



LASER ENERGY 0.87  
PHOTON BOLTS 100

STARFIGHTER

0.87 LASER ENERGY  
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# THE LAST STARFIGHTER

## CAST

**Lance Guest** Alex Rogan

**Dan O'Herlihy** Grig

**Catherine Mary Stewart** Maggie Gordon

**Barbara Bosson** Jane Rogan

**Norman Snow** Xur

**Robert Preston** Centauri

**Christ Hebert** Louis Rogan

## CREW

Directed by **Nick Castle**

Produced by **Gary Adelson** and **Edward O. Denault**

Written by **Jonathan Betuel**

Director of Photography **King Baggot**

Art Director **James D. Bissell**

Production Designer **Ron Cobb**

Film Editor **C. Timothy O'Meara**

Associate Producer **John H. Whitney, Jr.**

Costume Designer **Robert Fletcher**

Music by **Craig Safan**





## “I’M A KID FROM A TRAILER PARK”: BLUE COLLAR HEROES IN OUTER SPACE AND THE AMERICAN DREAM

by Amanda Reyes

On March 23rd, 1983, a little less than a year and a half before *The Last Starfighter* hit theaters, United States President Ronald Reagan gave an impassioned speech regarding the role the solar system could play in keeping communism and nuclear devastation at bay. In this heightened era of the Cold War, the president introduced the Strategic Defense Initiative (also known as SDI; but more popularly coined “Star Wars” just days later). A lofty project, SDI was essentially meant to be a shield that existed in space, and which would work as a force field of sorts against nuclear bombs.

Unbeknownst to the world at the time, the United States and the Soviet Union were just a few years shy of ending their decades-long antagonistic relationship (for a spell, at any rate). But in the early to mid-eighties, the Cold War still loomed large, and World War III remained an underlying anxiety fueled by politics and the media, keeping Americans in the grips of terror as they attempted to look into an uncertain future.

In that same speech, Reagan not only suggested that the United States needed to support his multimillion-dollar scientific (and possibly sci-fi) project, he also made a point to address the young patriots who were doing their part in fighting the Red Scare. In his speech, Reagan commented:

*“Ask around today, especially among our young people, and I think you will find a whole new attitude toward serving their country. This reflects more than just better pay, equipment, and leadership. You the American people have sent a signal to these young people that it is once again an honor to wear the uniform. That’s not something you measure in a budget, but it’s a very real part of our nation’s strength.”*







We saw this kind of youthful patriotism in many of the films that ran during the Reagan years, where young, everyday adolescents resisted communism and oppression. Just look at that spunky group of motley teens in *Red Dawn* (1984). They formed a modest guerilla force to thwart a foreign invasion. There was also the youthful computer hacker in *WarGames* (1983) who challenged the notion that nuclear devastation was an inevitable end point. And, heck, even Kevin Bacon stood up to small town tyranny so he could enjoy the freedom of dancing in *Footloose* (1984).

To put it into perspective, as America neared the end of the 80s, the country was recovering from the devastating losses of the Vietnam War, a recession, and a general distrust with government that had been stewing for some time thanks to Nixon, Watergate and other harmful government controversies. Then, an actor-turned-politician ran for president, Reagan was characterized as an unassuming Midwesterner, who, through hard work and tenacity, found his own fame and fortune. He was a self-made man that was also viewed as “one of the guys.” And, to many, he was the epitome of the American Dream. The films of the 1980s would often mirror similar characteristics in their protagonist.

According to John Bodnar’s *Blue-Collar Hollywood: Liberalism, Democracy, and Working People in American Film*, Reagan attracted support from the working-class denizens of America by concentrating “more on traditional institutions and authorities, morals, and political values like national loyalty and capitalism that had been discredited in the sixties.” The filmic images that support that “return” to life before the counterculture movement run far and wide. Sometimes they celebrate a more innocent time, such as *Back to the Future* (1985), *Peggy Sue Got Married* (1986), and even *La Bamba* (1987). Additionally, many films of the 1980s revere the little guy, embracing self-made characters who always found a way to continue on, even when the chips were down. Titles that fit this mold range from blockbusters such as *Flashdance* (1983) and *The Karate Kid* (1984) to the lesser known *Playing for Keeps* (1986). These films, and so many more, remain grand expressions of how one could reach their dreams if only they try hard enough. To make it all the more poignant, a majority of these movies are led by dynamic and youthful actors. Or, in essence, those young Americans Reagan talked about in his Star Wars speech.

However, *The Last Starfighter*’s sci-fi spin did many of those films one better, because it is an unintentional but astute reflection on the Reagan years, as the president attempted to move us forward while also holding on to the idea that those more innocent times could return. Although the film went into production before Reagan’s famous speech, *The Last Starfighter* works as a companion because of its blue-collar aesthetic and utilization of the then-state of the art technology to explore Reagan’s spectacular space ideologies. Mainly, the film espouses that for the world – and perhaps even the universe – peace might be found in outer space and will come to us via a young (American) patriot (Lance Guest as Alex Rogan). *The Last Starfighter* flies high on that notion, making a great case that the working-class kid from the heartlands can move up the ranks to become a great leader. An intergalactic one, even.

Perhaps writing grand feats of courage comes naturally to *The Last Starfighter*’s screenwriter, Jonathan Betuel. He worked as a men’s adventure novelist before moving into filmmaking. Yet, the male protagonists of his movie scripts never come across as too macho or overbearing. A year after *The Last Starfighter*, Betuel wrote *My Science Project* (a film that would also serve as his directorial debut), and he did much of the same work with that movie’s heroic lead. John Stockwell is Michael Harlan, a lower middle-class kid who is thrust into a dangerous and grand affair when he lifts a “time warp” machine from a junkyard, inevitably opening up a gateway to time travel. He is very much like *The Last Starfighter*’s Alex in that both characters are stuck in the humdrum life of a kid who is expected to go nowhere fast, yet surprises everyone by leading the charge to defend mankind.

Betuel’s fascination with everyday heroes is an unmovable fixture in those two films. In an interview to promote *The Last Starfighter*, the screenwriter told *Starlog* magazine that although his script went through several drafts (fourteen in total), very little actually changed from the original premise about a kid who plays video games and saves the world.



The setting of the film did change, however. *The Last Starfighter*’s director, Nick Castle, said that the film was originally set in the suburbs, but eventually he felt that might be too reminiscent of something seen in a Spielberg movie. Betuel added that at some point, the story was to be told in a desert setting, but that was rejected because audiences might feel a kinship



with those surroundings and the *Star Wars* universe. So, while it came into play later, the trailer park locale ultimately provides a perfect foundation to build *The Last Starfighter* on. It positions Alex into a very distinctive dead-end life, where there's little hope for the future. It is impossible not to champion his grand rise as a hero (and in the course of just two days, no less!). Although he becomes a savvy space traveler, his humble beginnings provide a relatable scenario to many who watch the movie.

Critics honed-in on this magical hybrid of (red, white and) blue collar heroism and sci-fi. In her review for *The Washington Post*, Rita Kempley complimented the "down to earth" direction. Her words offer both a clever play on words, and an astute observation of the focus Castle places on the teen protagonist, Alex. While the visuals are quite grand, the film never loses itself in the myriad of computer effects. Further to this, Lawrence Van Gelder of *The New York Times* mused, "What enhances the dramatic credibility of *The Last Starfighter* and invests it with a good deal of charm is the reluctance of Alex – who has heretofore been determined to avoid a future characterized by pickup trucks, Saturday night beer busts and the local city college – to don the hero's mantle."

Foreign film reviews tapped into these ideas as well. The UK based *Screen International* appraised *The Last Starfighter* as "wish fulfillment for boys, which cheerfully sacrifices all presentations to reality and plausibility to enable the young viewer to imagine himself as a superhero." Likewise, academics also took note. In a reflective essay in a 1986 issue of *The Journal of Popular Culture*, Denis Wood surmised that the film is the quintessential story of "the young kid who makes good."



Betuel's script certainly does its best to ease cultural and geopolitical anxieties through its young, reluctant hero. Guest further enhances that aspect by looking at his character's dilemma as less of a conscious decision on Alex's part than simply understanding the situation and then doing the right thing. In a promotional interview that also appeared in *Starlog*, the actor expresses that Alex may start out reticent but then says, "I really wasn't aware of any 'choice' – if you have to do it, you do it."

In fact, Guest does not want to overemphasize Alex's acts of bravery. In the same *Starlog* interview he comments, "Alex is not a hero in the conventional sense. It's realistic to assume that, put in a dangerous situation, you don't necessarily become a blood and guts guy." The actor's unassuming but acerbic approach to the character added that extra dose of naturalism and relatability to Alex, which further endears him to the audience as a capable blue collar lionheart.

Aside from making the best use of a heartland setting and employing a relatable young hero, there are also heady nods to Cold War imagery, which is seen throughout *The Last Starfighter*. The Kodan Armada's uniforms are red, which brings to mind Russia and the Red Scare. The film is a battle of good against evil, where the evil is an oppressing force that seeks to take over the universe and rule with an overreaching, totalitarian hand. Xur (Norman Snow), the leader of the Kodans, is grandiose, self-centered and cruel. His Armada has no diversity, whereas the Starfighters are inclusive, and feature a myriad of aliens from every corner of the universe. Finally, Ambassador Enduran (Kay E. Kuter), the leader of the Rylans, who also serves as the commander of the Star League, is wise and kind. When the Rylans and Starfighters are wiped out, it's an emotional moment in the film, because it's clear that this democratic society is very much like our own. And now it is in mortal jeopardy and needs to rise up to claim victory.



The studio promoted *The Last Starfighter* by playing into those anxieties and tropes. As Universal Pictures awaited the premiere of the film on July 23rd, 1984, the marketing department filtered all of those complex and perhaps seemingly divergent ideas into a colorful and somewhat stirring poster that promises to tell the story of a "small town boy with big time dreams." To further entice audiences, the tagline is accompanied with an artistic rendering of Alex looking up with a wide-eyed innocence into the cosmos, a beautiful ringed planet nestled behind his flannel shirt and All American teenage good looks. The image and text conjure up all of the aspirations of the working-class American Dream of the 1980s that Reagan so passionately championed, while also opening up our sense of the wonder of space.





And, it is those glorious space set-pieces in *The Last Starfighter* that audiences lovingly remember most. If a major part of the Cold War was a competition between two political ideologies, then there are two layers of rivalry to be seen in the film. One is behind the scenes, the other is onscreen. Theatergoers reveled in the then-contemporary and grand visuals, which showcase the progress the United States was making in the fields of filmmaking and computer technology. But what viewers also saw was a kid from the U.S. who just happens to play a video game better than anyone else in the universe. He symbolizes a Western world superiority.

It is not unusual to use the tableau of sci-fi as a metaphor for liberty. When discussing why he wrote science fiction, respected genre author Theodore Sturgeon remarked, "It gives me almost complete freedom of speech and absolute freedom of thought." Indeed, in her 2004 address to the International Conference on the Fantastic in the Arts (ICFA), genre novelist Daina Chaviano notes, "The fantastic genres, with their overload of symbolic elements, can serve to camouflage ideas that human beings intend to safeguard or disseminate in the midst of social or political chaos inherently opposed to freedom." Freedom of thought, peace of mind and a reason to look up into the stars. In those last, lingering days of the Cold War, all it took was a kid from a trailer park to let us know we could survive our nightmares, achieve our dreams and (live long and) prosper.

*Amanda Reyes is an author, an academic and a film historian. She edited and co-wrote Are You in the House Alone: A TV Movie Compendium: 1964-1999 (Headpress, 2017).*





# THE MACHINERIES OF JOY

by Greg Bear

## Introduction

In October of 1983, I travelled from San Diego to Los Angeles and San Francisco, researching a proposed article for *Omni* magazine. What I saw astonished me... and influenced me heavily when I went on to write the novel-length *Blood Music* and *Eon*. Here was not the beginning of the computer graphics revolution, which had occurred decades earlier, but the beginning of the flowering of that revolution. I could hardly restrain my enthusiasm. I suspect the last few pages of this piece will date badly as time goes by, but they show my frame of mind. And the frames of mind of dozens of other authors, as well; the information age has taken science fiction by storm.

*Omni* never used this piece, although they paid me for it. Nor did they use the hundreds of pictures I gathered, a selection from which would have accompanied it. Many people gave generously of their time, yet never saw their names or ideas in print. I hope this publication pays them back in some small measure.

The circumstances described below have, of course, changed considerably. Digital Productions has changed hands and management; Robert Abel and Associates is no longer an independent company. The revolution has become even more stimulating and promising. Its effects are everywhere.

This article was completed in early 1984.



Ray Bradbury (left) and Greg Bear (right)

## THE MACHINERIES OF JOY

"Dinosaurs!" The artist spreads his arms as if to embrace them. "I need the exact specifications – gridwork layouts of bones, muscles, scale patterns." The artist's office is covered with drawings of spaceships and alien beings, strange landscapes and mechanical diagrams. "If I have those, I can put them into the computer. We can program each muscle, make the skin ripple over the muscles. Tell the computer how they took a step, how they fought..."

And once again, dinosaurs will walk and fight. The artist is living a childhood daydream: he has the power to bring dead creatures to life. Even more remarkable, he has the power – with the aid of dozens of technicians, programmers and fellow artists – to film objects that have never existed in any material form and make them interact with live actors.

But dinosaurs are a future project. The matter immediately at hand is a space battle. At night, within a stark white-walled enclave, the artist, director and technician sit before a video monitor, examining the progressive stages of a non-existent spaceship's destruction. Highly detailed ships – complete with crew – are dueling to the finish. One spaceship is destined not to survive; its hull is disassembled in the first of six boxes on the monitor. The early stages of an expanding blast are overlaid in subsequent boxes.

The artist describes an explosion in space. "I'd like the whole screen to flash white for one frame. Next we see an opaque fireball – fuzzy at the edges – surrounding the debris." He demonstrates an expanding sphere with hand gestures. "Then we ramp it down to transparency as the fireball grows." (To "ramp" is to smoothly increase or decrease any function.) "When the shockwave passes, all the little stuff – gases and tiny fragments – fly past and then we see the big scraps, a little slower, not as much energy." His grin is gleeful now. The director nods in agreement; this is, indeed, an explosion in space, not your usual smoke-and-fireworks exhibit.

The stages of the explosion are being fed into powerful computers, isolated beyond glass walls at the opposite end of the studio in a pristine white-floored environment. Artist, director and technician are playing God games in an unreal universe.

Ultimately, it is all numbers, points charted in a space of three dimensions within a computer. Each number represents part of the position of a pixel, or picture element, millions of which go together to form a shape. It is the computer's duty to keep track of the numbers, and the shapes they represent. Perspective, color, shadow, motion, must all be processed with scrupulous accuracy or the apparent reality will collapse.

The numbers are then converted to signals which can be displayed on a monitor. The pixels assemble, and a spaceship is destroyed, frame by frame. When the result is printed onto film, it will be indistinguishable from very high-grade special effects accomplished with painstaking model work.

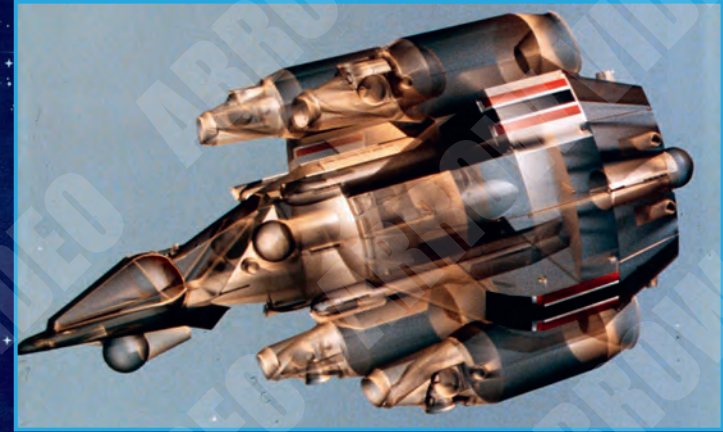
It will look as real as anything else in the finished motion picture. The artist, director and technician are, of course, fictitious, and the scenario is a technological fantasy, not to be realized for years, perhaps decades to come –

And if you believe that, you haven't been keeping track of recent advances in the incredible field of computer graphics.

It is happening now.

The artist is veteran production designer Ron Cobb (*Alien*, *Conan the Barbarian*); the director is Nick Castle (*Tag*, *Skatetown U.S.A.*) and the motion picture is *The Last Starfighter*, a joint Universal-Lorimar production. Under the auspices of Los Angeles-based Digital Productions, headed by John Whitney, Jr., all of the special effects for *The Last Starfighter* are being done by digital scene simulation – computer graphics designed to match reality. Using two powerful Cray super-computers and a phalanx of other machines,

Digital Productions is taking a gamble – some say a big-gamble – by committing itself wholeheartedly to the future.



*The Gunstar from The Last Starfighter, designed by Digital Productions*

The future of computer graphics will be extraordinary. Most of the experts in the field – the best can still be numbered on two hands – agree that we are on the verge of a revolution perhaps more basic and disruptive than Gutenberg's movable type. Communications and education will be fundamentally reshaped. The entertainment industry will experience changes far more drastic than the transition from silent movies to talkies, and talkies to TV.

The power that presently resides in the hands of a knowledgeable few, will soon be available to all.

But first, back to the numbers.

The world of the computer is a very simple one. Everything is broken down into bits, a bit being the information required to answer any question with yes or no; in binary, yes equals 1, and no equals 0. Binary numbers consist of chains of ones and zeros. (In binary, 01

equals one, but 10 equals two.) More elaborate codes have been created to relate letters and symbols to certain numbers – thus allowing computers to display both numbers and text. Other codes relate the positions of glowing dots on a video screen using coordinates much like those on a map. A picture can be “digitized” – broken down into these numbered positions – and put into a computer, which can then manipulate the picture in a wide variety of ways.

A picture can also be formed within the computer by charting key elements on a graph, feeding the computer coordinates and instructing it to draw lines or curves between the points. Mathematical equations which determine fixed geometric figures or curves can simplify the process; the computer can be instructed to draw a circle of a certain diameter around a point, or an ellipse; to trace out a square and expand it into a cube, and so on.

In fact, a “space” is determined within the computer, having three or more dimensions, and any object can be described within that space, given sufficiently detailed coordinates. If the object is simple, like a cone, a “lathe” program can rotate a triangle around an axis to form a cone, or a circle can be turned around any diameter to create a sphere, much as a shape is spun from a block of wood on a lathe. More complex, irregular shapes take more complicated instructions, and much more time. Once the object is constructed in a simple line drawing, or “wireframe,” additional programs can add a light source to give it highlight and cast a shadow. Colors and textures can be “mapped” on its surface. A point of view can be established, and what is not seen from that point of view – the back of the object – can be clipped, making it appear opaque and solid.

The process seems simple enough, but in reality the work involved in creating real-seeming objects on today’s machines is extensive. The most complicated methods of creating objects in a computer – such as a technique called “ray tracing” – can take weeks of computer time. Simpler techniques can reduce the time to fractions of a second, but with a corresponding loss of color, shadow and detail.

Once the object’s numbers have been fed into the computer, the computer knows what the object looks like from all sides, at any distance, in relation to any other object or perspective within the machine’s memory. A non-existent spaceship can be made to zoom past a simulated planet, approach a much larger “mother ship” and dock inside a highly detailed landing bay, all in perfect perspective.

The computer can then display the objects in two dimensions on a video screen or send signals to a printer to transfer images to film. Since the object has actually been mapped in more than two dimensions, the computer can be instructed to project two points of view,

creating a parallax similar to that between our two eyes. The slightly separated images can be combined stereoscopically for a realistic feeling of depth.

If the film image needs to be “squeezed” anamorphically onto 35mm stock for later projection on a wide screen, the computer can do that, as well. Any required lens can be simulated within the machine. In the 1950s, artists and programmers began to pioneer the techniques still being elaborated upon today. John Whitney, Sr. was among the earliest, starting in the late 1940s. He later received the first IBM grant to study computer graphics in detail and was installed in a ground-floor corner window of the IBM building in New York, displaying images for passers-by.

Bill Fetter began exploring the possibilities of wireframe animation at Boeing in the late 1950s and assembled the first computer generated commercial in the late 1960s.

In the early seventies, Ken Knowlton and Michael Noll came on the scene – Knowlton working for Bell Labs, and Noll arranging for the first gallery showing of computer art. Noll’s specialty was simulating “clay paintings” – made with plasticine – using computer images. Many viewers couldn’t tell which were pictures of real clay paintings, and which were simulated.

In the last ten years, the progress has been astonishing; around the world, computers are helping to create images for scientific research, education, fine art and entertainment.

Sometimes the divisions between these categories are erased; the enchanting beauty of a moving computer image can turn a prosaic enterprise – such as stress analysis of pipe joints – into art. The most extensive use of computer animation has been in advertising. Already familiar to TV viewers are the plethora of “neon”-look commercials for banks, airlines and automobile manufacturers. Generically, computer animation relying on line graphics is known as “vector” animation. Using various animation techniques – inside and outside the computer – the lines of these “wireframe” drawings can be made to glow like neon tubes. This look has become so widespread that within the industry it is becoming a cliché, to be avoided if possible. Filling in a wireframe object with color, shadow and texture is called “raster graphics” or “raster” animation. This requires a more powerful computer, such as the Evans and Sutherland, or the Digital Equipment Corporation VAX machines commonly found in commercial studios. Some interesting effects can be obtained by fudging (not a technical term). The surface of an object to be vector-animated can be covered with “cross-hatching,” using more lines instead of full raster graphics. This is known as “pseudo-raster” animation and can be charming, even though it falls in a middle range likely to be used less often as equipment and programming improve.

Crude raster graphics can be judged by “aliasing” – the appearance of the “jaggies” along an object’s edges. Each pixel stands out against a contrasting color, and when the object moves, the pixels can appear to march along the edge. These can be eliminated by coloring alternating edge pixels in shades that mediate between the contrasting colors. The border is softened slightly, and the graphics are said to be “anti-aliased.”

The most powerful computers available to animators – the Cray series (the Cray 1, an expanded version called the Cray X-MP, and a much smaller, even faster Cray 2) usually reside in defense establishments and major research laboratories. Digital Productions is the only private effects studio that owns Crays. The Cray corporation is reluctant to release the locations of all its machines, but it is well known that the Sandia Labs and Lawrence Livermore National Laboratory have a number on hand.



The Cray X-MP supercomputer used by Digital Productions for the special effects of *The Last Starfighter*

By time-sharing – having the computers process their work when not otherwise busy – researchers in several such establishments have done important work programming computers to “understand” and draw transparent objects, lenses and realistic landscapes.

Two of the most prolific of these researchers are James F. Blinn at the Jet Propulsion Laboratory in Pasadena, and Nelson Max at Lawrence Livermore National Laboratories. Blinn’s group at JPL animated the striking computer simulations of the Voyager probes’ journeys to the outer planets, widely shown on network and public television in 1980-81. Nelson Max has worked largely on graphic representation of biological processes. Using his graphics programs, he has been able to predict how molecules will interact before lab tests have been made. Max has also investigated the effects of mutagens on DNA, and modeled the structure of very tiny viruses.

After months or years of painstaking labor, computer artists display their wares at annual SIGGRAPH conventions. (SIGGRAPH stands for Special Interest Group, Graphics, a division of the Association of Computing Machinery, or ACM.) Private individuals, employees of giant research establishments and commercial film studios gather to compare notes and keep up on the latest developments.

C.P. Snow’s “Two Cultures” are inevitably wedded in computer graphics.

Not since Leonardo da Vinci have so many technical disciplines been required of working artists. Not only must they have basic drawing and drafting skills, but they must know at least the rudiments of programming. They must understand how light reflects, refracts and diffuses – and be able to translate their knowledge into terms the computer can digest. The artist can no longer stand aloof from science and math. New techniques can take him to the frontiers of theory. Recent work in the texturing of surfaces has used fractals, mathematical entities capable of generating very complex patterns. Perhaps the most familiar example of computer animation with fractal-generated landscapes is the “Genesis” sequence from *Star Trek II: The Wrath of Khan*, made for Paramount Pictures by Sprockets, the computer division of Lucasfilm’s Industrial Light and Magic.

One of the focal points for computer animators was the Walt Disney production of *TRON*. Information International, Inc., (known as Triple-I), Mathematical Applications Group, Inc. (MAGI), Robert Abel and Associates and Digital Effects all contributed their expertise; yet *TRON* contained only ten to fifteen minutes of full computer animation. The rest was accomplished with conventional special effects and animation techniques.

A great many of the people who worked on *TRON* have now moved on to positions in companies around the country. A few, such as Richard Taylor, are still involved with feature-length motion pictures. Taylor is reportedly hard at work on a film called *Dreamer* for Paramount. In advertising, two of the biggest film companies have made a major commitment to computer graphics. Robert Abel in Hollywood – long renowned

for the beautiful combinations of live action and back-lit animation in his Levi's and 7 Up commercials – assembled a computer graphics division while assigned to do special effects for *Star Trek: The Motion Picture*. Unlike Digital Productions, however, Abel kept all his other special effects techniques, considering computer graphics as another tool, not an end in itself. “A lot of the stuff we do is combination,” Abel explains, “where we combine miniatures and live action with computer images.” Pure computer animation, at present, is more expensive than many other techniques, and in Abel's view, flexibility and variety are necessary to the production of commercial advertising films.

Bo Gehring, in charge of Bo Gehring Associates in Venice, California, originally came to the West Coast to do computer animation tests for Steven Spielberg's *Close Encounters of the Third Kind*. The tests proved unsatisfactory but Gehring stayed on to found his own company – again, with a complete spectrum of techniques at his disposal. Unlike Abel, who began as a documentary film maker, Gehring's roots are in computer graphics, but he agrees with Abel that commitment to one technique is risky. As for getting involved in feature films: “Ninety million dollars is spent each day on advertising in the United States,” Gehring says. “Feature films can't begin to match that level of financing. I'm secure where I am.”

Both Gehring and Abel believe that computer graphics is still in its infancy and will probably have a major effect on all forms of visual communication. For the moment, however, neither is willing to make the leap of faith required for an operation such as that being conducted



Gary John of Digital Productions, with a Ramtek 9460 computer

at Digital Productions. And truthfully, Gehring admits that his financial backing is not equal to Digital Productions', which is supported by Ramtek, a major computer company. “I am a bit envious of what John Whitney, Jr. and Gary Demos have come into at Digital – all that [computing] power. But I'm happy with my situation, and just can't see taking that kind of risk right now.”

Gehring also expresses an interest in digital sound synthesis. “I'm one of those people who has to pull off the road when something really intriguing comes on the car radio. I firmly believe that sound is at least the equal of sight in bandwidth – complexity of information – and synthetic sound is a fascinating area that's barely been explored.” Another of the Big Three companies, R. Greenberg in New York, is rapidly building its computer graphics division.

Computers have revolutionized the film industry in many more ways than computer graphics. Virtually all commercial studios, whether producing advertising or feature films, use computers to control complex camera movements or integrate different elements of photography. At Robert Abel, slit-scan photography is a staple item. The process was originally developed by Con Pedersen and Douglas Trumbull while working for Stanley Kubrick on *2001: A Space Odyssey*. Pedersen now works at Abel, where he supervises other aspects of special effects production, including computer graphics. (Trumbull, interestingly, seems to eschew full computer animation. In his recent film *Brainstorm*, even sequences which appeared to be computer-generated were done using other techniques.)

In slit-scan, a camera is mounted at the end of a long track, at the opposite end of which a piece of flat artwork is masked to reveal only a narrow horizontal slit. As the camera moves forward very slowly, a computer coordinates the motion of the slit up or down on the artwork. The result is a drawn-out image of the artwork, stretched in perspective by the camera's approach.

Computers are also responsible for the many forms of motion-control used to photograph space battles at Lucasfilm and elsewhere. Signals from a camera mount are fed into a computer, which memorizes the camera positions and can then control the camera for repeated passes. Different models, mattes and other special effects elements can be added with great precision.

Computers are even involved in stop-motion puppet animation at Industrial Light and Magic. The “Go-Motion” computerized system was used in *Dragonslayer* to memorize the motions of an armatured miniature dragon as it was manually “walked through” its sequences.



All these elaborations – from slit-scan to Go-Motion puppet animation – are likely to become passé before the end of the century. Whatever the risks, Digital Productions is obviously where the field is moving. But computers have one major hurdle to leap before they dominate. Character animation – whether it be the fluid motions of a Disney cel-animated deer, or a human being – is still very difficult for computers. Computers are happiest when dealing with shapes defined by simple mathematics – planes in perspective, spheres, cones, polygons and polyhedrons. Humans (not to mention Bambi or dragons) are



*Outside the Digital Productions building in Los Angeles, California*

not composed of these objects, at least not at first glance. Living characters are lumpy, bumpy and in constant motion – all parts of them. Muscles shift beneath skin and skeletal angles change. Facial expression is a nightmare of complexity, with hundreds of muscles providing a bewildering variety of shapes – all of them familiar to the viewer, and therefore difficult to fake convincingly.

For the artist, years of study are required to convincingly replicate human and animal shapes. The human mind is enormously more complicated than any modern computer, with millions of “algorithms” all smoothly blending in unconscious processes. How can a computer hope to match the work of a skilled cartoon animator, much less the reality of a human being?

Tim Heidmann, at R&B EFX in Glendale, believes character animation is the stumbling block of computer graphics. “When you think of all the expertise required to get a Disney-type character on film – including the distortion of reality, stretching characters to add life, exaggerating expressions – the problem seems insurmountable.” Heidmann does computer graphics for R&B EFX using a much smaller Hewlett-Packard business computer. The HP manipulates wireframe images which are then photographed and enhanced by hand in R&B’s own small animation studio. The entire system cost under \$25,000. “What computers do best,” he explains, “is what human animators do with the most difficulty – changing perspective, drawing geometric shapes. And what humans do best is most difficult for computers – especially a small system like ours: coloring, shading, characters.” R&B combines the two with ingenuity instead of massive number-crunching.

Digital Productions is hard at work using both ingenuity and brute computing power to overcome the difficulties of animating characters in a computer. Most of this work is under tight wraps of security, but it appears they are building up human and human-like figures by creating “intelligent shapes” which will mimic muscles on fixed skeletal frames. These “intelligent shapes” will be programmed to interact with other shapes – other muscles – around a skeleton, within the constraints of skin.

Motion studies of animals and humans are programmed into their machines to give them parameters within which to work. Ron Cobb explains: “A computer doesn’t know where to stop. If you have a character’s arm swinging, the arm in the machine isn’t real. It doesn’t have an elbow or a shoulder to stop it. It just keeps swinging in a circle until you tell it what the limits are. Then it has the limits in memory, but you have to be very specific, very careful.”

The computer cannot intuit anything. It is literal. Everything must be described in detail. Consequently, the computing capacity and time required to control these figures will be enormous – at first. But the cost of the early stages in labor and money can be compared to research and development costs in any industry. The initial outlay is always greater than the cost of later work.

One small hint of the coming revolution is provided by the locations of two major companies relying on computer graphics. Cranston-Csuri, founded by pioneer computer artist Charles A. Csuri, is located in Columbus, Ohio. Computer Creations takes pride in being based in South Bend, Indiana – far from the advertising capitols of New York and Los Angeles. Electronics can deliver messages and products around the world; in the future, location will be less and less important.

Size will also become less important. With computers, a commercial studio can begin operations with only a handful of creative people. Pacific Data Images, in Sunnyvale, California, has only four employees, yet has already landed major advertising and promotional contracts. With initial costs of less than a million dollars, entrepreneurs like PDI's Carl Rosendahl are already taking advantage of the built-in flexibility of the computer. Costs are dropping, and software is improving, albeit more slowly than hardware. Within ten years, the big advertising companies will be surrounded by smaller, tougher firms with equal capabilities. The bottom-line will then be not money, but creativity. There is no lack of creativity. The computer images and motion pictures produced by artists around the world are dizzying in variety and quantity. California's David Em is well known for his architectural fantasies and abstractions. Paul Allen Newell has animated M.C. Escher-inspired tessellated designs that transform with enchanting smoothness and precision.

Nancy Burson of New York (profiled in *Omni*, "The Arts," June 1983) uses computers to digitally combine photographic images of people and animals. She was responsible for the portrait of Big Brother commissioned for CBS's tribute to Orwell's *1984*. By digitizing and melding the portraits of the twentieth century's worst tyrants, she came up with a hauntingly familiar, somehow benevolent and yet very unsettling hybrid. Much more charming is her mix of woman and cat.

Em, Burson and Newell highlight the successes and problems of presenting computer graphics on the printed page. Em's and Burson's images are static, suitable for magazine reproduction, but the charm of Newell's work lies in motion.

Even more difficult to convey is the wonder of a live computer art performance, where performer and audience are one. Ed Tannenbaum of RaSter Master in San Francisco has installed a performance art center in his city's public-access science center, Exploratorium. A video camera photographs people in a room as they move about and then feeds their images to a computer. The result is projected in real-time (that is, live) on a large screen, allowing infinite varieties of human-machine artwork. Children can dance and paint with their bodies, becoming their own kaleidoscopes.

Educators inevitably become more involved with computer graphics as classroom computers proliferate. Simple graphics programs can teach even very young children how to work (and play) with computers. Today's youngsters will find computers and computer art a part of their lives. This is where the revolution truly becomes powerful.

In one or two decades, at the present rate of progress, computers cheap enough for home use will be capable of graphics even more sophisticated than those being produced by

today's major studios. Graphics buffs will be creating, trading and selling programs to generate different kinds of images – including images of realistic characters.

Eventually, perhaps by the end of this century, a kind of visual typewriter will be possible. Any scene the programmer/artist/writer can imagine will be brought to life using computer animation. As software and hardware advance and become cheaper, and as information and image networks expand, virtually anybody can become a Cecil B. DeMille. The major requirements will be time and talent – not money.

The greatest handicap to cinema at the moment is the dominance of accounting over creativity. Faced with budgets of tens of millions of dollars, studio executives are justifiably concerned that their products should appeal to large numbers of people. The result is often pabulum. Primary creativity is endlessly ignored or second-guessed.

Commercial television networks are even more handicapped; to satisfy advertisers, incredible numbers of people must tune in to their programs. Few artists or writers have ever made anything worthwhile by pandering to the lowest common denominator, yet this is the current state of most of network television.

The printed word allows more freedom. A pencil and a piece of paper are all that is required for expression in print. The production of a book is measured in tens of thousands of dollars for an average press run, not millions. Publishing – for the moment – still allows a great many writers to create personal works. A writer can establish a reputation with only a few hundred or a few thousand steady readers.

Yet only ten to twenty percent of Americans regularly read books. Newspapers and magazines fare better – but less than half of all Americans receive any of their information from the printed word. What we have is a colossal failure of a communications medium – print – to reach the masses.

For many people, print is difficult to assimilate. It has many uses and advantages, but often it cannot convey information as quickly and efficiently as other media. The dilemma is clear. Print offers diversity and individual expression – as well as the active participation of the reader, in imagining and fleshing out what the words convey – but cannot reach as many people as television or motion pictures.

Television and motion pictures appeal to the masses, but more often than not spoon-feed pabulum to a barely conscious viewer.

By combining both print and vision, computers will break the money monopoly and allow many more people to work with "pictorial narratives," a catch-all phrase for the multitude of art forms which will inevitably develop.

Robert Abel sees a future society with individuals becoming more and more isolated, physically, as the electronics revolution allows them to work at home. With increasingly sophisticated entertainment forms, there will be less need to leave home for recreation. With more leisure time, the public will demand more entertainment. And with more artists able to produce complicated pictorial narratives, the demand could well be met with an explosion of creativity – if the audience isn't already conditioned to textureless drivel. If it isn't too late even now...

Take a deep breath.

We're going to enter a possible future, and it will take some effort to get used to it.

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## ABOUT THE RESTORATION

*The Last Starfighter* has been exclusively restored by Arrow Films and is presented in its original aspect ratio of 2.39:1 with 2.0 stereo, 5.1 audio and a 4.1 mix originally created for the film's 70mm release.

The original 35mm camera negative was scanned in 4K resolution at EFILM. The film was graded and restored at R3Store Studios in London. Audio remastering on all audio mixes was completed at Deluxe Audio, Los Angeles.

All materials for this restoration were made available by NBC Universal.

Restoration supervised by James White, Arrow Films

R3Store Studios: Gerry Gedge, Jo Griffin, Nathan Leaman-Hill, Rich Watson, Jenny Collins

Deluxe Audio: Jordan Perry

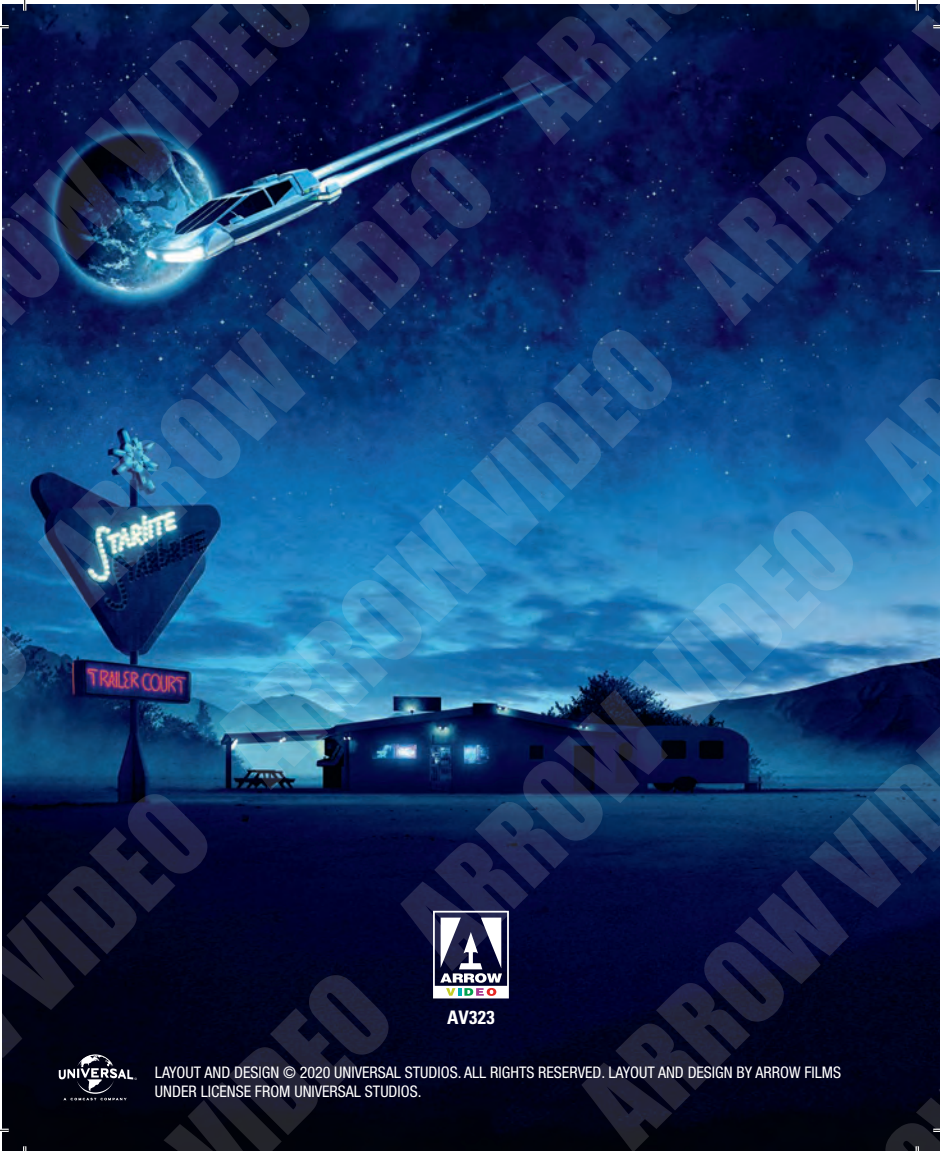
NBC Universal: Peter Schade, Tim Naderski, Jefferson Root, John Edell

## PRODUCTION CREDITS

Disc and Booklet Produced by **Ewan Cant**  
Executive Producers **Kevin Lambert, Francesco Simeoni**  
Technical Producer **James White**  
Disc Production Manager **Nora Mehenni**  
QC **Alan Simmons**  
Production Assistant **Samuel Thiery**  
Blu-ray Mastering **Fidelity in Motion**  
Subtitling **The Engine House Media Services**  
Design **Obviously Creative**  
Artist **Matt Ferguson**

## SPECIAL THANKS

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