A RAND NOTE

Upgrading an Office Automation Environment: The Army's DCSPER Automation Project Final Report

Herbert J. Shukiar, Roy O. Gates, Richard J. Kaplan

RAND

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PREFACE

In November 1990, senior staff members of the Army's Office of the Deputy Chief of Staff for Personnel (ODCSPER) asked RAND's Arroyo Center to examine the ODCSPER office automation/computing environment and recommend enhancements to that environment. The Arroyo Center began the project in January 1991 after an initial meeting in December 1990. The project ended in May 1991 after having surveyed over half of the ODCSPER staff regarding ODCSPER computing, analyzing survey results, and presenting recommendations to the DCSPER and ODCSPER's Information Management Organization. This Note, the project's final report, summarizes survey results and suggests several evolutionary enhancements to ODCSPER's computing environment. The enhancements are designed to address survey concerns and provide ODCSPER with a flexible computing architecture that permits ready adaptation to changing technologies as they arise, allowing the ODCSPER computing environment to continue to evolve in response to changing user requirements.

In addition to the ODCSPER Information Management Organization, this Note should be of general interest to those with responsibility for managing, evaluating, or enhancing an organization's computing resources. It discusses mechanisms for determining objectives and organizational issues requiring attention.

THE ARROYO CENTER

This Note was prepared under sponsorship of the U.S. Army at the Arroyo Center, the Army's federally funded research and development center for studies and analysis operated by RAND. The Arroyo Center provides the Army with objective, independent analytic research on major policy and organizational concerns, emphasizing mid- to long-term problems. Its research is carried out in four programs: Strategy and Doctrine, Force Development and Technology, Military Logistics, and Manpower and Training (under whose purview the DCSPER Automation Project falls).

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The Arroyo Center is housed in RAND's Army Research Division. RAND is a private, nonprofit institution that conducts analytic research on a wide range of public policy matters affecting the nation's security and welfare.

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SUMMARY

The DCSPER Automation Project, a special assistance project conducted from January to May 1991, was chartered to evaluate the current[1] Office of the Deputy Chief of Staff for Personnel (ODCSPER) computing environment, particularly in terms of its support of ODCSPER office automation, and recommend office automation enhancements. The project was asked to complete its evaluation and brief results within a time frame of four months.

To complete the project within the stipulated time frame, the project developed a questionnaire that all ODCSPER staff were asked to complete. Development was based on extensive discussions with ODCSPER's Information Management Organization (IMO) and Plans, Analysis, and Evaluation directorate (DAPE-ZXP), conducted early in the project's life cycle. The questionnaire was sent to 329 people, and 174 responses (53 percent) were received. This Note, the project's final report, presents questionnaire results and recommendations. It also discusses organizational issues associated with the recommendations.

QUESTIONNAIRE STRUCTURE AND RESULTS

The questionnaire addresses five broad categories: user characteristics; user sophistication; desktop and nearby equipment usage; user communication; and problems, limitations, and desired capabilities. The 174 responses are reasonably distributed over the ODCSPER organizations and the military and civilian grades.

User Characteristics/User Sophistication

The average questionnaire respondent spends about half his time (46 percent) using a computer. Half of that time is spent at word processing, and one-third is spent at PROFS-related activities (PROFS is a mainframe-based office automation system providing electronic mail, calendar management, database, and analysis facilities). Based on responses to the questionnaire's user characteristics section, project staff judge that about one-third of ODCSPER respondents have moderate to high user sophistication.

[1]Current refers to January–April 1991.

Equipment Usage

This questionnaire section examines the degree of equipment usage and sharing among ODCSPER staff. Three out of four respondents have an IBM-compatible personal computer (PC) on their desks. Almost half of those with a PC must share it with others. Further, one-third must use a nearby PC and almost two-thirds must use a nearby printer that is not attached to the desktop PC.

User Communication

This questionnaire section addresses the types of formal communication within ODCSPER, both electronic and hard copy. For communication totally within ODCSPER (does not originate or terminate outside of ODCSPER), about half of the respondents use electronic means of communication approximately once a day. About one out of five use hard-copy communication once a week or so.

Problems, Limitations, and Desired Capabilities

This questionnaire section asks the respondent to describe, in his own words, the problems and limitations of the current environment as well as desired capabilities not now available. Narrative responses were categorized into the following classes: work station-related; software-related; printer-related; PROFS/Forecast-related; local area network-related; memory-related; and disk-related. One out of three to one out of four respondents commented on work station-, software-, and printer-related problems. Many people noted PROFS' poor response time and frequent unavailability.

Response Summary

We believe the current ODCSPER computing environment adversely affects staff effectiveness. The amount of computer sharing that takes place, the incompatibility associated with nonstandard software and hardware, and the lack of effective peer-to-peer connectivity combine to degrade productivity. *Cooperative processing,*[2] one of the major benefits of a well-integrated office automation environment, is not being achieved.

RECOMMENDATIONS

The project makes several recommendations. First, we recommend that enhancements to ODCSPER's office automation/computing environment take place in an incremental, evolutionary manner, with experience gained from early increments influencing

[2]Cooperative processing is defined to be the staff's ability to electronically participate in the preparation and review of a document or other product.

the objectives associated with later increments. Additionally, the process of establishing ODCSPER objectives, especially long-term strategic objectives, should be approached incrementally as well, with review and adjustment of the objectives in concert with review and adjustment of the incremental, evolutionary steps.

Second, to address concerns raised in the questionnaire, we recommend three conceptual steps that, taken together, would foster a well-integrated cooperative processing environment. The first step would integrate the ODCSPER computing environment via a local area network (LAN), providing direct peer-to-peer connectivity among computer users. The second step would add centralized file managers/servers to the network, within which would be stored important documents in preparation, other important products, and databases down-loaded from the mainframes. The third step would enhance the environment by adding centralized compute servers to the network, coupled with migration from the mainframe to the servers of the electronic mail function. The electronic mail function must be compatible with the current PROFS electronic mail capability.

Placing a LAN within ODCSPER will significantly reduce the amount of PC/printer sharing that currently takes place within ODCSPER. Addition of the file servers to the LAN will promote a more integrated environment by providing centralized file maintenance and access. It will also permit the centralized down-loading from the mainframes of important databases, providing access to the databases independent of mainframe availability. It can also provide access to software that would be too expensive to provide on local PCs. Addition of the compute servers to the LAN, coupled with the migration of electronic mail and certain analysis capabilities supported today only on the mainframes, would provide more responsive access to these capabilities while further unburdening the mainframes.

ORGANIZATIONAL ISSUES

Implementing the recommendations may require some organizational changes. Centralized system administration is required to ensure proper LAN performance and to support normal server maintenance and disk file backup functions. A central organization should also be the focus for development and periodic evaluation of ODCSPER computing objectives and for the specification of standard hardware and software configurations. Newly acquired PC or Macintosh work stations should be configured to have at least the minimum hardware and software specified in the standard configuration(s).

Compatibility among standard software packages (word processing, spreadsheets, briefing graphics) is important to ensure that the packages can be employed in an integrated fashion. Further, a standard software package's graphic user interface should assist the new

user in learning how to use the package. Indeed, standard packages should be selected at least in part based on the similarities of their graphic user interfaces. Learning the first package should make it easy to learn the others.

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ODCSPER'S CURRENT COMPUTING ENVIRONMENT

We briefly describe the current ODCSPER computing environment here. (A more detailed discussion appears in Section 3 and is illustrated in Figure 3.1.) IBM and compatible PCs, some with printers directly attached, are linked directly to a suite of IBM and compatible mainframes. Some personal computers, most notably Macintoshes, are not linked to the mainframes, but rather serve as stand-alone, graphics-oriented work stations. Electronic mail, both within ODCSPER and to the outside world, is provided by the IBM mainframes, and PC users sign onto the mainframes for electronic mail. The mainframes provide access to other office automation capabilities, as well as to databases and decision support packages.

Although it is possible to transfer documents and other electronic files from one PC to another via the mainframes, the procedure is both detailed and cumbersome, with a high likelihood of error. Users generally choose not to use this capability.

The current environment includes printers that are directly attached to specific PCs. It is not possible in this environment to access a printer without utilizing the PC to which it is attached. A user whose own PC does not have an attached printer must copy the document to be printed onto a floppy disk, and seek out and possibly interrupt other users in order to gain access to a PC with a printer.

Questionnaire responses, discussed in detail in the next section, support the conclusion that the computing environment has an adverse effect on productivity. The lack of peer-to-peer connectivity (the ability to communicate electronically without mainframes) makes it impossible to engage in cooperative processing[5] and requires an undue amount of PC and printer sharing.

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[5]Cooperative processing is the staff's ability to electronically participate in the preparation and review of a document or other electronic product.

2. THE ODCSPER AUTOMATION SURVEY

The DCSPER Computing Practices Questionnaire can be found in Appendix A. This section addresses the questionnaire's contents, survey results, and conclusions drawn from those results.

SURVEY AREAS

The questionnaire addressed five broad subjects. *User characteristics* asked respondents about the kinds of computing they perform—word processing, PROFS-based[1] electronic mail, or analysis. *User sophistication* represents the authors' assessment of each respondent's computer adeptness, based on the user characteristics section. *Desktop and nearby equipment usage* examined the degree of personal computer sharing that takes place and the reasons for that sharing. *User communication* examined the degree of electronic and hard-copy communication within ODCSPER. *Problems, limitations, and desired capabilities* asked each respondent to describe in his own words the computing problems encountered with ODCSPER's computing environment and to list the capabilities not currently available that would make him more productive.

The questionnaire asked about *problems* with ODCSPER's computing environment, not what is good about it. However, it is important to keep in mind that ODCSPER has a significant computing capability. The organization enjoys access to a powerful suite of mainframe computers which, in addition to providing electronic mail and calendar coordination, also supports a wide range of analysis and database management activities. Most of the ODCSPER staff have personal computers at their desks, with sophisticated personal computer software packages. Finally, ODCSPER's IMO is staffed by knowledgeable, dedicated people eager to broaden staff skills. Therefore, although ODCSPER does have some serious computing problems, it also enjoys a solid foundation on which to build an enhanced capability.

SURVEY RESPONDENTS

A total of 329 questionnaires were distributed to all ODCSPER staff, and 174 (53 percent) were completed and returned. Table 2.1 provides details on each organization's participation. It indicates the number of questionnaires sent by grade and the number of

[1]PROFS is a mainframe-based office automation system providing electronic mail, calendar management, database, and analysis facilities.

Table 2.1

Response Profile by ODCSPER Organization

Grade	Number Sent	Number Returned	ODCSPER Organizations						
			CP	HR	MB	MP	MR	ZX	Other
Total	329	174	41	8	51	22	13	31	8
O-6/7	19	9		2	3	2		1	1
O-5	60	29	2	2	10	8	3	4	
O-4	41	26	1	2	13	3	1	3	3
O-3	13	10			3	3		4	
CW/E	31	11			2	2	1	5	1
SES	4								
GM-15	8	5	4	1					
GM-14	14	9	5		1		1	2	
GM-13	61	30	17		5	1	3	4	
GS-12	7	6	2		3			1	
GS-11	7	3			1		1	1	
GS-6/9	49	29	7	1	8	3	2	6	2
GS-4/5	15	7	3		2		1		1

NOTE: CW/E refers to warrant officers and enlisted staff.

completed questionnaires returned by both grade and ODCSPER organization. We note that, because only 53 percent of ODCSPER personnel responded to the survey, it could represent a biased sample of the ODCSPER staff. However, although no senior executive service (SES) responses were received, all officer grades and senior GS/GM civilian grades are represented, as are all ODCSPER organizations at both the civilian and officer levels.

SURVEY RESULTS

User Characteristics

This questionnaire section asked respondents to indicate the amount of time per week they spend in performing four mutually exclusive types of computing activity: PC/Macintosh word processing and other personal computer activities; PROFS-related activities, including electronic mail, calendar coordination, and decision support activities; analysis-related activities, including data analysis and modeling activities; other activities not included in the previous three, for example, dumb terminal and Display-writer work.

Table 2.2 presents the results of these responses. Respondents spend just under half their work-week time (46 percent) using the computer. Of this time, they spend almost half doing PC activities, including word processing and briefing chart construction. About a third of their computing time is spent using PROFS, the bulk of this time being spent at PROFS-based electronic mail. These figures indicate that the average respondent spends about 23 percent of his work-week time (49 percent of 46 percent) on PC/Macintosh activities and

Table 2.2

Respondent Computing Activities

Computing Activity	Percent of Time Spent
At the computer	46%
Word processing	49% of 46% (23%)
PROFS	33% of 46% (15%)
Analysis	9% of 46% (4%)
Other	9% of 46% (4%)

about 15 percent (33 percent of 46 percent) on PROFS activities. Since PROFS serves as the integrating mechanism for ODCSPER office automation, providing the only means of electronic connectivity, 15 percent is surprisingly low.

User Sophistication

Based solely on responses to the User Characteristics questionnaire section, the authors assigned to each respondent one of three user sophistication levels: low, moderate, or high. We applied the response criteria summarized in Table 2.3. We judged a respondent to be of low personal computer sophistication if his responses indicated that he uses two or fewer personal computer tools, for example, WordPerfect, FreeLance, PowerPoint, Excel, Lotus 1-2-3. A respondent was judged to be of moderate personal computer sophistication if he uses more than two personal computer tools. We judged a respondent to be of high sophistication if he uses more than two personal computer tools and performs some programming.

The distinction between low and moderate sophistication is the respondent's ability to use personal computer tools in an integrated fashion, i.e., not just using each tool independently but using the tools in concert to produce a product. For example, a user who performs some calculations in a spreadsheet and electronically *cuts and pastes* or otherwise links the results to a word processing document rather than laboriously retyping them into the document is using those two tools in an integrated fashion. Since direct querying on this

Table 2.3

Personal Computer Sophistication Levels

Sophistication Level	Response Criteria
Low	Uses two or fewer PC tools
Moderate	Uses more than two PC tools
High	Moderate PC plus programming

issue could leave room for misinterpretation, we applied the *more than two PC tool* criterion to respondents, arbitrarily assuming that a respondent who uses three or more PC tools has successfully integrated their use. Adopting this assumption has not influenced other study findings.

Respondents are considered of high sophistication if their responses indicate that they have some skill in computer programming. However, by computer programming we do not exclusively mean program development in a traditional computer programming language. Although some respondents indicated that they do indeed develop such programs, we judged other respondents to also possess programming skills—respondents doing spreadsheet-based model development, respondents engaging in model development using a mathematical programming package, respondents using a relational database management system query language to perform data analysis, or respondents using a statistical data analysis package.

Table 2.4 presents the user sophistication results. The number of respondents in each sophistication level is presented on the left of the total column, and the row percentage in each sophistication level is presented on the right.[2]

The table indicates that 38 respondents, or 22 percent, are of moderate sophistication, and 19 respondents, or 11 percent, are of high sophistication. Stated differently, one-third of the respondents are either moderate or high. This is one reason why we stated, at the beginning of this section, that ODCSPER already has a solid computing foundation.

Looking at GM-13/15, 36 out of 44 respondents (82 percent) are categorized as low and none are categorized as high. Combining O-4/7 respondents, 43 out of 64 (67 percent) are categorized as low and 8 (13 percent) are categorized as high. We are concerned about the small percentage of senior management in the high category, and in particular about whether their subordinates are receiving sufficient incentive to broaden their computing skills.

Equipment Usage

This questionnaire section examines the degree of personal computer sharing that takes place among ODCSPER staff and the reasons for the sharing that does take place. Table 2.5 presents the results. The table's left-hand side indicates the number of

[2]Percentages are supplied for each pay grade to more easily reflect the distribution of respondents. For those pay grade entries having small numbers of respondents (where the sampling error is necessarily large), we strongly discourage the comparison of entries. For example, to be statistically different the percentages for two pay grades of sample sizes 15–20 each would have to differ by at least 30 points. The required difference would be about 50 points for sample sizes of 5–10 each.

Table 2.4

Respondent Personal Computer Sophistication

Grade	No. of Respondents			Total	Percent		
	Low	Moderate	High		Low	Moderate	High
Total	117	38	19	174	67	22	11
O-6/7	6	2	1	9	67	22	11
O-5	19	6	4	29	65	21	14
O-4	18	5	3	26	69	19	12
O-3	3	3	4	10	30	30	40
CW/E	7	3	1	11	64	27	9
GM-14/15	11	3		14	79	21	
GM-13	25	5		30	83	17	
GS-12	3	2	1	6	50	33	17
GS-11	3			3	100		
GS-9	4	1	2	7	57	14	29
GS-8	2	2		4	50	50	
GS-7	7	3	1	11	64	27	9
GS-6	3	2	1	6	50	33	17
GS-5	6	1		7	86	14	
GS-4			1	1			100

Table 2.5

Desktop and Nearby Equipment Usage

Usage	No. of Respondents				Percent			
	Dumb Terminal	PC	Mac	Nothing	Dumb Terminal	PC	Mac	Nothing
At desk	34	128	5	16	20	74	3	9
Shares with others	9	52	3		26	41	60	
Also uses:								
Nearby PC	17	42	2	13	50	33	40	81
Nearby Mac	3	21	1	4	9	16	20	25
Nearby printer	18	81	3	11	53	63	60	69

respondents in the indicated category, and the right-hand side indicates the relevant percentages.[3] For example, 128 respondents (74 percent of the 174 respondents) have PCs at their desks, and 52 of these people (41 percent of the 128) must share their desktop PCs with others. Furthermore, 42 of the 128 (33 percent) must use a nearby PC, 21 of the 128 (16 percent) must use a nearby Macintosh, and 81 of the 128 (63 percent) must use a nearby printer that is not directly attached to the desktop PC. The total number of respondents on

[3]Table 2.5's percentage segment can be confusing because the percentages on the top line are based on 174 total respondents, while those on subsequent lines use the top line number as the basis. Looking at the PC columns, the top line 74 percent reflects 128 out of 174 total responses, while the second line's 41 percent reflects 52 out of 128 responses.

the table's top line adds to more than 174 because some respondents have more than one desktop work station.

One point to note is the presence of a PC on three-fourths of the respondents' desks. This is a fairly high percentage. However, almost half of these respondents (41 percent of the 128) must share their desktop PCs with others. Furthermore, fully one third of these respondents must also use a nearby PC and almost two-thirds must use a nearby printer, which itself implies use of a nearby PC. Why all this sharing? Some of the reasons mentioned: obsolete PC, obsolete software, software not available on desktop PC, insufficient memory, and insufficient disk space.

Electronic and Hard-Copy Communication

This questionnaire section examined the degree to which respondents use PROFS' electronic mail capabilities, other forms of electronic communication, and hard-copy communication. It asked about communications that remain totally within ODCSPER (I→I or Inside to Inside), those that originate from outside of ODCSPER (O→I or Outside to Inside), and those that originate from within ODCSPER but have an outside destination (I→O or Inside to Outside). Each respondent was asked to list the types of electronic and hard-copy reports and other communication he receives or originates and the frequency, for example, "I send and receive electronic mail on a daily basis;" "I receive a finance tape from — on a monthly basis;" "I create the following hard-copy report on a weekly basis." Table 2.6 indicates the frequency values assigned to communications received once a day, once a week, once every two weeks, or once a month.

Tables 2.7 and 2.8 summarize questionnaire results for electronic and hard-copy communications. Each table has two side-by-side segments separated by a double vertical line. The first is the average frequency of the indicated type of communication, and the second is the percentage of respondents engaging in that type of communication. For example, for electronic communication that takes place totally within ODCSPER (the I→I entries in Table 2.7) its average frequency is 1.3, and 45 percent of the respondents engage in it.[4] The *percent of respondent* categories are not mutually exclusive. For example, some of the 45 percent who utilize electronic mail totally within ODCSPER (the I→I entries) may also be part of the 30 percent who receive electronic mail from the outside (O→I) and may

[4]An average frequency of 1.3 means that, for those respondents that engage in electronic communication totally within ODCSPER, each uses it somewhere between once a day and once a week. Note that lower average frequency implies more frequent use of the communication type; for example, once a day is more frequent than once a week, and the associated frequencies are 1 and 2.

Table 2.6

Frequency Legend

Value	Message Frequency
1	Once per day or more frequently
2	Once per week
3	Every other week
4	Once per month

Table 2.7

Respondent Electronic Communication

	Average Frequency		Percent of Respondents	
	Message Origin		Message Origin	
Message Destination	Outside DCSPER	Inside DCSPER	Outside DCSPER	Inside DCSPER
Outside DCSPER		I→O 1.3		I→O 17%
Inside DCSPER	O→I 1.6	I→I 1.3	O→I 30%	I→I 45%

Table 2.8

Respondent Hard-Copy Communication

	Average Frequency		Percent of Respondents	
	Message Origin		Message Origin	
Message Destination	Outside DCSPER	Inside DCSPER	Outside DCSPER	Inside DCSPER
Outside DCSPER		I→O 2.0		I→O 20%
Inside DCSPER	O→I 2.9	I→I 1.9	O→I 20%	I→I 16%

further be part of the 17 percent who send electronic mail to recipients outside of ODCSPER (I→O). The same is true for those engaging in hard-copy communication.

We see that most electronic communication occurs more frequently than does hard-copy communication, somewhere between once a day and once a week. Hard-copy communication occurs somewhere between once a week and once every two weeks. Further, a higher percentage of respondents engage in electronic than in hard-copy communication. Electronic mail is the most common form of electronic communication. Other forms include

computerized files transmitted on tape or floppy disk. In addition to hard-copy reports and documents, hard-copy communication includes electronic communication that recipients choose to process in hard-copy form.[5]

What is surprising is the relatively low percentage of respondents, 45 percent, who engage in electronic communication that remains totally within ODCSPER. Given the availability of PROFS electronic mail and calendar coordination, we expected this percentage to be much higher. We see this as a strong indicator of respondents' negative feelings about the utility and availability of PROFS-based electronic mail.[6]

Computing Environment Problems

This questionnaire section asked respondents to describe in their own words "the problems/limitations presented by the current computing environment. Describe computing capabilities, not currently available, that would make your job easier." We selected seven categories of problems from the responses. See the left-most column of Table 2.9. The table's right-most column indicates the types of comment associated with each categorization.

The top three categories, with at least one out of four respondents commenting on each, refer to work stations, software, and printers. Respondents with desktop PCs must use other PCs because software and printers are unavailable, PCs are obsolete and cannot run current software versions, or analyst PCs are incompatible with secretarial PCs.

The fourth category, which relates to PROFS and Forecast, finds almost one out of five respondents commenting on PROFS unavailability and slow response time. Some respondents were quite vocal in their comments, not only noting that it takes a long time to log onto PROFS but also that the user interface is very cumbersome. They also noted that PROFS is frequently unavailable because the mainframes have been preempted for higher-priority processing. We believe that PROFS performance contributes to the low intra-ODCSPER electronic communication percentage (45 percent) shown in Table 2.7.

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[5]The frequency data associated with electronic communication is unimodal, with the peak at the daily (frequency of 1) point. For hard-copy communication the frequency data is bimodal, concentrating at the daily and monthly points—frequencies of 1 and 4, respectively. Complete electronic and hard-copy bar charts of frequency data are included in Appendix B.

[6]The 45 percent figure is surprising for another reason as well. A recent RAND office automation utilization study found that, while 75 percent of electronic message traffic was generated by only 25 percent of the network users, virtually *all* users engaged in electronic communication to some extent. The network architecture being studied was similar to that which we recommend in Sec. 3. See T. K. Bikson, J. D. Goodchilds, L. Huddy, J. D. Eveland, and S. K. Schneider, *Networked Information Technology and the Transition to Retirement: A Field Experiment*, RAND, R-3690-MF, 1991.

Table 2.9

Problem Categorization and Associated Comments

Problem Category	Percent Responding	Associated Narrative Comment
Work-station-related	30	Sharing work stations Obsolete work stations Incompatible work stations
Software-related	28	Software unavailable on desktop PC
Printer-related	24	Printer unavailable on desktop PC
PROFS/Forecast-related	17	PROFS unavailable Slow response time
LAN-related	16	Unable to electronically coordinate work
Memory (RAM) related	10	Insufficient memory on PC
Disk-related	7	Insufficient disk storage on PC

NOTE: LAN = local area network; RAM = random access memory.

CONCLUSIONS

The questionnaire results lead to several conclusions. First, the degree of personal computer sharing means that ODCSPER staff are doing a lot of walking to get to personal computers that have needed capabilities. This also means that other ODCSPER staff are interrupted by those needing personal computers or printers. This has to result in degraded productivity. Certainly some personal computer sharing should be expected in an organization, but not the degree of sharing reported in Table 2.5.

Second, and related to the above point, a substantial portion of the personal computer sharing results from obsolete equipment, lack of appropriately configured equipment, or lack of appropriate software on the desktop PC. Addressing this issue means committing the funds on a regular basis to keep ODCSPER relatively current at the personal computer hardware and software levels. The cost of not addressing the issue is continued productivity degradation.

The survey has illuminated another issue that seriously degrades staff effectiveness. ODCSPER's connectivity is supplied by PROFS, a mainframe-based office automation system. PROFS provides electronic mail, calendar coordination, decision support, and database management on IBM-like mainframe computers. Questionnaire responses indicate that PROFS suffers from poor availability, poor response time, and a cumbersome interface. As a result, more than half of the respondents choose not to utilize PROFS to communicate within ODCSPER.

Yet, even if the entire staff utilized PROFS, it still suffers a serious deficiency. One of the advantages of an effective office automation system is its ability to support cooperative

processing, whereby multiple developers of the same product can electronically collaborate their activities—for example, working from the same electronic version of a document in preparation rather than multiple hard-copy versions. Because of the cumbersome and detailed protocols needed to up- and down-load files between PCs and PROFS, and further because of PROFS' uncertain availability, PROFS does not readily permit this electronic coordination.

3. AUTOMATION ENHANCEMENTS

Because ODCSPER already has a functioning computing environment, representing significant capital and human investment, we suggest an evolutionary, incremental approach to enhance that environment and address questionnaire concerns. The suggestions are presented in three parts. First, we suggest a way to think about automation objectives and propose some initial objectives. Next we suggest specific architectural enhancements that we believe will improve the ODCSPER automation environment. Finally, we examine organizational issues that must be addressed if an evolutionary, incremental approach is to succeed.

AUTOMATION OBJECTIVES

Automation objectives are needed to judge the worthiness of architecture enhancements. But establishing these objectives should not be viewed as a one-time endeavor. Rather, the objectives *and* the architecture should be developed in an evolutionary manner, with regular and systematic objective and architecture evaluation that considers recent advances in computing technology. The state of personal computing continues to change as new software tools and capabilities are brought to the market. These tools can significantly enhance staff productivity. For example, they can reduce the time it takes to develop a product, such as taking advantage of integrated graphics and word processing to more rapidly produce a document. In addition, the tools can make it possible to enhance the product's quality and scope, perhaps taking advantage of new analysis capability not previously available. Further, the technology that helps to electronically integrate an organization is also undergoing rapid evolution. This technology serves to enhance an organization's ability to engage in cooperative processing, contributing to reduced product development time and enhanced quality. Because of the rapidly advancing state of the art, we suggest regular and systematic review of automation objectives.

What should the objectives be? They should at the very least be tailored to the needs of the organization. This presents another reason for the regular and systematic review of automation objectives. An organization inexperienced with current technology will probably not be able in advance to evaluate the utility of that technology. To be able to conduct such a technology evaluation the organization needs experience using it. The organization should therefore stand ready to encourage preliminary use of new technologies, for example, new

software tools, especially where the buy-in cost is low. However, such use should be managed in a systematic manner and not left solely to the staff's discretion.

Some Suggested Objectives

With this preface, we suggest the following as a minimal set of office automation objectives:

- Reduce paper flow within ODCSPER
- Reduce paper flow into and out of ODCSPER
- Reduce *people* flow
- Improve graphic quality
- Improve document processing/coordination
  - — Electronic tracking versus hard-copy tracking
  - — More complete and accessible historical record
- Improve ODCSPER product
  - — Timeliness
  - — Quality
  - — Coordination.

Reducing paper flow within ODCSPER addresses the finding in Table 2.7 that only 45 percent of the respondents use electronic communication for communication that stays totally within ODCSPER. Improving this can occur, not by edict, but rather by enhancing the current computing environment to make such communication easier to accomplish. Because this communication takes place totally within ODCSPER, environment enhancement is totally within the organization's purview.

Reducing paper flow into and out of ODCSPER, because the communication depends on the action of outside players, is not totally within the organization's control. However, care in promoting the first objective can help promote the second. The approach taken to improve electronic communication within ODCSPER should be compatible with mechanisms that link ODCSPER electronically to the outside world.

Reducing *people* flow simply means reducing the need for ODCSPER staff to share PCs. Three out of four staff have a PC at their desktops, but one out of these three must use a nearby PC and almost two out of these three must use a nearby printer (see Table 2.5). Correcting the first part of this situation—reducing the need to share PCs—can be accomplished by replacing obsolete equipment, upgrading existing equipment by adding

memory and/or disk space, and with upgrade or acquisition of software. Correcting the second part—reducing the need to walk to nearby printers—can be accomplished with improved integration of the computing environment.

Setting improved graphic quality as an objective should not be seen as a criticism of the organization's current personal computing practices. A number of respondents are already taking advantage of graphics-based tools—FreeLance, Harvard Graphics, and PowerPoint. The intent in suggesting this objective is to encourage systematic evaluation of new graphics-based capability for incorporation as part of ODCSPER's computing capability.

Setting improved document processing/coordination as an objective is an attempt to further capitalize on the first three objectives. A more electronically integrated environment is a necessary but not sufficient condition to improving document processing/coordination. Other enhancements are also needed.

Finally, satisfying the final objective, improving the ODCSPER product, is promoted by satisfying the first five. It is included to recognize that this is the ultimate objective. All proposed enhancements to the ODCSPER computing environment should be measured against this final objective. Further, we believe that it is not enough to "tinker at the margin" of ODCSPER's existing capability. Achieving the six objectives requires some fundamental enhancements to the current computing environment.

ARCHITECTURE ENHANCEMENTS

With the above objectives in mind, we suggest an incremental, evolutionary approach to enhancing ODCSPER's computing environment. The current environment, which was briefly described in the first section, is illustrated in Figure 3.1. The suite of IBM and compatible mainframes forms the center of the environment, providing connectivity for primarily IBM and IBM-compatible personal computers. The mainframe supports electronic mail within ODCSPER, and it provides an electronic mail link to the outside world as well. Through this link it is possible to engage in electronic dialogue with other Army and non-Army organizations, including RAND. The architecture also supports calendar coordination among ODCSPER staff. It additionally serves as a platform for database management and decision support; for example, the Notional Force Model can be accessed via PROFS.[1]

Users interact with PROFS by logging directly into it. This can be done from those PCs that are directly connected to PROFS (most within ODCSPER are so connected) or via dumb terminals. It is through this PROFS interface that users can compose and read

[1]See, for example, General Research Corporation, *Personnel Authorizations Module (PAM) Total Army Analysis (TAA3) User's Guide,* August 1990.

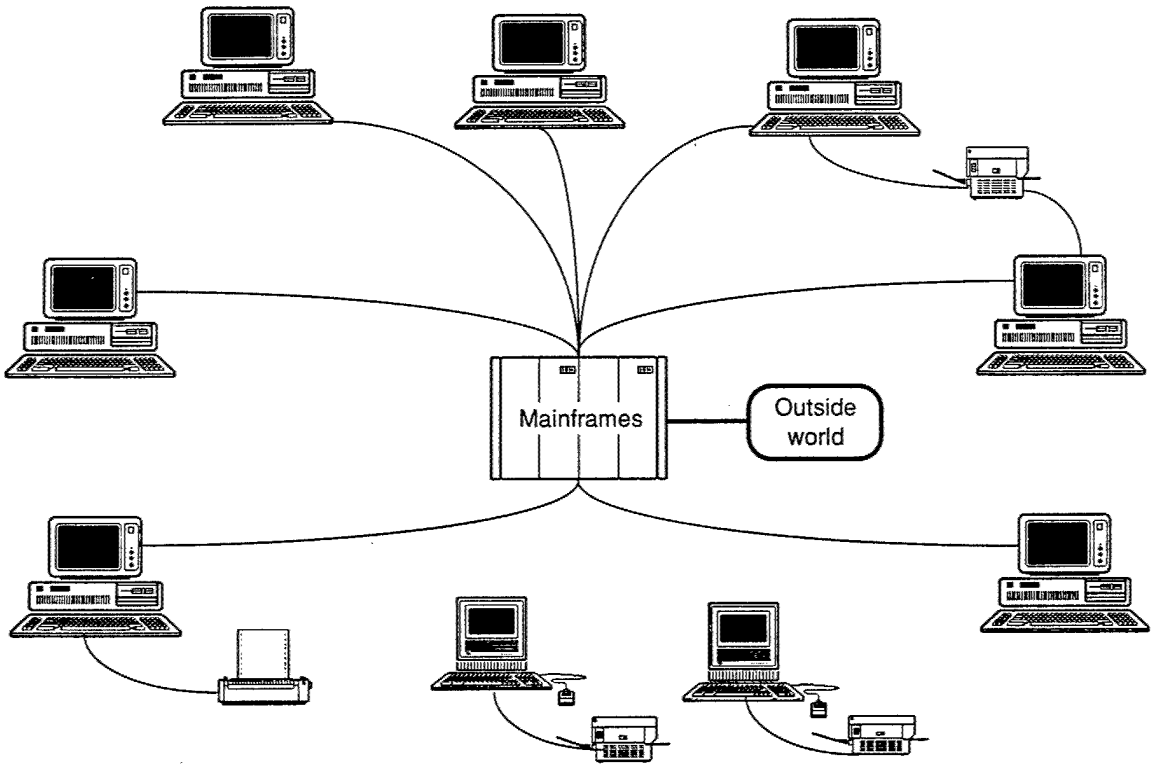

Figure 3.1—Current Computing Architecture

electronic mail and access database management and decision support capabilities. File up-load and down-load are possible between the user PCs and PROFS, but the procedure is both detailed and cumbersome, with a high likelihood of error. Since document processing takes place at PCs rather than via PROFS, and since PROFS is the only connectivity vehicle in the current computing architecture, users generally refrain from engaging in electronic document coordination.

Printers, both impact and laser, are available in the current computing environment, but only via the PCs. Some PCs share printers, but access to a printer requires the user to be at a PC that is directly connected to that printer. This means that a person whose PC is not directly connected to a printer must copy his document onto a floppy disk and look for a PC with an attached printer in order to generate hard copy. Thus the user can neither easily transfer a document electronically to another person nor easily print his document at his desktop PC. The solution is not more printers; it is better connectivity to permit electronic document transfer and direct access to printers.[2]

[2]A user can give his floppy disk to a colleague and thereby effect electronic document transfer. However, once the floppy is transferred the user loses control over it. Better connectivity will not solve

Some ODCSPER staff members have Macintosh work stations on their desks. These usually have laser printers attached to them. With rare exceptions, no Macintosh work stations are connected to PROFS, even though modestly priced hardware is available to support this connectivity.

An Initial Enhancement: Improved Connectivity

A local area network (LAN) is required to address the problems inherent in the current computing architecture. Figure 3.2 illustrates how such a network might fit into the current environment. In the figure, all PCs, Macintoshes, and laser printers are connected directly to the network.

The local area network would provide connectivity independent of PROFS. All printers would be accessible from all work stations,[3] thereby allowing individuals to print products without leaving their desks. This would reduce the amount of searching an

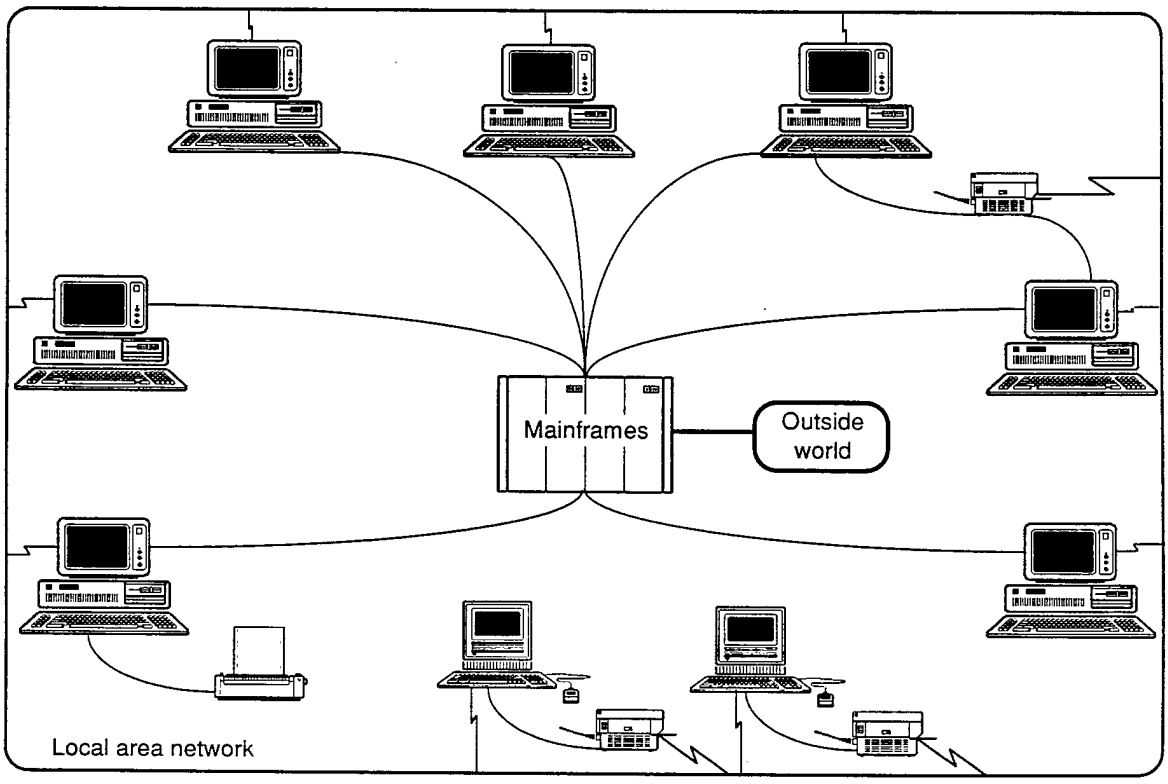

Figure 3.2—Adding a Local Area Network

this problem, since the transfer of a document over a network is just like its transfer via floppy. An additional enhancement is needed, which we suggest in the discussion of file servers.

[3]We use the term *work station* to include PCs, Macintoshes, and *servers,* which will be introduced in the next subsection.

individual would have to do to print a product, and it would also reduce the amount of "colleague with a printer" interruption that now takes place. Electronic file transfer would also be possible, allowing for multiple users to have multiple copies of the same product.

Addition of a LAN can result in a reduced demand for printers. That is why, in Figure 3.2, we connect only laser printers to the network. The availability of a few LAN-accessible high-quality laser printers at various ODCSPER locations (not tied to specific work stations) should result in higher printer utilization and lower printer acquisition cost.[4]

An Additional Enhancement: Centralized File Management

Although a LAN improves printer accessibility and provides a framework within which electronic document transfer can take place, it does not address other concerns. PROFS still handles electronic mail and calendar coordination and supports database management and decision support access. PROFS' cumbersome interface, poor response time, and unpredictable availability remain concerns.

Three enhancements can address these concerns. Their primary goal is to unburden PROFS and the mainframes of tasks better performed on other platforms, leaving the mainframes free to support those requirements for which they are uniquely suited. This would improve mainframe response time and reduce the negative impact of mainframe preemption.

The first enhancement, illustrated in Figure 3.3, is the addition of transparently accessible centralized file management—file servers—to the LAN.[5] Centralized file management provides several useful capabilities. First, the file server can serve as a vehicle for document coordination. A "master" draft would reside on the file server, and a staff member working on it could "check out" a copy, make revisions thereto, and then check it back in. The individual with primary responsibility could then review all returned copies,

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[4]For example, when RAND began to acquire personal computers, before their connection to a LAN, each acquisition included a printer. Today RAND has four geographically dispersed locations, three in Santa Monica and one in Washington, D.C. All locations are linked via a "local" area network, and 50 laser printers support approximately 1000 work stations. Today's users neither need nor want their own personal printers. Timeliness and print quality are high, as is user satisfaction. Because all the locations are linked by network, an individual in Santa Monica can print in Washington or one of the other Santa Monica locations just as easily as he can print locally. This has proven very useful when documents need to be distributed in hard-copy form quickly.

[5]*Transparently accessible* means that an individual can access files on the file server as easily as he can access files that reside on his local work station, that is, without needing knowledge of the computer system on which the file resides, only its name. In the PC world, the files would be accessible when the user defines another PC disk volume that "points" to the central files, for example, the K:\ volume. In the Macintosh world, the files would be accessible as another volume on the Macintosh's desktop, with the user needing only to "point and click" on the volume to access its contents.

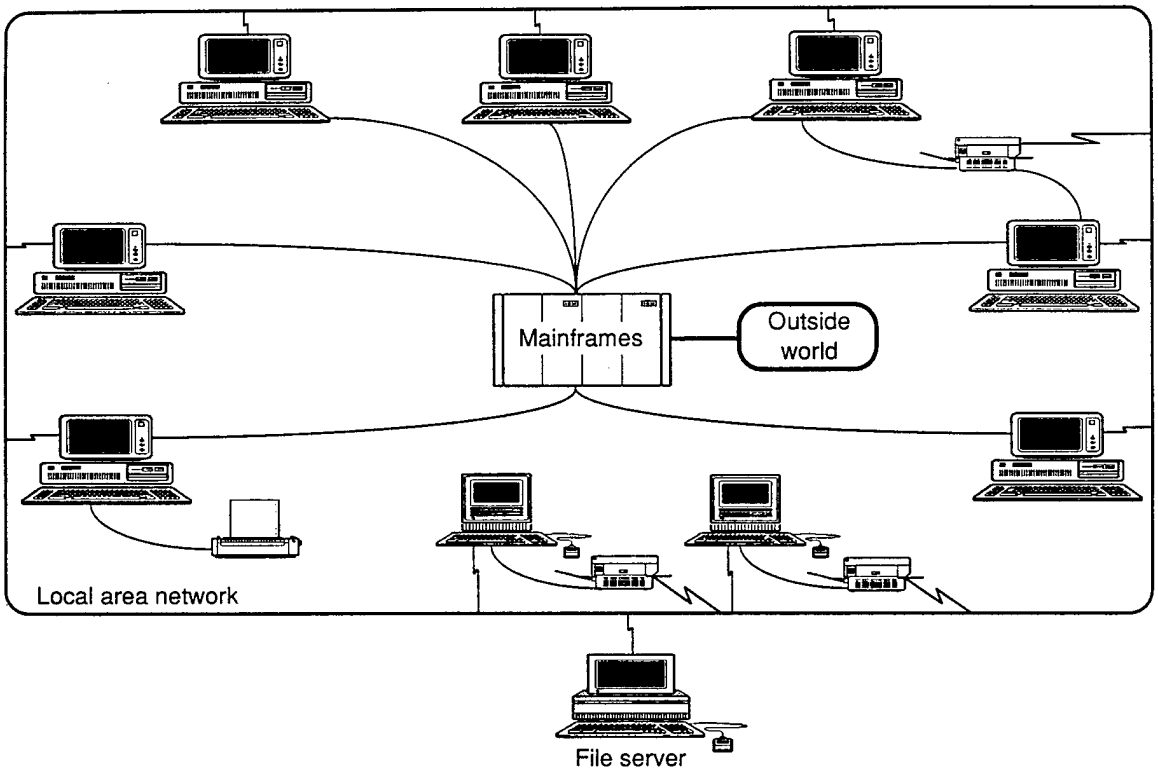

Figure 3.3—Adding Centralized File Management

incorporating appropriate revisions into a final product.[6] This individual would still need to review submitted comments, but the file server's coordination software would help him by indicating the staff members to whom copies have been checked, and by highlighting the revisions suggested by those staff members.

Another useful capability is the file server's ability to serve as a central repository for important documents, for example, all personnel-related Army regulations. Instead of having multiple hard-copy versions of a document, with some copies possibly being obsolete, the file server can provide timely electronic access to the latest version. If a hard-copy version is needed, the individual that needs it can print it. In most instances, however, we

[6]If the file server is a UNIX system, powerful and user-friendly library software, *Revision Control System* or *RCS,* is available. This software, originally intended as a software configuration management tool, has proven useful in monitoring the preparation of documents that require multiple contributors. It also provides a useful audit trail of when and by whom a document has undergone revision.

expect the demand for hard copy to decrease, thereby reducing the amount of paper required.[7]

Another useful capability helps to relieve the mainframe of some database management load. The file server can serve as a repository for frequently accessed databases, those that currently reside on the mainframes and others that may not. As it happens, many ODCSPER staff already choose to down-load database segments from the mainframes to their personal work stations so they can have immediate access to them in a user-friendly setting. This means that multiple copies of databases may reside on many work stations, with no configuration control of those copies (some of those copies may be out of date, even though the mainframe copy is current). Placing those databases on the file server reduces the need for locally resident copies. Proper file server system administration also ensures that the databases are current.

We do not advocate that databases that reside on the mainframe be removed. We suggest that the system administrator be responsible for down-loading relevant segments to the file server, with access via the file server instead of the mainframe.[8] This should also result in improved mainframe response time for the capabilities it continues to support.

Another useful benefit of having LAN-accessible centralized file management is the user's ability to use his work-station-based software on the centralized files. For example, users can place database query results in a spreadsheet, thereby permitting use of the spreadsheet's arithmetic and graphics features. Other PC tools can be applied as well. These tools are generally more user-friendly and robust than tools found on the mainframes, and their integrated use with centrally maintained and LAN-accessible documents/databases can enhance the staff's work quality and productivity. Indeed, many of these PC-based tools are not available on the mainframe.

A final benefit derives from the ability to share expensive software. For example, many ODCSPER staff members might find a statistical analysis package to be useful. Although PC-based versions of the package are available, they are probably somewhat costly and of more limited capability than their server counterparts. We might find a large number of these packages resident on staff members' individual PCs. With a centrally managed file

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[7]It is important to keep in mind that a centralized repository of important documents requires at least two things. First, the documents must be placed in electronic form, preferably in a manner that permits text processing of the documents. Second, effective management of this electronic library is also required. We'll say more about this management function at the end of this section.

[8]The system administrator should not be required to manually down-load database segments from the mainframe. Rather, he should administer specific software that automatically down-loads database segments. This software might run periodically, perhaps once per week. Or it might detect when data within a mainframe-resident database change, thereby triggering the down-load process.

server, it would be possible to acquire a more powerful version of the same package that can be used by all ODCSPER staff. The need for individual PC-based packages would diminish, and the staff would have access to the more powerful, server-based capabilities. Just as the addition of a LAN would reduce demand for printers while simultaneously providing more readily accessible and higher-quality printing, the addition of a file server can reduce the demand for some classes of PC-based software while simultaneously providing broader access to more powerful, server-based capability.

Another Enhancement: Adding Network-Accessible Computing Capability

Figure 3.4 illustrates an additional enhancement that also reduces mainframe load and improves the ODCSPER computing environment. The figure shows the addition of a *compute* server to the LAN, that is, more powerful LAN-accessible computing capability.

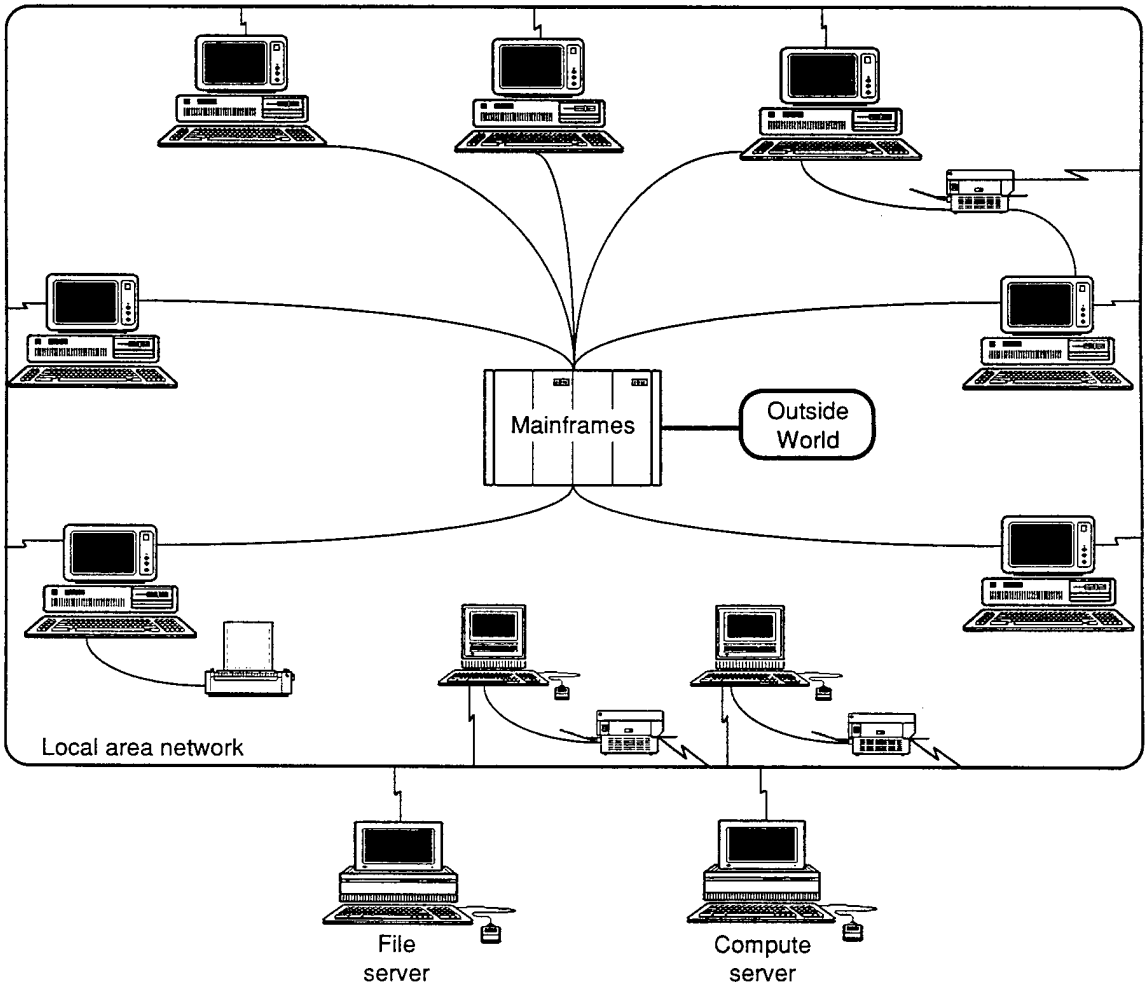

Figure 3.4—Adding Local Computing Capability

This too is desirable for reasons similar to those for file servers. First, LAN-based computing capability means that ODCSPER staff can develop and utilize models in a nonmainframe setting, without concern that the modeling platform will be preempted for higher-priority processing. Second, just as PC-based software can be used in an integrated fashion with file server applications, it can be used with compute server applications as well. The ability to work in an integrated fashion, using PC-based tools in tandem with server-based models, provides robust, productivity-enhancing analysis capability unavailable on the mainframes. Third, there is also the opportunity to acquire server-based analysis software, for example, mathematical programming software, unavailable on the mainframe, that is either unavailable at the PC level or of limited utility because of PC performance limitations. Finally, moving model development and utilization off the mainframes will reduce mainframe load, thereby improving mainframe responsiveness for those tasks the mainframes can do best.

The mainframes already provide access to important models. We do not suggest the automatic reimplementation of these models on LAN-accessible compute servers. However, if ODCSPER decides to develop a new modeling capability, or if the decision is made to replace a mainframe model with a another "new and improved" model, we strongly suggest that the compute server be considered as the new model's home. The ability to use the model and PC-based tools in an integrated environment can enhance analysis quality and timeliness.

A Final Enhancement: Electronic Mail Migration

PROFS currently provides ODCSPER's electronic mail capability, both within ODCSPER and to/from the outside world. To use electronic mail, an individual must log onto PROFS directly and engage in PROFS' menu-driven dialogue in order to compose, receive, send, and save his mail. In this environment, it is not impossible for an individual to include a PC-created document as part of an electronic message. However, because the mechanism for doing so is cumbersome and detailed, staff members choose not to use it. Additionally, PROFS' poor response time and unpredictable availability have led many ODCSPER staff members to avoid its use (see Table 2.7).

For these reasons, we suggest that electronic mail migrate away from PROFS. Figure 3.5 illustrates how this might be accomplished. In the figure, the LAN is connected to the outside world, a linkage that can be accomplished today with off-the-shelf hardware and software. Because PROFS also connects to the outside world, ODCSPER staff would be able

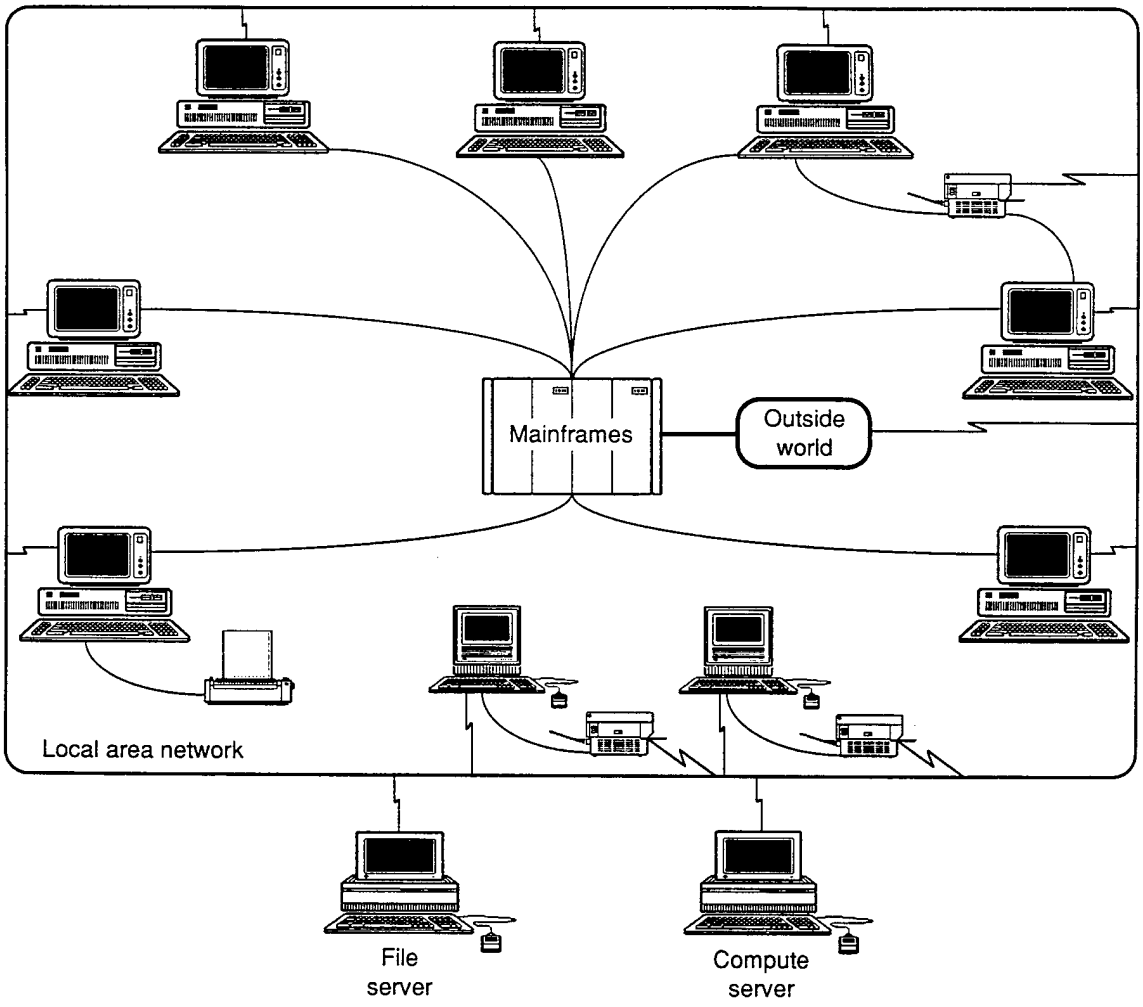

Figure 3.5—Adding PROFS-Compatible Electronic Mail

to communicate with other Army organizations that utilize PROFS exclusively for electronic mail.[9]

Commercial LAN-based electronic mail packages are available. However, an important feature of any selected package must be its ability to link to the Defense Data Network (DDN)/Internet and thereby provide connectivity to other Army and "outside world" electronic mail systems. It would be undesirable to implement a LAN-based electronic mail system within ODCSPER that does not have such connectivity.[10]

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[9]Connecting to the outside world can be accomplished by making the LAN a node on the DDN/Internet. The mainframes/PROFS are already so connected, and ODCSPER LAN users would be able to communicate electronically with other PROFS users via the DDN/Internet.

[10]Promoting computer security and virus protection argues for a dedicated electronic mail server, where all electronic mail must pass through that server to other ODCSPER work stations. Such

Overall Benefits

How do the suggested enhancements help promote the objectives presented at the beginning of this section? Paper flow within ODCSPER is reduced by providing LAN-based connectivity, file servers, and convenient electronic mail. Paper flow into and out of ODCSPER can also be reduced by providing the same convenient electronic mail linkage to the outside world. *People* flow is reduced because printers are directly accessible to all work stations, while LAN-based connectivity and electronic mail provide a solid foundation for document coordination and cooperative processing. Graphic quality can be improved through the integrated use of PC and Macintosh tools, coupled with the LAN-based access to databases and models that reside on the file/compute server(s).

Document processing and coordination can be improved because: (1) LAN-based connectivity provides the foundation for convenient electronic transfer of documents; (2) the file/compute server(s) provide the centralized storage medium, and (3) LAN-based electronic mail provides the vehicle for document distribution. If the server also provides a configuration management system, then an audit trail of all document modifications and participants therein can be created and maintained. The net result is a computing environment that is more user-friendly, accessible, and supportive of the ODCSPER staff members' needs.

The environment affords another important benefit: adaptability. The basic LAN architecture we suggest can be tailored to meet changing organization needs. If, for example, an analysis requirement emerges that requires more computing power than either the mainframes or the existing servers can supply, other computing servers can be added to the LAN, fitting into the environment with relative ease. If the requirement is short-lived, the servers might be borrowed or leased, being returned when the analysis is complete. Similarly, additional PCs and Macintoshes can be easily added to the network as new work stations are acquired. Further, gateways to other LANs can be created if the need arises.[11]

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a server would act as a fire wall, ensuring that network-proliferated computer viruses cannot infect work stations on the ODCSPER side of the mail server. We have chosen not to include this as a formal option because it is inconsistent with the evolutionary, incremental approach we've taken. PROFS is used by other Army organizations, both within and outside the Pentagon, not all of whom are connected to the Internet. Severing the ODCSPER PROFS network mail link would remove ODCSPER's ability to communicate electronically with those organizations.

[11]In this context a *gateway* is a hardware device that permits the connection of separate LANs, either in the same location, such as the Pentagon, or at geographically dispersed locations. RAND, for example, has four geographically dispersed locations, each with its own local area network. Yet gateways exist that connect all of them, giving a user at any location complete, almost transparent access to the capabilities of all the networks.

ORGANIZATIONAL ISSUES

Earlier in this section we stated that the establishment of automation objectives should not be viewed as a one-time endeavor. Rather, the objectives and the architecture should be developed in an evolutionary manner, with periodic and systematic evaluation of both. We then recommended several enhancements to the current computing environment to deal with concerns raised by the questionnaire. This subsection suggests some organizational issues to consider in implementing those recommendations and in conducting the ongoing evaluation. The issues involve computer system administration, technology assessment, and incentives. Given IMO's current charter and staff expertise, we believe these additional issues are best treated within that organization.

Centralized Computer System Administration

Implementing the recommended enhancements is not just a matter of LAN, server, and other hardware/software acquisition. Ongoing centralized oversight and administration are needed for three reasons. First, the local area network itself requires oversight. For example, network traffic levels should be monitored to ensure that the LAN has sufficient capacity to handle current and projected load, and that network hardware problems do not degrade LAN performance. Further, evaluation of competing LAN technologies can best be accomplished centrally, where cost/performance trade-offs can be evaluated systematically and consistently.

Second, servers and their generally accessible disks require central system administration. Disks require regular backup to ensure data integrity against hardware malfunctions and user error. The servers themselves require periodic attention to deal with system or hardware problems. Databases and other important files (databases down-loaded from the mainframes, important Army regulations) require periodic attention to ensure that they are current.

Third, the evaluation of software and hardware requested by non-IMO ODCSPER organizations can best be administered centrally by experts. Central management need not personally evaluate new software or hardware capabilities. The organization requesting a new capability can serve this function. The central management's role would be to (1) acquire the capability, (2) ensure that it is evaluated systematically and consistently by the requesting organization, (3) build an archive of such evaluations for use when other organizations require similar capability, and (4) encourage compatibility and standardization among ODCSPER directorates.

Technology Assessment and Objectives Evaluation

Just as we believe that IMO should serve as the central system administration/ management organization, we also believe that IMO should take the lead in establishing and periodically evaluating ODCSPER office automation objectives. Further, and related to this, we believe that IMO should be proactive in evaluating new hardware and software technologies to determine if they contribute to achieving those objectives.[12] IMO should not wait for another organization to make the request but should work to stay out in front on the technology side to identify and make available new productivity-enhancing technology.

Evaluating new technology should be done within the context of ODCSPER office automation objectives. Some questions to consider are: How does the new technology improve the organization's ability to achieve the objectives? Are the new technology's acquisition and training costs sufficiently offset by the improved capability? Is there upward compatibility between what ODCSPER currently utilizes and the new capability?

Incentives

A number of respondents commented on the need for hardware and software standards[13] as well as training. Although standards exist within ODCSPER, there appear to be no incentives for ODCSPER staff to adopt them. Further, formal training is performed by a non-ODCSPER organization and can prove difficult to attend.[14] We therefore suggest the creation of a formal in-house training program, administered by IMO, but only for standard software packages. Instructors could also serve as consultants, helping staff members solve problems associated with the use of a specific package.

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[12]This is not to imply that IMO does not already evaluate new technologies. Indeed, during the conduct of this study, senior IMO staff were evaluating a newly available PC window environment as well as the word processing and graphics tools which operate within that environment. Additionally, IMO was in the process of acquiring an ethernet local area network for one directorate and a token ring local area network for a second directorate, the intent being to evaluate their suitability as an ODCSPER-wide LAN.

[13]By *hardware standards* we mean a list of standard hardware configurations. For example, a secretarial configuration might include the specification of personal computer type, e.g., 386-class PC; monitor type; amount of memory; amount of hard disk space; number and types of peripheral devices, e.g., floppy disk or diskette; communications requirements, e.g., a communications card to permit connection to PROFS, connection to the LAN. By *software standards* we mean a list of recommended software products organized along types of function. Functions might include word processing, briefing graphics, more sophisticated graphics, spreadsheet, statistical package, and optimization package. Hardware and software standards should be tied together. For example, a secretarial configuration should include the minimum set of necessary hardware and software. Acquisition should include both the hardware and software to achieve this minimum configuration.

[14]Among the responses noting training problems, one indicated that the respondent had been "canceled from more training classes than I've taken."

An in-house training capability has several benefits. First, it provides a vehicle for IMO staff to become expert in the use of the standard software. Second, it provides positive incentive for ODCSPER staff to use the standard software rather than other packages for which training and consulting services are not available.[15] Third, as ODCSPER staff become familiar with the standard software, informal peer assistance can have a high payoff; five minutes of advice from an office mate can save hours of documentation reading.

Establishing and reviewing software standards should consider four issues. First, it should be easy to start using specific software packages. The software should have a friendly graphic user interface as well as easy-to-understand on-line assistance. A new user should be able to get started and produce a reasonable product without having to read much documentation.

Second, within a standard configuration the software should be compatible. It makes no sense to have spreadsheet or graphics software whose products cannot be integrated with the word processing software. Compatibility is more than the ability to *cut and paste* from one application to another. It also includes graphic user interface compatibility—learning how to use one software package should make it easier to learn how to use the others.

Third, across standard configurations the software should be compatible. A secretary, for example, should be able to work with a product developed on an analyst's or administrator's work station, be it a spreadsheet, graphics, or a word processing product.

Finally, in evaluating new software for inclusion in the standard set, that software's compatibility with existing standard software must be considered. Adding incompatible software carries a price in terms of the staff's ability to work in an integrated fashion. The magnitude of that price should be understood.

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[15]We do not suggest that staff members be prohibited from acquiring and using nonstandard software, especially if they already have skill in that software's use.

Appendix A
ODCSPER COMPUTING PRACTICES QUESTIONNAIRE

The project's short time frame required a rapid assessment of ODCSPER's current computing environment in order to create a framework within which to place recommended enhancements to that environment. A DCSPER Computing Practices Questionnaire was developed, originally intended for distribution to action officers and their supervisors only. Based on face-to-face personal administration of an early questionnaire version to ODCSPER's Plans Analysis and Evaluation Directorate (DAPE-ZXP), the questionnaire was revised and distribution was expanded to include all military and civilian ODCSPER staff. A small, select civilian and military audience completed the revised questionnaire to evaluate its clarity and focus. The questionnaire beginning on the next page is the final product, based on experience with the early and revised versions.

NAME: _____

GRADE: _____

OFFICE: _____

DCSPER COMPUTING PRACTICES QUESTIONNAIRE INTRODUCTION

The attached questionnaire seeks to determine current DCSPER computing capabilities and deficiencies, as well as desired enhancements to current capabilities. It has the following specific objectives:

1. To determine the current computing load within each DCSPER office.

2. To determine the electronic communication that currently takes place within each DCSPER office. Electronic communication refers to activities such as electronic mail, calendar coordination and floppy disk transfers.

3. To determine the communication, electronic or otherwise, that currently takes place among DCSPER offices, and between DCSPER offices and the outside world.

4. To determine the mainframe access required by each DCSPER office. Mainframe access refers to the need to access analytic models available on the DCSPER mainframes, not electronic mail or calendar coordination.

5. To determine deficiencies in the above and solicit suggestions for improvement.

6. To solicit suggestions for additional computing capabilities not currently provided.

The questionnaire will assist a project that is examining DCSPER's current computing capabilities, both on the mainframe and on personal computers, whose aim is to identify deficiencies and suggest improvements. Your response is important to meet the project's objectives. We appreciate your timely attention.

DCSPER COMPUTING PRACTICES QUESTIONNAIRE

PART 1: YOUR COMPUTING ENVIRONMENT

List the equipment you have at your desk/work space that is used by you alone.

List the equipment at your desk/work space that you share with others.

List equipment nearby but not included above that you share with others on a regular basis.

List equipment, not included above, that you use occasionally and give its location.

DCSPER COMPUTING PRACTICES QUESTIONNAIRE
(Continued)

PART 2: YOUR COMPUTING ACTIVITIES

What portion of your time do you spend using a computer? _____%

Of the total computer time, estimate the hours per week spent doing each of the following:

PC/MACINTOSH-RELATED

_____ Organizing your personal computing environment

_____ Learning

_____ Writing informal notes

_____ Writing intra- and inter-office memos

_____ Writing formal reports

_____ Building briefing charts using _____

_____ Integrating graphics and other text using _____

_____ Other, please list _____

PROFS-RELATED

_____ Reading electronic mail

_____ Answering/composing electronic mail

_____ Calendar coordination

_____ Other, e.g., using decision support tools _____

NON-PROFS ANALYSIS-RELATED

_____ Retrieving data from, e.g., down-loading from _____

_____ Entering data into, e.g., up-loading to _____

_____ Running models stored on _____

_____ Running analysis programs of type, e.g., SAS, LOTUS _____

_____ Programming in _____ language

_____ Other, please list _____

DCSPER COMPUTING PRACTICES QUESTIONNAIRE
(Continued)

PART 2: YOUR COMPUTING ACTIVITIES (continued)

OTHER ACTIVITIES, E.G., DISPLAY-WRITER-RELATED

_____ Other _____

_____ Other _____

_____ Other _____

_____ Other _____

_____ Other _____

_____ Other _____

_____ Other _____

_____ Other _____

_____ Other _____

_____ Other _____

DCSPER COMPUTING PRACTICES QUESTIONNAIRE
(Continued)

PART 3: YOUR COMMUNICATION ACTIVITIES

What information do you receive, whether on a regular basis or not, from others, e.g., monthly report from another DCSPER office, electronic mail about general officer calendars, a computerized database for use on the mainframe? For each type of information, please indicate the following:

1. Type of information.
2. Originating office or agency.
3. The medium, e.g., hard copy report, computer tape, electronic mail.
4. How often you receive it, e.g., once a week, once a month, irregularly. Please use the following scale:

    1. Once a day
    2. Once a week
    3. Every other week
    4. Once a month
    5. Less than once a month

TYPE OF INFORMATION	ORIGINATING OFFICE	MEDIUM	HOW OFTEN

DCSPER COMPUTING PRACTICES QUESTIONNAIRE
(Continued)

PART 3: YOUR COMMUNICATION ACTIVITIES (continued)

What information do you provide to others? Use the same guidelines as above. Please use the following scale:

1. Once a day
2. Once a week
3. Every other week
4. Once a month
5. Less than once a month

TYPE OF INFORMATION	DESTINATION OFFICE	MEDIUM	HOW OFTEN

DCSPER COMPUTING PRACTICES QUESTIONNAIRE
(Continued)

PART 4: ANALYSIS ACTIVITIES

List the analysis tools that you use and where, e.g., LOTUS on the PC, SAS on the mainframe, notional force model via PROFS.

PART 5: PROBLEMS/LIMITATIONS/DESIRED CAPABILITIES

Describe the problems/limitations presented by the current computing environment.

DCSPER COMPUTING PRACTICES QUESTIONNAIRE
(Continued)

PART 5: PROBLEMS/LIMITATIONS/DESIRED CAPABILITIES (continued)

Describe computing capabilities, currently not available, that would make your job easier. Please try to be specific.

Appendix B
ELECTRONIC AND HARD-COPY DOCUMENT USAGE

Tables 2.7 and 2.8 summarize respondent usage of electronic and hard-copy communication. For example, Table 2.7 indicates that those responding to questionnaire part 3 use electronic communication somewhere between once a day and once a week. Table 2.8 indicates that respondents use hard-copy communication between once a week and once every other week. Because averages of categorized responses can be misleading, this appendix presents the actual data from the questionnaires in the form of bar charts, three for electronic communication and three for hard-copy communication.

The X-axis of each bar chart indicates the message frequency in terms of the following five categories:

1 One or more messages per day
2 One message per week
3 One message every other week
4 One message per month
5 Fewer than one message per month

For each bar in a bar chart, the Y-axis indicates the percentage of respondents that receive/send messages at the indicated frequency.

ELECTRONIC MESSAGES AND DOCUMENTS

Figures B.1, B.2, and B.3 illustrate message frequency for electronic communication. Figure B.1 shows O→I messages: those received within ODCSPER that originate outside of ODCSPER. Figure B.2 shows I→O messages: those that originate within ODCSPER with destinations outside of ODCSPER. Figure B.3 shows I→I messages: those whose origin and destination are entirely within ODCSPER. All entries in these figures represent only those respondents engaged in the indicated type of communication. Thus, Figure B.1 shows only those respondents who receive electronic messages from outside of ODCSPER, and the first

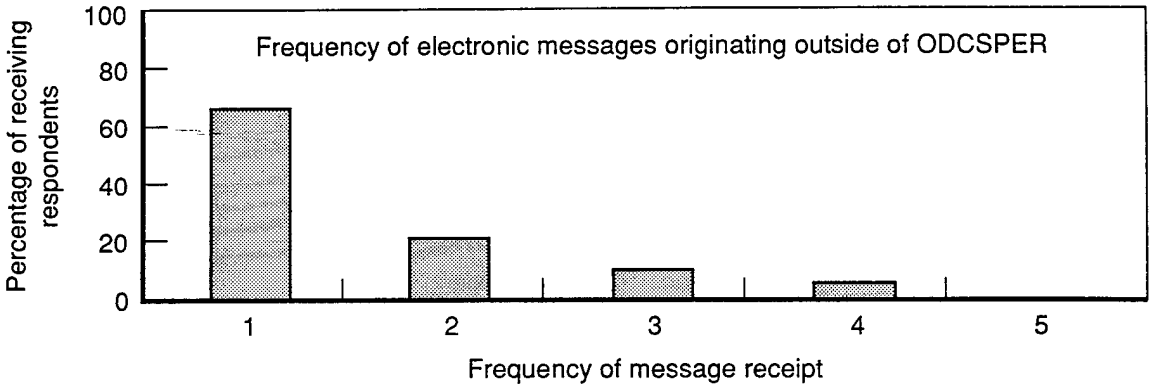

Figure B.1—O→I: Electronic Message Frequency

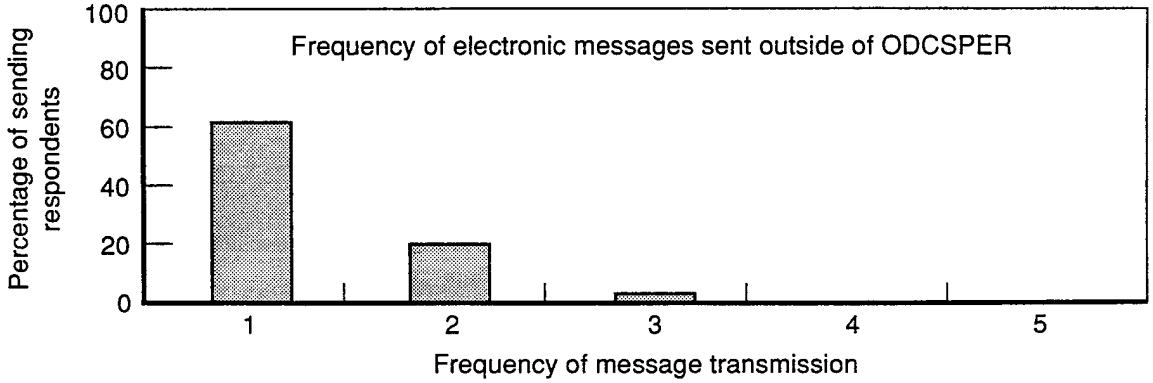

Figure B.2—I→O: Electronic Message Frequency

bar in the figure indicates that just over 60 percent receive such messages at least once per day.

Figure B.3 contains two series because it reflects two types of response: those *receiving* messages that originated within ODCSPER and those *sending* messages whose destination is within ODCSPER. Both types of response are available from the questionnaire, and we included both types to provide an internal consistency check on survey results. I→I values reported in Table 2.7 are averages of the two types of response.

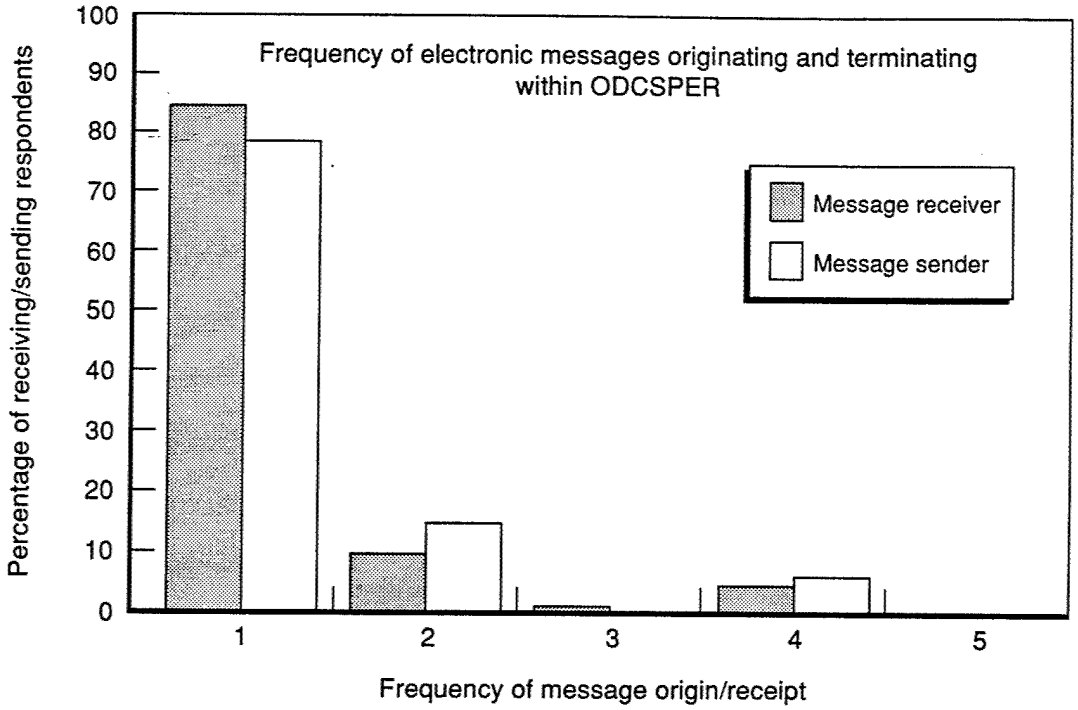

Figure B.3—I→I: Electronic Message Frequency

HARD-COPY MESSAGES AND DOCUMENTS

Figures B.4 through B.6 provide corresponding respondent data for hard-copy messages and documents. Whereas Figures B.1–B.3 show a definite unimodal pattern with strong modality at the daily receipt of electronic messages, the hard-copy data do not display the same tendency. The hard-copy data tend to be bimodal at the daily and monthly points.

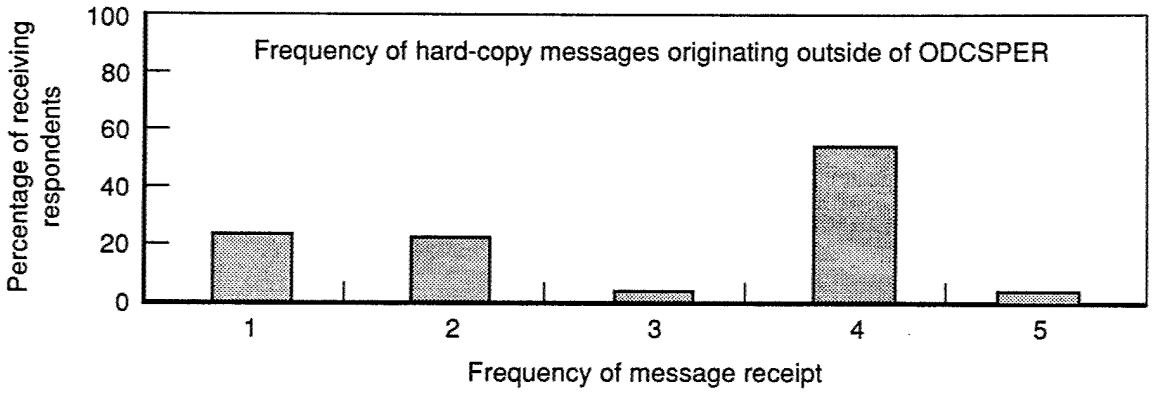

Figure B.4—O→I: Hard-Copy Message Frequency

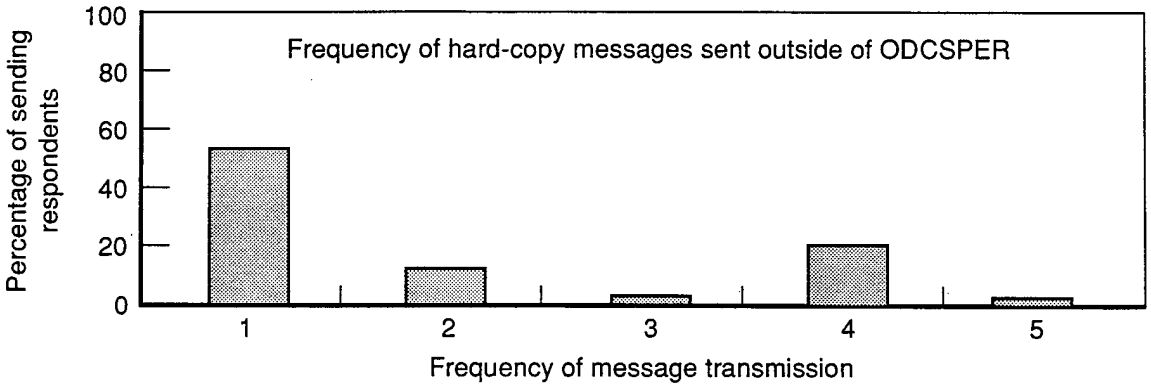

Figure B.5—I→O: Hard-Copy Message Frequency

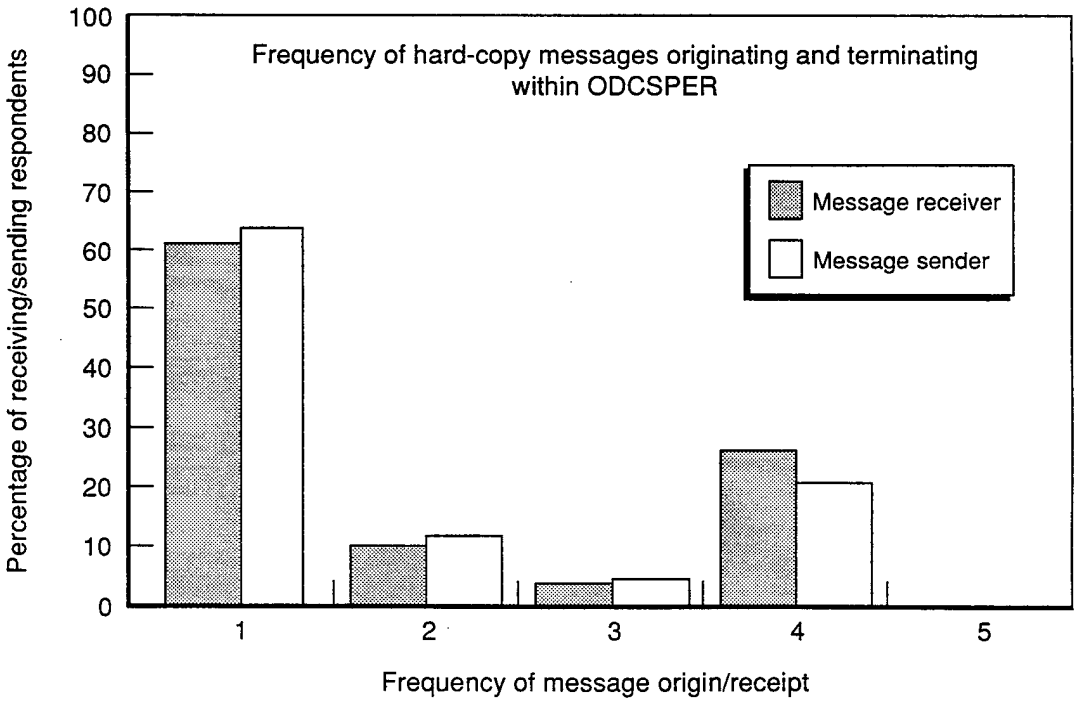

Figure B.6—I→I: Hard-Copy Message Frequency

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