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**REPORT OF THE
CENTRAL INTELLIGENCE AGENCY
COMPUTER STUDY PANEL
ON
CONTAINMENT OF ODP COMPUTER
SPACE GROWTH IN THE EXISTING
AND NEW HEADQUARTERS BUILDINGS**

15 FEBRUARY 1985

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**CENTRAL INTELLIGENCE AGENCY
COMPUTER STUDY PANEL**

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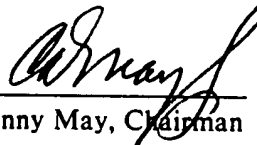
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C. Danny May, Chairman

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EXECUTIVE SUMMARY

Introduction

A Panel, convened at the direction of the CIA Deputy Director for Administration, studied the planned expansion of Office of Data Processing (ODP) computer systems with the goal of determining the most feasible and cost-effective method to prevent the continuing displacement of personnel in the Headquarters building.

The Baseline information which provided the foundation for the study included:

- ODP's estimates of ADP system growth through the year 2001.
- ODP and Office of Communications (OC) plans for satisfying that growth.
- Plans for allocation and use of computer-grade space in the new Headquarters building addition.

None of the basic assumptions in the ODP plans were challenged by the Panel; therefore, the findings and recommendations in this report are based on the premise that ODP's growth projections are reasonable and that their plans for satisfying the demand are similarly reasonable . . . or, at least, that alternatives which might be better on some dimensions did not differ materially with respect to space needs.

Findings

- ODP plans to retain 36,000 sq. ft. of computer space in the present Headquarters, even after the computer-grade space in the new addition becomes available. The Panel sees no benefit in this approach, and urges that all ODP computer space in the present Headquarters be released. This would assure effective use of available space in the new addition, which has TEMPEST features, and is specifically designed for machines.
- The computer-grade space available to ODP (150,000 sq. ft.) in the new Headquarters addition could satisfy all growth requirements up to the year 1995, but not without displacing people. Initially, (1987), ODP plans to use 60,000 sq. ft. of this space for computers, with the remainder used for ODP office space. As computer space needs grow, the ODP people would be displaced to make room for the computers.
- Improved technology (such as disk drives with greater storage density and more powerful computers) make better use of space. More improvements are forecast. ODP plans include the acquisition of this improved equipment as it becomes available. These measures can slow the rate at which computers will displace personnel, but not stop it.
- As long as the Agency was committed to locating all its computers in the Headquarters building, there was no alternative but displacement of people to accommodate computer growth. The displaced people could be readily accommodated elsewhere, as is evidenced by locations for offices.

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- While there may have been valid reasons in the past for not doing so, today it is technically possible to relocate all or part of ODP's computer files and processing capability to a remote site:
- The security, communications, and operational problems associated with such a remote operation are manageable, although the risks would be high if the entire ODP processing capability were to be located to a remote off-campus site.
- Dividing ODP services into a local and a remote operation will have a major impact on the ADP system architecture, but not to the extent that technical risks are high. There is a significant peripheral benefit from a divided operation. With proper planning and design, the remote facility and the Headquarters facility can back each other up, providing protection against a catastrophe at either site.

Recommendations

The Panel recommends that:

- The Agency set a ceiling of 100,000 sq. ft. of space for ODP computers in the Headquarters compound, which would be obtained from the computer-grade space in the new Headquarters building addition;
- The 47,462 sq. ft. of computer space in the present Headquarters building be released for use as office space;
- An expandable, computer-grade facility of initially 50,000 sq. ft. plus support space be provided (purchased or leased) off-site by 1992 for ODP computers and peripheral equipment;
- The off-site facility be located at any one of several possible sites:
- The off-site facility be used to provide services which are less communications-intensive (i.e., Community, development, and possibly batch applications);
- The off-site facility be linked to the Headquarters building via redundant, secure, high bandwidth communications;
- Both the off-site facility and the Headquarters building contain computer systems sufficiently similar to each other to provide mutual backup;
- Less critical, less frequently used computer files be relocated to data storage facilities in the off-site facility, which could be retrieved on-line by the on-site computers;
- A modified system architecture (computing, communications, and user services) with its implementation plan be developed by ODP and OC to support the relocation by 1992 of some computing services off-site;
- All future ODP budgets for procurement of large computer systems be accompanied by communications plans from OC and facility plans from OL; and,
- The user offices be required to budget for the start-up costs (computer procurement, applications development, and facility expansion) for major new ADP systems. (The Directorate for Administration would budget for common user systems serving many offices.)

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Costs

Rough budget estimates (highly site dependent, recurring costs not included, and no addition for inflation) for implementing the above recommendations are as follows:

- Construction of a new off-site facility, including security and support - \$44M
- Providing redundant, secure communications to remote site - \$2M

The Panel notes that locating the new remote facility on the Langley compound rather than off-site could eliminate most of the communications costs and risks associated with a remote operation. The Panel did not recommend the Langley location for two reasons:

- Local community opposition might indefinitely delay its construction.
- The remote facility's benefits as a backup would be partially lost.

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**REPORT OF THE CIA COMPUTER PANEL
ON CONTAINMENT OF ODP COMPUTER SPACE GROWTH
IN THE EXISTING AND NEW HEADQUARTERS BUILDINGS**

1. INTRODUCTION

At the direction of the CIA Deputy Director for Administration, a study panel was convened on 5 November 1984, and given the charter to "determine the most feasible and cost-effective method to prevent the continuing displacement of personnel in the Headquarters building" (including the new Headquarters building addition) "by machines." Membership on the Panel consisted of the following:

C. Danny May, (Chairman), Computer Sciences Corporation
James H. Burrows, National Bureau of Standards
James Croke, MITRE Corporation
[redacted] Central Intelligence Agency
[redacted] National Security Agency
Willis H. Ware, Rand Corporation
Frederic Withington, Arthur D. Little, Inc.

The Panel was assisted in its work by [redacted] of CIA, serving as the Panel's Executive Secretary, and a support staff consisting of representatives from the Offices of Data Processing (ODP), Communications (OC), Logistics (OL), and Security (OS).

Early in the Panel's deliberations, upon advice from the Deputy Director for Administration, it was decided to focus on the machines (computers and associated equipment) that are the responsibility of ODP. The Panel is aware that Agency computer growth outside of ODP's purview could also result in displacement of personnel. However, the Panel did not review non-ODP plans and is not offering any comments in that area. Additionally, the requirements baseline for the Panel's study was the ODP-provided projections of growth in machines and services, and ODP plans for satisfying that growth. The Panel did not attempt to verify those projections or ODP's plans.

The Panel requested and received a series of briefings and handout material from ODP, OC, OL, and OS. These included information on:

- a. The current ODP computer center and workstation environment, the services it provides, its expected growth, and its transition to space that will be available in the new Headquarters building addition.
- b. Present and planned communications support of the ODP machine environment.
- c. Feasibility, costs, and risks of providing secure communications to a future ODP environment which would include off-site computers and associated files.
- d. Options for splitting the ODP operations by service (some on-site and some off-site).
- e. Considerations involved in site acquisition and new building construction, on-site and off-site.
- f. Security considerations in providing ODP services from an off-site location.

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2. BACKGROUND

ODP currently has the following space allocated for large mainframe computer centers in the present Headquarters building:

[] nter	20,949 sq. ft.
Center	15,363 sq. ft.
Special Center	9,800 sq. ft.
FOURC Center	1,350 sq. ft.
TOTAL	47,462 sq. ft.

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The new Headquarters building addition has 200,000 sq. ft. designed for accommodating technical equipment (computers and communications). The utility support (air conditioning, UPS, etc.) for the Headquarters compound is being upgraded to accommodate a total of 200,000 sq. ft. of technical equipment space in the present Headquarters building and the new Headquarters building addition. 50,000 sq. ft. of machine space in the new Headquarters building addition is reserved for the Office of Communications. ODP plans to use the remaining 150,000 sq. ft. Initially, 60,000 sq. ft. of this will be used for machines, and the remaining 90,000 sq. ft. will be occupied with ODP people. As machine space requirements grow, the ODP people will be relocated to make room. When the new Headquarters building addition is ready for occupancy in 1987, ODP plans to establish a New Center in the new Headquarters building addition, release the Special Center, and rearrange all the services as follows:

[] enter:	DDO Support and FOURC
Center:	CAMS2, W2, and DESIST
New Center:	DDI Expansion [] equipment, and SAFE

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At that time, according to ODP plans, 96,000 sq. ft. will be available for machines (36,000 sq. ft. in the present [] Centers, plus a 60,000 sq. ft. "New Center" in the new Headquarters building addition.) This will satisfy ODP space needs until 1990. Beginning in 1990, further growth in space requirements would be largely met by enlarging the New Center at the expense of ODP office space in the new Headquarters building addition. However, some expansion of the [] Centers is planned by ODP beginning in FY 90. At this rate of growth, the load on the utility support system would be nearing the limit by the year 1995, with ODP using about three-fourths of the utility systems capacity, and OC using one-fourth.

The Panel believes that it is not possible to put a ceiling on the growth in ODP services and the Agency's eventual space requirements for information processing. The behavior patterns of analysts and consumers of the intelligence product are changing in response to the new capabilities available, and the volume of information to be processed is continuing to grow explosively. Instead, measures must be sought which will moderate the rate of growth in space requirements where feasible, and channel the growth in a direction where it will not compete for Headquarters personnel space. The balance of this report addresses these measures, which include technical, managerial, and new building options.

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3. TECHNICAL OPTIONS

There are a number of technical options available to the Agency which may offer some reduction in Headquarters space requirements for ODP computer systems. These include:

- Use of new technology, direct access, data storage devices which provide greater storage density per unit volume.
- Architectural changes which enable space consuming on-line computer files to be remotely located.
- Use of new technology computers which provide greater processing capacity per unit volume.

The Panel considered each of these options as discussed below:

3.1 Direct Access Storage Devices

Figure 1 shows the historic growth in space requirements for ODP computer systems and the projected space needs through 1995. The space requirements in Figure 1 are further broken down to show which part is for Mainframes (computers), Direct Access Storage Devices (DASD) and All Other (tape drives, printers, etc.). As can be clearly seen, the major contributor to the explosive growth in space requirements is DASD. Figure 1 does not take into account any reductions in space needs that might result from technological improvements.

The Panel asked one of its members, Ted Withington of A. D. Little, to conduct an assessment of what improvements in data storage density might be possible as the result of technical improvement. ODP also provided estimates of possible space reductions from technical advances. The results of these studies are summarized in Figure 2. This provides a snapshot of what might be expected in 1995—10 years from now.

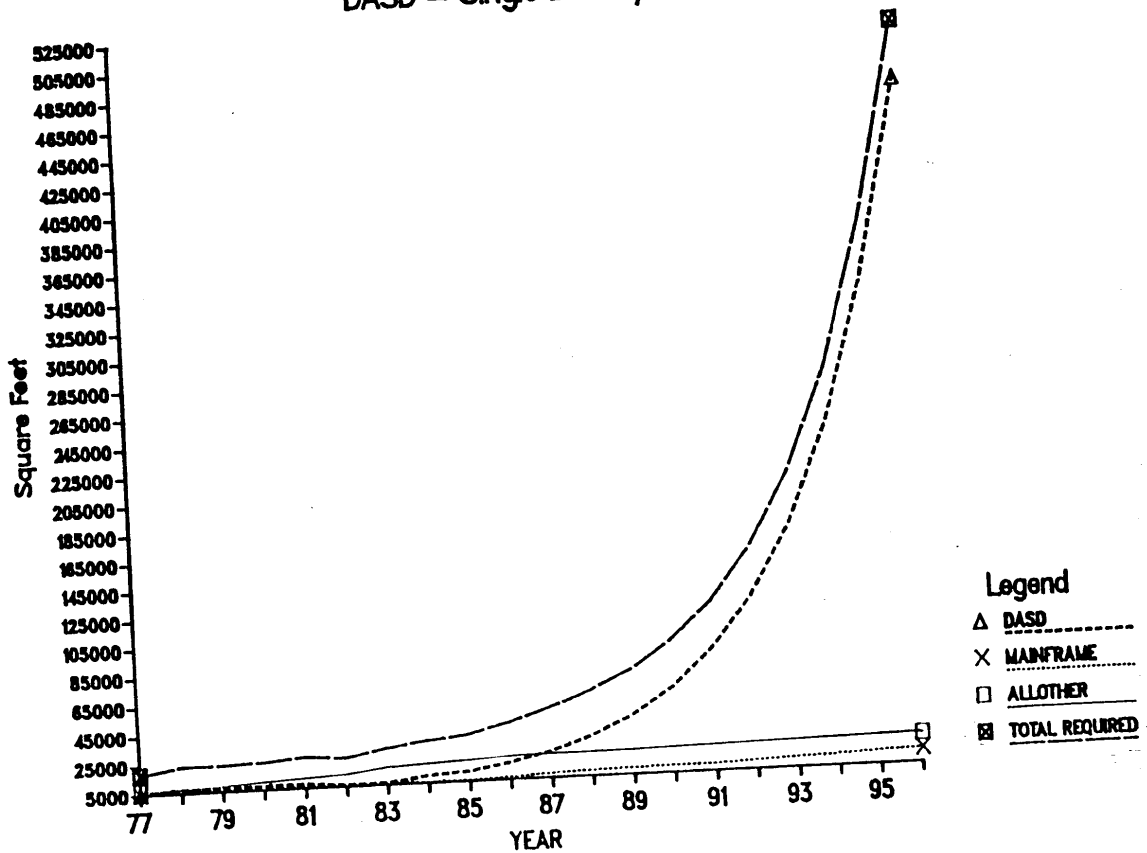
ODP estimates that 17,146 gigabytes (gb) of storage capacity must be available in 1995. Assuming that space available to ODP for computers will be limited to a fixed amount (100,000 sq. ft.), only 3,247 gb could be provided in this limited space using today's technology. ODP's planning is based on a 4X improvement in storage density by 1995 due to technical improvements. This would provide a capacity of 12,990 gb in 1995 which is still inadequate to satisfy the requirement of 17,146 gb. The A. D. Little study projects a minimum capacity of 17,800 gb, about adequate to satisfy the need. This estimate is based on the most advanced magnetic storage technology expected to be available with some optical storage. A. D. Little also believes that a predominately optical storage capability might be available in 1995, thus providing a capacity as high as 71,200 gb. On the other hand, ODP's estimate of the maximum capability that technology might provide is 44,750 gb.

ODP's plans reflect a continuing improvement in storage capacity due to technical improvements as shown in Figure 3. But they believe that the rate of growth in requirements will exceed the rate of growth in capacity and that requirements will exceed capacity by 1992 if space is limited.

The Panel has concluded that substantial improvements in storage technology can be expected in the future; however, it cannot be certain that the improvements will be sufficient to satisfy growing needs if space continues to be limited. As can be seen in

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ODP SPACE REQUIREMENTS and PROJECTIONS 1977 - 1996 DASD = Single Density



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FORECAST STORAGE CAPACITY 1995 100,000 Sq Ft COMPUTER SPACE

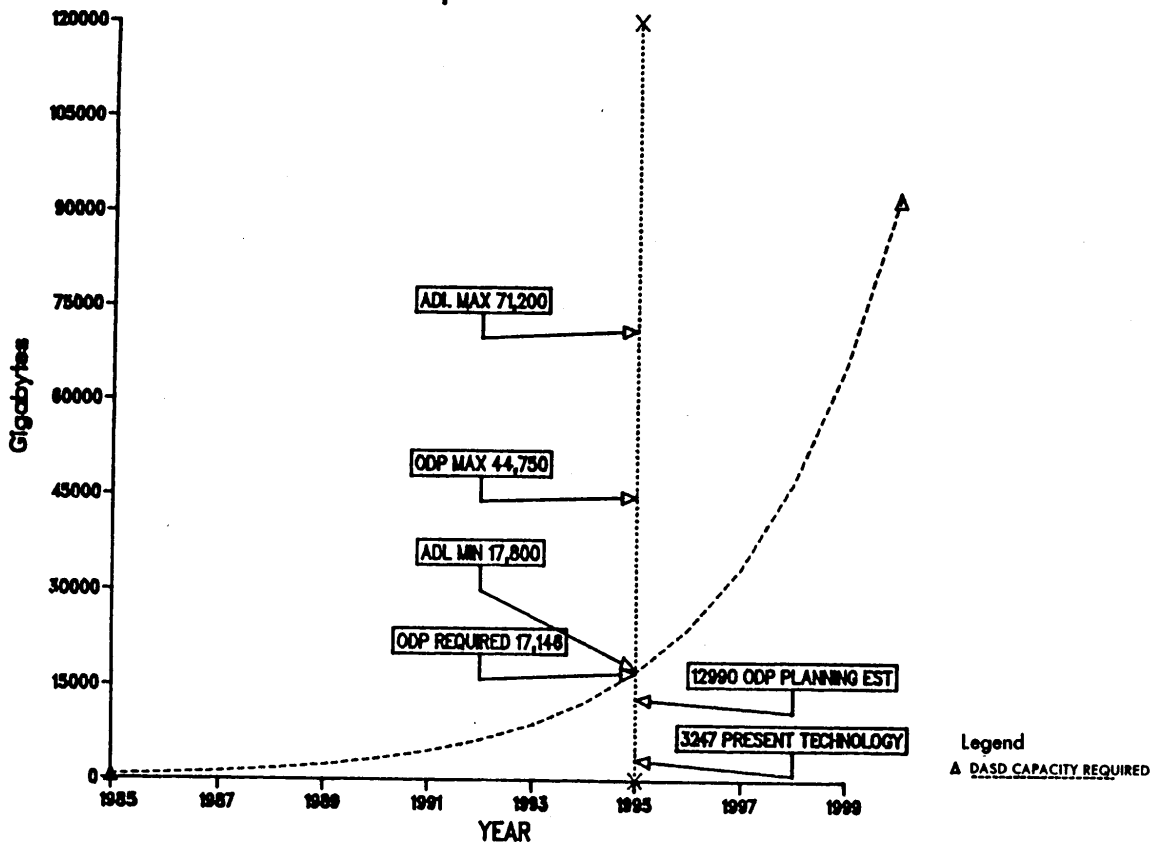
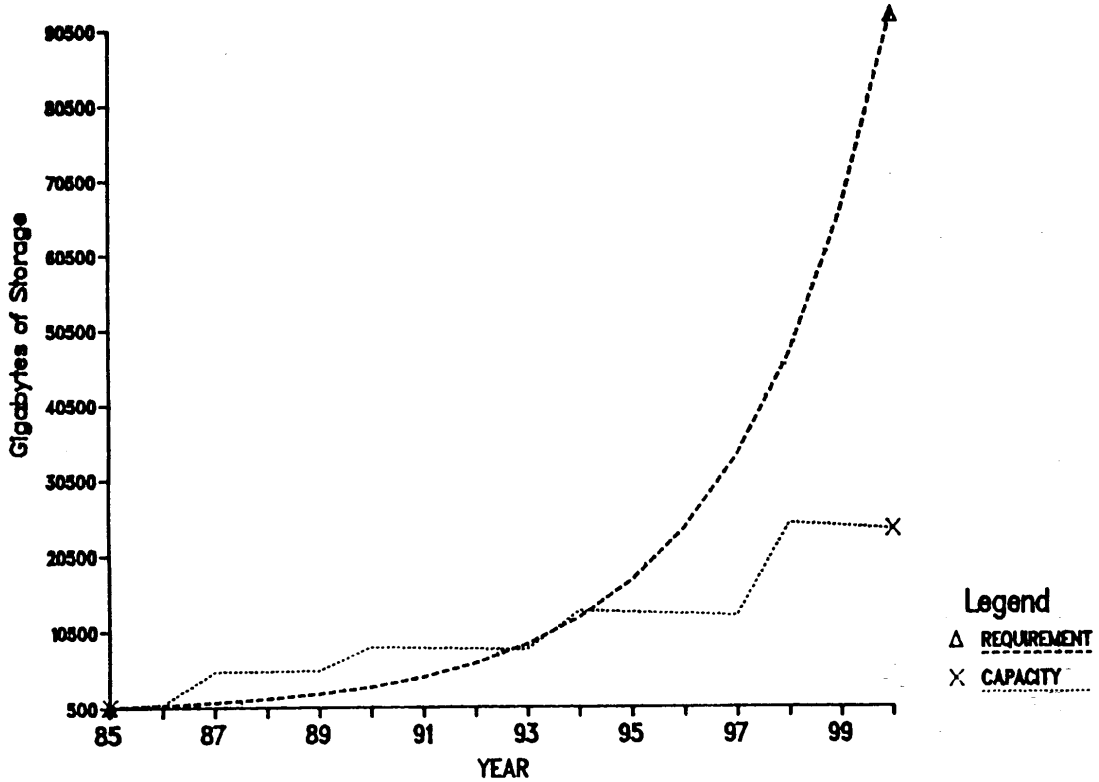


Figure 2

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**ODP DASD STORAGE REQUIREMENT
1985 - 2000
with PLANNING ESTIMATES of
ODP STORAGE CAPACITY
in a Space Limited Facility**



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Figure 2, there is a 5 to 1 spread in estimates regarding what technology might do for us. Furthermore, the growth projections also introduce another element of uncertainty. These projections reflect ODP's best judgement based on growth expected in today's services. Major new systems—not identified at this time—could cause storage growth even greater than that projected.

3.2 Remote Computer Files

Because of these uncertainties, the Panel believes that ODP must develop an alternative to continuing to locate all on-line files (DASD and tape) in Headquarters space. Architectural changes should be developed to permit the relocation of some of these files to a remote site, but accessible on-line via secure, redundant communications. It is likely that some compromise in access time would need to be accepted by the users to keep the costs of such an arrangement within reasonable bounds. Therefore, files to be relocated would be those infrequently accessed and those which would be less time-sensitive. The Panel believes that the uncertainties are such that ODP could well reach the saturation point in DASD space in the mid-90's. Therefore, remote storage capability should be in place by that time.

3.3 New Technology Computers

In Figure 1, it can be seen that mainframe space requirements have been, and are expected to remain, relatively flat. Also, mainframes are a relatively small part of the total space required. However, some space savings would be possible from greater use of new technology mainframes than that presently planned by ODP. The new technology machines would provide about twice the processing power as the largest old machine in the same amount of floor space. ODP presently plans to acquire 15 of the new technology machines between FY 85 and FY 91, but also plans the continued use of 3081 and 3083 mainframes (old technology) to support some SAFE, DDO, and common user services. Thirteen of these old technology mainframes could be replaced by seven of the new technology machines, soon to be available (Sierra machine). But, even if this were done, it would release about 1,450 sq. ft. which is not nearly enough to accommodate DASD space requirements. While there may be some operational advantages from the new technology machines that were not addressed by the Panel, it is clear that the space savings alone from greater use of these machines is insufficient to significantly impact the space requirement for DASD.

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4. MANAGEMENT OPTIONS

For years, senior Agency management has struggled with the question of how to best manage the growth of computer services in the Agency. During that time, computers have continued to grow and have now become a powerful and essential tool enhancing the Agency's operational productivity.

Historically, for a variety of reasons, the Agency has chosen to keep most of its ODP computing resources in the Headquarters. When additional space was needed to accommodate computer growth, it was obtained at the expense of office space in the Headquarters. Space for the displaced personnel, as well as for other personnel who could not be fitted into the Headquarters, was obtained by converting dollar resources into leased off-site office space. (There is currently leased space in over 30 buildings).

Management has reviewed and approved the growth in on-site computing as appropriate and essential to mission performance. Each new requirement was handled separately on its individual merits, and there was little incentive or opportunity to develop a general solution to the resultant space problem, i.e., the gradual displacement of people to off-site locations.

In order to assure that future space requirements are given proper consideration as a part of the overall resource picture when new systems are proposed, two things are essential. First, the total resource implication of a proposal for a new (or significantly expanded) computing requirement, including space, must be identified. All the resources needed for establishing the new or significantly expanded capability should be budgeted by the user directorate (Common user systems serving many users will be budgeted by the Directorate for Administration, as will the continuing operational costs of the systems). Second, a more responsive mechanism for converting the budgeted funds into required new computer and support space must be established. The required new space must not be in the Headquarters or its new addition, otherwise people will continue to be displaced.

These new procedures, if adopted, will achieve two important goals. First, the user-level organizations will participate in justifying and obtaining resources to support new and expanding requirements. This should result in more careful screening of needs when they are in competition for directorate resources. Second, management has available another option for satisfying computer space needs other than personnel displacement, namely, acquiring new space for expansion with budgeted dollars.

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5. NEW BUILDING OPTIONS

From the preceding discussions it can be seen that some technical and managerial options could contribute to the solution of the space problem, and both point towards the acquisition of additional computer grade space, not derived from the Headquarters or its new addition, which can be readily expanded as future needs develop. In this Section the Panel examines the ancillary benefits from establishing a separate computer grade facility and optional approaches to its establishment.

5.1 Security, Backup, and Continuity-of-Service

Establishing a computer grade facility separate from the Headquarters and its new addition would have the added benefit of providing backup to vital computer services in the event of a major Headquarters catastrophe. Currently, continuity-of-service is vulnerable to fire/water damage and possible damage from a terrorist attack. Information stored in Agency computers is already backed-up onto magnetic tape and stored off-site to enable reconstitution of vital files in the event of catastrophes small and large. The use of a connected off-site facility to house the backup tapes, and perhaps provide some on-line backup, can provide for speedier recovery. The security implication of two computing sites vice one is principally the cost of defending a second perimeter. It is unclear if a single large target is more or less attractive to hostiles than either of two smaller ones. A coordinated attack on two separated, secure installations requires much more complicated planning and much more careful execution. There are added costs in securing a second site to the same standards as the current Headquarters facilities. Moreover, an off-site facility with accommodations for a (small) user community could be used for emergency people relocation as well.

Damage to habitable space in Headquarters could be compensated for by temporary relocation of personnel to an off-site facility where they could be properly supported by proximal computing.

5.2 Range of Options Considered

There are several choices of how this could be done:

- A new expandable, technical equipment building could be constructed on-site or off-site;
- This building could accommodate either part or all of the Agency's computer equipment;
- The division between this building and Headquarters could be either by type of equipment (e.g., all DASD and controllers moved out of Headquarters) or by function (e.g., the complete computer systems needed to support Community information systems moved out of Headquarters or by mixes of equipment and function).

The CIA support staff, at the request of the Panel, performed and reported on a number of studies to assist the Panel in understanding the feasibility, costs, risks, and other considerations associated with these options. To bound the support staff studies, the Panel identified representative off-site locations to be considered for studying variations in costs and operations (construction costs, communications, security, manning, etc.). The Panel also requested a study of an on-site location for the new technical equipment building.

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The support staff also provided a set of six options for dividing the ODP workload functionally. They are cumulative: the first (Option a) includes the services ODP considers easiest to move; the second adds the next easiest group. The sixth includes all ODP services. The options are:

- a. Community systems are moved out, the rest remain at Headquarters.
- b. The Community systems and those used in developing new software are moved out, the rest remain at Headquarters.
- c. The Community, development, and batch processing systems are moved out.
- d. The Community, development, and batch processing systems are moved out, along with the GIMS and VM services.
- e. All the above, plus the Project SAFE services are moved out. Only the special DDO services remain at Headquarters.
- f. All data processing is moved out.

All six of the options appear to be technically possible, though the degree of risk increases from (a) through (f).

The ODP staff prepared estimated space requirements for the six options of dividing the workload functionally. They are summarized in Table 1. The first six columns contain estimates for different parts of the computer facility including computer-grade space. The next three are for support space. (The square footages mentioned in the discussion below are for computer-grade space. Support space is not shown, but can be found in Table 1.)

5.3 Reasons for the Panel's Selection

During the process of narrowing the options, the Panel made three decisions:

- *The division of computer equipment between the new building should be primarily based on functions rather than type of equipment.*

While equipment at the two sites would be based on the functions supported, each site could contain complete, interchangeable, computer systems, which (with appropriate planning) could support the highest priority services of the moment and provide mutual backup. Some tertiary or archival storage might properly be put entirely in a new off-site building in the preferred area.

- *A ceiling should be placed on the amount of computer space permitted at Headquarters.*

This would permanently solve the people dislocation problem, because by definition, all growth beyond the ceiling would be in the new off-site building. The question then is: how high should the ceiling be? The remainder of the Panel's deliberations focused on this issue.

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The Panel's final choice was among three options. Option 1 assumes that all computer facilities will be moved to a new building (equivalent to ODP's functional division Option f, in Table 1). Option 2 will set a ceiling of 50,000 sq. ft. of computer space at Headquarters (initially corresponds to ODP's functional division Option c, and later to Option d). Option 3 will set a ceiling of 100,000 sq. ft. of computer space at Headquarters (corresponds to ODP's Option c).

5.4 Description of Space Options

Option 1: Under this option, all ODP computer facilities would be moved out of the Headquarters building and its new addition, thus requiring no space in these buildings. Under one variation of Option 1, the new expandable technical equipment building would be built on the Langley compound to house the ODP computers. Under another variation, the new building would be built at a remote site.

It is inconceivable that this new off-site building could be ready for occupancy in time to avoid some rearrangement of ODP computer facilities and services in 1987, when the new Headquarters building addition becomes available. Considering budgetary and construction lead times, availability of the new building in 1992 might be possible to achieve. At that time, about 100,000 sq. ft. of computer-grade machine space would be needed to accommodate the ODP equipment. Some upward adjustment in size would be needed if initial availability is delayed beyond 1992. Cost of construction at each of the 5 sites studied (as estimated by OL) ranged from \$65M to \$80M for the 100,000 sq. ft. computer-grade space and required support facilities. A summary of these costs is included in Table 2 (see paragraph 5.5 for communications cost estimates). The two large mainframe computers that ODP plans to acquire in FY 89 and FY 90 could provide a vehicle for starting the transition of computer services to the new building, when it is ready for occupancy in 1992.

This option has the main advantage of completely relieving the pressures to expand ODP computer space in the Headquarters building at the expense of people. When more space is needed, it will be obtained by incremental expansion of the on- or off-site new building designed and dedicated to house machines. If an on-site location for the new building is chosen, the added communications and security problem would be minimal. On the other hand, an off-site location would have significant communications costs and risks. Redundant, high capacity, secure communications links would be needed to tie Headquarters and the on-line users to the remote computer facility. OC estimates that redundant, high capacity communications systems to satisfy this requirement could involve one-time costs ranging from \$.3M to \$6.7M, depending upon the location of the remote site. These links would be vulnerable to disruption either intentionally or accidentally. The bandwidths required may push the communication state-of-the-art which, in turn, could limit the architectural alternatives which might be considered for the terminal network.

The Agency has invested substantial resources in the construction of computer grade space and supporting utilities in the present Headquarters building. Additional resource expenditures are planned to prepare the machine space in the new Headquarters addition, and to upgrade the Langley utility support. These investments would be lost under Option 1, except that some use could be made of upgraded utilities if the new technical equipment building were built on-site at Langley.

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Option 2: Under this option, a fixed amount of space of 50,000 sq. ft. in the Headquarters and new addition would be allocated for ODP computers. The remaining ODP computers would be installed at a remote off-campus site and tied to the Headquarters and other users by redundant, secure, high capacity communications links. The services that would continue to be offered out of the Headquarters-located computers would be those whose users generate high communications volumes, and whose services would be severely degraded by communications problems. The less communications-intensive services would be provided from facilities located in a new building constructed at a remote site similar to that in Option 1. The off-site facility should have about 50,000 sq. ft. of space available initially, and probably would require the same budgetary and construction lead time as in Option 1 (availability no earlier than 1992). (It is noted that the new 50,000 sq. ft. building could be built on-campus as previously discussed under Option 1. However, the Panel does not support this approach because of the uncertain political climate, as previously stated.) For the sites considered, construction of the 50,000 sq. ft. computer-grade space and support facilities range from \$41.5M to \$44.0M. Table 3 provides a summary of those costs. (See paragraph 5.5 for communications cost estimates.)

ODP could begin rearrangement of services within the Langley complex when the new Headquarters building addition becomes available in 1987. Services to be moved to the new off-site center could remain in place in the present Headquarters computer centers until the new off-site center is ready for occupancy in 1992. However, if the Headquarters space in the present computer centers is needed sooner for offices, the services to be moved could be temporarily relocated to the new Headquarters building addition. During this transition period, in either case, the 50,000 sq. ft. Headquarters ceiling will be exceeded.

The Panel believes that the logical services to be moved off-site to the new center under Option 2 would be the Community, development, and possibly batch services. The 50,000 sq. ft. new off-site center would initially accommodate these services with some growth margin. There is concern, however, that this option does not provide sufficient flexibility to accommodate growth in the services that would remain on-site. Other significant measures would need to be taken eventually to prevent Headquarters machine growth from displacing people. These could include off-loading large segments of infrequently used shared data files to the off-site location. This, of course, could quickly consume the small growth margin planned for that location.

There is a significant advantage to be gained from splitting the ODP operations as proposed in Option 2 and also in Option 3 which follows. Under this arrangement, some portion of ODP's processing capability at the remote site is protected from catastrophic loss caused by a disaster in the Headquarters building and vice versa. Furthermore, with careful planning and some additional investment, the remote facility could serve as a full backup to the Headquarters system. This would solve a long-standing Agency problem with modest additional cost.

The communications risks and costs would be lessened under Option 2 because efforts would be made to keep the communications-intensive ODP services on the Langley compound near their users, where providing reliable communications is not a problem. Security risks would also be lessened, but access to the remote processing capability and files could be more readily denied because of dependence on long communications links.

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As in the case of Option 1, the failure to fully utilize all the computer-grade space in the Headquarters building and its addition would forego any benefits from that investment.

The Panel favors Option 2 over Option 1, but is concerned that all of the vital communications-intensive services could not be adequately provided from the Headquarters compound beyond 1992 if the available space is limited to 50,000 sq. ft. If some of these services or files had to be shifted to the remote site, communications costs would rise, and reliability and responsiveness might suffer.

Option 3: Under Option 3, a fixed amount of space would be allocated to ODP in the Headquarters complex. It is suggested that this allocation should be 100,000 sq.ft. and that it be provided as follows. While it would be feasible to retain some or all of the present Headquarters space as part of the 100,000 sq.ft. allocation, the Panel believes that utilization of the machine space in the new Headquarters building addition is to be preferred over continued occupancy of computer center space in the present Headquarters. Initially, 60,000 sq.ft. in the new addition would be used for computers with the remainder providing room for growth, but temporarily used for ODP office space. The TEMPEST protection afforded by the new addition appears to be consistent with the President's Directive on Automated Information Systems Security (NSDD 145). Furthermore, the benefits from the investment made to provide TEMPEST protection in this space would be lost if it was not used for machines. The transition would begin in FY 1987, when space in the new Headquarters building addition becomes available and newly acquired computers begin to arrive.

Additionally, a new 50,000 sq.ft. expandable facility would be constructed off-site to house ODP computers which would be connected to the Headquarters user population by secure, redundant, high capacity communications links. The estimated cost of constructing the new off-site 50,000 sq.ft. computer grade space and required support facilities range from \$41.5M to \$44.0M for each of the 5 sites considered. (See paragraph 5.5 for communications cost estimates.) The computers located at Langley would be used to provide vital communications-intensive services which, if located off-site, would be severely degraded by communications problems sometimes experienced with long off-site links. Those located in the new off-site building would provide services which are more tolerant of communications problems, such as Community, development, and batch services. Under this Option, ODP would work towards releasing the present Headquarters machine space of about 47,000 sq.ft., and eventually occupying a maximum of 100,000 sq.ft. for machines in the new Headquarters building addition.

Because the communications-intensive services would continue to be provided from the Langley compound, communications costs and risks would be reduced considerably when compared to off-site location of these services. However, those services served by the remote facility would be more vulnerable to disruption because of communications failures.

The Panel favors Option 3 over Options 1 and 2. This Option provides sufficient on-site space to meet expected growth of those vital services whose users could best be served by computers located in the Headquarters compound. There can be flexibility built into the schedule for this Option to make allowances for delays in obtaining construction funds for the off-site new facility. The allocated space in the new

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Headquarters building addition can be used immediately, when available, to begin to configure the equipment and services that will remain when the other equipment and services move to the off-site new building.

5.5 Communications Costs

OC provided input to the Panel regarding cost and feasibility of providing communications support to the new dedicated technical equipment building, which could be required under all of the three options studied. Each of the candidate sites under study was examined in the course of the study. Rather than attempt to analyze all possible options, OC selected two cases—one in which only Community Systems would be served from the new off-site building, and the other in which all of the ODP on-line systems would be served from the new building. Additionally, OC examined how the costs and feasibility would be affected by two different communications architectures now under consideration by OC-

the results of those studies. Tables 4 and 5 summarize

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6. FINDINGS AND RECOMMENDATIONS**6.1 Findings**

- ODP computer equipment now occupies less than 50,000 sq. ft. of computer space at Headquarters, but significantly more will be needed soon. The 150,000 sq. ft. of computer-grade space which will be available to ODP in the new Headquarters building addition in 1987 could potentially satisfy all ODP-estimated growth requirements up to the year 1995. However, to accommodate its machines in 1987, ODP plans to retain 36,000 sq. ft. in the present Headquarters, plus using 60,000 sq. ft. in the new addition, with the remainder used for ODP offices initially. The majority of future growth will be accommodated by displacing ODP personnel in the new addition, who are occupying the unused computer-grade space. By the year 1997, the entire 150,000 sq. ft. of the new addition will be required for computers and data storage, in addition to the 36,000 sq. ft. of present Headquarters space which would be retained by ODP. Before that condition is reached, the utility support capacity available for technical equipment in the Headquarters complex will be over committed, and no further expansion of on-site computer systems would be possible without increasing the capacity of utility support.
- Special features (such as TEMPEST protection) were planned and are being designed into the new Headquarters building addition to accommodate technical equipment which processes classified information. The Panel believes that this space should be utilized for its intended purpose, and that the 36,000 sq. ft. in the present Headquarters computer centers be released when the new Headquarters building addition space becomes available.
- Aggressive pursuit of new technology will help postpone space saturation problems in the Headquarters and its new addition. The greatest benefit will be realized in the Agency's fastest growing area of space consumption—direct access storage devices. Technology improvements, such as double-density magnetic disks and optical disks, are expected to yield as much as a 4X-9X improvement in storage density by 1995. Additionally, new technology main-frame computers will produce twice as much work in the same physical volume as old technology. However, the Panel concludes that technology improvements alone will not produce sufficient space savings to solve the space problem.
- As long as the computers and people were competing for the same space, and the Agency was committed in its architectural approach to locating all its computers in the Headquarters, there was no alternative but displacement of people to accommodate computer growth. The displaced people could be readily accommodated elsewhere, as is evidenced by the off-campus locations for offices.
- While there may have been valid reasons in the past for not doing so, today it is technically possible to relocate all or part of ODP's processing capability to a remote site. Staff studies performed at the Panel's request indicate that security, communications, and operational problems are all manageable. However, it seems prudent to retain the most communications-intensive services at Headquarters (little would be gained by moving them all out, and substantial added cost and risk would be incurred). As part of the relocation of

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some of the Headquarters computer files to the remote site with on-line access from the Headquarters computers. The Panel also believes that if some computers and files relocated to a new, separate building, then it should be located at any one of several possible sites [redacted]

- It is important to note that a division of ODP services will have a major impact on the ADP system architecture, but not to the extent that technical risks are unreasonable. There is a significant peripheral benefit from a divided operation. With proper planning and design, the remote facility and the Headquarters facility can back each other up, providing protection against a catastrophe at either site.

6.2 Recommendations

The Panel recommends that:

- The Agency set a ceiling of 100,000 sq. ft. of space for ODP computers in the Headquarters compound, which would be obtained from the computer-grade space in the new Headquarters building addition;
- The 47,462 sq. ft. of computer space in the present Headquarters building be released for use as office space;
- An expandable, computer-grade facility of initially 50,000 sq. ft. plus support space be provided (purchased or leased) off-site by 1992 for ODP computers and peripheral equipment;
- The off-site facility be located at any one of several possible sites [redacted]
- The off-site facility be used to provide services which are less communications-intensive (i.e., Community, development, and possibly batch applications);
- The off-site facility be linked to the Headquarters building via redundant, secure, high bandwidth communications;
- Both the off-site facility and the Headquarters building contain computer systems sufficiently similar to each other to provide mutual backup;
- Less critical, less frequently used computer files be relocated to data storage facilities in the off-site facility, which could be retrieved on-line by the on-site computers;
- A modified system architecture (computing, communications, and user services) with its implementation plan be developed by ODP and OC to support the relocation by 1992 of some computing services off-site;
- All future ODP budgets for procurement of large computer systems be accompanied by communications plans from OC and facility plans from OL; and,
- The user offices be required to budget for the start-up costs (computer procurement, applications development, and facility expansion) for major new ADP systems. (The Directorate for Administration would budget for common user systems serving many offices.)

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