Film-Tech

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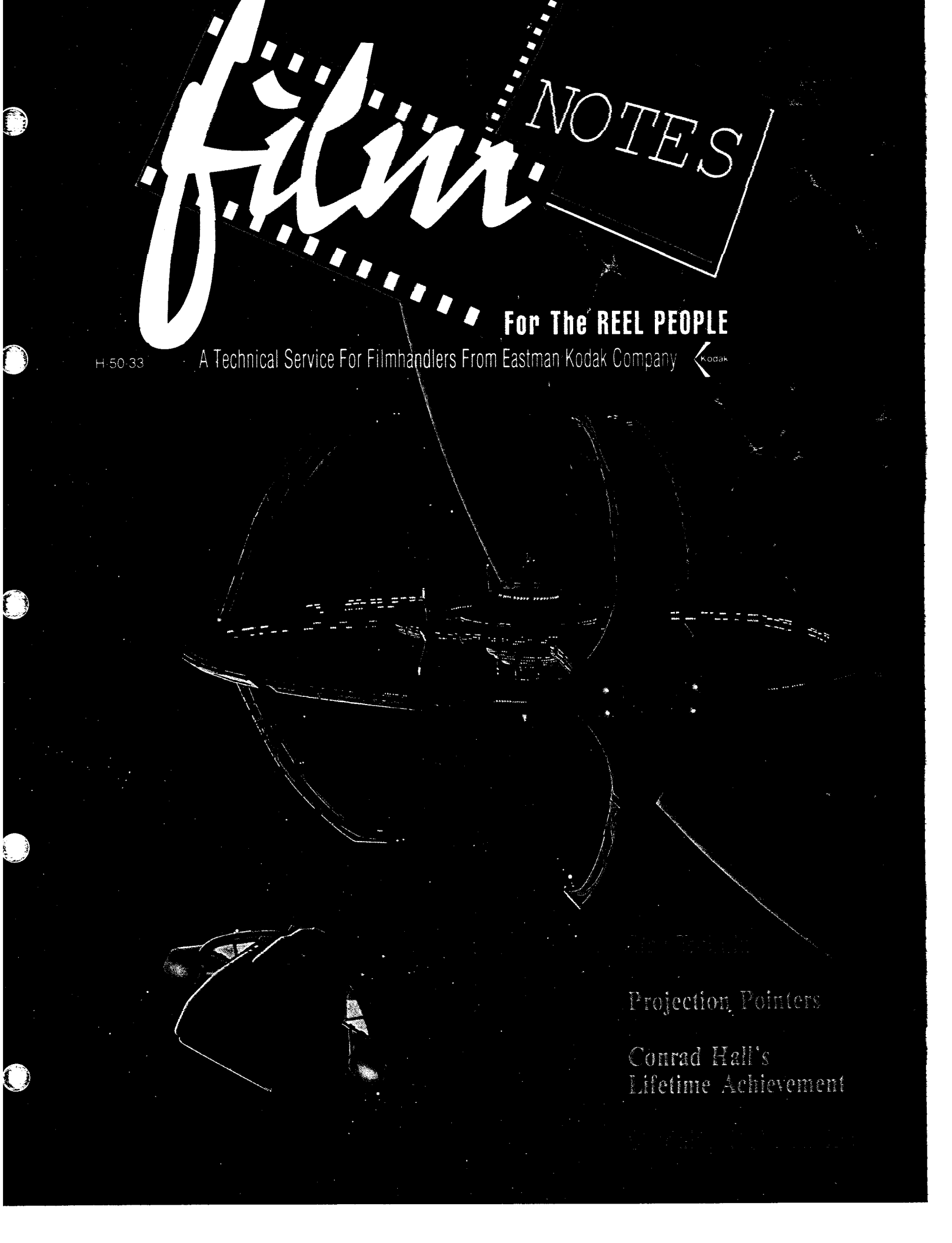
Film NOTES

For The REEL PEOPLE

H-50-33 A Technical Service For Filmhandlers From Eastman Kodak Company Kodak



Projection Pointers

Conrad Hall's Lifetime Achievement

H-50-33

Film NOTES

SPRING 1994

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On the Cover:
Cover Painting by Shigemi Numazawa from an original design by Herman Zimmerman in association with the Philip Edgerly Agency.

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Herman Zimmerman Practical Dreamer

Many people take for granted the environment in which they live. Day to day, many of us wander through life not paying attention to the small details. But to someone making a film or telling a story on television, the reality is in the detail. It's the background, the structures, and the minutia that transform the viewer or reader into a time or a place they've never been before, or in some cases, exactly where they once were. Herman Zimmerman is the man behind these details. His credentials can be visualized by naming two television series titles: *Star Trek: The Next Generation* and *Star Trek: Deep Space Nine.* Most of us can instantly recall images from these shows, and in many ways it's unfair to Mr. Zimmerman, because of his other talents and accomplishments as a Production Designer and an Art Director. It's this man behind the scenes that has taken us, as the *Star Trek* motto goes, "Where no one has gone before."

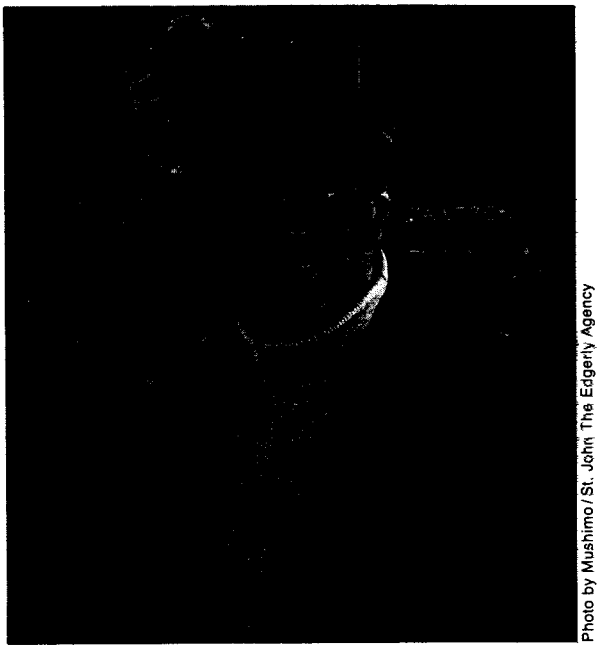


Photo by Mushimo / St. John The Edgerly Agency

Herman Zimmerman

Can you tell us how you got into Art Direction?

A. I wanted to become an actor, but I also had an avocation in architecture. I went to Northwestern University studying acting and directing. When I decided to go to graduate school I got an assistantship (which paid for tuition), but it wasn't in acting or directing – it was in technical theater. I had to change my major to scene design in order to justify the assistantship. I worked for the Children's Theater of Evanston (which was one of the two premiere Children's Theaters in the country at that time) as the technical director and scene designer. They liked my work and asked me to stay on. So I was an associate professor of Drama at age 23, and for the next four years I did sketches, built and painted sets, and stage managed. But I still wanted to act, so I got a job in a musical comedy called *Tongue in Chic.* I was one of six members of the cast. We sang and danced and did a lot of sketches; it was fun. *Tongue in Chic* was successful for a time and they talked about taking it to downtown Chicago but the theaters were all booked and by the time the theaters were available the show had lost its impetus. I was working and teaching so I left the show. But the producer of the show called to let me know he had a job for me in Nevada as the entertainment manager for Harrah's Reno Club. The salary was twice as much money as I made teaching school, so I took the job. I went to Reno still thinking I was going to be an actor or a singer somewhere in front of the scenery. I stayed there two and a half years; it was a great job, and I learned a lot. I thought I had a lot of contacts in the business so I came to Los Angeles, not realizing that the lounge and the big room casino circuit

had nothing to do with motion pictures or television. I had come to Los Angeles with three thousand dollars I had saved from my time in Reno which only lasted about three months. I had a family and needed a job, so I went to the Scenic and Title Artists' Union. I asked about getting a job as a scene painter. I showed them my sketches and my plans from my university days, and the business agent said, "I can give you a job as a scene painter, but what you really want to be is an Art Director." I said "Oh what's that?" so he told me. He informed me that NBC had been looking for an assistant art director several weeks back, but I'm sure he was just being polite to get me out of his office. NBC however had not filled the job, so I went in. They looked at my work and thanked me for coming. I thought, well I'm back on the street again and I'm not a scene painter or an art director, and still looking for work. Two days later I was called back to show my drawings to another art director, Spencer Davies, who at that time was doing *The Dean Martin Show.* Spencer looked at my work, and I remember him distinctly saying "That's the kind of stuff we do." They hired me that day, which was December 6th, 1965, and I've been doing it ever since.

How did this road lead you to Star Trek*?*

"When I got the job at NBC I knew how to design, but I didn't know anything about television, and less about film."

A. When I got the job at NBC I knew how to design, but I didn't know anything about television, and less about film. I would stay after work and look at the other shows' drawings, open up all of the drawers, not to copy their work, but to see what it was I was supposed to know how to do. It wasn't all that hard. I was there for three months as an assistant art director working on a brand new show which was called *Days of Our Lives* with a wonderful man named John Schrum, who was more or less my mentor in this business. John was moved onto another show, and they gave me *Days of Our Lives*. So in a period of three months' time I was a full art director. I tell this story to people who've spent twelve years just trying to become an assistant art director. If they get to be an assistant they are never guaranteed of becoming an art director. They get very angry with me. But I just happened to walk in at the right time. It's a union job and the difficulty, as in any union, is getting that first job. You can't get the first job unless you're in the union, and you can't get in the union without the first job, so it's a "Catch 22" which can be very frustrating. I worked in live television for about nine years. I was getting asked to do films, but I wasn't able to do them because I wasn't in that part of the motion picture and television art directors guild. So, I went back to being an assistant art director, this time

"Life in Desire"

at Universal, for about two years. I worked for a lot of different art directors. I did *Kojak*, a series called *Heck Ramsey*, and a series called *Toma* until I finally got the number of requisite hours to get my credentials to do film. Immediately I ended up getting a very nice job with Sid and Marty Kroft and stayed in live television for another couple of years. I did all of the Kroft Saturday morning shows: *Land of the Lost, Dr. Shrinker, The Lost Saucer, Far Out Space Nuts,* and a couple of others. I worked on the Atlanta Amusement Park for the Kroft's and did *The Donny and Marie Osmond Show.* I then went into doing movies of the week for about seven years for two different companies, EMI and Charles Fries Productions. I worked on some fairly important movies of the week, *Rumor of War, The Word, Silence of the Heart,* and *The Burning Bed,* among others which got a lot of awards. I made a good living doing that, but in 1980 there was a big actors' strike, and I was out of work for over half a year. I came to Paramount when the strike

was over, and I started doing a series called *The Powers of Matthew Starr* and I've been with Paramount ever since. I started doing *Star Trek: The Next Generation* in a sense because nobody else at the studio wanted to. Everyone thought when *Star Trek IV* was mounted in 1986 and shot in 1987, that *The Next Generation* was a bone that the studio had thrown to Gene Roddenberry, so they could have permission to do *Star Trek IV*, which they knew was going to be a big money-maker. The film people didn't think there was going to be much of a future for another television series based on the *Star Trek* theme. They took the gamble and allowed Gene to make it. He hired me partly because all of the art directors that were very experienced with science fiction didn't want to touch it. They all thought it was going to fail. It turned out to be very lucky for the studio, and a very good show. To this date we have done three times the episodes the original series did. It has made stars out of some very fine actors and has become part of the household vocabulary for people who watch television and like science fiction. It made me important to the studio as the Star Trek Production Designer, and for me personally, it's been a very rewarding experience. I was asked to do the next two features from the original series, and to design *Star Trek: Deep Space Nine*. I am now working on *Star Trek: The Next Generation – The Movie*, so I feel very blessed. I have come a long way from looking for work as an actor in a musical review.

Do you find it difficult to go from television to film?

A. We make our television shows on film, so there is less of a jump than you might think. What we do is print the film on digital video tape. In other words, we process the negative but never make a print that gets shown anywhere on a movie screen. For television we create a visual background that has to look good up to a 37″ diagonal. Most average television sets are around 19″ diagonal. That's very forgiving of detail, so for television we are less concerned with the texture of the walls, the details of the set. When you start to blow up those images from a 19″ diagonal to a 30′ high screen for a big movie theatre, then the attention must be focused on the detail. Otherwise it won't be believable. If you want to make it look like it is indeed 400 years in the future, and this is the way reality will be, then you must focus on the detail. It's easier to do this with a feature because the budgets are usually better. *Deep Space Nine,* however, even though it is a television series, was actually budgeted more like a film, partly because we started with three empty stages and there were no preconceived concepts or directions, and partly because the studio had great faith in the marketability of the product. With *Deep Space Nine* we had a completely new vision from the producer and the writers to guide us, unlike *Star Trek: The Next Generation*, which had been a derivative of the earlier series. When we did *Deep Space Nine*, we were starting completely from scratch.

"If you see a beam and a column in a piece of wall, that's what is supporting the station. There is nothing cosmetic about it."

How difficult was it to create something close enough to, but still different from the other series?

A. The marching orders were to make the *Deep Space Nine* station as high tech and bizarre as possible. Because it is an alien culture, we created an alien set of standards by which to measure the architecture. We decided that the Cardasians were a race of intergalactic Nazis who were very interested in order. They have certain likes and dislikes, for instance they like things in sets of threes, they like things in a very militaristic cut-and-dried manner, and they like honesty of structure. If you see a beam and a column in a piece of wall, that's what is supporting the station. There is nothing cosmetic about it. Everything is designed to have a function, even if it's just to hold up that particular piece of wall, or to be able to support a piece of equipment. That is not to say that it's not beautiful, but the beauty is intrinsically designed, not added on, not applied or ornamental. The beauty comes out of the organic need of the structure. That was quite a challenge because it gave us both a direction and told us when we were wrong. The real challenge has been, that as generous as the TV budget was for the pilot, the rest of the series has been

typically more episodic with budgets to match, financially lean, similar to other television shows. So to keep coming up with things that are as good as the pilot, was and continues to be a difficult job. I think we are doing it pretty well, and I must say I've had an awfully good time doing it. Because it is a daily challenge, it's a lot better than any other kind of design work.

> *"I like to call people who do what I do 'Practical Dreamers'. We dream about things while we're driving our cars, and that's not necessarily good..."*

Supposedly Einstein came up with many of his theories while he was shaving. Where do you get most of your ideas?

A. I think designers get ideas everywhere they are, and it's both a blessing and a curse that we look at things with an eye to changing them. I like to call people who do what I do "Practical Dreamers." We dream about things while we're driving our cars, and that's not necessarily good, because we sometimes get into accidents. We dream about things in restaurants on napkins, and in the shower, but then we have to take those dreams and deliver them up as real objects. We have to deal with dreams in feet, and inches, and pounds, and segments of circles, and real objects. Then real environments must be created out of those dreams.

Preliminary sketch of Quark's Bar on the *Deep Space Nine* Promenade. ©Paramount Pictures

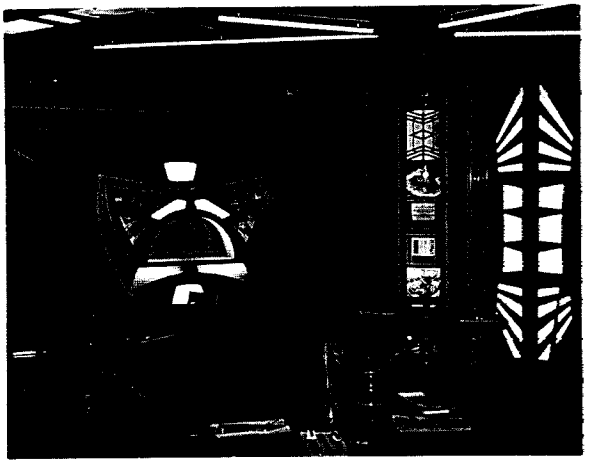
How would you spend a normal day, or is there such a thing?

A. Well, on any given design day, I have a sketch artist and some set designers working with us. (*Set designers are the draftspersons who actually do the physical drawings that go to the carpenters, prop makers, and effects people to create environments.*) The work proceeds in a fairly orderly manner based on the requirements of the shooting schedule. The script is broken down into a number of days of shooting, with each day requiring a certain compliment of equipment, actors, sets, etc. From the shooting schedule we know our priorities. For *The Next Generation Movie* we are currently working on the bridge of the Enterprise B, which is a ship we haven't seen before in the *Star Trek* universe. We started sketching the exterior of the ship first so we can have a model made. Then we sketch the interiors, particularly the bridge, the sickbay, and the deflector room because they are important to the story. Once we get the producer to agree that this is the look that he likes, we do working drawings and get estimates to see if it fits into the budget. It's a lot like keeping a ball up in the air while trying to pick up several more from the ground. If all goes well, we start building. You can't say that process takes a day, but more like several weeks. Part of the daily routine is keeping all those balls in the air for each of the 31 interiors and 7 exteriors we have in this movie.

How much has technology made a difference in your job in the last 10 years?

A. Technology is very important. Since 1986-87 we have seen a tremendous use of computer generated graphics and television monitors used as what we call electronic wallpaper in the making of science fiction films. *The Next Generation* used a technique called polar

motion, which is basically a backlit polarized film being manipulated by a circular reel against another piece of polarized film to create movement. It's what you see on a Hamm's beer sign where the waterfall seems to be flowing. There are a wide variety of interesting polarized film patterns and we've made very good use of them. Michael Okuda, who is our graphic supervisor, has been ingenious in creating backlit electronic wallpaper using that particular technique. It's limited in that it is very repetitive, everything moves the same way in the cycle, but it is usually seen for a couple of seconds at a time on screen. It does give you the sense of something important, but it's not like seeing a really well produced computer graphic or a real piece of film projected on a TV monitor. What we've made in the way of assumptions regarding technology 400 years in the future is that by then we'll have an unlimited source of power (dilithium crystals) which gives us greater possibilities. We try to be very faithful in the *Star Trek* family to Gene Roddenberry's vision of the future. He imagined people as educated, well intended, homo sapiens whose humanism is worn on our sleeves. We are bound by the prime directive not to interfere with other cultures, and to be careful with the resources of the universe, not just of our planet as the staunchest ecologist would want. We would be very remiss if we thought that we were the only intelligent life form in this vast array of stars, billions and billions of them, and we should feel a little humble about our arrogance as human beings, and be hopeful about the future. Rarely in science fiction, and I've said this on various platforms, do you see on film, television, or even in the comic books a positive view of humankind's future. I guess it's not too popular, because sex and violence are what sells. Gene Roddenberry said it doesn't have to be that way. Sex doesn't have to be prurient, and violence doesn't have to be mayhem, torture, or intentional cruelty. In the *Star Trek* saga stories when violence occurs, it is used for the purpose of telling the story, not just for the sake of violence. In almost every other science fiction philosophy, the world is going to be destroyed by aliens from another planet, or blown up by mean and thoughtless humans usually by pollution, lack of care for the human race, or just wanton destruction. These are stupid ideas if you stop and think about it. They may sell a popular brand of entertainment, but they don't sell a philosophy of living. One of the strong appeals of *Star Trek* is that it does have a philosophy of living that you can use right now. Four hundred years into the future, humankind can provide for itself and each person can live up to his or her potential. Technology is our servant and we are not enslaved by it. We can go beyond technology to make things that are not just useful, but beautiful as well. We are good entities that are always desirous of improving ourselves and those around us. That's pretty strong stuff, and while Roddenberry, I don't believe, said that in so many words, he was able to create that kind of a world. We are still dedicated to his vision and want that to be the central theme of *Star Trek*.



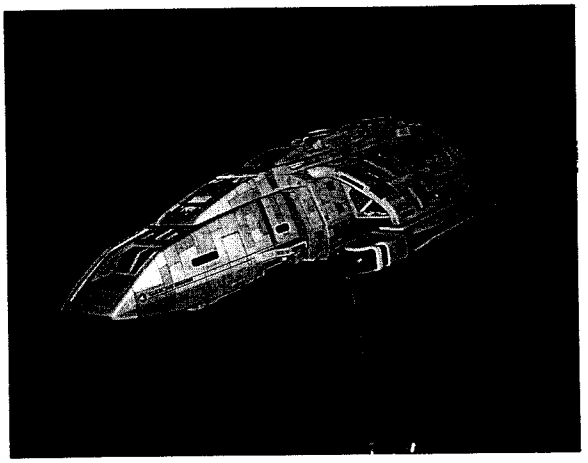
Promenade, second season improvements, *Deep Space Nine*. ©Paramount Pictures

> *"We try to be very faithful in the Star Trek family to Gene Roddenberry's vision of the future."*

What is your first movie memory, and how did it influence you?

A. I don't think I can answer that. I was very

nearsighted as a kid and during WWII my parents both worked, so I would come home after school and make myself some soup and crackers and go out to a movie. Movies were very cheap then. I would hate to tell you how cheap, though I swear it wasn't a nickelodeon. I spent a lot of time at the movies never really seeing them because of my poor eyesight. I heard them and only saw them later when I was older during the late shows in Los Angeles. Movies that I like a lot are, all of Frank Capra's films, many black-and-white movies, Errol Flynn's *Robin Hood, The Portrait of Jenny,* and a horror film called *The Uninvited,* which was terrifyingly well done. I like films that imply that mankind is more than what you see everyday, and that there is something guiding us and something that we each have to accomplish in life.



Deep Space Nine runabout miniature. ©Paramount Pictures.

Were you a fan of the first series?

A. Yes, I was, but I was also very critical of the first series. I felt one story in four was really important to me personally, and the others were nice, but didn't really get to me. Now looking back on it, and having experienced it first hand in two television series, if you hit one in four that's a pretty good track record. I do think we are doing better than that now, and are actually doing three out of four shows that are really interesting science fiction. It's hard to produce a show every seven days that is of dynamic appeal, has great potential for thought, and is entertaining as well.

Was it a challenge for you to work with the original cast on their last two feature films?

A. Yes, I like all of them enormously. They are fun to be around and each of them has a very distinct attitude and personality. Some of them are the actor's actor, and some of them are just ordinary folks. I have enjoyed being a part of their later days. I also enjoy being a part of the beginning of *The Next Generation* and *Deep Space Nine*, and all of those actors are my friends as well.

How do Star Trek *fans approach you?*

A. I think *Star Trek* fans are just beginning to understand in a nuts and bolts way what it takes to make a picture. But *Star Trek* fans by and large are the intelligent and super intelligent people who in the past were called nerds. When I went to school, the people who were interested in physics, chemistry and mathematics always wore pocket protectors and carried various types of pencils and a slide ruler, etc. Certain groups made fun of them but the balance of that has changed. These well educated individuals are now the movers and shakers (and maybe have always been), and most of them are *Star Trek* fans. I know the people at JPL and NASA who are *Star Trek* fans. I went to buy a car a month or so ago and the car dealer was a *Star Trek* fan, and all of his friends were *Star Trek* fans. Every time I tell somebody that I'm associated with the show, they have a dozen questions to ask me about it, and are always impressed that anybody they know or come into contact with has something to do with the show. I think the show's impact has had a greater impression on people than anybody might have imagined. Certainly more than Roddenberry would have imagined when he first came up with the idea. He was really interested in getting around the censors at NBC more than promoting this philosophy of life or science fiction. He was a writer who wanted to write about important topics, but wouldn't have been able to write about them if he couched them, say, in the year 1976. But, if he said it was 2376, he could get away with it because nobody would be able to dispute him. They wouldn't be able to say "he's poking fun at me." By going into the future, he created something even he didn't realize, that *Star Trek* would become an American art form. I'm very pleased to have been a part of it.

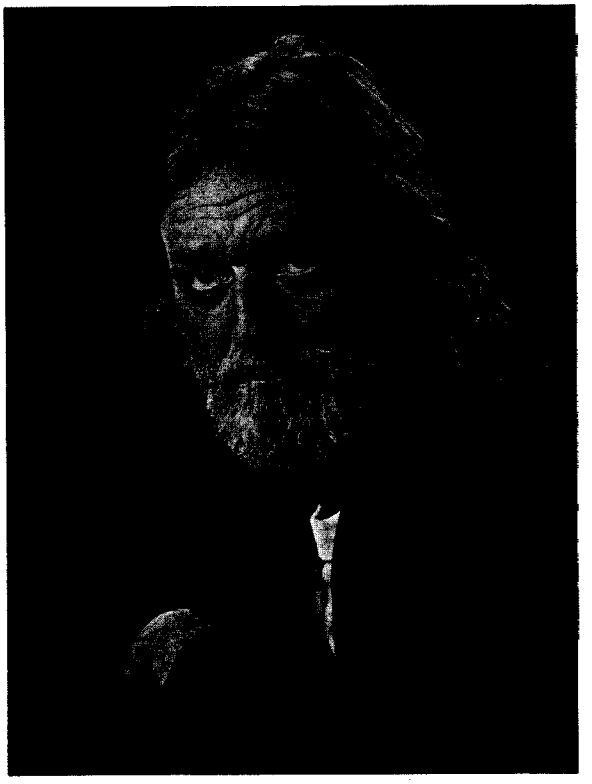
Conrad Hall Receives ASC Lifetime Achievement Award

Conrad Hall, ASC, has just received the 1994 Lifetime Achievement Award from the American Society of Cinematographers. It marks a milestone in a prestigious and lauded career.

He won an Oscar in 1969 for the cinematography of *Butch Cassidy and the Sundance Kid.* He has earned other Oscar nominations for *Morituri, The Professionals, In Cold Blood, The Day of the Locust,* and *Tequila Sunrise.* Hall was a nominee again this year for *Searching for Bobby Fischer.*

In 1988, he won the ASC Outstanding Achievement Award for feature film cinematography for *Tequila Sunrise.* His body of work also includes *Harper, Divorce American Style, Cool Hand Luke, Hell in the Pacific, Tell Them Willie Boy Is Here, Marathon Man, Class Action,* and *Jennifer Eight.* Hall is currently shooting the Warner Bros. film *Love Affair* starring Warren Beatty and Annette Bening.

He was born and raised in Tahiti. His father was James Norman Hall, who co-authored *Mutiny on the Bounty* with Charles Nordorff. His mother descended from a marriage between a Tahitian woman and an English-American sea captain.



Conrad Hall

"My father instructed me to find a career," he says. "I enrolled in the journalism program at USC in 1948. Soon afterwards, I switched to cinema after discovering I was better able to communicate with images than words. I found it appealing that movies were a new art form, barely 50 years old. I was getting in on the ground floor."

Hall says his mentor was Slavko Vorkapich, who chaired the cinema program at USC. "He taught the principles of filmmaking as a new visual language," Hall recalls. "He had a deep disdain for photoplays, which were how most movies were categorized. That left an enduring impression."

The ASC Lifetime Achievement Award is given annually to a cinematographer with a significant body of work which has created a lasting impression. It was awarded for the first time in 1988. The previous winners are George Folsey, ASC; Joe Biroc, ASC; Stanley Cortez, ASC; Charles Lang, ASC; Philip Lathrop, ASC; and Haskell Wexler, ASC.

"One of the questions asked when Conrad Hall was nominated was whether he was too young to receive a Lifetime Achievement Award," says ASC president Victor Kemper. "Connie is clearly in the prime of his career. He is tremendously innovative and creative, and is consistently pushing the art form in new and exciting directions. He is a continuing source of inspiration for every filmmaker young and old. But at the same time, he satisfies all of the criteria for a Lifetime Achievement Award. He has earned this recognition. Why wait? We hope Connie is still turning out films many years from now."

"Connie is clearly in the prime of his career. . . . tremendously innovative and creative. . ."

Hall graduated from USC in 1949. He and two classmates, Marvin Weinsten and Jack Couffer, organized a company called Canyon Films. They produced documentaries, commercials and industrial films. They bought a short story with the idea of turning it into a feature film. All of them worked on the script. Then they put three slips of paper into a hat. One said "producer," one "director," and the third, "cinematographer."

Hall drew the third slip, and that launched his career. He continued working as a cinematographer, mainly on commercials, documentaries and industrial films, until he was finally accepted into the International Photographers Guild as an assistant cameraman several years later. He served a short apprenticeship, working as an assistant and later camera operator for Ted McCord, ASC, Ernie Halle, ASC, Bob Surtees, ASC, and other legendary Hollywood cinematographers until the boom in television created opportunities for advancement.

Hall was in the first wave of film school graduates who entered the industry as cinematographers. He filmed *Stoney Burke* in 1958 and *The Outer Limits* a year later. He shot his first feature, *The Bad Seed,* in 1961. During a 15-year period, he compiled 18 feature credits, including five of his Oscar nominations. His crew included William Fraker, ASC, and Jordan Cronenweth, ASC, who have subsequently become two of Hollywood's most revered cinematographers.

After completing *Marathon Man* in 1976, Hall inexplicably set his brilliant career aside. During most of a 10-year hiatus, he wrote scripts for films he intended to direct. He and Haskell Wexler formed a partnership, and Hall directed and filmed hundreds of commercials. He returned to features in 1986, when he filmed *Black Widow.*

Aficionados have speculated on what Hall might have achieved if he had continued working on features during that period. However, he claims no regrets. Hall affirms that he spent some of the happiest days of his life during that period at a table writing.

Hall still plans to film and direct one of his scripts, based on a William Faulkner book. But he has no intention of giving up cinematography. "I believe my best work is still ahead," he says. "The language of cinematography is almost infinite in its variety, and learning it is a lifetime job. No one can be a master of this art form. You always have to be a student."

ASC presents annual awards for Outstanding Achievement in feature film and television cinematography. "Our goal is to recognize and inspire the pursuit of excellence, and to share our love for this art form with our collaborators and colleagues working in other disciplines," says Kemper. "This event is a celebration of an art form which makes an enormous impact on our society."

Kemper notes the 1994 Outstanding Achievement Award ceremony marks a major milestone. "ASC was founded in 1919," he says. "We are celebrating our 75th anniversary. During all of that time, ASC has provided a sense of continuity, from one generation to the next, in its members' continuing commitment to advancing the art form."

Kemper points our that ASC was founded only 30 years after Thomas Edison began experimenting with the development of a motion picture camera and projector at his research lab in New Jersey. The organization was founded only 16 years after Edwin Porter filmed *The Great Train Robbery,* which is generally considered the first successful feature film.

The ASC Outstanding Achievement Awards are managed by a volunteer committee consisting primarily of members and associates of the organization. The committee is chaired by Burton (Bud) Stone, president of DeLuxe Laboratories.

Xenon Bulb Failure Analysis

by Ray F. Boegner
Strong International

There are two things that are always true regarding xenon bulbs: they are expensive, and they will eventually require replacement...hopefully, not on a Saturday night when you have a full house! There are various reasons why a bulb requires replacement; it doesn't operate, it operates poorly, or it simply gets old.

The bulb doesn't work any more! That's a broad statement defining a problem. It's like saying your car doesn't run. Is it out of gas? Are the tires flat? Did someone steal your engine? One must first be more definitive when describing the problem; this will save much time and eliminate unnecessary and costly mistakes. The easiest thing in the world for a bulb manufacturer or a lamphouse manufacturer to do is blame the other guy. Both believe they make the perfect product, and if there's a problem, it can't be their fault. They are both correct to an extent: there are such things as bad xenon bulbs, and there are also bad lamphouses and power supplies. Obviously they are not consistently bad, or the manufacturers would be out of business.

Let's start by defining the common bulb failure modes. Then, we'll get into what can cause them – both within the bulb itself, and in the lamphouse/rectifier system. Once we've analyzed the symptoms, it's much easier to find the problem.

CONTAMINATED BULB ENVELOPE. This is indicated by a blackened or dark envelope. It is usually most prominent around the anode side of the envelope.

FAILURE TO IGNITE. This is indicated by the bulb's refusal to establish a maintained arc, either from the automatic or the manual ignition system of the lamphouse.

EXPLOSION. Or, as bulb manufacturers call it, a "catastrophic failure." This requires little explanation once you've encountered your first one.

LEAKER. This is indicated by a bluish-white color of the envelope when the bulb is operating. The real "tell-tale" of a leaker is high amperage and low voltage during bulb operation.

LOW LIGHT OUTPUT. Usually occurring with older bulbs, it is indicated by low foot–lambert readings of light level at the screen.

UNSTABLE ARC OR FLICKER. Indicated by the bright spot on the screen jumping around. This is especially noticeable on bright sky scenes.

CONTAMINATED BULB

The contaminated bulb is one of the harder ones for a bulb manufacturer to blame on the lamphouse manufacturer. It is usually caused by poor quality tungsten and/or tungsten processing. In many cases, it is evident by excessive pitting on the face of the anode electrode. It can also be caused by an inadequate vacuum prior to filling the bulb with xenon. Sometimes the bulb manufacturer will blame the rectifier, saying that it has **excessive current ripple.** Be certain to examine both electrodes prior to returning the bulb for credit. Excessive current ripple destroys cathodes much sooner than anodes. This could be evident by excessive cathode disfiguration with lengthwise slits in the cathode head.

If you suspect the power supply is producing excessive current ripple, don't call your local electrician. He probably won't know how to measure it. Talk to your equipment dealer. If you've done what all bulb and lamphouse manufacturers recommend and kept good records of each system, you'll be able to tell right away if you're experiencing short bulb life in a specific system. If that's the case, attack the problem. Ask your dealer to contact the manufacturer or a trained service technician.

FAILURE TO IGNITE

Failure to ignite is by far the most complex problem to diagnose. However, as with all bulb problems, if you've kept good records, the solution is much easier to establish. One must know what it takes to start a xenon bulb, and the components used to accomplish that desired result.

First, the lamphouse has an igniter which is similar to a coil in an older car. This device uses either 115- or 220-volt AC input and converts it to 40,000 volts RF which is used to break down the arc gap, or the space, between the anode and cathode electrodes. This is accomplished by means of a high voltage transformer which steps the 115- or 220-volt input up to approximately 5,000 volts, a few doorknob-type capacitors, and an RF transformer which steps the 5,000 volts up to approximately 40,000 volts. This high voltage is then induced into the DC line going to the bulb.

The igniter has one function: to break down the arc gap, or the space, between the electrodes of the bulb. After the arc gap is broken down, the xenon power supply takes over in two steps. First, there are a couple of large capacitors in the power supply which discharge across the arc gap directly following the breakdown by the igniter. This phase of the ignition cycle is called the **boost current** and is typically two to three times the normal operating lamp current. This boost current portion, or phase, of the ignition process lasts for no more than 250 milliseconds (1/4 second). This is the most detrimental phase of the ignition cycle to a bulb's life. Excessive boost current of higher than three times the operating current will help start hard-starting bulbs, but in turn destroys cathode electrodes. In a study performed by the military in the late 1960's, it was found that each bulb ignition, because of the effect of boost current, decreased the expected bulb life by thirty minutes.

The last portion of the ignition cycle is the running DC voltage supplied by the power supply rectifier. Most theatre xenon bulbs operate between 22 and 33 volts DC, depending on the size and wattage. This running voltage, along with the corresponding current, follows the boost current in the ignition process.

Most theatres have automation systems to light the lamp and operate the projector. This is the easiest item to eliminate in an ignition problem. See if the bulb lights without the automation; if it does, the ignition problem is in the automation system. Refer to that specific system's manual or drawings to correct the problem.

Another item that is easy to eliminate is the lamphouse

or console auto-strike circuit. This circuit typically consists of a relay and a zener diode which senses that the open circuit voltage is high enough. The auto-strike circuit then provides a closure to the high voltage transformer in the igniter. If the bulb starts using the "manual" or "emergency" switch, but does not start otherwise, the problem is in this circuit. When using the "manual" or "emergency" switch, never hold it in longer than two seconds, as you can destroy the igniter's high voltage transformer. In certain xenon power supply models, a shorted blocking diode can also cause this problem.

The reason that lamphouse manufacturers use the auto-strike circuit is to ensure that the open circuit voltage is at a pre-determined level prior to bulb ignition. This pre-determined level provides the proper level of charge for the power supply boost capacitors for bulb ignition. Depending on the lamphouse manufacturer, this open circuit level is usually between 80 and 110 volts DC, and can usually be monitored by depressing the bulb voltage switch. It can also be measured at the power supply using a voltmeter.

If the bulb doesn't attempt to strike with the "emergency" switch depressed, the problem is usually in the igniter. In most cases, it is either a defective high voltage transformer or spark gap. If you can hear the igniter operate, but the bulb fails to ignite, it is a good idea to turn off the booth lights, and, looking through the lamphouse observation port, attempting to ascertain where the arc is occurring. The lead from the bulb to the igniter should be at least one half inch from any metal lamphouse components. If the path between the lead and a metal component is shorter than the gap between the bulb electrodes, the RF arc will occur between the lead and the lamphouse, and not between the electrodes.

If an arc does go across the electrodes, and the bulb does not start, the problem is **not** in the igniter. Look at the boost circuit of the xenon power supply. A very common reason for this phenomenon is loose or corroded DC connections in either the lamphouse or the rectifier. These connections should be checked during periodic lamphouse maintenance, or whenever the bulb is changed. Another possible cause is a defective boost capacitor in the rectifier. If you have repeated occurrences of this nature in the same system with several consecutive bulbs, it's a good idea to exchange these capacitors with those of another system not exhibiting the same problem. See if the problem follows the capacitors. If you change the bulb, and the problem is corrected for five or six hundred hours before it recurs, try the capacitor trick and document the results; see if there is a pattern.

The bulb itself can be the cause of ignition problems. The cathode contains thorium to lower its work function and provide easy ignition. If the bulb is operated at a level of less than 75% of its rated amperage, the cathode electrode will not become charged enough to replenish the surface thoria. In turn, the bulb will exhibit starting problems after four or five hundred hours of operation. Bulb-related ignition problems usually center on the cathode electrode. A good visual examination of the condition of the cathode is in order if you are encountering ignition problems. A cathode with a mushroom-shaped tip can cause erratic ignition problems.

Bulb fill pressure and arc spacing can be suspect in bulb ignition problems. While high xenon fill pressure will provide higher initial light output in a xenon bulb, it can also lead to poor bulb ignition after the bulb ages and some contaminants are induced into the xenon from the normal outgassing of the electrodes during operation. The higher the xenon pressure is, the higher the resistance of the arc in the bulb will be. The spacing of the arc gap also effects the resistance of the arc; the wider the gap, the higher the resistance. Running the bulb at higher-than-rated current will cause excessive burn-back on the cathode electrode and in turn increase the length of the arc.

So what is the purpose of the wire around the outside of the envelope? This wire is usually made of nickel or ni-chrome (short for nickel-chromium). It is used to set up an "E" field during bulb ignition. Picture it as a grid of an electron tube. Without this wire on the bulb, you will more than likely experience ignition problems halfway through the bulb's life, particularly if the bulb is hot when you attempt to start it.

BULB EXPLOSION

A bulb explosion does one thing for the projectionist, technician, and manager/operator: it causes respect for the warning labels on the bulb box. The pressure inside an operating xenon bulb is as much as three times the non-operating pressure, which is typically 60 p.s.i. (pounds per square inch) absolute pressure. When the

bulb explodes, it makes an extremely loud "bang," and usually causes considerable damage to the lamphouse. If you've experienced a bulb explosion, you will become an avid advocate of wearing the recommended safety equipment when handling xenon bulbs.

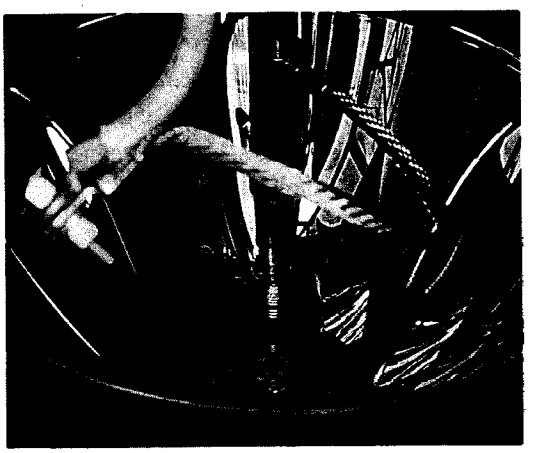
What causes a bulb explosion? The Number One cause is excessive strain on the bulb's quartz envelope. Once the envelope has developed a strain pattern, it is only a matter of time and thermal cycling until the envelope ruptures, or actually explodes, because of the high internal xenon pressure. It is a very rare occurrence for a bulb to explode when **not** in operation because of the lack of temperature and the reduced xenon pressure of a non-operating bulb. When the bulb is operating with strain in the envelope, the internal quartz pressure at the elevated temperatures works against the vitreous structure of the quartz (SiO_2), and the strain pattern actually grows until the integrity of the envelope gives way, resulting in an explosion.

Strain is usually induced into an envelope during the fabrication process of the bulb. However, this strain is removed by an annealing process at the factory and is inspected using a polariscope to ascertain its removal. The only other possibility of manufacturing-induced strain is during the filling operation and the following tip-off from the fill station. Manufacturers do inspect for strain induced during this process, and will reject the bulb if the strain is severe. The polariscope test for strain around the fill tube is not as accurate as that of the envelope because of the optical distortion created by the fill tube. This results in a judgement by the quality-control inspector as to the product's acceptability.

Another cause of bulb explosion is devitrification of the quartz used in the bulb. The quartz used in xenon bulbs is both a chemically stable and a refractory material of pure silica. When this material is subjected to chemical impurities, such as skin oil in a human fingerprint, and then heated, irreversible damage is done to the integrity of the material. The vitreous structure is changed to a crystalline condition, and the material's strength is greatly reduced. This reduction in strength will eventually decay to a point that the bulb can no longer contain the pressure, and an explosion occurs.

Operating a bulb with a very dark envelope will result in poor screen illumination. You will eventually lose a show when it explodes. The bulb envelope is transparent for two reasons: one is to let the light out, and the other is to let the heat out. The envelope on a new, clear bulb can be up to 600 degrees Celsius. As the bulb darkens, this temperature increases because the heat cannot escape the darkness of the envelope.

It goes without saying that one should always check the condition of the lamphouse's exhaust fans and blowers. Most lamphouse manufacturers run extensive tests in the development of their bulb cooling system. Another thing to remember is to clean the dust off the bulb occasionally, using a clean towel free from lint and oil. This will help to prevent external envelope contamination which leads to devitrification.



Clean reflectors and bulbs are essential to a trouble-free presentation.

LEAKER

A "leaker," as the name implies, is caused by a seal failure which allows the xenon to escape from the bulb. This can be detected by monitoring your lamphouse ammeter. A leaker will have higher than normal amperage and lower than normal voltage. It is also signified by low screen illumination. When observing the arc through the observation port, you will notice a much larger flame of bluish color between the electrodes. When inspecting a leaking bulb after its removal, you will sometimes see discolored electrodes, and, depending on the severity of the leak, a white or blue colored envelope.

Three things can cause a seal failure: faulty manufacturing, overheated lamphouse, or mishandling during unpacking or installation. The individual bulb manufacturer knows if they've had a high incidence of leakers in a certain model of bulbs. A good theatre supply dealer

can usually tell if they've returned more bulbs of a certain model than others.

An overheated end seal is usually evident by the discoloration of the bulb's end fittings. While a bulb's envelope requires little if any external cooling, that's not so with the end seals. The highest safe end seal temperature recommended by most bulb manufacturers is 250 degrees Celsius. The reason for this, on both molybdenum and graded glass seal bulbs, is that tungsten and molybdenum oxidize at approximately 300 degrees Celsius. When this happens, the mechanical structure of the refractory metal is destroyed, and it can no longer contain the pressure.

A discolored end fitting does not always mean that the lamphouse, or a lamphouse connection, has overheated the bulb. Inside the end fitting, where you can't see it, is a braze of braided nickel wired to the end of the tungsten or moly-electrode shaft. This wire is there to provide a flex joint between the electrode shaft and the end-fitting. If the bulb manufacturer makes a high resistance, or poor braze, of this wire to the shaft, the seal will overheat and fail. Keep accurate bulb records on the individual systems to see if a pattern is established.

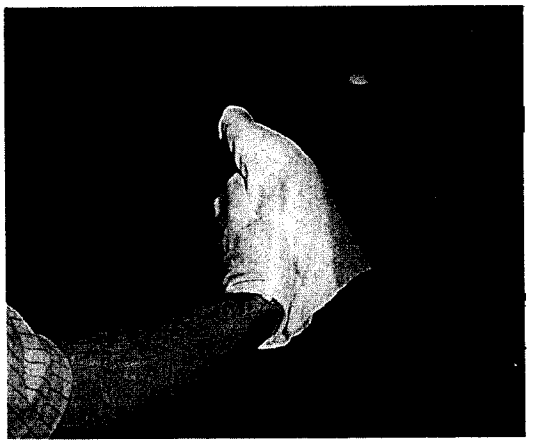
The last method of seal failure is caused mechanically. This occurs frequently during unpacking or upon installation into the lamphouse. Don't apply excessive pressure on the end-fitting of the bulb! The seal is only an inch or so away, and you can easily fracture it. Never install an end cable without supporting the fitting into which you are connecting the lead; that is, do not hold a cathode end-fitting when installing an anode lead.

LOW LIGHT OUTPUT

There are several things that can cause low light output of the xenon bulb. As we've discussed earlier, both a leaker and a contaminated bulb can cause low light output among other problems. However, if a bulb is operating within electrical specifications and is not contaminated, the problem lies elsewhere.

The light output of a xenon bulb falls off drastically over the first 200 hours of operation due mostly to the cathode electrode. With a new xenon bulb, the origination of the arc is much like the point of a pin. There are a large number of electrons confined to a very small area, and the lamphouse's optical system is focused on this point. In time, this pin point widens to one which more closely resembles a ten-penny nail. While the same number of electrons is still present, they are spread over a wider area and cannot be as efficiently collected optically by the lamphouse's optical system. This phenomenon is very evident if the bulb is operated in a micro-radiance fixture which projects the bulb's arc. It is called diffuse arc, and cannot be corrected with the current state-of-the-art technology. Therefore, be certain to install a lamphouse and bulb which will meet your illumination requirements when a bulb has burned for 2000 hours.

In theory, a xenon bulb, when first installed, should meet your illumination requirements when operated at 80 percent of its rated amperage. At the end of its warranted bulb life, the same bulb should meet your requirements when operated at 100 percent of its rated amperage. However, simply raising the current won't guarantee the results. One should check the focus of the bulb in the lamphouse at approximately half life of the bulb warranty, and readjust if required. It's also a good idea to regularly clean your lenses and porthole glass.



If your port glass is NOT lens glass, the use of commercial glass cleaners is acceptable.

If a single sheet of clear glass causes approximately 8 percent light loss, just think what a dirty one must cause!

UNSTABLE ARC OR FLICKER

To analyze this problem, you must first determine what problem you have. This is accomplished by observing the arc through the lamphouse's bulb observation port. You can usually see an unstable arc, while you can only observe screen flicker on the screen. Screen flicker is often caused by the light level being too high; above

twenty foot-lamberts. If you see screen flicker, try turning the power supply amperage down to see if the problem corrects itself. But don't forget what happens if you run the bulb at too low an amperage setting – you may have to de-focus the bulb to maintain proper current settings.

An unstable arc, on the other hand, is a much more complex problem. There are several things that can cause this phenomenon, both within the bulb and within the lamphouse. Let's examine the most common ones:

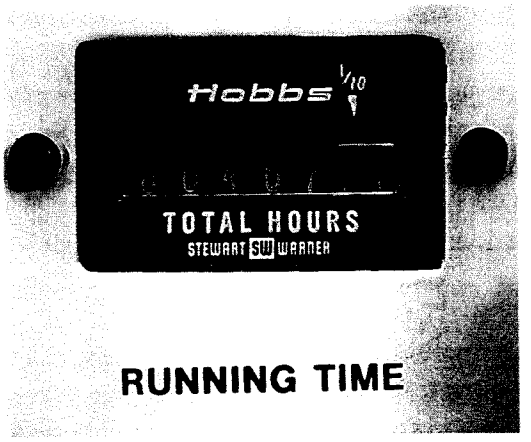
CATHODE ELECTRODE – An improperly processed cathode will not have sufficient surface thoria, and in turn will raise the work function of the electrode. This will cause the ball of the arc to constantly seek an area with a lower work function on the cathode surface. On older bulbs, with more rounded or two-penny looking cathodes, the arc will constantly pop from a diffuse arc to a point source on the cathode as the electrode heats up during operation. Another possibility is an improper vacuum prior to filling the lamp. Oxygen, while we need it to breathe, is extremely detrimental to the cathode electrode. When oxygen is present in an operating bulb, the oxygen molecules will combine with the thoria on the cathode tip to form thoria-oxide, which raises the work function of the cathode.

POWER SUPPLY – A power supply with a high percentage of ripple can also cause an unstable arc. This happens because a theatre bulb is a point source device, and requires pure direct current. You'll never get flicker on a perfect xenon bulb if you operate it on batteries. This, however, is impractical and very expensive. In laymen's terms, ripple is defined as an AC component in the DC line of a power supply. If you're a technician, you can check for this by setting your multimeter on AC and reading the power supply DC output. There are more accurate ways to read this and it makes sense to contact your dealer or manufacturer for their recommendations.

OVERCOOLING – In the earlier days of the xenon lamphouse and bulbs, we were always taught that you could never have too much exhaust or air flow. This is far from the truth! The cooling of a xenon bulb is to prevent seal failure **only.** There are 30,000-watt bulbs in solar simulators and airborne searchlights that operate without cooling the envelope. They have water cooled designs to maintain seals and electrode shaft temperatures at a desired level as dictated by the bulb's design. If the envelope of a bulb is properly designed, it will require no forced-air cooling. By blowing or exhausting large volumes of air over the cathode side of the envelope, you can actually create an unstable condition and affect the integrity of the cathode envelope.

Picture the envelope of your bulb as a chamber which contains heat and pressure – more precisely, a plasma-thermal arc chamber. If one side of the chamber is cooled more than the other, you will set up excessive and even unpredictable gas flow patterns. This high density swirling action can and will interfere with the plasma arc between the electrodes and create annoying arc instability.

POOR ELECTRICAL CONNECTIONS – Another source of possible flicker is a poor electrical connection with or within the lamphouse or power supply. As these connections heat while the lamp is operating, the electrical conductivity of the connection is decreased because of thermal expansion which creates a loose electrical connection. Periodically check the connections when performing routine maintenance.



Make sure the hour counter on your lamphouse is working properly.

RECORDS

BE SMART and keep bulb and lamphouse performance records. When you do encounter a problem, it'll be much easier to troubleshoot if you have some system history. You'll also find that this will eliminate the bulb or lamphouse manufacturer's blaming "the other guy." It will give you the analytical data you need to make a decision on your own.

Pytlak's Practical Projection Pointers

INTRODUCTION

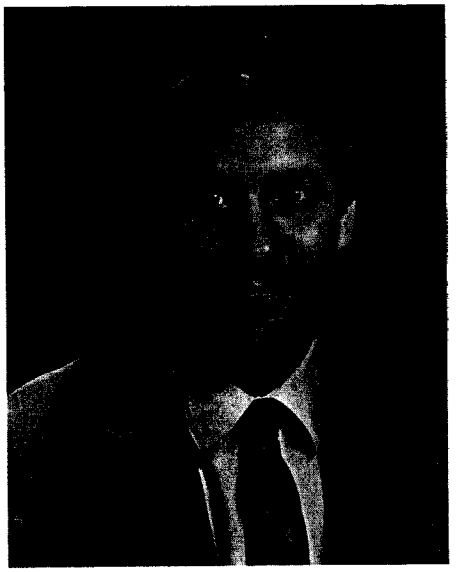
Kodak's "Film Notes for Reel People" is now old enough to vote, having been published since 1976. From its inception, the emphasis has been on helping the people who are the final, and perhaps most important, link in "putting the dream on the screen." As "a technical service for filmhandlers from Eastman Kodak Company," Film Notes has always offered practical advice on the business and technology of motion-picture exhibition.

Long-time readers of this publication remember the first 14 issues were a veritable "how-to-do-it" on topics that included Splicing, Film Handling, Projection Practices, Troubleshooting, Showmanship, the Intermittent Movement, Test Films, Theatre Operation, Film Cleaning, Platters, Light Sources, and the hilarious "Legendary Lexicon of Projection." Fortunately, these "classic" issues are preserved for posterity in the "REEL PEOPLE Collection" (Kodak publication H 50).

Issues 15 through 32 have carried on the tradition, focusing on a variety of topics intended to enhance the theatrical experience. Industry experts have written articles about the present and future technologies of exhibition, and have given a "behind-the-scenes" view of motion-picture production and distribution.

We enjoy hearing from you, and have often published your "Letters to the Editor" where you've commented on our publication, asked technical questions, or simply inquired "Why is it that...?" Expanding upon this concept, we'd like to offer a new column in "Film Notes" that tries to combine the "how-to-do-it" spirit of the early issues with a "mailbag" for your technical questions.

For this ambitious endeavor, we've enlisted John Pytlak, who's spent his entire 24-year career at Kodak working on motion-picture product development and customer technical service. John has an electronic engineering degree from the State University of New York at Buffalo (yes, he's still a Bills fan), graduating in 1970. But his "reel" education in film began as a projectionist at several "hardtops" and drive-ins in the Buffalo area, as he worked his way through school. It was "in the booth" that he formed his life-long love affair with 35 mm film. Over the years, John has worked on a wide variety of projects at Kodak to help improve the quality of the prints theatres receive, and to help theatres put all that quality on the screen. He has served on the Theatrical Projection Technology Comttee of the Society of Motion Picture and Television Engineers (SMPTE) since 1979, including four years as Chair of the committee. After almost three decades of experience, if John doesn't have the answer, he certainly knows someone who does.



John Pytlak

We've decided to call this column **"Pytlak's Practical Projection Pointers."** The idea is to offer practical insight into the technology behind the film you use, and how best to utilize it.

Pytlak's Practical Projection Pointers

I've recently received a print that had both color and black-and-white films spliced together. Prior to this, I have shown each type of film separately (The Elephant Man, Manhattan, ***etc.) without any serious problems. But now, I notice that the focus is different between the color and black-and-white sections, requiring me to refocus the projector. Why does the focus shift? Is it because the film has a different thickness, or because the splices cause the projector gate to "pop"?***

A. I don't think the focus shift is due to the film thickness or splices. Even though there are slight differences in thickness between color and black-and-white print films, or between the various print film manufacturers, these differences are within the "depth of focus" of all but the shortest focal length lenses used in projection. I also don't think the splices are at fault, or you would have seen the gate "pop" and change position with the splices used in your normal color prints.

The real answer lies in the fact that the silver image in black-and-white print film absorbs much more radiant energy than the dye image in color film during projection, causing the film to lie in a different (and usually curved) focus plane as the lens "sees" it. Because black-and-white film print absorbs more infrared energy and heats up more during the instant of projection, its focus plane shifts more than color film. So if you focus on the color print, the black-and-white section will require a different focus setting.

"Because black-and-white film print absorbs more infrared energy and heats up more during the instant of projection, its focus plane shifts more than color film."

The focus difference increases as the amount of energy (and therefore film heating) increases. So the difference will be greater at higher power levels. In other words, you are much more likely to see the difference with a 6000-watt lamphouse than a 1000-watt lamphouse. The difference is likely to be more apparent when using a short focal length lens, which has less depth of focus. Because some of the focus shift occurs as moisture in the film emulsion is being driven off by the film heating, the focus difference is more apparent in freshly processed ("green") prints, or when the humidity is high.

Some things can be done to minimize the focus shift. Be sure your lamphouse has good rejection of infrared energy (dichroic heat filters or reflectors) to minimize heating of the film. Ideally, only visible light should reach the film. Be sure the lamp is optically aligned and adjusted for uniform illumination of the film without any "hot-spots." Adjust the projector gate tension to optimize steadiness, and minimize focus non-uniformity – the SMPTE 35-PA (RP40) Projector Alignment Film is an ideal tool for checking this. Finally, be patient with a freshly processed print since the focus stability will usually improve after it has been projected a few times. Be sure to keep the projection room's relative humidity between 50 and 60 percent RH for optimum projection performance.

Because it absorbs so much more radiant energy, black-and-white film is more likely to suffer heat damage caused by excessive power levels, inadequate heat filters, or misalignment of the lamp, causing "hot-spots." With care, black-and white prints can provide excellent projection performance and screen quality. After all, theatres have been showing them for almost a century!

Why do base-side scratches look black on the screen? Shouldn't a scratch look lighter than the surrounding area, since some film material has been removed?

A. A base-side scratch causes a disruption in the smooth surface of the film. When projected, this "furrow" causes the light passing through the film to refract or scatter away from the area of the scratch. So when the film is imaged on the screen, there is less light in the area of the scratch, and the scratch looks black.

If you routinely see scratches develop on prints shown in your theatre, you should try to find out why the film is getting scratched and remedy it. If your theatre is "first run," the new prints should be nearly scratch-free when you receive them. (You do inspect all prints carefully before mounting them on the platter or house reels, don't you?) If you find any scratches, damage, or excessive dirt during inspection, you should immediately notify the distributor and film exchange. They may be able to provide a replacement print, or at least not hold you at fault when they find damage at the end of the run. Make it a point to look carefully at a few minutes of the film on the screen early in the run, to verify that the print is near-perfect. A few weeks later, look at the same section again to see if any scratches, dirt, or damage has occurred. Ushers or other floor personnel should look

at the picture whenever they are in the auditorium and immediately report any damage to management. Some quality-conscious theatres offer free admission to one or two tech-minded film buffs in exchange for carefully watching and listening to the movies they see and reporting any problems.

If you do find scratches occurring, the orientation and location of the scratch often provides a clue to the cause. Continuous vertical scratches that don't move side-to-side are usually caused by the film running over a burr or other sharp object in an area where the film is being guided by a roller or sprocket (e.g., rubbing against a dirt deposit on the lens in the soundhead). Some side-to-side movement shows that the scratch occurred in an area where the film could wander slightly (e.g., an abrasive particle caught on a web-type film cleaner). If you see short vertical emulsion-side scratches in the same location on each frame, you've probably threaded with too large a film loop above or below the gate, such that the loop beats against the projector housing. Short, vertical, random scratches are "cinch marks," caused when the film rubs against itself when it's wound too loosely. Horizontal cinch marks are usually caused when an unevenly wound roll is flattened. Diagonal scratches that seem to have a repeat pattern usually occur when the film rides up against the flange of a mispositioned guide roller alignment is one of the most common sources of film scratches. Finally, any scratch or dig that seems to have a repeat pattern will often repeat at a distance on the film equal to the circumference of the roller causing it.

Another sign to look for is an unusual buildup of film skivings, powder or other debris. For example, a guide roller that is not turning freely will often have debris generated by the abrasion of the film or roller. If you find the cause of any print damage, fix it immediately. Ignoring it will lead to more damage, unhappy audiences, and paying for a new print.

> *"So spread the word:*
>
> *'Always wind a print emulsion in, or your focus will be out.'"*

When making-up film onto a platter, should the film be wound emulsion-in (emulsion side toward the hub) or emulsion-out?

A. Theatrical release prints should ALWAYS be wound emulsion-in. The Society of Motion Picture and Television Engineers (SMPTE) Recommended Practice RP 39 'Specifications for Maintaining an Emulsion-In Orientation on Theatrical Release Prints" details the reasons for doing this. Work by Kodak in the 1960's clearly demonstrated the improvement in screen image quality to be gained when theatrical prints are wound, used, and stored consistently in an emulsion-in orientation. Consistent emulsion-in winding imparts a slight "core-set" that is favorable to maintaining more stable focus on the screen, resulting in a sharper image edge-to edge, and less tendency for focus flutter or "breathing." Winding the film emulsion-out, even for a short time, greatly reduces these benefits.

Emulsion-in winding is especially important when the film is wound on a reel having a relatively small hub, such as shipping reels. Film wound on the 4-inch hub of a shipping reel takes on much more "core-set" than film wound on a 16-inch platter hub. Winding emulsion-out results in the wrong core-set, lessening image quality.

Unfortunately, old habits die hard. When projectors still used 2000-foot fire proof magazines designed for using flammable nitrate film, the magazine rollers required the film to come off the reel counter-clockwise (emulsion-out). Even though Kodak hasn't made nitrate print film since 1950, and almost all of these old projector magazines are long gone, some film handlers are still in the habit of winding film emulsion-out. By sticking to this outdated habit, they are throwing away the opportunity for putting a sharper image on the screen.

So, spread the word: "Always wind a print emulsion-in, or your focus will be out."

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Rochester, NY 14650, U.S.A.

KODAK Publication No. H-50-33

Printed in U.S.A.
Spring/94

EASTMAN KODAK COMPANY
343 State Street
Rochester, New York 14650-0315

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