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Iridium LLC

On Friday August 13, 1999, Iridium LLC filed for bankruptcy in the United States Bankruptcy Court in Delaware. The company, a $5.5 billion venture backed by Motorola, offered global phone, fax, and paging services via satellite, but had been having trouble attracting customers ever since it began commercial service in November 1998. In explaining the bankruptcy, some people blamed everything: "Make a list of everything you can think of—technological glitches, marketing and distribution mishaps, management turnover, etc.—and then just get to the bottom and check all of the above."[1] Others, such as Mark Gercenstein, Iridium's Vice President of Operations, highlighted the system's technological complexity:

> More than 26 completely impossible things had to happen first, and in the right sequence (before we could begin operations)—like getting capital, access to the marketplace, global spectrum, the same frequency band in every country of operations.[2]

Most people, however, blamed Iridium's marketing and sales efforts:

> True, Iridium committed so many marketing and sales mistakes that its experience could form the basis of a textbook on how not to sell a product. Its phones started out costing $3,000, were the size of a brick, and didn't work as promised. They weren't available in stores when Iridium ran a $180 million advertising campaign. And Iridium's prices, which ranged from $3.00 to $7.50 a call, were out of this world.[3]

Yet bankruptcy was, after all, a *financial* problem. The protection afforded by Chapter 11 would give Iridium an opportunity to rethink its competitive strategy and restructure its balance sheet. The restructuring process, combined with a need to convince the bankruptcy judge that the company was unlikely to go bankrupt again, required a thorough understanding of the relation between the firm's financial strategy and its demise. For example, did it have too much leverage: was its target debt-to-total capital ratio of 60% too high? If not the amount of debt, perhaps it had the wrong kind of debt, or had raised it in the wrong sequence vis-à-vis equity. Answers to these questions were critical not only to Iridium as it struggled to emerge from Chapter 11, but also to at least 14 other firms that were in the process of spending more than $40 billion on satellite communications systems (see **Exhibit 1**).

Professor Benjamin Esty, Research Associate Fuaad A. Qureshi, and William Olson (MBA '00) prepared this case. It is based, in part, on Scott Vuchetich's (MBA '99) Faculty Sponsored Research project. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

The Global Telecommunications Market

In 1999, the $835 billion market for telecommunications services consisted of three segments based on the mode of transmission.[a] Wireline communication systems utilized terrestrial cable and fiber-optic technology to transmit voice and data signals. In contrast, wireless and satellite systems used radio systems and satellites, respectively, for transmission, along with wireline infrastructure to route calls. **Exhibit 2** provides details on the size, historical growth rates, and expected future growth rates of each segment.

The satellite communications segment was further divided into Fixed Satellite Services (FSS) and Mobile Satellite Services (MSS). The former used fixed stations on earth to transmit and receive signals, while the latter utilized mobile receivers, such as hand-held phones, and one of three types of satellites (see **Exhibits 3a** and **3b**). *Geosynchronous Earth Orbit* (GEO) satellites maintained fixed positions relative to the earth, but were relatively inefficient at handling real-time voice and data applications because of the long time delay caused by sending signals over great distances. Located closer to earth, *Low Earth Orbit* (LEO) satellites greatly reduced the propagation loss, time delay, and power required for real-time communications yet required significantly more satellites because orbiting satellites covered only a small fraction of the earth. *Medium Earth Orbit* (MEO) satellites were between these two systems and helped to bridge the gaps in cellular networks in addition to handling mobile satellite telephony.

Without a doubt, the market for mobile satellite systems would be large, yet analysts disagreed on just how large it would be. For example, Leslie Taylor Associates, a telecommunications consulting firm, predicted a user base of 7 million to 12 million subscribers and revenues of $8 billion to $20 billion by 2003.[4] On the other hand, Forrester Research predicted that the global satellite market would be as much as $36 billion in 2005.[5] Given the potential size of this market, analysts were excited by the prospect of companies capturing even a small part of it. CS First Boston analyst Cynthia Motz commented**:**

> . . . our take is that the dream behind global mobile communications via satellite is really pretty impressive . . . why would one not consider an industry that is in its nascent stages of development, (or a competitor like Iridium) that can do what no other player can do right now, . . . has high barriers to entry, and 70%-90% operating cash flow margins if it works?[6]

Iridium LLC

According to legend, the Iridium concept originated in 1986 when a Motorola executive and his wife were vacationing in the Caribbean and she was unable to make a cellular phone call. This predicament spurred the idea of a global telecommunications system.[7] At the time, Motorola was developing inter-satellite communications systems for military applications, but was searching for new, commercial applications for its communications technology. Motorola engineers began to study the feasibility of a global system in 1987. Shortly thereafter, Motorola unveiled the plans for a $3.4 billion communications system named Iridium. The name came from its proposed constellation of 77 satellites (later reduced to 66 satellites) which resembled the 77 electrons orbiting the element Iridium. In addition, the system would require 12 ground stations (gateways) located around the world to link the satellites with ground lines.

[a] This figure excludes equipment revenues associated with building and supporting these services (Telecommunications Services, U.S. Industry and Trade Outlook, 1999).

The Iridium system differed from the existing, and most of the proposed, satellite systems which used "bent pipe" technology. In a bent pipe system, calls were routed along ground lines to a transmitter, beamed up to a satellite, sent down to a receiver, and then routed using ground lines to the other party. Whereas these systems kept most of their technology on the ground, Iridium put the technology in its satellites using "intra-satellite" technology. Consider a customer on top of Mt. Everest calling her children at home in New York. Her call would be transmitted directly to the nearest satellite, and then passed from satellite to satellite until it reached a ground station in Arizona where it would then connect to her home in New York using existing ground lines. If she placed a call to another Iridium user, the signal would be relayed from satellite to satellite, and beamed directly to the recipient's handset. A key requirement of the Iridium system was the need for direct line-of-sight connection with a satellite. Thus, the phones could not be used indoors without a special, oversized antenna to boost signal strength.

Seamless global operations were made possible by the fact that satellites transcended national boundaries. But to achieve a seamless system, Iridium had to obtain worldwide spectrum rights and negotiate royalty agreements with local phone companies. In fact, Iridium had signed 256 operating agreements with local providers in over 100 countries by July 1999.[8] While these agreements covered 90% of its targeted customer base, the company still had to negotiate agreements with another 140 countries and territories.

Iridium's Financial Projections

Iridium's target customer consisted primarily of traveling professionals, corporate executives, government employees, and rural users in both developed and developing markets. Analysts regularly cited the figure of 1% of the global cellular market as the likely initial customer base of satellite phone users.[9] Although the exact origin of this figure was not known, it quickly became the mantra of all players in the industry. If Iridium were to capture 1% of the 225 million cellular subscribers in 1998, and each one spent $1,000 annually, then Iridium would have revenues of $2.3 billion per year. If the number of cellular subscribers continued to grow at 15% per year, then 1% of the market in 2004 would equal five million customers and revenues of more than $5 billion.

Using similar analysis, Wall Street analysts made predictions about Iridium's future revenues and cash flow. **Exhibit 4a** depicts how Thomas Watts, Merrill Lynch's telecommunications/satellite analyst and the top-ranked analyst on *Institutional Investor*'s 1998 All America Research team, revised his revenue projections between 1997 and 1999.[b] As of May 1999, he was still predicting total revenues of $6.4 billion in 2005. Besides changing over time for specific analysts, revenue projections also varied across analysts. **Exhibit 4b** shows the range of revenue projections made by five analysts at approximately the same time (year-end 1998). The revenue projections for 2005 ranged from a low of $4.5 billion by CIBC Oppenheimer to a high of $6.9 billion by CS First Boston. **Exhibit 5** presents Iridium's cash flow projections and balance sheet data, as well as capital market data from year-end 1998.

Based on similar projections, and an assumed private market discount of 15% to 20% (only 8.5% of Iridium's shares were publicly traded at the time), four out of the five analysts surveyed had buy recommendations for Iridium: Salomon Smith Barney, CS First Boston, Merrill Lynch, and Lehman Brothers had price targets of $60, $57, $68, and $75, respectively, using free cash flow discount rates (i.e., weighted average costs of capital, WACCs) ranging from 17% to 25%. Only CIBC Oppenheimer had a hold recommendation.[10] John Coates, the bullish analyst at Salomon Smith Barney, wrote:

[b] Merrill Lynch underwrote Iridium's initial public offering (IPO) in July 1997.

"Iridium presents a clear investment opportunity. . . . Accordingly, we reiterate our buy rating, maintain our $60 price target, and offer 10 reasons to buy the stock immediately."[11] Coates and the other analysts cited high margins, first mover advantages, strong partnership potential, and better breadth of coverage as reasons to invest in Iridium. They also cited uncertain demand, technology, competition, and regulation as the most important risks, and the company's sizeable funding need as a potential threat to completion.

Competition in the MSS Segment

Although INMARSAT had been providing commercial mobile satellite service since 1982, Iridium considered three new companies as its main competition (see **Table A**). Globalstar, a $3.3 billion joint venture between Space Systems/Loral and Qualcomm, was expected to begin service in late 1999. Its constellation would offer low-cost communication services using bent-pipe technology and phones that were similar to today's cellular units. Like Globalstar, ICO Global Communications would integrate satellite technology with terrestrial networks using bent-pipe technology; unlike Globalstar and Iridium, it was a MEO system that required many fewer satellites. Inmarsat and Hughes founded the $4.5 billion system in 1995, and expected it to be operational by year-end 2000.

While other systems promised global coverage, Ellipso proposed to cover only heavily populated areas. Its satellites would follow elliptical orbits, focussing on high-potential regions, thereby significantly reducing capital costs. As of 1999, Ellipso was still in early development with a target launch date of late 2002. Like Iridium, these other systems were largely limited to outdoor use.

Table A Comparison of Mobile Satellite Service Providers

	Iridium	Globalstar	ICO	Ellipso
Total cost ($ billions)	$5.5	$3.3	$4.6	$1.4
Satellite life span	5-8 years	7-8 years	12 years	5 years
Orbit	LEO	LEO	MEO	MEO
Initial/expected cost per minute				
-Wholesale	$0.50-$1.99	$0.30	$0.30-$0.50	$0.33
-Retail	$3.00-$7.50	$2.00-$4.00	$1.50	$1.00-$1.50
Number of ground stations	12	50-80	12	6-14
Headset cost (initial)	$3,000	$750-$1500	$700	$750-$1000
Number of satellites	66	48	10	17
Market share (estimate)				
2000	72.6%	26.2%	0.9%	0.0%
2005	35.4%	26.6%	23.5%	8.3%

Source: Project Finance International, July 29, 1998, Issue 150; CS First Boston, "The Sky's the Limit," December 23, 1998; Sandra Sugawara, "Battle in the Skies," *The Washington Post*, October 18, 1993; casewriter estimates.

Iridium's Operating and Financing History

Iridium's operating and financing history prior to bankruptcy can be divided into three chronological phases: Research to June 1995, System Development to June 1998, and Commercial Launch through July 1999, ending with the bankruptcy declaration in August 1999.

Research: June 1990 to June 1995

During its start-up phase, Motorola designed the system, developed the basic technology, and raised the initial equity needed to fund early development. Motorola unveiled the project in June 1990 with simultaneous press conferences in Beijing, London, Melbourne, and New York. The following year, it incorporated Iridium as a separate company to build and operate the system. At the time, Motorola was rated AA-, and had total assets of $9.4 billion, sales of $11.3 billion, and net income of $454 million. In comparison, Iridium was initially expected to cost $3.4 billion, generate revenues of $5 billion, and have assets of $4 billion by 2002.

Between 1990 and 1993, Motorola invested $100 million in research and development. One of the company's major achievements during these early years was reserving specific radio frequencies for the system. In fact, 160 countries agreed to allocate a band of radio frequencies to LEO systems in March 1993.

To fund actual development, Motorola decided to raise the initial capital from 21 strategic partners including major telecommunications and aerospace firms such as Nippon Iridium Ltd. (a joint venture between Kyocera and DDI Corporation), Telecom Italia, SK Telecom (South Korea), Sprint, Raytheon, and Lockheed Martin. The largest strategic partners, in terms of total investment, were entitled to board representation. **Exhibit 6** shows the composition of Iridium's board of directors. Except for the two independent directors who received $20,000 per year, $2,500 per quarterly meeting, and 1,000 options, none of the other directors received compensation from Iridium.

According to the financing plan, Iridium would raise $1.6 billion of equity followed by $1.8 billion of debt giving it a debt-to-total capital ratio of approximately 50%. By August 1993, Iridium had obtained commitments for $800 million from its strategic partners, including a total of $270 million from Motorola.[12] It hoped to raise another $800 million from the strategic partners in 1995, at which time, Motorola's ownership share would decline from 34% to 19%.[13]

In reality, the second round of equity financing came sooner than expected. Iridium secured commitments for another $734 million of equity in September 1994.[14] Based on investor demand for the equity and general interest in the project, Iridium's bankers thought it could raise 60% of the total cost in debt.[15] The theory behind this target leverage ratio was that Iridium, once complete, would resemble a utility with high margins and steady cash flows. **Exhibit 7** shows leverage ratios for a variety of industries as of year-end 1998. **Exhibit 8** provides financial statistics for satellite communications companies as of year-end 1998. **Exhibits 9a** and **9b** illustrate Iridium's capital structure in terms of total capital invested and leverage (debt as a percentage of total capital), respectively, from 1993 to 1999.

System Development: July 1995 to June 1998

By mid 1995, most of the research was done and the company began developing the system. Motorola signed a Terrestrial Network Development Contract in 1995, under which it agreed to develop the gateway hardware and software. As part of this effort, Iridium signed 12 gateway contracts in late 1995, but needed more money before it could create and launch the first satellites—each satellite cost approximately $13 million. With revenues still more than three years away, Iridium decided to issue $300 million of zero coupon bonds. Although zero coupon bonds were more expensive than cash-pay bonds by anywhere from 100 basis points (bps) to 300bps depending on their rating and market conditions, they were attractive to highly-leveraged firms with limited cash flow.

When Iridium tried to market the bonds, however, it encountered resistance. Investors wanted the bonds to come with warrants, thereby raising the effective yield to approximately 25%, and a completion guarantee from Motorola.[16] These demands, combined with Standard & Poor's CCC+ rating on the issue, prompted Iridium to cancel the offering in September 1995, because it undervalued the company and its prospects. And so, Iridium proceeded with development funded by its initial equity.

Development proceeded at a steady pace throughout 1996, highlighted by an organizational change, a new chief executive officer (CEO) named Edward Staiano, and additional fund raising. Iridium converted from a corporation to a limited liability company named Iridium LLC, which meant its income would not be subject to U.S. taxation, but it would still provide limited liability for the strategic partners. With money running out and a failed public offering behind it, management decided to raise debt from the strategic partners instead of the public markets. It sold $238 million of ten-year bonds with warrants in April 1996. For the first five years, the bonds accrued interest at a rate of 14.5%; for the last five years, beginning in September 2001, they paid cash interest.[17] But this was still not enough money and so Iridium signed a $750 million bank facility in August 1996. Because Motorola, by then a AA rated company, had agreed to guarantee this facility in exchange for Class 1 warrants, the banks priced the loan at the prime rate—technically, the interest rate was a function of several indicator rates of which the prime rate was the best known.

Iridium used the funds to pay for satellites and the first launch, which occurred on May 5, 1997. Over the next 12 months, it deployed a total of 47 satellites aboard U.S., Russian, and Chinese rockets. As Iridium was deploying satellites, it also began developing the handheld phone units through an agreement with Kyocera of Japan. One observer described the original phones as "a brick with a baguette sticking out of it."[18]

In addition to being a critical year for Iridium in terms of system development, it was also a critical year in terms of raising badly needed capital. Prior to 1997, Iridium had only been able to raise capital from its strategic partners and banks. Yet in 1997 alone, it issued $240 million of equity through an initial public offering (IPO), issued three tranches of high-yield debt totaling $1.1 billion, and signed a $1 billion secured bank facility.

Its first foray into the public markets occurred in June 1997, when Iridium World Communications Ltd. (IWCL), a Bermuda corporation, sold 12 million shares at $20.00 a piece—these shares represented 8.5% of Iridium's total outstanding shares (technically, the shares were called Class 1 "interests"). IWCL's creation, like Iridium LLC's creation, was done for tax reasons: it precluded U.S. taxation of dividends paid to IWCL shareholders. Unlike its previous attempt to sell public bonds, investor demand was strong prompting management to increase the offer size from $200 million to $240 million. According to one source, Iridium could have sold $1 billion of equity.[19]

The IPO's success encouraged Iridium to issue $800 million of high-yield debt in two tranches, under Rule 144A, in July 1997. The Series A senior notes were priced to yield 13% and came with warrants to purchase IWCL shares; the Series B senior notes required a higher yield (14%) because they did not come with warrants. Both were semi-annual, cash-pay bonds with an 8-year maturity; they were due in 2005. Initially rated B-, these bonds sold at an effective yield of almost 700bps over Aaa rated bonds. **Exhibit 10** depicts Iridium's stock and bond prices since the IPO.

Continued strength in the bond market allowed Iridium to issue a third series of senior notes in October 1997. The Series C notes sold at par with a coupon of 11.25%, a spread of 400bps over Aaa-rated bonds. A banker commented on Iridium's second trip to the high-yield debt market in just over three months: "The high yield market runs hot and cold. When it is available and pricing aggressively, you go for it. In a project this size, you get money whenever and wherever you can."[20]

Following this advice, Iridium established a two-year senior secured line of credit with a syndicate of banks in December 1997. The line consisted of a $350 million term loan and a $400 million revolving line of credit, with an additional $250 million available on the revolving line in September 1998, if Iridium achieved certain operating milestones. Prior to signing the loan agreement, Iridium conducted an "asset drop-down transaction" in which Iridium LLC transferred all of its assets and liabilities to a wholly owned subsidiary known as Iridium Operating LLC (see **Exhibit 11**). The purpose of this transaction was to pledge all of Iridium's assets to the lending syndicate as security for the loan. In addition, the line was secured by a $243 million capital call on the strategic partners. In other words, the banks could require the strategic partners to invest up to $243 million if default were imminent. While the pledge of assets and the capital call made the secured debt cheaper than the public notes, it was, nevertheless, significantly more expensive than the guaranteed line of credit. It had a variable interest rate equal to prime plus 2.75%. Both lines matured in September 1998, the scheduled commercial launch date, but could be extended until June 30, 1999, by mutual agreement.

Having created the gateways, deployed the first satellites and tested the system, Iridium began to prepare for commercial launch. It deployed the remaining 19 satellites in early 1998. Iridium's perfect record in satellite deployment impressed industry experts who cited a 10% to 15% failure rate as typical, and pleased investors as the stock price soared to over $70 per share.[21] Globalstar, in contrast, suffered a major setback in September 1998, when it lost 12 satellites in a single, failed launch. Iridium also began to court prominent customers for the launch. Its first major customer was the U.S. government, which purchased a high-capacity connection for military use.[22] Also in preparation for the launch, Iridium issued a fourth series of senior notes ($350 million of Series D notes) in May 1998. Like the previous high-yield issues, this one was rated B- and was due in 2005, but had a lower interest rate of 10.88%.

Commercial Launch: July 1998 to July 1999

Iridium announced the new service in July 1998, with a $140 million advertising campaign in 16 languages across 45 countries with the slogan "Freedom to Communicate. Anytime, Anywhere."[c],[23] Iridium, however, quickly ran into trouble: it failed to answer over one million sales inquiries due to internal confusion, and experienced logistical problems trying to distribute phones.[24] These problems forced Iridium to delay the start of commercial service by two months. Nevertheless, commercial service began on November 1, 1998, with a phone call from Vice President Albert Gore at the White House to Alexander Graham Bell's great-grandson in Virginia.[d]

Within weeks, it became clear that Iridium was not attracting as many customers as it had expected, a fact that concerned the bankers and forced Iridium to negotiate new bank facilities in December 1998. Unfortunately, it was not a good time to raise capital in the wake of the financial crisis in Russia, turmoil in Asia, and near collapse of Long-Term Capital Management (LTCM). Rather than replacing the bank loans with long-term debt as planned following launch, Iridium was forced to renew its bank facilities. At the time, the banks reviewed the company's strategic plans, hired independent consultants to review the projections, and conducted their own market analysis. Feeling satisfied with the results, the banks provided a new guaranteed facility and a new secured line of credit. The new guaranteed facility consisted of a $475 million term loan due in December 2000, and a $275 million revolving credit facility expiring in December 2001. Once again, Motorola

[c] Despite the quote on page 1, the advertising campaign cost approximately $140 million, not $180 million.

[d] Vice President Gore greeted Gilbert M. Grosvenor with the famous words Bell uttered to his assistant in 1876: "Mr. Watson, come here, I want you." (Iridium World Communications Annual Report 1998, p. 1.)

guaranteed the full $750 million in exchange for warrants and cash payments based on the spread between the bank loans and Iridium's Series A and B bond rates.[25] This guarantee allowed Iridium to borrow at the prime rate.

Iridium also signed a new $800 million secured credit facility. The facility provided $800 million in cash priced at prime plus 2.75%.[26] In an effort to increase their security, the banks included a number of new covenants on the loans that established quarterly milestones in terms of revenues and subscriber levels. **Table B** (below) provides details on the new covenants.

Table B Covenants on the New Secured Bank Facility, December 1998

Date	Cumulative Cash Revenue ($ millions)	Cumulative Accrued Revenue ($ millions)	Number of Satellite Phone Subscribers	Number of System Subscribers [a]
March 31, 1999	$ 4	$ 30	27,000	52,000
June 30, 1999	50	150	88,000	213,000
September 30, 1999	220	470	173,000	454,000

Source: Iridium World Communications Ltd., 1998 Annual Report.

[a]Total system subscribers includes users of Iridium's phone, fax, and paging services.

With new bank loans, but lower than expected cash flow, management began to search for ways to conserve cash. For 1999, the firm projected aggregate cash needs of $1.65 billion to cover system operation, financing costs, working capital, and software development; the firm would need similar amounts annually for the next three years. Beginning in 2000, the firm would have to increase system capacity; the following year it would have to start replacing the satellite constellation assuming a 5-year useful life for the satellites. These two activities would require more than $6 billion of capital expenditures between 2000 and 2004 (see **Exhibit 5**). To reduce its immediate cash requirements, Iridium reached an agreement with Motorola to defer up to $400 million in contract payments. **Exhibit 12** documents Iridium's previous payments and future obligations to Motorola. In an effort to raise cash, Iridium conducted a secondary equity offering in January 1999, that raised an additional $240 million at a price of $37.38 per share. After this offering, IWCL's executive officers and directors owned 3.8% of IWCL, which, in turn, owned 13.3% of Iridium LLC (see **Exhibit 6**).

While these steps temporarily solved the cash flow problems, Iridium continued to stumble in terms of execution. In March 1999, it was unable to fill 15,000 orders for satellite phones because the manufacturer could not ramp up production fast enough. This and other distribution problems made it clear that Iridium would miss its first quarter targets on both revenues and the number of subscribers. In fact, Iridium announced that it had only 7,188 satellite subscribers, 10,294 total service subscribers, and cumulative cash revenues of $195,000 as of March 31, far short of the required 27,000 satellite subscribers, 52,000 total subscribers, and $4 million of cash revenues.[27]

The banks, however, granted a 60-day extension to the end of May. Shortly thereafter, Roy Grant, the company's chief financial officer (CFO), announced his resignation. The next month, John Richardson, head of Iridium's African gateway, replaced Staiano as CEO, and Leo Mondale became CFO. In May, the banks waived the covenants until the end of June. When Iridium missed the June

targets as well, the bankers extended the deadline one more time until August 11, 1999. The only bit of positive news during this time, at least from Motorola's perspective, came when Teledesic announced that Motorola had been selected as the prime contractor for its $10 billion "internet in the sky" system.

In an attempt to save the company, Iridium took increasingly more drastic measures. The new management fired 15% of the workforce in June 1999, and revamped the company's marketing strategy. They cut the usage charge from as high as $7.00 per minute to $1.89, and slashed the advertising budget to $12 million.[28] But even these actions were not enough, as Iridium missed the scheduled interest payments on its notes on July 15. When asked whether Iridium might declare bankruptcy, CFO Mondale stated that bankruptcy was not a realistic option because, "Our investors, partners, and distributors do not feel that Iridium will quickly, if ever, recover from a bankruptcy."[29]

Default and Bankruptcy

By August, Iridium had still not attracted enough customers or generated sufficient revenue to meet the covenants on its secured credit facility. As a result, it was in technical default when the August 11 deadline arrived. Two days later, a group representing the public bondholders filed an involuntary bankruptcy petition based on cross-default provisions in the notes. Later that same day, Iridium filed a voluntary Chapter 11 bankruptcy petition to protect itself from the creditors. Iridium's CEO, John Richardson, explained: "The action is the most efficient way to conclude Iridium's restructuring negotiations. . . . We are confident that Iridium will emerge from this process as a stronger and more vibrant company in the telecommunications marketplace."[30] Twelve days later, *The Wall Street Journal* published a letter from Richardson to the public in which he wrote:

> We recognize our missteps and are working diligently to correct them. Our single most important goal is to provide world-class service to our customers. To meet our goal, we must get our financial house in order. . . I want to assure our customers, investors, and partners worldwide that Iridium will continue to provide its pioneering, high-quality global telecommunications service without interruption. We are still in business, and it is business as usual.[31]

Exhibit 1 Existing and Proposed Satellite Systems

Segment/Project	Lead Sponsor	Constellation Specifications	Estimated Cost ($billions)
Voice Transmission			
(1) Iridium, LLC	Motorola	Low orbit, 66 satellites, plus 6 spares	$ 5.5
(2) Globalstar	Loral, Qualcomm, Vodafone, Airtouch	Low orbit, 48 satellites, plus 8 spares	3.3
(3) ICO	Inmarsat, TRW, Hughes, various PTTs	Medium orbit, 10 satellites, plus 2 spares	4.6
(4) Ellipso	Mobile Communications Holdings	17 satellites, most in elliptical orbit	1.4
(5) ECCO	Constellation Communications	Low orbit, 46 satellites, plus 8 spares	3.0
(6) ACeS	Pacifik Satelit, Phillipine Long Distance	2 geosynchronous satellites	0.9
(7) Thuraya	Etisalat (United Arab Emirates)	2 geosynchronous satellites	1.0
		Total Cost (Voice Transmission)	**$19.7**
Data Transmission			
(1) Teledesic	Gates, McCaw, Motorola, Boeing	Low orbit, 288 satellites, plus 12 spares	$10.0
(2) Skybridge	Alcatel, Loral	Low orbit, 80 satellites	4.2
(3) CyberStar	Loral	3 geosynchronous satellites	1.6
(4) Astrolink	Lockheed Martin	9 geosynchronous satellites	4.0
(5) Spaceway	Hughes Electronics	8 geosynchronous satellites	3.2
(6) Orbcomm	Orbital Sciences	"Little LEO," 36 satellites	0.3
(7) Leo One	Leo One	"Little LEO," 48 satellites	0.5
		Total Cost (Data Transmission)	**$23.8**
		Total Cost (Voice & Data)	**$43.5**

Sources: Various newspaper and industry articles.

Exhibit 2 Global Telecommunication Service Segments

Segment	1999 Size ($billions)	1990-1999 CAGR [c]	2000-2004 Est. CAGR [c]
Wireline	$609.0	8.0%	8.0%
Wireless	$206.8	14.2	15.0
Satellites			
-MSS [a]	$1.9	21.4	60.3
-FSS [b]	$17.3	31.7	28.0
Total	**$835.0**	**10.2%**	**10.1%**

Sources: Adapted from McKinsey & Company, Telecommunications Industry Report (1999) and *U.S. Industry and Trade Outlook,* Telecommunications Services (1999).

[a] Mobile Satellite Services.

[b] Fixed Satellite Services.

[c] CAGR is the compound annual growth rate.

Exhibit 3a LEO/MEO/GEO Satellite Orbits

Illustration by Chris Vuchetich

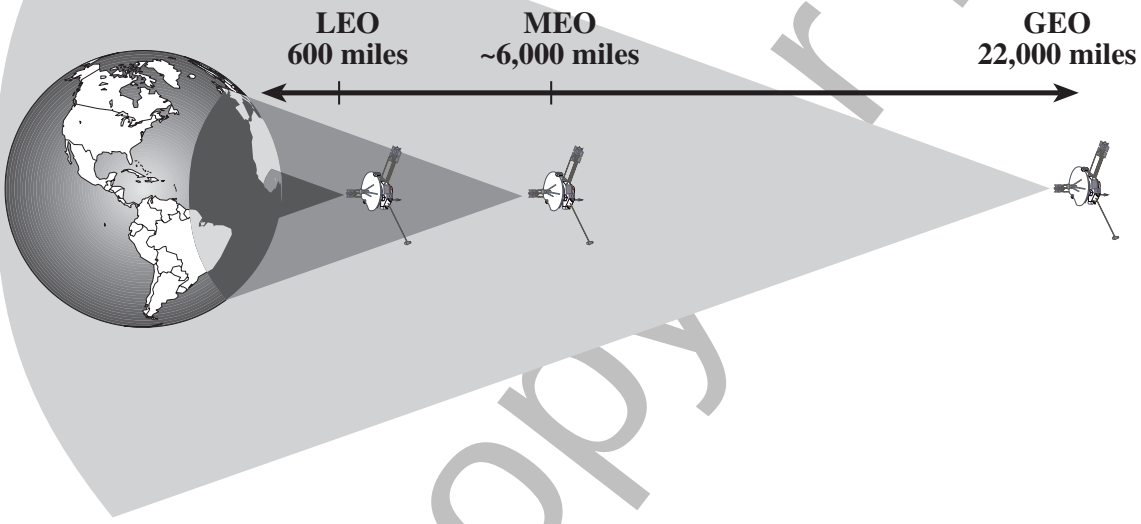


Exhibit 3b Satellite Technologies

	Low Earth Orbit (LEO)	Medium Earth Orbit (MEO)	Geosynchronous Earth Orbit (GEO)
Orbit Distance (miles)	600	6,000	22,000
Type of Orbit	Non-geosynchronous	Non-geosynchronous	Geosynchronous
Minimum number of satellites for global coverage	48	20	3-5 [a]
Typical Applications	Corporate WANs Mobile Voice & Paging Rural Telephony	Corporate WANs Mobile Phones	Corporate WANs Carrier Backbones Video Broadcast
Delay Time (milliseconds)	70	120	500
Orbit Time	100-114 minutes	6 hours	24 hours
Satellite Life (years)	5-8	10-12	7-15

Sources: Adapted from data contained in Forrester Research reports, CSFB Equity Research Report, December 23, 1998, and from casewriter estimates.

[a] In reality, GEO systems experienced difficulty in reaching extreme northern and southern areas. While three GEO satellites could cover the Earth, five would provide better service.

Exhibit 4a Merrill Lynch's Revenue Forecasts for Iridium by Research Report Date (note: phone service began 11/1/98)

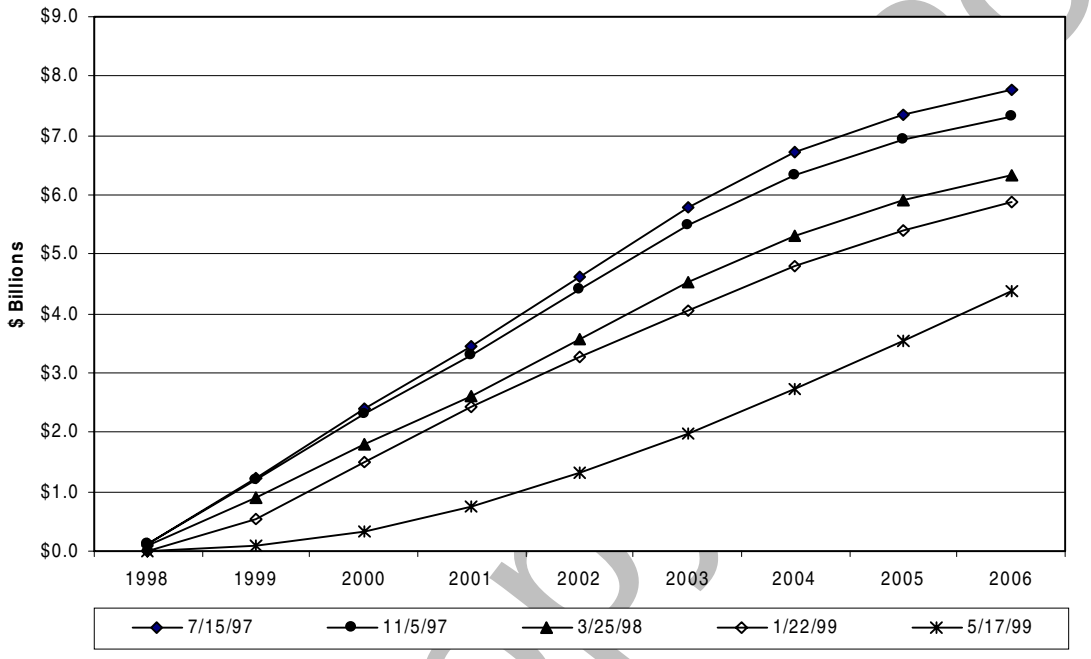
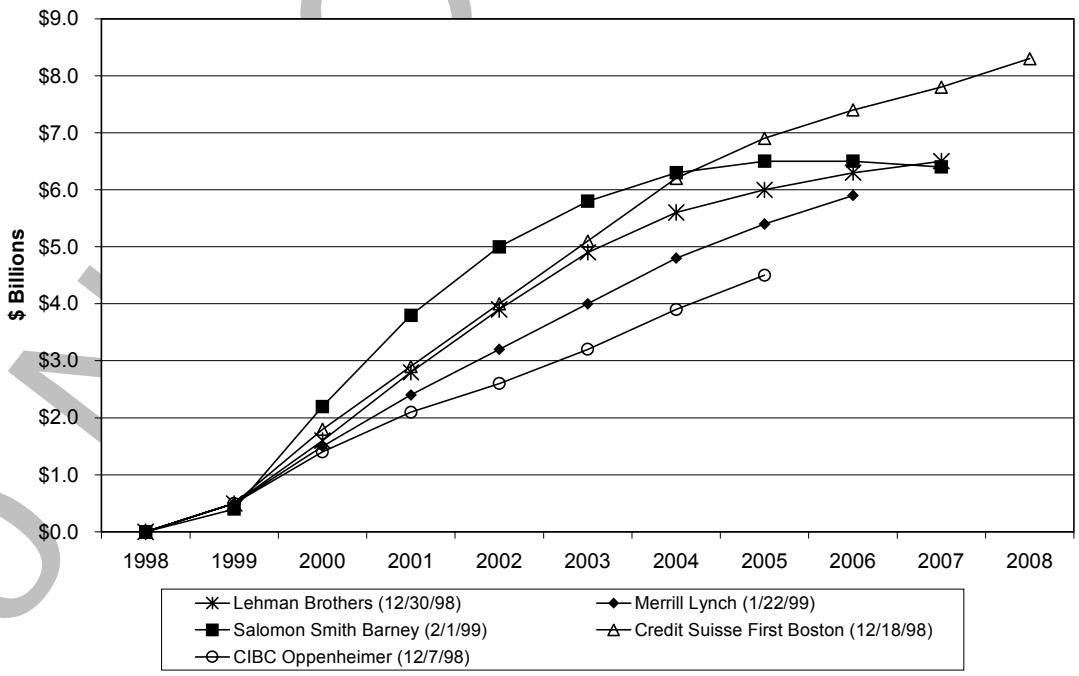


Exhibit 4b Analyst Revenue Forecasts for Iridium as of Year-end 1998



Source: Casewriter Analysis.

Exhibit 5 Iridium Financial Projections and Capitalization, 1999-2007 ($millions)

	1998 Act.	1999	2000	2001	2002	2003	2004	2005	2006	2007
Income Statement (millions)										
# Voice Subscribers	5	600	1,475	2,525	3,675	4,550	5,275	5,900	6,525	7,150
# Paging Subscribers	0	50	125	225	325	425	525	600	650	690
Revenues	$0.2	$403	$2,183	$3,748	$4,994	$5,821	$6,249	$6,435	$6,495	$6,481
EBITDA	-436	-351	1,339	2,809	3,859	4,611	4,973	5,100	5,084	5,001
Depreciation/Amort.	552	811	966	1,213	1,333	1,084	1,109	1,020	822	605
EBIT	-988	-1,162	373	1,596	2,526	3,527	3,864	4,080	4,262	4,396
Interest Expense, net	265	387	454	424	278	59	0	0	39	92
Profit Before Tax	-1,253	-1,549	-81	1,172	2,248	3,468	3,864	4,080	4,223	4,304
Taxes @ 15%	0	0	0	176	337	520	580	612	633	646
Net Income	-1,253	-1,549	-81	996	1,911	2,948	3,284	3,468	3,590	3,658
Cash Flow Data										
Depr./Amortization	552	811	966	1,213	1,333	1,084	1,109	1,020	822	605
Capital Expenditures	716	927	1,349	1,246	1,258	1,274	385	391	413	844
Incr. (Decr.) in NWC [a]	(398)	290	63	(102)	(81)	(54)	(28)	(12)	(4)	(1)
Balance Sheet Data										
Cash	25	10	10	10	10	20	30	50	50	50
Prop., Plant & Equip.	3,584	3,215	3,597	3,630	3,555	3,745	3,020	2,390	1,981	2,103
Total Assets	3,739	3,319	3,833	3,979	3,990	4,270	3,582	2,988	2,583	2,704
Total Debt	2,854	3,930	4,437	3,352	1,266	0	0	0	450	1155

Iridium, LLC, Capitalization as of 12/31/98

	($millions)
Debt	
Secured Bank Debt, @ Prime + 2.75%	$500
Guaranteed Bank Debt, @ Prime	625
Sr. Sub. Notes @ 14.5%, due 2006	323
Senior Notes A @ 13.0%, due 2005	278
Senior Notes B @ 14.0%, due 2005	480
Senior Notes C @ 11.25%, due 2005	300
Senior Notes D @ 10.88%, due 2005	348
Total Debt	2,854
Deferred payments due to Motorola	$218
Equity	
Preferred Partnerships (Equity—Class 2)	$46
Total Class 1 Equity Raised	2,114
Accumulated Losses	1,683
Net Class 1 Equity (book value)	$431
Debt/Total Capital (book value)	86%
Debt/Total Capital (market value)	34%
Debt/Total Capital (capital raised)	57%

Capital Market Data as of 12/31/98

Iridium Information	
Stock Price (IRIDQ)	$39.56
Equity Beta (weekly data)	1.58
Asset Beta (1998 average)	1.25
Class 1 Interests (shares)	141 million
Class 1 Interests (fully diluted) [b]	185 million
Proceeds from Class 1 warrants [b]	$220 million
Yields on US Treasury Bills, Notes and Bonds	
3-month	4.48%
1-year	4.53%
10-year	4.65%
30-year	5.09%
Prime Rate	7.75%
Yields on Corporate Bonds	
Aaa Rated	6.23%
Baa Rated	7.23%

Sources: Salomon Smith Barney, Equity Research Report, 2/1/99; casewriter estimates. *Federal Reserve Bulletin*; Iridium World Communications, Ltd. 1998 Annual Report.

[a] Changes in net working capital excludes cash and cash equivalents.

[b] Exercise of the outstanding Class 1 warrants would increase the number of interests from 141 to 185 million, and yield $220 million of proceeds to the company.

Exhibit 6 Iridium LLC Board of Directors as of 3/31/99

Name of Director	Age	Director Since	Company	Title	Designated by	IWCL Director?	IWCL Shares [a]
1) Aburizal Bakrie	51	7/97	The Bakrie Group	Chairman	South Pacific Iridium		
2) Hasan M. Binladin	50	1/96	Saudi Binladin Group	Senior VP	Iridium Middle East		
3) Herbert Brenke	61	9/98	E-Plus Mobilfunk	Chairman (retired)	Vebacom Holdings		
4) Gordon J. Comerford	61	7/93	Motorola, Inc.	Senior VP (retired)	Motorola		
5) Atilano de Oms Sobrinho	55	6/96	Inepar S.A.	President	Iridium SudAmerica		
6) Stephen P. Earhart	50	3/99	Motorola, Inc.	SVP, Dir. of Finance	Motorola		
7) Robert A. Ferchat	64	1/95	Iridium Canada, Inc.	Chairman	Iridium Canada, Inc.		
8) Alberto Finol	64	7/93	Iridium SudAmerica	Chairman	Iridium SudAmerica	Yes	127,900
9) Edward Gams	51	7/93	Motorola, Inc.	VP, Dir. Inv. Relations	Motorola		
10) Durrell Hillis	58	6/98	Motorola, Inc.	Senior VP	Motorola		
11) Kazuo Inamori	67	7/93	DDI Corporation	Founder & Chairman	Nippon Iridium		
12) Georg Kellinghusen	51	1/99	o.tel.o communications	Chief Financial Officer	Vebacom Holdings		
13) S.H. Khan	60	10/94	Credit Analysis & Research	Chairman	Iridium India		
14) Robert W. Kinzie, **Chairman**	65	10/91	Iridium LLC	Chairman	Iridium LLC	Yes	108,382
15) Anatoly I. Kiselev	59	7/93	Khrunichev State Research	Director General	Khrunichev		
16) Richard L. Lesher, **Vice Chairman**	65	6/97	US Chamber of Commerce	President (retired)	**Independent Director**	Yes	9,367
17) John F. Mitchell	71	7/93	Motorola, Inc.	Vice Chairman	Motorola		
18) Giuseppe Morganti	66	4/96	Iridium Italia S.p.A	CEO	Iridium Italia		
19) J. Michael Norris	52	7/96	Motorola, Inc.	Senior VP	Motorola		
20) Yusai Okuyama	67	7/96	DDI Corporation	President	Nippon Iridium		
21) Moon Soo Pyo	45	1/99	SK Telecom Co., Ltd.	Senior VP	SK Telecom		
22) John A. Richardson	56	3/98	Iridium Africa Corp.	CEO	Iridium Africa		
23) Theodore H. Schell	54	7/93	Sprint Corp.	Senior VP	Sprint		
24) William A. Schreyer	70	6/97	Merrill Lynch & Co.	Chairman (emeritus)	**Independent Director**	Yes	10,367
25) Edward F. Staiano, **Vice Chairman**	62	10/94	Iridium LLC	CEO	Iridium LLC	Yes	387,400
26) Sribhumi Sukhanetr	66	7/93	Thai Satellite Telecom. Co.	Chairman	Thai Satellite		
27) Tao-Tsun Sun	49	1/94	Pacific Electric Wire & Cable	President	Pacific Iridium		
28) Yoshiharu Yasuda	58	1/96	Nippon Iridium Corp.	President	Nippon Iridium	Yes	2,000
29) Wang Mei Yue	57	10/95	Iridium China	Chairman & President	Iridium China		

Source: Iridium LLC, Form 10K Annual Report for the year ended December 31, 1998.

[a] As of 3/1/99, there were 20,223,000 IWCL shares outstanding including shares that could be acquired within 60 days pursuant to the exercise of options (19,725,986 shares not including share equivalents). Officers of IWCL and Iridium LLC (the parent) collectively held 768,480 shares.

Exhibit 7 Financial Statistics for Select Industries, December 31, 1998

	1998			
	Debt to Total Capital (book value)	Times Interest Earned	Return on Assets	Projected Growth in Sales [c]
Retail (General Merchandise)	60%	5.8X	7.96%	6.5%
Retail (Food Chains)	59	4.0	6.08	7.5
Telephone (Local Service)	59	4.5	8.09	4.5
Tobacco	57	8.5	9.88	9.0
Electric Utilities [a]	57	2.6	2.86	4.5
Natural Gas Utilities [a]	53	2.9	3.65	9.4
Lodgings-Hotels	53	9.9	9.75	9.0
Airlines	53	5.9	7.09	7.2
Water Utilities [a]	52	3.1	3.04	5.8
Hardware & Tools	50	-1.4	-11.96	NA
Aerospace/Defense	50	6.1	3.66	2.4
Railroads	45	2.9	2.56	5.6
Household Products	40	6.9	11.26	8.7
Restaurants	38	4.4	8.03	11.7
Publishing (Newspapers)	38	8.1	9.09	7.9
Iron & Steel	38	14.8	6.92	10.9
Personal Care	36	11.5	9.43	9.4
Chemicals (Specialty)	36	46.8	7.93	5.2
Telecommunications (Long Distance)	33	3.6	3.60	8.0
Textiles (Apparel)	28	5.8	9.01	7.4
Health Care (Drugs)	25	25.1	15.16	10.3
Leisure Products	25	5.0	6.60	10.0
Telecommunications (Cellular)	24	4.0	2.17	14.5
Retail (Specialty)	23	8.7	6.20	10.7
Textiles (Home Furnishing)	19	2.5	2.60	8.6
Electronics (Semiconductors)	15	33.0	15.03	10.1
Electronics (Components Distribution)	11	27.6	11.34	12.0
Biotechnology	8	30.6	23.51	18.0
Computer (Software/Services)	3	16.3	18.25	23.5
Computers (Networking)	1	112.3 [b]	13.58	44.5
Mean	36	14.1	7.75	10.4
Median	38	6.0	7.95	9.0

Source: *S&P Analyst's Handbook*, Standard & Poor's Corp., New York, 1999, and Value Line.

[a] Data from S&P Compustat database.

[b] 1996 data used instead of 1998 data.

[c] Three to five year projected compound annual growth rate from Value Line Investment Survey.

Exhibit 8 Fiancial Statistics for Satellite Companies as of December 31, 1998

Company	Sales ($ millions)	Assets ($ millions)	Debt/Total Capitalization [a] Book Value	Debt/Total Capitalization [a] Market Value	Interest Coverage	Provision for Taxes ($ millions)	Net Income ($ millions)	Current Debt as % of Total Debt	Current Ratio	Cash as % of Assets	Equity Beta	S&P Senior Debt Rating
(1) Iridium, LLC	$0.2	$3,738.9	86%	34%	0.72	$0.0	-$73.6	4%	0.19	0.7%	1.58	CC [b]
(2) Globalstar L.P.	$0.0	$2,670.0	79%	29%	-1.28	$0.0	-$50.6	15%	0.59	2.1%	1.70	B [b]
(3) ICO Global Communications	$0.1	$2,659.4	24%	21%	N/A	$3.8	-$110.7	0%	4.84	20.6%	1.36	B
(4) Gilat Satellite Networks	$155.3	$410.3	26%	32%	-15.70	$0.3	-$81.6	2%	1.60	1.8%	1.71	N/A
(5) PanAmSat Corp.	$767.3	$5,890.5	22%	12%	3.04	$95.9	$124.6	1%	2.36	3.0%	0.96	A-
(6) Comsat Corp.	$616.5	$1,790.8	41%	20%	1.72	$5.8	$26.4	3%	1.41	1.7%	1.47	A-
(7) Orbital Sciences Corp.	$734.3	$962.7	29%	11%	0.70	$4.5	-$6.4	13%	1.21	2.8%	1.35	BB

Sources: Company Annual Reports, S&P Compustat, *S&P Bond Guide*, Bloomberg.

[a] Debt/Total Capitalization is calculated as the ratio of total debt to the sum of debt, equity, and preferred stock.

[b] S&P Long-Term Debt Rating for 12/98 used in lieu of S&P 1998 Senior Debt Rating.

Company Descriptions:

(1) Iridium employed a network of 66 satellites to provide handheld global satellite telephone and paging network. It was based in Washington, D.C.

(2) Globalstar was a joint venture between Space Systems/Loral and Qualcomm. It used a constellation of 48 satellites and was based in New York, New York.

(3) ICO Global Communications, based in the Cayman Islands, would provide mobile and cellular services via a system of 12 satellites.

(4) Gilat Satellite Networks, based in Israel, employed VSAT (Very Small Aperture Technology) for telecommunications and data transmission.

(5) PamAmSat, with 20 satellites, was the leading commercial provider of satellite-based communications services. It was based in Greenwich, Connecticut.

(6) Comsat provided global telecommunications using the 19 Inmarsat satellites (the INTELSAT system). It was based in Bethesda, Maryland.

(7) ORBCOMM, the satellite division of Orbital Sciences, had total sales of $0.8 million, an operating loss of $4.0 million, and identifiable assets of $241.5 million in 1998. ORBCOMM used a constellation of 28 LEO satellites for global data transmission, and was based in Dulles, Virginia.

Exhibit 9a Iridium Capitalization (dollars), 1993-1999

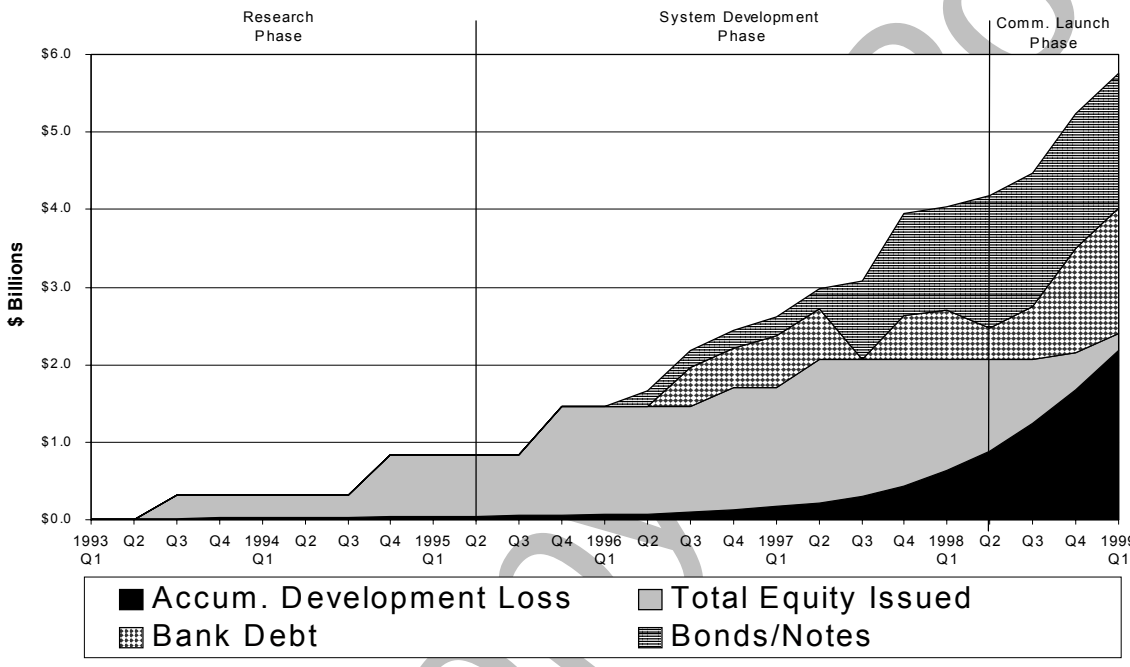
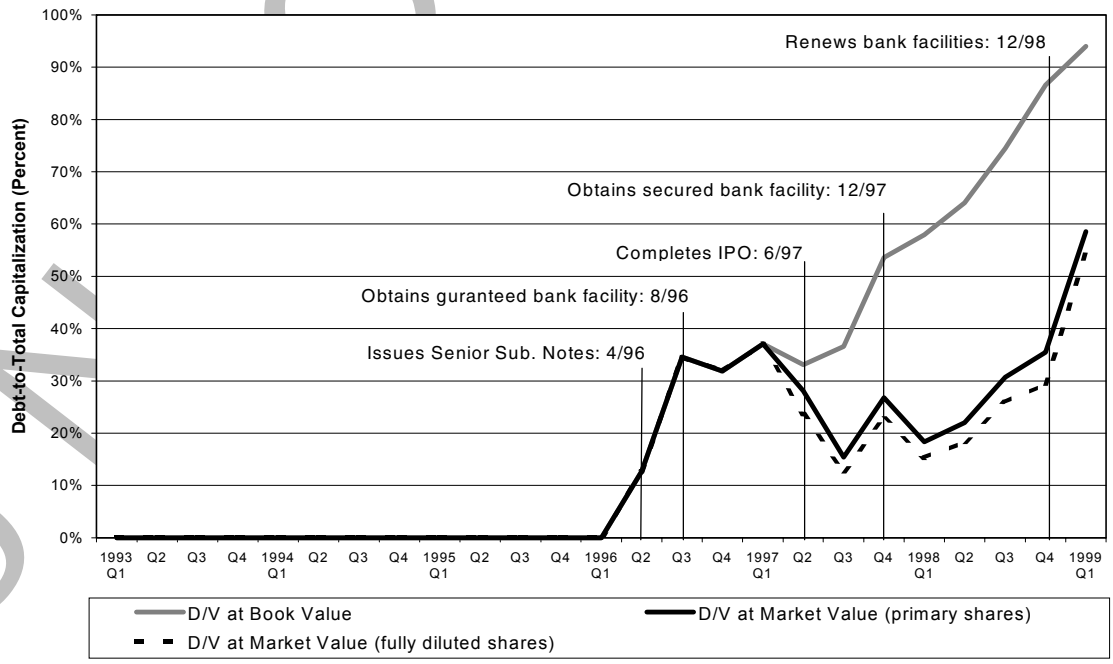
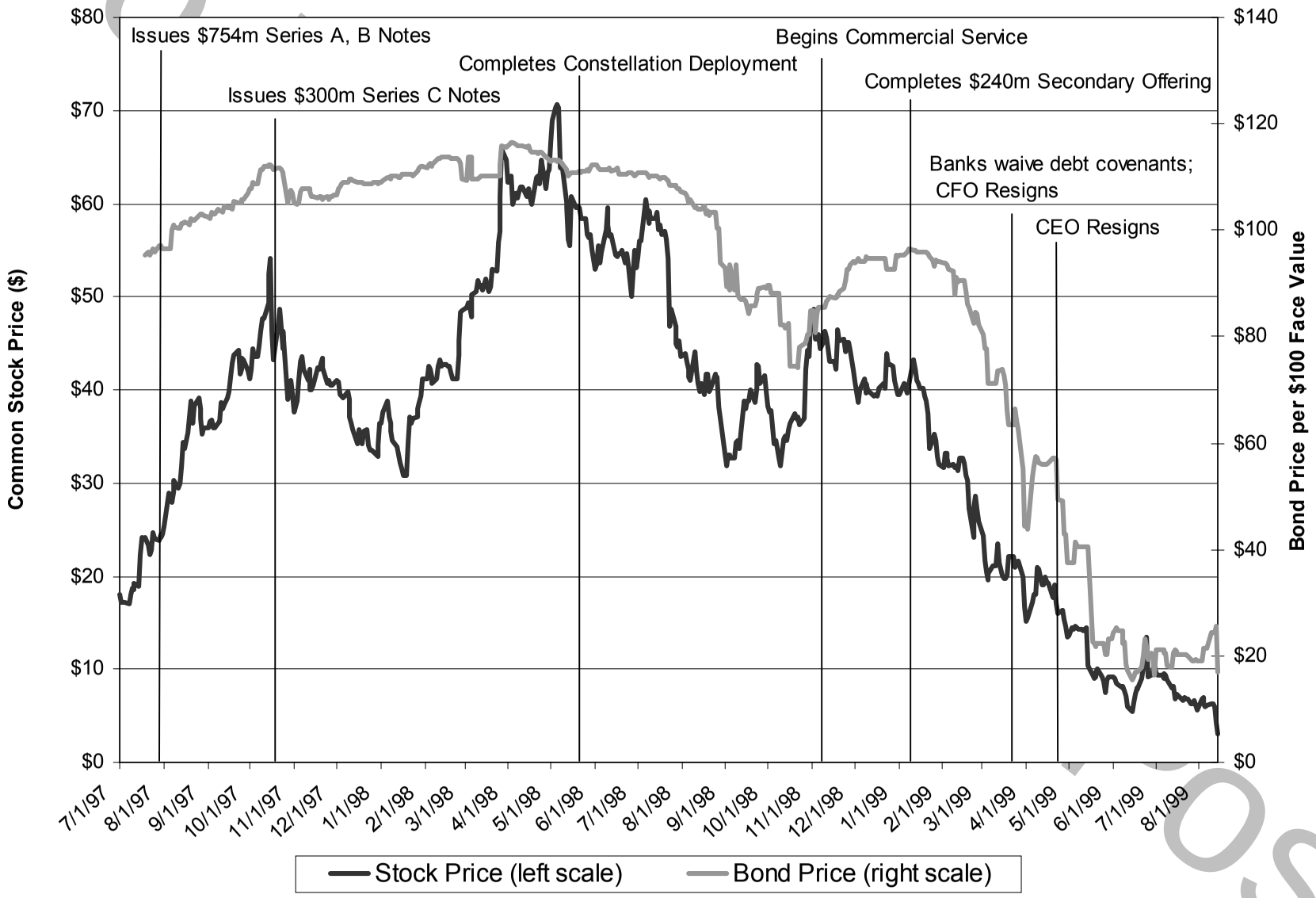


Exhibit 9b Iridium Capitalization (percent), 1993-1999



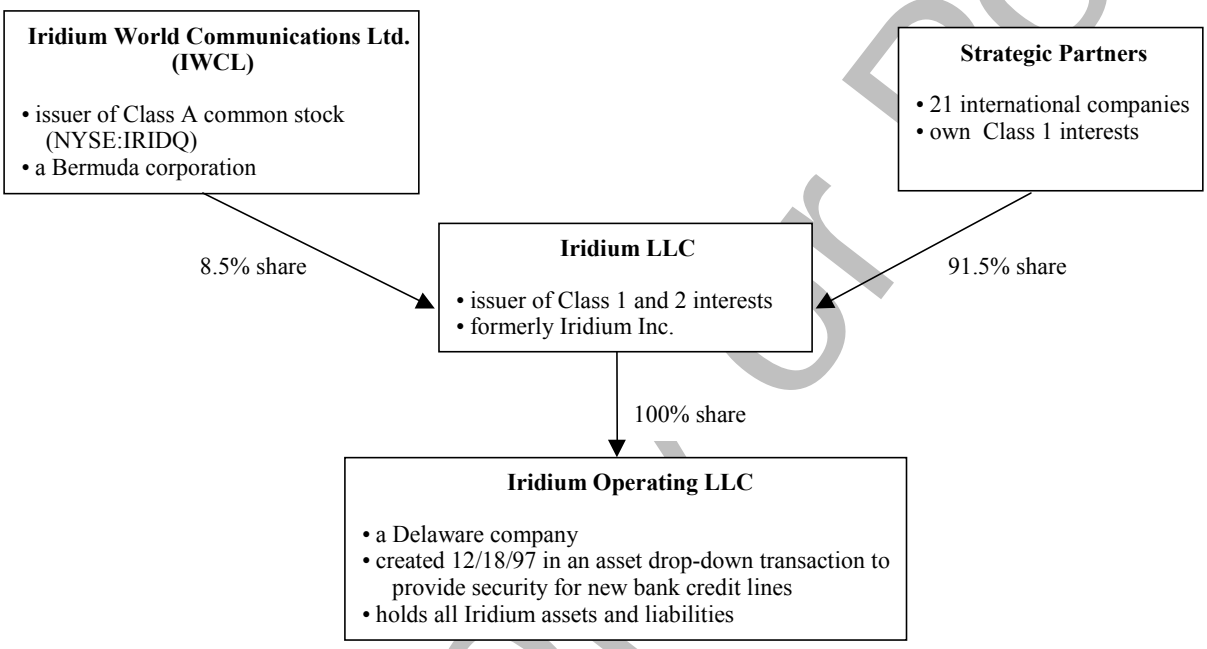
Source: Iridium Annual Reports and 10K Statements.

Exhibit 10 Stock and Bond Prices, July 1997-September 1999



Source: Adapted from Datastream.

Exhibit 11 Iridium Organizational Structure, December 31, 1998



Source: Casewriter.

Exhibit 12 Payments to Motorola from Iridium LLC ($ millions), 1995-2003

	System Development			Operations	
Year	Support Agreement	Space System	Terrestrial Network	and Maintenance	Total
1995	$0.6	$802			$803
1996	0.9	836	64		901
1997	0.7	577	74		652
1998		589	139	129	857
1999 est.			6	537	543
2000 est.				558	558
2001 est.				581	581
2002 est.				605	605
2003 est.				472	472
Total	$2.1	$2,804	$283	$2,882	$5,871

Source: Iridium World Communications Ltd. Class A Stock Prospectus, January 21, 1999.

Endnotes

[1] Peter List, "Crash and Burn," *ProjectFinance*, October 1999, p. 18.

[2] Peter Grams and Patrick Zerbib, "Caring for customers in a global marketplace," *Satellite Communications*, October 1998, p. 24.

[3] *Fortune Magazine*, James Surowieckipp "The Latest Satellite Startup Lifts Off. Will it too Explode?" October 25, 1999, pp. 237-254.

[4] Telecommunications Services, U.S. *Industry and Trade Outlook*, 1999, pp. 30-22.

[5] Alan Cane, "Satellite phones prove their worth," *Financial Times*, November 13, 1997, p. 2.

[6] Cynthia Motz and Robert Hordon, "The Sky's the Limit," *Credit Suisse/First Boston Analyst Report*, December 23, 1998, pp. 5, 7.

[7] Iridium web page, corporate history, (http://www.iridium.com/english/inside/comback/index.html).

[8] Chris Bulloch, "Will Mobile Satellites Fly?" *Telecommunications*, September 1999, p. 89.

[9] Michael Stroud, "Motorola's $3.4 Billion Iridium Project Finds Backers," *Investor's Business Daily*, August 3, 1993, p. 4. See also the report by Cynthia Motz and Robert Hordon, "The Sky's the Limit," *Credit Suisse/First Boston Analyst Report*, December 23, 1998, p. 7.

[10] See the reports by Salomon Smith Barney on February 1, 1999, Credit Suisse First Boston on December 18, 1998, Merrill Lynch on January 22, 1999, Lehman Brothers on December 30, 1998, and CIBC Oppenheimer on December 7, 1998.

[11] John B. Coates, "Iridium World Communications," Salomon Smith Barney Equity Research Report, February 1, 1999, p. 2.

[12] G. Christian Hill, "Motorola Completes the First Round of Funding for Satellite-Phone Project," *Wall Street Journal*, August 2, 1993, p. B3.

[13] Michael Stroud, "Motorola's $3.4 Billion Iridium Project Finds Backers," *Investor's Business Daily*, August 3, 1993, p. 4.

[14] "Iridium Inc. Completes Its Equity Financing," *Wall Street Journal*, September 21, 1994, p. B7.

[15] G. Christian Hill, "Iridium Hopes to Line Up Its Financing Soon," *Wall Street Journal*, January 29, 1993, p. B2.

[16] Quentin Hardy, "Iridium Pulls $300 Million Bond Offer; Analysts Cite Concerns About Projects," *The Wall Street Journal*, September 22, 1995, p. A5.

[17] Iridium World Communications Ltd., Class A Common Stock Prospectus dated January 21, 1999, p. F29.

[18] Henry Goldblatt, "Just a Few Customers Shy of a Business Plan," *Fortune Magazine*, March 29, 1999, p. 40.

[19] Chris Donnelly, "Debt issuance puts Iridium in orbit," *Project Finance International Yearbook* 1998, p. 74.

[20] Anonymous conversation between the case writer and a banker who worked on the deal, 2/17/00.

[21] Cynthia Motz and Robert Hordon, "The Sky's the Limit," Credit Suisse First Boston Analyst Report, December 23, 1998, p. 27.

[22] Quentin Hardy, "Iridium Gets U.S. Military as First Big Customer," *Wall Street Journal*, January 26, 1998, p. B7.

[23] Christopher Price, Iridium: Born on the Beach but Lost in Space," *Financial Times*, August 20, 1999, p. 22.

[24] Leslie Cauley, "Losses in Space: Iridium's Downfall," *Wall Street Journal*, August 18, 1999, p. A1.

[25] Iridium Annual Report, 1998, p. 59.

[26] Iridium form 8-K, dated December 19, 1997, p. 6.

[27] Iridium LLC, form 10-Q, 3/31/99, p. 24.

[28] Quentin Hardy, "Iridium, in Bid to Bolster Ailing Service, Cuts Staff and Prices, Shifts Marketing," *Wall Street Journal*, June 14, 1998, p. B8.

[29] Leslie Cauley, "Iridium Official Says Chapter 11 Isn't Viable Option," *Wall Street Journal*, p. A4.

[30] Iridium LLC Press Release, August 13, 1999.

[31] *Wall Street Journal*, August 25, 1999, p. B7.