



3M Optical Systems: Managing Corporate Entrepreneurship

In January 1992, Andy Wong faced an important decision. As manager of the Optical Systems (OS) business unit, how should he proceed with the Authorization for Expenditure presented to him by his management team working on a new computer privacy screen? Despite two previous market failures, the group assured him that the totally redesigned product would now succeed. Although Wong had great confidence in his team, he was also aware that the credibility of the unit, and even his own personal reputation, had been damaged in recent years. He believed in the privacy screen project, but he was also very conscious that he would soon need to get funding for the unit's other two development projects. He reflected on his options:

The problem with the formal approval process is that, because it involves so many layers, there are lots of opportunities to kill ideas. So, one of my main jobs is to manage that process. One alternative is to use informal channels and seek support from some of my mentors higher in the organization, but that's an option you have to use carefully, and not too frequently. And of course, a final possibility would be to try to restructure the project so that we can do it within the unit without seeking approval through either the formal or informal systems.

At the same time, Wong's boss Paul Guehler, division vice president of the Safety and Security Systems Division (SSSD), was also worried about the OS unit. Although it was the smallest of SSSD's five business units, it occupied more of his time than any of the others. Optical Systems had been losing money since its formation as a business unit in 1979, and there were many in the division who felt it should start paying its way by milking its existing business rather than continuing to invest in new ones such as the privacy screen. Guehler reflected on his concerns:

When I was asked to head this division, I was given a short list of priorities. Number one was "clean up Optical Systems." . . . The priority is to demonstrate the unit's economic viability, but it also has to protect its credibility. They have a second unrelated project that may need an additional \$5 million investment, but they tell me it could develop into a \$200 million business.

Professor Christopher A. Bartlett and Research Associate Afroze Mohammed prepared this case as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

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3M: Profile of an Innovative Company¹

Founded in 1902 to mine abrasive minerals in Minnesota, by 1992, 3M had evolved into a highly diversified global company whose \$14 billion sales were generated by a portfolio of thousands of products managed through the company's 3,900 profit centers located within 47 divisions and sold through its organizations in 57 countries worldwide. Its well-deserved reputation for innovativeness was reflected in a long-standing company objective that 25% of its sales be generated by products introduced within the last five years. The company's new CEO, "Desi" DeSimone, had recently emphasized the need for even greater efforts in this area of 3M's distinctive capability by raising the objective to 30% of sales from products introduced within the past *four* years.

The Founding Philosophy

After a difficult first quarter century during which it evolved from a mining company to a sandpaper manufacturer, 3M's fortunes took a dramatic turnaround in the 1920s when a couple of young inventors applied the company's coating and adhesive know-how to develop two products—waterproof sandpaper and adhesive tape—that differentiated its commodity product line. From that time on, management developed a commitment both to building the company's core technologies and to creating an environment in which people could draw on them to innovate—"to stimulate ordinary people to produce extraordinary performances" as 3Mers put it.

By the early 1990s, 3M had developed a pool of over 100 technologies, extending from its roots in abrasives, adhesives, and coating processes to specialized high-tech expertise in areas as diverse as micro-interconnection, digital imaging, and transdermal drug delivery. To maintain its technological leadership, 3M maintained over 100 laboratories worldwide. The company funded these R&D efforts at a rate of between 6% and 7% of sales—twice the average rate for U.S. industrial companies, and amounting to \$914 million in 1991.

To ensure that this technology was developed and applied effectively, 3M tried to ensure an innovative and creative environment. The value put on individual initiative was reflected in "the 15% rule" which allowed employees to devote up to 15% of their time on nonprogram activities that were related to innovative ideas they believed could be of value to the company. Project teams were formed around the most creative developments, and these were funded incrementally to allow the idea to be market-tested under the oft-repeated principle of "make a little, sell a little." Projects that survived the rigorous stage by stage review became departments, and departments that grew into substantial businesses were spun off as new divisions which seeded their own new set of projects to meet the 30% new product sales objective. The process had become self-perpetuating and was institutionalized as the company's "grow and divide" philosophy.

But the decentralized organization was held to demanding performance standards. In addition to the sales from new products target, each division was expected to contribute to the corporate objectives of inflation-adjusted sales growth of 10%, pretax profit margins of 20%, and return on capital employed of 27%. As one ex CEO explained, "We recognize some of our businesses as established but none as mature, and exempt none of them from striving to meet our standards for growth and profitability."

A vital component of the 3M machine was a structure and a culture that facilitated the linking and leveraging of the widely dispersed pockets of knowledge and expertise. Early in their careers, all employees learned that "products belong to divisions, but technology belongs to the company." A variety of organizational means were employed to encourage managers and scientists alike to

¹For a detailed company background, see "3M: Profile of an Innovating Company," No. 395-016.

develop extensive informal networks. Routinely, people called on experts wherever they were in the company to solicit advice or to ask them to work with them on a project. Cross-divisional "loans" of technical personnel were common.

The New Priorities

While these well-established policies and practices remained central within 3M, the 1980s brought a slowing of economic growth, an increase in the pace of technology development, and an intensification of global competition that led management to impose more discipline, coordination and control on their increasingly diverse and widespread businesses. This was particularly true after 1986 when Alan "Jake" Jacobson became CEO. Under the pressure of his tough productivity program, the company reduced the labor content in its products by 35% and average manufacturing cycle time by 21%. Coupled with this new emphasis to "do more, faster with less" came a new focus on competitive strategy that encouraged managers not only to work on developing differentiated products, but also on creating defensible product-market positions.

As part of this new competitive focus, the company also began to change some aspects of 3M's vaunted innovative product development process. In response to the pressure for faster development and implementation of innovations, the old model of the technological genius making a breakthrough in the laboratory was increasingly supplemented by teams of scientists, production engineers, and marketers working together from the outset. The need for speed also put pressure on the old "make a little, sell a little" philosophy. Particularly in some high-tech areas, the company was having to supplement the traditional approach with a model that allowed major front-end technological decisions and financial commitments. To facilitate this shift, Jacobson introduced the "Pacing Program" which aimed at identifying, among the thousands of projects in progress at any time within 3M, the hundred or so which could "change the basis of competition," and ensuring they received the funding and management attention they deserved.

On assuming the CEO's position in 1991, "Desi" DeSimone was determined to build on the disciplined legacy Jacobson had left. At the same time, however, he recognized the importance of protecting 3M's legacy of innovation-based entrepreneurship and the need to tolerate "well-intentioned failure." While the company had to be highly selective in supporting the ideas bubbling up, and equally firm about cutting off projects that were not achieving their objectives, it had to do so without damaging front line initiative or threatening the careers of those who became project champions.

Like his predecessors, DeSimone celebrated the tenacity of front-line entrepreneurs fighting for their projects, and loved to tell the story about how as a division general manager he had repeatedly tried to stop a development team that was working on insulated materials. Despite his efforts, the team persisted, eventually developing the highly successful Thinsulate brand insulation widely used in outer garments. DeSimone explained the delicate management balance between discipline and flexibility:

At the center of 3M's values are a respect for the individual and a commitment to creating an entrepreneurial environment where innovation flourishes. That requires managers to have respect for ideas coming up from below. They have to ask, "What do you see that I am missing?" And they may have to close their eyes for a while, or leave the door open a crack when someone is absolutely insistent that their idea has value. But in the end, there has to be performance. We can't allow every project to continue indefinitely. So we start to starve it. We force it to show it can survive.

Birth of a Business

In 1979, the Optical Systems business unit was created to exploit light control film, a product based on 3M's innovation of microlouver technology (see Exhibit 1 for a brief description). This technology, which was considered to have substantial potential by many, already had a 15-year history in 3M, having begun its life in the New Business Ventures Division (NBVD) as "a technology in search of a market." The plastic film with its closely spaced microlouvers simulating a mini venetian blind, seemed to have many potential applications from window treatment to ski goggles, but despite the best efforts of NBVD, only one major user was found: 3M's own Visual Products Division. The overhead projectors of the time created a glare problem for the presenter, and division product engineers became interested in the idea of placing a sheet of light control film beneath the glass projection stage. Although the film was expensive, it was effective, and was used on the top end projector models.

When the NBVD was disbanded in 1979 on the belief that new businesses were more effectively developed within a "mother" division, management recognized that the optical microlouver technology was not going to develop beyond overhead projector screens if it was left in Visual Products. Bundled together with several other optical technologies with undefined applications, it became one of the assets of a new free-standing Optical Systems (OS) unit that reported directly to the group vice president of the Traffic and Personal Safety Products Group.

Despite these changes, the OS group continued to struggle, developing marginal products from its grab-bag of optical technologies, from magnifying lenses for rear projection television, to condensing lenses for microfilm readers. Light control film using the microlouver technology found its best application on automobile dashboards, where it controlled windshield reflection. But in the price-sensitive auto market, the product was regarded as an expensive luxury that did not add greatly to the perceived value of the car. Some products were sold at prices calculated on the basis of optimistic expectation of manufacturing cost reductions that were never realized. As a consequence, the unit was losing money at the rate of \$3 to \$5 million a year into the mid-1980s.

By this time, morale in the unit was low, with many losing confidence that they could build a viable business. But not Ron Mitsch, R&D vice president for the Life Sciences Sector of which the Traffic and Personal Safety Products Group was part. When he became involved in the interviewing process for the open position for a new lab manager for OS, he convinced Andy Wong that the job represented a great opportunity. As an 11-year 3M veteran, Wong had spent most of his career in one of 3M's more mature divisions, but was beginning to get bored. Because Mitsch had previously acted as a kind of mentor, he trusted his judgment, about the opportunities of working in a unit he saw as "exciting, stimulating, and kind of risky." Yet he was unprepared for the problems he soon encountered.

Under increasing pressure to boost performance, the OS unit's manager undertook a major rationalization of its diverse portfolio soon after Andy joined in late 1984. In the short term, this move exacerbated rather than improved the financial situation, since several of the projects were making contributions to the unit's overhead costs. A subsequent downsizing did little to boost OS's sagging morale. Through this turmoil, Wong tried to identify the unit's core technologies and unique competencies so he could recruit the right talent to focus on them. He decided he would build its capabilities around the emerging field of microreplication, a technology that involved creating microscopic structures in plastic to produce certain optical performance such as the louvered light control film. He then began using his personal network as well as formal channels to identify key technical specialists who could contribute to his objectives.

Through the mid-1980s, pressure to close the unit continued, but it had a staunch defender in Ron Mitsch, who in 1986 had been appointed vice president of the Traffic and Personal Safety Products Group. In 1987, Mitsch asked Wong to expand his responsibilities by taking on

manufacturing as well. Despite his lack of prior experience, Wong tackled this new responsibility energetically. With the help of his key manufacturing experts, he analyzed the situation and came to the conclusion that the unit had been devoting too much attention to the latest exciting invention, an approach that tended to focus people on conceptual visions rather than on operating realities.

To redirect attention to the practical problems, Wong developed a three-year manufacturing strategy. For two years they concentrated on streamlining processes at their small plant in Petaluma, California, hoping to win the credibility and support for new investments. Next, OS's lab and manufacturing teams collaborated to develop a new extrusion process for light control film. On the basis of their record of improvements, the unit won approval to purchase an extruder, thus permitting them to consolidate manufacturing operations in Petaluma rather than simply assembling components from their other 3M plants. With much greater control over their own costs, quality, and scheduling, Wong estimated that between 1987 and 1990, manufacturing costs were reduced by 50% while quality was improved.

In 1988, Mitsch decided that the OS unit was beyond the incubation stage where it needed to be kept as a group-level development project. Believing it now had to prove itself as part of an operating division, he merged the unit into his group's Safety and Security Systems Division (SSSD) as one of five emerging businesses being developed under that divisional umbrella. (Exhibit 2 shows the OS unit's location in 3M's organization.)

Under New Management

In late 1989, a year after OS had been folded into SSSD, Andy Wong was asked to take over as the business manager of the unit. The business that Wong was appointed to lead was still in difficulty. While costs had been trimmed through technology focus and manufacturing economies, many of those gains had been offset by a declining sales volume. After several years of selling light control film for auto instrumentation applications, OS decided to deemphasize this application because it was unprofitable. Another major application, the "light bar" for the Mercury Sable's headlights was also canceled in 1990, partly due to a styling change, partly due to Ford's need to lower costs. The problem was, no major new applications were being developed to replace these and other sales declines. With OS losses increasing, this situation became the new business manager's first priority.

From Ammunition to Aiming Device

In Wong's mind, the need was clear. He had spent five years creating what he called "the ammunition"—the technological competence and the manufacturing capability. Now what he felt was needed was "an aiming device"—a means to direct those internal assets towards external opportunities. The unit's existing four-person sales force scattered around the country working with specific customers on specific projects did not provide either the targeting or the power Wong was looking for. He wanted a professional marketing manager.

Wong took his argument to the division vice president for SSSD, but in a corporate environment of cost control, and with the OS unit's track record, he received a cool reception. But Wong was determined, and asked if he could take his request to Group Vice President Ron Mitsch. Fortunately for Wong, Mitsch had remained not only a believer in the potential of optical technologies, but also a personal mentor. He approved the new position, but only if OS would cut one of his unit's technical positions.

Wong then began searching for the best candidate for the job, using personal contacts and references as well as formal personnel channels. One of those who heard about the opening was Rob

Noirjean, whose nine-year 3M career had seen him develop from a salesman to a marketing manager in the Office Documents System Division. In a hallway conversation, a friend told him that a marketing manager's position had recently been approved for a high risk emerging business called Optical Systems. Like Wong, Noirjean saw such an opportunity as exciting. And if it didn't work out, at least it would provide good experience for his next assignment. He submitted his application, and was selected over more than a dozen other internal candidates.

Soon after Noirjean joined OS in February 1990, Wong asked him to focus his attention on identifying applications for the microlouvered light control film. Reviewing past applications but eliminating markets that would continue to demand high up-front engineering costs for one-time sales, Noirjean defined 11 broad areas of potential (see Exhibit 3 for Noirjean's list). Wong then suggested he try to develop a sense of priority by investigating each of these markets for three months at a time. The first two market opportunities Noirjean decided to focus on were specialty lighting and privacy viewing.

After six months of customer interviews and focus groups, he became excited about a handful of specific applications—museum lighting, where the value added would justify the high cost; automatic teller machines (ATMs), where controlled viewing through light control film provided a desirable privacy feature; and government computing, where some sales had also been made to the Customs and Immigration Services on the same basis of privacy viewing for the workstation operator. Yet even as he explored these options, he became discouraged. Initial advertising generated leads among museums, but they were not translating into sales. Market research on teller machines indicated that banks were removing the privacy screens because some customers complained that they could not read the screen easily. And Customs officers who dubbed the pilot products "the privacy screens from hell," had often taken the filters off their terminals complaining of eye strain due to glare reflection.

To better understand the problems of the "privacy screens from hell," Noirjean persuaded a secretary in his office to install one of the filters on her computer screen. With some experimentation, the excessive glare problem was solved. Meanwhile, however, the secretary had become increasingly attached to her test screen's privacy benefits. As an ex-salesman with an eye well practiced at scanning purchasing agents' offices for clues of competitive bids, Noirjean was sensitive to the value of office privacy, and recognized that workstation screens often contained sensitive information that the operator did not want passers-by or office visitors to read. Intuitively, he began focusing on a previously unidentified application he defined as "corporate computing."

Tightening the Standards

In October 1990, as Noirjean was continuing his market research, Paul Guehler arrived as SSSD's new divisional vice president. Reflecting the more disciplined approach that 3M top management had begun to emphasize, Guehler made it clear that despite the fact that OS represented less than one-tenth of the division's sales, would be getting a lot of his attention:

My impression was that the unit had been churning for the previous five years, at least. Because their results had never matched the high potential of their very visible technology, the management had become defensive, isolated, and sometimes almost secretive about their activities. And although they had the support of one or two top executives in 3M, they lacked broad credibility elsewhere in the organization. My job was to help develop the people to develop the business.

From the OS business unit, the new management style seemed threatening. At an informational meeting that the new vice president held with division staff, he openly acknowledged to the assembled group that if OS didn't perform, it would not be around next year. "It certainly added a sense of urgency to what we were doing," recalled Rob Noirjean. Andy Wong also found the

situation had changed for him. Not only was there a new division vice president, but his long time mentor and project supporter Ron Mitsch had been promoted to senior vice president of Corporate R&D, and was no longer directly responsible for the SSSD in which the OS unit was located. Wong reflected how the change of bosses affected his role:

I viewed my role as business unit manager encompassing four major responsibilities. First, I had to attract and retain good people—not always an easy task in a unit under threat. Then I had to build the team's motivation and commitment to the project. I think we achieved that. Everyone really believed in what we were doing, and we were all prepared to fight for it. Third, I had to ensure we kept making progress towards our objective. But because we first concentrated on building our internal capabilities—our ammunition—it was difficult to recognize progress until we began to fire it at market opportunities. Finally, I had a responsibility to keep senior management in the boat, not only by demonstrating steady progress, but also by painting a picture of the cathedral we were building. It was this fourth role that began to dominate when Ron moved on to his new job and Paul took over the division.

Guehler's approach to managing the OS unit was what he described as a "give and take" strategy: he was willing to offer support and invest in the business, but he also took resources away and forced them to meet their financial objectives:

First, they had to define clearly their core businesses. I helped them focus on three opportunities—computer filters, electronic display lighting enhancement, and automotive optics. The last one was a well-established segment and would help them survive while they tried to prove the first two. Next, I had to get them to open up, to communicate, to get more support particularly within the division. I forced them to commit their ideas to paper, to add multiple scenarios to their planning, and most of all, to articulate and defend their ideas. What they needed was discipline.

Testing the Business

With no budget remaining for additional market research and under pressure to bring a product to market fast, Noirjean decided to pursue the recently identified corporate computing opportunity. He conducted an informal survey among secretaries in another 3M division to determine their need for computer screen privacy, and the product attributes most important to them. On the basis of this information, he developed his marketing proposal for a new product—a computer privacy filter for general office applications.

Although several anti-glare screens existed on the market, the proposed product would open an entirely new privacy screen segment, and because of the new pressures, Noirjean needed to bring it to market quickly with little investment. He proposed taking light control film, cutting and shaping it to fit various monitor sizes, then packaging and selling it through computer supply distributors. The proposed product would be priced to distributors at \$70, and by adding the distributors' normal 100% markup, the suggested retail price was set at \$140, although many were expected to be sold below that level—perhaps as low as \$99. Apart from minimum investment in packaging and inventories, both of which were commitments that the OS unit could fund internally, no major additional investment was required. It took little persuasion to get Andy Wong to agree to the proposal.

Implementing the plan was also relatively simple, and in February 1991, the first custom privacy filters were shipped. Sales gradually rose, reaching a level of about \$10,000 a month—good basic demand, but far from the "home run" the unit needed. Growth stalled out due to two basic problems. First, distributors kept calling for different sizes of the screens, each of which was cut and

formed to conform to the size and curvature of variously shaped models of computer screens. Within nine months, OS inventories listed more than 100 sizes. Another problem related to the perceived value of the screen. Although most appreciated its performance, the initial consumer reaction to paying over \$100 for a formed sheet of plastic was one of surprise. By summer, Noirjean and the other OS managers had decided to redesign and relaunch the screen.

Their decision was to put the filter in standard size frames which would hang over the front of the monitor rather than fit exactly on the screen. To minimize investment, they negotiated a supply agreement for two standard size frames with a company selling an antiglare computer screen. With a redesigned package and brochure, they relaunched the product in October 1991.

However, even as this product was launched, Noirjean was aware that it would not meet the market need. Consumer reply cards he was receiving from users of the first-generation privacy screen were beginning to show a pattern in their responses. Typically scoring the product a "three" on a five-point scale, the comments indicated that while people loved the privacy feature, many of them complained that the screen created an uncomfortable glare. Feedback on the new universal screen design confirmed the perception. While there was a decline in distributor complaints about size availability and consumer comments about perceived value, the reply cards continued to highlight the glare problem.

While sales increased to around \$20,000 a month, many in the SSSD saw the new privacy screen as yet another minor product from a group unable to fulfill its promises. But within the OS unit, everyone remained convinced they could make this product a winner.

The New Multiprotection Filter

Through selling the privacy screen, Noirjean became aware of the substantial sales volume being generated by the simpler and more commonplace antiglare filters that had been on the market for several years. As he conducted further market research, he became increasingly convinced that they had to reposition their product to overlap into this booming product market segment. He was also aware that such a decision would involve substantial new investment.

To respond to the new disciplined approach, the team prepared for their product relaunch by working through a four-phase development process that Guehler had instituted. Noirjean took primary responsibility for Phase I—the definition of a clear product and market concept.

Phase I: Developing the Product Concept

Noirjean's market research identified that there was a total potential untapped market of over 30 million PCs in the United States. Selling to this market, the antiglare filter market had developed into a \$70 million business by 1991, and was growing at 20% annually. (Exhibit 4 presents key data from this study.) The market had become increasingly competitive, with the four largest players being Acco, a leading manufacturer of office supplies and therefore having good channel access; Polaroid, a company with a good brand image and a strong reputation in light filtering lenses; Fellowes, an office products manufacturer and supplier to the banking and financial service industry; and Optical Coating Laboratory Inc., the pioneer of the antiglare computer filters in the market. (Exhibit 5 provides a brief profile of each competitor.)

The products these companies supplied were quite similar, indeed all except Optical Coating Laboratory bought the coated glass from the same supplier. They differentiated their products by the design of the frame, through branding, and increasingly on price. As Noirjean prepared his Phase I analysis, he concluded that 3M would have two important sources of advantage over competitive

products—the unique privacy filter feature, and distribution offered by the company's access to office supply channels through its Commercial Office Supply Division (COSD) and to computer distribution outlets through the Data Storage Markets Division (DSMD).

In order to ensure the appropriate expertise and support for the development process, Wong asked his lab manager, Jeff Melby, to lead a cross-functional new product introduction team. From Noirjean's analysis, the team specified a product they felt would be truly top of the line in this segment. In addition to the antiglare and contrast enhancement offered by existing products, it would incorporate an electrically conductive coating which, when grounded, would prevent static electricity and dust buildup on the screen. This coating also proved effective in blocking 99.9% of low frequency E-field electromagnetic radiation which some reports (still inconclusive and somewhat controversial) had associated with health risks including miscarriages and leukemia. Finally, the filter would offer 3M's unique privacy feature, which was expected to be of increasing importance as the trend to open plan office design continued.

At the Phase I review meeting, the main concern was whether such a screen could be produced economically. Initial estimates suggested that adding all these features might result in a retail price approaching \$300—clearly infeasible for an option on a \$500 monitor. Noirjean's research suggested that the list price for such a product would have to be well under \$200—a specification whose feasibility would have to be confirmed in Phase II.

Phase II: Undertaking the Feasibility Assessment

Having gained agreement on the broad concept, the unit's next challenge was to determine whether the product defined by Noirjean's research and Melby's team was technologically feasible within the prescribed cost parameters. To investigate this issue, Melby assigned two development subteams to explore the technical feasibility of both the glass specifications and the screen frame. Right away both teams began to involve people, resources, and expertise from many other parts of 3M and from the outside. (See Exhibit 6 for team membership.) Melby explained the philosophy:

Management had been pounding on us to do more with less—and we certainly had very little! So we began drawing outsiders onto our team. In 3M's technical community we all have our personal networks of contacts, and the culture is one where you just have to ask for help and it's available. For example, we drew on experts in our Specialty Film Division who had expertise in film lamination, our Optics Technology Center for their knowledge about film surface roughness, and our Corporate Process Technology Lab for advice on surface adhesion. We put all that expertise together in our work with a glass coater who had access to optical lamination capability, and together, we developed a proprietary process for laminating their coated glass with our microlouver film.

The frame design subteam also found ways to tap into a wide range of internal and external expertise that allowed it to develop a universal frame with a simple customizing adjustment that could be mounted without adhesives. They located an outside injection moulder and invited him to participate as a team member. They also tapped into internal expertise of the corporate Hardgoods Engineering Services and an engineer in Surgical Products Division who Wong had heard was an excellent hardware design person. With the help from Paul Guehler to win clearance with their bosses, both individuals were drafted as team members.

The team jelled quickly and soon came up with a unique design, as Rob Noirjean described:

It was amazing how well everyone worked together, even the outsiders we pulled onto the team. We all knew what we needed to do, we all had complete faith in each other, and we all shared an absolute belief that we were developing a

winning product. I guess it was because everyone sensed this was our last shot. . . . We did some benchmarking of our competitors' products, and eventually designed an inexpensive frame with all their features and a unique innovation. While the competition had to offer seven sizes of each of their models, we developed a squeeze adjustment feature that allowed us to offer only two.

Preparing Phase III: Developing the Business Plan

With agreement that the technical questions had been answered, the OS team was now ready to move into the Phase III Development process that led to the Phase IV Introduction stage. Before they could do so, however, they were required to attach hard cost estimates and sales forecasts to the broad product concepts and design parameters they had developed. The new frame had been designed not only with market differentiation in mind, it also aimed at reducing supporting inventory levels and minimizing the tooling investment. Nonetheless, the final calculations arrived at an investment authorization request for \$750,000 primarily for new moulds and assembly equipment.

The business plan also required the team to develop sales forecasts and risk assessments (see Exhibit 7). Rob Noirjean, who prepared much of the data used in the plan acknowledged that his forecast of \$1 million of sales in the first six months faced a good deal of skepticism. And his estimate of worldwide sales of \$10 million in 1993 was dismissed by some as being nothing more than a way of showing a one-year payback on the investment. Said Noirjean:

The forecasts seemed high to many of them, especially compared to our sales of the first two generations of the product. But we tried to point out that they were a drop in the bucket compared to the total PC market size. . . . There are always a lot of soft facts in these presentations, and because 90% of new products fail, we knew management's role was to challenge the logic and expose the risks. Paul had certainly done that in the Phase I and II reviews, and we expected even tougher questioning in this style. . . . There certainly was a lot of doubt in the division. People were openly saying that we were just planning to throw money down a black hole again with this project. But we really believed our numbers.

Some concern also centered on the likely competitive response from the companies already established in the computer filter market. The OS team was aware that Sumitomo Chemical had developed a film that was clear when viewed head on, but caused objects to appear blurry from the side. Sumitomo had even approached 3M to determine their interest in the technology. Observed Noirjean:

When we tested their product, end users told us they didn't like the feeling it gave them when they moved their heads and the screen went out of focus. . . . It is probably as expensive to produce as our louvered film, so that's not an advantage. Still, it could be a threat if an existing filter product incorporates it.

Finally, some worried that achieving the forecast sales volume at a distributor price of \$79 (recommended retail \$175) would require substantial support in sales and distribution. The OS team was assuming that they could access the office market channels through 3M's Commercial Office Supply Division (COSD) and the computer distribution outlets through Data Storage Markets Division (DSMD). But while corporate management strongly encouraged cross-divisional marketing efforts, units like COSD and DSMD still had to choose carefully among the products offered to them so that their specialized sales forces would not become overwhelmed and inefficient. Indeed, COSD had rejected OS's previous requests to distribute its earlier model privacy screens, predicting (correctly, as it turned out) that those products would not have broad enough market appeal. And despite Paul Guehler's urging, the OS team had not yet persuaded either division to commit to distributing the new product.

Apparently the doubts and concerns about OS and its twice-failed screen were being taken seriously. While he was working on the business plan, Rob Noirjean received a request for information about the unit's sales from 1986 to the present. When he asked why management wanted ancient history, he was told it was for a review to decide the OS unit's future :

You feel a bit like those guys on a submarine in the old war movies when someone calls out "Torpedo off the port bow." But there's nothing to do but keep going and hope you can go fast enough so you get by it. As a team, we were all totally confident in the new product and completely committed to making it work. We just hoped we would be given the opportunity.

Meanwhile, Andy Wong continued to feel pressure. The situation in OS contrasted sharply with the other four units in SSSD, two of which were sponsoring new products that had been nominated to the company's highly visible and prestigious Pacing Program. Because profits were reported by business unit, everyone was aware that the OS unit was pulling down the division's overall performance numbers. Yet here was Wong trying to support not only the privacy screen proposal, but also another risky project that the unit was developing—a brightness enhancement product for electronic display applications that internal champions claimed was a potential \$200 million a year business. One senior manager within the division asked Wong if OS wouldn't be better off switching from his aggressive but unsuccessful growth mode to a harvest strategy. By reassigning people to other units and cutting off R&D, the business unit could generate a profit with its ongoing auto components sales. While it would eventually put OS out of business, it was a strategy that would probably help Wong's personal evaluations, which had been low for the last three years.

Bottom of the Ninth, Two Out

In early 1992, some key decisions had to be made. For Andy Wong the question was, should he back the authorization for expenditure for the proposed computer filter? And if so, how should he seek support? Essentially he had four options: to postpone or reject the proposal; to try to fund it within his unit by outsourcing a standard frame, cutting inventory, and taking a more incremental approach; to try to get divisional funding; or to take the proposal to one of his senior-level mentors for support.

At the same time, Paul Guehler knew that he, too, may soon have to respond to this latest attempt to revive the privacy screen project after two previously unsuccessful launches of this product. He had five business units to develop, and because funding decisions put the whole division's credibility on the line, he wanted to ensure that other managers in the division were supportive of new initiatives. He also knew that within a year or so OS planned to ask for another \$5 million for its promising electronic display brightness enhancement project. He reflected on the situation:

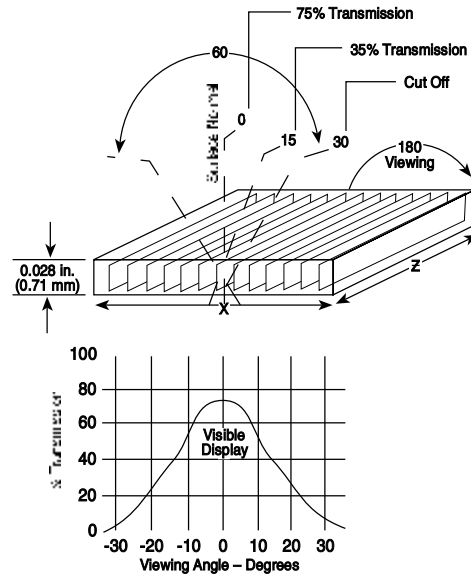
Their credibility within SSSD and the corporation was pretty low. Two of our other business units had Pacing Program projects and were getting high level corporate attention and support. Meanwhile, Optical Systems was still losing \$3 million on sales of \$10 million. Some people felt it was time to pull the plug.

Exhibit 1 Light Control Film: Description and Potential Applications

Product Description

3M Light Control Film (LCF) is a thin plastic film containing closely spaced black microlouvers. The film simulates a tiny venetian blind to shield out unwanted ambient light and direct display light of electronic instrumentation (**Figure A**).

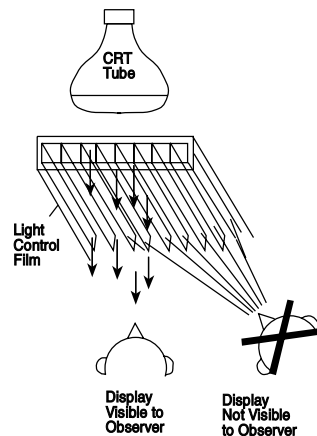
Figure A



Potential Applications

- **Privacy Viewing:** Light Control Film allows for controlling viewing, so that unauthorized observers will have their line of sight blocked (e.g., on CRTs or Automatic Teller Machines (ATM) (**Figure B**).

Figure B



- **Sunlight Readability:** Light Control Film microlouvers help block out annoying off-axis light while maximizing the transmission from the display to the viewer. The result is improved display contrast with little loss of brightness (**Figure C**).
- **Light Directing:** Light Control Film directs light to where it is needed or away from where it is not. It eliminates night time window reflections in automotive and aeronautical applications. It can also be used to hide the light source in incandescent lighting application (**Figure D**)

Figure C

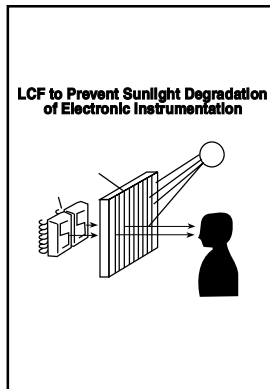
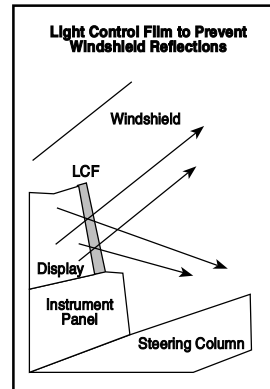


Figure D



Source: Company documents.

Exhibit 2 OS Unit in the 3M Organization

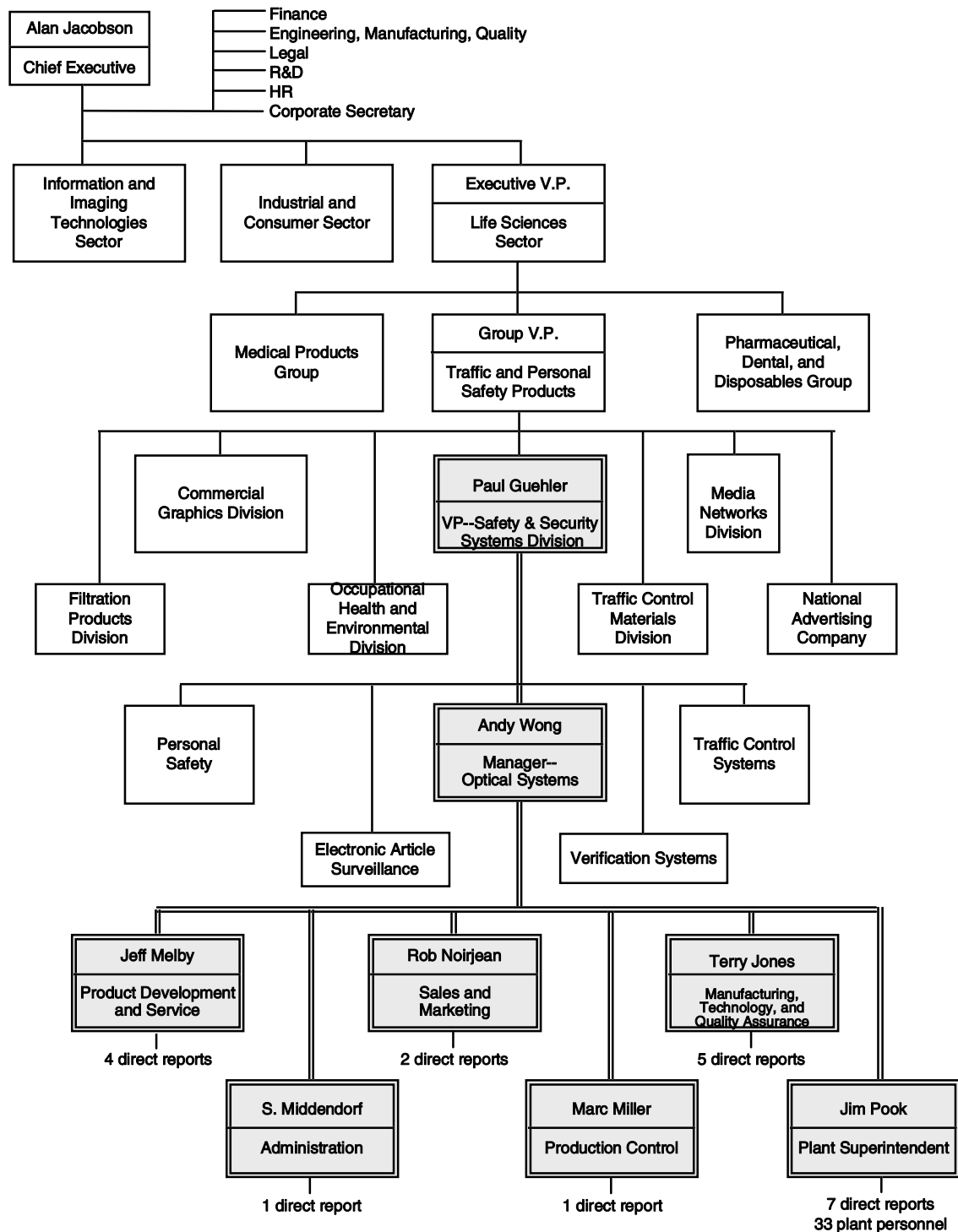


Exhibit 3 Noirjean's List of Potential Markets

- **Specialty Lighting Applications**
 - Museum lighting
 - Architectural lighting
 - Task lighting
 - Hospital lighting (bed lamps)
 - Film processing lighting
- **Privacy Viewing**
 - ATM
 - Government computing
 - Corporate computing
 - Hospital radiology departments
- **Electronic Display Applications**
 - LED
 - PDP
 - Vacuum fluorescent
 - Electroluminescent
 - CRT (i.e., airport control tower display)
- **Automotive Lighting**
 - Courtesy lighting
 - Map lights
- **Outdoor Electronic Display**
 - Gas pump displays
 - Industrial use displays
- **Avionic Display Lighting**
- **Copiers**
 - Internal directional lighting
- **Analog Gauge Lighting Applications**
- **Machine Vision Applications**
- **Automotive CRTs**
- **Automotive Switches and Displays**

Source: Company document.

Exhibit 4 Multiprotection Filter Market Research Summary Data**New PC Installations (1990)**

Personal computers sold in 1990:	11.6 million
• Of which for business use only (i.e., excluding home use and laptop)	5.9 million
• Of which 3M filters would fit (estimated at 90% of units)	5.3 million

Existing PC Installations (pre-1990)

Number of pre-1990 PCs	60.0 million
Business use only	30.5 million
3M filter size coverage	27.4 million

Total Potential Market in 1990**32.7 million****Stanford Resources Estimates**

Total number of antiglare filters sold in U.S. in 1990	1.3 million
Total estimated market value (at distributor prices):	
1990	\$53.0 million
1991	\$70.0 million
1995	\$136.0 million
Estimated CAGR: 1990-1995	20.3%

Note: Privacy filter is a "new-to-the-world" product with unknown market potential.
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Source: Company document (some data disguised).

Exhibit 5 Summary Competitive Profile

Optical Coating Laboratories Inc. (OCLI)

OCLI is the market leader with an estimated 37% market share. They reached the market through data supply and OEM channels. OCLI also private labels filters for large customers and sells directly to monitor manufacturers. OCLI does not have a privacy filter. They do not have a strong distribution position through the office supply channel.

Frame Design(s) Side hanging universal, center mount, and contoured "profile" mount

Models	U.S. Distribution Price	Features		Glass
		Anti-glare	Anti-radiation/ Static	
Vantage	\$25.00	Yes	No	Yes
Professional Plus	49.00	Yes	Yes—98%	Yes
E-Shield	75.00	Yes	Yes—99.9%	Yes

ACCO

ACCO is a strong supplier to the office supply market. They offer two filters similar to our AF100 and AF200 in two sizes 12" and 13" and 14" to 15" and hold approximately 14% of the filter market. Presently they do not have an extra large size like 3M's XL size. We have heard that ACCO may introduce a Privacy Filter using a Sumitomo technology that makes the screen go out of focus from the side rather than darken like our privacy filter.

Frame Design(s) Side hanging universal

Models	U.S. Distribution Price	Features		Glass
		Anti-glare	Anti-radiation/ Static	
ACCO GS	\$26.53	Yes	No	Yes
ACCO VS	44.98	Yes	Yes—98%	Yes

Fellowes

Fellowes is a strong supplier to the office supply channel and also to both computer and office supply superstores. They offer two products similar to our AF100 and AF200 which together hold 13% market share. They do not have privacy but they are searching for a supplier to provide this feature. Although Fellowes offers a side-hanging frame design, customers tend to feel it is flimsy. The hanging arm requires velcro to hold it in place since it is too short. Fellowes frame design is usually the lowest priced.

Frame Design(s) Side hanging universal, center mount, and contoured "profile" mount

Models	U.S. Distribution Price	Features		Glass
		Anti-glare	Anti-radiation/ Static	
Fellowes Anti-glare	\$24.98	Yes	No	Yes
Fellowes Anti-glare/radiation	40.78	Yes	Yes—98%	Yes

Polaroid

Polaroid is a supplier to both the computer and office supply distributors. They sell low cost plastic filters in two sizes (10"-13" and 14"-15"), and one high cost glass filter. Polaroid offers a universal mounting but it requires adhesive to hold it on the monitor. The performance of their plastic filters is not at the level of glass anti-glare filters. They have an estimated 11% share of the filter market.

Frame Design(s) Side hanging universal, center mount, and contoured "profile" mount

Models	U.S. Distribution Price	Features		
		Anti-glare	Anti-radiation/ Static	Glass
CP60	\$20.00	Yes	No	No
CP60 SC	32.00	Yes	Yes—98%	No
CP90	60.00	Yes	Yes—98%	Yes

Others

(Sunflex, Norad, COS, Eyesaver, Optech, etc.) A variety of other smaller suppliers together account for around 25% of the market.

Exhibit 6 3M Multiprotection Filters—Management Team Structure and Phase Status

New Product Introduction Team Members	
S. Cobb	Laboratory
K. Fox	Quality Assurance
K. Castro	Quality Assurance
T. Jones	Manufacturing Technology
M. Miller	Manufacturing
D. Kingston	Lamination Development
K. Bramble	Packaging
V. Linse	Filter Assembly
J. Melby	Laboratory (Leader)
S. Middendorf	Program Administrator
R. Noirjean	Marketing
S. Theirl	Product Development
J. Packard ^a	Corporate Hardgoods Engineering
J. Drake ^a	Surgical Products Division
Representative ^b	Injection Moulder
Representative ^b	Coating Subcontractor

Source: Company document.

^aMember from other 3M unit.

^bNon-3M team member.

Exhibit 7 Excerpt from Multiprotection Filter Business Plan**Summary Filter Sales and Profit Forecast**

	1991 (Act)	1992 (6 mo)	1993	1994
Forecast filter sales (\$000)	180	1,000	10,000	20,000
Forecast operating income (%)	N.A.	0%	15%	20%

Summary Risk Analysis and Response 3M Multi-Protection Filters

Risk	Level	Plan
Light control film Supply	Low	<ul style="list-style-type: none"> • Continue Petaluma supply • Continue cost reduction • New equipment
Adhesive supply	Low	<ul style="list-style-type: none"> • Qualify second source
Lamination source	Low/Medium	<ul style="list-style-type: none"> • Develop close partnership with key component vendor • Document process • Qualify second source • Develop new process
Laminate durability	Low	<ul style="list-style-type: none"> • Qualify per IBM Class C • Audit program with traceability
Frame source	Low	<ul style="list-style-type: none"> • Support molder insure capacity • 3M owns tooling • Document process
Back-order status	Low	<ul style="list-style-type: none"> • Insure component supply and filter assembly capacity
Low sales demand	Low	<ul style="list-style-type: none"> • Introduce all necessary features plus privacy • Quality product line • In place distribution • Sales support package • Replace competitors • 3M name
Existing competition	Low/Medium	<ul style="list-style-type: none"> • Leverage 3M distribution • Sell product family • Offer same or better features and benefits
Emerging competition	Low/Medium	<ul style="list-style-type: none"> • Leverage 3M distribution • Patent new and higher performance filter • Patent frame/hanger • Leverage 3M global presence/technical support • Business agreements with vendors • Offer package of benefits to overcome price issue

Source: Company document (some data disguised).