Pictures and Parts: Delivering an Automated Automotive Parts Catalog

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This case study reviews the experiences of Bell & Howell's Publication Systems Division (PSD) from the late 1970s until the present in successfully developing an automated parts catalog lookup system. * It examines the transformation of a microfiche publishing service business in applying new and unique electronic technology to meet its customers' information retrieval requirements.

The case also illustrates the critical success factors of continued and intense focus on customer needs; application of new technology to meet customer needs; persistence in spite of failures of several products; the necessity of active, ongoing corporate support; and, finally, strong project and program management of new technology for PSD.

EARLY HISTORY

One of the world's largest micropublishers, PSD converts thousands of catalogs, manuals, and price lists to microfiche. Organizations responsible for high-volume communications with hundreds of dealerships, branches, and field-support facilities often rely on micropublishing to reduce communications to a manageable size and to controllable costs. By dramatically reducing printing and mailing costs, micropublishing enables large documents to be economically distributed frequently, providing dealers and service operations with more current information. Producing more than 10 million

* Prior to March 11, 1985, the name of the Publication Systems Division was the Micro Photo Division. For purposes of this case study the Division will be referred to as PSD.

microfiche a month—the equivalent of 2.5 billion pages of printed information—PSD's business mission is to continue as the market share and quality leader of technical document republishing.

Parts Catalogs and Service Manuals

Most manufacturers of vehicles and heavy equipment use a mix of paper and microform documentation to support their own or their dealers' repair and parts businesses. Documentation is essential to parts sales and customer satisfaction. Parts sales top $1 billion annually for several automakers, and for many farm equipment dealers, parts and service revenues exceed new product sales.

One set of parts catalogs for General Motors cars requires 16 feet of shelf space and larger dealers may subscribe to 10 or more sets. Each set consists of more than 20,000 pages of illustrations, 15,000 pages of charts, and nearly one-half gigabyte of ASCII text (filling additional tens of thousands of pages). Larger data bases are common—the parts catalogs for Caterpillar contain nearly five times as much documentation.

New editions of a parts catalog are published, on average, every four months and mailed to the dealership. In paper form catalog distribution (mailing) costs are substantial. Between editions, corrections and other changes are sent as bulletins, and the number of bulletins can be very large.

Manufacturers choose to publish their parts catalogs on microfiche rather than paper mainly to save costs. End-users' attitudes range from neutrality to dislike of microfiche as compared with paper (owing to legibility and convenience factors).

The Creation of Parts Catalogs

The process of creating new parts catalog editions evolved simultaneously with data processing. By the early 1970s computerized photocomposition for parts catalogs was popular. Changes to the text were identified and entered for each individual catalog; then photocomposition tapes were written which, in turn, were used to print the catalog. In this form, microfiche versions of the catalog could be produced directly, but the relationships between data elements necessary for an "electronic parts catalog" did not exist.

As data processing techniques for relational data base management spread to publishing in the mid and late 1970s, a parts catalog data base became an important way of lessening the time and labor content required to update a set of catalogs, as well as a way of improving accuracy and consistency. The basic data base element is the parts record containing all applications of the part across all catalogs. A part change or addition, although affecting many catalogs, had to be entered only once. Essential to a commercially

viable electronic parts catalog, the existence of a parts catalog data base is referred to as an "automated" catalog.

The processes of creating a publication edition are known as "prepress" activities because they are the steps taken before the printing press makes copies or the micropublisher (such as PSD) generates copies on microform.

Micropublishing Processing

The data processing for parts catalogs is very different from typical management information system operations. Data bases typically contain 100 to 500 megabytes of ASCII data. The data base also includes thousands or tens of thousands of images—a data type foreign to nearly all data processing operations. Even the control and format encoding of text is different—" photocomposition" files have their own unique rules.

Text data are received on reels of standard 1/2-inch, 9-track magnetic tape. The text data are reformatted, resequenced, and indexed. Art is received in three forms: paper, raster data on magnetic tape, and vector data on magnetic tape. Paper copies are photographed, and image data records from magnetic tape are scaled and sequenced. The art and text are then combined and fiche masters are produced. Masters are then used to produce duplicate fiche for distribution. Silver halide-based film duplicating is capital intensive, whereas diazo and vesicular film duplicating are not.

In the 1970s PSD was regarded as the "Cadillac" of micropublishing service bureaus in terms of product quality, service, and indexing. PSD was one of the few service bureaus to use all three microfilm technologies (vesicular, diazo, and silver) to meet customers' technical documentation duplicating needs. Recognized as the best technical document micropublisher, PSD had acquired a substantial market share. Its customers were primarily automobile, construction, agricultural, and computer equipment manufacturers.

The 1632 Project—GM I

In the mid-1970s, through the efforts of Bell & Howell's Document Management Products Division (DMPD), PSD became aware of GM's desire to improve parts catalog lookups. GM was interested in improving its automobile dealerships' ability to retrieve parts catalog information.

John Marken, the division president at the time, recalls:

> The general sales manager at GM wanted a fast automatic frame selection microfilm system. When we learned about the situation from DMPD, a competitor was far ahead of us. They had already proposed a cartridge microfilm system. Dick Miller,*

* Dick Miller, past president of DMPD, started Bell & Howell's parts catalog micropublishing business (when it was part of DMPD) in the 1960s and was well known to GM.

> from DMPD, did some superb selling to slow down the process and provide us with time to develop a concept. In 1976 the GM 1632 project was assigned to PSD from DMPD. We proposed to GM management that we would introduce more automation. We would use a "roll" of microfiche, for the entire GM parts catalog, giving them more information, and a way to get to the image faster than with a multitude of microfilm cartridges. We convinced them of the concept. We built 125 units and did a field test. The result was favorable.

In 1978 the 1632 rollfiche reader concept was presented to GM's Dealer Council in Brownsville, Texas. John Marken remembers dealers' reactions as, "Can't you automate this more? We want to access the information immediately. It wasn't that they were against microfilm—it was just that they wanted even more automation."

In an effort related to the 1632 program, GM planned to create an automated parts catalog database. PSD was awarded a $1 million contract to design the automated parts catalog data base for GM. The project was completed successfully and it generated a small profit.

A meeting was held in 1980 between GM and PSD in Flint, Michigan, to conclude the negotiations for the 1632 rollfiche reader project. At that meeting, GM's management told PSD management that the automotive industry had suffered a serious decline and that no more contracts could be signed. Those close to the project noted that technical problems with the 1632 and the fact that it did not meet users' needs were as critical as the recession to the program's cancellation. Write-offs on the program's cancellation totaled $3 million and total program losses exceeded $5 million. In addition to this, during the early 1980s several events occurred that had a serious impact on PSD's business.

Silver Crisis

The first shock to current business practices was the silver crisis. Silver was the predominant film for parts catalog microfiche systems. Owing to its higher quality, silver fiche could be left on a microfiche reader for extended periods of time with no deterioration. When silver prices soared, PSD's silver film business was dramatically affected. As the prices of silver kept rising, so did silver film prices. The price of silver in August 1979 was $10 per ounce. By December 1979 it had risen to $34 per ounce and reached an all-time high of more than $50 per ounce by January 1980. John Marken recalls, "the silver crisis drove us and our customers to diazo film."

Dave Gump, who was then general manager, remembers, "The profit margin on silver was higher, and we had few competitors in silver microfiche. The profit margins went down significantly with the switch to diazo film."

Don Prince, who is now vice president of operations, was production manager at the time, and notes that with the switch from silver to diazo:

Many companies saw ours as an attractive business and for relatively small capital investments were able to start small diazo microfilm businesses. That's not to say that they could compete with us in terms of our copy preparation and film expertise, but these smaller companies were capable of nibbling away at our business.

The result was that the microfiche service bureau business began to deteriorate into a commodity business.

Search for High Tech

Don Gardner, application development manager, recalls that during this period, a second factor began affecting PSD's business:

> Our customers were increasing the sophistication of their publishing. Industry was waiting anxiously for the birth of office automation. The panacea of the future was in a black box—new tech was coming and our customers believed it was going to make our microfilm outdated. This was making our business extremely difficult. We tried to prepare to meet the technological opportunity.

As Dave Gump recalls, "the business was experiencing declining margins—we were the only source of new business for our competitors. The company had to find a way to change the product or expand the business."

In April 1981 PSD ventured into prepress services by acquiring DDSI, which offered high-speed plotting of computer-generated illustrations, highspeed typesetting, and data base publishing services. PSD's goal was to vertically integrate its publishing services by moving upstream into processes done before micropublishing. Dave Gump's comments on the DDSI acquisition:

> Automated technical publishing (ATP) was a very complex business. Our microfiche customers wanted in-house capability, not a service bureau. We thought the Department of Defense would be an excellent market for ATP. As we found out, there was no incentive for DOD contractors to reduce their labor since they were cost-plus. In September 1982 we closed the California office (losses totaled $800,000) and brought ATP back to our Wooster, Ohio, facility. We are still selling ATP services.
>
> Included in the acquisition was a very high resolution photocomposition system that output paper and microfilm. To utilize the equipment, we learned to create programs to handle customers' photocomposition files (before this, with the exception of GM's photocomp files for the 1632 program, PSD processed only standard data processing files). We became much better at talking with publishing departments. This equipment made a new venture with GM possible.

A FRESH START

Microfiche Catalog—GM II

In February 1981, PSD started development of a standard 105-mm microfiche parts-catalog system designed for small-to-medium-sized GM dealer

ships. In 1982, PSD secured a contractual arrangement with GM for the microfiche parts catalog program, because of the savings to GM in switching from paper to fiche—the traditional microfilm benefits. Don Gardner explains:

> We were able to design some user-oriented indices to make it acceptable. Our system design approach has made us unique in this marketplace. We didn't just sell microfiche, we designed information retrieval systems. We even designed and redesigned fiche readers to meet the applications.

The microfiche program was presented to select GM dealerships in Houston in April 1982 (see Figure 1). These dealers indicated that the microfiche system was acceptable, but they strongly preferred an automated solution. They asked for "push button" access to the GM factory parts data; 67 percent said that they would wait for a more automated solution. But 25 percent were willing to switch to fiche from paper—enough for the program to proceed.

John Ramagli, then vice president of sales, recalls:

> In April of 1983, the first GM parts catalog microfiche publication went out to the field. We had reasonable support from the GM dealers. The GM Fiche Program is ongoing today with 1,500 to 2,000 of GM's 10,000 dealers. At the same time, however, GM's management was strongly urging us to do something else.

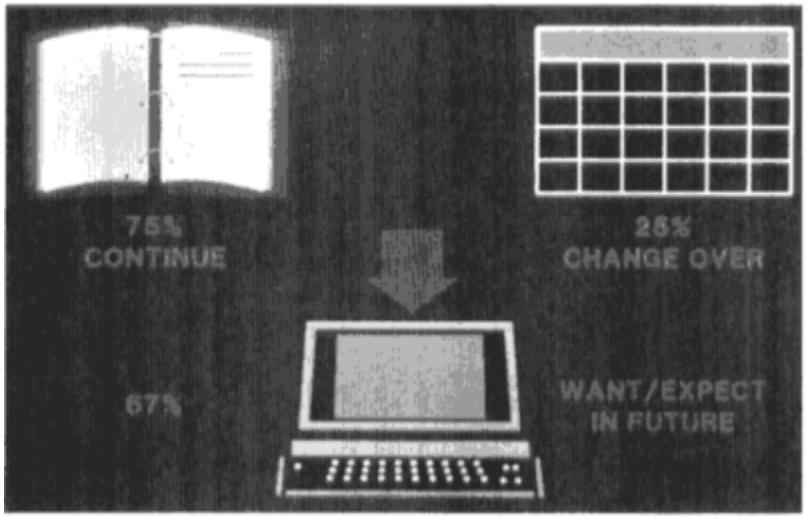

Figure 1 A 1982 presentation to GM dealerships yielded information about dealers' preferences on automation of catalog access.

A Hybrid Solution Pursued—GM III

By this time, PSD had made several attempts to improve its business. Acquisition of DDSI, increased marketing efforts directed at traditional business, and internal productivity incentive programs were all undertaken.

PSD's limited market had matured. New products to speed catalog access were seen as necessary to preserve the customer base and ensure growth. PSD marketing continued to hear parts catalog users demand "automated access." At the same time, PSD's customers were in various stages of automating their parts catalog data bases.

PSD marketing proposed development of a system that would use microfilm for graphics and a PC for text. A hybrid solution, using microfilm for parts illustrations, was proposed rather than an all electronic approach that the market seemed to be seeking because (1) no computer solution that had adequate storage space for all the parts catalog illustrations was available; and (2) the cost per image in microfilm was stunningly cheap compared to the alternatives.

John Marken remembers:

> The standard fiche program was very important in keeping the door open to future more automated solutions for the parts catalog. We kept talking with GM, updating them. Within PSD, John Ramagli developed an idea for a more automated system for GM dealers. The concept was to employ cartridges containing high-reduction images of parts illustrations printed on high-density 35-mm strips. The PC would assist in selecting the correct cartridge, strip and frame as well as providing access to text portions of the catalog.

The concept was presented in April 1983 at the annual Bell & Howell Technology Conference, an interdivisional forum to promote discussion of technology trends and to present new product concepts. John Marken remembers Donald Frey, the chairman of Bell & Howell, suggesting that PSD should pursue an all electronic solution because dealers would not accept a mixed microform/PC system. Dave Gump recalls that it was also at this conference that he first learned about low-cost compact disk read-only memory (CD-ROM) drives. At this point CD-ROM technology was evolving and interest in it was growing.

In response to PSD Marketing's desire to offer a more automated parts catalog system to GM dealers, Don Gardner became involved. He explained:

> In the summer of 1983 Dave Gump called me to discuss Marketing's proposal for a system to improve the productivity of our GM fiche users. In order to prove productivity improvement, I needed to know the current productivity. In July of 1983 we proposed that we would have a survey done. I hired an industrial engineer and designed the measurement methods and in September we proceeded with on-site studies of dealers in the truck/transportation, agricultural, heavy equipment, and automotive industries. The focus was on the parts department and particularly on

parts catalog lookups. We took into consideration the size of dealerships. We did time studies and analysis of their operations (including profit and loss and management records) to understand the parts business and its impact on the dealership (by industry).

The Electronic Parts Catalog (EPC) Concept—GM IV

The research verified a product need, but not PSD's product concept. Dealers would not realize sufficient benefits to justify a partially automated solution in which a cartridge microfilm reader driven by a PC was priced at $5,000 per workstation. The concept of PC-aided-retrieval of microfilm for parts catalogs would no longer be pursued—dealers insisted on a completely electronic system. The question became: could the likely price of an all electronic parts catalog (EPC) be supported?

Results from this initial study led Don Gardner to recommend that the best opportunity for developing an EPC was GM because (1) the automotive industry represented the best single market segment; (2) within the automotive industry, GM had the largest dealer network; (3) GM had an automated parts database that PSD had designed and implemented; and, (4) PSD had also implemented a catalog fiche system for GM (gaining experience in processing GM's photocomp tapes) and was already familiar with their parts lookup application.

In November 1983 Don Gardner began to concentrate application research on the GM parts catalogs at GM dealerships. Detailed data on their parts lookup activities were recorded. The research verified the need to automate the parts counterperson's catalog lookups.

However, from Don Gardner's research (completed in March 1984) it was determined that a parts counterperson uses the catalog in just under half of all transactions. Actual use of the catalog accounts for approximately 10 percent of a parts counterperson's day. Just over a third of parts catalog lookups involve the illustrations.

Dave Gump notes:

> Reducing the parts department's labor cost for catalog lookups was what we expected would provide the cost justification for an electronic catalog. But when Don discovered that only 10 percent of a parts counterman's time is spent using the catalog we almost killed the project—there could be no way to justify the product. But we also learned that 16 percent of the counterman's time was consumed in transcribing part numbers and entering them in the parts inventory system.

By interfacing an EPC with the parts inventory system nearly all the transcribing and key entry could be eliminated—possibly enough productivity improvement to justify purchasing the product. The design specification was modified to include a hardware interface to dealer computer systems and software to communicate with the parts inventory program.

GM Dealer Business Environment

At a dealership the parts business consists of three components: retail, wholesale, and service. The retail parts business is usually small. The wholesale business is the sale of parts to repair shops, garages, and other dealerships. The service business is parts consumption by the dealer's own service operation.

GM has 50 parts catalogs covering 1976–1987 model cars and light trucks. Each catalog is two catalogs in one: the white pages contain part name, part number, and usage data; the green pages have illustrations and references to the white pages. It generally takes 18 months for a parts counterperson to become proficient at using the parts catalogs. Experienced personnel frequently are very well compensated, but despite that, parts counter personnel turnover is high.

Parts lookup is complicated by the infrequency that individual catalogs are updated and the flood of loose corrections, notes, and bulletins that are received between new editions of the catalogs. The process of inserting the bulletins and finding the notes associated with particular parts often is too cumbersome to actually be done.

It is not unusual for a dealership to return to GM each year more than 5 percent of its ordered parts, usually owing to mistaken part numbers. GM offers a program of credits to encourage dealers to reduce returns.

Nearly half of all GM dealers have computerized inventory control systems, and most of the larger dealers have computerized inventory control, usually as part of a "dealer services" system sold by a data processing equipment value-added reseller. A value-added reseller typically combines industry-specific software it has developed with purchased hardware and sells the package directly to that industry.

The Challenge

PSD was confronted by a major task: to find a technical solution to automating the parts counterpersons' access to the GM parts catalogs in a manner producing sufficient economic payoff. From Don Gardner's research, the dealers had identified what they wanted in an automated system:

1. To access information in 1 second.
2. Illustrations and photographs to be clear and easy to see.
3. To integrate with existing dealer systems and be able to communicate text data to their currently installed inventory management systems.

PSD was determined to find a solution for GM. John Marken explains, "General Motors was the biggest company in our biggest market and they had the biggest data base. We could see the opportunity. We had to hold the focus on that one product."

At this point, the "beta" project team consisted of only Dave Gump and Don Gardner. Don Gardner recalls, "In 1984 we began a year of 'airplane research.'" They traveled around the country learning of the alternatives available in CRT technology, high-volume electronic storage, data base management software, and image scanning.

Dave Gump explains his strategy for acquiring technology:

> We didn't want to replicate what was already there. We wanted to use as many off-the-shelf components as were available. We were also interested in finding solutions to avoid sole source situations.

There were three initial technical issues facing the PSD "beta" project team: data volume, response time, and electronic image display quality. Each of these issues had to be resolved to design an effective electronic lookup system. GM parts catalogs were extremely large paper-based data bases. Each GM car line had several thousand illustrations and a similar number of charts. In addition, a large single car line requires approximately 100 megabytes of storage for text data.

Response time, the second technical issue, was affected by data volume and image resolution. Catalog users insisted on I-second access and display. Figure 2 shows the image data transfer time and the relationship between resolution in dots per inch (DPI) and the seconds to display. As shown, the higher the resolution, the greater the time for image display. Response time considerations excluded standard approaches to networking and data decompression.

The third technical issue, image display quality, centered on the counter-person's desire to see detailed illustration drawings and to easily identify the

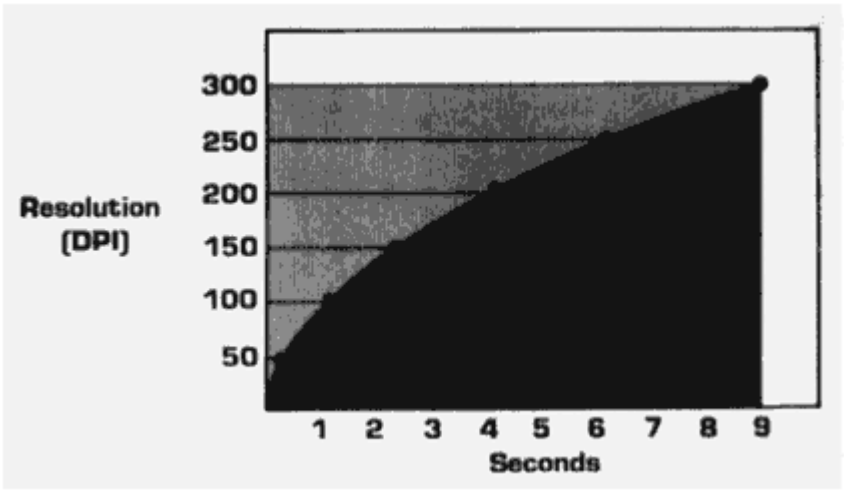

Figure 2 Image data transfer time versus resolution (via RS-232 link).

part call-out number without "pan and zoom." Many illustrations in GM parts catalogs contain very fine, complex detail. Also, because of PSD's expertise in designing microfiche retrieval systems for service applications, the project team was aware that service and repair documentation contained photographs with very small print describing repair procedures (see Figures 3 and 4).

Sources of Information

In search of a technical solution for the "beta" project, Dave Gump and Don Gardner began to investigate and evaluate the options available. They

Figure 3 Illustration from GM parts catalog.

carried sample graphics from one electronics company to another to be scanned and displayed. They experimented with a number of 200 dots-per-inch (bitonal) monitors, but the display quality was not acceptable. In early 1984 they met with a consultant affiliated with Massachusetts Institute of Technology (MIT), who was familiar with medical imaging and scanning systems and found a satisfactory gray-scale imaging and display system. Other technology decisions were made. The specific relational data base was selected. Evaluations and decisions on optical disk drives and high-capacity Winchester disk drives were made. Incorporating a touch screen was considered, and a source was selected.

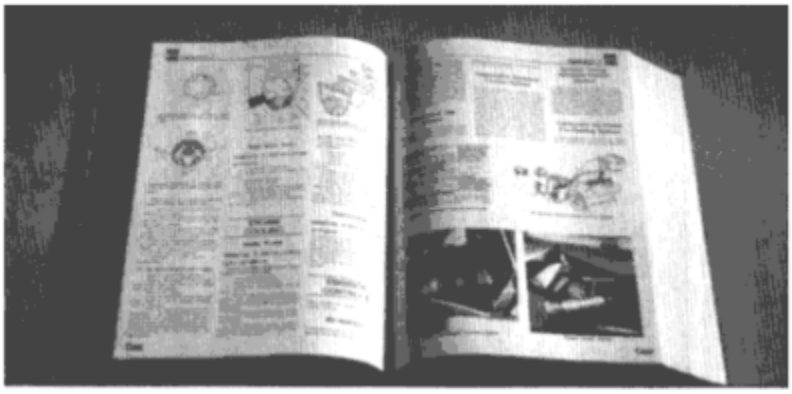

Figure 4 Photograph of service manual.

By the spring of 1984 the team had defined what to do. In April 1984 the project team presented its marketing and technical research along with its product concept at the annual Bell & Howell Technology Conference. It proposed building a prototype system. Subsequent discussions with senior management focused on optical disk as the medium of the future, and thus the direction for "beta" was set.

Dave Gump explains his thoughts on the importance of the Bell & Howell Technology Conferences:

> Not only did these conferences foster the sharing of technical research among the Bell & Howell divisions, they also provided annual reinforcement and corporate support for technological change. The conferences afforded us the opportunity to present new product concepts which could easily have been stifled.

Organization Structure

At the time, Dave Gump was vice president and general manager of PSD. Recognizing that the "beta" development program was going to be as de

manding as starting a new business, requiring full-time supervision, Dave recommended an organizational change that John Marken approved. In May 1984 Dave Gump became the vice president of development responsible for the program's research and development on a full-time basis.

Gray Scale

One key technology issue was image display quality and the decision to use gray scale. Dave Gump explains:

> We saw a demonstration that visually confirmed that gray scale solved our image quality problem at an affordable cost. Our contact at a Boston consulting firm explained that there was scientific support for gray scale and referred us to research being done at MIT. This reassured us we were following a reasonable path.
> Gray scale versus bitonal was an intense issue among the engineers in different divisions within Bell & Howell. To prove that gray scale was the correct approach to PSD's parts and service applications, we hired an outside consultant, Battelle Institute, to research this issue.
> Battelle confirmed that gray scale was the correct approach for our application.

Selection of gray scale (rather than bitonal image data) had the added advantage of requiring only half the storage because Image Data Base (IDB) used fewer lines of resolution. Despite these benefits and user preference for gray scale, opposition to gray scale continued from engineers in divisions that had adopted the facsimile (bitonal) standard for office imaging products.

Prototype Development

Don Gardner recalls the activities in 1984:

> Interspersed throughout 1984 were meetings with GM dealer managers. 1984 was not just a year of identifying hardware, it was a time to solidify the perception of the system . . . redefine how the product would function, try our ideas of what it could do, as well as listen to users' ideas on what they wanted, and then determine what hardware was needed.

The expected benefits and estimated value of the IDB were constantly being refined by market research. In addition to labor savings at the parts counter identified earlier, it became clear that another benefit expected from an electronic parts catalog was reduced part number errors. Error reductions were expected because transcription could be eliminated, information was more easily accessible, and publishing could become more frequent. As a result of fewer part number errors, customer satisfaction would be improved and restocking fees could be much lower. It was also believed that IDB's ease of use would reduce the lost time and productivity of new employees learning the GM parts catalog.

By July 1984 the PSD project team had developed a full proposal on the

costs to design and build a prototype system. In August 1984 this proposal was presented to the chairman on his annual visit. The funding necessary for prototype development was estimated to be $425,000. "How could dealers justify purchasing a $50,000 electronic catalog system if a $5,000 1632 reader could not be justified?" This was the central question posed by the chairman. An economic justification based on parts counter productivity gains, reduction in part order error rates, and enhanced customer satisfaction revealed that at $10,000 per workstation, the EPC was justifiable whereas the 1632 was not. The chairman agreed in principle, and remembers that throughout August, PSD management proceeded to push the proposal up through channels for funding approval "with acceptance at best neutral from outside the division."

On September 6, 1984, an outside consultant was contracted to develop the prototype. During the same time, the project team increased to five people. In response to the growing need for prototype hardware development to be carefully supervised, Dave Fehr was hired as manager of Systems Integration in October. Two application programmers were hired to begin the software design.

Throughout the fall and winter of 1984, Dave Fehr supervised "beta" prototype development, including design and coding of publishing software and workstation "retrieval" software. The software engineering effort benefited substantially from PSD's participation (1978–1979) in the development of GM parts catalog data base. The two "beta" programmers were assisted by the original data base designers. The "beta" publishing software was able to incorporate files and code from the 105-mm fiche publishing software for GM parts catalogs. Months of design, surprises, and redesign owing to complexities in the data were avoided as a result of experience from the 1632 and 105-mm fiche programs. By December the prototype system, consisting of a display workstation and scanning system, was up and running in the 1984 GM Cavalier parts catalog.

In January 1985 Don Gardner developed a slide presentation that explained how the system and parts lookup application would work, how it would be used, and what would be delivered. Don explains:

> We had our first monitor, and the first images displayed on the monitor were so good, I was really impressed. We had a photographer develop a series of slides of the display. We took our slide presentation to the GM dealers in Houston—the same dealers who back in 1982 had said they would wait for a fully automated system. We got absolute confirmation that functionally the system was going to do more for them than they had asked.

John Ramagli recalls:

> On February 28, 1985, the first people to see a demonstration of the parts catalog lookup application on the "beta" system were the managers from General Motors. We flew them from Detroit into Wooster to see the prototype.

At this point all we had on the system was the 1984 Cavalier parts catalog. We showed them a demo of the system. They loved it, and urged that PSD take it to pilot. (GM provided no funding nor even a commitment to allow PSD to publish the catalog data electronically on a commercial basis.)

In February and March, the prototype system was demonstrated to Chrysler and Ford. Chrysler showed a reasonable level of interest. Ford's interest was modest.

During June and July the prototype (with only the 1984 Cavalier) was demonstrated to GM dealers throughout the country. The PSD project team confirmed that they had a viable product and through research were able to establish their goals—a $10,000 workstation. In August PSD received funding for full development of the project. During the remainder of 1985 the production and software development team built the data base for three GM car lines: Chevrolet, Oldsmobile, and Light Truck. Marketing identified the activities that would be required to bring the product to market, and the "beta" product was named the Image Data Base 2000 (IDB2000). In addition to development activities on the GM parts catalog application, during 1985 research projects on GM dealers' service and repair procedures and Chrysler dealers' parts operations were started.

Field Tests

In January 1986 the IDB2000 prototype system was demonstrated at the National Automotive Dealers Association (NADA) trade show in the booth of a parts inventory system vendor specializing in very large "mega" dealers. PSD's Marketing team successfully solicited pilot dealerships and support from GM management. Several small companies demonstrated videodisk-based systems with sample pages from parts catalogs. The image quality was poor; vital reference numbers ("call outs") were illegible. Computerized microfilm systems for parts catalogs were shown by a major vendor of data processing systems to dealers and by others. The strongly positive reaction to IDB convinced PSD to further accelerate the IDB program.

In March PSD and GM management held a review meeting to discuss the criteria for a successful field test and the strategic implications of a good pilot program. Lustine, the largest GM parts dealership, and Hutton Chevrolet, the second largest, were selected to be part of the pilot program. GM requested that the pilot be expanded to include a medium-sized dealership, Bell Dean, and that a system also be installed at the GM Technical Center.

In April field tests of the IDB2000 parts catalog application began. The first field test location had only three workstations, and yet the users complained about the system's response time. Internal testing with many more workstations (large customers would need 15 to 25) revealed that communications completely bogged down in the CPU, largely because of the combined overhead and interaction of the network software, the relational data

base, and the operating system. It was a major setback. In June after much consideration, the PSD development team determined that IDB2000 design changes would be necessary. Dave Gump explains:

> The number of users that we had to support and the performance requirements indicated that it would require a very large computer. Our target price couldn't support that size computer. We chose to put the application into the user-level computer, eliminate the CPU, and switch to a network server for data base storage.

John Ramagli remembers his discussions with GM management about the design revision, which had been named the "Jade" project:

> It was a crisis. At this point we had growing concerns about the speed implications of using the MicroVAX II computer to run the application on a multi-user workstation system. I met with the director at General Motors to explain to him that our decision to design and build our own hardware would significantly reduce the cost and increase the performance.

GM agreed to have PSD continue with the pilot tests, and, as part of the program, PSD agreed to replace each of the pilot sites with Jade systems. In July 1986 the design revision was funded and the Jade project began. The first Jade system was available in October and the system was installed at the Lustine dealership. Lustine's management was so pleased with its improved performance that it offered to buy the system. On November 19, 1986, after completing his pilot test research, Don Gardner returned from Lustine with the first purchase order.

As Jade systems were installed at the remaining GM pilot sites, the marketing group was developing the product introduction plans for the IDB2000 EPC and working with GM to complete the negotiations for rights to the parts catalog data base. On December 18 the contract providing Bell & Howell with rights to the data base was approved by GM. PSD worked with several units of GM including, for data processing, Electronic Data Systems, a billion dollar provider of data processing services and automation acquired by GM in October 1984. The diverse interests of each unit made securing a commitment from GM an exacting process.

During the field test many recommendations were made by the users for improvements in the application software, but of even more significance was how the system was used. One dealer placed a workstation in the service area (rather than placing all at the parts counter), and discovered that mechanics could find their own parts and have the list of requested parts printed out in the stock room. Each mechanic was thus able to increase billable time an average of 5 hours per week. The additional service work provided more financial justification than parts counter labor savings, reduced part number errors, or any other quantified factor. Table 1 summarizes the measured productivity improvements owing to IDB installation.

Although none of the four dealers that field tested the Jade system was

interfaced to inventory control systems, all four purchased systems. It appeared that interfacing to the inventory control system was desirable but not required by the market. Lack of cooperation from the two major inventory control system vendors was likely to turn into opposition and competition at product launch.

TABLE 1 Benefits of Image Data Base for Dealers

MEASURED PRODUCTIVITY IMPROVEMENTS
Wholesale parts orders/day: Up 20% after image data base installed.
Service revenues: 10% increase if mechanics order parts; 2% increase otherwise.
Parts returns: Reduced from 7 to 6% without emulation. Reduced from 7 to 4% with emulation (dollar-for-dollar credit for reductions paid by GM to dealer).
DEALER CHARACTERISTICS[a]
Annual wholesale parts: $1,940,000 (gross margin 16%)
Annual parts sales to service: $669,327 (gross margin 22%)
Annual service labor revenues: $2,430,000 (gross margin 54%)

[a] Prospect for 10-workstation ($100K plus 20% per year operating costs) system. A dealer of half the size would need a 5-workstation system. This "ideal" dealer is evenly split between wholesale parts and service; most divisions are skewed in favor of one or the other.

Product Launch

Early in 1987, PSD's Marketing and Sales Management was completing the plans for the IDB2000 product introduction and adding the marketing and sales staff required to successfully launch and actively sell the system to GM dealers. A training department was established and customer support specialists were hired to be prepared to train IDB2000 customers. Sales managers and a national sales force were hired and trained. The Bell & Howell national service force was trained on installation and repair procedures for the IDB2000.

In February 1987 the IDB2000 EPC was introduced at the NADA trade show. Figure 5 shows the terminal and the display quality in the commercially available EPC. The IDB was in five booths: GM, Chrysler, and three vendors of dealer data processing equipment. The IDB and competitive EPCs drew large crowds. The two largest data processing equipment vendors and IBM demonstrated PC-based EPCs that did not use gray scale. Several publishers that were developing CD-ROM products for libraries presented parts catalog concepts at other shows the next month. Computerized film retrieval and videodisk parts catalogs were absent.

In March sales of the IDB2000 began, and during this month the first "nonpilot" system was sold. Although no competitive electronic GM catalogs were on the market, a vendor of data processing equipment to dealers

was field testing an Acura EPC with Honda dealers. The two largest data processing equipment vendors were advising dealers not to buy the IDB, but sales continued to be strong—surpassing one large system sold per day within 3 months of launch. During May the Chrysler Parts and Service Technical Information System pilot program began that included pricing, supersedence, and service bulletin data bases not included in the GM application.

Figure 5 Terminal for IDB2000 electronic parts catalog.

By the March launch PSD had spent $11 million on development (both engineering and marketing) of the IDB System. When added to the 1632 project, the loss on DDSI, and the 35-mm cartridge film/PC study, total investment approached $18 million. This was also the amount budgeted for IDB Sales in its first year and nearly the annual sales for the entire division in past years for micropublishing.

From the point of launch, major cost reduction redesigns were under way to expand the target market to include medium-and smaller-sized dealerships.

What brought the IDB2000 this far? Dave Gump comments:

> First, the IDB2000 is really an extension of current business. We built on what we

know. Our forte is application expertise and the design of information retrieval systems for technical documentation users. We have combined technology in an innovative way to meet our customers' needs. Bell & Howell Company has always had a desire and an attitude to move the company technologically forward.

John Marken attributes IDB2000's success to perseverance. He recalls:

We could have easily walked away from pursuing "beta" but we were determined, and the risk was worth the effort. Back as far as the late 1970s, the dealers knew what they wanted. The technology just didn't exist to provide them with fast access to pictorial part information at the right price.

We have been successful because we have been able to combine talent and knowledge and have always been focused on what our customers wanted. It took guts and sponsorship. Everybody we reported to wasn't necessarily in favor of it. But, we had a sense of customer need and corporate support.

By dwelling on the needs of our customers and being persistent in our search for a solution we have met with success in the IDB2000. At all times our strength was our focus on the application, the dealers' needs, and the ability to include the right technology to meet their needs. It is no question that we were living on the forward edge of technology and continue to do so.

April to October 1987

During the spring and summer of 1987 a steady stream of software changes that improved access, saved storage space, or made system usage easier (particularly updates) were successfully released to users. The fine-tuned application software incorporated an understanding of GM's data and its use that PSD had gained over the past decade. Also, a substantially lower cost "pedestal" was developed to replace the data storage "rack." The new device allowed affordable pricing of smaller systems (two to four workstations).

The major dealer computer systems (DCS) vendors' efforts to discourage IDB sales became more effective over time. By midsummer IDB sales plateaued as the DCS vendors promised full integration of their future EPCs to existing packages (such as inventory control packages), and demand for interfacing the IDB grew. In August a nonexclusive, sole distributorship agreement was reached between PSD and the largest DCS vendor, Reynolds & Reynolds. The second largest DCS vendor announced a competitive product and acquired access to the GM parts catalog data.

PSD developed simple interfaces to the more popular DCS packages. But without support from the DCS vendor the simple interfaces were awkward at best and often unworkable. In response PSD developed "emulation" software. This software allowed the IDB2000 workstations, when interconnected to the DCS system, to behave exactly as the DCS vendor's terminals did (i.e., emulation). By October the emulation package had become very

popular and was displacing DCS terminals in dealership parts departments. Emulation was expected to create more value to the dealers than simple interfacing. In addition to increased speed and accuracy—no keypunch or transcription errors—provided by simple interfacing, emulation was expected to be more convenient and save counter space, equipment cost, and time spent moving from IDB workstation to DCS terminal. By November nearly all IDB System sales included purchase of emulation software.

At the end of October 1987, PSD's fiscal years revenues were forecast to achieve 100 percent of budget and 1988 IDB revenues were budgeted at approximately twice those of 1987.

CONCLUSIONS

This case chronicles the efforts of Bell & Howell PSD to meet its customers' desire for an "automated parts catalog lookup system." It describes the transformation of a micropublishing service bureau through the search for a technical solution to meet its customers' unique information retrieval requirements.

The EPC system developed is a back-room system for GM auto dealers. It is one part of the dealer's strategic information system. Its value is largely owing to its effectiveness rather than its efficiency. Originally envisioned to increase efficiency by reducing parts catalog lookup time, and then to reduce part order errors, the EPC has been found by dealers to increase service billings (labor and parts) up to 15 percent—providing for more profit opportunity than possible from cost savings.

This case presents the trends and issues affecting the micropublishing industry as far back as the 1970s, and identifies specific events that led management to pursue the development of the IDB2000. Five management and policy issues were critical to the success of the IDB2000 and responsible for PSD's ability to achieve technological change.

The first and most important issue is the division's constant focus on its customers' needs. Study of users continued through the field test and into product launch, revealing new insights well after the formal studies ended. Efforts by PSD to understand the parts business and its impact on dealerships provided confirmation of the product need and a clear understanding of the user benefits to be achieved through "automation." By performing detailed time studies, PSD gained a complete understanding of the parts counterperson's daily use of the paper parts catalog. This provided the foundation for PSD to develop the parts lookup application based on how the catalog user wanted to access part description, part number, and part illustration information. Ongoing customer surveys, focus groups, and one-on-one interviews were responsible for the achievement of a system that has received exceptionally positive dealer responses.