Appendix Case Studies

Overview

This appendix presents seven case studies that illustrate various problems that arise in MIS. Remember that most problems can affect many areas of a company. Any realistic situation will have many different problems or symptoms. It is important to search for the causes of the symptoms. Chapter 3 presented some hints and techniques that can be used to approach case problems and look for causes. One useful step is to try to classify the level of the problem: operations, tactical, or strategic. Although many problems will affect all three areas, the fundamental causes often focus at one level.

When you are searching for solutions to business problems and cases, it is often helpful to examine what other companies have done in similar situations. The previous chapters had several examples of cases and applications that might prove useful. Also, business and MIS publications continually provide examples of problems faced by existing firms and of innovative solutions.

Remember that business problems rarely have a single correct *answer*. There is always room for creativity and innovation. Just make sure that your solution will actually solve the main problems. Also, think about the implications of any solutions. Will it cause more problems than it solves?

Virtually any MIS case could be *solved* with the simple statement that the firm needs more computers. However, a one-line statement is not a very useful plan. In any business setting, you not only have to find an *answer*, you must also persuade others (executives) that your answer is the best alternative. Additionally, a good solution will contain an implementation plan—perhaps with a timetable that delineates each step of the process.

Crystalline Entities

According to the sign on the building, *Crystalline Entities (CE)* (a fictional company) was founded in 1895 by Hugo Salazar. In reality, the company was started in 1957 by Denise Luzon to import crystal glass figurines and china plates for sale in the United States. Hardly anyone who works at the company today remembers that Denise was really responsible for the creation and initial success of the company, and that irritates John Balrun, the current CEO. Denise retired years ago and the firm is now a publicly traded company with annual sales of about $20 million. John has been CEO for seven years. All but one of the vice-presidents have been hired within the last five years. The VP of finance, Martha Vaniche, has been with the company almost as long as John. Because of turnover, most of the 342 employees at the corporate offices are younger and have worked there an average of about three years.

The company is organized in a traditional hierarchy by business function (marketing, accounting and finance, production and purchasing, distribution, and human resources). About 15 years ago, *CE* bought several small manufacturers in Ireland and Spain. These firms make up about 15 percent of current production. They are located in small towns with low labor costs and are run independently by local managers. The local managers know their employees personally and emphasize quality production. Items that don't pass the quality inspections are either destroyed or sold to local buyers. The other 85 percent of the production is purchased from a variety of companies around the world. Quality is maintained by inspecting all shipments and by dropping suppliers who cause problems.

Although there are many products, there are three basic types of sales. First, many of the products are given as gifts (especially for weddings and anniversaries). These purchases are typically made through department and specialty stores. The second type of sale

consists of add-on and replacement pieces that complement or complete a set. Many of these items are sold as special orders that are placed by customers through the department stores. Occasionally customers will order pieces directly from *CE*. The third type of sale is through various factory outlet stores. These stores are scattered across the country and typically offer out-of-date items for 20 to 30 percent discounts. The stores are independently owned, and *CE* offers them substantial discounts whenever they wish to drop certain patterns and clear their warehouse.

Core Products

The core products are crucial to Crystalline Entities. By keeping costs down, and by offering lower prices and special packages, CE uses the core products to capture market share. As a result, the core products represent about 60 percent of the total sales, but only 15 percent of the profits. The special orders are considerably more profitable and make up about 70 percent of the total profits. Miscellaneous products and impulse purchases make up the rest of the sales. When CE experienced decreasing sales growth 15 years ago, the decline not only hurt current profits but also sales for the next three years because of lost sales of specialty items for matching sets.

Going back to the early days of the company, Denise decided that it was best to focus on a few core products. To compete against the established companies she wanted to offer good-quality crystal and porcelain products at a lower price than the competitors. Her deception about the age of the company was deliberately used to build an image of an established, high-quality company—without spending much money. To keep management costs down, the company was organized to emphasize decentralized decisions. Products were ordered in bulk from overseas producers with low labor costs. The core items were stocked in inexpensive warehouses. Marketing consisted of making regular visits to department and

specialty stores and convincing managers to carry the *CE* products. When buyers became convinced of the quality and compared prices to existing brands, sales increased. As sales increased it became easier to convince additional stores to carry the products. Corporate profits increased and the company expanded. About 15 years ago, the company ran out of new markets and experienced major growing pains. Budgets were cut, staffing was slashed, and the company searched for new ways to increase profits.

At some point, *CE* began experimenting with new designs and items that were aimed at impulse purchases. The goal was to increase sales by capitalizing on the *CE* reputation for good-quality products at reasonable prices. Today, there are two basic categories of products: a core group of styles and patterns that is always in stock, and temporary or experimental items and china or crystal patterns. *CE* guarantees that the core items will always be available so that customers can expand their sets or replace broken items.

When the company experienced the decline in sales, management decided to recommit the company to providing high-quality products at lower costs than the competition. As part of that strategy, they decided the best way to hold costs down was to keep management operations as simple as possible. Hence, the various operations were delegated to decentralized departments. Marketing consists mainly of contacting department store buyers and processing orders that are sent to the distribution department. Marketing also produces rough sales forecasts for the next quarter. These reports are based on comments by salespeople and focus on categories of products (crystal, core products, experimental, special orders, and miscellaneous products). The reports are sent to production and senior management. New designs are sent to production and purchasing for final approval and to estimate the production costs. Every month, basic accounting numbers on costs are sent to the accounting department.

Business Function Responsibilities

Purchasing and production focus on quality and are responsible for finding low-cost production facilities that can produce large quantities of standardized products. Production reports and schedules are sent to the marketing department every month, with quarterly summaries sent to management. Quarterly production cost and profit numbers are sent to the accounting department for the quarterly financial reports. On the purchasing side, purchase orders are sent to accounting, with monthly summaries sent to marketing. When the manufacturer ships products, the company includes an invoice and also sends a separate shipping list to the distribution warehouses.

The distribution department is responsible for transporting the products, storing them in warehouses, and delivering the appropriate items to each store. Costs are kept under control by billing retail stores for freight charges. Each warehouse manager has control over which products are sold at a discount to factory outlet stores. When products have been around too long, they are offered to outlet stores at whatever price they can get. Each warehouse produces a quarterly inventory report and a monthly list of sales to outlet stores. Both reports are sent to marketing, which sends them on to accounting. When products arrive at the warehouse, a receiving list is created that is sent to purchasing which cross checks the list with the supplier shipping lists. Weekly reports of items shipped from the warehouse to stores is sent to accounting which handles the billing.

Finance and accounting create traditional quarterly statements that are distributed to the other departments and to management. Accounts receivable send bills to customers and records payments. All of the financial records are stored on the IBM AS/400. Analysis of some of the reports and taxes are processed on the personal computers.

Existing Computer Facilities

As a result of the decision to simplify management of the firm, each department tends to operate independently of the others. Basic financial and personnel data is collected by accounting and finance to produce quarterly and annual reports. The MIS department consists of three people who work in the accounting department. The midsize IBM AS/400 computer records orders from the department stores, basic payroll data, inventory, and standard financial data. It produces traditional accounting statements and other basic reports for the government. Accounting and human resources use the computer most often.

All of the VPs and most of the managers have personal computers on their desks that are attached via a LAN to the AS/400, giving them access to the basic reports. The personal computers are also used to write memos and perform simple calculations using spreadsheets. The LAN is used by some employees for e-mail messages.

Currently, around 1400 stores are regular customers of *CE*. They typically place one or two orders a week for core products and miscellaneous new items. On average, *CE* receives about 800 orders a day for specialty items. Most orders are filled and shipped within three working days. Orders are generally shipped from the nearest warehouse. There are five warehouses scattered across the United States—all in low-wage and low-rent areas. Occasionally, when a warehouse does not have enough items, the warehouse manager will call the other warehouses and have them ship the product. Orders, shipment invoices, and billing are handled by the computer. The accounting department uses the data to track accounts receivable. Because of the volume of data, the orders and shipping invoices are moved to tape backup every month and removed from the online system. Only the basic order data (date, buyer, totals, etc.) are kept on the system.

The design department in marketing has a small network of computers to help the group with art designs. Many of the patterns and colors are created with graphics packages. Some people do initial designs on paper and scan them into the computer to experiment with variations and different colors. Members of the design department actively use their network to share ideas and pieces of designs. Although their smaller LAN is also connected to the central computer, there has been little reason for them to use the central computer.

Choosing Core Products

The issue of core products causes considerable friction within the company. Every year, the designers introduce new patterns, and they want to place them in the core group. It is a personal status symbol for the workers to have their designs placed in the permanent collection. Yet, the company cannot afford to have thousands of different patterns in the core group, because it would require a huge inventory. On the other hand, some items in the core group have not sold very well for many years. Every year, there is a meeting among all the VPs and departmental managers to decide which products should be included in the core group. These meetings often degenerate into arguments and shouting matches. Lately, John Balrun has noticed that the younger staff members and VPs seem to be joining together and yelling at him and Martha. The accountants have supported the decision to hold the core products stable and to hold costs down. The marketing department believes it would be better to increase sales by offering more products.

It seems that the arguments and political negotiations have started early this year. Several managers have been circulating a memo complaining that the finance and accounting departments refuse to cooperate with the designers. Jan Dover, the head of the design department, is complaining that the group can't get sales figures for each of the new pat-

terns. They want also want to track sales of the core patterns during the last few years to see which ones could be dropped. The designers are claiming that the accounting department refuses to furnish the data.

John Balrun initially dismissed Jan's complaint, because there has been considerable antagonism between her and Martha. John suspects that Jan's memo is just a political ploy to gain attention before the annual design meeting. However, it seems that Jan went to the MIS department with her request for additional information. The MIS department complained to John—saying the staff are already overworked. They say *CE* will need a new faster computer, a massive increase in disk space, and at least two new programmer analysts just to do the initial work requested by Jan.

John called a meeting with Jan, Martha, the head of accounting, and the MIS members. At the meeting, the MIS group stated that it was impossible to provide the data requested by the design team. The only data that was kept for more than a year were the basic financial and accounting statements. These statements provide summary values for sales by category, but not for each design pattern. In fact, the only detail records that might be available on backup tapes were production data and some inventory figures for the last couple of years. After considerable discussion of the experimental patterns, it was decided that it was impossible to obtain accurate sales figures. At best, the only numbers available were orders and shipments to the retail stores. Occasionally, the *CE* sales people submit informal reports on which items they believe are selling well, and which ones are sitting on the shelves. Someone at the meeting suggested using final inventory levels at the warehouse as an indicator of how well products were selling. However, the distribution managers have control over the size of the warehouse inventories. Sometimes a product sells well when it is introduced and the managers load the warehouses, but then have a high inven-

tory at the end of the year. In other cases, the warehouse manager might have already unloaded weak-selling items to a factory outlet at a discount price. To keep costs under control, the warehouse managers record outlet sales only by category, which is not itemized by design pattern and color.

The designers now accept that the data they want is not available to make design decisions this year. However, they have stated that they want to change the current system so that they can make better decisions next year. John Balrun does not know where to start. It appears that most of the data does not exist. Plus, it looks as if any attempt to change the current system will go against the fundamental goals of *Crystalline Entities*: provide quality crystal, porcelain, and china at prices below those of the competition.

Case Questions

1. Can MIS help *Crystalline Entities*? In particular, is it possible to get the data requested by the designers?
2. What system problems exist?
3. What level (operations, tactical, strategic) is the primary source of problems?
4. Diagram the flow of data through the organization.
5. Devise improvements that will solve the basic problems of *Crystalline Entities*. Include an implementation plan.
6. What resistance do you expect to encounter? How can it be minimized or overcome?
7. Is it possible to satisfy the designers and keep the essential goals of the company?

Tennessee Valley Authority (TVA)

The Tennessee Valley Authority (TVA) is a quasi-public federal organization headquartered in Knoxville, Tennessee, that was founded in 1933. It provides electric power; flood control; navigation; and agricultural, economic, and industrial development through the Southeastern United States. It is the nation's largest electric utility. It makes most of its money ($5.1 billion in 1992) by selling electric power to regional power associations. It provides power to more than 160 municipal and cooperative power distributors who service more than 7 million consumers. In addition, special projects are funded by Congress (amounting to $135 million in 1992). The 19,500 employees are divided into several business units, including finance, power generation, marketing, and navigation. The IS department consists of 925 employees and has an annual budget of $100 million. Through restructuing, by mid-1995 the total number of employees had been reduced to 16,500.

	1990	1989
Operating revenue ($ billion)	5,339	5,287
Total assets ($ billion)	27,677	27,183
Generation capacity (megawatts)	28,328	28,654

Like other businesses, the TVA faces a changing environment with deregulation. For years, it was the only supplier of electricity in its region—cooperatives and municipalities signed agreements to purchase power solely from TVA. Many of these contracts had extended time frames of 35 to 50 years. Many of these contracts are now due for renegotiation, and other utilities are eager to expand their markets. Additionally, the federal government is encouraging competition in the production of electricity. As a result, TVA has to become more cost conscious. As of 1994, the Energy Policy Act of 1992 effectively frees customers to choose the electric company they wish to use. Wholesale corporate utility customers can already buy their electricity from a variety of sources. It is unclear at this time whether individual households will have

the option of selecting power providers. The act is primarily designed to provide multiple choices to large factories, power distributors/resellers, and municipal utilities.

Management and Employees

The TVA is governed by a three-person board of directors, with one of them appointed as the head of the board. The day-to-day activities are governed by the general manager, the comptroller, the general counsel, the chief budget officer and the director of information. The separate business units are largely independent of each other. They have separate divisional leaders, separate budgets, and different objectives that occasionally conflict. Also, many of the offices are located in different cities.

The TVA has an interesting history in terms of management and labor relations. Although it is technically an agency within the federal government, its employees are not subject to Civil Service regulations. Congress decided that because of the technical nature of the agency, it required highly trained employees, so it should be free to hire employees from the national job market without the political considerations involved in the Civil Service system. In 1940, TVA became the first U.S. federal agency to adopt collective bargaining. By 1977, 99 percent of eligible trade and labor employees were members of a union. Even management level and “white-collar” employees are members, with 87 percent of eligible salaried workers belonging to an employee union.

At the TVA, membership in unions is encouraged by personnel rules and practices. Employee promotions and raises are based on merit evaluations. As part of the employee merit evaluation system, membership in a union is considered a sign of professional competency, merit, and efficiency. Hence, membership in a union virtually guarantees job tenure and merit raises.

Because TVA is a federal agency, an unusual problem has arisen. The TVA Act of 1933 that established the agency set a maximum salary of $10,000 for members of the board of directors. More importantly, it stipulated that no employee could receive a higher salary than the amount paid to the directors. Because this value was fixed by Congress, it could only be changed by Congress by passing new legislation. Consequently, the value is not changed often and the TVA has had trouble hiring and keeping professional employees. As a result, the agency has a history of relying on outside consultants who are not directly affected by the salary cap because they are paid for individual tasks.

Recent MIS Activity

Prior to 1992, the IS department was highly fragmented; each business unit essentially had its own IS department. Computer hardware consisted primarily of large IBM and compatible machines centrally located in the Knoxville offices. Data management and software development were largely left to the individual business units. Most development of software was in COBOL. The business units were happy controlling their own group of IS employees. However, there was considerable duplication of effort. Additionally, the individual departments and their software tended to be maintained separately from other departments. There were virtually no corporate standards, so hardware and software purchased and designed for each business unit often required major modifications whenever someone wanted to share data across departments. Overall, the IS staff was spread too thin, and they were developing redundant, incompatible systems.

Overall responsibility for the MIS department technically belonged to a centralized core MIS team. However, the operating divisions tended to mistrust the central MIS department. They had earned a reputation of being late and over budget with most projects. The central MIS team was also accused of being heavily biased in favor of solutions involv-

ing centralized programs written in COBOL. It was generally accepted that the MIS team would always advocate a solution that they knew best—regardless of the technical merits of the alternatives. As a result, the business units often turned to outside consultants and programmers to create new information systems, bypassing the internal IS department completely. For instance, in 1992, the finance department called on Coopers & Lybrand and Oracle Corporation to develop a major new client-server based financial system.

In 1991, TVA signed a five-year contract to purchase up to $60 million worth of personal computers and local area network equipment from Concept Automation Inc of Sterling, Virginia. Part of the goal is to shift the company toward an open systems environment. Managers who need PCs within the company will order them from TVA offices in Chattanooga. The bulk of the purchases are expected to come from the headquarters in Knoxville, but offices in Huntsville, Alabama, and Chattanooga are expected to buy several PCs through the contract as well.

In early 1992, TVA took the first steps to implement an agencywide geographic information system. The authority awarded a $750,000 contract to ESRI for Arc/Info running on Sun workstations. The goal is to create a $13-million Automated Land Information System over eight years. The goal is to provide better management data to foresters, biologists, and engineers throughout the organization.

Centralization

In 1990, the head of IS decided to centralize the IS department to reduce duplication and help control costs. This centralization offended the heads of the various business units, largely because they saw it as a loss of control. In the process of consolidating the IS departments, the head of IS also offended the IS workers because he was stressing a shift to a client-server approach. In particular, he tried to emphasize development using the Oracle

database management system, signing a $16-million contract. The IS programmers and analysts felt that management was "shoving Oracle down their throats." The IS department is represented by three different unions, which provide alternative channels for complaints and grievances. As a result, the initial agreements with Oracle were investigated by the TVA inspector general for alleged collusion and kickbacks. After three years of investigation, the inspector cleared the contract.

A New IS Director and a New Plan

In August 1992, the IS director was replaced by Robert Yates, previously the corporate treasurer to "clean up the mess" in the IS department. Yates noted that there were "a lot of turf battles, no clear-cut domains, and built-in conflicts of interest."

Yates consulted with N. Dean Meyer and Associates, Inc., and with the IS workers to help create a new IS structure that would satisfy the business units, please the IS workers, and improve the competitive position of TVA. The new plan basically keeps the current (centralized) structure. It organizes the IS workers into four categories: (1) service bureaus consisting of IS operations staff, maintenance, administration, and PC support; (2) technologists consisting of programmers, application specialists, database administrators, and various technical experts; (3) a consultancy of about 30 members who will help the business units determine their needs as well as market the IS capabilities; and (4) A small number of architects to define corporate standards. Yates also plans to institute a charge-back system to bill the business units for IS services. He is concerned that they look at IS as a "free good"; hence there would be incentive to overuse the IS department, instead of searching out other solutions.

In 1993, the MIS department began searching for a management software tool to help them centralize the administration of all the workstations throughout the company.

For example, in 1993 there were more than 100 Sun high-end workstations and 400 smaller Sparcstation 2 machines in use. Robert Khym, TVA's manager of distributed systems software support, noted that "The next step will be finding something that will integrate all of our open systems."

In 1993, TVA began replacing its mainframe computers with Unix-based midrange computers. Each of the 24 dams, 12 fossil fuel plants and 4 nuclear reactor plants operate as separate entities. The agency wants to install lower-cost open-system minicomputers at each site. There is limited information flow between the various sites, but TVA is in the process of installing a wide area network to allow easier transfer of financial data. The existing IBM mainframes will be kept as centralized file servers.

As part of its consolidation plan, TVA signed a contract with PeopleSoft Inc. to use that company's client-server payroll software package. After some alleged problems about making the package work with the IBM DB2 database applications, the TVA inspector general's office called a halt to the installation and began an investigation into the purchasing process.

TVA in the 1970s

The GAO reports that the TVA was experiencing a huge growth in the use of electricity in the late 1960s and early 1970s,

> *when power sales were growing at a steady rate and were expected to double every 10 years. In the Tennessee Valley, the number of electricity customers rose to over 2 million in the 1960s and about 30 percent of all the homes were heated with electricity.*
> *By 1970, TVA customers used nearly twice as much electricity as the national average. At that time, TVA was experiencing an annual growth rate of about 8 percent in demand for electricity, and TVA's forecasts through the mid-1970s were showing continued high growth in demand.*

In 1966, TVA announced plans to build 17 new nuclear plants in seven states. Many other utility companies announced similar (though less ambitious) plans. The oil crises of 1973 and 1978, the Three Mile Island disaster of 1979, and construction problems and cost overruns caused most companies to cancel the construction of the majority of nuclear plants. A changing regulatory environment of the 1980s also encouraged electric utilities to focus on conservation instead of new construction. Encouraging customers to add insulation, purchase more energy-efficient appliances, and employ newer heating and cooling systems resulted in a significantly smaller growth rate in consumption. By 1984, after investing $5 billion in construction, TVA canceled 8 of the 17 plants.

Of TVA's nine remaining nuclear sites, three were operational in 1995 (Browns Ferry 2, Sequoyah 1 and Sequoyah 2). After 22 years of construction, Watts Bar 1 was beginning final testing and expected to be placed on-line in early 1996. One unit (Browns Ferry 3) began operations but was shut down because of repeated problems. Four other units were placed into "mothball" status, pending an analysis to determine whether they should be continued, converted to alternative fuels, or shut down completely. Total TVA spending on nuclear facilities is more than $25 billion, of which only $5 billion applies to functional plants. TVA is the only U.S. utility still actively constructing nuclear plants. The $25 billion constitutes the bulk of the $26 billion debt (mostly public bonds) of TVA, but the nuclear plants generated only 14 percent of TVA's total power supply in 1994.

TVA in the 1990s

TVA is under federal mandate to fund its electricity production from ongoing operations. By its internal accounting methods, TVA is meeting this mandate; however, $14 billion of the nuclear construction debt is not being financed from current operations. In 1995, TVA had a total debt of $26 billion, with financing costs of $1.9 billion a year (35 percent of

its power revenues). TVA faces a Congressionally imposed debt ceiling of $30 billion, and TVA expects to increase its debt to about $28 billion by 1997—in part to cover final production costs at Watts Bar, in part to cover interest payments on its debt. As a federal agency, TVA cannot sell stock (like most traditional utilities), so all funds must be raised from bond sales. Although these sales are not guaranteed by the federal government, some investors believe that the federal government will not allow TVA to default on the bonds. Consequently, TVA has a slight advantage over potential competitors in terms of interest rates. Similarly, TVA does not pay federal income taxes.

TVA also anticipates the need for substantial expenditures to improve existing hydroelectric and coal-fired plants. Additional expenses will also be incurred in bringing all of the coal-fired plants into compliance with the Clean Air Act. Based on preliminary estimates, TVA anticipates spending between $1.1 and $1.6 billion between 1995 and 2015 (in constant 1994 dollars).

In public statements, TVA repeatedly emphasized that they have not raised electricity rates in nine years, and they are trying to hold them stable for at least 10 years. Nonetheless, TVA is not the lowest-cost producer in the area. However, for the immediate future, other firms are prohibited from selling electricity to TVA's customers.

As part of the Energy Policy Act of 1992, TVA is conducting an integrated resource planning (IRP) process—largely to determine future goals, changes in production and operations, and the least-cost means of providing power. TVA is conducting the plan with several interdisciplinary teams:

- Issues and Values Translation Team
- Evaluation Criteria Team
- Load Forecasting Team
- Existing Capabilities Team
- Supply-Side Options Team

- Customer Service Options Team
- Environment Team
- Rankings Team
- Strategy Development Team
- Uncertainties Team
- Integration Team

Each of these teams is responsible for identifying problems, making forecasts, and presenting and evaluating alternatives. Many of the teams use statistical and computer simulation models to test assumptions and evaluate the alternatives. The final report will present the reduced list of options to the governing board.

In 1998, the TVA chairman became frustrated with negotiating with Congress. He offered to drop all federal subsidies—in exchange for complete control of the company and its resources. He is beginning to concentrate on the opening of the electricity market to competition. On the other hand, several people have complained about the possibility of losing federal subsidies for the administration of thousands of acres of land and lakes open to the public.

TVA Financial Performance

In 1995, the Congressional Government Accounting Office (GAO) undertook a comprehensive investigation of TVA and its problems. The GAO's financial comparison of TVA with potential future competitors is particularly useful. Additional comments and statistics are available in the total report.

Comparison of Key Financial Ratios for TVA and Neighboring IOUs, 1994
(figures in percent)

Utility	Financing costs to revenue	Fixed financing costs to revenue	Net cash from operations to expenditures for PP&E and CSD	Accumulated depreciation/amortization to gross PP&E	Deferred assets to gross PP&E
AEP	16	8	90	38	1
CP&L	16	7	132	35	2
DR	19	9	86	34	5
DP	16	7	81	36	4
ENT	20	13	121	32	2

IL	14	11	115	31	5
KU	15	6	54	40	4
LG&E	14	6	82	35	1
SC	18	9	92	31	4
TVA	35	35	57	17	47
IOU Summary					
Average	16	8	95	35	3
High	20	13	132	40	5
Low	14	6	54	31	1

Notes: CSD: Common Stock Dividends; PP&E: Property Plant & Equipment; AEP: American Electric Power; CP&L: Carolina Power and Light; DR: Dominion Resources; DP: Duke Power; ENT: Entergy; IL: Illinova; KU: KU Energy; LG&E: LG&E Energy Corp.; and SC: Southern Company.

Source: GAO analysis of 1994 annual reports.

Fiscal Year 1994 Key Statistics for TVA and American Electric Power
(Dollars in millions)

	TVA	AEP
System capacity (MW)	25,913[a]	23,670
System sales (in millions of kilowatt hours)	122,574	116,714
Net total assets	$31,842	$15,713
Deferred assets[b]	$15,726	$259
Total debt	$26,136	$6,309
Operating revenue	$5,401	$5,505
Net financing costs	$1,772	$887
Net fixed financing costs	$1,772	$443
Depreciation and amortization expense	$639	$572

[a]Represents dependable capacity currently in service. It excludes about 2,230 MW of capacity for Watts Bar 1 and Browns Ferry 3 that TVA plans to bring into commercial service in 1996.

[b]Deferred assets are included in net total assets. The deferred assets include about $8 billion associated with Watts Bar 1 and Browns Ferry 3.

Source: GAO summary of 1994 annual reports.

Introductory Questions

1. How would you classify the operations and management structure of TVA? In particular, does it lean toward centralization or decentralization?

2. How would you classify the management information systems at TVA? How has the authority changed between 1991 and 1994?

3. What are the advantages of each business unit having its own MIS department? What are the disadvantages?

4. What did the MIS director attempt to accomplish in 1992? What went wrong?

5. How is Yates altering the MIS department and its mission? Will his plan work?

6. Create a five-year plan for the MIS department at TVA. Examine the potential problems you expect to encounter and how they should be solved. How can the MIS department support the new opportunities and changing environment?

7. How does the management environment at TVA affect your alternatives and implementation of solutions?

Additional Reading

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Greyhound Bus Lines

Greyhound Bus Lines started in Hibbing, Minnesota, in 1914, when Swedish immigrant Carl Eric Wickman began shuttling passengers to nearby Alice, Minnesota, using his seven-seat Hupmobile. By 1930, the company put together a national network by acquiring other small bus lines. The company then moved to Chicago and adopted the Greyhound as its corporate logo and name.

Up to the early 1960s, Greyhound was very successful. However, increased automobile ownership and decreased airline fares put considerable pressure on bus companies. From 1960 to 1994, the industry's share of interstate travel dropped from 30 percent to approximately 6 percent of the traffic.

In 1987, Greyhound was purchased in a leveraged buyout by Dial Corp. Suffering from high debt payments and two violent strikes (some bus drivers were shot at in 1989-1990), Greyhound filed for bankruptcy protection. In late 1991, the company emerged from bankruptcy protection with Frank Schmieder at the helm.

Schmieder and his lieutenant, J. Michael Doyle, began an ambitious re-engineering plan. Neither Schmieder nor Doyle had much experience in transportation: Schmieder came to Greyhound in 1989, Doyle in 1987. Their plan called for significant cost cutting, by dropping routes, cutting workers, and cutting the fleet from 3700 down to 2400 buses. Their plan also called for a new, comprehensive computer system that would handle everything from passenger reservations to scheduling.

Wall Street was impressed with the new managers and their plan. Within a month after emergence from bankruptcy, Greyhound stock was selling for $13.50 a share—twice as high as expected by Greyhound's own advisers. In 1992, the cost-cutting measures led to a

year-end profit of $11 million on revenue of $682 million, the first profit shown by Greyhound since 1989. By May 1993, the stock price reached $22.75.

Discord at Headquarters

Life at Greyhound during the years from 1991 to 1994 was schizophrenic, depending on where you looked. Until Schmieder, Greyhound headquarters were in a Dallas high-rise, near the bus terminal. The offices were spartan and filled with bus memorabilia. Schmieder moved the company to an upscale building in the suburbs. He hired an interior-design firm, paying it as much as $90,000 a month. Decorating costs included $50,000 of fixtures, custom cabinets, and $4500 for two chairs in Doyle's office. Company funds also paid for season tickets to the Dallas professional sports teams. The executives also flew first-class and stayed at expensive resorts. There were also monthly bills for consulting firms and executive-search firms. One bill from Bain & Co. ran to $175,000 a month. Schmieder also arranged two "communication breakthrough" seminars with the Meridian Institute for $560,000. Few lower-level managers were invited to participate in these sessions, and even headquarters workers scoffed at the calls for teamwork and customer service that began appearing in the corporate newsletter. In two years, Schmieder's salary rose 57 percent to $526,000, and Doyle's by 65 percent to $264,000.

In the meantime, workers throughout the company were squeezed by the cutbacks. At corporate headquarters, employees scrounged vacant offices for supplies. Mr. Oller, a marketing manager who worked for Greyhound for six months in 1992, observes that "There were never-ending meetings about who was going to get fired."

Several other corporate employees lasted a year or less. In the field, experienced managers were routinely sacked to cut costs. Most of the terminals were staffed with part-time workers and "customer-service associates." These employees earned $6 an hour re-

gardless of their jobs, with little or no chance for a raise. Few of them had completed high school. Turnover at some terminals ran 100 percent a year and 30 percent was common. Ralph Borland, a long-time Greyhound manager working as vice-president for customer satisfaction, notes that the turnover rate did not bother Greyhound management, since "If people stayed around too long, they would get too sour and cynical."

When touring facilities, customer-service executives were "shocked" to find terminal workers making fun of customers and ignoring others. Ridership was falling. To cut costs further, the number of buses and drivers was cut (down by half since the mid-1980s) and routes were rescheduled. Bus drivers began complaining that they had to exceed speed limits to meet the new schedules.

A New Information System

When Greyhound was the market leader and millions of people rode the buses, there was little need for a comprehensive information system. The company set basic schedules and sold tickets at the station. If demand was high, the company simply added more buses and drivers. If buses ran half-empty, it did not matter, because margins were high enough to cover the costs.

With tight margins and a push for efficiency, Greyhound managers needed better data. Existing ridership data was often months old; the company needed a system to track ridership, plan schedules, and identify where it was necessary to cut prices to compete. Management also wanted to be able to sell tickets in advance, enabling customers to reserve seats.

Elements of the proposed system are similar to the issues faced by the airline reservation systems. In some ways, the Greyhound system would be simpler, because reservations and tickets would be sold only through existing terminals, or through a toll-free phone

number. The airline reservation systems provide additional support to travel agents. On the other hand, a bus trip is considerably different from an airline flight. An airline passenger traveling coast-to-coast might make one stop. A coast-to-coast bus trip would probably make 10 or more stops. Each leg of the trip would carry slightly different travelers, as some got on and off at intermediate destinations. Greyhound systems analysts estimated they would have to handle as many as 1800 vehicle stops a day, more than 10 times as many as an airline system.

Greyhound management assigned about 40 full-time people to develop the new Trips reservation system. They were given a $6 million budget and slightly over a year to develop the system. Systemwide rollout was planned for the summer of 1993. Thomas Thompson, senior vice-president for network planning and operations, notes that "Every bone in my body knew that we were starting a very difficult undertaking."

A First Attempt

The base software for Trips was written by an outside firm. The system was a nightmare. It required 40 hours of training for station clerks. Even then, the screens were cluttered and disorganized, often requiring several screens and options to book a simple ticket. The system also did not include all of the Greyhound destinations, so clerks often had to resort to the old log books to write tickets.

Greyhound tested the system in Houston, Dallas, San Antonio, and Austin during the 1992 Christmas season. The system crashed repeatedly, and it took twice as long to issue a ticket with Trips as it did manually.

In an executive meeting in February 1993, Thompson suggested that the system needed to be redesigned from scratch. He also suggested that the planned summer 1993

implementation be delayed. But Doyle reportedly ruled out any discussion of delays, declaring that "We made these commitments, and, by God, we're going to live up to them."

Thompson now believes that he should have pressed harder for a delay or that he should have quit the company. Instead, he kept on, and all notes and references to his comments were destroyed. Doyle denies that he destroyed documents or fought against the decision, claiming that the designer team made the decision to continue.

In April 1993, Greyhound executives made public promises that the reservation system would be operational by the summer. They also filed with the SEC for a public offering of an additional 4 million shares of stock. The prospectus promised that the Trips system would make it easier to purchase tickets, reserve space and improve customer service. An unnamed executive comments on the internal climate, noting that

> *My clear impression was that as long as we could have some form of reservation system—as long as we could just book one reservation somewhere—then by some means, we would be living up to our obligations.*

Through June 1993, the team continued to revise the software. They also installed the system in additional terminals. At the end of May, it was running at 50 locations. However, computer terminals routinely froze up. The company also changed its long-distance phone carrier and established a toll-free phone number for reservations. In June, technicians were seriously considering delaying system when Doyle walked into a meeting and said the idea was not to be discussed.

In July, the board of directors was told that Trips was ready to go. Announcement of an increase in second-quarter earnings and strong ridership numbers resulted in a 4.5 percent increase in the stock price.

Rollout

On July 27, Greyhound activated the toll-free number service, which was to book reservations through the now-200 terminals connected to Trips. The Omaha, Nebraska service had 400 agents selling tickets, in addition to the agents at the terminals.

Systems designers were uncertain about what to expect, except they believed the system would not work. It did not. The new phone lines handled 800,000 calls a day (up from a traditional 60,000). Many of them were repeated attempts by customers to get through—callers often tried a dozen times to reach the ticket agents.

The computers in Dallas were swamped. Ticket agents sometimes had to wait 45 seconds for the computer to respond to a single keystroke. It often took five minutes to print a ticket. The system crashed so often that agents resorted to writing tickets by hand. At some terminals, passengers were told to stand in line so that their tickets could be reissued by computer.

Passengers missed connections, were separated from their luggage, and often had to sleep in the terminals. At the New York Port Authority building, competing regional bus lines called in extra buses and lured away passengers. By September, technicians pulled the plug on reservations west of the Mississippi river. On at least one weekend, they told the Omaha center not to take any more reservations.

Somewhat surprisingly, none of this news seemed to reach analysts on Wall Street (of course, most of them travel by air). On August 4, Greyhound stock was trading at $21.75 a share—that's when Doyle decided to sell 15,000 shares that he had purchased with options for $9.81 a share. In the first two weeks of August, Schmieder also exercised options and sold 13,600 shares for a profit of $155,000.

On September 23, almost two months after the introduction of the Trips system, Greyhound announced that ridership fell 12 percent in August and that earnings would not meet the early forecasts. Greyhound stock fell to $11.75 a share in a single day. Thompson was removed as head of the Trips development team. His successor lasted only until January 1994.

In May 1994, the Trips system caused problems again. Hoping to gain riders, Greyhound offered a $68 fare for any trip in the United States with a three-day advance purchase. The price attracted thousands of customers. The Trips system crashed again. With too few buses and drivers, terminals were packed with angry customers. Agents simply stopped selling tickets.

In the first half of 1994, Greyhound's operating revenue plummeted 12.6 percent, with a net loss of $61.4 million ($4.19 a share). Meanwhile, the nine largest regional carriers in the nation showed increased operating revenue of 2.2 percent. In July 1994, Schmieder announced that Greyhound would abandon the long-haul business on concentrate on shorter routes. Three weeks later, he was forced to resign. Doyle also resigned. Shareholders filed suits alleging that Greyhound's public statements miscommunicated the status of the company.

We Can't Quit Now

In January 1994, Greyhound hired Bradley Harslem, a former American Airlines reservations executive, as chief information officer to oversee the Trips system and solve its problems. In late 1994, the revised system was running at 248 locations. Training time was reduced to 16 hours, but even Harslem sometimes has trouble using the system. The system is finally beginning to produce ridership data to assist managers in planning and scheduling. However, it still could not guarantee a passenger a seat on the bus.

Case Questions

1. List all of the things that Greyhound did wrong.

2. What were the primary causes of the problems?

3. If you were running Greyhound, what could you have done differently to prevent or minimize the problems?

4. Because no one can change the past, what would you suggest Greyhound do now to solve its problems?

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Blockbuster Video

Blockbuster Video is to the video trade what McDonald's is to fast food and Holiday Inn was to the hotel industry. Blockbuster took an industry typified by mom-and-pop neighborhood rental shops and went national. Blockbuster's stores are family-oriented, bright yellow and blue, and well-lit. They do not have the back-of-the-store pornography section. Blockbuster's growth has been so phenomenal that it claims to open a new store every seventeen hours. Blockbuster also commands influence with the movie studios. Home video now makes more money than theaters:

Home Video	$2.9 billion
Theaters	$2.2 billion

Blockbuster has distinguished itself by offering a huge videotape selection that has expanded into CD-ROM and video games. It initiated a three-night, $3 rental program that does not result in additional charges when tapes are not returned within 24 hours.

Blockbuster was started by David P. Cook, a Dallas computer expert who wanted to develop a big, bright, computerized video superstore. H. Wayne Huizinga purchased a stake in the company in 1987, became its chairman within months, and was the catalyst for its growth.

Huizinga is the son of Dutch immigrants and began his career driving garbage trucks. He started a garbage business in Miami that merged with his grandfather's in Chicago. At one point he went on a buying spree and bought 90 garbage companies in nine months. Ultimately, he merged all of his companies together into Waste Management Corporation.

Huizinga applied the same fervor to the purchase and opening of video stores. At the end of 1990, Blockbuster owned 787 stores and franchised 795. Even so, it represented only 11 percent of the market. As a result, Blockbuster Company executives planned to open 400

stores per year and double the market share over the following three years. Proposed sites were carefully monitored; many were rejected.

Because most families now have access to cable television, which is expanding its offerings, video rentals may not have the strength they had in the past. Blockbuster's formula for success has been successfully copied by others. Its 8000 titles once provided the widest choice. In some markets, competitors such as Tower Video sell or rent the latest in home video technology, including 8-millimeter videos and laser disks. At the Video Factory in Buffalo, New York, clerks in Tuxedos escort shoppers to their cars under umbrellas when it rains. In San Antonio, Texas, HEB Video Central Stores dropped the charge for new movie rental to $1.50 or $0.99.

Some video rental markets have reached saturation. According to Video Store Magazine, a video store may have six rivals within a three-mile radius. In other markets, Blockbuster videos have oversaturated the market. Cox Enterprises in New York and Pennsylvania wants to sell 26 franchises back to the company or trade them for new locations in Baltimore or across the South.

Blockbuster’s growth has paralleled the growth of the VCR. Since the mid-1980s, the growth of movie rentals paralleled sales of videocassette recorders. With the fall in VCR prices, up to 65 million VCRs were sold in six years. With VCRs now in 70 percent of United States households, growth in the rental market is also stabilizing.

Today's customers are more interested in current hits than old movies. Old movies cost less to buy and as a result, Blockbuster has invested heavily in this inventory. Even the three-night rental policy detracts from having the latest movies in stock. Blockbuster's customers rent the big hits on Thursday nights, leaving few of the big hits available for the

weekend. This leads many customers to “move beyond” Blockbuster because “it never has the movies that I want.”

According to Patrick Clifton, president of The Movie Superstore in Phoenix, “the movie rental business is location, location, location.” Blockbuster has been criticized for not having the best locations. In 1990, Blockbuster ranked eighth in revenue on a per-store basis. Some analysts view Blockbuster's growth in revenue gains as the result of the addition of new stores.

Although Blockbuster continues to assert that there is plenty of room for growth in the industry, it is looking for new products and customers. To increase revenue, it is testing film-processing and the sale of compact disks and audiotapes. It is moving into small-town markets that have at least 20,000 people within 50 miles. It has also opened 51 stores in Canada and 30 in the United Kingdom.

According to Robert Wussler, president of Comsat Video Enterprises, “Blockbuster will do just fine for the next several years. Whether they will still be around 10 to 12 years from now, that's another question.”

Changing Technology

The video-rental market, of which Blockbuster is the dominant player, is estimated to be worth $13 billion in revenue a year. Yet, some analysts have predicted that the rental approach of Blockbuster would be flattened by the information superhighway. Video--on-demand systems are aimed directly at the video-rental market.

The barrage of new releases for videos or video games present additional problems for Blockbuster Video. Although the constant introduction of new movies and games present problems in terms of tracking for the video-rental organization, without it, there would be no reason for individuals of all ages to return to the store. The key issue,

then, becomes not the limiting of the number of titles offered, but the development of a mechanism to register, track, and evaluate the demand for the new videos and games. Hot new games draw an immediate demand; however, the number of these games must be limited because they will go out of vogue just as quickly as they came in. If the past is an accurate indicator, the speed with which games come into and go out of vogue is also increasing significantly. Of particular importance is the fact that customers walking out of a store without a video rental are particularly problemsome because they represent actual lost revenue.

Blockbuster Video and Client-Server Technology

Blockbuster Video is a young, aggressive company with a serious commitment to technology. Since it was established in 1986, it has grown to well over 5,000 stores and expected a $4 billion revenue in 1994. It operates in nine countries and in four languages. Blockbuster Video enjoys a 20 percent market share in 1994, which makes it larger than its next 550 competitors combined. It opens an average of 400 new stores every year, amounting to more than one per day.

As the CIO of Blockbuster, H. Scott Barret's goal is to keep the organization "technology appropriate." He believes there is a "herd mentality" about client-/server systems and has publicly questioned the financial return on this additional investment. In his opinion, many companies are pressured to implement client-server by the collective weight of hype issued by the press and vendors.

As a young company, Blockbuster could have written its information systems from scratch. Instead, it has chosen to remain with legacy systems. Each of the company's 5,000 stores has a Microvax running Fortran code that provides a variety of services to DEC terminals. Except for recently acquired music stores, "every store stands completely alone."

Each Microvax is tied to a Digital cashier system, printers, a manager's workstation, and a modem. Blockbuster Video is not online. Each store is called by the corporate headquarters twice a day.

Blockbuster has maintained this arrangement because it is simple, solid, reliable, replicable, and consistent. In Barret's opinion, client-server technology is too complicated because it has too many combinations of products from too many vendors.

Blockbuster is, however, planning to implement client-server, to recapture the major benefit offered by its legacy system, a consistent retail systems architecture. In 1994, Blockbuster acquired a music store business that runs different systems and has different requirements than do its video stores. The music stores came with five different PC-based systems. Blockbuster Video wants to get back to a single system for all its stores. To standardize its retail systems, Blockbuster is working with Microsoft and Oracle to build a Windows NT-based retail system that can be implemented throughout its stores worldwide. As it migrates to client-server, Blockbuster will still maintain its traditional host architecture. All processing will occur on the server; client computers will be relatively dumb.

Blockbuster is looking for other benefits from moving to client-server: reduced training; reduced support costs; and access to more advanced technologies, software, and graphical user interfaces.

Video Game Market

NewLeaf Entertainment, a joint venture between Blockbuster and IBM, invented a reprogrammable video game cartridge designed to end this revenue difficulty. During the summer of 1994, 15 Blockbuster stores tested the system. The system consists of a network that is able to store music, movies, games, and CD-ROM titles. Retail stores, such as Blockbuster, will hook up to a server and print the digital information. Sega hopes to use this

technology to boost the video-game rental and sales market by using the systems in Blockbuster stores, where consumers rent video games before making long-term purchasing decisions. Industry analysts feel that video games are ideal for the proposed system, because they can be easily copied onto a cartridge.

The NewLeaf system can stamp out any Sega Genesis game on a blank cartridge in less than a minute. The new system eliminates the inventory problem and makes it possible for every customer to leave the store with a game in hand and money safely deposited in the cash register.

The NewLeaf system takes the form of a personal computer kiosk that lets customers browse a multimedia catalog of Sega Genesis titles, complete with video previews of the games. Customers choose the game they want and the computer prints out a ticket that contains a bar code. If there are no prepared cartridges of the selected game, the clerk can record a new one on a blank cartridge within 20 seconds from an in-store server that contains the code for every Sega game. In conjunction with generating the game, the server also prints a one-page instruction sheet. The entire transaction is to take less than a minute.

The new system enables Blockbuster to adjust its stock dynamically. To further save time, store employees will be able to prerecord the hit titles. NewLeaf's server, designed by its sister company, Fairway Technologies, can be updated at any time with new games by modem or CD-ROM. Of particular import is the ability to customize individual games on the spot. This is particularly useful during the basketball playoff season. For example, Acclaim can update its NBA Jam game so the video characters are wearing the jerseys of the teams that are in the current NBA finals.

NewLeaf has enlisted Sega to join the Blockbuster trial and is pursuing the individual Sega Genesis game publishers and Nintendo to try out the system. The advantage to the game developers is the opportunity to make money on the rental market. Ultimately, this could reduce sales to the marketplace, however. Today, Blockbuster buys copies of a game and then rents it without paying additional royalties for each rental.

To interest the game developers, NewLeaf has promised to give publishers a percentage of the rental profit as well as regular reports on how often the games have been rented. According to NewLeaf president David Lundeen, most game publishers are interested, particularly because the system will have built-in security features to prevent unauthorized copying. Some of the larger publishers have expressed concern, however, that the system will level the competitive playing field because revenue generation is not equally distributed across the games; a few titles generate most of the profit margins.

In Lundeen's opinion, large publishers will make the most in royalties: "We're testing to see what happens if you make games ubiquitously available at retail; what happens on the first weekend after the launch of a hot game. How high is up?"

Lundeen hopes to expand the NewLeaf system beyond the rental market into toy and electronics stores. He envisions stores being able to sell children their first game on a rewritable cartridge for approximately $70. When children tire of the game, they can bring the cartridge back to the store where a salesperson will use the NewLeaf system to reprogram it with a new game for a lower price, perhaps $30. The stores and game publishers will make more profits through additional sales and lower materials costs. The game players will save money and be able to play more games. NewLeaf will make money selling its system. Potentially, the only losers would be Sega and Nintendo, who manufacture cartridges, and their suppliers.

NewLeaf's server is designed to support rewritable CDs as well as cartridges. Flexibity will be introduced through offering stores an add-on device that supports the platform's storage format. Lundeen is also presenting this option to the music industry for adaptation to the audio CD market. However, an earlier proposal to the music industry by a different company was turned down, largely because the industry feared loss of sales due to illegal copying.

Blockbuster Video Enters the CD-ROM Market

Blockbuster Video is test marketing a new program in 57 company-owned stores in its San Francisco market. As part of the trial, Blockbuster plans to stock more than 200 CD-ROM titles from more than 37 software publishers. These include Compton's NewMedia, Software Toolworks, and the Voyager Company. Fast-action games have proven to be most popular.

Titles will range from games and adventure to education, entertainment, and reference. Each of the stores will carry five different hardware platforms: Panasonic's Real 3DO Multiplayer, Sega's Genesis CD player, Philips' CD-I platform, Apple's Macintosh TV and IBM's PS/1 computer system. Blockbuster will station trained salespeople at each machine to answer questions about the hardware and to demonstrate various software titles. Customers will be able to try the software in the store or rent the software or equipment to try at home.

Blockbuster has a range of action and strategy games, educational programs, and reference works available. For $4, any program can be rented for three evenings. Blockbuster charges $14.95 to rent a SEGA, Magnavox, or Panasonic CD player, and $19.95 to rent a player and three programs for three evenings. If customers decide that they like the

program or equipment after a test drive, Blockbuster has both for sale and will credit $5 toward a purchase of any title. An equipment purchase provides 10 free program rentals.

Currently 37 companies—including Compton's NewMedia, Software Toolworks, and the Voyager Company—have signed on their titles. Fast-action games have proven to be most popular.

If the program takes off in the Bay Area, Blockbuster plans to extend it nationwide. Blockbuster's try-before-you-buy approach may be the jump-start the CD-ROM technology needs. Although sales of CD-ROM players have been growing at a rapid rate, CD-ROM titles have not been moving as quickly. Nearly 80 percent of the titles shipped are bundled with equipment when it is purchased, says Bruce Ryon, principal multimedia analyst with the San Jose market research firm Dataquest. Ryon thinks people hesitate to buy more titles because they are unsure of the quality.

Blockbuster's business model for the pilot was based on extensive research in tracking consumer profiles and buying habits at its stores. Research indicated that the average Blockbuster customer profile is one that every multimedia publisher desires. Typical customers are in their mid-thirties, are married with children, and have median incomes of more than $50,000. The percentage of Blockbuster customers with personal computers in their homes is nearly two times the national average.

To further its ability to track its customers, Blockbuster tracks every single customer's rental history, every single store's daily business, and every single store item's sales record. More than 40 million customers gives Blockbuster an important source of information on consumer demographics and purchase decisions.

Additional data that convinced Blockbuster to pursue new media markets came from the game industry. Sega concluded that three out of five of its video games are rented be-

fore they are purchased. Gaming magazine and Game Pro both found that more than 80 percent of the people they questioned would prefer to rent game cartridges and CD-ROMs before buying them.

Blockbuster has designed areas for interactive technologies within its stores that it hopes will appeal to consumers unfamiliar with new media. Each of the five multimedia machines is set up in its own color-coded kiosk, with promotional material surrounding it. Similar to Blockbuster's practice with videos, original packaging for the software is prominently displayed, with copies of the software behind the box.

Blockbuster color-codes the kiosks and shelves as well as placing color stickers on software packages to alleviate consumer confusion about which software will play on which machine. In addition, Blockbuster promises an employee versed in use of the game players to demonstrate the system and answer questions about the titles.

Through putting different platforms in the store, Blockbuster is making the shift to interactive media easier on the consumer. By doing so, the company is developing a scenario in which it can generate consumer interest and excitement by lowering the economic barriers for experimenting with the new technology. In addition, it is providing an opportunity to satisfy "impulse" purchases of hardware.

Competitors Tower Records and Wherehouse indicate that they are conducting research on the marketplace and may come out with similar programs.

Blockbuster Video Enters the Modem Market

Realizing that the video rental market is particularly susceptible to technological change, Blockbuster Video has become a substantial investor in Catapult Entertainment. Based in Cupertino, California, the new venture’s first two products are a modem for 16-bit game consoles and an online service to connect them. The modem plugs into a console’s car-

tridge port and includes a port for a second cartridge. It will initially be available for Sega Genesis and Nintendo's Super NES. Catapult is positioning the system to support existing multiplayer games without modification. Players insert a game into the modem's own cartridge port and then dial into Catapult's network. There, they are paired with a connected opponent who has the same game cartridge installed, and with whom they can exchange messages while playing. Catapult's modem will retail for the same price as an average cartridge game and is scheduled for release on Sega's and Nintendo's cartridge platforms. The service will be available for a monthly base fee that will allow the player a currently unspecified number of gaming sessions.

The video game network will enable players to compete with each other over standard telephone lines. Video game publisher T-HQ is the exclusive distributor of the modems, which will support all the popular multiplayer games without modification to the game machine or the software. The modems will serve as add-ons to the Sega Genesis and Super Nintendo units already in the market.

Technologically, the modem works in 16-bit game platforms and will also work with future 32-bit and 64-bit CD-ROM-based platforms. Preprogrammed with Catapult's toll-free phone number, the modem can fit into the game cartridge slot of either the Sega Genesis or the Super Nintendo. The game then plugs into the top of the modem. Consisting of a printed circuit board, signal processing hardware, and a phone line interface, the modem draws its power from the game machine and only requires a modular telephone line connection.

Blockbuster's research indicates that players buy games for their competitive aspects; competing via the phone lines is expected to be popular. In the Catapult network,

players will have “handles” to protect their privacy and can receive game playing tips, scores, rankings compared to others, and competitions for prizes.

Catapult is expected to cost $5 to $10 per month to play, which can be paid by check, credit card, or cash using a rechargeable Smartcard that functions like a debit card. The card is charged at a retail outlet and then debited when inserted into the Catapult modem. All calls will be local.

To play, each player must have the same game cartridge. The modem confirms the user's telephone number, lets the user enable long-distance or disable the call-waiting feature (which could interrupt game play and possibly cause disconnection), and asks how long the user is willing to wait for a compatible or specific competitor.

Once connected, the network finds a match for the user, the players’ telephone numbers are exchanged invisibly to the players, the modem hangs up on each end, and one modem then calls the other user’s modem again. All of this is invisible to the individual users. Because players’ machines call each other to actually play, the network capacity of 2,000 simultaneous users is enough for millions of games a week. Each system exchanges the information each player has decided to share with the other, including each player’s “handle.”

The players play in real time. During play they can send prerecorded messages to each other, such as brags or taunts, by making special moves with the controller. At the end of the game, players can continue to play with the same player or they can disconnect and log back on to find another competitor or a new game.

If a competitor cannot be found immediately, say in less than one minute, the modem sends the particular game and skill level to the network and then disconnects. While waiting for a match, the player can look at game tips or play in single-player mode. Catapult keeps up-to-date records of the logons concerning rankings. All calls are local calls

unless the player specifically indicates otherwise. Parents can control game play by setting spending limits on the account or on the Smartcard.

Catapult plans to work in cooperation with game developers to offer extensions that can be downloaded into the system through the network. This will enable new characters, soundtracks, moves, or other enhancements to be made to the games.

Competitors in this area include AT&T, which has developed The Edge, a modem for the Sega system costing between $100 and $150, and the Time Warner and Sega Enterprises, which developed the Sega Channel, an interactive game available over the cable network.

Introductory Questions

1. What business problems are faced by Blockbuster video?
2. What types of data do they need to collect? How is it collected? What types of reports are produced?
3. What ad hoc queries might arise at Blockbuster Video? Give examples.
4. Why did Blockbuster choose to not connect all of the stores online?
5. What problems arise from having different systems in the video stores versus the record shops? What data issues are it raised?
6. What does Blockbuster gain from the new technologies the chain is installing to handle CD-ROMs and video games? What potential problems can arise? How is Blockbuster responding to minimize these problems?
7. Will the Catapult video game system be successful? What challenges does it face?
8. Will video stores be around 10 years from now?
9. In building the Catapult game system, what data will be needed? Describe the database features and components that will be needed.

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The Air Traffic Control System

Aging Technology in an Increasingly Complex Environment

The Federal Aviation Administration (AAA) is charged with overseeing all public (nonmilitary) flight operations in the United States related to safety and access to the air. The agency establishes safety criteria, issues licenses for pilots, and provides air-worthiness certificates for planes. The agency also operates the air traffic control system throughout the United States. Funding for the agency is generated through user fees and taxes on aircraft fuel, tires, and airline tickets. By 1990, the Aviation Trust Fund held $41 billion, built up from the prior 20 years. The FAA is an executive agency and theoretically operates under the direct control of the U.S. president. However, tax rates and expenditures are established by Congress.

Since 1960, the FAA has exerted control over all commercial airliners from takeoff to landing. Once they take off, planes are tracked in the following ways:

- By tower controllers with binoculars and local radar.
- By controllers in terminal radar approach controls, or Tracons, that may serve airports.
- By controllers in the 20 air route traffic control centers around the country.

Controllers in the airport towers, Tracons, and control centers share data from a nationwide network of radar installations. They use a network of radar installations to talk to the planes.

Air traffic control in the U.S. is an exceedingly complex problem. In 1994, the 300 major airports generated 50,000 flights a day. The air traffic control system is responsible for scheduling the takeoffs, landings, and flight paths of all these flights. By 1990, 455 million passengers a year were flying on U.S. airlines.

Traffic control is organized into three levels: nationwide U.S. airspace, 20 regional air traffic centers, and individual airports. Air traffic control operators at each airport have immediate control over takeoffs and landings. Regional operators watch traffic within their defined air space. Systemwide control is provided by the Central Flow facilities located in Washington, D.C. The Central Flow managers examine traffic across the entire United States and resolve conflicts and problems that arise between regions. The 40 traffic management specialists plan each day in advance, creating alternative routings for problems arising from snowstorms, accidents, and closed runways.

Early Systems

The early traffic control system was built with hardware and software from Sperry-Rand/Univac, a computer company that was purchased in the mid-1980s by Burroughs. The combined company is now called Unisys. The airport-based traffic control computers were based on a 256K bytes of main memory and performed 500,000 instructions per second. The original systems were installed in the early 1960s. The 20 regional centers had their own computers—IBM 9020 machines that were custom made for the FAA in the 1960s.

Improvements

In 1981, the FAA was given approval for a comprehensive new plan to upgrade the computer system. New airports, such as Dallas-Fort Worth coupled with deregulation of the airline industry in 1978 led to huge increases in air traffic. The $12-billion plan called for replacement of 12 major systems during the course of 12 years. An additional 80 smaller projects were included in the plan.

By 1990, only 1 of the 12 systems had been replaced and the project was $15 billion over the original budget and was an average of four years late. The one project that was

completed was known as Host, because it called for replacement of the mainframe computers at the 20 regional control centers. IBM installed its 3083 mainframes on schedule but was $16 million over budget. Even then, the 3083s were technologically obsolete at the time they were installed, because the newer IBM 3090-class machines had been available for a year.

In 1982, the White House Science Council examined the problems being encountered by the FAA and ordered the agency to

> *engage a prime contractor to formulate performance goals, design specifications and systems integration, [including] design, implementation, and maintenance of hardware and software . . .*

The council's goal was to force the FAA to hire an outside contractor, rather than attempt to hire its own staff and build the system in-house. The FAA chose not to accept the advice, allegedly because the agency found it difficult to separate the new system from the existing processes. Martin Pozesky, assistant administrator for the upgrade program at the FAA claims that

> *We would have had to turn over the current air traffic control along with the modernization plan and then have [the contractor] turn it back to us at the end.*

Instead, the FAA gave a $3.6-billion contract to IBM in 1988 to build the new system. Other subcontractors were involved both directly with the FAA and indirectly through IBM. In terms of managing the process, the FAA subcontracted to Martin Marietta for advice but did not give the subcontractor control over the contractors, such as IBM, that were working on the new system. When the six-year contract expired, the FAA issued a new $139 million contract with TRW to provide additional advice and day-to-day management.

This lack of oversight and control is somewhat surprising, given the negative evaluations that were given the FAA for prior contracts. In 1980, the Senate Appropriations Committee noted that

> *The FAA has no ongoing, well-defined and systematic management approach to evaluating software and operational cost, capacity, and performance of the current system to meet projected short-range workloads.*

The General Accounting Office (GAO), the watchdog of Congress, echoed that sentiment several times later.

Problems

The computer systems to run the air traffic control system were originally written in 1960. Because the computers and the programs are now 35 years old, serious problems exist in their continued operation and maintenance. The FAA is still operating equipment with vacuum tubes, dense webs of wiring, thousands of circuit boards, and other out-of-date components. This equipment often stumbles or breaks down completely. In 1994, there were at least 11 times when the systems failed completely. This situation leaves the air traffic controllers with no means to keep airplanes separated and flying on course.

The influx of young technicians who were hired in 1960 are now facing retirement. This issue is exacerbated by the firing of those air traffic controllers who struck the government under the auspices of the PATCO Union in 1980. Many of the technicians who could retire did so in 1995 or 1996 because Congress planned to cut the retirement benefits of those who retire subsequently after this time period.

Few technicians are in training and there is no one to hire from industry because some pieces of the equipment are so old that they are used nowhere else. The FAA stopped training technicians to repair them years ago. Parallel to this, the FAA is cutting back on

maintenance and repair. To reduce costs and the need for technicians, equipment is going unattended on night shifts.

Breakdowns occur with increasing frequency. Some are obvious only to pilots because they are told to wait on the ground or to increase spacing in the sky. This enables controllers to reduce the traffic to a level the antiquated equipment can handle. Others are obvious when there is no controller's voice at the other end of the radio. When this happens, pilots must switch frequencies to reach the controller they left.

A near collision in 1995 underscores the seriousness of the situation. Faulty equipment in San Juan, Puerto Rico, led a controller to direct to planes toward a head-on collision. This was only prevented by the plane's on-board collision-avoidance systems.

The National Transportation Safety Board sent investigators to the Aurora, Illinois, center as well as others to investigate the safety issue. Aurora is 1 of 20 high altitude and intercity control centers across the country.

Even newer equipment has problems. Eleven failures have occurred since a 75 minute power failure September 14 at the Chicago Air Traffic Control Center in Aurora. Power failures have also occurred at the Ronkonkoma, Long Island, and Oakland, California, Chicago, Washington, and Fort Worth centers. The unions representing the controllers cite failures at centers in Miami, Los Angeles, and San Juan. Union officials cite their ability to make-do with equipment so old there are no spare parts commercially available. Neither the manufacturer nor third-party vendors service it. Jack Johnson, president of the Professional Airways Systems Specialists, has stated that inadequate maintenance is responsible for the growing number of failures and long repair times necessary to rectify them.

A study of the New York Center concluded that the IBM 9020e had failures 90 times between January 1992 and June 1993. This was particularly crucial because this is the sec-

tion of the system that takes radar and flight-plan data from the mainframe and delivers it to the controllers' screens.

Since 1993, the FAA has reduced its annual budget by $600 million nationwide and has cut its workforce from 53,000 to fewer than 47,000.

The FAA continues to defend its cuts in the technician force, even though this results in cuts in maintenance. Consequently, parts that break tend not to get fixed. Equally important, careful records are not kept of how often each part needs service. According to Stanley Rivers, deputy director of the Airways Facilities Service of the FAA, the FAA cannot afford to have technicians do repairs that are not necessary or are redundant.

At the Air Traffic Control Center in Aurora, of the 55 technicians, 24 are eligible to retire immediately; 5 more will be eligible within three years. The last time someone was hired was three years ago; it takes three to five years for a new technician to be qualified.

Because of the critical situation in the Chicago Center, the FAA wants to transfer 50 people from other centers to augment the current 400-controller staff. According to Mark Scholl, the top union official in the Chicago Center, the learning curve for inexperienced controllers is so high that even hiring in September 1995 did not cause a benefit for at least a year.

According to Wanda Geist, the head of the Aurora union branch,

> *We have 70 items waiting to be fixed on the bench. We're not covering midshift. I don't know about the control technicians, but the techs' morale is as low as I've seen it, and people who've been here 30 years are saying it, too. We're in a situation where our workload has doubled, we're losing incentive pay, and there's constant talk we're going to lose benefits—retirement, health, the whole bit.*

According to Jerry Weller, the U.S. House Representative from the area: "Not only is there a technology failure, but there is a personnel failure as well."

The age of the system is contributing to its lack of integrity. Faulty and unreliable performance lead to "ghost targets" of planes that are not really there; some planes not showing up at all, and others that are hard to discern in all the flickers and blinks. A *ghost* is an artifact made somewhere in the center's cluster of computers that integrates data from eight radar stations covering 120,000 square miles. The equipment is increasingly unreliable; it cannot be trusted to be doing the functions that it reports it is doing. The limited memory means that information about a plane may not be placed on the screen. Ghosts complicate the controllers' job by forcing them to remember which locations are real and which are illusions.

A May 17, 1995, failure at the Aurora site provides an example of the integrity problem. At 8:30 the screens on the system began to flicker; it then lied to the controllers about the functions that were still in operation. The green circular screens indicated that the system was continuing to work when in fact it was not. For seven minutes the system told the controllers it was all right to use the mouse when in fact the computer switching was not working.

Each controller is supposed to be limited to 15 planes at any one time, with no more than 49 in an hour. In reality, controllers are assigned 25 to 30 planes in a rush period. Summer is a particularly difficult time because air traffic is heavy, afternoon thunderstorms force planes to be rerouted, and air traffic controllers schedule vacations.

Computer Failure Causes Blackout in the Chicago Center

On August 9, 1995, the green radar screens in the Chicago Air Traffic Control Center in Aurora went blank, losing vital radio contact with more than 150 planes. The cause was a power outage at a regional control center near Oakland, California. This problem was

the result of computer problems, power outages, telephone line failures, equipment breakdowns, and human error.

Overall, six major outages impacted air traffic facilities from coast to coast in 1995:

- May 17, 1995, Chicago Center. At 8:30 the screens on the system began to flicker; the system then lied to the controllers about the functions that were still in operation.
- May 19, 1995, New York Center. A 2½ hour outage in a telecommunications line delayed 83 flights.
- May 25, 1995, New York Center. A power outage caused by human error resulted in 485 flight delays over six hours.
- June 6, 1995, Washington, DC Center. A computer that processes radar data went down for two days.
- July 19, 1995, Dallas-Fort Worth Center. Computer problems interrupted work at a regional control facility.
- August 9, 1995. Chicago Center. Both radar and radio contact with more than 150 planes was lost.

The centers in Chicago, Washington, Cleveland, Dallas, and New York experienced 20 interruptions from June to September 1995. They all depended primarily on an IBM 9020E computer. This computer should have been retired by now. However, the replacement system is not in place to accomplish this goal. David Hinson, FAA administrator, revamped the original plan with equipment scheduled to arrive in 1999.

These interruptions and the safety hazards that they have caused got the attention of the Congress. Hearings were held at the Chicago Center the week of September 26, 1995, to analyze the enormity of the problem and to "hold the FAA's feet to the fire."

Air traffic controllers have been reporting problems with existing systems for years:

- In 1992, West Coast air traffic was delayed for several hours. An IBM 3083 at the regional station crashed. In the process, it removed the identification labels from the radar screens of controllers from Oregon to Los Angeles. The controllers switched to an older backup system but had to increase plane separation from the typical 3 miles up to 20 miles. Pilots and controllers used radio communication and manually filed flight plans to compensate. Ron Wilson, a spokesman for the San Francisco airport, notes that although there are frequent disruptions, "The FAA computer failures generally don't last long, just long enough to screw things up." At Oakland, California, an average of three times a month the controller screens fail, and controllers have a few seconds to memorize the position,

speed, course, altitude and destination of the 12 planes they are typically guiding. Then their screens go blank for at least 10 seconds. Sometimes when the screens come back, they are missing critical data.

- In 1991, the FAA ordered 44,000 small planes to be equipped with transponders that transmit flight information to the controller screens. Previously, only commercial planes were required to use the transponders. The additional information will increase the load on the FAA computers, pushing the constraints even harder.
- In 1988, a software upgrade at the regional station in New Hampshire crashed the computer and resulted in a loss of the data labels that enable controllers to identify the planes.
- October 14, 1989, was a big day at the Dallas-Fort Worth (DFW) airport. A football game between the University of Texas and the University of Oklahoma brought in hundreds of extra commercial and private planes. The computers overloaded and some systems were taken offline. Controller screens froze for 19 minutes. More than 100 planes were in the airport's airspace and several reported "near collisions," in which they were too close for safety. Controllers at DFW kept track of computer blackouts, recording 12 computer failures in 1988 and 1989.
- Joel Willemssen, assistant director of the US GAO's information management and technology division, reports that 70 percent of the 63 largest airports in the United States have experienced problems with blank or flickering computer screens. John Mazor, a spokesman for the Airline Pilots Association, notes the problems cause

  delays, diversions and, in the worst possible cases, accidents. It's not as dangerous as you might think, but it's not something you want to have happen to you.
- The Los Angeles basin region handles 21 airports with 6.5 million flights a year. The GAO notes that the FAA computers in the region have repeatedly suffered from the loss of critical data and slow responses because of the overload.
- The airlines estimate that the problems with the FAA cost travelers $3 billion a year, not counting the frustration and stress of delays and missed connections.

Advanced Automation System

One of the more visible components of the plan is the Advanced Automation System (AAS), which is designed to provide updated tracking displays to the controllers. It was supposed to be completed by 1990, but at that time was delayed until 1993. The system is designed to utilize IBM RS-6000 computers to display flight information, schedules, and current location along with weather fronts. The color systems will have higher resolution, be easier to read, and carry more information.

In 1994, an internal study of the AAS showed that it was still two years behind schedule, and probably would fall back another two years before completion. The project at that time has cost $2.3 billion and is estimated to eventually cost about $7 billion. David Hinson, FAA administrator, announced that he was replacing top managers on the project, dropping portions of uncompleted work, and demanding performance guarantees from the contractors. One system being canceled is the Area Control Computer Complex, which was designed to interconnect the host computers at the airport and regional levels.

Alternatives

- Private pilots have objected to the FAA plans, led by the Aircraft Owners and Pilots Association (AOPA) of 300,000 noncommercial owners. The AOPA has proposed a satellite-based system that the association estimates would save $6 billion over the current AAS proposal. The FAA response is that "satellites aren't a replacement for the current [system]." The commercial airlines are also resisting the proposal and suggesting that it should be delayed until 2010.
- In the meantime, because the new AAS is not available, the FAA is trying to make-do with the existing Univac terminals. For starters, the agency is increasing the internal memory systems with modern technology. The FAA also awarded a $150-million contract to Unisys to either refurbish older machines or open up an old production line to produce more of the 15-20 year old terminals. Much of the equipment, the 30-bit Univac terminals, radar-gathering and data-filtering units, are still based on vacuum tubes.
- IBM is continuing work on the contract. Noting that it is the largest contract the company ever received, the workers note that they underestimated the complexity of the problem. They also experienced problems with the Ada compilers and limited support environment. The project was estimated to require two million lines of new code. There is some belief by the GAO that even if the project is completed, it will be obsolete.
- The GAO and FAA have considered additional options, such as entirely new systems from IBM or from BDM Corp. However, they have been rejected because they are too risky or would take too long to implement.
- Airlines and governments in other nations are also upset at FAA plans to implement a satellite-based locating and instrument landing system (ILS). International airlines prefer to have a worldwide standard system, but they are concerned about using a satellite system that is controlled by the U.S. Department of Defense.

The National Control Flow

Experts at the national Control Flow center deal with different types of problems. Although they are not responsible for the immediate location and safety of planes, they solve problems across the entire United States. For example, in 1994, a traffic management specialist observed a thunderstorm in Chicago and diverted approaching flights to outlying airports. Although the decision seemed reasonable, it caused some problems. One airline lost millions of dollars when it found out the next day that its planes were not where they were supposed to be (in Chicago) and had to retrieve them.

To assist planners at the national level, the FAA is building an expert system called the Smartflow Traffic Management System. The system was developed by one senior programmer from the Computer Sciences Corporation using TAE Plus, a GUI generator from Century Computing, Inc. Code is generated in C++, with the rules created by a NASA-developed language called CLIPS. The system was developed with the support of 10 veterans with 10 to 15 years experience. It encompasses 15,000 rules, 30 screens, 100 buttons and 50,000 lines of C++ code. Yet, the GUI-based system was developed by Kevin Brett in about two months. It runs on an HP-based midrange computer across a LAN. Users see color-coded maps at each of the three FAA levels and can click on each object to obtain more detail. The system replaces a DSS that enabled controllers to perform limited "what-if" analyses. The new system uses flight-plan data to examine the traffic patterns eight hours in advance to anticipate problems and recommend solutions.

The Future?

Interim computers have been ordered, but will not be delivered until 1997. The problem is the software, not the hardware. The existing software is written in a very old language. The emphasis is being placed on writing an interface between a new language and

the old one. In addition to the interface, the technology must be thoroughly tested to ensure that it will work accurately. The interim equipment has been ordered because of the concern for the increasing frequency of outages.

The original plan was to test only at the FAA's technical control center in Atlantic City. To reduce the test plan by six months, plans now call for testing at five control facilities. The new computers will run in tandem with the old to check their reliability.

Case Questions

1. What problems arise from the use of out-of-date technology?
2. Why is the FAA relying on ancient hardware and software?
3. Why will it take several years to convert to new hardware and software? What problems are the controllers likely to encounter in the conversion process?
4. What options are available to the FAA? Hint: Do some additional research.
5. As a governmental agency, costs and funding are an important issue. Are there ways to minimize the issues with cost?

Additional Reading

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Reebok International

Reebok is a youthful, entrepreneurial culture. But it has grown from $50 million in sales to more than $3 billion in little more than a decade. It isn't the same company anymore. My job is to enable the kid in Reebok to stay fresh and creative while also allowing the grown-up corporation to compete in global markets, [Pulliam and Pereira].

This is how Tom Trainer, CIO of Reebok, describes his company and his job. To accomplish these objectives, Trainer has implemented videoconferencing, computer-aided design, the Internet, and laptops for the sales force. This has resulted in better communications among employees, faster development of products, and more effective sales presentations.

Reebok's 1993 sales of $2.9 billion placed it second behind $4.4-billion Nike, Inc. The nearly $1 billion increase in sales from 1989 to 1993 indicates Reebok's success in gaining market share.

Before Trainer joined Reebok in 1991 as vice-president of information systems, the information systems area was less than up-to-date, with no global information system or way to look at data. Communications, primarily by telephone and fax, between the manufacturing partners and worldwide distribution network were slow. Turnaround on new products was equally slow. This was a critical problem because Reebok is a fashion-oriented business with three product cycles a year in footware and five in apparel. While sales representatives from Nike were walking in with laptops to display their lines, reps from Reebok were walking into offices with bags of shoes.

Trainer's early days were spent accomplishing short-term projects that got him points with the board of directors. He fired six of eight senior staff. He kept 85 percent of the old programming staff, retraining many of them.

Comment: Susan Pulliam and Joseph Pereira, 1995, Reebok CEO Fireman faces criticism by institutional holders, WSJ, 9-14-95, p. B1, B2.

Ralph T. King Jr., 1995, Nike reports 55% gain in earnings for fiscal 1st period, lifting stock, WSJ, 9-19-95, p. B2.

Joseph Pereira, 1995, In Reebok-Nike war, big Woolworth chain is a major battlefield, WSJ, 9-22-95, p. A1, A5.

In addition to his IS responsibilities, Trainer drove the re-engineering process in the company. To do so, he spent a great deal of time on the road, building relationships with Reebok executives around the world. He also studied Sony Corporation to learn ways that it meets customer needs.

To accomplish his re-engineering, Trainer formed five megaprocesses that streamlined procedures for production, sales and marketing, research and development, administration, finance, and distribution. In 1992, he presented a four-year, $75-million strategic information systems plan to Reebok's executive committee. The board approved it on the condition that it give Reebok strategic advantage.

One piece of the new plan was to implement *Lotus Notes*, particularly in the legal area. This uses an endorsement database to control the contracts of more than 2000 athletes.

To improve its communications, Reebok has installed a privately designed architecture for voice, video, and data. Reebok communicates not only with its worldwide distribution base but also with its ad agency and other suppliers. IS is currently developing an electronic image library to enable product shots to be distributed to every country where Reebok does business. The system dropped the new product lead time from six months to three, and, in some cases, 30 days.

Before the new ordering system was installed, orders were first printed out locally and faxed to the international headquarters in London. London would take all of the faxes and send them to the United States to be entered in the mainframe. Different standards for shoe sizes from different countries added to the delay. Once the information was entered in the mainframe, production and manufacturing would evaluate the orders.

To improve this process, Trainer developed a software package called *Passport*. *Passport* rationalizes product codes and shoe sizes. It also gives small distributors and subsidiaries access to the system through personal computers. It can also function as a module by plugging into larger systems.

Laptops are also being given to the entire Reebok sales force. When orders were paper based, replacing material in a shoe to change its price from $95 to $65 might take 30 days and mean a lost sale. With the new system, these changes could be made almost automatically. When the rollout is completed 1,500 486-based NEC and Toshiba laptops will be online. Salespeople will be able to check inventory and look into special orders. They will also be able to access two years' catalogs with full motion video and sound clips of Reebok's advertisements. *Lotus Notes* is used to store the catalogs with mail links through *cc:Mail*.

Another Reebok initiative is to use electronic data interchange with 10-15 percent of its retailers. This commitment enables goods to be tracked through shipping companies, customs, and warehouses.

Hoover, a data capture system to "suck in" information from databases around the world, is linked to customer databases that track what customers have ordered and what they want.

Planet Reebok is an Internet World Wide Web page to which people can sign on and learn more about products as well as provide marketing information about themselves to the company.

Touch-screen kiosks are planned to display product information and ask potential buyers to key in data about themselves.

Reebok's new systems have not been implemented completely smoothly, however. Particularly difficult is effort to integrate the Canadian operations into the U.S. business operation. Concentrating development and support in the United States did not take into account the specifics of invoicing under the Canadian law. This mistake added time and resources that had not been budgeted to the project.

Paul Fireman, president and CEO of Reebok

Paul Fireman founded Reebok in 1979 and remains the largest shareholder with 10.3 million shares in 1995. From 1986 to 1990, Fireman was one of the ten highest paid executives in the United States. Under his control, Reebok sales grew from $1.5 million in 1980 to $1.4 billion in 1987.

In 1988, Fireman relinquished the CEO role to spend time working on other projects, including developing golf courses in Puerto Rico and Cape Cod. In the late 1980s and early 1990s, Reebok suffered from two weak marketing campaigns ("Reeboks Let U.B.U." and "Physics behind the Physique"). More importantly, the aerobics fitness craze began to subside. Women aerobics shoes were a major component of Reebok sales, so the sales decline hit them especially hard. In 1992, Fireman returned as CEO.

Reebok early 1990s

In the early 1990s, facing continuing declines in the aerobics' market, Fireman changed the focus and tried to expand into other areas. In 1993, he estimated that the outdoor-wear division would sell $350 million worth of shoes in 1995. He also tried to increase sales of basketball shoes to a 25 percent market share. Outdoor sales fell far short of the goal, reaching about $110 million. The basketball market strategy copied a page from Nike, and relied on the new "Shaq Attaq" line supported by Shaquille O'Neal from the Orlando

Magic. While sales did increase, they did not reach the levels predicted by Mr. Fireman—reaching only 20 percent market share.

More importantly, expenses skyrocketed, increasing from 23.6 percent of sales in 1991 to 32.7 percent in June 1995. Experts say shoe company expenses typically average about 27 percent of sales. Investors blamed most of the increase on the cost of endorsements.

Nike Mid-1995

At the same time that Reebok was suffering, Nike reported a 55 percent jump in first-quarter 1995 earnings, with revenue increasing by 38 percent. Part of the increase was from expanded international sales, with a 34 percent increase in orders from France and Germany. Sales in Japan increased by 65 percent. Nike is also expanding sales of tennis shoes, partly through endorsements from tennis stars Andre Agassi and Pete Sampras. In the first quarter of 1995, revenue from tennis shoes increased by 92 percent with a 42 percent increase in orders.

At the same time sales were increasing, Nike managed to decrease its expense ratio. Selling and administrative costs dropped to 22.3 percent of revenue from 25 percent in the prior year. Much of the improvement came from an improved distribution system, including a new warehouse in Belgium that consolidated operations from 30 different facilities in Europe.

Reebok mid-1995

In 1990, Nike surpassed Reebok in footwear sales. In the year ending in August 1995, Nike had $4.7 billion in sales compared to Reebok's $3.37 billion. One of the largest battlegrounds is the retail Foot Locker stores owned by Woolworth Corp. The 2800 retail stores sell 23 percent of U.S. sport shoes, representing $1.5 billion of the $6.5 billion U.S.

market for athletic shoes. Sales at Foot Locker stores account for almost 60 percent of the 1$ billion U.S. sales gap between Reebok and Nike.

Insiders note that the problems between Reebok and Foot Locker go back to the days when Reebok shoes were selling rapidly. Foot Locker wanted concessions on price and wanted Reebok to make some styles exclusively for them. Reebok was busy selling to other outlets and was unwilling or unable to alter its production and distribution systems. Nike was eager to build custom products for Foot Locker and now sells a dozen products exclusively at the chain. Ex-employees at Reebok note that the company had additional problems providing samples and design plans to Foot Locker:

> *Sometimes the samples would come in late and sometimes not at all—which got Foot Locker mad. . . . Sometimes, fashions last less than six weeks; if you don't get it in right then, there goes a major sale.*

Mr. Fireman is responding by trying to improve relations with Foot Locker. He has also offered to begin building exclusive styles for Foot Locker, but the introduction of the products remains uncertain. He also notes that Reebok is working hard to cut costs and improve its order and information tracking system. One problem that remains is that the clerks at Foot Locker stores tend to push the Nike brands harder.

By September of 1995, major shareholders were getting upset with Reebok management. One of the leading outsider shareholders, Glenn Greenberg of Chieftain Capital Management, noted that

> *The major shareholders have no confidence in the management of this company. If it was up to us, they would have changed horses or sold the company a long time ago.*

Reebok and The Internet

Like other shoe manufacturers, Reebok relies heavily on celebrity endorsements. Signing Alan Iverson (NBA rookie of the year) and Venus Williams (tennis sensation) gave Reebok greater visibility in 2000. In 2000, Reebok also increased its visibility by sponsoring the Survivor television show with humorous ads. Their website followed these themes. In 2000, Reebok stopped selling shoes direct from its website. It was concerned about competing with the traditional retail outlets. So now the site focuses on image, technical information about products, and then directs consumers to the retail partners.

Internationalization and SAP

Facing weak sales, Reebok began focusing on reducing costs in the late 1990s. Net sales dropped from $3.6 billion in 1997 to $2.9 billion in 1999 to about $2.8 billion in 2000. Worse yet, from 1999 to 2000, gross margin declined from 38.5 percent to 37.9 percent. The company implemented a version of SAP specifically designed for the footwear industry. It took a year or so to resolve technical issues in configuring and installing the software. Consequently, the software was implemented in phases at the various divisions (e.g., Ralph Lauren Footwear in 2001, Rockport in early 2002, and Reebok North America in mid 2002). Some of the anticipated strengths of the software are to integrate financial data across several countries. Virtually all manufacturing is handled by independent contractors outside the United States. Approximately 44 percent of Reebok's sales are outside the United States. One concern in Europe is that pricing products in euros may provide price transparency, so that the company will be forced to charge the same price for an item in every country—giving up some profits made from charging higher prices in some markets. In 2000, Paul Fireman was promoted to the position of President and CEO. Much of the top staff was replaced at the same time.

Nike

Beginning in the late 1990s, the footwear industry lost its luster. However, Nike revenue increased from $3.4 billion in 1998 to $9.0 billion in 2000 to $9.5 billion in 2001. In 2001, Nike installed a customized retail supply chain system from i2 Technologies, Inc. The implementation, including ties to other ERP systems, did not go well, and Nike faced a serious inventory reduction and misplacement. Nike management was disappointed in the problems, and Nike chairman questioned: "This is what we get for $400 million?"

Introductory Questions

1. Why is business integration important to Reebok?

2. Diagram what information is collected and how it is used in the new system at Reebok. Specify the format of the data collected at each point.

3. Describe the components and links in the global network that Reebok uses. Hint: Do additional research, or "estimate" what connections are needed.

4. When problems arise with the network, or the software, how can they be identified and resolved? How do we set up an IS group to solve problems and help users?

5. How has Reebok been hampered by its information system?

6. Design a new information system for Reebok that will help officials make better decisions and regain sales and profitability.

Additional Reading

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The Internal Revenue Service (IRS)

Between personal and business returns, the IRS processes more than 200 million tax returns a year. Some of the returns are simple one-page forms, others run to thousands of pages of supporting documents. Overall, they handle more than 1 billion information documents a year. The IRS brings in more than $1.25 trillion in tax revenue a year. The IRS estimates that there is a $150 billion backlog of uncollected taxes. The IRS has 10 regional service centers that are responsible for processing and storing individual forms. In 1989, it cost the IRS $34 million just to store 1.2 billion tax returns in some 1 million square feet of storage space. By 2001, the IRS expects to receive 224 million tax returns annually.

In 1995, the IRS had a total budget of $7.48 billion. By any measure, the IRS is a large organization, with 114,000 full-time employees (more than 9000 in the national office, the rest in field offices). There are 7 regional offices, 63 district offices, and 10 service centers. The IS department is also large, with a 1993 budget of $1.5 billion, including more than $500 million for modernization). The IS department in 1993 had 8,868 employees with 3100 in the national office, 3462 in field offices, and 2300 in two computing centers. The main computer center is in Martinsburg, West Virginia.

Until 1990, all documents at the IRS were stored as paper records in a central warehouse. Documents were organized according to the year of filing. As a result, if a taxpayer had a problem or question that covered multiple years, the citizen had to schedule multiple meetings with IRS officials to correct problems for each of the years. In some cases, it could take weeks or months just to get the files. Occasionally, the IRS found it was faster to ask the taxpayer for a copy of the return. By the early 1990s, this problem was resolved by having each of the 10 service centers store digital images of the tax returns—making them

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... [1]

available to agents on their terminals. Even so, the IRS knows that it needs more automation, especially the ability to scan the returns directly into a computerized information system.

Of course, automation sometimes creates additional problems, such as the situation faced by Dickie Ann Conn. The IRS determined that she owed $67,714 in back taxes. As a result, she was sent a bill for more than $1 billion in interest and penalties. On challenge, the IRS admitted that there was an error in the interest computation.

IRS History of Automation Problems

The IRS seems like a logical candidate for improved automation. The benefits of faster processing, fewer mistakes, and easier access to data ought to save a considerable amount of money. The computer's ability to search the data, automatically match transactions, and to analyze each return presents several additional opportunities that can either cut costs or raise additional revenue. Managers at the IRS are fully aware of the potential, and they have proposed several systems over the years. The problem has been in implementation and in getting Congress to support the plans.

In the late 1960s, the IRS knew that it needed to redesign its basic systems and began planning for a system to be installed in the 1970s. Congress eventually killed the plan for two main reasons: it was too expensive, and the members of Congress were concerned about security and taxpayer privacy. The IRS then focused on keeping its existing computers running.

In 1982, the existing system was nearing capacity and the IRS established the Tax System Redesign program. It was a major redesign and consisted of three major components. According to the GAO, changes in management resulted in the system never getting past the design stage. A new assistant commissioner in 1982 embarked designing a new

system that would carry the IRS through the 1990s. Initial costs were estimated at $3 to $5 billion over the entire project. The primary objective was to replace the old central tape-based system with an online database. Eventually optical technology would be used to scan the original documents and store the data in the database. A new communication system would carry the data to any agent's workstation. By 1989, initial planning had already cost the IRS more than $70 million, with no concrete proposal or results.

The main computer systems were replaced at the IRS service centers in 1985. The change in the systems was almost disastrous for the IRS. The change delayed returns processing, leading to delays in refunds that cost the IRS millions of dollars in interest payments. IRS employees worked overtime but still could not keep up. Rumors were flying that some employees were dumping returns to cut down their backlog. Because of the delays and backlogs, the IRS managed to audit only about half the usual number of returns.

In 1986, the IRS initiated a plan to provide 18,000 laptop computers to make its field auditors more productive, with its Automated Examination System (AES). Unfortunately, the service bought the Zenith laptops a full year before the software was ready. The system was written in Pascal and was delivered to agents in July 1986. The system was designed to help examine Form 1040 returns. Its biggest drawback was that it used 18 different diskettes, requiring agents to continually swap the disks. From privatization efforts by the Reagan administration, the system was subcontracted to outside developers. As IRS funding was cut, programmers with experience in Pascal were cut. The system had to be rewritten in C.

A survey in 1988 revealed that 77 percent of the agents were dissatisfied with the software, and it was used by only one-third of them. By 1989, the IRS revised the software and managed to reduce it to eight disks. Overall, by 1989, the AES project was more than

six years behind schedule and the GAO observed that it would be $800 million over the original budget. The IRS originally anticipated that the AES would produce $16.2 billion in additional revenue over nine years by making agents more productive. The GAO disputed those numbers, noting that

> *the IRS has been unable to verify that the use of laptops has actually resulted in the examination of additional returns or increased tax revenues.*

In 1990, the White House cut funding for the program from $110 million down to $20 million.

Tax System Modernization

By 1989, the IRS knew that it desperately needed to redesign its entire system for collecting taxes and processing information. In hearings before Congress, Sen. David Pryor (D-Ark.) noted that the 1960s era IRS computers were headed for a "train wreck" in the mid-1990s. The GAO estimated the original project would cost between $3 and $4 billion. The projected date for implementation slipped from 1995 to 1998.

The overall design calls for a centralized online database, smaller departmental systems containing local information, and a nationwide network to tie them together. Tax return data would be entered with a combination of electronic filing and optical scanners.

By 1991, the estimated cost of the plan had expanded to $8 billion. Although it was anticipated that the system would cut $6 billion in costs, the plan was rapidly attacked by members of Congress. Three studies of the plan by the GAO were released in early 1991. (1) The GAO was concerned that optical technology was not sufficiently advanced to perform the tasks demanded by the IRS. The GAO urged greater emphasis on electronic filing. (2) The GAO was concerned about management issues such as transition planning, progress

measurement and accountability. (3) The GAO and Sen. John Glenn (D-Ohio) voiced concerns about security. GAO official Howard Rhile notes that

> *This is a serious omission in view of the fact that the IRS intends to allow public access . . . to some of its systems and because concerns over the security of taxpayer information helped doom the first [IRS] modernization effort in the late 1970s.*

Despite these misgivings, the IRS was committed to the plan. Fred Goldberg, IRS commissioner agreed with the GAO findings but observed that

> *We have been running our business essentially the same way, using essentially the same computer and telecommunications systems design for 25 years. [Existing systems] will perform well and achieve incremental improvements for the next few years. . . Our best judgment is that [OCR] technology will be there when we need it, by the end of the decade.*

By 1992, the situation was worse. Shirley Peterson, the new commissioner of internal revenue stated at a Congressional hearing that

> *Our systems are so antiquated that we cannot adequately serve the public. The potential for breakdown during the filing season greatly exceeds acceptable business risk . . . Some components of these computers are so old and brittle that they literally crumble when removed for maintenance.*

In December 1991, the IRS awarded a 12-year, $300-million contract to TRW to help manage the process and provide planning and system integration services.

The new system is ambitious, calling for 60 major projects, two dozen major purchases, 20 million lines of new software, and 308 people just to manage the purchasing. Despite their efforts, elements of the IRS modernization plan were stalled because of purchasing difficulties. In July 1991, the IRS awarded a billion-dollar Treasury Multiuser Acquisition Contract (TMAC) to AT&T. The goal was to standardize purchasing for the IRS and the Treasury Department by routing all purchases through one vendor. The contract was challenged by other vendors and overturned. The contract was rebid and AT&T won a second time. IBM (one of the original protesters) again objected to the process, noting that the IBM bid of $708 million was less than the $1.4 billion bid by AT&T.

In 1993, the IRS acknowledged that the TSM Design Master Plan needed to be re-written. In particular, it had to focus on business aspects instead of technology. To better coordinate technical planning with IRS needs, the agency established a research and development center, funded by $78.5 million of federal money but run by the private sector. The center is responsible for providing technical assistance and strategic planning for the TSM. The IRS also established a high-level "architect office" to evaluate technologies and their likely uses.

Through 1992, the IRS had spent $800 million on TSM. In 1993, new IRS estimates indicate that TSM will cost $7.8 billion above the $15.5 billion needed to keep existing systems running. The new system is expected to generate $12.6 billion in total benefits by 2008 through reduced costs, increased collections, and interest savings. Additionally, the improved processes should save taxpayers $5.4 billion and cut 1 billion hours from their time spent with the IRS.

The IRS asked Congress for a 1996 allocation of $1.03 billion, a substantial increase from the $622 million it spent on automation in 1995. However, Hazel Edwards from the General Accounting Office noted that

> *after eight years and an investment of almost $2 billion, IRS' progress toward its vision has been minimal.*

IRS commissioner, Margaret Milner Richardson, denies the GAO claims, noting

> *I think we have made significant progress, not minimal progress . . . but we do know we can and must do more.*

The IRS situation represents a typical dilemma for Congress. The IRS claims that by spending more money, it will be possible to create a system that finally works. The GAO believes it is impossible to complete the complete project envisioned by the IRS. The GAO believes the IRS should focus on smaller projects that can be completed in one to two years.

Electronic Filing

The IRS introduced electronic filing in 1986, when 25,000 forms were filed electronically. By 1990, 4.2 million people filed for tax refunds electronically. In 1992, the number increased to 10 million filers. In 1994, about 16 million tax returns (7.8 percent of the total) were filed electronically. About half were 1040A forms. In 1995, the IRS expects electronic filing to decrease to about 15 million (7.2 percent).

The primary target of electronic filing is the millions of individual taxpayers who will receive refunds. To control the process and ensure that documents are properly filed, electronic filing is only available through authorized tax preparers. The IRS is deliberately avoiding providing access to individual taxpayers. As a result, taxpayers who use the system pay an additional charge to the preparer. Interestingly, the preparer does not have to pay a fee to the IRS. However, the electronic system provides for refunds within a couple of weeks.

Electronically filed returns cost the IRS one-tenth the processing cost of paper forms. They also eliminate the cost of paper storage. The IRS notes that the service is able to store 800,000 returns on one side of a 12-inch optical disk.

For taxpayers with easy returns, the IRS is simplifying the process even further—providing for filing over the telephone. In a 1992 pilot, 117,000 Ohio taxpayers filed for refunds using TouchTone phone calls. The system was expanded nationwide in 1994. It can only be used by taxpayers who qualify to use the 1040EZ form. A replacement form (1040-TEL) must still be signed and filed with the IRS, along with the W-2 (withholding) statements.

Document Processing System

Despite initial efforts in electronic collection of tax data, the IRS remains committed to handling paper forms. To make that task more efficient, the service is designing a new document processing system. Operators at personal computers will scan in paper documents. They will then correct and key in additional data. The goal is to move 100 percent of the data to an electronic format—compared to today's 40 percent content stored in electronic form.

General Accounting Office

The General Accounting Office (GAO) has examined the IRS systems and development methods several times. The GAO issued a comprehensive report in 1995. Despite the progress of the IRS, the major findings were negative:

- *Despite IRS efforts to improve its tax processing, pervasive management and technical weaknesses still remain that could impede its modernization efforts.*
- *IRS does not have a comprehensive business strategy to reduce paper submissions, and it has not yet fully developed the requisite software and technical infrastructures to successfully implement its modernization efforts.*
- *IRS will not maximize electronic filings because it only targets taxpayers who use third-party tax return preparers or transmitters, are willing to pay a fee to file electronically, and are expecting tax refunds.*
- *IRS does not target the large segment of tax filers who prepare their returns on their personal computers and then submit paper returns.*
- *IRS failure to maximize electronic filings could impair its future ability to process paper returns.*
- *Other tax system modernization (TSM) weaknesses include IRS failure to fully implement strategic information management practices, an immature and weak software development capability, and incomplete systems architectures and integration and system planning.*
- *IRS should manage TSM as an investment and ensure that systems development is driven by re-engineering efforts and that IRS staff have the necessary skills to meet future IRS needs.*

- *IRS has not assigned responsibility, authority, and accountability for managing and controlling systems modernization to one individual or office.*

One of the fundamental GAO complaints deals with the overall strategy of the IRS. The IRS claims to be working toward a paperless system. However:

> *IRS's goal is to have electronic filings for 70 million individual returns and 10 million business returns by 2001. This goal of 80 million electronically filed returns represents 35 percent of all returns. On the basis of the current rate of electronic filings from individuals, IRS estimates that by 2001, only about 29 million individuals will file electronically. If 10 million business returns are filed electronically as projected, a total of about 39 million filings will be electronic. This is only about 17.4 percent of the 224 million tax returns anticipated in 2001, less than half of IRS's goal.*

Table 1: CMM Levels

Level	Name	Description
5	Optimizing	Continuous process improvement is enabled by quantitative feedback from the process and from testing innovative ideas and technologies.
4	Managed	Detailed measures of the software process and product quality are collected. Both the software process and products are quantitatively understood and controlled using detailed measures.
3	Defined	The software process for both management and engineering activities is documented, standardized, and integrated into an organizationwide software process. All projects use a documented and approved version of the organization's process for developing and maintaining software.
2	Repeatable	Basic project management processes are established to track cost, schedule, and functionality. The necessary process discipline is in place to repeat earlier successes on similar projects.
1	Initial	The software process is characterized as ad hoc and occasionally even chaotic. Few processes are defined and success depends on individual efforts.

The GAO is also extremely concerned about the IRS development methods. The IRS has been criticized repeatedly for not adopting strong SDLC development controls. Carnegie Mellon University has developed a system (CMM) for evaluating development teams, which the IRS used to evaluate its development methodologies.

In August 1993, using CMM, IRS rated its software development capability as immature, the lowest level. This level of maturity—CMM level 1—is described as ad hoc and, at times, chaotic, and indicates significant weaknesses in software development capability. Since that date, IRS's software development capability has not improved significantly. IRS's software development activities remain inconsistent and poorly controlled, with no detailed procedures for systems engineers to follow in developing software.

Several problems have arisen because of inconsistencies and multiple, scattered development teams. The IRS took a step to resolve some of these problems by naming the "modernization executive" as an "associate commissioner" in May 1995. All development operations and the CIO were reassigned to report directly to the associate commissioner. The one exception was the research and development division.

The fragmented nature of the IRS TSM project has already caused several problems. These problems are especially acute in handling data. Several data definition problems were uncovered by the GAO:

- *Updated data on one system is not immediately available to users of other systems.*
- *Master data files are updated once a week, and it can take up to two weeks for data in a taxpayer account to be changed.*
- *Inconsistent and incomplete data on different systems can affect fundamental computations and can result, for example, in inconsistent calculations of interest and penalties.*
- *Data is stored in unique formats on different systems and is accessed using various techniques.*

Along with overall strategy and control, the IRS has been faulted for performing limited testing and quality control.

IRS also performs systems testing in operational environments, including its service centers or computer centers, rather than in a controlled environment dedicated to thorough testing.

Planning and Systems Development

The GAO has been especially critical of lack of strategic direction and planning by the IRS. Each year the IRS returns to Congress and requests more money for its independ-

ent projects. The IRS has also been criticized for being sloppy in estimating benefits and costs of the proposed systems. In one example, the IRS claimed the new system would generate additional revenue—but the GAO found that the revenue increase really came about from hiring additional workers for collection. To be fair, the IRS understands and agrees that it has some serious problems with designing and implementing the new systems. They have undertaken several steps to help evaluate and control the project development. For example, there are several planning documents:

- *Business Master Plan: reflects the business priorities set by IRS's top executives and links IRS's strategic objectives and business vision with the tactical actions needed to implement them.*
- *IRS Future Concept of Operations: articulates IRS's future business vision so that the Congress, IRS employees, and the public can see and better understand IRS's plans for serving the public.*
- *Integrated Transition Plan and Schedule: provides a top-level view of the modernization program's tasks, activities, and schedules and is the primary tool used for accountability for delivering the products and services necessary to implement modernization.*

Unfortunately, as of May 1995, these plans had not been completed. For example, the Future Concept of Operations was only 60 percent completed. The plans are also somewhat independent and concepts in one are not necessarily related to the other documents. In the meantime, ad hoc development continues, along with requests for more development money. Interestingly, the IRS maintains that all TSM projects have equal priority, and that they must all be completed together, or the entire project will fail. On the other hand, they have identified six areas that are critical to their operations:

> *IRS has identified 6 core business areas and defined 11 business processes that support these areas. Of these 11, 3 were selected to begin re-engineering efforts. Those selected for initial redesign are (1) processing returns, (2) responding to taxpayers, and (3) enforcement actions.*

From past criticisms, the IRS has begun to evaluate its development efforts. These evaluations are largely keyed toward appeasing Congress and monitoring the time and expenses involved.

> *IRS currently holds program control meetings to assess and control information technology. However, these meetings have generally focused on the costs and implementation schedules of individual projects, rather than on comprehensively evaluating and prioritizing risks and returns expected from these investments. Instead of using explicit criteria to measure risks and returns, IRS evaluates each project's progress using a time-line.*

The IRS has created several teams with specific tasks to help the servie design and build the new systems. The major teams are:

- The Requirements Management Team
- The Software Quality Assurance Team
- The Project Planning and Tracking Team
- The Testing Team
- The Configuration Management Team

Despite these initial efforts, the GAO notes that the teams currently are not used on all projects, and they are being held up by lack of a strategic plan, and limited customer involvement with the teams. Consequently:

> *Although the teams have made progress, their accomplishments have not significantly improved IRS's software development capability.*

In 1993, the IRS committed to an information engineering systems development methodology, which is used to create an information strategic plan that will guide future purchases and development decisions. However, in July 1993, the IRS stated that the "integrated systems architecture" will be completed as each of the TSM components is built.

Security

The IRS has experienced several problems with security in the past few years. Most of them have arisen from problems with its own workers. In particular, the IRS's internal reviews have found several instances where IRS employees

- *Manipulated taxpayer records to generate unauthorized refunds.*

- *Accessed taxpayer records to monitor the processing of fraudulent returns.*
- *Browsed taxpayer accounts that were unrelated to their work, including those of friends, relatives, and neighbors.*

The GAO notes that current IRS controls do not adequately protect taxpayer data. In particular, the IRS has not adequately

- *Restricted access to taxpayer data to only those employees who need it.*
- *Monitored the activities of thousands of employees who were authorized to read and change taxpayer files*
- *Limited the use of computer programs to only those that have been authorized.*

At this point, plans for security in the future systems do not look much better. In its 1995 review, the GAO found several problem areas in which security was lacking:

- A disaster recovery and contingency plan.
- A security concept of operations to define IRS plans under TSM.
- A security certification and accreditation plan to evaluate and test the proposed security.
- A communications security plan to control transfer of data among distributed sites.
- An identification and authentication plan to verify user identities.

Expert Systems

By 1989, the IRS realized that it faced an embarrassing problem: The GAO found that IRS employees give wrong answers to taxpayer questions 36 percent of the time. Admittedly, the problem facing the 5000 telephone "assistors" is challenging. If they do not know the answer to a question, they need to search 159 IRS publications, or in the worst case, search through 10 volumes of tax regulations. In 1988, the assistors answered 38.5 million questions. Each assistor handles an average of 150 calls a day.

To deal with the huge volume of data and improve the answers, in 1990, the IRS Artificial Intelligence Lab developed the Taxpayer Service Assistant, an expert system that contains knowledge from the IRS publications. The prototype could handle 50 complete tax topics and was designed to improve the performance of the novice assistors. It also helped

train the novices to ask the appropriate questions and learn the answers to common situations.

By 1992, the ES was renamed as the Taxpayer Services Integrated System and had been phased into most of the IRS service centers. Henry Philcox, the IRS chief information officer, noted that it provided correct information 85 percent of the time. Although this result represents an improvement, in some cases, the taxpayer had to respond to 43 questions before getting an answer. The IRS found it could get the same accuracy by providing booklets to IRS assistors.

Another use of expert systems lies in sending IRS letters to taxpayers. The IRS annually sends 15 million letters to taxpayers, answering questions and claims. The IRS initially built a file of 300 form letters. Agents extract paragraphs and add sections as needed. Yet, the errors persisted.

In the early 1990s, the GAO estimated that 30 percent of the letters (about 4.5 million) contained errors. In response, the IRS AI lab created the Correspondex Expert System (CES). The system is based on the same file of form letters. However, it contains rules that check for nonstandard word usage, look for conflicting or redundant paragraphs, check spelling, and identify the needed enclosures. The CES also insists that each letter begin with a polite paragraph.

The IRS also has an infamous expert system that it uses to evaluate returns and decide which people should be audited. It is known as the Automated Issue Identification System (AIIS). The internal statistical rules are secret—although a group once tried to sue the IRS to reveal the rules. Ted Rogers, founding chief of the IRS AI lab, noted that in tests, the AIIS identified 90 percent of the audit issues found by IRS experts. The system can be used

to either reduce the amount of preaudit labor by 80 percent or, by keeping the labor the same, to improve tax collections by $60 million a year.

Automated Under-Reporter (AUR)

The Automated Under-Reporter (AUR) is another component of the TMS. The AUR is a system designed to monitor returns and identify people who are most likely to underpay their taxes. The system was first installed in 1992 at the Ogden, Utah regional center. The system pulls data from the service center's Unisys 1180 mainframe. It is downloaded across a local area network to a Sequent Computer System S-81 minicomputer, and from there it is sent to one of 240 networked Unix workstations on the employees' desks.

The system automatically matches distribution documents (such as 10-99's and W-2's) with the filings of individual taxpayers. Mark Cox, assistant IRS commissioner for information systems development, notes that in trials with the AUR "We've been able to cut down the rework of cases from 25 percent to less than 5 percent. We see this type of work enabling us to share in more of a connectivity mode."

The system uses an Oracle Corp database running SQL to compare the data. It also performs basic tax computation and helps agents send notices to taxpayers. Managers note that although the new system has not improved the speed of the agents, it has cut down the error rates. As agents become familiar with the system, they expect productivity to improve.

In 1991, the Ogden center processed 26 million tax returns, collecting $100 billion in tax payments. It processed $9 billion in refunds. In 1992, it won the Presidential Award for Quality for improved tax processing, by saving the government $11 million over five years.

Currency and Banking Retrieval System

In 1988, Congress passed a new law in an attempt to cut down on crime (notably drugs) and to provide leads to people who significantly underreport their income. Every cash transaction of more than $10,000 is required by federal law to be reported to the IRS on a Form 8300. The IRS created the Currency and Banking Retrieval System to match these forms against the filer's tax return. The system automatically identifies people who had large cash purchases but claimed little income. However, due to a programming error, the system missed forms covering $15 million in cash transactions between 1989 and 1990.

The problem stemmed from the fact that the IRS used the same code number on the 8300 forms that it had been using on other cash transaction forms. The IRS later assigned separate codes for each form. But when programmers created the new matching programs, they did not know that there were now two codes for each transaction.

The system was corrected in 1991, and by 1992 was used to process more than 1 million queries a year.

Jennie Stathis of the GAO notes that there are additional problems with the Form 8300. In particular, the filings are often incomplete or contain incorrect taxpayer identification numbers. The IRS is developing software that will allow businesses to automatically verify the taxpayer ID numbers before the customer completes the purchase.

Document Processing System and Service Center Recognition/Image Processing System (SCRIPS)

In 1994, the IRS awarded a $1.3 billion contract to the IBM Federal Systems Co. to design a document processing system that by the late 1990s will convert virtually every tax return to digital form. A day after the contract was awarded, IBM sold the Federal Systems Co. to Loral Corp for $1.52 billion.

The 15-year systems integration contract called for having the system online in 1996. The plan calls for scanning incoming tax forms. Special software will digitally remove the form layout and instructions, leaving just the taxpayer data. OCR software will then convert the characters (including handwritten numbers) into computer data.

The system is scheduled for initial installation at the Austin, Texas regional center in August 1995. Plans call for installing it at Ogden, Utah, Cincinnati, Ohio, Memphis, Tennessee, and Kansas City, Missouri by 1998.

Despite the popularity of electronic filing, the IRS still sees a need for the OCR system. The IRS anticipates receiving 252 million paper filings in the year 2001.

SCRIPS is a less ambitious project ($88 million) that was awarded in 1993 to Grumman Corp.'s data systems unit. SCRIPS was designed to capture data from four simple IRS forms that are single-sided. SCRIPS was supposed to be an interim solution that would support the IRS until DPS could be fully deployed. However, delays have pushed back the delivery of the SCRIPS project.

Interestingly, Grumman Data Systems was the loser in the contest for the DPS contract. The IRS noted that Grumman failed a key technical test.

Security Breaches

In 1983, Sen. John Glenn (D-Ohio) released an IRS report indicating that 386 employees took advantage of "ineffective security controls" and looked through tax records of friends, neighbors, relatives, and celebrities at the Atlanta regional IRS office. Additionally, five employees used the system to create fraudulent returns, triggering more than 200 false tax refunds. Additional investigations turned up more than 100 other IRS employees nationwide with unauthorized access to records. Glenn observed that the IRS investigation

examined only one region, and looked at only 1 of 56 methods that could be use to compromise security. He noted that "I'm concerned this is just the tip of a very large iceberg."

The IRS itself noted that the Tax Systems Modernization (TSM) program "greatly increases the risk of employee browsing, disclosure and fraud," because of the online access to the centralized databases.

Margaret Richardson, commissioner of internal revenue, notes that the system used by the perpetrators is 20 years old and is used by 56,000 employees. It meets all federal security standards, using passwords and limiting access based on job descriptions. The IRS found the problems in Atlanta by examining records of database access during the last three years. Because the system generates 100 million transactions a month, the data is stored on magnetic tape, making it difficult to search.

In 1989, the IRS arrested Alan N. Scott, of West Roxbury, Massachusetts, for allegedly submitting 45 fraudulent returns via the new electronic filing system. The IRS claims the man received more than $325,000 in refunds.

The IRS requires tax return preparers to fill out an application before it issues an access code. Scott apparently used a fake taxpayer ID number and lied on the application form to gain the access number. The IRS claims he then submitted false returns using bogus names and taxpayer ID numbers to get refund checks ranging from $3000 to $23,000.

IRS officials note that the electronic filings actually made it easier to identify the problem, because the computer could scan the data earlier than if it had been submitted by hand. Once the situation was identified, the IRS was able to immediately lock out further transactions from Scott's access number.

IRS Records

In 1993, Congress allowed some high-income taxpayers to spread a portion of their tax payments over three years. The IRS was responsible for tracking and billing for these payments. In August 1995, the IRS issued a public notice that many of the thousands of "delinquent" notices it sent were wrong, but because of weak records, the service did not know how many might be wrong. In July, the IRS issued more than 43,000 incorrect notices.

The General Accounting Office (GAO) in 1995 cited the IRS with failure to keep proper internal accounting records. The GAO stated that the records were so bad, they were unable to express an opinion about the reliability of the IRS financial statements. For example, the GAO was unable to verify "a significant portion" of the $2.1 billion the IRS spends annually in nonpayroll expenses.

IRS Budget

Like any Congressional agency, the IRS budget is set by Congress and approved by the president. In 1995, The Clinton administration asked Congress to increase the IRS budget by 10 percent—allocating the money to improving the information systems and procedures at the IRS to make it more effective. Congress responded by cutting the IRS budget by 2 percent. The Clinton budget called for $8.23 billion, and the Congressional numbers cut the budget from $7.48 billion in 1995 to $7.35 billion in 1996. Congress did grant a slight increase in the budget for tax system modernization. Rep. Jim Lightfoot (R-Iowa) observed that

> *Without modernization, I think you're throwing good money after bad. The IRS is still working out of cardboard boxes. It's basically that bad.*

Virginia

In 1991, John D. Johnson, the chief financial officer of the IRS was surprised when he contacted the Virginia state tax office regarding his personal state tax refund. On receipt of John's social security number, the Virginia tax commissioner typed it into the terminal on his desk. Within seconds, the answer was displayed on the terminal.

Mr. Johnson was shocked that the state agency could provide the information so rapidly. Attempting to obtain the same information from the U.S. IRS would take at least three days and probably several phone calls. The IRS promptly sent the chief information officer and 10 deputies to Richmond to check out the system.

United Kingdom: Inland Revenue

In 1993, the United Kingdom decided to privatize computing for Inland Revenue, the UK equivalent of the U.S. IRS. Fueled by the success of privatizing the motor vehicle registration system, government managers evaluated the benefits of outsourcing the computer functions of the tax agency.

Inland Revenue signed a 10-year contract worth up to $2 billion with EDS subsidiary EDS-Scicon Ltd. to take over the information processing. EDS must still answer questions about security and labor/hiring practices. The arrangement calls for EDS to purchase $105 million of equipment from Inland and to hire 2000 of its 2500 workers. Inland would keep about 300 managers.

The union representing Inland information-processing workers is protesting the decision, citing security and privacy concerns as reasons to block the deal. Inland managers responded by noting that Inland Revenue and the British government "attach the greatest importance to safeguarding the privacy" of taxpayer information. They also stated that In-

Inland would retain responsibility for confidentiality and would punish any breaches through "legal sanctions." An EDS spokesperson concurred and noted that EDS has strong safeguards to protect confidential information.

Client Server Technology to Provide Federal Tax Collection

The First National Bank of Chicago and NationsBank Corporation in Charlotte, North Carolina, are developing one-half of the federal government's Electronic Federal Tax Payment System. In doing so, it has nine months to put together a program that will process taxpayer data and provide online querying and batch updates on settlement transactions for customers and the IRS. AT&T is developing the telecom and voice-recognition services; ISSC is providing the data-processing services; and Intranet is providing the Automated Clearing House transaction-processing software. Because the development deadline is so short, the focus is on client server rather than a mainframe application.

According to Marybeth Anderson, manager of the project for First Chicago, the development group wanted to focus on object-oriented technology in the database work because development using DB2 would take much longer.

To construct their half of the program, NationsBank has subcontracted the project to First Data Corporation in Hackensack, New Jersey. First Data is building the program on their current base of *TaxLink*.

Once the program is completed, First Chicago and NationsBank will become the financial agents for the Treasury Department. They will develop and operate information systems that will enable the electronic handling of tax payments and taxpayer information. Treasury projects it will save $433 million through 1999 by eliminating paperwork from the collection of the corporate and individual tax payments. The two banks will each collect

more than $400 million in transaction fees for their half of the total volume of tax payments.

According to John McGuire, director at Treasury's Financial Management Services, splitting the systems between the two banks will give taxpayers the best possible service and the government the best possible bargain.

Case Questions

1. What problems have been experienced by the IRS in developing its information systems?

2. How are these problems related to the IRS' systems development methodologies?

3. What other factors are involved in causing the IRS difficulties?

4. Is the IRS pushing technology too hard? For example, are the OCR systems technically reasonable?

5. The GAO thinks the IRS should place more emphasis on electronic filing. Is the accounting office correct, or is the IRS approach better? Write a proposal supporting one of the two sides, emphasizing costs, benefits, risks, and opportunities.

6. Why was the State of Virginia able to build an integrated system by 1991, but the IRS still does not have the same capabilities?

7. Are there any ways to speed up the development of systems for the IRS? What would be the costs and risks?

8. Are the IRS problems the result of technology or management difficulties?

9. What would be the advantages and drawbacks to outsourcing the IRS information systems, similar to the UK approach? How does that approach differ from the methods used by the IRS?

10. Write a 5-year and 10-year management plan for the development and adoption of technology at the IRS. Be sure to include transition and implementation details.

11. Why did the IRS choose private banks to develop the electronic payment system? Could this technique be used for other systems?

12. Why would NationsBank choose to focus on object-oriented technology instead of a traditional database system to build the federal electronic payment system?

13. What are the differences between the IRS proposals and the GAO suggestions? What

are the advantages of each approach?

14. Is there any hope? Can the IRS improve its development processes? Outline a methodology that the IRS can use to develop its systems.

15. Design a strategic plan for the IRS tax modernization system. Specify the goals and the re-engineering that will be involved.

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