

Inside the Magic Factory

by **Alex French** and
Howie Kahn

**The definitive oral
history of ILM,
the special effects
powerhouse that
revolutionized
moviemaking and
changed entertainment
forever.**



A miniature model of the Death Star II from the production of *Return of the Jedi* (1983).

1977
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992

No one wanted *Star Wars* when George Lucas started shopping it to studios in the mid-1970s. It was the era of *Taxi Driver* and *Network* and *Serpico*; Hollywood was hot for authenticity and edgy drama, not popcorn space epics. But that was only part of the problem.

As the young director had conceived it, *Star Wars* was a film that literally couldn't be made; the technology required to bring the movie's universe to visual life simply didn't exist. Eventually 20th Century Fox gave Lucas \$25,000 to finish his screenplay—and then, after he garnered a Best Picture Oscar nomination for *American Graffiti*, green-lit the production of *Adventures of Luke Starkiller*, as *Taken From the Journal of the Whills*, *Saga I: The Star Wars*. However, the studio no longer had a special effects department, so Lucas was on his own. He would adapt, and handily: He not only helped invent a new generation of special effects but launched a legendary company that would change the course of the movie business. ¶ Industrial Light & Magic was born in a sweltering warehouse behind the Van Nuys airport in the summer of 1975. Its first employees were recent college graduates (and dropouts) with rich imaginations and nimble fingers. They were tasked with building *Star Wars*' creatures, spaceships, circuit boards, and cameras. It didn't go smoothly or even on schedule, but the masterful work of ILM's fledgling artists, technicians, and engineers transported audiences into galaxies far, far away. ¶ As it turns 40 this year, ILM can claim to have played a defining role making effects for 317 movies. But that's only part of the story: Pixar began, essentially, as an ILM internal investigation. Photoshop was invented, in part, by an ILM employee tinkering with programming in his time away from work. Billions of lines of code have been formulated there. Along

ALEX FRENCH (@frenchalex) and HOWIE KAHN (@howiekahn) wrote the oral history of The Right Stuff in issue 22.12.

the way ILM has put tentacles into pirate beards, turned a man into mercury, and dominated box office charts with computer-generated dinosaurs and superheroes. What defines ILM, however, isn't a signature look, feel, or tone—those change project by project. Rather, it's the indefatigable spirit of innovation that each of the 43 subjects interviewed for this oral history mentioned time and again. It is the Force that sustains the place.

1.

Origin Story

"Forget the Industrial and the Light—this is going to have to be Magic."

Lucas had been toying with the idea of what he called a "space opera-fantasy thing"—and had even hired artist Ralph McQuarrie to sketch out some of his ideas—but he was hamstrung by technical constraints.

George Lucas (founder): I knew it was going to move very fast, with lots of pans and this giant space battle at the end. Only in those days, you couldn't do that. I thought, "We'd better figure it out." It was destined to be my undoing.

Dennis Muren (creative director): Fewer movies were being made. Occasionally studios would make effects films: an *Earthquake* here, a *Towering Inferno* there. But there was no future.

Steven Spielberg (director, producer): George said, "I'm going to figure this out one month at a time."

Lucas: We hired a handful of people—a lot of young kids, basically. Very few of them had worked on a feature film.

John Dykstra (VFX supervisor): I got a call from George and we met at a bungalow on the Universal lot. He wanted *Star Wars* to feel like it was shot with a World War II gunsight camera, to have that sense of intimacy with the action.

Lucas: I wanted to set up shop in San Francisco, but there was no film processing lab, so John insisted we stay in Los Angeles. We found an industrial warehouse space in Van Nuys, next to the airport.

Steve Gawley (model maker/supervisor): There was no interior; our walls were two-by-fours, Visqueen stapled onto them. Every once in a while we'd get crazy with the music—the big record was Fleetwood Mac's *Rumours*—and you'd have to turn it down because the walls were plastic.

Lucas: We had about 45 people working for us. The average age was 25 or 26.

Charlie Bailey (creature and model maker): Everybody there was an industrial designer or architect or engineer.

Gawley: Across the street was a military surplus store. We bought a lot of used, obsolete things there to use in our models because we were trying to stretch the dollar.

Lucas: We were working on the articles of incorporation and we said, "What are we going to call this thing?" We were in an industrial park. They were building these giant Dykstraflex machines to photograph stuff, so that's where the "Light" came from. In the end I said, "Forget the Industrial and the Light—this is going to have to be Magic. Otherwise we're doomed, making a movie nobody wants."

Dykstra: The warehouse was probably 1,300 square feet and smelled like a gym locker. It was hotter than hell. If you lit a model with 6,000 watts, you could get to 130 degrees.

Lorne Peterson (model maker, model shop supervisor): Somebody found a big



GROOMING BY AMY LAWREN/ARTIST UNITED

When George Lucas set about assembling his own special effects shop, it didn't have a name or a mission—beyond making *Star Wars* happen.

0 7 3

STAR WARS

THE EMPIRE STRIKES BACK

RAIDERS OF THE LOST ARK
DRAGONSLAYER

STAR WARS II: THE WRATH OF KHAN
THE EXTRA-TERRESTRIAL
THE DARK CRYSTAL
POLTERGEIST

RETURN OF THE JEDI
TWICE UPON A TIME

AND THE TEMPLE OF DOOM
STAR WARS I: THE SEARCH FOR SPOCK
THE NEVERENDING STORY
THE EWOK ADVENTURE
STARMAN

THE GOONIES
COCOON
BACK TO THE FUTURE
EXPLORERS
MISHIMA
AMAZING STORIES
STAR WARS: THE BATTLE FOR ENDOR
YOUNG SHERLOCK HOLMES
OUT OF AFRICA
ENEMY MINE

THE MONEY PIT
LABYRINTH
GENERAL CINEMA TRAILER
HOWARD THE DUCK
STAR WARS IV: THE VOYAGE HOME
CAPTAIN EO
THE GOLDEN CHILD

STAR TOURS
HARRY AND THE HENDERSONS
THE WITCHES OF EASTWICK
INNERSPACE
EMPIRE OF THE SUN
BATTERIES NOT INCLUDED
STAR WARS V: THE NEXT GENERATION

WILLOW
STAR TREK ATTRACTION
WHO FRAMED ROGER RABBIT
CADDYSHACK II
STAR WARS: THE MAN AND HIS DREAM
COCOON: THE RETURN
THE LAST TEMPTATION OF CHRIST

THE 'BURBS
SKIN DEEP
BODY WARS
MICKEY - EISNER SPOT
TUMMY TROUBLE
FIELD OF DREAMS
STAR WARS AND THE LAST CRUSADE
GHOSTBUSTERS II
THE ABYSS
STAR WARS IV: THE VOYAGE HOME PART II
ALWAYS

ROLLER COASTER RABBIT
KIKI KUROSAWA'S DREAMS
THE HUNT FOR RED OCTOBER
JOE VERSUS THE VOLCANO
STAR WARS V: THE EMPIRE STRIKES BACK PART III
DIE HARD 2
GHOST
STAR WARS: THE GODFATHER: PART III

MICKEY'S AUDITION
SPACE RACE
ARACHNOPHOBIA
THE DOORS
SWITCH
BACKDRAFT
HUDSON HAWK
THE ROCKETEER
TERMINATOR 2: JUDGMENT DAY
HOOK

STAR TREK VI: THE UNDISCOVERED COUNTRY

THE YOUNG INDIANA JONES CHRONICLES
MEMOIRS OF AN INVISIBLE MAN
ALIEN ENCOUNTER
ALIVE
DEATH BECOMES HER



water tank, and we filled it with cold water. We'd dip in during break time.

Dykstra: At the surplus store, we got an escape slide from a 727. You'd put a little Wesson oil and water on there—it made for a hell of a good Slip 'N Slide.

Gawley: Sometimes in the afternoon we'd duck out with our bag lunch and three golf clubs. In an hour we could knock out six or seven holes, but we ran in between.

Peterson: We also got an oxygen tank. I'd think, "God, it doesn't seem to do anything, just kind of smells different." But after, people in the hallway would ask me, "What are you smiling about all the time?"

Gawley: The studio finance people thought we should shut down. They called us the country club.

Dykstra: Our reputation wasn't stellar, because we were breaking a lot of rules. But at the same time, we were there at 3 o'clock in the morning when those studio guys were asleep in their beds.

Peterson: The shots were not happening very fast.

Dykstra: It was an impossible number of shots for an era in which none of the equipment or the processes that were used to produce the film existed. It was overwhelming. It took almost a year just to get the camera going.

Lucas: The budget for the whole movie was \$9,999,999. The visual effects budget was \$2 million. The camera was probably going to cost \$400,000.

Dykstra: We built cameras using all kinds of weird technology. We built computers. We designed and built our own electronics from scratch.

Gawley: The track for our camera was probably about 3 or 4 feet wide and 40 or 50 feet long.

Dykstra: It was nice of them to name the camera after me, but it was obvious that every one of those guys made some contribution to the system that became known as the Dykstraflex.

Peterson: George was disappointed when he came back from filming in England.

Lucas: Those guys didn't quite understand the critical nature of making a movie. You can't be a day late;

"We built cameras using all kinds of weird technology. We built computers. We designed and built our own electronics from scratch."

it just doesn't work. It all fits together into a giant mosaic. All the pieces have to fall together.

Spielberg: I saw the film in a rough cut. No effects, just black-and-white World War II newsreel footage George had cut in to show where the star wars were actually occurring.

Lucas: We had 800 shots to get through. They'd spent a year and a million dollars and had one shot—a cannon going *boom, boom, boom*. I said, "OK, at least we're on our way." This was in August 1976. The film came out in May 1977.

2.

A New Home

"We're here to do stuff."

The movie was an immediate hit—but Lucas left for a Hawaii vacation soon after it premiered, so he didn't realize the scope of the phenomenon until friends called him a week later. When he returned, he decided to finally relocate his budding effects shop to Northern California. Not everyone would make the move with him, it turned out—including John Dykstra.

Lucas: Before that I was completely burned out, so I didn't really care. But then I began to say, "Gee, I could do the sequels." We got a place in San Rafael and started moving.

Gawley: Twenty people moved up. Our assignment was to set it up again.

Spielberg: On Kerner Street.

Bailey: The sign, which we kept from the business that was there before, said Kerner Optical. But we were under siege. There were people going through our dumpsters at night. Guys would pose as flower deliverers just to get inside.

Cary Phillips (research and development supervisor): Kerner was an absolute dump. But it was infused with this sense of "we're here to do stuff."

Kathleen Kennedy (cofounder, Amblin Entertainment): Jerome's Chocolate Chip Cookies was behind us. The smells would just waft in.

Muren: John was completely different from George. Skilled at the electronic side but sort of a let's-wing-it type.

Dykstra: I wasn't interested in going to San Francisco. I wasn't invited.

Muren: I hadn't heard from George and other people had, so I called his producer, Gary Kurtz. He'd been afraid to talk to me about it because he thought I was in alliance with John. And I said, "I'm not. I'd love to come."

Peterson: 40 years later ...

Spielberg: The person with the most Oscars alive today is Dennis Muren.

J.J. Abrams (director, producer): Working with Dennis is like playing guitar with Paul McCartney. You can't believe you're getting to collaborate with him.

Muren: *The Empire Strikes Back* was the hardest film I've ever worked on. We had to train people to do work that we barely knew how to do.

Lucas: The big challenge on *Empire* was Yoda. We knew how to fly spaceships; the thing we didn't know how to do was have a 2-foot creature make you believe that it was a real live thing and not just a Muppet.

Ron Howard (director, producer): I remember going over to the old warehouses he'd rented, and what they were doing on *Empire* was jaw-dropping. I felt absolutely like the kid who'd gotten into Santa's workshop at the North Pole.

Spielberg: It was just a great place to hang out: mad sound scientists, mad visual scientists, and in between shots we'd go set off M-80 firecrackers between buildings and shake up the whole neighborhood. I was in my early thirties, and it was the most fun playground I had ever been to.



(1) 1:5-scale model of the DeLorean DMC-12 from *Back to the Future* (1985); (2, 4) whip and Ark of the Covenant from *Raiders of the Lost Ark* (1981); (3, 7) articulated puppets of Jetsam and Carmen from *batteries not included* (1987); (5) miniature of Igoe's pod from *Innerspace* (1987); (6) 1:7-scale miniature of the *Messiah* command module from *Deep Impact* (1998).

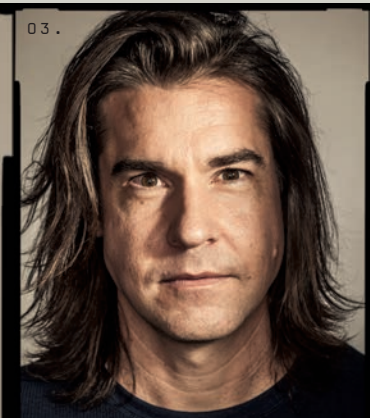
- FIRE IN THE SKY
- JURASSIC PARK
- LAST ACTION HERO
- RISING SUN
- THE METEOR MAN
- MANHATTAN MURDER MYSTERY
- MALICE
- THE NUTCRACKER
- SCHINDLER'S LIST
- THE HUDSUCKER PROXY
- FORREST GUMP
- MAVERICK
- THE FLINTSTONES
- WOLF
- BABY'S DAY OUT
- THE MASK
- RADIOLAND MURDERS
- DISCLOSURE
- STAR TREK GENERATIONS
- IN THE MOUTH OF MADNESS
- VILLAGE OF THE DAMNED
- CONGO
- THE INDIAN IN THE CUPBOARD
- CASPER
- JUMANJI
- THE AMERICAN PRESIDENT
- SABRINA
- SPECIAL EFFECTS (AN IMAX FILM)
- TWISTER
- MISSION: IMPOSSIBLE
- DRAGONHEART
- ERASER
- THE TRIGGER EFFECT
- SLEEPERS
- STAR TREK: FIRST CONTACT
- 101 DALMATIANS
- DAYLIGHT
- MARS ATTACKS!
- MARS TRILOGY SPECIAL EDITION
- THE LOST WORLD: JURASSIC PARK
- SPEED 2: CRUISE CONTROL
- MEN IN BLACK
- CONTACT
- SPAWN
- STARSHIP TROOPERS
- THE GARDEN OF GOOD AND EVIL
- FLUBBER
- AMISTAD
- DECONSTRUCTING HARRY
- TITANIC
- DEEP RISING
- MERCURY RISING
- DEEP IMPACT
- SMALL SOLDIERS
- SAVING PRIVATE RYAN
- SNAKE EYES
- REACH THE ROCK
- MEET JOE BLACK
- CELEBRITY
- JACK FROST
- MIGHTY JOE YOUNG
- THE LAST DAYS
- OCTOBER SKY
- THE MUMMY
- STAR WARS EPISODE I: THE PHANTOM MENACE
- WILD WILD WEST
- THE HAUNTING
- DEEP BLUE SEA
- BRINGING OUT THE DEAD
- SLEEPY HOLLOW
- THE GREEN MILE
- MAGNOLIA
- SNOW FALLING ON CEDARS
- GALAXY QUEST
- SWEET AND LOWDOWN
- MISSION TO MARS
- THE PERFECT STORM
- THE ADVENTURES OF ROCKY AND BULLWINKLE
- SPACE COWBOYS
- POLLOCK
- PAY IT FORWARD
- THE PLEDGE
- SWEET NOVEMBER
- THE MUMMY RETURNS
- PEARL HARBOR
- A.I. ARTIFICIAL INTELLIGENCE



01.



02.

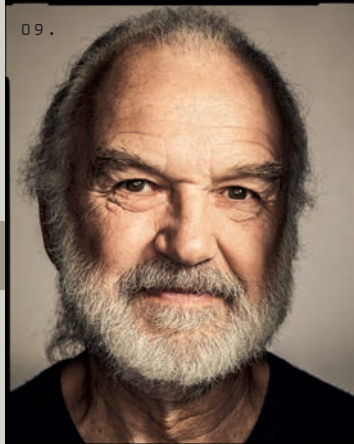


03.

- 01. GARY RYDSTROM
(SOUND DESIGNER AND DIRECTOR)
- 02. LYNWEN BRENNAN
(FILM PRESIDENT)
- 03. AARON MCBRIDE
(ART DIRECTOR)
- 04. BRICE CRISWELL
(SENIOR SOFTWARE ENGINEER)
- 05. JOHN KNOLL
(CHIEF CREATIVE OFFICER)
- 06. ALEX JAEGER
(ART DIRECTOR)
- 07. MAIA KAYSER
(ANIMATION SUPERVISOR)
- 08. SCOTT BENZA
(ANIMATION SUPERVISOR)
- 09. LORNE PETERSON
(MODEL MAKER, MODEL SHOP SUPERVISOR)
- 10. CARY PHILLIPS
(R&D SUPERVISOR)
- 11. STEVE GAWLEY
(MODEL MAKER/SUPERVISOR)
- 12. CHRISTIAN ALZMANN
(ART DIRECTOR)
- 13. J.J. ABRAMS
(DIRECTOR, PRODUCER)
- 14. JEFF WHITE
(VFX SUPERVISOR)
- 15. BILL GEORGE
(VFX SUPERVISOR)
- 16. CHARLIE BAILEY
(CREATURE AND MODEL MAKER)
- 17. DENNIS MUREN
(CREATIVE DIRECTOR)
- 18. BEN SNOW
(VFX SUPERVISOR)



06.



09.



10.



11.



15.



16.



17.



“It’s fascinating to watch people who are as much investigators and scientists as they are artists.”

—J.J. Abrams



3.

The Computer Age

“I had no idea what the hell he was talking about. It blew my mind.”

Given Lucas and Spielberg's friendship, ILM had a strict policy to never turn away the director's projects, so the years after Empire were full of Spielberg productions. That era also saw the beginning of ILM's switch to digital effects.

Lucas: We did *Raiders* and then *E.T.* That's when I realized we could actually make a go at a real company, not just working on *Star Wars*.

Muren: We made it through two years without a *Star Wars* film. I think we did five films in that time. *Dragonslayer* was when we managed to make stop-motion animation look more real than it had before, by putting blurs on it.

John Knoll (chief creative officer): The dragon looked like it was alive. How were they doing that?

Muren: We had a miniature dragon Phil Tippett had made, and we programmed it at slow speed instead of having an animator moving one frame at a time. We got a Technical Achievement Award for that. We called it “go motion.” A lot of people still think it's the best dragon that's been done.

Ed Catmull (president, Pixar): George wanted to bring high technology into the industry, so I got a call out of the blue with the opportunity of a lifetime.

Lucas: I started what I called the computer division: Ed, Alvy Ray Smith, and a whole bunch of MIT guys Ed knew. We brought them in and put them in a building next door to ILM. ILM didn't want anything to do with them.

Catmull: I joined in July of '79. I worked in George's office for the first several months because he was off shooting *Empire* in London.

Lucas: I gave him a list of things I wanted to build: a digital editing system, a sole-purpose graphics computer. It was a visual computer—the Pixar. The first thing we ever did with it was a little piece from *Star Trek II*, when they convert a barren planet into a fertile one.

Catmull: The goal was to get it so you could mix computer-generated images in with live action. The more momentous sequences in that sense were actually in *Young Sherlock Holmes* and *The Abyss*.

Spielberg: John Lasseter created the shot in *Sherlock*, which was the Knight Templar jumping out of a stained glass window in a church and attacking the priest.

Bill George (VFX supervisor): With the stained glass man, there were some really amazing things that gave you an insight into where computer graphics were heading.

It was clear that CG could help make magic—but while Lucas saw the Pixar computer as the way to make Yoda sword-fight, Catmull and his team wanted to use it to create animated movies. Ultimately the two divisions parted ways: ILM kept the team's technology for its own use but sold the computer division to Steve Jobs as the company Pixar. Meanwhile, ILM's stature and reach continued to grow; the company not only strengthened the Star Wars empire with Return of the Jedi, it also handled the special-effects shots for Back to the Future, Cocoon, The Goonies, and many other '80s favorites.

James Cameron (director, producer): ILM was the establishment, the big-bucks guys up on the top of the hill. If you were a big studio and you were doing a giant movie, you went with ILM.

Bailey: With *Howard the Duck*, we went through a huge R&D project finding the right feathers. A lot of us put in more than 100 hours a week. Each feather had to be very carefully trimmed with surgical scissors—there are people credited as “featherers.”

Lucas: Someday, I hope, Marvel will make a new version of *Howard the Duck*, and you'll see it could be a good movie. A digital duck will make that thing work.

Knoll: If you were a new guy at ILM, they put you on the night crew—my shift was from 7 pm to about 5 am. In my free time I was working on an idea with my older brother, a software engineer getting his doctorate at the University of Michigan. Ultimately it developed into Photoshop.

Muren: Somewhere around the time before we made *Ghostbusters II* and *Willow*, it seemed like we really hit a wall. CG had been floating around as this carrot: It was promising all this stuff for like 10 years but wasn't really delivering on it.

Howard: But what a transformation we had to do for *Willow*.

Lucas: In the script, a goat morphs into all kinds of animals and finally into an elderly woman.

Howard: I expected it to be done the way werewolf transformations had always been done, with prosthetics and dissolves and cutaways. Dennis Muren wandered into our story conference one day and said, “I think we could do the transformations a little more seamlessly. It wouldn't be shot in-camera, it would be in the computer.” I had no idea what the hell he was talking about. It blew my mind.

Colin Trevorrow (director, *Jurassic World*): When I was a kid, my dad brought me to Kerner Optical to be an extra in *Ghostbusters II*. I'm not sure if I recognized how special it was at the time.

Cameron: Set the clock forward to 1988. I'm starting to do *The Abyss*. There was one sequence in that film that I imagined but couldn't figure out—the pseudopod sequence, the big water weenie that comes through the ship and makes faces. CG was completely unproven. We didn't know how it could be integrated with film.

Catmull: Pixar, as a new company, bid against ILM to do the effects for *The Abyss*. But Cameron gave the job to ILM, probably wisely, because if it didn't work with the computer then he knew they could do it some other way, whereas we only had one way of approaching the problem.

Cameron: Dennis Muren was curious and excited and wasn't at all how I thought the ILM guys would be. He helped produce this soft-surface character: flowing, rippling, very complex. It became a pivot point in the history of visual effects.



(1, 2) Prototype animatronic heads for the Scoleri Brothers from *Ghostbusters II* (1989); (3) fiberglass mold to create a foam Roger Rabbit for on-set reference; (4) foam E.T. model used for chest-illumination shots; (5) miniature of the alien spacecraft from *Cocoon* (1985); (6) life-size fiberglass Davy Jones for *Pirates of the Caribbean: Dead Man's Chest* (2006); (7) prototype animatronic head/performance helmet for Slimer from *Ghostbusters II*.

IMPOSTOR
 THE TIME MACHINE
 T. THE EXTRA-TERRESTRIAL: 20TH ANNIVERSARY
 BIG TROUBLE
 STAR WARS EPISODE II: ATTACK OF THE CLONES
 THE BOURNE IDENTITY
 MINORITY REPORT
 MEN IN BLACK II
 K-19: THE WIDOWMAKER
 SIGNS
 BLOOD WORK
 PUNCH-DRUNK LOVE
 STAR WARS BOUNTY HUNTER
 HARRY POTTER AND THE CHAMBER OF SECRETS
 GANGS OF NEW YORK
 TEARS OF THE SUN
 THE HUNTED
 DREAMCATCHER
 THE HULK
 TERMINATOR 3: RISE OF THE MACHINES
 THE CARIBBEAN: THE CURSE OF THE BLACK PEARL
 THE LEAGUE OF EXTRAORDINARY GENTLEMEN
 11'9"01 - SEPTEMBER 11 (SEGMENT USA)
 ONCE UPON A TIME IN MEXICO
 TER AND COMMANDER: THE FAR SIDE OF THE WORLD
 TIMELINE
 STUCK ON YOU
 PETER PAN
 ALONG CAME POLLY
 TWISTED
 HIDALGO
 VAN HELSING
 THE DAY AFTER TOMORROW
 HARRY POTTER AND THE PRISONER OF AZKABAN
 THE CHRONICLES OF RIDDICK
 THE BOURNE SUPREMACY
 THE VILLAGE
 SKY CAPTAIN AND THE WORLD OF TOMORROW
 NY SNICKET'S A SERIES OF UNFORTUNATE EVENTS
 ARE WE THERE YET?
 SON OF THE MASK
 THE PACIFIER
 EROS
 THE AMITYVILLE HORROR
 XXX: STATE OF THE UNION
 STAR WARS EPISODE III: REVENGE OF THE SITH
 ADVENTURES OF SHARKBOY AND LAVAGIRL IN 3-D
 HERBIE: FULLY LOADED
 WAR OF THE WORLDS
 THE ISLAND
 JARHEAD
 CHICKEN LITTLE
 RENT
 HARRY POTTER AND THE GOBLET OF FIRE
 ARNIA: THE LION, THE WITCH AND THE WARDROBE
 MUNICH
 CHEAPER BY THE DOZEN 2
 EIGHT BELOW
 MISSION: IMPOSSIBLE III
 THE FAST AND THE FURIOUS: TOKYO DRIFT
 POSEIDON
 PIRATES OF THE CARIBBEAN: DEAD MAN'S CHEST
 LADY IN THE WATER
 THE NIGHTMARE BEFORE CHRISTMAS 3D
 ERAGON
 PIRATES OF THE CARIBBEAN: AT WORLD'S END
 EVAN ALMIGHTY
 TRANSFORMERS
 HARRY POTTER AND THE ORDER OF THE PHOENIX
 RUSH HOUR 3
 LIONS FOR LAMBS
 NATIONAL TREASURE: BOOK OF SECRETS
 TOUCHING HOME
 THERE WILL BE BLOOD
 THE SPIDERWICK CHRONICLES
 IRON MAN
 SPEED RACER
 A JONES AND THE KINGDOM OF THE CRYSTAL SKULL
 THE HAPPENING
 THE LOVE GURU
 WALL-E
 MIRACLE AT ST. ANNA
 TWILIGHT
 THE TALE OF DESPEREAUX



4.

Band of Outsiders

“We did whatever the fuck we wanted.”

The Abyss, as Cameron puts it, was “a first date” with ILM. The second date would be Hollywood’s biggest-ever gamble on computer graphics. Enter a handful of mad geniuses with rock-star reputations.

Cameron: *Terminator 2* was the most expensive film ever made at that point, and it all hinged on this liquid metal guy. So now we’re making, essentially, one of the two main characters of a \$100 million movie a CG effect. That was really scary.

Stefen Fangmeier (VFX supervisor): The graphics department was small, and the spirit was pioneering. These days you can buy all this off-the-shelf software, but back then we invented everything as we went.

Cameron: Spaz Williams and Mark Dippé helped solve these problems.

Mark Dippé (VFX producer): We did whatever the fuck we wanted, and because we were from ILM, people gave us respect.

George: Steve Williams had a motorcycle and played hockey, and all the guys who came in behind him wanted to be Steve “Spaz” Williams. Spaz and Mark Dippé weren’t nerds with glasses working on computers. They were these unusual, freaky guys coming up with new technology and really brilliant ideas.

Steve “Spaz” Williams (VFX supervisor): I used to serenade the machines with my bagpipes so they wouldn’t crash.

Dippé: We made so much noise that they put us in an old sound-mix bay with soundproof doors. We called it the Pit.

Williams: We used to blast Beethoven and Alice Cooper’s *Love It to Death*.

Alex Jaeger (art director): You would go down this really steep stairwell—down into this little dark, windowless room.



Transformers, 2007

Dippé: Robert Patrick, who played the T-1000, agreed to come be our puppet. He had to stand there, like being crucified, while makeup artists carefully painted all these lines on him so we could re-create everything on the computer. We digitized his face! It was so painful, but he was totally game. He went all the way, man.

Fangmeier: There’s that scene after the truck crashes and the T-1000 emerges—we wanted to have the flames reflecting off the alloy skin as the T-1000 walks through them.

Gary Rydstrom (sound designer and director): When the T-1000 goes through the doors in the mental institution? Turns out that if you hold a can of dog food upside down, the sound of that cylinder slowly coming out of the can is the perfect combination of mud, metal, and suction. That sound effect cost 75 cents.

Cameron: It always seemed like it was in the last 5 percent of the process that it came together. You’d see these wireframes, there was always this feeling like, “My God, we’re never going to get this.” And then you’d go from a wireframe to a gray surface. And you’d think, “Well, it’s kind of getting there.” And then? You’d just be shitting yourself.

5.

The Digital Divide Grows

“Stop-motion as a process is extinct.”

Just as T2 work was wrapping up at ILM, another Spielberg production came through the doors, this one involving dinosaurs. As much as The Abyss and T2 had advanced the cause of CG effects, Jurassic Park would become a watershed moment—the demarcation between the days of antiquity and the byte-sized future.

Williams: Dennis Muren took us across the street for lunch and said that there was this huge job coming in from Spielberg—something with dinosaurs.

Phil Tippett (founder, Tippett Studio): After *Empire*, I’d started Tippett Studio. *Jurassic Park* was a co-venture between Tippett and ILM.

Jim Morris (former ILM president): Phil was gonna do the dinosaurs with stop-motion, and we were gonna composite them into the plates with the actors.

Williams: We said, “Why don’t we just fucking build the whole thing in CG?” The authorities here told me not to bother trying. But we knew digital was capable of this shit.

Dippé: We didn’t have the go-ahead. Spaz and Stefen and I were fearless fools.

Fangmeier: We went to the Oakland Zoo and filmed elephants and rhinos just to see how that kind of skin folds.

Williams: I was riding my bike and I ran into a guy from Tippett’s department. He says, “What are you working on?” I say, “I’m building the T. rex.” And he goes, “What the fuck are you talking about? We’re doing that!” He almost got physical with me.

Tippett: I’d done a lot of studying with dinosaurs—I’d made a stop-motion dinosaur film—so I had totally boned up on the latest paleontological ideas.

Dippé: The CG dinosaur was accidentally shown to Kathleen Kennedy [one of *Jurassic Park*’s producers].

Williams: I finished a CG demo on Sunday night, and the next day Muren and Kathleen Kennedy came walking in and the T. rex walk cycle was playing on a big monitor. She stops and goes, “What’s this?” I say, “I’m just messing around, just working on stuff.”

Dippé: After Kathleen saw the test, the decision was | CONTINUED ON PAGE 104

CONFESSIONS OF A SHOPAHOLIC
STAR TREK
TERMINATOR SALVATION
TRANSFORMERS: REVENGE OF THE FALLEN
HARRY POTTER AND THE HALF-BLOOD PRINCE
JONAS BROTHERS: THE 3D CONCERT EXPERIENCE
SURROGATES
AVATAR

IRON MAN 2
THE LAST AIRBENDER

I AM NUMBER FOUR
THE ADVENTURES CONTINUE
RANGO
BEAN: ON STRANGER TIDES
SUPER 8
FORMERS: DARK OF THE MOON
COWBOYS & ALIENS
HUGO
POSSIBLE - GHOST PROTOCOL
THE ULTIMATE 3D BATTLE

RED TAILS
THE AVENGERS
BATTLESHIP
CLOUD ATLAS
PARANORMAL ACTIVITY 4

IDENTITY THIEF
G.I. JOE: RETALIATION
PAIN & GAIN
THE GREAT GATSBY
STAR TREK INTO DARKNESS
NOW YOU SEE ME
THE LONE RANGER
PACIFIC RIM
RED 2
WORLD WAR Z
SAVING MR. BANKS
R.I.P.D.
ELYSIUM

NOAH
LONE SURVIVOR
THE WINTER SOLDIER
THE AVENGERS: AGE OF EXTINCTION
LUCY
THE MUTANT NINJA TURTLES
THE PARK: ULTIMATE ENERGY
UNBROKEN
SELMA

THE AVENGERS: AGE OF ULTRON
JURASSIC WORLD
TERMINATOR GENISYS
AGENT 47
ANT-MAN
TOMORROWLAND
THE MUMMY: THE GHOST DIMENSION
SPECTRE
STAR WARS: THE FORCE AWAKENS

STAR WARS: THE FORCE AWAKENS

STAR WARS: THE FORCE AWAKENS

STAR WARS: THE FORCE AWAKENS

*OTHER PROJECTS MAY BE IN PRODUCTION
BUT HAVE YET TO BE ANNOUNCED



Orgrim, an orc from director Duncan Jones' upcoming film *Warcraft* (2016).



Inside the Magic Factory

CONTINUED FROM PAGE 81

made to show it to Steven. Dennis brought it down to LA and projected it for Steven at Amblin.

George: They had the T. rex chasing the raptors.

Lucas: The test blew everybody away. People cried.

Spielberg: The fluidity of the running cycles was such that there was no comparison—even with go-motion. I just said, “Well, stop-motion as a process is extinct.”

Trevorrow: I had a friend who worked at the Grand Lake Theater in Oakland, and the night before *Jurassic Park* came out we sat in the middle of this empty, massive movie palace and had a special screening all for ourselves. I went in as a somewhat jaded 15-year-old who thought he knew how everything worked, and I came out as a kid marveling at the adventure that we were all taken on.

6.

Flooding the Zone

“Once you had digital, there was no end to what you could do.”

“It was like a giant switch was thrown overnight,” Ed Catmull says about Jurassic Park’s effect on Hollywood. CG began to spread everywhere, with movies being green-lit on the strength of a single test shot. Projects once thought impossible became possible—and for Lucas, that meant his long-imagined but never-realized Star Wars prequels.

Lucas: I never thought I’d do the Star Wars prequels, because there was no real way I could get Yoda to fight. There was no way I could go over Coruscant, this giant city-planet. But once you had digital, there was no end to what you could do.

Bailey: When the CG started up, we all panicked. It was like, “Oh my God, these guys can put us out of business in about a year.”

Tippett: It was catastrophic for me. All my skill and craft was thrown out the window. There was no way I was going to work on a computer.

Bailey: But then they generated so much more interest in special effects that we got even more work.

Tippett: That necessitated bumping me upstairs, operating more in an animation supervisory capacity.

Williams: The technology was in its infancy, and we had a chance to shape it—but that became fucking Casper the Friendly Ghost.

Aaron McBride (art director): I didn’t think much of *Casper* at the time, but it had the first digital star character of a feature-length film.

Kennedy: ILM did a proof-of-concept shot for *Twister*. The minute we took that shot into the studio and they saw it, they said, “Done. We want to make it.” We didn’t even have a script yet!

Ben Snow (VFX supervisor): We probably got up to around 100 staffers by *Casper* [1995] and *Twister* [1996]. Doing *Dragonheart* [1996], it got to 200. By the time we did *Star Wars: Episode I* [1999], we’d gotten up to a thousand.

George: By the third prequel, almost all of the environments and everything were all done on the computer.

Muren: For *Phantom Menace*, George wanted us to produce 2,200 shots in a year and a half. And you just think, there’s no way you can do it. And then he says, as he usually does, “Well, just think about it,” and he walks out.

Knoll: People don’t give George the credit that he deserves. The work he did on the prequels enabled a kind of filmmaking that has kept the industry alive.

Jaeger: The company grew to more than 1,200 people.

Gretchen Libby (executive in charge of business development and global strategy): We had to create new spaces for people to work. We brought in triple-wide trailers.

7.

The Bay Effect

“It was nuclear-level screaming.”

In the early 1980s, a teenager named Michael Bay had a summer job at Lucasfilm, filing artwork. Two decades later he would become ILM’s most ... hands-on collaborator.

Spielberg: Michael Bay is the most demanding special effects director ever. When we do the Transformers movies, Michael lives at ILM with them. He just goes up and camps out there.

Michael Bay (director, producer): They’re always thinking about story, that’s what I like about ‘em. It’s not just paint-by-numbers there. It’s a very involved shop.

Jaeger: I’ve worked on seven of his films now. It’s come to the point where he asks for me, like, “Make sure Alex takes a look before you guys

send it out.” But on *Pearl Harbor* I was just “the guy.” I didn’t have a name.

Bay: *Pearl Harbor* was the first time I worked with ILM.

Jaeger: At the beginning of the process he came at us like, “I want to see real explosions, real planes, real ships.” We built a 35-foot-long battleship with teak decking, but as the model was getting prepped, we developed a computer-generated version.

Bay: We filmed 20 real planes, but we would’ve never been able to do the shots without making those digital planes.

Jaeger: In one scene where we fly over the USS *Hornet*, there’s supposed to be a whole deck full of B-25 bombers. We only had two on the real aircraft carrier. We sat down with Michael and said, “Pick out which one is the real plane and which ones are the CG planes.” And he’s like, “I was there, I shot this.” He probably looked at it 10 times, and he’s like, “Well, the first one’s gotta be real because you wouldn’t put a fake one first.” “Nope, it’s CG.”

Bay: After *Pearl Harbor*, George Lucas wrote me a note saying we’d raised the bar at ILM.

Phillips: There is a Michael Bay incident that looms large in our culture. We’d gotten the original concept art for Optimus Prime, and we started building a model.

Bay: A lot of artists worked on Optimus’ face. Getting it right was very important. But it’s like a bad face-lift. And I’m there meeting with the artists and we can’t figure out why it doesn’t look right.

Phillips: One of our technical directors—the artist who designs how parts move relative to each other—is a guy named Keiji.

Bay: Keiji wasn’t even on Optimus’ face, but he had a meltdown.

Keiji Yamaguchi (technical animator): I wanted Optimus Prime to look like a hero, but he didn’t, and I exploded. It was very gentle; I wanted the transformation to be huge, like a wrestler in a sumo ceremony. I said, “You’re insulting the Japanese idea of animation.”

Phillips: Nobody talks to Michael Bay like that.

Bay: I just smiled and I’m like, “Oh my God, I want you to do Optimus Prime.” So he took it and fixed the face. And he also was the genius who helped us figure out how to take these 10,000 parts and make them transform.

Jeff White (VFX supervisor): It’s equal parts technology and artistry.

Wayne Billheimer (VFX executive producer): The second *Transformers* was my first real working relationship with Bay. I went into a couple of early preproduction meetings with him where I began to get what was going on: “I’m going to shoot it, I’m going to give it to you guys, and you guys are going to have to come up with some stuff. It’s going to be brutal.”

Bay: It has gotten heated a few times. Directors like me love our crew and we love the people we work with, but we push 'em and push 'em and push 'em.

Billheimer: There was a point toward the very end of production when he lost it. He had just come from a screening with Jerry Bruckheimer and didn't have a complete third act. He called me, screaming: "I just saw a movie that I can't fucking release!" It was nuclear-level Bay screaming. All I could do was scream back at him. There was a good five minutes of screaming along those lines. The next day he goes, "That was a fun little yell yesterday."

Bay: They never let you down.

Billheimer: He gets very hot very fast, and very swears, which is always entertaining.

Phillips: He's a tyrant. He's a nonstop string of obscenities. He'll berate you and tell you you're an idiot. But he always makes your shot better.

Billheimer: And the movie makes a billion dollars.

8.

Raising the Bar

"The technological doorway to the future has been crossed."

In 2005 the company moved from San Rafael to the Presidio of San Francisco. Its legacy is well cemented, but as effects houses continue to send work overseas, ILM increasingly seems like a rarity in its world. Age has also brought maturation: Decades and many Oscars removed from its Animal House-like beginnings, ILM has sought to bring more women into its ranks of artists and engineers. Yet its ambition—like its innate enthusiasm—remains unchanged.

Gore Verbinski (director, producer): ILM does cost a little bit more, but they're like the name-brand pharmaceutical: They're willing to find the cure. ILM has an R&D department.

Colette Mullenhoff (research and development engineer): There are five women in R&D today. At one point I was the only one.

Lynwen Brennan (president, ILM): I was so happy to see Colette get a standing ovation at the Sci-Tech Awards a few months ago. That's really huge.

Verbinski: It's like Xerox PARC or Imagineering in its heyday.

Brennan: Am I happy that there is still this gender bias within the industry? No. But I am happy to see it's changing. I just think it'll take a while.

Scott Benza (animation supervisor): Nobody can understand from a financial standpoint how this made sense for us, to buy some of the most expensive land in the state right here in the Presidio. But it was George's desire to create a state-of-the-art facility in a beautiful place

for the people that work here.

Muren: We're in a national park. It's crazy.

White: I can see the Golden Gate Bridge from the office. I drive over it every day, and I see it get destroyed a lot in our movies. If a monster is coming, it's coming here first.

Muren: The other effects houses are still working in an industrial park somewhere, because the margins are so low on doing this work. A lot of companies have gone out of business.

Roger Guyett (VFX supervisor): Digital Domain has struggled on. Rhythm & Hues filed for bankruptcy. CafeFX went out of business.

Phillips: There were three times in my 20 years here that I've almost soiled myself looking at a challenge we were going to take on. The first was the concept art for *Star Wars: Episode I*. The second time was Davy Jones in *Pirates of the Caribbean: Dead Man's Chest*.

Brice Criswell (senior software engineer): We needed to create some type of procedural algorithm that could describe the different emotional states of the tentacles.

Verbinski: Davy Jones' tentacles were a very big struggle.

Criswell: What it turned into was a system that was useful for all sorts of things, like doing the destruction simulations in *Avengers*.

Joss Whedon (director, *Avengers: Age of Ultron*): ILM really has been our introduction to the everything-is-possible version of fantasy filmmaking.

Christian Alzmann (art director): The sleight-of-hand tricks that they use are just mind-blowing. Lorne Peterson would tell me how he made foam rocks behave like real ones on *Wild Wild West* and I'd almost get a nosebleed from trying to process the physics in his head.

Phillips: The third time I almost soiled myself was seeing the concept art for the film we're working on now, *Warcraft*; it's the most amazing work we've done in the 20 years I've been here.

Duncan Jones (director, *Warcraft*): I think we recently rang the bell on having less than a thousand shots to go. That was a good thing to hear.

Guillermo del Toro (director, *Pacific Rim*): When I visit it's always work-related, but we're all raised on pop culture and *Cinefex* magazine and Cheetos.

Rian Johnson (director, *Star Wars: Episode VIII*): When I was in high school, somebody gave me a copy of this ILM coffee table book called *The Art of Special Effects*. I almost burned my house down because of that book.

del Toro: We geek out about Hammer horror films. We go model shopping in San Francisco. I always come out with 20 or 30 models.

Johnson: My friends were doing a *Back to the Future* parody, and I decided I was going to recreate the tire trails behind the DeLorean. Genius that I am, I soaked strips of paper towel in gas-

oline and laid them out in a line behind this big model car of the DeLorean that I'd built in my parents' garage. I don't remember how I got the fire out, but I almost destroyed my family's house. And now I'm doing *Star Wars*. That's how you do it.

Maia Kayser (animation supervisor): My first exposure to ILM was watching *Jedi* with my dad. Then I started here as an apprentice working on *Attack of the Clones*—and now I'm working on *Star Wars* again. It has a special meaning 30 years after that first time.

Muren: For every show I've done, I have convinced myself the work was obsolete. That was an intentional thing. If there's another film out next summer, I don't want to be reminded of the last one, even if the theme's the same. It's up to me to find some way to make that different.

Trevorrow: Harsh top light has often not flattered the dinosaurs, but in *Jurassic World* they're very naked and out in the open—it took that encouragement from Dennis for us to be willing to let these dinosaurs have sunlight hit their skin and not add any additional effects to mask them. It helps the movie feel intensely real.

Lucas: The technological doorway to the future has been crossed. We went from the silent era to the sound era, and now we've done it again. Now that we're digital, I assume we will stay digital for at least 50 years.

Muren: I don't know what the next one is, if there is another one. Everyone says hologram. I say, "Show me."

Lucas: Everybody says, "Oh, you're going to replace actors." You can't replace actors. We've created duplicates, clones, but they can't act. They're a computer, for God's sake.

Abrams: If you think back to what was done in the *Star Wars* films, it unbridled people's imaginations. That of course fueled the business at ILM because they were being approached more and more to keep raising the bar.

Doug Chiang (executive creative director, Lucasfilm): Everybody has that attitude of "no one has ever done it, but let's do it." Why not? If there's going to be a first, let's be the first.

Abrams: Every time you work on a project, they will have just learned something based on the project that preceded you. It's fascinating to watch the evolution of a group of people who are as much investigators and scientists as they are artists.

Spielberg: I always thought that if ILM had run the space agency we'd have colonized Mars by now.

Lucas: Every one we did there was a moment—whether it was the very first one or the very last one—there was a moment where they said, "This is impossible, we can't do this." And I said, "That's my job. My job is to make you do the impossible." ■