

Applied Corporate Finance

Iridium Class-Case Discussion

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- Background and Objectives
- Proposed Solution/Discussion of the Case
- What Happened?



- Iridium was one of the largest private sector projects in corporate history.
 - The case analyzes the reasons for filing for bankruptcy.
- While being liquidated, despite almost \$6bn investment, the assets appeared to be worth less than \$50m.
- Through a "post-mortem" analysis, we will highlight some of the relevant issues involved in financing large, greenfield projects.
 - The lessons on financial strategy and execution extends beyond the realm of large projects.



- Valuation of a Large-Scale Project.
 - APV/CCF vs. WACC
- Illustrate difficulties in valuing a large project with unproven technology.
 - Wide ranging revenue projections from some of the most informed investors.
 - Combination of large, certain, upfront costs and large, uncertain, distant revenues can make a large-scale investment highly risky.
- Discuss reasons for Iridium's failure.



- Illustrate the financial execution of a very large, greenfield project.
 - Reasons for selecting highly leveraged capital structures.
 - Reasons for using specific types of capital.
 - Sequence in raising capital.
- Since Iridium is a start-up and has no previous financing, we can understand in depth the choice of and initial optimal capital structure.
- Illustrates not only the benefits of using project finance for high-risk projects, but also the dangers of using project finance for hightechnology and retail projects.
 - Learn from Iridium's mistakes.
 - Financial structure can improve firm performance and increase the probability of success, but it cannot save a project with flawed economics.



How To Proceed?

Iridium's Analysis Can Be Divided In Three Parts

- Part I: Valuation
 - Describe Iridium's creation, development and commercial launch of the business.
 - Discuss the vision behind the project.
 - Estimate its value from discounted cash flows.
- Part II: Why Did Iridium Fail?
 - Understand possible reasons for its failure.
- Part III: Financial Strategy and Execution
 - Examine the target debt-to-total book capital ratio of 60%.
 - Understand the reasons for the different kinds of capital used.
 - Sequence of capital raising.



Part I: Valuation



Valuing The Project (1)

- Iridium had a market value of \$5.6bn = 141m shares *\$39.5 at year-end 1998 [Ex.5]:
 - Down from almost \$10bn in May 1998 [Ex.10].
 - Nevertheless, Iridium defaulted within 3 months and went bankrupt six months later.
- Iridium is a project with grand vision but high risks:
 - "the dream... is really pretty impressive" [p.2].
- The challenge is to explain:
 - Why did the market value Iridium so highly through 1998.
- In retrospect Iridium looks like such a flawed concept,
 - Was it really a flawed concept from the start?



- Huge upside potential
 - The project is a bet on the future.
- For the equity-holders (strategic partners), it was an opportunity to:
 - Sell communications equipment.
 - Gain monopoly distribution rights for certain geographic markets.
- For the debt-holders, it was an opportunity to earn high yields with (perhaps seemingly) limited risk.
 - They may have incorrectly assumed that the system had value in liquidation.
- Which valuation method should we use?



Valuing The Project: APV

Inputs for APV Analysis

- Need to compute r_{A.}
- Iridium has a target leverage ratio of 60%.
 - We will assume that the risk of the tax shield is equal to the risk of the assets and discount it by the same discount rate.
 - Compressed APV = Capital Cash Flow Method (CCF).
 - Alternatively, we can discount the tax shield at the cost of debt, if you decide to view debt as relatively riskless.
- Why not just use WACC?



Valuing The Project: Why Not WACC?

- There are some problems in using WACC methodology.
- At least a couple of concerns:
 - The tax rate is neither constant nor positive in several years; it is 0% until 2001.
 - 2. Capital structure weights are changing over time as leverage changes.
- Bottom Line:
 - APV/CCF addresses these problems.
 - Yet does not resolve the many sources of input uncertainty.
 - Revenue projections, risk premium, asset beta, TV growth...



APV/CCF: Discount Rate (1)

- In terms of inputs to calculate r_A:
 - Risk premium of 5-8%.
 - Is $\beta_A = 1.25$ high?
 - Perhaps, but other satellite communication firms also have high β_A or β_E [Ex. 8].
 - Looking at competitors (next slide) → β_A = 1.25 does not seem to be too high.
 - 30-year vs. 10-year US T-Bills risk-free rate?
 - **5.09 vs. 4.65% [Ex.5**]
- These assumptions yield discount rates ranging between 10.9% and 15.09%



• Using [Ex.5] we calculate r_A:

$$\mathbf{r}_{A} = \mathbf{r}_{f} + \beta_{A} \cdot [\underline{\mathbf{r}_{m} - \mathbf{r}_{f}}] = 14.5\%$$

5.09% [30-year] 1.25 [Ex.5] $\cdot [\underline{\mathbf{r}_{m} - \mathbf{r}_{f}}] = 14.5\%$

- An advantage of APV/CCF approach:
 - Uses a single discount rate even when the capital structure is changing over time.



APV/CCF: Discount Rate (3)

Comparative Financials Among Main Competitors

Company	Debt/Total C Book Value	capitalization a Market Value	Interest Coverage	Provision for Taxes (\$ milhons)	Tax rate	Net Income (S millions)	Current Debt as % of Total Debt	Current Ratio
(4) Initiations 11.0	00%	0.40/	0.70	#0.00	00/		40/	0.40
	80%	34%	0.72	\$0.00	0%	(\$73.60)	4%	0.19
(2)GlobalstarL.P.	79%	29%	-1.28	\$0.00	0%	(\$50.60)	15%	0.59
(3) ICO Global Communications	24%	21%	N/A	\$3.80	0%	(\$110.70)	0%	4.84
(4)GilatSatelliteNetworks	26%	32%	-15.7	\$0.30	0%	(\$81.60)	2%	1.6
(5) PanAmSat Corp.	22%	12%	3.04	\$95.90	43%	\$124.60	1%	2.36
(6) Comsat Corp.	41%	20%	1.72	\$5.80	18%	\$26.40	3%	1.41
(7) Orbital Sciences Corp.	29%	11%	0.7	\$4.50	0%	(\$6.40)	13%	1.21
Average	44%	23%	-1.80		9%		5%	1.74
Average Without Iridium	37%	21%	-2.30		10%		6%	2.00
Avg Main Competitors	52%	25%	-1.28		0%		8%	2.72

Company	Current Ratio	Cash as % of Assets	Equity Beta	Senior Debt Rating	D/E Market	(Assumed) Debt Beta	Asset Beta	Mkt/Book Total Cap
(1) Iridium, LLC	0.19	1%	1.58	CC b	52%	0.4	1.18	2.53
(2)GlobalstarL.P.	0.59	2%	1.70	Вb	41%	0.2	1.27	2.72
(3) ICO Global Communications	4.84	21%	1.36	В	27%	0.2	1.12	1.14
(4)GilatSatelliteNetworks	1.6	2%	1.71	N/A	47%	0.4	1.29	0.81
(5) PanAmSat Corp.	2.36	3%	0.96	A-	14%	0	0.89	1.83
(6) Comsat Corp.	1.41	2%	1.47	A-	25%	0	1.22	2.05
(7) Orbital Sciences Corp.	1.21	3%	1.35	BB	12%	0.2	1.22	2.64
Average	1.74		1.45		31%		1.17	1.96
Average Without Iridium	2.00		1.43		28%		1.17	1.87
Avg Main Competitors	2.72		1.53		34%		1.19	1.93



APV/CCF: Capital Cash Flow (1)

- We define CCF as:
 - CCF = FCF + ITS
 - = NI + Dep. CAPX Δ NWC + Interest Expense.
 - Discount at unlevered cost of capital using β_A .
 - Recall: we assumed tax shield is as risky as the assets
- There are two possible ways in which we can treat the Net Operating Losses (NOLS) in 1999:
 - 1. Use NOLs Carry-Forward.
 - 2. No Use of NOLs Carry-Forward.
- In this particular case, the final value will not be significant affected by this.



APV/CCF: Capital Cash Flow (2)

- With NOL's:
 - The usage of NOLs affect the 2000 and 2001 projections.
 - This is slightly different to the projections you are given in Exhibit 5.

Capital Cash Flow	NS									
From Ex. 5	1998 Act.	1999	2000	2001	2002	2003	2004	2005	2006	2007
Net Income	(1253)	(1549)	(81)	1172	1980	2948	3284	3468	3590	3658
-Net CAPEX	(164)	(116)	(383)	(33)	75	(190)	724	629	409	(239)
-Increase in NWC	398	(290)	(63)	102	81	54	28	12	4	1
+ Interest expense	265	387	454	424	278	59	0	0	39	92
Capital Cash Flows	(754)	(1568)	(73)	1665	2414	2871	4036	4109	4042	3512

- No NOL's:
 - The projections of the cash flows look as follows:

From Ex.5	1999	2000	2001	2002	2003	2004	2005	2006	2007
Net Income	-1,549	-81	996	1,911	2,948	3,284	3,468	3,590	3,658
Depreciation/Amortization	811	966	1,213	1,333	1,084	1,109	1,020	822	605
Capital Expenditures	927	1,349	1,246	1,258	1,274	385	391	413	844
Increase in NWC	290	63	-102	-81	-54	-28	-12	-4	-1
Interest Expense, net	387	454	424	278	59	0	0	39	92
Capital Cash Flow	-1,568	-73	1,489	2,345	2,871	4,036	4,109	4,042	3,512



APV/CCF: Capital Cash Flow (3)

Cash Flow Pattern

- It is characteristic of "large-scale investments".
 - Starts very large and negative.
 - Breaks even by year 3 or 4.
 - Large and positive in later years.
- Why is the CAPX so high from 2000 to 2004?

- Bottom Line: Large-scale projects involve:
 - Few years of very large, and quite certain negative cash flows.
 - Followed by many years of very large and uncertain positive cash flows.



APV/CCF: Terminal Value (1)

- The analysts mentioned in the case [**p.3**] use both EBITDA multiples and growing perpetuities to calculate TV.
- For my valuation, I start with g = 2%.
 - $TV = CCF_{2007}(1 + g)/(r_A g) = \frac{3,512(1 + 2\%)}{(14.5\% 2\%)}$
 - TV = \$28,658
- Is Iridium in steady state?
 - Notice that Iridium is not in steady state in 2007 because of its cyclical investment and funding cycle.
 - The satellite constellation lasts only 5 years.
- How should we handle this?



- Annual capital expenditures are:
 - As low as \$ 385m in 2004.
 - As high as \$1,349m in 2000.
 - With an average of \$880m from 1998 to 2007.
- As of 2007, the expenditure is rising, but it is approximately equal to the average over the cycle.
- One possible solution is:
 - pick an "average year."
 - 2007 fits this criterion well.
- Another possible solution is:
 - to extend the cash flows to that the terminal value becomes a smaller fraction of total value.



- To obtain Equity Value from Enterprise Value we need to:
 - Subtract the debt value of \$2,854m as of 12/13/98.
 - Subtract the \$218m due to Motorola; it is debt. [p.8 & Ex. 5]
 - Subtract the Preferred Equity (Class 2 Interest) of \$46m.
 - Add \$220m proceeds from exercising Class 1 warrants.
 - Footnote b, Exhibit 5 \rightarrow 44m warrants @ \$5 = \$220m.

 \rightarrow Equity Value = \$13.8bn.

- Total Number of Fully Diluted Shares assuming the warrants are exercised is:
 - − 185m \rightarrow \$74.35 p/share.
- Question: How do we deal with the fact that only 8.5% shares of Iridium trade in the market?



- Need to adjust for a private market discount since only 8.5% of Iridium's shares trade in the market [p.3 & Ex.11].
- The analysts apply a discount rate of 15%-20% because of nonmarketability of the holdings.
- Studies claim private market discounts range from 10%-40% with an average somewhere between 18% and 28%.
 - Cornell (1993, pp.251-262), Pratt (1989, Ch.10) and Koeplin et al.
 (2000)
- Bottom Line:
 - A 15% private market discount balances the high numbers above with the fact that Iridium is a public company that has a small float.



No NOLs Case

From Ex.5	1999	2000	2001	2002	2003	2004	2005	2006	2007
Net Income	-1,549	-81	996	1,911	2,948	3,284	3,468	3,590	3,658
Depreciation/Amortization	811	966	1,213	1,333	1,084	1,109	1,020	822	605
Capital Expenditures	927	1,349	1,246	1,258	1,274	385	391	413	844
Increase in NWC	290	63	-102	-81	-54	-28	-12	-4	-1
Interest Expense, net	387	454	424	278	59	0	0	39	92
Capital Cash Flow	-1,568	-73	1,489	2,345	2,871	4,036	4,109	4,042	3,512
Discount rate	14.5%								
PV(CFC)	-1,369	-56	992	1,364	1,459	1,791	1,593	1,368	1,038
TV (@2%)									28,658
PVTV	8,472								
Enterprise value	16,652								
(-)Total debt	2,854								
(-)Amount due to Motorola	218								
(-)Preferred equity	46								
(+)Proceeds from Class 1 warrants	220								
Equity value (Class 1 interests)	13,754								
# of Class 1 interests (millions)	185								
Value per Class 1 interest	74.35								
(-)Private market discount	15%								
Public market value per interest	63.20								



Summarizing So Far...

- With No NOLs:
 - Share price is \$63.20 p/share.
- With NOLs:
 - Share price is \$65.92 p/share.

	1998	1999
Enterprise Value	14407	17245
-debt	(2854)	(2854)
-Motorola pyts	(218)	(218)
-Class 2 preferred	(46)	(46)
+warrant proceeds	220	220
=Class 1 value	11509	14347
Number of shares	185	185
Price/share	\$62.21	\$77.55
Private mkt discount	15%	15%
Price w/discount	\$52.88	\$65.92



- Projections in [Ex.5] are perhaps overly optimistic since they are based on Solomon-Smith-Barney numbers.
 - [Ex.4b] shows that SSB has the highest revenue projections at least through 2004.
- The presence of risky debt complicates the analysis in several ways.
 - Public notes are trading slightly below face value as of year-end 1998 [Ex. 10].
 - With risky debt, β_D is not 0.
 - Promised interest payments overstate expected interest payments and the face value of debt overstates the market value of debt.



- Analysis ignores embedded optionality.
 - Iridium could be valued as a call option.
 - With a strike price equal to the fixed investment needed to launch the system, and;
 - An underlying price equal to the value of an operating communications system.
 - Options: Staged investment, abandonment, follow-on products and services, etc
- Bottom Line:
 - Lots of Uncertainty! Need to do sensitivity analysis:
 - Discount Rate.
 - TV Growth Rate, Terminal year margins, Terminal year CAPX.
 - Revenue Multiple (a proportional increase or decrease in annual revenues all years).



Sensitivity Analysis (1)

TV Growth Rate and TV Year EBITDA Margin

		D	Discount Rate					
		11.5%	14.5%	17.5%				
	0%	\$84	\$57	\$40				
	1%	\$90	\$60	\$41				
TV Growth	2%	\$97	\$63	\$43				
Rate	3%	\$105	\$67	\$45				
	4%	\$116	\$71	\$47				
	5%	\$130	\$77	\$50				

		Discount Rate				
		11.5%	14.5%	17.5%		
	60.0%	\$78	\$51	\$35		
TV Year	70.0%	\$89	\$58	\$40		
EBITDA	77.2%	\$97	\$63	\$43		
Margin	80.0%	\$100	\$65	\$44		
-	85.0%	\$106	\$69	\$46		

• Note: All sensitivity performed on No NOLs case.



Sensitivity Analysis (2)

TV Year CAPX and Revenue Multiple

		Discount Rate					
		11.5%	14.5%	17.5%			
	\$500	\$104	\$67	\$46			
TV Voor	\$800	\$98	\$64	\$43			
	\$844	\$97	\$63	\$43			
CAPX	\$1,100	\$92	\$60	\$41			
	\$1,400	\$86	\$56	\$38			

		TV Year EBITDA Margin					
		60.0%	77.2%	85.0%			
	50%	(\$19)	(\$7)	(\$2)			
	60%	(\$5)	\$7	\$13			
Revenue	75%	\$17	\$28	\$34			
Multiple	90%	\$38	\$49	\$55			
	1 00%	\$52	\$63	\$69			
	110%	\$66	\$78	\$83			
	1 25%	\$87	\$99	\$104			

• Bottom Line:

Value ranging from \$0 to \$100 are possible given quite reasonable assumptions!



- Impact of changing revenues multiples and terminal year margins, illustrates the importance of revenue forecast.
 - A 10% change in revenue, results in a 22%-24% change in the per value share.
 - High operating leverage as a result of Iridium high fixed costs.
- Notice that the value obtained is well above the market price of \$39.50 [Ex.6].
 - \$63 vs. \$39.5 implies a pricing error of almost 60%
- This shows how difficult it is to accurately value large projects with *unproven* technologies and highly *uncertain* cash flows.



Time Series Analysis

- This is evident also from how ML equity analyst changed his revenue projections over the course of two years [Ex. 4a]
 - 2003 revenue falls from \$5.8bn to \$2.08bn, a decline of 66%

- Do you trust the equity analyst report?
 - He is a star. Top ranked from "Institutional investor".
 - ML is the firm that did Iridium's IPO They probably have the best information available.



Cross-Sectional Analysis

- One can also see the dispersion of valuation among analysts as of year-end 1998 [Ex. 4b].
 - 2003 revenues vary from:
 - A low of \$3.2bn for CIBC Oppenheimer.
 - A high of \$5.8bn for Salomon Smith Barney.
 - A difference of more than 81%!
- This dispersion illustrates why valuing large, "first-of-a-kind" project is so difficult and why investing in them is so risky!
- Why was Iridium so valuable?



Factors Underlying High Value

- The telecom market was very large and growing.
 - Growth rate *could* be very large.
 - From [Ex.2] shows that the total market size is of \$835bn with a compound annual growth rate of 10%.
 - The mobile satellite segment (MSS) is a small fraction of the total market, but is expected to grow at 60% p/year.
 - At this rate the MSS would have a total value of \$20bn in 2005.
 - In the range of the estimates given by industry analysts [p.2]
- Besides market size, the analyst on [p.4], has:
 - "10 Reasons To Invest"
- Bottom Line:
 - If Iridium succeeds will have huge margins!



Part II: Why Did Iridium Fail? Bad Strategy, Bad Execution or Bad Luck?



- Iridium's chosen strategy left it exposed to important technological and market risks.
- Engineering project rather than market driven project.
 - "Cadillac" system with little flexibility:
 - A system with 100% coverage was likely to be very costly.
 - Complex technology [p.1]
 - Intra-satellite technology instead of "bent-pipe" technology.
- Product strategy and design was dubious:
 - Product was bulky ("a brick with a baguette sticking out", [p.6])
 - Cannot be used indoors.
 - Expensive to buy and use relative to competitors.



Iridium Phone





- Are first-mover advantages real?
 - What are the switching costs for potential customers?
- Could company have anticipated cellular phone revolution?
- Note:
 - It is easy to criticize Iridium's strategy ex post.
 - The idea was novel and exciting.
 - Who knew that within 10 years cellular phones would become so small, so powerful, and so cheap?



- Iridium had execution problems. See quotes on [p.1]:
 - "Iridium committed so many marketing and sales mistakes that its experience could form the basis of a textbook..."
 - "make a list and...check all of the above".
- To name a few problems:
 - Delayed launch, while advertising campaign on schedule [p.7].
 - Phones not in store due to logistical problems [p.1].
 - Failed to answer one million phone inquiries [p.7].
 - Could not fill orders due to manufacturing problems [p.8].
- However, Iridium was successful in other aspects:
 - Perfect satellite launch record.
 - Successful in negotiating operating agreements.
 - Raised \$ 5.5bn of capital.


- Actually, they did have some good luck.
 - Perfect launch record (industry's failure rate was 10-15%)
 - Hit "hot" capital markets in the summer of 1997 when it completed the IPO and raised \$800m of high-yield debt.
- Some bad luck:
 - Russia/Asia/LTCM crisis.
 - Capital markets went cold as Iridium tried to refinance its short-term bank debt with longer-term, permanent financing.
 - But Iridium is in part to blame for that.
 - Need for refinancing at the same time as commercial launch.



Part III: Financial Strategy and Execution



- Three questions arise throughout this analysis:
 - 1. Did Iridium have the wrong amount of debt?
 - 2. Did Iridium have the wrong kind of debt?
 - 3. Did Iridium follow the wrong sequence of raising debt and equity?



Wrong Amount Of Debt? (1)

- High leverage ratio:
 - Target: 60%.
 - By EOY 1998, 57% of the raised capital is in the form of debt.
 - (Debt) / (Debt + Class 1 Equity + Class 2 Equity)
 - \$2,854 / (\$2,854 + \$2,114 + \$46) = 57%
- Compared to an average book value leverage ratio of 36% across industries [Ex.7], Iridium is a highly-leveraged entity.

	D/TC	Int.Coverage
Median Industry	38%	6х
Mean High-Technology	19%	287x
Mean Telecom	29%	4x
Mean Telecom Cellular	24%	4x
Mean Satellite Companies	37%	-2.3x
2 Main Competitors	52%	-1.3x



Wrong Amount Of Debt? (2)

- The argument behind the 60% target ratio is that, once complete, Iridium would resemble a utility [p.5]
 - Utilities have a D/V ratio of 54% [Ex.7].
- But is Iridium really a utility?
 - Historically utilities have been monopolies with proven technologies, regulated rates of return, and no construction risk.
 - Iridium will operate in a competitive market, with an unproven technology, unregulated returns and, significant construction risk.
 - Iridium is more like a deregulated utility or telecommunication firm which have 29% D/V ratios.
- Bottom Line:
 - Both the across and within-industry analysis indicate that Iridium is more levered than other firms



Capital Structure Theories

- Which theory could help understand/justify Iridium's 60% leverage?
- 1. Static Trade-off
- 2. Asymmetric Information
- 3. Agency

- Static Trade-off:
 - Iridium should have high leverage if high tax shields or low likelihood/costs of financial distress.
 - Does this apply?



Theory I: Static Trade-Off (1)

Benefits of Tax Shields:

- Likely to be low.
- Operating Losses for first years and (possibly) NOLs.
 - No taxes until 2001 and 15% afterwards [Ex.5]
- The existence of tax-loss carry forwards and large depreciation tax shields imply that interest tax shields will not add much value.



Theory I: Static Trade-Off (2)

Probability Of Distress:

- Likely to be high.
- Development phase with high uncertainty about:
 - technology
 - demand
 - future competitive and regulatory environment.
- Uncertainly about revenues/cash flows.
- Uncertainty about costs:
 - Operating costs (level of fixed costs and margins).
 - Level of fixed financial charges relative to expected cash flows.



Theory I: Static Trade-Off (3)

Probability Of Distress:

Revenue Uncertainty

- Analysts forecasts cluster around each other.
 - Indicating low uncertainty [Ex. 4b]
 - But could be "herding".
- Fundamental factors say that uncertainty is high:
 - Unknown technology.
 - Unknown demand and market share.
 - Unknown future competitive structure.
 - Unknown future regulatory structure.
 - Unknown construction and execution risks.
 - Unknown political risk in foreign operations.



Theory I: Static Trade-Off (4)

Probability Of Distress:

Structure of Costs

- Fixed cash costs are huge.
 - CAPX of about \$1bn p/year every year.
- And there are two more cash negative years [Ex.5] with a cumulative debt growing to \$4.4bn.
- On the other hand, cash margins are very high.
 - Around 80% of EBITDA/Revenue Ratios [Ex.5].



Probability Of Distress:

Effect of Level of Financial Fixed Charges

- In its base case plan, Iridium has around \$400m of interest charges in each of the next 3 years.
- Combined with more than \$1bn of CAPEX in each year, this gives a breakeven level of EBITDA of about \$1.5bn (or more)
- Bottom Line:
 - Combined with the high uncertainty about the revenue stream, the high breakeven means that probability of getting into situation with cash shortfall by 2001 is high.



Probability Of Distress:

Will The Cash Shortfall Lead to Financial Distress?

- Not if the shortfall can be refinanced or operating policies can be adjusted at low cost.
- The problem with refinancing:
 - Who is going to lend more to a firm that is missing its financing targets, has high leverage ratio, and is some way away from breaking even?
 - Who is going to put equity into a firm that has a lot of high risk debt, unless debt is renegotiated?
- The problem with adjusting operating policies:
 - What plausible asset sales or costs savings are there that will not impact the operating business?
- Bottom Line:
 - The likelihood of financial distress is very high



Theory I: Static Trade-Off (7)

Costs of Financial Distress:

- The cost of financial distress is the value of any deviation from the optimal operating policy caused by being in distress.
- Which of these apply to Iridium?
 - Reduction in Investment in Physical Assets, R&D, Training
 - Forced Sale Assets
 - ☑ Loss of Customers
 - ☑ Loss of Suppliers, Reduction in Credit From Suppliers
 - ☑ Inability To Compete Aggressively
 - **Quality Cutting**
 - ☑ Diversion of Management Time
 - Employee Concerns/Discontent



Costs of Financial Distress:

- Need External Funds To Invest In CAPX or Market Share?
 - More generally, reduction in investment in physical assets, brand, training, R&D, acquisition? Quality cutting?
 - Need to keep huge CAPX and R&D.
- Competitive Threat If Pinched For Cash?
 - Inability to compete aggressively; more aggressive competition from other firms?
 - If looks weak, rivals will beat them up.
- Customers and Suppliers Care About Distress?
 - Loss of customers? Loss of suppliers? Employee discontent?
 - Unlikely that people will buy \$3,000 phones from a company in distress.



Theory I: Static Trade-Off (9)

Costs of Financial Distress:

- Are Assets Easy To Re-Deploy?
 - Short of completion, not much value.
 - Even after completion, highly specialized assets.
- Bottom Line:
 - For Iridium, both probability of financial and costs of financial distress are high



Static Trade-Off Theory Conclusions

- It seems that Iridium's proposed structure should be more conservative
 - Costs of Distress > Benefits of Tax Shield
- Optimal long-run target maybe 30% with a Int.Cov.= 4-6x.
 - Probably lower in short-run to ensure BBB rating.
- Instead:
 - Long-Run Target = 60%.
 - Short run 86% and increasing > 100% \rightarrow CC Rating
 - Will need to raise \$2.3-\$3.4bn with this capital structure.



- There are two main information-based theories:
 - "Pecking-Order Hypothesis":
 - Firm prefers the least information-intensive form of capital available: internal finance, debt and equity.
 - "Signaling Theory":
 - Firms issue debt to signal their quality.
- Both are good in explaining changes in leverage, but not necessarily levels of leverage.
- Does Iridium fit these theories?



Theory II: Asymmetric Information (2)

- On the surface, Iridium may appear to fit both theories.
 - As a high-growth start-up firm with low cash flows, Iridium turned to external finance just as the pecking order would predict.
 - "Private" debt instead of "Public" debt fits pecking order [p.5].
- With regard to the signaling theory, there is some evidence that Iridium's managers revealed private knowledge through their actions.
- What evidence?



Theory II: Asymmetric Information (3)

- Cancellation of equity issue because price was too low indicates asymmetric information.
 - Restricted the size of their IPO to \$240m when analysis said they could have raised \$1bn [p.6]
- Cancelled debt + warrants issue because yield was too high.
- However, its sequencing of capital, and the types of debt and equity used do not fit the pecking order hypothesis.
 - Multiple equity rounds before issuing debt
- Bottom Line:
 - Neither theory fully explains the 60% ratio.
 - At a more general level, the pecking order hypothesis cannot explain why most high-growth firms, startup firms have very low, if any, leverage.



Theory III: Agency Theory (1)

- Jensen and Meckling (1976) present a theory of capital structure based on the minimization of agency costs
 - This theory focuses on cost minimization rather than value maximization
 - equivalent in perfect markets
- Two ideas:
 - Firms with too little leverage are subject to the "agency costs of equity (ACE)".
 - Managers overinvest, waste free-cash flows (Jensen 1986).
 - Firms with too much leverage are subject to the "agency cost of debt (ACD)"
 - Managers under-invest in risky, *positive* NPV projects and over-invest in risky, *negative* NPV projects (*i.e.* risk-shifting)
- Bottom Line:
 - To justify the 60% Iridium needs to have high ACE and low ACD.



Potential for High ACE?

- Low Inside Ownership:
 - 3.8% of IWCL, which owns 13.3% of Iridium. Thus, insiders own 0.51% = 3.8%*13.3% (~\$29M).
 - While large in dollar terms, the insiders hold less than 1% of the firm, a relatively small number compared to the average holdings of 11.8% (McConnell and Servaes, 1990).
 - Managers may not have the incentive to work efficiently or invest optimally.
- Post completion,
 - Iridium will resemble the kind of mature firms with high free cash problems and low investments needs.
- How can sponsors control high ACE?



Theory III: Agency Theory (3)

- Sponsors can:
 - Closely monitor managers.
 - Use pay for performance compensation.
 - Use high leverage as a disciplinary device that forces project managers to operate efficiently and disgorge free cash flow (Kaplan 1989).
 - Increase payouts.
- A highly leveraged capital structure can increase value as long as leverage does not create offsetting costs.
 - As long as the opposing ACD are not too high
- Key issues involve inefficient-investment and monitoring.



- For project companies:
 - risk-shifting and underinvestment are quite low because firms typically require less on-going investment other than maintenance expense.
- Iridium is unusual because satellite constellation must be replaced every 5-8 years:
 - Large asset substitution is unlikely.
 - managers can only invest in satellites and the design specifications are very detailed and agreed upon prior to financing.
 - Under-investment is unlikely.
 - The firm pays down its debt prior to rebuilding the constellation
- Cost of monitoring is also lower with large tangible assets:
 - It is much easier to verify the existence, quality and progress of a satellite than a pharmaceutical R&D program.



- With less asymmetric information:
 - It is cheaper to
 - dictate performance contractually *ex ante*.
 - to monitor, verify, and enforce compliance ex post.
- Investment distortions due to high leverage should *not* be as costly in this case.
- Given the potential for high ACE and low ACD, this suggests:
 - High leverage is desirable *post-completion*.
 - But what about pre-completion?
- Bottom Line:
 - It is a question of timing more than amount.



Wrong Kind Of Debt? (1)

Short-Term Bank Loans vs. Long-Term Notes

	Bank Debt				Public Notes (Rule 144A)					
	Old Guaranteed Facility	Old Secured Bank Line of Credit	New Guaranteed Facility	New Secured Bank Line of Credit	Senior Subordianted Notes	Series A Senior Notes	Series B Senior Notes	Series C Senior Notes	Series D Senior Notes	
Amount Issued	\$750M	\$750M	\$750M	\$800M	\$238M	\$300M	\$500M	\$300M	\$350M	
Date of Issue	Aug.96	Dec.97	Dec.98	Dec.98	Mar.96	Jul.97	Jul.97	Oct.97	May 98	
Rate	Prime	Prime + 275bp	7.75% (Prime)	10.50% (Prime + 275bp)	14.50% Zero Coupon w/warrants	13.00% W/ warrants	14.00%	11.25%	10.88%	
Fixed Rate?	No	No	No	No	Yes	Yes	Yes	Yes	Yes	
Maturity	2 Years	1 Year	2 Years	2 Years	10 Years	8 Years	8 Years	8 Years	7 Years	
Covenants	Many	Many	Many	Many	Few	Few	Few	Few	Few	
Secured?	No	Yes	No	Yes	No	No	No	No	No	
Guaranteed?	Yes	No	Yes	No	No	No	No	No	No	
Issue Costs	Small	Small	Small	Small	Large	Large	Large	Large	Large	

Why would a project company want to use short-term bank debt?



- Advantages of Bank Debt:
 - Lower issue costs.
 - Avoid negative carry on unused funds.
 - Useful as a bridge to getting long-term bond debt.
- Disadvantages of Bank Debt:
 - Variable rates.
 - Covenants.
 - Ultimately, the bank loan covenants triggered default
 - Refinancing risk?
 - Particularly costly due to the turmoil in the capital markets in the Fall of 1998 [p.7].
- Iridium's execution problems essentially precluded them from getting long-term finance at the time.



Wrong Kind Of Debt? (3)

Why An Investor Would Want Bank Debt?

- External Review [p.7].
- Monitoring:
 - Bankers, through their contacts with borrowers and loan covenants, also provide valuable monitoring services.
- Other creditors require bank debt to demonstrate the feasibility of the project.
 - The role of "hard" (senior, non-postponable) debt is to curb managerial excess and force efficient liquidation.



- The reason creditors insist on the inclusion of a class of shortterm debt is that it is a tripwire for bad performance.
 - Default prompts corrective action in a form of a changes in:
 - Strategy:
 - Changes in pricing strategy
 - Management:
 - Replaced senior management [p.8]
 - Default prevented additional investment in a losing system.
- Bottom Line:
 - Early default may have been the best result given the circumstances



General Lessons



Two Benefits of Project Finance

- Project finance may better isolate project risk and encourage risk-averse managers to invest in risky projects:
 - Iridium was large relative to Motorola, was high-risk, and had correlated returns
 - Good candidate for project finance.
- High leverage in project companies prevents managers from wasting FCF by forcing disbursement.
 - Iridium unfortunately did not survive to the point where it generated substantial cash flow.



- The Iridium case shows the danger of using project finance for new technology projects.
 - Iridium took 8 years from incorporation to commercial launch and was worth virtually nothing at the end!
 - In the technology world, 8 years is an eternity.
 - Assets of failed systems are often virtually worthless
- Investors may refuse to provide funds on a project basis thereby forcing firms to use corporate finance.
 - Limits project viability if managers unwilling to put such large risks on their balance sheets.
- The Iridium case shows how difficult it can be to estimate demand for and market to retail customers.
 - Wholesale projects appear to be more successful than retail projects.



- You do not have to immediately reach your target leverage, especially before completion of the project.
- Danger of using short-term debt.
 - When the project goes wrong, it will often cause the project to default thereby alerting investors to potential problems.
 - Illiquidity or insolvency?
- Little flexibility in changing direction once the project is underway.
- What about the role of corporate governance in these types of projects?



Governance of Large Greenfield Projects (1)

- Studies seem to show that firm value increases when:
 - Board size decreases.
 - More directors are independent (outside, non-executives)
 - Directors hold more equity (at least for low levels).
- All three may have contributed to Iridium's problems.



Governance of Large Greenfield Projects (2)

- Board Size:
 - 29 directors [Ex.6].
 - Average is 12.
 - Yermack (1996) finds a negative relation between firm value and board size. Smaller boards tend to use pay for performance compensation.
- Board Independence:
 - Two independent directions (Schreyer and Lesher)
 - 7% compared to an average of 54% in large industrial companies.
 - Schreyer is the former chairman of ML
 - Worked on Iridium's IPO)
 - Various studies document the advantages of having outside directors.



- Board Equity Ownership:
 - Directors own very little equity (0.51%).
 - Many studies document a positive relation between inside ownership and firm value, at least over low ranges of ownership.
- Overall equity concentration is high:
 - 21 strategic partners own 91.5% of Iridium.
 - But people doing the actual monitoring, the directors, had very little personal wealth linked to Iridium's performance.
 - Directors do not receive cash compensation for serving on the board [p.5].



- One can argue that Motorola was in a no-lose situation.
 - Tremendous upside potential if Iridium were successful.
 - Mediocre returns if it failed.
- In trying to understand Motorola's incentives, we need to examine the costs and benefits from Motorola's perspective
 - Invested \$270m equity, guaranteed \$750m of debt [pp.5-6] and agreed to defer compensation.
 - Substantial upside if successful
 - In return, controlled roughly 19% of the equity, and got development and operating contracts worth \$335m in PV.
 - Even if Iridium turns out not to be very successful!
 - The actual payments from 1995 to 1999 have a PV of \$257m assuming a 10% net margin and 15% discount rate [Ex.12].


• NPV as EOY 1994 of the contractual payments paid or payable to Motorola based on a range of assumed after tax-margins and discount rates.

Assumed After-Tax Margin	Discount Rate		
	10.0%	15.0%	20.0%
5%	\$199	\$168	\$144
10%	\$398	\$335	\$288
15%	\$597	\$504	\$433
20%	\$797	\$672	\$577
25%	\$995	\$840	\$721

- If Motorola would have gotten a perpetual contract, then the payment stream becomes a growing perpetuity.
 - At g = 2%, the contract payment after 2003 would add \$150-\$500m of PV.
- **Bottom Line:** Motorola's returns were, even in the worst scenarios, not that bad! Very limited downside.



Why Did Iridium Fail?



Why Did Iridium Fail? (1)

- In the end, the cash flows were simply not high enough to meet interest payments.
- Demand had been overestimated.
- Poor execution.
- But was Iridium a failure for Motorola?



- Iridium was also a Motorola customer [Ex.12]:
 - \$803m in payments in 1995.
 - \$901m in payments in 1996.
 - \$652m in payments in 1997.
 - \$857m in payments in 1998.
- Only \$400m in payment deferred.
- Credit guarantee came with warrants.
- Was poor financing the cause of the failure?



Why Did Iridium Fail? (3)

- Iridium should have failed on the basis of poor economics,
 - But did banks contribute?
- By December 1998 Iridium had obtained \$2.85bn of debt financing. Of this:
 - \$650m was bank debt guaranteed by Motorola.
 - \$500m was in a credit line (bank facility).
- When the company wanted to renew the bank facilities:
 - Bankers reviewed strategic plans.
 - Hired independent consultants.
 - \rightarrow Only then were facilities extended
- The bank facility had covenants in terms of:
 - Cash revenues.
 - # Subscribers.



Why Did Iridium Fail? (4)

- What happened when the firm was unable to meet covenants in March 1999?
 - Bankers waived the covenants for 60 days.
- What happened when the firm was unable to meet covenants in May 1999?
 - Bankers waived the covenants until June.
- What happened when the firm was unable to meet covenants in June 1999?
 - One last chance, and then...
- Finally pulled the plug in August 1999.
 - Would Iridium been able to do this with public debt?



What Happened?



- August 1999: Iridium declares bankruptcy (Chapter 11).
- August 1999: ICO declares bankruptcy. Claims it cannot raise money because of Iridium's collapse!
 - A ML analyst commented: "Iridium has caused investors to look on the satellite sector with a jaundiced eye."
 - Craig McCaw invests \$1.2bn in ICO in November 1999 in exchange for a 48% stake.
 - Visionary behind merger of ICO with Teledesic in May 2000.
- October 1999: Globalstar begins limited service.
 - Started full commercial service in April 2000.
 - Defaulted on its bond in January 2001.
- Iridium in slow decline since August 1999.



What Happened? (2)

- November 1999: Motorola paid \$743m of Iridium's guaranteed debt.
 - Phone orders never realized in a meaningful way.
- December 1999: Motorola provided \$20m of cash to keep the firm running until February 2000.
- February 2000: McCaw offered to invest \$75m to keep Iridium operational until June 2000.
 - He was considering a three-way merger: Teledesic, ICO, Iridium.
 - He invested only \$5m to keep the company afloat.
- June 2000: A group of bond-holders received approval from the court to sue Motorola for \$3.5bn for its alleged part in Iridium's failure.



What Happened? (3)

- March 2000: Iridium told the bankruptcy court it had been unable to find a buyer.
 - Contacted 21 potential buyers!
 - The only known bid came from Crescent Communications for \$25m → It was declined because the buyer could not issue a \$10m bond.
 - One lawyer noted: "The fact that no one came forward to save the assets tells you a lot about how quickly wireless technology is changing." [The Washington Post, March 18, 2000]
- Bankruptcy judge grants permission to terminate service and liquidate assets.
 - Iridium terminates service for 55K customers.
 - Cost of \$30-\$50m to bring down satellites.
 - Suddenly, the Pentagon stepped in and requested service.



- June 2000: Pentagon to pay \$36m for 1 year of unlimited use.
 - Has an annual option for use until 2007.
 - System will continue to operate on a limited basis until the constellation wears out.
- July 2000: Iridium Satellite LLC buys all assets for \$25m
- March 2001: Iridium to re-launch service immediately.
 - Phones are worth \$900-\$1,500. Calls cost \$1.50 p/min.
 - Boeing to operate the satellites.
 - Expect system to last 10 years
- 2009: Time Magazine named Iridium to the list:
 - "Top Ten Tech Failures of the Decade."



What Happened? (5)

 2015: Net income was \$26.0 million, or \$0.21 per diluted share, for the second quarter of 2015, as compared to \$15.0 million, or \$0.14 per diluted share, for the second quarter of 2014