[1 of 2] Polaroid Corp. v. Eastman Kodak Co. (DC Mass) 16 USPQ2d 1481 Polaroid Corp. v. Eastman Kodak Co.

U.S. District Court District of Massachusetts
16 USPQ2d 1481

Decided October 12, 1990
No. 76-1634-MA

Headnotes

REMEDIES

1. Monetary - Damages - Patents - Lost profits (§ 510.0507.05)

Award of lost profits is preferred measure of damages against patent infringer; patent owner has "reasonable probability" burden of proof, and any doubts concerning calculation of lost profits must be resolved against infringer.

2. Monetary - Damages - Patents - Lost profits (§ 510.0507.05)

All market influences must be considered in determining lost profit or reasonable royalty damages, even if no non-infringing alternatives are available, and thus federal district court, in awarding damages for infringement of instant photography patents, must consider effect which competition between instant and conventional photography had on price which consumers were willing to pay for instant photography, even though conventional photography was not acceptable substitute for instant photography.

3. Monetary - Damages - Patents - Lost profits (§ 510.0507.05)

Patent owner seeking to recover lost profits must, even in two-seller market, show that it had marketing capability to make its sales combined with infringer's sales, through proof of factors such as adequate distribution system and sales personnel.

4. Monetary - Damages - Patents - Lost profits (§ 510.0507.05)

Determination, for purposes of calculating lost profits, of demand in two-seller instant photography market requires careful examination of each party's actual marketing capabilities, since demand for instant cameras is highly susceptible to marketing influences; thus, demand for instant camera products, absent infringer's entry into market, cannot simply be said to be total sales actually made by both parties, since such approach fails to take into account reasons why consumers purchase instant cameras, and thus patent owner cannot recover lost profits on any sales to which infringer brought something unique and critical.

5. Monetary - Damages - Patents - Lost profits (§ 510.0507.05)

Demand for instant photography products is subject to whim of consumers who may be influenced by brand names, and thus award of lost profits to owner of infringed instant photography patents must include consideration of consumer loyalty to infringer's brand name, and must determine whether such loyalty overcomes otherwise reasonable inference that infringer's cameras were purchased because of patented features owned by plaintiff.

6. Monetary - Damages - Patents - Lost profits (§ 510.0507.05)

Award of lost profits to owner of infringed instant photography patents should not be reduced in order to account for effect of combined advertising produced by patent owner and its infringer/competitor, in view of parties' failure to create reasonable analytical tool for considering dual-advertising phenomenon, since in such case burden of uncertainty must fall on infringer.

7. Monetary - Damages - Patents - Lost profits (§ 510.0507.05)

Corporate owner of instant photography patents, which has failed to show that opportunity to make infringer's sales existed at any time other than when those sales actually occurred, must, in order to recover lost profits, demonstrate steps it conceivably could have taken to meet increased demand, including time-consuming capital investment; corporation should show not only its theoretical technical and physical potential but also its forecasting and decisionmaking skills, thereby establishing what it, with its unique corporate personality, could have achieved in sales without infringer.

8. Monetary - Damages - Patents - Reasonable royalty (§ 510.0507.03)

Ten percent royalty is sufficient under 35 USC 284 to "adequately compensate" owner of infringed instant photography patents; such rate represents slightly more than 60 percent of infringer's anticipated profits through 1986 on those sales of cameras and film for which lost profits were not sufficient or could not be proved.

PATENTS

9. Infringement - Willful (§ 120.16)

Willful infringement must be demonstrated through clear and convincing evidence that infringer deliberately disregarded patent, flagrantly disregarded patent laws, or had no reasonable basis for believing it had right to act as it did.

10. Infringement - Willful (§ 120.16)

Patent infringer which consulted patent counsel early and often as it developed its instant photography system that included products found to infringe, and which engaged in extensive patent clearance process, has not been shown to have willfully infringed.

REMEDIES

11. Monetary - Attorney's fees; costs - Patents - Exceptional case (§ 510.0905.03)

Attorney's fees are not, as general rule, awarded in patent cases, but rather should be awarded only to deter blatant, blind, and willful infringement; thus, award of fees is not warranted against non-willful infringer of instant photography patents, in view of lack of any evidence of its misconduct during litigation.

12. Monetary - Damages - Prejudgment interest (§ 510.0511)

Award of prejudgment interest, to owner of infringed instant photography patents, should be based upon pre-tax profits and should be calculated upon Treasury bill rate for period April 1976-present, compounded annually.

Particular patents - Instant photography

3,245,789, Rogers, photographic products and processes, damages awarded.

3,362,821, Land, diffusion transfer processes, damages awarded.
3,578,540, Land, color photographic product formed by diffusion transfer, damages awarded.
3,594,165, Rogers, novel photographic products and processes, damages awarded.
3,689,262, Rogers, photographic products and processes for color diffusion transfer, damages awarded.
3,753,392, Land, film advancing apparatus, damages awarded.
3,810,211, Wareham and Paglia, self-developing camera system, damages awarded.

Case History and Disposition:

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Action by Polaroid Corp. against Eastman Kodak Co. for patent infringement. Following entry of judgment against defendant, damages are now awarded.

Prior decisions: 228 USPQ 305 **,** 229 USPQ 561 **,** 5 USPQ2d 1080 **.**

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[1 of 2] Opinion Text

Opinion By:

Mazzone, J.

I. INTRODUCTION

On April 26, 1976, Polaroid Corporation ("Polaroid") filed its complaint charging that Eastman Kodak Company ("Kodak") had infringed twelve Polaroid patents relating to integral instant cameras and film. Over the next five years, the parties engaged in extensive discovery on the issues of liability and infringement. Those issues were tried before Judge Rya Zobel between October 5, 1981 and February 26, 1982. On September 13, 1985, Judge Zobel, in a comprehensive and carefully detailed Memorandum of Decision, found Kodak had infringed twenty claims of seven valid Polaroid patents. Two patents were found invalid. One was found not infringed. One was found invalid before trial and Polaroid withdrew its claims on another patent before trial. Judge Zobel did not assign to any single patent credit for the success of integral instant cameras and film, but found that integral instant photography, as commercialized by Polaroid and Kodak, relied on the inventions of the seven patents held valid and infringed. Judgment was entered on October 11, 1985, and, on January 8, 1986, Kodak was enjoined from further infringement of the five patents which had not yet expired. The damages issues were reserved to the post-liability phase of the bifurcated trial. *Polaroid Corp. v. Eastman Kodak Co.*, 641 F.Supp. 828 [228 USPQ 305] (D. Mass. 1985), *stay denied*, 833 F.2d 930 [5 USPQ2d 1080] (Fed. Cir.), *aff'd*, 789 F.2d 1556 [229 USPQ 561] (Fed. Cir.), *cert. denied*, 479 U.S. 850 (1986).

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The story of this case to date is told in the foregoing trial and appellate opinions. That story will not be retold here except where necessary for a complete understanding of the particular issue under consideration. Suffice to say that this case involves not only the patents, but the history of a new industry, that of integral instant photography. It involved from the outset the only two competitors in the field, locked in a bitter, unyielding exhausting and expensive litigation for over fourteen years, and the struggle has not yet ended. This is the latest, but probably not the last time the parties confront each other.

The precise issues that were reserved for this phase of the litigation are:

1. Whether Kodak's infringement of any one or more of the patents in suit was willful and deliberate.
2. The amount of damages adequate to compensate Polaroid for Kodak's infringement, together with interest, and whether such damages should be increased up to three times the amount found, all in accordance with 35 U.S.C. §284.
3. Whether costs shall be taxed against either party.
4. Whether Polaroid is entitled to its reasonable attorneys' fees because this is an "exceptional case" within the meaning of 35 U.S.C. §285, and if so, the quantum of those fees.

Polaroid Corp., supra, 641 F.Supp. at 878.

The overriding issue, which therefore commands the greatest portion of this opinion, is determining the amount of damages adequate to compensate Polaroid for Kodak's infringement. In this introduction, I describe the trial as it was conducted. I follow with the elemental legal principles which I kept constantly in mind as I considered particular issues. I then set out the pivotal questions and my approach to those questions.

This case came before me for trial without jury. The trial lasted ninety-six days. Polaroid rested its case after fifty days, calling twelve witnesses, and introducing hundreds of exhibits. It also submitted portions of the depositions of an additional seventy-three witnesses. Kodak rested its case after forty-six days, calling fifteen witnesses, introducing hundreds of exhibits, and submitting portions of the depositions of seventy-one Polaroid witnesses, one Kodak witness, and fourteen non-party witnesses. Experts of national repute were presented by both sides to render their opinions of what *would* have happened in a world that never existed. They testified as to what management strategy, planning, and control would have been in a world without Kodak. They testified about marketing capability, about camera and film manufacturing capabilities, and produced econometric models to fortify their conclusions. They testified about cost accounting methods, reasonable royalty rates, interest rates, and the basis upon which to calculate interest. Their opinions were predictably, and discouragingly, widely disparate on almost every point.

The case presented many difficult and intricate factual questions. There were broad, sweeping questions of corporate vision, motivation, and management decision-making. There were discrete, narrow questions of product forecasting, product quality, manufacturing processes, and costs. The case also presented complex legal questions unique to the instant photography industry and its market. One most difficult problem was avoided. Just as Judge Zobel did not single out any one patent to credit with the success of integral instant photography, the parties here have treated the patents as a group for the purpose of a damage award. Assessing damages for the infringement of each patent individually based on that patent's contribution to the product would have added a hopelessly complex analysis to an already complex trial and was well avoided.

Not surprisingly in a case of this magnitude, lead counsel for both sides divided up the issues, assigning counsel exclusively to prepare and present specific segments such as manufacturing capacity, marketing, costs, willfulness, and royalty rates. Experts were not deposed prior to trial, but their reports were submitted and exchanged. Except for one area - willfulness - counsel had years to prepare their assignments and their witnesses. One positive result was an efficient trial with minimum delay and interruption except as necessitated by my schedule and docket demands. One negative result was a highly stylized, very technical presentation. The only surprise was that despite sharing all of the evidence that was ultimately produced at trial among all of the experts, the parties' positions were irreconcilably apart in every area. It was necessary to forge an independent course in technical, complicated areas in an effort to reach a principled result. I believed then, and continue to believe, that this matter could and should have been resolved by the parties at enormous savings to themselves, and to the resources of the court.

Throughout the trial, I kept in mind fundamental guidance. The recovery of damages for patent infringement is governed by 35 U.S.C. §284. Section 284 reads, in relevant part:

Upon finding for the claimant the court shall award the claimant damages ade quate to compensate for the infringement, but in no event less than a reasonable royalty for the use made of the invention by the infringer, together with interest and costs as fixed by the court.

The U.S. Supreme Court defined damages contemplated by the statute as follows:

he present statutory rule is that only "damages" may be recovered. These have been defined by this Court as "compensation for the pecuniary loss he [the patentee] has suffered from the infringement ...." They have been said to constitute "the difference between his pecuniary condition after the infringement, and what his condition would have been if the infringement had not occurred."

Aro Mfg. Co. v. Convertible Top Co., 377 U.S. 476, 507 [141 USPQ 681] (1964) (citations omitted).

[1] The law recognizes two possible measures of recovery, lost profits or a reasonable royalty. Under either method, the purpose is the same: to compensate the patentee for actual injuries. 1 The choice between the lost profits method of determining damages and the reasonable royalty method has been explained as follows:

The general rule for determining the actual damages to a patentee that is itself producing the patented item, is to determine the sales and profits lost to the patentee because of the infringement. Although the statute states that the damage award shall not be "less than a reasonable royalty", 35 U.S.C. §284, the purpose of this alternative is not to provide a simple accounting method, but to set a floor below which the courts are not authorized to go.

Del Mar Avionics, Inc. v. Quinton Instrument Co., 836 F.2d 1320, 1326 [5 USPQ2d 1255] (Fed. Cir. 1987). Lost profits are the preferred measure of damages. Therefore, I begin my analysis with a determination of lost profits.

Both sides recognize the approach to lost profits set out in *Panduit Corp. v. Stahlin Bros. Fibre Works,* 575 F.2d 1152 [197 USPQ 726] (6th Cir. 1978). To meet the *Panduit* test, Polaroid must prove: (1) demand for the patented product in the market; (2) the absence of an acceptable non-infringing substitute; (3) its manufacturing and marketing capability to exploit the demand; and (4) a detailed computation of the amount of profit it would have made. *Id.* at 1156. Polaroid's burden of proof on the lost profits is not absolute, but one of "reasonable probability." *Paper Converting Machine Co. v. Magna-Graphics Corp.,* 745 F.2d 11, 21 [223 USPQ 591] (Fed. Cir. 1984). Doubts concerning the calculation of lost profits must be resolved against the infringer. *Del Mar Avionics, Inc.,* 836 F.2d at 1327.

Beginning with the *Panduit* lost profits method, even if it is later decided that a reasonable royalty is more appropriate for some years, the question of demand must be resolved first. Everything else flows from demand. While issues such as manufacturing capacity are extremely complicated factually, they are not conceptually difficult. The question of demand, however, contains at least two profound conceptual problems.

The first problem is the question of market expansion. It has both legal and factual elements. Initially, I will investigate the legal standard to be applied and see what type of factual questions the rule leaves open. I will consider the evidence of market expansion. There is some direct evidence, such as predictions and contemporaneous statements about market expansion. The bulk of the evidence is inferential, however. There is testimony of Polaroid and Kodak executives about what happened in the relevant years and consumer market research examining the question of why people bought instant cameras.

There is expert testimony of Professors Dolan and Buzzel, based upon their surveys of market conditions, historical sales, and market research. There is expert testimony of Professors Fisher and Baumol, based on their econometric models.

The second problem is intimately related to the first; it is the question of translating Kodak sales into Polaroid sales in the world without Kodak, the "but for" world, or to put it more directly, what price Polaroid could have charged for the additional camera sales in the world without Kodak. The only undisputed fact is that quantity and price of the cameras and film Kodak did sell in the infringing years.

Once those questions are resolved, I will turn to marketing and manufacturing capability, costs, and other issues in the following order: an overview of the historical background of the case and the parties' positions (Section II); the instant photography market (Section III); Polaroid's manufacturing capacity (Section IV): costs (Section V); the calculation of lost profits (Section VI); the calculation of the reasonable royalty rate (Section VII); willfulness (Section VIII);

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attorneys' fees (Section IX); and prejudgment and postjudgment interest (Section X). My conclusion and a summary of the award appears in Section XI, followed by the appendices [omitted].

This introduction closes with my acknowledgement that this opinion is lengthy, partly because my findings and conclusions contain specific references to certain witnesses, events, or exhibits. Those references should not be construed as the most critical portions of the record. I considered the entire record, whether produced through trial witnesses, deposition, exhibits, or stipulations. Not only were witnesses in sharp disagreement, but thousands of pages of documents, dredged up from long dormant corporate files by industrious counsel over years of discovery, often contained statements, sometimes by the witness or by associates, which appeared to belie the position taken at trial. When confronted with these inconsistencies or discrepancies, witnesses sought to put their own "spin" on the statements. For example, conflicting views in marketing studies were sometimes ignored, or dismissed out of hand, or disparaged as "half ideas" or "half truths," or a "rare sensible comment." Of course, I assessed a witness's credibility, and weight to be given the testimony, on the usual criteria of fairness, motivation, candor and demeanor of the witness. In accepting or rejecting positions, I make specific references to the record when I find the testimony or exhibit particularly compelling or illustrative.

II. AN OVERVIEW

Edwin H. Land, the founder of Polaroid, began work on instant photography in 1944. In December 1948, Polaroid introduced the first instant cameras and film. Instant photography created a sensation, even though it required special handling. In order to develop the film after taking the picture, the user had to time and pull the print out of the camera, peel off and dispose of a protective chemical-laden paper backing and apply a special coating to the final picture. The cameras were heavy and bulky. Over time, Polaroid refined the early system, developing more sophisticated technology, better design and appearance, better quality photographs and, finally, color prints. 2 Still, even as late as 1971, the user still had to peel away the protective layer from the finished print.

The peel-apart business was a profitable one for Polaroid. In the early years of pack camera sales, 1963-1969, Polaroid grew three and a half times with after-tax profits averaging above thirteen percent of sales. After the initial learning curve was mastered, gross margins for peel-apart film were in the range of fifty to sixty percent and gross margins for cameras were in the range of forty to fifty percent. Despite these margins, however, the technology problems of the system kept it from being attractive to the average consumer and, as later marketing research showed, made a lasting negative impression on the public. Even as late as 1979, seven years after the peel-apart system was replaced, many people still associated Polaroid photography with the messy peel-apart product.

In 1972, Polaroid introduced a sleek folding camera, the Model SX-70. The film used with this camera developed without any special handling by the user and, because the film was exposed and viewed from the same side, the peel-off, protective paper was eliminated. Perhaps the most amazing feature of the SX-70 system was that the picture developed before the eyes of the consumer. The SX-70 was so revolutionary that both *Time* and *Life* magazines reported its introduction as a cover story in 1972.

Although almost a million SX-70 cameras were sold in 1974, a record for cameras priced over $100, Polaroid did not earn a satisfactory profit on this model. First, Polaroid predicted greater demand in 1973 and 1974 than actually materialized. Therefore, when sales failed to measure up, Polaroid was forced to cancel the planned construction of additional manufacturing facilities and lay off workers. Second, the first three years of SX-70 production were plagued with manufacturing problems. For the first time in its history, Polaroid manufactured many of the components for its cameras instead of contracting with outside vendors for their production. Modules were always in short supply. The precision plastics and the film batteries also created a great deal of trouble. Not until 1975 did Mr. William McCune, then Chief Executive Officer of Polaroid, believe that all the SX-70 problems had been worked out.

These problems chipped away at both Polaroid's profit margins and its public image. The company had been aiming for a profit margin of forty to fifty percent on cameras and between fifty and sixty percent on film,

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but they never came close to achieving these goals. In 1974, Polaroid sold SX-70 film at a loss. A battery problem required costly repair and the company had to give away a great deal of replacement film. Manufacturing difficulties kept Polaroid from meeting the demand for cameras in 1973. These problems also hurt Polaroid's image with consumers; SX-70's problems were well publicized and market research as late as 1978 revealed lasting negative impressions of the SX-70 system.

The "top of the line" SX-70 was originally priced at $120 and remained at that price until 1976. Polaroid did not raise prices for fear demand would be adversely affected. (TR 910, DF 20,2404). 3 In 1974, Polaroid introduced the SX-70 Model 2, a slightly less sophisticated camera which sold for $102. In 1975, Polaroid went one step further and introduced the Model 3, priced at $83, $13 below Polaroid's cost to manufacture the camera. Sales of Model 3 were particularly disappointing. In 1975, total SX-70 sales fell to 741,000 units. By 1976, Polaroid had invested about $600 million on the SX-70

project.
In March of 1976, Polaroid introduced the Pronto!, a non-folding integral camera, which retailed for approximately $60. Polaroid had begun work on the Pronto! as early as 1973, aiming to incorporate the new integral technology, but making the camera simpler to produce, thereby increasing gross profit margins to a goal of forty percent. The Pronto! body was one piece of precision plastic molding which required only a single screw. It did not have the SX-70 through-the-lens viewing, but it used SX-70 film. As early as 1970, Polaroid had received strong signals that Kodak was going to enter the instant market, but Mr. McCune testified that the design, price and timing of the introduction of the Pronto! would not have been any different without Kodak's entry in the market. In 1976, Polaroid sold 1,788,000 Pronto! cameras worldwide.
In April 1976, Kodak introduced its infringing EK-4 and EK-6 cameras in Canada. In response to the Pronto! price, Kodak changed the introductory U.S. retail prices for these hard-body models to bracket the Pronto!. The non-motorized EK-4 was priced slightly below and the motorized EK-6 slightly above the Pronto!. However, net dealer prices positioned the EK-6 at about the same price as the Pronto! and the EK-4 about $10 below. Kodak cameras were boxier and heavier than the Pronto! and the EK-4 required the user manually to eject the picture by turning a hand-operated crank. The cameras were moderately successful; Kodak sold 501,500 EK-4s and 610,000 EK-6s in 1976 despite some negative reports in the press about picture quality. Still, with only one month's headstart, Pronto! far outsold EK-4 and EK-6 in 1976.
Kodak initially priced its instant film, PR-10, only three cents lower than SX-70 film despite the fact that PR-10 did not contain a battery and, thus, compared to Polaroid film, was overpriced. PR-10 produced a rectangular picture with rounded corners compared to the square SX-70 prints. In addition, Kodak prints had matte finish as opposed to the glossy finish of the Polaroid prints. As with the SX-70 film, Kodak experienced initial quality problems, particularly fading.
In 1977, the instant photography business continued to grow rapidly and the competition between Polaroid and Kodak intensified. In March, Kodak announced the upcoming May introduction of the EK-2 model, which came to be commonly known as the "Handle." 4 The Handle was a fixed focus camera that required no special optical mirrors to direct the light path. This design reduced cost, weight, and the chance of consumer error. Like the EK-4, the Handle featured a manual crank to eject the picture. Kodak priced the Handle at $26.98 dealer low net expecting product-feature parity with Polaroid models. However, the Handle announcement had the effect of a "bombshell" at Polaroid. (TR 218).
Work on a low-priced camera had begun before the Handle announcement and Polaroid was able to respond by bringing the OneStep, a fixed-focus version of the Pronto!, to the U.S. market in June. It was dealer priced at $28. The OneStep, which Polaroid produced in about three months time at a capital cost of only $250,000, was its best selling camera ever. Contrary to Polaroid's claims that the simple OneStep hurt the quality image of instant photography, a 1978 study of OneStep owners concluded that "OneStep owners expressed the highest satisfaction level of any owners ever surveyed." (DF 20,687).

The instant camera market exploded in 1978. Polaroid's worldwide amateur camera sales increased approximately thirty-two percent over 1977 levels. Both companies accumulated significant backorders for cameras; Mr. McCune reported to the Polaroid Board of Directors several times during that year that demand was exceeding supply for both cameras and film. Despite all of this selling activity, however, the new integral era was not as profitable as the pack camera era had been. Mr. McCune reported that although sales had increased sixty-eight percent over 1968 pack-era levels, profit was only seventy-one percent of what it had been. (PT 2082). Polaroid executives blamed this loss of profit on Kodak's competitive presence which they claimed prevented them from increasing prices.

From May 1977 to July 1978, Kodak gradually lowered its price to dealers on the Handle by offering dealer rebates and bonus discounts such as introductory specials. In July 1978, Kodak was selling Handles to dealers at cost, about $18.95. Although the Kodak camera was non-motorized, Polaroid executives testified that they felt compelled to bring prices down on both their motorized and folding cameras. 5 Polaroid lowered the price of the SX-70 by $25.50 and offered the Pronto Rangefinder, the fanciest camera in the Pronto line, at $15.50 less by removing the tripod mount and the timer.

Sales began to slow in 1979. I. McAllister Booth, Polaroid's Vice President in charge of manufacturing, testified that retail prices were off, the earlier projections were not holding true, and Polaroid dramatically changed its expansion plans to avoid building inventories that would not be sold. Although first quarter sales increased about ten percent, by October, Mr. McCune reported that sales for the year were essentially flat. Although sales were still at a high level - the second highest in Polaroid history - Polaroid had planned for the continued, explosive growth rate of 1978. As a result, the company had to make costly reductions in its production schedule. Approximately 800 workers were laid off and the construction of additional production facilities was halted.

Kodak was faring much worse. Even by 1979, Kodak had not turned a profit on its instant business. Although Kodak had anticipated a negative cash flow in the beginning years, it did not expect the turnaround to be so slow. In 1980, when Kodak executives examined the diminished demand and market studies which indicated that no relief was in sight, they considered abandoning the instant business. However, while in the throes of this fast-paced competition, Kodak introduced three new models in 1979, only one of which represented a significant price cut. The non-motorized Handle 2 was packaged with a case at a net dealer price of $19.95 and shelf price of $22.95. In late 1979, that price was lowered to $17.95. The other two models were priced at or above the OneStep. The CB50, a motorized camera, was dealer priced at $26.95. The CB250 was more in the mid-range; it had a built-in strobe and a shelf price of $54.95.

In early 1980, Polaroid introduced a significant innovation: Time Zero film, which reduced the ex-camera development time by half. Dr. Land had always dreamed of truly instant pictures. Indeed, his goal was a photograph that emerged from the camera completely developed. Mr. Booth testified, however, that the urgency propelling Time Zero to market in early 1980 was Dr. Land's insistence on Polaroid's need to compete better with Kodak, "to beat Kodak." (TR 2198). Time Zero caused a drain on the company's resources and forced other projects to the back-burner. But Mr. Booth testified that he believed that without Kodak in the market, Time Zero film would never

have been developed. Instead, Polaroid would have focused its efforts on the Sun camera series and brought them to market earlier.
Polaroid sold the most film in its history in 1980. Camera sales, in contrast, continued to decline as did their profitability. Polaroid introduced "The Button" camera in August 1980, but it was nothing more than the OneStep with a new finish, priced about $10 less. Between 1977 and 1980 the margin on the OneStep decreased fifty percent. The margin on film remained the same but during this time period, the price of SX-70 film, in constant dollars, actually declined from $4.64 to $4.06.
Both Kodak and Polaroid recognized that the key to increasing profit in this period was to raise prices but were apprehensive about how price increases, especially on film, would affect demand. While mindful of the keen competition within the instant camera market, both companies were increasingly concerned with the growing threat of conventional 35mm photography and advances in photofinishing quality and speed. Polaroid began studying the 35mm photofinishing business in 1979. By the early 1980's 35mm photography had dropped in price so as to compete directly with instant photography.

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In 1981, Mr. McCune asserted that, "I think we could all agree that our major competition comes from conventional photography - not Kodak instant. It is 35mm sales that have grown at the expense of instant." (DF 61,742). In 1981, Mr. Booth reported to Polaroid's Board of Directors that the relative price of instant and conventional prints was a major concern. He reported that anything more than a five percent increase in film price would widen the "already high" two-to-one ratio between the price of an instant and conventional print.
The introduction of Time Zero film gave Polaroid the chance to raise film prices by six percent in March 1980, double the usual annual increase of three percent. This increase followed a Kodak increase in January 1980. In January 1981, Kodak again increased its film prices, this time by almost ten percent. Polaroid followed Kodak's lead in February. During this time period, Kodak also began to concentrate its efforts on the premium channel of distribution, selling cameras to companies for use as promotional incentives or prizes. These cameras were sold at a considerable loss to Kodak and generated few film sales.
Polaroid introduced its Sun series of cameras and film in June 1981. The cameras were Polaroid's first models with built-in flash. In combination with the high-speed film, the Sun cameras allowed shorter exposure times, extended indoor flash ranges, and had a smaller aperture opening, which improved the photograph's depth of field. The Sun 660, with state-of-the-art automatic focusing, was dealer priced at $62.50. The 640 model, without automatic focusing, had a dealer price of $46.50. Unfortunately, in 1981 and 1982, Polaroid sold only half the number of Sun cameras predicted. 1981 was the first year that Polaroid had an overall negative gross margin on camera sales.
Kodak introduced a new series of its own in 1982. The Kodamatic series included Kodak's lowest-priced camera to date, the Kodamatic Champ, which had a dealer price, after rebates, of $19.95. Three other cameras Kodak introduced at this time were priced in the mid-range. The top of the line was the auto-focusing Kodamatic 980L which, after rebates, sold to dealers at $74.45. The Kodamatic 960 low net price was $49.95 and the

970L was $59.95. Kodak continued to offer special discount programs to its dealers which lowered these prices somewhat.

In March 1982, Polaroid introduced the lower end of the Sun series line with the Amigo/620, dealer priced at $37.75. Due to disappointing sales and allegedly to meet the competition from the Kodak Champ, Polaroid decided it had to lower prices further. Later that year, Polaroid simply changed the name of the 640 camera to the Sun 600 LMS, the 660 camera to the OneStep 600, and lowered the price by twenty dollars. Not surprisingly, negative margins increased and losses continued. Sales did not increase. Kodak introduced the last in the Kodamatic series in March 1983; the 940 had a dealer low net of $31.50.

Although the demand for film was significantly less than either Polaroid or Kodak had expected, film margins remained satisfactory and even increased slightly during this period. The price of Polaroid and Kodak film was very close throughout the entire infringement period. Professor Dolan, Polaroid's marketing expert, testified that both companies pursued a policy of "parity pricing." (TR 4112). Mr. Booth testified that Polaroid was concerned that Kodak would not follow any price hike initiated by Polaroid. There was conflicting testimony about whether this concern was reasonable given some increases which Kodak premiered. Overall, although the shelf price of film rose significantly during the infringement period, it increased only fifty-nine percent of the rate of inflation as reflected in the Consumer Price Index.

Around 1982, Kodak was taking a hard look at its strategy in the steadily declining amateur business. At first, the company believed that raising prices and offering better quality photographs was the key to success. When the new Kodamatic line failed to produce large sales, and higher film prices reduced demand, Kodak changed its plans, focusing its sales efforts on large volume users such as insurance companies. Kodak also pulled out of the premium channel, which generated few film sales, and stopped media advertising. From 1983 onward, distribution in consumer channels was reduced significantly. Eventually, in 1984, Kodak decided to pull out of the amateur market completely. By the time it was ordered to leave the market in 1985, Kodak had lost $600 million on the instant photography business, not including the cost of exiting the market.

Polaroid feared that Kodak would dominate the instant photography field but, in fact, during the entire infringement period, Polaroid maintained the dominant market share for camera and film worldwide. Its lowest worldwide market share for cameras was about fifty-five percent in 1977, but after 1983, it never dipped below sixty-five percent. Its lowest market share for film

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came in 1980 at about sixty-four percent, but its share topped seventy percent for half of the infringement years.

With a consistently larger market share and more efficient production, Polaroid fared better than Kodak overall. According to Professor Anthony, a Kodak accounting expert, Polaroid lost $82.1 million pre-tax dollars on its instant business from 1976 to 1985. In the years following Kodak's departure, Polaroid has raised its film prices to within about eight percent of the Consumer Price Index. In 1987, the average unit price for film went up twelve percent and in 1988 it went up another thirty percent. Not surprisingly, sales of film and cameras decreased in both years. (DF 61,034).

The foregoing overview provides the factual setting for the parties' claims. Polaroid's position is beguilingly simple. It claims that its historical business practices, and the sensible business direction it would have taken, was altered and diverted because it had to respond to Kodak's entry into the instant photography market.

Without Kodak, Polaroid claims it would have continued the growth and profitability it enjoyed in its early pack camera years because of its unique management organization, its innovative style and, above all, the inventive brilliance of its founder and leader, Dr. Edwin Land. Instead, in order to respond to Kodak's entry into the field, it was compelled to alter its usual marketing strategies of introducing lower priced cameras in a systematic and orderly fashion which exploited manufacturing and marketing efficiencies. Aware of Kodak's price-cutting policies and practices, and Kodak's enormous power in the entire photography field, Polaroid claims it was not free to price its products at levels which would have brought it into line with its historical margins. Polaroid claims that Kodak forced it into a fierce price war which was inimical to its traditional style, and, as importantly, to its image as the innovative, inventive leader in instant photography.

Polaroid also claims it was damaged by what it describes as Kodak's "trashing" or trivialization of instant photography. Because Kodak entered the market with only a lower priced camera, not competing at the higher SX-70 camera level, its advertising, marketing, and pricing practices encouraged consumers to look at the instant camera as a toy or a gimmick, designed mainly for parties or festive occasions, rather than the camera of the future, - a camera which, according to Dr. Land and other Polaroid marketing executives, would eventually replace the conventional camera because it could produce photographs of equal quality with no waiting period. "Why wait?" was Polaroid's marketing theme.

Polaroid seeks to recover lost profits it would have earned in the world without Kodak, the "but for Kodak" world, during the period it would have enjoyed a lawful monopoly, 1975 through early 1991, when the final Polaroid patent would have expired. 6 Under its *Panduit* analysis, Polaroid claims that it would have made each of Kodak's camera sales and each of Kodak's film sales at an incremental profit, albeit at different prices and in a different time frame. In addition, citing its traditional reluctance to grant a license to a competitor, the presumptive validity of the infringed patents, and the bright future for its product as the basis for its negotiation posture, Polaroid seeks, in the alternative, a reasonable royalty rate which approximates its lost profits.

Not surprisingly, Kodak presents an entirely different perspective on compensable damages and a reasonable royalty rate. On lost profits, while not conceding that *Panduit* is the established formula for determining damages, Kodak's position is that even when the *Panduit* formula is used, the result is a much lower award than Polaroid claims. Kodak takes the position that *Panduit* does not create a legal presumption that the demand and market for instant products would have been identical in a world without Kodak, but that Polaroid must prove actual demand for instant photography and not simply add up the total sales by both companies. Kodak also argues that its contribution to the creation or expansion of the market must be considered. Even in a two-supplier market, Kodak asserts, Polaroid must prove that it could have made the infringing sales. Kodak questions whether a separate market for instant photography exists and argues that any analysis of the market must include the impact of conventional photography. Kodak claims that Polaroid's track record of corporate planning and management ability, together with the financial resources available to it, shows that Polaroid *would not*

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have made the decisions necessary to expand its manufacturing and marketing capacities. And even if Polaroid increased manufacturing substantially, it would have done so at greater costs than it now presents and at a much lower profit than it now posits. Kodak also argues that any profits that are awarded for the infringement period are taxable at the tax rates applicable at the time they would have been made.

Kodak presents several analytical methods of determining a reasonable royalty, and, needless to say, its analysis results in startlingly different figures than those proposed by Polaroid. Kodak traces the history of licenses in the photographic field and examines the history of licenses between Kodak and Polaroid to arrive at its submission of a reasonable royalty rate in this case. Finally, Kodak disputes strenuously Polaroid's request for treble damages and attorneys' fees.

As stated earlier, the objective of this phase of the litigation is to fairly compensate Polaroid for the injury caused by Kodak's infringement. Of all the approaches suggested, *Panduit* initially presents the clearest roadmap to lost profits. It is a step-by-step, quantifiable method for arriving at a rational, comprehensive, and fair result and is the preferred approach in this case if it results in a fair award. A reasonable royalty rate alternative is unnecessary if Polaroid can prove lost profits. I begin my analysis by setting out my evaluation of the facts and figures in the case to arrive at lost profits. If the result is not satisfactory in light of the objective to fairly compensate Polaroid, I will turn to a reasonable royalty rate as the alternative.

III. THE INSTANT PHOTOGRAPHY MARKET

A. *Absence of a Non-Infringing Substitute*

Legal Principles and Factual Findings and Conclusions

B. *Relationship Between Marketing and Demand in the Market of Instant Photography*

Legal Principles and Factual Findings and Conclusions

1. *Incredible Shrinking Market Without Kodak, According to Kodak*

a. Kodak Sales Attributable to Kodak Name and Kodak Features

Name

Features

Quality

b. Kodak Sales Attributable to Kodak Distribution, Sales Force and Dealer Support

U.S. Distribution

Sales Force and Dealer Relations

International Distribution

Premium Sales

c. Kodak Sales Due to the Effect of Two Competitors Advertising and Promoting Instant

Products
d. Evidence of Market Expansion
2. *The Market of the Future, According to Polaroid*
a. Polaroid's Historical Pricing Behavior
b. Effect of Higher Prices in Instant Photography Market
This section examines the nature of the instant photography market in order to assess what the demand for instant products would have been in the absence of Kodak's infringement. It includes an examination of whether any non-infringing substitutes for instant photography existed during the infringement period and also considers the effect of competition from conventional photography. It considers whether Kodak's entry expanded the demand for instant products and whether Polaroid had the marketing capability to create and exploit existing demand. Finally, this section concludes with a discussion of the probability and the potential impact on the market of the actions Polaroid claims it would have taken in a Kodak-free world, namely, if it had delayed introducing certain products and charged substantially higher prices.

A. *The Absence of a Non-Infringing Substitute.*

Legal Principles

In order to recover lost profits the patent owner must show a reasonable probability that but for the infringement it would have made the sales that were made by the infringer. *Del Mar Avionics, Inc. v. Quinton Instrument Co.,* 836 F.2d. 1320, 1326 [5 USPQ2d 1255] (Fed. Cir. 1987). An integral step in determining whether the patent owner could have made the infringer's sales is to discover whether, during the infringement period, any non-infringing substitutes for the patented product were available which possessed "all the beneficial charac

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teristics of the patented device." *TWM Mfg. Co. v. Dura Corp.,* 789 F.2d 895, 901 [229 USPQ 525] (Fed. Cir.), *cert. denied,* 479 U.S. 852 (1986). The inquiry is quite narrow; acceptable substitutes are those products which offer the key advantages of the patented device but do not infringe. *Central Soya Co. v. Geo. A. Hormel & Co.,* 723 F.2d 1573, 1579 [220 USPQ 490] (Fed. Cir. 1983). Mere existence of a competing device does not make that device an acceptable substitute. *Id.; TWM Mfg.,* 789 F.2d at 901. In markets where non-infringing alternatives are available, the court must determine what portion of the purchasers of the infringing product would have purchased the substitute instead of the patented product. *See, e.g., Amstar Corp. v. Envirotech Corp.,* 823 F.2d 1538, 1543 [3 USPQ2d 1412] (Fed. Cir. 1987).

Findings and Conclusions

There is no genuine dispute between the parties on this issue. Both agree that the instant feature is the "beneficial characteristic" of instant photography and that no other suppliers of instant photography existed in the market. 7 (*See* Polaroid's Post-Trial Submission at Facts-I, at 19; Kodak's Post-Trial Submission at Facts (Topic I), at 8, n.10). However, there is substantial dispute between the parties concerning the extent to which conventional photography influenced the demand for instant photography and the extent to which that influence may be considered in light of the finding that conventional photography was not an acceptable non-infringing substitute during the infringement period.

At various times during the trial Polaroid seemed to argue that all evidence about conventional photography should be excluded because conventional photography was not an acceptable substitute for instant photography. (*See, e.g.,* TR 6699-702; 11134-35). Kodak argued that conventional photography was an "economic substitute" for instant. (Kodak's Post-Trial Submission Facts (Topic I), at 8, n.10 and Law (Topic I), at 7, n.5). Kodak did not attempt to quantify the number of Kodak instant purchasers who would have turned to conventional products in Kodak's absence; Kodak simply urged that the relative price of instant and conventional photography was a significant variable in the demand formula for instant products and therefore must be considered in any assessment of the market. (TR 11134-35; 11312-15).

Instant photography occupied a unique niche in the overall photography market during the infringement period. Consumers sought the emotional "instant experience" of having a picture develop immediately, usually in the presence of the subject. (*See e.g.,* PT 2409, PT 2454, and discussion in Section B, Part 1(a)). Although instant photography was unique, it did not exist in a vacuum; it also competed with conventional photography for the consumer's photographic dollar. (See discussion in Section B, Part 2(a) and (b)). Those who purchased infringing Kodak instant products at Kodak prices would not have considered conventional products as an acceptable substitute at the time of purchase, but the relationship between the relative advantages of conventional and instant photography was an integral part of each consumer's decision. If Polaroid were simply claiming that it could have made Kodak's sales at the same time at similar prices, there would be no question in my mind that consumers would have made the same choice vis-a-vis conventional photography. However, Polaroid's claim is not so simple.

Polaroid's experts spun a scenario in which the prices Polaroid would have charged were substantially higher and in which, through a complicated massaging of the demand curve, the great bulk of sales would have occurred later than they did historically. In this "but for" scenario, the effect of conventional photography on the instant photography market must be considered. The evidence of competition between instant and conventional products is overwhelming. Even Polaroid's econometric expert attempted to include the effect of competition from conventional photography in his computation. The relative values of instant and conventional changed throughout the period of infringement. On the facts before me, I must consider that relationship when deciding whether Polaroid's scenario, which differs so substantially from the historical world, is feasible.

[2] Contrary to Polaroid's urging, the law does not require this Court to ignore the effect of competitive forces on the market for patented goods just because there are no non-infringing alternatives. Indeed, the law requires a careful assessment of all market influences when determining lost profit or reasonable royalty damages. *State Indus., Inc. v. Mor-Flo Indus., Inc.,* 883 F.2d 1573, 1581 [12 USPQ2d 1026] (Fed. Cir.), *reh'g denied,* 1989 U.S. App. LEXIS 14711 (Fed.

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Cir.), *reh'g denied en banc,* 1989 U.S.App.LEXIS 16954 (Fed. Cir. 1989), *cert. denied,*

— U.S. —, 110 S.Ct. 725 (1990) (although fiberglass was not a noninfringing alternative to the patented foam insulation, the two were in direct competition and therefore, it was in the district court's province to consider that fact in assessing the appropriate reasonable royalty rate); *Water Technologies Corp. v. Calco, Ltd.,* 850 F.2d 660, 673 [7 USPQ2d 1097] (Fed. Cir.), *cert. denied,* — U.S. —, 109 S.Ct. 498 (1988) (as a basis for reversing the district court's award of lost profits, the court held that a finding of but/for causation was negated by the finding that the patentee's price significantly exceeded that of the infringer); *Paper Converting Mach. Co. v. Magna-Graphics Corp.,* 745 F.2d 11, 21 [223 USPQ 591] (Fed. Cir. 1984) (in considering the magnitude of demand in a two-seller market, the court upheld the district court's consideration and rejection, on factual grounds, of the infringer's claims that consumers of the patented product would have foregone the purchase except for their lower price); *Pfizer, Inc. v. International Rectifier Corp.,* 218 U.S.P.Q. 586 (C.D. Cal. 1983) (in deciding what demand would have been for certain prescription drugs in the absence of infringement, the court considered price and demand elasticities and competition from other non-infringing drugs).
I find that conventional photography was not an acceptable substitute for instant photography during the period of infringement. Competition between conventional and instant photograph (which changed throughout the ten years of infringement) did, however, affect the price that consumers were willing to pay for instant photography. Therefore, in Section B, Part 2, I have assessed what effect the competition would have had on Polaroid's ability to charge more for its instant products and on the profitability of delaying the introduction of certain lower-priced products.

B. *The Relationship Between Marketing and Demand in the Market for Instant Photography.*

Legal Principles

On its face, the inference that in a two-seller market, but for the infringement, demand for the patented product equals the combined sales of the patent owner and the infringer seems reasonable. *Lam, Inc. v. Johns-Manville Corp.*, 718 F.2d 1056 [219 USPQ 670] (Fed. Cir. 1983). The rationale supporting this inference is the idea that when the infringement was occurring, the combined sales represent the number of consumers who desired the patented product. *See Livesay Window Co. v. Livesay Indus. Inc.,* 251 F.2d 469, 473 [116 USPQ 167] (5th Cir. 1958).
[3] The law looks behind the facial appeal, however, and requires more of the patentee. The patent holder must show that it had the marketing capability to make the sales. *State Indus.*, 883 F.2d at 1577; *Datascope Corp. v. SMEC, Inc.*, 879 F.2d 820, 826-27 [11 USPQ2d 1321] (Fed. Cir.), *reh'g denied en banc*, 1989 U.S. App. LEXIS 13416 (Fed. Cir. 1989), *cert. denied* , — U.S. —, 110 S.Ct. 729 (1990). Typically this requires proof of factors such as an adequate distribution system and sales personnel. *See, e.g., Datascope Corp.,* 879 F.2d at 827 (upholding the district court's determination that the patentee was not entitled to lost profits on infringer's foreign sales of heart catheters because patentee had no sales representative's assigned to foreign customers and never made "inroads in the area"); *Yarway Corp. v. Eur-Control USA, Inc.*, 775 F.2d 268, 276 [227 USPQ 352] (Fed. Cir. 1985) (upholding the district court's decision to award the patentee profits on only eighty-five percent of the infringer's sales of desuperheaters

because of court's finding that some buyers might not be aware of the patentee and thus not purchase from it). This factual inquiry is consistent with the role of marketing in markets where demand is relatively inelastic or dependent on variables outside the seller's control, such as a rate of new construction or population growth. *See Ryco, Inc. v. Ag-Bag Corp.,* 857 F.2d 1418, 1427 [8 USPQ2d 1323] (Fed. Cir. 1988). In those situations marketing has a dual purpose: to make the availability of the product known and then a sort of "clean up" operation to get the product to those who need it.

[4] Kodak claims that demand and marketing in the instant photography market are not as neatly severable as in the recorded cases. It claims instead that determining demand in the absence of infringement requires a careful examination of the parties' actual marketing capabilities. I agree.

In this respect, the instant photograph market may be unique. Instant cameras are discretionary luxury items usually purchased as gifts. (TR 8043-46). Therefore, sales are highly susceptible to the influences of marketing: advertising, name and reputation, product design strategies, in-store promotion and demonstration. (TR 8039-42; 8046-47). Consumers are motivated both by the inven

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tion itself and its marketing. Answering the question of how many of Kodak's sales Polaroid would have made depends, in part, on determining what unique marketing influences, if any, Kodak brought to bear on the marketplace. Potential influences include the Kodak brand name, advertising, any unique product or service offerings, as well as such garden variety marketing topics as distribution channels and the level of sales support. To simply assume, as Polaroid urges, that the demand for instant products absent Kodak's illegal entry would be the total sales actually made by both companies is analytically flawed, for it fails to consider *why* consumers purchased instant cameras and ignores the unique facts of this case.

The Federal Circuit has recognized that limited marketing capability may curb an award for lost profits, but has not discussed it in terms of stimulating demand. *Datascope Corp.,* 879 F.2d at 827; *Yarway Corp.,* 775 F.2d at 276. Even the parties basically agree on the critical topics; they just do not agree whether the focus should be on Polaroid's marketing capability or Kodak's expansion of demand. (See exchange at TR 4319-20). Polaroid believes the appropriate marketing capability topics are products, pricing, advertising and promotion, and distribution. (Polaroid's Post-Trial Submission Facts-II, at 5-14). Kodak believes that the means by which it expanded demand were name and reputation, marketing efforts, product variety and features, advertising and promotion, sales force, dealer support, and distribution. (Kodak's Post-Trial Submission Facts (Topic II), at 1). For the topics common to both parties, it is only a question of semantics: do these factors stimulate or facilitate purchasers? In either case, if Kodak offers something unique and critical to those purchases, Polaroid cannot prove lost profits on those sales.

I would like to emphasize that it is not a question of whether Kodak's marketing acumen was better than Polaroid's or whether consumers preferred Kodak to Polaroid. It is a question of whether any unique Kodak marketing influence was essential to significant consumer interest in instant photography. Only in that case can it be said that demand

would be diminished in Kodak's absence.
The main dispute between the parties on this issue is over the extent to which the effect of Kodak's name and reputation on the market may be considered in determining what sales Polaroid could have made absent the infringement. Polaroid argues that customer brand preference is irrelevant to the question of demand. *Datascope Corp.,* 879 F.2d at 825. I disagree with this reading of *Datascope. Datascope* involved the sale of a heart catheter, which, through the operation of a percutaneous balloon, allowed doctors to clear blocked arteries. *Datascope Corp. v. SMEC, Inc.,* 594 F.Supp. 1306 [224 USPQ 694] (D.N.J. 1984), *aff'd in part and rev'd in part,* 776 F.2d 320 [227 USPQ 838] (Fed. Cir. 1985) (infringement). Before this invention, doctors were required to insert catheters through surgery which required more time, more anesthesia, and caused the patient more pain than with the percutaneous method. *Datascope Corp. v. SMEC, Inc.,* 678 F.Supp. 457, 459-60 [5 USPQ2d 1963] (D.N.J. 1988), *aff'd in part and rev'd in part,* 879 F.2d 820 [11 USPQ2d 1321] (Fed. Cir. 1989) (damages). The district court held that early in the infringement period, many of the infringer's sales were made because of doctors' confidence in the president of the company and that many of the infringer's customers would not have switched from using surgical balloons to percutaneous balloons but for that faith in the infringer's president. *Datascope Corp.,* 678 F.Supp. at 459-60. The court held that the patentee was not entitled to lost profits and instead awarded a reasonable royalty. *Id.* at 462-64.
The Federal Circuit reversed this finding not because it found customer preference to be irrelevant to the question of demand, but rather because it found it irrelevant to the question of marketing capability. *Datascope Corp.,* 879 F.2d at 825. The circuit court explained that if customer preference were relevant, it would be relevant to the question of demand:
The question at this point in the appeal, rightly stated, is whether [the infringer's] showing that the loyalty of some of its customers overcame the reasonable inference (when the patentee and the infringer are the only suppliers of the patented product) that the patent owner would have made the sales made by the infringers. It did not. The district court found, and [the infringer] does not challenge the finding, that those sales would have been made by [the patentee] (albeit later): "[R]egardless of the doctors' high regard for [the infringer's president and the infringer], these doctors would have adopted the percutaneous method because of [its] advantages [over prior art methods]."
Id. at 826 (citations omitted). In other words, the court is saying that preference may be relevant to demand but because of the advantages of patented invention over prior art the court had already determined that demand equalled the combined sales of

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the patentee and infringer. In medical science, an undisputed improvement is inevitably adopted. The nature of this special market made customer loyalty, which may have existed when the invention was new, inconsequential.
[5] In our case, demand is much more complex. Instant photography is unique but it cannot be compared to an inevitable next step in medical science. Demand for instant products did not depend on an independent variable, such as the number of blocked arteries. Like the demand for other mass market consumer goods, the demand for instant

photography was subject to the whim of consumers who, in deciding where to spend their discretionary income, may have been influenced by brand name. I believe *Datascope* compels this Court to examine whether loyalty to the Kodak brand name can overcome the otherwise reasonable inference that consumers bought instant cameras because of the patented features owned by Polaroid.

Polaroid argues that if this Court is allowed to open the inquiry to include the effect of Kodak's marketing efforts on demand, and if the infringer enjoyed established marketing clout, few, if any, patentees would be entitled to lost profits. I do not believe this is so. First, the patent owner is only required to prove the reasonable probability that it would have made the sales. The patent owner need not prove causation as a certainty, nor must it negate every possible purchase of another product. *See, e.g., Water Technologies Corp.,* 850 F.2d at 671; *Gyromat Corp. v. Champion Spark Plug Co.,* 735 F.2d 549, 553 [222 USPQ 4] (Fed. Cir. 1984); *Lam, Inc.,* 718 F.2d at 1065. Moreover, when the amount of damages cannot be ascertained with precision (in the present case because it is impossible to sort out the various effects on the marketplace), any doubts regarding the amount must be resolved against the infringer. *Story Parchment Co. v. Paterson Parchment Paper Co.,* 282 U.S. 555, 563 (1931). The infringer's marketing clout must be significant and critical in order to overcome this protection.

Second, demand is not a function of marketing in every case. Where the two are intimately related, however, I believe the parties' relative capabilities must be assessed in order to determine what the patent owner has lost as a result of the infringement. The Federal Circuit has considered a price differential between the patented goods and the infringing goods as relevant to demand even when there were only two suppliers of the patented good. *Water Technologies Corp.*, 850 F.2d at 673; *Paper Converting Mach. Co.*, 745 F.2d at 21. The same reasoning applies in this case to any differences in marketing capabilities.

Of course, if a patentee's product is infringed by a company with unique marketing capabilities, in a market where demand depends, to some extent, on those abilities, the patentee is still entitled to damages. Although the award of lost profits is the preferred measure of damages, where lost profits cannot be proven, the patentee is not left out in the cold but is entitled to a reasonable royalty, sufficient to compensate for the infringement. *Fromson v. Western Litho Plate & Supply Co.,* 853 F.2d 1568, 1574 [7 USPQ2d 1606] (Fed. Cir. 1988); *Stickle v. Heublein, Inc.,* 716 F.2d 1550 [219 USPQ 377] (Fed. Cir. 1983).

It is impossible to prove what purchasers of Kodak instant cameras would have done in a world without Kodak; it is not Polaroid's burden to do so. Polaroid must show, however, that a reasonable probability exists that those consumers would have purchased Polaroid cameras. To determine whether Polaroid could make those sales, I must examine *why* they purchased Kodak. That inquiry necessarily entails an exploration of the effect of Kodak's marketing efforts. While Kodak's entry may have been critical to a few sales here and there, I find that it was not critical to most.

Factual Findings and Conclusions

Introduction: The Parties' Factual Claims About Demand and Marketing Capability

Kodak claims that its market entry triggered the boom in instant photography and that competition from conventional photography touched off its decline. Kodak bases this claim, in large part, on Professor Baumol's econometric model, which attempts to explain and quantify the various forces at work in the market. Kodak concluded that its presence expanded the market by about seventy-five percent. Kodak's reputation, product offerings, advertising, sales efforts, and distribution were the reasons for this market expansion, Kodak concluded.

I will analyze these claims in reverse order. In Part 1, I will first determine whether there is any evidence that some offering unique to Kodak brought a significant number of consumers into the market. The parties' relative marketing capabilities are a

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part of this analysis although, depending on the topic, the nomenclature of economics is not always appropriate. Having examined any mechanisms by which Kodak may have expanded the market, I will review Professor Baumol's model and other evidence of market expansion offered by Kodak.

Although Polaroid claims that it could have made all of Kodak's sales during the infringement period, it believes the demand would have looked entirely different without Kodak. Demand would not have peaked in 1978 but would have grown more slowly and, by 1990, Polaroid would not only have sold every camera Kodak sold from 1976 to 1985, but would have sold both these additional cameras and every Polaroid camera historically sold at significantly higher prices. This conclusion is based largely on Professor Fisher's econometric model which sought to measure the effects of certain market variables. Professor Fisher used this model not only to explain but to predict what sales would have been without Kodak, given various sets of prices and camera model introduction dates. His conclusion was that but for the infringement, Polaroid could have made a profit, with interest, of over $3.9 billion dollars.

In Part 2, I will examine Professor Fisher's model for its soundness and reliability and I will consider whether Polaroid's pricing and introduction decisions would have happened as he and other Polaroid witnesses testified. I will also assess the effect of such decisions on the market and on Polaroid's potential profits.

1. *The Incredible Shrinking Market Without Kodak, According to Kodak*

I believe that the law requires this Court to address the question of whether Kodak contributed something unique to the market such that without Kodak, consumers would not have purchased instant photography. As demand for instant photography is heavily influenced by marketing, one way in which this question can be narrowed is to ask: Can any factor be identified that was both unique to Kodak marketing and critical to consumers' desire to purchase an instant camera? From this flows a discussion of the Kodak name and reputation and Kodak product features in Section (a).

The same question in a different form is whether Kodak's distribution in the United States and abroad was critical to the sales made through those channels. Could Polaroid have made those sales? Were Kodak's salespeople and their relationship to dealers critical or merely incidental to sales? This is the more typical marketing capability analysis and is

covered in Section (b).
In Section (c) I will consider the effect of Kodak's advertising and promotion. This inquiry differs slightly from the first two because instead of claiming that its advertising was unique, or that its in-store promotions were geared differently, Kodak simply claims that two competitors can stimulate demand better than one, even if the total amount and type of advertising is the same. Kodak claims that the "hype" created by its market entry expanded consumer desire for instant photography and could not have been duplicated by Polaroid.
Lastly, in Section (d), I examine the evidence offered by Kodak to show that its presence expanded the market. I consider both Professor Baumol's models and the other empirical evidence that Kodak offered to show market expansion.

(a) *Kodak Sales Attributable to the Kodak Name and Kodak Features*

Kodak claims that many customers were drawn to instant photography because of the unique features it offered, namely, Kodak camera and film attributes, Kodak quality, and the Kodak name. While it may be true that some consumers preferred Kodak, this Court must determine whether these product features were critical and necessary to significant consumer interest in instant photography. Such a finding requires examination of the statements and actions of instant photography purchasers in the mid-1970s and early-1980s in order to see what motivated their purchases.
The overwhelming reason consumers purchased instant cameras during the infringement period was because of the instant feature. Study after study confirmed this. For example, a 1977 survey of 357 instant camera owners found that the top three reasons for getting an instant camera were the same whether one purchased Kodak or Polaroid: seventy-seven percent of Kodak purchasers said they chose the convenience of having pictures immediately; sixty-nine percent of Polaroid purchasers agreed. The other top two reasons - knowing almost immediately whether the picture turned out and the convenience of no processing - also stem from the instant feature. (PT 2454).
The reasons for purchasing instant cameras did not vary depending on which brand consumers ultimately chose. One 1981 Kodak study of about 1000 instant picture-takers was summarized by Kodak:
Picture-takers see instant as instant, not "Kodak-instant" and "Polaroid-instant."

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Thus, the fundamental attractions and barriers for acquiring and using a Kodak instant are no different from those for a Polaroid instant camera. Likewise, picture-takers' basic attitudes toward, perceptions of, and positioning of instant apply to the category as a whole and exhibit no meaningful brand-related differentiation.
(PT 2409). These studies, and other evidence consistent with their conclusions, have convinced me that, overall, Kodak did not offer the consumer something unique and critical to their decision to purchase instant.
The Kodak Name. Professor Buzzell, Kodak's marketing expert, testified that Kodak's name and reputation drew many new customers to instant photography - customers who would not have purchased an instant camera without a Kodak label. He testified that

many amateur photographers were loyal to Kodak, many Kodak purchasers were anti-Polaroid and, most importantly, a large group viewed the Kodak name as a "reassurance or risk-reducing mechanism" which legitimized, and therefore made attractive, the instant photography field. (TR 8161). Professor Buzzell based this conclusion partly upon contemporaneous market research which tried to identify why consumers bought instant cameras.

There is no doubt that Kodak is a well-known brand and that the Eastman Kodak Company has a fine reputation. There is also no dispute that Polaroid is known the world over as a photographic company of first quality. Were the Kodak name and reputation somehow critical to consumers' decisions to purchase instant photography?

To answer this question, Professor Buzzell cited several small, unstructured studies of Kodak and Polaroid instant purchasers which contained some statements that Polaroid and Kodak were perceived differently and that corporate image influenced the decision to buy instant. However, the record is devoid of any convincing evidence that the Kodak brand name was critical to a meaningful number of consumers who chose instant.

In one such study, Stage One, a marketing consulting group hired by Polaroid, conducted one-on-one in-depth interviews with two small samples of camera owners: thirty-two OneStep/Pronto! owners and twenty-two Kodak Instamatic owners in 1978, and twenty-nine Kodak Handle purchasers in 1979. At most, this study showed that some instant purchasers perceived Kodak and Polaroid differently. Some Kodak buyers thought that Kodak was more for the "man on the street" and Polaroid did not make cameras "for me." However, this type of random statement conflicted with other findings in the study; for example, both Kodak and Polaroid purchasers gave the same reasons for the appeal of instant photography. (DF 20,776).

Other studies mentioned by Professor Buzzell contained similar conflicts and no conclusive evidence. An October 1976 demonstration tested alternative versions of the Pronto!, EK4, and EK6, and concluded that when ranking the importance of various features in selecting a camera, reliability was rated number one, followed by value for money, simplicity of operation, and ease of use. Brand was considered the least important reason for choosing a particular camera, followed by appearance, weight, and size.

Professor Dolan, Polaroid's marketing expert, and Professor Buzzell's colleague at the Harvard Business School, also considered the question of whether Kodak's name and reputation were a major structural factor which influenced demand during the infringement period. While he admitted that for some loyal Kodak customers, Kodak's entry was the impetus for purchasing an instant camera, there were not meaningful numbers of these people. Like Professor Buzzell, Professor Dolan based his conclusions on market research. These conclusions, however, were buttressed with his analysis that the instant camera market did not need legitimizing by a well-known company because Polaroid was also well-known and trusted, especially in the field of instant photography. Moreover, Professor Dolan opined that legitimization is more likely when consumers themselves are unable to judge the quality of the product. This is not the case in the field of instant photography. I agree and adopt Professor Dolan's analysis as confirmation of the fact that the Kodak brand name did not expand demand for instant photography.

Even with its small sample and unstructured methodology, one finding which stands out from the Stage One study is that ninety-three percent of Kodak purchasers had negative impressions of Polaroid. These impressions were mostly based on antiquated notions about Polaroid photography from the pack era; some were derived from direct experience with a Polaroid camera and some from word-of-mouth and news reports. This finding deserves attention because it is consistent with other market research during the infringement period.

I believe the record supports a finding that some anti-Polaroid animus existed in the marketplace due to largely outdated notions about instant photography. This was not an

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impenetrable barrier for some consumers, and sixty-seven percent of the Polaroid owners in the Stage One study had negative impressions of Polaroid. For the consumers who were permanently turned off, however, Kodak's entry was critical and represented market expansion. Nevertheless, it is impossible to quantify this effect. Professor Buzzell admitted that the results of the Stage One study could not be applied to the general camera-purchasing public. (TR 8147-49). Keeping in mind that Polaroid is not required to prove that it could have made every sale and that any doubts in this matter must be resolved against Kodak, *Lam, Inc.*, 718 F.2d at 1065, I cannot conclude that any anti-Polaroid animus that existed would have diminished demand in the absence of Kodak's infringement. The same reasoning applies to those sales made to the small number of loyal Kodak-only customers, such as certain Kodak employees. I am sure these customers existed but I do not believe their numbers are significant, and, in any event, no reliable evidence was offered to prove those numbers.

Kodak Product Features. Kodak alleges that certain features of its instant photography system expanded the demand for instant products as a category. Polaroid has claimed that the law assumes that demand is due only to the patented invention, but I have previously found that many other factors may influence demand in this market. Here, Kodak claims that physical attributes of its products, along with the patented technology, expanded demand. Kodak also claims product variety in and of itself, expanded consumer interest in the whole product line. As usual, the answer lies in the facts and not in assumptions. I find that one Kodak attribute so transformed the product for certain purchasers that it did expand demand in one market segment. I also find, as I did above when considering the Kodak brand name, that the weight of the evidence shows that it was the instant feature, not Kodak extras, that caused the greatest demand for instant products.

The features that Kodak believes most influenced demand were the shape and finish of Kodak prints, Kodak quality color, and the built-in flash. Kodak also presented evidence on the handle feature and finishes on certain camera models, but the effect of those features on sales was negligible.

In April 1980, Polaroid commissioned a study of picture alternatives which asked 600 interviewees to choose between two prints and give the reasons for their choice. This study concluded that, " [In] a direct comparison of the current square SX-70 and Kodak's rectangular PR-10 show that the majority of consumers prefer the rectangle." (DF 21,180). The 1974 National Analyst Study found that sixty-nine percent of consumers preferred the matte finish of the Kodak print as opposed to the glossy Polaroid surface. (PT 2458). Neither of these facts compel a conclusion that the Kodak print features influenced demand.

However, Kodak's 1979 introduction of the Colorburst 250, equipped with a built-in electronic flash, did expand demand in one particular market - Saudi Arabia. There, privacy is of great concern. Instant photography which does not require the public act of developing is desirable. More importantly, religious customs prohibit photographing women outside the home. Therefore, an instant camera without a flash is of little use. When Kodak introduced the Colorburst model with a flash, the Middle Eastern market exploded. Sales grew from approximately 40,000 cameras in 1979 to over 200,000 in 1980 and 1981. Polaroid introduced its flash model in 1981 and, in 1982, Kodak sales fell to 80,000. Mr. Samper, a Kodak marketing executive, attributed the bulk of Kodak sales in this time to the built-in flash. Professor Dolan agreed that, given the particular culture and religion of the region, Kodak cameras better met consumers' needs than Polaroid cameras for one or two selling seasons. The evidence does not show that Polaroid could have made these sales later in time. Therefore, I find that Polaroid could not have made all of those sales. 8

The same two-year time lag before Polaroid introduced a camera with a built-in flash also existed in the United States and other countries, but in those markets, the built-in flash did not have the significance of the same transforming quality as in Saudi Arabia. Market research shows that some consumers preferred this feature, but there is no evidence that it was critical to their decision to purchase instant cameras and film.

Kodak Quality. Kodak argues that consumers preferred Kodak picture quality and that this preference was so strong that demand for instant photography would have shrunk without Kodak in the market. This is a narrow issue. Especially for consumers who have made no direct comparison, perceptions of quality are intimately associated with brand name. I have already examined that evidence, however, and found that the Kodak name, and all that goes with it, was not

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critical to sparking significant consumer interest in instant photography. To the extent consumers associated Polaroid with pack-era technology and Kodak with integral technology, quality was an issue. Again, I have examined the evidence of anti-Polaroid animus. Here, I am only concerned with the narrow question of how "quality" influenced consumers who compared Polaroid and Kodak integral products. The record shows that many Kodak customers did compare, usually at the point of purchase.

Again, Kodak has done a good job of market research, showing that some consumers, both in the United States and abroad, preferred Kodak quality and cited it as a reason for choosing Kodak. Kodak has not convinced me, however, that consumers were so impressed with Kodak pictures that they would have foregone the purchase of any instant camera had Kodak products been unavailable. Polaroid outsold Kodak in every year of the infringement period, often by a margin of two-to-one. If Kodak pictures were of such better quality to keep some buyers out of the market without them, the opposite sales pattern would be expected.

Conclusion

With the exception of the built-in flash in the Middle East, I find that Kodak's name, reputation, quality, and product features did not expand the demand for instant photography. Polaroid possessed adequate marketing capabilities in this regard.

(b) *Kodak Sales Attributable to Kodak Distribution Sales Force and Dealer Support*

Both Polaroid and Kodak recognize that differences in their relative abilities to distribute goods to the market are relevant to determining what sales Polaroid could have made but for Kodak's infringement. Kodak claims that its distribution strengths expanded the market for instant products, while Polaroid simply sees distribution as relevant to serving demand that already existed. It is difficult to discuss distribution in the nomenclature of economics. For instance, can it be said that because a camera is available in a department store, its mere presence causes a consumer to want the camera? Or is it that the consumer wants the camera but may never act on that desire until it is available in that channel? In either case, because the company not distributing in that particular channel would miss out on the sale, I need not decide that interesting question. For the moment, I am also putting aside the question of the advertising side effects of having products available in any particular channel. That matter will be discussed in section (c)

United States Distribution. Polaroid and Kodak distributed through the same channels in the United States: domestic dealers, catalog sales, military PX stores, food stores, department stores, mass merchandisers, and drug stores. For the first five years of the infringement period, both companies achieved product volume exposure of ninety percent. This shows that both Kodak and Polaroid reached near total distribution and it was very easy for a consumer to find their products. In 1980, Kodak's product volume exposure began to decline and fell to about sixty-nine percent in 1985. This reflects Kodak's decision to pull back from the amateur market and dealers' decisions to de-stock the number two brand during the market decline. I conclude that Polaroid had full distribution capability throughout the infringement period.

Sales Force and Dealer Relations. Kodak claims that its presence expanded the market, and that it made sales Polaroid could not have, because Kodak employed more salespeople, trained them more extensively, called on its dealers more frequently, and maintained good relationships with them.

During the years of infringement Polaroid had a sales force dedicated solely to selling instant photography. Although the Kodak sales force outnumbered Polaroid's, 9 and Kodak representatives called on dealers more frequently, Kodak's salespeople were also responsible for selling other products. Professor Dolan testified that only about fifteen percent of Kodak's sales efforts were devoted to instant products. (TR 4027). Moreover, Polaroid also employed merchandise service representatives who delivered inventory to retail outlets, arranged stock, and trained counter personnel. Polaroid representatives provided in-store demonstrations of its instant photography system. Polaroid did not do extensive training with its sales force, but it only hired experienced salespeople. Perhaps most importantly, I am not convinced that the frequency and quality of sales calls significantly influenced the number of cameras sold. Indeed, one study concluded that sales clerks were generally

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neutral about instant products, but when clerks emphasized one brand over another, they more frequently pushed Polaroid. (PT 2413). Polaroid initially experienced difficulties with dealer relations. Beginning with the Focus '71 program, which offered year-end bonuses, payment of freight, and specialty lines, dealer relations strengthened considerably. Polaroid also participated in cooperative advertising where it shared the cost of a dealer's local promotion. In Europe, according to a Kodak document, Kodak's and Polaroid's image differed little, but, because Polaroid offered better financial terms, dealers did not actively push Kodak. (PT 2484).

I find that Polaroid's initially troubled relationship with its dealers did not make them reluctant to sell Polaroid products in the face of consumer demand. Setting aside the effect of in-store promotion on consumer demand, dealers responded to, and did not create, consumer demand. Kodak had good relationships with its dealers but did not prevent those dealers from de-stocking only Kodak products when demand slackened. After considering all the evidence, I conclude that Polaroid's sales force and dealer relations were fully capable in this regard.

International Distribution. Polaroid and Kodak sold instant products outside the United States through wholly-owned subsidiaries and distributors. 10 All witnesses agreed that it was advantageous to operate through a subsidiary rather than a distributor. 11 Subsidiaries offer more control, are more interested in the company's long term goals, and invest more in advertising. Distributors are independent organizations, usually more interested in short-term profits, and may not advertise as extensively. In sum, subsidiaries make it easier to distribute goods and cultivate demand.

In most of the large foreign markets such as Canada, France, Italy, West Germany, and the United Kingdom, Polaroid and Kodak operated through wholly-owned subsidiaries. Kodak and Polaroid subsidiaries used the same distribution channels in these countries. Although Kodak had manufacturing facilities in some countries where Polaroid did not, 12 and may have emphasized some channels more than others, I find that these differences did not influence demand. Polaroid opened one of its first foreign subsidiaries in Japan in 1960; Kodak had only a distributor there until 1984.

Outside of the six major markets (Canada, France, Italy, West Germany, the United Kingdom, and the United States) significant differences existed between Kodak's and Polaroid's distribution capabilities, differences which would have led to lost sales for Polaroid in certain markets. Kodak operated thirty-five overseas subsidiaries outside the six major markets, compared to Polaroid's fourteen. Kodak's subsidiaries were particularly strong in Latin America, the Middle East, and South Africa. Together these three regions accounted for thirty-seven percent of Kodak's international sales. (TR 7947-48).

In 1979, Kodak operated nine subsidiaries in Latin America where Polaroid had only two. Kodak outsold Polaroid in this region, capturing sixty-five percent of the camera market and sixty-eight percent of all film sales during the infringement period. Polaroid experienced particular difficulty with its distributor in Mexico who teetered on the verge of bankruptcy in the early 1980s. For these reasons, I find that Polaroid did not have the capability to make all of Kodak's sales in this region. Considering all the evidence on this point, I conclude that Polaroid would have made thirty percent of Kodak's sales in Latin America.

Kodak's presence was stronger in the Middle East as well. Polaroid only had distributors in this region whereas Kodak had four subsidiaries in the major markets of Iran (until

1979), Lebanon, Egypt, and Dubai. Kodak's operation in Saudi Arabia employed six people. In Dubai, Polaroid could not sell through Kodak distributor-owned outlets. Polaroid had problems with its distributors in this region, too. Not surprisingly, Kodak captured the larger market share in the Middle East, selling fifty-six percent of all cameras and sixty-one percent of all film. Considering that Kodak also expanded demand in the Middle East, particularly Saudi Arabia, by introducing the built-in flash two years before Polaroid, I conclude that Polar

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oid could only have made ten percent of Kodak sales in this region.

Protesting the government's policy of apartheid, Polaroid stopped selling products in South Africa in 1976. Kodak continued to sell in South Africa until 1987. Polaroid would not have made any of Kodak's sales in this region.

Premium Camera Sales. The premium channel is a method of selling goods to organizations that use the goods as gifts, incentives, or bonuses. Kodak was very active in the premium channel, both in the United States and abroad, beginning in 1977. During the entire infringement period, Kodak sold about four million cameras this way. As early as 1981, however, Kodak executives began to have concerns over premium camera sales. First, the cameras had to be extremely low-priced. In addition, market research showed that premium camera owners did not use as much film as those owners who purchased their own cameras or even compared to those who received a Kodak instant camera as a gift. Because of these problems, in 1984, Ms. Katherine Hudson, the head of Kodak's instant program, decided that Kodak should discontinue premium sales.

From 1974 to 1982, Polaroid only sold a few cameras in the premium channel. Polaroid executives testified that they did not like selling cameras this way because of the low price and low film-use rate. Mr. Booth specifically excluded premium camera sales in his assessment of what sales Polaroid could have made in the absence of Kodak. (TR 2624). Dr. Young testified that he was not enthusiastic about this channel. (TR 1145). Polaroid devoted minimal sales staff to this market consistent with these views.

In 1983, however, partly as a result of research which led Polaroid to believe that the premium camera business might be profitable, the company stepped up its participation in this channel. In the United States, premium sales went from 58,600 in 1982 to 629,500 in 1985. Even so, upon reflection at trial, Mr. Booth stated that "it was not the type of market place that is worth the energy and effort to go after in great number." (TR 2294). I find that in a world without Kodak, Polaroid would not have made all the sales that Kodak made through this channel, especially in the years 1977-1982. Polaroid would have made some of the sales, because it did use this channel, but the testimony of Polaroid executives convinces me that the company would never have participated fully. Therefore, for the years 1977-1982, I find that Polaroid would have made ten percent of Kodak's premium sales. Beginning in 1983, I find that Polaroid would have increased its participation, as it did historically, and would have made fifty percent of Kodak's sales. After 1983, Polaroid was fully active in this channel and I believe it could have made all of Kodak's premium sales.

Conclusion

For the most part, Polaroid's marketing capability was adequate to meet the demand for instant products but for Kodak's infringement. Polaroid would have been unable to make Kodak's sales in the premium channel, the Middle East, Latin America, and South Africa, as follows:

Premium Sales Lost (90%, 50%, 0%)	2,910,150
Middle East Sales Lost (90%)	1,085,642
Latin American Sales Lost (70%)	1,490,609
South African Sales Lost (100%)	587,667
Total Camera Sales Lost Due to Marketing	6,074,069 (rounded off)

The resulting loss in film sales is discussed in Section V.

(c) Effect of Two Competitors Advertising and Promoting Instant Products

Except in certain foreign markets, Kodak does not claim that its advertising and promotion was unique or better than Polaroid's. There is no dispute that Polaroid spent more on advertising than Kodak in every year of the infringement period and outspent Kodak two-to-one over the entire period. Moreover, Polaroid agrees that it would have had to spend even more on advertising to make additional sales. Polaroid included this cost in its lost profits calculation. In contrast, Kodak claims that even if Polaroid spent as much as the two companies combined it could not have duplicated the impact of two competitors' advertising. Kodak claims Polaroid alone would have been unable to generate the free media attention, dealer shelf space, and in-store display that Polaroid and Kodak jointly achieved for instant photography.

Professor Buzzell testified that when a competitor like Kodak enters a mass market like this one, a lot of "hype" is generated. News media report the story. Dealers stock both brands and may display them side by side. Consumers become engaged in the comparison and pay more attention to the market. Even some Polaroid executives believed

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that Kodak's advertising in the first few years of its entry expanded demand for instant products. Mr. Wensberg testified that:

It is my belief that [the dual impetus of the heavier Polaroid advertising and the advertising which Kodak did] expanded [the market] temporarily, yes, and it is my belief that that was a short-term gain which was largely negated by other forces that were taking place in the marketplace.

(TR 993). Mr. McLaughlin, Mr. Brewer, and Mr. Voekel, who worked with Polaroid subsidiaries in Europe, made similar statements. (DF 60,528; DF 60,620; DF 60,532). Even Professor Dolan thought "that advertising spending and the publicity surrounding the entry of Kodak into the market, it [sic] had some impact on people's awareness of the instant photography category." (TR 4293). Of course, Professor Dolan also testified that additional Polaroid advertising could compensate for this effect.

Alone in the market, Polaroid could not have commanded the shelf space, point-of-purchase promotion, and amount of in-store demonstration that Polaroid and Kodak together achieved. This is true even if Polaroid had paid for additional trade support. Two Polaroid television commercials in a given evening would not engage the attention of consumers in the same manner as one Kodak and one Polaroid commercial. A synergy is created when a competitor enters a mass media market and the whole is soon greater than the sum of its parts. I find that the instant photography market was subject to this phenomenon.

Still, it is impossible to gauge the magnitude of the two-competitor effect. Professor Dolan testified that according to contemporaneous market research which assessed the impact of advertising, neither consumers' brand awareness nor purchase intention increased as a result of Kodak's entry. However, these studies focused only on Kodak and Polaroid instead of assessing whether awareness or purchase intention for the category as a whole had increased. Awareness of instant photography was nearly 100% even before Kodak entered, so it is not surprising that it did not increase. The purchase intention studies answered the question, "If you were to buy an instant camera today what brand would you buy?" The more helpful question is, "How likely is it that you will purchase an instant camera soon?" In addition, Professor Buzzell challenged the relevance of Professor Dolan's conclusions regarding purchase intention, finding that, according to Professor Dolan's evidence, it had actually decreased between 1974 and 1978. There was a small increase in purchase intention in the true sense in France and Italy between May and September 1977. (PT 2532). However, no witness analyzed the significance of this change.

I have examined other evidence that helps me quantify this effect. In response to my question, Professor Baumol agreed that his market expansion variable may have partially captured this effect when he calculated that the market expanded seventy percent with Kodak's entry. Because Professor Baumol did not find market expansion after 1981, it coincides well with Kodak's decision to sharply reduce promotion efforts around 1981. Even if I found that measure reliable, it would not tell me what portion resulted from the dual-advertising phenomenon. Kodak proffers many other reasons for the expansion which I have rejected. Professor Dolan opined that the portion of historical sales which he could not attribute to lower prices were probably attributable to advertising, but he concluded that Polaroid could make up that difference by spending more advertising dollars. Professor Fisher concluded that advertising levels had no effect at all on the demand for instant cameras, a conclusion which I cannot accept.

Conclusion

[6] Having no firm basis upon which to judge what portion of sales Polaroid would not have made absent the dual-advertising phenomenon, I must let the burden of uncertainty fall upon the infringer. Neither party has given me a reasonable analytical tool for sorting out this effect. The consumer's purchase process is immensely complicated and it may be impossible to identify individual motives except in a very general way. 13

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Therefore, I conclude that Polaroid's profits should not be reduced to account for the dual

advertising effect.
Kodak also claims that in some of its foreign subsidiary markets, its advertising strategies were more in tune and targeted at the particular culture and thereby created interest in instant photography. Polaroid's advertising was not as effective, Kodak argues, because it employed, essentially the same basic themes used in the United States and was not tailored to foreign markets. I find nothing in the record to suggest empirically which approach was best, and I do not find that Kodak's advertising in these markets induced sales that Polaroid's advertising could not have produced.

(d) *The Evidence of Market Expansion*

After considering the means by which Kodak claims it expanded the market and having arrived at the conclusion, with a few exceptions, that Kodak did not influence the market in a way that Polaroid could not duplicate, I turn now to examine Kodak's empirical evidence that the market did, indeed, expand by its entry.
Kodak offers three types of information to show that the market expanded: (1) contemporaneous research that Polaroid and Kodak purchasers were drawn from different groups; (2) contemporaneous predictions and conclusions about market expansion by Polaroid executives and outside financial analysts; and (3) Professor Baumol's econometric model which, by estimating the influence of various factors on the demand for instant cameras, concluded that Kodak expanded the market so substantially that Polaroid would have captured none of Kodak's sales from 1976 to 1978, a small percentage in the middle years, and all of Kodak's sales in the last three years.
The contemporaneous statements that Kodak offers do not compel me to conclude that the market expanded. First, the contemporaneous predictions by Polaroid personnel were largely fueled by the belief that Kodak would be bringing a unique product to the market. In some cases, statements were made in order to quell fears that Kodak's entry might have a devastating impact on Polaroid. In addition, the statements were merely guesses about the future. Second, the concurrent statements of Polaroid executives and conclusions of analysts that the market had expanded are not as reliable as my hindsight review of the facts. Moreover, some speakers had different concepts of market expansion; some statements imply that the speaker considered additional Kodak advertising - not just the synergistic effect - as a market expanding mechanism.
Kodak also presented the results of research it claims tends to show that Polaroid and Kodak drew their customers from "somewhat different groups." (TR 11152). One study, conducted between April 1976 and January 1978, surveyed 25,000 registered owners of Kodak instant cameras and reported that seventy percent of these purchasers had never owned an instant camera before. (DF 61,574). A 1979 survey of an unspecified number of new Polaroid purchasers found that only thirty-five percent had never owned a *Polaroid* camera before. (DF 20,097). From this, Kodak concludes that it drew an untapped pool of new purchasers into the market that Polaroid could not have exploited. I find otherwise. These two studies are not comparable, as they were conducted at different times and with apparently different sample sizes and types. They catch only a small snapshot of time. They do not specify, nor does Kodak offer, any explanation for the phenomenon it claims they expose. Standing alone, they cannot establish market expansion.
Professor Baumol's models showing market expansion are also problematic. Using

multiple regression analysis, Professor Baumol attempted to ferret out Kodak's influence on the market by estimating the relationship between certain key variables and the demand for instant cameras. He then introduced a variable to account for Kodak's presence and found that it demonstrated a significant effect on the market. These models are quite complicated and so I will start by explaining, as simply as I can, how the models work. 14

Professor Baumol reviewed the facts of this case and made various assumptions

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about what forces were operating in the instant camera marketplace. Although in the beginning he identified more variables, in the end he chose five: (1) integral camera prices; 15 (2) the per print price ratio of integral and conventional film; (3) 35mm wholesale camera prices; (4) dollars spent on total integral advertising; and (5) Kodak market expansion. For each variable except market expansion, the model calculated the effect on camera sales of an increase or a decrease in the independent variable. By taking into account all four relationships at once, the model generated the relative influence of each variable as it operated historically. This is the basic technique of econometrics.

In his standard demand model, Kodak Model I, Professor Baumol introduced a "dummy variable" to capture the effect of Kodak's market entry. Instead of using a value, such as the price of 35mm cameras, he inserted a "0" for those years when Kodak was absent and a "1" when it was present. The model then answers the question: what possible relationship or correlation exists between this difference and the demand for cameras that best fits the facts? If that correlation is strong the difference is significant. Professor Baumol found a significant relationship between Kodak's presence in the market and camera demand in the first six years of the infringement period. In the later years, the coefficient was not statistically significant; any influence on demand as a result of the difference was just as likely due to chance as to Kodak's presence.

Professor Baumol freely admits that any model is colored by the assumptions upon which it is based and by the influences the model builder chooses to include or to omit. Although Professor Baumol chose to include market expansion, I have found, with a few exceptions, that there was no market mechanism unique to Kodak which the facts show could have expanded the market. Although I cannot paint a perfect picture of the market from the testimony of fact witnesses, contemporaneous documents, and market research, I find that evidence much more reliable than even the best econometric model. The direct evidence is, after all, the factual basis of the case, not some approximation built on facts. Besides being contrary to the facts, the extreme results of Professor Baumol's model - that Polaroid would have captured none of Kodak's sales between 1976-1978 and only a small percentage from 1979-1983 - add to my conviction that it is unreliable. I, therefore, reject its conclusions as contrary to other evidence which I find more credible. 16 Even Professor Baumol's final and conservative conclusion that Polaroid could only have captured twenty-five percent of Kodak's sales is far removed from my view of the facts. Still, because I respect Professor Baumol's expertise and he did include the dummy variable for market expansion and find it significant, I will attempt to explain why he might have found this effect.

First, both Professor Baumol and Professor Fisher agreed that market expansion cannot be measured econometrically if all one considers is the demand for low- and medium-range cameras. (TR 11193; TR 5103-4). There are not enough years when low- and medium-priced cameras were available and Kodak was not in the market to make the comparison reliable. So, in order to measure market expansion, Professor Baumol included high-priced instant cameras. He was thereby able to include the years 1973-1976 as "0" years and make the statistic reliable. The model therefore compares demand in two different eras: when low- and medium-range cameras were not in the market and when they were available. Supposedly, the market expansion variable will not capture any change in demand due to price, because the price variable will measure that effect. I believe, however, the dummy variable could be capturing something else entirely: a change in the marketplace that is not easily quantifiable, - instant photography's metamorphosis from a sophisticated picture-taking technique for the wealthier buyer or the photography buff to a fun system accessible to everyone. When Polaroid and Kodak offered low- and medium-priced cameras, they did more than lower prices; they made cameras available to more people thereby changing the image of the entire

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field. Call it a fad. Call it the development of a mass market. For reasons not having to do only with Kodak, the market changed. Since it changed at the same time Kodak entered, the market expansion variable may be capturing this sensation.

While I do not accept these models in this case, I am not critical of the field of econometrics as a whole. I believe it can provide valuable insight into complicated matters. However, in this case the models contain assumptions contrary to the facts and achieve extreme results which by their very nature are suspect. Perhaps the inner workings of the models, which I cannot fully comprehend, are biased. Perhaps the instant photography market does not lend itself to mathematical interpretation. Whatever the reason, I cannot adopt Professor Baumol's model as evidence of market expansion.

Conclusion

But for Kodak's infringement, Polaroid had the marketing capability to make most of Kodak's sales. I find that while Polaroid was not capable of making all Kodak's sales in the premium channel and in some foreign markets, there was nothing unique and critical to Kodak's entry such that without its infringement, demand would have been diminished.

2. The Market of the Future, According to Polaroid

Having considered Kodak's claim that the market would shrink without them, I now turn to Polaroid's claim that without Kodak the market would have been more profitable and would have extended far into the future. Polaroid's case is based, in the first part, on their assertions that Kodak's behavior in the market forced them to lower their prices and that without Kodak, they would have charged considerably more for their cameras and film. Polaroid also claims they would have introduced the OneStep camera one and one-half to two years later, allowing them to capitalize on Pronto! sales, produce a better OneStep and avoid the boom (and therefore, the fall) of instant sales. Polaroid uses the econometric model of Professor Fisher to show how their alternative strategy would have generated demand for cameras and film which would result in profits of over $3.9 billion dollars. In Section (a), I examine Polaroid's historical pricing behavior and in Section (b), I discuss generally the relationship between higher prices and demand in this market. Section (b) also includes a discussion of Professor Fisher's model.

Section (a): Polaroid's Historical Pricing Behavior

The key to Polaroid's alternative damage scenario is the proposition that Kodak caused them to lower their prices and its corollary, that higher prices would have meant more profit. To some degree, whether Kodak caused Polaroid to charge less for cameras is irrelevant if I conclude that the higher prices Polaroid proposes would not have been more profitable. Still, since I find that Polaroid lowered their prices consistent with their past behavior as a monopolist and in response to the market, irrespective of Kodak's influence, the first proposition sheds light on the second.

The record contains a great deal of evidence from which one can infer that Polaroid, even without Kodak in the market, would have lowered prices and introduced the OneStep as they did during the infringement period. Although Polaroid may not have lowered prices as far or as fast as they did historically, it is important to note that the general pattern was not new to Polaroid. Polaroid was aware of the price points in the industry; it knew that the majority of camera sales were made with cameras priced under $50. In the pack era, Polaroid offered successively lower-priced models. It sold the Swinger for $20 in 1966. It sold the Colorpack II in 1969 for about $30. It offered other cameras in this price range. (TR 227-28). Mr. McCune testified that Polaroid was aware that "there were parts of the public who would respond to low-price products that didn't respond to middle-price products." (TR 228).

Polaroid followed a pattern of quickly introducing lower-priced models with the folding SX-70. Although Polaroid did not achieve full distribution of the deluxe SX-70 until 1974, it introduced the lower-priced Model 2, with reduced margins, in that year. The Model 3 was introduced in 1975 at a $13 loss. In an August, 1974 memo to Polaroid top executives, Peter Wensberg justified introducing the Model 2 and 3 with "unacceptable margins" because it would increase camera volume as well as generate additional film sales. (DF 20,244). He testified that Polaroid believed it was not profitable to raise prices:

"But by increasing prices, we obviously felt we would not sell as many cameras; hence, not improve camera division variance; hence not achieve incremental film sales."

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(TR 910). Polaroid knew the advantages derived from lowering prices and historically followed a pattern of doing so.

Polaroid took the first leap into mid-priced integral cameras with the Pronto!. The Pronto! was specifically introduced to have wider appeal among consumers. Although Dr. Land did not want to introduce the hard-bodied line, Mr. McCune, who became president in late 1974, advocated a mid-priced model. Pronto!'s introduction was not influenced by Kodak even though Polaroid had strong signals as early as 1970 that Kodak planned to enter the market. (TR. 344). Kodak reduced the initial price of the EK-4 and EK-6 models because of Pronto!'s low price.

Although Polaroid had no firm plans to introduce the OneStep in 1977, the elements of a low-priced model were being explored. This is the reason Polaroid was able to respond so quickly to the Handle. (TR 234-35; 341-42). Mr. Bassett, Polaroid's sales forecaster, recommended to Mr. Wensberg that Polaroid "[i]ntroduce an under $25.00 SX-70 type camera early in 1977." (DF 70,076B). Mr. Wensberg also advocated a product priced under $50. (DF 20,279). Throughout the infringement period, whenever Polaroid introduced lower-priced models, Kodak executives felt they had to respond because the Polaroid cameras at comparable prices usually had more features. (TR 7816-30). Moreover, some price cuts Polaroid instituted were deceptive as the cheaper product often offered fewer features. The 1978 Pronto RF price cut for example, occurred after Polaroid removed the camera's tripod mount and timer.

Polaroid claims it was unable to raise its film price as high as it would have liked because of competition with Kodak. Yet, well before Kodak's entry, Polaroid knew that "the strongest reason consumers do not buy a Polaroid camera is due to our film price." (DF 61,606, Tab 9, see also Tab 11). Both companies priced their film almost identically throughout the infringement period. In only one instance was there was a nine month delay between when Polaroid raised its film prices and Kodak followed. Kodak also initiated several price hikes which Polaroid followed. Mr. Brewer stated:

From my personal perspective, we basically set our prices predicated upon what we felt would have impacted both our volume and margins; and the Kodak film price, to my recollection, they were normally quite responsive to whatever we did, in terms of if we increased our price, the sense was that Kodak increased their prices. So the sensitivity level in pricing was not very intense at all in the film area.

(DF 70,007A). Still, Polaroid claims it feared raising prices because of Kodak.

From about 1980 on the foremost concern of Polaroid executives in pricing film was the competition with conventional photography, specifically, 35mm cameras and film. In 1981, Mr. Booth reported to Polaroid's board that "[the] relative price of an instant picture to a conventional picture is a major concern" and that "if we raise our prices much more than five percent per year we will widen the ratio of instant to conventional and it is already very high." (DF 10,413 at 0838-39). In 1982, Polaroid's Director of Strategic Planning wrote a series of memoranda concluding that the widening gap between the price per print of instant and conventional photography "had a substantial negative effect on Polaroid's share of the amateur photographic market." (DF 61,606, Tab 6). Many other Polaroid reports, memos and studies report the concern of the relative film prices between instant and conventional. (*See, e.g.*, DF 61,606 Tab 22, Tab 27). This constraint on film pricing would have been present without Kodak and I believe Polaroid's response would have been present without Kodak and I believe Polaroid's response would have been the same.

Conclusion

After reviewing all the evidence in this regard, I find that even in Kodak's absence Polaroid would have lowered camera prices, introduced the lower-priced OneStep and felt constrained regarding film prices just as it did historically. Polaroid claims that it would not have lowered prices but the proof is to the contrary. The decline in instant film prices cannot be laid at Kodak's door. The market was changing, influenced both by the competition from conventional photography and changing consumer perception of instant photography. Perhaps Polaroid would not have lowered prices as quickly or significantly as they did. Unfortunately, Polaroid has not made such a modest and reasonable claim. Instead, it has presented scenarios which include large price increases on both cameras and film. This Court has neither the evidence nor the tools to generate a demand curve based on more modest and more realistic price increases.

Section (b) The Effect of Higher Prices in the Instant Photogra p hy Market

Although Polaroid was pricing its cameras and film independent of Kodak, that finding

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is not crucial because I also find that the higher prices Polaroid says it would have charged would have depressed demand so substantially that the strategy they historically pursued is actually the more profitable one.

If Polaroid had raised its prices as high as they claim, demand would have been substantially diminished. Polaroid presented basically two alternative pricing strategies. The prices it originally planned to charge for cameras and film were generated by Professor Fisher and in one scenario ranged from fifteen percent to 113% over historical prices. 17 (DF 61541; Tr. 11667). In response to my question during his direct examination, Mr. Booth testified on re-direct that Polaroid would have charged $10 more for each camera, but for Kodak. Mr. Booth also testified that film prices would have risen at ninety percent of the Consumer Price Index in normal years and eighty percent in years of hyper-inflation. Historically, Polaroid priced its film at about fifty percent of the Consumer Price Index. (PT 2303; TR 2462-64).

Despite these higher prices, both Professor Fisher and Mr. Booth conclude that Polaroid would have been able to sell substantially more cameras. Mr. Booth predicted that from 1976 to date, Polaroid could have sold all the cameras it historically sold and seventeen to twenty million more. Even with the higher prices on film, he believes they could have sold 300 to 350 million additional packs of film. Professor Fisher concludes that from 1976 to 1990, Polaroid could have sold essentially all the cameras that it sold historically *and* those that Kodak sold, all at his higher prices. I reject both of these conclusions because they contradict the overwhelming evidence of extreme price sensitivity in this market. Professor Fisher's conclusions also conflict with the substantial evidence that film and camera prices were seriously constrained after 1980 by the increase in the relative value of conventional photography.

As I discussed in Section (a), Polaroid was well aware that raising prices would diminish demand. Numerous Polaroid documents, including market research studies, establish that demand was very sensitive to price, especially to the price of film. (For a list of some relevant excerpts in this regard, see DF 61,606). Since Kodak left the market and Polaroid has raised its camera and film prices, sales have dropped significantly. (DF 61,025; DF 61,034; TR 8169-71). Professor Dolan underscored this price sensitivity in his analysis of what affects demand. He demonstrated how you could explain almost all of the boom and fall of instant photography simply by tracing price changes. (TR 4253-81). Professor Baumol also concluded that higher film prices would have a drastic effect on demand. One of his scenarios showed that if Polaroid raised its prices as little as ten percent, revenues on cameras and film would decrease by ninety-one percent. (DF 61,622).

Higher prices and diminished demand can result in higher profits. An increase in profit per camera can outweigh the smaller profit realized from a larger number of sales. But this fact holds true only to a certain level, for if demand falls significantly, profits will also fall. In light of all the evidence on this point and given the high prices Polaroid used in its demand scenario, I find that they would have generated less profit pursuing the higher pricing strategy than the strategy it pursued historically.

Polaroid's ability to charge higher prices was and would be seriously constrained after 1980 by competition with conventional photography, chiefly the 35mm camera system. In the late 1970s, 35mm cameras commanded an increasingly larger market share. In the period 1979-1982, average annual sales of 35mm cameras totalled about four and a half million units, up from about a million units annually in the period 1976-1978. By 1979, 35mm camera sales accounted for sixty-four percent of all camera dollars spent by consumers. (DF 61,742, Tab 1). Other conventional photography products also competed with instant, but not to the same degree. (TR 2556; DF 60,1744).

Consumers were attracted to 35mm photography because of the high quality that an amateur photographer could achieve. When 35mm manufacturers began to add features such as auto-focusing, auto-exposure, auto-load and auto-advance, the chance of consumer error decreased. Increasingly, the kind of photographs consumers took with

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these cameras became the standard of what constituted a good, acceptable quality print. In this way, they began to compete with instant even before the prices became more directly comparable. In internal reports during this time period, Polaroid recognized that 35mm had become the new industry standard. (*E.g.,* PT 2293; *see also* TR 1660).

The price of 35mm cameras declined on the order of thirty to forty percent in the early 1980s. Average customs values on 35mm single lens reflex ("SLR") cameras declined by thirty-six percent from 1976-1985. As advertised in the New York Times, the price of the Canon Sure Shot, an immensely popular non-SLR camera, declined from $144 in 1980 to $103 in 1983, or twenty-eight percent. In 1983, non-SLR cameras were offered for as low as $70. Although these cameras were still above the lowest-priced instant cameras, the relative value placed them directly in competition. In 1983, Polaroid asserted:

The decline in the demand for the instant category as a whole, rather than for Polaroid in particular, points toward conventional cameras, especially 35mm cameras, as Polaroid's main competition rather than Kodak instant.

(DF 61,742, Tab 5). Other Polaroid documents show that in the minds of Polaroid executives, the difference in quality between conventional and instant prints was a major factor in the declining demand for instant. (*E.g.,* DF 61,742, Tab 2; DF 21,054). Mr. Booth testified that he believed that from 1980 onwards 35mm quality and convenience surpassed the quality and convenience of instant prints, while the price for instant prices were higher. (TR 2538-39).

The cost per print of instant became more expensive relative to conventional during this period. In 1981, Mr. Booth reported that the ratio was an "already high" two-to-one. The ratio increased partly because the cost of conventional photofinishing was declining. First, color paper costs were dropping. Second, with the proliferation of photo-developing kiosks in the 1970s and minilabs in the early 1980s, competition between photofinishers was keen and drove the price down. Polaroid executives were concerned about this ratio and knew it affected the purchase of both cameras and film. (*E.g.*, PT 2293; DF 60,174).

Developments in 35mm photofinishing contributed to the declining demand of instant and reduced Polaroid's ability to raise prices in any "but for" world. First, it became more convenient. The number of minilabs grew from 1000 in 1980 to 14,000 in 1988; it was easier for consumers to find a film developer. Second, the time to develop pictures went from a week, to three days, to twenty-four hours and finally, to an hour. Consumers could now get high quality prints in a very short time, cutting into instant's traditional domain. Since photofinishers were often camera retailers, too, and there is also some evidence that they were more likely to stock and sell conventional cameras.

I find that Polaroid would not have been able to raise its prices significantly without greatly reducing demand. Not surprisingly, Professor Fisher reached a different conclusion. I have considered his analysis in my review of the record and I reject it as being unreliable and contrary to the bulk of evidence in this case. I do not have the skill or the obligation to parse his model to show why we come to different conclusions. Professor Christiansen, an econometrician who testified for Kodak, dissected the intricacies of Professor Fisher's model and exposed its unstated assumptions, biases and errors. 18 Below, I will attempt to explain in a broad, non-technical sense why I find his model unreliable.

Professor Fisher constructed a model reflecting his judgments about what influences the demand for instant cameras and film. His work includes two models: a "film burn" model which estimates the number of film packs that a camera owner will use over the life of a camera, and a camera demand model which calculates the number of cameras that consumers would have purchased given a certain set of camera and film prices and introduction dates. Professor Fisher arrived at his model just as Professor Baumol did: by making assumptions about the

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influences on demand, entering the historical values of those influences and arriving at a mathematical relationship between the influences and the number of cameras that were purchased. Professor Fisher then took one further step and used this framework of relationships to predict the future. By changing the price and the introduction dates, he claimed that he could show how demand would have been affected by Polaroid's alternative strategies. Professor Fisher concluded that by pricing its cameras and film higher and delaying the introduction of the One-Step, Polaroid would have been able to make between $3.1 and $3.5 billion dollars in additional sales of cameras/film. 19

In Professor Fisher's model, Polaroid charges more in the Kodak-free world, and yet sells the same number of cameras from 1976 to 1990 that Polaroid and Kodak sold together from 1976 to 1985. The model achieves this result because price is the only factor which ultimately influences demand. The model assumes that consumers have in mind a price which they will pay for an instant camera system. The price includes both the camera and the number of film packs the consumer is estimated to use from Professor Fisher's film burn model. 20 The consumer compares her "reservation" price to the system price and if it is the same or less, she becomes, in model parlance a "probable buyer." Once a probable buyer, only "search rate" ultimately influences when the consumer will purchase a camera. The search rate assumes that in each year only twenty-one percent of the probable buyers will purchase. The search results in a mean waiting time of 4.5 years before purchase. 21 In this manner, Professor Fisher's model pushes off demand into the future; regardless of the different prices and dates used, the typical pattern of results is lower sales in the beginning years and higher sales thereafter.

In this way, Polaroid is able to have its cake and eat it, too; they can exploit those who would pay more and capture the rest later. This is really just a version of the "skim pricing" which monopolists often employ. The market would not have worked in the way Professor Fisher envisions, however, because consumers' willingness to pay for instant photography was changing. The market was heavily influenced by the relative value of conventional photography. Professor Fisher's model does not adequately account for that variable.

Professor Fisher's attempts to capture the effect of competition from conventional photography are minimal and misguided. His model includes a variable reflecting the number of 35mm, instamatic, and disc cameras purchased. Not only is this contrary to the way in which Polaroid documents routinely discuss the effect of conventional photography, Professor Christiansen points out that measuring competition by stock rather than price is wrong and leads to error. (TR 11549-50). Not surprisingly, Professor Fisher found no effect from conventional photography on the sales of low-priced instant cameras. As a result, none of his pricing scenarios captures any competition at this level. This conclusion contradicts the views of Polaroid executives who reported that conventional photography products competed with instant products at all price ranges. Professor Fisher's model does not account at all for the competition between the relative price per print between instant conventional pictures. As I have already found, Polaroid believed conventional film with processing competed directly with instant film. Professor Fisher's own consulting group, Charles River Associates, determined that seventy-seven percent of Polaroid households also owned a conventional camera and that consumers can and do choose between whether to use conventional or instant film. (TR 11290). In his scenarios, Professor Fisher assumed that conventional film prices constrained Polaroid's ability to raise its own prices, yet the scenarios do not consider that constraint until 1985, considerably later than the evidence shows it was significant to consumers and to Polaroid officials.

By not capturing the profound effect of the competition from conventional products, Professor Fisher overestimated the prices Polaroid could have charged for instant prod

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ucts. He also overestimated how much consumers valued the technological changes of the Sun system. In his model, consumers were assumed to change their valuation of instant photography and therefore be willing to pay more for an instant system after the Sun introduction; this allows Polaroid to raise its prices even higher without losing sales. Yet, the record shows that consumers did not view the Sun system as new technology.

Sales were poor and there was no evidence of market expansion. Eventually, Polaroid lowered its prices on this line in order to stimulate sales.

Other elements in Professor Fisher's model run counter to the evidence. Professor Fisher found no effect on demand from advertising - contrary to the opinion of almost every other witness who testified about the market. Professor Fisher found that the price of film did not affect the number of packs that an owner would use over the camera's lifetime - contrary to the opinion of almost every other witness who testified about the market. The packs per camera total included in the system price in Professor Fisher's model is not susceptible to changes in film price - contrary to the opinion of almost every other witness who testified about the market. Professor Fisher had incomplete data for markets outside the United States and yet felt confident to model the sales in those countries. These factors and others lead me to find Professor Fisher's model unreliable in predicting demand.

The profits which Professor Fisher believes Polaroid would have realized without Kodak are so high, given the fact that both Polaroid and Kodak lost money in the real world, that they cast doubt on the credibility of his analysis. Professor Fisher supported his results by pointing out that his calculations generate profits as a percentage of sales that are consistent with Polaroid's experience in the pack era. Irrespective of Kodak's entry, however, there are so many differences between the market in the 1950s and 1960s and the market from 1976 to 1985 that I do not find this comparison helpful. In the 1970s, Polaroid began manufacturing almost all of its own components. In the 1970s, conventional photography rose in value to compete with instant. Professor Fisher has not acknowledged these changes.

Mr. Booth also believed that higher prices would not significantly affect the total demand. For some of the same reasons that I reject Professor Fisher's conclusions, I also reject Mr. Booth's. Chiefly, the demand at those prices is too high given the price sensitivity of demand in the instant photography market. However, I am limited in my analysis of Mr. Booth's opinion because he did not explain his methodology or assumptions. Of course, in the process of considering Professor Fisher's model I have encountered the "essence" of Mr. Booth's numbers, but the flaws of that analysis belong to Professor Fisher and not to Mr. Booth.

Conclusion

It would be ridiculous to conclude that Kodak's presence in the market did not influence how Polaroid conducted its instant business from 1976 to 1985. Other than losing the sales that Kodak made, however, Polaroid has not proven additional damage. It has not shown that it would have charged higher prices. It has not proven that it would have introduced the OneStep later. Even if I were to conclude that Polaroid would have waited to introduce the OneStep, it has failed to prove that would have resulted. Polaroid failed to prove, even in a rough way, what those consumers who historically purchased OneSteps and Handles would have done in a world without Kodak. Even giving Polaroid every benefit of the doubt, the Court is unable to conclude that the company would have reaped greater profits. Liability does not extend to speculative damages. *Yarway,* 775 F.2d at 275; *Bio-Rad,* 739 F.2d at 616.

Polaroid has failed to prove that higher prices would have brought it greater profit or that Kodak caused price erosion. As a result, Polaroid has not proved that its damages extended beyond 1985; in its proposed scenario, the high prices and delayed introductions would have increased demand from 1985 to 1990. Polaroid's prices after 1985 were not affected by Kodak's infringement. Polaroid is only entitled to lost profits from the sales Kodak made minus those sales Polaroid would have been unable to make because of limits in its marketing capability.

IV. *POLAROID'S MANUFACTURING CAPACITY*

Legal Principles

Factual Findings & Conclusions

A. *Film Manufacturing*

Introduction

1. Polaroid's In-Place Capacity: Film
a. In-Place Capacity of Assembly Machines
No Coverage
No Material Time

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Conclusion

B. *Camera Manufacturing*

Introduction

1. Polaroid's In-Place Capacity
1976
1977-1980
1981-1985

Legal Principles

To recover profits on lost sales, in addition to marketing *capacity,* Polaroid must also show that it had the *ability* to manufacture sufficient cameras and film to meet Kodak's sales volume. *State Indus.*, 883 F.2d at 1577; *Datascope Corp.*, 879 F.2d at 825; *Water Technologies Corp.,* 850 F.2d at 672. This showing is an integral part of proving that Polaroid is entitled to lost profits; if Polaroid could not manufacture the product to meet demand, it cannot prove that it would have made the sales in the "but for" world.

While Polaroid is not required to show it had empty factories waiting for additional work, *see Livesay Window Co.*, 251 F.2d at 473, it must prove, by a preponderance of the evidence, that it had at least the potential capability to meet the demand. *Bio-Rad Laboratories, Inc. v. Nicolet Instrument Corp.*, 739 F.2d 604, 616 [222 USPQ 654] (Fed. Cir.), *cert. denied,* 469 U.S. 1038 (1984). *Accord State Indus., Inc. v. Mor-Flo Indus., Inc.,* 8 U.S.P.Q.2d 1971, 1979 (E.D. Tenn. 1988), *aff'd in part and vacated in part,* 883 F.2d 1573 [12 USPQ2d 1026] (Fed. Cir. 1989); *Kori Corp. v. Wilco Marsh Buggies & Draglines Inc.*, 561 F.Supp. 512, 527 [217 USPQ 1302] (D. La. 1981), *aff'd,* 708 F.2d 151 [219 USPQ 286] (5th Cir. 1983), *transferred to* 761 F.2d 649 [225 USPQ 985] (Fed. Cir.), *cert. denied,* 474 U.S. 902 (1985); *W.L. Gore & Assoc., Inc. v. Carlisle Corp.,* 198 U.S.P.Q. 353, 362 (D. Del. 1978). Although both Polaroid and Kodak agree that the law does not require Polaroid to have *in place* the ability to make the combined volume, they disagree about what kind of showing will satisfy Polaroid's burden of proving that it had the potential to meet the demand. This may be a simple dispute about whether Polaroid has met its burden or it may be a genuine dispute about the standard to be applied. In either case, the issue deserves some preliminary discussion.

[7] The seed of this dispute is that Polaroid's in-place manufacturing capacity was not sufficient to satisfy the combined demand which came fast and furious in the first three years of the infringement. Polaroid has not convinced me that the opportunity to make Kodak's sales existed at any other time than when Kodak historically made the sales. (*See* Part II). Therefore, Polaroid must necessarily present an expansion scenario which shows what steps, including some time-consuming capital investment, it conceivably could have taken to meet the demand.

One interpretation of Polaroid's proffer on this issue is that Polaroid believes that if the patentee can put forward any possible expansion scenario that meets the production requirements, regardless of how unlikely or unreasonable it may be, it has met its burden. 22 In other words, Polaroid may be urging that if it theoretically could have taken steps to produce the combined volume, it has proven it could have made the sales. During trial, Kodak commonly referred to this approach as the *could have* standard. Kodak claims that what *could* have done is irrelevant; Polaroid must show, by a preponderance of the evidence, what it *would have* done. Kodak argues that Polaroid must show exactly why, when, and how it would have increased capacity. Kodak argues that the record shows a disparity between what Polaroid would have and could have done, given Polaroid's history of inaccurate forecasting, conservative decisionmaking, and other quirks of its corporate personality.

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Neither claim is quite right. The case law does not define potential capability very clearly. To be sure, patent owners have not been held to the type of absolute proofs Kodak desires. *See, e.g., King Instrument Corp. v. Otari Corp.,* 767 F.2d 853, 864 [226 USPQ 402] (Fed. Cir. 1985), *cert. denied,* 475 U.S. 1016 (1986) (lost profits awarded where the patentee did not manufacture a product equivalent to the infringing product at all during the infringement period). The cases make it clear that the patentee's proof on all issues is that of a reasonable probability. *E.g., Aro Mfg. Co. v. Convertible Top Replacement Co.,* 377 U.S. 476, 507 [141 USPQ 681] (1964); *A. Stucki Co. v. Worthington Indus., Inc.,* 849 F.2d 593, 597-98 [7 USPQ2d 1066] (Fed. Cir. 1988); *Yarway Corp.,* 775 F.2d at 275. Polaroid's standard, if that is in fact what it is urging, renders the manufacturing capability requirement meaningless. Any patentee can concoct a scenario to achieve the necessary result.

In reality, the legal standard has substance and meaning. Courts have refused to award lost profits when, for example, the use of an alternative facility to meet demand would have required the patent owner to curtail production of another more profitable product. *Deere & Co. v. International Harvester Co.,* 218 U.S.P.Q. 403, 407 (C.D. Ill. 1982), *aff'd in part and rev'd in part,* 710 F.2d 1551 [218 USPQ 481] (Fed. Cir. 1983). In *Deere,* the district court found no evidence that the patentee *would have* made the decision to curtail the more profitable product although they *could have* done so. *Id.* at 407. In *Water Technologies,* the Federal Circuit found no manufacturing capability and refused to award lost profits in part because the patentee had no facilities to manufacture the product commercially. 850 F.2d at 673. Under Polaroid's theory, the patentee in *Water Technologies* could have met its burden by showing, even under the most improbable scenario, that it *could have* built a production facility. The law is not so easily satisfied.

While it may have been physically possible to match Kodak's volume if Polaroid began to greatly expand its manufacturing capacity from the moment the infringement began, Polaroid has not proven its ability to do so. What is physically possible does, however, serve as a starting point for determining what reasonably could or would have occurred. In this analysis, Polaroid is entitled to every benefit of the doubt. *Del Mar Avionics,* 836 F.2d at 1327; *Lam,* 718 F.2d at 1065. Polaroid need only show that it is more likely than not that it would have added the necessary manufacturing capacity. The Court must assume that Polaroid would have labored to meet the demand to the best of its ability.

Of course, the question of Polaroid's ability to expand manufacturing capacity in a timely manner involves not only the company's theoretical technical and physical potential, but also its forecasting and decision-making skills. The task is not to determine what any corporation with Polaroid's assets could have achieved, but rather to find what Polaroid, with its unique corporate personality, would have done in a world without Kodak. In this sense, what Polaroid could and would have done may be the same thing. Mr. Zaffino, Kodak's camera manufacturing expert, put it this way:

In my analysis I have determined what Polaroid realistically and reasonably could have done given all the resources at their disposal and given all the things they did well and things they didn't do so well.

And in my mind, with that understanding, I see no difference between what Polaroid reasonably and realistically could have done and what they would have done.

(Tr 8903). With these principles in mind, I now turn to the facts.

Factual Findings and Conclusions

A. *Film Manufacturing*

Introduction

Instant film is the key to Polaroid's integral film system. The film is, in and of itself, a fascinating mini-darkroom which must be created with the utmost precision and care. Polaroid designed and built the assembly machines which manufacture its instant film, each machine bigger than my courtroom. These complicated instruments assemble all the principal film components: the positive and negative sheets, the developer pod, and the mask or frame. The machines also cut and seal the individual film units and assemble them in packs of ten with a battery, spring, and cover sheet. The machines are automatic and completely synchronized. They are driven by one shaft which runs along the length of the machine; each turn of the shaft completes one cycle of each sub-assembly station. Packaging is done at the very end, by another connected machine.

Since 1972, Polaroid has produced all the major components for its film: the negative sheet or base, which is the photosensitive material that captures the image; the positive sheet, where the image is formed and

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upon which the developed picture is viewed; the developer pods, which contain the chemicals that control the developing process; and the batteries, contained in the film pack, which power the camera.

Negative preparation is done on a complex coating machine, called the "x500," which is five stories high and several hundred feet long. Unlike positive sheet coating, which is done one layer at a time, all the chemical layers of the negative sheet are applied simultaneously to a sixty-inch web of material which runs through the machine at a speed of several hundred feet each minute. Because many of these layers are light-sensitive, the operation must be performed completely in the dark. Polaroid designed and built a special facility in New Bedford which houses the negative coating machine and is itself part of the negative sheet apparatus. The entire process must be completely pure and free of dirt. After coating, the negative material must be aged for six months in a special humidity and temperature controlled environment. Beginning in late 1979, with the advent of Time Zero film, Polaroid prepared part of its negative base in Building W-5 in Waltham on one of the positive coating machines and then transferred this partially-coated negative base to New Bedford for completion.

The positive sheet is prepared by coating successive layers of chemicals onto a base web sheet. The positive coating and drying machines are hundreds of feet long and several stories high. The web passes through the applicators at several hundred feet a minute. After the first chemical layer is applied to the web, it is dried and re-wound and the process is repeated until all the required layers have been coated on the sheet. During the infringement period, Polaroid housed all its positive coating in Building W-5 in Waltham.

Polaroid also manufactured the card-like batteries which were included in the film pack to power the camera. The batteries were assembled on separate machines and then fed into the film assembly machine for packaging with the film.

In order to manufacture film, Polaroid needed a sufficient supply of each of the components, sufficient assembly machines, and trained employees to operate and maintain the machines. Without any one of these resources, film production would come to a halt. Therefore, my analysis takes into account each of these factors.

Polaroid's ability to manufacture integral film also depends heavily on the effectiveness of its planning process. Polaroid planned its integral film production each year based on a sales forecast. From that forecast, Polaroid prepared a "finished goods" plan and determined the manufacturing requirements for each component. Planning was necessary at successive levels to integrate the numerous operations in the manufacturing process. I have also considered how Polaroid's planning ability affected the company's manufacturing capacity. Of course, to the extent that it is possible, I have tried to ferret out Kodak's influence on that process.

First, I will consider what untapped resources Polaroid had in place during the years of infringement. Next, I will determine whether and when Polaroid could have expanded its manufacturing capacity.

1. *Polaroid's In-Place Capacity: Film*

Both parties presented an analysis of what incremental production Polaroid could have achieved without investing additional capital. Using the resources Polaroid historically had at its disposal, 23 Mr. McNamara for Polaroid and Messrs. Smith and Cook for Kodak, calculated how many additional film packs could be squeezed out of Polaroid's existing operation.

(a) *In-Place Capacity of Assembly Machines*

Mr. McNamara, whose experience with manufacturing operations is limited to the accounting work he has done for various clients of Arthur Young & Co., prepared what he called a "fanciful" (TR 3350) schedule in which Polaroid ran its existing operations 353 days a year in every year of the infringement period. Mr. McNamara and his team arrived at these parameters by analyzing Polaroid's historical records and speaking to various Polaroid personnel. Based on the information they gathered, the team estimated how much additional "run-time" was available on the assembly machines and how many packs of film could therefore be produced. Mr. McNamara con

cluded that even by running 353 days a year in every year, Polaroid could not have satisfied the combined demand for instant film. This analysis was not intended to provide a serious estimate of what Polaroid could achieve, but rather to show that even based on the most optimistic assumptions, Polaroid needed something more in order to meet demand. (TR 3221). However, the basic elements of Mr. McNamara's analysis - how much a particular machine can be expected to produce, how much time is actually available to produce film, and the availability of components - appear again in both his nine-month and eighteen-month advance scenarios, which are intended as a serious estimate of Polaroid's additional manufacturing capacity. Therefore, I believe it is prudent to examine these assumptions now.

Kodak presented its in-place capacity analysis through Mr. David R. Smith and Mr. Wendell Cook. Mr. Cook analyzed the incremental in-place capacity of Polaroid's negative and positive sheet facilities as well as its battery production capability. Mr. Smith analyzed the in-place capacity of Polaroid's film assembly machines. Together they prepared a chart which sets forth the incremental in-place capacity in all four of these areas. The chart identifies which part of the film manufacturing operation presented the most significant constraint in each year. (DF 61,300B, Tab 2).

At the time of the trial, Mr. Smith headed Kodak's Automatic Machine Systems Design Division, a consulting group within Kodak which designs automatic machinery systems for companies other than Kodak. He was also the Director of Kodak's Converting and Packaging Line of Technology. From 1971 to 1976, he worked on the design and installation of Kodak's instant film assembly machines. Mr. Smith presented a painstakingly detailed and thorough analysis of the additional time available to Polaroid to produce film to meet market demand, and the number of additional film packs Polaroid could produce in that time. Like Mr. McNamara, Mr. Smith concluded that Polaroid could not satisfy 100% of the demand for instant products. Mr. Smith also concluded that Polaroid was capable of producing more film with its existing capacity during the infringement period.

Mr. Smith's analysis is sound and reliable. He started with the basics, examining daily shift reports to determine how the assembly machines were being used. Just as Polaroid managers did historically, he divided assembly machine use into "scheduled" and "non-scheduled" time. Of the scheduled time, Mr. Smith determined how much was spent producing "good" product and how much was taken up by unplanned stops and producing unsalable product. He further analyzed the non-scheduled time and determined what portion of that time was available for additional production. Mr. McNamara's analysis differed in one important respect: the portion of non-scheduled time allotted for additional production. This disagreement highlights the reason I find Mr. Smith's analysis so compelling.

There were reasons why Polaroid did not "schedule a machine" other than not needing it for production. Sometimes a machine sat idle because there was no one to run it, such as during a holiday or a storm. Sometimes a machine was idle because it was awaiting maintenance or updating or conversion of parts of the machine. In attempting to expand production, Polaroid could not avoid these particular "downtime" activities. Mr. McNamara and Mr. Smith differed as to whether Polaroid would have been able to eliminate much of the "no coverage time," the time required for machine updating and conversions, and the time production stopped because materials were not available. Especially in the later years, Mr. McNamara and Mr. Smith disagreed about whether Polaroid would have converted some machines to make products besides instant film.

No coverage. Polaroid could not "schedule machines" when it had no one to run them. When employees for whatever reason, did not attend work, Polaroid was unable to staff the machines and those machines would be placed on "no coverage" status. Polaroid experienced a significant amount of no coverage time throughout the infringement period.

No coverage time peaked in 1978. At that time, Polaroid was operating three-shift, five-day schedule but was so pressed to produce film that it was actually running seven days a week on overtime. The company also cancelled the annual vacation shutdown in July. Faced with the prospect of no vacation from this demanding schedule, employee absenteeism increased. A 1978 employee survey showed a high level of employee stress from overwork. (DF 25,371). When Polaroid replaced the overtime work with regularly scheduled shifts, "no coverage time" decreased.

The question is whether Polaroid management, under different circumstances, could have reduced the no coverage time and produced additional film packs. Mr. McNamara assumed that the increased demand would have prompted Polaroid to adopt a seven-day schedule earlier, in January 1978. Mr. Smith "struggled with this one" (TR

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10303), but concluded that since Polaroid historically faced more demand than it could handle during those months and yet did not respond, it is unlikely that the combined demand would have made any difference in how Polaroid acted.

On the basis of its historical performance, I find Polaroid could not have reduced coverage time if faced with additional demand. Nothing in the record convinces me that Polaroid could have managed employee absenteeism any better in more demanding circumstances. Polaroid management had to experience extensive no coverage time in 1978 before it corrected the problem. Once Polaroid recognized the need for the off-standard schedule, it took almost nine months to implement it. To begin the new schedule in January 1978, as Mr. McNamara envisions, Polaroid would have had to recognize the need in the spring of 1977. Nothing in the record persuades me that Polaroid reasonably could have taken this step earlier than it actually did.

No material time. Polaroid also took machines out of the production schedule when material was not available, when there were problems with material quality, when the wrong material was supplied, or material did not perform as expected. This "downtime" is distinct from constraints on film production imposed by a lack of material or component capacity. Material time concerns the scheduling and technical problems with the material, not the sheer ability to produce it. For example, each component in instant film must be the proper size. The combination of developer, pod, mask, and rail creates a certain gap between the positive sheet and negative. If the gap is wrong, the chemicals released from the pod may not cover the sheets completely or may leak. So while Polaroid may have had material to supply the machines, it may not have been of the right quality.

Problems of no material capacity became critical at times, especially during the introduction of new products such as Time Zero film. Technical problems coating the L coat on the negative base of the new film caused Polaroid to shut down six assembly machines in 1980.

The summary reports Mr. McNamara used as the basis for his analysis did not account specifically for no material problems before 1982. Mr. McNamara may have factored some no material time into his assessment of "runtime." (PT 3114). Mr. Smith's detailed analysis, in contrast, identified significant blocks of time in those years when production ceased for lack of materials. Polaroid could not have eliminated no material time when pressing operations to the limit. No material time is an unavoidable part of the manufacturing process. Indeed, it may be generous to Polaroid not to increase this time given the extra strain that would be placed upon all its operations in attempting to increase production. I find that the exclusion of no material time from non-scheduled time available for additional production reflects a realistic and reasonable judgment about

Polaroid's ability to manufacture more film.

Engineering Updates. Polaroid consistently took machines out of production to implement engineering advances that made the machines run more quickly or efficiently. Polaroid engineers were always working on ways to improve machine performance and as they discovered and refined these breakthroughs, they installed them on their machines. Partly as a result of these updates. Machine speeds increased and yields generally improved during the infringement period.

Mr. McNamara took the time used for engineering updates and added it to the total that could have been used for additional production. Yet Mr. McNamara also used the increased historical machine speeds which resulted, in part, from these updates, Mr. Smith excluded this time but gave Polaroid credit for its historical increases in efficiency and speed. I find that Polaroid could not have avoided these updates and still achieved the company's historical production totals. For example, total yield, a measure of efficiency, grew from sixty-three percent in 1976 to ninety-one percent in 1985, a forty-four percent improvement. If Polaroid had decided not to take its machines out of production for updating in those years, the effect on film production would have been devastating. At the very least, any analysis which eliminates that downtime must adjust the total yield accordingly. No such analysis was offered.

Conversion of machines to produce other products.

Polaroid used its film assembly machines to manufacture products other than consumer instant film. Polaroid also converted some film assembly machines to new processes or new integral products, such as "faceplace," a batteryless film used in photo booths, and "autofilm," a commercial product designed for use with computer terminals. Some machines were also converted to produce Spectra film and integral film with a capless cartridge.

Polaroid's analysis of non-scheduled time assumed that machine downtime for making products other than integral film would have been deferred or eliminated entirely to make

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more time available for instant film production. Kodak claims that there is no reason to believe that Polaroid would have passed up the opportunity to develop its non-consumer film business in order to make more integral film. I agree. In fact, at the time autofilm was introduced in 1984, Polaroid was making a concerted effort to expand its commercial and industrial business, which by then generated forty percent of the company's revenues. Polaroid has also not accounted for any profits it earned on the sale of non-integral products. Faceplace was sold throughout the infringement period.

There is particularly strong disagreement about whether Polaroid would have put off the capless conversion of its integral film. This conversion would have molded the end cap, the flap which covered the opening of the film "box," into the film cartridge in order to prevent it from breaking off and ruining the camera. Moreover, end cap production problems were the number one cause of assembly machine downtime. The request for capital funds for the capless conversion also claimed that the molded end cap would improve the way the chemicals were distributed across the film when the pod was burst. The net associated cost savings from capless conversion was projected to be in the order of $900,000 per 100 million units.

Polaroid commenced the capless conversion process by a 1-A work order, a type of order reserved for emergency projects that allowed work to begin on a capital project without Board approval. When the project began in November 1978, film production was operating seven days a week and was still unable to keep up with demand for film. Polaroid was also building SX-70 cameras as fast as it could at this time. The capless conversion was eventually abandoned because the machines were a disappointment and did not perform as well as before the conversion.

Mr. George Fernald, the Polaroid fact witness who testified about machine operating parameters, stated that Polaroid would have shelved the capless conversion in the face of higher demand. Mr. Fernald's opinion, however, ignores the fact that Polaroid, at the time the conversion was attempted, already faced more demand than it could handle and, because of limited film production capacity, was considering limiting camera production. On cross-examination, Mr. Fernald did not recall what the demands were on the film division at that time. (TR 2812-17). Mr. McNamara incorporated Mr. Fernald's opinion in his analysis.

I believe Polaroid could not reasonably have avoided the capless conversion. While the change was not ultimately profitable, manufacturing problems were a leading cause of machine downtime and, when the cap did break off, it destroyed the consumer's camera. Perhaps, with hindsight, the conversion seems like the type of activity that could be eliminated in favor of more machine production hours but I do not believe Polaroid should be credited with 20/20 hindsight that shows today that the attempted conversion was futile. The capless conversion time could not have been used for additional production. Mr. Smith's analysis of the new products/conversion time is sound and I adopt it.

For these reasons, I find that Mr. Smith's opinion of the incremental capacity of Polaroid's in-place assembly machines is reasonable and credible and I adopt it as fact. In each year, Polaroid would have been able to produce some additional film without expanding its facilities consistent with Mr. Smith's findings as reported in Tab 2 of DF 61,300B. Polaroid, however, would not have been able to make 100% of Kodak's sales.

(b) *In-Place Capacity of Components*

Mr. Cook performed Kodak's analysis of the incremental in-place capacity of Polaroid's negative and positive sheet coating and battery operations. At the time of his retirement in 1986, Mr. Cook was a Vice-President of Eastman Kodak and the general manager of Kodak Park Division, the division of Kodak which manufactures all Kodak photographic film, paper, and chemicals. Mr. Cook was the assistant general manager of that division during the infringement period. In his early days at Kodak, Mr. Cook held positions of increasing responsibility in the Roll Coating Division which manufactured photographic film base.