

PIXAR 1996*

Forces are working to establish a defensive position against a perennial enemy. It's those pesky grasshoppers, the antagonists in Pixar Animation Studio's upcoming full length feature *A Bug's Life*. As the technical staff departs the screening room after the evening's daily production review in December, 1996, three men contemplate their next strategic move:

Ed Catmull, the founder, executive vice president and chief technical officer. The quiet, unassuming techie who started it all. But perhaps his greatest talent is finding the *people* who provide pieces to the computer graphics puzzle – even if it takes almost 30 years to pull them all together.

Steve Jobs, the larger than life CEO. The ultimate deal maker. Creator of three of the most revolutionary products in modern times – the Apple II, the Macintosh and the laser printer. He has already sunk an estimated \$50 million into Pixar, and over the last few months has been splitting his time between Pixar and the floundering Apple.

John Lasseter, the Vice President of Creative Development. The man with the artistic vision and capability that made *Toy Story* a \$200 million blockbuster.

Given the box office success of their first feature, *Toy Story*, this group should be celebrating their achievements. Instead, they have been left to answer a difficult, and perhaps unexpected, question. How can Pixar turn a sustainable profit?

The Roots of Pixar (1970 – 1984): Technical Development

The Academic Years: 1970 – 1979

The University of Utah

Pixar's technical roots date back to 1970, when Ed Catmull joined the computer science program at the University of Utah. While the Utah program had many facets, it was primarily recognized as the world's leading research center for computer graphics. Under the leadership of computer pioneers Dave Evans and Ivan Sutherland, creator of the first computer drawing program called Sketchpad, the computer graphics program flourished during the early part of the decade. Given the program's notoriety and leadership, several young stars were attracted to Utah. John Warnock was one of those early pioneers; he would later found Adobe Systems and create a revolution in the publishing world with his PostScript page description language. Jim Clark, another alumnus, would later start Silicon Graphics and then lead Netscape Communications.

During the 1970's, the program made significant headway into the development of computer graphics. The first major advance in 3D computer graphics, the hidden-surface algorithm, was borne at Utah. This advance allowed a computer to draw a representation of a 3D object by determining which surfaces were behind the object and thus needed to be partially hidden when the computer created or "rendered" the image. Catmull himself made a significant advance in computer graphics in his 1974 doctoral thesis, which focused on texture mapping, z-buffer and rendering curved surfaces. Substantially greater realism was achieved through Catmull's

* Catherine Crane, Will Johnson, Kitty Neumark. Christopher Perrigo prepared this case under the supervision of Professor Allan Afuah.

concept of texture mapping, a method of taking a flat 2D image of an object's surface, and then applying that flat image to a 3D computer generated object -- much the same way that one would hang wallpaper on a blank wall.

New York Institute of Technology (NYIT)

In 1974, interest in the work of the Utah program came from an unexpected source, Alexander Schure, founder of the New York Institute of Technology (NYIT). Schure, an eccentric millionaire, wanted to use the story from a children's record album called *Tubby the Tuba* to develop an animated film. He had already established a traditional animation facility at NYIT, but found that conventional, hand drawn animation was both slow and technically limited. Frustrated with the progress of his film project, Schure was eager to learn about computer generated graphics. After viewing the facilities at the University of Utah, he told his people to "get me one of everything they have." However, Schure needed someone to be the director of the new Computer Graphics Lab. He found a partner in Ed Catmull; in addition to his technical skills, Catmull had long dreamed of making cartoons, despite the fact he could not draw very well.

From the ranks at Utah, Catmull recruited a team of talented computer scientists and began experimenting with computer generated animation. Although *Tubby* was never developed, the computer graphics lab of NYIT eventually grew to more than 60 employees. The initial work of this group was focused on 2D animation, specifically creating tools to assist traditional animators. A scan-and-paint system was developed to scan and then paint pencil-drawn artwork. (Catmull and Pixar would later evolve this technology into Disney's Computer Animation Production System (CAPS)).

Next, the NYIT group branched into 3D computer graphics for motion picture production. A movie called *The Works* became NYIT's major project for over two years. Much time and money were invested in creating 3D models and rendering test animations. However, none of the people in the Computer Graphics Lab understood the scope of motion picture production, and the project languished. Several team members became discouraged and eventually left for other employment opportunities.

The Lucasfilm Years: 1979 – 1986

Creating the Cutting Edge Team

While Catmull's group struggled at NYIT, Hollywood was beginning to see the benefits of computer graphics for production. One early Hollywood pioneer was George Lucas, whose *Star Wars* had been a stunning special effects achievement. With this blockbuster under his belt, Lucas became interested in using computer graphics for image editing and producing special effects for his next movie, *The Empire Strikes Back*. Lucas worked with an outside computer graphics production house, Triple I, to create effects for *Empire*, but in the end these effects were not used. However, the experience had proven that photorealistic computer imagery was possible, and Lucas decided to assemble his own computer graphics division within his special effects company, Lucasfilm.

In 1979, Lucas discovered Catmull's group at NYIT. George Lucas extended an offer to the team to come to Northern California to work as part of Lucasfilm; the team was more than happy to accept. Catmull was named Vice President and over the next six years, the new computer graphics division of Lucasfilm would assemble one of the most talented teams of artists and programmers in the computer graphics industry. One talented programmer, Loren Carpenter, wrote the first renderer for Lucasfilm, called REYES (Renders Everything You Ever Saw). REYES would eventually become Pixar's RenderMan rendering engine.

Innovation Outside of Lucasfilm

The success of Catmull's group was due to external breakthroughs as well as its internal innovations. On the hardware front, a major milestone in computer graphics was the founding of Silicon Graphics (SGI) by Jim Clark in 1982. SGI focused its resources on creating the highest performance graphics computers available. Wavefront, a company formed in 1984, produced the very first commercially available 3D animation system software. Prior to this development, early animation companies such as Triple-I, Digital Productions, and Lucasfilm had to write their own software for creating computer graphics.

From academia, a new rendering method based on the theory of diffuse lighting was developed at Cornell University. In 1984 Cindy Goral, Don Greenberg and others at Cornell published a paper entitled, "Modeling the Interaction of Light Between Diffuse Surfaces." The paper described a new method called radiosity, that used formulas, previously used for simulating heat dispersion, to determine how light reflected between surfaces. Pixar would later incorporate many principles from this research into its own 3D animation technology.

Pixar Is Born (1984 – Present): Creative Development

Enter the Story Man: John Lasseter

Like Ed Catmull, John Lasseter had long envisioned the future of computer graphics animation. Lasseter had worked on Disney's first major foray into computer-aided production – *Tron* (1981). *Tron* required nearly 30 minutes of film quality computer graphics and was a daunting task for computer graphics studios at the time. The computer generated imagery of *Tron* was technologically dazzling, but the underlying story was an unappealing cyber-adventure. Disney sunk about \$20 million into the picture, but it bombed at the box office. The resultant financial loss alone served to all but kill Disney's interest in the computer graphics medium.

Despite the commercial failure of *Tron*, the film was an epiphany for Lasseter. Watching what fellow animators were doing with computer graphics imagery, he started to see the possibilities of full-scale computer animation: "the minute I saw the light-cycle sequence, which had such dimensionality and solidity," Lasseter recalls, "it was like a little door in my head opening to a whole new world."

Lasseter and fellow animator Glen Keane (who went on to make *Beauty and the Beast*) tried to interest Disney in the medium by animating 30 seconds of Maurice Sendak's *Where the Wild Things Are*, using standard animation drawings in computer-generated settings. But Disney, who was struggling to rejuvenate itself after years of lackluster box office performance, was not interested in further experimentation with untried computer animation. In 1984, a disappointed Lasseter left Disney after the studio passed on his proposed animation project *The Brave Little Toaster*, based on a Thomas Disch children's book told from the point of view of toys. (*Toaster* was produced without Lasseter as a conventionally animated movie in 1987.) Ed Catmull, a friend of Lasseter, convinced him to come to Lucasfilm to experiment for just a month. John Lasseter liked what he found and never left.

Pixar is born in the "Next" Generation: Steve Jobs

While the computer graphics division of Lucasfilm was strengthened with the addition of Lasseter in 1984, George Lucas' interest in the project waned. Although Catmull saw tremendous further potential in the technologies being developed, Lucas viewed the project as complete and began looking for a buyer of the computer division. An early potential buyer of the division was a partnership between the behemoth General Motors' Electronic Data Systems

(EDS) and a unit of the Dutch conglomerate Phillips NV. Much to Catmull's relief, the sale fell through.

Steve Jobs, then CEO of Apple Computer, heard about Lucas' intended sale of the computer division. Jobs thought the situation provided a strong acquisition opportunity for Apple, but unfortunately, Apple's Board disagreed. When Jobs left Apple in 1985, Pixar remained a division of Lucasfilm.

Ironically, it was the ousting of Jobs that ultimately permitted the sale of the computer division. With a personal net worth of more than \$100 million resulting from his sale of Apple stock, Jobs approached Lucas and reiterated his interest in the division. In 1986, at a price of \$10 million, Lucas sold the division to Jobs. Steve Jobs considered the idea of absorbing the group into his other firm, NeXT Computer, but instead decided to incorporate Pixar as an independent company, installing himself as Chief Executive Officer and Ed Catmull as Chief Technical Officer.

Jobs appeared to be the visionary behind the transformation of Pixar from a production house to a creative studio. Along with Catmull and Lasseter, Jobs viewed the ultimate goal of the company as producing computer animated cartoons and full length films. However, there were still several intermediate steps required to meet this objective. One of the most important of these hurdles was developing and refining software tools that would enable the creation of the films the team envisioned.

Drawing the Pixar Foot in the Door: RenderMan

Released in 1989, Pixar's first tool was RenderMan, a rendering software system for photorealistic image synthesis that enabled computer graphics artists to apply textures and colors to surfaces of 3-D images onscreen. Pixar licensed the tool to third parties and eventually sold upwards of 100,000 copies. RenderMan quickly became an industry standard and was used extensively to augment live action films.

A major success for RenderMan and computer generated graphics was initiated by award winning director James Cameron. In his 1989 film *The Abyss*, Cameron wanted a creature to emerge from a pool of water, extend itself and explore an underwater oilrig, and then interact with live characters. Cameron felt it couldn't be done with traditional special effects tools and so put the effect up for bid. Pixar and ILM, ironically both Lucasfilm graduates, bid on the project. ILM won the bid, but used Pixar's RenderMan to create the desired end sequence. The effect worked so well that Cameron was confident enough to use computer generated images to create a major character in his next film, *Terminator 2*. "T2" was released in 1991 and set a new standard for computer generated special effects. The evil T-1000 robot in *T2* alternated between actor Robert Patrick and a 3D computer animated version of Patrick.

For several years, while other projects were being developed, RenderMan provided the company with its primary source of revenues. A secondary revenue stream was CAPS (Computer Animation Production System), a software system developed exclusively for Disney that helped to automate the time consuming painting/colorization process on hand drawn sketches.

Two additional software tools were also developed by Pixar but not licensed for external use. Marionette, an animation software system provided modeling, animating and lighting simulation capabilities. RingMaster was a production management software system for scheduling, coordinating and tracking computer animation projects. These two products helped to provide a considerable competitive advantage to Pixar, as they were critical to the production of high quality 3D graphics and comparable tools were simply not available on the market.

Developing the Creative Side of Pixar

Eventually Steve Jobs realized that the sales of RenderMan and other tools alone would not be able to fund Pixar's technology research and internal projects, including film development. "The problem was, for many years, the cost of computers to make animation we could sell was tremendously high." He decided that the company could earn money by developing content for third parties. Jobs put Pixar technology to use in developing TV commercial campaigns for a variety of clients. As the company evolved into a successful animation studio producing TV ads for Listerine, Lifesavers, and others, John Lasseter, the director of the ads, became Pixar's big breadwinner. The company won a Gold Medal Clio Awards for its LifeSavers "Conga" commercial in 1993, and another Gold Clio Award in 1994 for Listerine "Arrows" commercial.

A second successful creative outlet for Pixar was short film. In 1986, Pixar's first short movie, *Luxo Jr.*, earned an Academy Award nomination for Best Short Film (Animated). In 1988, another of Pixar's short films, *Tin Toy*, became the first computer animated film to win an Academy Award for Best Short Film (Animated). John Lasseter, who had directed both films, had established a well-deserved reputation as one of the leading animators in the industry. Indeed, Lasseter's reputation set the creative foundation for Pixar. Meanwhile, Lasseter's success did not go unnoticed. Disney's Michael Eisner and Jeffrey Katzenberg tried to woo the director back, but Lasseter declined. "I was having too much fun," he said. "I felt I was on to something new--we were pioneers."

The Toy Story Story

Teaming Up to Break New Frontiers: Disney and Pixar

In 1991, John Lasseter reviewed Pixar's work in short films and commercials and was confident enough in the company's progress to propose the idea of producing an hour-long animated TV special. He pitched the idea to his previous studio, Disney, with the hope that the two companies could collaborate on the project. He was also hoping Disney would be able to provide part of the money necessary to fund the idea.

The timing was just right. Unlike his pitch for *Toaster* in 1984, Disney in 1991 was riding high on the phenomenal success of its animation department. With smashes in *The Little Mermaid* (1989) and *Beauty and the Beast* (1991) - both had utilized computer animation to some extent - Disney was ready to invest in new technology. Although Disney CEO Michael Eisner and film chief Jeffrey Katzenberg rejected the TV project, they countered with a deal Lasseter and Pixar could hardly have hoped for: Disney proposed a full length movie, which it would fund and distribute.

In July 1991, Pixar signed a three film deal. The deal stipulated that Disney would fund the production and promotion costs and Pixar would earn a modest percentage of box-office and video sales gross revenues. Pixar's share in the deal was estimated to amount to approximately 10 – 15% of the film profits, depending on the sales levels achieved. Pixar was required to pay a portion of the costs over specified budget levels, as well as provide the funding for the development of any animation tools and technologies necessary to complete the films.

In return for taking the lower cut of box office and video profits, Pixar gained access to Disney's marketing and distribution network, as well as creative advice from Disney's veterans.

However, a substantially higher share of revenues was not the only price Disney extracted from the deal. In addition, Disney retained all ownership to the characters appearing in the films. Disney also maintained sole licensing rights to the films and characters, including very lucrative ancillary merchandise such as toys and clothing. Pixar was only able to retain the rights to any direct-to-video sequels, as well as the data files and rendering technologies employed to develop the films.

When asked about the agreement signed, Steve Jobs remarked that if the first movie was “a modest hit – say \$75 million at the box office – we’ll both break even. If it gets \$100 million, we’ll both make money. But if it’s a real blockbuster and earns \$200 million or so at the box office, we’ll make good money, and Disney will make a lot of money.”

“To Eternity and Beyond...”: *Toy Story* Rockets to Life

With the deal signed, Pixar now had to prove it could deliver on its technology and creativity. With a staff of only a few dozen people in 1991, Pixar had to quickly gear up to begin design and production of the first of the three films. The screenplay selected for development was *Toy Story*, a tale about the rivalry between a toy cowboy, Woody, and a birthday gift that instantly becomes his young owner's new favorite, a plastic spaceman named Buzz Lightyear.

Once Disney approved the “Roy Rogers-versus-Buck Rogers” plot on Jan. 19, 1993, Pixar needed to cast its characters’ voices. Lasseter set his sights on Tom Hanks for Woody because he had “the ability to take emotions and make them appealing”. Hanks related instantly to his character. At the first meeting, Lasseter showed him 30 seconds of a computer-animated Woody with Hanks' voice from *Turner & Hooch*. Hanks howled with laughter and asked, “When do we start?”

Preserving the essence of the animation cost structure meant no superstar salaries. Neither Hanks nor Disney’s Tim Allen (who was cast as macho superhero Buzz Lightyear during the second season of *Home Improvement*) made *Toy Story* for the money--they were paid slightly more than voice-over union scale by the day.

Even after all of the key ingredients were in place – Disney, Lasseter, Hanks, Allen and the staff of animators – the film almost failed. On Nov. 19, 1993, a date that the makers of *Toy Story* refer to as “Black Friday”, Disney questioned the creative direction of the film. “Guys, no matter how much you try to fix it,” Disney animation chief Peter Schneider told them, “it just isn't working.”

The issue was not simple – the two primary characters were viewed as too grating and harsh. Based on initial direction from Disney, “the intention was to make it less juvenile,” says Lasseter, “and more edgy, more adult.” “We pushed them too far,” suggested Disney’s Tom Schumacher, then Disney's executive vice president of animation. “They interpreted us wrong and made the film too abrasive. It lost a lot of its charm.”

At this point, Pixar found itself faced with an important test: could it produce the story along with picture? Lasseter and his team retrenched. They diverted the team of 27 animators to work on TV commercials while they hammered out a revised storyline. Disney helped with the rewrite, but at the end of the day, Lasseter and his crew delivered the film's look, style, and performance.

Technically, Pixar and Disney animators worked hard to bring the story and its characters to life on the computer screen. Lasseter's 27 animators were high-tech puppeteers who had to “coax” character out of the programmers' 400 computer models. Woody, the most complex character, was operated by 723 motion controls, including 212 for his face and 58 for his mouth. Once completed, each frame required a “farm” of 117 Sun Microsystems computers to

render and transfer it to film. This process took between one to three hours of computer time for each of the 110,000 individual frames (1,000 CD-ROMs hold the film's data).

Computer animation, known for its cold, clear, impersonal crispness, posed a special challenge. "It's easy to make things look perfect," said Lasseter. "We had to make things look more organic. Every leaf and blade of grass had to be created. We had to give the world a sense of history. So the doors are banged up, the floors have scuffs."

"John was able to take animation that was limited to special effects," said Schumacher, "that was perceived as cold, unappealing, and slick, and project into it his warmth and charm and dimensionality."

After over three years, Pixar was able to complete *Toy Story*. It did so with a staff of 110, roughly one-sixth the number Disney and other studios typically use to make animated productions. Of the staff, 27 were animators, compared to the 75 or more animators required for previous animated Disney films. With animators earning \$100,000 or more each, the total cost savings amounted to more than \$15,000,000 over a three year production for the movie.

Toy Story Is A Blockbuster

After 20 years of cultivation – and over three years of production - *Toy Story* opened to great fanfare in U.S. theaters on November 22, 1995. Media coverage of the film was extensive as was other secondary publicity, including a nation wide in-store Burger King promotion. During the five day Thanksgiving Weekend, *Toy Story* box office receipts totaled \$39.1 million, a record debut for the weekend. In all, *Toy Story* was expected to gross almost \$200 million in domestic box office receipts.

Aside from financial rewards, *Toy Story* was a critical success. That year, it was nominated for two Golden Globe awards (Best Musical Score or Comedy Film and Best Original Song). At the Oscars, it was nominated for Best Screenplay first-ever for an animated film) and John Lasseter was awarded a Special Achievement Academy Award for the development and inspired applications of techniques that made *Toy Story* possible. On the technical side, Ed Catmull and Thomas Porter, director of effects animation, received special awards from the Academy for their technical and scientific achievements in digital image compositing.

Beyond Buzz and Woody: Post *Toy Story* Pixar

A Special Weekend for Thanksgiving: Pixar's IPO

At the same time that *Toy Story* was a top box office smash in the highly competitive holiday season, Pixar executives were busily preparing for its Initial Public Offering (IPO), which took place on November 29, 1995. Investors, buoyed by the opening weekend's enormous success of the world's first feature-length computer animated film, drove the stock from an opening price of \$22 per share to a high of \$50 on the first day of trading. Jobs remained the primary shareholder, retaining over 60% of the stock.

What investors might also have realized was the downstream value of the Pixar assets, beyond just human capital. For the first time, characters, sets, props and even scenes became warehoused for future use in a digital format. Adapting and reproducing any element of the film would become highly economical for an infinite variety of ancillary products – like CD-ROM interactive games, film and video sequels, and television specials. Within 6 months of release, Pixar followed up *Toy Story* with two interactive CD-ROM products : *Toy Story Animated Story Book* (April) and *The Toy Story Activity Center* (October). The versatility of their digital

characters appeared to be a significant contributor to the speed and quality of the interactive releases.

Projects In the Pipeline

Toy Story2

After the success of *Toy Story*, animators and developers started work in the summer of 1996 on the direct-to-video sequel. The video is expected to be released at the end of 1997 and represents Pixar's first product for the home video market.

The decision to put the sequel directly on video offered Pixar financial benefits. First, direct-to-video offered lower distribution costs than a feature film; and according to Pixar's CFO, Lawrence Levy, "...the distribution of videos is the most profitable piece of any package". Second, the ability to reuse part of the original *Toy Story* provided production savings by the shorter development time in the film making process.

A Bug's Life

Pixar's second animation film in the Disney contract is *A Bugs Life*. The story, derived from the fable "The Ant and the Grasshopper" revolves around an ant colony, lead by a rebel ant named Flick, and its quest to fight off the grasshoppers who steal the ants' food every winter. The computing power used in *A Bug's Life* is expected to be almost 10 times the power used in *Toy Story*, resulting in more realistic special effects.

A Bug's Life is scheduled for release in November, 1998. Marketing support from Disney is expected to exceed *Toy Story*. By the time the movie is released, Disney intends to have signed at least 65 licensing agreements. This compares to just 7 licensees at the time *Toy Story* was launched. Concurrently, Disney is also working on a *Bugs* theme park attraction which is expected to be completed at the time the movie is launched.

Commercial Group

Pixar announced on July 8, 1996 that it was closing down its television commercial group. Pixar had produced commercials for companies including Coca-Cola, McDonalds, Levi, Nabisco, Kellogg and Hershey Foods. Despite the critical and fiscal success of this group, Pixar decided to redirect its 18 employees working in the television commercial group to its longer film format and interactive projects.

The Troubling Issue: Making Money?

So, why are there long faces at Pixar?

From the heady opening day, the Pixar stock price had plummeted from a high of \$50 to an all time low of just over \$12. Work on commercials and sales of RenderMan were consistent, but Pixar's small share of receipts from *Toy Story* were tapering off significantly. In fact, it was expected that by mid-1997, the firm would be operating at a loss, and would continue to be in the red until the release of the second film in November 1998.

Disney had used their market power, brand equity and vast distribution network to gain significant concessions from Pixar in the original 1991 contract. As an untried entity, Pixar received only 10-15% of the gross theater and video receipts for their own feature, and they were also locked out of the highly lucrative revenue streams of merchandising and licensing. Additionally, Pixar did not retain creative ownership of the characters - it could not use Buzz

Lightyear or Woody in other products without express consent from Disney. However, they did retain ownership of the data files of the characters and sets, as well as their core technology.

There is also concern over the continued interest in animated features by audiences. Pixar's next feature, *A Bug's Life*, was not due out until November 1998. In the meantime, Disney had been releasing an animated feature every six months - or re-releasing films from their classics, such as *101 Dalmatians* and *Snow White*. Instead of being "events", animated feature films were now perceived as standard movie fare. Recent animation releases (*Hunchback of Notre Dame*) had not broken \$100 million in domestic box office receipts.

Additionally, other major studios had been developing extensive animation departments. Twentieth Century Fox, under the direction of Don Bluth (*An American Tail*, *All Dogs Go to Heaven*), was preparing its own blockbuster release, *Anastasia*, for a November 1997 release. All early indications were that the film would be a hit supported by a significant marketing effort, including merchandising and licensing tie-ins from Fox. DreamWorks SKG was also working on their own animation department headed up by Jeffrey Katzenberg, a former Disney executive. Katzenberg was credited with the revival of Disney animation with blockbuster hits like *Beauty and the Beast* (1991) and *The Lion King* (1994).

However, despite a menacing environment, Pixar had still created *Toy Story*, a world wide blockbuster, and had developed cutting edge proprietary digital animation technology. This technology gave them a clear competitive advantage over other digital animation houses. Ed Catmull and John Lassiter still seemed committed to the ideals of Pixar, even though Lassiter had an open invitation to return to Disney at any time. Pixar also had promising projects in the pipeline. A second feature film, *A Bug's Life*, was scheduled for a November 1998 release, and a direct-to-video sequel to *Toy Story* was scheduled for a late 1998/early 1999 release. Michael Ovitz, ex-CAA and ex-Disney entertainment guru, had commissioned a series of commercials. Pixar was also working on a number of CD-ROM projects.

Next Steps

Steve Jobs and the rest of the executive committee pondered their next steps. The plunging stock price sent a clear message to the committee. How would Pixar fund and sustain the technical and creative development required to create the next digital feature masterpiece and a corresponding flow of motion picture revenues? As the new years approached, it was clear was that Pixar need to make some key decisions to guide the next several growth years of the firm. As a result of restructuring of the firm to focus solely on feature films, commercial revenues had ceased, but the high costs of production and development remained.

Was this the best strategy for Pixar at this time? Should they move away from the capital and labor intensity of feature films and diversify into other uses for the technology – commercials, interactive technology, and special effects? Was Disney the right partner for Pixar? With the advent of new animation studios, might Pixar be able to structure another film deal with another studio? More immediately, how can Pixar fund its operations until its next feature release and return to profitability?

Exhibit 1: Pixar Key Dates

- 1986 Purchased from Lucasfilm, Ltd. by Steven P. Jobs; incorporated as an independent company
- 1986 Academy Award nomination for Luxo Jr.
- 1987 Red's Dream world premiere at SIGGRAPH
- 1988 Academy Award for Tin Toy (Best Short Animated Film)
- 1988 U.S. Patent - RenderMan
- 1989 KnickKnack world premiere
- 1989 RenderMan launch
- 1990 Moved to offices in Point Richmond
- 1990 U.S. Patent - Point Sampling
- 1991 Pixar and Walt Disney Pictures team up to develop, produce and distribute up to three feature-length animated films.
- 1992 Academy Award for CAPS (jointly with Disney)
- 1992 U.S. Patent - Non-Affine ImageWarping
- 1993 Academy Award for RenderMan
- 1993 Gold Clio Award for Listerine Arrows
- 1994 Gold Clio Award for Lifesavers Conga
- 1994 U.S. Patent - Creating, Manipulating & Displaying Images
- 1995 Academy Award for digital scanning technology
- 1995 U.S. Patent - Imaging Volume Data
- 1995 First fully computer-animated feature film, Toy Story, distributed by The Walt Disney Company
- 1995 Initial public offering 6,900,000 shares
- 1995 Toy Story nominated for two Golden Globe awards (Best Musical Score or Comedy Film and Best Original Song)
- 1995 Special Achievement Academy Award for John Lasseter for the development and inspired applications of techniques that made Toy Story possible
- 1996 Toy Story Animated StoryBook released in April, Pixar's first interactive CD-ROM product, also available in French, German and Japanese
- 1996 Pixar's second CD-ROM released in October: The Toy Story Activity Center
- 1996 Toy Story video released in October, as well as deluxe and laser editions
- 1996 Buena Vista International releases video of Pixar Shorts.

Exhibit 2: Expected Time Line of Future Events

1995	Release of <i>Toy Story</i> (Nov. 22)
Q1:96	
Q2:96	Release of 1 st <i>Toy Story</i> CD-ROM Start of Production of 2 nd Film
Q3:96	
Q4:96	Release of <i>Toy Story</i> to Home Video Release of 2 nd <i>Toy Story</i> CD-ROM

Future Developments

Q1:97	Enter Development of 3 rd Film
Q2:97	Release of 3 rd CD-ROM
Q3:97	
Q4:97	Release of 4 th CD-ROM Release of <i>Toy Story</i> direct-to-video sequel
Q1:98	Release of 5 th CD-ROM
Q2:98	Start Production of 3 rd Film
Q3:98	
Q4:98	Release of 2 nd Film (<i>A Bug's Life</i>) Release of 6 th CD-ROM

Source: Robertson, Stephens & Company Institutional Research

Exhibit 3: Pixar Movie Economics

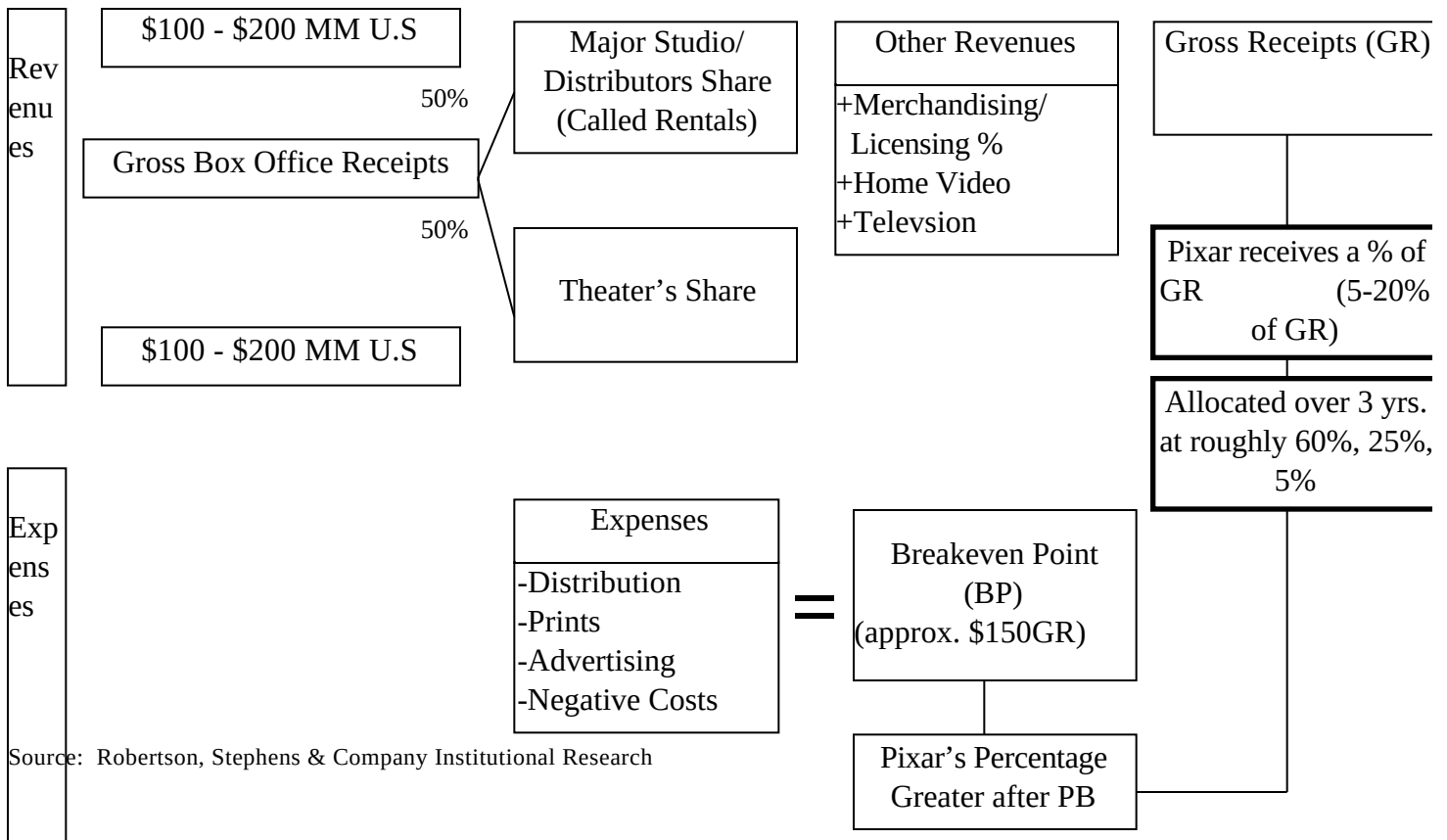


Exhibit 4: Key Personalities at Pixar

Steve Jobs

After a short stint at Atari in 1974, Jobs went on to found Apple Computer with Steve Wozniak in 1976. Jobs was fired by then CEO John Sculley in 1985 only to be rehired in 1997 as acting CEO (while still maintaining a seat on the Board of Directors). When first fired from Apple, Jobs went on to found NeXT Computer in 1989 which sold object-oriented software for client/server business applications. NeXT was later purchased by Apple in 1997. Jobs purchased the computer division of Lucasfilm in 1986, incorporated the company as Pixar Animation Studio and became the Chairman and Chief Executive Officer, a role he continues to play today.

John Lasseter

Perhaps most well known for writing and directing short animation films such as *Tin Toy* (which won the 1988 Best Short Animated Film) and television commercials such as Listerine, John Lasseter is the creative talent that drives Pixar. Originally Lasseter started his career at Disney in the studio's feature animation division. In 1983, Lasseter visited Pixar, was impressed with the computer graphics technology potential and left Disney in 1984 to become a part of the Pixar management team. Lasseter's first short film while at Pixar, *Luxo Jr.*, was nominated for an Academy Award. Two years later, Lasseter later did receive an Academy Award for *Tin Toy*, for Best Animated Short Film. Lasseter continued to produce short animated films and Clio award-winning commercials, but *Toy Story* was Lasseter's first animated feature film. For *Toy Story*, Lasseter received the Academy's Special Achievement Award. Lasseter currently holds the position of Vice-President, Creative Development.

Ed Catmull

As Executive Vice President and Chief Technology Officer of Pixar, Catmull is the lesser known, but key driver behind Pixar's success. In 1979, Catmull, with his PhD in computer science, brought his high-technology expertise to Lucasfilm when he joined the firm as vice president of the Computer Division. Catmull went on to manage four development efforts in computer graphics, video editing, video games and digital audio. He was the key developer of RenderMan software, and was awarded the Scientific and Technical Engineering Award from the Academy of Motion Picture Arts and Sciences for the work his software produced. He also won the Coons Award, the highest achievement in computer graphics, for his lifetime contributions. Ed Catmull is President of Pixar. In the past he was Director of the Computer Graphics Laboratory at NYIT, and Vice President of and Managing Director of the Computer Division of Lucasfilm, Ltd.

Exhibit 5: Other Animation Film Studios

Disney Studios

The Disney Studios have been the main source of animation innovation since the very beginning of animated film. The studio's first success was with Mickey Mouse as Steam Boat Willie in 1928. Their first full length animated feature, *Snow White*, debuted in 1937 and has been a classic ever since. The animation of Disney was widely regarded to be the best, and they have had no competition in feature length animated films until very recently. Other huge animated hits included *Fantasia* (1940), *Pinocchio* (1940), *Dumbo* (1941), *Bambi* (1942), *Song of the South* (1946), *Cinderella* (1950), *Alice in Wonderland* (1951), *Robin Hood* (1952), *Peter Pan* (1953), *Lady and the Tramp* (1955), *Sleeping Beauty* (1959), *101 Dalmatians* (1961), *The Sword in the Stone* (1963), and *The Jungle Book* (1967), among many others. After the death of Walt Disney in 1966, the animation division of Disney languished, and in 1979, several key Disney animators, led by Don Bluth left the company, citing a deterioration in the studio's artistic standards. This coincided with a general lack on market interest for family oriented features, Disney's main product theme.

During the 1980's, several management changes reoriented the company, and Disney became a market leader again. Michael Eisner, along with Jeffrey Katzenberg, managed to revitalize the animation division with such animated hits as *The Little Mermaid* (1989), *Beauty and the Beast* (1991), *Aladdin* (1992), *The Lion King* (1994), *Pocahontas* (1996), *The Hunchback of Notre Dame* (1996) and *Fantasia Continued* (1997).

Twentieth Century Fox

In 1994, Fox Filmed Entertainment Chairman and CEO Bill Mechanic, citing the studio's significant commitment to animated feature film production, announced the inception of the Fox Animation Studios in 1994. The announcement was followed by the naming of two of the industry's most influential filmmakers, Don Bluth and Gary Goldman, to produce and direct the Studios' first project, *Anastasia*.

Bluth and Goldman brought to Fox Animation Studios a wealth of experience in the animation field. Forging a partnership in the early 1970s during their tenure at Walt Disney Animation, they shaped such films as *Pete's Dragon* and *The Rescuers*, on which Bluth was the animation director and Goldman was a directing animator. In 1979, they ventured out to create their own canon of work as independent filmmakers, breaking new ground in the field with *The Secret of NIMH* and *An American Tail*. From late 1986 through the spring of 1994, Bluth and Goldman operated the Bluth Animation Studios in Ireland, where they produced *The Land Before Time* and *All Dogs Go to Heaven*.

Anastasia utilized Fox Animation Studios' latest techniques in animation. Digital effects were inlayed into traditional handdrawn animation to augment the handdrawn animation cels. Digital animation was used to drastically expand the number of cels which could be laid on top of one another to produce one scene, and they were also used to expand the palette of colors available to animators from 1400 paint colors to over sixteen million digital color choices. Digital effects were grafted to traditional elements to give sequences the appearance of being hand-drawn.

Exhibit 6: Digital Animation and Effects Houses

Industrial Light and Magic

Founded in 1975 by director George Lucas, Industrial Light and Magic (ILM) has been at the forefront of film effects since its first work with *Star Wars* (1977). As a division of Lucasfilm Ltd., ILM went on to become Hollywood's premier effects house, hired by studios to create the fantastic visions of screenwriters and directors. Numerous innovations in effects technology have been created at ILM, including front projection, go-motion, morphing and the very first digital effects. ILM has worked on a number of feature films including the *Star Trek* series, the *Indiana Jones* series, *E.T. the Extraterrestrial*, the *Back to the Future* series, *Poltergeist*, and *Jurassic Park*.

Pacific Data Images

Pacific Data Images (PDI) is a leading computer animation studio specializing in high-end 3D animation and visual effects for the entertainment industry. PDI popularized "morphing" techniques with the seamless effects created for Michael Jackson's music video, *Black or White*. In March 1996, PDI signed a co-production deal with DreamWorks to create original, computer-animated feature films. The first full-length animated feature film co-produced by DreamWorks and PDI will be *Antz*, the tale of an insect whose personal struggle with the day-to-day drudgery of a world populated by drones and dullards forces him to become the reluctant leader of a colony-wide revolt against conformity.

Sony Pictures Imageworks

Sony Pictures Imageworks was founded in late 1992 as the first in-house visual effects company to be established by a major studio, Sony Pictures Entertainment. The effects firm works primarily with their parent company, Sony, and its Sony Pictures Entertainment. They have created a number of spectacular digital effects for film, most notably jumping a bus across a freeway overpass in *Speed*. Other work includes placing Clint Eastwood into a presidential motorcade for *In The Line of Fire*, creating an adventuresome experience for *James and the Giant Peach* or perching Jim Carey atop a 200 foot tower in this summer's *The Cable Guy*.

Others

Other effects houses have also been active in feature films. Metrolight Studios, which originally produced digitally animated clips for television shows, moved into trailers for AMC Theaters, and then created a memorable sequence of animated "skeletons" for 1989's *Total Recall*. MetroLight won the Oscar for Visual Effects that year the first for use of CGI in a feature film.

Rhythm and Hues, an effects house started by ex-ILM management, has also been very active. They produced the now famous polar bear commercials for Coke Cola. The digital effects of Rhythm and Hues have been integral in movies such as *Mouse Hunt*, *Speed 2: Cruise Control*, *Batman and Robin*, *The Nutty Professor* and *Waterworld*. In 1985, the firm won an Academy Award for Best Visual Effects.

Another effects house which relies heavily on digital animation is Digital Domain. Digital Domain was conceived by director, writer, producer James Cameron, and is a fully integrated digital studio.

Exhibit 7: Pixar Animation Process and Digital Backlot

CREATIVE DEVELOPMENT	Story Concept	Treatment Outline	Screen Play	Story Board	Story Reels	Voice Recording
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Creative development is an iterative process in which the story and its characters are created and developed. The first step in creative development involves the development of a story concept, which often takes the form of a story summary or outline known as a treatment. After numerous iterations and research into the story and characters, a first draft of a screenplay is written. The screenplay is then turned into story boards, which are panels filled with thousands of sketches that represent the story to be animated. The story boards are then transferred to film or video so that they can be electronically edited into a photo play of the film called story reels, a process which enables editing of the film before the production phase begins. Voices are then selected, recorded and added to the story reels. Throughout the creative development process, plans are developed for the style, colors and look of the film.

PRODUCTION	Modeling	Layout	Animation	Shading / Lighting	Rendering	Film Recording
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Pixar's production stage consists of six phases: modeling, layout, animation, shading and lighting, rendering and film recording. In the modeling phase, digitized models of each set and character are created by defining their shapes in three dimensions (height, width and depth) and by adding animation control points that allow the model to be moved or animated. In some cases, a model has hundreds of animation controls. In the layout stage, artists place the digital models into a scene and position the digital cameras at the angles from which the three-dimensional shot is to be seen. The assembled shot is then given to the animator together with the prerecorded voice.

In the animation stage, the digitized models are animated, or "brought to life," in three dimensions to create a motion sequence. Animation is performed by defining "key frames," which are the frames containing the extremes of motion that will occur in a scene. The computer then interpolates frames in between the two most extreme positions in a particular segment of movement to create smooth motion. The animators can then adjust the interpolation and key frames repeatedly until they achieve the desired result. The next step in completing a scene requires attaching to each object and model a description of its surface characteristics. These "shaders" describe the pattern, texture, finish and color for every object in the scene. Next, lighting is added by placing digital lights into the scene. In the rendering phase, the renderer takes the modeling, layout, animation, shading and lighting data and, for each frame in the sequence, computes a three-dimensional image of what the scene looks like at that point in time from the point of view of the camera. The final rendering of a single frame can take between one and twenty hours. The final rendered data is then sent to one of Pixar's film recorders for imaging onto film.

Exhibit 7: Pixar Animation Process and Digital Backlot (con't)

POST PRODUCTION	Sound Effects Design	Print Musical Score	Sound Mixing	Color Correction	Delivery of Print
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The post-production stage consists of two parallel processes: the picture process and the sound process. In the picture process, images are put on film, the film is sent to a laboratory for color correction and final prints are made. In the sound process, the sound effects and musical score are added and the final sound is mixed. Pixar's post-production is simpler than post-production in a live-action film, which requires more significant editing. In most live-action films, many hours of film are shot, and the film is then significantly edited and re-edited in the post-production stage to create a feature film. Pixar, like other animation studios, edits the film throughout the entire creative development and production process. Thus post-production involves only final editing.

Exhibit 8: Technology

Marionette

Marionette is Pixar's software system for modeling, animation and lighting for computer animation. Marionette is the primary software tool of every animator and technical director at Pixar. In contrast to many commercially available animation systems which are designed to address product design, corporate logo graphics or cinematic special effects, Marionette has been designed and optimized for character modeling and animation. Marionette is portable across many of the standard Unix workstations, including those from Silicon Graphics and Sun. Pixar has also ported Marionette to IBM and Hewlett-Packard workstations for hardware evaluation purposes.

Ringmaster

Ringmaster is a production management software system for scheduling, coordinating and tracking a computer animation project. Due to the enormous amount of data required in three-dimensional animation, accurate production information is essential for producing high quality animation. Pixar's production coordination staff uses Ringmaster to plan and track projects ranging from short commercials to feature films.

A key component of Ringmaster is a distributed rendering system for managing the huge quantity of images and data that must be rendered to create Pixar's products. Pixar does its rendering on an array of powerful Unix processors which are dedicated to rendering 24 hours a day. These machines, which Pixar calls the RenderFarm, are connected via a local area network. To achieve the desired quality level, the average time to render a single frame at film resolution is between one and four hours; for video resolution the average time to render a single frame is between 30 and 90 minutes. Since an animated feature film contains well over 100,000 frames, each of which may be rendered several times in the production process, Pixar typically has a large number of frames to render at any give time. To manage this process, Ringmaster coordinates and schedules all the processors in the RenderFarm. Ringmaster includes a compositing system and also maintains an array of disk drives as a central data repository for the digital image files generated by the rendering and compositing steps of the production process. Finally, Ringmaster controls the filming phase of production and is responsible for backing up shots for archival purposes.

RenderMan

RenderMan is a rendering software system for high quality photo realistic image synthesis that Pixar uses internally and also licenses to third parties. Today, RenderMan is used by many major film studios and special effects firms. Examples of projects which have used RenderMan include Terminator 2, Jurassic Park, True Lies, Aladdin, Casper and Apollo 13. By licensing RenderMan to film studios, visual effects houses, commercial production facilities and other computer animation companies, Pixar believes that RenderMan has been established as a de facto industry standard for high quality rendering. RenderMan was designed to be easily portable. It runs on a wide variety of Unix workstations, including those from Silicon Graphics, Sun, Hewlett-Packard and Digital Equipment. Pixar has also ported RenderMan to the Windows and Macintosh platforms.

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