Case 18

Gravity-Free High

Inspired by late night conversations, four friends have decided to form a high-tech start-up company. Glenn works in the space industry. The other three work for a pharmaceutical company. They intend to produce a variant of mood-altering drug used in psychiatry. The production process is slow, and it requires both heating and a very precise mix of ingredients. When produced on earth, the heating produces density changes. The resulting convection currents change the local mixture, and then the process may halt with a contaminated product. If the process is conducted in a "weightless" environment, then the density changes do not induce convection currents, and a purer drug is obtained.

The four friends represent an auspicious mix of experience, enthusiasm, energy, and attitudes. As the career and expertise of each are based directly on their academic training, that may be the easiest way to introduce them. Glenn majored in aeronautical engineering. Joe received an MBA with an emphasis in marketing, while Francine concentrated on finance for her MBA. Fred received his doctorate in biochemistry.

Glenn no longer does engineering design; but instead, he manages projects. He readily identifies where things go wrong, and he has a broad understanding of the cost end of the launch business. He may not be a creative genius, but he has very strong analytical skills.

Joe is an idea man whose dream is to be the perceptive leader and conceptual genius for a new product breakthrough. Although he is only 31, his rapid rise through the normally staid ranks of a safety conscious pharmaceutical firm substantiates the possibility of his dream.

Francine is the most senior of all, but she has been frustrated by the persistence of the "old-boy" network in the financial end of the pharmaceutical industry. She is tired of having to be significantly better than male coworkers to be the one to receive a promotion. She anticipates no problem in arranging financing for the firm.

Finally, Fred is a recent graduate who has spent three years on a postdoctoral research assignment followed by only a year in the company's lab. He wants a much faster route to the top than he sees in the bureaucratic maze of a large lab.

For the past year, they have spent weekends and evenings generating, refining, and analyzing ideas. Now they need to obtain financing so that they can go forward. They plan on asking a trio of Atlanta business executives for the initial venture capital. Later they will negotiate the terms, but first they must establish their plan as a good fiscal risk. The four entrepreneurs agree that their presentation must explicitly treat the uncertainty in outcomes.

Here the agreement ends. Francine and Joe are used to scenarios and spreadsheets, while Glenn and Fred are more used to formulas, statistics, and graphs. A portion of their discussion follows.

Joe: "Look, these executives have backgrounds similar to mine and Francine's, and they will be most comfortable with a low, a medium, and a high scenario."

Glenn: "While the three bottom lines are useful, they know the worst case is going belly-up. And that it may be the most likely! The best case involves going public with incredible returns, while in-between is a small loss or profit. We can develop and show them a better understanding through charts of relative sensitivity and breakeven analysis. This way we and they can tell which financial elements are most critical to our success."

Fred: "Why not quantify the probabilities of different profits? This includes the information of the scenarios and adds more. We could state the probability of losing the initial investment, of staying even, or of doubling or quadrupling or even increasing by a full order of magnitude."

Francine: "I believe we must do all of this, but some of it may not be in our proposal. They expect us to be honest, but they also expect that we will show our proposal in a favorable way. I think we should each analyze the problem individually, so that we will have four draft proposals with appendixes showing our complete calculations. Then we can combine them for the best possible proposal."

The four agreed on Francine's suggestion; and before they broke up for the night, they defined a common data set (Tables 18-1 to -4).

Project Start-up

This phase is expected to take six months to arrange financing, locate a facility, order lab equipment, etc. Note that the four have agreed to fix their salaries at their current levels even though their workweeks are likely to double for the next three to five years.

Table 18-1 Project Start-up Phase

Salaries:	$205,000 + 21% for benefits
Legal fees:	$50,000 (primarily incorporation expenses)
Insurance:	$5000/employee-year (unemployment and liability)
Deposits:	$20,000 (75% for lease, 25% for equipment orders)

Production Prototype

This phase lasts 18 months. The laboratory development of the production equipment to be used in space requires 20 lab employees. The secretary hired during start-up will be supplemented with three more office employees. These employees will all be carried over into later stages, and the laboratory and its equipment will be a permanent facet of the company. The company will also be planning and contracting for the later stages.

Table 18-2 Production Prototype Phase

Salaries:	$750,000 additional per year
Legal fees:	$40,000 (primarily for contracting)
Equipment cost:	$2.3 million (half replaced every five years, with another $0.8 million in new purchases each year)
Lease costs:	$180,000 annually

Initial Production

This phase takes a year and adds another 15 employees. The main costs are for the space-based equipment, for launch fees, and for contractual fees of the agency employees who monitor the equipment and recover the product. Because of initial debugging requirements, the costs for launches and agency employees are double what should follow in later years. Similarly, the equipment costs are 50% higher.

Table 18-3 Initial Production Phase

Salaries:	\$500,000 additional
Legal fees:	\$80,000
Launch fees:	\$6 million
Agency fees:	\$2 million
Equipment costs:	\$3 million (production facilities)

Although this equipment will last 5 to 10 years, the plan is to replace the space-based portion each year. This keeps up with technological progress and the growth in demand. Its chief salvage value is in cutting costs for earth-based production facilities to a minimum—only 10% of what their expected level would otherwise have been. The initial production level is likely to be low, but it should be adequate to cover the cost of the marketing efforts that will begin this year.

Growth Phase

This phase is likely to last 10 years. Although explosive growth for the product is expected, this should not result in any significant increase in the number of employees after the initial hire to support this phase. This initial hire will be made up mostly of field representatives for the marketing effort, along with the office-based support staff, for a total of 20 new employees. This phase will require more liability insurance costing about \$3 million per year.

The explosive growth in demand will not increase launch fees, agency employee fees, etc., as most production will be mechanized, and technological advances are expected to counteract increases in size and weight. From an initial level of 200,000 units, demand is expected to grow along the S-curve detailed in Table 18-4. Raw material costs, energy costs, and other variable production costs will be added onto the cost of the product later.

As this is a prescription item, it is not particularly price sensitive. Politically (since National Aeronautics and Space Administration (NASA) is involved in the launches), the price should be set so that the expected rate of return is not too high. The four agreed to use .6, .3, and .1 respectively for the probabilities of failure, OK, and success. They also believe NASA will accept a 25% expected rate of return for the first 10 years of project life (7 years of production).

Table 18-4 Volume (in millions)

Year	1	2	3	4	5	6	7	8	9	10
Volume	0.2	0.4	0.8	1.6	3.2	4.8	5.8	6.6	7.2	7.6

Options

1. Modify the failure assumption with these conditional probabilities: 20% at the end of start-up, 25% after the prototype, and 30% after initial production. The rest of the 60% failure probability comes after the first year of growth.

2. Add to Option 1 the following. During the growth phase, there is about a 3% chance each year of a competitor developing a ground based and much cheaper alternative.

3. After five years of large-scale use, the Federal Drug Administration may allow the sale of a milder non-prescriptive variant. This euphoric would follow a similar growth pattern, but its maximum volume might be 700 million units in the U.S. alone. The price would have to be cut to \$3.50 per unit to compete with alcohol. The production and marketing costs would increase by an order of magnitude, while the legal costs would increase a hundredfold. A key question is whether patent protection can combine with limited access to space to protect the exclusive position of Gravity-Free High.