

EXPERIENCES WITH TELE-COMMUTING

When employees perform some or all of their work outside of 'the office,' and perhaps outside of regular working hours, it is called 'remote work.' If they use computers and tele-communications in their remote work, it becomes 'tele-commuting.' Technology now makes it feasible to take 'the office' to some employees, rather than vice versa—but this is not very common yet. Since tele-commuting appears to be a significant new trend, we look at the experiences of some pioneering companies, to learn more about how tele-commuting is evolving. (An executive summary of this report is on page 16.)

George Cannon is a software tools specialist at Logicon, Inc. He is a regular, full-time employee, except that for the past four years he has worked out of his home, which is some 180 miles away from 'the office.'

Logicon is a high technology company that supplies electronic products and services to industry and government. They employ some 1000 people in offices around the U.S., and they had revenues of over \$50 million last year. Mr. Cannon works in the strategic and information systems division, which has headquarters in San Pedro, California, a suburb of Los Angeles.

Cannon began working remotely when he decided to take a half-time leave of absence to work on a Ph.D. At the time, he was manager of their Vandenberg of-

fice, near his home. The company consented to the leave of absence, and allowed him to work part-time out of his home. After he returned to work full-time, they agreed to let him continue working from his home.

As the software tools co-ordinator for the entire division of 400 employees, Cannon keeps up-to-date on what tools are available within the company; also, he acts as an in-house tools consultant to projects in his division. His division supplies software to the U.S. military and performs independent software validation and verification. So the knowledge of available software tools is important for many of their projects. Cannon performs much of this co-ordinator work from his office in his home.

Having worked remotely for four years, and observing one other Logicon employee working remotely for one year, Cannon told us about the problems and some solutions for working in this new environment—from the employee's point of view. His major conclusion is "it's the little things that can cause this work arrangement to fail."

Logistics is a major (yet often overlooked) problem for the remote employee. Logistics refers to having close at hand what you need to do your work. For example, remote employees generally must rely on the mail service to send things to others. The logistics of photo-copying material and then mailing it can be a problem, if one's office is in one's home; a photocopier generally is not available and mailing late in the day or mailing large documents may require driving to the post office. Also, if the company does not supply a photocopy machine, the employee must travel to a photocopy service, pay for the service, and then obtain a petty cash reimbursement from the company.

These are typical of 'the little things' that can cause headaches for remote employees. Cannon solves these problems by having a postage scale and a roll of stamps in his home; he does not yet have a copier. He also has business cards and stationery with his home address, so that people will correspond directly with him, not through a distant company office.

Another problem is having access to reference material. To solve this problem, Cannon uses microfiche (and he feels that tele-commuting will promote its use). In one filing cabinet in his home, he has a library rivaling the paper-oriented company library. The compact nature of his file makes organizing, controlling, and accessing these documents easier; also, it permits him to retain old versions of program listings, correspondence, and so on.

He finds microfiche easier and cheaper to handle than paper for many purposes. He has a step-and-repeat camera service create a microfiche copy of a document (with 96 pages to a fiche) for five dollars. Duplicates cost only fifteen cents per fiche. And the fiche copy is lighter than a single sheet of paper, making it easy to mail. He also orders commercial publications in micro-

fiche form, and then uses a bibliographic search service to find the references to these publications on subjects he is studying. By using microfiche, he has resolved two logistics problems—the problem of having an extensive library close at hand and the problem of distributing copies.

Communicating with others is another major problem, in that it requires more concerted effort by the remote employee. Primarily, the employee needs to keep his or her presence felt within the company. In fact, Cannon believes that *the remote employee must create the illusion that he or she is 'just down the hall.'* Cannon does this in several ways.

First, he visits the office for two days every two weeks. During his visits, he 'wanders the halls' talking to people, he attends meetings, and he picks up office supplies. His principle purpose in going to the office is to be with people, to attend meetings, and to catch up on 'office politics.' He believes that he spends about 10 to 20 percent of his work time in such travel. So his travel costs to the company are higher than with other employees; however, his office space, secretarial and other support costs to the company are much less.

Second, he publishes a newsletter and writes numerous memos, to keep people up-to-date on his work. He tries to keep his name in front of co-workers about twice a week—whether they read the material is less important than their receiving the feeling that he is working and is accessible. And he is having the company add his home business telephone number to their automatic dialer.

And third, he has electronic communication connection to his company's computers. For his Ph.D. work, he bought a micro-computer, a letter-quality printer, and a modem, which he now uses extensively in his work. He does much of his work off-line, and then sends the work to others via the company computers. He finds his micro to be indispensable. In one project, where he communicated with the other team members via electronic mail, he found they had better team communication than such teams generally have. He is urging the company to look into more extensive use of electronic mail.

In short, due to his efforts to keep in touch with colleagues who work at the office, Cannon says that many Logicon employees do not realize he works remotely.

He had a business telephone installed in the office in his home, and the bill for that telephone is paid directly by Logicon each month. He uses the telephone to call colleagues frequently to chat and keep in touch. He has his longer documents prepared on a company word processor; then he retrieves them electronically for editing. And, although accessing the company computers requires a long distance telephone call from his home, he finds that his total telephone bill is not high, about \$100 a month.

Cannon is trying to prepare the groundwork for remote work in his company so that when the need arises, Logicon will be ready. He suspects that it will be feasible for no more than 10% of all employees to work at home, but for these, tele-commuting is an alternative.

Control Data Corporation

Control Data Corporation, with headquarters in Bloomington, Minnesota, is a leading supplier of computer services, mainframe computer systems, computer peripherals, and financial services. CDC is ranked third on the *Datamation* list of the top 100 companies in the data processing industry, with combined revenues of \$4.2 billion.

A widely publicized, and most unusual, full-time work-at-home program is Control Data's HOMEWORK™ program. It originally was aimed at: (1) re-training long-term disabled CDC employees in computer programming or PLATO® course development, and (2) placing them in full-time jobs with CDC. The newly trained employees were then allowed to work from their homes, or even from their rehabilitation centers, in their new careers.

CDC developed the HOMEWORK program in 1978 to allow disabled CDC employees to return to active working life. This would increase their self-esteem, improve their family relations, and make them more self-sufficient. It would provide CDC with a new source of employees, and it would reduce CDC's costs of maintaining these employees on long-term medical leave of absence.

Due to the success of the HOMEWORK program within CDC, the company began marketing it as a product in 1980.

CDC estimates that the direct cost of maintaining one employee on medical leave from age 45 to age 65 is \$365,000. Re-training and then re-employing that person reduces this cost and benefits both the employee and the company.

In HOMEWORK, CDC uses its computer-based training system, PLATO, to re-train disabled employees who have a desire and an aptitude for the work. The PLATO terminal has a high-resolution CRT display with a touch sensitive screen, a keyboard, and a modem. The keyboard can be modified to accommodate a person's disability. The student uses the PLATO terminal to interactively take the HOMEWORK training from a central computer in Minneapolis. HOMEWORK instructors are available to help students during regular working hours. The HOMEWORK training course takes about eight months to complete. On completion of training, a HOMEWORK student is qualified for an entry level business applications programming position.

An interesting phenomenon has occurred in the HOMEWORK program—a 'community' of HOMEWORK students and employees has developed. These people, although they have never met face-to-face, communicate with each other via the network on many personal and social matters. For instance, some regularly play chess or checkers via the system. Others have struck up strong friendships, and all of them support each other during times of personal stress.

The HOMEWORK product that CDC offers includes the HOMEWORK training hardware and software as well as several consulting services—instructors for the programmer training course, personal counseling to help the students learn to live and work with their disabilities, and job search support for students who are seeking employment. In addition, CDC provides employers with information on how to manage remote disabled employees. The training course costs about \$25,000.

For more information on HOMEWORK, see Reference 7.

The changing work-day

Before the industrial revolution, people generally worked in their homes or on their farms. With the start of the industrial revolution, people began 'going to work'—to factories and to offices—because it was more cost effective to move people to central sites.

Today, however, it has become more cost effective to move information electronically rather than to move people. In a landmark study in the mid 1970s, John Nilles of the University of Southern California looked at "the relative energy consumption advantages of tele-commuting over commuting" (Reference 1). He calculated that, at that time, commuting was 29 times more expensive than tele-commuting when the commuter used his or her own car; commuting was eleven times more costly when using normally loaded public transit; and it was twice as expensive when using fully loaded mass transit. He believes these ratios are probably too high today, due to the use of more energy-efficient cars.

But with the increasing cost of energy, such comparisons are of interest to both commuters and employers, who indirectly subsidize commuting through higher wages.

The reasons for considering remote work, or tele-commuting, are varied. Some office employees are looking for ways to increase the quality of their working life. For some this means working away from the office at least part of their work-day or work-week. For others it means living in a specific part of the country, while working for a company located somewhere else. And still others are anxious to enter or re-enter the work-force, but they cannot or will not work in a traditional nine-to-five office. These potential employees include people going to school, parents with either small children or elderly parents to tend, handicapped or elderly people, and people undergoing medical treatment.

Some employers are investigating the feasibility of restructuring the office work-day, so as to offer more flexible work arrangements for some office workers. Some companies have instituted flex-time and job sharing. Flex-time is where employees are allowed to arrive at work within,

say, a two-hour period, such as sometime between 7 AM and 9 AM. And they are allowed to leave, within, say, a two hour range, such as from 4 PM to 6 PM. The main requirement is that they work a full eight-hour day. Job-sharing is where two part-time employees share one job, working alternate hours, generally at the office.

Tele-commuting is another option being tried in a few companies. Some feel that tele-commuting might decrease office costs, for such necessities as office space, parking space, heating, electricity, air conditioning, and so on. It might increase employee productivity and decrease turnover. And, perhaps most important, it might allow companies to attract new talent or retain existing talent that they could not employ otherwise.

Proponents of remote work see such flexible working arrangements as an important new type of 'employee benefit' that companies should seriously consider.

Remote work options

There are currently four tele-commuting options. Several of these categories were first envisioned by Nilles in the mid 1970s. Margrethe Olson of New York University, who has studied remote work recently, discusses these options in her paper (Reference 2).

Occasional work-at-home. The most common form of remote work *among professionals and managers* is occasional working at home. In this arrangement, the employee works part-time at the office and part-time somewhere else, generally at home—but there is no set schedule. Occasional remote work is common because it requires little or no change in employee/employer relations.

Occasional remote work includes the common practice of allowing some programmers to take computer terminals home, so that they can work at home after hours or partially during working hours.

Regular work-at-home. A less common form of remote work is regular work-at-home, either full-time or part-time.

In full-time work-at-home, the employees rarely go to the office. For some people, this is

their only viable employment option. They may be handicapped or elderly and thus unable to work for long periods of time. Or they may have small children or elderly parents whom they do not want to leave or cannot leave with another person.

Full-time work-at-home is rarely offered to professional employees, but it is sometimes available to clerical people, because their career paths and visibility within the company are not considered important, says Olson. She points out that companies may, unfortunately, take advantage of remote clerical workers by seeing telecommuting as an alternative to providing day care. Believing that this work takes less concentration, they conclude that it can be mingled with child care. In her interviews with remote workers, Olson found that the two do not mix; most had someone else care for their offspring part of the time.

In full-time work-at-home, the employees receive their work over the telephone, through the mail, or by courier. They then perform the work, typically data entry or word processing. Some use computer terminals communicating to central computers, while others have terminals with limited local storage, so that they can work offline most of the time and transmit batches of work to the central computers periodically. They may be paid on an hourly basis or a piece-work basis.

In regular part-time work-at-home, the employee's time *in the company office* is scheduled and regular—say, the same two days every week, or the same week each month. Companies see this type of remote work as a more dramatic change than occasional work-at-home, discussed earlier, because supervisory styles need to be adjusted, schedules re-arranged, duplicate reference materials acquired, and equipment supplied.

When an entire group is working under this arrangement and the members have to meet together periodically, they are generally scheduled to be in the office at the same time. However, if the group does not need to have meetings, then the members are scheduled to be at the office at different times, so that they can share office space and equipment. In several pilot projects, the employees did not object to sharing desks—

although it often took them some period of time to learn where the other people put things.

Many foresee future managers and professionals beginning most of their workdays at home, using terminals to review and answer their electronic mail, writing memos, etc. Then they will commute to the office after the rush hour. This is a regular part-time tele-commuting arrangement that is already in use at a few information systems departments. Interestingly, as employees become used to this arrangement, their schedules become more flexible—they sometimes work at home full days if needbe—because they can always be reached by electronic mail.

Satellite work centers. A satellite work center is a remote office where one or more employees work; it is generally closer to the employees' homes than is the main office, and these employees typically work for the same department. Sometimes, the employees work full-time at the remote office; in other cases, they work part-time there and part-time at their homes.

It was originally thought that these remote work groups would be moved out of the central site and relocated in the suburbs. This has happened at a few companies. But what is happening more often is that companies are setting up satellite work centers in other cities, using mostly new employees. The satellite sites are generally connected to the central office by telecommunications facilities.

Satellite work centers are still rare, because it is difficult to find a group within a company that can be moved away from the central site. Many professionals and managers need to interact with peers in other groups. So, until tele-conferencing and electronic mail become commonly used, this option may not be widely adopted.

Neighborhood work centers. The neighborhood work center, as proposed by Nilles in the mid 1970s, is based on the idea of one or more companies establishing several neighborhood work centers within a city. An employee would go to whichever center was closest to where he or she lived. Thus, each center would have employees from different departments of a company and even from different companies.

This alternative is the most futuristic; in fact, we do not know of any in existence today. It is a difficult option, because a working group could conceivably be spread over a wide area. Until remote work habits are developed, this option probably will be the least likely to be considered.

Concerns about tele-commuting

There are, of course, two sides to the remote work picture—management's view and the employees' view. We will look at these individually.

Management's concerns

Olson (Reference 2), based on her study of a number of organizations that are experimenting with all types of remote work projects, found that managers have three main concerns:

- What kinds of jobs are suitable?
- What kinds of individuals are suitable?
- How do we manage remote workers?

What kinds of jobs are suitable? Olson found that the jobs that were most conducive to remote work (not just occasional work-at-home) had five characteristics. These attributes often applied to professional and managerial jobs as well as to clerical jobs.

First, the jobs had minimum physical requirements. That is, they did not require much, if any, equipment. Paper, pens, and reference materials often were all that were needed. In one-half of the cases, a telephone and a terminal (or computer) were necessary.

Second, the work-pace of the job could be controlled by the employee. Few of the tele-commuters' jobs had short-term deadlines. The professional jobs were generally projects with longer-term deadlines, and the clerical jobs were often piece-work.

Third, the jobs had well-defined deliverables. The progress on the job could be managed by looking at the output. For the longer term projects, there were also measurable milestones.

Fourth, the professionals' jobs required concentration, although the clerical jobs did not.

And fifth, the jobs did not require the employees to continually communicate with others.

These employees could work on their own for relatively long periods of time. And when they did need to communicate with others, they could do it on the telephone or visit the office to talk to several people in one trip.

The jobs we have heard mentioned as likely candidates for remote work are programming, word processing, data entry, accounting, course writing, and some analysis jobs.

What types of individuals are suitable? Olson found that the overriding criteria was to pick volunteers. Beyond that, she found four distinguishing personal characteristics of people who enjoyed the regular work-at-home arrangement.

First, these individuals were self-motivated and self-disciplined. They could work at home without continually wanting to watch television, raid the refrigerator, or visit with neighbors. These employees set strict work routines for themselves, and they stayed with those routines by generally working in the same place and during the same hours.

Second, these people felt that either their skills or their loyalty to the company gave them bargaining power. Thus, they felt they could ask for unusual, more flexible working conditions from their employers than would be true for employees in general.

Third, these individuals often had family obligations. They felt they should be at home, where they could also tend to family matters, rather than work in an office and delegate the family matters to others. This characteristic is two-sided, however. Many employees cannot handle both family and work matters at the same time in one setting (the home). They find that the dual role causes too much conflict. So employers should not look at this one characteristic as the main determinant of who is likely to want to work at home.

And fourth, these employees liked to be alone or liked to work in a quiet atmosphere. Working at home much of the time does mean being alone. Many office workers cannot make this adjustment; they like to socialize. Some can compensate for the loneliness by fostering other contacts. McClintock (Reference 3) found, in fact, that the tele-commuters in one group began to socialize more with each other outside the office

than they had when they were all working at the office.

Another interesting question on this subject is the effect of electronic mail on tele-commuters' contacts with others. McClintock found that the availability of electronic mail *enhanced* their communications in several ways. First, it allowed the tele-commuters to handle routine communications (arrange meetings, distribute announcements, and such) more efficiently than they had performed these tasks previously. This in turn allowed them to enhance the quality of the fewer person-to-person contacts that they did have. In addition, these tele-commuters kept in daily contact with their counterparts at the office, something that tele-commuters without electronic mail did not do.

Working at home is different from working in an office. Some people like it, others do not. So even if a job is appropriate, the job-holder's personality may not fit remote work.

How can we manage remote workers? Remote work requires a certain type of management style. For one thing, it requires mutual trust and respect on both sides. As Ferrarini and Farrell (Reference 4) point out, managers who feel that they must "see that the person is working hard" will not easily adapt to managing remote workers. If, however, the manager is more interested in subordinates' work products rather than their methods of work, then that manager is more likely to be able to handle remote workers.

Part of the management question seems to revolve around the type of job—professional or clerical. There is apparently more fear of allowing clerical employees to work remotely, so companies have devised methods of measuring the work of these employees.

As Sample (Reference 5) discusses, some companies use the remote word processor or terminal as a 'time clock,' to keep track of when the employee is working. Others measure work by output—amount of data entered, number of forms completed, and so on. Sometimes, a company has estimated 'standard' amounts of work and then pays bonuses for employees who accomplish more work in a given time. Olson points out that unions cast a suspicious eye at

such arrangements, because they fear exploitation and a return to 'sweatshop' conditions.

At the professional level, work measurement is based on trust and deliverables. Often, both the manager and the remote employee estimate how long a project will take. Once they have reached an agreement, it provides the basis for measurement and for future estimates. Sometimes, the remote employee keeps a log of the amount of time he or she spends on different projects. Generally this is for use in making future estimates, rather than for judging whether the person has been working or not.

Most professional remote workers are full-time employees. However, at F International, a software consulting firm in Great Britain, they use contract remote professionals. And they rely heavily on a project control system that they have refined over the past 20 years. As Shirley describes in Reference 6, the first important element is estimating. Each project starts with an in-depth estimate of the project content. F International has an estimating group that handles all this estimating—they make the initial estimates, negotiate with team members on those estimates, then create official estimates and track and refine them as a project progresses.

Second, F International keeps detailed staff performance records. They use these to: (1) put together complementary teams, (2) create more accurate project estimates, and (3) monitor work on projects to more quickly catch deviations.

The third element of their project management system is the project manager. The project manager is responsible for keeping the project on target and getting it back on target when it slips. Project managers are the communication link between the client and the remote team members, so they make weekly progress reports to the client and they contact team members frequently. They also re-estimate project progress at each milestone, and (quite unusual) they create the project documentation. F International budgets 12% of project costs for documentation.

And fourth, all projects are broken down into short assignments, about two weeks of work, with a deliverable at the end of each. They use this technique to give their systems people fre-

quent achievement points and to catch schedule discrepancies as early as possible.

Shirley points out that remote professional employees (and their managers) need more precise project management procedures. And she recommends that project leaders monitor work much more closely, because things tend to slip more easily in the remote setting. Specific procedures are required on remote projects in the areas of standards, quality control, staff performance records, and documentation, she states. By providing more formal management, her company is able to use teams of remote professionals.

Data security. There is a need to supply remote workers with access to a corporate computer. This brings up the question of security.

Many information systems managers that we have talked with are most concerned with this security question. They feel that there is more of a security threat from people using terminals in their homes than using them at the office. This is a definite problem, and not just for computerized data, but for other company records that are taken off of company premises. Due to this problem, most companies are allowing only very trusted employees to work off-site. And, in a few cases, the tele-commuters dial up to a separate, non-production, computer.

Employees' concerns

The thought of working at home at least part of the time intrigues many office workers, who think they see numerous benefits. Remote employee probably need to spend less money on clothes, lunches, and commuting. Also, they may have less stress—from commuting, from co-workers, and from the office environment in general. Furthermore, they will have more time to concentrate due to fewer interruptions. And remote employees can work when they feel they will be productive—such as in the evening when the children are in bed, or on a weekend morning.

Yet, there are a number of concerns raised by employees who have been tele-commuters. These are concerns about their companies, their careers, their own motivations, and their families.

Concerns about the company. Remote employees must feel that they are being treated equitably by their companies. Thus they are concerned about insurance coverage, benefits, and pay. As Sample (Reference 5) mentions, the companies he talked with provided their full-time remote workers with the same benefits that they received while working at the office. And the companies considered these employees' home work-spaces as extensions of the company offices, so that the company's liability for job-related accidents was based on the same criteria.

Concerns about one's career. When a person works at home much of the time, there is a tendency for others to "forget about him." This reduced visibility among co-workers, and even by one's boss, can hurt one's career. Unless the remote worker purposely keeps a 'high profile' with his or her boss, the boss may subconsciously pass over this person at promotion time. This is why frequent, clearly defined work deliverables are important; they show everyone that the remote employee is indeed working and producing useful results.

In addition, informal job training occurs in the office between co-workers. This is missed if someone is working alone at home. Staying professional often requires working closely with peers. Electronic mail may allow some of this give-and-take, but it may not completely compensate for all that is lost in not being at the office.

Concerns about one's own motivations. Many people wonder whether they can cope with the loneliness of working alone, whether they have the determination to work in a non-working environment, such as their home, and whether they will miss the more structured and social atmosphere of the office.

Concerns about one's family. People who work at home must train their families to not disturb them. Children and spouses often think that if you are at home, you are available for conversation, chauffeuring, shopping, cooking, and so on. Conflict can arise when someone works at home, and some families cannot resolve this conflict.

Also, mothers of infants and young children often cannot combine work and child care, Ol-

son points out. Most have to arrange for supplemental day care in order to get any work done at home.

These then are the concerns about remote work that both managers and employees have voiced.

To get a better appreciation for the benefits, problems, and side effects of remote work, here is a summary of the experiences on one remote project.

One remote project

A major life insurance company wished to gain first-hand experience in the use of remote program development work. They approached Heights Information Technology Services, of Tarrytown, New York, to undertake a program conversion project on a remote programming basis. The company was particularly interested in finding out what level of productivity could be achieved by the remote workers and whether their in-house people could effectively interface with this new work environment.

The project required re-programming a ten year old application written in a previous version of COBOL. The system was not documented or commented, and it was being maintained by patching the old code. In addition, some enhancements were needed.

A client team was set up to interface with the Heights project manager. It contained both user and information systems personnel. The contract was awarded to Heights after two estimates had been made—one by the users and one by information systems. The Heights bid was within the constraints of these two estimates, for both cost and schedule.

The work plan called for Heights to provide two experienced COBOL programmers, both of whom had worked on applications under the appropriate IBM time-sharing system. The project was led by a project manager with only limited project leadership background. Each of these three Heights 'panel members' (Heights' term for the independent sub-contractors they use) planned to work approximately 25 hours a week for four months, and all planned to work remotely.

The log of the project

The project manager of this remote project kept a daily log of her work, for the 18 weeks that the project lasted. Her work consisted of: (1) co-ordinating and guiding the project work, (2) being the sole link between the client's employees (about five of them) and her two team members, (3) dealing with 'outsiders,' such as the telephone company, and (4) keeping Heights management informed on project progress. Following is a condensation of her log, by week.

Week 1. Met with client, Heights management, and the two team members in two separate meetings. Started making arrangements with client to supply terminals (printer terminals, although CRTs would be preferable), and with telephone company to install needed telephone circuits in team members' homes. Also checked into messenger service rates. Began to set initial project schedule. Received some data from client.

Week 2. Met with client and received more information on the requirements of the output reports, including samples (which do not agree with previous descriptions received). Completed input and output descriptions and system design. Realized project was larger than planned. Created copies of client's COBOL standards and mailed to team members.

Contacted client's hardware vendor several times about receiving needed manuals for team members. Contacted several 'telephone' companies concerning connection requirements and costs for their services from the team members' homes to the client's site. Decided to use inward toll-free service. Told team members to order additional home telephones. Wrote progress report.

Week 3. Visited client and reviewed input and output designs. Later in week made changes and updated system design. Received 'skinny' description of input/output standards used by client. Received two of the three needed terminals.

Mailed information on standards and new data to team members. Visited with one project member at Heights office and presented her with her terminal and ran a walk-through of the project.

Ordered own telephone, discussed project status and scheduling with Heights management, and prepared Phase 1 summary and sign-off report—input, output and file descriptions.

Week 4. Visited client, received third terminal and 'skimpy' information about interactive debugging facilities. Was told that toll-free line would be available next week.

Revised file layouts, prepared summary of client's system for team members, made more refined schedule of project.

Visited second team member at Heights office; gave him his terminal and some supplies and materials. Explained his first assignment. Wrote progress report.

Week 5. Visited client, presented schedule. Received paper for terminals, specifications for one program, and information about test files.

Mailed manuals, more data, and specifications to team members several times during the week. Talked with them on the telephone, explained details, and answered their questions. Wrote progress report.

Week 6. Did much co-ordinating between client and the two team members concerning problems they had encountered trying to use the system through the remote terminals. Wrote documentation and specifications for second and third tasks. Made list of questions for next visit to client.

Week 7. Visited client to obtain resolution of system's utilities problems. Learned of resolution two days later.

Received more phone calls from team members regarding other problems they were having using the client's system. Visited with one team member at Heights office to exchange terminals, since hers would not work. Wrote progress report.

Week 8. Returned faulty terminal to client, discussed specification for upcoming tasks, discussed presenting completed programs and user documentation to client.

Completed specifications for fourth task. Performed month-end administrative tasks for the project, after talking with the programmers about their status. Received several problem calls from team members. The more experienced programmer was not following the client's pro-

gramming standards; therefore, switched tasks between the two, giving the other programmer the more difficult tasks.

Week 9. Received new terminal at client's location, asked about more terminal paper. Was unable to meet with anyone, so left completed work for them to review. Client called next day, said programming standards had not been met (although we had not been given sufficient guidelines or samples). Checked programs and sample output to be sure they met specifications.

The more experienced programmer having problems using test files remotely, so I asked other programmer to solve the problem.

Week 10. Presented eighth progress report to client and discussed major problems encountered so far: (1) not all of the needed system utilities had been available to the programmers from the outset, (2) printer terminals less convenient to use than CRTs, (3) client personnel were often unavailable to answer questions, and (4) there had been problems with some test files. Client requested several additional application changes.

Discovered that the more experienced programmer's file problem was due to a poorly structured program and program bug. Decided to remove her from the project; she was having trouble working remotely. Picked up her terminal and manuals later in the week. Asked other team member if he could handle remainder of the project's programming work; he said yes. Did bi-monthly billing; wrote specifications for next task.

Week 11. Mailed specifications for fourth phase to programmer. Edited work done to date. Calculated actual versus projected project costs for first two phases.

Visited client, met new client team member. Received some specification changes and more terminal paper. Unable to meet with one person, so left list of requirements for future testing.

Sent paper, report formats, and notations about needed changes to programmer. Placed advertisement in paper for documentation typist. Worked on discharged programmer's programs.

Week 12. Continued testing and altering discharged programmer's work. Met with client concerning testing. Sent job control statements to client via system for verification.

Week 13. Wrote progress report, adjusted project estimates, and wrote some documentation. Sent programs, output and input to client via system for meeting. Had group meeting at client's site concerning following week's on-site testing. Visited Heights estimator/reviewer and described project progress for her auditing needs. Ran into some problems preparing for testing.

Week 14. Went to client's location for on-site testing for three full days this week.

Week 15. Continued on-site testing for one day and remote debugging for two days. Completed documentation. Wrote progress report and did bi-monthly billing.

Week 16. Continued on-site testing for one day. Printer at client location was down entire day, so one of client's personnel found a way to re-route the batch printouts to the terminal. If we had known this re-routing was possible, we could have performed testing remotely as programs were being developed. Continued debugging remotely two more days this week.

Week 17. Met with client on Tuesday and reviewed output. Client found some overlooked or misinterpreted requirements. Spent much time explaining these changes to programmer that afternoon. Spoke with several of client's employees on Wednesday; they reported more needed changes. Told programmer of these. Client called on Thursday with more changes. Spent more time on Friday on telephone with programmer.

Week 18. Client approved output. Project considered complete.

Assessment of this project

The project was completed about 20% above the original Heights estimate (but below the client's ceiling) and 15 days longer than the four-month delivery schedule. At the conclusion, Heights was asked to review the pros and cons of the project and suggest whether and how to proceed with 'in house' remote programming. The Heights report included the following points.

Four major problems had been encountered. (1) There was a lack of current, well-documented standards on program formatting and

procedures for using the computing facilities on a remote basis. (2) Due to other assignments, client technical interface personnel were not readily available, either by phone or in person. Nor were they attuned to the types of problems likely to occur when trying to access their computer system remotely. (3) The initial user statements regarding calculations for the output reports were not complete, and required substantially more work than originally anticipated. An additional client person was added late in the project, through whom all material needed to be cleared. However, this did not affect the schedule. And (4) the client originally stated that all systems testing needed to be performed on-site. This significantly delayed the identification of problems and the correction of errors. It was later determined that testing could have been performed remotely and that the print-outs from these tests could have been routed to the programmers' remote terminals.

Based on these problem areas, Heights drew several conclusions and made some suggestions regarding preparing for future remote programming work. Heights felt the project demonstrated that program construction, conversion, or maintenance can be carried out by programmers at remote locations. But to conduct this type of work successfully, these people need to be taught the company's program construction and documentation standards, computer use procedures, and techniques for remote programming, testing and debugging.

While hard copy terminals are economical and easy to install, they do not provide the productivity or speed of CRT terminals. The use of an inward toll-free number and a dedicated phone at the programmers' locations were satisfactory.

In-house employees who interface with remote people need to have a thorough knowledge of the computer system's characteristics and should be evaluated on their ability to support the work of these remote people. Careful work is needed on application definition and specifications before programming commences. This includes a satisfactory statement of an acceptance test and a clear understanding of who will provide the test databases and test transactions.

Remote programmers and project leaders should be responsible for providing weekly reports, showing planned activities versus actual work performed and future milestones. And the work must be sub-divided into small enough modules for tight scheduling and good control.

Formal walk-throughs by senior technical personnel and reviews by users on a regular basis should insure that work is being carried out as planned and that changes are not creeping in due to mis-communication. These formal reviews should be conducted every four to six weeks, but even sooner on the first few programs.

Selecting remote programmers needs careful attention. These people need to have the appropriate technical skills, but they also need to accept direction and be able to point out difficulties logically, in an unemotional fashion. Conversely, they must provide their own day-to-day discipline, rather than rely on discipline provided by on-site management.

In conclusion, Heights felt there were no technical barriers to accomplishing the particular project in a timely, cost-effective fashion. However, there were personnel and organizational considerations which any company will need to evaluate before making a decision to proceed with remote programming.

Conclusion

Futurists suggest that within a few years we will have the power of a mainframe computer in a briefcase or pocket computer. And a widening array of communication options are appearing for linking such portable computers. Put these two together and there are no technical barriers to tele-commuting. What remain are the social, managerial, and psychological barriers.

In addition, Olson believes that programming projects in the future will very likely be conducted by remote work groups, who communicate, debug, and walk through programs via ter-

minals. She sees several advantages to this approach: reassignment without relocation, better documentation, enforcement of standards, and more use of structured design and walk-throughs—all part of a more formal job environment for these remote workers.

As office employees place more emphasis on the quality of their working lives, tele-commuting may become a desirable work style for some. Thus, regular part-time tele-commuting may become popular among managers and professionals, and full-time tele-commuting may provide work opportunities for some for which 'going to the office' is not feasible.

REFERENCES

1. Nilles' original work appeared in *The telecommunications/transportation tradeoff* published in 1976 by Wiley Interscience. That book is now out of print. A recent reference that discusses some of his findings is: *Computing Newsletter*, College of Business Administration (University of Colorado, Colorado Springs, Colo. 80907), May 1981, pg. 5; price \$2.50.
2. Olson, M. E., "Remote office work: Implications for individuals and organizations," Center for Research on Information Systems (New York University, Graduate School of Business Administration, 90 Trinity Place, 7th Floor, New York, New York 10006), Paper No. 25, 1981, 43 pages; price: no charge.
3. McClintock, C. C., "Working alone together: Managing telecommuting," *National Telecommunications Conference Record*, (IEEE Service Center, 445 Howes Lane, Piscataway, New Jersey 08854), 1981, Order Number CH 16790, pp. A8.2.1 - A8.2.2; price \$88.00.
4. Ferrarini, E. and G. Farrell, "Telecommuting: High tech's new cottage industry," *Computerworld/Extra!* (Box 880, 375 Cochituate Rd., Framingham, Massachusetts 01701), March 17, 1982, pp. 63-65; price \$1.25.
5. Sample, R. "Coping with the 'work-at-home' trend," *Administrative Management*, (Geyer-McAllister Publications, 51 Madison Ave., New York, New York 10010), August 1981, pp. 25-27; price \$3.
6. Shirley, S., "The remote control of projects," *IFIP 79 Proceedings* North Holland Publishing Company (P.O. Box 103, 1000 AC Amsterdam, The Netherlands), pp. 115-121.
7. For more information on HOMEWORK, contact Control Data Corporation, PLATO Marketing, Box O, Minneapolis, Minnesota 55440.

Prepared by:

Barbara C. McNurlin
Associate Editor

EDP ANALYZER is published monthly and copyright© 1982 by Canning Publications, Inc. 925 Anza Avenue, Vista, California 92083. All rights reserved. Photocopying this report for personal use is permitted under the conditions stated at the bottom of the first page. Also, see Declaration of Principles on page 15.

COMMENTARY

VIEWS ON THE FUTURE OF TELE-COMMUTING

by Mrs. Steve Shirley, F International Group, United Kingdom

(We asked Mrs. Shirley, who is Chairman of F International and who has been awarded the Order of the British Empire, to discuss the likely future role of tele-commuting, based on her company's 20 years of experience with remote programming professionals—Ed.)

It is only comparatively recently that 'office' has meant a separate place rather than the official nature of the activity. The office is not restricted to typists and secretaries, but revolves around the overall commercial policies. I define office work as the management, administration, and servicing of an organization and its customers/users.

Yesterday's office worker in a so-called advanced country had the use of little equipment—valued at (say) only \$2,000. Tomorrow's office worker will be supported by about \$10,000 of mostly computer-based equipment. And since the cost of computing continues to fall by some 25% per year, this represents a greater than 5:1 increase in support.

These distributed office information systems are unlikely to bring any change to line and staff management roles in traditional office environments.

But it is the *tele-commuter*, effectively self-employed and working mainly at home or in a nearby satellite office or shared workshop, who may need a different (and not necessarily easier) relationship with management. It is already obvious that certain types of leadership do not readily transfer to the tele-commuter mode.

Human factors. All sorts of human factors come into the concept of working away from headquarters.

For example, motivating remote people requires far greater skill, tact, and leadership. Also, self-discipline is becoming more important. The early remote workers (the *cottagers*) did mainly low level work, such as transcribing dictation, which could be monitored on the basis of volume and accuracy. Now much higher skilled office work is being done remotely. Such work depends on the self-discipline of the tele-commuter (who is becoming one of the elite).

Electronic office equipment, though it can reduce much routine work, can also remove some of the more satisfying aspects of peoples' jobs. This is because integrated office systems have fragmented and de-skilled human tasks. The concept of job satisfaction has been missing—and how much job satisfaction can an unemployed office worker have?

Such status factors as type of car, size of office, a personal secretary, etc. need to be re-assessed.

Being independent of location, tele-commuting has a major impact on recruitment and labour turnover. New forms of training (probably computer based), supervision, and assessment will be needed for remote workers.

There are some add-on costs as well as cost savings. For instance, some trade unions may seek various allowances for people working at home, to compensate for wear-and-tear to the home and for communications charges. Incentive schemes previously confined to sales and a few shop floor workers could extend to tele-commuters. Conversely, people working in conventional offices may view tele-commuting as a privilege, and therefore demand compensatory benefits.

Greater emphasis will be placed on two-way communication of general information, memoranda, and employee newsletters. Probably all will be distributed electronically.

In summary, work and home will interact, as they always have, but more obviously.

Ten years hence. As the range of home facilities becomes more impressive, employers will need to adapt their work practices to control overhead—such as eliminating unnecessary journeys and minimizing administrative overhead—thus maximizing the productive time enjoyed by their managers and key specialists.

As yet, there is no convincing evidence that organizations will make do without central offices (although the percentage of people employed in such environments is falling). Such city centre offices as remain in use ten years hence will be supplemented by a physically remote work force which tele-commutes with, rather than commuting to, the central office. The role of headquarters will change to a sophisticated social club, which employees will look forward to visiting for face-to-face meetings.

Many people will be working, ten years from now, mainly at home or in nearby sub-offices. As an extension of a corporate sub-office, work centres will be used on a shared basis by several organizations. Such centres will retain the essential elements of social contact which paid work provides. But overall, face-to-face contacts will be much reduced, being replaced by various aspects of tele-conferencing.

Multi-national companies can foresee home-based specialists being employed on an international basis, via long distance data links. It seems as if such specialists, particularly the high technology ones, will be enhanced in status. Their working hours can be extremely flexible, since large cheap buffer stores allow the data to be transmitted at the most economic times.

There will be an enormous impact on the family and its attitude toward the neighbourhood. Architecture, transport planning, and design of equipment and furniture are but a few disciplines likely to be radically affected by the opportunities of tele-commuting. Only one aspect of office activity will remain effectively unchanged—the gregarious and innovative nature of *Homo sapiens*.

Copyright © 1982 by F International Limited, U.K.

SUBJECTS COVERED BY EDP ANALYZER IN PRIOR YEARS

1979 (Volume 17)

Number	Coverage
1. The Analysis of User Needs	H
2. The Production of Better Software	H
3. Program Design Techniques	H
4. How to Prepare for the Coming Changes	K
5. Computer Support for Managers	C,A,D
6. What Information Do Managers Need?	C,H
7. The Security of Managers' Information	L,C,A
8. Tools for Building an EIS	C
9. How to Use Advanced Technology	K,B,D
10. Programming Work-Stations	H,B
11. Stand-alone Programming Work-Stations	H,B
12. Progress Toward System Integrity	L,H

1980 (Volume 18)

Number	Coverage
1. Managing the Computer Workload	I
2. How Companies are Preparing for Change	K
3. Introducing Advanced Technology	K
4. Risk Assessment for Distributed Systems	L,E,A
5. An Update on Corporate EFT	M
6. In Your Future: Local Computer Networks	F,B
7. Quantitative Methods for Capacity Planning	I
8. Finding Qualified EDP Personnel	J
9. Various Paths to Electronic Mail	D,M
10. Tools for Building Distributed Systems	E,B,F
11. Educating Executives on New Technology	K
12. Get Ready for Managerial Work-Stations	C,A,B

1981 (Volume 19)

Number	Coverage
1. The Coming Impact of New Technology	K,A,B
2. Energy Management Systems	M
3. DBMS for Mini-Computers	G,B
4. The Challenge of "Increased Productivity"	J,K,A
5. "Programming" by End Users	C,H,B,G
6. Supporting End User Programming	C,H,B,K
7. A New View of Data Dictionaries	G,B
8. Easing the Software Maintenance Burden	H,B,G
9. Developing Systems by Prototyping	H,B,G
10. Application System Design Aids	H
11. A New Approach to Local Networks	F,K
12. Portable Software for Small Machines	B,H

1982 (Volume 20)

Number	Coverage
1. Practical Office Automation	A,B,C,K
2. Computer Graphics for Business	K,C,B
3. Interesting Decision Support Systems	C,B,H,A
4. Can Tele-communications Replace Travel?	A,F,J,L
5. The Human Side of Office Automation	A,J,K
6. Some Users Want Their Own Computers	B,C,K
7. Using Minis and Micros	B,E
8. Training for End Users	C,B,K,J
9. Query Systems for End Users	C,B
10. Relational Database Systems Are Here!	G,C,H
11. Experiences with Tele-Commuting	C,K,D

Coverage code:

A Office automation	E Distributed systems	I Computer operations
B Using minis & micros	F Data communications	J Personnel
C Managerial uses of computers	G Data management and database	K Introducing new technology
D Computer message systems	H Analysis, design, programming	L Security, privacy, integrity
		M New application areas

(List of subjects prior to 1978 sent upon request)

Prices: For a one-year subscription, the U.S. price is \$66. For Canada and Mexico, the price is \$66 in U.S. dollars, for surface delivery, and \$73 for air mail delivery. For all other countries, the price is \$78, including AIR MAIL delivery.

Back issue prices: \$7 per copy for the U.S., Canada, and Mexico; \$8 per copy for all other countries, sent via AIR MAIL.

Reduced prices are in effect for multiple copy subscriptions, multiple year subscriptions, and for larger quantities of a back issue. Write for details. Agency orders are limited to single copy subscriptions for one-, two-, and three-years only.

Please include payment with order. For U.S. subscribers, you can use your Visa or MasterCard charge card; include your card name, number, and card expiration date on your order.

For payments from outside the U.S., in order to obtain the above prices, take your choice of three options: (1) use an international money order, (2) pay in U.S. dollars with a check drawn on a bank in the U.S., or (3) use any of the following charge cards: Visa, MasterCard, Eurocard, Access Card, Standard Bank/Kaart, Union Card International, or Diamond Card International. Please be sure to include your card name, number, and card expiration date on your order.

Editorial: Richard G. Canning, Editor and Publisher; Barbara McNurlin, Associate Editor. While the contents of this report are based on the best information available to us, we cannot guarantee them.

Missing Issues: Please report the non-receipt of an issue within one month of normal receiving date; missing issues requested after this time will be supplied at the regular back-issue price.

Copying: Photocopying this report for personal use is permitted under the conditions stated at the bottom of the first page. Other than that, no part of this report may be reprinted, or reproduced or utilized in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or in any information storage and retrieval system, without permission in writing from the Publisher.

Address: Canning Publications, Inc., 925 Anza Avenue, Vista, California 92083. Phone: (714) 724-3233, 724-5900.

Microfilm: EDP Analyzer is available in microform, from University Microfilms International, Dept. P.R., (1) 300 North Zeeb Road, Ann Arbor, Mich. 48106, or (2) 30-32 Mortimer Street, London WIN 7RA, U.K.

Declaration of Principles: This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. It is sold with the understanding that the publisher is not engaged in rendering legal, accounting, or other professional service. If legal advice or other expert assistance is required, the services of a competent professional person should be sought. — From a Declaration of Principles jointly adopted by a Committee of the American Bar Association and a Committee of Publishers.

EXECUTIVE SUMMARY

Some companies are beginning to allow a few employees to work remotely, usually at home, either full-time or part-time. Why? Because of the increasing costs of commuting, office space, and energy, coupled with the growing accessibility of computers and tele-communication facilities. When the employees use computers to stay in touch with their offices, they are considered to be 'tele-commuters.'

However, many companies have been hesitant to institute remote work pilot projects. But with 'quality of working life' becoming increasingly important to all employees, these companies may want to reconsider. A remote work option may be a new employee benefit that allows a company to retain or attract valuable personnel.

The most common remote work arrangement is to allow some employees to work at home *occasionally*. This option does not disturb the existing employer/employee relationship. The next most common arrangement is to allow a few employees to work at home *regularly*, either full-time or part-time. The few companies that offer this option have it on a pilot project basis only, because it requires finding the right jobs, the right employees, and the right managers to experiment with new working relationships. There are other possible remote work arrangements described in the text.

Some jobs are suitable for remote work. They have specific deliverables, they require few tools, and the job holder can work alone for extended periods of time. In addition, not all individuals can work alone at home; many prefer the work environment and the social atmosphere of an office. The ones who can work remotely are self-paced, trust-worthy, like to work in a quiet atmosphere, and, very importantly, want to work at home. And finally, many managers will not feel comfortable managing people they cannot see continually. Remote employees need more formal management to replace the many casual conversations and work atmosphere in the office. And they need managers who communicate well.

Computer programming is one area where tele-commuting is expected to grow fairly rapidly. There is a shortage of experienced programmers so that good ones have a high bargaining power. A case example of a programming project involving remote work is given in the text, along with some practical guidelines that participants drew from it. Information system executives may soon be facing demands for tele-commuting.