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CONTINUED IMPLEMENTATION
AND TESTING OF A
NEIGHBORHOOD OFFICE CENTER (NOC)

AND

INTEGRATION OF THE NOC WITH AN
ADMINISTRATIVE CORRESPONDENCE
MANAGEMENT INFORMATION SYSTEM

Final Report, Contract NASw-3057
16 March 1978

prepared for

NASA Headquarters
Washington, D.C.   20546

by

S. ROSS AND COMPANY
156 MILK STREET
BOSTON, MASSACHUSETTS   02109

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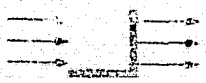
1.0   INTRODUCTION

A special inter-Center task team established in 1974 at the request of the Deputy Administrator was charged with investigating ways in which telecommunications and telecomputing could reduce the Agency's consumption of scarce natural resources and the proliferation of paper copies of correspondence. A primary result of this effort was the recommendation to establish four specific pilot projects to investigate the feasibility of this approach*.   Two of the projects represented new efforts:

- o   An interactive data management system for standardized budget reporting throughout NASA,

- o   A management information system for handling Headquarters administrative correspondence.

The other two were to upgrade and enhance systems already in existence:

- o   The NASA Teleconference Network

- o   Space-shuttle data base management, including configuration control, problem reporting, and corrective action for reliability and quality assurance.

During the study the task team came to realize that any of the four proposed projects, if implemented, could create a capability for exchanging voice messages, video images, and digital data within a totally self-sustaining communications network environment.   This in turn suggested the possibility of eventually using such a capability for evaluating a new concept of work, based on decentralized (remote) neighborhood offices linked

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* cf. Final Report, NASA Headquarters Task Team on the Applications of Computers and Communications, Code E, June 1974
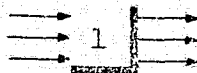
together through such a network, which could certainly be con-
structed within the current state-of-the-art. The concept came
to be known as the Neighborhood Office Center (NOC). At the
suggestion of the Deputy Administrator, the NOC concept formed
the subject of a fifth effort, to determine its feasibility,
quantify its operational advantages and identify its limitations.

A study of the NOC concept undertaken in 1975 reported* that
the current technological state-of-the-art was adequate to
support the scheme, and that the benefits to be gained by such
applications of digital data processing and communications could
include reduced consumption of fuel in vehicles used for travel,
a decrease in all expenses normally incurred by both employer
and employee as a result of commuting or long distance travel,
reduced paper consumption in conventional correspondence proced-
ures, and various convenience factors associated with elimination
of certain travel requirements and decreased commuting time.

At the same time, a survey of current management information
systems (MIS) used for correspondence tracking showed that the
implementation of the second pilot project cited above was
straightforward and well within realization, requiring only a
commitment to begin development and a decision as to specifics
of the hardware configuration to be adopted.

Also related to these actions, a decision was reached within
the Office of Applications to establish an Administrative Office
Center (AOC) service based on the use of (non-communicating)
magnetic-medium word-processing typewriters to handle the bulk
of the daily typing load generated within Code E.

It was felt that the establishment of the three systems, *viz.*
NOC, MIS and AOC, operating in close connection with an

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* "A Study of the Remote Neighborhood Office Center Concept", S. Ross and
   Company, Final Report, Contract NASw-2743, 31 August 1976

augmented teleconference network, might ultimately form a unified means of creating, storing and retrieving administrative documents, records and data, while simultaneously permitting users of the system to track their status. Much of this would probably involve the transfer of information and access to the contents of documents without using paper at all, that is, merely through digital electronic communications and display—an important step towards the establishment of a true Agency-wide electronic mail system.

The above considerations motivated a study effort* whose goals were to undertake, on a preliminary basis, (a) the implementation, demonstration, and testing of the NOC concept, and (b) the evaluation of the three other pilot projects cited above, i.e., MIS, AOC, and teleconference network—all in the present context. The first year was devoted to testing NOC, MIS, and AOC functions separately. By treating these functions on an individual basis, problems that might arise within each area could be addressed directly without the further complication of crosscoupling effects among them.

Having identified and addressed the principal individual factors involved in equipment performance, communications and operator interface, we proceeded with the next step—to evaluate the concept quantitatively and to plan hardware and procedures for an integrated multifunctional system. This report documents the evaluation and integration phase.

Section 2 of the report explains the NOC configuration, the statistics of the Center's production, and an experiment planned to demonstrate NOC network integration via satellite. Section 3 describes the hardware selected for implementation of the

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* "Implementation and Testing of a Neighborhood Office Center (NOC) and Integration of the NOC with an Administrative Correspondence Management Information System," S. Ross and Company, Final Report, Contract NASW-2889, 7 February 1977.

integrated NOC/MIS network.   Finally, Section 4 discusses the
evaluation of the NASA Teleconferencing Network.

2.0 NEIGHBORHOOD OFFICE CENTER (NOC)

2.1 NOC Configuration

The long-term approach centers around the establishment of a
scattered group of suburban administrative support offices which
in themselves constitute a kind of simulation of an ultimate
network of fully implemented neighborhood office centers. Most
of the fundamental procedural problems that would likely be
experienced in the full configuration of office centers are
perforce to be found in the small-scale administrative support
office environment as well, viz. the difficulties involved in
communicating nuances of thought between people who are separated
by large distances, dealing with equipment reliability problems,
determining the minimal levels of ability and skills required to
operate the equipment in a satisfactory manner, the need for
scheduling jobs among several centers, and the complementary
problem of coordinating inputs from several locations—even
simply keeping track of the current status of any job—will
require careful coordination of system hardware and support
software with effective administrative techniques.

The initial efforts concentrated on establishing a link between a
single work station and a single user location. The aim was to
establish procedures necessary for smooth communication of raw
and finished products, to investigate the level of performance of
off-the-shelf equipment in the present application, and to
uncover unanticipated problems in working at a distance.

Three major functions were undertaken:

    o   reception of incoming material;

   o   processing (typing and editing) material, and
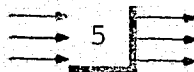
o   transmission of completed material back to the
        originator (or to some other destination, if
        requested).

Work stations were established both in the users' area at NASA
Headquarters and in a remote location at S. Ross and Company's
Washington Office—initially 3524 K Street, NW in Georgetown, and
later at 8150 Leesburg Pike, Tysons Corner, Virginia. At each
work station the functions described above were performed by
identical items of equipment.

Incoming hard copy, either typed or handwritten, was received by
a Rapifax 100 telecopier, which could feed and receive
(unattended) automatically at an average rate of 1½ minutes per
page. The Rapifax also provided a fast means of transmitting
edited hard copy, particularly in draft form, back to the
originator.

Incoming dictation was recorded on magnetic discs with a
six-minute capacity using an IBM 6:5 Tone Input System. Linked
to a standard telephone line with an RDMZR coupler, this system
answers a user's call automatically and emits "talk-down" tones
that indicate whether the recorder is stopped or ready for
further dictation. By touching buttons 1 through 6 on a
Touchtone telephone, the user can stop the recorder, continue,
rewind a disc to any point, eject a disc and continue with the
next, issue special instructions, call the NOC attendant, and
terminate the dictation session.

The heart of the NOC was a Wang 1222 TC telecommunicating
dual-cassette typewriter, a word processor that allows the typist
to delete, insert, replace, re-order, re-format, and in other
ways manipulate text that is entered through a Selectric keyboard
and stored on magnetic tape cassettes. By changing the Selectric
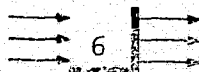
typing element, the operator can create the same letter in different type faces or insert Greek symbols and words in Italics. The Wang 1222 TC is equipped with a vertical half-space platen and both 10- and 12-pitch spacing. Once the input material was edited, the typist was ready to transmit a finished product back to the originator. This transmission was accomplished by the telecommunicating feature of the Wang 1222 TC, which allows it to transmit directly to another 1222 TC (tape-to-tape) or to a computer.

2.2 Production Statistics

Summaries of NOC activity are presented in Appendix A. The summaries include tabulations of dictation, telecopier, and word processing activity on a daily and monthly basis from January 1977 through February 1978. Word processing job time is broken down to allow analysis as a function of the length of the job submitted.

In January 1977 word processing time in hours, T, could be expressed by the equation $T = .3 + .2p$, where p is the number of pages in the job. As the word processing operators became more proficient, however, the time for draft jobs was more accurately represented as $T = .2 + .2p$, and for final jobs, $T = .2 + .1p$. Thus, a constant job set-up time of 0.2 hours became typical of operator performance, while actual typing time approached 0.2 hours per page for original keyboarding and draft revisions, and 0.1 hours per page for final copy. The latter number, of course, represents the raw speed of the typewriter itself.

These times would have been improved still further by the incorporation of CRT-based word processors with Diablo-type printers, although the analysis of this hardware was planned originally, procurement delays prevented their acquisition. This matter is discussed in Section 3.0.

2.3 Satellite-based NOC Network Experiment

In pursuit of the implementation of an integrated system
supporting a variety of functions, Dr. Ross visited NASA/ARC and
the University of Southern California to discuss possibilities
for conducting a satellite-transmission demonstration of the NOC.
Mr. Brad Gibbs, head of the ARC Communications Center, expressed
interest in participating in such a demonstration. The
transmission would be between antennas at ARC and GSFC, with the
NOC connection to the GSFC antenna handled through C&P telephone
line interconnection. Mr. Gibbs was interested in exploiting the
three-hour time difference between East coast and West coast to
handle "overtime" typing at one location by "straight-time"
typists at the other. Dr. Ross prepared a description of such an
experiment, which was oriented toward the ATS or CTS satellites.
The text of the preliminary plan is included in Appendix B.

The visit to USC stimulated interest on their part, and they
expressed the general desire to participate in a cooperative
experiment. Although S. Ross and Company followed up with a
telephone conference call including USC and NASA Headquarters, no
firm decisions were made as a result of the meeting.

Dr. Ross investigated the details of the hardware link between
the satellite ground station and the two NOC's to be used in the
experiment. A series of discussions with Messrs. Whalen,
Chitwood, Mace, and Kahle at GSFC, and Messrs. Hoffman, Lumb, and
Gibbs at ARC indicated that connection of the equipment necessary
to conduct at least a minimal-scope test is available at both
sites. Its use requires only the official sanction of the
program office to undertake the experiment. In support of the
satellite experiment integration effort, Dr. Ross also attended a
Public Service Communications Satellite System Review and
Experiment Definition Workshop at the Twin Bridges Marriott Hotel
on March 27-29, 1977.

3.0 MANAGEMENT INFORMATION SYSTEM (MIS)

In order to develop an integrated Management Information System
(MIS) that would operate in conjunction with the equipment in the
NOC, word processing/MIS hardware was required that would enable
the COBOL software developed under our prior contract to be
utilized. After a thorough search of the equipment available in
the word processing and minicomputer industries, we concluded
that the only unit of capable of satisfying all the requirements
of the project within a reasonable cost was the Digital Equipment
Corporation (DEC) WS-100 EA. This system, a PDP-8
minicomputer-based system, has a DIBOL compiler available for
implementation of the MIS software. The other unit considered
seriously, the Wang System 20 word processor, cannot be
programmed by the user. The system specified by
S. Ross and Company included two units, one for the NASA
Headquarters work station and one for the S. Ross and Company
work station. Each of the units would be provided with extended
list processing, and installation and applications support
package, two WP310-AY asynchronous communications options, and
two MM8-AB memory expanders.

After a variety of delays concerning leasing agreements vs.
outright purchase of the equipment, the project was notified that
an Automatic Data Processing Equipment Acquisition Plan had to be
submitted. Accordingly, S. Ross and Company prepared the plan,
which is included as Appendix C. As of the date of this report,
a decision to procure the equipment had still not been made.

4.0 EVALUATION OF THE NASA TELECONFERENCING NETWORK

We continued evaluation of the use of the NASA Teleconferencing
Network by compiling the results of the evaluation forms in a
computer printout for January through November 1976. This
printout, submitted to Mr. Fordyce, contained a sufficient number
of inconsistencies with the data available from the MSFC network
switch, that a correlation of the two data sources was deemed
appropriate. Simultaneous reports on teleconference activity
from both evaluation forms and the MSFC switch were analyzed for
the period March 1976 through November 1976.

Daily correlations of these data were submitted to Mr. Fordyce.
The most consistent data occurred from April through September, a
six-month period in which 328 teleconferences were reported on
forms and 873 by the MSFC switch. Of these teleconferences, 175
could be correlated. Thus, for this six-month period, 53 percent
of the teleconferences submitted on evaluation forms were also
recorded by the MSFC switch, while only 20 percent of the
teleconferences recorded by the switch were substantiated by at
least one evaluation form from any participating station.

The 47 percent of uncorrelated form data was almost entirely a
result of the inability of the switch to record teleconferences
involving 50-A units and Speakerphones, whose connections are not
made through MSFC. Most of these are direct-dialed 50-A
teleconferences using FTS.

The 80 percent of uncorrelated switch data is due partially to
the inclusion of test sessions and unsuccessfully completed
(i.e., attempted) teleconferences in the counts; these are
generally not reported on forms. For the most part, however,
lack of correlation is due simply to the neglect of the Centers
in completing the forms. One notable exception was JSC, which

was especially accurate and consistent in the completion of its forms.

From both sources the number of conferences reported for the year was 1,645. The number of trips reported saved averaged 4.3 per teleconference. Therefore, the total number of trips saved is 7,074 ($2.186M) for the period during which reports were made. An additional 25 percent should be added to the above figures to compensate for the months of missing data.

These statistics were used as a partial basis for the final teleconference report, written by Mr. Fordyce of Code EC.

APPENDIX A

NOC PRODUCTION STATISTICS

Summary of NOC Activity - January 1977

Category	Total Units	Submissions	Units/Submission
Dictation	77 discs	42	1.8 discs/sub
Rapifax In	5 pages	3	1.7 pages/sub
Rapifax Out	67 pages	20	3.4 pages/sub
WP	508 pages	78	6.5 pages/sub

Word Processing Time

No. Pages

	1	2	3	4	5	6	7	≥8	All Jobs
No. Jobs:	6	16	13	20	2	8	1	12	78
Avg. Time (Hrs):	.5	.6	1.3	1.3	1.3	1.5	2.0	2.3	1.3

NEIGHBORHOOD OFFICE CENTER

Daily Word Processing Activity - January 1977

D — . — DRAFT, AVERAGE: 15.6 PAGES/DAY

F - - - FINAL, AVERAGE: 8.6 PAGES/DAY

T ——— TOTAL, AVERAGE: 24.2 PAGES/DAY

NUMBER OF PAGES

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

DATE
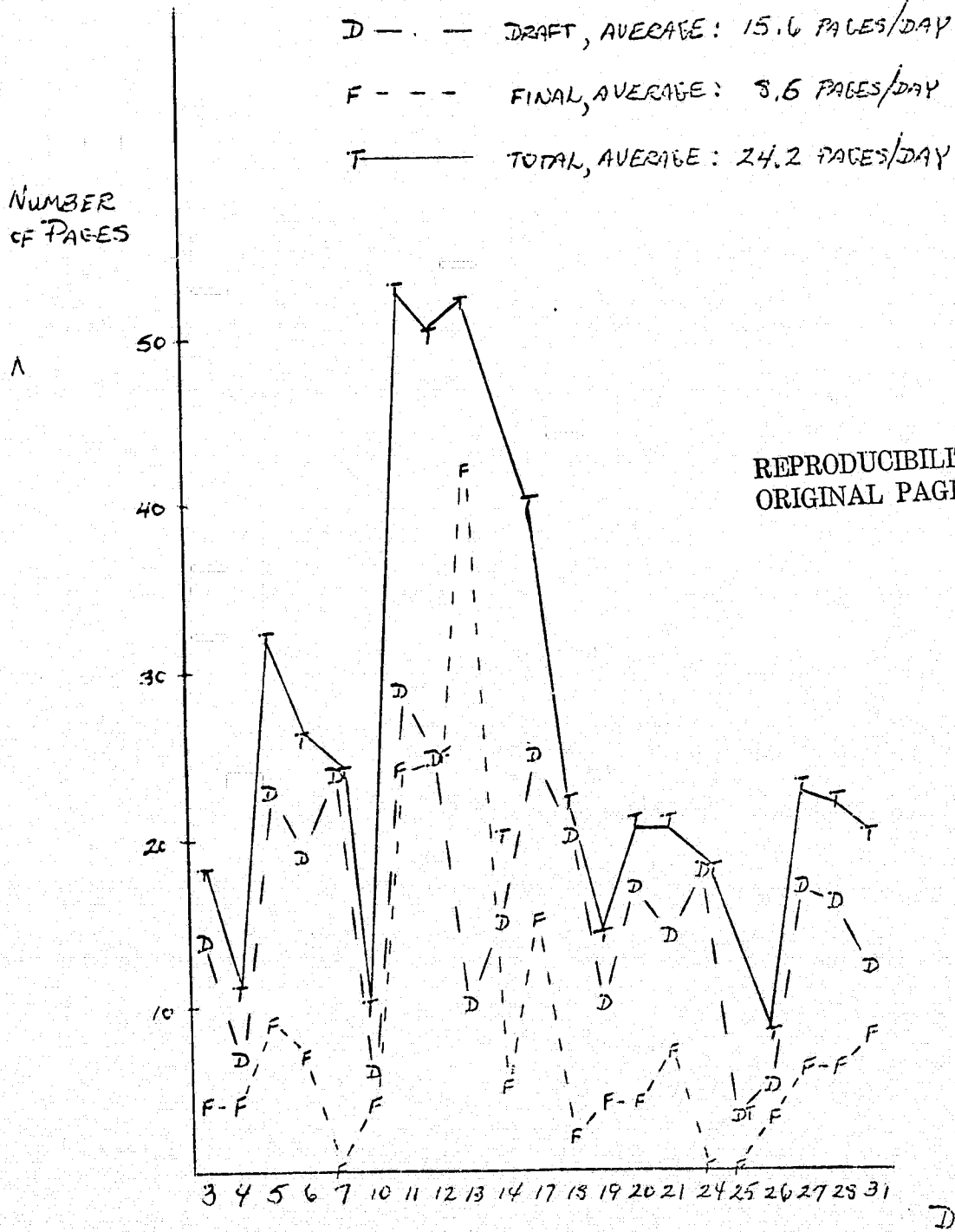
NEIGHBORHOOD OFFICE CENTER

Daily Input/Output Activity — January 1977

D———— DICTATION, AVERAGE: 3.7 DISCS/DAY

I - - - - RAPIFAX IN, AVERAGE: 0.2 PAGES/DAY

O———— RAPIFAX OUT, AVERAGE: 3.2 PAGES/DAY

NUMBER OF
DISCS OR PAGES

DATE
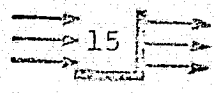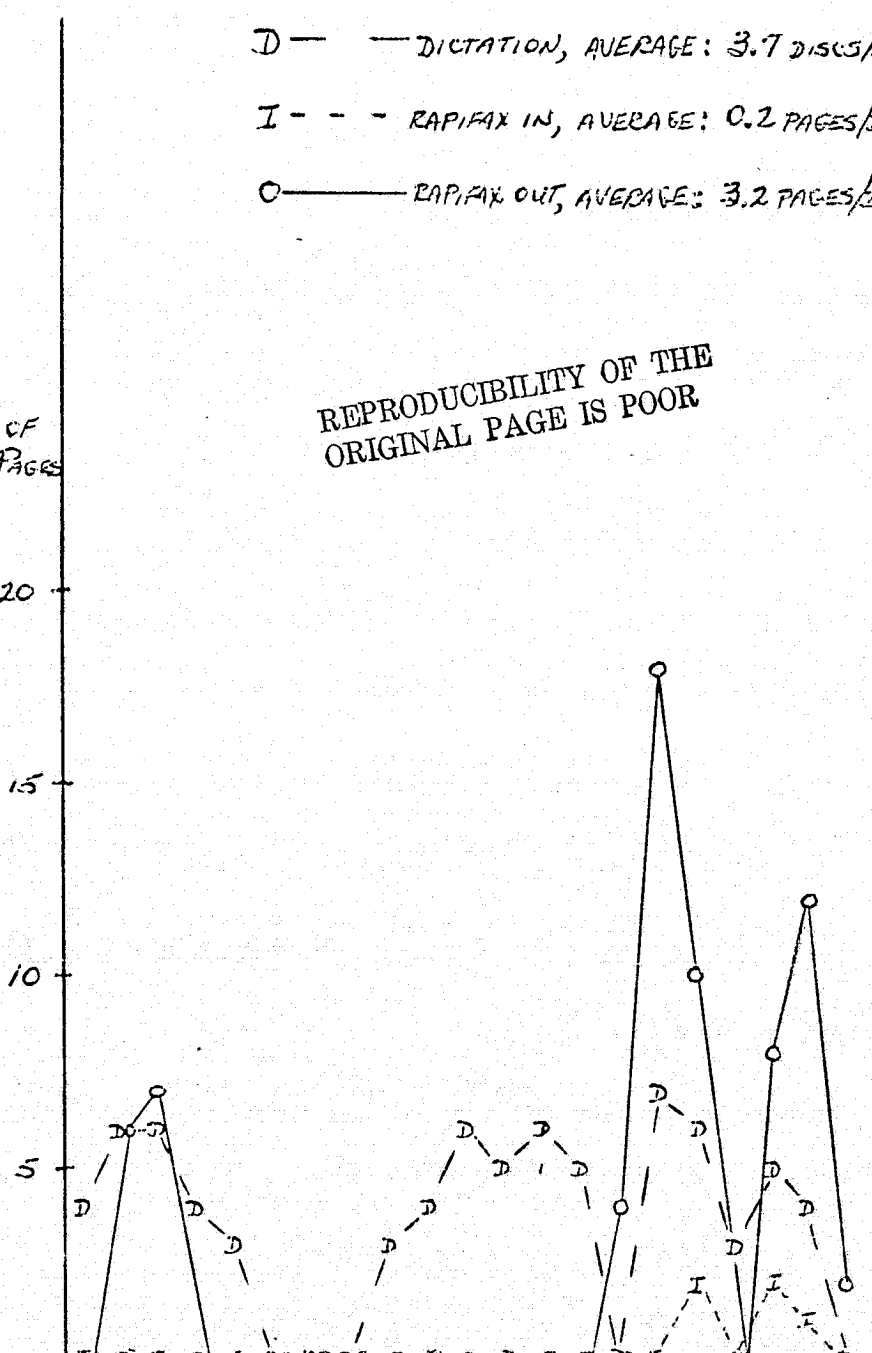
Summary of NOC Activity - February 1977

Category	Total Units	Submissions	Units/Submission
Dictation	35 discs	22	1.6 discs/sub
Rapifax In	45 pages	14	3.2 pages/sub
Rapifax Out	65 pages	18	3.6 pages/sub
WP Draft	122 pages	31	3.9 pages/sub
WP Final	120 pages	24	5.0 pages/sub

Word Processing Time

No. Pages

		1	2	3	4	5	6	7	≥8	All Jobs
No. Jobs:	Draft	4	9	10	1	2	2	0	3	31
	Final	5	7	4	3	2	0	0	7	24
Avg. Time (Hrs):										
	Draft	.4	.6	.8	1.5	1.3	1.5	-	2.0	.9
	Final	.4	.6	.8	1.0	1.1	-	-	2.3	.9

NEIGHBORHOOD OFFICE CENTER

Daily Word Processing Activity - February 1977

D— —— DRAFT, AVERAGE: 6.8 PAGES/DAY

F - - - FINAL, AVERAGE: 6.7 PAGES/DAY

T ——— TOTAL, AVERAGE: 13.5 PAGES/DAY

NUMBER OF PAGES

50 —
40 —
30 —
20 —
10 —

1 2 3 4 7 8 9 10 11 14 15 16 17 18 21 22 23 24 25 28

DATE

17
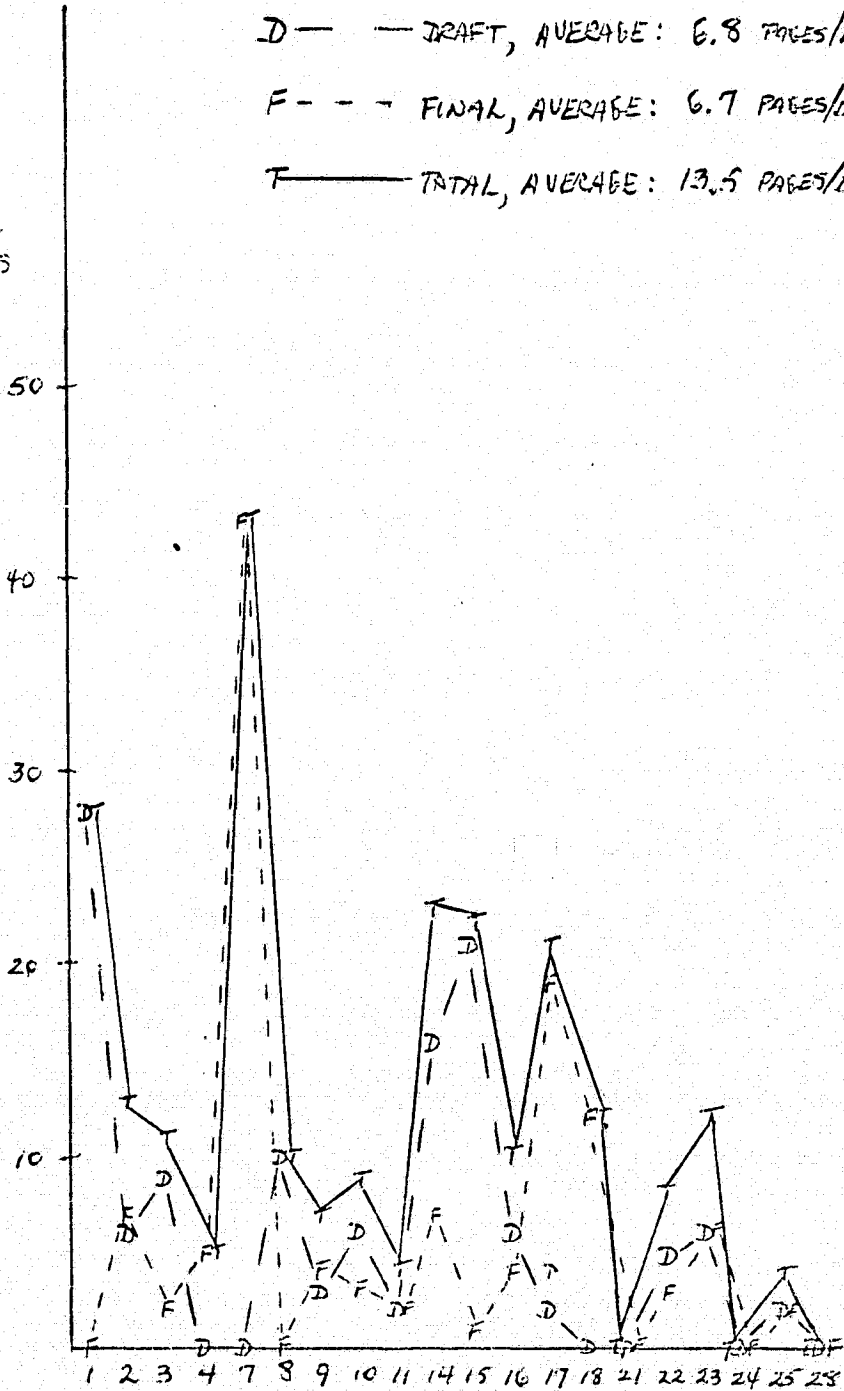
NEIGHBORHOOD OFFICE CENTER

DAILY INPUT/OUTPUT ACTIVITY - FEBRUARY 1977

D — — DICTATION, AVERAGE: 1.9 DISCS/DAY

I - - - RAPIFAX IN, AVERAGE: 2.5 PAGES/DAY

O———— RAPIFAX OUT, AVERAGE: 3.6 PAGES/DAY

NUMBER OF
DISCS OR PAGES
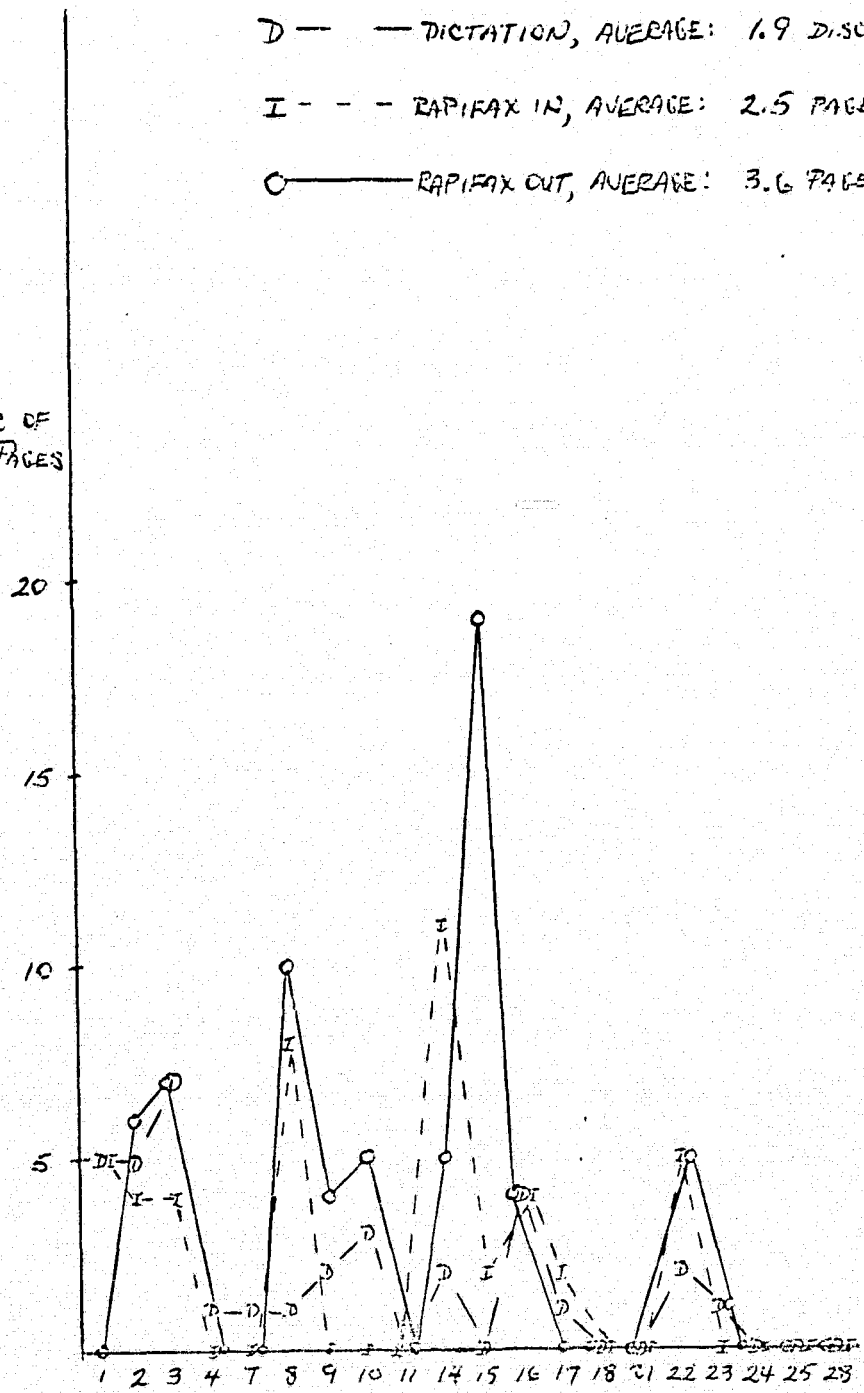
DATE

Summary of NOC Activity - March 1977

Category	Total Units	Submissions	Units/Submission
Dictation	88 discs	37	2.4 discs/sub
Rapifax In	55 pages	20	2.8 pages/sub
Rapifax Out	178 pages	37	4.8 pages/sub
WP Draft	207 pages	54	3.8 pages/sub
WP Final	127 pages	31	4.1 pages/sub

Word Processing Time

No. Pages

		1	2	3	4	5	6	7	≥8	All Jobs
No. Jobs:	Draft	10	10	14	5	1	6	1	7	54
	Final	8	9	3	3	1	1	1	5	31
Avg. Time (Hrs):										
	Draft	.4	.5	.6	.7	.8	1.1	2	1.5	.8
	Final	.3	.6	.7	1.1	1.0	.5	1.0	1.1	.7

NEIGHBORHOOD OFFICE CENTER

DAILY WORD PROCESSING ACTIVITY - MARCH 1977

D — — DRAFT, AVERAGE: 12.2 PAGES/DAY

F - - - FINAL, AVERAGE: 7.5 PAGES/DAY

T ——— TOTAL, AVERAGE: 19.7 PAGES/DAY
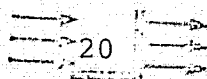
Number
of Pages

50

40

30

20

10

4 7 8 9 10 11 14 15 16 17 18 21 22 23 24 25 28 29 30 31

DATE

20

NEIGHBORHOOD OFFICE CENTER

DAILY INPUT/OUTPUT ACTIVITY – MARCH 1977

D———DICTATION, AVERAGE: 5.2 DISCS/DAY

I – – – RAPIFAX IN, AVERAGE: 3.2 PAGES/DAY

O———RAPIFAX OUT, AVERAGE: 10.5 PAGES/DAY

NUMBER OF
DISCS OR PAGES

20

15

10

5

4 7 8 9 10 11 14 15 16 17 18 21 22 23 24 25 28 29 30 31

DATE

Summary of NOC Activity - April 1977

Category	Total Units	Submissions	Units/Submission
Dictation	72 discs	35	2.1 discs/sub
Rapifax In	93 pages	27	3.4 pages/sub
Rapifax Out	176 pages	42	4.2 pages/sub
WP Draft	234 pages	55	4.3 pages/sub
WP Final	109 pages	36	3.0 pages/sub

Word Processing Time

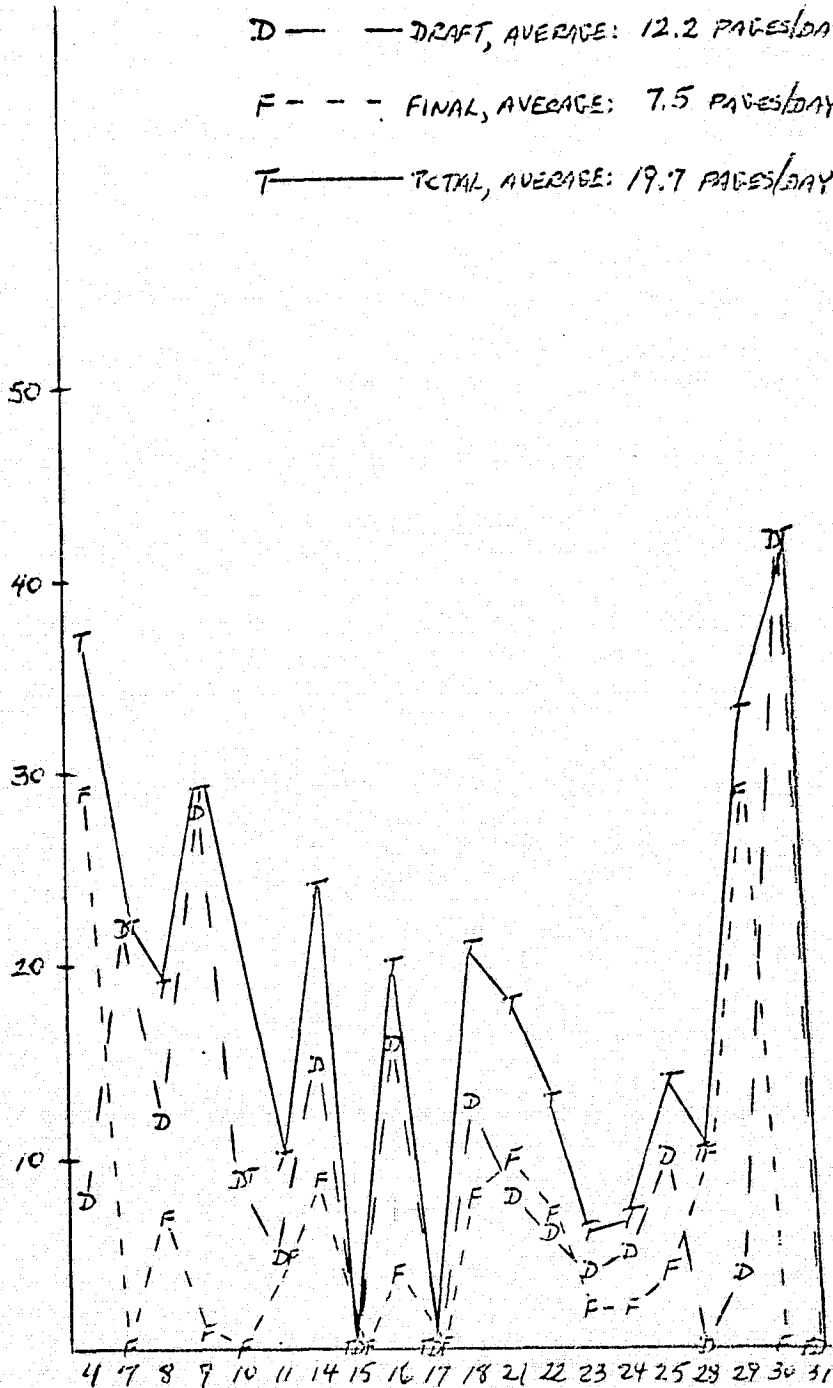|					No. Pages					All Jobs
		1	2	3	4	5	6	7	≥8	
No. Jobs:	Draft	6	14	12	5	3	7	0	8	55
	Final	15	8	3	0	2	4	0	4	36
Avg. Time (Hrs):										
	Draft	.5	.6	.8	.8	1.3	1.3	–	1.8	.9
	Final	.3	.6	.4	–	1.1	.9	–	1.4	.6

NEIGHBORHOOD OFFICE CENTER

DAILY WORD PROCESSING ACTIVITY – APRIL 1977

D —— — DRAFT, AVERAGE: 11.7 PAGES/DAY

F - - - FINAL, AVERAGE: 5.5 PAGES/DAY

T ———— TOTAL, AVERAGE: 17.2 PAGES/DAY

NUMBER OF PAGES
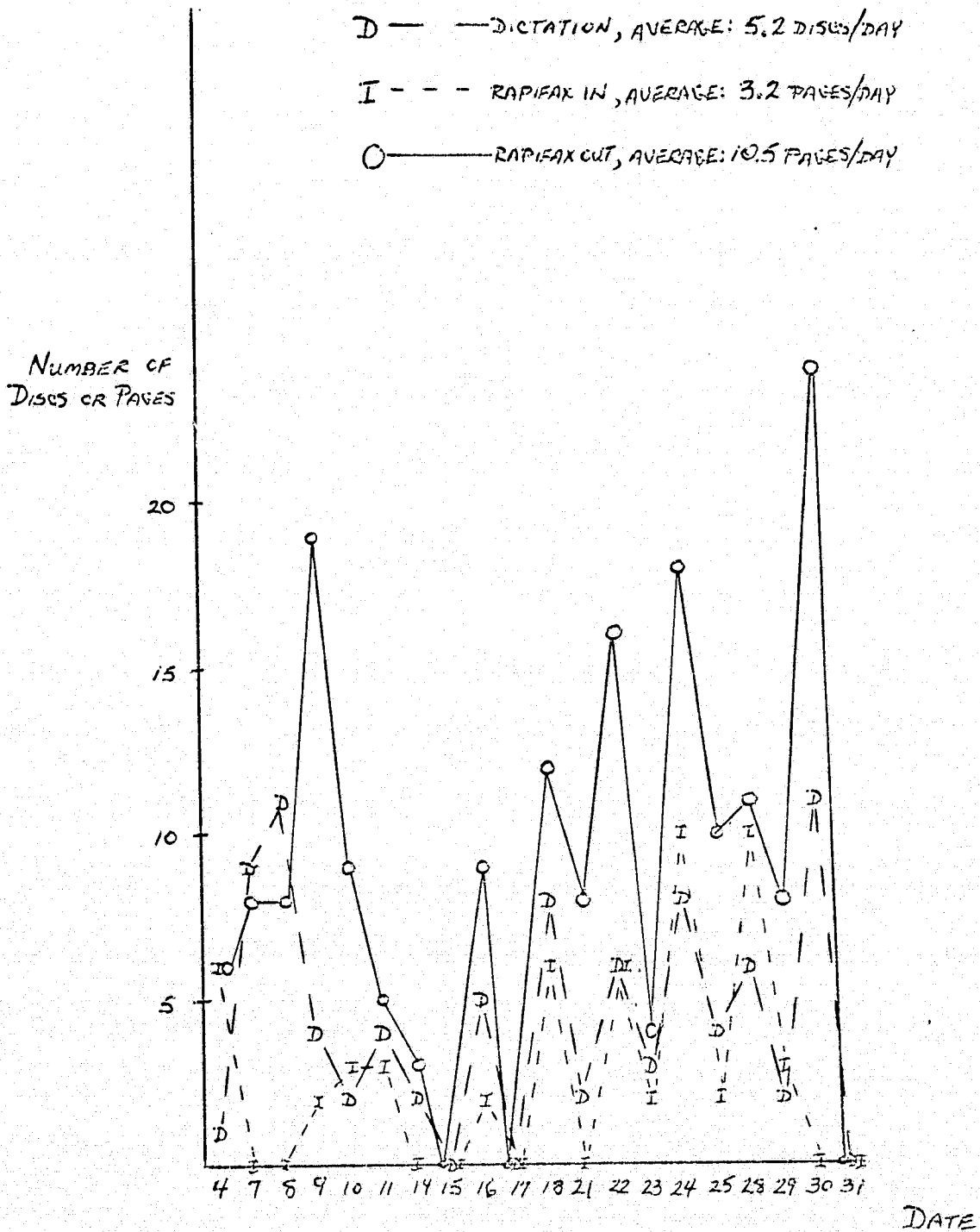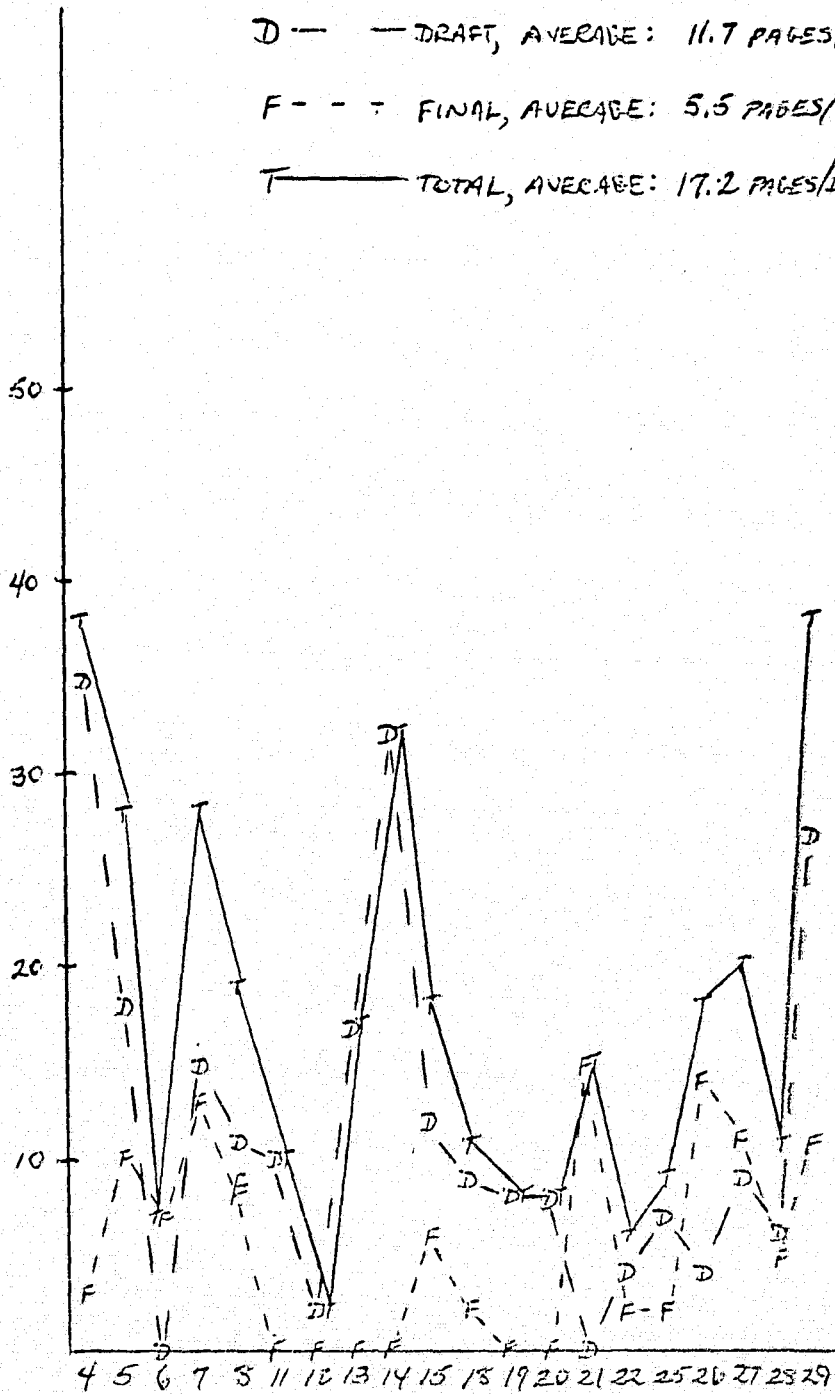

DATE

NEIGHBORHOOD OFFICE CENTER
DAILY INPUT/OUTPUT ACTIVITY - APRIL 1977

D — — DICTATION, AVERAGE : 3.6 DISCS/DAY

I - - - RAPIFAX IN, AVERAGE : 4.7 PAGES/DAY

O —— RAPIFAX OUT, AVERAGE : 8.8 PAGES/DAY

NUMBER OF
DISCS OR PAGES

DATE

Summary of NOC Activity - May 1977

Georgetown

Category	Total Units	Submissions	Units/Submission
Dictation	66 discs	38	1.7 discs/sub
Rapifax In	68 pages	20	3.4 pages/sub
Rapifax Out	158 pages	20	7.9 pages/sub
WP Draft	220 pages	57	3.9 pages/sub
WP Final	190 pages	50	3.8 pages/sub

Word Processing Time

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	3	24	9	7	4	3	0	7	57
	Final	10	20	5	5	2	1	3	4	50
Avg. Time (Hrs):										
	Draft	.3	.4	.8	.8	1	1.1	–	1.3	.7
	Final	.3	.5	.7	1	.8	.8	1.4	1.8	.5

Summary of NOC Activity - May 1977

NASA Headquarters

Category	Total Units	Submissions	Units/Submission
Dictation	7 discs	2	3.5 discs/sub
Rapifax Out	31 pages	24	1.3 pages/sub
WP Draft	54 pages	27	2 pages/sub
WP Final	93 pages	58	1.6 pages/sub

Word Processing Time

		No. Pages								
		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	7	12	6	0	1	1	0	0	27
	Final	44	7	0	3	2	1	0	1	58
Avg. Time (Hrs):										
	Draft	.3	.4	.8	–	1.3	1.3	–	–	.5
	Final	.1	.4	–	.4	.4	2	–	1.5	.2

NEIGHBORHOOD OFFICE CENTER

GEORGETOWN

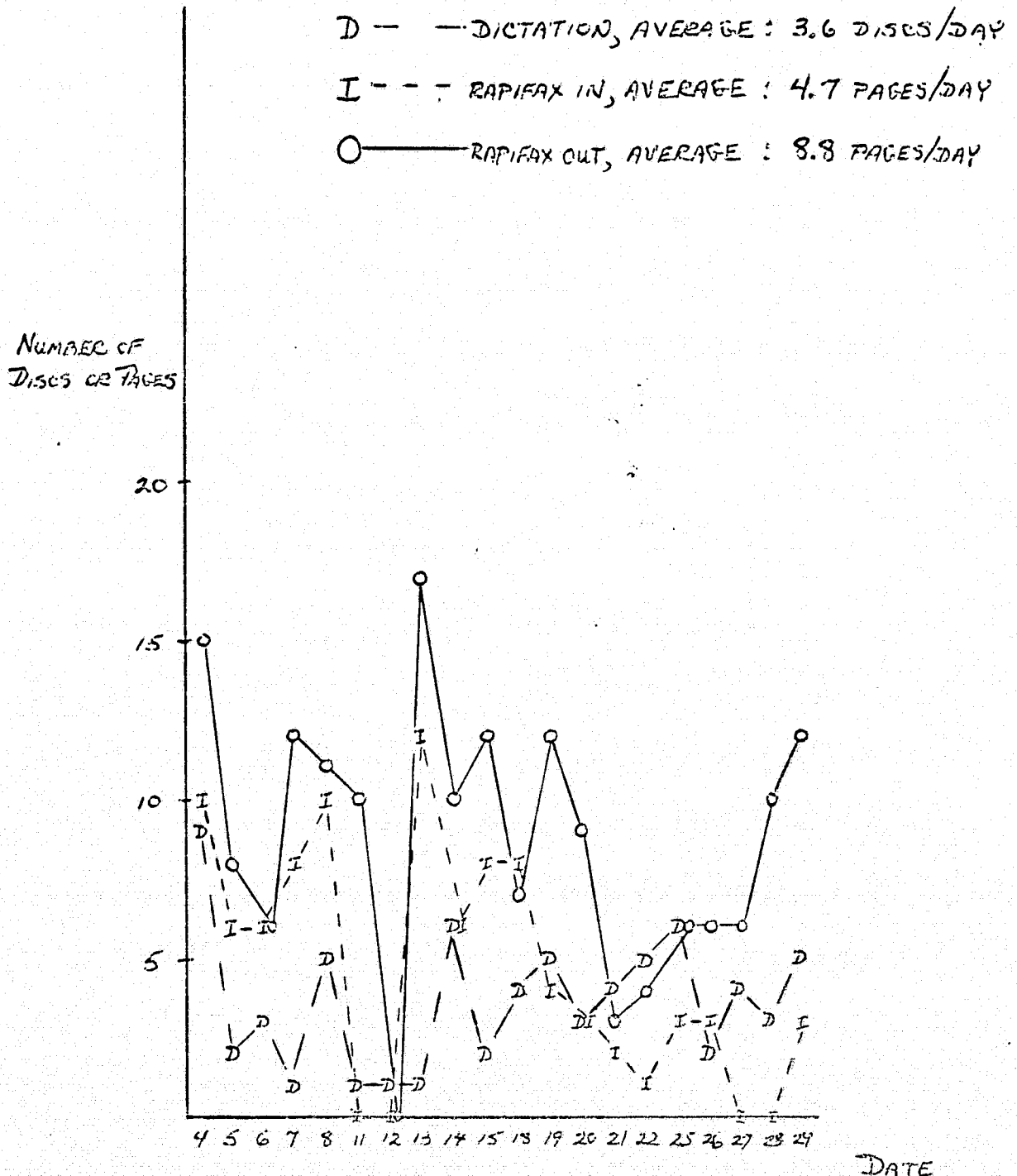## DAILY WORD PROCESSING ACTIVITY - MAY 1977

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- F - - - FINAL, AVERAGE: 9.0 PAGES/DAY
- T —— TOTAL, AVERAGE: 19.5 PAGES/DAY

DATE
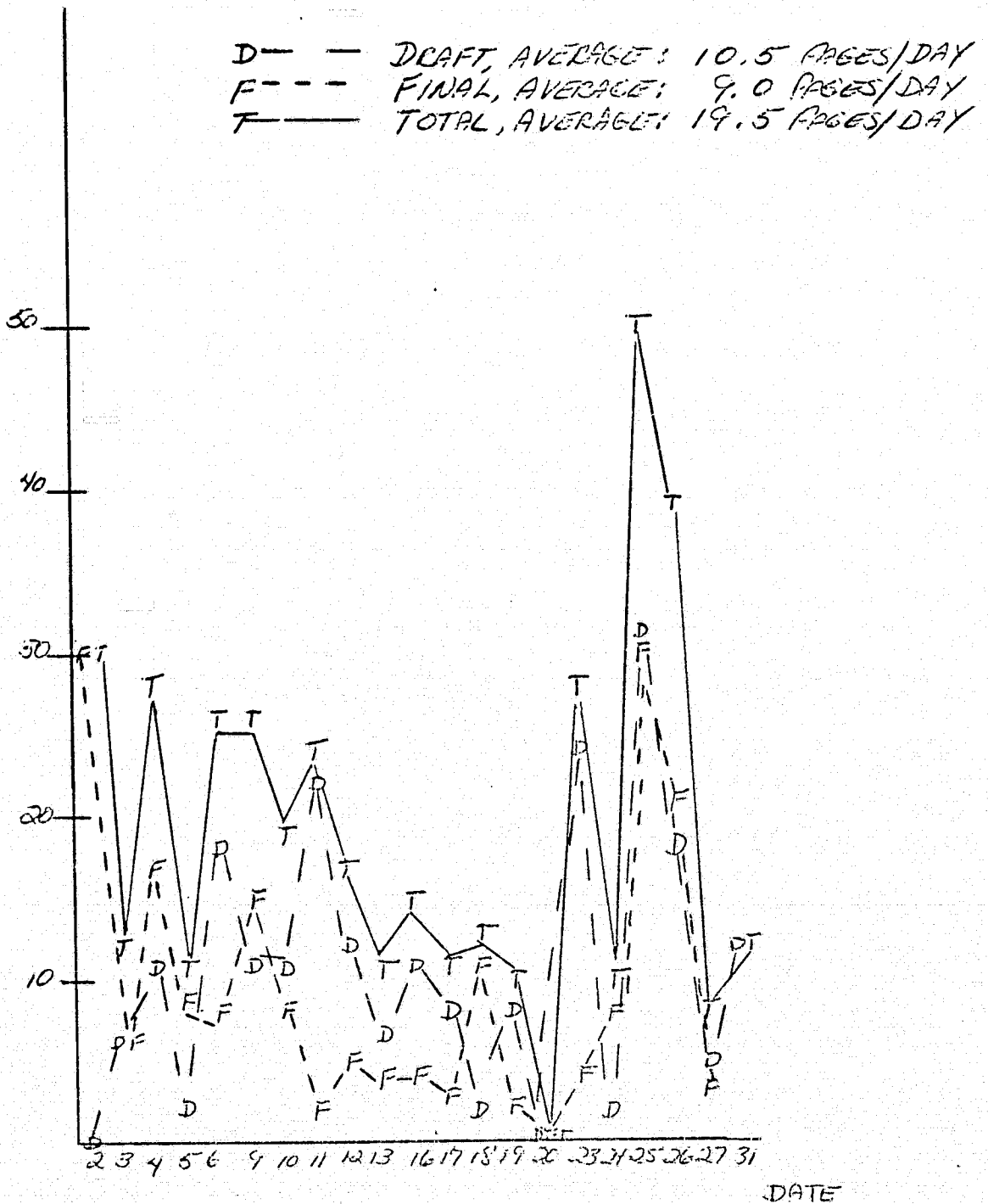
NEIGHBORHOOD OFFICE CENTER
GEORGETOWN
DAILY INPUT/OUTPUT ACTIVITY — MAY 1977

D — — — DICTATION, AVERAGE: 3.1 DISCS/DAY
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O ——— FAX-OUT, AVERAGE: 7.5 PAGES/DAY

DATE
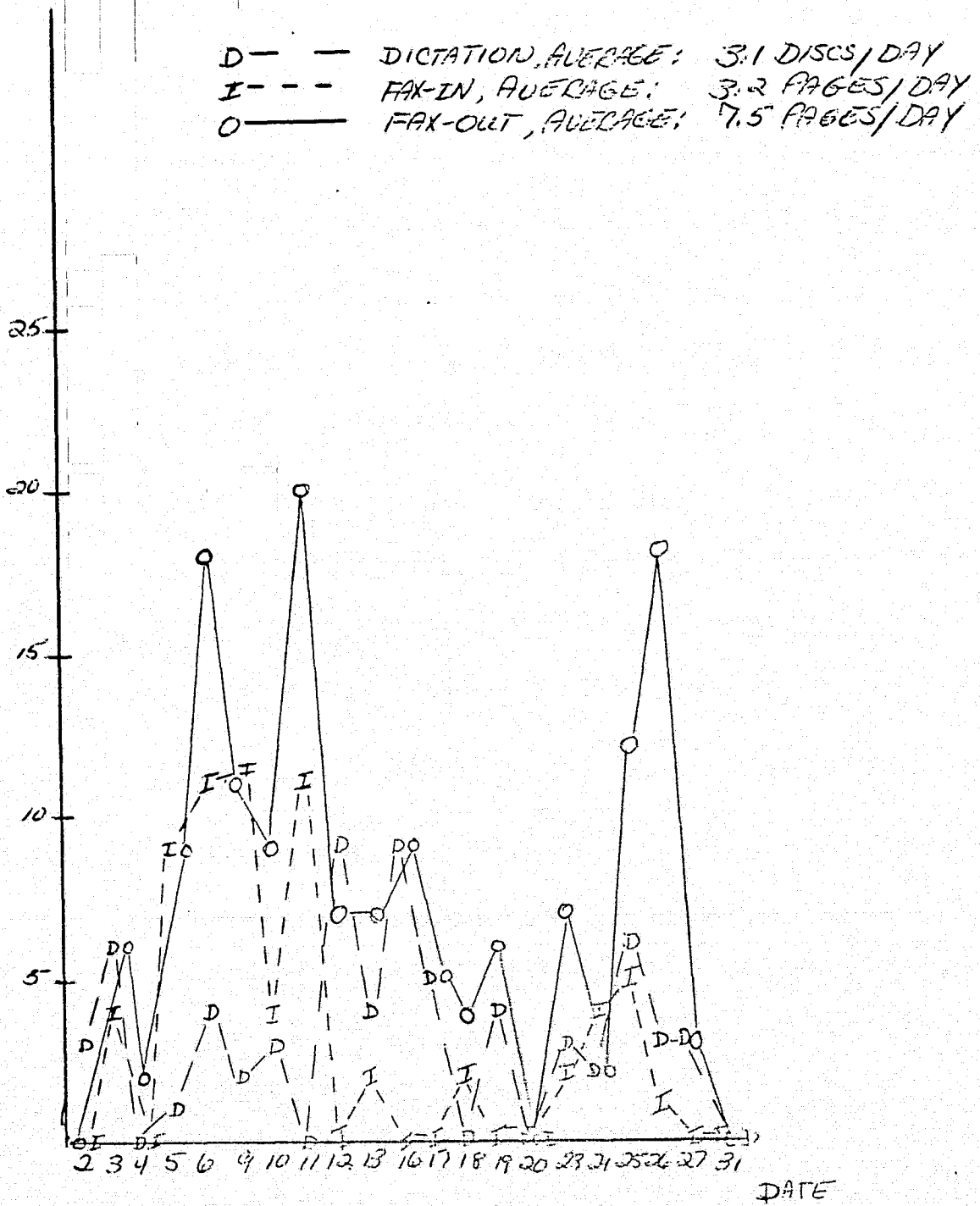
NEIGHBORHOOD OFFICE CENTER

NASA HEADQUARTERS

DAILY WORD PROCESSIN ACTIVITY — MAY 1977

D — — DRAFT, AVERAGE: 5.4 PAGES/DAY
F — — — FINAL, AVERAGE: 9.3 PAGES/DAY
T ——— TOTAL, AVERAGE: 14.7 PAGES/DAY

16 17 18   19 20 23 24 25 26 27 31
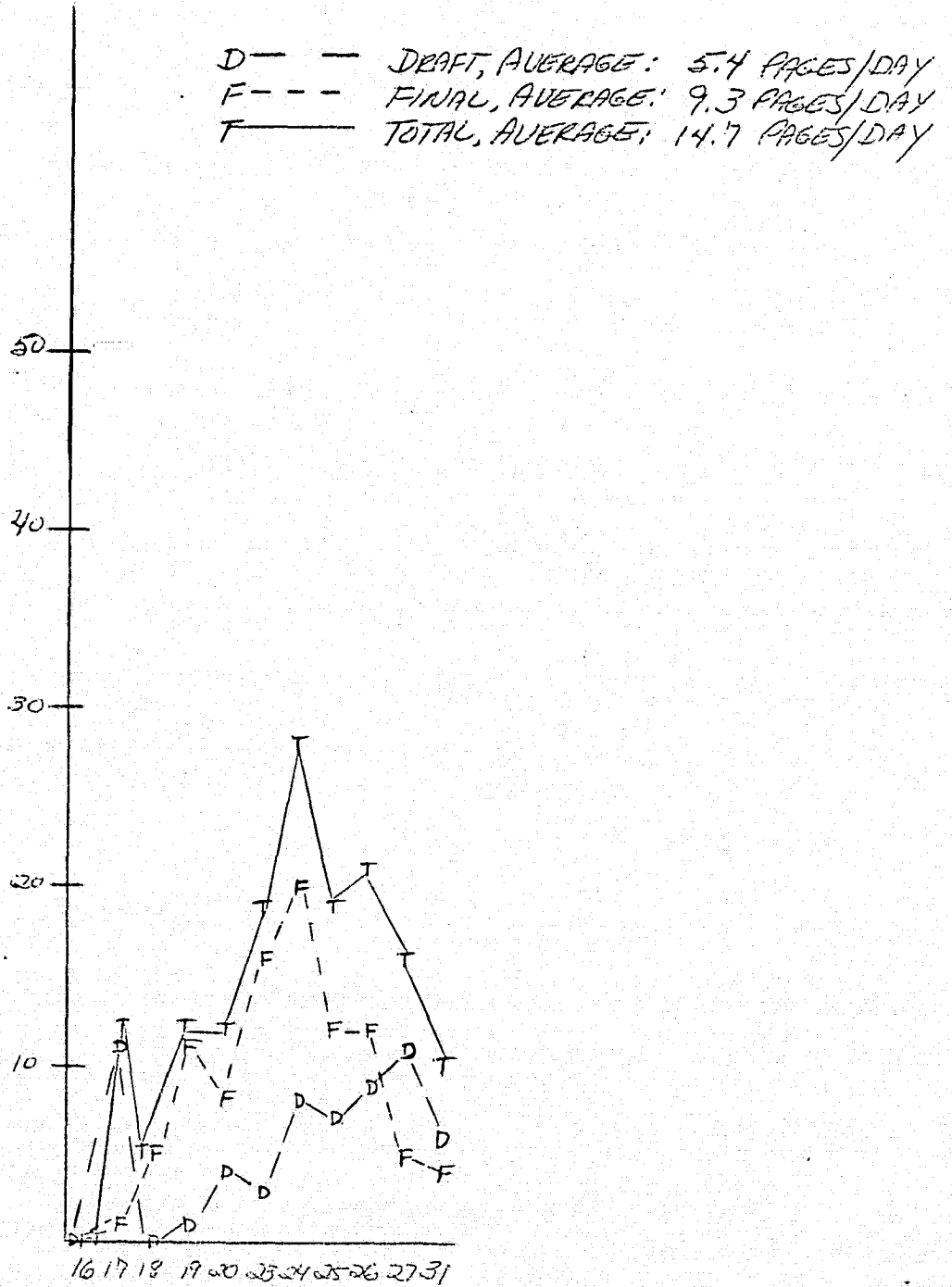
NEIGHBORHOOD OFFICE CENTER

NASA HEADQUARTERS

DAILY INPUT/OUTPUT ACTIVITY — MAY 1977

D— — DICTATION, AVERAGE: .7 DISCS/DAY

O——— FAX-OUT, AVERAGE: 7.5 PAGES/DAY

25

20

15

10

5

16 17 18 19 20 23 24 25 26 27 31

DATE

30
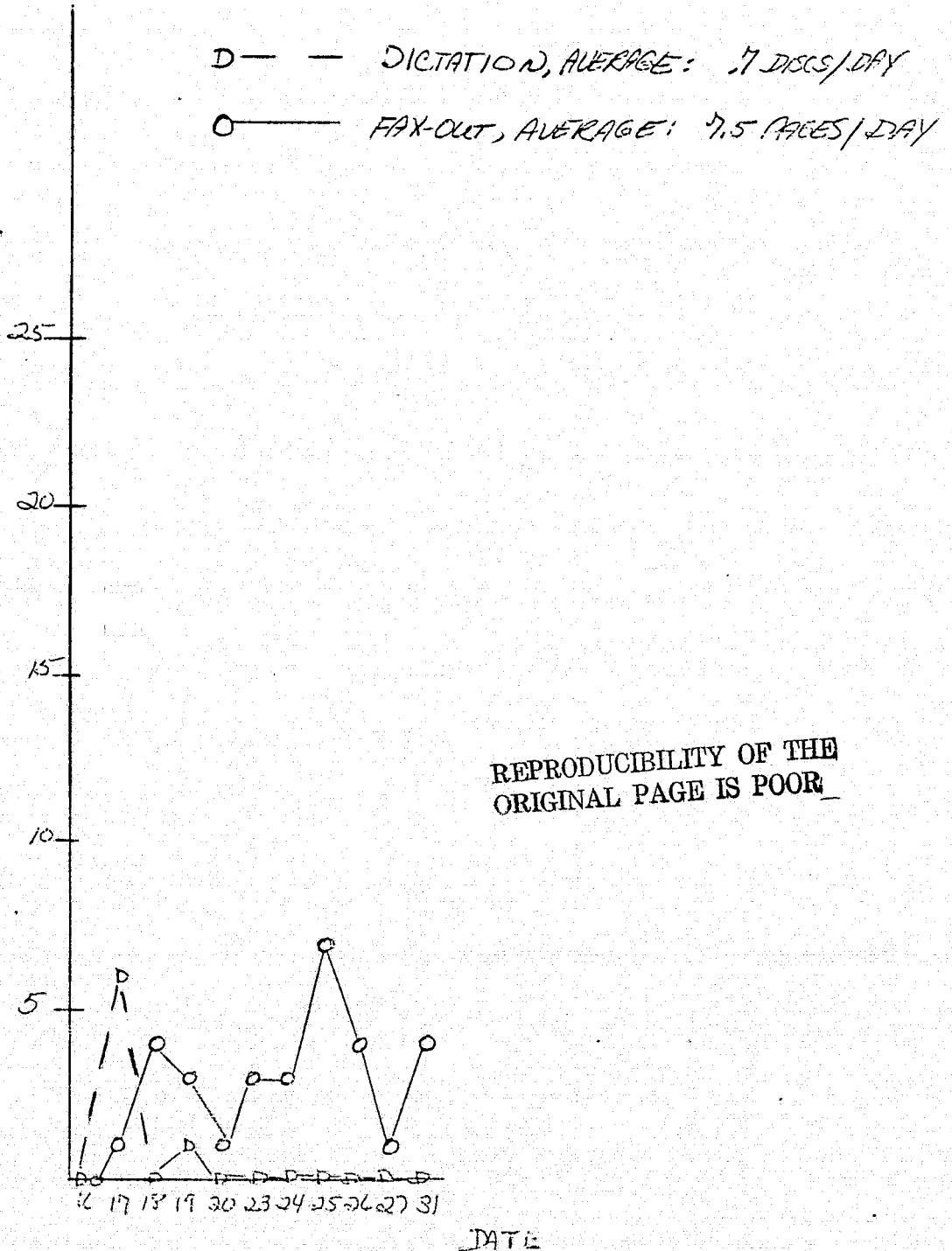
Summary of NOC Activity - June 1977

Georgetown

Category	Total Units	Submissions	Units/Submission
Dictation	48 discs	19	2.5 discs/sub
Rapifax In	30 pages	6	5.0 pages/sub
Rapifax Out	90 pages	20	4.5 pages/sub
WP Draft	155 pages	37	4.2 pages/sub
WP Final	195 pages	31	6.3 pages/sub

Word Processing Activity

		No. Pages								All Jobs
		1	2	3	4	5	6	7	8	
No. Jobs:	Draft	4	12	5	4	2	2	1	7	37
	Final	5	9	0	1	4	1	1	10	31
Avg. Time (Hrs):										
	Draft	.2	.4	.6	.6	1.4	.6	1.3	1.8	.8
	Final	.2	.4	–	1.0	.8	.3	.5	1.1	.7

Summary of NOC Activity - June 1977

NASA Headquarters

Category	Total Units	Submissions	Units/Submission
Rapifax In	3 pages	2	1.5 pages/sub
WP Draft	52 pages	32	1.6 pages/sub
WP Final	203 pages	120	1.7 pages/sub

Word Processing Activity

					No. Pages					
		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	21	6	3	0	2	0	0	0	32
	Final	78	22	10	4	3	1	2	0	120
Avg. Time (Hrs):										
	Draft	.2	.4	.8	–	1.0	–	–	–	.4
	Final	.1	.4	.7	.2	.3	.3	.9	–	.3

NEIGHBORHOOD OFFICE CENTER

DAILY WORD PROCESSING ACTIVITY — June 1971

GEORGETOWN

D — — DRAFT, AVERAGE: 7.0 PAGES/DAY

F - - - FINAL, AVERAGE: 8.9 PAGES/DAY

T —— TOTAL, AVERAGE: 15.9 PAGES/DAY

Number of Pages
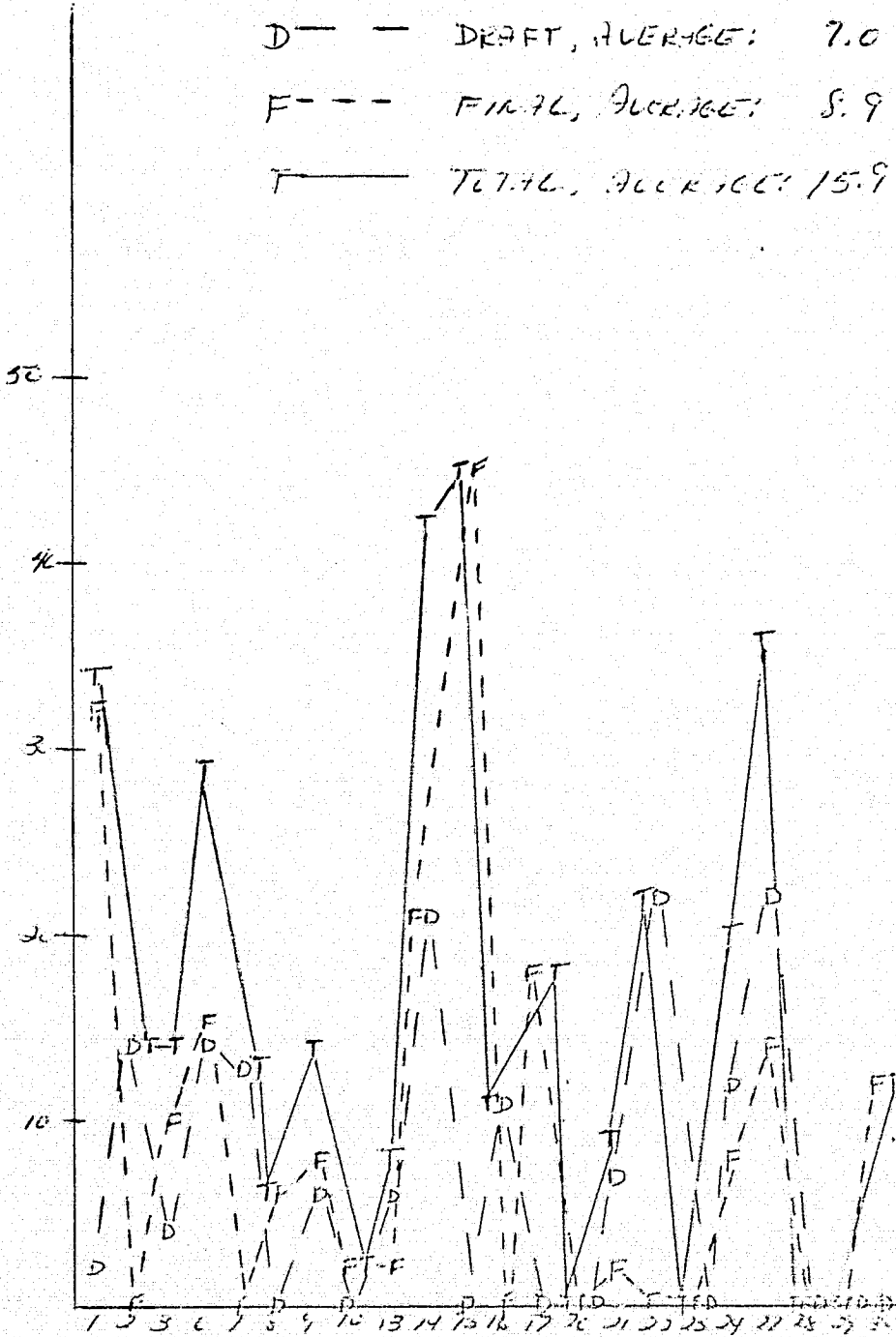
NEIGHBORHOOD OFFICE CENTER

DAILY INPUT/OUTPUT ACTIVITY — JUNE 1971

GEORGETOWN

D— — —   DICTATION, AVERAGE: 2.2 DISCS/DAY

I - - -   RAPIFAX IN, AVERAGE: 1.4 DISCS/DAY

C————   RAPIFAX OUT, AVERAGE: 4.1 PAGES/DAY

NUMBER OF
DISCS OR PAGES

20

15

10

5

1 2 3 4 5 6 7 8 9 10 13 14 15 16 17 20 21 22 23 24 27 28 29 30

DATE

DECLASSIFIED OFFICE CENTER
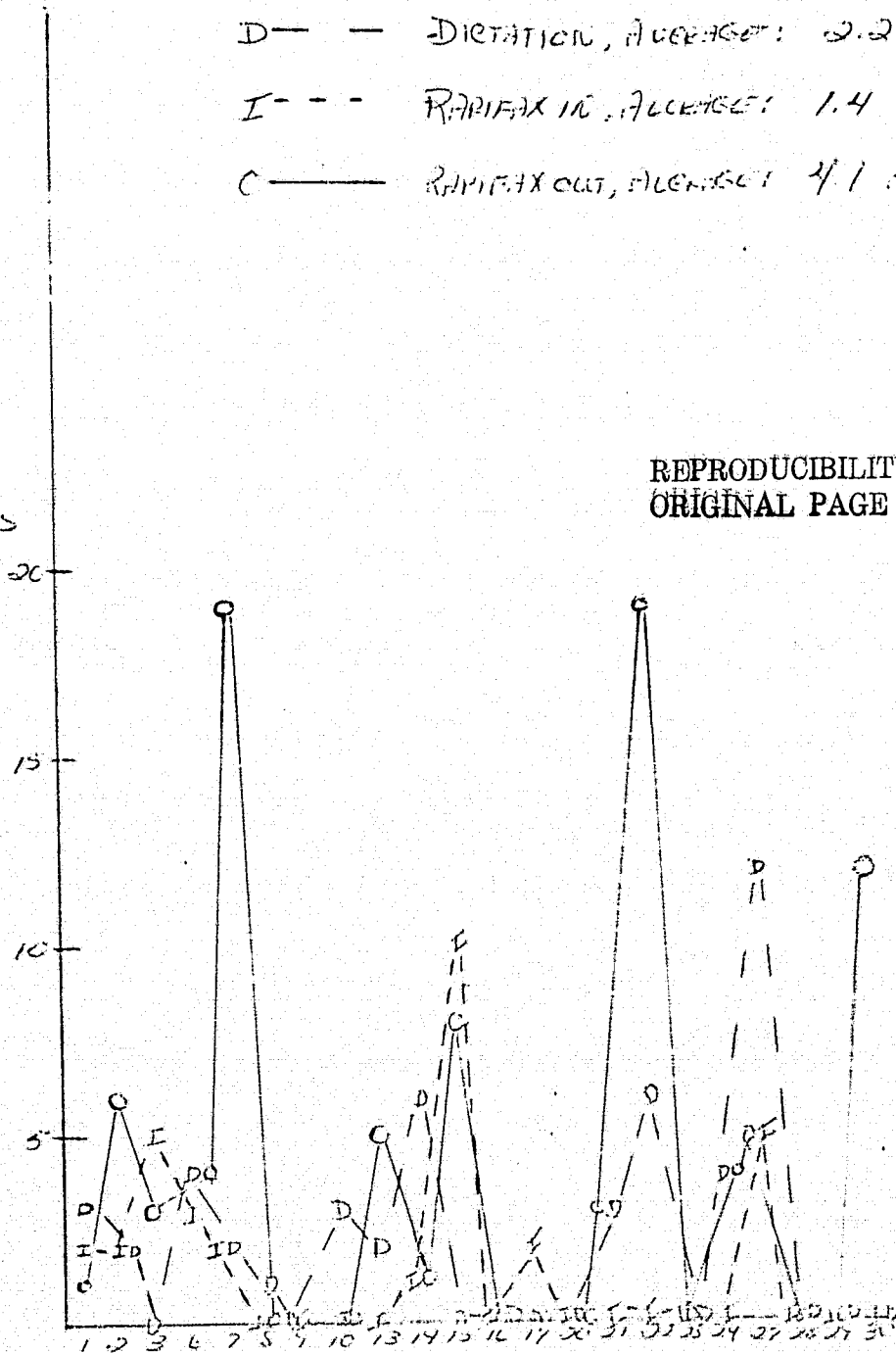
DAILY WORD PROCESSING ACTIVITY — JUNE 1977

NASA HEADQUARTERS

D— — DRAFT, AVERAGE: 2.4 PAGES/DAY
F— — — FINAL, AVERAGE: 9.2 PAGES/DAY
T———— TOTAL, AVERAGE: 11.6 PAGES/DAY

Number of
Pages
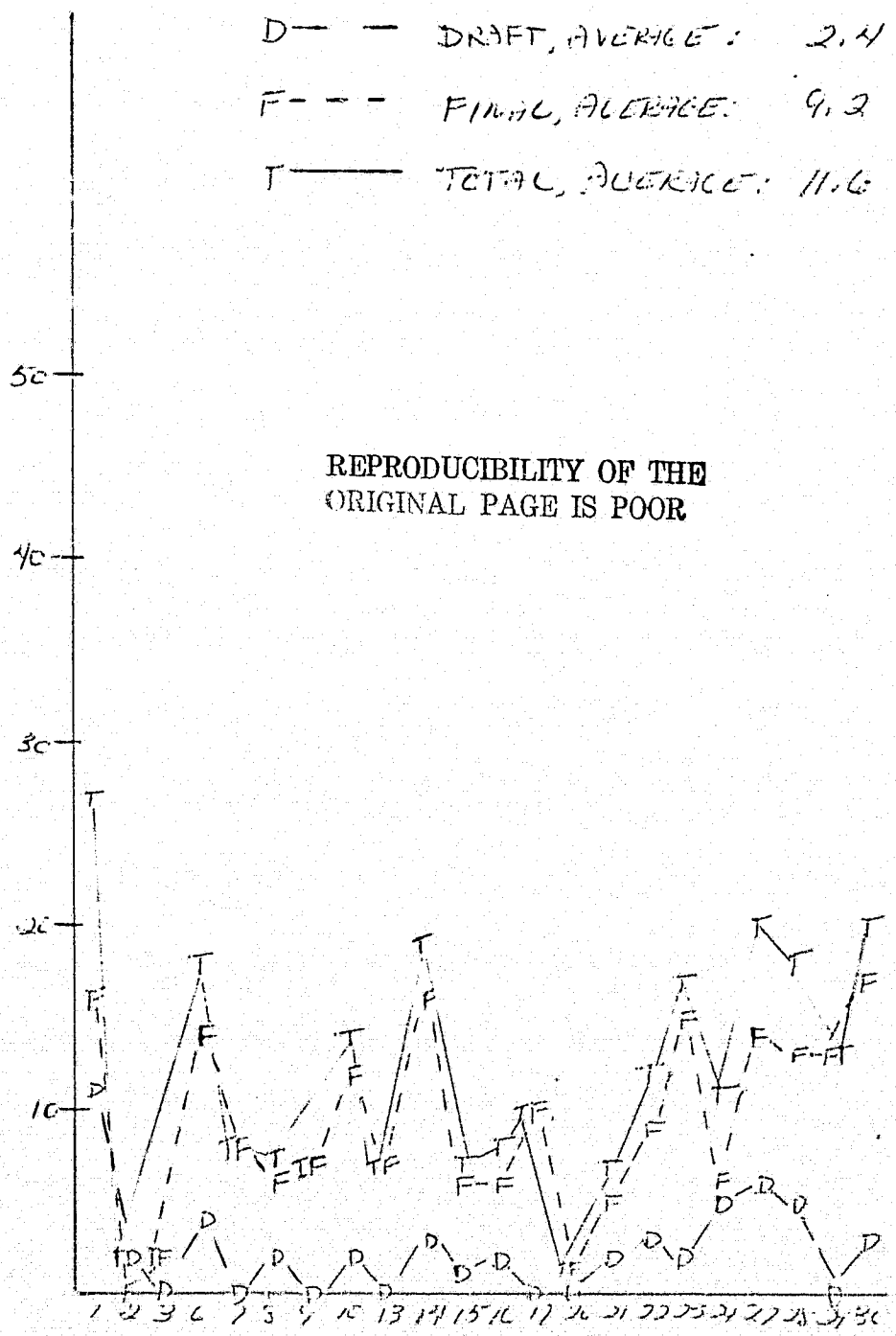
Summary of NOC Activity - July 1977

Georgetown

Category	Total Units	Submissions	Units/Submission
Dictation	34 discs	26	1.3 discs/sub
Rapifax In	80 pages	17	4.1 pages/sub
Rapifax Out	54 pages	18	3.0 pages/sub
WP Draft	176 pages	37	4.8 pages/sub
WP Final	103 pages	40	2.6 pages/sub

Word Processing Activity

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	9	12	8	3	1	1	0	3	37
	Final	19	11	4	1	1	1	0	3	40
Avg. Time (Hrs):										
	Draft	.2	.2	.4	1.3	.5	.5	--	3.1	.6
	Final	.2	.2	.4	1.0	.1	.5	--	1.4	.3

Summary of NOC Activity - July 1977
National Aeronautics and Space Administration

Category	Total Units	Submissions	Units/Submission
Dictation	3 discs	3	1.0 discs/sub
Rapifax In	2 pages	1	2.0 pages/sub
Rapifax Out	4 pages	1	4.0 pages/sub
WP Draft	102 pages	67	1.5 pages/sub
WP Final	197 pages	113	1.7 pages/sub

Word Processing Activity

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	51	12	1	0	0	1	0	2	67
	Final	77	25	4	3	0	0	0	4	113
Avg. Time (Hrs):										
	Draft	.2	.4	.5	--	--	1.3	--	1.3	.3
	Final	.2	.4	.4	.3	--	--	--	0.8	.3

NEIGHBORHOOD OFFICE CENTER
DAILY WORD PROCESSING ACTIVITY - JULY 1977
GEORGETOWN
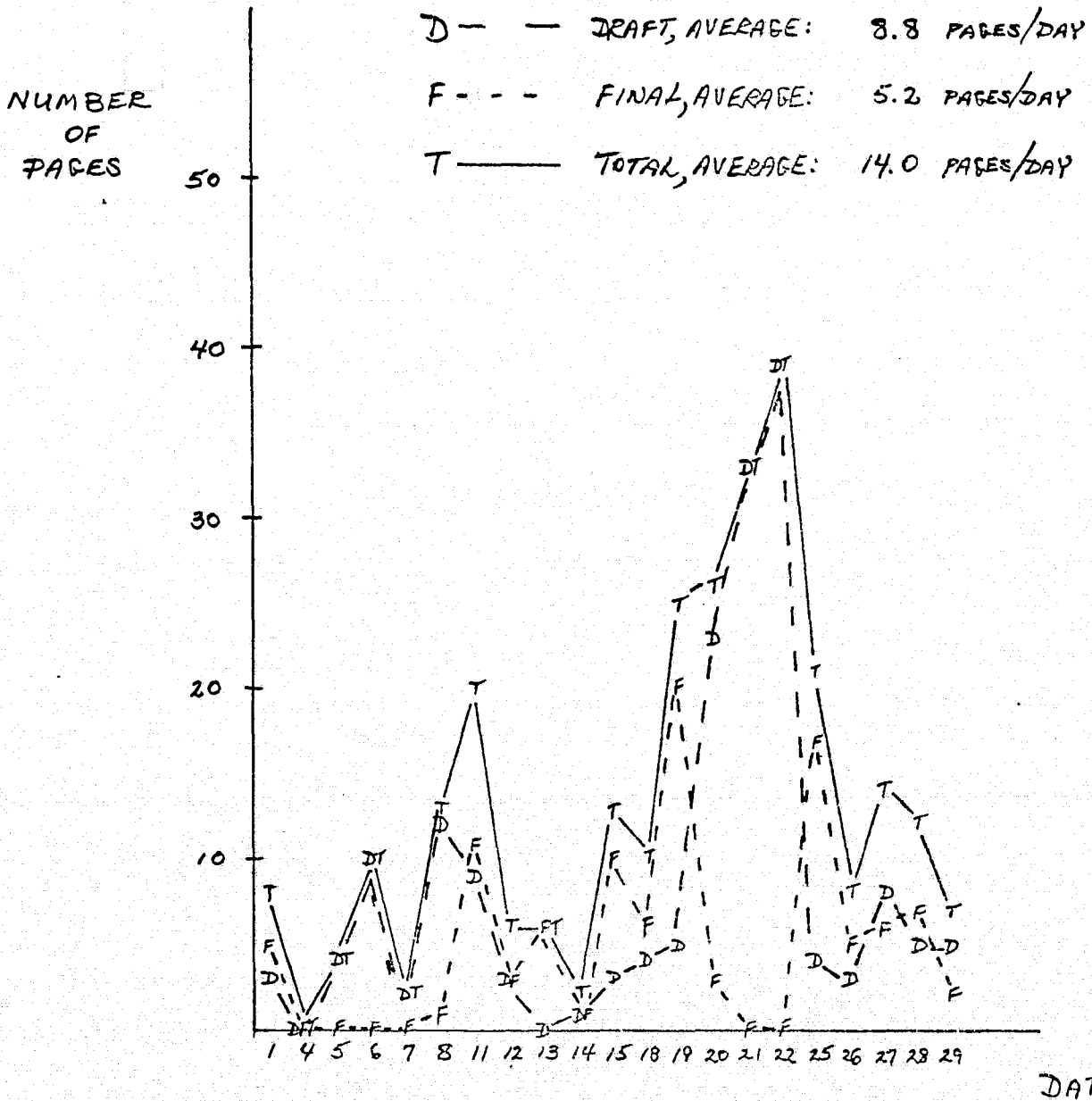
NUMBER OF PAGES

D — — DRAFT, AVERAGE: 8.8 PAGES/DAY

F - - - FINAL, AVERAGE: 5.2 PAGES/DAY

T —— TOTAL, AVERAGE: 14.0 PAGES/DAY

DATE

NEIGHBORHOOD OFFICE CENTER
DAILY INPUT/OUTPUT ACTIVITY — JULY 1977
GEORGETOWN

D — — DICTATION, AVERAGE: 1.7 DISCS/DAY
I - - - RAPIFAX IN, AVERAGE: 4.0 PAGES/DAY
O ——— RAPIFAX OUT, AVERAGE: 2.7 PAGES/DAY

NUMBER OF
DISCS OR PAGES

DATE
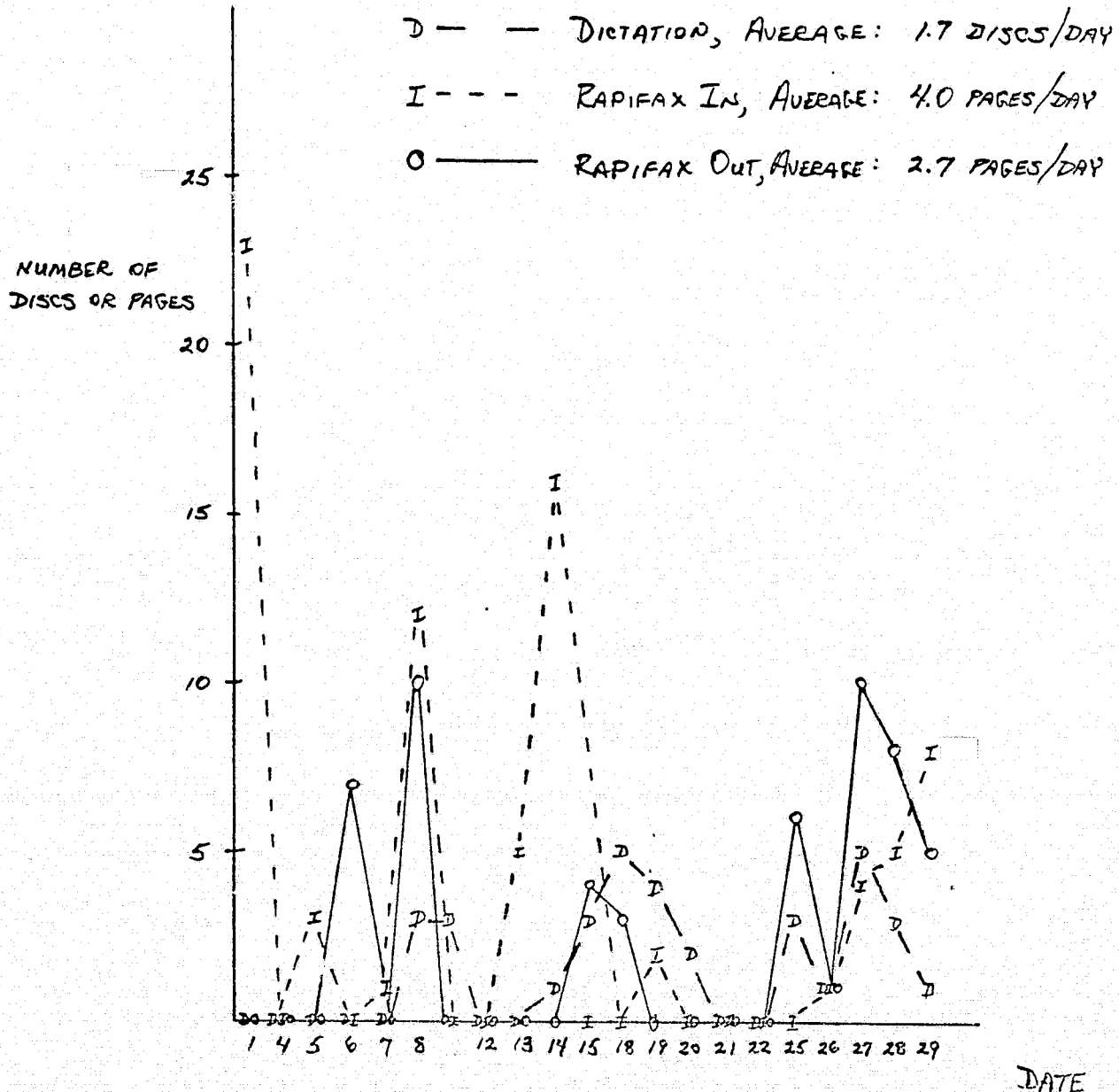
NEIGHBORHOOD OFFICE CENTER
DAILY WORD PROCESSING ACTIVITY - JULY 1977
NASA HEADQUARTERS

D — — DRAFT, AVERAGE: 5.1 PAGES/DAY

F - - - FINAL, AVERAGE: 9.9 PAGES/DAY

T ———— TOTAL, AVERAGE: 15.0 PAGES/DAY

NUMBER OF PAGES

DATE
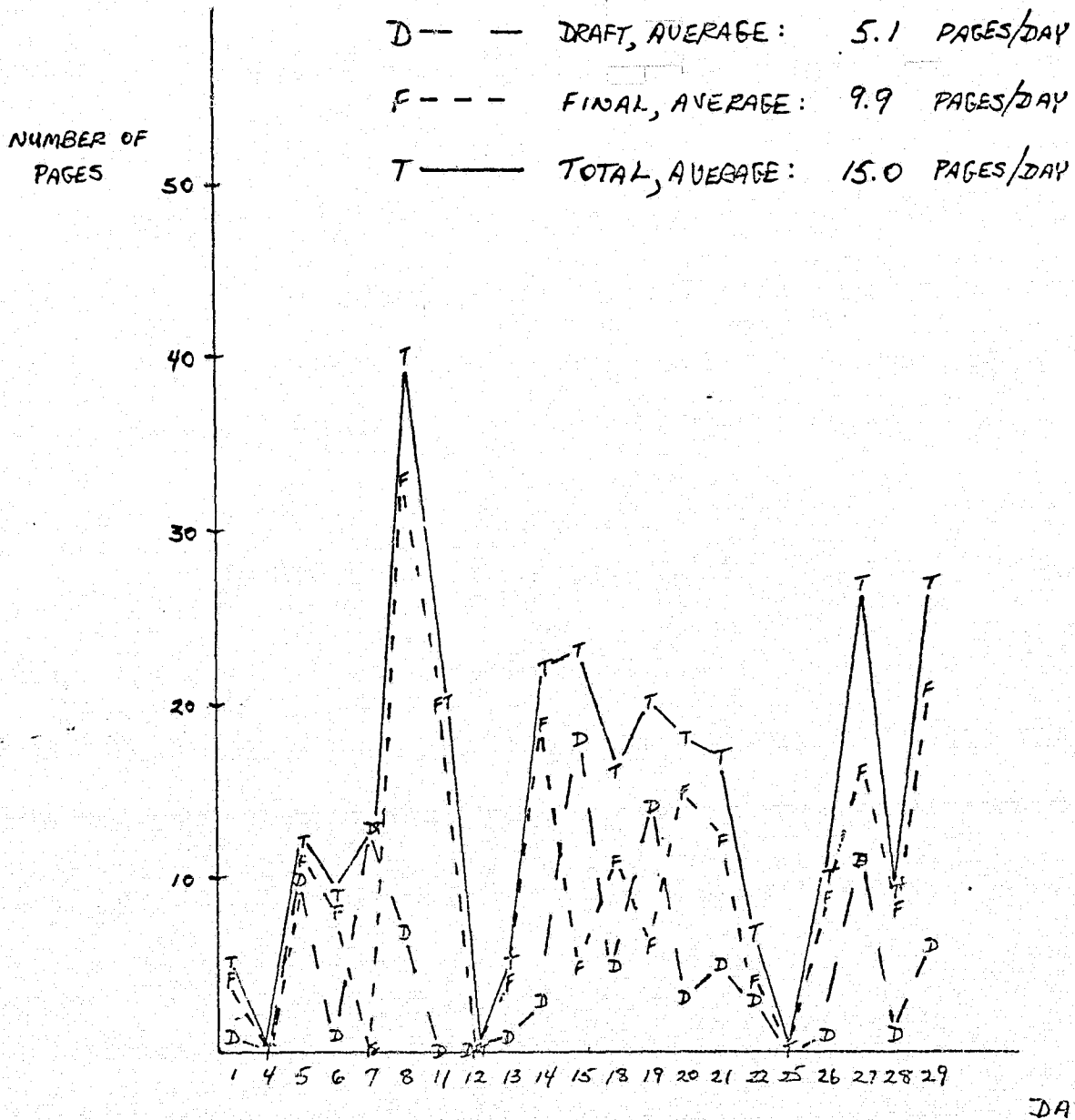
Summary of NOC Activity - August 1977

Georgetown

Category	Total Units	Submissions	Units/Submission
Dictation	86 discs	47	1.8 discs/sub
Rapifax In	39 pages	6	6.5 pages/sub
Rapifax Out	152 pages	33	4.6 pages/sub
WP Draft	517 pages	87	5.9 pages/sub
WP Final	83 pages	32	2.6 pages/sub

Word Processing Activity

		No. Pages								
		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	20	21	6	7	5	3	4	21	87
	Final	16	7	4	--	1	--	--	4	32
Avg. Time (Hrs):										
	Draft	.2	.3	.4	.5	.7	1.3	1.5	1.8	.8
	Final	.2	.3	.4	--	.5	--	--	0.9	.3

Summary of NOC Activity - August 1977

National Aeronautics and Space Administration

Category	Total Units	Submissions	Units/Submission
Dictation	48 discs	2	24 discs/sub
Rapifax In	--	--	--
Rapifax Out	--	--	--
WP Draft	380 pages	96	4 pages/sub
WP Final	109 pages	65	1.7 pages/sub

Word Processing Activity

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	27	5	46	0	6	0	0	12	96
	Final	51	9	1	1	0	0	0	3	65
Avg. Time (Hrs):										
	Draft	.4	.8	.5	--	1.2	--	--	2.4	.8
	Final	.3	.4	.8	1.0	--	--	--	2.2	.4

NEIGHBORHOOD OFFICE CENTER
DAILY WORD PROCESSING ACTIVITY — AUGUST 1977
GEORGETOWN

NUMBER
OF PAGES

D — — — DRAFT, AVERAGE: **22.5** PAGES/DAY

F - - - FINAL, AVERAGE: 3.6 PAGES/DAY

T ———— TOTAL, AVERAGE: 26.1 PAGES/DAY
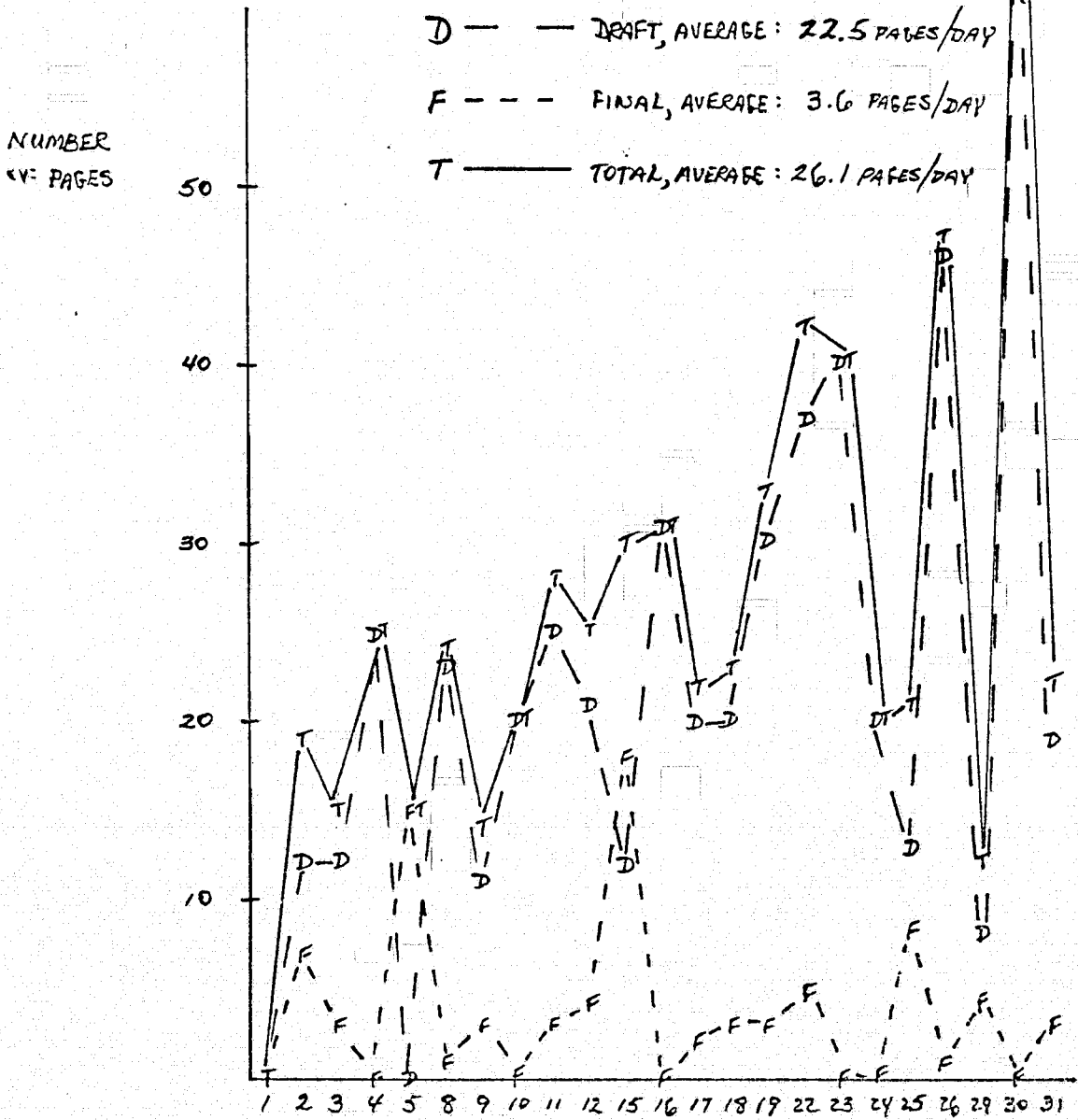
DATE

NEIGHBORHOOD OFFICE CENTER

DAILY INPUT/OUTPUT ACTIVITY — AUGUST 1977

GEORGETOWN

D — — DICTATION, AVERAGE: **3.7** DISCS/DAY

I - - - RAPIFAX IN, AVERAGE: 1.7 PAGES/DAY

O —— RAPIFAX OUT, AVERAGE: 6.6 PAGES/DAY

NUMBER OF DISCS OR PAGES
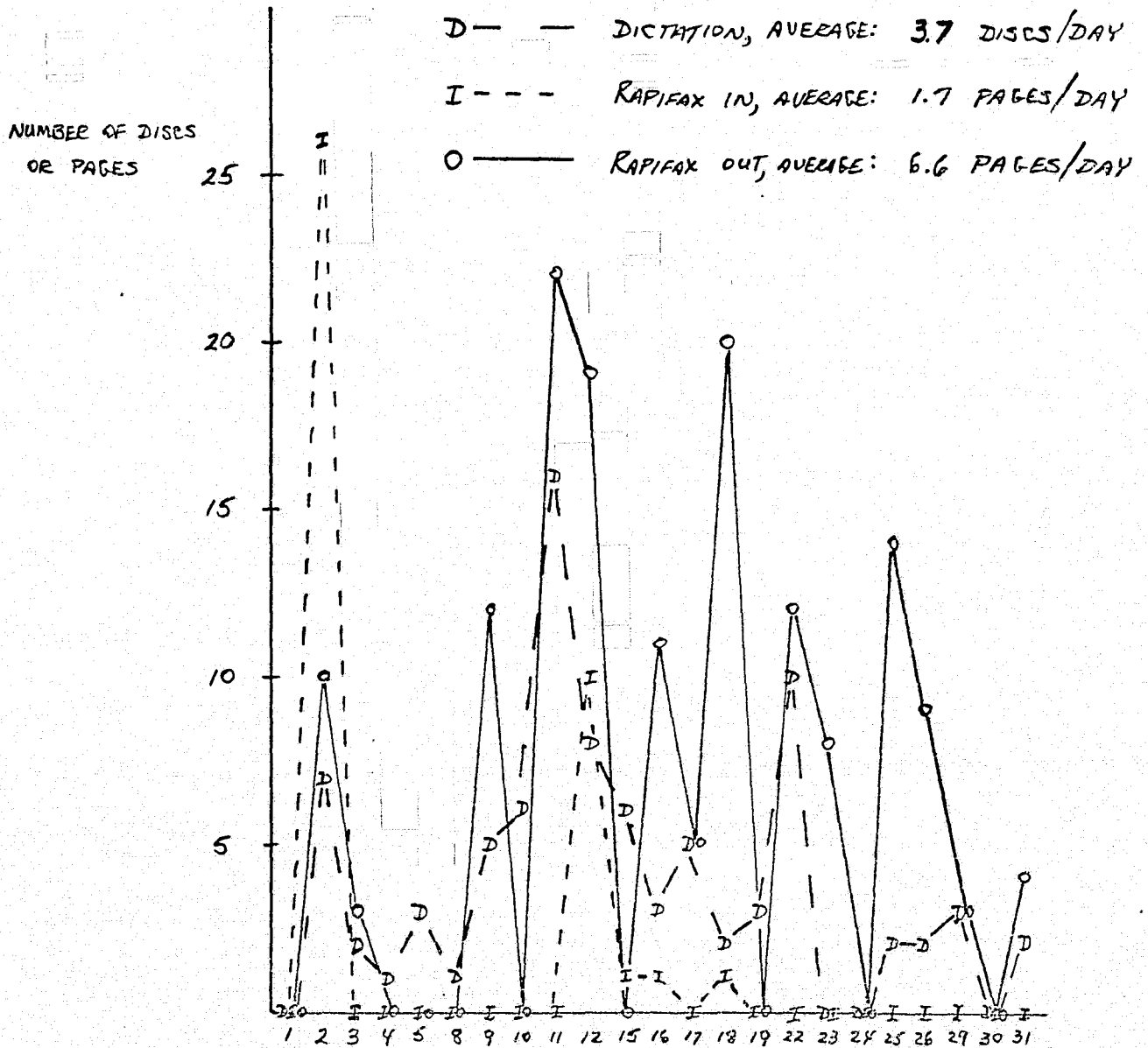
DATE

NEIGHBORHOOD OFFICE CENTER
DAILY WORD PROCESSING ACTIVITY - AUGUST 1977
NASA HEADQUARTERS

D ———— DRAFT, AVERAGE: 16.5 PAGES/DAY

F - - - FINAL, AVERAGE: 4.7 PAGES/DAY

T ———— TOTAL, AVERAGE: 21.2 PAGES/DAY

NUMBER OF PAGES

T (168)
D (159)
T (110)

50

40

30

20

10

1 2 3 4 5 8 9 10 11 12 15 16 17 18 19 22 23 24 25 26 29 30 31

DATE
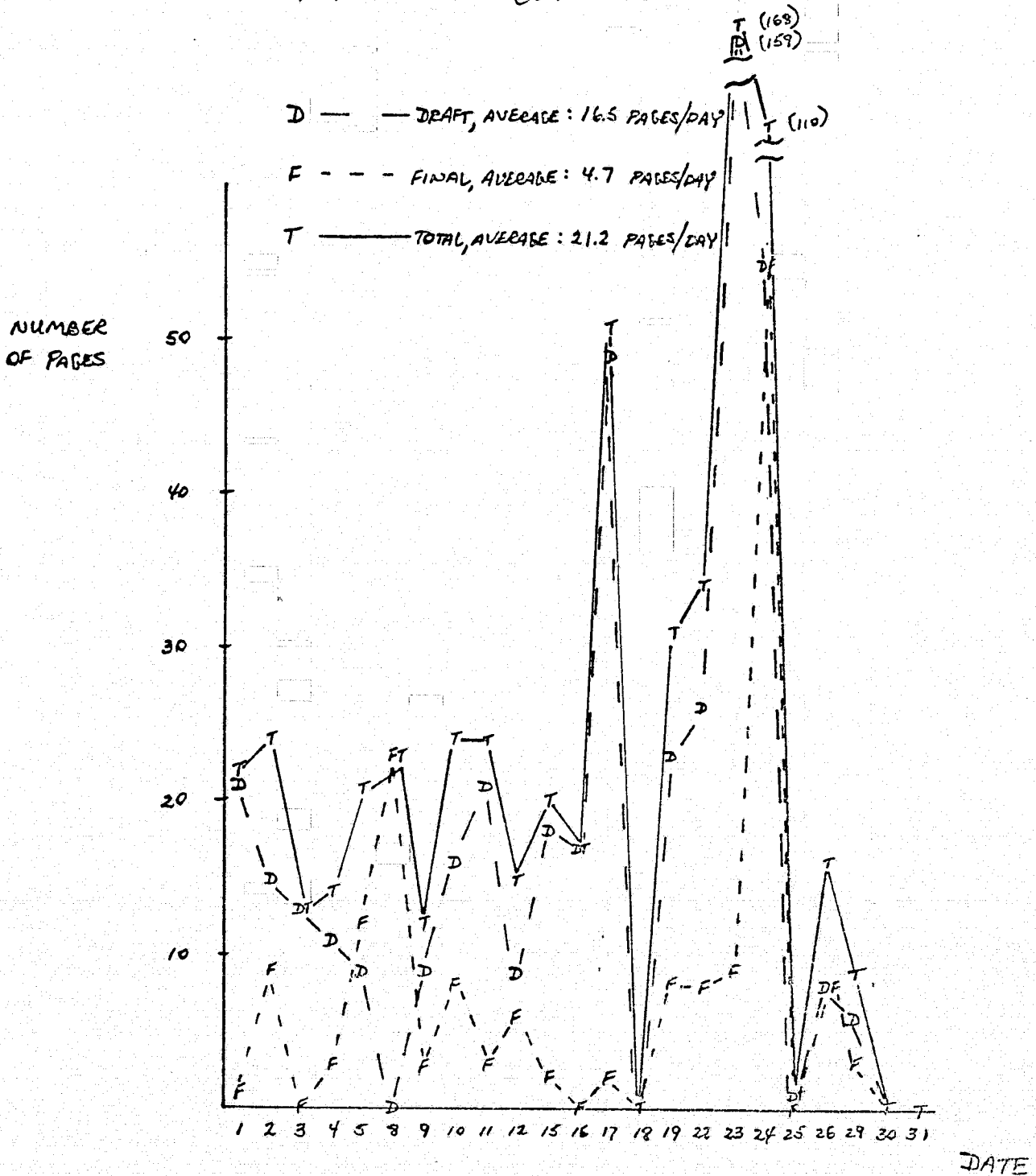
SUMMARY OF NOC ACTIVITY - SEPTEMBER 1977

Georgetown

Category	Total Units	Submissions	Units/Submission
Dictation	22 discs	16	1.4 discs/sub
Rapifax In	0 pages	0	0 pages/sub
Rapifax Out	28 pages	11	2.5 pages/sub
WP Draft	485 pages	53	9.2 pages/sub
WP Final	75 pages	20	3.8 pages/sub

Word Processing Activity

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	7	9	4	1	3	2	1	26	53
	Final	8	7	1	2	0	0	0	2	20
Avg. Time (Hrs):										
	Draft	.1	.3	.6	1.0	.7	.8	.8	1.5	1.0
	Final	.1	.3	.5	.5	---	---	---	1.3	.3

NASA Headquarters

Category	Total Units	Submissions	Units/Submission
Dictation	7 discs	7	1.0 discs/sub
Rapifax In	0 pages	0	0 pages/sub
Rapifax Out	0 pages	0	0 pages/sub
WP Draft	48 pages	25	1.9 pages/sub
WP Final	148 pages	80	1.9 pages/sub

Word Processing Activity

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	15	5	2	2	0	0	0	1	25
	Final	51	15	3	5	3	2	0	1	80
Avg. Time (Hrs):										
	Draft	.3	.6	.8	.6	---	---	---	2.0	.5
	Final	.1	.4	.3	.6	.5	.6	---	1.0	.3

NEIGHBORHOOD OFFICE CENTER

DAILY WORD PROCESSING ACTIVITY — Sept. 1977

GEORGETOWN

D — — DRAFT, AVERAGE: 23.0 pages/day

F - - - FINAL, AVERAGE: 3.6 pages/day
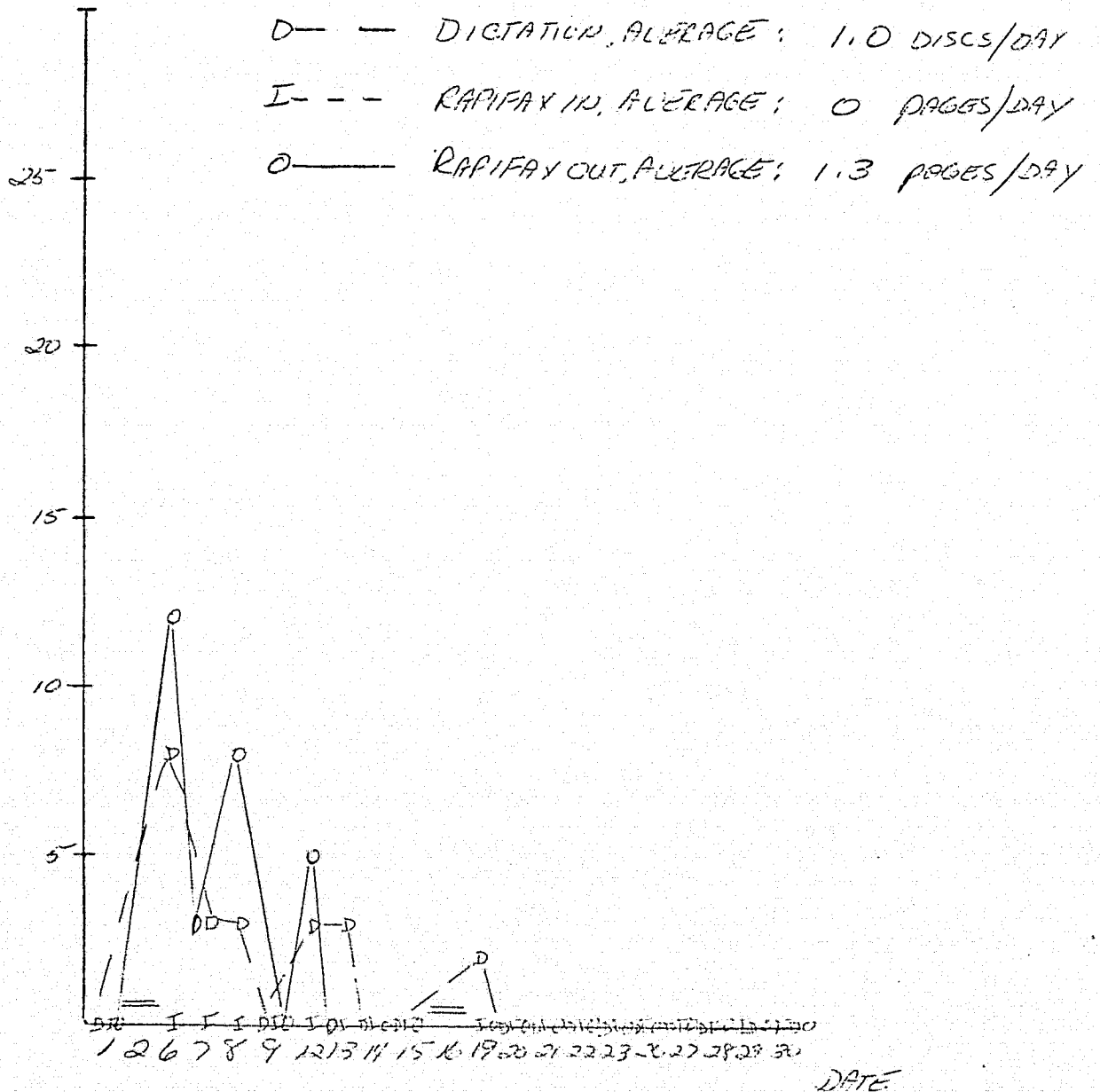
T ——— TOTAL, AVERAGE: 26.6 pages/day

NUMBER OF
PAGES

60+
50
40
30
20
10

1 2 6 7 8 9 12 13 14 15 16 19 20 21 22 23 26 27 28 29 30
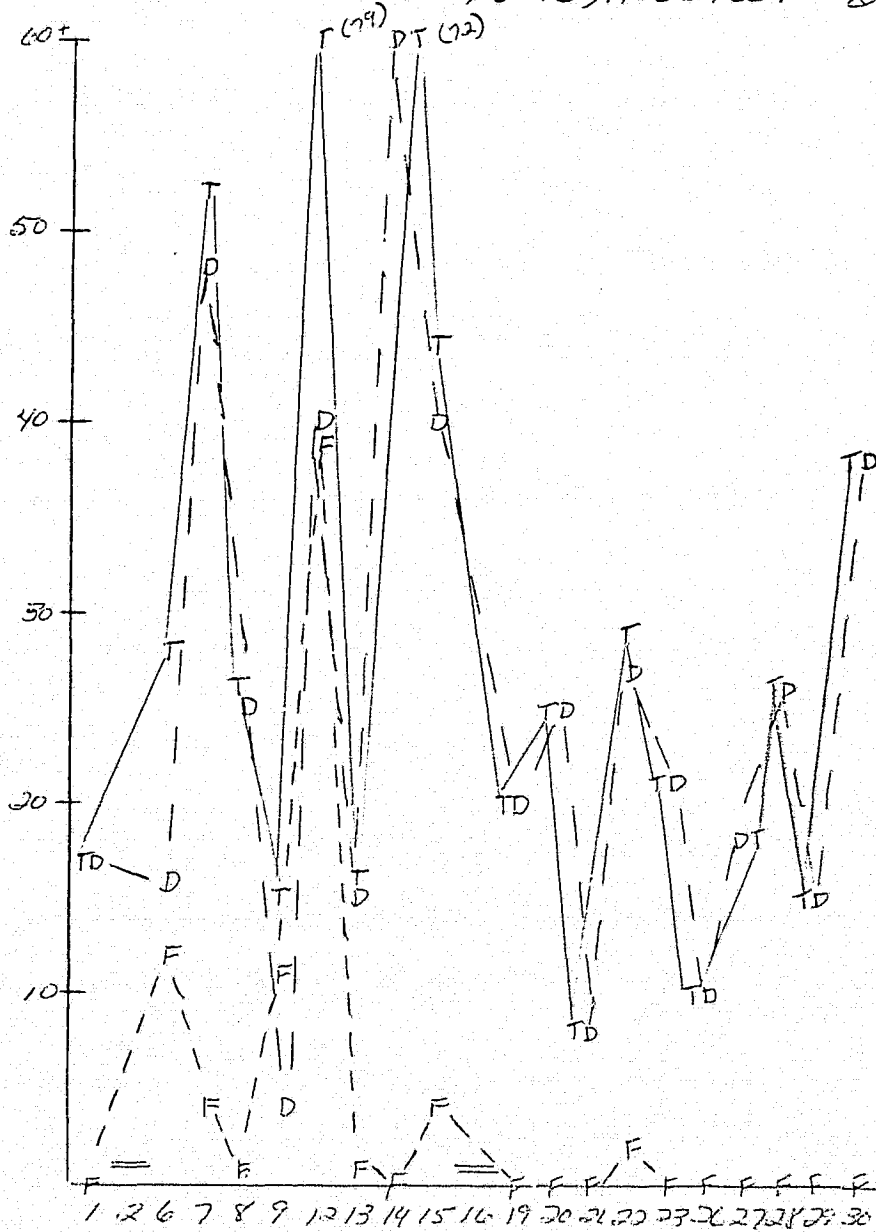
DATE

— = ABSENCE

NEIGHBORHOOD OFFICE CENTER
DAILY INPUT/OUTPUT ACTIVITY - SEPT. 1977
GEORGETOWN

D— — DICTATION, AVERAGE: 1.0 DISCS/DAY

I- - - RAPIFAX IN, AVERAGE: 0 PAGES/DAY

O——— RAPIFAX OUT, AVERAGE: 1.3 PAGES/DAY

DATE

= - ABSENCE

NEIGHBORHOOD OFFICE CENTER
DAILY WORD PROCESSING ACTIVITY - SEPT. 1977
NASA HEADQUARTERS
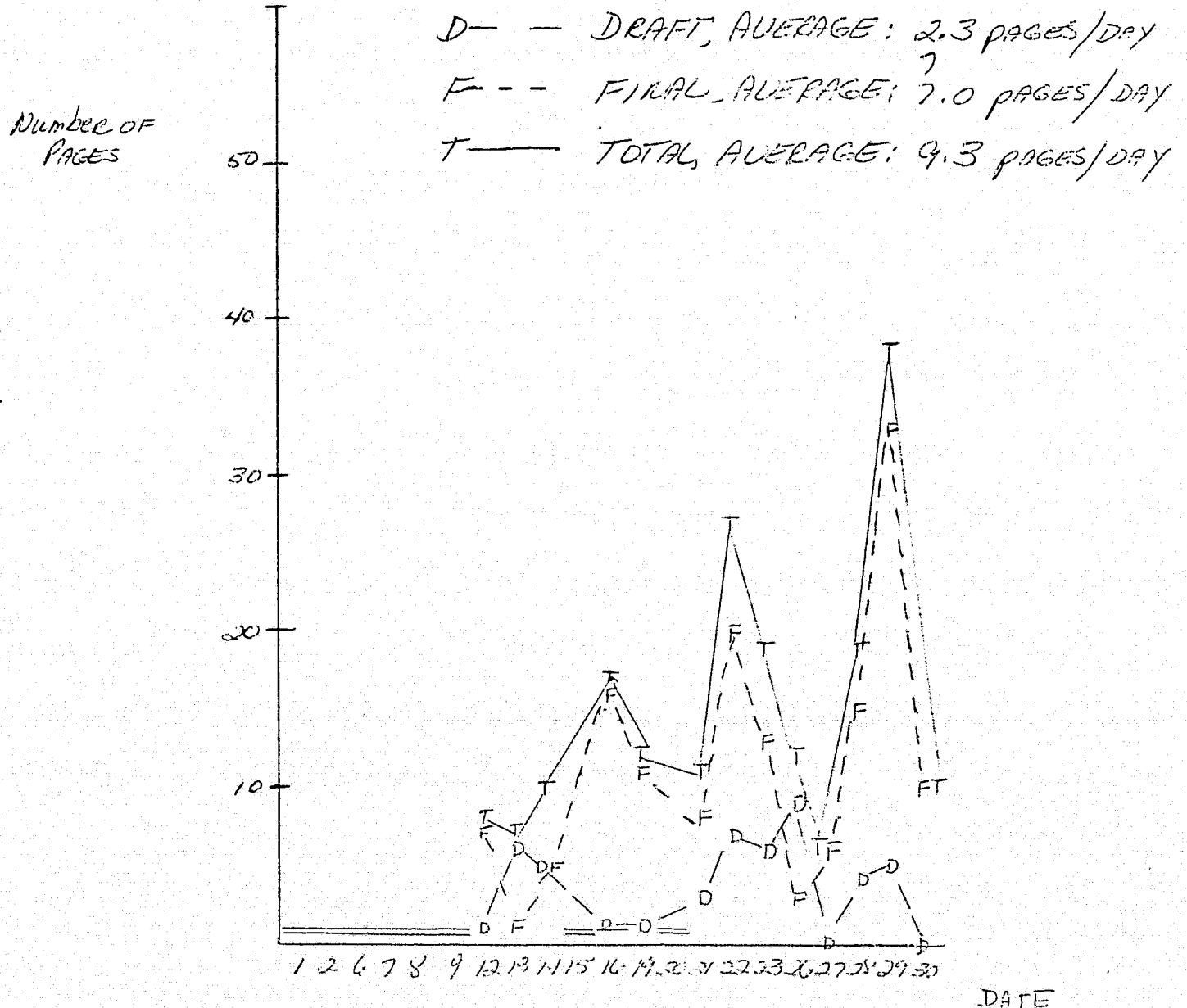
SUMMARY OF NOC ACTIVITY - OCTOBER 1977

Georgetown

Category	Total Units	Submissions	Units/Submission
Dictation	0 discs	0	0 discs/sub
Rapifax In	0 pages	0	0 pages/sub
Rapifax Out	0 pages	0	0 pages/sub
WP Draft	622 pages	31	20.0 pages/sub
WP Final	86 pages	4	28.7 pages/sub

Word Processing Activity

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	0	2	1	1	1	1	0	25	31
	Final	0	0	2	0	0	0	0	2	4
Avg. Time (Hrs):										
	Draft	---	.5	.3	.3	.5	1.0	---	2.3	2.0
	Final	---	---	.8	---	---	---	---	4.0	2.4

SUMMARY OF NOC ACTIVITY - OCTOBER 1977

NASA Headquarters

Category	Total Units	Submissions	Units/Submission
Dictation	7 discs	6	1.2 discs/sub
Rapifax In	1 pages	1	1.0 pages/sub
Rapifax Out	0 pages	0	0 pages/sub
WP Draft	101 pages	34	3.0 pages/sub
WP Final	152 pages	77	2.0 pages/sub

Word Processing Activity

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	11	5	7	5	2	1	1	2	34
	Final	39	23	6	6	1	0	0	2	77
Avg. Time (Hrs):										
	Draft	.4	.5	.6	.7	1.1	1.0	1.3	1.5	.6
	Final	.2	.4	.5	.7	.8	---	---	1.6	.3

NEIGHBORHOOD OFFICE CENTER

DAILY WORD PROCESSING ACTIVITY — OCTOBER 1977

GEORGETOWN

D — — DRAFT, AVERAGE: 32.7 pages/day
F - - - FINAL, AVERAGE: 4.5 pages/day
T ———— TOTAL, AVERAGE: 37.2 pages/day
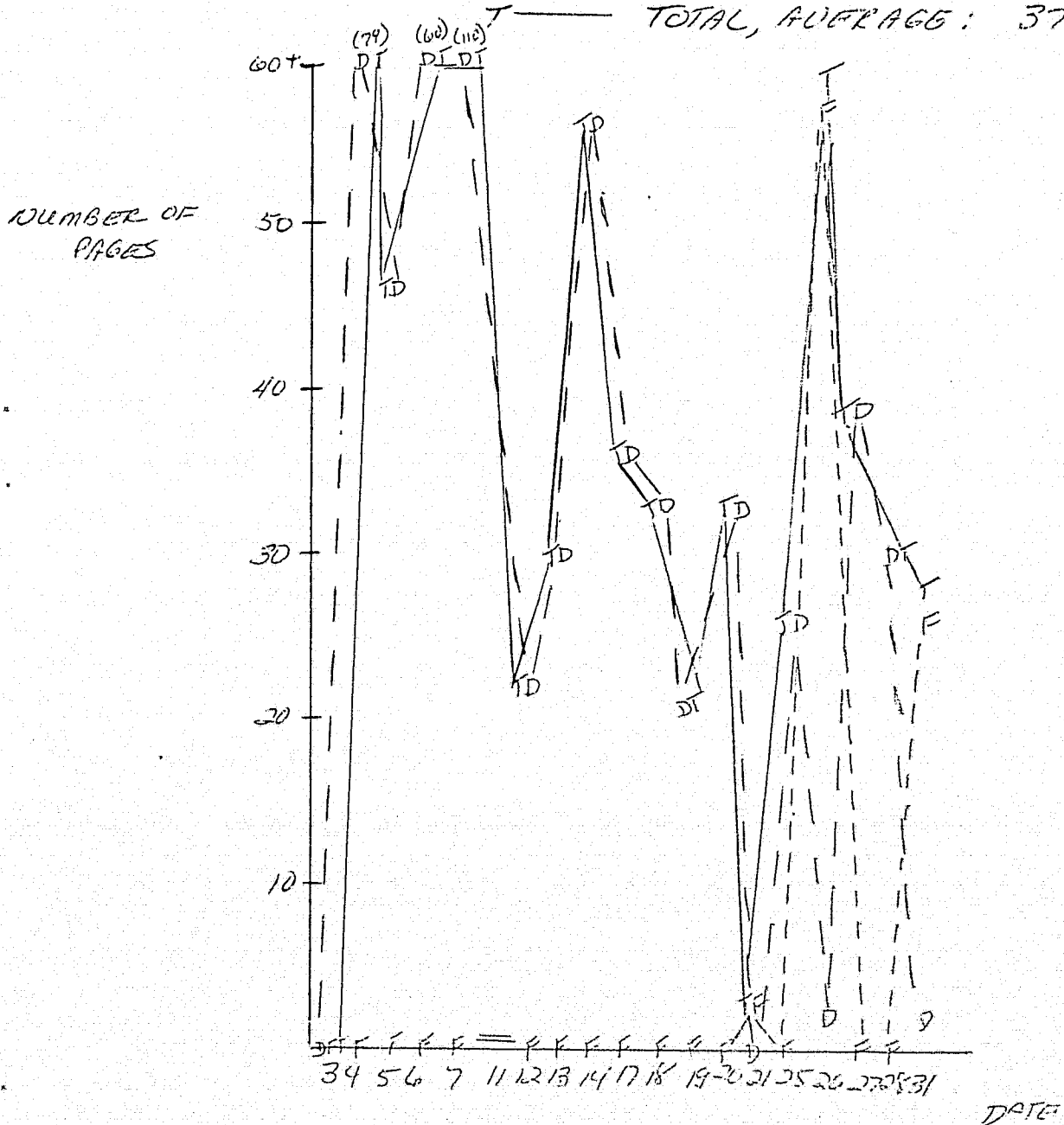
NUMBER OF PAGES

DATE

= ABSENCE

53

NEIGHBORHOOD OFFICE CENTER
DAILY WORD PROCESSING ACTIVITY — OCTOBER 1977
NASA HEADQUARTERS

D— — DRAFT, AVERAGE: 5.3 pages/day
F- - - FINAL, AVERAGE: 8.0 pages/day
T——— TOTAL, AVERAGE 13.3 pages/day
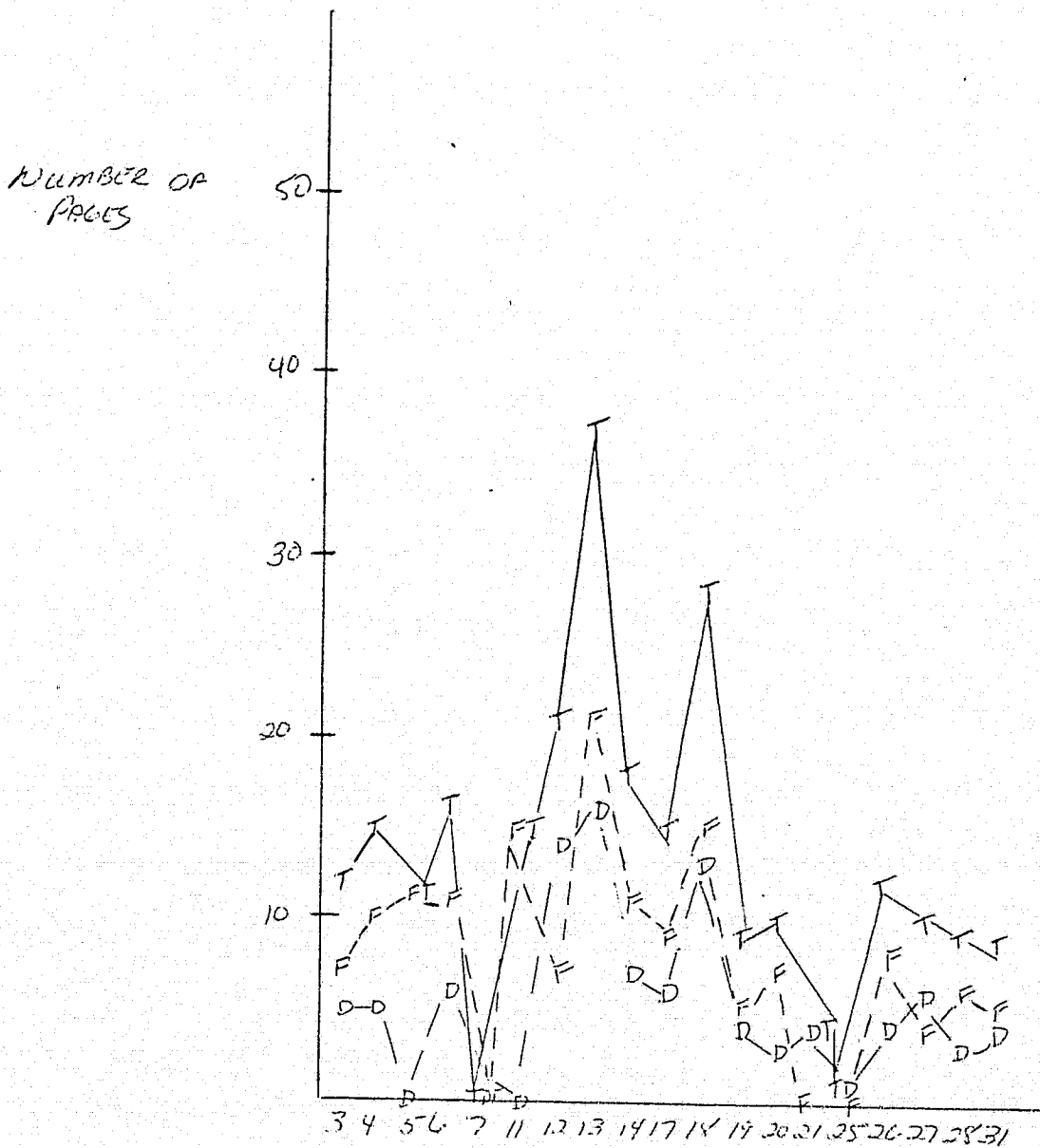
NUMBER OF
PAGES

DATE

SUMMARY OF NOC ACTIVITY - NOVEMBER 1977

Georgetown

Category	Total Units	Submissions	Units/Submission
Dictation	19 discs	10	1.9 discs/sub
Rapifax In	0 pages	0	0 pages/sub
Rapifax Out	57 pages	10	5.7 pages/sub
WP Draft	554 pages	59	9.3 pages/sub
WP Final	10 pages	5	2.0 pages/sub

Word Processing Activity

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	7	14	3	7	1	3	1	23	59
	Final	3	0	1	1	0	0	0	0	5
Avg. Time (Hrs):										
	Draft	.2	.6	.5	1.0	.8	1.0	1.3	2.2	1.2
	Final	.3	---	1.0	1.0	---	---	---	---	.6

SUMMARY OF NOC ACTIVITY - NOVEMBER 1977

NASA Headquarters

Category	Total Units	Submissions	Units/Submission
Dictation	0 discs	0	0 discs/sub
Rapifax In	0 pages	0	0 pages/sub
Rapifax Out	0 pages	0	0 pages/sub
WP Draft	119 pages	25	4.8 pages/sub
WP Final	175 pages	48	3.6 pages/sub

Word Processing Activity

No. Pages

|		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	5	11	3	1	1	2	0	2	25
	Final	18	13	4	5	3	3	0	2	48
Avg. Time (Hrs):										
	Draft	.3	.6	.5	1.0	2.0	1.1	---	3.5	.9
	Final	.2	.4	.4	.5	.5	.6	---	1.8	.4

NEIGHBORHOOD OFFICE CENTER

DAILY WORD PROCESSING ACTIVITY - NOVEMBER 1977

(GEORGETOWN)

D — — DRAFT, AVERAGE: 27.7 pages/day

F - - - FINAL, AVERAGE: .5 pages/day

T ———— TOTAL, AVERAGE: 28.2 pages/day

NUMBER OF PAGES
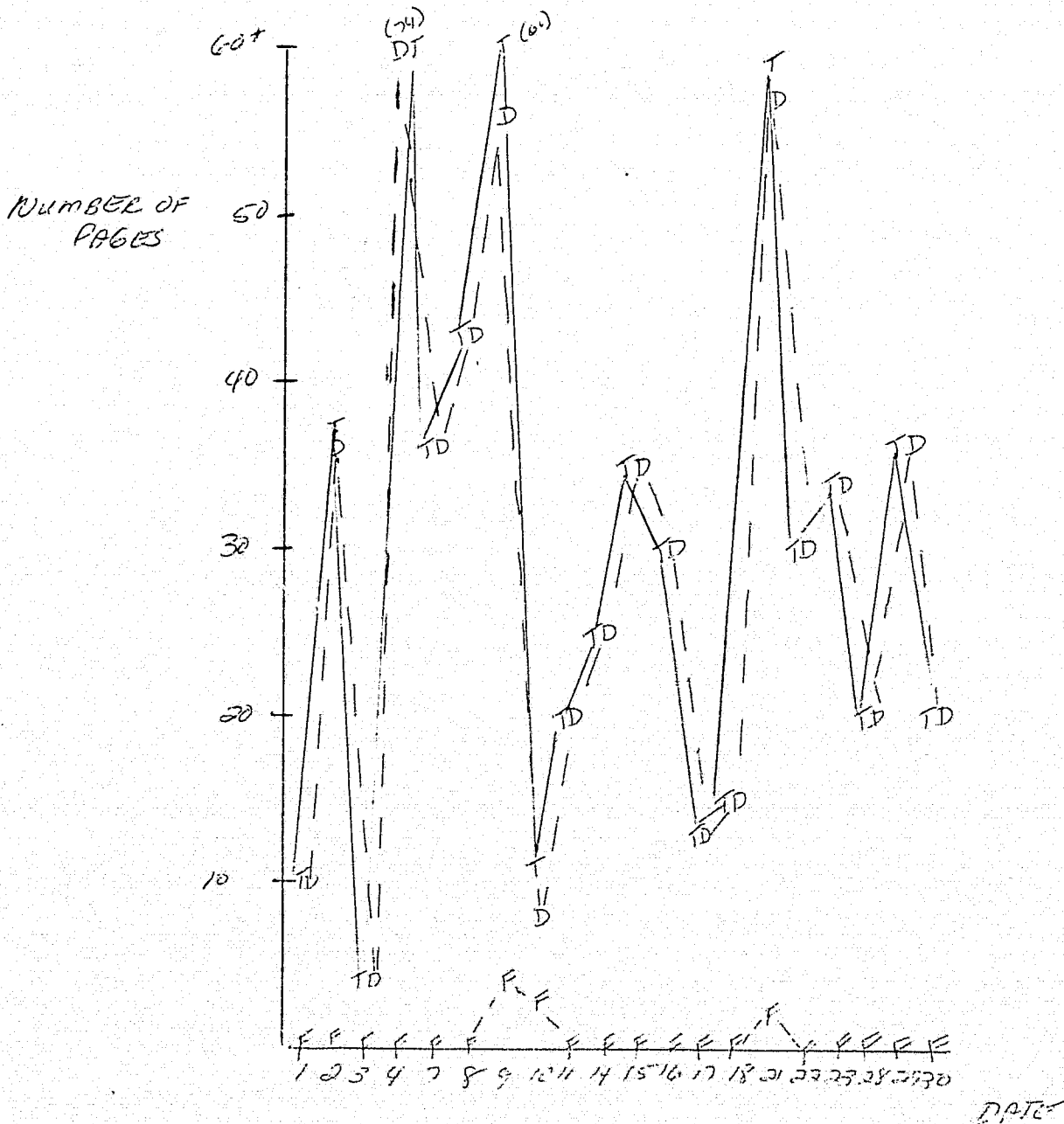
DATE

NEIGHBORHOOD OFFICE CENTER
DAILY INPUT/OUTPUT ACTIVITY - November 1977
GEORGETOWN

D —— DICTATION, AVERAGE: 1.0 discs/day,

I - - - RAPIFAX IN, AVERAGE: 0 pages/day

O —— RAPIFAX OUT, AVERAGE: 2.9 pages/day,
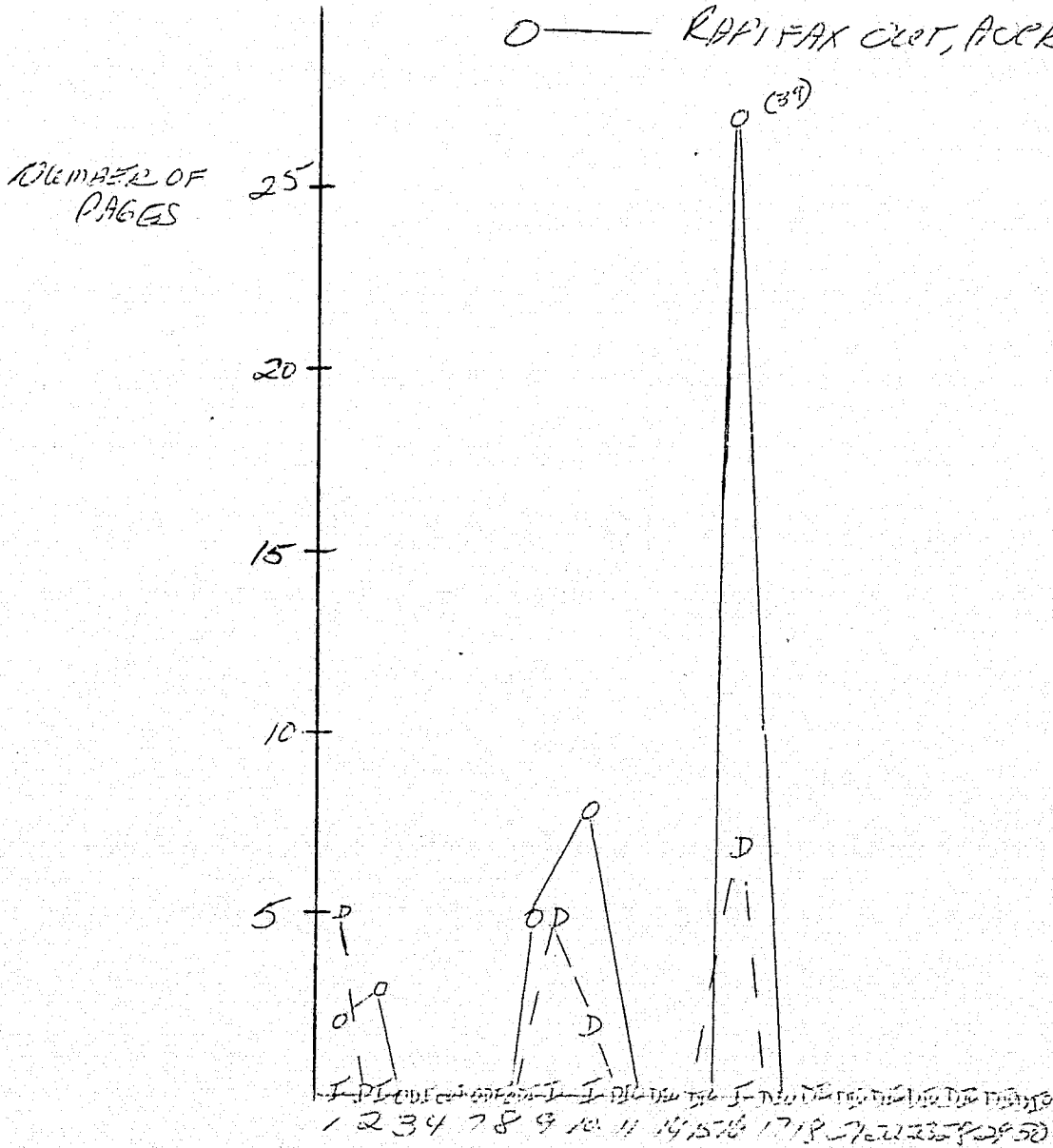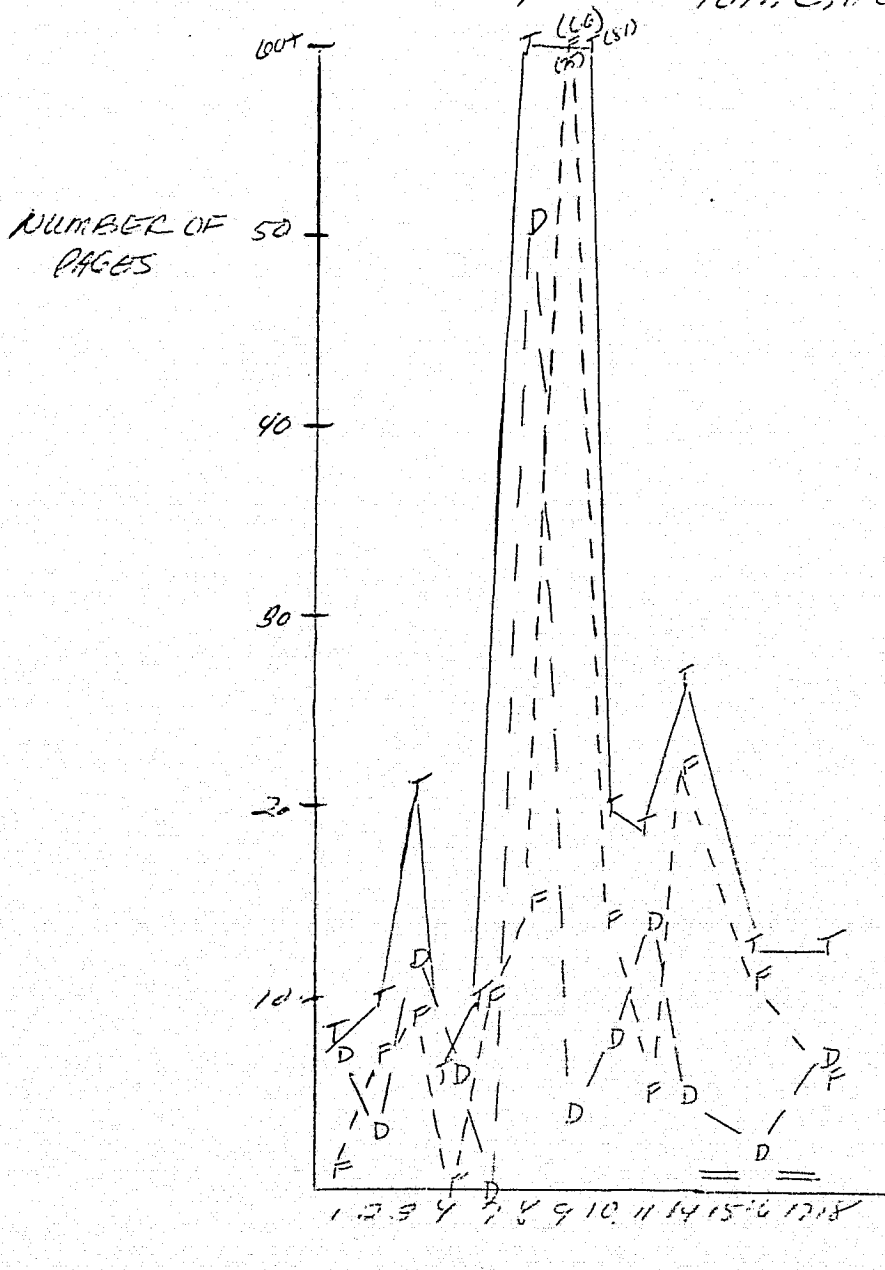

NUMBER OF PAGES

DATE

NEIGHBORHOOD OFFICE CENTER

DAILY WORD PROCESSING ACTIVITY - NOVEMBER 1977

NASA HEADQUARTERS

D — — DRAFT, AVERAGE: 8.5 pages/day

F - - - FINAL, AVERAGE: 12.5 pages/day

T ———— TOTAL, AVERAGE: 21.0 pages/day

NUMBER OF PAGES

DATE

= = ABSENCE

SUMMARY OF NOC ACTIVITY - DECEMBER 1977

Tysons Corner

Category	Total Units	Submissions	Units/Submission
Dictation	10 discs	5	2.0 discs/sub
Rapifax In	0 pages	0	0 pages/sub
Rapifax Out	0 pages	0	0 pages/sub
WP Draft	390 pages	21	18.9 pages/sub
WP Final	4 pages	1	4.0 pages/sub

Word Processing Activity

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	0	1	3	3	1	1	0	12	21
	Final	0	0	0	1	0	0	0	0	1
Avg. Time (Hrs):	Draft	---	.5	.7	1.3	1.0	1.0	---	3.5	2.4
	Final	---	---	---	1.0	---	---	---	---	1.0

NEIGHBORHOOD OFFICE CENTER
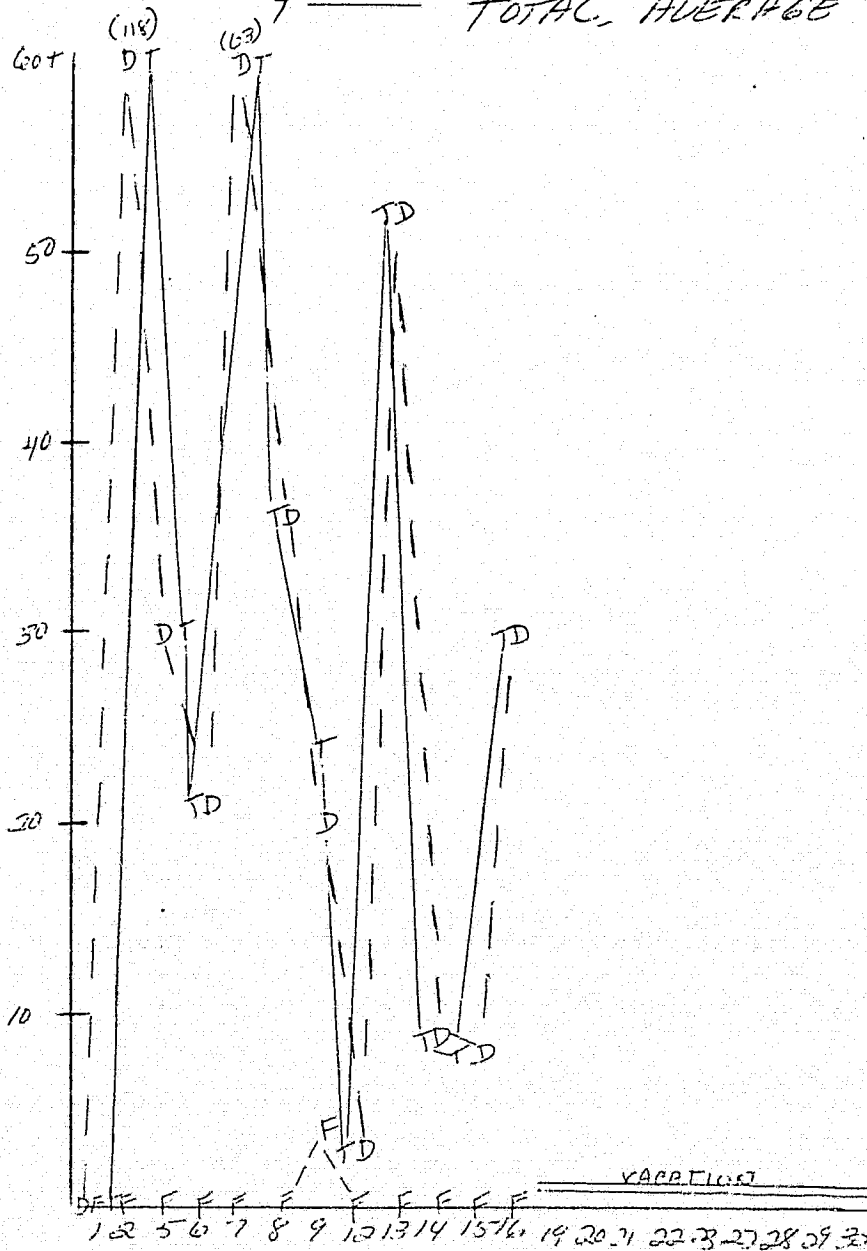DAILY WORDPROCESSING ACTIVITY – DECEMBER 1977
TYSONS CORNER

D— — DRAFT, AVERAGE: 18.6 pages/day
F- - - FINAL, AVERAGE: .2 pages/day
T——— TOTAL, AVERAGE 18.8 pages/day

NUMBER OF PAGES

DATE

Summary of NOC Activity - JANUARY 1978

Category	Total Units	Submissions	Units/Submission
Dictation	27 discs	15	1.8 discs/sub
Rapifax In	55 pages	4	14.0 pages/sub
Rapifax Out	83 pages	18	4.6 pages/sub
WP Draft	159 pages	35	4.5 pages/sub
WP Final	110 pages	32	3.4 pages/sub

Word Processing Time

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	3	11	8	3	2	0	1	7	35
	Final	6	10	8	3	0	4	1	0	32
Avg. Time (Hrs):										
	Draft	.3	.3	.7	.5	1.1	---	1.0	2.1	.8
	Final	.1	.3	.6	.4	---	1.1	1.5	---	.5

NEIGHBORHOOD OFFICE CENTER
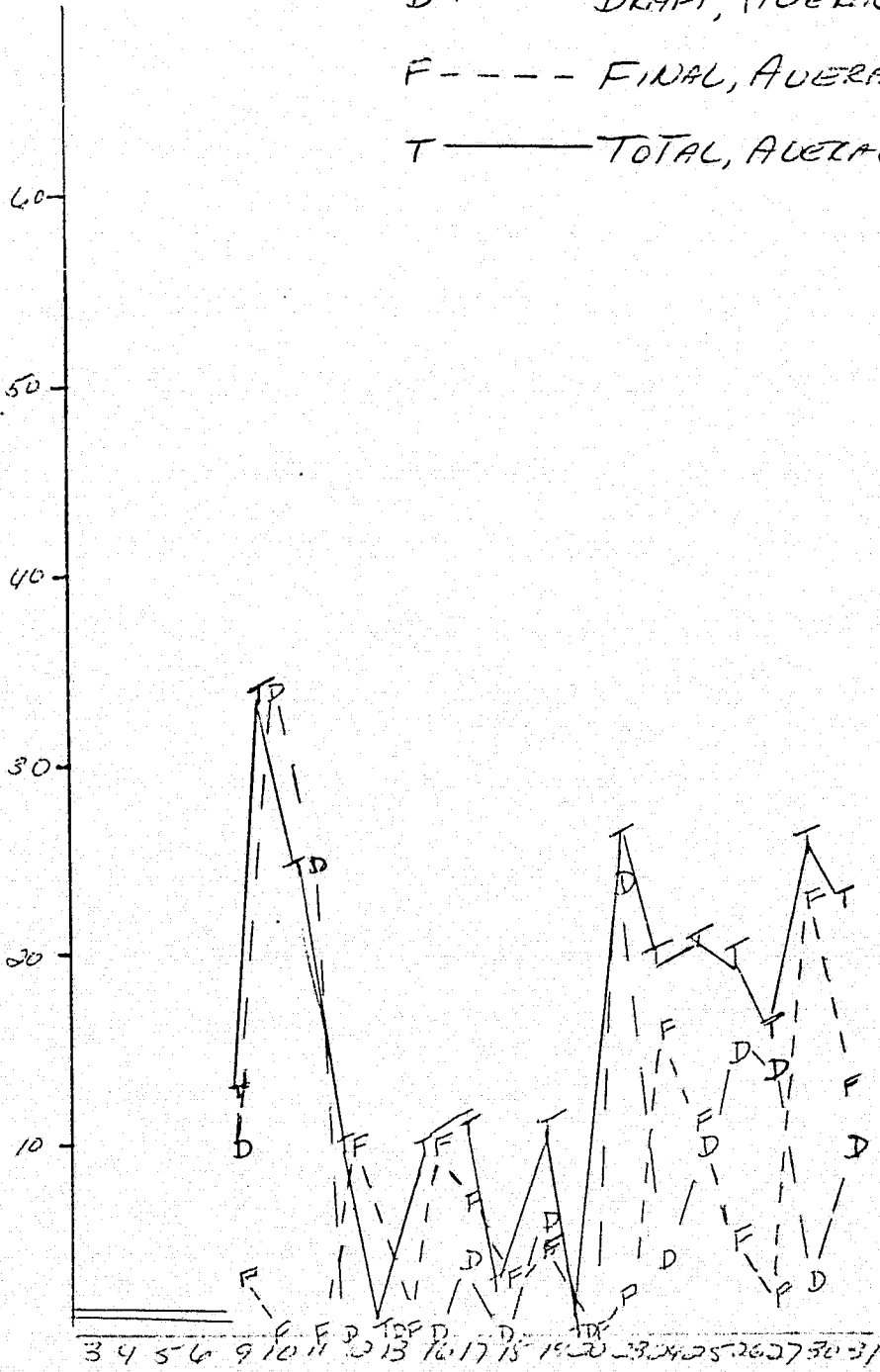## DAILY WORD PROCESSING ACTIVITY - JANUARY 1978
TYSONS CORNER

D— — — DRAFT, AVERAGE: 7.6 pages/day

F — — — — FINAL, AVERAGE: 5.2 pages/day

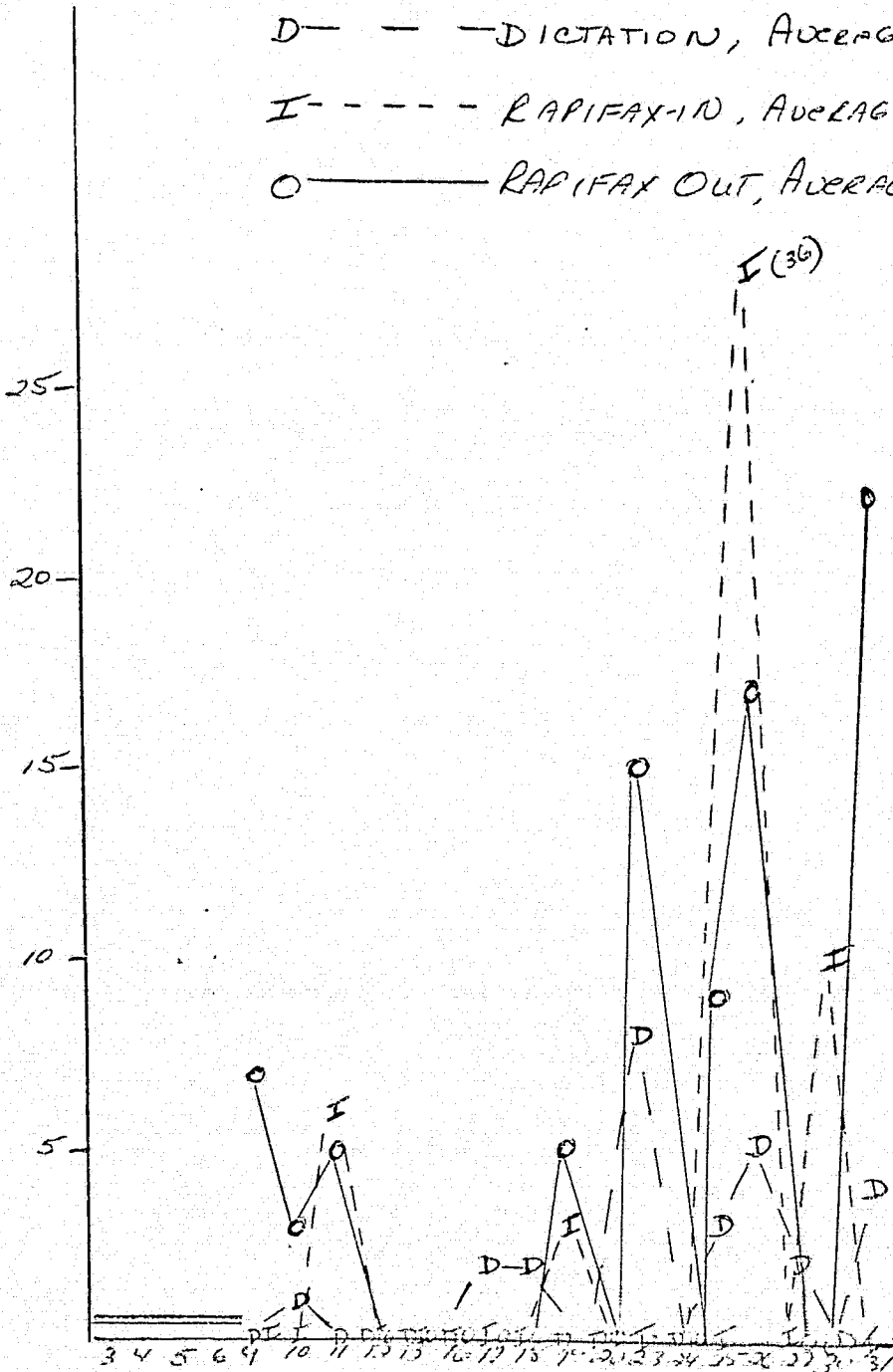T ———— TOTAL, AVERAGE: 12.8 pages/day

Number of pages

DATE

NEIGHBORHOOD OFFICE CENTER
DAILY INPUT/OUTPUT ACTIVITY - January 1978
Tysons Corner

D — — — DICTATION, Average: 1.3 discs/day
I — — — — RAPIFAX-IN, Average: 2.6 pages/day
O ———— RAPIFAX OUT, Average: 4.0 pages/day

NO. OF PAGES

DATE

Summary of NOC Activity - FEBRUARY 1978

Category	Total Units	Submissions	Units/Submission
Dictation	21 discs	14	1.5 discs/sub
Rapifax In	3 pages	1	3.0 pages/sub
Rapifax Out	34 pages	10	3.4 pages/sub
WP Draft	576 pages	31	18.6 pages/sub
WP Final	139 pages	18	7.7 pages/sub

Word Processing Time

No. Pages

		1	2	3	4	5	6	7	8	All Jobs
No. Jobs:	Draft	3	5	2	1	1	1	0	18	31
	Final	3	4	1	3	0	1	0	6	18
Avg. Time (Hrs):										
	Draft	.2	.3	.4	1.0	1.0	1.0	---	3.0	1.9
	Final	.1	.3	.3	.3	---	.5	---	.6	.7

NEIGHBORHOOD OFFICE CENTER
DAILY WORD PROCESSING ACTIVITY - FEBRUARY 1975
TYSONS CORNER

D— — DRAFT, AVERAGE: 30.3 pages/day

F— — — — FINAL, AVERAGE: 7.3 pages/day

T————— TOTAL, AVERAGE: 37.6 pages/day

NUMBER OF PAGES

DATE
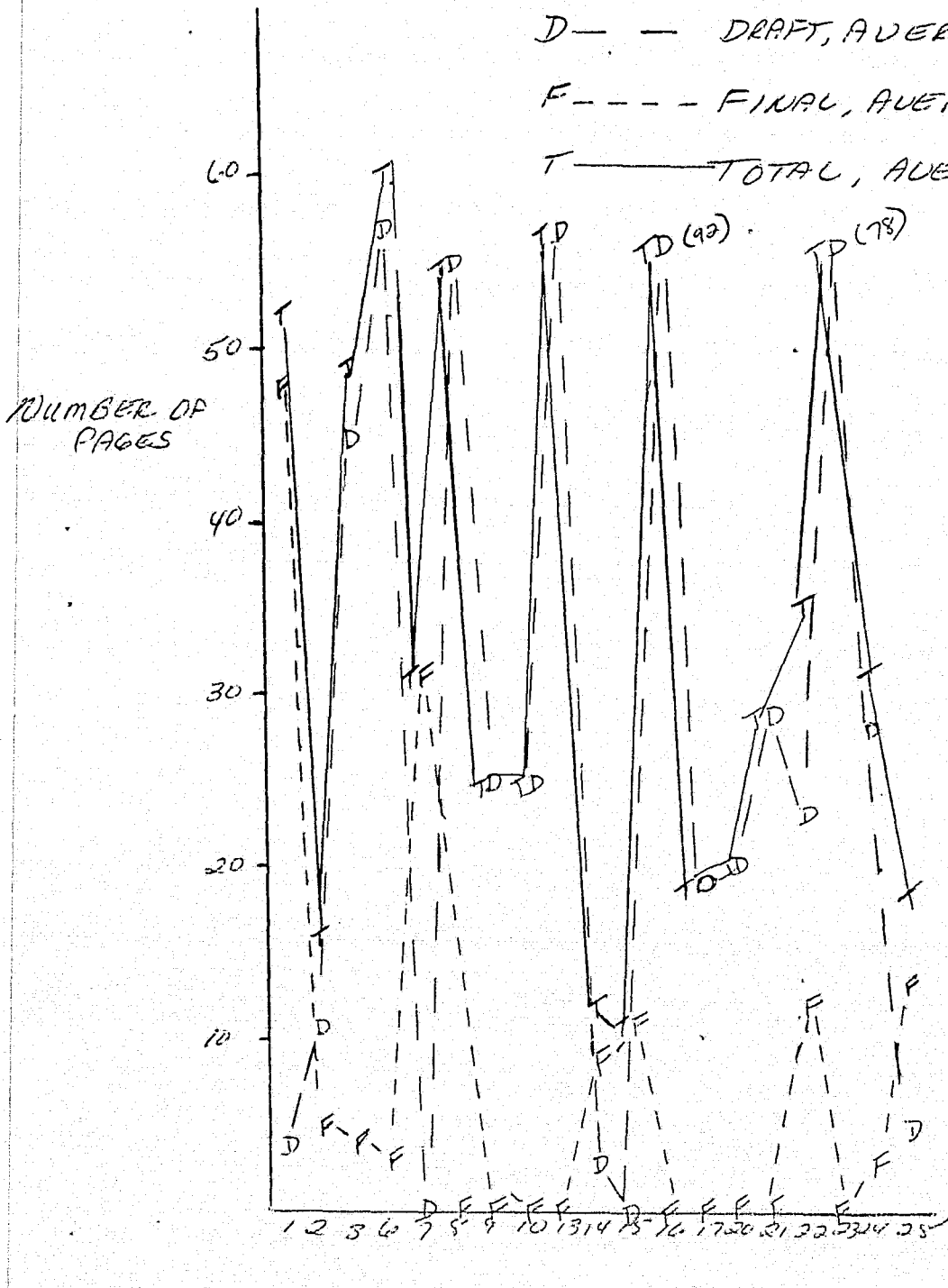
NEIGHBORHOOD OFFICE CENTER
DAILY INPUT/OUTPUT ACTIVITY – FEBRUARY 1978
TYSONS CORNER

D— — DICTATION, AVERAGE: 1.1 disc/day

I - - - - RAPIFAX IN, AVERAGE: .1 pages/day

O —————— RAPIFAX OUT, AVERAGE: 1.8 pages/day

NUMBER OF PAGES

DATE
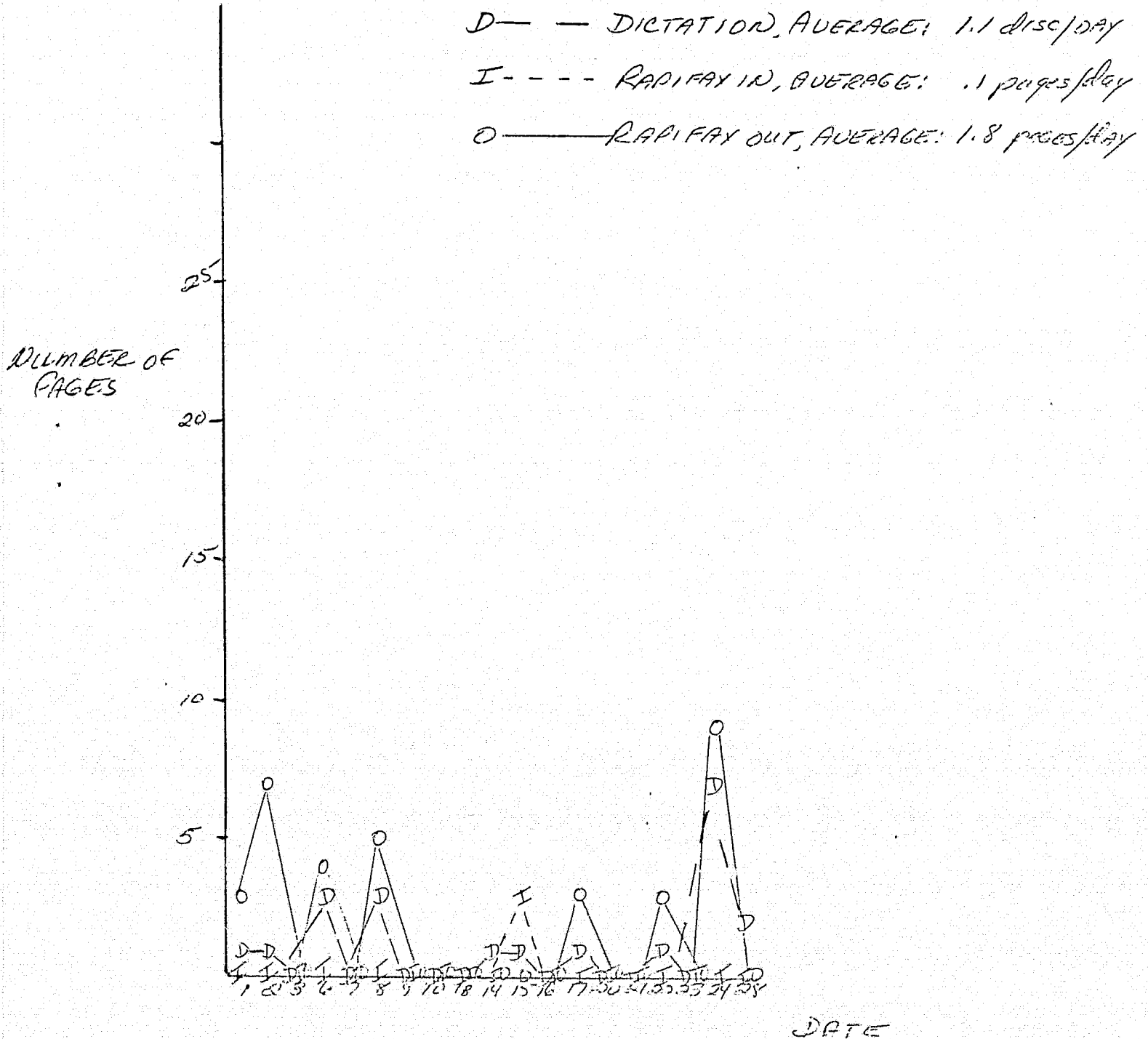
APPENDIX B

POSSIBLE ATS/CTS EXPERIMENT
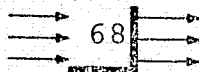
SATELLITE COMMUNICATIONS EXPERIMENT

TITLE: NOC Network Interconnection

DISCIPLINE: Communications as a Substitute for Travel

SYNOPSIS: A series of tests is to be undertaken to evaluate the
                    role of satellite-based communications links in imple-
                    menting a nationwide network of geographically dispersed
                    Neighborhood Office Centers (NOCs). Test results will
                    also be useful in specifying performance requirements
                    for new space communications system elements.

BACKGROUND: A study conducted by NASA in 1975 investigated the use
                    of telecommunications to help reduce the expenditure
                    of energy and the depletion of scarce resources. One
                    result of the study was the recommendation that consid-
                    eration be given to the idea of substituting communi-
                    cations for commuting to work. A network of office
                    centers established in residential neighborhoods could
                    help achieve significant benefits by eliminating the
                    need for many people to commute to their jobs. A nation-
                    wide pool of qualified talent would be available for
                    any kind of work that can be performed within such a
                    system.

                    This kind of arrangement would certainly improve the
                    quality of life for NOC employees. However, it would
                    also reduce significantly the rate of depletion of
                    motor fuel and natural resources that go into commuting.
                    The greater degree of geographical dispersion this
                    concept permits would help alleviate urban congestion,
                    and the reduced commuting would lessen the costs of
                    highway maintenance, traffic management and law
                    enforcement.

                    An NOC network will handle an enormous amount of data,
                    for which land lines alone are neither sufficient nor
                    cost-effective; a space-based communications system is
                    essential for this application. Consider a fully imple-
                    mented, nationwide network that encompasses some 10,000
                    office centers, each accommodating an average of twenty
                    employees. Althoug such a system would require approxi-
                    mately the same number of telephone handsets as are in
                    use now, one can expect to experience an increase in

telephone traffic by a factor of 2 to 5 in rate, and 10 times in individual call duration, with many more calls made over toll-rate distances. In addition to voice messages, digital data from typing and information storage/retrieval functions could ultimately reach flow rates of perhaps 100-1,000 Mbits/sec. Facsimile messages could eventually amount to some 1 million pages/min. throughout the system, and slow-scan video might add 10,000 frames/min. to the load.

Satellite technology will certainly be required, but before the practical utility of using satellites to augment or replace conventional links can be assessed, many problems in space communications engineering must be addressed and disposed of. This was the motivation behind the establishment of a pilot project in 1975 to test and evaluate the concept. Prototype centers linked by conventional land lines were set up to form an experimental framework for evaluating the operational aspects of the NOC concept. The project has progressed to a point where it is appropriate to begin substituing satellite links for land lines so that the system can be evaluated on a more realistic basis.

OBJECTIVES: The overall objective of the experiment is to identify and investigate pacing problems of satellite-related technology that must be solved if the NOC concept is to become a viable alternative to commuting to work. Individual tests revolve around the transmission via satellite of digital, voice, facsimile and (in some cases) video signals that characterize certain kinds of office work such as accounting, stenography, records and files maintenance, administration, and even program management in some cases. Some specific goals are:

  o to demonstrate the operational use of satellite links as an effective means for transmitting the kinds of voice, data, fax and video signals that characterize NOC functions, and to evaluate the economic feasibility of such an application

  o to develop a basis for determining the most effective mix of land and satellite links to serve the projected NOC network in its operational configuration

  o investigate the use of computer techniques in handling and switching signals within the NOC network. Possible applications areas include data compression, data concentration and multiplexing, store-and-forward operations, and digital queueing and switching of messages.

APPROACH:

Phase I (Data-Link Substitution). Successful demonstration of two-way serial ("trunk") transmission of NOC messages between two stations will be the goal of this first phase. An NOC will be established at NASA/ARC, and integrated into the existing NOC network via FTS land line connections. After the operation of this Center has been established, a satellite link will be substituted for the FTS connection.

Ground Terminals Required: Near each participating NOC, a single antenna with a phone-line interface.

Communications Links: Access to FTS through digital modems in the range of 300-2400 baud. For some equipment, such as the fax telecopiers, the modems are built in. Also, if the distances from NOCs to antennas are too long for hard-wire connection, phone lines will be used as relays.

Procurement, Installation and Use of Special Equipment. None, except for data modems if telephone connections are to be used between NOC and antenna. However, the modems may already be in place as part of the ongoing test.

Training. No special training required beyond the training normally provided to NOC equipment operators. It will only be necessary to instruct them on the procedure for accessing the antenna instead of the FTS line.

Publication and Dissemination of Experimental Results. Via contractor reports and NASA documents, as appropriate.

Phase II (Multiple Stations). The goal of the Phase II effort will be to demonstrate and test the use of satellite communication links for interconnecting three or more NOCs, i.e. a configuration of stations in which multiple message paths are possible. Initially, each message path will be assigned its own subcarrier frequency, and "dispatching" of messages will in effect be performed by the sender of a message. Later, however, a dispatcher's station will be added to the network, containing store-and-forward capabilities and message reformatting and addressing features. Message multiplexing, packet switching and multiple access techniques will be studied, with the object of maximizing the message-carrying capacity of each communications channel.

Details of the Phase II plan will be furnished at a later date.
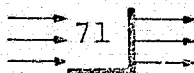
PROCEDURE: Step 1 (Local Operation). NOC's at NASA Headquarters and Georgetown (GNOC) to be used. Connection via local dial-up lines, except that the fax communications are handled thought the NASA fax network via MSFC gateway switch.
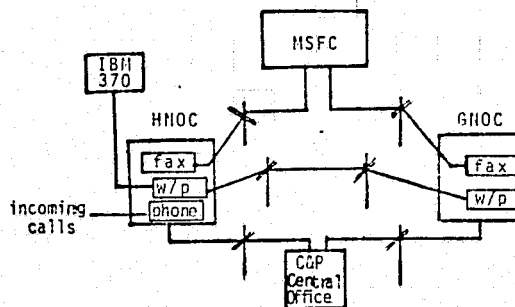
Modes of operation:

  Dictation - via dial-up phone line from Heaquarters (or anywhere else) to IBM 6:5 recorder/playback at GNOC

  Fax - via NASA fax network as per usual

  Text - between communicating word-processing terminals via dial-up service

  Incoming Calls (received at selected Hq. phones) - transferred to GNOC using C & P Call Forwarding service. GNOC operator ascertains status and location of Hq. callee by interrogating data base through CRT display. Messages stored for later pickup, or transmitted to "mailbox".

Step 2. (CTS Phone Patch Test). Using the Step 1 configuration as a baseline, augment the arrangement by providing an alternate voice/data link via CTS which can be used from time to time, subject to satellite availability. See configuration below:
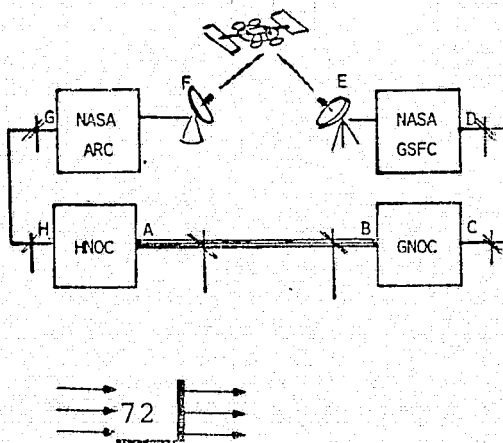
Operation is as follows:

Option 1. Operation exactly as described in Step 1,
along path AB, using conventional connections.

Option 2. Communication via path CDEFGH, but using FTS
between C&D and G&H. Especially at first, it may be
necessary to use some combination of paths AB and C → H
until equipment and procedures can be developed for
all modes of data transfer. Ultimately, however, all
traffic will be routed via satellite during periods
when it is available; otherwise via path AB.

Step 3 (ANOC Implementation). Physically transfer GNOC
to ARC (call it ANOC) and eliminate land link CD. Possibly
secure the use of a mobile CTS antenna terminal at Hq,
so that phone link GH can also be dispensed with.

Regardless of whether GNOC is transferred to ANOC, tie ARC
into the network of NOC's via fax, dictation and some sort
of digital printer/plotter which can receive edited text
sent from the word processing terminals. For this latter
feature it may be necessary to route edited text through
a computer at ARC, or possibly Hq., so that typewriter
carriage-control commands, etc. can be propoerly interpreted.
Details to be negotiated with ARC personnel.

With ARC in the network, tests will be conducted to deter-
mine the feasibility and expediency with which the 3-hour
time difference between stations can be exploited to
arrange for West Coast "overtime" typing to be done during
East Coast "straight-time" hours. If GNOC word-processing
terminal is moved to ARC, then similar tests can be attempted
in the opposite direction.

APPENDIX C

AUTOMATIC DATA PROCESSING EQUIPMENT
ACQUISITION PLAN
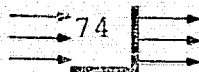
ADPE ACQUISITION PLAN

GENERAL-OVERVIEW

An approved Headquarters pilot project is underway to
evaluate the role of satellite-based communications links in
implementing a nationwide network of geographically
dispersed Neighborhood Office Centers (NOCs). Test results
will also be useful in specifying performance requirements
for new space communications system elements for such
applications.

A study conducted by NASA in 1975 investigated the use of
telecommunications to help reduce the expenditure of energy
and the depletion of scarce resources. One result of the
study was the recommendation that consideration be given to
the idea of substituting communications for commuting to
work. A network of office centers established in
residential neighborhoods could help achieve significant
benefits by eliminating the need for many people to commute
to their jobs. A nationwide pool of qualified talent would
be available for any kind of work that can be performed
within such a system.

This kind of arrangement would certainly improve the quality
of life for NOC employees. However, it would also reduce
significantly the rate of depletion of motor fuel and
natural resources that go into commuting. The greater
degree of geographical dispersion this concept permits would
help alleviate urban congestion, and the reduced commuting

would lessen the costs of highway maintenance, traffic
management and law enforcement.

An NOC network will handle an enormous amount of data, for
which land lines alone are neither sufficient nor
cost-effective; a space-based communications system is
therefore considered essential for this application.

The project was initiated in 1975. Prototype NOCs were
established at Headquarters and in Georgetown, with
inter-Center communications handled over telephone lines.
As a start, remote administrative services such as typing,
stenography and bookkeeping were considered, and two Wang
Model 1222 TC communicating word-processing typewriters were
rented to handle the typing. Since then the project has
progressed to a point where it is now appropriate to begin
substituting satellite links for the land lines so that the
concept can be evaluated on a more realistic scale. Also,
inadequacies of the Wang equipment that have come to light
during the past two years have made it cost-effective to
replace these units with more modern CRT-based units which
are faster and more flexibly adaptable in the present
application.

SECTION I - Requirements for Additional ADPE Capability

GENERAL. Requirements motivating the anticipated
procurement fall into three areas of justification. The
first stems from the fact that the Wang typewriter-based
equipment in present use is too slow to keep pace with the
typing demand. Monthly usage statistics compiled and
analyzed as a part of the test program indicate that job

processing operations have progressed to where job' throughput is now limited by the physical speed of the typing (i.e., printing) unit. With the Wang equipment, displaying a page to view the text or to insert corrections requires that the page be physically typed. Wang uses an IBM Selectric typewriter which prints at the relatively slow rate of 15 characters per second (cps). However, modern CRT-based units display a full page instantly, and almost all incorporate character or dot-matrix printers of substantially higher speed, typically ranging from 45 to 300 cps, depending on the type of unit. Demonstration of high throughput speed is essential to the project because the feasibility of the remote approach to providing administrative services depends largely on being able to process enough work to compensate for the required capital investment in equipment and communications costs.

The second area of justification arises from the need for having some limited programming capability to support the next phase of the project. The goals of this phase include a demonstration of compatibility among dissimilar equipment at different NOCs, and the development of efficient dispatching procedures which will permit jobs to be shunted between NOCs to fit the current workload and the available manpower.

The third area addresses the need to gather, compile, analyze and display statistics on equipment usage, turnaround times, throughput volumes and other indicators of system efficiency. All three functions motivate the need for a capability to perform simple operations of arithmetic processing, data reformatting and job control scheduling;

these in turn demand the availability of a small
programmable computer.

PHYSICAL SPECIFICATIONS.

-   Equipment must be operable in a standard office
    environment, and without power or cooling requirements
    beyond what is normally available at such locations.
    In particular, operational temperature limits must be
    between $+60^{\circ}$ and $+95^{\circ}$F; humidity, 40% to 80%
    (non-condensing). Electrical specifications are 115V
    AC $\pm$ 10% @ 60Hz; 10 amps for 400 ms max.

-   Typist and word-processing terminal must be comfortably
    accommodated within 125 sq. ft. of floor space, and
    under a ceiling 7 ft. or higher.

-   All terminals within the system must be equipped with
    AIA RS232C compatible digital communications interface.
    Digital communications among all word processing units
    must be assured, via commonly acceptable communications
    protocols and handshake conventions. Data formats may
    be either standardized or able to be reformatted
    through the programmable processor within the system
    configuration. Transmission speeds from 300 to 4800
    baud, switch-selectable.

    Printing element must produce text at an effective
    speed of not less than 45 cps. CRT screen must be
    provided with each unit, and must be capable of
    presenting a minimum of 24 lines of text at 80
    characters per line.

- Disc storage of at least 250,000 characters integral to each word-processing unit. Interface to access larger memories is desirable.

- The system as a whole must have at least one digital processing element that is programmable in either assembly language or some convenient higher-order language. This will permit applications programs to be written to reformat messages, collect statistics and evaluate them, and perform job scheduling operations. Core memory of 32,000 or greater must be available within the system to support these applications programs.

PERFORMANCE SPECIFICATIONS.

- Each word-processing terminal must be capable of causing the following text operations to be performed, as a minimum: automatic centering, decimal alignment, margin justification, form letter merge, user-definable command sequences, simultaneous printing and editing, shorthand dictionary, text scrolling, block text movement, and search-and-replace.

- Typists with normal intellectual ability and manual skills should be trainable on the word-processing terminals. The operations performed should correspond as closely as possible with normal typing operations, both in their conceptual representation and in the mechanical implementation of them; specifically, knowledge of computer programming must not be a precondition for using the terminals.

- To as great a degree as is possible, complex text
  manipulation operations, such as "delete sentence" or
  automatic centering should be addressable through
  single-function keys or switches.

- Training of inexperienced operators through program
  "menus" that can be displayed on the CRT scope is
  highly desirable.

SECTION II - Alternative Approaches Considered

The only possible alternatives that could satisfy the
requirements stated above are:

1. A CRT-based word processing system whose digital
   processor is programmable and capable of handling the
   tasks outlined above. This is the alternative
   selected. It embodies a unified approach to meeting
   all of the stated requirements, and eliminates the need
   to couple a processor to several text-editing units,
   which would certainly be a more complex and expensive
   approach to adopt.

2. A CRT-based word processor and a separate programmable
   computer. This alternative is unacceptable because of
   its cost and complexity, both of which exceed those of
   the previous alternative.

3. A time-shared computer, with remote TTY-format
   CRT-terminals. This is unacceptable because it
   violates the requirement that the terminals be usable

by typists without special training in programming.
Also, operation of the system in this mode will often
not be at interactive speeds, especially if there are
many users sharing the service.

SECTION III - Available ADPE

This application requires the full-time use of a family (2
or more) of compatible, communicating word processors. No
suitable units of this description are presently available
from other NASA Centers or Government sources, as was
determined from personal contacts and a survey of the best
data available (e.g., surplus lists, etc.). In view of the
fact that units of this type are relatively new to the
market, it is unlikely that any can be expected to become
available in the near future through surplus channels.

SECTION IV - ADPE System Upgrading Actions

None is possible. The Wang units in current use cannot be
converted. Also, they are only being rented, and therefore
cannot be modified in any event.

SECTION V - System Component Costs

The few components that compose the proposed small system
are only available as an integrated package and could not be
purchased separately.

SECTION VI - Funding Information

Acquisition of this ADP equipment will be effected under R & D funds for the NOC pilot project under the cognizance of Office Code ECF. Funding for the procurement was based on the following:

1. The pilot project requires the ADP equipment for a limited one-year evaluation period.

2. Because of the limited evaluation period and the rapid advances in design and capability of the type of equipment under consideration, planned funding was based on rental rather than on purchase of the ADPE. Funds for this equipment have been approved for FY 77 and should be sufficient to cover the evaluation period.

SECTION VII - Method of Acquisition

This acquisition is to be a sole source procurement following the Federal Property Management Regulations (FPMR), Office of Management and Budget (OMB) Circulars, and applicable NASA regulations. Rental of the equipment is recommended because of the limited (one-year) duration of the pilot project evaluation period and the rapid advances in the state-of-the-art of word-processing equipment capability being achieved.

SECTION VIII - Acquisition and Implementation Schedule

The Wang 1222 TC's currently in operation at the Georgetown
NOC and at NASA Headquarters will be replaced with the new
equipment as soon as practicable. It is anticipated that
approval of the acquisition plan and procurement request by
the end of October will allow installation of the new
equipment during December 1977. Evaluation of the new
equipment will be completed within one year of installation.

SECTION IX - Equipment Installation

There are no special requirements, except that modems must
be furnished. This will be accomplished through a rental
arrangement with the telephone company.

SECTION X - Utilization of Equipment After Installation

Acquisition of the subject ADP equipment is required to
allow completion of the NOC pilot project evaluation
discussed in Section I and in the Overview.

SECTION XI - Cost Savings

The anticipated cost savings over alternative methods were
discussed in Section II. Additional savings are expected to
be achieved as a result of replacement of the current Wang
equipment with the DEC word processors, since the latter has
three times the typing speed and an ability to perform

simultaneous output and editing. This improved capability should more than double the throughput of each NOC work station. The effective saving, measured in terms of the salary and overhead of an NOC operator, is approximately $1,500 per month per station. This amount would have to be expended for an additional operator using the older equipment to accommodate the larger workload that can be handled by a single operator using the new equipment.

SECTION XII - Planned Future System Changes

No future system changes are planned. This is to be a one-year lease in connection with a limited evaluation period under the pilot project.

SECTION XIII - Location after Installation

One terminal will be located at NASA Headquarters, Code E; a second will be at the offices of the test program contractor, S. Ross and Company, in Georgetown, DC. Further units may be located at other NASA Centers, but this cannot be verified at the present time. Equipment will be used by S. Ross and Company personnel at both locations.