I would like to acknowledge my colleague, **Roger B. Myerson**, Kellogg School of Management, Management and Decision Science Department, Northwestern University who prepared this case.

Any resemblance to actual companies or individuals is completely coincidental.

WARE MEDICAL CORPORATION

Louis Richardson, a polymer chemist at Ware Medical Corporation routinely scanned the contents of the new *Federal Bulletin of Materials* every month, but the June issue this year brought him quite a shock when he saw the announcement of FR 8420. FR 8420 was a new acrylic polymer with silicate sidechains that had just been developed by NASA scientists, as a byproduct of their research on materials for use in the space shuttle. Richardson immediately recognized that this new discovery could threaten Ware's position in the market for dental materials.

Ten years ago, after six years of research, Ware Medical Corporation had received a patent for a new method of making translucent composite materials that combined glass particles in a matrix of plastic. Before that time, prosthetic dental restoratives had been predominantly made of plastic and porcelain. Porcelain had the advantage of being more resistant to abrasion, but it was also more brittle than plastic, so that neither material was clearly superior for all purposes. Ware's composite material, which was marketed under the name of Dentosite, combined the best properties of both materials. Dental laboratories and manufacturers of artificial teeth were quick to recognize the advantages of Dentosite. According to a study that was published four years ago by Data Research Corporation, Dentosite had captured a 60 percent share in the market for materials used in dental prosthetics.

National Dental Corporation was the largest supplier of materials for dental prosthetics before Dentosite. Five years ago, National had entered into lengthy negotiations for the right to manufacture and sell composite materials using Ware's patent process. At times, it had seemed that an agreement was imminent; but negotiations broke down two years ago and National initiated a lawsuit to contest Ware's patent. Although the suit was still pending, Ware's lawyers were confident of winning.

Charles Piper was the vice president of Ware responsible for the dental products group. On June 21, three days after Richardson read the announcement of FR 8420, Piper held a meeting with Louis Richardson and Benjamin Gretter, who had general responsibility for the Dentosite product.

Richardson began the discussion. "Our Dentosite material has held a unique position in the market essentially because of our patented process for preparing the glass particles to bond to plastic. However, such preparations could be entirely omitted if the usual plastic materials were replaced by this new material FR 8420, because it bonds directly to glass.

Of course, it would take some time to develop a new composite with FR 8420 that could serve as a dental material. The main problem is that the glassplastic bond that one could get with FR 8420 would not be as strong as what we get with our process. The only way to overcome that problem would be to try to use a fibrous glass component. I figure that there is a 50% chance that an acceptable translucent composite is feasible using fibers with FR 8420. So if we are lucky, it might not be feasible, but we cannot count on such luck. It seems to me that our best bet is to work on developing a translucent fibrous composite ourselves. If the technique is feasible, then we would have just as good a chance as National of being the first to prove it. Then, if we developed it first, we could extend our patent protection to this technique and prevent any competitor from making fibrous composites with FR 8420."

"Lou and I have gone over the numbers to justify this plan," Gretter said. "If the technique is feasible at all, it should take two years of work, for us or for National, to develop an acceptable fibrous composite using FR 8420. We would have to budget about $500,000 per year to the project. National would probably need to spend more, about $1 million per year for two years, because their goal would be to develop a product ready for mass production, whereas we are just trying to prove feasibility to get the patent."

"Our current patent expires seven years from now, after which anybody can make composites like Dentosite using our current techniques," Gretter continued. "So this alternative fibrous technology would be only valuable to National during the next seven years. That means that they really would need to get this new composite developed and into production within two years or it is just not worthwhile for them. On the other hand, if they do develop an acceptable fibrous composite in two years (and if we do not stop them by getting a patent on the process first), then during the last five years of our patent we will probably lose about onehalf our market for Dentosite to them. From their point of view, it must look pretty risky, and I cannot imagine that anybody else besides National Dental Corporation would be willing to even consider trying to develop this technology."

"According to the projections of the Data Research study, demand for our composite should be between $15 million and $20 million per year over the next seven years. Our profit margin has been 20% of sales of Dentosite, and I expect that National would follow a similar pricing policy. They would not need to start a price war to take market share from us in this field, once they had a product to sell. So if we project sales at $17.5 million per year and use a 10% discount rate, the present discounted value of profits from onehalf the market for Dentosite during the period between two and seven years from now is $6.0 million."

After Gretter finished, Piper made a few notes and tried to summarize the situation. "Our whole problem seems to depend on what National does," he said. "It is foolish to spend money to develop a technology that we do not want to use if National is not trying to develop it. On the other hand, if National is trying to develop this technology, then we cannot afford to drop out of the race. So it all depends on how the people at National see this situation. Do you think that they see it as you have just described? Is there anything that we know that they do not know?"

"Everything that we have discussed so far is commonly known in the industry," Gretter replied. "Certainly National has people who check the *Federal Bulletin* every month, just as we do. If they have not noticed FR 8420 yet, they certainly will soon. Except for a few minor details, we probably have the same information about the technology and economics of the situation. I used Data Research's expected projections precisely because they are what National would be considering. Actually, our annual sales have been around $16.0 million per year, and that is probably a better estimate of future annual sales than $17.5 million. But that does not look like a significant distinction, in view of all the other uncertainties."
