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TEMPES CORPORATION (A)

Analyzing a New Design Choice

Tempes Corporation manufactures timers, gauges, and other precision equipment used in "extreme" sports. Its products are highly regarded by enthusiasts for SCUBA diving, mountain and rock climbing, and rappelling. Since its founding in the early 1960's by two former professional divers and a mountain climber, Tempes has grown to become a leader in the market for sports equipment of this type. In addition, over the past fifteen years, the company's equipment has found an important use in scientific research. Scientists use Tempes timers, gauges, and monitors in deep sea conditions, where they are installed in diving bells and ocean-floor robotic probes, as well as in severe climates, such as on the Antarctic continent. Located in western Massachusetts near the Berkshire mountains, Tempes Corporation has built a solid reputation as a maker of high-quality specialty products that appeal to the professional and true connoisseur.

This case was prepared by Lawrence Molinaro, Jr., William Lovejoy, and Christopher A. Cummings, as a basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation. It was subsequently revised by Anjali Sastry and Henry Jacoby, Sloan School of Management, Massachusetts Institute of Technology. This case was developed with support from the World Resources Institute.

Originally, Tempes sold timers and gauges for use in environments subjected to pressure extremes (i.e., high altitudes or depths). For its early designs, the company manufactured only the casing for the equipment, purchasing internal electronic and mechanical assemblies. Over the past twenty-five years, however, Tempes has extended its range of products and expanded to full manufacturing operations. In 1981, the company struck a distribution agreement with a small Swiss sports equipment manufacturer. As a result, Tempes greatly increased its presence in the European market: now, about one third of the company's revenues are from Europe. The company's worldwide annual sales for 1994 exceeded $40 million. The company is conservative in marketing and strategy, and it has built a strong reputation for technical expertise and customer service. In its operations, Tempes adopts a loose management style and inspires a fierce loyalty among its employees as well as its customers. The company was taken public in the mid 1980's and saw a solid performance in the stock market during the decade that followed.

On the advice of a reputable Boston-based consulting firm, management has decided to undertake a major revision of one of its strategic product lines - the *Water Moccasin* monitor - to take advantage of recent technological developments. In particular, improvements in assemblies for timer and gauge construction are desired; these changes will involve retooling the *Water Moccasin* manufacturing process. The entire decision is, however, aimed at increasing the overall quality of the product and efficiency of operations.

The *Water Moccasin* is designed for use in deep-sea diving. The instrument provides readings of depth (in both meters and feet), pressure (in atmospheric equivalents), and temperature (C° and F°). It also records elapsed time under water and calculates (based on pressure, elapsed time, body weight, and age) the approximate time left for the dive before the diver incurs a serious risk to health. All models electronically calculate the amount of time the diver must remain at normal atmospheric pressure (i.e., out of the water, at sea level) before attempting another dive or being subjected to changes in pressure (such as flying at high altitudes)[1]. In addition, the *Water Moccasin* determines ionic concentrations of sodium, potassium, and zinc, although this feature is not normally used by recreational divers.

At the request of the company president, the engineering staff have worked out two different designs with comparable functionality. The principal architecture of the two designs is similar: each consists of a monitor "head," which houses a lighted readout display panel, and a base, which can be hand-held or attached to the diver's buoyancy compensator for ease of carrying. Pressure-sensitive gauges and electrodes are located in the head, with some ancillary equipment extending down into the base.

The Designs

The casing of **Design A** is formed of three separate sections: the base, the monitor head, and the monitor cover. The separate base and cover means that repair is relatively easy. This type of

[1] This precaution is necessary for divers in order to maintain a balanced level of nitrogen in the bloodstream. Exposure to alternations of high and low pressures can result in bubbles of nitrogen gas forming in the blood, a condition colloquially known as “the bends”. Most divers use a set to tables developed by the US Navy in order to determine proper atmospheric conditions and time intervals.

assembly also provides optimal strength to the unit. The specifications call for the use of acrylic polymer as the principal material, and require that the metal parts of the device be coated with cadmium to inhibit water and salt-induced corrosion. Cadmium is classified as a hazardous waste by the EPA, and its use requires proper permitting and disposal techniques. In addition, the acrylic polymer generates a significant amount of hazardous waste which must be disposed of appropriately.

In contrast, **Design B** requires only two parts for assembly. A new engineering thermoplastic[2] allows the base and head of the monitor to be molded by injection as one piece while retaining its strength. The new material is fully recyclable, but it is also some 50% more expensive (on a weight basis) than the more conventional acrylic polymer used for Design A. However, adding a recycling step to the manufacturing process virtually eliminates thermoplastic scrap by feeding all scrap back into the raw material pellet loop. With the inclusion of recycling, the overall material cost premium for Design B can be kept to approximately 23%. Significant additional capital costs are required for the recycling step.

All repairs to a Design B *Water Moccasin* involve removing the monitor cover, so this model is less convenient for the repair technician. On the other hand, because the flange and fastener are eliminated, ruinous leaks are much less likely. The molded body, in conjunction with the properties of the thermoplastic, means that a Design B model can withstand tremendous pressure although it is thought that its pressure tolerance is somewhat less than that of Design A.

The Tempes Decision

Susan Barclay, the business manager of the *Water Moccasin* line, faces a choice between the two designs. While she initially favored Design A because of its cheaper cost, she has learned that engineering prefers Design B as an example of "design for efficiency", i.e., the use of a minimum number of parts, which makes manufacturing easier. Marketing data from Tempes' internal department, as well as research from an external consultant, indicate that interest in aquatic sports and diving is on the rise. An increase in government funding for both marine research and polar atmospheric effects also suggests a potentially strong market. Nevertheless, given the high degree of specialization, the market is relatively small. Reliable estimates put total first-year sales at 14,000 units, with an estimated growth rate of about 10% per year.

For either of the new designs, extensive retooling of the existing *Water Moccasin* production facility is required. **Exhibit 1** lists the capital investments for each option. Either new plant will yield a capacity of 35,000 units per year without further investment. The product life span is estimated to be eight years before product sales will be lost to newer technologies. The higher variable costs of Design B make this model more expensive to produce than Design A (see **Exhibit 2** for a complete listing of relevant assumptions). However, the sleekness and leak-proof characteristics of Design B will allow it to sell for a slight premium over Design A. Pricing will fall around $550 per unit for Design A and $615 per unit for Design B.

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[2] Plastics which can perform engineering tasks, like load-bearing, and can be reheated and remolded.

Your Task

As assistant to the *Water Moccasin* business manager, your task is to compute cash flows for Designs A and B. You are to follow the traditional Tempes approach to capital budgeting decisions: for your analysis, use only the information provided in this document and the memos sent to you by colleagues in the manufacturing, design, and finance divisions (**Exhibits 1**, **2** and **3**). Barclay has asked you to provide her with a spreadsheet showing your year-by-year cash flow calculations as well as an NPV (net present value) for each option and each design's internal rate of return.

Exhibit 1
Design A and B capital costs

Memorandum

To: Water Moccasin team
From: Pat Cooper, Manufacturing Division
Re: Product design revision - capital costs

I've put together the numbers on the capital investments that you requested. These figures should cover all the up-front costs required for the retooling and initiation of the new manufacturing processes.

We estimate that the manufacturing process modifications will take one year for installation and to become fully operational. All capital expenditures will be made in this year (we call this year zero). That means that we can expect revenues from the beginning of the next year.

Because we expect this technology to become obsolete at the end of the product's life span, salvage value of the project is zero. Any revenues we may get from scrapping parts of the plant at the end will be offset by other plant and equipment disposal costs.

Capital costs are as follows (in $000s):

Description	**design A**	**design B**
Production equipment	13,000	12,500
Recycling equipment	n/a	3,500
Installation labor	1,200	1,650
Start-up costs	150	200
Environmental permitting (one-time costs)	150	150

Exhibit 2
Design A and B operating costs and revenue assumptions

Memorandum

To: Water Moccasin team
From: Chris Lee, Design Division
Re: Expected operating costs, maintenance costs, and revenues

I've collected information from the design and marketing staff. This memo should give you a good idea of the operating and maintenance costs and revenues we expect for the two designs. Research from the consulting firm in Boston corroborates our estimates, so we are confident of their accuracy.

For either design, our market estimates put first-year sales at 14,000 units. According to our research, our sales volume will grow at 10% per year. That is, of course, only for the product life span, which we expect to be eight years. We expect an entirely new product design will be needed at the end of that period.

Some of the operating and maintenance costs are tabulated below, with additional information in the notes that follow. Figures in the table are in dollars per unit:

Description	**design A**	**design B**
Raw material	200	245
Labor	30	40
Disposal costs	10	n/a
Cadmium environmental overhead	15	n/a
Operating supplies	15.5	9

•Variable overhead is 10% of labor costs.
Annual fixed plant overhead for both designs is $100,000.
Recycling adds $50,000 every year to fixed plant overhead for design B.

•Sales, general, and administrative expenses (SG&A) is calculated at 5% of sales.

•The tax rate is 34%.

•The depreciation schedule, which is the same for the two alternatives, is as shown in the memo from the finance department.

Exhibit 3
Project financing and depreciation schedule

Memorandum

To: Water Moccasin team
From: Alex Zemansky, Finance Department
Re: Financing and depreciation strategy for the product design revision

As requested, a few notes on our financing approach. Following the Tempes financial practice of recent years, the investment costs of either design option will be financed out of retained earnings. No debt will be tied to the project.

The company cost of capital remains at 15%, in real or constant dollar terms. To simplify the analysis, the Finance Department recommends that inflation be ignored in the analysis.

Lastly, our current depreciation schedule is the following.

Depreciation schedule

year	depreciation %
1	14.3
2	24.5
3	17.5
4	12.5
5	8.9
6	8.9
7	8.9
8	4.5