

Flexibility Within Complexity: Design of Automation by Solution Systems, Inc., for WHEELS, Inc., of Philadelphia

SUZANNE AXWORTHY AND NEIL L. KLEEMAN

WHEELS, Inc., manages some 8,000 trips per day—4,500 paratransit and 3,500 fare-reimbursable transit trips—using automation developed by Solution Systems, Inc., (SSI) in collaboration with WHEELS. With this system, WHEELS registers clients, reserves and schedules paratransit trips, verifies transportation charges, and collects and distributes reimbursements to carriers and individuals. SSI processes the data and operates the system on its mainframe computers. The successful development of this system suggests that any such system must take into account all program features, the complexities of daily management and activities, and the program's need for flexibility in dynamically managing change and growth. Transportation management must thoroughly define its needs for information entry, use, processing, recall, and storage. The computer supplier must respond by designing programs and procedures that can be enhanced readily over time, by providing for data processing and maintenance, and by placement of equipment that meets original and changing needs.

Specialized transportation and computerization for the industry are both relatively new enterprises. However, any specialized transportation service or computer system supplier may find some guidelines for designing, installing, and servicing a system in the experience of WHEELS', Inc., Medical Assistance Transportation Program (MATP). WHEELS is coordinator of Medicaid-funded transportation for the city and county of Philadelphia. WHEELS manages the program under a contract awarded by the Pennsylvania Department of Public Welfare—a contract that WHEELS has held since 1983 when the state first placed the program in the hands of county administrators.

WHEELS uses a computerized system developed for the MATP by Solution Systems, Inc., (SSI) of Narberth, Pennsylvania. That development suggests that such a system must take into account the fundamental features of the transportation program, the complexities of day-to-day transportation management and activities, and the associated need for great flexibility. Experience also suggests that managing a computer system is a separate area of expertise. The success of the WHEELS-SSI collaboration also shows that the transportation management must thoroughly define and think through its needs for information entry, use, processing, recall, and storage. The computer system supplier must be equally thorough in designing, providing, maintaining, and improving the procedures and equipment needed.

CHALLENGES OF AUTOMATION

To Computer System Suppliers

The environment of specialized transportation challenges computer system suppliers because of its program complexities. Most programs require handling information for a diverse series of activities—client registrations, trip reservations, trip scheduling, records of paratransit trips or trips by other modes, multiple sponsors with various service standards, and a variety of fiscal arrangements. Moreover, static record keeping does not suffice for specialized transportation. An effective computer system must be flexible enough to enable the transportation manager to handle frequent and sometimes constant changes within and among program elements. The system must offer procedures that interact continuously in managing and processing those changes.

Specific to SSI

WHEELS challenged the supplier, SSI, to design a system for a program with large volumes—up to 25,000 active clients, 4,500 daily paratransit trips, and 3,500 daily trips by means of public transit with fare reimbursement. In the MATP, WHEELS registers the medical assistance clients, ensures their current eligibility, and assigns each to travel either by paratransit or by fare-reimbursed modes. WHEELS reserves and schedules all paratransit trips, brokers delivery of services to private paratransit carriers, manages and monitors the carriers' delivery of service, reviews and analyzes in-service records, invoices the Pennsylvania Department of Public Welfare, distributes all state reimbursements for the program, and prepares and distributes all service reports. The basic roles of the state and WHEELS are outlined in Figure 1.

WHEELS outlined to SSI how the data to support this complex program would need to flow through an automated system. Each client enters the system by registration with WHEELS, which makes the appropriate assignment to travel by paratransit or by a fare-reimbursed mode. Each client's registration is rigorously checked by WHEELS to determine its accuracy and currency. Each client's paratransit trips are reserved and scheduled by WHEELS, with private carriers receiving their schedules from WHEELS daily. All transportation records, both paratransit and transit, are reviewed trip by trip, by WHEELS' staff. When and as verified by WHEELS,

S. Axworthy, WHEELS, Inc., 919 Walnut Street, Philadelphia, Pa. 19107. N. L. Kleeman, Solution Systems, Inc., 114 Forrest Ave., Narberth, Pa. 19072.

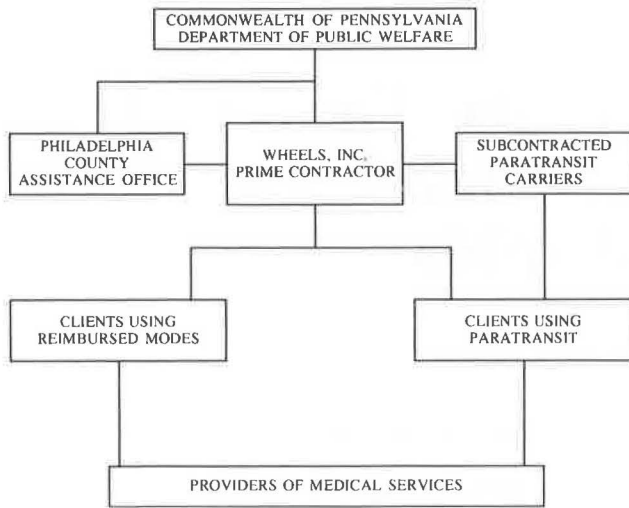


FIGURE 1 Medical Assistance Transportation Program organization chart, Philadelphia, Pa.

all claims for reimbursements—from private paratransit carriers and from individuals who use transit—are invoiced to the state by WHEELS. The state’s payment is distributed for all verified reimbursements by WHEELS.

WHEELS outlined the general flow of data required for these processes as presented in Figure 2. WHEELS also pro-

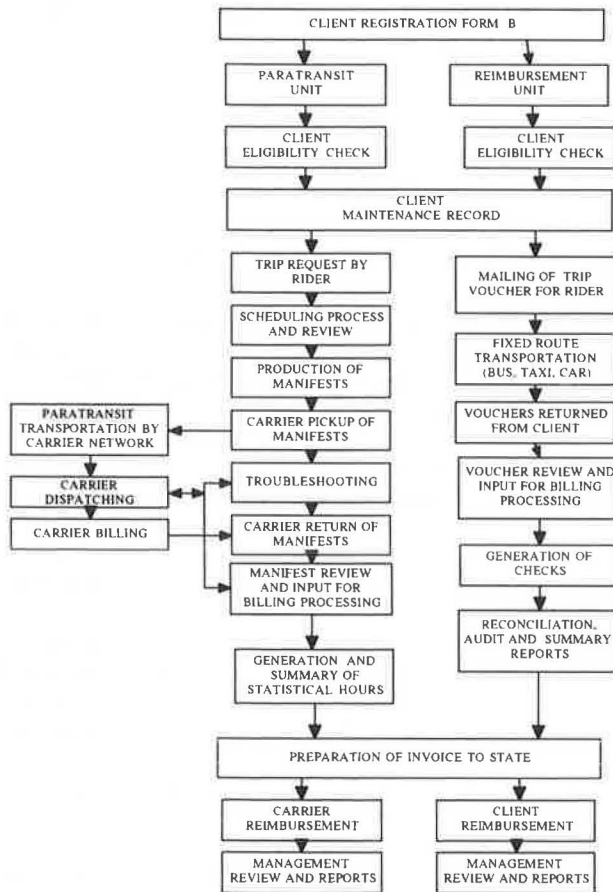


FIGURE 2 WHEELS overall data flow.

vided SSI with a closer look at the flow of data it needed to administer various types of clients. For example, as shown on Figure 3, multiple complexities are introduced with reservations and scheduling of trips, trip delivery by the carrier network, analyses of returned manifests (driver logs), monitoring and quality assurance activities by WHEELS, and statistical summaries to support billings. On Figure 4, different requirements are involved—clients are supplied with vouchers to record their fixed-route trips, the vouchers are returned and analyzed to support reimbursement, checks are produced to pay each client, and statistical analyses are performed to support billings.

In discussion with SSI during development of the system, WHEELS also made it clear that, like all specialized transportation systems, the MATP is subject to change at many levels. Client eligibility has a limited duration and, often, potential reinstatement. The state may add, delete, or alter eligibility categories, affecting thousands of client records and trip plans. The paratransit schedules for the 150 vehicles in service change daily. The subcontracted carrier group changes at least annually. Preplanned vehicle tours must be revised because of real-time incidents in daily delivery of service and fundamental changes in service methods may be introduced from time to time. WHEELS’ challenge to SSI was to translate its established manual procedures for handling all changes into procedures that could be operated through computer terminals and printers, and filed by using the power of automation to store immense quantities of data.

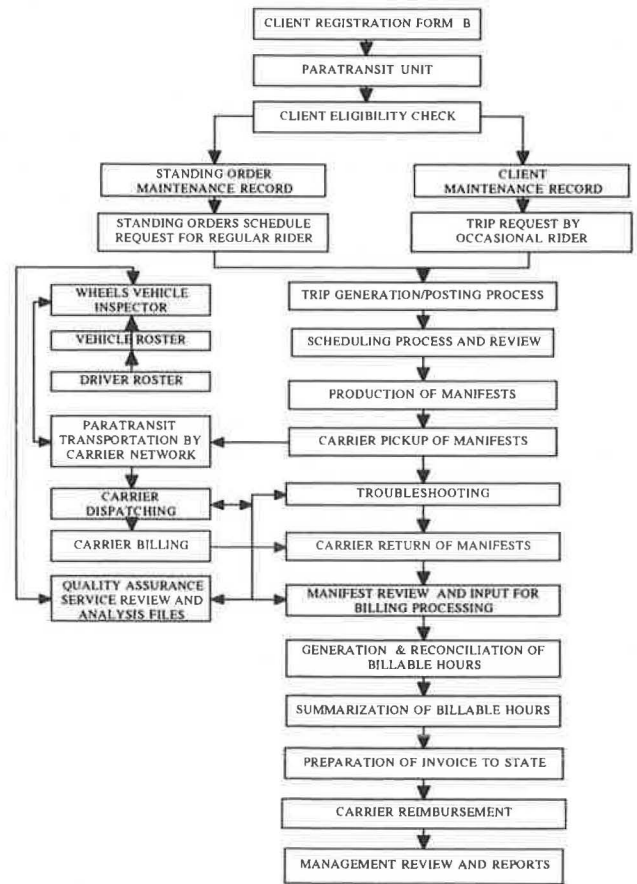


FIGURE 3 WHEELS data flow for paratransit unit.

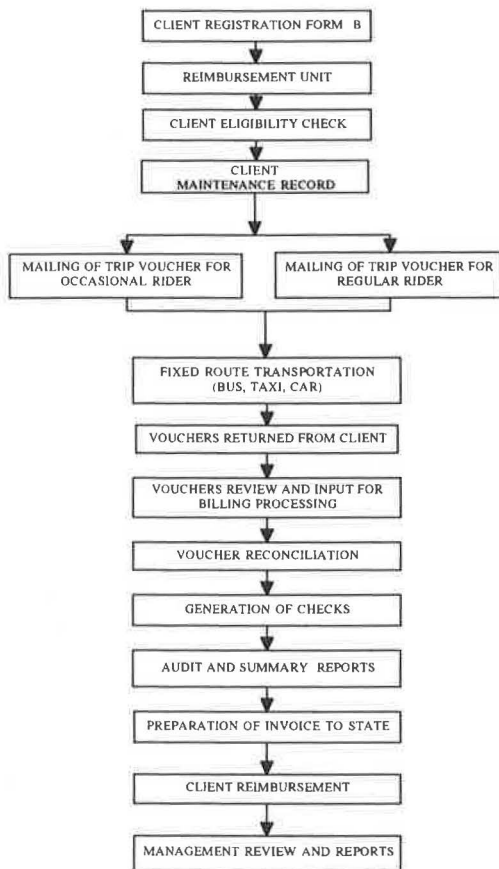


FIGURE 4 WHEELS data flow for reimbursement unit.

In its procurement, WHEELS also asked SSI to satisfy certain fundamental concepts that reflect how the information is used—concepts that demonstrate the need for flexibility and for interaction among the program elements. WHEELS asked for a dynamic approach in which many users, working simultaneously at separate work stations on different activities, are able to access the specific information that they need, selected from literally scores of files. The normal flow of information may be bypassed to present to the worker only those records needed for a particular process. WHEELS also asked SSI to enable selected information to flow in any direction needed, similar to the “people-flow” of information, which is evident when using manual procedures. WHEELS added a challenge to SSI for ready and fast manipulation of data. The system must act quickly on each process. Moreover, the scheduling element of the system must conduct repetitions, each with some change, and quickly, which enable the scheduler to arrive at a finely tuned set of vehicle routings. To help SSI to meet these challenges, WHEELS acquainted SSI with its staff and their organization, as outlined in Figure 5. WHEELS requires no more than 50 individuals to carry out all of the steps involved in this massive program of 2 million trips per year.

WHEELS also addressed SSI on the challenges of computer system management. Having been selected by the Department of Public Welfare as an expert in specialized transportation that could manage the MATP efficiently, WHEELS in turn sought an expert computer systems supplier. WHEELS adopted off-site system management as recommended by SSI. As a result, WHEELS has not had to incorporate the staff, time, and activities of computer system management. That collaboration has worked well for WHEELS’ specific needs.

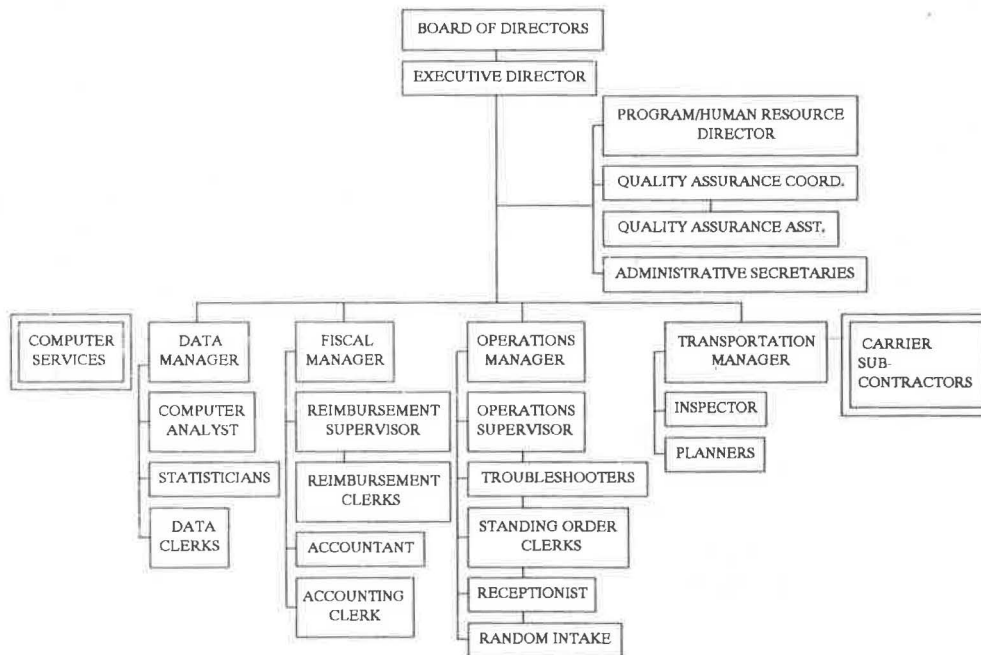


FIGURE 5 WHEELS organizational chart (MA division).

Other forms of transportation and computer system collaborations may better serve the needs of other programs. Whatever the arrangement, the WHEELS-SSI experience points out the rewards of making a joint effort to arrive at thorough understanding of the system's purposes and uses before the system is in place. Furthermore, the value of establishing a mechanism for continuing consultation and development of the system is highlighted.

SSI AND RESPONSES TO WHEELS' CHALLENGES

Outsourcing Service

The term outsourcing means contracting the responsibility for data processing and the associated resources and management to an outside firm that specializes in computerized technologies. The outside firm acquires and constantly upgrades the computer while also providing software design, vendor interface, control of power and the environment for the equipment, and communications systems. The outside firm provides the programming, maintenance, and enhancement of the applications themselves. With outsourcing, suppliers can also offer alternative arrangements that incorporate the client's own hardware but maintain the essential proactive, ongoing relationship with the client.

SSI recommended that WHEELS use SSI's outsourcing services on the premise that most organizations, especially smaller ones like WHEELS, cannot even come close to the level of experience required to perform all of the data processing tasks that are essential to a program as large as the MATP. The outsourcing approach allows WHEELS to manage specialized transportation while SSI does the computing. The outline of the approach used by SSI for WHEELS is depicted in Figure 6.

Design and Operation of SSI's System for WHEELS

WHEELS required that SSI develop custom software. SSI designed computer programs that are specific to the WHEELS application, as well as the tool for managing the data. That

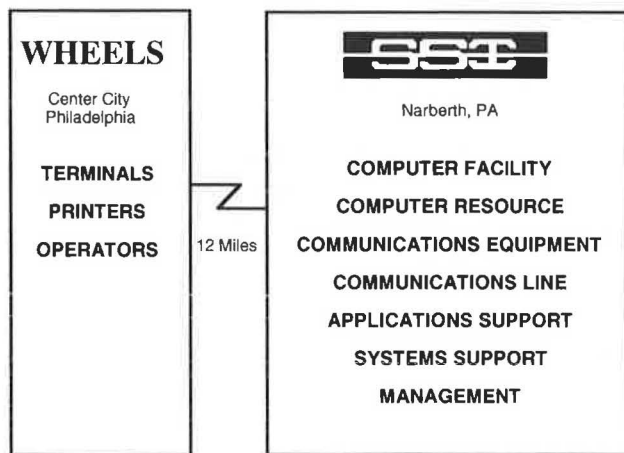


FIGURE 6 WHEELS-SSI outsourcing.

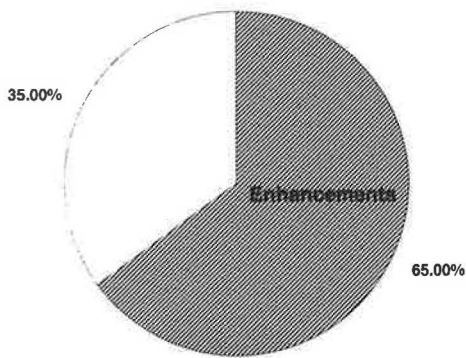
tool is Prime Information, which offers a dictionary-based file-management system and sophisticated techniques within an industry-standard system. Despite its complexities, the system is easy for WHEELS' managers to use because the data are immediately and readily accessed by WHEELS. SSI included an ongoing software warranty, which ensures that problems are corrected by SSI at no additional cost. WHEELS can report problems on line, and many can be corrected that day.

SSI saw that WHEELS needed a computer system powerful enough to ensure the storage and swift processing of a large volume of transportation data that are input by many users simultaneously performing various functions in the operation. SSI also saw that, beyond the requirements of efficient storage and processing of records, WHEELS needed a system with the flexibility to handle continuous fluctuation in the size of each of the many files. SSI saw that the data processing, which it could supply through outsourcing, would enable WHEELS to tap into a resource that had virtually no limitations. The WHEELS system is connected to SSI, where it operates on a Prime 6350 computer system. That system supports about 30 other SSI clients and up to 150 terminals and printers. For WHEELS and other clients, SSI is providing an invisible but highly flexible computing resource.

SSI responded to WHEELS' challenge of no down time by placing the systems for WHEELS in a complete computer environment. SSI provides hardware backup, uninterrupted power, redundant environmental systems, constant computer-room monitoring of power and temperature, and security against fire and water damage. This is the kind of computing environment usually enjoyed only by large companies. In the SSI application, WHEELS is sharing the resources with many other clients, each benefitting from all of the safeguards against down time.

SSI understood that WHEELS is constantly working to improve and enhance its management of the MATP. Therefore, SSI provides system upgrades—the resources to satisfy WHEELS' changing requirements. Upgrading systems is routine practice for SSI. WHEELS and other clients are not even aware of SSI's work on memory, processors, speed, and interface with vendors to accomplish enhanced systems. WHEELS' experience does not require added costs for equipment enhancements, because upgrades are built into the negotiated relationship. WHEELS benefits from improvements to computer facilities without planning, acquisition, and installation of new and different equipment. In addition, upgrades facilitate overall system growth: software applications are often enhanced as a result of hardware changes. To effect these enhancements, however, consistent interaction between WHEELS and SSI is required. As shown in Figure 7, SSI has upgraded the applications WHEELS uses by 65 percent since 1987.

SSI provides people backup as well as equipment backup for the WHEELS system. SSI assigned experienced staff to design the system and then to maintain and enhance it as it is used. The SSI staff becomes an ongoing consultant for WHEELS, where the data manager is the technical consultant who acts as the liaison with SSI. The SSI consultant works on each WHEELS requirement that arises—application design, system analysis, programming, documentation, training, and system monitoring. The relationships between SSI and WHEELS personnel are outlined in Figure 8.



Additional 31% Growth in System Capabilities

FIGURE 7 Percent of system enhanced in the last 3 years.

To design the system, WHEELS had already established its needs for a range of computer files, encompassing client, trip, provider, carrier, and reimbursement voucher information. By extensive consultation between WHEELS and SSI at the outset, SSI had the guidelines it needed to interpret WHEELS' needs, write the programs to be used, and install the full automation process. Following the design stage, the daily interaction between the two companies inherently fulfills WHEELS' requirements for immediate applicability, ongoing adaptability, and system flexibility. This proactive coordination of system implementation has resulted in growth for both WHEELS and SSI in data management of the MATP.

In both initial design and further development, the same basic procedures apply. WHEELS' requirements are closely defined, usually through face-to-face meetings using a preliminary analysis by the data manager at WHEELS. The technical consultant at SSI writes a synopsis of the project, which is reviewed by WHEELS. Each procedure is demonstrated as early as possible, results studied, and improvements incorporated in the final development. This process minimizes development time and costs. The final stage is issuance of an Authorization for Software Services, which documents the services, their costs, and the duration of the project development. In further development, many procedures can be accomplished by WHEELS itself. The interactions between

SSI and WHEELS for design and enhancement activities are depicted in Figure 9.

Overall, the WHEELS-SSI relationship enables both firms to view the computerization as a system that is never finished. Because the requirements of the MATP are in constant evolution—like those of all programs of specialized transportation—the relationship guarantees ongoing programming and support. WHEELS is not faced with the problem of growing out of the hardware or software in a short time. Rather, this collaboration supports ongoing development and improvement of the MATP.

RESULTS

The close, consistent interface just presented has resulted in a successful, efficient, and cost-effective data management facility for WHEELS. Its multiple-sided approach, which coordinates the computing hardware, the computing facility, communications, and especially the personnel to implement the software, has been successful—much more successful than a fragmented hardware-software consulting approach would have been.

WHEELS has consistently achieved some notable results in coordinating and managing the MATP. Before WHEELS became involved, the Department of Public Welfare paid \$20.00 or more for each medical assistance trip in Philadelphia. With WHEELS' coordination, the department's overall cost per trip has been reduced to between \$5.00 and \$6.00, including a paratransit cost per trip of only \$9.00 to \$11.00. Only 14 percent of the annual budget of \$12 to \$13 million is used by WHEELS for administrative expenses.

WHEELS does not owe its success solely to the computerized system. WHEELS' achievements in the MATP reflect the firm's overall experience with specialized transportation. WHEELS has provided and managed its own program of free medical trips for more than 30 years and has contracted services for more than 15 years. In previous conferences on specialized transportation, WHEELS has presented discussion of its brokerage methods and approaches in some detail (1). In undertaking coordination, WHEELS was ready to apply expertise, insights, and a skilled staff to design and carry out the program.

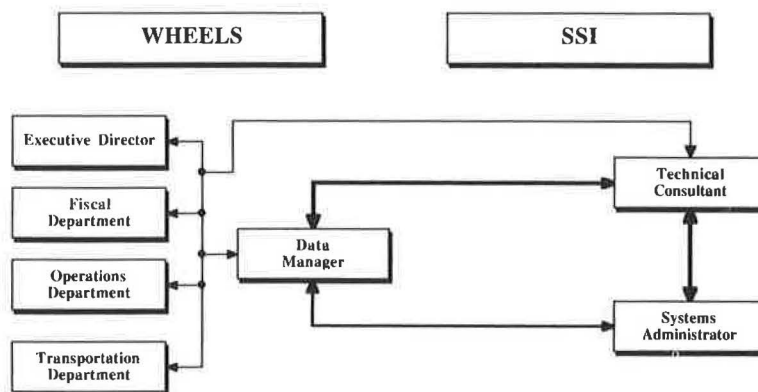


FIGURE 8 Flexibility within communication and design.

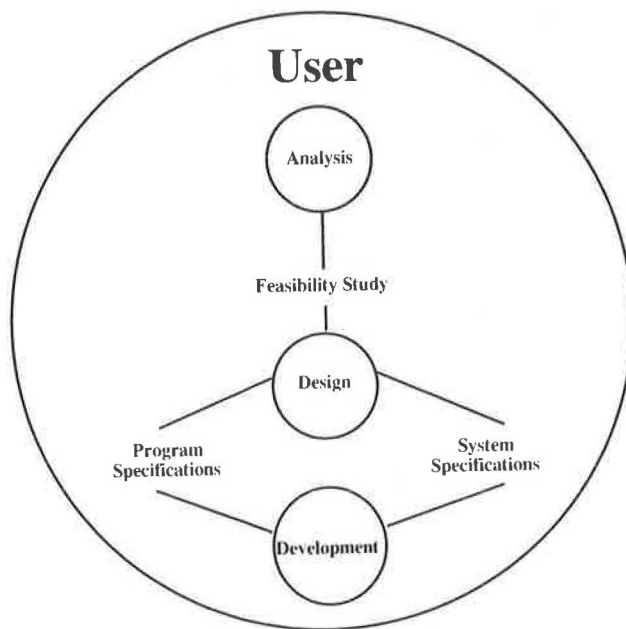


FIGURE 9 Interactive design process.

SSI also brought extensive experience to bear upon design and development of the system for WHEELS. SSI was formed in 1981 to provide state-of-the-art computing to business and industry in the areas of custom data management systems and scientific and engineering applications. This goal has been satisfied by constantly updating computers, communication systems, data management system software, applications development, and attention to people—both internal technical consultants and clients.

Providing an outsourced resource for clients for all of their data processing requirements is the message of this experience. This can include the provision of hardware and software, along with the applications personnel needed to solve a myriad of data processing or data management problems in many different industries.

For WHEELS, SSI has provided access to significant computer resources, communications from WHEELS' center city office to SSI's suburban computer center, and, most importantly, the personnel to design, develop, maintain, and expand the software. In addition, SSI's delivery method also provides system maintenance, constant monitoring of communications, a backup facility with terminals and printers, and complete management of the data processing resource. This has enabled WHEELS' personnel and management to focus on their goal of providing specialized transportation.

It is hard to overstate the significance of the flexibility provided by the SSI system. Because of this highly effective technology, managers' energies are freed for thinking, planning, evaluating, and initiating program and service improvements to deal with the ever-changing challenges of the MATP. In turn, WHEELS has confidence in asking the system to accommodate revision, expansion, and new procedures while also dealing with the hour-by-hour, day-to-day changes in operating and managing the service—superior features in automation for specialized transportation.

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