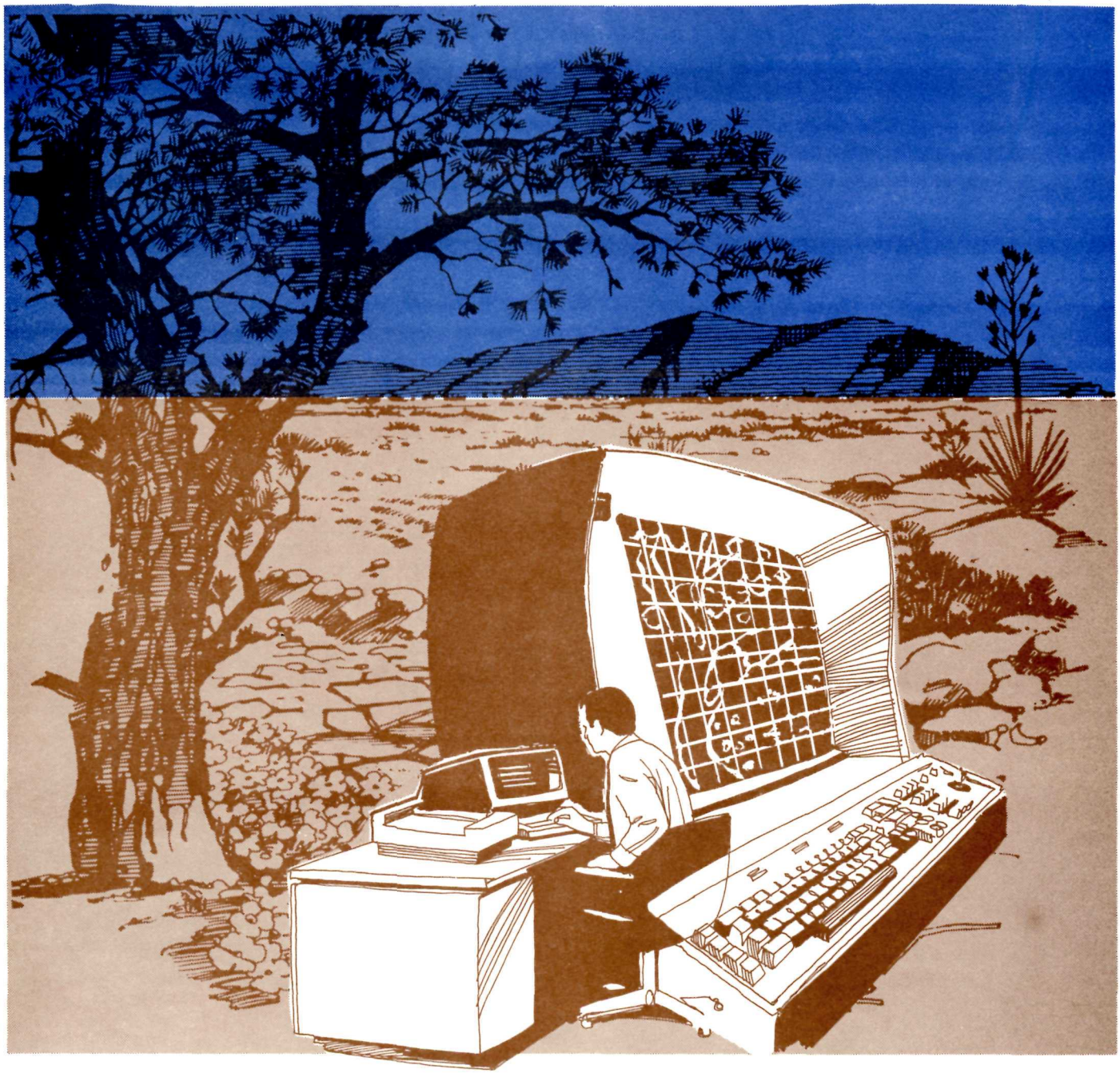
National Park Service
U.S. Department of the Interior
and
National Recreation and
Park Association

Trends

1983
Volume 20
Number 1

Trends in Computers in Parks and Recreation



Trends

A PUBLICATION OF THE PARK PRACTICE PROGRAM

The Park Practice Program is a cooperative effort of the National Park Service and the National Recreation and Park Association.

Russell E. Dickenson, Director
National Park Service

John H. Davis, Executive Director
National Recreation and Park Association

EDITORIAL STAFF

Division of Cooperative Activities
National Park Service
U.S. Department of the Interior

Frank C. Goodell, Program Manager

James A. Burnett, Editor, *Design, Grist*

Kathleen A. Pleasant, Editor, *Trends* and Writer, *Grist* and *Design*

Glenn O. Snyder, Designer

NRPA PRINTING STAFF

Albert H. Ziegenfuss, Manager

The program includes:
Trends, a quarterly publication on topics of general interest in park and recreation management and programming; *Grist*, a bimonthly publication on practical solutions to everyday problems in park and recreation operations; and *Design*, a quarterly compendium of plans for park and recreation structures which demonstrate quality design and intelligent use of materials.

Membership in the Park Practice Program includes a subscription to all three publications and selected back issues in vinyl binders with indices and all publications for the calendar year.

The initial membership fee is $80; annual renewal is $20. A separate subscription to *Trends* is $15 initially, and $10 on renewal. Subscription application and fees, and membership inquiries should be sent *only* to: National Recreation and Park Association, 3101 Park Center Drive, Alexandria, VA 22302.

Articles, suggestions, ideas and comments are invited, and should be sent to Park Practice Program, U.S. Department of the Interior, Division of Cooperative Activities, National Park Service, Washington, DC 20240.

Contents

Trends in Computers in Parks and Recreation

Introduction

Computers: A Perspective for the Park and Recreation Profession

by Richard J. Schroth, Re.D.

Not since the industrial revolution has a technology had the impact on society as great as the advent of the computer. One of the most wondrous things about the computer is the speed at which it performs. Thomas R. Billadeau, President of Automated Office Systems, suggests you spill a cup of coffee to see just how fast a computer operates. Before the coffee hits the floor, "a large computer could debit 2,000 checks to 300 different bank accounts, analyze the electrocardiograms of 110 patients, score 150,000 answers on 3,000 examinations while concurrently analyzing the effectiveness of the questions, and process the payroll of 1,000 employees!"

Intimidating? You bet it is. Thousands of our fellow professionals in the park and recreation field are currently struggling with the notion of installing or using one of these number-crunching monsters in their departments and feeling very unsure. Some of the insecurity we experience stems from the unknown impact it will have on employees, budgets and the "traditional way of doing things." Questions such as staff education, adjustments in organizational methods and structure, and our general lack of knowledge of how a computer works, all represent components that cause us to wave flags of great caution when the word "computer" is spoken.

William Mills, Mont. County Public Schools

Excitement and enthusiasm can result from proper computer system development.

Some agencies and universities have looked beyond these barriers and have aggressively made the new computer technology work for them. Others are carefully and methodically grinding through the process of making computers part of their daily routine. Many others are either ignoring the existence of the computer or are just recognizing that the new "fad" may be here to stay.

With whatever group you find yourself most aligned, computers are a part of our world and one which our profession should take an active role in adapting for the benefit of the public it serves. The thrust of this introduction and this entire issue of TRENDS is focused on putting into perspective some of the current usages, future directions and existing problems facing our changing park and recreation profession.

Positive Steps Being Taken by the Park and Recreation Profession Related to Computer Applications

Our profession has taken a number of positive steps in attempting to respond to the introduction of computer technology in our society. Many of these attempts have been quite successful while others have proven less effective, but have added to the body of knowledge.

NRPA Computer Workshop

Probably one of the more successful means of presenting the use of advanced technology in our field today is the yearly Workshop on Computers in Parks and Recreation sponsored by the National Recreation and Park Association (See Who Can You Turn To?). Having just finished its sixth year, this workshop probably has done more than any other single thing in attempting to introduce the ideas of computer usage and advanced technology to the park and recreation profession. The workshop focuses primarily on the applications used by various departments and the interchange between workshop attendees about ideas and problems they have encountered in using the computer.

Literature Availability

For the past few years, the park and recreation profession has experienced a serious void in the available literature about computers and their use in parks and recreation. Only in the last few years have significant literary resources become available. The NRPA computer workshop proceedings serve as a primary resource and are considered the most popular reference source for many departments. A new publication capsulizing the best of the workshop's papers is soon to be released.

Efforts have been made on the part of some universities to compile reference tool publications related to system applications and bibliographic data. In some cases, the response to such publications has been overwhelming, while in other instances the lack of knowledge that the resource even exists has become a problem.

Scarcity of literature about computers and their use is the antithesis of the situation outside our profession. In the past years, thousands of articles have been written about the subject. We can find ourselves equally confused with the overabundance as we did with the void. Nonetheless, one can utilize much of the information from outside our immediate professional boundaries and should consider this as a primary source.

Expanded Educational Opportunities

As mentioned above, for the first few years, the NRPA Workshop on Computers in Parks and Recreation served as the primary educational source if one wanted to learn more about computers as they directly related to our profession. Recently, however, an expanded educational horizon has opened to our professionals with many opportunities for learning. Most of the professional state and national conferences and workshops now include at least one session on computers.

Some park and recreation curricula are now instructing future park and recreation graduates on the use and application of computers. This fact alone is bringing about initial attitudinal changes in departments as these young people are hired into new jobs. As a result of their training, acceptance of the computer as an important park and recreation program tool is becoming apparent.

Finally, an attempt is currently under way by some of the more progressive universities to take the next step in workshops and educational materials related to the use of the computer. Rather than focusing on the "What can it do"? question, an emphasis is being placed on "How do I effectively interpret and utilize data"? This shift will prove to be a very significant new direction for the profession.

Growing Historical Base

Acknowledging that many departments have been using the computer in financial applications for many years, the onset of operational applications is a rather new phenomena. We are just beginning to reach a point where a wide range of such uses is developing a track record and is providing us with an experiential base. Some of these applications are also beginning to show significant improvements in operational efficiencies and cost savings. As a result, more and more agencies are making information and techniques available.

Problems Yet to be Overcome by Our Profession in the Use of Computers

Recognizing that the park and recreation profession has made many significant strides in the

use of the computer, we must also face our shortcomings. For the most part, our deficiencies fall into one of the following two groups.

General Lack of Understanding About Computers

More educational opportunities are now open to learn about computers. However, many tend to ignore this opportunity. In viewing the profession as a whole, our understanding about computers and their usage has not kept pace with either the business community or even the recreational habits of our citizens. Computer usage is all around us, touching almost every aspect of our lives, and yet a tendency to strongly oppose even the mention of the word "computers" when referring to parks and recreation is the immediate reaction of some.

This is very unfortunate as we see millions of our youngsters, teens, and adults thoroughly enjoying the challenges computer technology brings to them in their leisure time. We have also been shortsighted when we ignore the significant cost savings and productivity improvements that are being recognized by some park and recreation departments around the country. Obviously, our traditional park and recreation programs still remain the cornerstone for our service mission, and many of our ways of managing are still applicable. We can't ignore the fact that advanced technology is carving into people's leisure behavior and departmental administrative practices, no matter how much we try to convince ourselves we should.

The general conservative nature of our profession clearly evidences itself when we ignore or dispute such issues, knowing that our future is moving in this direction. If proper recognition is given to the computer's role in a department, controls can be used to allow the technology to serve rather than frustrate. Regardless of whether those of us choose to accept the usage of computers or continue to ignore their presence, progress will be made in utilizing this technology.

William Mills, Mont. County Public Schools

Computer assisted instruction is becoming a commonplace event in many elementary schools.

University Dilemmas

One of the more disturbing situations is that in many of our university park and recreation curricula there is a lack of attention toward developing computer skills for the students. In some of our more progressive institutions, programs are currently in place, or are being planned, incorporating such training into the curriculum. For the most part, primary attention is being given at the graduate course level and not at the undergraduate. The institutions that have developed undergraduate course work in computers are the exceptions rather than the rule. Although department heads often express interest and recognize the need to address the subject of computers, most have not taken any positive steps toward the implementation of such programs.

Again, only those institutions with foresight are responding to the challenge. A real disservice is created for our young professionals and the field as a whole when either park and recreation departmental course offerings for computers are unavailable; or inadequate counseling causes the individual to leave the institution without some exposure to the computer elsewhere in the curriculum. Functioning in tomorrow's society will require all individuals to have some level of computer literacy, and yet we continue to train and graduate individuals who are computer illiterates. If we don't adjust now, how can we hope to recruit and train the person who has been exposed to this technology from an early age.

Future Trends

Trying to predict the ways in which our profession will use computers is close to impossible, as new advances are made daily in all aspects of the computer industry and our profession. However, since there are certain trends emerging, the following might provide some insight into the crystal ball of technology and its role in our professional lives.

Computer Resources Available to All

A service bureau is an organization that sells computer resources to a customer. These resources may range from computing capabilities to providing specialized informational data bases. Use of such services will grow very rapidly once a greater understanding of their availability and applicability is known. Being able to process data, inquire into available grants from world-wide funding sources, review the literature on a particular topic contained in the National Agricultural Library or Library of Congress, and utilize investment models to predict cash flow decisions are just a few of the uses provided by service bureaus that will expand through the use of the computer. The largest and smallest departments alike will have access to world-wide and affordable system resources.

Interpretation & Public Education

In the years ahead, many departments will be using advanced computer technology as an integral part of their interpretation and public education programs. As illustrated, the National Park Service used such technology at the 1982 World's Fair to inform visitors about nearby National Park areas.

In the same context, microtechnology will also be applied to the use of small gaming systems specifically designed to assist in flora and fauna identification and interpretation. As an example, it is not unrealistic to think of a game as exciting as PAC-MAN but which features nature as a central theme. Current research now allows us to use the computer to monitor the actual changing environmental conditions and immediately displays the results. Someday such programs will be well integrated into our nature and botanical programs.

Many instances can be cited where the computer is currently being used to provide educational information to the public which is tailored to their specific situation and needs. A good example of such usage is a gardening program developed by Purdue University. This program produces custom-made garden plots and, in addition, provides specific plant information regarding the requested vegetables.

Under the umbrella of public education, computers will also be used to interpret information about the departmental leisure activities and management programs. Detailed operating budgets, capital projects and other management information as well as capabilities to reserve park facilities, to select recreational activities and to provide other meaningful information will be available to the public via cable television and your department's computer. Such installations will be found in the public schools, libraries and even the home.

Clearer Understanding Through Graphics

There is a current trend toward greater use of computer graphics to help explain the volumes of data currently being collected. Low cost, highly visual systems are now available on even the least expensive computer systems.

Linking the Profession Together

The concept of statewide/nationwide "networking," or hooking computers together to form a communication linkage, will be another direction our profession will explore. Currently, Purdue University, the Kellogg Foundation and the U.S. Cooperative Extension Service have established such a statewide linkage in Indiana called FACTS. Similar systems will grow within other states throughout the country with specialized networks spanning the United States.

Shared Resources

The idea of sharing a central computer facility among many park and recreation agencies may become an attractive alternative for many communities. This concept is currently working quite well in the Chicago suburban area and may spread as software and programming costs continue to rise.

Expanded Use of the Computer for the University

Universities will expand the use of computers for instructional, field service and administrative purposes. Departmental word processing and record keeping, internship analysis and placement assistance, interactive class registration and career placement

National Park Service

NPS Exhibit at the 1982 World's Fair.

will constitute just a few of the uses found in the automated park and recreation curriculum offices. Teaching models simulating simple to complex environmental and/or administrative conditions will receive greater utilization as an integral part of most departmental course instruction.

University field and extension personnel will also see increased uses in computers for their community programs. Computers will serve as a vital informational linkage to provide university specialists instant data recall and specialized analysis capabilities as they visit field locations throughout their state.

The list of creative applications for computer usage is virtually endless. Outlined above are a few of those items which are with us today, and will probably increase in popularity in the next few years.

A Final Note

Take the Initiative to Learn and Understand

We can't stop exploring and learning. When we stop this part of our lives, we perpetuate mediocrity. The opportunity to introduce computer technology into our work places challenges creativity and vision in a new environment. This medium has opened up to us and poses an exciting opportunity to expand our management knowledge, research abilities, and programs for the public. It represents a chance to be more productive, improve our ability to communicate, to understand, and to interpret more completely the world around us.

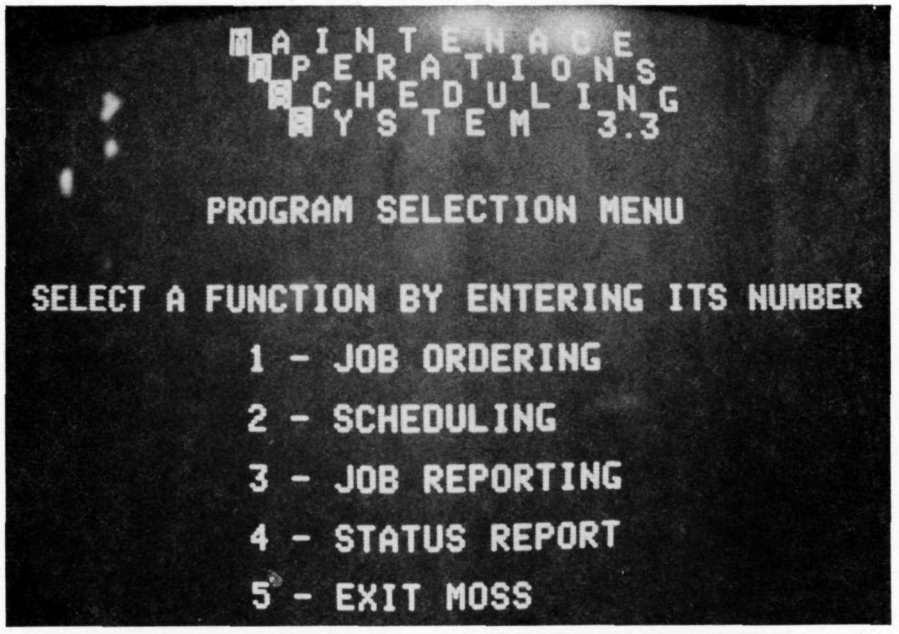
Richard Schroth, Re. D., is a Management Analyst with The Maryland-National Capital Park and Planning Commission.

Maintenance Scheduling and Management System

by Chrystos D. Siderelis

Park managers are responsible for scheduling, controlling, and directing worker efforts, while locating requisite funds to operate a quality maintenance program. Recent demands on the part of park managers for greater productivity have required better, more economical methods to manage maintenance resources, greater understanding of work programs, increased documentation of the cost of work, and the use of this information in future planning.

In the evaluation of maintenance operations for such agencies as the Corps of Engineers, the National Park Service (Blue Ridge Parkway) and from informal interviews with park managers currently using cost-accounting systems to monitor day-to-day operations (Siderelis, 1978, See Who Can You Turn To?), park personnel have consistently encountered a need for an efficient method to process work orders, schedule park maintenance work, and document the completion of work. In all instances, there was either a cumbersome manual work order process or a lack of any degree of systematization in work scheduling.



Program Selection Menu.

Crystos D. Siderelis, Ph.D., NCSU

The Problem

As the problem was defined by Bentley and Siderelis, 1982 (See Who Can You Turn To?), facility and grounds maintenance typically consists of separate jobs occurring at different work sites throughout a city or regional area, with each job normally requiring the effort of one or more workers. Managers of even modest-sized operations must therefore choose from a combination of numerous jobs to set daily or weekly work schedules, and the most efficient schedules are difficult, if not impossible, to devise from a simple inspection of workers present.

Furthermore, the best annualized plans may be aborted due to unforeseen changes in numbers of people using a facility, plain neglect by maintenance workers, or the non-specific crises that invariably occur. And of course, current fuel prices are such that managers must combine and sequence jobs so that there is no wasted travel between work sites.

The Solution

A solution to this problem was the design and development of a computerized Maintenance Scheduling and Management System (MS2) following the earlier development of the Workload Cost Tracking system (See Winter 1978 Trends, Vol. 15, No. 1). MS2 was customized for application to the National Park Service's Blue Ridge Parkway, field tested under the acronym of MOSS (Maintenance Operations and Scheduling System), and the resulting employee reactions were reported in the March 1982 issue of Parks and Recreation magazine. Briefly, MOSS was needed to perform three essential functions for maintenance workers at the Blue Ridge Parkway.

First, a procedure for reporting total maintenance deficiencies was needed so that work could be ordered and placed into an up-to-date file of work needing to be done.

Second, since budget limitations controlled the quantity of work that can be scheduled, the arrangement of jobs in priority order at a time when work could be effectively accomplished became all important.

In addition, allowing for computer-devised travel plans to direct workers to job sites, developing a file that could con-

tain all the jobs a subdistrict could afford in a fiscal year, and measuring work progress and maintaining job completion records was also necessary.

Third, limited budgets, minimum staffing, and unexpected work needs all contributed to the development of a maintenance backlog. For future planning and the budget justifications needed to support planned results, the quantity and type of deferred maintenance work had to be known if we were to develop an effective preventive maintenance operation and justify future maintenance needs. MOSS was designed to satisfy the aforementioned needs and it was computer programmed for use on the Apple II Plus micro-processor with one or two disk drives.

How MS2 Works

MS2 performs seven essential functions for the maintenance manager: (1) job ordering, (2) job status, (3) job weeding, (4) job scheduling, (5) vehicle routing, (6) job reporting, and (7) job analysis and graphing.

Job Ordering

Job ordering is the means by which maintenance deficiencies are entered into the computer for future worker action. Information is removed from a Maintenance Supervisor or foreman-approved Job Order Request form, Work Order, etc. and entered onto a video displayed work entry form. This information is then fed into the computer which automatically assigns to the job request a work order number and places the job in "backlog" to await future scheduling.

MS2 uses much the same information presently included on Work Orders in park departments. Entries include the work location, job classification (also known as the job tracking code, e.g., minor repair/upkeep, preventive maintenance, and regular maintenance recording categories), a description of the job, estimated or actual man-hours if available from previously reported work to MS2, budget accounting or work charge account code, bad or good weather job, and date job is due for completion. Man-hour estimates include set-up and break-down time, but do not include travel time. Routine (cosmetic), preventive, and cyclic work that recurs periodically is pre-programmed into the computer and is automatically re-scheduled on a recurring basis.

Since each maintenance management situation is different, the job classification scheme adopted for use must be as compatible with the existing situation as possible. Experience with Workload Cost Tracking (Siderelis, 1978, See Who Can You Turn To?) has shown that the job classification scheme need not be too detailed for use in most practical maintenance situations.

For example, in previously reported Workload Cost Tracking applications, workers were expected to collect data on the amount of time spent cleaning each picnic table, bathhouse, comfort station, picking up litter, and trim mowing. (See Chambliss and Hodges, 1978, in Who Can You Turn To?)

This information was far too detailed for maintenance personnel to report and for managers to digest. It was suggested that one job classification replace these detailed maintenance activities for documentation purpose and be titled "regular maintenance — developed areas" (Bentley and Siderelis, 1982, See Who Can You Turn To?). If more detailed information is needed, a time study should be periodically conducted to capture precise data on the time spent by workers on individual work activities.

Job Status

Jobs are maintained within a Job Status File. MS2 places jobs into five status categories:

1. Backlog—Jobs that have been sequenced (information from Job Ordering function) and are awaiting execution.
2. Holding—Jobs where work has been undertaken towards the completion of the job, but as yet is only partially complete, as in the case of a job awaiting the arrival of ordered materials.
3. In-progress—Work is presently being performed on jobs.
4. Complete—Jobs have been reported as finished.
5. Terminated—Jobs backlogged or holding with no work or partial work performed on them. This classification is particularly important due to budget constraints and the need to report all maintenance deficiencies. It provides a useful summary of those jobs which, if the resources had been available, could have been executed.

The status of jobs submitted to the computer and acted upon by

the maintenance work force can be obtained on demand through the computer-produced Job Status Report. Jobs are organized on the status report into those categories described above. Included with each job is the work number, requested due date, actual completion date, description of the job, work location, man-hours needed to complete the job, and in the holding category, the reported percent completion of the job.

Job Weeding

Important to the scheduling of work is the due date for job completion. In designing MS2, two different approaches were tested to assess work priority. One procedure involved the assignment of urgency values through the use of a numerical scale that defined varying levels of urgency based on the extent and potential hazard of the maintenance deficiency. This technique was not only found to be time-consuming, but when left to the interpretation of the foreman, practically all jobs were given a high urgency.

The more satisfactory approach was to recognize the urgency of jobs based on an Earliest Due Date job sequence. Jobs in backlog or holding status categories whose proposed completion dates are before and during the scheduling period are scheduled based on the length of time they remain incomplete. Jobs with later due dates are then moved up the queue as work is scheduled and completed. The longer a job remains incomplete, the higher its urgency. Jobs with the same due dates are ordered based on the shortest task time.

This type of job sequencing process complements the park maintenance situation very well. One of the benefits of this sequencing procedure is the elimination of workers starting one job to partial completion, then moving onto the next job to partial completion, as if each and every job was a crisis.

Job weeding, a control function, was developed to cope with the problem of workers reporting more work deficiencies than budgeted man-hours available. Obviously, if every deficiency were reported, maintenance workers would today be working on last year's backlog of jobs. Job weeding then affords park managers the ability to terminate those jobs in backlog or holding status categories for which manpower or financial resources are not available. Or the park manager can elect to re-assign these jobs new due dates for scheduling.

The second job weeding alternative is for the park manager to assign a maximum tardiness time where maintenance jobs with due dates exceeding the tardiness measure are terminated automatically and placed in the terminated status category for the reassignment of due date.

Job Scheduling

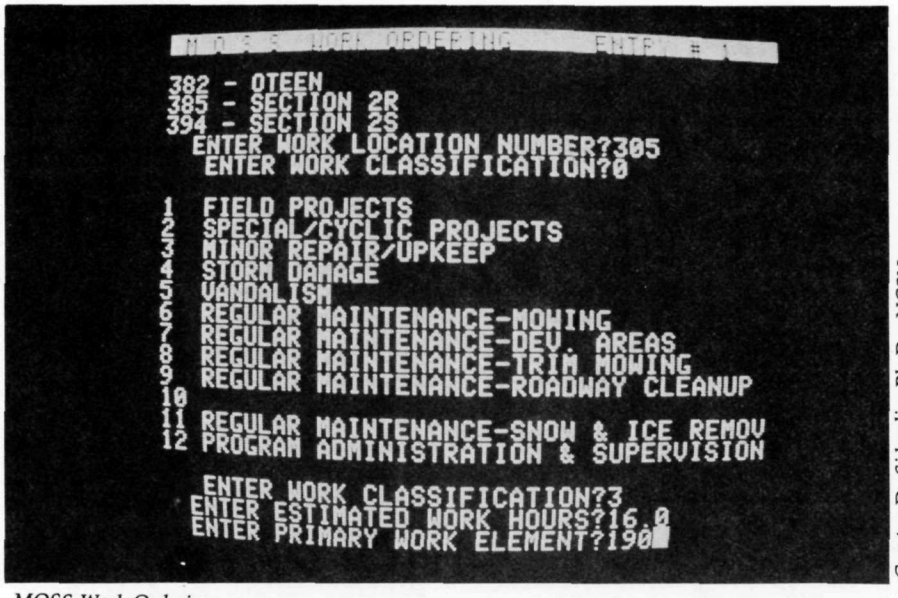
The job scheduling function was designed to outline the sequence of jobs in work planning to be followed on a daily or weekly basis. In scheduling work, the job classification scheme devised by the manager and foreman is very important. Job classifications should be set so that the jobs ordered complement the skills of individual workers or crew. In this manner, the foreman can request those jobs within a job classification that precisely meet worker skills, or a combination of two or more job codes.

In order to schedule jobs the foreman must provide the computer with the types of job classification (coded categories) for the scheduling period, the number of man-hours available during the scheduling period, and the work sites where the foreman is considering work to take place during the scheduling period.

The computer asks for this information in question form and literally holds a conversation with the foreman. The computer then searches the job status file for backlog and holding jobs to find jobs that meet the foreman's criteria. Various combinations of jobs are examined to arrive at the most feasible working schedule.

A mathematical program is used to generate three alternative working schedules subject to the man-hour constraint imposed by the foreman. The determination of the exact set of jobs to compose a working schedule can be a combinatorial exercise of staggering proportion for a practical application involving lengthy computation times. As an alternative to the enumeration technique, we developed a simple mathematical procedure that was computer programmed to run quite effectively on the Apple II Plus microprocessor (Siderelis and Blair, 1981, See Who Can You Turn To?).

In the discussion to follow, frequent reference will be made to two ordered sets of jobs. The working schedule will ultimately consist of a set of jobs, called the



MOSS Work Ordering.

Cyrstos D. Siderelis, Ph.D., NCSU

basic set, that will match, as closely as possible, the number of jobs which can be accomplished with the total man-hours available to the foreman without exceeding that number. The basic set will be a selection of jobs from a whole list of possible jobs which we will refer to as simply "the list." A working schedule is produced as follows:

Step 1. The maintenance foreman must specify the amount of man-hours available for an individual worker or crew throughout the scheduling period. This we will label as Tmax hours.

Step 2. From the job ordering function a record of each job is created and stored in the Job Status File. Based on a job's due date and the criteria specified by the foreman as to job classification(s) and work site(s), the priority of each job is set automatically by the computer as described in the next step.

Step 3. The computer creates the list of unassigned jobs, sequencing as to their earliest due dates and jobs with equivalent due dates by shortest task times. That is, a job with a higher urgency (earlier due date) is placed before those jobs with later due dates.

Step 4. The computer produces the first copy of the basic set by removing jobs from the top of the list and adding them to the basic set, and at the same time accumulating task times (man-hours) which we will call Ts. This process continues until the addition of the next job from the list when added to Ts would cause Ts to be greater than Tmax.

The process of assigning jobs to produce a working schedule could stop here. But a single version of the schedule may be inadequate to meet the contingencies on a given work day. For this reason a total of three optional versions of the working schedule are produced by the computer so that the foreman has a choice that will most fully meet his/her needs and utilize available man-hours. The computer devises these three schedules according to the following steps in the modification process. (These steps are not to be confused with the versions of the schedules themselves; rather, three possible combinations of steps are produced which are described below.)

Step 5(a). The Forward Exchange. This step is necessary when the first job on the list is too large to be added to the basic set, yet there are still man-hours available for a smaller job to be added from further down the list. Let Ts+ denote the accumulated time to complete the working schedule if the first job on the list, say job k, is added to the basic set.

Note that Ts, the total time to complete all tasks on the working schedule, is less than Tmax, and Tmax is less than Ts+ where Ts+ = tk + Ts. In this instance the computer reviews the basic set from the bottom to the top to find the first job, say job n, whose completion time (tn), when substracted from ts+ is less than or equal to Tmax. If such a job is found, the job at the top of the list (job k) is exchanged with job n in the basic set. The jobs in both sets are placed in the proper order as described in Step 3.

Step 5(b). The Backward Exchange. The computer deletes the last job in the basic set — we will call the result Ts—. It then reviews the list from top to bottom to find the first job, say job k, whose time requirement, when added to Ts—, does not exceed Tmax. Both jobs (i.e., k and the job originally at the bottom of the basic set) are placed in their proper sequencing.

Step 5(c). The Expansion. The computer reviews the list from top to bottom and adds a job to the basic set, i.e., removes it from the list, if the job, say job k, is less than or equal to Tmax minus the accumulated task time (Ts) in the working schedule. The three working schedules are: (1) The basic set from Step 4 followed by 5(c), (2) the basic set from 5(a) followed by 5(c), and (3) the basic set from 5(b) followed by 5(c). The maintenance foreman can interact with the computer at this point to request job exchanges which he/she may prefer, based on his/her experience and other qualitative factors. The computer then prints out three more alternative work schedules.

Once one of the three working schedules is identified, the computer will print job tickets that the foreman can hand to workers describing the job to be done, job order number, work site, job classification, and projected due date. Or the foreman can put off the printing of a working schedule and first request that a travel plan be devised by the computer and included in the schedule. The travel plan groups scheduled jobs by work sites, and accounts for travel time to and from and between work sites.

Vehicle Routing

The travel plan is derived from the work schedule selected by the foreman. This schedule is produced by a separate computer program that uses work site codes of jobs scheduled and a travel matrix in which the amount of travel time in man-hours to move between sites is recorded.

Travel times are assumed to be symmetrical; that is, the amount of time to travel from work site A to work site B is the same as from site B to site A. Once loaded into the computer's storage device, the travel matrix is loaded automatically into the computer's memory in the future. The travel matrix needs to be loaded only once into the computer. The computer functions to evaluate the amount of travel time between work sites, with the starting and ending work sites provided by the foreman, to minimize the amount of travel time workers will spend moving between all scheduled work sites.

The problem of routing workers to assigned tasks at different locations is referred to as the "traveling salesman" problem. This problem and its potential solutions are discussed by Baker (1974, See Who Can You Turn To?) and in most textbooks on Operations Research. The mathematical formulation adopted for MS2 was presented by Krog and Thompson (1964, See Who Can You Turn To?). It did not necessitate a large amount of computer memory required of the more exact solutions, and performed well against other mathematical formulations on a variety of test problems (Rieter and Sherman, 1965, See Who Can You Turn To?). This technique could be performed manually provided one has the appropriate amount of time and patience.

The method begins by the foreman selecting starting and ending work sites. This constitutes a tour of length 2. Then a third work site is inserted to minimize the resulting three-site tour; then a fourth work site is inserted, and so on, until a complete tour of work sites has been constructed.

For example, the "seed" pair of work sites 1-2 form a starting and ending two-site tour. A three-site tour is selected by evaluating the tours 1-3-2 since site 1 is the starting site and site 2 is the ending site. A four-site tour is formed by inserting site 4 somewhere in the three-site tour and evaluating the shorter tour. In other words, the shorter tour is selected among 1-3-4-2 and 1-4-3-2. At the last stage, a full tour is selected from among the work site candidates.

Job Reporting

After a work plan is designated by the foreman, the computer prints job tickets listing pertinent information about each job (work description, work site, requested due date, and job classification), and three items to be completed by the foreman once the job is complete. Reported will be the amount of man-hours spent on the job, the percentage of the job completed, date job completed, and optional notes as to the maintenance equipment and materials or supplies used on the job.

This information is then entered into the computer where it is used to update scheduled (in-progress status) jobs in the Job Status File for printing the labor tracking device, the Job Status Report, described earlier. Even with the planned work schedules it is impossible to predict unforeseen jobs, such as equipment or facility malfunctions or other emergencies. Consequently, a feature for reporting unscheduled jobs was included as part of the reporting function. In addition, jobs may be reported as partially complete and placed in the holding status category to await future scheduling action. The percent completion is reported by the foreman, while the man-hours remaining to complete the job are calculated in the computer by the following formula.

The resulting number of man-hours for job completion is recorded along with the job and placed in the holding status category within the Job Status File. From job ticket information a variety of reports can be generated by the computer. These management reports can be produced through customized computer programs or with "data management" computer programs currently available on the micro-processor market. One such customized computer program useful in analyzing maintenance work reported through MS2 was written by the author and called "Job Analysis and Control Graph" (see *A Computerized Maintenance Analysis and Control Procedure* elsewhere in this issue).

Conclusion

The complexity of the park manager's job, given the multitude of factors he or she has to consider in making decisions, as well as the number of economic pressures facing him or her requires the use of an automated decision-support system for maintenance like MS2. Such a computerized system ensures that budgets will be met, necessary work will be completed on time, and crucial information can be stored and retrieved from which important future decisions will be made.

C.D. Siderelis, PhD, is an associate professor of Recreation Resources and Administration at North Carolina State University, 4008 Biltmore Hall, Raleigh, NC, 27650.

Scheduling of Outdoor Athletic Facilities

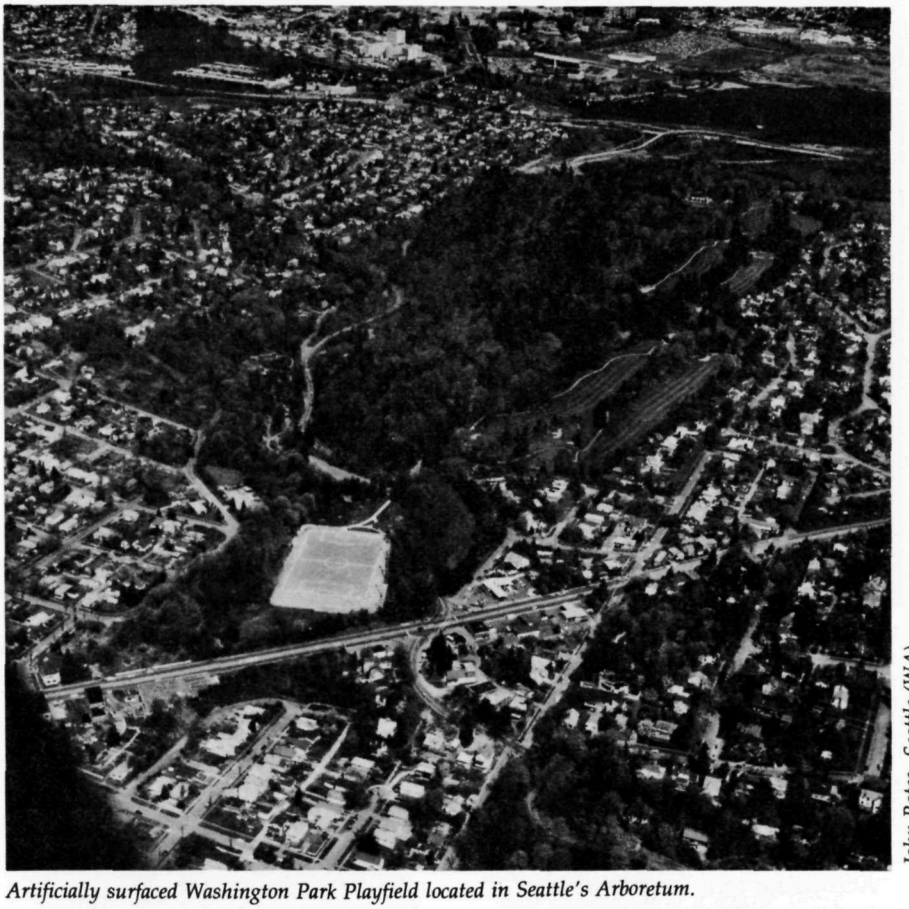
by Dan Dahlquist and Ron Bullock

The City of Seattle Parks and Recreation Department, through its Recreation Information Office, has been scheduling outdoor athletic facilities with the aid of a computer since June of 1980. The Recreation Information Office (RIO) also schedules all of the Seattle School District's outdoor athletic facilities. Combining the two agencies' facilities, RIO has responsibility for the scheduling of 185 different athletic sites throughout the Greater Seattle area.

The decision to use a computer to schedule athletic events developed from the rapid growth of athletic uses, and the need for accurate and timely statistical information. In 1976, the Seattle City Council undertook a study of recreation services provided by the Parks Department. The statistical information for the study had to be manually assembled by the Recreation Division. RIO staff spent many hours condensing and correlating scheduling data into usable information for the Council study.

Once assembled, the planning and program value of the information added momentum to the Department's need for regular production of usage reports. The RIO staff subsequently began systems analysis of its scheduling functions, with the objective of developing a formal management information system. The analysis concluded that a computer was essential to operate the system in a timely and cost-effective manner.

In 1978, the Department obtained a computer terminal with a telephone hookup to the City's Univac 90/80 computer. With the help of a Work Study student, the RIO staff started work on a ballfield league scheduling system that would lend itself to a computer application. A system was developed and programs were written, debugged, and tested.



John Bates, Seattle (WA)

Artificially surfaced Washington Park Playfield located in Seattle's Arboretum.

Beginning in June, 1980, a fully operational computer-assisted League Scheduling System was implemented. The programs were written in Univac's version of BASIC. Reports are generated by MARK IV and BASIC. The system now handles scheduling for over 600 softball/baseball teams and over 750 soccer/rugby/lacrosse/cricket teams. In one year's time, the system will handle over 70,000 individually scheduled league games and practices.

The Ballfield Scheduling Program (BSP) has been divided into six categories which are interrelated and dependent upon each other. Prior to the BSP, these six individual functions were done manually under the following categories:

1. League Scheduling/Reports
2. Maintenance Reports
3. Ballfield Availability Reports
4. Ballfield Closure Reports
5. Ballfield Attributes
6. Organization Reports

League Scheduling/Reports

Prior to the development of the computer-assisted BSP, all field scheduling was done manually. The latest system used was that of transaction cards, with one card showing all scheduled activities for a field for one month. Prior scheduling was done out of a notebook with each field scheduling on a full page for a full season and/or year.

When more fields built with 1969 Forward Thrust Bond Issue monies came on line and the demand for playing time by organized groups reached all-time highs, RIO staff concluded that a better, more efficient scheduling system was needed.

The League Scheduling System (LSS) of the BSP was then created by RIO staff as a more rapid and accurate means of scheduling sports leagues on the Seattle Department of Parks and Recreation's athletic fields.

Preprogramming

According to a Department of Parks and Recreation's policy, fields are scheduled on a historical basis with past users having priority. This policy, which contains an expansion clause for leagues, allowed the Department in 1977 to institute a new method of scheduling leagues called preprogramming.

Prior to 1977, various sports leagues and organizations submitted schedules to the scheduling staff with no regard for other leagues' needs or the caliber of their play; thus causing overusage of some fields. Schedules were submitted for departmental approval ten days to two weeks before play was to begin, creating a burden on the RIO staff to schedule and approve 90% of all submitted game schedules in short time frames.

Preprogramming was created to eliminate this situation. The concept was simple. Instead of the leagues submitting schedules to RIO staff, staff would preprogram a schedule of fields that the leagues could use, based on their prior usage. The results were positive for all parties concerned.

Preprogramming was successful in part due to the expansion clause in the policy and procedure for field scheduling. This clause allowed for expansion, but only upon written request three months prior to the start of a season. Without a request for expansion, the usage patterns remained the same and RIO staff was able to start preprogramming league schedules months in advance of a season's start.

There are many advantages to this system. It allows for fewer scheduling errors due to the increased lead time available for preparation. Staff is able to double and triple check schedules and distribute them faster to the leagues. Leagues now have time to pair up teams and present their schedules to the RIO staff for a double check weeks prior to their season's start. The percentage of rescheduling is now approximately 3-5% (as compared to 25-30% prior to preprogramming).

Leagues have favored this type of scheduling since the first year it was introduced. League organizers' jobs have been made easier with the knowledge that their field demands have been reserved automatically for their organizations. Another favorable aspect is that double-booking errors have gone from 3-5% to less than 1/10 of 1%.

Prior to the BSP, manual preparation of the preprogrammed schedules took one RIO staff person two-to-three months to complete. Utilizing the League Scheduling System of the BSP, this time has been reduced to one-and-a-half to two weeks of data entry, with another one-to-two-weeks to double-check the computer-generated printouts of the league schedules. These printed schedules are then distributed to the organizations at the annual league scheduling meetings held twice a year.

Maintenance Reports

Utilizing the data entered for the League Scheduling System, Ballfield Maintenance Reports are generated on a weekly basis for the Grounds Maintenance Division. These reports help staff determine what maintenance needs to be scheduled on the fields. The reports are printed in six sections, corresponding to the Department's six different Grounds Maintenance Districts. Within the reports, fields are listed by the way the District crews are organizationally structured.

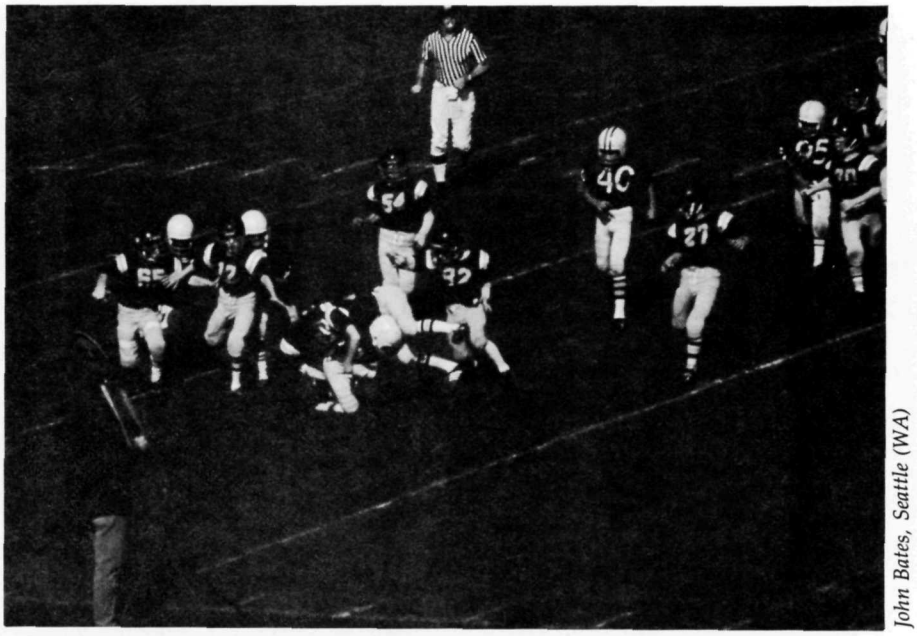
Prior to the implementation of the BSP, it took approximately 32 man-hours to manually compile a one-week report for all facilities that were scheduled. With the automated system, the same report takes approximately 20 minutes to print.

Ballfields Availability Reports

Due to a need to reschedule games and allocate time for practices, scheduling staff has a continual need to know what sites

are available at any particular time. The capability for RIO staff to print out a Ballfield Availability Report was provided as part of the League Scheduling System. This report lists all scheduled and non-scheduled times on all requested fields for a time frame chosen by staff. All scheduled times are shown with the users' Organization Code Numbers so staff will know who the scheduled users are. The Organization Code is a four digit number given to every user. (This is explained in greater detail in Section Six.) Staff may choose to use this report as a manual means of scheduling, and enter data later, or use it to find available sites and use the automated system.

Fields shown on the Ballfield Availability Report may be selected by the scheduler from programmed options. These include all fields, lighted fields only, or selected fields. These options generate a quicker printout since individual field names do not need to be entered.



John Bates, Seattle (WA)

Junior football at the Riverview Playfield in Seattle, WA.

Ballfield Closure Reports

Often it is necessary to have some fields closed and unscheduled such as when the outfield portion of a softball/baseball diamond becomes a soccer/football field during the fall and winter months. The field is treated as two separate ballfields by the League Scheduling System. One ballfield will have attributes describing it as a softball/baseball field and the other as a soccer/football field. The League Scheduling System prevents the use of a softball/baseball field by users playing sports other than softball or baseball. The same is true for softball/baseball users attempting to use a soccer or football field. In order that softball/baseball teams and soccer/football teams do not wind up actually using the same field at the same time, the softball/baseball field will be closed during soccer/football season and vice versa.

A Ballfield Closure Report may be generated by the scheduling staff to show the months that each field is open and closed. Although programmed in advance, changes may occur any time of the year if the Grounds Maintenance staff deems a field should be closed due to deteriorating physical conditions.

Field Attributes

Before the Ballfield Scheduling Program could be instituted, the particular attributes of each field had to be identified and catalogued. Thirteen different features for each field are identified in this program. Examples of these features are base peg distances, lights, youth size only, and goal post type (soccer or football). These features or attributes are checked by the League Scheduling System at the time a usage is entered and causes a rejection if a contradiction is detected.

For example, if a game were scheduled from 9:00 pm to 10:30 pm and the field did not have lights, the entry would be rejected. The program is written to tell the user what error has occurred. In the case above, the program would indicate that the field did not have lights and usages could not be scheduled later than 9:10 pm. This system allows the novice scheduler the ability to select a field for a particular usage and know the facility can accommodate that usage.

Organizations

To expedite data entry, user organizations are assigned a unique four digit number. The

John Bates, Seattle (WA)

Soccer play at Lower Woodland (Seattle, WA).

first digit indicates the sport; the second, the sex; and the third and fourth identify the organization. Through experience, RIO staff find it easier to enter a four digit number than an organizational name or an abbreviation if the name is long. The four digit identification system also lends itself to easy statistical data generation.

Statistics

Prior to the development of the computer-assisted League Scheduling System, all statistics were generated manually from the transaction cards mentioned earlier. Because of budget cutbacks, the manual preparation of usage statistics was suspended in 1979. The League Scheduling System now offers the opportunity to generate the following statistics:

1. Number of games or practices
   a. by field
   b. by sport
   c. by sex
   d. by age group (adult vs. youth)
2. Number of participants
   a. by field
   b. by sport
   c. by sex
   d. by age group
3. Number of hours of field light usage
   a. by field
   b. by organization

These statistics aid RIO staff in making scheduling decisions, in budget preparation, in billing user groups individual usage fees, and in answering numerous requests for usage data not only from City and Department planners, but from many other state and national recreational agencies. One very beneficial use of these statistics has been the ability of Department staff to correlate field usage and patterns with field conditions and maintenance practices. The results of the correlations have been the basis for more equitable distribution of demand throughout the system and a subsequent reduction in athletic field maintenance costs.

Conclusion

The utilization of a computer in athletic field scheduling has been a success in Seattle. One of the keys to success was the development of the League Scheduling System prior to the introduction of the computer. The addition of the computer enhanced the system and added the ability to quickly generate valuable scheduling data reports.

Most importantly, the computer has enhanced the Department's ability to meet the needs of Seattle's athletic community. Timely and accurate data can now be produced inexpensively for the Grounds Maintenance Division, and scheduling errors have been drastically reduced. Four teams showing up at the same time has not been eliminated, but it now happens about as frequently as Mount Saint Helens erupts.

Dan Dahlquist is a Program Coordinator with management responsibilities for the Seattle Department of Parks and Recreation Information Office.

Ron Bullock is a Computer Programmer and Systems Analyst for the Seattle Department of Parks and Recreation.

Labor Cost-Tracking System

by Richard J. Schroth, Re.D.

Other than using the computer for basic financial applications such as payroll and accounting, probably one of the first departmental application areas for the computer is tracking the cost of maintaining park areas or particular recreation programs. This is a primary starting point since most agencies are faced with increased public concern for governmental accountability and efficiencies.

Too often, however, many departments turn to the computer as the key to solving management dilemmas without giving consideration to all of the alternatives. Before implementing labor cost-tracking, careful consideration should be given to the need to have and maintain such detailed information. Once such a program is initiated, it must then become an integral part of the daily work program of the department.

The mistake should not be made of turning to an extensive commitment just to answer occasional inquiries by a board or council member. Many times, isloated labor samplings from the field can be used to determine general cost-related figures. We raise this point since there can be major staff and operating expenses involved in the development of a computer system.

There are many other important considerations that need to be taken into account before a department embarks on the development of a labor cost-tracking system. One of the primary issues is the fact that the implementation of a labor tracking system is one of the few things your agency does that will affect every employee. This results from the fact that every individual must in some way or another report all daily activities.

Problems arise when one begins to look at the multi-level educational training each employee has received. Some employees may barely read and write, whereas others may have many years of formal education.

It has been our experience that if the time cards (data collection forms) are structured properly, the impact on those with lower reading and writing skills can be overcome.

Generally, we have found that after implementation of the labor costing system, labor force comments regarding the "additional paperwork" do increase. The challenge, therefore, is to minimize the impact. Resistance to such reporting can range anywhere from a week or two of complaints to outright defiance towards new reporting methods. It has been reported that in some agencies threats of withholding paychecks and dismissal actions were necessary to insure compliance. We have never had such dramatic instances with our current labor reporting system and our implementation has been clouded with only a few complaints. You can expect, however, that you will have some "startup complaints."

Implementation Methods

The following elements were found to contribute to a positive implementation process.

1. *Begin slowly with a small group, gradually introducing labor reporting into the system, while improving the forms with each expansion.* In utilizing this method, both management and the employees have a chance to analyze the recording procedures, quality, and usefulness of the data.

   In our case we chose a park division of approximately 50-70 persons for participation. This group was already keeping some field records on work they performed and were already familiar with doing "paperwork" as part of their normal routine. We replaced their old reporting methods with the new system, which the individuals found was actually easier to use.

   As this group of employees used the new time sheets for a one-year test period, other park divisions became exposed to the new time recording methods through discussions with their fellow workers. We were able to make significant changes to our original form design based on constructive supervisor and employee comments. As the forms became more refined, and as a broader spectrum of the labor force became exposed to and used the time recording sheets, the computer impact throughout the entire department was minimized.

2. *Design the labor reporting forms with the maintenance worker in mind, not the computer!* One of the most unfortunate things that often occurs is to design a reporting form for the computer, rather than for the individual. Although a computer's requirement for data in precise forms is essential for the system to properly operate, the system can fail just as badly if the individuals responsible for recording the data are not considered on an

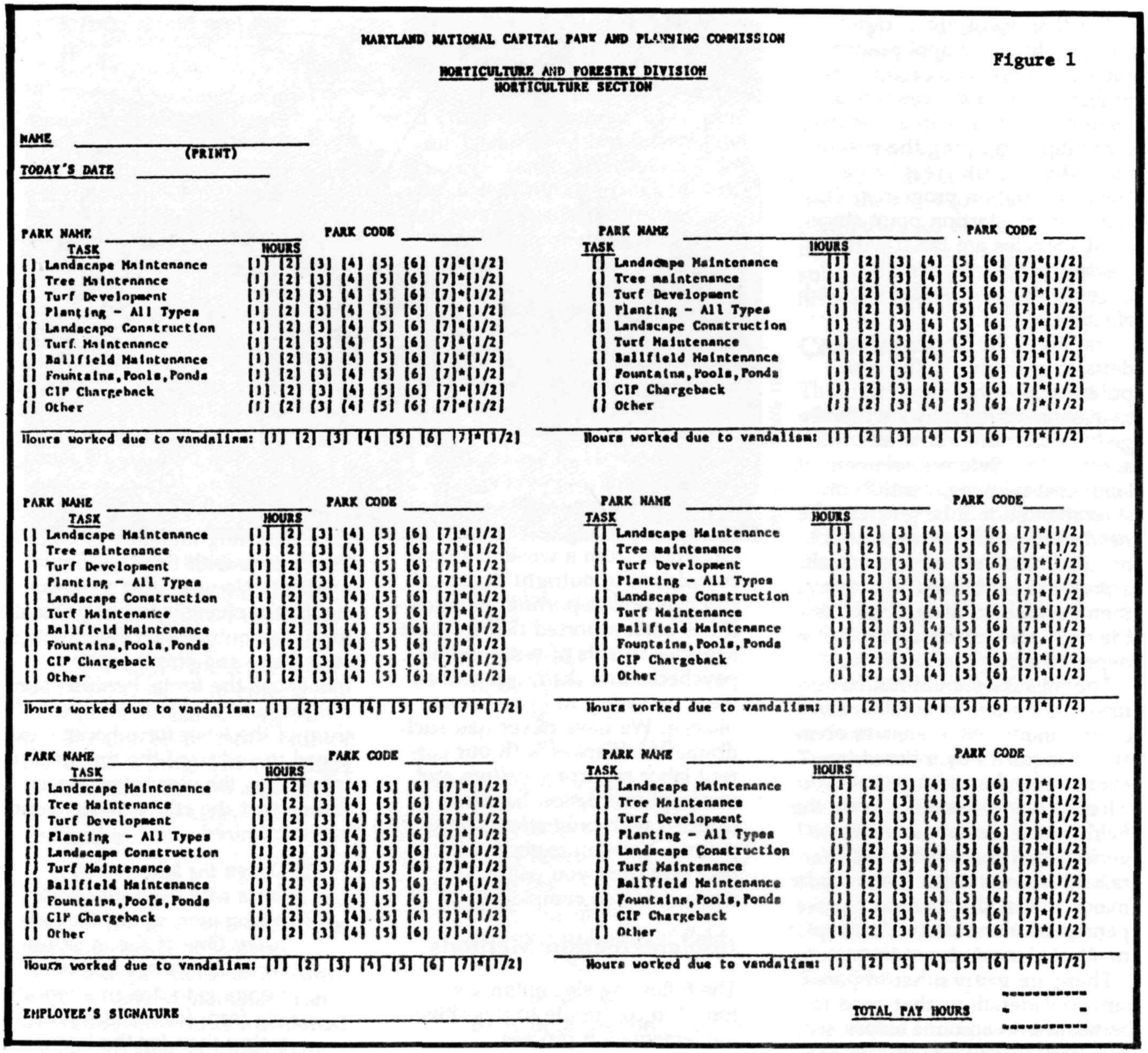


Figure 1

MARYLAND NATIONAL CAPITAL PARK AND PLANNING COMMISSION

HORTICULTURE AND FORESTRY DIVISION
HORTICULTURE SECTION

NAME ______________________ (PRINT)

TODAY'S DATE ____________

PARK NAME ______________ PARK CODE ________

TASK	HOURS
[] Landscape Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Tree Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Development	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Planting - All Types	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Landscape Construction	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Ballfield Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Fountains, Pools, Ponds	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] CIP Chargeback	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Other	[1] [2] [3] [4] [5] [6] [7]*[1/2]

Hours worked due to vandalism: [1] [2] [3] [4] [5] [6] [7]*[1/2]

PARK NAME ______________ PARK CODE ________

TASK	HOURS
[] Landscape Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Tree maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Development	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Planting - All Types	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Landscape Construction	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Ballfield Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Fountains, Pools, Ponds	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] CIP Chargeback	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Other	[1] [2] [3] [4] [5] [6] [7]*[1/2]

Hours worked due to vandalism: [1] [2] [3] [4] [5] [6] [7]*[1/2]

PARK NAME ______________ PARK CODE ________

TASK	HOURS
[] Landscape Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Tree maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Development	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Planting - All Types	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Landscape Construction	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Ballfield Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Fountains, Pools, Ponds	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] CIP Chargeback	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Other	[1] [2] [3] [4] [5] [6] [7]*[1/2]

Hours worked due to vandalism: [1] [2] [3] [4] [5] [6] [7]*[1/2]

PARK NAME ______________ PARK CODE ________

TASK	HOURS
[] Landscape Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Tree maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Development	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Planting - All Types	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Landscape Construction	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Ballfield Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Fountains, Pools, Ponds	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] CIP Chargeback	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Other	[1] [2] [3] [4] [5] [6] [7]*[1/2]

Hours worked due to vandalism: [1] [2] [3] [4] [5] [6] [7]*[1/2]

PARK NAME ______________ PARK CODE ________

TASK	HOURS
[] Landscape Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Tree Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Development	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Planting - All Types	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Landscape Construction	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Ballfield Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Fountains, Pools, Ponds	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] CIP Chargeback	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Other	[1] [2] [3] [4] [5] [6] [7]*[1/2]

Hours worked due to vandalism: [1] [2] [3] [4] [5] [6] [7]*[1/2]

PARK NAME ______________ PARK CODE ________

TASK	HOURS
[] Landscape Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Tree Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Development	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Planting - All Types	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Landscape Construction	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Turf Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Ballfield Maintenance	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Fountains, Pools, Ponds	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] CIP Chargeback	[1] [2] [3] [4] [5] [6] [7]*[1/2]
[] Other	[1] [2] [3] [4] [5] [6] [7]*[1/2]

Hours worked due to vandalism: [1] [2] [3] [4] [5] [6] [7]*[1/2]

EMPLOYEE'S SIGNATURE ______________________

TOTAL PAY HOURS ----------

even higher basis. Figure 1 illustrates a typical time card used by our crews. The time cards were designed with the following criteria in mind:

a. ease of use by the employee

b. minimize the amount of writing by the employee

c. minimize the amount of time an employee must spend recording time information

d. provide a mechanism where legibility can be optimized

e. provide a system which may be machine-interpreted, minimizing data entry.

3. *Establish your agency's level of reporting information based on actual requirements, not what would be "nice or interesting."* When systems such as labor-tracking are brought into a department, the tendency is to try to gather too much detailed information. This generally results from some infrequent and obscure request that was made for information which was difficult to report. Avoiding the pitfall of *too much information* will provide you with a much cleaner and easier method of cost-tracking implementation and continuation. This is not meant to discourage the gathering of some isolated detailed levels of job task information.

What it is meant to say, however, is that there is a price the organization must pay for the gathering of comprehensive information. The price goes higher as the level of detail is increased. Price, in this case, is calculated in terms of more time filling in reporting forms, staff member morale levels, and a greater potential for decreased accuracy in the reporting of the information.

4. *Work closely with the staff which will be using the form - in the design as well as implementation phases.* In our agency's time reporting design, we worked with each of our divisions to try to establish the level of detail they needed for better management. This level was then matched against the requirements of our administrative office. By combining the two, we were then assured of supplying useful information to each division while at the same time maintaining the integrity of consistent reporting for overall park administrative purposes.

5. *If you expect the workers to code park or program area information on a time card, provide them with a reference tool that is easy to use, handy to keep, and easy to update.* At the Maryland-National Capital Park and Planning Commission, we developed a Park Reference Guide for our staff. This document was designed to be reproduced on a six-month update basis, which would allow us to keep the crews well informed on new park changes. We show park location maps, park code information used in identifying a park for the computer, safety information, and room to incorporate other useful job-related information.

6. *The more frequent the collection of time cards, the more reliable is the data.* In the coming months, we will be conducting field research to determine the accuracy of this statement. For the present, however, we believe that the collection of a crew member's time card on a daily basis provides us with the most accurate means of data retrieval.

7. *Whatever level of information you are trying to retrieve from the field, recognize there must be a commitment by the employee, the supervisor and management to obtain it.* Organizational teamwork is the only answer to a successful labor tracking system. All levels of participation within the organization must have some accomplished understanding of how recording their time and the tasks at particular parks affects the overall departmental work program. In order to successfully establish these levels of understanding, crew, foreman, supervisory and administrative staff meetings need to be held during the initial implementation week.

8. *The task of recording information by the employee must be thought of as part of the job and "not something additional."* Referencing

the point made in Item Number 7 and during these meetings, it must be made clear *by the Director* that the proper recording of labor activity is just as important as any other job task that an individual performs for the day. The comments that "they aren't increasing my salary to do extra paperwork" should be laid to rest. The "paperwork" *must* be recognized as part of their job with additional time *taken from* their other job duties to complete the records. As stated earlier, there is a definite price to pay if accurate and continuing labor cost reports are to be kept. In summary, we feel our labor reporting system is working reasonably well. At the same time, we are exploring other areas which will help make the labor cost-tracking a much more useful management tool. Some of the future areas of our research will include:

- Reliability Testing of Field Data
- Performance Measurement Standards
- Personnel Evaluation Criteria related to Work Performance
- Maintenance Scheduling

Other Computer-Related Areas at M-NCPPC

The Maryland-National Capital Park and Planning Commission is presently engaged in exploring many other areas to utilize computer technology such as:

- Utility Cost Monitoring
- Management Graphics
- Plant Records Management
- Nursery Management
- Botanical Management
- Contract Reporting and Processing
- Gas Records
- Capital Improvements Reporting
- Facility Planning
- Long-Range Budget Projections
- Police Ticketing
- Land Records Management
- Park Property Management
- Recreational Needs Analysis
- Economic Modeling for Park Enterprise Functions
- Vehicle Preventive Maintenance
- Police Record Keeping Systems

The above programs have either been installed or are currently being brought on line. Our commitment to staff/user training is also as varied as the programs which we are attempting to accomplish. We consider our future plans in using the computer to improve our park management and public services bounded only by the limits of our imagination! Future requests for information regarding the programs we have outlined or inquiries into our long-range management plans should be addressed to:

Stanton G. Ernst
Director of Parks
Maryland-National
Capital Park & Planning Commission
9500 Brunett Avenue
Silver Spring, Maryland 20901

Richard Schroth, Re.D., is a management analyst with the Maryland-National Capital Park and Planning Commission in Silver Spring, MD.

Computer Assisted Reservations

by Richard H. Keifer

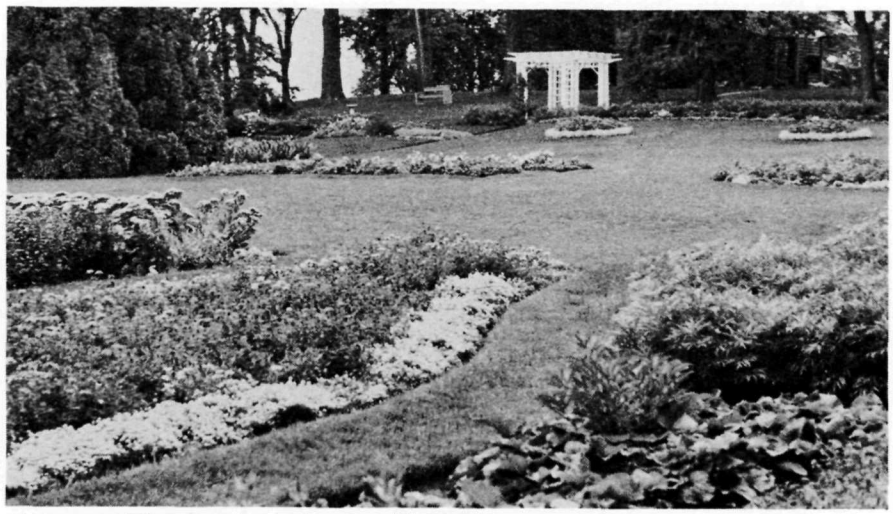
Primarily a resource based regional park system, the Hennepin County Park Reserve District is a system of large parks (150 acres to 5,000 acres) in the largest populated county in Minnesota (approximately 1,000,000 people). Presently, the District comprises over 23,000 acres of parkland, employs 140 full time and 300 to 400 seasonal personnel and manages a budget nearing $6 million.

Computerization

The use of computers in the District started in the early 1970's through the use of Hennepin County government's computer. In the mid 1970's a service bureau of Hennepin County was assigned to aid the District in providing specific park and recreation applications. After two years, it was agreed that there existed a potential for unique programming needs which could not be easily addressed without adequate exposure to an operating park system. In order to accomplish this, the District hired a computer professional.

During the past three and a half years, equipment totaling $75,000 has been installed at six park sites, providing for the entry and reporting of management information in various forms. Some of the major systems installed include: budgeting, payroll, detail project history (based on a general ledger), budgeted versus actual expenditures, word processing and site reservations.

The staff consists of three professionals and secretarial staff trained in data entry at five parks. The budget for the management information section is $170,000 for fiscal 1983.



Hennepin County Park Reserve District

This memorial flower garden can be reserved for weddings.

Reservations

The Park Reserve District doesn't involve itself in ball diamonds, tennis courts, etc.; it emphasizes a more natural experience instead. To this end, both reservation and non-reservation picnicking and camping is provided at seven parks. No two picnic or camping areas are the same; thus a multitude of information must be "remembered" on each site. Along with camping and picnicking reservations, reservations for large bar-b-que grills and weddings at a memorial flower garden are also provided. All reservations are taken at the headquarters site.

These parameters, coupled with a high turnover rate in the position handling the reservations, caused management to ask for help through computerization. A study began in October 1981, and it was quickly learned that the manual system was having problems for very good reasons. A total of 700 reservations were taken in 1980. In 1981, this exploded to 1700. Many of the reservation camping areas were scheduled to be split in 1982, thus creating the potential for untold additional reservations. The high rate of turnover, the chaos displayed by all involved in 1981 and the fact that the position didn't have a back-up person, made it obvious that a computer could aid in the process. The areas of reservations targeted for computerization included:

- printing permits (copies at the various parks)
- displaying the availability of a site
- updating information
- usage reports
- display of all information pertaining to a site or park
- display of all fees relating to site and equipment rental.

Solution

The most obvious solution was to install a reservation system on the main computer at the service bureau. This proved to be a costly venture because the cost of necessary equipment would be $5,500, plus nearly $5,000 in

Group picnic area at Hennepin County Park Reserve District.

Hennepin County Park Reserve District

development costs.

A second solution was to use a micro-computer in conjunction with the larger computer. Because the District was experiencing a shortage of funds due to state financial problems, it was decided that the second solution should be investigated further. A company named VISICORP marketed some software which could be used to set up our information and the software cost only $350.

As mentioned before, development of the necessary software would cost nearly $5,000, so this alternative seemed very attractive. Further investigation found that we could use our existing printers and save the cost of purchasing new ones. It must also be noted that reliability of the system was a main concern. The system must be available every working hour. From a public relations standpoint, a prospective user should not call in, just to be turned away due to a computer malfunction. This must be kept to a minimum. The existing computer system had become very reliable, but a new computer was due to be installed during the summer of 1982. With many new installations comes substantial down-time, which contrasts with the Apple computer's great track record and repairs which can be done within hours.

The decision was made to purchase an Apple II Plus for $3,500 which included: Apple II Plus Computer with 48k of internal memory, two disk drives, a video display monitor, VISICORP Software's VISIDEX and VISITERM programs. The VISIDEX program is used to display, update, retrieve and print certain data and the VISITERM program is used to transfer the data to the service bureau's computer for formatting prior to printing use permits and usage reports.

Features

The system is designed to provide retrieval of the following information:

- fees charged
- general information on each site
- general information on each park
- reservations made.

The system is designed to provide updating of:

- sites available
- information for printing permits.

Retrieving information for reviewing or updating is accomplished through the use of a "keyword" or "index" on each record. All information can be set up to be indexed by many keywords. There are no maximum number of keywords, but they are limited by a combined maximum of 256 characters. This allows for the creation of keywords which are meaningful to the application.

Site availability information is displayed on a one-week basis, starting with Wednesday. The particular one-week period can be selected two ways. First, it can be selected by entering the park and month codes (four characters). This will display all sites for the month, one week at a time. Second, it can be selected by entering the park, month and day codes (six characters). This will display all sites the particular week that the day falls in. General information, along with fee information, is selected by a unique keyword. This information is retrieved when a particular question on a park or site is made, such as:

- location
- size of site
- maximum number of people
- water availability
- etc.

After retrieving the site information, it is quickly determined if the site is available or if another site is available. If the site needed is available, the record is updated with a one-character letter. Next, all information which is needed for the printing of the permit is entered. This record is assigned the following keywords or indexes:

- user's name
- affiliated organization (if any)
- week of use beginning date
- date of entry.

Keywords

A major plus of the system is data retrieval through the use of keywords. The keywords were designed to be easy to use and utilize abbreviations which comprise names known and used by most park personnel.

For example, all site and general data pertaining to a particular park begins with that park's two position abbreviation. The next portion of the keyword represents either camping, picnicking, grills or weddings. The standard for this is one alpha character; the letter C - camping, P - picnicking, G - grills and W - weddings. The final portion of the keyword is the actual name of the site. In our system, this can be as long as 15 characters, but there is no limit.

When the money for the reservation arrives, the record which contains the permit information is retrieved and updated with amount received. This is done through the use of the user's name or organization. At this time, the information is transferred to a separate disk for transfer to the Hennepin County service bureau's computer.

On a minimum of twice a week, the permit information is reformatted and printed, with copies being distributed through printing at the needed locations. There are two reasons why we print use permits through the use of the Hennepin County service bureau's computer.

First, all of our locations are connected to this computer which allows for two benefits. The permits can be printed at the locations needed and they are stored to be printed when time permits. Second, the Apple need not be tied up printing. Although it takes some time to transfer the data, it is comparatively a fraction of the time. For protection, all information is backed-up at noon and at the end of each day. This, along with the fact that site information and permit information are kept on separate disks, provides for ample back-up.

Implementation

The decision to purchase was made in mid—February of 1982. By that time, nearly 100 reservations had been taken on the manual system. The pressure was on to develop and install the system as soon as possible. Within 30 days (200 man-hours) the system was ready for input, but printing of permits, reports and a manual were not complete. The printing had to wait for preparation of computer forms, which was to take four to six weeks. It was decided to wait until the new reservation clerk started (in four weeks) to implement the system. During that time, the manual was completed, a back-up person was trained and approximately three hundred reservations were input.

As fate would have it, the clerk started at the beginning of the busiest reservation time. This, coupled with the fact that she had never touched a computer, created some anxiety. As our reservation season draws to a close, we have taken nearly 2,000 reservations. During this time, we have had two occasions to stop reservations due to equipment problems. In both cases, the problem was due to the diskette being put in at an angle. Each problem took ten minutes to solve and the data was not damaged.

Analysis

The system, as designed, is serving our needs well. One key to our success in using a micro computer is the fact that all of our reservations are made at one location. Another plus is that the Apple is easy to use and understand. The final appeal is the use of VISICORP's programs, which are easy to use and adaptable.

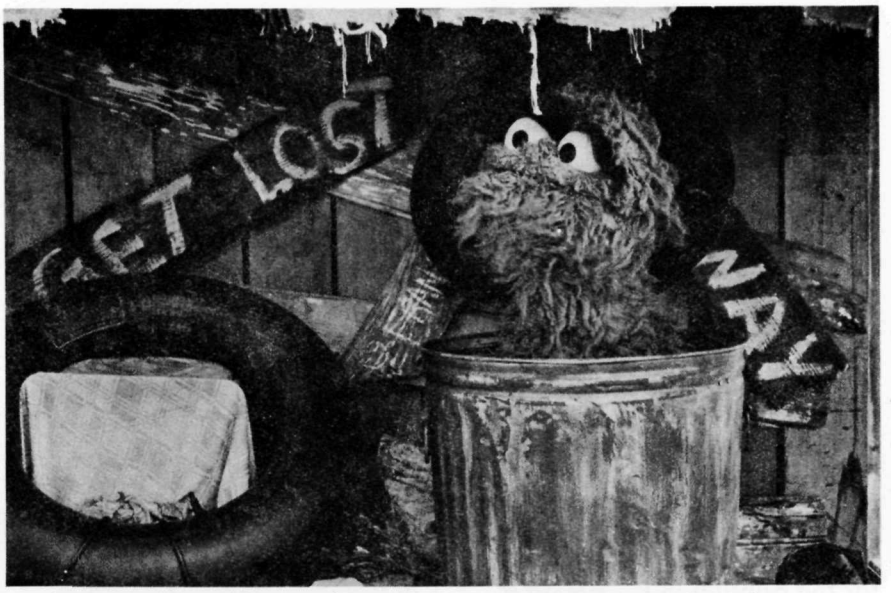
Future Reservations

This winter, the Apple computer will be used to take cross country ski lesson reservations. Lessons are given at several locations on various weekends during January and February. Problems which plagued us in the past included overbooking, underbooking, not having complete information, thus not being able to contact the person if we had bad weather; not collecting all of the fees and finally, not having an up-to-date list of the people taking the lessons. Although the system has yet to be designed, I believe it will parallel our original system quite closely, as well as have its own unique features.

Richard H. Keifer is a management information specialist with the Hennepin County Park Reserve District in Minnesota.

Sesame Place

by Sandra G. Hanna



Sesame Place, Langhorne, PA.

Automated Muppet Oscar the Grouch looks and sounds like the real Sesame Street character, but actually has been pre-programmed in voice, movement and setting to duplicate the original.

Sesame Place, Langhorne, PA.

This father and daughter team enjoy the challenge of one of the nearly 60 computer games at Sesame Place.

For children and their parents, discovering new things about themselves and the world around them is what a day in Sesame Place is all about. Sesame Place opened in Langhorne, Pennsylvania in 1980, through the joint efforts of Busch Entertainment Corporation, owners and operators of Busch Gardens theme parks, and the Children's Television Workshop, creators of "Sesame Street," "The Electric Company" and other educational television programs.

A second Sesame Place was opened in Irving, Texas in 1982. Additional Sesame Place parks are planned during the next few years in selected locations around the country.

The focus of Sesame Place is to encourage skill building and promote the park philosophy of learning through doing. Families explore together and experience such concepts as problem solving with a computer, learning about the law of gravity through scientific exhibits, and feeling the thrill and excitement of completing a new physical challenge such as scaling cargo nets or climbing a slippery vinyl mountain.

Sesame Place consists of five separate play and learn areas: The Computer Gallery, which houses one of the largest collections of computer games in the country; The Sesame Science Studio, which provides hands-on experiments in sound, energy and light; more than 40 outdoor play elements that encourage and support physical activity for both children and adults; The Sesame Food Factory, where an open kitchen and a menu of nutritional foods give families exposure to better eating habits; and Mr. Hooper's Store which encourages children to browse and play as they shop.

Computer Gallery

The Computer Gallery is a two-level building which houses more than 60 specially designed stand-alone micro-computers with a simplified keyboard that arranges letters in alphabetical order to make them easier for youngsters to use. The games combine fun and learning by challenging the skills of children of all age levels. They invite players to solve puzzles, form patterns, make words and letters, create musical compositions and test hand-eye coordination.

A game called "Lemonade" demonstrates how to use the computer to solve the economical problems of running a lemonade stand at a profit. "Tune-In" invites players to compose a melody by arranging musical phrases that are pre-programmed into the computer. "Fire Fly" tests eye-hand coordination as players try to see how many windows in a city they can light up with a flash of light. For younger children, there are more simple games like "Mup-o-Matic" in which players guess the Muppet character emerging in the video patterns. Although the techniques are similar to the more commercial arcade games, the games at Sesame Place are

designed to be non-competitive and non-violent.

Additional Uses

During the late fall and winter months, when the 3½-acre park is officially closed for the season, after-school computer workshops are offered for children, parents and teachers, with parents and teachers among the most enthusiastic students.

In conjunction with the Boy Scouts and Girl Scouts, Sesame Place offers an opportunity to fulfill badge requirements at the park. There are science experiments, computer projects, and outdoor tests of skill that scouts can complete to gain scouting badges.

When the idea for the Computer Gallery was first conceived, child development specialists, educators and scientists were consulted in designing the project. Children also tested the computer games to make certain that they enjoyed them and could understand the instructions.

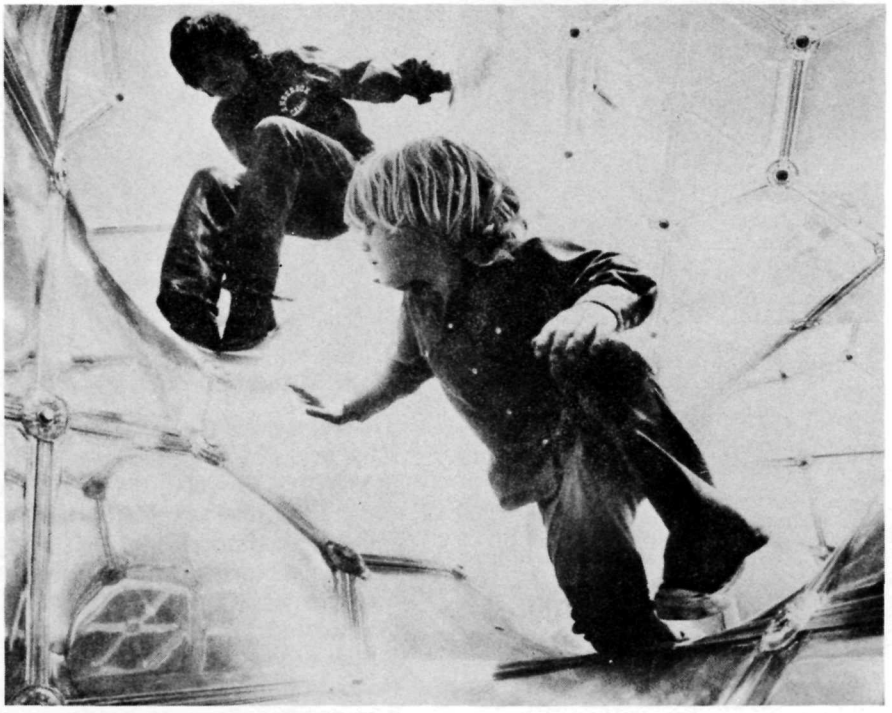
While children adapt easily to the new computer technology, some parents actually have to overcome fear of using the computer. However, once parents sit down at the specially designed keyboard, the fear subsides and they quickly begin to enjoy the games with their children.

Because Sesame Place is based on the popular TV show "Sesame Street," many children already are familiar with the friendly characters that appear on the computer screen. Muppet characters "Bert" and "Ernie," among others, teach children about numbers, pictures and concepts.

Automatic Muppets

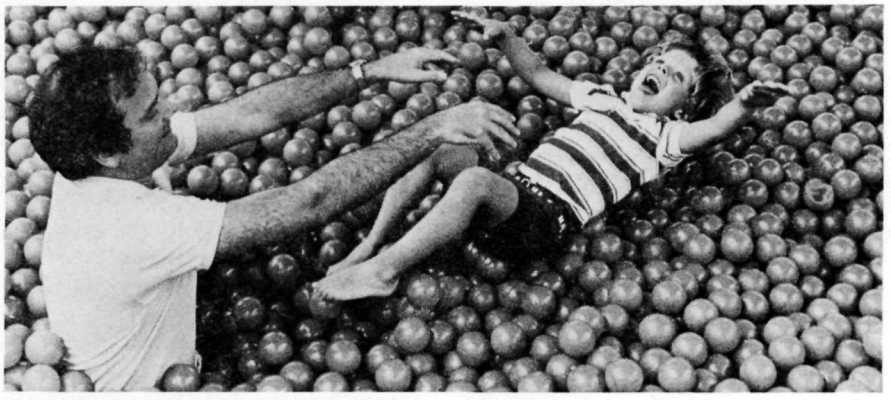
In 1982, Sesame Place added a new entertainment element in the form of Automated Muppets. These are computer-programmed performances of the Sesame Street Muppet characters Oscar the Grouch and the Cookie Monster.

The Automated Muppets were developed jointly by Jim Henson & Associates, creators of the Muppets, and Astrosystems, Inc., (ASI) which provided the engineering and technical expertise.



Sesame Place, Langhorne, PA.

The Crystal Climb allows children and parents to experience being inside a molecule, while they play in the clear, multi-level, three-dimensional structure.



Sesame Place, Langhorne, PA.

A youngster is tossed into a giant "pool" of 80,000 lightweight plastic balls on a waterbed surface in the Count's Ballroom.

Through the automation process, the Muppets speak, tell jokes, sing and laugh just as they do on Sesame Street. The characters have their own displays at Sesame Place with Cookie performing in the Sesame Food Factory and Oscar just behind Mr. Hooper's Store.

The automation process involved duplicating, by computer, the movements of Frank Oz (Cookie Monster) and Carroll Spinney (Oscar the Grouch), just as they perform their Muppet roles. Recording sessions held to tape the Automated Muppet programs were produced and directed by Christopher Cert, a consultant to Children's Television Workshop. Helping children to interact and become familiar with computer technology in a fun and family-oriented environment makes Sesame Place an exciting and popular attraction to young and old alike.

Sandra G. Hanna is Marketing Manager and Director of Educational Programs at Sesame Place in Langhorne, PA.

Plant Management System

by Carl R. Hahn

There is virtually no area of our lives which does not directly or indirectly involve computers. Banking transactions, travel reservations, theatre tickets, supermarket checkout, Pac Man, and now Ms. Pac Man, are all computer-based operations which have changed the way America works and plays.

The park and recreation profession today finds itself in the midst of a rapidly changing technological society which increasingly finds computers involved in areas where they were not previously employed, and in some cases their use was not deemed possible or even useful.

Parks and recreation, along with horticulture, forestry and allied disciplines have long been perceived as "laid-back" professions involving a close and direct association with people and nature; seemingly not the sort of working environment compatible with machines capable of performing thousands of computations per second. Yet, a closer look at these professions reveals that they have many elements in common with enterprises which have employed computer technology for years.

When one looks at the diversity of elements and disciplines which are lumped together under parks and recreation it can be seen that scheduling athletic field use or park reservations, for example, is essentially the same type of process as reserving a hotel room or a seat on an airplane.

Maintaining an inventory of a group of trees and shrubs in a park system is not materially different, in terms of a process, than keeping any other inventory whether it is parts in an auto shop or canned goods in a supermarket.

Plant Management System

The Maryland-National Capital Park and Planning Commission's (M-NCPPC) involvement in developing our computerized plant management system (PMS) began with an analysis of what activities our Division of Horticulture and Forestry performed which might be more easily or efficiently handled with the aid of a computer. Concern in this area was sparked by a need to become more efficient in a time of reduced operating budgets concurrent with an expanding park system. In an era of tight budgets, employee efficiency and productivity and agency accountability must undergo detailed examination for the sake of survival. We decided to look into the potential uses of computers as this technology had a proven record in industry and other park and recreation agencies.

We operate a complex and large park system under The Maryland-National Capital Park and Planning Commission. The Montgomery County Parks Department of the M-NCPPC has some 500 employees, 400 parks and 25,000 acres of parkland. The Horticulture and Forestry Division has 75 full-time employees involved in three major activity areas: (1) the management and maintenance of two botanical gardens; (2) landscape maintenance and development for all Montgomery County Parks; and (3) management of an 85-acre tree and shrub nursery which contains 14,000 plants.

In analyzing these three major functions we determined that there were a number of activities such as tree nursery inventories, tree planting and watering schedules, record management of the botanical gardens and coordination between landscape architects and the horticultural staff in the development and renovation of parks which we felt had the potential for improved management through automation.

Preliminary Meetings

In 1979 we began a series of meetings with the managers of our botanical gardens, tree nursery and landscaping groups with the aim of brainstorming what ways a computer could make their jobs easier, provide for better accountability, and allow their units to function more effectively. We were also interested in learning if the managers lacked needed information or did not have the time to get necessary data through manual methods.

It should be noted that the managers of the botanical gardens, landscaping and tree nursery units all had strong horticultural backgrounds, but no previous knowledge of data processing or computers. One or two had never seen a computer terminal. At the brainstorming sessions we wanted to give the managers free reign, allowing imaginations to run wild, without considerations of cost or even if computer was capable of doing what they wanted. It was felt that this initial approach, without predetermined restrictions, would provide a free flow of ideas and not stifle individual initiative.

Our horticultural staff then met with representatives of our data processing group to determine if the ideas developed by the horticultural staff were capable of being handled by a computer.

We have had a data processing

staff and our own Hewlett-Packard 3000 mini-computer for several years. Up to this point, however, the computer had only been used for financial and accounting purposes. The development of a horticultural program was a new experience for our data processing staff.

Early on, we found that our computer and data center people and our horticultural people did not speak the same language. While the horticultural staff was talking about genus, species, variety, forma and cultivar the data processing people were casting about terms such as "hipos," "strings," "bits," and "bytes."

This phase of the development was facilitated by having first thoroughly documented which functions we wanted the computer to perform and by backing up our commitment to the project with sufficient funding.

With a good deal of patience and willingness on both sides to cooperate, an educational process ensued in which the horticulturists learned something of computer terminology and function, and the data processing staff came to understand botanical nomenclature and horticultural terminology. As it turned out this was a vital ingredient in the process as it eliminated a number of real or potential problems at an early stage of development of the plant management system.

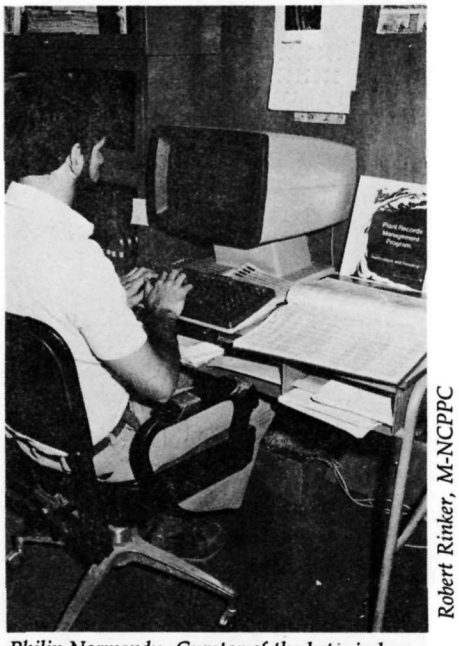
A thorough understanding between the users and those who write the computer program at every step in the development process is essential to ensure that the final product works. This was the most tedious and time-consuming element in the development of PMS, but the effort paid off.

PMS Specifications

From the horticultural perspective in developing PMS, we wanted a system that was user-friendly; that is, a computer program that could be used easily on a daily basis by individuals who did not have a computer-oriented background. We required a system which, to the maximum extent possible, would not allow the input of erroneous data; primarily scientific plant names. In a like manner, we felt that our system should be completely interactive, allowing us to retrieve or combine any number of data elements to produce reports which would aid our managers.

Upon reaching agreement between our horticultural staff and data processing group about the specifications for the system, we surveyed other horticultural, botanical and park institutions to determine if anyone had a system capable of meeting our requirements. A thorough study of existing software packages revealed that there was no single system capable of meeting our needs since we required a system capable of handling a plant inventory for parks, botanical gardens and tree nursery.

The specifications for the software were prepared by our data center staff and requests for proposals were sent to several computer software firms. The contract for development of PMS was awarded to Data Base Managemant, Inc. (DBMI), Arlington, Virginia. Throughout the six-month course of the development of PMS, our horticultural and data center staff met with the DBMI approximately every two weeks during the development of the software. This process was very useful in identifying and addressing problems and



Robert Rinker, M-NCPPC

Philip Normandy, Curator of the botanical gardens collections updates plant records via a computer terminal.

answers developed by both parties. Because of this close association between the users and contractor, the project proceeded smoothly and in the final testing phase very few problems surfaced.

It bears mentioning that PMS is a very complex program which is easy to use. The written documentation for the PMS program is contained in a document two feet thick; thus it was in our interest to ensure that errors and problems were kept to a minimum.

PMS is essentially a master plant inventory, divided into three subinventories: botanical, nursery and park, corresponding to the three major functions of the Horticulture Division. Security features built into the system allow, for example, the nursery manager to access only the nursery inventory, while the botanical gardens curator can only use the botanical inventory. Overall control of the system rests with the PMS Manager, the Chief of the Horticulture and Forestry Division.

Botanical Inventory

The M-NCPPC operates two public botanical gardens: Brookside Gardens and McCrillis Gardens. Prior to the development of PMS, plant records were

Robert Rinker, M-NCPPC

Visitors to Brookside Gardens admire an upright form of English Oak.

kept manually on file cards, a laborious and time-consuming process. The plant collections at the two botanical gardens comprise some 8,000 different types of plants, in some cases these are duplicated several times.

With the PMS system we essentially substituted paper file cards for electronic file cards, and at the same time expanded the types of information collected. The botanical inventory allows four basic operations which permit the botanical curator to add, move, update information or record the death of a plant.

Features of the botanical inventory:

- PMS allows the addition of up to 100 plants of the same type from the same source in one operation, requiring a few seconds. Done manually (that is, one record card for each plant) the process could take several hours.
- If a plant is entered into PMS which has not been entered previously, the system informs the user of this fact as a spelling check.
- If a plant or group of plants is moved from one location to another, the new location can be recorded instantly.
- PMS is compatible with the Statistical Package of the Social Sciences (SPSS) allowing statistical computations to be made with ease.
- PMS can generate numerous reports which can list any combination of data elements such as lists of plants by location, family, nativity, source, accession number, etc.

Nursery Inventory

The nursery inventory is somewhat more complex than the botanical inventory. Briefly, the highlights of the nursery inventory features are:

- The system records the name, size, quantity and location of every tree in the nursery.
- The system allows our designers and landscape architects to reserve plants for new parks or landscape renovations from the nursery by entering the plant's name and desired size parameters. In the event plants are not available in the given species or size, the computer automatically produces a list of plants to be purchased from commercial sources.
- The computer prints labels which can be attached to trees giving instructions on where trees are to be planted.
- PMS produces a tree availability list, essentially a nursery catalogue of plants.
- Reports are available which will produce nursery tree data in any desired format such as by plant size, family, genus, source, cost/value, etc.
- PMS keeps track of all trees for two years after they have left the nursery, and prepares lists of recently-planted trees by location as a reminder to tree-watering crews. In a like manner it generates a report indicating which trees need to have stakes and wires removed.
- The PMS nursery inventory is compatible with SPSS.
- PMS retains in its memory the last three plants to occupy a given space in the nursery. This allows the tracking of tree performance by nursery location or source.

Park Inventory

The third and least complex of the subinventories, the park inventory, monitors trees and shrubs in each of the 400 parks in the system. The various parks in the system range in size from a few hundred square feet to more than 3000 acres. The PMS system is used to maintain an inventory of trees and shrubs planted in any given park or to record data on the historic, large or especially noteworthy trees.

- The PMS park inventory is used to record the movement of plants from nursery to park, from the botanical

collections to a park or from park to park. The movement of plants from one location to another can be recorded by simply changing one park identification to another.

- The PMS park inventory is essentially a record-keeping system for various plants in parks. Typical information kept on such plants includes the scientific name, location within a park, source, date planted, special notes, comments, etc. This portion of the program, as with the other subinventories, allows four options: to add a plant to a park, to move a plant, to update information and to record a death.
- The park inventory can generate reports such as the listing of all plants of a particular species which can be used by landscaping personnel as a guide for spraying or pruning work.
- Reports can be generated for use by the public giving the name, size and location of rare and interesting plants in the parks. This, in effect, allows an interpretive use of the parks as an extended botanical garden.
- The park inventory is compatible with SPSS.

PMS has been in use for two years with excellent results. While the conversion from a manual to an automated system required a certain amount of staff time devoted to training personnel in the use of PMS, these costs have been minimal as proficiency in the use of PMS can be gained after a few hours of instruction.

Staff resistance to change was a minor factor in part, we feel, because users were thoroughly involved throughout the development of the program. Initially some staff members were reluctant to give up their paper records - perhaps these records served as a type of security blanket - but when it was demonstrated that all of the information previously kept on file cards, scraps of paper and other obscure repositories could be transferred to the computer, all reluctance vanished.

PMS has radically altered the way our horticultural division conducts its business. As we are now in our second year we have had ample time to evaluate the program. We find that we are doing our work differently and also doing it better.

PMS Benefits

Among the benefits of PMS are:

- Substantial reduction in labor required to keep and update records.
- The system works for us rather than the other way around.
- Field operations such as planting, watering and removal of plant support stakes are more efficient than ever before.
- The program produces a large variety of reports which allows managers to make better and more rapid decisions about the management of plants and parks.
- The majority of time and labor expended on developing bids for the purchase of plant materials has been eliminated.

In the time PMS has been operational we have noted and are exploring possibilities for enhancements and spin-offs. To date we have created a plant propagation record system which ties into PMS, and other system enhancements are expected within a year or so.

We feel that PMS represents the state-of-the-art in plant management systems and our agency is willing to share our experiences with any interested party. For more information about PMS please write to Stanton G. Ernst, Director of Parks, M-NCPPC, 8787 Georgia Avenue, Silver Spring, MD 20907.

Carl R. Hahn is Chief of the Horticulture and Forestry Division of The Maryland-National Capital Park and Planning Commission.

The position and current size of each of the 14,000 trees in the Montgomery County Park Department's tree nursery is recorded in PMS.

Robert Rinker, M-NCPPC

An Approach to In-House Computer Training

by Deborah Arfman White

Park and recreation agencies across the country and around the world are moving into the world of automation with the use of computers for better management and communication of information. One area that agencies should be concerned with is that of training personnel to use the computer. In most cases, leisure services personnel do not possess formal computer training and may be intimidated by computer jargon and/or the computer's capabilities.

An alternative to having your staff enrolled in a computer course that seldom applies to an agency's individual situation is the use of in-house training. This is the approach we have utilized in the Montgomery County Department of Parks of The Maryland-National Capital Park and Planning Commission (M-NCPPC) because demand for computer services is very high. This article has as it's principal focus the establishment, operation and evaluation of an in-house park and recreation training program. References to resource materials and case study examples have been used throughout the article in order to accentuate the program components.

Charles W. McGovern, M-NCPPC

Training resources are integral to a successful training program.

Establishing the Program

The first step in establishing the training program is to select the proper individual who will have ultimate responsibility for it's success or failure. Customarily, an individual from the city or county data center, or someone with data processing responsibilities conducts the training. We chose not to follow this route. Instead, a staff person from the Parks Department was selected to train the Parks personnel. The selection of this individual was an involved process as this person had to possess not only data processing skills, but also exhibit an understanding of the role played by the Parks Department. Sensitivity to, and acceptance of, a staff with little or no computer background was another important factor.

Finally, the Department made a commitment to this training program by providing the selectee with the necessary time and resources to develop and conduct such a program. We believe that the ultimate success or failure of any new program, especially this one, is highly dependent upon the Montgomery County Parks Department's commitment of it's time and resources. As a result, great strides were made to tailor the heart of our training program to the actual needs of our managers and employees.

After the determination is made as to who will conduct the training program, it is important that a framework be established which delineates the boundaries of the program. Listed below are a number of the goals and objectives we feel constitute the basis for our training effort.

Training Goals and Objectives

1. Provide continuous staff training in the concepts and use of automated systems.
   - Coordinate an annual Department-wide seminar with staff and guest speakers.
   - Coordinate, plan and implement small monthly group workshops focusing on applications benefiting those participants.
   - Create a resource library for professional staff development.
   - Organize and conduct on-going individual training sessions.

- Organize and develop video illustrations as a training resource.
- Provide avenues and/or assistance for staff to receive advanced training in-house or through outside resources.

2. Provide competency-based levels of achievement for employee performance measurement.
   - Define achievement levels for managers as well as non-managers and secretarial/clerical staff.
   - Develop labs and reviews to provide methods for achieving higher levels of performance.
   - Research and recommend possibilities for advancement opportunities or special commendation based on achievement levels.
   - Develop a mechanism to monitor computer competency.
3. Provide a continual communication link with staff of new developments and/or changes.
   - Provide continual assistance by being available to staff for questions.
   - Develop a quarterly newsletter to aid in the departmental communication effort.
   - Serve as a reference focal point in providing an assortment of training manuals and other learning resources.
4. Provide an on-going evaluation process of the training program.
   - Develop standards to evaluate the program.
   - Organize and evaluate the training program on a yearly basis.
   - Provide the mechanisms for staff to have input into the evaluation process.

Making the Program Operational

The second phase of the training effort is program design. Prior to implementation of the program design, training requests were handled without formal guidelines. It became obvious that staff training levels were often indefinable, leading to inconsistent benefits. It seemed apparent that an organized program defining user categories as well as competency levels was necessary. Below is the breakdown of the categories and competency levels used in our Department.

User Categories

Managerial — This category is designed for managers who want to focus on what the computer system can do for them. Managers should have hands-on experience with relevant applications that assist in more effective management.

Secretarial/Non-Managerial — This category involves secretarial and non-managerial staff. Attention is given to the role computers play in various operations focusing on word processing capabilities.

Special Applications — Training in the special applications category provides staff with the ability to operate divisional application software. Horticulture supervisors, for example, require the ability to process automated nursery inventories while park planners need the ability to track land parcels.

Sophisticated User — This category provides training for software such as graphics, SPSS (Statistical Package for the Social Sciences) and Data Base Development. These packages allow users to produce graphics and do data analysis or program development without programming assistance.

Competency Levels

I. Introduction to Computers

The introduction is designed to provide an overview of computers and their usage. Topic categories include:

- Terminology
- Available resources
- Hands-on experience
- The various terminals and their use
- Communication with computer systems

II. Word Processing

This level focuses primarily on teaching participants the fundamental concepts of word processing and their value in the office setting. Topics included:

- Creating files
- Updating files
- Saving files
- Error recovery
- Terminal use

III. Areas of Specialization

Once a user has progressed through the first two levels, training becomes more special-

ized in nature. Level III may be defined in one of four ways:

1. Intermediate/advanced word processing provides staff with a solid background in word processing concepts so that they are proficient in its use. Topics include sorting capabilities, special formatting options and automatic mailings.
2. Managers who choose not to receive instruction in word processing as well as for those who have, can now proceed to review information available to them through special packages and divisional applications (i.e., time-labor tracking, graphics, budgeting, utility monitoring).
3. The sophisticated user receives training for various special-use packages mentioned in the category definition.
4. Special applications training is directed to new software systems uniquely designed for divisional operations. Examples include a Capital Improvements Program, a Land Parcel Tracking System or a Plant Management System.

IV. Special Departmental Seminars

Departmental seminars focus on new products and state-of-the-art technology utilizing guest speakers and demonstrations. The manner in which the program design is implemented is instrumental in its success. The following concerns play a contributing role in the training effort of the Montgomery County Parks Department.

Charles W. McGovern, M-NCPPC

Small group workshops offer training that focuses on relevant applications for the participants.

- Implement program gradually. Computers, with their associated jargon, still may bear a mystique which can frighten some people. A graduated installation will likely take stronger hold than if it is suddenly forced upon staff.
- Limited use of technical terminology can help smooth communication channels.
- Users often have unrealistic expectations that influence their attitudes toward computers. Attempting to define these attitudes and expectations and incorporating them into individual training sessions will aid in a user's understanding and acceptance. Users need to realize that computers are merely a vehicle for processing information.
- Allow for creativity. Problem-solving techniques help instill the ability for staff to be creative in using the computer as a tool for better record keeping and/or management of information.
- Provide a means for employee recognition for accomplishments. This could possibly be through verbal communication, through additional responsibilities such as training fellow staff, or even possible monetary bonuses or promotional opportunities. Recognition can often support a program in that an employee will feel more satisfied and work toward the program goals.

Training Resources

Training materials and the training environment are central to any training program. By providing access to as many resources as possible, employees can supplement or enhance their current level of competency. Encouragement of their use during the actual training sessions will aid staff in becoming familiar with the contents. So what should the resource library contain?

Books — Many books today address the subject of computers on a variety of topics ranging from computer games to programming languages.

Manuals and Pamphlets — These cover specific operations relating to the agency's computer. They may be distributed by the computer manufacturers or software development firms. Development of in-house resources can help ease user frustrations resulting from the inability to comprehend commercially developed manuals or guides.

Self-Guided Tours — These

booklets are excellent for the beginning user who isn't interested in starting with formal training but wants to get "a finger in the pie" so to speak. These may either be in booklet form or possibly through audio-visual methods.

Other Resources — A catalogue of available seminars, workshops, and conferences offered by universities, other public agencies, professional organizations or the private sector. Current seminars, etc. are announced in the newsletter.

In addition to the resource library, attention must be given to the training environment. The approach taken by the Montgomery County Parks Department is the use of a conference room as a training center which is proving to be very beneficial in eliminating distractions and interruptions. This center is used mostly for group seminars and workshops. A porcelain board serves jointly for illustrations and as a screen for audio-visual displays. A large conference table provides working space and an area for placement of terminals.

In the future, T.V. monitoring equipment for use in the training center will allow participants to view examples and demonstrations as they are discussed. Individual training sessions are conducted in an office area containing a small porcelain board, a terminal and a printer.

Although this arrangement is available in most divisions, bringing the participant to an area especially designed for training eliminates interruptions. Even though training materials and the training environment may seem secondary to the training program, they are the most significant. These factors can mean the difference between contented users and ones who are frustrated.

Evaluating the Training Program

In order to avoid a static training program, evaluations should be conducted on the overall program and on the various performance levels. The evaluation should be approached as a joint effort with both the trainer and trainee involved. Feedback from participants can be very healthy for programs, especially in the early stages. If employees see their recommendations put into action, it may give them an incentive to become more involved and adds additional credibility to the program. When performing an evaluation, however, certain areas of concern should be examined.

1. **Environment** — Are the facilities adequate and effective? As discussed above, training areas should be distraction-free, comfortable, and have an effective arrangement for visual aids and terminal hook-up.
2. **User's Expectations** — Are they defined and was an attempt made to incorporate them into the program? Did the user know from the beginning what to expect? The more the user understands, the less unrealistic the user's expectations will be.
3. **Trainer Evaluation** — The trainer should evaluate his/her performance on certain established characteristics. Staff should be provided the opportunity to evaluate the effectiveness and abilities of the trainer.
4. **Resources Evaluation** — Are the current resources adequate? Should additional in-house materials be developed? What type of resources have staff requested? There should be a constant review of literature for new available resources.
5. **Program Design and Content** — Are the desired results being achieved? Are employees performing as expected? Are the levels of performance defined adequately and do the categories include all employees?

Because every training program is different, the evaluation process must take place. This process helps provide a method for defining problems occurring in the program. As a rule, the most difficult problem in training is the differing levels of understanding that occur during the training process. For this reason a competency-based program is crucial as it aids in defining a participant's progress and current level of knowledge.

Another major problem encountered is the varying degree of expectations and the effect it has on the user's attitudes. The differing levels of understanding and varying expectations have a major impact on the program design and the training effort. A constant evaluation can bring to light problems occurring in the program, and solutions can then be incorporated into the training program.

Conclusion

How vital is a training program? Montgomery County Parks found it to be of significant value. We have trained approximately 60 secretaries, supervisors, managers and other park staff in the operation of the Department's computer. Our tailored program has aided in turning unrealistic expectations into realistic results. It has turned skepticism into acceptance and apprehension into confidence.

In a desire to become computer-literate, many staff members have requested training. They see others ulitizing the system with excitement and this has become contagious. These reversals and new attitudes have helped play an important role in the overall acceptance of the Department's Management Information System.

Deborah Arfman White is a Management Analyst with the Montgomery County Department of Parks, The Maryland-National Capital Park and Planning Commission, Silver Spring, Maryland.

The Paperless Office

by Karen H. Michaels

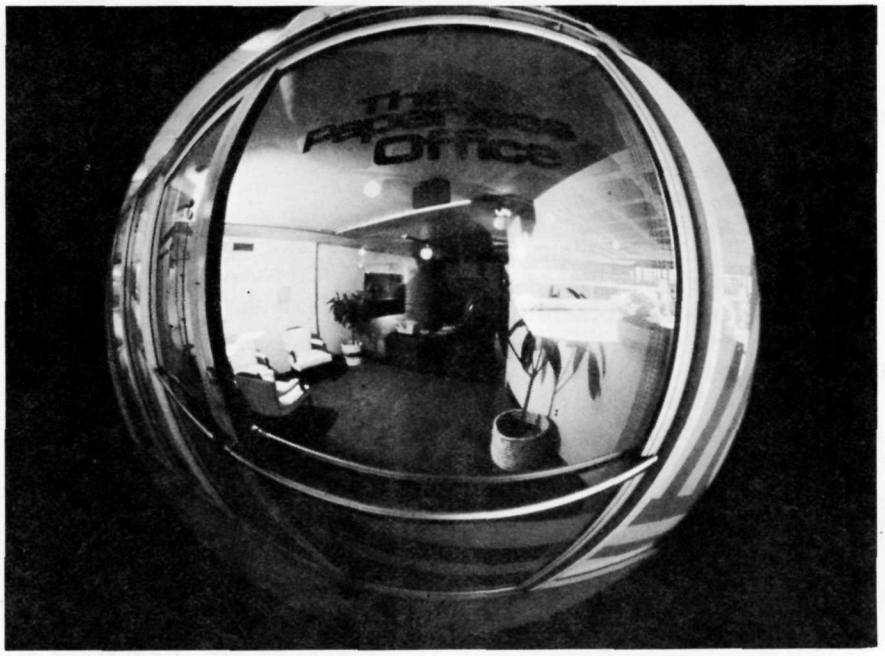
The Information Age

Throughout the past decade, the "office of the future," "the electronic office," "the paperless office," have existed as abstract concepts for most organizations. However, today's offices are faced with serious information processing problems requiring immediate attention. We have become very proficient at creating information, both manually and through data and word processing, but have fallen behind in our ability to manage and control that information successfully. And no wonder — we create millions of documents every day!

Mankind has grown through the ages from an agriculturally-based society to one steeped in the effects of the Industrial Revolution. Each era has brought with it phenomenal economic, social and psychological changes — the "third wave." The Information Era will bring even greater changes which will affect us rapidly. By 1900 the delineation between the "haves" and the "have-nots" might well be between the "Information Rich" and the "Information Poor."

No matter what business an organization is in, it is also in the information business. In every industry, people communicate — they talk to one another, fill out forms, synthesize data, etc. The office has expanded to include wherever work is performed — the traditional office, school, home, car, truck, plane, etc. Communications is the key to every office operation.

Information has become an economic commodity in and of itself. In fact, 50% of the Gross National Product is information products or related services.



Micronet/Kappa Systems, Inc.

However, according to Department of Labor statistics, white-collar worker productivity (4%) has lagged far behind that of blue-collar workers (84%). What do these figures mean? Considering the fact that the number of white collar workers is outgrowing production (factory or farm) workers almost 5 to 1, our economy could face serious problems unless we can make this labor and capital-intensive segment of society more productive.

But where do we begin in this endeavor? Looking behind the scenes to determine why blue collar workers have been so productive, we discover that approximately $35,000 per worker per year is invested in tools required to do his or her work; whereas only $3,000 per worker per year is invested for the "tools" that office workers need. Currently, most office workers only have writing implements, a desk and chair, a filing cabinet, and a telephone — the tools of 50 years ago.

Management Challenges and Technological Change

Within the past 5 years enormous changes have begun to take place, not only in the office but in our lives in general. How many people do not own a pocket calculator or have not heard of word or data processing? Whether we are aware of it or not, our lives are surrounded by computerized parts — in supermarkets, electronic arcades and home games, digital watches, microwave ovens, gas pumps, etc.

Although the primary topic of this article concerns technological change in the office, an overriding influence evolves from the basic understanding that routine and tedious tasks are slowly, but very surely, being automated.

The major challenge facing organizations in the 1980's is information management — determining what kind of information is important to whom, and knowing how to route it in the most cost-effective and timely manner.

Information is only as valuable as it is accessible — and is most valuable if handled properly.

There is no one "supertool" but there are varied technologically advanced tools which can help us access and use information more efficiently. The challenge here is in understanding what needs to be known by whom, and determining which technology is most appropriate for the specific *applications* required. The "catch" is that to be successful, information processing systems must be *integrated.*

These two buzz words, *applications* and *integration,* form the backbone of the successful office of the future. Each component in the office should function as a subsystem of the larger system's architecture. The end result of successful information management is not only well-designed and integrated hardware and software, but also good procedures, facilities, training, office organization, and attention to human and psychological factors.

The Paperless Office

These are some of the premises that promoted the development of Micronet, Inc.'s Paperless Office demonstration and training facility at the Watergate in Washington, D.C. Micronet gained world acclaim as the first fully automated, integrated office (1979) by designing, developing, and implementing the system architecture, communication protocols, procedures, and interfacing software used for its daily business operations.

Technologies included in the information processing flow include dictation; data and word processing; electronic mail; source document, updatable, and computer output microforms; computer assisted retrieval; large scale automated micrographic document storage and retrieval; computer color graphics; optical character recognition; and multifunction microcomputer-based executive workstations. Working daily in its automated office, Micronet/Kappa Systems, Inc. (management consulting firm) has the unique ability to practice what it preaches in terms of managing information and technology in the 80's.

An Integrated Records Management System

The Paperless Office information processing network begins by defining two basic issues: 1) the source of document creation (internal or external) and 2) the anticipated activity (long-or short-term retention; high or low distribution priority; etc.). The flowchart (Figure 1) generically illustrates information processing at the Paperless Office, and is representative of integrated possibilities within any office.

A major portion of the information contained in Micronet/KSI's records management system is externally created. These documents are varied in format, typefont, color, size, etc., and consequently are fairly inflexible, i.e., we cannot cost-effectively convert them to digital form for manipulation or distribution, etc.

Since most externally prepared material arrives in paper form, Micronet/KSI's procedural handling includes internal routing in paper form, and subsequent batching and coding for source document or "updatable" microfilming and long-term storage.

A.B. Dick's System 200 allows us to use a fiche (film about the size of an index card) as a substitute for a manila folder. We can add images anywhere on the fiche master (up to 98 pages/fiche), and have opportunities to override obsolete data, duplicate fiche, and to bring images back to paper if necessary. Source document filming is sent to AmeriCOM (a local service bureau) for filming and indexing.

Some information, however, arrives through our telephone-based dictation system or in digital form through electronically mailed documents or through our electronic mail system. This information can then be treated more like internally prepared materials — in other words, we have options to convert the data from one medium to another; to edit, answer or forward information; or to throw it away if we have no further use for it!

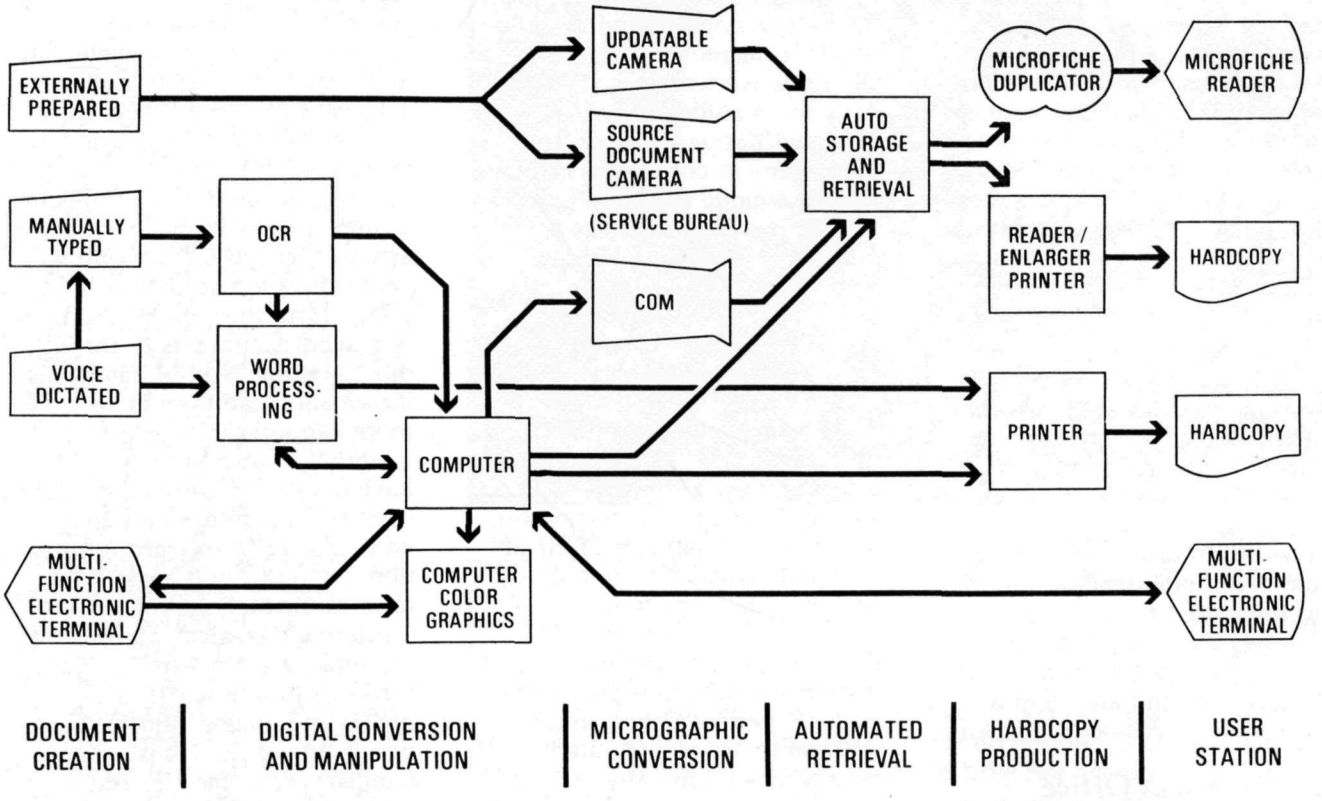
Internally created information can enter the "system" in varied forms including paper, and digital and analog signals. Dictation is one of the oldest, most familiar, cost-effective, and underutilized technologies in the office today. Dictaphone's Thought Tank Master, a telephone-based (4 dial-up lines) system, provides our staff with one of the quickest and most accessible ways to communicate — 24 hours a day, regardless of where we are.

As with all systems, there are benefits and drawbacks — an hour of dictation is comparable to two hours of transcription. However, unless standard procedures are used and attention is paid to grammar, increased requirements for editing should be expected.

The most economical input device for transcription is the electric typewriter used in con-

MICRONET'S PAPERLESS OFFICE INTEGRATED RECORDS MANAGEMENT SYSTEM

Figure 1



junction with an optical character recognition system (OCR). Internal studies have revealed that 70% of all keystrokes are first draft typing, while only 30% are edited and revised. This means that for many organizations, the total reliance on more expensive word processors (equipment and personnel) can be lessened.

The Paperless Office uses two Dest Corporation OCR's, one with multiple communications capability designed for centralized operations and a table-top unit, designed for decentralized or word processor-dedicated operations. This allows the NBI 3000 word processor to perform the functions it was designed for — text manipulation, active storage, and letter quality output. In The Paperless Office the OCR is hard-wired to the word processor, but could transit to the computer, photocomposer, or other telecommunications channel.

Once in digital form, information can be much more readily manipulated, disseminated, accessed, etc., but the document storage costs are the key to deciding particular media applications. We have found that on the average, the following media costs are connected with storing a half million characters of text created at the word processor.

WP floppy disk	=	$30.00/month
Computer disk	=	9.20
Magnetic tape	=	5.80
Paper	=	2.10
Microfilm (fiche)	=	.75

Certainly storage costs for records which need to be retained for any length of time will be substantially less if documents are off-loaded to the most cost-effective medium. Documents in microform can be stored in a centralized, automated or computer-assisted retrieval system (we use an Access System M-1) which allows any authorized user to ac-

cess documents in seconds. Another advantage is that many users may use the same "file" simultaneously at very low reproduction costs. To copy a fiche with 270 images (48x) costs about a $0.05 — the same cost as copying just one piece of paper!

Computer Output Microfilm

For information no longer active enough to reside on the computer, (i.e., electronic mail), we have procedures for converting to microforms using a DatagraphiX AutoCOM recorder (with software supported by AmeriCOM). This device (Computer Output Microfilm) allows us to reformat information from a magnetic tape (which we have generated directly from OCR, WP, and the computer) to alpha-numerics while placing that image on a microform.

COM is output in an OCR readable typefont, so if any documents need to be reactivated we can convert the image back to paper and scan the document through OCR. COM allows for archival storage of information, automated retrieval of information and cost-effective duplication, storage and dissemination.

In many cases, alphanumeric representation is not as effective as graphic displays, so our Iconix Autograf color graphics system is often employed to better format statistical data into easily understood charts and graphs as well as for developing interactive, self-training programs. Data can be extracted from our multi-function executive work stations (Axxa System 90's) or from our DEC mini computer, formatted as charts and graphs, and output to paper, transparencies or color slides with electronic ease.

For such applications as list processing, a shared-logic word processing/data base management program, Microsystem's Engineering Corporation's, MASS-11, provides a "user friendly" capability.

Users are provided with Realist desk-top and portable fiche readers, as well as the Axxa executive work stations which allow all personnel to input data electronically; track projects, documents and calendars; write BASIC programs; link to electronic mail (we use Computer Corporation of America's COM-ET software); as well as to perform other management functions from their desks.

Although organizations cannot cost-justify automation based on electronic mail alone, it is the ideal medium for distributing brief messages and memos, etc., and supplies valuable productivity benefits such as reductions in the generation, copying, and filing of paper; increased speed of delivery among remote offices; key word filing; reductions in the number of frustrating telephone interruptions and "telephone tag" activities; and archival filing opportunities through COM.

Staff in The Paperless Office work at Westinghouse Architectural Systems Division Open Office Systems Work Stations. This modularly styled furniture accommodates cabling requirements, paper file storage, ergonomically-designed chairs, desks and lighting, and enables office reconfigurations necessitated by systems or organizational changes.

Goals for the Office of the Future

Micronet/KSI's primary goal in integrated records management system design is to efficiently and effectively serve its internal operations and its clients with the most appropriate technologies and in the most cost-beneficial way possible. By the end of this decade, the "paperless office" will exist for many organizations. In closing, a few "words to the wise":

a. As information increases in value, management of this resource must also be strengthened;
b. Information management tools must ultimately be directed at improving executive productivity, i.e., decision-making;
c. Successful office automation programs must be well organized, and reflect a "macro-level" perspective of corporate communications; and,
d. Integrated office systems will succeed only if top management is committed, employees participate, objectives and strategies are outlined from the beginning, and everyone in the organization understands their changing roles.

In the office of the future, many routine and tedious tasks will be eliminated, which will hopefully provide more time for creativity and organized information access.

Karen H. Michaels is Systems Coordinator for Micronet/Kappa Systems, Inc. in Washington, D.C.

A Computerized Maintenance Analysis and Control Procedure

by Chrystos D. Siderelis

Park operations and maintenance costs continue to rise faster than appropriations, which means reductions in levels of maintenance. Thus, park managers have begun to redevise traditional funding allocation schemes for maintenance. Managers are placing a greater emphasis on establishing work performance standards and analyzing operating and maintenance costs through Workload/Cost Tracking (See Siderelis, 1978 in Who Can You Turn To?).

However, park managers have encountered a difficult problem in using Workload/Cost Tracking. There appear to be no established techniques for analyzing maintenance workload data. This problem was investigated by Siderelis, Lawrence (U.S. Army Corps of Engineers, Waterways Experiment Station), and Martin for managers of Corps of Engineers Resource Areas, and reported by Martin (1981). The primary purpose of the study was to examine various work performance indicators that could be combined into a managemant informational report which, when applied by managers, would provide for a quantitative assessment of maintenance operations.

Design of An Analysis and Control Procedure

Surveyed results from park managers produced the following useful suggestions for designing a maintenance analysis and control procedure:

1. Provide computer products from the analysis of workload data that could be understood and easily utilized in managing park operations.

2. Devise a computer program that would perform the necessary computations given the limited frequency with which most maintenance tasks are performed by workers.

3. Provide a computer printout containing: (a) an entry listing of work activities, date completed, work site, work description, and percent of work completed (see Exhibit I); (b) work measurement and analysis statistics that can be readily interpreted by the manager in evaluating maintenance tasks; (c) graphical display of work performance over time for the purpose of observing trends and percent changes in manpower efforts between task observations.

The control chart concept used in industrial engineering applications was reviewed as a possible design solution. Briefly, this chart provides a graphic display of the relationship between task completion dates and man-hours to indicate the possible presence of unusual or abnormal conditions. In addition, three other benefits can be gained from using a control chart:

1. Managers can readily detect variability in worker efforts over time from the chart. In most reported industrial applications on use of control charts, the primary measure of the quality characteristic (item plotted on the graph) was the number of man-hours necessary to complete the maintenance task. In the case of park maintenance, park managers or foremen can evaluate this characteristic in

EXHIBIT I

-->1. JOB ENTRY TABLE

->MMDD	HOURS	WORK SITE	WORK DESCRIPTION	%	YY<-
-> 604	12	CITY PARK	MOWING AND TRIM	100	82<-
-> 612	3	CITY PARK	MOWING AND TRIM	100	82<-
-> 620	10	CITY PARK	MOWING AND TRIM	100	82<-
-> 630	5	CITY PARK	MOWING AND TRIM	100	82<-
-> 713	20	CITY PARK	MOWING AND TRIM	100	82<-
-> 722	4	CITY PARK	MOWING AND TRIM	100	82<-

MM(MONTH) DD(DAY) YY(YEAR)

EXHIBIT II

-->2. WORK MEASUREMENT AND ANALYSIS

-->SEE DOCUMENT, 'JOB GRAPHING AND TRENDS' BY CHRYSTOS SIDERELIS TO INTERPRET THE TREND FOR THE 6 DAYS PLOTTED ON THE GRAPH.

1 -->TOTAL MAN-HOURS WAS 54 FOR PERIOD BEGINNING 820604 AND ENDING 820722.
(YYMMDD) (YYMMDD)

-->FOREMAN, PLEASE READ:

3 F-FIRST QUARTILE (25%) = 3.5 MAN-HOURS WHICH IS THE INNER CONTROL LIMIT.
2 S-SECOND QUARTILE (50%) = 7.5 MAN-HOURS WHICH IS THE AVERAGE.
3 T-THIRD QUARTILE (75%) = 16 MAN-HOURS WHICH IS THE OUTER CONTROL LIMIT.

4 -->QUARTILE DEVIATION IS 6.25 MAN-HOURS WHICH IS A STATISTICAL MEASURE OF THE VARIABILITY BETWEEN MAN-HOURS AND IS OFTEN USED AS THE RANGE MEASURE.
-->THE SMALLER THE DEVIATION, THE CLOSER THE DISPERSION OF MAN-HOURS TO THE AVERAGE.

5 -->MINIMUM = 3 MAN-HOURS
5 -->MAXIMUM = 20 MAN-HOURS
5 -->RANGE = 17 MAN-HOURS

light of visitor use patterns and skill levels of workers.

2. Managers can observe the consistency of worker performance from the chart.

3. The control chart reports an average level of task completion in man-hours.

However, statistical measures that accompany the control chart are primarily used for quality control purposes in the industrial setting and therefore require the frequent collection (usually 30 observations) of data for each work activity. But most maintenance activities occur infrequently in a park, and this is not the only fundamental difference between the industrial and park setting. Thus we chose a percentage system to indicate maintenance performance in place of the control chart. Statistical measures displayed on the computer printout (Exhibit II) include:

1. The total man-hours spent during the reported work period.

2. The median, which is the mid-value (or second quartile) of the set of task work observations when arranged in numerical sequence.

3. A 25% band on either side of the median which defines the 25% (first quartile) and 75% (third quartile) control limits. That is, at least 50% of all man-hour observations will fall within these two limits.

4. The quartile deviation, which is a statistical measure of the variability in man-hours and is often used as a measure for the range in man-hour observations since it is not as sensitive to extreme values as is the range (See Who Can You Turn To? Nickerson, 1981).

5. The range which, on the other hand, is the difference between the minimum task times.

Control Graph

The control graph can plot task times over a week, month, or longer time horizon. Printed on the graph are the 25% (first quartile) and 75% (third quartile) control limits, and the average (sec-

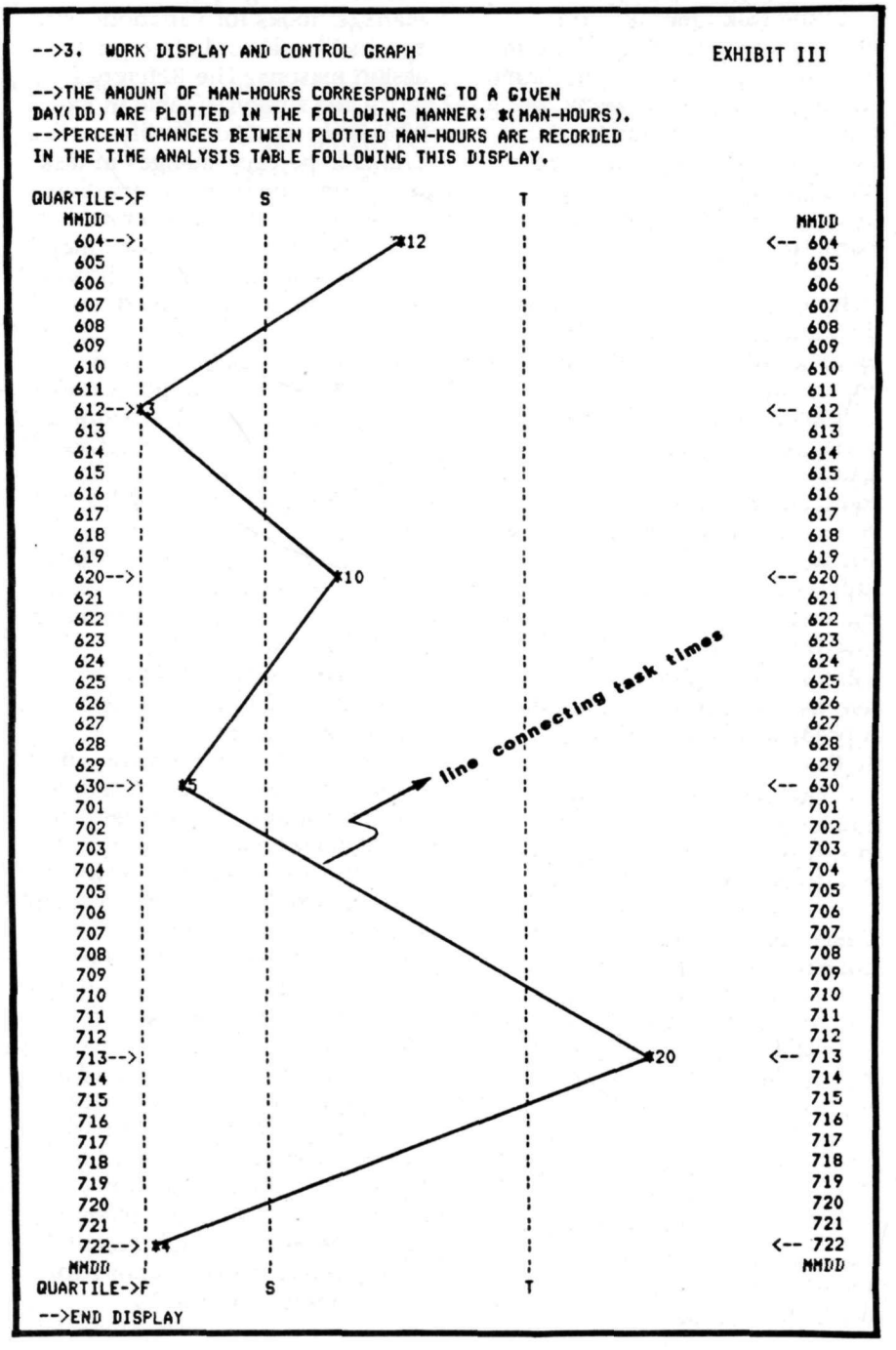


EXHIBIT IV

-->4. JOB REFERENCE AND TIME ANALYSIS TABLE

-->PLEASE NOTE: THE % CHANGE IN THE REFERENCE TABLE IS THE RELATIVE CHANGE BETWEEN PRECEEDING MAN-HOUR OBSERVATIONS.

->MMDDYY	HOURS	% CHANGE & CONDITON
-> 60482	12	0% NO CHANGE
-> 61282	3	-75% DECREASE
-> 62082	10	233.3% INCREASE
-> 63082	5	-50% DECREASE
-> 71382	20	300% INCREASE
-> 72282	4	-80% DECREASE

ond quartile). Task times that fall below the 25% limit and above the 75% limit are noted as exceptions and may require further investigation.

As the task times are connected, which has been done in Exhibit III, patterns in variations called "trends" emerge on the graph. The interpretation of trends may indicate one of four different types of effects noted by Erwin 1978 (See Who Can You Turn To ?):

1. MIXED EFFECT — when task times have little order and fluctuate toward the lower and upper control limits like the trend appearing in Exhibit III.

Problems - task times are being averaged for more than one work activity. Work activity must be standardized for reporting purposes. Actual task times fluctuate due to poor methods, lack of supervision, or insufficient training (See Erwin, 1978 in Who Can You Turn To?).

2. CYCLIC EFFECT — when task times fluctuate periodically, at predictable intervals, in a rhythmic manner.

3. TREND EFFECT — when task times increase gradually in an upward direction or decrease in a downward direction.

Problem - Upward trends indicate increases in task times and in a park setting are usually indicative of increased visitation or work delays like the occurrence or breakdowns in critical pieces of maintenance equipment. Downward trends are desirable if they reflect improvements in task efficiency. They are not desirable when work activities are being partially completed by workers.

4. MEDIAN EFFECT — when plotted task times tend to cluster around the median.

Problem - workers are reporting what they feel is expected by management.

In evaluating a trend in performance on the graph, the manager looks for variations with specific causes and attempts to assign reasons. The Reference and Time Analysis Table in Exhibit IV is used to identify dramatic percent changes in task time from one daily observation to the next. One must remember that many minor variations may occur by chance, and are difficult to eliminate from the work situation.

The quartile deviation and range statistics are important in measuring the overall amount in variation between extreme task times. In the performance of routine maintenance tasks, a small amount of variation is generally tolerated with the setting of narrow distances in man-hours above and below the median task time.

On the other hand, in the analysis of non-routine tasks (e.g., electrical, plumbing, carpentry, etc.), a great amount of tolerance is allowed in setting the control limit boundaries. Or the manager may elect to expand or contract the distance between each control limit and the median with so-called "natural tolerances," particularly where the variations between task times in relation to the median are small.

In addition to the setting of control limits, the median task time for work activity at a park can be used as the standard for worker efficiency, while the control limits bounding the median act as the low and high acceptable levels of worker quality for that maintenance activity.

Separate control graphs can be set up for each class of maintenance activity or a combination of activities. Or separate graphs for each crew may be derived for the productive comparison of work between crews.

The occurrence of individual maintenance activities at an individual park or at multiple parks can also be graphed for trend analysis or comparison purposes. If one is willing to ignore differences in park conditions such as variations in terrain, variable worker skill levels, periodic weather conditions, obstacles like variations in tree or shrub layouts, or activity room layouts for custodial maintenance (to name a few), the computer programs can be modified from their present forms to display units of task times (e.g., man-hours per square foot, acre, linear foot, mile, etc.) for comparison purposes.

Computer Program Operation

Two computer programs, JOB ENTRY CONTROL and JOB ANALYSIS AND CONTROL, were written in Appplesoft BASIC for the Apple II Plus micro-processor with CCS firmware and the IDS 445 printer. Once the computer programs have been transferred to a diskette and entered into the computer, they can be accessed by typing in the following line entry after the bracket (]): RUN JOB ENTRY CONTROL (press return). The computer will begin to request information about each task for computer processing. Entries made in the JOB ENTRY CONTROL program are recorded in the Job Entry Table (Exhibit I). During program operation there are several minute delays between the printing of tabular and graphic information.

C. D. Siderelis, PhD, is an associate professor of Recreation Resources and Administration at North Carolina State University. *The author would like to acknowledge Mr. Tim Goodfellow for his advice and assistance in the writing of computer programs.* *A diskette of the computer programs listed in this article can be obtained from the author for $20 by writing to P.O. Box 33524, Raleigh, NC 27606.*

JOB ENTRY ROUTINE

```
10  TEXT
20 D$ =  CHR$ (4)
30 F$ = "JOB#"
40 FL = 70
50  PRINT D$;"OPEN";F$;FL;",L";FL
60  PRINT D$;"DELETE";F$;FL
70  PRINT D$;"OPEN";F$;FL;",L";FL
80  PRINT D$;"WRITE";F$;FL;",R0"
90 EOF = 1: PRINT EOF
100  PRINT D$: PRINT : HOME
110  REM  START CONVERSATION
120  HOME : VTAB 7
130  PRINT "ENTER '99' TO EXIT DATA
ENTRY OR -->"
140  PRINT ">ENTER YEAR (YY)-";
150  INPUT YY
160  IF YY = 99 THEN 620
170  IF YY < 80 OR YY > 83 THEN  CALL  -
198: GOTO 140
180  PRINT ">ENTER MONTH (MM)-";
190  INPUT MM
200  IF MM < 1 OR MM > 12 THEN  CALL  -
198: GOTO 180
210  PRINT ">ENTER DAY (DD)-";
220  INPUT DD
230  IF DD < 1 OR DD > 31 THEN  CALL  -
198: GOTO 210
240  IF MM = 1 OR MM = 3 OR MM = 5 OR MM
= 7 OR MM = 8 OR MM = 10 OR MM = 12 THEN
270
250  IF DD > 30 THEN  CALL  - 198: GOTO
210
260  IF MM = 2 AND DD > 29 THEN  CALL  -
198: GOTO 210
270 DE = MM * 100 + DD
280  PRINT ">ENTER MAN-HOURS: ";
290  INPUT V
300  IF V < .1 OR V > 999 THEN  CALL  -
198: GOTO 280
310  PRINT ">ENTER WORK ACTIVITY <40
SPACES"
320  INPUT DI$
330  IF  LEN (DI$) < 0 OR  LEN (DI$) >
40 THEN  CALL  - 198: GOTO 310
340  PRINT ">ENTER LOCATION NAME <15
SPACES"
350  INPUT LO$
360  IF  LEN (LO$) < 0 OR  LEN (LO$) >
15 THEN  CALL  - 198: GOTO 340
370  PRINT ">MUST ENTER PERCENT OF JOB
COMPLETED"
380  PRINT "   (0 - 100) : ";
390  INPUT CO$
400  IF  LEN (CO$) < 1 OR  LEN (CO$) > 3
THEN  CALL  - 198: GOTO 370
410  HOME : VTAB 5
420  PRINT "YEAR-";YY
430  PRINT "MONTH/DAY-";DE
440  PRINT "MAN-HOURS: ";V
450  PRINT "WORK DESCRIPTION-";DI$
460  PRINT "LOCATION-";LO$
470  PRINT "% COMPLETE-";CO$
480  VTAB 12: PRINT "IS THIS OK (Y/N) ";
490  GET A$: PRINT A$
500  IF A$ <  > "Y" AND A$ <  > "N" THEN
CALL  - 198: GOTO 480
510  IF A$ = "N" GOTO 120
520  PRINT
530  PRINT D$;"WRITE";F$;FL;",R";EOF
540  PRINT YY
550  PRINT DE
560  PRINT V
570  PRINT DI$
580  PRINT LO$
590  PRINT CO$
600 EOF = EOF + 1
610  PRINT D$: GOTO 120
620  PRINT D$;"WRITE";F$;FL;",R0"
630  PRINT EOF
640  PRINT D$;"CLOSE"
650  PRINT D$;"RUN TEST50 JOB"
```

WORK ANALYSIS AND CONTROL ROUTINE

```
10  TEXT
20  DIM YY(100),DE(100),V(100),DI$(100),
LO$(100),CO$(100),RL(100)
30 F$ = "JOB#70"
40 FL = 70
50 D$ =  CHR$ (4)
60  ONERR  GOTO 130
70  PRINT D$;"OPEN";F$;",L";FL
80  PRINT D$;"READ";F$;",R0
90  INPUT EOF
100  PRINT D$
110  IF EOF >  = 2 THEN 180
120  PRINT D$
130  PRINT "NO DATA IN JOB ENTRY FILE
!!!!!!!"
140  POKE 216,0
150  CALL  - 198: PRINT
160  PRINT D$;"CLOSE"
170  PRINT D$;"RUN JOB ENTRY CONTROL"
180 M = EOF - 1
190  POKE 216,0
200  FOR I = 1 TO M
210  PRINT D$;"READ";F$;",R";I
220  INPUT YY(I)
230  INPUT DE(I)
240  INPUT V(I)
250  INPUT DI$(I)
260  INPUT LO$(I)
270  INPUT CO$(I)
280 DE(I) = YY(I) * 10000 + DE(I)
290  NEXT
300  PRINT D$
```

```
310 B$ =  CHR$ (124)
320  HOME : INVERSE
330  VTAB 8
340  HTAB 5
350  PRINT "JOB ANALYSIS AND CONTROL
GRAPH"
360  PRINT
370  PRINT
380  HTAB 12
390  PRINT "BY SID'S SYSTEMS"
400  PRINT : PRINT
410  NORMAL : PRINT "COMPUTER WORKING.."
420  PRINT
430  PRINT "PLEASE TURN PRINTER ON
!!!!!"
440  PRINT "-->WAIT FOR FLASHING MESSAGE
TO SIGNAL": PRINT "     PROCESSING
COMPLETED ": PRINT : FLASH : PRINT "
PLEASE WAIT": NORMAL
450  GOTO 750
460 MA = M - 1: REM  START SORT
470  FOR J = 1 TO MA
480 JA = J + 1
490  FOR K = JA TO M
500  ON FLAG GOTO 510,530
510  IF V(K) >  = V(J) GOTO 690
520  GOTO 540
530  IF DE(K) >  = DE(J) GOTO 690
540 TEMP = V(K)
550 V(K) = V(J)
560 V(J) = TEMP
570 TEMP = DE(K)
580 DE(K) = DE(J)
590 DE(J) = TEMP
600 TEMP = YY(K)
610 YY(K) = YY(J)
620 YY(J) = TEMP
630 TEMP$ = DI$(K)
640 DI$(K) = DI$(J)
650 DI$(J) = TEMP$
660 TEMP$ = LO$(K)
670 LO$(K) = LO$(J)
680 LO$(J) = TEMP$
690 TEMP$ = CO$(K)
700 CO$(K) = CO$(J)
710 CO$(J) = TEMP$
720  NEXT K
730  NEXT J
740  RETURN
750  IF M > 2 THEN 1020
760  IF M = 2 THEN 800
770 MEDIAN = V(1)
780  PRINT : PRINT "ONLY 1 JOB,
PROCESSING CANNOT CONTINUE": PRINT :
PRINT  SPC( 14)"MEDIAN = ";V(1)
790  GOTO 3020
800  PRINT : PRINT "ONLY 2 JOBS,
PROCESSING WILL CONTINUE": PRINT :MEDIAN
= (V(1) + V(M)) / 2: PRINT  SPC(
14)"MEDIAN = ";MEDIAN
810 FLAG = 1
820  GOSUB 460
830 Q1 = V(1):Q3 = V(M):SUM = V(1) +
V(M):RA = V(M) - V(1)
840 W = V(1):MXHOURS = V(M)
850 FLAG = 2
860  GOSUB 460
870  GOSUB 2800
880  PRINT  SPC( 21)"JOB ANALYSIS AND
CONTROL PROCEDURE": PRINT
890  PRINT  SPC( 25)"DESIGNED AND
WRITTEN BY": PRINT : PRINT  SPC(
27)"CHRYSTOS SIDERELIS": PRINT
900  PRINT  SPC( 28)"COPYRIGHTED 1982":
PRINT : PRINT
910  PRINT "-->1.  JOB ENTRY TABLE":
PRINT
920  PRINT "->MMDD";B$;"HOURS";B$;"WORK
SITE      ";B$;"WORK DESCRIPTION
";B$;" % ";B$;"YY<-"
930  PRINT "----------------------------
----------------------------------------
----------"
940  FOR I = 1 TO M
  950 DE$ =  STR$ (DE(I) - YY(I) *
10000):V$ =  STR$ (V(I))
960  PRINT "->"; SPC( 4 -  LEN
(DE$));DE$;B$; SPC( 5 -  LEN
(V$));V$;B$;LO$(I); SPC( 15 -  LEN
(LO$(I)));B$;DI$(I); SPC( 41 -  LEN
(DI$(I)));B$; SPC( 3 -  LEN
(CO$(I)));CO$(I);B$;YY(I);"<-"
970  NEXT
980  PRINT "----------------------------
----------------------------------------
---------"
990  PRINT "   MM(MONTH) DD(DAY)
YY(YEAR)"
1000  PRINT D$;"PR#0"
1010  GOTO 1590
1020  FOR I = 1 TO M
1030 SUM = SUM + V(I)
1040  NEXT
1050 FLAG = 2
1060  GOSUB 460
1070  GOSUB 2800
1080  PRINT  SPC( 21)"JOB ANALYSIS AND
CONTROL PROCEDURE": PRINT
1090  PRINT  SPC( 25)"DESIGNED AND
WRITTEN BY": PRINT : PRINT  SPC(
27)"CHRYSTOS SIDERELIS": PRINT
1100  PRINT  SPC( 28)"COPYRIGHTED 1982":
PRINT : PRINT
1110  PRINT "-->1.  JOB ENTRY TABLE":
PRINT
1120  PRINT "->MMDD";B$;"HOURS";B$;"WORK
SITE      ";B$;"WORK DESCRIPTION
";B$;" % ";B$;"YY<-"
```

```
1130  PRINT "---------------------------
----------------------------------------
---------"
1140  FOR I = 1 TO M
1150 DE$ =  STR$ (DE(I) - YY(I) *
10000):V$ =  STR$ (V(I))
1160  PRINT "->"; SPC( 4 -  LEN
(DE$));DE$;B$; SPC( 5 -  LEN
(V$));V$;B$;LO$(I); SPC( 15 -  LEN
(LO$(I)));B$;DI$(I); SPC( 41 -  LEN
(DI$(I)));B$; SPC( 3 -  LEN (CO$(I)));
CO$(I);B$;YY(I);"<-"
1170  NEXT
1180  PRINT "---------------------------
----------------------------------------
---------"
1190  PRINT "   MM(MONTH) DD(DAY)
YY(YEAR)"
1200  PRINT D$;"PR#0"
1210 MZ = M
1220  FOR I = 1 TO M - 1
1230  IF I = MZ THEN 1370
1240  IF DE(I) = DE(I + 1) THEN 1260
1250  GOTO 1340
1260 V(I) = V(I) + V(I + 1)
1270 Z = Z + 1
1280  FOR K = (I + 1) TO (MZ - 1)
1290 V(K) = V(K + 1)
1300 DE(K) = DE(K + 1)
1310  NEXT K
1320 MZ = MZ - 1
1330  GOTO 1360
1340  NEXT I
1350  GOTO 1370
1360  GOTO 1220
1370 M = MZ
1380 FLAG = 1
1390  GOSUB 460
1400 MXHOURS = V(M)
1410 W = V(1)
1420 RA = V(M) - W
1430 M% = (M + 1) / 2
1440 M2 = (M + 1) / 2
1450 Q1 = (M + 1) / 4
1460 Q3 = 3 * (M + 1) / 4
1470 M2 = (M + 1) / 2
1480 Q1% = (M + 1) / 4
1490 Q3% = 3 * (M + 1) / 4
1500  IF M% <  > M2 GOTO 1520
1510 MEDIAN = V(M%): GOTO 1530
1520 MEDIAN = (V(M%) + V(M% + 1)) / 2
1530  IF Q1% <  > Q1 THEN 1550
1540 Q1 = V(Q1%): GOTO 1560
1550 Q1 = (V(Q1%) + V(Q1% + 1)) / 2
1560  IF Q3% <  > Q3 THEN 1580
1570 Q3 = V(Q3%): GOTO 1590
1580 Q3 = (V(Q3%) + V(Q3% + 1)) / 2
1590  DIM JD(366),MH(366)
1600  FOR I = 1 TO 366
1610  READ JD(I)
1620  INVERSE
1630  HTAB 19: VTAB 14: PRINT I
1640  NORMAL
1650  NEXT I
1660 FLAG = 2
1670  GOSUB 460
1680 FIRST = DE(1) - (YY(1) * 10000)
1690 BEG = 1
1700 TEST = YY(1)
1710  DATA 101,102,103,104,105,106,
107,108,109,110,111,112,113,114,115,
116,117,118,119,120,121,122,
123,124,125,126,127,128,129,130,131
1720  DATA  201,202,203,204,205,206,
207,208,209,210,211,212,213,214,215,
216,217,218,219,220,221,222,
223,224,225,226,227,228,229
1730  DATA  301,302,303,304,305,306,
307,308,309,310,311,312,313,314,315,
316,317,318,319,320,321,322,
323,324,325,326,327,328,329,330,331
1740  DATA  401,402,403,404,405,406,
407,408,409,410,411,412,413,414,415,
416,417,418,419,420,421,422,
423,424,425,426,427,428,429,430
1750  DATA  501,502,503,504,505,506,
507,508,509,510,511,512,513,514,515,
516,517,518,519,520,521,522,
523,524,525,526,527,528,529,530,531
1760  DATA  601,602,603,604,605,606,
607,608,609,610,611,612,613,614,615,
616,617,618,619,620,621,622,
623,624,625,626,627,628,629,630
1770  DATA  701,702,703,704,705,706,
707,708,709,710,711,712,713,714,715,
716,717,718,719,720,721,722,
723,724,725,726,727,728,729,730,731
1780  DATA  801,802,803,804,805,806,
807,808,809,810,811,812,813,814,815,
816,817,818,819,820,821,822,
823,824,825,826,827,828,829,830,831
1790  DATA  901,902,903,904,905,906,
907,908,909,910,911,912,913,914,915,
916,917,918,919,920,921,922,
923,924,925,926,927,928,929,930
1800  DATA  1001,1002,1003,1004,1005,
1006,1007,1008,1009,1010,1011,1012,
1013,1014,1015,1016,1017,1018,
1019,1020,1021,1022,1023,1024,1025,1026,
1027,1028,1029,1030,1031
1810  DATA  1101,1102,1103,1104,1105,
1106,1107,1108,1109,1110,1111,1112,
1113,1114,1115,1116,1117,1118,
1119,1120,1121,1122,1123,1124,1125,1126,
1127,1128,1129,1130
1820  DATA  1201,1202,1203,1204,1205,
1206,1207,1208,1209,1210,1211,1212,
1213,1214,1215,1216,1217,1218,
```

```
1219,1220,1221,1222,1223,1224,1225,1226,
1227,1228,1229,1230,1231
1830  GOSUB 2800
1840  PRINT : PRINT : PRINT
1850  PRINT "-->2.  WORK MEASUREMENT AND
ANALYSIS": PRINT
1860  PRINT "-->SEE DOCUMENT, 'JOB
GRAPHING AND TRENDS' BY CHRYSTOS
SIDERELIS TO INTERPRET"
1870  PRINT "THE TREND FOR THE ";M;"
DAYS PLOTTED ON THE GRAPH."
1880  PRINT
1890  PRINT "-->TOTAL MAN-HOURS WAS
";SUM;" FOR PERIOD BEGINNING ";DE(1);"
AND ENDING ";DE(M);"."


1900  PRINT "
(YYMMDD)            (YYMMDD)"
1910  PRINT
1920  PRINT "-->FOREMAN, PLEASE READ:"
1930  PRINT "F-FIRST QUARTILE (25%)  =
";Q1;" MAN-HOURS WHICH IS THE INNER
CONTROL LIMIT."
1940  PRINT "S-SECOND QUARTILE (50%) =
";MEDIAN;" MAN-HOURS WHICH IS THE
AVERAGE."
1950  PRINT "T-THIRD QUARTILE (75%)  =
";Q3;" MAN-HOURS WHICH IS THE OUTER
CONTROL LIMIT."
1960  PRINT
1970 QD = (Q3 - Q1) / 2
1980  PRINT "-->QUARTILE DEVIATION IS
";QD;" MAN-HOURS WHICH IS A STATISTICAL
MEASURE": PRINT "OF THE VARIABILITY
BETWEEN MAN-HOURS AND IS OFTEN USED AS
THE": PRINT "RANGE MEASURE."
1990  PRINT "-->THE SMALLER THE
DEVIATION, THE CLOSER THE DISPERSION OF
MAN-HOURS": PRINT "TO THE AVERAGE."
2000  PRINT
2010 W$ =  STR$ (W):MXHOURS$ =  STR$
(MXHOURS)
2020  PRINT "-->MINIMUM = "; SPC( 5 -
LEN (W$));W$;" MAN-HOURS"
2030  PRINT "-->MAXIMUM = "; SPC( 5 -
LEN (MXHOURS$));MXHOURS$;" MAN-HOURS"
2040 RA$ =  STR$ (RA)
2050  PRINT "-->RANGE   = "; SPC( 5 -
LEN (RA$));RA$;" MAN-HOURS"
2060  PRINT
2070  PRINT "-->3.  WORK DISPLAY AND
CONTROL GRAPH": PRINT
2080  PRINT "-->THE AMOUNT OF MAN-HOURS
CORRESPONDING TO A GIVEN": PRINT
"DAY(DD) ARE PLOTTED IN THE FOLLOWING
MANNER: *(MAN-HOURS)."
2090  PRINT "-->PERCENT CHANGES BETWEEN
PLOTTED MAN-HOURS ARE RECORDED": PRINT
"IN THE TIME ANALYSIS TABLE FOLLOWING
THIS DISPLAY."
2100  PRINT
2110  IF RA < 2 THEN RA = 2
2120  IF W = MEDIAN THEN W = MEDIAN - 1
2130 T2% = (50 * (MEDIAN - W)) / RA - 1
2140  IF Q1 = MEDIAN THEN T1% = T2% - 1:
GOTO 2180
2150  IF M < 4 THEN T1% = 0: GOTO 2180
2160  IF Q1 = W THEN T1% = 0: GOTO 2180
2170 T1% = (50 * (Q1 - W)) / RA - 1
2180  IF Q3 = MEDIAN THEN T3% = T2% + 1:
GOTO 2200
2190 T3% = (50 * (Q3 - W)) / RA - 1
2200  PRINT "QUARTILE->"; SPC( T1%)"F";
SPC( T2% - T1% - 1)"S"; SPC( T3% - T2% -
1)"T"
2210  PRINT  SPC( 3)"MMDD"; SPC( 3);
SPC( T1%)B$; SPC( T2% - T1% - 1)B$; SPC(
T3% - T2% - 1)B$;
2220  PRINT  SPC( 63 - T3%)"MMDD"
2230 SWITCH = 0
2240  FOR I = BEG TO M
2250  IF YY(I) <  > TEST THEN 2340
2260 DE(I) = DE(I) - (YY(I) * 10000)
2270  FOR K = 1 TO 366
2280  IF JD(K) = FIRST THEN F1 = K
2290  IF DE(I) <  > JD(K) THEN 2320
2300 MH(K) = V(I)
2310 L1 = K
2320  NEXT K
2330  NEXT I
2340 BEG = I
2350 TEST = YY(I)
2360 FIRST = DE(I) - YY(I) * 10000
2370  IF BEG < M THEN L1 = 366
2380  IF SWITCH > 0 THEN F1 = 1
2390  FOR I = F1 TO L1
2400 T4% = (50 * (MH(I) - W)) / RA - 1
2410  IF T4% < 0 THEN T4% = 0
2420  PRINT  SPC( 3 + (JD(I) <
1000))JD(I);
2430  IF MH(I) > 0 THEN  GOTO 2480
2440  PRINT  SPC( 3) SPC( T1%)B$; SPC(
T2% - T1% - 1)B$; SPC( T3% - T2% - 1)B$;
2450 COL = T3% + 1
2460  PRINT  SPC( 64 - COL + (JD(I) <
1000))JD(I)
2470  GOTO 2500
2480  PRINT "-->";: GOSUB 3040
2490  PRINT  SPC( 61 - COL)"<--"; SPC(
JD(I) < 1000)JD(I)
2500  NEXT
2510 SWITCH = SWITCH + 1
2520  FOR I = 1 TO 366
2530 MH(I) = 0
2540  NEXT
2550  IF BEG <  = M THEN 2240
2560  PRINT  SPC( 3)"MMDD"; SPC( 3);
```

```
SPC( T1%)B$; SPC( T2% - T1% - 1)B$; SPC(
T3% - T2% - 1)B$;
2570  PRINT  SPC( 63 - T3%)"MMDD"
2580  PRINT "QUARTILE->"; SPC( T1%)"F";
SPC( T2% - T1% - 1)"S"; SPC( T3% - T2% -
1)"T"
2590  PRINT : PRINT "-->END DISPLAY"
2600  PRINT : IF Z = 0 THEN 2620
2610  PRINT "-->THERE WERE ";Z;" JOBS
THAT OCCURRED ON SIMILIAR DATES.": PRINT
"PLEASE CHECK THE JOB ENTRY TABLE TO
IDENTIFY THESE ";Z;" JOBS.": PRINT :
PRINT
2620  FOR I = 1 TO M
2630  IF V(I) = V(I + 1) THEN RL(I + 1)
= 0: GOTO 2660
2640 RL(I + 1) = (V(I + 1) - V(I)) /
V(I) * 100
2650 P = 10:RL(I + 1) =  INT (RL(I + 1)
* P + .5) / P
2660  NEXT
2670  PRINT "-->4.  JOB REFERENCE AND
TIME ANALYSIS TABLE": PRINT : PRINT
"-->PLEASE NOTE: ";
2680  PRINT "THE % CHANGE IN THE
REFERENCE TABLE IS THE": PRINT "RELATIVE
CHANGE BETWEEN PRECEEDING MAN-HOUR
OBSERVATIONS.": PRINT
2690  PRINT  SPC(
6)"->MMDDYY";B$;"HOURS";B$;"% CHANGE &
CONDITON"
2700  PRINT  SPC( 6)"--------";B$;
"-----";B$;"--------------------"
2710  FOR I = 1 TO M
2720  IF RL(I) < 0 THEN SH$ = "DECREASE"
2730  IF RL(I) > 0 THEN SH$ = "INCREASE"
2740  IF RL(I) = 0 THEN SH$ = "NO
CHANGE"
2750 DE$ =  STR$ (DE(I)):V$ =  STR$
(V(I)):RL$ =  STR$ (RL(I))
2760  PRINT  SPC( 6)"->"; SPC( 4 -  LEN
(DE$));DE$;YY(I);B$; SPC( 5 -  LEN
(V$));V$;B$; SPC( 8 -  LEN (RL$));RL$;"%
";SH$
2770  NEXT
2780  PRINT  SPC( 6)"-------------------
----------------"
2790  GOTO 2860
2800  PRINT D$;"PR#1"
2810  REM  TURN ON PRINTER AND SET FOR
80 COLUMNS
2820  ONERR  GOTO 2840
2830  PRINT  CHR$ (9);"80N"
2840  POKE 216,0
2850  RETURN
2860  PRINT D$;"PR#0"
2870  REM  TURN OFF PRINTER
2880  HOME
2890  VTAB 10: PRINT
2900  FLASH : HTAB 7: PRINT "
"
2910  HTAB 7: PRINT " PROCESSING
COMPLETED "
2920  HTAB 7: PRINT "
"
2930  FOR I = 1 TO 7000
2940  PRINT ;
2950  NEXT
2960  NORMAL
2970  HOME : PRINT "DO YOU WANT TO
CONTINUE? (Y/N) ";
2980  GET A$: PRINT A$
2990  IF A$ <  > "Y" AND A$ <  > "N"
THEN 2970
3000  IF A$ = "N" THEN 3020
3010  PRINT D$;"RUN JOB ENTRY CONTROL"
3020  HOME : PRINT "    REMOVE DISKETTE
FROM DISK DRIVE"
3030  END
3040 HR$ =  STR$ (MH(I))
3050 L =  LEN (HR$) + 1
3060  FOR J = 1 TO 4:S(J) = 0: NEXT
3070  IF T1% < T4% THEN S(1) = 1: GOTO
3130
3080 S(1) = 4
3090  IF T1% > T4% + L THEN S(2) =
1:S(3) = 2:S(4) = 3: GOTO 3220
3100  IF T2% > T4% + L THEN S(3) =
2:S(4) = 3: GOTO 3220
3110  IF T3% > T4% + L THEN S(4) = 3
3120  GOTO 3220
3130  IF T2% < T4% THEN S(2) = 2: GOTO
3180
3140 S(2) = 4
3150  IF T2% > T4% + L THEN S(3) =
2:S(4) = 3: GOTO 3220
3160  IF T3% > T4% + L THEN S(4) = 3
3170  GOTO 3220
3180  IF T3% < T4% THEN S(3) = 3:S(4) =
4: GOTO 3220
3190 S(3) = 4
3200  IF T3% > T4% + L THEN S(4) = 3
3210  GOTO 3220
3220 COL = 0
3230  FOR J = 1 TO 4
3240  IF S(J) = 0 THEN 3260
3250  ON S(J) GOSUB 3280,3300,3320,3340
3260  NEXT
3270  RETURN
3280  PRINT  SPC( T1% - COL)B$;:COL =
T1% + 1
3290  RETURN
3300  PRINT  SPC( T2% - COL)B$;:COL =
T2% + 1
3310  RETURN
3320  PRINT  SPC( T3% - COL)B$;:COL =
T3% + 1
3330  RETURN
3340  PRINT  SPC( T4% - COL )"*";HR$;:COL
= T4% + L
3350  RETURN
```

Who Can You Turn To?

Bibliography
by Robert T. Watts, Ph.D.

Selected Individuals and Organizations Concerned with Computer Use in Parks and Recreation

ALASKA

William H. Horr
Research Analysts
Dept. of Natural Resources
Division of Parks
619 Warehouse Ave, Suite 210
Anchorage, AK 99501
907/274-4676

Visitor Count
Park Incident Reports
Facility Inventory
Vehicle Monitoring

ARIZONA

Ron Pies
Dept. of Parks & Recreation
Tempe, AZ

Park Maintenance

CALIFORNIA

Marilyn A. Jensen
Dept. of Rec. & Leisure Studies
Cal. State Univ.-Long Beach
1250 Bellflower Blvd.
Long Beach, CA 90840
213/498-4071

Information Systems
Cartographic Mapping
Education-Training

Gary H. Elsner
U.S. Dept. of Agriculture
P.O. Box 245
Berkeley, CA 94701

Campground Users
Planning

COLORADO

Management Information Center
217 S. Wahsatch
Colorado Springs, CO 80903
303/636-5760

Class Registration
Sports Sign-up
Team Scheduling
Tree Inventory

Paul H. Swoboda
Parks & Rec. Dept.
City of Boulder
Boulder, CO 80302

Program Budget
Program Evaluation
Registration

CONNECTICUT

Dorothy G. Mullen
National Rec. & Park Assoc.
1800 Silas Deane Highway
Suite 1
Rocky Hill, CT 06067
203/721-1055

National Workshop on Computers in Parks and Recreation

FLORIDA

Barry A. McConnell
P.O. Box 2676
Tallahassee, FL 32304
904/575-8005

Handicapped
Scientific
Microcomputers

IDAHO

Robert T. Watts
Idaho State University
Box 8322
Pocatello, ID 83209
208/236-2355

Microcomputer Centers
Education-Training
Bibliography
Applications
HP3000

ILLINOIS

Steven S. Plumb
Elmhurst Park District
225 Prospect
Elmhurst, IL 60126
312/834-2215

Park Maintenance

INDIANA

Dan Sharpless
Dept. of Parks & Rec.
Room 133, HPER Building
Indiana University
Bloomington, IN 47401
812/337-4711

Information Systems
Microcomputers
Education-Training

KANSAS

Gary Haller, Director
Johnson County Parks
6501 Antioch Road
Shawnee Mission, KS 66202
913/831-3355

Registration

MARYLAND

Richard Schroth
Maryland-National Capital Park & Plan Commission
8787 Georgia Avenue
Silver Spring, MD 20907
301/565-5828

Information Systems
Graphics
HP3000

MICHIGAN

Daniel J. Stynes
Dept. of Park & Rec. Resources
Natural Resources Building
Michigan State University
East Lansing, MI 48824
517/353-0822

Research
Simulations

Robert I. Wittick
Computer Institute for Social Science Research
Michigan State University
East Lansing, MI 48824
517/353-2040

Geography Program Exchange

MINNESOTA

Richard Keifer
Hennepin County Park Reserve District
3800 County Road No. 24
Maple Plain, MN 55359

Remote Job Entry
Time Cards
Fuel Tickets
Statistical Surveys
Personnel Reports

MISSOURI

Steven C. Lamphear
Dept. of Rec. & Park Admin.
608 Clark Hall
Columbia, MO 65211
314/882-3426

Microcomputers
Education-Training
TRS-80

Wayne C. Kennedy, Director
Dept. of Parks & Recreation
7900 Forsyth Boulevard
Clayton, MO 63105
314/889-3208

Reservation System
Facilities Inventory
People Data Base

NEW HAMPSHIRE

Wilbur F. LaPage
U.S. Dept. of Agriculture
Forest Service
Northeastern Forest Exp. Station
Outdoor Rec. Trend Research
P.O. Box 640
Durham, NH 03824

Campsite Pricing
Campsite Attendance
Satisfaction Index
Occupancy Index Analysis
Park Data Analysis

NEW MEXICO

ERIC/CRESS
Box 3AP
New Mexico State Univ.
Las Cruces, NM 88003
505/646-2623

Outdoor Education
Outdoor Recreation
Interpretation

NORTH CAROLINA

Karen Siderelis

Graphics

Chrystos Siderelis
Dept. of Rec. Resources Admin.
4008 Biltmore Hall
N.C. State University
Raleigh, N.C. 27650
919/737-3276

Systems Analysis
Education-Training

OREGON

Scott Reese
Bureau of Parks & Rec.
409 S.W. 9th
Portland, OR 97205
503/248-5324

Municipal Applications

Michael Starr
Dept. of Parks & Recreation
Medford, OR

Maintenance Management

SOUTH CAROLINA

Doyle E. Allen
Camden-Kershaw County
Recreation Department
City Hall
1000 Lyttleton Street
Camden, SC 29020
803/423-4607

TRS-80
Umpire Scheduling
Cost Tracking
Word Processing
Registration

TEXAS

Dan Kamp
Dept. of Rec. & Park Admin.
Texas A. & M. University
College Station, TX 77843
713/845-5411

Education-Training
Parks Management

David L. Loughridge, Director
Parks & Recreation Dept.
P.O. Box 309
Richardson, TX 75080
214/235-8331

TRS-80
Labor Analysis
Attendance
Budget
Greenhouse

VIRGINIA

National Recreation & Park
Association
3101 Park Center Drive
Alexandria, VA 22302
703/820-4940

APRISE-Information
Retrieval System

WATSTORE
Chief Hydrologist
U.S. Geological Survey
437 National Center
Reston, VA 22092

National Water Data
Storage & Retrieval
System

WASHINGTON

Michael Herrin
Dept. of Parks & Recreation
210 Municipal Building
Seattle, WA 98104
206/625-4671

Maintenance Management
Field Scheduling

Lynn Stokesbary
Parks & Recreation Dept.
13204 S.E. 8th Place
P.O. Box 1768
Bellevue, WA 98009
206/455-6881

Registration

Market Computing
93 Pike Street, Rm. 310
Seattle, WA 98101
206/621-9181

Registration
Employee Management
League Registration

WASHINGTON, D.C.

Public Technology, Inc.
1140 Connecticut Ave., NW
Washington, DC 20036
202/452-7700

Systems Transfer
Technical Assistance
Land Use Forecasting
Computer Mapping

CANADA

Parks Canada
Socio-Economic Division
Ottawa, Ontario K1A 1G2

Campground Use
Campground Inventory

Willian E. Knott
Ontario Research Council
on Leisure
77 Bloor St. W, 8th Floor
Toronto, Ontario M7A 2R9

Research

Selected References for Computer Applications in Parks and Recreation

Proceedings: 1978, 1979, 1980, 1981, 1982 National Workshop on Computers In Recreation and Parks
National Recreation and Park Association
3101 Park Center Drive
Alexandria, Virginia 22302
703/820-4940

Recreation and Parks Management Systems Computerized: A Reference Guide, 1980
Chrystos D. Siderelis
Dept. of Recreation Resources Administration
4008 Biltmore Hall
North Carolina State University
Raleigh, NC 27650
919/737-3276

A Guide to Urban Tree Inventory Systems, 1979 Research Paper No. 43, C. J. Sacksteder and H. D. Gerhold
The Pennsylvania State University, College of Agriculture
Urban Forestry Specialist
USDA Forest Service
State and Private Forestry
P.O. Box 2417
Washington, DC 20013

The moving seacoast, 1981
Leonard, Jay E. *Perspectives in Computing*, Vol. 1, No. 2 (April) pp. 12-21.

SCANIT: Centralized Digitizing of Forest Resource Maps or Photographs, 1981.
Gen. Tech. Report PSW-53 (June).
Elliot L. Amidon & E. Joyce Dye.
Pacific Southwest Forest and Range Experiment Station
P.O. Box 245
Berkeley, CA 94701

FOCUS: A Fire Management Planning System - Final Report, 1981.
Gen. Tech. Report PSW-49 (May).
Frederick W. Bratten, et al.
Pacific Southwest Forest and Range Experiment Station
P.O. Box 245
Berkeley, CA 94701

How a calculator aids in desert searches, 1982.
Salisbury, David F. *The Christian Science Monitor*, Jan. 13, p. 16.

Returns on Investments in Management Sciences: Six Case Studies, 1981.
Gen. Tech. Report PSW-52 (June).
Ernst S. Valfer et al.
Pacific Southwest Forest and Range Experiment Station
P.O. Box 245
Berkeley, CA 94701

RECAL: A Computer Program for Selecting Sample Days for Recreation Use Estimation, 1980.
Gen. Tech. Report SE-19 (Sept.).
D. L. Erickson et al.
Southeastern Forest Experiment Station
P.O. Box 2570
Asheville, NC 28802

Special issue on information retrieval, 1978. Vol. 76, No. 2 (February).
Journal of Forestry
Society of American Foresters
5400 Grosvenor Lane
Washington, DC 20014
202/897-8720

RUN WILD: A Storage and Retrieval System for Wildlife Habitat Information, 1978.
Gen. Tech. Report RM-51 (January).
David R. Patton.
Rocky Mountain Forest & Range Experiment Station
USDA Forest Service
Fort Collins, CO 80521

Simulation of Recreational Use for Park and Wilderness Management, 1978.
Mordechai Shechter and Robert C. Lucas.
Johns Hopkins University Press
1755 Massachusetts Ave., N.W.
Washington, DC 20036

Touch Sensitive Visitor Information Systems: The Experience at Rocky Mountain National Park.
Information Dialogues, Inc.
7850 Metro Office Park
Bloomington, MN 55420
612/853-9200

Monitoring Forest Canopy Alteration Around the World With Digital Analysis of Landsat Imagery, 1979. (August).
D.L. Williams and L.D. Miller.
Dr. Lee D. Miller
Professor of Forest Science
Remote Sensing Center
Tesas A.&M. University
College Station, TX 77843

Simulating Forest Pictures by Impact Printers, (1978).
Gen. Tech. Report PSW-25.
Elliot Amidon & E. Joyce Dye.
Pacific Southwest Forest and Range Experiment Station
P.O. Box 245
Berkeley, CA 94701

Better parks management: establishing the system, 1979.
Anderson, Robert D. & J.R. Brown. *Park Maintenance*, (Three parts) Vol. 31, No. 10, 11, 12 (Oct.-Dec.).

A simulation approach to outdoor recreation planning, 1975.
Cesario, Frank J. *Journal of Leisure Research*, Vol. 7, No. 1, pp. 38-52.

Analyze then computerize, 1982.
Siderelis, Chrystos D. *Management Strategy*, Vol. 6, No. 2, p. 1;3 (Summer).

Directory of Selected Forestry-related Bibliographic Data Bases, 1979.
Gen. Tech. Report PSW-34.
Peter A. Evans.
Pacific Southwest Forest and Range Experiment Station
USDA Forest Service
P.O. Box 245
Berkeley, CA 94701

PUBLIC: A Procedure for Public Involvement. Case, Pamela J., Terry D. Edgmon, and Donald A. Renton.
USDA Forest Service
3825 E. Mulberry
Ft. Collins, CO 80524
303/482-7653

North Carolina State Forest Fire Management Game.
Thomas V. Gemmer
North Carolina State University
School of Forest Resources
P.O. Box 5488
Raleigh, NC 27607

Linear programming in land-management planning on National Forests, 1980.
Kent, Brian M. *Journal of Forestry*, Vol. 78, No. 8 (August) pp. 469-471.

Applications of parks management information systems, 1980.
Kamp, B. Dan, Gail Rex Miller, and Arthur Haley. *Leisure Sciences*, Vol. 3, No. 1, pp. 83-98.

Robert T. Watts, Ph.D., is Associate Professor and Director of the Microcomputer Learning Facility at Idaho State University, Pocatello, Idaho.

Other Resources

Baker, K.R., *Introduction to Sequencing.* John Wiley and Sons, N.Y., 1974

Bentley, J. and C.D. Siderelis, *"MOSS Grows Successfully on the Blue Ridge Parkway."* Parks and Recreation Magazine, April, 1982.

Erwin, P.E., *Work Sampling Procedures.* Industrial Extension Service, NCSU, Raleigh, NC, 1978.

Hodges, L. and G. Chambliss, *"Computer Workload/Cost Tracking."* Proceedings, National Workshop on Computers in Parks, 1978.

Kraemer, B., *"Computer Application of a Cost-Tracking System."* Proceedings, National Workshop on Computers in Parks, 1978.

Krog, R. and G.L. Thompson, *"A Heuristic Approach to Solving Traveling Salesman Problem."* Management Science, Vol. 10, No. 2, 1964.

Martin, Daniel, *"Efficient Managerial Indicators for Use in the Assessment of Recreation and Park Operations and Maintenance."* Unpublished Thesis, North Carolina State University, 1981.

Nickerson, Charles, *"Statistical Analysis for Decision-Making."* A Petrocelli Book, 1981.

Reiter, S. and G. Sherman, *"Discrete Optimizing."* SIAM Journal, Vol. 13, No. 3, 1965.

Siderelis, C.D., *"Workload/Cost Tracking."* Trends, Vol. 15, No. 1, 1978.

Siderelis, C.D. and E. Blair, *"The Park Maintenance Work Scheduling Problem."* Working Paper, North Carolina State University, Raleigh, NC, 1981.

Organizations

National Recreation and Park Association's Computer Workshops
3101 Park Center Drive
Alexandria, VA 22302.
(703) 820-4940.

Explore New Happenings in Park Management and Operations with Trends

1978

Vol. 15, No. 1 Trends in Park Management

Vol. 15, No. 2 Serving Special Populations

Vol. 15, No. 3 Medley of Summer Concerns/Opportunities

Vol. 15, No. 4 Urban Park and Recreation Opportunities

1979

Vol. 16, No. 1 Energy Conservation and Environmental Education

Vol. 16, No. 2 Rivers and Trails

Vol. 16, No. 3 What's New in State Parks

Vol. 16, No. 4 Law Enforcement and the Park Mission

1980

Vol. 17, No. 1 Safety and Occupational Health

Vol. 17, No. 2 Partnerships for Survival

Vol. 17, No. 3 The Park and Recreation Employee

Vol. 17, No. 4 Vegetation Management

1981

Vol. 18, No. 1 Water-based Recreation

Vol. 18, No. 2 Coping with Cutbacks

Vol. 18, No. 3 Equipment and Facilities Design

Vol. 18, No. 4 Urban Forestry

1982

Vol. 19, No. 1 Natural Resources Management

Vol. 19, No. 2 Maintenance Management

Vol. 19, No. 3 Energy Management

Vol. 19, No. 4 Research and Applied Technology

1983

Vol. 20, No. 1 Computers in Parks and Recreation

Vol. 20, No. 2

Vol. 20, No. 3

Vol. 20, No. 4

Contents prepared by the National Park Service. Printing and distribution by the National Recreation and Park Association. For additional copies, back issues, or subscriptions to TRENDS, write to: NRPA, 3101 Park Center Drive, Alexandria, VA 22302.