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CREO INC.

Creo Inc. is a high tech company headquartered in Vancouver. They produce equipment for printing industry prepress operations. Though Creo has a reputation for quality and an ability to aid customers' throughput, Creo's finances are suffering because of an industry downturn. In addition, rapid technological changes need to be addressed.

Background

In 1968 Dan Gelbart graduated from Technion, Israel's top engineering school. After serving four years in the Israeli army he decided to leave the land his parents had come to after surviving the Holocaust some two decades earlier. Gelbart considered immigrating only to destinations that "were English-speaking, had a temperate climate and had no military draft." At the time, that left only three choices: Australia, New Zealand and Canada. Gelbart chose Canada because, he says, it was "beautiful and peaceful." He immigrated in 1973 (Olijnyk, 2002).

Gelbart began working at MacDonald Detweiler in Vancouver, British Columbia (BC). The company produced remote sensing equipment and ground stations for satellite systems. At that time Gelbart designed a film recorder for satellite imagery in his home laboratory. NASA later used the device to circulate pictures of the moon and Mars.

Fellow MacDonald Detweiler engineer, Ken Spencer joined with Gelbart to form Creo in 1983. They initially worked out of Gelbart's basement. Though the two intended to develop the world's first optical tape recorder (a device for storing vast amounts of data), Creo mostly helped engineer products for other companies. It was not until 1991 that Creo shipped its first optical recorders to the Canadian federal Ministry of Energy, Mines and Resources. The equipment, still used there today, was for storing satellite images. Though a technical success, the product had little market potential.

Gelbart decided to get some business help from a fellow Israeli Technion graduate: Amos Michelson. Michelson, an electrical engineer with a Stanford MBA, had worked Orbotech: a firm that was a reseller of Creo's film-imaging engine for the declining Printed Circuit Board industry. Michelson became Creo's vice-president of business strategy in 1991 and took over Spencer's job as CEO in 1995. It was Michelson who convinced Creo management to turn its focus on the prepress phase of printing. With over 200,000 companies and hundreds of billions in annual sales (all figures here are in US dollars), the printing business is one of the world's largest industries. (Creo's home North American market making up about 20% of the printers and over 40% of the world's sales.)

In 1993, RR Donnelley & Sons – at the time the world's largest printer – was looking for a company to develop a computer-to-plate (CTP) process capable of eliminating the film stage of printing. Creo delivered its first light based CTP image-setters in 1994. One year later, Creo introduced a thermal CTP process that allowed for higher resolution. The thermal imaging technology developed by Creo offered several key advantages to the prepress phase of printing. First, this technology significantly improved sharpness, since it countered problems associated with the use of conventional materials, such as soft edges. A second advantage of the technology – one that resulted in significant cost savings for users – was that thermal platesetters can operate in a daylight environment and do not need to be operated in a custom-built self-contained darkroom. Lastly, the thermal plates used high temperatures; this allowed for faster production since less sensitive coatings could be employed and this leads to plates that do not need chemical development.

In the late 1990's Creo undertook a number of steps to establish and maintain leadership in the prepress industry. In 1996, Creo formed a joint venture with press manufacturer Heidelberg that combined Creo's expertise with prepress 'digital front end' (DFE) and Heidelberg's leadership in presses. In the last years of the 1990s Creo developed *Prinerger* to allow better DFE workflows with use of Adobe *pdf* files. Starting at this time – and up to the present day – Creo has worked on the development of Direct Imaging (DI) technology (also known as Digital Offset Press or DOP technology). This technology could eliminate additional steps in the printing process.

As the new millennium began, Creo's stock went public on Nasdaq and it acquired the prepress business of one of its major competitors: Scitex. In an all-stock deal worth \$551 million, Scitex became a 27% owner in Creo. The deal also left Creo with a more extensive distribution system, a larger customer base and a broader range of products. Another consequence of the deal was that Creo severed its joint venture with press maker Heidelberg (because of Scitex's presence in the printer industry). As 2003 opened, Scitex's ownership share of Creo was down to 13%. At this point, Creo manufactured more than 300 products (See Table 1) and was "the world's largest independent supplier of digital prepress systems and other equipment and software for commercial printing, packaging and the newspaper businesses (Olijnyk, 2002: 56)."

Table 1: Creo Product Summary

Category	Major Products
CTP: 4 and 8 Page	Platesetters, loaders and conveyers.
CTP: Very large format	Platesetters, loaders, handlers, conveyers, carts, debris removal and cassettes.
Flexography	Flexography Thermal Plate and film imagers.
Printers	Print-on-demand digital printers.
Proofers	Inkjet & halftone digital proofer hardware and workstations.
Scanners & Cameras	Color and copy dot scanning systems and professional digital cameras.
Servers	Workstations & servers for color high-speed, print-on-demand digital printers.
Service Contracts	Service contracts for various hardware, software and conversions to CTP.
Workflow Management	Workstations, servers, memory, drives, disks, accessories & software.

Today, Creo's locations are all over the world including Japan, Israel, Europe, Australia and several locations across the United States. However, the company is still based out of Burnaby, BC, Canada. Creo has over 4,000 employees and 25,000 customers worldwide. Customers range from printing giants to small and mid-sized printers, with no customer providing more than 2% of total revenues.

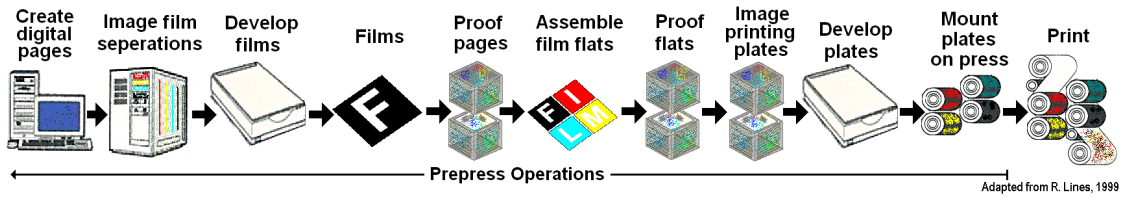
Creo faces a number of ongoing recruiting challenges at its head office location. These include general challenges of the high tech industry, like finding employees with the highly specific skills required, and additional challenges like the difficult economic conditions in the region in which it operates (e.g., an expensive housing market). A majority of Creo employees are recruited from the Vancouver (or BC's "lower mainland") region.

The Prepress Process

Prepress refers to all the steps related to preparing the master printing plate, before the actual printing process begins. In general, the process begins with the image the printer wishes to duplicate being copied onto film negatives. If the image is full color there are four separate filtered film negatives. These negatives are then used to produce master printing plates. The plates are then

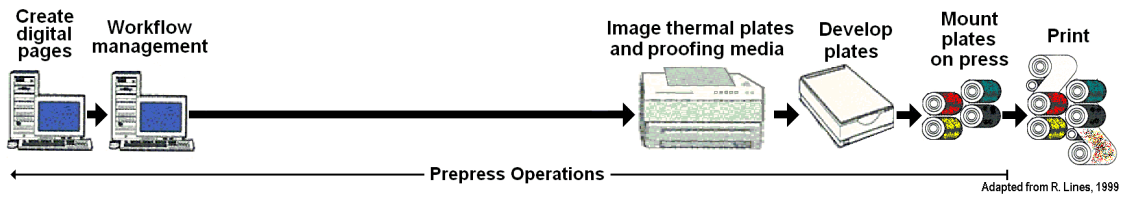
chemically developed. For offset printing, developing results in ink chemically adhering only to the desired parts of an aluminum or polyester plate; for flexographic printing the printing parts are raised on a flexible mat. (Flexography allows for printing on rough or flexible surfaces like corrugated cardboard or plastic bags. Flexography is less expensive than offset but is limited in image resolution and therefore print quality.) The plates – offset or flexographic – are then mounted on a press and aligned with one another (within 2 thousands of an inch) so that the colors (cyan, magenta, yellow and black for full color printing) line-up to make a recognizable image.

Figure 1: Prepress to Press Operations



Before the development of CTP, the existing significant method in prepress technology was computer to film (see Figure 1). Computer-to-Film (CTF) imagesetters employ large laser plotters to create films for the master printing plates. This technology is still available and continues to be common in some book printing and large newspaper applications.

Figure 2: Computer-to-Plate (CTP) Prepress Workflow



CTP processing allows printers to eliminate many of the steps involved in prepress operations (see Figure 2). The resulting process creates better, sharper, more consistent images, involving no need to buy and store negatives for plates. Thus, printers can produce better product, e.g., printers can produce more vibrant and accurate colors. One customer uses Creo equipment in the prepress operations for printing 1000s of different shades of colors for samples that must exactly match a paint color. The up-front cost for CTP may be higher but the supply cost (i.e., film) and storage cost overhead is reduced.

Figure 3: Digital Offset Printing Operations



While CTP offers the printer a reduction in prepress steps, the plates still have to be mounted on the press. The new Direct Imaging (DI) technology offers printers the ability to electronically send digital files straight to the press (see Figure 3). Thermal laser heads in the press create offset plates automatically mounted onto the press for printing. Thermal heads last years and can be refurbished. Because they are not used as frequently as off-press heads, on-press heads are expected to last longer than those on high-use CTP devices. DI presses have been designed so that plates can still be imaged off line or plates can be moved from those produced on another press if the thermal heads break down.

Down time between jobs run with DI is greatly reduced and jobs requiring as few as 500 copies become economical. A number of blank plates are held in some form of cartridge or magazine in the press so that a number of print jobs may be produced before additional plates need to be loaded. Major press manufacturers – Heidelberg, KBA (through its Karat joint venture with Scitex), Komori, and MAN Roland – all use Creo components for some DI entries. However, the large press manufacturers also support rival Presstek components as well (see Table 6 below, for details). The future standard is that some kind of reusable plate will be available so that waste and downtime between jobs is reduced because of reduced plate mounting time. Creo’s software *SQUAREspot* systems are designed to work with DI systems.

The Graphic Arts Industry

The graphic arts industry (which includes print) is among the top five industries in world and generates approximately \$371 billion in printing shipments annually. In the year 2000, sale of print products exceeded \$163 billion in the United States alone, with heavy domination by small and midsize businesses. It is estimated that only 17% of the worldwide market has shifted towards any form of digital printing technology. Therefore forecasts for the prepress systems are encouraging, with projections to surpass nine billion dollars annually (www.creo.com, 2002).

In recent years, the print segment of the industry has been strongly impacted by several key factors. First, is the rise of what has been called “on-demand” printing has created viable small volume producers. Essentially “on-demand” printing employs photocopying equipment supplied by such industry giants as Xerox and Cannon; this segment of the industry is characterized by production runs of between 100 and 5000 copies. Beyond 5000 copies, offset printing is more economical. Second, the advancement of desktop publishing has allowed for editing and production of single copies. The combination of inexpensive yet powerful computers and extensive software tools make for an environment that can easily handle text and graphics on a single page.

Along with more powerful computing hardware, a further factor impacting the industry is the Adobe *PostScript* language which aids desktop systems in creating an output that is compatible with other computer systems – that is, a wysiwyg (“*what you see is what you get*”) that works across computer platforms. These systems allow print customers to transfer digital files directly to the printer without the use of any physical copies. The systems can carry out a number of steps and help prepare the master printing plate for larger volume production runs. The combination of these factors has, in effect, redefined the prepress phase and who its customers are. Smaller operations can now survive economically.

In general terms, the industry also faces the ongoing debate as to the degree of impact that a paperless society would have on the viability of printing. Contributing factors like wider scale use of CD-ROMs and increasing access to online books, magazines and newspapers via the Internet, suggest that this the printing industry is a “sunset industry” (Portsmouth, 2000). However, president and chief technology officer of Creo products, Dan Gelbart, has a more optimistic view about the future of the industry. Gelbart suggests that “printing’s a growth industry, [and] paper production worldwide is increasing, so the outlook for the prepress system is very strong (Portsmouth, 2000: 29).”

The impact of the CTP technology on the industry has been extensive. As an early provider of a functional CTP solution, Creo has had a key role in shaping the prepress segment of the industry. The initial relationship between Creo and R.R. Donnelley (as the world’s largest publisher / printer at the time) was instrumental in forging the company reputation in the industry and allowed them to carve a place in this market. Today 60% of the CTP solutions installed in the North American market are Creo prepress systems. This is approximately five times greater than installations provided by its closest competitor (www.creo.com). Yet as of the year 2000, only about 5% of printing presses worldwide were using CTP technology. This suggests a large opportunity for future growth in the market (Portsmouth, 2000).

The Prepress Industry

A great deal of the potential competition in the prepress area is limited for a number of reasons. First, prepress purchases are complex (e.g., they include servers, workstations, software, and imaging devices). Purchasing different components from different companies can cause interface problems. A firm entering the prepress market has to convince a printer to replace its entire system, or that the interface problems do not exist. Second, learning means that customers do not want to change systems. For example, when *PostScript* was fairly new, Scitex designed a proprietary data format that ensured a reliable workflow. This workflow solution was successful, many printers were trained on the system, and it became easier for Scitex to sell a CTP device to these printers. It is much more difficult for another CTP vendor to convince the printer to learn another workflow, or that the competitor has successfully copied Scitex's format. Finally, the technical knowledge required to implement and perfect a CTP laser imaging system makes it difficult for new competitors to enter.

While Creo's move into CTP was at the urging of a very large printer – R.R. Donnelley – large accounts now make less than 10% of Creo's revenue. Though each of the world's eight largest publishers / printers (excluding those with significant telecommunications interests like AOL Time Warner) have over \$5 billion in revenue, together they account for less than 15% of the Graphic Arts market (see Table 2). However, even though the market is quite fragmented, larger accounts are still important. This is because large printers have the resources to easily facilitate entry of other competitors into the CTP market.

Table 2: Worlds Top 10 Publishers/Printers

Printer	Home Country	Revenue (\$ millions US)
Dai Nippon Printing Co. Ltd.	Japan	\$10,150
Toppan Printing Co. Ltd.	Japan	9,800
Quebecor Inc.	Canada	7,300
Gannett Co. Inc.	United States	6,350
Pearson PLC	United Kingdom	6,150
Thomson Corp	Canada	6,100
R.R. Donnelley & Sons Co.	United States	5,300
Tribune Co.	United States	5,250
Rexam PLC	United Kingdom	4,750
McGraw-Hill Cos. Inc.	United States	4,650

Source: Industryweek.com, 2002 (<http://www.industryweek.com/iwinprint/IW1000/2002/database/ResponseIWNNew.html>)

Suppliers to printing industry vendors and Creo include; piece part manufacturers, labor, and industry partners. The competitors within the printing industry are mostly global companies, and are located throughout the world. Consequently, Creo's suppliers are distinct from its competitor's suppliers, except in the very special instances of lasers and strategic industry partners.

Creo is one of the largest high tech manufacturers in the Vancouver area (the "lower mainland" of BC). As is the case for many of the industry's companies, suppliers are located locally and they produce custom metal, plastic and electrical parts and subassemblies. Creo has many qualified vendors, and has a policy of finding second sources for most of its product parts. However, worldwide there are only a few suppliers of laser diodes (the vast majority of which are made for Compact Disks) and all CTP makers source from this small group of suppliers.

Locating skilled employees with the technical know-how is difficult. While the weakness of the Canadian dollar is a major factor when recruiting from the US, the Canadian personal tax policy makes it difficult to attract talent from other areas in the world like Israel. Because of their importance in guidance

and defense systems, there is a cluster of optical technology companies in Israel. Because of the unrest in the Middle East, some of the workers in this industry may be available for moves to other countries.

Substitutes for Prepress Activities

The emergence of the desktop publishing industry combined with new, powerful and inexpensive computers and software create the possibility of small quality production runs. In addition, the Adobe *PostScript* language enabled desktop publishers to create the final four-color separations used to expose printing plates. This moved a number of the prepress stages away from the traditional printers.

Computer-to-Film (CTF) large format imagesetters create film negatives from *PostScript* files; the negatives are then used to create plates. CTF systems have been gradually replacing manual photographic manipulation of individual pages. Sales of equipment for manual photographic manipulation (e.g., film-stripping tables and vacuum pull down frames using contact film) have been declining at a rate of eleven percent per year (Lines, 1999). It is expected that CTP will eventually replace imagesetters, except in applications in which the same film is used multiple times to expose plates – such as in large newspaper and some book printing applications. While imagesetters still enjoy a large market, the growth in imagesetter film only averages 6% per year and is slowing (Lines, 1999).

Another substitute for CTP equipment is Direct Imaging (DI) or the Digital Offset Press (DOP) discussed earlier. In theory, the DI system writes directly on the plate cylinder, which, through the blanket cylinder, prints the paper. Ideally, the plate cylinder is then “erased” and new data is written on it for the next print job. As a practical matter, simply extending the life of consumables so that they last nearly as long as the plate cylinder would greatly aid workflows and reduce downtimes.

Other printing techniques include color, on-demand computer-to-paper printing equipment. For a variety of reasons these on-demand xerographic printing methods are effective only for very short run printing jobs. Substitutes for the entire printing industry are also of some concern. These substitutes include CD-ROMs, the Internet and personal printers. These segments are not candidates for CTP due to very small print runs.

General Conditions of Rivalry in the CTP Market

General conditions in the prepress market are related to demand and technological factors. On the demand side, “The advent of CTP has allowed the entry of new competitors into a [relatively] non-growing prepress market. This situation has produced intense rivalry that is causing consolidation and strategic alliances within the market. Today CTP products are differentiable, but the intense rivalry is driving competitors to eliminate these competitive advantages, producing a trend toward homogeneous product offerings (Lines, 1999: 35).”

Demand for print services also plays a role. Though CTP improves scheduling, efficiency and quality, printers will not invest while there is a downward trend in the market. The National Association for Printing Leadership (NAPL) studies such trends. Recently, more than 40% of those reporting to NAPL stated that their prices were lower than they were a year prior and that they had lower profitability. Only about 25% reported higher profits. In the third quarter of 2002 the NAPL *Printing Business Index* rose to over 50 for the first calendar quarter in eight quarters (since the third quarter of 2000). The 50 mark is where more printers report activity is picking up versus those who report activity is slowing down (NAPL, 2001; 2002). If this trend can be maintained printers may be in the market for equipment – provided interest rates for big-ticket items (like printing presses) remain low.

Technologically a significant industry trend has been the development of infra-red (IR) sensitive thermal film and plate materials. Thermal materials are sensitive to heat instead of light

and thus require exposure by a very high concentration of IR light. The advantages of thermal materials are that they do not require development, have high resolution, can be exposed to full daylight, and have very long shelf life. Thermal plates are, however priced higher than visible light plates. Creo was an early developer of high-resolution thermal exposure plates, though over the course of the last few years most other players have introduced thermal systems. In addition, DI development – as discussed elsewhere in this paper – is likely to have great impact on the forces impacting the industry.

Prepress Competitors

There are several key players in the industry. First are the four big press manufacturers (see Table 3). Creo’s prepress systems are designed to produce plate images that fit on these companies’ products. In addition, the companies sell prepress solutions that are either developed in-house, developed jointly with prepress solutions providers like Creo, or as dealers of prepress suppliers systems.

Table 3: The Big four Printing Press Manufactures

Company	Em- ployees	Assets (\$000,000)	Sales (\$000,000)	Profit¹ (\$000,000)	Market Share²	Comments
Heidelberg	25,000	5,800	5,000	200	45%	90% of sales from presses
Man Roland	10,500	1,800	2,000	50	19%	Backed by the Man Group
KBA Group	7,800	950	1,300	75	10%	CTF → newspaper presses
Komori	2,400	2,000 ³	850 ³	60 ³	8%	40% of sales to home market

¹ Income after interest & taxes. ² Market share figures are estimates derived from company reports. ³ \$1 = ¥120

The largest three producers are all from Germany. Heidelberg is the market leader and known for quality (so much so that in the 2002 Spielberg movie, *Catch Me If You Can*, forger Frank Abagnale, Jr. – played by Leonardo DiCaprio – is shown using Heidelberg presses to create perfect fake checks). Heidelberg has prepress products including scanners, workflow management, CTF, and CTP technologies. Man Roland, though far smaller than Heidelberg, offers complete print solutions, including prepress solutions. The company has the backing of its parent: the Man Group. The group is a substantial force with \$16 billion in sales and \$12 billion in Assets (at \$US1 to €1). As well, Man Roland has a DI system that does not require plates. Koenig & Bauer AG (KBA), in third position, focuses on the production of presses for newspaper printing (newspaper publishers are more likely to use CTF rather than CTP prepress systems).

The last of the big four is Japan’s Komori. In 2002 Komori developed the world’s first automatic plate changer for the larger 32 page offset web press. There are some smaller competitors worth noting because of their presence in the DI market. These competitors include Japan’s Sakurai (with about 300 employees) and the Czech Republic’s Adast (\$40 to \$50 million in sales).

Among the largest companies involved with the graphic arts industry are the big three film providers (see Table 4). Belgium’s Agfa, Japan’s Fuji Film, and America’s Kodak Polychrome Graphics (KPG) all provide what are called “prepress consumables.” These products include film, printing plates, processing chemicals, proofing materials, etc. The profit margin has been squeezed out of printing plates and consumable manufacturers have focused instead on differentiating their film products offered to other markets. While all three companies can bring substantial resources to bear on the competitive situation in the prepress industry there are reasons why they are unlikely to do so in the short run. Both Agfa and Kodak have had to throw resources into restructuring their operations. The costs of restructuring at Agfa ran the company about a half billion dollars. At Kodak, restructuring costs ran almost three-quarters of a billion dollars. Though Fuji Film is performing far better than Kodak, its “Document Solutions” area is principally concerned with photocopying through its Fuji/Xerox subsidiary and not offset printing.

Table 4: The Big three Prepress Consumables Providers

Company	Em- ployees	Assets (\$000,000)	Sales (\$000,000)	Prepress¹ (\$000,000)	Profit² (\$000,000)	Comments
Agfa	21,000	4,500	5,000	1,900	(250)	Scanners, image setters, plates
Fuji	72,500	25,000	20,000	2,000 ³	700	Document Area = Fuji/Xerox
Kodak	75,000	13,350	13,200	1,460	75	Broad range of products

¹ Sales ² Income after restructuring charges, interest & taxes. ³ Estimate based on R. Lines, 1999.

Creo's most relevant competitors are those providing prepress solutions. These companies include some of the firms mentioned above: most certainly Heidelberg, most of the press makers and Agfa, to a great extent Kodak, and to a large degree Fujifilm. In addition, to the main prepress competitors (see Table 5), a wide range of smaller specialized international competitors exists. Luscher of Switzerland, and an early CTP pioneer, Krause of Germany, specialize in very large format CTP production. Amazys, a Swiss company has become a color expert through mergers with Gerber, CSI, MacBeth and Gretag. About \$40 million of their \$85 million in sales come from color management solutions for the paints, plastics, textiles, inks, automobiles. About \$45 million of their sales deal with packaging to digital imaging, graphic arts, desktop publishing, and printing.

Table 5: Prepress Only Solution Providers

Company	Em- ployees	Assets (\$000,000)	Sales (\$000,000)	Profit² (\$000,000)	Comments
<i>Creo</i>	4,000	500	540	(24)	<i>Discussed further later in the report</i>
Screen	4,400	2,000	1,450	(160)	Graphic Arts are only 25% of sales
Esko	1,100	250 ¹	250	N/A ³	Backed by Kirkbi (LEGO's owners)
Presstek	150	105	100	(4)	Developed DI with several press makers

¹ Estimated

² Income after restructuring charges, interest & taxes.

³ Privately held

Dainippon Screen or **Screen** is principally a manufacturer of electronic equipment and components. About 75% of Screen's sales are from communications and IT-related market production equipment. Their products have such esoteric descriptions as: coater/developers, single bath cleaning systems and spin scrubbers for 300-mm semiconductor wafers; production equipment for flat panel display and small liquid crystal displays for mobile phones and personal digital assistants; printed circuit board production equipment; and cathode-ray tube masks. Because the production technologies are related, the remaining 25% of sales (about \$350 million US) is related to the graphic arts industry and CTP technology.

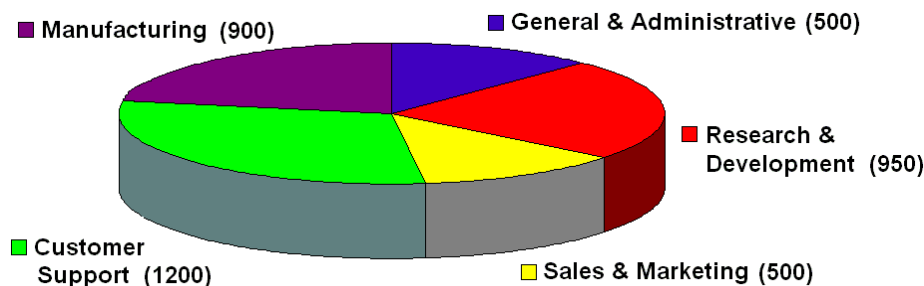
Esko-Graphics is headquartered in Gent, Belgium. It was formed when Kirkbi A/S – a Danish investment company owned by the Christiansen family (the folks who own LEGO) – formed the company by merging Belgium's Barco Graphics NV and Denmark's Purup-Eskofot A/S. Esko claims to have one of the widest product ranges in the industry. They have offset CTP solutions for the commercial printing market and CTP devices for polyester printing plates in the quick prepress segment. In the packaging markets – where Esko plans to focus – the company claims world leadership on integrated software solutions for graphic and structural design and workflow. As well, Esko has a strong position in copydot scanners and filmsetters.

Presstek, an American company, expects its sales to triple to \$300 million in the next three years on the strength of its DI technologies. In the past, Presstek dealt with mostly producing plates. The arrival of DI systems has created an opportunity for the company to move into on-press imaging. Presstek is aggressively exploiting this opportunity. On-press Presstek imaging heads and plates replace much of the CTP hardware of the recent past. (Presstek hardware is designed to work with most other graphics and workflow software components.) Heidelberg, KBA, Ryobi, Sakurai and Xerox have installed Presstek technology on DI press systems marketed. As well, Presstek also produces its own laser components, including semiconductor diode lasers, integrating lasers, laser drivers, digital electronics, and motion controllers for adaptable to CTP or on-press direct imaging systems.

Creo

Creo's corporate philosophy is as follows: "Creo is a place where strong values and solid management philosophies hold true. Our goal is to provide highly valuable and innovative solutions to help make our customers successful. We also wish to be known as an excellent place to work and a great company with which to do business (www.creo.com, 2003)."

Figure 4: Employees by Functions



Source: Creo Annual Report, 2002

Approximately 40% of Creo's 4050 employees are involved in interactions with customers either through support functions or sales. In order to co-ordinate the actions of these individuals the company espouses "The Creo Way:"

"At Creo we try...to minimize bureaucracy; to give everyone the authority and responsibility to do their job in the best way they can. Quickly reacting to market changes and customer's needs requires everyone to understand what is happening and to make effective decisions as close as possible to the action. (Lines, 1999: 63)"

To aid in implementing these values and maintaining the innovative nature of the company is its decentralized structure, use of self managed teams and open access to information. Creo focuses on creating a work environment that is both relaxed and rewarding. The company also provides opportunities for the ongoing training of its employees to ensure that employees have the skills necessary to perform their jobs well. While the company is accommodating enough to encourage self-scheduling of work time, they are also pragmatic enough to make sure that employees understand the economic goals of the organization. Creo management endeavors to ensure that there is a fairly broad company-wide understanding of the concepts revenue, cost, profit, and net present value. Almost all business decisions from R&D projects to relatively small purchases are made with some form of pay back-analysis (Lines, 1999). In support of these efforts the company maintains a stock option plan based on employee contributions to the company, not position or salary. Thus, the employees, as owners, have incentive to pursue the economic goals of the company. Most employees own a significant amount of options or stock in the company.

In addition, Creo employees conduct peer evaluations for team members with whom they directly work. This performance assessment focuses on progress in terms of job responsibility and salary levels. This practice is strongly supported by management and seen as an important mechanism for sustaining growth and maintained good talent in the company (MacNeil, 1999). Moreover, Creo is also highly recognized in British Columbia, where it maintains one of its largest offices, as one of the best companies to work for in the province. The company also enjoys an employee turn rate far below the industry average (MacNeil, 1999).

Creo was started as a small engineering company and engineering still has a lead role in the company – many of the top management team have engineering backgrounds. As the company grew, it simply added the functional groups of manufacturing, sales, and service to its engineering function. By 1998 the functional structure had become inappropriate. Creo was supporting too many products, and communication problems, along with a lack of focus, were beginning to create product implementation problems. Deadlines were being missed and product introductions delayed. In 1999 Creo reorganized into a product groups matrixed with process and infrastructure groups (Lines, 1999).

Creo's products are used in producing direct mail, catalogues, packaging, and books. Many of today's largest magazine publications – including Time, Newsweek, National Geographic and Sports Illustrated – are also created using Creo printing technology (MacNeil, 1999). The company continues to offer innovative printing solutions, and remains a global leader in the graphic arts industry. In fact, the Printing Industries of America (PIA), who have held Premier Print Awards annually since 1950, recently provided evidence as to the quality of Creo's products. The PIA awards honor excellence in design and quality printing. Competition for the awards is the largest and most prestigious one in the printing industry: the 2002 competition attracted 4800 entries from 725 printers in 15 countries. While the Academy Awards has the *Oscar*, PIA has the *Benny*. The Benny, or Benjamin Franklin / Best of Category Award, is the most sought-after distinction in the industry. Nearly two-thirds of the winners of the 2002 Bennys were Creo customers (Creo 2002 *Annual Report*).

Financially, while Creo has a half-billion dollars in sales, industry conditions over the last two years have made profitability difficult. Creo has trimmed its work force by 5% over the last year or so. In 2001, Creo also suffered a loss of \$414.8 million– almost all of which stemmed from write-downs related to the Scitex purchase. In 2002, the company's revenues were down by almost 20% from a year earlier. Creo's 2002 loss of \$24 million puts it behind all leading press makers (Heidelberg, Man Roland, KBA, and Komori) and prepress competitor Presstek (who lost \$4 million). On the other hand, Creo fared better than prepress rival Screen who lost \$160 million. In the final fiscal quarter of 2002 Creo did turn a profit of \$580,000. While Creo has negative Retained Earnings of over \$400 million, there are indicators of underlying financial health in the balance sheet – see Appendix 1A. Other financial details are included in Appendix 1B.

Research and Development was Creo's foundation and is consistently its strength. Innovation at Creo is intense with over 600 patents in place and new patents under issue almost weekly. With extensive research operations in a wide range of areas, including plateless digital offset printing (DI) technology, the objective of the company remains providing functional operational solutions to printers (www.creo.com). The company retains one of the largest research and development teams in the graphic arts industry. In the year 2002, approximately one fourth of Creo's 4,050-employee workforce was dedicated towards research and development efforts (see figure 4). Moreover, Creo's strength in research and development has allowed the company to develop a core expertise in thermal CPT technology and to take vital role in revolutionizing this industry.

Partnerships are very prevalent within the printing industry. In particular, CTP vendors partner with media vendors. This allows a 'bundled' deal to be offered to the customer. Creo has a partnerships with all the largest press makers for their DI entries: Heidelberg's *Speedmaster 74 DI*, Komori's *Project D*, MAN Roland's *DICOWeb*, and KBA's *Karat Digital*. Creo has a partnership

with Kodak Polychrome Graphics (KPG), for distribution of platesetters to the European newspaper industry and with NEC Engineering in Tokyo to develop CTP thermal imaging devices for the Japanese newspaper industry. In general, both Creo and each partner contribute irreplaceable parts of the market solution.

The Future of the Industry and Creo

As Computer to Film (CTF) began to replace traditional methods, late adopters embraced the latest technology: Computer to Plate. CTP is where Creo made its name. Manual systems users, some CTF, and all CTP users are likely to eventually move to DI. DI systems that use plates are likely to continue to be used for longer press runs. For shorter runs (less than 30,000 impressions), reusable plates or film are likely to become standard.

Table 6: Digital Offset Press / Direct Imaging Systems

Imaging System	Manufacturer	Media	IPH²	
Presstek <i>PEARL</i>	Adast 705C DI ¹	Presstek <i>PEARLdry</i>	10,000	
	Heidelberg <i>Quickmaster</i> DI 46-4	Presstek <i>PEARLdry</i> Plus	10,000	
	<i>ProFire</i>	KBA <i>Karat</i> 46	Presstek <i>PEARLdry</i>	7,000
		Ryobi 3404DI ¹	Presstek <i>PEARLdry</i> Plus	7,000
		Sakurai <i>Oliver</i> 474EPII DI	Presstek <i>PEARLgold</i> & Others	13,000
Screen 633-nm diode	Screen <i>TruePress</i> 544	Mitsubishi Silver <i>Digiplate</i>	3,200	
	Screen <i>TruePress</i> 742 & 744	Mitsubishi Silver <i>Digiplate</i>	8,000	
Creo Laser diodes	KBA <i>Karat</i> 74	Presstek <i>PEARLdry</i>	15,000	
	<i>SQUAREspot</i>	Heidelberg <i>Speedmaster</i> 74 DI	Most thermal CTP plates	15,000
		Komori <i>Project D</i> (40")	A variety of plate materials	16,000
		MAN Roland <i>DICOWeb</i>	Erasable rolled thermotransfer ribbon	20,000

¹ Also sold as part of Xerox Docucolor Series ² Images Per Hour Source: Oller, S. & A. K. McLean. (2002).

Presstek and Creo are the main providers of DI technology to press makers (see Table 6). Presstek products are featured on two-thirds of the DI press models widely marketed today. In fact, even the KBA Karat 74 press – which uses Creo laser diodes for plate making – employs Presstek plates. Half of Creo’s DI presses (shown in gray in Table 6) are new product introductions that are just past being experimental. In fact, Creo’s current DI technology is featured on only about 30 installed presses in the U.S. On the other hand, Presstek technology powers nearly 1,000 installed KBA, Heidelberg, Ryobi, Adast and Sakurai presses in operation in the US.

There are differences in how the two companies position their DI entries. Presstek’s *ProFire* laser-imaging system integrates lasers, drivers, electronics and motion control into a single package that accommodate a wide range of printing applications. In addition one of Presstek’s goals is to expand the usability of its process-free thermal CTP plates. Creo’s DI thermal-imaging technology – *SQUAREspot* – drives Heidelberg, Komori and MAN Roland DI systems. *SQUAREspot* can achieve an optical resolution of 10,000 dpi (this is three times better than the next best system) and can be integrated into conventional offset presses and allows for a wide range of standard inks and papers.

While installation of Creo hardware in DI systems has lagged behind Presstek, the company is working at advancing the limits of the technology. In June 2001 Creo worked with MAN Roland, to bring on-line its web press installation in Germany at the publishing company Nussbaum Medien. Nussbaum, headquartered near Stuttgart, produces official bulletins and notifications for about 250 municipalities and local authorities in production runs from about 500 to 30,000 copies. The *DICOWeb* press allows imaging, erasing and re-imaging directly to a plate-like cylinder. The technology uses Creo's on-press thermal imaging head to image a thermotransfer tape. A recent *American Printer* article (Oller & McLean, 2002: 25) describes the key attributes of the process as follows:

“Resembling a videotape cassette, the tape consists of a thermotransfer layer on a thin carrier film. The transferred image is heated to give the ink-receptive substance durability... Imaging may take as little as two minutes, depending on format. After the press run, the ink and thermotransfer material are wiped off, making the form cylinder ready for the next job. The recommended run length for the DICOWeb is between 1,000 and 30,000 impressions, making it suitable for short-run color applications.”

Creo's plateless DI technology, however, will not be widely available for a few years. This is because of the fact that the technology needs to be tightly integrated into the press, and press development times can be lengthy. In the meantime, Creo is still actively making strategic moves.

In late 2002, Creo purchased ScenicSoft, a privately held company located near Seattle, WA. Creo acquired 100% of ScenicSoft for approximately \$9.5 million in a combination of cash, convertible notes and assumption of liabilities. ScenicSoft's production planning software is touted as a natural complement to Creo's range of products. ScenicSoft's *UpFront* product will help Creo to automate print production at every stage of customers' prepress, press, and postpress processes.

Partnerships were also a big part of Creo's plans. In late 2002, Xerox agreed to purchase Creo *Spire* color servers for sale with current and future Xerox high-end digital production presses / photocopiers – in particular the *DocuColor iGen3*. Thus proving Creo's computer related products are not only for the offset press industry. In early 2003, Creo partnered with GretagMacbeth, to ship GretagMacbeth's award-winning *Eye-One Pro* spectrophotometer with Creo's *Profile Wizard*. The move gives Creo equipment some of the best color matching possible.

Internationally, Creo and Brazil prepress dealer AlphaPrint were honored in early 2003 with the “Premio Graphprint” award for the most reputable graphic arts supplier in Brazil. Creo is one of the largest CTP suppliers in Brazil. Creo systems comprise nearly half the total number of CTP installations in Brazil.

In addition to these moves, Creo needs to decide what course of action to take to insure that it can complete its mission, restore and maintain profitability, and insure that the company keeps pace with the technological changes in the industry. A first step would be to strategically analyze the general and industry environment as well as the current situation at Creo – giving consideration to the organization's resources, capabilities, and core competencies. Studying Creo's strengths, weaknesses, opportunities and threats would then aid in developing some alternative courses of action, evaluating the alternatives and making solid recommendations for the future.

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Appendix 1A: Creo Inc. Consolidated Balance Sheets for the Years Ended 9-30-01 and 9-30-02

(In thousands of U.S. dollars)	Year End 9-30-02	Year End 9-30-01
Assets		
Current assets		
Cash and cash equivalents	\$ 70,671	\$ 60,241
Accounts receivable	117,989	140,551
Other receivables	30,974	27,041
Inventories	91,799	99,438
Income taxes receivable	5,073	-
Future income taxes	16,919	11,034
Total Current assets	<u>333,425</u>	<u>338,305</u>
Investments	11,625	-
Capital assets, net	109,939	111,768
Goodwill & other intangible assets, net	3,971	-
Other assets	20,161	24,005
Future income taxes	16,084	13,629
Total Assets	<u>\$ 495,205</u>	<u>\$ 487,707</u>
Liabilities		
Current liabilities		
Short-term debt	\$ 16,440	\$ 19,298
Accounts payable	59,682	60,707
Accrued and other liabilities	61,549	54,928
Income taxes payable	-	2,286
Deferred revenue and credits	53,441	48,067
Future income taxes	1,200	1,200
Total Current Liabilities	<u>192,312</u>	<u>186,486</u>
Long-term liability	14,136	-
Future income taxes	4,812	2,556
Total Liabilities	<u>211,260</u>	<u>189,042</u>
Shareholders' Equity		
Share capital	696,193	691,955
Contributed surplus	2,060	2,060
Cumulative translation adjustment	4,425	(919)
Retained earnings (deficit)	(418,733)	(394,431)
Total shareholders' equity	<u>283,945</u>	<u>298,665</u>
Total Liabilities & shareholders' equity	<u>\$ 495,205</u>	<u>\$ 487,707</u>

Appendix 1B: Creo Inc. Income Statement and Statement of Retained Earnings for the
Years Ended 9-30-01 and 9-30-02

(In thousands of U.S. dollars)	<u>Year End</u> <u>9-30-02</u>	<u>Year End</u> <u>9-30-01</u>
Revenue:		
Product	\$ 336,329	\$ 447,241
Service	158,986	161,753
Consumables	44,537	47,533
Total Gross Revenue	<u>539,852</u>	<u>656,527</u>
Cost of sales	<u>306,581</u>	<u>378,176</u>
Gross Margin	<u>233,271</u>	<u>278,351</u>
Expenses:		
Research and development, net	73,378	79,048
Sales and marketing	97,893	101,632
General and administration	67,259	82,134
Other expense (income)	(5,397)	258
Restructuring	8,376	4,081
Operating income (loss) before undernoted items	<u>(8,238)</u>	<u>11,198</u>
Business integration costs	764	13,150
Goodwill and other intangible assets amortization	309	74,314
Write-off of goodwill, other intangible assets & investments *	-	336,170
Royalty arrangement	15,530	-
Earnings (loss) before income taxes	<u>(24,841)</u>	<u>(412,436)</u>
Income tax expense (recovery)	(2,680)	2,319
Equity loss	2,141	-
Net income (loss)	<u><u>\$ (24,302)</u></u>	<u><u>\$ (414,755)</u></u>
Income (loss) per common share		
- Basic and Diluted, Canadian GAAP	<u><u>\$ (0.49)</u></u>	<u><u>\$ (8.56)</u></u>
- Basic and Diluted, U.S. GAAP	<u><u>\$ (0.74)</u></u>	<u><u>\$ (8.76)</u></u>
Retained earnings (deficit), beginning of period	\$ (394,431)	\$ 20,324
Net income (loss)	<u>(24,302)</u>	<u>(414,755)</u>
Deficit, end of period	<u><u>\$ (418,733)</u></u>	<u><u>\$ (394,431)</u></u>

* 2001 Write-off of Goodwill remaining from the Scitex purchase.