

TOP SECRET

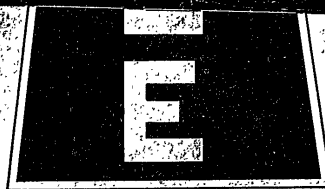
HANDLE VIA TALENT-KEYHOLE CONTROLS ONLY

TCS-1453-63-KH, Cy 1
w/aTCS-1454-63-KH, Cy 1
w/a 1, Cy 1
TCS-1404-63-KH, Cy 1

20 MAY 1963



SUBJECT: STATUS REPORT ON UTILIZATION
OF THE IBM 1401 AND
REMINGTON RAND 490 COMPUTERS



WARNING

"This document contains information affecting the National Defense of the United States within the meaning of the espionage laws, Title 18, USC, Secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law".

It is to be seen only by U. S. PERSONNEL especially indoctrinated and authorized to receive TALENT-KEYHOLE information. Its security must be maintained in accordance with KEYHOLE and TALENT regulations.

TOP SECRET

HANDLE VIA TALENT-KEYHOLE CONTROLS ONLY



WARNING

"This document contains information affecting the National Defense of the United States within the meaning of the espionage laws, Title 18, USC, Secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law".

It is to be seen only by U. S. PERSONNEL especially indoctrinated and authorized to receive TALENT-KEYHOLE information: Its security must be maintained in accordance with KEYHOLE and TALENT regulations.

SECRET KEYHOLE CHANNELS
ONLY

TCS-1453-63-KH
7 May 1963

SUBJECT: Status Report on Utilization of the IBM 1401
and Remington Rand 490 Computers

- 1. TCS-1454-63-KH
- 2. TCS-1404-63-KH

Distribution:

- Cys 1 & 2 - Ex/Dir ✓
- 3 - TID
- 4 - PDS
- 5 & 6 - CSD

NPIC/CSD

(7May 63)

50X1

SECRET KEYHOLE CHANNELS
ONLY

~~SECRET~~KEYHOLE CHANNELS
ONLYTCS-1453-63-KH
7 May 1963Copy No. 1

MEMORANDUM FOR: Executive Director, NPIC

SUBJECT : Status Report on Utilization of the IBM 1401
and Remington Rand 490 ComputersREFERENCE : Memorandum of 1 April 1963, same subject, from
Executive Director, NPIC to Chiefs, CSD & TID,
and P&DS

50X1

1. Attached are two staff studies explaining the present status and future plans for the two computer systems in NPIC and listing additional equipment required for operations of the Collateral Support Division. A memorandum to the Office of Logistics thru the Chairman, CIA ADP Committee requesting rental of this equipment is forwarded seperately for your signature.

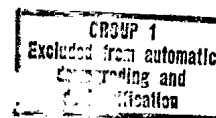
2. The paper on the Remington Rand 490 system shows that the development time and the ultimate equipment utilization is far more extensive than originally visualized.

3. When rental of the two computer systems was approved by the CIA Automatic Data Processing Committee, it was stipulated that conversion of the 1401 be studied and, if possible, accomplished at the earliest practicable moment.

4. The study cannot profitably be undertaken at this time. The major reasons are:

a. It is too early to forecast the demand volume for either system. This is especially true for community demands; exploratory discussions in this area with CIA components and representatives of the newly-established Defense Intelligence Agency are just beginning.

b. Any immediate attempt to transfer Collateral Support Division (CSD) computer activities to the Remington Rand 490 system will delay the schedule of the Technical Intelligence Division for development of the real-time mensuration system. Conversely, NPIC immediate reporting requirements cannot tolerate the delays necessary to train programmers and reprogram the 1401 applications on the 490.

~~SECRET~~HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

SECRET

**KEYHOLE CHANNELS
ONLY**

TCS-1453-63-KH
7 May 1963

SUBJECT: Status Report on Utilization of the IBM 1401
and Remington Rand 490 Computers

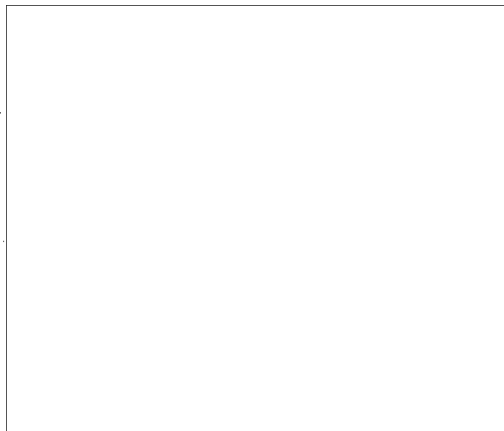
c. Changes in the collection systems will have a major effect on the 490 system, requiring extensive reprogramming. Several new systems are already in late stages of development.

d. Although the real-time mensuration response will probably take no more than five percent of the available time on the 490 system, batch programs necessary to prepare for the real-time capability are more time consuming than originally anticipated (because a more accurate method is now planned). It is possible that TID applications may require up to 80 percent of the available time on the 490 system.

e. It has already been found that some major computer activities of CSD and TID peak at the same time. This eliminates simple time sharing of one computer and requires careful evaluation of the details of each such program to determine the possibilities for overlap.

5. We therefore recommend that immediate consideration be given to the CSD request for additional equipment and that the question of ultimate convergence of the two systems be deferred until the 490 photo measurement system is in operation and the items in paragraph 4 above become definitive. We believe the deferral should be for a minimum of two years and that four years is more likely.

50X1



Attachments:

SECRET HANDLE VIA **KEYHOLE CHANNELS**
GROUP 1 Excluded from automatic downgrading and declassification

TOP SECRET

KEYHOLE CHANNELS
ONLY

TCS-1454-63-KH
Copy No. 1

1401 SYSTEM

Present Status and Future of the IBM 1401 System

I Problem

To determine the status of the IBM 1401 System relative to current utilization and future demands on this equipment within the Center.

II Facts Bearing on the Problem

A. Background

1. Beginning in January 1957, NPIC developed a punched card system for the production of immediate photo interpretation reports (IPIR, OAK, SITSUM and MCI, hereafter called IPIRs and MCIs) and background Target Briefs utilizing the IBM 407 Tabulating Machine's 150-lines per minute printing capability. This system provided for individual target readouts to be punched as read, sorted into any desired sequence, listed on reproduceable offset masters for hard copy reproduction and converted to punched paper tape for electrical transmission. Corrections, insertions and deletions could be made easily up to the time of printing. The readouts were then used to update the Target Brief file. (See Figure 1.)

2. With the advent of satellite reconnaissance, which covers 3-5 million square miles and 2-3,000 targets in one mission, the IBM 407 could not handle the printing demands. Installation of an IBM 1401 system (8K, 4 slow-speed tape drives) was approved in mid-1961 to obtain the better and faster printing capability of the 600 lines-per-minute 1403 printer. Training of programmers, systems design, and programming began in January 1962. The system was delivered and became operational on 16 July 1962.

B. Present Status of the 1401 System

1. The utilization of the 1401 system since delivery has grown rapidly, averaging 230 hours per month during the first Quarter of 1963. (See Figure 2.) The growth in utilization has been due primarily to daily Cuban overflights and to TALENT missions on China, Tibet and SE Asia. It should be noted that there was no successful KH mission from mid-December 1962 to April 1963.

2. An appreciation of the applications on the 1401 may be obtained from Attachment 1, which lists all operational programs and the frequency of their use. Machine utilization divides into the following primary applications. (See Figure 3.)

GROUP 1
Excluded from automatic
downgrading and
declassification

TOP SECRET

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRETHANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TCS-1454-63-KH

a. The Immediate Reporting Cycle accounts for 80% of total 1401 utilization and involves four sets of programs:

1) Those which produce proofs and offset reproduction masters for IPIR's. (An average of 225 targets is processed for each IPIR.)

2) Those which produce partial and final MCI proofs, final MCI reports, and magnetic tape output to update the Target Briefs and MCI master tape files. (Each KH MCI includes readouts on 1,200-2,000 targets selected from some 2,000-3,000 targets reviewed by the PI.)

3) Those which are used to update and/or list the target briefs file (containing approximately 12,000 targets) and prepare indexes as required.

4) Those designed to select various portions of the target brief files as required.

b. "All Source"/Minicard applications account for 5% of total 1401 utilization. This category includes publication of the "All Source" listings which index more than 16,000 photo interpretation and photo related reports; retrieval of specific bibliographies in response to analyst requests; library circulation control over approximately 10,000 codeword documents; and edit/control programs which produce error check listings and control listings for Minicard input. Approximately 300 documents are accessioned per month.

c. Support of other NPIC components accounts for 3% of 1401 utilization. Included are the generation and listing for publication of acquisition numbers which are assigned to downgraded photography; the editing of original ephemeris data and printing of the "Best Guess" and final ephemeris reports; cumulative monthly listings of regular and overtime hours worked on projects by NPIC personnel; monthly NPIC project status and contract status reports.

d. Preparatory and utility operations, which include assemblies, testing operations, sorting operations, etc., account for 12% of the 1401 utilization.

C. Future Demands Upon the System

1. Expansion of NPIC

a. According to current plans, PI strength at NPIC will expand substantially during FY-64. The effective increase in PI strength will be even greater, moreover, since the consolidation

GROUP 1
Excluded from automatic
downgrading and
declassification

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY- 2 - **TOP SECRET**

TOP SECRET**HANDLE VIA
KEYHOLE CHANNELS
ONLY**

TCS-1454-63-KH

of Army, Navy and Air Force detachments into a DIA element will permit PI teams to be cut from four to three and possibly two members.

b. It is estimated that there will be a threefold increase in satellite missions in FY-64. The resolution of imagery received is expected to increase to the point where detailed interpretation of target facilities similar to that accomplished by TALENT material will be possible. As a result, requirements for PI readout and for collateral information to support the PI will increase very rapidly and substantially.

c. Film inputs from U-2 photography are expected to remain at the current high level. Moreover, pressure to extend coverage mounts daily. Excluding Cuba, it is estimated there will be 35 missions flown as compared with 20 flown to date in FY-63.

2. Implication for Operation of Present System

We conservatively estimate that the conclusion of the **present** calendar year will witness no less than a 70% growth in **size** and a 100% increase in activity directed against the data base in the 1401 system. Applying these factors to operations during the four month period October 1962 thru January 1963, it is estimated that utilization will reach 590 hours per month by the end of 1963 (Figure 4).

III Discussion

A. System Problems and Equipment Requirements

1. To keep pace with the increasing volume and tempo of NPIC intelligence production, it is imperative that certain limitations of the present 1401 system be eliminated. Production of IPIR's and MCIs will be constantly overlapping each other. Each readout should be added to the data base as soon as feasible. Each new listing of target briefs will have to reflect all available data whether it be from a completed report or from an initial proof of a report still in the production cycle.

2. With the present system, entire files must be passed through the computer memory whenever it is desired to update Target Briefs. Because of the extensive run time (12 hours for the main Target Brief file), updating additions and corrections must be batched extensively. An on-line immediate access

TOP SECRET**HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY**

GROUP 1 Excluded from automatic downgrading and declassification

TOP SECRET**HANDLE VIA TALENT
KEYHOLE CHANNELS
ONLY**

TCS-1454-63-KH

storage capability, allowing the file to be updated by processing only the portions to be changed would alleviate this problem.

3. The Target Brief file cannot be updated if it interferes with the proof listing or mat-generation of an IPIR. The core storage of the 1401 system is insufficient to permit incorporation of interrupt and restart routines and an immediate report must be processed as soon as it becomes available. Since we have been averaging two to three IPIR's daily, seven days a week since October, this presents a considerable scheduling problem. The ability to interrupt lengthy operations to handle urgent priority demands is now required. Resumption of the interrupted operation at or near the point of departure is also a requirement.

4. Multiple runs are required to accomplish one maintenance operation involving both updating from immediate reports and corrections. The restriction is primarily due to limited computer memory space for instructions to perform more complex operations and the necessity to maintain like sequences between the updating information and the file being updated. Additional memory and random access storage would permit consolidation of runs.

5. Because of limited core capacity, present programs are necessarily sophisticated, difficult to write, and time consuming to modify. Additional core would permit straight-forward, modular programming, facilitating check out and modification.

6. Retrieval operations are unnecessarily time consuming. Retrieval speed should be augmented by faster data transfer rates and by use of random access storage.

7. The present system is limited in the various sequences in which large files can be arranged, due to the time consumed by magnetic tape sorting of the entire file. This means, for example, that it is not feasible to list target briefs in pass sequence. With immediate access storage, however, only a relatively small index to the files need be sorted.

8. The present system is overwhelmed with the enormous printing load. This can be alleviated by overlapping input, output and processing operations and by faster printer speeds.

- 4 -

TOP SECRET**HANDLE VIA TALENT
KEYHOLE CHANNELS
ONLY**

GROUP 1 Excluded from automatic downgrading and declassification

TOP SECRET**HANDLE VIA TALENT
KEYHOLE CHANNELS
ONLY**

TCS-1454-63-KH

B. Additional Requirements

There are a number of additional applications for machine processing identified at the present time and many more will develop as the activities and staff of NPIC expand and diversify. They point to the need for greater system throughput capability and flexibility. Additional requirements include:

1. The purging of target brief files to prevent them from becoming too bulky for efficient use by the photo interpreter.
2. Maintenance of a Report File to satisfy the increasing number of requests for listings of published IPIRs and MCIs cumulated by installation and sorted in various sequences. The total collection of these reports can no longer be contained in the Target Briefs file.
3. The Operations Staff is developing a detailed management information system to provide daily information on the status of work in progress and to provide a base for projection of future requirements. Machine support is required.
4. A program is needed to prepare clear text bibliographies of reports pertinent to specific requests of the Minicard system, so that requesters may select the documents they wish duplicated.
5. A comprehensive program is required for supplying or exchanging ~~port~~ portions or all of the various files of interest to each of the major commands, agencies, centers or services.

C. Conversion to the UNIVAC 490

1. Theoretically it would be possible to convert the present and anticipated 1401 applications to the 490. It has been decided, however, that such conversion is not feasible at the present time because of the delays such transfer would incur in the implementation of the real time mensuration system.
2. Furthermore, major activities of both systems peak concurrently necessitating very detailed consideration of the possibilities for overlap. Neither 490 programmers conversant with CSD applications nor the time to train programmers and write, assemble, and test programs are available. To train programmers and reprogram would involve at least a year's time; the present 1401 system cannot keep up with the anticipated workload during

**HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY**

GROUP 1 Excluded from automatic downgrading and declassification

TOP SECRET**HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY**

TCS-1454-63-KH

this period. See the attached staff study "Present Status and Future of the UNIVAC 490 System."

D. Equipment Recommendations

1. A careful review of present and anticipated NPIC workloads and requirements has been made jointly with IBM. As a result, we recommend as a minimum that the present 1401 system (monthly rental \$6,630.00) be replaced by the equipment listed below as quickly as possible. The 1401 system will be phased out after acceptance and full conversion to the new system.

<u>Qty</u>	<u>Type</u>	<u>Model/Feature</u>	<u>Description</u>	<u>Mo. Rental</u>
1	1411	3	Processing Unit	\$ 5,400
1		3470	Dual Synchronizer	325
1		5620	Priority	125
1		5730	Processing Overlap	200
1		3302	Disk Storage Adapter	65
1		4659	I/O Adapter	25
1		7823	Tape I/O Adapter	55
1		7824	Tape I/O Adapter	55
1	1415	1	Console	250
1	1414	3	I/O Synchronizer	675
1		7680	Synchronizer Storage	550
1		7681	Synchronizer Storage	60
2	1414	1	I/O Synchronizer	1,950
1		3585	800 cpi Feature	35
1		3586	800 cpi Feature	35
1	1402	2	Card Read Punch	615
1	1403	2	Printer	775
4	729	5	Magnetic Tape Units	3,000
1	7631	1	File Control	835
1	1301	2	Disk Storage	<u>3,500</u>
TOTAL				\$18,530

2. Further, we recommend that the 1403 model 2 printer (600 lines/min) and 7680 and 7681 synchronizer storage be replaced by a 1403 model 3 printer (1100 lines/min) with the necessary 7682 synchronizer storage as soon as they become available (scheduled for mid 1964). The additional cost will be \$875.00 per month. Three character changes will be required in each printer.

**HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY**

GROUP 1 Excluded from automatic downgrading and declassification

TOP SECRET

TOP SECRET

TOP SECRET
GROUP 1
EXCLUDED FROM AUTOMATIC
DOWNGRADING AND
DECLASSIFICATION

TCS-1454-63-KH

3. The recommended disk system best satisfies the equipment requirements identified in sections A & B above, provides program compatibility with the existing 1401 system, and will permit us to utilize the experience and training of the present 1401 programming staff. (See Figure 5). The effect on estimated utilization is shown in Figure 6.

IV. Conclusions

1. The existing 1401 system will not continue to satisfy NPIC data processing requirements.

2. Conversion of 1401 applications to the 490 is not now feasible.

3. As a minimum, a 1410 disk system is needed.

V. Recommendation and Action

It is recommended that we proceed with the installation of the 1410 disk system specified in Section D.1 above as rapidly as feasible. A memorandum requesting the Office of Logistics to issue a "letter of intent" to IBM is attached for your signature.



50X1

Chief, Collateral Support Division
NPIC

TOP SECRET

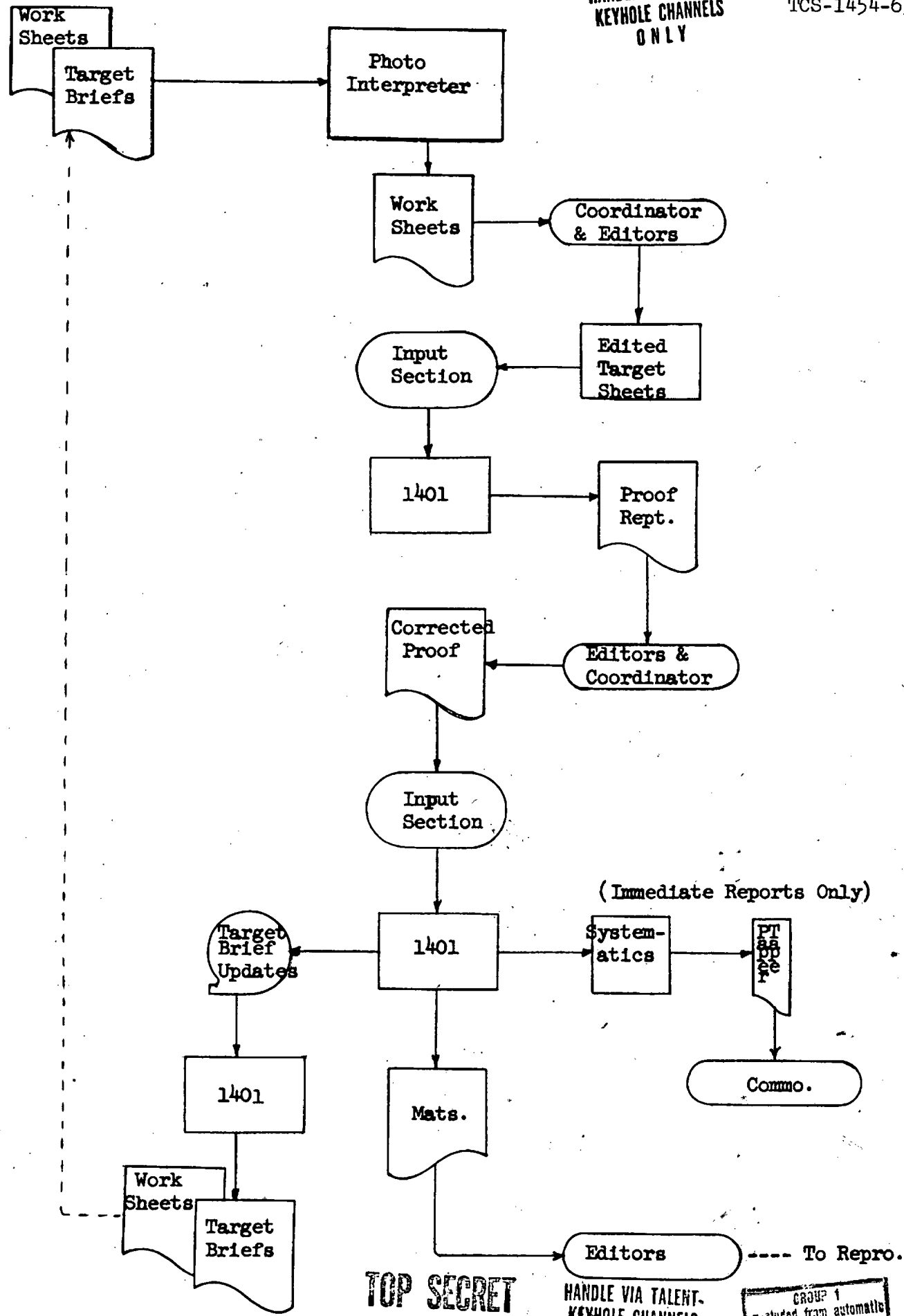
TOP SECRET
GROUP 1
EXCLUDED FROM AUTOMATIC
DOWNGRADING AND
DECLASSIFICATION

TOP SECRET
GROUP 1
EXCLUDED FROM AUTOMATIC
DOWNGRADING AND
DECLASSIFICATION

~~TOP SECRET~~
IMMEDIATE/MCI REPORTING CYCLES

HANDLE VIA TALENT-KEYHOLE CHANNELS ONLY

Figure I
TCS-1454-63-KH

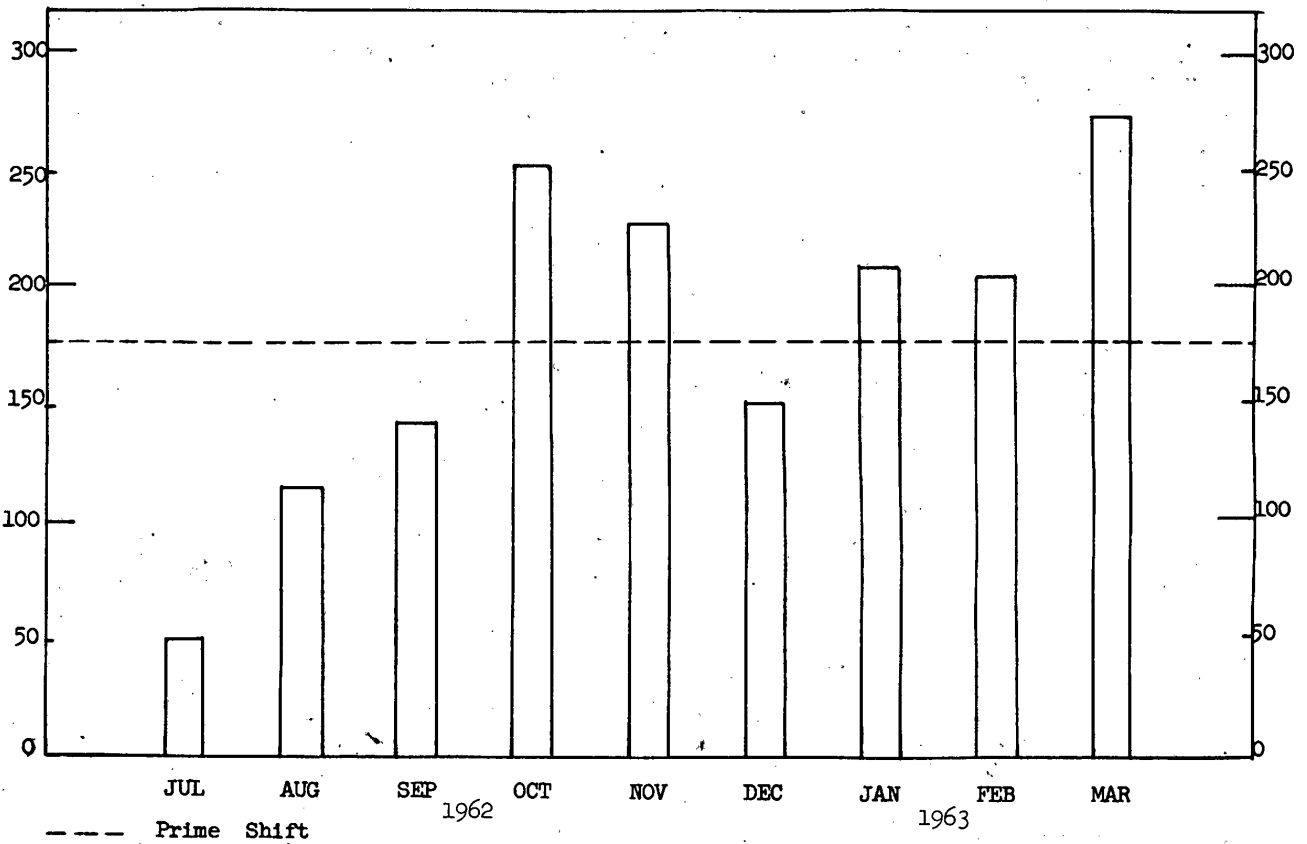


(Immediate Reports Only)

TOP SECRET

HANDLE VIA TALENT-KEYHOLE CHANNELS ONLY

GROUP 1
Excluded from automatic
downgrading and
declassification



--- Prime Shift
*NPIC Move
MONTHLY UTILIZATION
OF 1401 DATA PROCESSING SYSTEM
(Excludes Set-up Time)

TOP SECRET
GROUP 1
HANDLED VIA TALENT-
KEYHOLE CHANNELS
ONLY

GROUP 1
Excluded from automatic
downgrading and
declassification

TOP SECRET
HANDLED VIA TALENT-
KEYHOLE CHANNELS
ONLY

Figure 2
TCS-1454-63-KH

TOP SECRET

KEYHOLE CHANNELS
ONLY

Figure 3
TCS-1454-63-KH

1401 Utilization
Distributed According to Primary Applications

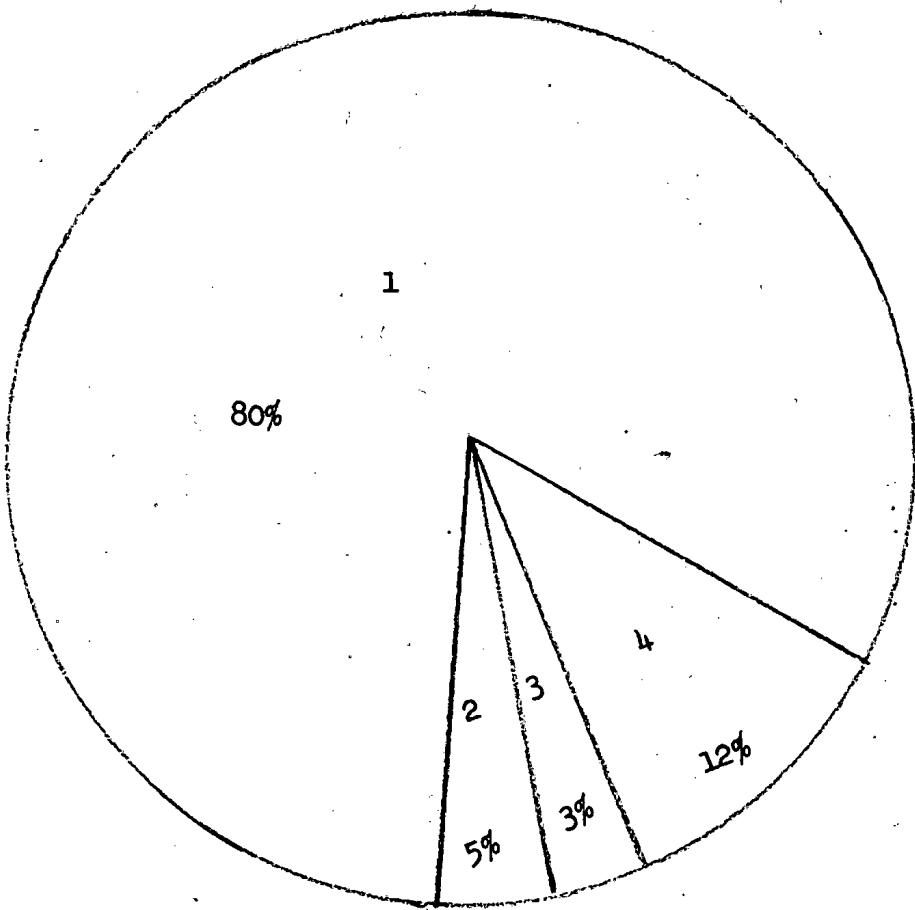


Chart Key

- 1 = Immediate Reporting Cycle
- 2 = All Source/Minicard Application
- 3 = Support of other NPIC Components
- 4 = Preparatory and Utility Operations

TOP SECRET

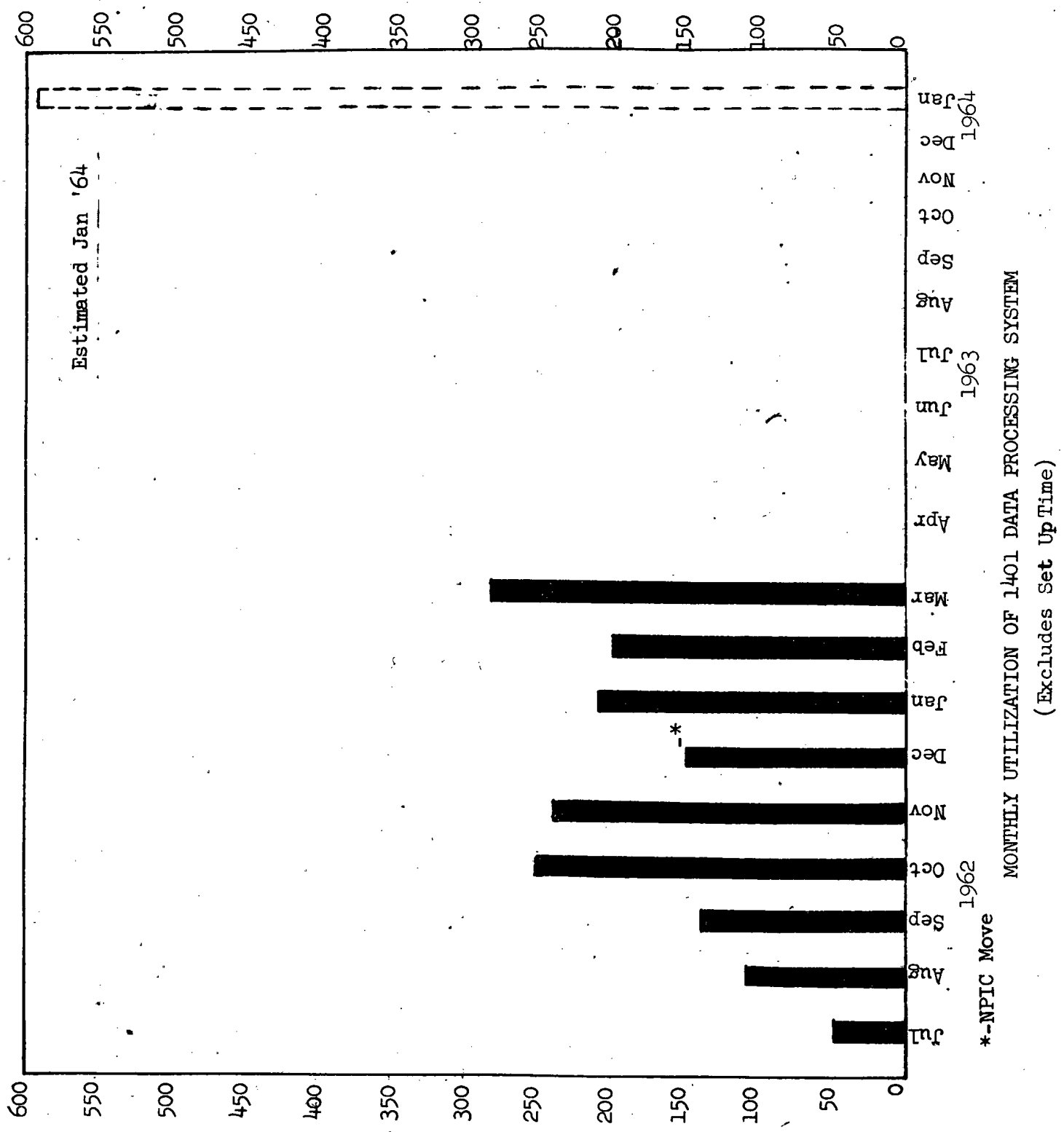
HANDLE VIA TALLIT-
KEYHOLE CHANNELS
ONLY

GROUP 1
Excluded from automatic
downgrading and
declassification

TOP SECRET

HANDLE VIA TALENT-
RETURN ONLY

Figure 4
TCS-1454-63-KH



Estimated Jan '64

TOP SECRET

HANDLE VIA TALENT-
KEYHOLE CHANNELS

GROUP 1
Excluded from automatic
downgrading and
declassification

Comparative Analysis of System Configurations Considered

Required Capabilities

Configuration Considered

expressed as a function of computer system's hardware.

	Present 1401	Expanded 1401	Dual 1401's	1460	1410 Tape	1410 Disk		
Printing Speed	600	600	600	1100	1100	1100		
Internal Speed	11.5	11.5	11.5	6	4.5	4.5		
Memory Capacity	8	16	8	16	20	40		
Large Volume, On-Line Data Storage	No	No	No	No	No	Yes		
Direct Access to Records	No	No	No	No	No	Yes		
Priority Interrupt	No	No	No	No	Yes	Yes		
Processing-Input/Output Overlap	No	No	No	No	Yes	Yes		
Variety of Access Equipments Possible	No	No	No	No	Yes	Yes		

Chart Key

Print speeds shown are rated maximum, in lines-per-minute, for the fastest model of printers which can be attached to the system.

Internal speeds are expressed in microseconds per core access.

Memory capacity figures indicate the recommended core sizes, expressed in thousands of addressable core locations, for each system configuration.

Yes indicates the presence of a hardware capability or capacity on the system, No its absence.

TOP SECRET
HANDLE VIA TALENT-KEYHOLE CHANNELS ONLY

GROUP 1
Excluded from automatic
downgrading and
declassification

TOP SECRET
HANDLE VIA TALENT-KEYHOLE CHANNELS ONLY

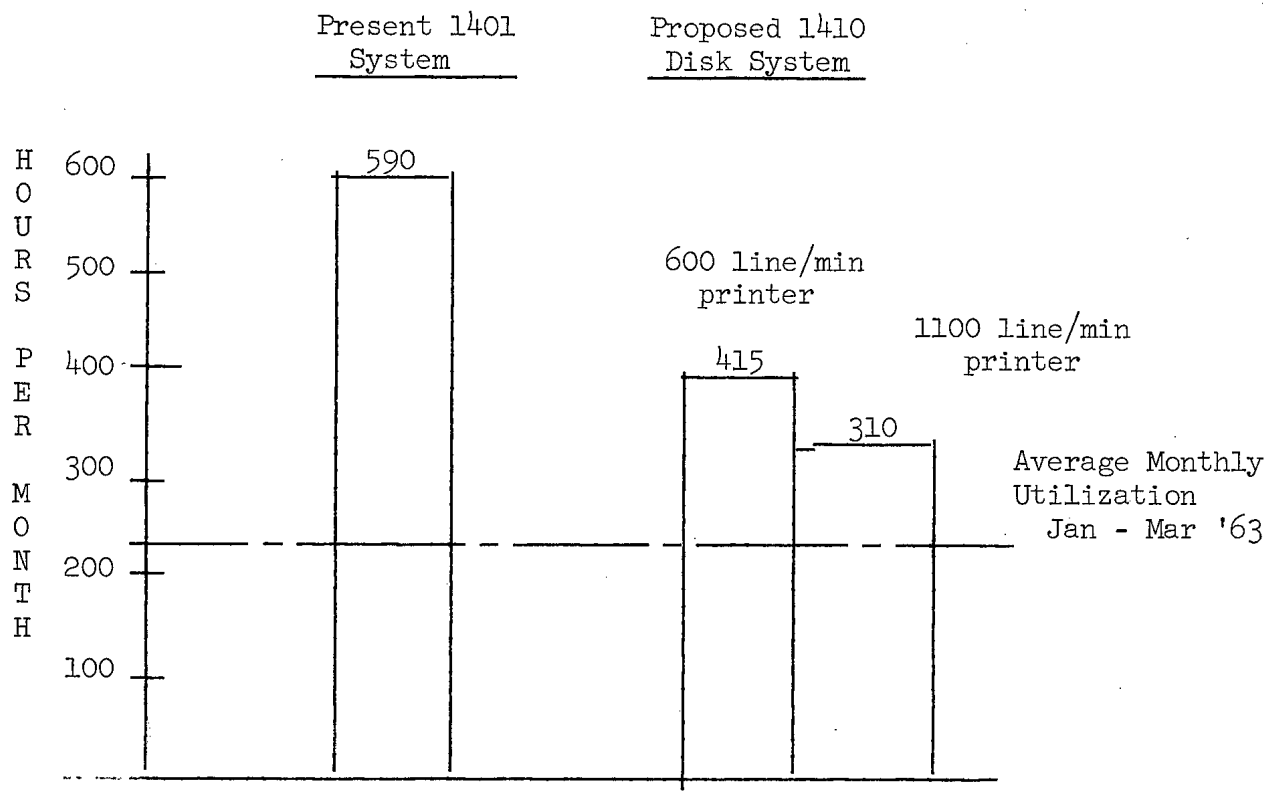
Figure 5
TOS-1454-63-KH

TOP SECRET

KEYHOLE CHANNELS ONLY

Figure 6
TCS-1454-63-KH

Estimated Utilization of the Present
and Recommended Computer Systems
by January 1964



TOP SECRET

**HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY**

**GROUP 1
Excluded from automatic
downgrading and
declassification**

HANDLE VIA TALENT-KEYHOLE CONTROLS ONLY



WARNING

"This document contains information affecting the National Defense of the United States within the meaning of the espionage laws, Title 18, USC, Secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law".

It is to be seen only by U. S. PERSONNEL especially indoctrinated and authorized to receive TALENT-KEYHOLE information: Its security must be maintained in accordance with KEYHOLE and TALENT regulations.

TOD SECRET

HANDLE VIA TALENT-
TOP SECRET ONLYAttachment I
TCS-1454-63-KHOPERATIONAL PROGRAMSCopy No. 1IMMEDIATE REPORTS1. IRO41 - OAK - IPIR - SITSUM

TYPE: Published Report--This program is designed to list the information obtained by aerial coverage on top priority targets. Output is punched to update the COMOR files.

USAGE: Daily. Proofs and Reports. Time varies from 10 minutes to 25 minutes each run. Averages two plus runs per report.

2. ICO61 - Card Conversion for SITSUM

TYPE: Conversion Card to Card, (old card system to new card system), then to tape.

USAGE: One time.

MCI REPORTS3. IEO11 - MCI Proof List and Edit

TYPE: Edit. This program is designed to produce a proof listing of an MCI publication.

USAGE: Not used to date.

4. IEO21 - MCI Final Proof

TYPE: Proof Listing: This program is designed to produce the final proof list which incorporates any changes observed on the initial proof listings. A tape is created for input to the MCI Mat Run.

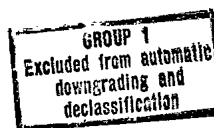
USAGE: One a week. Varies, 1 hour average.

5. IRO11 - MCI Mats Generation

TYPE: Published report. Lists MCI Report on Mats from tape produced from MCI final proof program. Also checks table tape for COMOR Targets, and as output punches card for each COMOR Target, produces a tape to update the MCI File and a tape to update the Master File.

USAGE: One a week. 30 minutes to 1 hour.

TOP SECRET

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRET

KEYHOLE CHANNELS

ON L ACS-1454-63-KH

MCI REPORTS (CONTINUED)6. IRO21 - MATS Index

TYPE: Published Report. The purpose of this program is to produce an index to the MCI publications.

USAGE: One a week, 15 minutes.

7. IRO31 - MCI Master File

TYPE: Update the Master MCI File and to produce a listing of all additions to that file on 5 x 8 cards. Output is an updated MCI Master Tape.

USAGE: One a month. 2½ hours average.

8. IMO31 - MCI Master File Maintenance

TYPE: Maintenance. This program is designed to make changes to the MCI Master File by the addition, deletion, or replacement of logical tape records. Output will be a corrected master tape.

USAGE: One a week. 1½ hours to 2 hours.

9. ICO11 - MCI File - Card to Tape Conversion

TYPE: Card to Tape conversion. Writes to tape in blocked format all the MCI Files.

USAGE: One time.

10. ICO31 - WAC - Coordinate Table

TYPE: Card to Tape. To build a table of coordinates within WAC, within Country. To be used in program to list first MCI proof copy.

USAGE: Will be used average of one weekly.

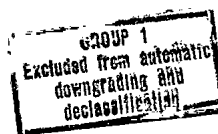
11. ICO41 - COMOR - NPIC Table

TYPE: Card to Tape. To build a table of COMORS to run against headers to determine if any regular headers are the same as COMORS. (Used in MCI Mat Run).

USAGE: One a week. 30 Minutes.

- 2 -

TOP SECRET

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRET

KEYHOLE CHANNELS

ONLY **TOP SECRET**TARGET BRIEF MAINTENANCE12. IM011 - Regular File Maintenance (Tape)

TYPE: Update and Maintenance. This program is designed to update the Regular Briefs Master File through the addition of the latest MCI tape to that file. Output includes an updated Regular Briefs Master File, an updated Regular Briefs Header File, and/or printed listing.

USAGE: One a week, 3 hours update selected NPIC briefs.
One a month, 10-12 hours print entire file. (UR).
One a month, 3 hours print entire file. (CU).

13. IM021 - Regular or Special Card Maintenance

TYPE: Update and Maintenance. This program is designed to print and/or update the Regular or Special Master File by using add, delete, or change cards. An updated Master File is output along with an updated header list tape used to print Briefs Lists B, C, D, and E. COMOR table cards are punched whenever updating the Special Briefs File.

USAGE: One a day or 11 a week, 2 hours per run.
(See Above)

14. IR131 - Target Briefs Index - 5 x 8 Cards

TYPE: Listing. To list the records on any briefs header tape on 5 x 8 cards.

USAGE: As required. Requirements not established. (Run once).

15. IR121 - Briefs List "A"

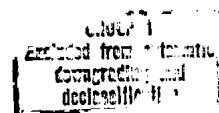
TYPE: Listing. To produce a listing of target briefs or of briefs headers. Listing is from card input.

USAGE: One a week. 15-20 minutes.

16. IR061 - Briefs Header Record Listing

TYPE: List Target Books. To produce Briefs Header Lists B, C, D, and E. (From tape produced by master file maintenance programs.)

USAGE: Three - four a week. 30 minutes average.

- 3 -
TOP SECRETHANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TARGET BRIEF MAINTENANCE (CONTINUED)17. IM051 - Master File Maintenance

Maintenance/Listing Program. Rewrite to include IM021 and IM011 in one program, having these additional capabilities:

- a. Assigning record numbers to the additions automatically.
- b. Reflecting all targets deleted from file.
- c. Variable output to work tape.

18. IR161 - Master File Edit Program

Listing/Edit Program. Designed to list all errors found by scanning the master file tapes. Also will test ability to recognize automatically the different types of References in the File. Output is a corrected Master File, with the option to split the file into sections by WAC.

19. SLCOM - Special Master File Retrieval Program

Special retrieval program, designed to select all "COMOR" targets onto a special output tape. (Used for recurring special requests).

OTHER20. IR051 - IBID File

TYPE: Published Report. This program is designed to list the acquisition numbers of downgraded aerial photography as authorized by COMOR.

USAGE: One every 3-4 months. 1 hour.

21. IO021 - IBID Control

TYPE: Builds table in core. To compute the total number of frames to be processed on each camera for the IBID listing.

USAGE: One every 3-4 months. 1 hour.

22. UC011 - IBID Conversion

TYPE: Card to tape conversion. Converts the cards used in the first 4 vols. of IBID to tape in the same format as the present IBID. (Old format to New).

USAGE: One time.

TOP SECRETHANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

REF ID: A63-118

OTHER (CONTINUED)23. IR101 - Ephemeris Pitch and Roll

TYPE: Listing. To produce a listing showing the pitch and roll status of the vehicle at the time each photograph is taken.

USAGE: Two every KH. 1 hour each run.

24. IE031 - Ephemeris Camera Check

TYPE: Listing this program check lists and edits the card output from the automatic "dot" reader. Shows clocking errors, etc., for each mission.

USAGE: Two every KH. 30 minutes each run.
Scramble and unscramble runs, two hours each KH.

25. URO11 - Minicard Tag Count

TYPE: Listing. Designed to count the number of numeric file words and 1-N Minicards to the Minicard System. Output will be a listing showing the number of Minicards by tag that will be made when file expanded.

USAGE: One a week. 1 hour.

26. IC111 - Conversion of Minicard Code Cards which are presently in System

TYPE: Card to tape conversion. Designed to write to one tape the 6, 7, & 8 codes, card number and "S" number, and to another tape the entire Minicard input cards. These tapes will be used with program No. IE 051 to check for invalid codes which presently exist in the Minicard File.

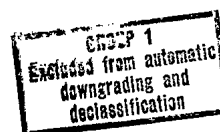
USAGE: One time.

27. AC101 - Conversion of Minicard Code Book to Tape

TYPE: A card to tape conversion program designed to write to tape all Minicard codes, descriptive information, and tags found in the Minicard Code Book. This is a one time program.

USAGE: One time.

- 5 -

TOP SECRETHANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRET

ONLY

TCS-1454-63-KH

OTHER (CONTINUED)28. IE051 - Minicard File Edit. (Future Input)

TYPE: An Edit type program designed to check for invalid codes on the input cards to the Minicard system. All codes which are presently in the system may be run against this program as well as all further input cards. Any error codes will be listed in code number order.

USAGE: One a month. 20 minutes.

29. IE061 - Minicard File Edit. (Existing Files)

TYPE: Edit program designed to list the complete input card which contains a file work error. This was designed to do a spot check of the codes presently incorporated in the system.

USAGE: One time.

30. URO31 - Master Minicard Code Book Listing.

TYPE: A card to printer utility program. Designed to list the contents of the Minicard Code Book as follows:

- a. By Authority -- Authorized designators for equipment, i.e., radar, aircraft, etc.
- b. By modifier--Status of items, i.e., active, inactive, etc.
- c. Numeric--File Word
- d. Alphabetic--by description
- e. Geographic Authority--Authorized designators for: localities, popular name and native name.

USAGE: As required. 15 minutes.

31. RRO11 - Project Status

TYPE: Published Report. A report of the status of the various projects within NPIC.

USAGE: Monthly Report (6 different runs) 2- $\frac{1}{2}$ hours, (total time).

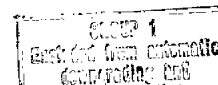
32. RRO21 - All Source

TYPE: Printed Report. Designed to list the All Source TALENT Reports. This is a card to printer program. (Temporary until tape system is designed).

USAGE: Request only.

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRET



TOP SECRET

ONLY

TCS-1454-63-KH

OTHER (CONTINUED)33. IRO81 - Time Correlation - Publications Division

TYPE: Listing. This program is designed to produce listings showing the number of regular and overtime hours worked per month. One listing by Project Number within employee.

USAGE: Once a month. 30 minutes (2 mins)

34. IRO91 - Time Correlation - DMD, CSD

TYPE: Listing. To list the regular and overtime hours worked by employee.

USAGE: Monthly. (30 minutes each run. Number of runs not established).

35. SRO11 - Inventory

TYPE: Utility. An inventory of all furniture and machines.

USAGE: Yearly. 2 runs, 1 hour each.

36. PRO21 - Building 213 Telephone Directory

TYPE: Listing. A card to printer routine to list all employees, room number and telephone numbers.

USAGE: One each three months. 20 minutes.

37. PRO11 - Listing of Special Security Clearance Cards

TYPE: Listing. To produce a listing of all employees who hold special clearances and which clearances they have.

USAGE: One time. This program and all materials pertaining to the program have been turned over to the Office of Security for their use.

38. PCO11 - Conversion of Special Security Clearance Cards

TYPE: Conversion - Card to Card. To convert the five different special security clearance cards to a common format.

USAGE: One time. This program and all material relating to the program have been turned over to the Office of Security for their use.

39. ICO11 - Regular and COMOR Files - Card to Tape Conversion

TYPE: Card to tape conversion.

USAGE: One time.

TOP SECRET

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRET
KEYHOLE CHANNELS
ONLY

TOP SECRET

OTHER (CONTINUED)40. "BEST GUESS"

TYPE: Listing. To list the contents of the "Best Guess" ephemeris tape from the West Coast.

USAGE: Three every KH. 20 minutes each run.

41. US001 - Merge Program

Utility program, designed to perform all functions of a collator, by use of control cards. (80 col compare is possible.)

42. RR031 - Contract Status Program

Maintenance report type program, designed to produce internal and sterile report on mats, showing the status of all contracts entered into by NPIC; while making appropriate alterations to make the report current.

43. RR022 - All Source Tape Program

Original RR021 modified to read magnetic tape and produce required all source reports.

44. IC121 - All Source Conversion Program

All source program to convert IBM cards to tape.

45. IC131 - All Source to Library Circulation Control Program

Produces the Library's "Circulation Control Master Cards", from the All Source File.

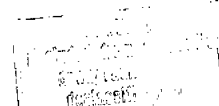
46. IM061 - IBID Maintenance Program

An update and maintenance program designed to place a "tag" beside the frame number to indicate that the frame has been downgraded. Used once every 3 months, 15-20 minutes.

47. IR151 - IBID Retrieval/Report Program.

Selects and prints all or desired portions of any IBID tape. Parameters are fed in on cards. Used once every three months, 15-20 minutes.

TOP SECRET

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

HANDLE VIA TALENT-

TOP SECRET

ONLY

TOP SECRET

PROGRAMS BEING WRITTENIMMEDIATE REPORTS1. OAK-IPIR-SITSUM (Rewrite).

Report producing program, designed to check all target headers to insure correct reporting has been accomplished; also produces card output for updating master files and updated header tape for use on subsequent run. When corrections have been made, produces mats.

MCI REPORTS2. IRO32 - MCI Master File Update Program

A rewrite of the MCI Master File update program designed to produce a listing on 5 x 8 cards of all additions to the file. An updated MCI tape will also be output. This program will eliminate the necessity of using map reference cards as input. A map reference tape has been created in WAC number order, which will replace the old map reference cards.

3. IROL2 - MCI Mats Generation

Modification of IROLL to eliminate blank NPIC targets and to provide a means of introducing an inactive target via MCI publications.

TARGET BRIEFS4. IR141 - Separation/Listing of Work Tape

This is a listing type program, designed to list the work tape generated by IMO51, to produce up to six different listings and/or six different output tapes. (Limited to 3 tapes per run).

5. IR161 - Special Target Briefs History Program

An update/listing program designed specifically for "Cuba" target briefs. The purpose is to update the history tape by adding all accumulated coverage from the current working tape to the history tape. Output will be a new working tape, an updated history tape and various list options.

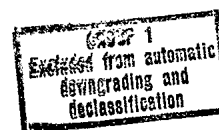
6. IR171 - Target Briefs Selection/List Program

Selection program designed to select by a variety of parameters simultaneously list in the standard briefs format, categories are:

- a. WAC
- b. WAC/PIC
- c. WAC/PIC/Specified Basket(s)

- 9 -

TOP SECRET

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRETHANDLE VIA TALENT
**KEYHOLE CHANNELS
ONLY**

TCS-1454-63-KH

TARGET BRIEFS (CONTINUED)

Item 6 Continued:

- This satisfies various weekly/monthly standard requests.

7. IMO51 - Master File Maintenance

Modification to incorporate the "split reel" feature, i.e., to be able to handle multi-part file, thereby reducing tape passing time to get to any portion of the file.

OTHER8. IOO41 - Coordinate Retrieval Program

This program is a pilot study to determine the accuracy which may be obtained when selecting target briefs on the basis of four corner points.

9. UO011 - Circulation Control Charge Out Program

This program is designed to list the "out" file and indicate all overdue documents, charged from the library.

10. UO021 - Circulation Control Accountability Program

This program will list the entire document control file, indicating all charged out documents and detecting those documents which control over has been lost.

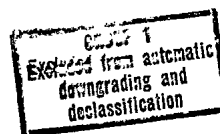
11. IO051 - General Retrieval Program

A retrieval program to select from any type tape, up to eight levels of different terms. The number of terms limited only by the amount of core available after program is loaded.

12. IEO71 - Minicard Input-Validity Check

A utility type program designed to check the validity of the input cards to the Minicard System and to punch additional characters into these cards which will control the camera and input mechanism.

- 10 -

TOP SECRETHANDLE VIA TALENT-
**KEYHOLE CHANNELS
ONLY**

TOP SECRET KEYHOLE CHANNELS
ONLY

TCS-1454-63-KH

APPLICATION AREAS UNDER CONSIDERATION/DEVELOPMENT

1. Information Retrieval:

- a. Three level, parameter type program, developed and tested. Can select on any number (limited only core) of parameters, specified in three levels.
- b. Eight level parameter type program, under development--same characteristics as above.
- c. Search term open and type program, under consideration, would enable selection on basis of subject codes within specified limits of input records.

2. Reference Library Circulation Control:

- a. Program developed to convert present card file to produce one card for every document in library with associated list.
- b. Program under consideration to list the librarians "out" file, producing an "out" listing and overdue notice card.
- c. Program under consideration to list the "out" file and all "shelf" cards, producing an "accountability" listing showing any "doc's" for which control has been lost.
- d. Also under development is the production of all input to the Minicard and "All Source Systems" at the time the document is introduced into the Library, and put under circulation control.

3. Reports/Documents Data Base Generation--Establishment, Maintenance and Use.

(Could be established at document introduction, and would require one program to maintain).

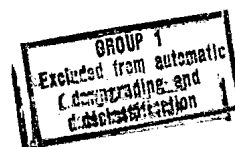
4. Main Applications Area:

- a. Considering and designing dual card system to standardize all of input to main application area.
- b. The storage of all back-up card files on magnetic tape to reduce the storage area required.

- 11 -

TOP SECRET

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY



HANDLE VIA TALENT
KEYHOLE CHANNELS
ONLY

TCS-1154-63-KH

LONG RANGE DEVELOPMENT

1. Total Data Base Index Development--establishment, format, cross-referencing, maintenance and use.
2. Purge criteria for the target briefs file--their employment after criteria approved.
3. Creation of History Files--their format and maintenance.
4. Relationship between electronic D.P. and Minicard for storage and retrieval.
 - a. Requirement-Indexing--their classification and relevant data retrieval.
 - b. MCI-Indexing--retrieval according to subject code and relevant targets.

TOP SECRET

HANDLE VIA TALENT:
KEYHOLE CHANNELS
ONLY

GROUP 1
Excluded from automatic
downgrading and
declassification

HANDLE VIA TALENT-KEYHOLE CONTROLS ONLY



WARNING

"This document contains information affecting the National Defense of the United States within the meaning of the espionage laws, Title 18, USC, Secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law".

It is to be seen only by U. S. PERSONNEL especially indoctrinated and authorized to receive TALENT-KEYHOLE information: Its security must be maintained in accordance with KEYHOLE and TALENT regulations.

TOP SECRETTCS-1404-63/KH
9 May 1963Copy 1

MEMORANDUM FOR: Executive Director, NPIC

SUBJECT: Present Status of the Univac 490 System

A. BACKGROUND

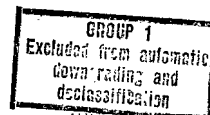
1. The Univac 490 computer system has as its raison d'etre its use as the information processing (or computational) element, or sub-system, within a larger system which we have been referring to as the "Photo-Measurement System" (PMS). The Photo-Measurement System has the simple goal of providing the photo-interpreter a capability for obtaining metrical information from present day photography with the same ease he enjoyed in days long past when aerial photography was, for the most part, taken in a nominally vertical position with a camera that had the same mathematical model as a box Brownie. In that situation measurement of ground distances or determination of lengths from photography was accomplished by using measurements made with tube magnifier or boxwood scale as the input data and a slide rule (or paper and pencil) as the computational element. The mathematical model was embodied in the two easily remembered equations:

Grd. distance = Photo distance x scale no.
and

Scale no. = Flying height divided by focal length

2. This simplicity is now apparently gone forever, the geometrically simple camera being now supplanted by systems wherein the film lies on some slice of the surface of a cylinder, different parts of the same frame are exposed at different instants of time, the lens moves during that time with relation to the film and does so with a varying rate, and the whole camera system is carried in a vehicle whose position in space changes greatly during the period required to expose one frame. Consequently the mathematical model now becomes a lengthy series of equations even when expressed in the compact notation of vectors and matrices. The two parameters, focal length and flying height, that were sufficient to describe a particular frame in the primitive case are now supplemented by a long list of items such as scan rate, IMC cam constant, lens velocity vector, vehicle velocity vector, Coriolis acceleration vector, geocentric position vector of exposure station, etc. Just as the complexity of the mathematical model indicates the use of a digital computer as the computational element in a present day system, the proliferation of parametric values required by that model implies that an efficient system will provide for maintaining a file.

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRET

TOP SECRET

TCS-1404-63/KH

of the values of these parameters for each frame of photography and for the automatic incorporation of these parameters into the appropriate mathematical model by merely referencing the unique identification of the photograph. Given the present and projected rates of input of new photographic materials to this Center the provision, maintenance, and automatic utilization of such a file gives rise to the concept of a single central file which, effectively, can be accessed automatically by any user of the system. Conceptually it would be possible to have a computer for each user with each such computer having automatic access to this large central file. This, at least, is less staggering than the prospect of providing both the large central file and computer for each user. The provision of asynchronous access to the central file would almost certainly require that the file be under the direct control of a central master computer to sequence the queries against it as well as to handle the maintenance of the file itself. A further disadvantage of the "multiple-small-computer" approach is that it would, we believe, tend to increase the problem of hardware maintenance and would also force the users of such systems to function as computer operators in addition to their duties as analysts. Thus, the third possible alternative was chosen:

A central file under the control of a central processor of sufficient capacity and speed to be able to handle the computational requirements of all users of the system. The computer chosen as being best suited for use in the computational element of this system was, of course, the Univac 490. Since it is a general purpose digital machine it can, potentially, be put to many other uses. And, indeed, one of the most important features of the U-490 is that it is possible to make concurrent use of much of its capability for such "other uses". It is important in considering the Univac 490 to clearly distinguish between its prime use as an element of a larger system and its "other" (i.e. "computation-center" type) uses.

B. PRESENT STATUS

1. The overall system can, rather arbitrarily, be broken down into three major areas or sub-systems:
 - a. Remote station equipments
 - b. Communications sub-system
 - c. Information processing sub-system (N.B. that the information processing function subsumes the computation function.

It must be pointed out that these subsystems stand in a rather complex inter-relationship to each other. Changes in one sub-system may be

- 2 -

HANDLE VIA TALENT-
KEYHOLE CHANNELS

TOP SECRET

O N L Y

TOP SECRET

TCS-1404-63/KH

reflected in all of the others. It is convenient to discuss these sub-systems in somewhat different order than the one given above (which stems from the ordering of information flow).

COMMUNICATION SUB-SYSTEM: The general method of tying remote stations to the central computer site was worked out early in the project and the special cabling required was "hardened" into the building during its reconstruction. The initial complement of central site equipment (Scanner/Selector, Communications Control Units, patch panel, modem units) is on hand and checked out.

REMOTE STATIONS EQUIPMENT: At the time the letter-of-intent for the computer hardware was issued no design work had been done on any remote station equipment. There was in effect, however, a contract with Richardson Camera Corporation for the production of "Measuring Viewers" under the specification that their output must be "compatible" with whatever computer system was selected as a follow-on to the Alwacs in use at that time. Compatibility had, to that point, been interpreted only to mean that the output of the device would be in a machine-readable form acceptable to the particular computer finally selected. Since this device was conceived by all parties to be basically an extension of the Richardson viewers that were being built for the sole purpose of studying new inputs in the early exploitation phases, the idea of providing a connection to the computer rather than paper tape output accorded well with the basic premise that the remote station equipments should be extensions of the equipments on which the analyst would normally study the film. The format of the output and the details of the commo interface were worked out and supplied to Richardson. It is understood that output format and commo interface have not contributed to any degree to the slippage that has occurred in this production of the first such device. The principal problem they seem to be encountering is in the design of the coordinate measuring system itself. It is understood that Richardson has recently given an oral commitment of 30 May 1963 for the completion of the prototype instrument. In view of the work accomplished to date on the machine this date may be rather optimistic.

Plans and Development Staff has issued specifications and request for proposal (RFP) for a viewer with measuring capability to serve the same functions as the Richardson and has received several proposals in response. According to [] two of these proposals look "very promising" in terms of their mechanical design and likelihood of achievement in the time indicated in the RFP. [] has informally indicated to the companies proposing that a PERT reporting procedure will be made a part of the contractual arrangement.

50X1

50X1

- 3 -

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRET

TOP SECRET

TCS-1404-63/KH

The Huston-Fearless Dual-Screen Measuring Projector (DSMP) falls in the category of "other uses" of the computer system since it is not, by any stretch of the imagination, suitable for general P-I analyst use. However, because it seemed likely that this would be a "work-horse" instrument for TID/TAB, it seemed advisable to connect the DSMP on-line to the 490 as a means of maximizing the productivity of the DSMP by eliminating most batch processing of its output. The communication formats and electronic interface of the DSMP were defined to be identical to those spelled out for the Richardson equipments, and the processing logic for messages from it, is an extension of the logic worked out for the Richardson Measuring Viewers. Consequently we will be able to check out the processing logic and procedures by treating the DSMP as if it were a Richardson Measuring Viewer. The arrival of the DSMP is now scheduled for 15 April.

INFORMATION PROCESSING SUB-SYSTEM: This aspect of the overall system can be further subdivided into (1) Hardware, and (2) Programming. The status of the first (Hardware) can be summed up by saying that the initial complement of Univac supplied equipment has been delivered and installed. An interim 30-inch incremental plotter is being manufactured and a 60 x 60 inch plotter has been selected for eventual incorporation into the system. The 30 inch incremental plotter is being configured in such manner that it can, when the 60 x 60 inch is delivered, be moved to a remote location in one of the analyst working areas and be used solely for the production of planimetric representations of entities being measured by the analysts using the system.

The initial programming goal (2) was keyed to the initially planned complement of remote station equipment and the incremental plotter. In retrospect it is realized that the basis for time estimates for attaining this goal were in terms of the progress that we had made in those areas that were considered the major problem areas in the system and program design activities, such as the "Real-Time Control" program. To explain why a routine called "Real-Time Control" (RTC) is a major problem area in comparison to, say a routine modeling a particular camera system (which was the type of major problem area encountered with the Alvac system) one could attempt an analogy (admittedly crude) to the problems that might be encountered by the manager of an organization that suddenly goes from being a small purely research establishment of, say, 25 people to being an establishment of perhaps 500 people and now having a manufacturing function as well as an expanded R&D function. In the first instance communication within the organization would not be a major problem. There might not even be any formal channels of communication. Even if there were it could be assumed that the manager also availed himself of the various informal channels of communication within his organization and was quite fully conversant with the work being done by his group. In this case the manager's

- 4 -

HANDLE VIA TALENT=
KEYHOLE CHANNELS
ONLY

TOP SECRET

TOP SECRET

TCS-1404-63/KH

major problems are, in general, the problems encountered by the individuals in his group and the extensions and consequences of these problems. In the expanded organization the manager must now face two problems that did not previously exist (at least as major problems) in his original organization:

(1) He can no longer be familiar with all details of all aspects of his organization. Consequently its normal functioning must be largely automatic and proceed without his having to be aware of the accomplishment of every action involved in that normal functioning.

(2) The manager now needs to be informed of the exceptions to normal functioning within his organization. To this end there must now be effective and orderly communication channels to report this exception information to him. Normally there must also be horizontal channels of communication for the automatic functioning. Both of these problems might be dismissed as organizational or administrative problems or as "house-keeping" problems. This they are, to be sure, but they are of prime importance to the successful functioning of the organization. Their solutions provide the essential framework in which the work of the organization is accomplished. The Real-Time Control program is analogous to the situation just described in that it provides the essential framework in which the "worker" programs function. In providing this framework it must provide for all the "clerical" record-keeping necessary for making decisions at any point as to what actions are to be taken. Further the Real-Time Control program is, itself, charged with making these decisions at various managerial levels, in order that the system function in an automatic manner. The only exception reporting it should do is to report to computer room operating personnel equipment failures that will require maintenance action. Just as the functioning of the large organization requires efficient communication between various of its components so must the Real-Time Control program provide for communication between various routines and sub-routines to insure the functioning of the various sequencings of these routines which it may establish.

The weakness in this analogy stems from the fact that in the Real-Time Control program there is no possibility of ad hoc decisions -- there must be a pre-established decision procedure and course of action for every contingency that can arise in the operation of the system. This is equivalent to saying that the system is completely formalized, and is in contrast to many a business organization whose actual operating mechanism turns out, under close scrutiny, to be quite different from its "on-paper" formal organization.

The move from our Alwac-centered system of reducing photo-coordinate data by batch processing techniques to the U-490 centered Photo-Measurement

- 5 -

HANDLE VIA TALENT-
KEYHOLE CHANNELS

TOP SECRET

TOP SECRET

TCS-1404-63/KH

system is at least of the same order of magnitude as the change postulated for the hypothetical business organization in our analogy. It is perhaps understandable then that we estimated our progress in terms of solutions to problem areas such as the RTC program and tended to dismiss as trivial those areas in which the approach to be taken was obvious for the problem was one of selecting the best of several alternative approaches. Unfortunately the system is not operable until all the links of the chain are forged. Selections between alternative approaches must be resolved by limited manpower on an appropriate time schedule. The most trivial sub-routine must be coded as well as the most complex. Each must be checked out. Each must be documented to far greater detail than our past programs were ever documented. Eventually all the component sub-routines, sub-programs, and controlling executive program must be merged together and made to function as one complete entity. Then this program that works in a simulated environment must be checked out on the equipment that is actually going to be used, and finally the all-important component, the analyst, must be added and the total "man-machine" system checked out. Before this final check-out stage is reached all the batch programs that support the system must also be formulated, coded, and checked out. We have, we believe, been aware from the start of this project of most of the complexities of the system and of the many activities that would have to be accomplished before the system became operational but lacked a "systematic method" of considering all of these simultaneously to arrive at some measure of the total effort that would be required to reach the goal or of the progress made toward it.

We have been aware of the PERT technique since its inception as a management device in the Polaris weapon system development program, but like many others held the belief that it was applicable only to programs comparable in size to the Polaris undertaking. The first realization that this was not necessarily the case came from the article "Does Pert Work for Small Projects?" in the December issue of Data Processing. Only a few weeks after this, [redacted] arrived at NPIC for his initial review of our operations and aspirations bringing with him not only his highly successful experience in computer-centered undertakings in a wide range of areas but also actual examples of the application of the PERT technique to undertakings comparable in size to that which we are involved in. With his advice and counsel there has now been produced a PERT network which is a reasonable representation of the activities involved, and the constraints between them. In the preparation of this PERT network time estimates were made for appropriate activities (the estimates made by ourselves or by the individuals already directly involved in the activity) and a copy of the PERT network with the information worksheets forwarded to [redacted]. He has had several analysis runs made on this information, using his 7090 PERT program, under various assumptions on equipment availability dates, and the listings are here now for review.

50X1

50X1

- 6 -

HANDLE VIA TALENT-
KEYHOLE CHANNELS
O N L Y

TOP SECRET

TOP SECRET

TCS-1404-63/KH

It is emphasized that despite our enthusiasm for PERT it is not a panacea. The process of constructing the network has been extremely valuable in forming a clear picture of where we stand. It is felt that this same process would greatly help other areas to more clearly define their future plans. For example, at the first network attempt it became clear that although many man-hours of effort have gone into programming various facets of the plotting program for the incremental plotter so much remained to be done that this could be the limiting item in the first implementation phase and further that the system could make a substantial contribution without the plotting capability. Accordingly the present network will give maximal return for the time and effort involved.

The goal shown as the ending event (designated Phase I) calls for implementing the distance and height "function" (and some other "by-product" functions) on the prototype Richardson viewer, using the soon-to-be-delivered DSMP as a test bed in advance of Richardson delivery. The executive portion of the real-time program (referred to as "The Control Program" or "Real-Time Control") has been coded and is well along in the checkout process. It provides for eight remote stations and is "open-ended" in terms of the number of functions it can control (i.e. it is applicable to all functions yet envisaged for the system). It is, in fact, useable for many more than eight stations, the upper limit being determined by the amount of core available for the station-specific tables (i.e. one fixed-location table for each remote station) around which it is organized. Similarly most of the other sub-programs for the phase I-A undertaking have been coded and in some cases partially checked-out (as separate entities) but none will be considered as being through the design phase until the appropriate documentation has been completed, nor will program integration commence until both detailed design specification and checkout products are at hand. Standards and examples for documentation are being freely adapted (plagarized is a more accurate term) from Aero-space Corp. "Milestone" definitions.

The batch programs that support the real-time system (as contrasted to programs used in responding to an input from a remote station) have the very general functions of establishing and maintaining the frame-organized "Photo-Parameter File". Thus we have in this category programs for reading in the so-called "binary clock" information for each frame, performing various checks and doing as much automatic correction of both random and systematic "clock" errors as possible, correlation of vehicle "clock" time to systems time, computing position of the vehicle for each "clock" reading, accepting horizon measurement information and then computing attitude information for each set of horizon images followed by smoothing of this information and updating the record for each frame by insertion of the smoothing values. Much of the present effort on the KH-6

- 7 -

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRET

TOP SECRET

TCS-1404-63/KH

system frame ephemeris is salvageable to further the vehicle position determination procedures. It should be noted that whereas we originally envisaged a very crude determination of vehicle position using a Keplerian orbit with subsequent updating on the basis of LMSC computation of a "final frame ephemeris" it now appears possible on the basis of discussion with LMSC to achieve that final accuracy in our initial file creation (for a new mission). LMSC has provided us with a new *closed* form orbital model that will "mesh" with their computational procedures. When a vehicle is in flight they will supply orbital parameters by cable with each set to hold over several revolutions without significant loss of accuracy. The program will be a substantial bit of computation however. The other important batch computing undertaking is the attitude reduction from horizon images. [] has formulated an excellent and rigorous reduction method that will permit construction of a program that will minimize the work involved in preparing horizon measurement information for input to the machine. A curve smoothing procedure has also been worked out.

50X1

One additional effort should be mentioned. The initial and rather sketchy documentation on the Neliac compiler developed by the Naval Ordnance Test Station (NOTS) and UNIVAC for the NOTS 490 configuration indicates a great extension in the capabilities of the compiler as compared to the original implementation for M-460 "Countess" computer described by Dr. Halstead in his published works on these efforts. At the time the project was initiated it was felt that the NOTS-Neliac version (then just getting under way) would require a great deal of modification and extension before we would be able to use it for anything other than occasional "one-shot" programs. In the intervening months there has been much discussion in the computer field on standardization of programming languages for command and control systems, and the Navy has abandoned its own offspring, Neliac, in favor of the Air Force sponsored JOVIAL language. The outlook for the Neliac language was rather bleak until the issuance of the Air Force sponsored RAND Corporation denouncing any standardization as premature by several years. In the meantime NOTS has carried out most of the major extensions required in the 490 version as far as arithmetic capabilities are concerned. The increase in scope of some of our own computational programs (such as the more refined orbital model) and the seemingly exponential increase in the number of distinct photographic collection systems are strong arguments in favor of using a problem oriented language in our programming effort, even at the possible expense of slight inefficiencies in the resultant object code. Accordingly we are now exploring the possibility of carrying out the requisite further modifications and extensions to Neliac to make it suitable for use as a programming language for our real-time system programming effort. It should be noted that the most popular of all problem-oriented languages,

- 8 -

HANDLE VIA TALENT-
KEYHOLE CHANNELS
O N L Y

TOP SECRET

TOP SECRET

TCS-1404-63/KH

FORTTRAN, does not have the capability of expressing all the functions normally required in any real-time application. Further supporting testimony for NELIAC is found in an LMSC proposal relative to the Gemini and Apollo in which they propose to use NELIAC (on the CDC 3600) as the basic programming language.

To conclude this discussion of the programming effort we submit that on receipt of the PERT network runs we will be able to provide a more meaningful and accurate analysis of where we stand.

C. POSSIBLE TRANSFER OF 1401 FUNCTIONS ONTO THE 490 SYSTEM

1. The thought that transfer of 1401 functions onto the 490 system might be feasible stemmed from a consideration prior to implementation of either system of the following three premises:

a. The "real-time" requirement on the 490 system was estimated as requiring not more than 5% of the total time available over any normal working day.

b. The 490 has a full range of standard input/output equipment fully compatible with the 1401 installation (i.e. 80 column cards, 729-IV tape capacity, 600 l.p.m. printer).

c. The use of the executive system, REX, permits both a "real-time" support activity and a normal batch processing operation to go on simultaneously by running the batch program in the intervals (ranging from milliseconds to minutes) between interrupt response action occasioned by inputs from remote stations.

Since the real-time program per se will make no use of the central site input/output equipment (excepting, of course, status messages printed at the console) an obvious conclusion from the above premises is that transfer of the 1401 function is altogether possible.

2. The premises given require further and more detailed consideration and, furthermore, do not constitute a complete listing of the areas that must be considered in making any judgement as to the feasibility or desirability of such a shotgun wedding. We now consider them in depth:

a. The 5% time requirement estimated for the real-time support of the remote stations is only for the real-time worker program itself and does not include the time requirements of the batch programs that directly support the real-time system by maintenance operations on the photo-parameter file. As previously indicated

- 9 -

HANDLE VIA TALENT-
KEYHOLE CHANNELS
O N L Y

TOP SECRET

TOP SECRET

TCS-1404-63/KH

some of the programs (orbital computations for example) are far more complex and time-consuming than originally planned. Nor does this figure make any allowance for the time requirement for batch processing of data produced by various off-line equipment within the division. Additionally there are a considerable number of programs for which there is a clear and valid justification that make use of information in the photo-parameter file for part, or even all, of their input data. A few examples are:

- (1) Listings of frame ephemeris information.
- (2) Production of photo-coverage plots.
- (3) Listings of attitude information (irrespective of mode of derivation -- i.e. horizon, inertial platform, or stellar photography).
- (4) Production of graphical plots of attitude to support operational groups.
- (5) In-flight production of coverage plots for briefing purposes.

b. The various batch programs listed above in amplification of the availability-of-time factor all introduce some measure or other of equipment availability constraint whether running concurrently with the real-time application or separately. Additionally it should be mentioned here that the real time program itself will normally require from four to six tape servos for its own use (we are still trying to devise techniques to reduce this requirement to have more servos free for concurrent operations).

c. The REX system and design philosophy result in several additional restrictions:

- (1) REX itself requires ca. 4500 words of core memory out of a total of 16 K words available in our machine.
- (2) REX assumes that the "real-time" program is permanently in core. Of course the total real-time program does not have to be in core since the real-time program itself can call in additional segments. As a practical matter these segments must be loaded in an absolute binary into a fixed working area which itself cuts into the amount of core available. At all

- 10 -

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRET

TOP SECRET

TCS-1404-63/KH

events the resident portion of the real-time program must always include the routine to accept communication from the remotes and the analysis portion of the control routine to analyze the input messages and initiate the appropriate actions to deal with them. A further restriction on the amount of free core stems at this point from the present design of the real time program itself.

3. The real-time program is organized on a station-specific basis, i.e. for each remote station a table is maintained in core, serving a wide range of purposes but essentially functioning as the interface between the stations and the various "worker" sub-programs, all under the direction of the RTC program. As is characteristic of many real-time programs these tables have the property that many entries can be set and/or used by several different routines or sub-programs within the over-all real-time system. These tables require a very substantial amount of core. It is recognized that, potentially, expansion of the system can require different approaches than these presently being followed (tables to be on drum, or maintenance of a variable length "station-active" queue of tables, etc.) but we are not trying to provide the "ultimate" system in our first implementation effort.

4. It is not here argued that core limitations prevent transfer of 1401 operations but rather that they would considerably complicate such an operation. The same holds for our own concurrent programs but with a clearer day-to-day picture of system status we probably are in a better position to make adjustments in both the batch and real-time portions of the total effort.

5. Perhaps the most important consideration relative to the two systems is that batch loads for both peak simultaneously. Any merger of the two would almost certainly be detrimental to both activities. The 1401 operation is against critical deadline and the same considerations will hold for the PMS when operational.

6. An additional factor that is difficult to assess precisely but which certainly must be considered is that the PMS itself will not be static. Change will continually be forced upon it from the outside by the development of new collection systems which will give rise to a high time requirement for program maintenance and modification on the PMS itself.

7. The motivation in seeking to merge the two systems is, presumably, economic. Yet in this case we could easily have a substantially increased and continuing programming cost that would stem from the increased complexity of programming for both groups. The increased time required for

- 11 -

HANDLE VIA TALENT-
KEYHOLE CHANNELS
O N L Y

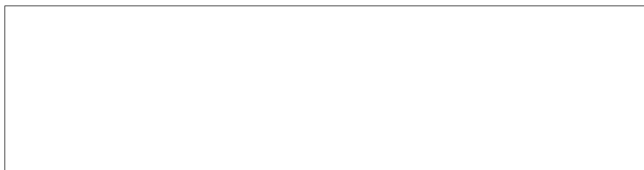
TOP SECRET

TOP SECRET

TCS-1404-63/KH

such programming may be even more significant than the increased indirect costs.

8. Our recommendation is that both groups consider partial back-up of their most critical functions but that no merger of the two operations be initiated at this time or even given any further study until the Photo-Measurement system is operational.



50X1

Chief, Technical Intelligence Division

Distribution:

- 1 & 2 - Exec. Dir./NPIC
- 3 - Ch/TID
- 4 - Ch/PDS
- 5 & 6 - Ch/CDS
- 7 - TID Chrono

NPIC/TID



50X1

HANDLE VIA TALENT-
KEYHOLE CHANNELS
ONLY

TOP SECRET