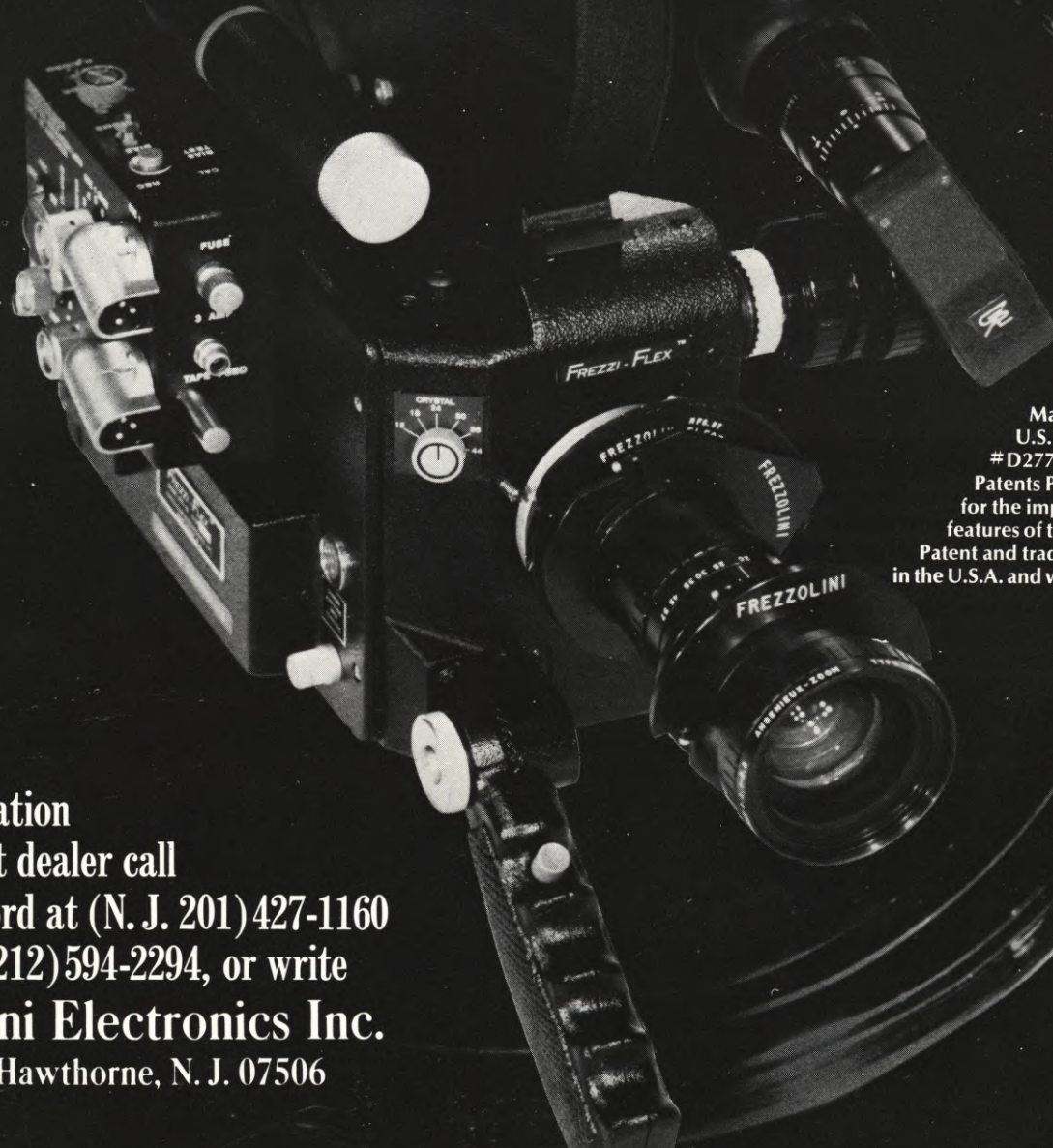
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