SFX – Tricks of the Trade
The Beginning 1895-2006

1890s
Motion pictures are invented, and filmmakers find magic in the movies.

1895 The Lumière Brothers debut the cinématographe, showing the first projected moving pictures to an audience in Paris. The Lumières thrill early audiences with documentary fare like "Feeding the Baby." Reportedly, patrons at a screening of "The Arrival of a Train" flee the theater in terror, fearing that the locomotive would burst through the screen.

1895 Alfred Clark of the Edison Kinetoscope Company figures out how an actress can be decapitated without losing her head for "The Execution of Mary Queen of Scots," reputed to be the first special effect. The substitution shot becomes an effects standard.

1898 French magician George Méliès begins making films for his magic act, using camera tricks like multiple exposure, miniatures and stop-motion animation, earning him the title of "grandfather of special effects." He produces more than 500 films, including "A Trip to the Moon" (1902). He made up and invented the film medium as he directed, including double exposure, the substitution shot, actors performing with themselves over split screens, miniatures, stop-motion, and use of the dissolve. He also pioneered the art of film editing.

1900s
Special effects become a moviemaker's staple as films move from documentaries to dramatic stories, and the basic arsenal of trick techniques is established.

1900 A Railway Collision
one of the earliest attempts to realistically re-create a large-scale railroad disaster by using miniature scale models; the film depicted two trains speeding toward each other on the same track, and colliding on the embankment.

1903 Edwin Porter's popular "The Great Train Robbery" features matte shots to composite two separate images, placing a shot of a train into the window of a station. He incorporated parallel editing, innovative camera movements, location shooting, jump-cuts or cross-cuts - and this early special effect - a composite made of two separate images. The in-camera matte effect was of two separately filmed segments: the interior of a train station and the window (where a shot of a passing train was matted).

1906 Humorous Phases of Funny Faces
Historically and technically, this was the first short, animated film (in other words, the first fully-animated film ever made). It was made by newspaper cartoonist J. Stuart Blackton, one of the co-founders of the Vitagraph Company.

1906 Edwin Porter directs "The Teddy Bears,"(a variation on the Goldilocks and the three bears story) one of the earliest stop-motion animation films. A short sequence of frolicking teddy bears, just over a minute in length, takes 56 hours to animate.

1907 Norman O. Dawn pioneers the glass shot for motion pictures, a gag that remains in the filmmaker's arsenal today. For "Missions of California," Dawn's innovation enabled directors to save money by only building a portion of a set and filling in the rest with a painting. Dawn later invents the stationary matte, the foundation of a technique allowing two shots to be combined in one.

1907 Richard Murphy creates a mechanical eagle for "The Eagle's Nest," the forerunner of today's animatronic creatures such as ET and Jaws. The stuffed eagle kidnaps a baby and battles the hero, played by silent director D.W. Griffith.
1910s
The movies become increasingly popular—and special effects more elaborate—as sophisticated moviegoers demand bigger and better.

1916 Frank Williams invents a traveling matte system to allow moving characters photographed against a monochromatic background to be separated as an element and combined with a different background. The technique is later refined as blue-screen photography.

1920s
The major U.S. and European film studios establish effects departments to accommodate the demand for visual and mechanical effects.

1923 The Ten Commandments
This early Cecil B. DeMille epic used primitive special effects techniques - the parting of the Red Sea was accomplished by filming water as it poured down two sides of a U-shaped tank, and then running the film backwards - to make the water appear to divide. The illusion of keeping the walls of water separated was accomplished by slicing a slab of jello in two and filming it in closeup - and then combining (or double-exposing) it with live-action footage of the Israelites walking into the distance and the Egyptian chariots in pursuit.

1924 The Thief of Bagdad
This early film used state of the art, revolutionary visual effects (for its smoke-belching dragon and underwater spider, to the flying horse and magic armies arising from the dust) and displayed legendary production design.

1925 Willis O'Brien is technical director of "The Lost World," for which he animates 49 prehistoric animals with stop motion. Astonished critics wonder if the creatures are real. The 'creature feature' story was based on Sir Arthur Conan Doyle's 1912 adventure/romance fantasy. Willis O'Brien, later famed for King Kong (1933), was responsible for this pioneering film's first major use (primitive) of stop-motion animation in a feature film - especially the sight of a brontosaurus running wild in the streets of London, and knocking down people with its tail. O'Brien used small-scale models that were filmed frame-by-frame on miniature sets and landscapes. Live action and stop-motion animation would be combined by putting the two negatives together. This film also used the technique of a traveling matte (the process of adding a moving element to a frame so that it could be separated as an element and combined with a different background).

1925 The $4 million epic "Ben-Hur" is released. The ill-starred production begins with location shooting in Italy and is recalled to the studio, amid skyrocketing costs and rumors that extras were killed in the filming of a sea battle. Back in Hollywood, Cedric Gibbons and A. Arnold Gillespie devise special effects to complete the film, including a hanging miniature. Forty two cameras cover the climactic chariot race scene. Five horses are killed in a chariot wreck.

1927 Fritz Lang's "Metropolis" premieres, featuring a dazzling array of state-of-the-art special effects techniques: miniatures, glass shots, mechanical effects, and animation. Lang's virtuoso effects artist, Eugene Shuftan, also invents the Shuftan process, which allows full-size actors to appear in miniature sets through a variation on the glass shot.
1928 Linwood G. Dunn joins RKO Pictures and raises optical printing to an art form in his 25-year tenure, contributing to classics like "Flying Down to Rio," "Citizen Kane," and "King Kong." With Cecil Love, Dunn designs the Oscar-winning Acme-Dunn Special Effects optical printer. The optical printer remains the foundation of visual effects until the 1990s, when digital compositing becomes feasible. Dunn continued his influential career until 1998.

1930s
"You ain't heard nothin' yet!" With Al Jolson's words in "The Jazz Singer" (1927) the era of talkies is born. Early sound recording equipment was cumbersome and difficult to use on location, so studio-bound directors turned more frequently to special effects to create the illusion of shooting in exotic locales. The first Golden Age of visual effects begins.

1933 Director Merian C. Cooper and animator Willis O'Brien join forces for a masterpiece of effects, "King Kong." Stop-motion animation, miniatures, rear projection and optical compositing artfully combine live actors, puppets, and miniatures. The stop-motion animation of a menagerie of prehistoric creatures takes 55 weeks to accomplish.

1937 Snow White and the Seven Dwarfs, This film was Disney's remarkable, groundbreaking, 83-minute masterpiece - the first full-length, hand-drawn animation. The film won an honorary Academy Award for Walt Disney "as a significant screen innovation which has charmed millions and pioneered a great new entertainment field."

1939 The first Academy Award for Achievement in Special Effects is awarded to "The Rains Came," featuring a flood of Biblical proportions in India mastered mind by Fred Sersen. The film bests such notable rivals as "Gone With the Wind" and "The Wizard of Oz."

1940s
Special effects delight audiences in genres like fantasy ("Thief of Baghadad", 1940), science fiction ("Dr. Cyclops") and war ("Flying Tigers"). But an increasing number of films in unlikely genres, like "Citizen Kane," "Rebecca," and "The Private Lives of Elizabeth and Essex," rely on invisible effects to tell dramatic stories.

1940 Alfred Hitchcock directs his second Hollywood feature, "Foreign Correspondent." A master of special effects, Hitchcock often used rear projection to bring exotic locales into the studio. For "Foreign Correspondent," Hitchcock and Lee Zavitz engineer a dramatic scene of a plane crashing into the ocean by using a rear projection of the ocean; on the plane's "impact," thousands of gallons of water are poured through the screen, flooding the set.

1943 Munchhausen, This colorful (Agfacolor), visually creative and extravagant film by director Josef von Báky, adapted from the story by R.E. Raspe and based on the fabulous baron nobleman of the title who was known for telling tall tales, featured marvelous special effects, including a life-like oil painting, a hot-air balloon trip to the Moon, dancing coats and trousers, a lady of the moon - nothing more than a head growing on a plant, and the Baron (Hans Albers) atop a speeding cannonball through the clouds into the Turkish sultan’s palace; the film was commissioned by the Nazi Third Reich’s Propaganda Minister Josef Goebbels to celebrate the 25th Anniversary of Germany's UFA Studios. Director Terry Gilliam's remake The Adventures of Baron Munchausen (1989) featured the same fantastic adventures and was nominated for an Academy Award for Best Visual Effects.
1949 Willis O'Brien directs another stop-motion animation classic, "Mighty Joe Young," assisted by animator Ray Harryhausen. It seamlessly and smoothly composited stop-motion animation with live action and rear-projection. Harryhausen went on to create more than 20 films, including "The Beast From 20,000 Fathoms", "Earth Vs. The Flying Saucers," "Jason and the Argonauts," and "Sinbad and the Eye of the Tiger." Harryhausen receives the Gordon E. Sawyer Award from the Academy of Motion Picture Arts and Sciences for his technological contributions in 1991.

1950s

Movie attendance drops as television rapidly gains in popularity. To bring moviegoers back to the cinema, producers introduce effects-laden spectacles and larger-than-life film formats like Cinemascope, Todd-AO, VistaVision, and 3-D.

1950 George Pal produces "Destination Moon," a tale of lunar travel that snare the Oscar for effects and ushers in a decade of science fiction features with high-profile special effects. (with an ingenious use of models) In addition to Pal's Oscar-winning "When Worlds Collide" (1951) and "War of the Worlds" (1953), audiences thong to "The Day the Earth Stood Still" (1951), "Forbidden Planet" (1956) and "Earth Vs. the Flying Saucers "(1956).

1952 Bwana Devil, an exploitative jungle adventure film – noted as the first 3-D feature-length, commercially-released color film ever made. The film featured man-eating Tsavo lions leaping toward the camera and flying spears thrown out of the screen. The gimmicky 3-D effect required that the viewer wear special polarization glasses, unlike anaglyphic 3-D that required red/blue glasses to be worn. 3-D technology was employed to try to combat the encroaching competition of television on the film industry.

1956 Forbidden Planet, one of the landmark science-fiction films of the 50s was this classic space adventure film from director Fred Wilcox - an adaptation of Shakespeare's The Tempest; it was the first science-fiction film in color and CinemaScope; its Oscar-nominated Special Effects included miniatures, innovative set and art decoration (with soundstage scenic paintings), cel animation, matte paintings, and the famed friendly servant prop (probably the most expensive film prop ever constructed at the time (at $125,000)) -- Robby the Robot; it also featured an all-electronic music score; one of the best remembered segments was the 'animated' night attack of the ID monster on the flying saucer spaceship - in actuality, Dr. Morbius' (Walter Pidgeon as Prospero) face-to-face encounter with his own projected sub-conscious, incestuous feelings for his lovely young daughter Altaira (Anne Francis).

1956 Cecil B. DeMille tackles "The Ten Commandments" for the second time. The Red Sea parting is considerably more elaborate than the Jello slab of the 1923 version, involving a blue-screen Charlton Heston, miniatures, pyrotechnics, 600 extras, matte paintings, and a 32-foot high dam channeling tens of thousands of gallons of water. Insiders speculate that the gag cost about two and a half years and $2 million—the most expensive special effect to date.
1960s
Many studios eliminate their effects departments, and a new generation of independents moves in to fill the gap.

1961 Ivan Sutherland invents *Sketchpad: A Man-machine Graphical Communications System*, the first interactive computer graphics program, for design and engineering applications. The software enabled a person, for the very first time, to interactively create an image on a computer display. According to Sun Microsystems, where Sutherland currently resides as vice president, "sketchpad pioneered the concepts of graphical computing, including memory structures to store objects, rubber-banding of lines, the ability to zoom in and out on the display and the ability to make perfect lines, corners, and joints. This was the first GUI (Graphical User Interface) long before the term was coined".

1963 "Cleopatra," the effects Oscar winner for 1963, premieres. Its $44 million budget, $300 million in today's dollars, makes it the most expensive film ever made. In addition to extensive effects, the film also includes a set of the Roman Forum larger than the real thing and a full-scale barge with a gilded stern.

1963 Jason and the Argonauts
This Ray Harryhausen-created scene deserved special mention -- the spectacular stop-motion dueling-skeletons scene, with life-like models manipulated and shot one frame at a time.

1964 Mary Poppins. This film was the first winner of the newly-named Academy Award for FX - Best Achievement in Special Visual Effects. (After 1963, the category was split into two: Best Special Visual Effects and Best Sound Effects.) The musical fantasy blended live-action with animation, such as the sequence in which Julie Andrews and Dick Van Dyke frolicked with cartoon penguins, sheep and carousel ponies.

1966 Fantastic Voyage. This science-fiction classic film - the winner of the year's Academy Award for Best Achievement in Special Visual Effects, told of an expedition by miniaturized human beings into the bloodstream of a human body, within a high-tech military submarine shrunk to microbial dimensions
1968 After three years in production, "2001: A Space Odyssey" premieres. The meticulously researched art direction and effects, including an early form of motion control and the slit-scan technique used for the dazzling Stargate Corridor sequence, set a new standard for special effects. The Star Gate and Star Child sequence and other special effects helped this film win the Academy Award for Best Achievement in Special Visual Effects. Stanley Kubrick's film featured the most realistic footage of space ever created - and it's still not dated by the passage of time. Models of spacecraft, computer-guided pre-motion control cameras, full-sized props or models, and other early techniques (such as a primitive type of "Go-Motion") were used. Near the film's end, astronaut David Bowman (Keir Dullea) traveled through the stargate corridor in a dazzling sequence (using a slit-scan technique), a sound and light hallucinatory journey in which he was hurled through and into another dimension - where he was reborn as a Star Child.

1970s
Special effects take a low profile, with naturalistic cinema verité films in the ascendancy, until several special effects hits herald the start of the blockbuster era.

1971 The Andromeda Strain
This film contained possibly the first use of 3D rendering (the rotating structure of the underground laboratory). It was another early feature film to use advanced computerized visual effects for its time, with work by Douglas Trumbull

1976 Futureworld featured the first use of 3D CGI - for a representation of Peter Fonda's face and hand, created by the early computer visual effects company Triple I.

1977 "Close Encounters of the Third Kind" features a spectacular UFO mothership aglow with thousands of lights overseen by visual effects supervisor Doug Trumbull; the 400-pound fiberglass model, four feet high by five feet wide, is meticulously wired with neon tubes, incandescent bulbs, and fiber optics. Additional lighting is added through projection.

1977 "Star Wars" is released, featuring highly complex space battles made possible by electronic motion control, invented by visual effects supervisor John Dykstra. Dykstra and the film receive Oscars, and "Star Wars" revitalizes the effects field.

There was a new name for the Academy Award for FX this year - Best Achievement in Visual Effects, won by this film. This was the first major work of George Lucas' visual effects company - Industrial Light & Magic (ILM), which would become the biggest, most prestigious FX company in film history.

The Empire's moon-sized weapon/battle station, the Death Star was assaulted by Luke Skywalker and other Starfighters. Before the assault was a brief sequence of the trench-run briefing - this was the first extensive use of 3D-CGI.
1979 *Alien*, This Ridley Scott film received the Oscar for Best Achievement in Visual Effects, defeating *The Black Hole* (1979), *Moonraker* (1979), *1941* (1979), and *Star Trek - The Motion Picture* (1979). It used raster wireframe rendering for the spaceship Nostromo's navigational monitors in the rough landing sequence on the foreign planet.

The film was best-known for the genuinely shocking and memorable chest-bursting special effects scene in which crew member Kane (John Hurt) had blood and the Alien graphically explode out of the front of his white T-shirt - the hissing, razor sharp-toothed monster-lizard looked around and then scurried off to hide. The trick shot involved a fiberglass chest piece (placed over the actor), tubes to squirt fake blood, a single hand puppet, and wires to help the alien race across the table.

1979 *Star Trek: The Motion Picture*. This film included Industrial Light & Magic's amazing depiction of the massive, clouded V'Ger, Mr. Spock's (Leonard Nimoy) "space walk", and the astonishing "meld" scene, in which Commander Willard Decker (Stephen Lang) and the android Ilia (Persis Khambatta) melded in a glowing spectacle, culminating in an explosion of light, from which the USS Enterprise majestically emerged.

1980s

Computer graphics take starring turns in feature films.

1981 *Dragonslayer*. This sword-'n'-sorcery film, a co-production of Walt Disney and Paramount, introduced the innovative technique of Go-Motion, a process created by Industrial Light & Magic (and Lucas animator Phil Tippett). The use of Go-Motion brought this film an Academy Award nomination for Best Achievement in Visual Effects, which it lost to *Raiders of the Lost Ark* (1981). It was a variation on the earlier technique of "stop-motion" animation (popularized by Willis O'Brien and Ray Harryhausen), by having the animated model (the Dragon) make several moves within a frame, thereby giving it a more fluid, blurry, and natural movement. By contrast, the traditional stop-motion technique was more jerky, static and wooden in appearance, as in Harryhausen's *Clash of the Titans* (1981) released in the same year.

1981 *Raiders of the Lost Ark*. Part of the reason for this film winning the Academy Award was due to its awesome climax with amazing visual effects, revealing the power of the Ark of the Covenant as it was opened by the face-melting Nazis.

1982 The Genesis Effect for "Star Trek: The Wrath of Khan," depicting a technology capable of instantly rejuvenating a dead planet, is the first all-digital CG sequence to appear in a film. The film included the scene of Spock's (Leonard Nimoy) self-sacrifice to save the Enterprise from the Genesis Device explosion, with his burial in space at the lifeless planet Regula, when struck by a Genesis 'torpedo' to cause the birth of a planet. This "Genesis sequence" effect, a brief computer-generated sequence, marked the first use of a fractal-generated landscape in a film (created by the Lucasfilm division). Its release barely beat *Tron* (1982) to take the unofficial honor of being the first film to use computer-generated images (CGI) to any extent.

1982 *Blade Runner - The Los Angeles Cityscape* One of the most awe-inspiring visuals in film history, paying homage to Lang's *Metropolis* (1927), the powerful vision of Los Angeles, circa 2015, at night, with giant, fire-belching towers, floating advertisements, giant television screens, and police "spinners" (flying cars) - all based on the art design of legendary artist Syd Mead, who would collaborate with Jean 'Moebius' Giraud on *TRON* (1982) (see below). It was nominated for Best Achievement in Visual Effects (as was the ghost-story *Poltergeist* (1982)), but both lost to *E.T. the Extra-Terrestrial* (1982).
1982  E.T. the Extra-Terrestrial
This Steven Spielberg film was famous for the flying bicycle scene in which the alien and Eliott were illuminated in silhouette against a giant-size full moon; also visual effects were employed for E.T.'s spaceship, and the believable alien itself, although altered or enhanced in the 2002 remake for the 20th anniversary edition.

1982  Tron
Steven Lisberger's inside-a-computer-game adventure film was one of the first films to be derived from the video-game craze. It was the first film to use computer-generated imagery (CGI) to any large degree. This film was heralded as the first live action film with over 20 minutes of full 3D graphics and computer animation.

Its most innovative sequence extensively employed 3-D CGI in the famed 'light cycle' sequence, using the artwork and vision of legendary artists Syd Mead and Jean 'Moebius' Giraud, and visual effects done with a combined effort by Triple I, MAGI/Synthavision, Robert Abel & Associates, and Digital Effects.

Another FX technique used was backlight animation, in which light was shown through a specialized filter through each frame to create extraordinarily vibrant colored light effects, in this case, through the inventive Oscar-nominated costumes worn by the actors. (Lisberger's animated film Animalympics (1980) had extensively used that effect in semi-preparation for what would become TRON.) The greatest testament to this film's unique visual effects, soundtrack, costuming, art direction and set decoration is that none of it has ever been duplicated, and remains unique to this day.

It was refused an Academy Awards nomination because the voters felt the film "cheated" by using computer animation; in reality, the process was an extremely arduous one for animators. The film also featured a soundtrack by Wendy (nee Walter) Carlos that melded synthesized music with the London Philharmonic's orchestral music.

1983  "Return of the Jedi" features one of the most complex optically composited shots to date, with over 300 separate film elements for one space battle shot. Featured over 700 visual effects shots, the most in movie history at that time

1985  The first fully CG character, a medieval knight, springs to life from a stained glass window in "Young Sherlock Holmes." (with effects by Pixar when it was still part of Lucasfilm and Industrial Light and Magic). The 30-second sequence takes six months to accomplish. This film was also the first to composite computer-generated animation with a live-action background.

1986  Flight of the Navigator, The first feature film to use reflection mapping -- for the shiny, flying CGI alien spaceship flying over and reflecting airports, fields, buildings, and oceans.
[This technique was also used in Terminator 2: Judgment Day (1991), and also for the reflective Naboo spacecraft in Star Wars Episode I: The Phantom Menace (1999).]
1986 Luxo Jr. This two minute short from Pixar about Luxo and his son - a pair of digital desk lamps - was directed by John Lasseter (of Toy Story fame) and William Reeves. It was notable as the first fully computer-generated, computer-animated (or CGI) film, and the first to use shadows in CGI. It was also the first computer animation short to be nominated for an Academy Award. The desk lamp later became the corporate symbol for Pixar.

1986 Star Trek IV: The Voyage Home. This was the first groundbreaking use of 3D scanning by Cyberware on a film. This type of 3D scanning was first used on the heads of actors in this film when ILM digitized them for a short time-warp travel scene. The CG heads of Shatner and Nimoy were too complex for conventional modeling techniques at the time - instead they were scanned by the first Cyberware 3D Scanner. [Cyberware pioneered the market for three-dimensional detailed scans of people and objects. The laser- and video-based technology can scan complex objects in only seconds to produce a detailed three-dimensional data-set of the facial features and a detailed texture map of the surface color.]

1988 Tin Toy. Pixar's 5-minute short film, the inspiration for Toy Story (1995), was the first computer animation to win an Academy Award Oscar - for Animated Short Film. Billy, the baby character in the short film, marked the first time that a CG character had realistic human qualities.

1988 Willow. Digital morphing (the seamless change from one character or image to another) of several animals was first introduced by ILM and debuted in the live-action film Willow.


Underwater visual effects, especially of the watery alien creature, a 'pseudopod,' were the first example of digitally-animated, CGI water. This was the first computer generated three-dimensional (3-D) character. The pseudopod with a watery tentacle replicated Mary Elizabeth Mastrantonio's face and appeared to communicate by movements that resembled facial expressions.

1989 Back to the Future, Part II. Computer-controlled camera work allowed three characters (all performed by Michael J. Fox) to match up and interact seamlessly in the same scene (the "instant pizza" scene), through impressive split-screen photography.

1989 Indiana Jones and the Last Crusade. The first all-digital composite, to demonstrate rapid aging, during Walter Donovan's (Julian Glover) death sequence. ILM scanned several filmed makeup transformations of his demise and "morphed" the elements together digitally - it sent the output back to film rather than arranging film elements with an optical printer.
1990s

1991 Backdraft
First use of photorealistic CG fire in a motion picture.

1991 The liquid-metal cyborg T-1000 debuts "Terminator 2: Judgment Day," with five and a half minutes of screen-time devoted to 100 elements of CGI. Following six decades of optical printing, all of the effects work for this film is composited digitally.

1992 Lawnmower Man
This breakthrough film with ground-breaking special effects introduced Virtual Reality to films. In one CGI sequence, the two lovers became liquid metal, melding with one another and transforming into metallic insects flying across the computer-generated terrain.

1992 Death Becomes Her
First human skin CG software.

1993 "Jurassic Park" introduces the first CG live animals to the movies—brachiosaurs, velociraptors, a T. rex, and an entire herd of gallimimus—which are intercut with animatronic dinosaurs.

This film from Steven Spielberg, the Academy Award winner for Best Achievement in Visual Effects (defeating The Nightmare Before Christmas (1993) and Cliffhanger (1993)), mixed animatronic and computer-generated (CGI), photo-realistic dinosaurs. The scenes of the living, eating, and breathing dinosaurs, especially the attack of the T. Rex, used mechanical robots and miniature models in stop-motion, frame-by-frame processing.

1993 The Nightmare Before Christmas. Tim Burton's masterpiece used sophisticated computer-controlled cameras to execute state-of-the-art camera movement for this feature film's stop-motion animation. Puppets (built of a foam latex material covering intricate metal armatures) were manipulated frame-by-frame on real miniature sets. The painstaking film took nearly three years to complete (dozens of animators and crew members averaged only 60 seconds of film per week), because each different pose or position equaled a 24th of a second.
1994 Forrester Gump. Robert Zemeckis' film was an Academy Award winner for Best Achievement in Visual Effects, defeating rivals The Mask (1994) and True Lies (1994), with its incredible computer-digitized effects: Tom Hanks' digitally-composited interplay with historic events (Governor Wallace's standoff in Little Rock and his assassination attempt), including his meeting with three past Presidents (Kennedy, Johnson and Nixon) and other celebrities (Elvis Presley, John Lennon), the removal of Gary Sinise's lower legs, his playing a Ping Pong game (with a digitized ball and crowd watching) in China, and the fluttering feather (with the string it was attached to erased) in the film's conclusion.

1995 Jumanji
ILM created the first computer-generated photo-realistic hair and fur for the digital lion and monkeys in this film. This movie also featured a stampede scene with dozens of elephants, rhinos, zebras and pelicans - all computer-generated.

1995 "Toy Story," the first entirely CG feature-length film, is released. Four years in the making, the 77-minute film generates 1,000 gigabytes of data and requires 800,000 machine hours of rendering.

1995 Waterworld
First realistic CG water.

1997 Contact, Robert Zemeckis' film contained, reportedly, the longest single digital effects shot ever created - the opening shot (Powers of Ten). It began with an image of the Earth, and then the camera slowly pulled back to reveal the Moon, the rest of the solar system, various layers of nebula and stellar debris, and the Milky Way. The shot moved deeper into space to reveal hundreds of other galaxies...and then pulled back to reveal that the light from all of these stars was actually the highlight in a young girl's eye.

1997 The Fifth Element. There were an extra-ordinary amount of individual FXs in this film, including a futuristic New York City skyline, a regeneration sequence during the creation of Leeloo (Mila Jovovich) in which a sophisticated machine built her skeleton, and strapped muscle tissue onto the bones, and its most celebrated sequence - the cab chase with flying cars. The cars were created both as motion-control models and CGI versions. The immense 2000 foot long pleasure cruiser - the Fhlostin Paradise - was a motion-control model.
1997 Starship Troopers. An army of humans were locked in visceral, gory combat against a frightening array of thousands of giant alien bugs. This was the first film to feature a large-scale CGI battle.

1997 "Titanic" receives 10 Oscars, including Achievement in Visual Effects. With more than 450 effects shots created by Digital Domain and 16 other companies, it becomes the highest-grossing film of all time worldwide.

The most expensive film ever made - up to its time, at approximately $200 million. With stunning digital effects in a historical epic/drama - the passengers on the ship's deck, the ship's launch, the Titanic's engine room, the helicopter fly-bys, the transition shot of the two lovers at the front of the ship transformed to an underwater shot -- even Kate Winslet's iris that was digitally inserted and morphed into one of Gloria Stuart's eyes. Both CG and miniature models were used to portray the ocean-liner as it tilted, split in two, and sank in the tragic finale.

1998 Mighty Joe Young
The creation of groundbreaking "hair, fur and feathers" technology for the CGI gorilla.

1999 Fight Club, With extensive and revolutionary use of photogrammetry, a CGI first-person image-based modeling technique. Wire-frame 3-D models were created from photographs or real, still objects. The photos were then reemployed as texture maps, augmented with additional paint work. This allowed for high-speed photo-realistic camera movements around (or inside and through) objects - and other seemingly impossible feats. Examples can be seen in the gunshot, also in the pull-back tour of the wastepaper basket and its contents, and in the sequence of the kitchen explosion when the connection between the gas leak on the stove's burner to the spark on the refrigerator compressor was visualized. Also used in The Cell (2000) and Godzilla (1998).

1999 The Matrix. A kinetic, sci-fi virtual reality film combining many elements, from the directorial writing team of the Wachowski brothers, with incredible Oscar-winning visual-effects (defeating Star Wars: Episode I - The Phantom Menace (1999) and Stuart Little (1999)) - with airborne kung fu, slow-motion bullet-dodging (the "flow-mo" and "bullet-time" effects) and shoot-outs, wall-scaling and other amazing visual effects.

1999 The Mummy
This film had the most realistic digital human character ever seen in film, with totally computer-generated layers of muscles, sinew and tissue.
1999 Star Wars: Episode I - The Phantom Menace (the club kill Jar jar binks) This film undoubtedly contained more computer animation and special effects than any previous film - over 90%. It also featured a completely CGI-generated (all digital), fully-articulated main humanoid character named Jar Jar Binks (voice of Ahmed Best), a widely-derided aspect of the feature film. Jar Jar was a "Gungan", an alien indigenous to the planet Naboo.

2001 Final Fantasy: The Spirits Within This science-fiction tale by director Hironobu Sakaguchi (creator of the interactive video game that inspired this film) took four years to make. It advertised itself as "Fantasy Becomes Reality".

It was the first hyper-real, computer-generated (CGI) feature-length film based entirely on original designs - no real locations, people, vehicles, or props were used. The film was hailed for having photo-realistic, life-like images - the amount of detail rendered into hair, clothing, skin texture, eyes, and movement was astounding and impressive. Characters' faces and skin included such detail as liver spots, wrinkles, veins in a clenched hand, individual hair strands, and so forth.


In the first segment, there was an impressive stand-off fight between Gandalf (Ian McKellen) and the fiery Balrog.

In the second part of the trilogy, CGI-imagery was combined with "motion capturing" (of the movements and expressions of actor Andy Serkis, who also served as the voice) to produce the barely-seen, supporting character of Gollum (originally known as Sméagol). A motion capture suit recorded the actor's movements that were then applied to the digital character. A more laborious visual effects process digitally "painted out" Serkis's image and replaced it with Gollum's. [The same technique was repeated in I, Robot (2004), with Alan Tudyk as the robot Sonny.]

Also in The Two Towers (2002), AI-driven agents were first used to create the digital army scene.

2001 Shrek. A fully computer-animated, colorful fantasy film (from DreamWorks and Pacific Data Images), and the first Oscar winner in the newly created category of Best Animated Feature, by the Motion Picture Academy of Arts and Sciences. The realistic-ness of the characters was actually scaled back to have a more "cartoony" look. The film also featured the most advanced CGI liquid and fire effects of the time. Followed by the biggest box-office earning animated film ever, Shrek 2 (2004).
2003 The Matrix Reloaded and The Matrix Revolutions
The Matrix Reloaded introduced high-definition 'Universal Capture' (or U-cap) or image-based facial animation into the special effects lexicon -- i.e., the fight scene in Reloaded between Neo and 100 Agent Smiths used this technique. Five high-resolution digital cameras recorded the real Agent Smith’s actions to produce data which was fed into a computer, where a complex algorithm calculated the actor’s appearance from every single angle the cameras had missed, and used them to generate digital or ‘cloned’ humans indistinguishable from real humans.

2003 Pirates of the Caribbean: The Curse of the Black Pearl
CGI effects were used to startling effect to seamlessly turn the cursed Black Pearl pirates from normal humans to skeletons. They sneak up on the British navy by walking across the ocean floor at night in skeleton form, then crawl up the sides of the ship undetected.

2004 The Polar Express . This film was marked by the first innovative use of the process of ‘Performance Capture’ -- a motion capture system by which an actor’s live performances were digitally captured by computerized cameras, and became a human blueprint for creating virtual, all-digital characters. Unlike existing motion-capture systems, Performance Capture simultaneously recorded 3-dimensional facial and body movements from multiple actors, using a system of digital cameras that provided 360 degree views. This allowed actor Tom Hanks to play many very different characters (the boy, the father, the conductor, the hobo, and Santa Claus) in the same film.
2004 Sky Captain and the World of Tomorrow. This was the first movie with very photorealistic, all-CGI backgrounds and live actors. This meant that human actors were completely filmed in front of a green/blue screen with no background sets at all. Everything except the main characters was computer-generated.

2006 Pirates of the Caribbean: Dead Man's Chest. CGI imagery had reached the point of becoming so convincing that the completely computer-generated Davy Jones (Bill Nighy), a monstrously Octopus-faced-and-tentacled villainous under-sea creature, was so realistic that some critics in their reviews mistakenly thought Nighy was wearing prosthetic makeup. Visual effects artists at ILM used an instant (or on-the-spot) motion-capture-to-CG process, and an inventive technique called sub-surface scattering (to believably mimic the look of semi-translucent skin) to create the effect - they even used CGI for Jones’ eyes. It won the Oscar for Best Visual Effects over Poseidon (2006) and Superman Returns (2006).

2006 Elephants Dream. First CGI short movie released as completely open source. Made with Open Source software, theatrical and DVD release under Creative Commons License. Unique that all 3D models, animatics and software are included on the DVD free for any use.