WING COMMANDER
SPACE ACE ENGAGEMENT
ARTICLE BY KEVIN H. MARTIN

Space warfare has been a staple in science fiction literature since the era of pulp magazines, but with relatively few exceptions — most notably the *Star Wars* and *Star Trek* films — motion pictures have steered well clear of this subject matter. In recent years, only *Aliens* and *Starship Troopers* have chosen to explore the subgenre. *Aliens* related thematically to America's involvement in Vietnam, with technology-dependent marines being routed by essentially unarmed foes, while *Starship Troopers* embraced an openly fascist government's defense of earth against monstrous bugs. Eschewing such political fare, the Fox Filmed Entertainment release of *Wing Commander* — replete with elaborate combat scenarios, armadas of aircraft-carrier-like capital vessels and swarms of fighter spacecraft — elected to evoke the feel and sensibilities of a World War II naval epic.

Wing Commander first took flight a decade ago as a CD-ROM computer game created by Chris Roberts, who would ultimately take the reins of the feature film as well. The interactive first-person adventure, released by Origin Systems, followed the exploits of young Confederation lieutenant Chris Blair as he dueled in his fighter spaceship against a catlike alien menace called the Kilrathi — a storyline that would be retained for the motion picture years later. The first two *Wing Commander* games featured animated characters; but with the 1994 release of *Wing Commander III: Heart of the Tiger*, computer gaming evolved further, incorporating live-action video segments. After Origin was acquired by Electronic Arts, Roberts' next *Wing Commander* entry continued the cutting-edge nature of the series, becoming the first computer game to include 35mm live-action. More recently, *Wing Commander V: Prophecy* proved so expansive in scope that production of the game required an

Nearly three hundred digital effects shots were produced by Digital Anvil for Wing Commander — *directed by Chris Roberts, creator of the popular computer game upon which the film was based.*

eight-figure budget — more than half of the $27 million figure allocated to Roberts for making the feature film.
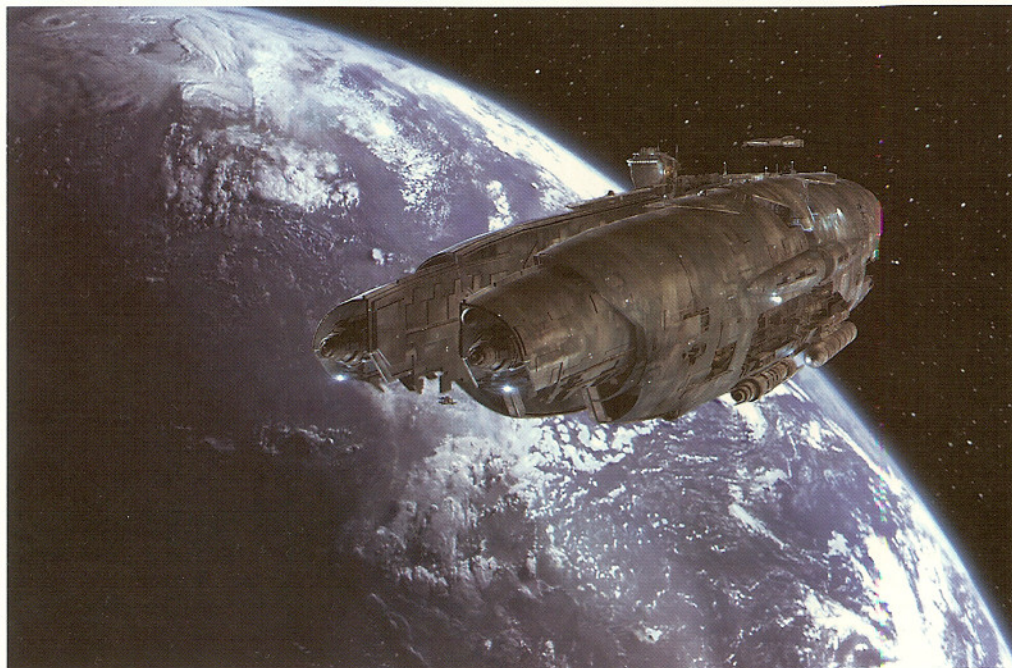
Roberts began development on the feature while still working for Electronic Arts. The film's deliberate retro look — featuring spacecraft that bore a strong resemblance to aircraft, battleships and submarines — arose from the director's desire to do a World War II movie in space. "I wanted to see spaceships going toe-to-toe, slugging it out and blowing up," Roberts remarked. "I hadn't seen any movie pull out all the stops and deliver that kind of action since *Return of the Jedi*. Fortunately, production designer Peter Lamont got on board with this approach right away, showing up with ten huge illustrated volumes containing blueprints

and detail of various warships."

In addition to pulling double duty as co-writer and director, Roberts employed his own newly formed company, Digital Anvil, to handle the 290-shot digital effects load. Time-Slice Films joined forces with Cinesite London to create a fresh spin on the 'frozen-time' look popularized in recent commercials. Animated Extras was hired to provide animatronic and prosthetic creature work, while Digiscope wrangled an array of 2-D effects. Pacific Title/Mirage Studio was called upon to render the film's opening sequence.

Before the notion of handling the majority of effects in-house took hold, a number of effects vendors, including Boss Film Studios, were invited to bid the show by the film's producer, Todd Moyer of No Prisoners. Two days after Moyer received its bid, Boss went out of business. Suddenly there were a number of very talented artists faced with unemployment. Moyer snapped up Chris Brown, Thomas Dadras and Erik Strauss immediately, hiring them as the film's visual effects supervisors and effects line producer, respectively.

The initial team of ten effects artists at Digital Anvil was to double during production — not too sizable an increase, given the heavy effects shot

The merchant ship Diligent *passes through a hypermass jump point that instantly transports the craft through space for a distant rendezvous with the gargantuan capital ship* Tiger Claw.

Rapier fighter spacecraft. In addition to the sets dominating Carousel's stages, the production also made its presence known in the Hotel Interconti-nental Luxembourg, where an online editing bay and CGI shop were established, as well as a T1 line that linked them to Digital Anvil's headquarters in Austin, Texas.

Overall, the DA visual effects thrust was a fully digital effort utilizing Alias/Wavefront Maya. "I'd always wanted to do a film with all-digital effects," said Roberts, "and the space environment really lent itself to CGI, since we could show audiences things they'd never before seen. With space, there isn't the same issue that arises when doing modern-day landscapes digitally, where a certain measure of artificiality destroys the illusion." Without the resources or manpower to fully utilize traditional production pipelines, DA established a unique hierarchy for producing effects shots. While the digital effort, overall, was headed by Tom Dadras, individual artists would sometimes take on all as-pects of a given shot, first modeling a ship, then animating, texturing and lighting it, an approach that led to a certain pride of ownership.

Since the Rapier fighters would be featured ex-tensively in the film's numerous CG space battles, the Rapier mockups in Luxembourg became the focus of an extensive series of measurements to ensure accurate CG replication. An abundance of other spaceships seen in the movie existed only as computer models. Although concept artist Ron Cobb performed some spacecraft design work early on, the look for these vessels was determined prin-cipally by the art department, which drew inspira-tion from the stacked and layered look of vintage Japanese battleships. Under the guidance of super-visor Mark Woollard, a staff of nineteen British modelmakers built several spaceship conceptual models. Built largely from polystyrene and detailed through the time-honored method of kit-bashing, these models were never intended for the screen or even to be scanned, instead serving as stylistic jumping-off points for the DA team's digital model-ing process. "The art department models stayed on our desks as reference," stated digital artist Scott Peterson. "We maintained the overall proportions and shapes, but couldn't really incorporate the details because they were a little underdeveloped

load. The fledgling firm's first task was to produce a trailer for the as-yet-unshot film. Much of *Wing Commander*'s colorful approach to outer space was worked out while creating the trailer, which also succeeded in its principal goal of generating inter-national presales — a key to securing the picture's multi-investor financing.

Taking advantage of a film subsidy available in Luxembourg, the filmmakers chose to mount their main unit shoot in that country, on stage facilities owned by the Carousel Picture Company. The num-erous spacecraft interior sets built there ranged from an enormous flight deck to cramped fighter

cockpits, all taking form under the eyes of Peter Lamont and supervising art director Charles Lee. Stylistically, the various sets kept to the utilitarian, 'exposed-innards' look pioneered in space films such as *Silent Running* more than a quarter of a century ago. Visible ducting and pipes wended through the overheads and behind an array of Nokia flat-screen LCD monitors — units on which video playback supervisor Harry Jarvis displayed three hundred monitor graphics generated by the French company Cryo. Decades-old British aircraft called Electric Lightnings were purchased and modified severely to serve as the film's full-sized

The Rapier fighters and the aircraft-carrier-like flight deck from which they launch were designed to impart the sense of a World War II naval epic.

— what looks good on a three-foot model won't necessarily work to represent a ship six miles long." While the concept model approach was used for several key spaceship designs — most notably the Confederation capital ship *Tiger Claw*, a Broadsword bomber, the merchant ship *Diligent* and a Kilrathi Snakeir vessel — other spaceships needed to fill out the warring space fleets were designed wholly at DA, a process that continued through to the end of postproduction.

The Confederation space vessels reflected a utilitarian World War II sensibility that contrasted strongly with the organic, buglike Kilrathi space-craft. The differing looks were further defined by color, with the alien craft painted in warmer hues. Although Chris Roberts was determined to keep the ship and creature concepts apart from their lower-budget gaming origins, one aspect of the designs done for a game did make its way into the movie. "The art department had hit on a tri-wing design for the Kilrathi Dralthi fighters that featured fold-up wings," Chris Brown recalled. "These were very organic, fitting well within the design parameters, but they just didn't work dramatically. We went back and sampled from all the wings of spacecraft used in the *Wing Commander* games, eventually settling on a knife-and-dagger form."

Extensive modeling of the ships was essential to creating credible space imagery. "Our approach was to build everything," Peterson stated. "Rather than bump-map all of the pipes and fixtures — an approach that would never have held up, as close as we'd be getting to the ships — we actually built little radar units and all the various panel cut-ins with geometry. It's important to include recognizable shapes and forms to which the viewer can relate. Applying that thought to the whole model resulted in a credible six-mile-long spaceship." To further enhance the scale of the ships, the armor-plate hull surfaces required additional geometry to break up specular highlights. "We built in linear bevels to create these specular breakers. Wherever there was a ninety-degree turn on the hull geometry, we'd chop it off and make it into a linear bevel. Even the smallest forms were beveled to add that bit of depth. It's hard to get specularity to work across any flat surface; so we'd build a slight slope, then push and pull to create irregularities in the surface." Since some of the single-ship files ran

to between sixty and seventy megabytes in size, to save on rendering times, closeup details and off-camera geometries were simply switched off once the digital camera had pulled away.

For continuity, texturing was usually handled by the modelers themselves. "We scanned in live-action plates to get real metal textures," Peterson said, "so our bump-maps featured this grainy kind of metal coloring, and we used projection mapping to ensure a consistent look all over the ship's hull. This coloration worked stylistically because we didn't need some futuristic material — these were functional, utilitarian *metal* ships. Lighting-wise,

the ships often fell into *2010* territory, with a very hot-looking sun side and a very cold side — therefore, details either blew out or went unseen. To keep the dark side from going completely black, we put in many running lights and let spill from the open landing bays illuminate these areas, adding color and depth."

Animatics for the production's space exteriors were rendered quickly at near-video resolution, with most shots becoming available for viewing on an Avid within two minutes. Even so, Chris Brown insisted the animatics be projected on a big screen. "A monitor can't fully duplicate the big-screen look

and feel," related Brown. "Being able to view even the roughest of ship and planet graphics through a half-decent video projector made a big difference in my ability to evaluate movement, appearance and composition."

The film begins with Kilrathi vessels attacking Pegasus, an asteroid colonized by earth's Confederation forces. With Digital Anvil cranking out a huge number of finals during the last month of post, Brown turned over the opening sequence to Pacific Title/Mirage Studio. "Pac Title also took later shots of the *Tiger Claw* setting down on an asteroid," said Brown. "In both instances, they worked from ships and backgrounds DA provided." PTM supervisor David Altenau used RenderMan to render the DA elements, a decision that led to a slight difference in look from the Maya-rendered cuts handled by Digital Anvil. "RenderMan had a really crisp look, as opposed to the soft near-glow that comes off the Maya renders. Since the Pac Title shots did not intercut directly with our stuff, the difference wasn't anything objectionable. The system had some initial bugs, which took Alias a while to rewrite, but the look we got with the Maya renderer was worth the wait."

With the asteroid's defenses smashed, the aliens are able to steal a crucial piece of equipment – the NAVCOM computer – and the colony soon falls to the overwhelming firepower of the Kilrathi. Chris Roberts was intent on bringing feature-film-quality visual elements to the *Wing Commander* universe, and the physical appearance of the Kilrathi was no exception. "When we did the first games, the level of graphics quality available resembled what you'd see on Saturday morning cartoons," Roberts observed. "On our later live-action games, we utilized animatronics, but that approach didn't jibe with my idea of the Kilrathi as big cats – I wanted them to be able to *move* like cats. Unfortunately, when you have a man in an eight-foot-tall suit, that kind of motion is not readily achievable. Ideally, the film's Kilrathi would have been full-blown digital creatures, but time and expense made such an approach impossible."

Roberts instructed Nik Williams of Animated Extras to avoid viewing any Kilrathi developed for past *Wing Commander* games. "Chris' original brief for us was to create feline Samurai," said Williams. "Descended from cats, the Kilrathi had since lost their facial hair and learned to walk upright. The principal challenge with the Kilrathi suit design – which was developed by Pauline Fowler and Julian Murray, who sculpted several third-scale alien pro-

totypes over a like-sized figure – was to disguise the human form within." Towards that end, the Kilrathi warriors sported stylized armor with an exoskeletal shell, which served to mask the points at which a human performer's knees and elbows bent. The costumes were constructed largely from fiberglass, with a chain-mail-like, foam-lined fabric providing flexibility in the midsection, hips and knees. Knee and ankle joints were hinged mechanically, with stilts utilized to make the performers both taller and mobile.

Two members of the Williams team, Mark Jones and Graham Riddell, played the Kilrathi admiral and captain, while fifteen additional Animated Extras crew members accompanied them to Luxembourg. The group's duties included dressing the performers and operating animatronic functions built into the heads of the three principal Kilrathi. These allowed snarling lip movements for dialogue scenes and featured nictitating membranes that could cover the eye from either side, in addition to a standard eyelid. More rudimentary animatronic heads were used for two midground Kilrathi, with the remaining background creatures produced as straightforward static masks.

Foam latex was selected over silicone for the manufacture of Kilrathi skin appliances. "With all the stunts and explosions going on," said Williams, "it was going to be too easy to tear silicone, which can be rather difficult to repair. With all the bullet hits involved, there was a lot of on-the-spot rigging. Fortunately, we took all the molds along with us so the chest pieces could be remade after special effects supervisor Harry Wiessenhaan's crew blew holes in them. We would pack blood bags and guts inside, then cover the bullet hits with a thin layer of plaster painted to match the armor."

Aboard the flagship *Concordia*, Admiral Tolwyn (David Warner) is notified of the Pegasus disaster. He realizes the Kilrathi fleet can now penetrate behind Confederation lines and will soon have a clear path to earth unless a capital ship can be brought in to oppose the alien menace. The action switches to a merchant vessel outward bound from earth, the *Diligent*, captained by Paladin (Tcheky Karyo). Also aboard, and fresh from the academy, are Blair (Freddie Prinze, Jr.) and Marshall (Matt Lillard), en route to their first assignment – the capital ship *Tiger Claw*. While imagery garnered by the Hubble Space Telescope served as a jumping-off point for the more distant and colorful environments seen later in the film, matte paintings of earth, Venus and Mercury drew on reference materials obtained

from NASA's website. However, those images wound up being enhanced rather extensively. "There were only six or seven shots of earth at the beginning and end of the film," Chris Brown said, "which was fortunate because creating credible views of earth is tough – the real thing looks like bad matte work. The NASA channel can manage because everyone knows that their stuff is real, but that same kind of imagery won't play in a feature."

Diligent receives a message from Tolwyn that must be delivered to *Tiger Claw*. Blair, partially descended from genetically engineered forebears, has inherited an extrasensory perception of space-time. Paladin puts the young officer's innate talent to good use, allowing him to co-pilot the *Diligent* through jump point Scylla – a stellar hypermass that bridges different sectors of space almost instantaneously. "When we were figuring out the rules for this space environment," Brown related, "it was decided that pulsars – rotating neutron stars, the stuff of collapsed suns – would be used for the entry and exit points we'd see our spaceships make their hyperspace jumps through."

Generating appropriate imagery for the stellar phenomena proved to be a time-consuming process. "Maya was still a beta version at that point," said digital artist Pauline Saab, "so we were lacking tools and didn't have proprietary software – there weren't any programmers to help us write stuff for particle effects. We combined Maya with older Alias product to achieve the pulsars and nebula seen in the film." The DA particle work was blended with transparent image planes and geometry-deforming animated texture maps, and then combined with the ship elements using Wavefront Composer. While entering and exiting jump points, the CG spaceships required interactive lighting to tie them into their environments. To accomplish this, a blurred image of the jump point was projected onto the ship to provide the proper colors and textures.

Three separate hyperspace jumps are shown in the film. The *Diligent* jump was handled primarily through exterior views of the streaking ship, while a later shot of Blair executing a jump in his Rapier fighter combined a zoom-in/dolly-out closeup with *Innerspace*-like light ray animation emanating from his face. A third jump, seen from inside the *Tiger Claw* bridge, utilized Time-Slice, a variant on the 'frozen-time' effect that has been popularized in a number of television commercials. Tim MacMillan, owner of Time-Slice Films, had recently completed work on the NBC miniseries *Merlin* in Europe, and

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Chris Brown met with him to view a demo reel.

In the past, frozen-time had been achieved via two different methods. One required mounting between one hundred and three hundred cameras in an arc around the subject, then laboriously registering each still image produced to the one following it. The other approach used fewer cameras, with morphing software creating in-between frames, but this process introduced distortions and often produced a diffuse and underdetailed look.

MacMillan's rig obviated the need for dozens of cameras and morphing. The unit was a curving arc of machined aluminum onto which were mounted 120 Zeiss lenses, facing inward. Film was threaded behind the array of lenses and along the length of the aluminum structure, which had a camera magazine at one end and a take-up reel on the other. "It was like a big box camera," Brown commented. "Tim just popped the rig's front cover to capture a whole arc of images through those Zeiss lenses simultaneously. There was some flexibility built in, as well — the cover could be opened incrementally along its length, allowing for shooting speeds between one and fifty frames per second. To capture the frozen moment on the bridge, we cut a mouth-shaped opening in the front of the set, put the rig on the end of a Phoenix crane, and then extended it right into the set. The beginning and end of the shot take place in real time, with our choreographed frozen moment occurring in mid-take." The Time-Slice footage went to Cinesite London — MacMillan's choice for all post work — where the aspect ratio was modified to conform to *Wing Commander*'s Super 35 format.

After emerging successfully from the hyperspace jump, *Diligent* makes her approach to *Tiger Claw*. "The big ships are really like central characters in this film, so the shots that introduce them required a lot of attention," stated digital artist Rhett Bennatt. "*Diligent* comes in from the top of the screen with *Tiger Claw* in the distance. We follow *Diligent* as it goes right down the length of this enormous capital ship. Then it stops and

Ablaze with interactive illumination, a Rapier approaches the jump point, created with particle systems and animated texture maps.

turns toward the larger ship as big doors open up to receive it. It's about a thirty-second shot that establishes scale and shows you everything in lingering detail."

Real-world imperfections were incorporated to make shots like this lengthy approach read as both spectacular and photorealistic. "When the *Diligent* is on final approach to *Tiger Claw*, we built a deliberate operator error into the move," Chris Brown said. "The camera overshoots, continuing to track along after *Diligent* has stopped and begun its descent. Then the camera corrects, looking back and down at *Diligent* as the smaller craft enters the landing bay." The landing bay/flight deck area of the *Tiger Claw* was constructed full-scale, but the Luxembourg stage was too short for the flight deck to be built in its entirety. This necessitated redressing and reshooting the set to produce two different plate elements that Digiscope seamed together, doubling the length of the set.

Tiger Claw enters a star system containing a brown dwarf sun, asteroid belt and Jupiter-like planet. This colorful environment was largely the creation of digital artist Mark Goldsworthy, who had also developed jump point Scylla. "Mark did a tremendous amount of R&D for us," digital artist

Rodney Brunet related, "plus more than seventy animatics. His brown dwarf star started out as a background painting for the original presentation trailer, but Chris Roberts loved it so much that a good deal of the film's action wound up being centered around it."

While on patrol in their Rapiers, Blair and his wing commander, Deveraux (Saffron Burrows), encounter a Kilrathi communication ship near the brown dwarf. After an aerial dogfight, the pair destroys two of the Dralthi fighters. Chris Brown directed second unit for the show. "I took a CYA approach to the Rapier fighter cockpit stuff," said Brown, "shooting everything three different ways. We utilized a half-cockpit for tight closeups, while medium shots were done from outside the Rapier mockup, looking in at the pilots through the cockpit glass, with a translight mounted behind for the background." Five generic nebulas were generated at Digital Anvil, then passed to the production art department, which produced the translights. A mesh screen was placed between the Rapier and the translight, softening the background and suggesting greater depth. These translights were also utilized for scenes on the bridges of *Diligent* and *Tiger Claw*, for angles that included only a sliver

Earth forces square off against Kilrathi invaders in a number of large-scale battles sweetened with pyrotechnic explosions and digital shockwaves.

of window in frame. "The translights saved us from an unmanageable number of greenscreen shots — I know I'll be using them again and again on future shows." For the third angle, the camera was moved back further from the mockup, which was mounted on a gimbal built for the taxi scene in *The Fifth Element* and shot against greenscreen.

The bold, hand-held look of the live-action was carried through to the digital space exteriors. "*Top Gun* had some terrific aerial dynamics, which served as inspiration," said Brown. "We decided to let the smaller ships blow right into camera while adding camera shake, as if a shockwave of air has

buffeted the camera operator. Of course, there's no air in space; but the visceral nature of this approach served the story best. Adding heat-ripple when a ship's engine passed close by was another thing we lifted from that film."

Another deliberate nod to the past took place whenever the Rapiers launched from the flight deck into space. "As they clear the deck, the fighters drop, making a little dip before flying off," noted digital artist John Ford. "This was reminiscent of the motion made by a plane after it's catapulted off the deck of an aircraft carrier. Then there's the clam-shell maneuver *Tiger Claw* performs as these huge

hinged sections of the ship fold over the runway flight decks — it's the deep-space equivalent to battening down the hatches and securing for battle." Rapiers returning from combat missions to either touch down safely or crash into the flight deck were wholly the province of Digital Anvil. "There wasn't any money to throw one of the full-size ships down the set or blow it up. So we did the landings and crashes with CG ships, adding them to the live-action flight deck."

Seeking inspiration for the movement of the juggernaut capital ships, Digital Anvil viewed documentary footage and studied the war films *Tora! Tora! Tora!* and *Midway*. "After viewing these films," Brown stated, "Chris Roberts was adamant about holding on shots of these big ships coming across screen for a *long* time. That was more daring an approach than I was at first comfortable with, but in the end these long-duration shots worked very well, and they went a long way toward establishing the necessary sense of spectacle."

This sense of spectacle — in the best *Victory at Sea* tradition — is particularly well illustrated partway through the film, when *Tiger Claw* is led into a trap and badly damaged during the ensuing battle. This sequence, along with the action in the movie's climactic scenes, featured vessels firing broadsides into one another, thus requiring extensive pyrotechnics to capture the grandeur of mighty ships in combat. Initially the idea had been to shy away from this scientifically inaccurate approach, since in reality, flames and fireballs would not long exist in the vacuum of space. "Pyro has been used extensively in space films, even prior to *Star Wars*," Chris Brown remarked. "So a lot of R&D went into developing an alternate look. But none of it worked for our traditional, World War II kind of story. Our R&D didn't go entirely to waste, however, since the digital shockwave accompanying the pyrotechnic blasts only came about because of it. The idea was to do something in the vein of *Star Trek VI*'s exploding planet shockwave, but then supplement it with rippling effects that enhanced the scale." Brown budgeted a pyro shoot into the schedule, but upon returning from Luxembourg, he discovered that the Digital Anvil team had created a viable and much less costly alternative. "They'd been experimenting with Pyromania's package of explosions on CD-ROM,

serrated skin pieces on its body. Then I developed a procedural graphic interface that allowed us to type in the speed, tension and force needed to rip it apart. It took about two months to figure out how to do all that."

T-Rex: Back to the Cretaceous concludes with an equally impressive, albeit smaller-scale, effect as Ally walks away from the fossil egg that launched her time-travel adventure. Behind her, the camera zooms in for a closeup as the egg rocks, cracks and finally hatches. A slimy baby T-rex emerges, leaping directly at the audience and freeze-framing in the film's final image. Matthew Hausman supervised the egg effects, an entirely digital sequence. "The tracking was amazing," remarked Phillips. "There were stacks of papers on the table, and we scanned some of those so that as the baby T-Rex breaks out of the egg, he slips on the loose paper and it moves accordingly. That worked well because you really buy that one is tied to the other. Interaction was the key."

Nominally educational, visually stunning and wholly entertaining, *T-Rex: Back to the Cretaceous* proved beyond a doubt that the very visceral experience of large-screen stereo in combination with dynamic computer generated visual effects makes for a powerful result. Already in production for its next Imax 3-D show, *Siegfried and Roy: The Magic Box* — which features a full twenty minutes of CG — L-Squared Entertainment hopes to position itself as one of the premier companies doing large-format pictures. "Things are really changing in the large-format community," said Jini Dayaneni. "More and more theaters are being built, and with films like *T-Rex* there is an opportunity for commercial enterprises to make their money back. That will, in turn, allow us to have bigger budgets."

For Brett Leonard, the inevitable drive toward feature-length Imax fare — particularly in stereo — holds infinite possibilities. "We're definitely going to be pushing for more character development in the medium and in the pictures that we do at L-Squared," Leonard commented. "With Imax 3-D you get something that you can't get in any other medium — scale *and* intimacy. To me, it fulfills the promise of pure cinema."

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and their tests were looking great. Rodney Brunet had tailored a number of the shots to make these generic explosions work for us in the context of our scenes."

Brunet began with a reference explosion from the Artbeats digital film library, then proceeded to add both geometry and particle effects. "The explosion would begin on an image plane *within* the ship's geometry," Brunet said. "That kept it from looking like a 2-D comp with the blast pasted over the ship. Then I did a lot of filling-in with particles that gave the blast some density." Another aspect to the space battle was the energy shield surrounding the ships. "The shields are initially transparent, but as they're pummeled, they grow weaker and become increasingly more visible. Eventually they are worn down to the point that missile strikes can pass right through them and impact the hull." To distinguish between the two warring fleets, the color of pyrotechnic hits was varied, with Kilrathi vessel hits reflecting the aliens' green atmosphere, while exploding Confederation ships registered the more traditional blue and yellow fireballs.

Creating the appearance of physical damage to the capital ships required additional modeling. "Rather than use texture deformation, we chose to break part of the digital model, then build an interior piece that could fly out in response to the ship taking a missile hit," commented Scott Peterson. "To build in this specific kind of battle damage, we were mostly pushing isoperms around. Isoperms are to NURBS models what quads are to polygonal models, a kind of construction history — once a given shape is built, the isoperms can be picked off the model and moved to form curves or other complex shapes elsewhere."

Blair joins a raiding party that storms the Kilrathi communication ship. In a pitched battle between man and Kilrathi, Confederation forces prove victorious, recovering the stolen NAVCOM and uncovering the Kilrathi fleet's plan of attack. Blair next takes his fighter through a jump point to warn Admiral Tolwyn's armada. "It became clear to us that the Confederation armada wasn't big enough," said Peterson, "so a cruiser-class vessel was added to beef things up. Since there wasn't time to sketch out ideas, the ship really took shape on the moni-

tor as opposed to being worked out in advance. We immediately opened Maya and started building. Maya's ability to reference the models was really nice — a ship that was only fifty or sixty percent complete could still be plugged into the animatic for lighting and effects tests. Then, as the ship developed further, whenever we loaded the model for another test, Maya would automatically update to show the current level of development. This allowed the animator to work out timings and resolve move issues without having to wait for the final version of the model."

Pursued by the Kilrathi Snakeir, Blair heads toward the Scylla jump point, maneuvering adroitly around the hypermass while the larger vessel is caught by the immense gravitational forces and destroyed. Tolwyn's task force masses around the jump point as the Kilrathi ships emerge single-file. The Confederation ships then vanquish the invasion fleet — ending the immediate threat posed by the aliens and concluding the film.

After the effects were delivered to Fox in late 1998, many of the personnel hired for *Wing Commander* remained at Digital Anvil, setting to work on a new slate of gaming, feature film and commercial effects projects. Others, including supervisor Chris Brown, joined producer Todd Moyer's startup effects facility, based at the No Prisoners offices in Santa Monica. There, preproduction would soon commence on a feature based on the *Battlestar Galactica* television series.

For Chris Roberts, *Wing Commander* succeeded not only in transposing his gaming vision of space combat to film, but also proved to be a learning experience. "If I knew then what I know now..." Roberts reflected. "Well, I'd probably have been a bit less ambitious. I now know the kind of time and effort necessary to make a film of this scope. The picture would have looked slicker with more time and money, but I'm proud to have brought it in at this price, and proud of the finished product." With a fresh proliferation of space sagas on bookstands, and new interactive space battle games being developed as successful, ongoing series, the space war film will have ample source material to draw upon for some time to come.