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ANALYSIS
OF A
DOCUMENT/REPORTING SYSTEM

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By

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ABSTRACT

This document describes an in-depth analysis of the information system within the Data Processing Branch. Quantitative measures are used to evaluate the efficiency and effectiveness of the information system. It is believed that this is the first documented study which utilizes quantitative measures for full scale system analysis. The quantitative measures and techniques for collecting and qualifying the basic data, as described herein, are applicable to any information system. Therefore this report is considered to be of interest to any persons concerned with the management design, analysis or evaluation of information systems.

ACKNOWLEDGMENT

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I. BACKGROUND

The Data Processing Branch (DPB) conducts a large production-oriented data processing operation. This operation has grown very substantially over the years both in terms of volume of data processed and in operational complexity. In consonance with this growth there has been an ever-expanding information system, including many types of forms and a multitude of reports.

No full-scale study had previously been performed of the branch's information system. Considering the size of the information system and its rapid growth one could reasonably expect that there was considerable potential for streamlining the system and achieving a more efficient and effective system. This rationale was the main factor in undertaking this study. A secondary factor was the realization that this study would provide the necessary detailed information for determining the degree to which the branch's information system should be integrated and automated. In other words, this could lay the groundwork for developing a centralized branch Management Information System if this were deemed advisable.

In order to evaluate the information system it was necessary to determine not only the characteristics to be investigated but also the basis for evaluating these characteristics. Quantitative measures of the selected characteristics were deemed to be the most useful method of evaluation. However, in searching the literature, a notable lack of such quantitative measures was found. This is rather surprising in view of the multitude of system studies that have been performed and the considerable emphasis and attention given to Management Information Systems within the past few years. Since the use of quantitative measures was felt to be an important factor in the system evaluation, a set of such measures was formulated and the methods for arriving at the measures were defined.

It is believed that the measures and methods described herein are of general applicability, i.e., they can be used to evaluate any fair-sized information and reporting system. Since, to the author's knowledge, this is the first attempt at applying quantitative measures to information systems, the author would appreciate comments, suggestions or criticism on this subject.

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II. METHODOLOGY

GENERAL

The main thrust of the study was concerned with documenting and evaluating the DPB recording and reporting activities. The initial effort delineated the various functions of the production system and collected the facts necessary to perform an accurate analysis of the current system. Note that the scope of this survey was limited to the information system per se of the DPB and not the operating procedures or work flow of the branch. Operational aspects of the various functions were considered only if the purpose of the operation was to collect or prepare information.

The user population of concern was defined to be the management and operations personnel of DPB, the IPD chief and his assistant, and DPSs (Data Processing Specialists) and some DPEs (Data Processing Engineers). Although distribution of several reports includes recipients outside this group, these recipients and their requirements were not considered in the evaluation of the DPB system.

TYPES OF INFORMATION SOURCES

The number and variations of information sources required some logical subdivision in order to simplify individual item and system evaluation. A functional (from an informational point of view) hierarchy was defined to include:

1. Basic documents — This pertains to the primary recording documents which are the source at which an informational element (datum item) occurs. Included here all forms, etc. on which information elements are collected or recorded for the first time within the branch. This group is further divided into:

    (a) Normal flow — Those that occur in the normal work cycle, and

    (b) Other — Those that occur occasionally or are the result of an unusual event, and whose frequency of occurrence cannot be predefined.

2. Reporting documents — This includes all reporting media within DPB and is also subdivided into:

    (a) Normal flow, and

    (b) Other

3. Work documents — This category includes all forms, etc. used within DPB as a regular part of a function to maintain control or awareness of the activity, and includes suspense files.

4. Data files — Under this category are included all permanently maintained data depositories, usually magnetic tape or card files.

5. Interoffice memos as a rule are initiated to provide for an unusual circumstance or are entirely administrative. As such, they were not included in this study unless they appeared to be of a regular report nature. Usually, if a memo were used as a report, the memo format is temporary until users have an opportunity to evaluate the proposed format and content. At this point, the memo would be changed to a standard report document.

6. Verbal communication plays a part in the information flow within the branch, but is not considered in any detail, even in those situations where it is the only means of transmitting certain elements of information essential to the total system.

TECHNICAL APPROACH

Historically, one of two methods has been used to evaluate an information system. One requires the analysis of the overall operation's goals and the goals of the subdivisions within the operation, and the comparison of the actual situation with the theoretically defined optimum. This technique does not lend itself very readily to any type of quantitative evaluation. The second method uses the current system as a starting point and attempts to evaluate it. Unfortunately the literature available on the second method refers to information system analysis in "philosophical" terms and is largely of a qualitative rather than a quantitative nature. The only methods mentioned in the literature are the graphic tools most often used in a study of this nature. Some of the more popular are:

(a) Information flow superimposed on an organization chart. This can be useful as a frame of reference but is awkward in depicting the lateral as well as the hierarchical paths of information flow within the organization.

(b) Multidimensional flow of elements. This is a trace of the routing of information from its origin to its destination and includes the factors of time, frequency, volume, physical distance, etc.

(c) Input-output array. This represents the inputs that are used to generate each output. This can provide a definition of the minimum number of recording points within an operation.

Several other types of matrices and representations of operational information systems appear throughout the literature, but these are essentially graphic aids requiring significant amounts of further study in order to develop any conclusion.

Therefore, the initial effort of this task was to define several measurement criteria and to establish guidelines for collecting and evaluating the raw data.

The defined quantitative measurements were:

(i) Redundancy/overlap — This is a measure of the duplication of information elements contained in the various documents within the system.

The most detailed collection of data for determining redundancy would require the design of a three dimensional matrix, the size of which would be defined by the number of information documents (two dimensions) and the total number of fields as the third dimension. Each document's contents would be compared with every other documents' contents and the identification of the duplicate fields indicated within the array. Computations could determine not only the redundancy at the document level but also redundancy at the element (datum) level.

However, a calculation of the approximate size of the required array indicates that such an array would contain 2×10^7 elements (200 × 200 × 500) — obviously too large to be generated or manipulated manually. Hence, such a detailed approach was not attempted. Instead, the technique adopted was to compute redundancy at the document level and obtain a numeric indication of the redundancy between documents. A two-dimensional matrix was prepared with the recording documents and reports (used in the normal flow of information) listed as rows and columns. Each item was compared with every other item for duplication of fields. The number of duplicate fields was entered at the intersection of the row and column being considered. Some relatively simple calculations provided redundancy rankings and distributions for each document. At a later point in this report, array elements with entries greater than a defined threshold value or percent are listed as candidates for a more detailed examination.

The matrix was set up to allow for separate redundancey measurements:

(a) Within the total set of recording documents.

(b) Between individual recording documents.

(c) Within the total set of report documents.

(d) Between individual reports.

(e) Within the total system.

Some basic considerations in the generation of this matrix were:

● A report generated separately for several satellites but with the same report content is not considered redundant with its own set of satellite reports.

● Reports with the same content but different time coverages are not considered redundant.

● Identification fields are maintained as a separate count in an attempt to isolate the redundancy of (Non-ID) information.

● Differences in the size of the reports (i.e., number of print lines per report) are not taken into account in the redundancy computation.

Redundancy measurements of interest are: total redundancy, redundancy of recording, redundancy of reporting, and average redundancy.

(ii) User Satisfaction — A second basic measure of the information system was considered to be a utilization factor — a measure of user satisfaction. Indices related to the number of users and their level of satisfaction with an individual report were sought.

Discussions were conducted with the primary recipients of those documents defined to comprise the normal information flow. It was assumed that each user could determine his information needs and therefore his views were the sole basis of ascertaining the degree to which his needs were being satisfied by the reporting system.

An effort was made during each interview to include, as a minimum, a set of specific questions in order to normalize all replies as to the usefulness or satisfaction of each report.

Questions of interest included (for each document and distribution frequency):

(i)   Individual's satisfaction with frequency of receipt.

(ii) Classification of the document.

(iii) Frequency of use as opposed to frequency of receipt.

(iv) Individual's satisfaction with format/content.

(v)   Approximate percent of document that is used per receipt.

(vi) Comments.

The classification of use of a document was an attempt to categorize the purpose of the various reports as follows:

- Monitoring a function
- Exception Notification
- Input to a report
- Reference Tool
- Work Document
- General Information

Frequency of use was defined as the ratio of periodicity of desired or actual use of the document versus the periodicity of the receipt. In many instances the user replies were stated in qualitative terms, e.g. regularly or infrequently, rather than in numeric terms. In these cases:

'Regularly' was equated to a ratio of 1.

'Infrequently' was equated to a ratio of 1/2.

Separate counts were maintained of the number of responses that indicated no further need for a particular report.

The percentage of a report's content that was used was defined as the ratio of the number of fields used on a regular basis to the total number of fields within the report.

To arrive at a composite utilization factor, the ratio of the use vs. receipt was multiplied by the ratio of use content vs. total report content. Utilization values can range between 0 and 100 with the latter indicating that the respondent uses and desires the report only as often as he is actually receiving it and that the total contents of the report are useful. Overall utilization of a given report is obtained by summing the individual respondent utilization values.

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(iii) Cost — The determination of the various costs for the total system and each of its parts is a necessary but complex task. Some of the obvious difficulties in determining the cost of a particular report are:

(a) Input collection or preparation activities can vary from simple extraction from one report to editing, collating, and keypunching of large volumes of data. Input may be generated only once, but used to produce several reports, in which case the cost must be distributed somehow among the reports.

(b) Data may be maintained in a different format than its original collection form in order to be used for future reporting purposes. The cost of this data maintenance must also be divided proportionately among the reports that extract data from it.

(c) The actual preparation — including publication and distribution — efforts must be included for the cost of each report. An attempt was made using these three categories to determine an accurate cost for each of the reports involved in the normal flow of operations within the DPB. Within each of these categories, the responsible personnel were requested to indicate the resources used. To be provided under each category were the number of manhours (by type), the amount of computer time required, and any supplies used, if significant. Responses were structured as follows:

                    REPORT ID   FREQUENCY
             INPUT PREPARATION
                        MANHOURS
                     COMPUTER TIME
                       MATERIALS
           DATA MAINTENANCE
                        MANHOURS
                     COMPUTER TIME
                       MATERIALS
       REPORT PREPARATION - DISTRIBUTION
                        MANHOURS
                     COMPUTER TIME
                       MATERIALS

In order to compare the cost of one report against any other, consideration was given to the normalization of the cost data collected. A rule was established that:

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● Frequency had to be adjusted from the period of publication to some standard. A reporting cycle was defined as one month and costs were adjusted to indicate cost required to produce a report for a one month period. By definition, there are 22 dailies per month, 4 weeklies per month, 1/3 quarterlies per month.

III. DATA GATHERING

Once the specific techniques for the quantitative measurement of the information system had been defined, pertinent facts necessary for the evaluation were collected. The collection and orderly arrangement of this data began with the several available sources of documentation:

(a) The three volume set generated earlier by C&S and contains a collection of all production and maintenance reports which were in use as of that time.

(b) Standard Operating Procedure manuals prepared by C&S for some of the functional activities.

(c) Informal discussions with several of the key NASA and C&S personnel.

(d) The NASA Forms Control Management (Code 233) provided access to the preprinted forms registered to the DPB.

(e) Other documentation provided an introduction to the remaining functional activities.

In addition to these sources, walk throughs of the individual sections determined first hand how the source information was recorded. This provided a general check on the documented information flow and also served to identify many of the work forms maintained and pointed out the different data media. During these tours of the facility, copies of available forms and reports were collected.

The first step in the process of organizing this collection of data was the division of all information media into two basic categories:

● Elementary Documents
● Report Documents

An additional distinction was made regarding the information fields. Two kinds of fields were defined: Basic and Derived. A 'Basic Field' is the datum

of original recording; it is the lowest hierarchal order of information that can be treated as a discrete entity. A 'Derived Field' is usually a summary or accumulation of basic fields, a statistical computation or other mathematical manipulation of one or more fields. This distinction is used to indicate the minimum number of information elements necessary to establish a centralized data base of all information now recorded and reported.

REDUNDANCY

Two forms were used to organize the data that was extracted from the documents and reports in order to perform the redundancy computations:

(1) Redundancy Matrix (80 by 80).

(2) A table to extract and accumulate the statistics from the matrix. (See Appendix I.)

The following example will illustrate the process used to determine redundancy. Consider four documents with their field identifications listed in parenthesis. Note that the same letter appearing with a different document indicates the same (redundant) field.

Document 1 (A, B, C, D, E, F, G, H)

Document 2 (A, B, E, H, J, K, L, M, R, S, Z)

Document 3 (B, E, AA, AB, AL, R, V)

Report 4 (A, F, G, H, I, J, M, R, S)

A comparison of each of these against the others shows the following overlap:

Comparison	Redundant Fields		Total
(1) vs. (2)	A, B, E, H	=	4
(1) vs. (3)	B, E	=	2
(1) vs. (4)	A, F, G, H	=	4
(2) vs. (3)	B, E, R	=	3
(2) vs. (4)	A, H, J, M, R, S	=	6
(3) vs. (4)	R	=	1

The total for each comparison would be accumulated and recorded in the table as follows:

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$$R_1 = 4 + 2 + 4 = 10 = \text{Redundancy for document \#1}$$
$$R_2 = 4 + 3 + 6 = 13 = \text{Redundancy for document \#2}$$
$$R_3 = 2 + 3 + 1 = 6 = \text{Redundancy for document \#3}$$
$$R_4 = 4 + 6 + 1 = 11 = \text{Redundancy for document \#4}$$

Interpretation of the data within the table should consider the following factors:

● The variation in the number of fields in the various documents

● Number of documents which contribute to the redundancy of a given document.

● The contribution of identification type information in the total redundancy figures.

Also, the following type of distinction should be provided, e.g. a situation where 6 documents contain one overlap indication each vs. a 7th document, as opposed to the situation in which only 1 of 6 contains six overlap indications vs. a 7th document. Note that both cases lead to the same redundancy figure. However, the second situation much more readily affords the opportunity to improve system efficiency.

UTILIZATION

Detailed interviews were conducted with personnel representing all activities and management positions within the DPB. Discussions were also held with Division Management and Code 565 DPEs and DPSs. The interview structure illustrated previously was followed as closely as possible, and shortly after the interview, the findings were listed in a table designed for this purpose (see Appendix II).

COST

All cost information was provided by C&SI personnel in the format requested. Some data collection and maintenance costs had to be distributed over several reports. A table was also prepared to list the data in a normalized manner (see Appendix III).

CHARACTERISTICS OF PRESENT SYSTEM

The dynamic nature of the DPB information system was readily apparent. During the course of this study, a number of reports or report subsystems were undergoing modification.

- A series of reports (Equipment Utilization Reporting System) were completely redesigned.

- One report (within the Quality Analysis section) was designed to replace five separate reports.

- A card generation process (T-card) was being altered.

- A new program to merge two separate data bases (telemetry data quality and accounting files) was prepared (ADICS).

- Several reports were discontinued.

- New forms were initiated.

As expected, the information flow evolves around the day-to-day production activities. The substance of the reporting system centers around production status reporting and facility activity (utilization) reporting. Within the DPB information system are included the following types of information:

Historical
Accounting
Activity Statistics
Cost/Utilization Statistics
Quality Statistics
Project/Process Status

Suspense files are the primary work documents of the several functional groups. These are maintained for a variety of reasons and in a number of different media. The two predominant media are copies of the original form or report and manual extraction of desired information into individual work documents.

Work files are used:

(1) To provide current status of a project.
(2) As a reference source.
(3) To assist in rating the contractor.
(4) To maintain control of distributed items.
(5) To record history of activity.
(6) To accumulate data for eventual publication.

IV. FINDINGS

GENERAL

A count of all documents and reports which were in use at the time of this
study revealed that within the present system, there are 50 basic documents
exclusive of those pertaining to Systems Maintenance & Reliability. Of the 50
documents, 31 are part of the normal production cycle and 19 are used occasion-
ally. During a normal cycle (one month) 67 reports in 90 separate formats are
published. Other documents including those prepared by the Systems Mainte-
nance & Reliability group account for another 53 reports. NASA Forms Control
has on record an additional 26 forms which are not included here; these are
either obsolete, added since the start of this study, or of doubtful use. All of the
preceding figures are based on unique document titles; if the number of reports
is increased to identify the occurrence of a report prepared for each project,
or the different formats within the report, the number of reports would increase
by about 75 entries. On this basis, the total count of the number of information
documents within the DPB would be about 280.

An accumulation of the unique fields reported and recorded within these
documents indicates that there are on the order of 600 separately reported in-
formational elements. Of this number, 1/3 are estimated to be basic elements,
the rest are elements whose value can be derived from the set of elementary
data.

Some identification (satellite, station, user, date,) information must appear
in every basic document and report in order to correlate the information content
to the system function. Within the DPB, identification information extended to a
maximum of eight unique fields. Any combination of these eight fields can provide
a valid identification. However, in the DPB information system, usually no more
than two of these fields are recorded on any document. Examination of those
documents which register a high system redundancy score shows that generally
these documents contain a higher number of identification fields than average.

REDUNDANCY

Measurements of redundancy (overlap) for each document are listed in Appendix I.

A measurement of the total system redundancy (for this set of documents) cannot be computed by accumulating the individual redundancies. This would overstate the actual amount, since each individual item's redundancy includes comparison with all other items. A computation using this method would double the actual system redundancy.

An accurate indication of the system redundancy is obtained by calculating 1/2 the total of the individual redundancies.

The total redundancy of the 31 normal cycle basic documents is 1515. As a finer breakdown of this figure, the redundancy within the set of basic documents is 714 and the redundancy between the set of basic documents and the set of reports is 801. The average redundancy of one basic document in relation to other basic recording documents is $\bar{R} = 714 \div 31 = 23$.

The top six basic documents, ranked in order of highest total redundancy are:

Buffer A/D Log
T - Card Form
Leadman's Log
Post Pass Summary
Tape Summary List
Dig Tape Assignment

Several interpretations of these redundancy values are possible. For these basic documents, reference may be made to the Redundancy matrix (not shown in this report) to determine if one or a few relationships accounted for a large percentage of the redundancy. For instance, the Buffer A/D Log was found to be highly redundant with the following basic documents:

Data Reduction Equipment Utilization Log (DREUL)
Leadman's Log
Line Log
Post Pass Summary
Special Req. & Approval

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Tape Summary Listing
TDAS Conversion Updates
T- Card Form

Additional analysis of the relationships of these forms to each other must be performed to determine if more efficient collection procedures are possible, or to determine if any other specific recommendations can be made to reduce the redundancy. The purpose and use of the forms must be known; ways to eliminate some of the forms or replace the group with the new form should be considered. For example, the TDAS conversion update form's relationship with the A/D Buffer Summary is simply one whereby a major part of the Buffer Summary is copied in a different format on to the TDAS conversion form. One possibility for reducing this redundancy would be to modify the Buffer Summary to allow direct key-punching of the TDAS cards from the buffer summary.

A list of the highest ranking redundancy relationships follows:

DREUL - Leadman's Log
        - Line Log
        - A/D Buffer Log
        - Questionable Data Report

Leadman's Log - Line Log
              - A/D Buffer Log
              - Special Req. & Approval
              - Questionable Data Report

Buffer A/D Summary - Post Pass Summary
                   - Special Request & Approval
                   - Questionable Data Report
                   - Tape Summary List
                   - TDAS Update List
                   - T-Card Form

Dig Tape Assignment Form - TAS Assignment
Dig Tape Assignment Card - TAS Assignment
Line Test Control Record - Line Test Evaluation Record
Tape Transaction Request - TSSF Gen. Pur. Form
TE Log - T Card Form
Post Pass Summary - T Card Form
Tape Summary List - T Card Form

This group of relationships account for 201 of the 714 redundancies within the set of recording documents. On the average, each document was found to have 1 identification field redundancy in comparison with each document. For the set of 31 normal cycle basic documents, a total of 450 (30 × 30 ÷ 2) unique comparisons were made between all documents within the set. Based on one redundant id field per document comparison, the total amount of non-id field redundancy is about 714 - 450 or 264. Next, by removing the average of one id field per comparison from the 21 highest ranking redundancy relationships shown above, the estimate of non-identification redundancy is 180. It can then be shown that 180/264 or 70% of all redundancy within the DPB's set of basic documents occurs in this highest redundancy subset of basic recording documents.

For the set of 67 reports the total redundancy was found to be 1418. However, at the reporting level, redundancy is more difficult to interpret. As a first step, the duplication of information between reports should be examined. For instance, information may be more meaningful or have greater utilization if duplicated in different formats to different personnel or even to the same personnel.

Usually it is not too difficult to justify partial overlap of information within reports, but a high percent of duplication may be difficult to justify, especially in the situation where the redundant reports are distributed to the same people. Cost and utilization of the reports (as shown later on) should be taken into account before deciding on actions regarding highly redundant reports.

A useful approach toward analyzing redundancy within the set of report documents is to rank the reports. A ranking of the highest six of the 67 reports gives the following:

Facility Status Report
Summary of Repro's
TDAS Chrono
TDAS Station
Redigitization Report
Utilization Reports

Some of the individual cases which exhibited a high redundancy characteristic were:

Production Analysis Summary — Data Analysis Status Report
Reprocess Files Report   — Edit Release
Listing of TDAS Cards   — TDAS Reports

Edit Release	— Summary of Repro's
Facility Status Report	— Project Status Report
Prod. Facil. Prob. Report	— Prod. Analysis Report
Edit Release	— Prod. Analysis Report
Reprocess Files Report	— Summary of Repro's

Some redundancy is bound to occur in any large system in order to reference the extracted data and the basic source documents. However, if a high redundancy occurs between a recording document and a report, consideration should be given to automation of the process (if it is not already so) to reduce manual transcription from source documents to output format. Redundancy computation of reports vs. basic documents amounts to 1666. A list of the highest redundancy cases involved in the comparisons between the two sets shows the following.

Report	Basic Document
Line Production Summary	— DREUL
Repro Reports	— Post Pass Summary
TDAS Reports	— Tape Summary List
TDAS Reports	— Post Pass Summary
Reprocess Report	— TDAS Update Form
Utilization Reports	— DREUL

Each of the intermediate work files prepared within the production process is totally redundant. The data is usually copied from another document or summarized to a personal recording form for future reference. It should be noted that these records are maintained because other sources are considered not current enough or accurate enough. Eventually all this information is available in some other location or form. A separate computation of the redundancy of these intermediate files is not provided here.

However, mention is made below of the intermediate work files which entail a large amount of manual effort. These are:

Three sets of manual records maintained at TS&S - One set for the activities in each of the groups within the operation.

Dispatch Chrono History of D-Tape Requests

Dispatch Files (by satellite) of Tape Assignments

Dispatch Manual Records

Analog Tape Request Status

Current Status Records

In general, these records are eventually processed into a more useful or available form. Most intermediate files serve to maintain awareness of currency of telemetry processing, including position of data within production cycle and location of related materials.

Other intermediate work records include:

- 407 listings of TDAS transactions (held at several positions along the production path)

- Copies of Buffer Log

- Copies of Post Pass Summary

- Copies of AITR

- Copies of Edit Release Form

Another major source of information is the data files which are maintained in the DPB. As with the documents and reports, a determination was made of the redundancy present in the data files. Figure 1 indicates the redundancy between the data files which are maintained on a regular basis. Excluded from the list is the 'Slant Range Data File' which was discontinued, partially as a result of questions raised during the study. Of interest in the case of data files is the potential for consolidating two or more files. By examining Figure 1 and other information (not shown here) collected for this study, a number of candidates were found for possible consolidation into a common data base. These are the TDAS, TAS, TE, UTIL, Q.C., and DTA files. From Figure 1, the following percentages of common fields between each of preceeding files and the TDAS file, can be derived:

% TAS fields in common with TDAS = 39%
% TE fields in common with TDAS = 47%
% UTIL fields in common with TDAS = 79%
% DC fields in common with TDAS = 72%
% DTA fields in common with TDAS = 60%

# of Fields	File ID	1	2	3	4	5	6	7	8	9	10	These numbers refer to the numbered field listed under File ID
180	1. TDAS	7	0	1	0	9	11	18	6	1		53
18	2. TAS		0	0	0	5	1	4	10	1		17
12	3. SIC			0	0	0	2	1	0	0		3
12	4. FAR				0	0	8	1	0	0		9
8	5. CALICO					0	1	0	0	0		1
19	6. TE						3	10	4	0		17
14	7. UTIL							5	2	0		7
25	8. Q.C.								3	0		3
10	9. D.T.A.									0		0
7	10. EAM											
		7	0	1	0	14	26	39	25	2		116

Note: To determine the redundancy of an individual file, add the column and row totals for the given file. For example, the redundancy for file #7 is 26 + 7 = 33.

Figure 1. Redundancy Matrix for Data Files

UTILIZATION

Discussions concerning document and report utilization were held with 35 people; generally more than one meeting was held with these individuals. A total of 272 responses (a response is one recipient's reply concerning one of the several reports he receives) were made. Of these 61 (23%) indicated they had no need to receive a particular report they had been receiving. Notations were made to remove these personnel from the applicable distribution lists. 189 (70%) indicated satisfaction with frequency of receipt. Only 159 (57%) indicated satisfaction with the format of the separate reports. Other notable findings were:

(1) Of all instances for which users indicated satisfaction with the frequency of receipt, 63% (173 replies) had a content utilization factor of 80% or higher.

(2) A total utilization factor was computed for the system. Using as a base the number of instances where the respondents indicated a desire to continue receiving a particular document, the average satisfaction with the total reporting system was calculated to be 85%. If average utilization of the total system encompassed those instances where the recipient indicated no further desire for the report, it would be lowered to 64%. The difference between the two percentages represents the improvement that can be attained solely by paring the distribution lists.

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(3) Of the total number of responses DPB management personnel accounted for 105 or 38%. In total, they indicated no need in 30 of the 105 instances. Utilization of the management group with reports they wish to continue receiving was calculated to be 85%.

A plot of redundancy versus utilization is presented in Figure 2. Note that the identification of reports represented by the numbers shown in the plot is given in Table 1. Particular attention should be given to those reports which have the combined characteristic of high redundancy and low utilization. One such report which possesses this characteristic is the 'Utilization Report and Production Status.' Both versions of this report, i.e. the weekly and monthly (items #30 and 31) respectively in Figure 2) exhibit this characteristic. Further investigation may reveal that the incremental information provided by these reports to the recipients can readily be provided by other reports that they are not receiving or by slightly expanding the content of one or more other reports.

Follow-up investigations should also be made of those reports which fall into the category of moderate redundancy and low utilization. Referring to Figure 2, one such report which fits this categorization is that numbered 36 titled '% Reprocessed Files Report.' Note was taken of the degree to which this report is redundant with the other reports in the system. Based on the information contained in the last 3 columns of Appendix 1, it can be determined that there are 10 reports that contain almost wholly redundant information (an average of 5/6 per report) as the % Reprocessed Report.

COST

According to some studies, the amount of effort that is expended in an average production-oriented facility in order to record and report information (operational and management) may range up to 75 percent of the total non-management manpower of a facility. Cost figures relating to the set of key documents used in this study are given in Appendix III. As anticipated, the largest percent of effort is spent in the maintenance and reporting of historical and accounting information – the Tape Accounting System and Tape Telemetry Data Accounting System groups of reports. These two systems require a large amount of manual involvement (data preparation, including editing, validating, and duplicate record maintenance) and large blocks of computer time for file maintenance.

It is important to consider cost in relation to redundancy and utilization, both singly and in composite. Plots of cost vs. redundancy and cost vs utilization are depicted in Figures 3 and 4, respectively. Referring to Figure 3, the main

Table 1
Key to Figures 2, 3, and 4

1. Daily Line Status Report	23. Redig. Report
2. Proj. Status Report	24. Prod. Fac. Prob. Report
3. DAO Worksheet	25. Tape Rec. & Eval.
4. EAM Daily	26. Active Stor. & Shipment
5. EAM Act. Report	27. Inactive Stor/Shipment
6. Dispatch Daily	28. Edit Release Form
7. Daily on Line Worksheets	29. Monthly Sum. of Line Bklg.
8. D51 Proj. Summary	30. W. UR & Prod. Stat. W
9. Prod. Anal. Report	31. W. UR & Prod. Stat. M
10. Line Test Evaluation	32. Activity Report of Tape Staging and Storage
11. Mag. Tape Summ.	33. Dispatch Report - Monthly
12. Sta. Telem. Rep.	34. Dispatch Report - Quarterly
13. Data Anal. Stat. Rep.	35. EAM Downtime
14. Repro Files Rep.	36. % Repro Files Rep.
15. Line Prod. Sum. Rep. (W)	37. Phase II Util. Chart
16. Line Prod. Sum. Rep. (M)	38. Act/Inact Sat. List
17. Line Prod. Sum. Rep. (Q)	39. EAM Down time
18. UTE. Phase II Util. Rep.	40. EAM Usage/User Code
19. Condensed Phase II Rep.	41. Tapes to Ship List
20. Bad Tape Rep.	42. Dig. Tape Inventory
21. TDAS Chrono Report	43. AS&R Library Inventory
22. TDAS Station Report	44. Library Report

concern are reports which fall into the category of high cost − high redundancy. This categorization highlights the potential for substantial cost savings through consolidating or eliminating reports. Following this line of attack, report numbered 30 in Figure 3 should be of particular interest. This is the Weekly Utilization and Production Status report. Further investigation should establish whether the information provided by this report can readily be provided by other reports, with minor modification.

In Figure 4, primary interest is in those cases which are categorized as high cost − low utilization. This type of plot is useful in segregating reports for which a substantial cost savings may be readily achieved by simply eliminating a report or reducing the frequency or perhaps making the information available on special request. One such candidate report is that number 32 in Figure 4, which is the Activity Report for Tape Staging and Storage.
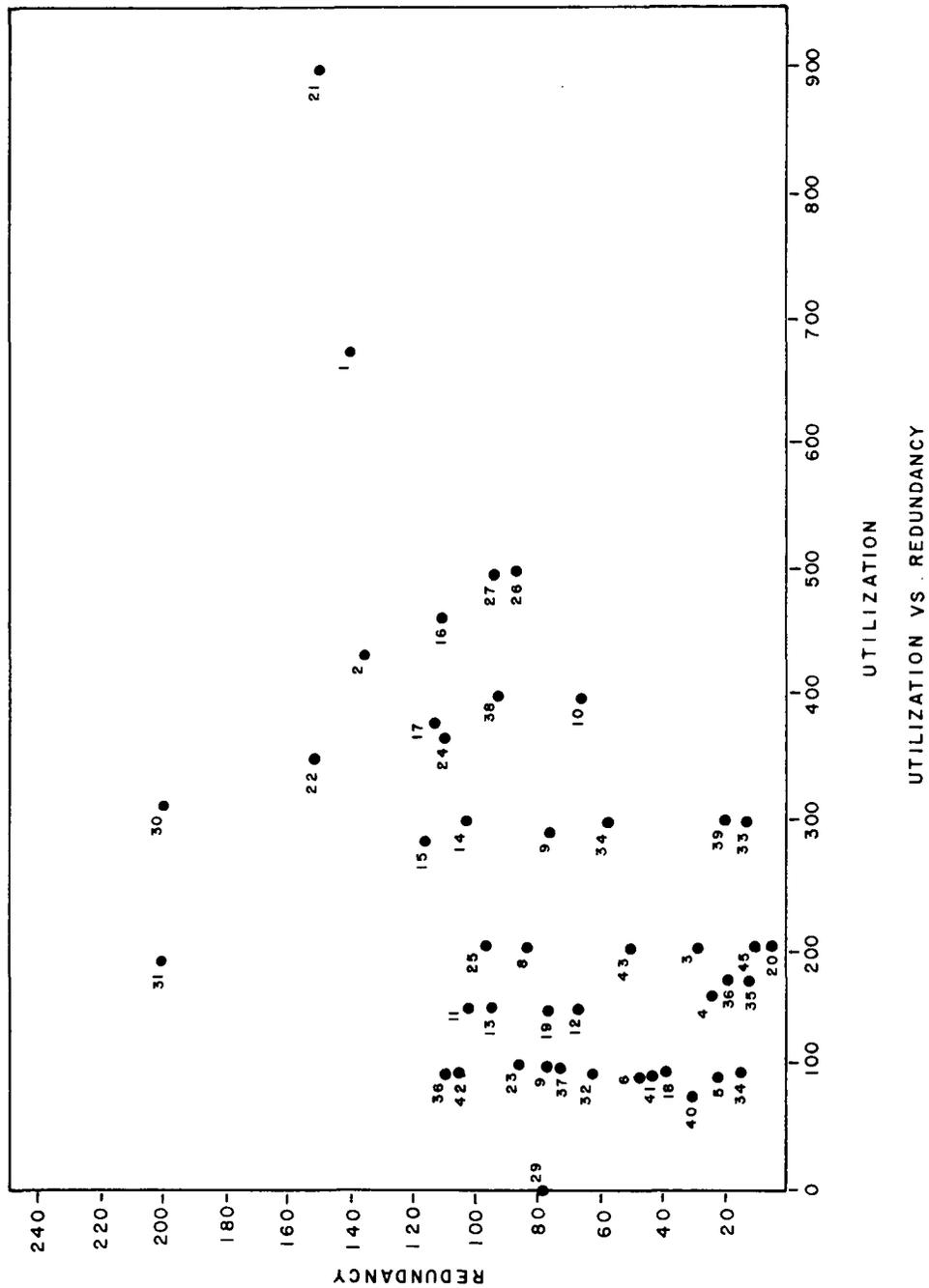
Figure 2. Utilization vs. Redundancy

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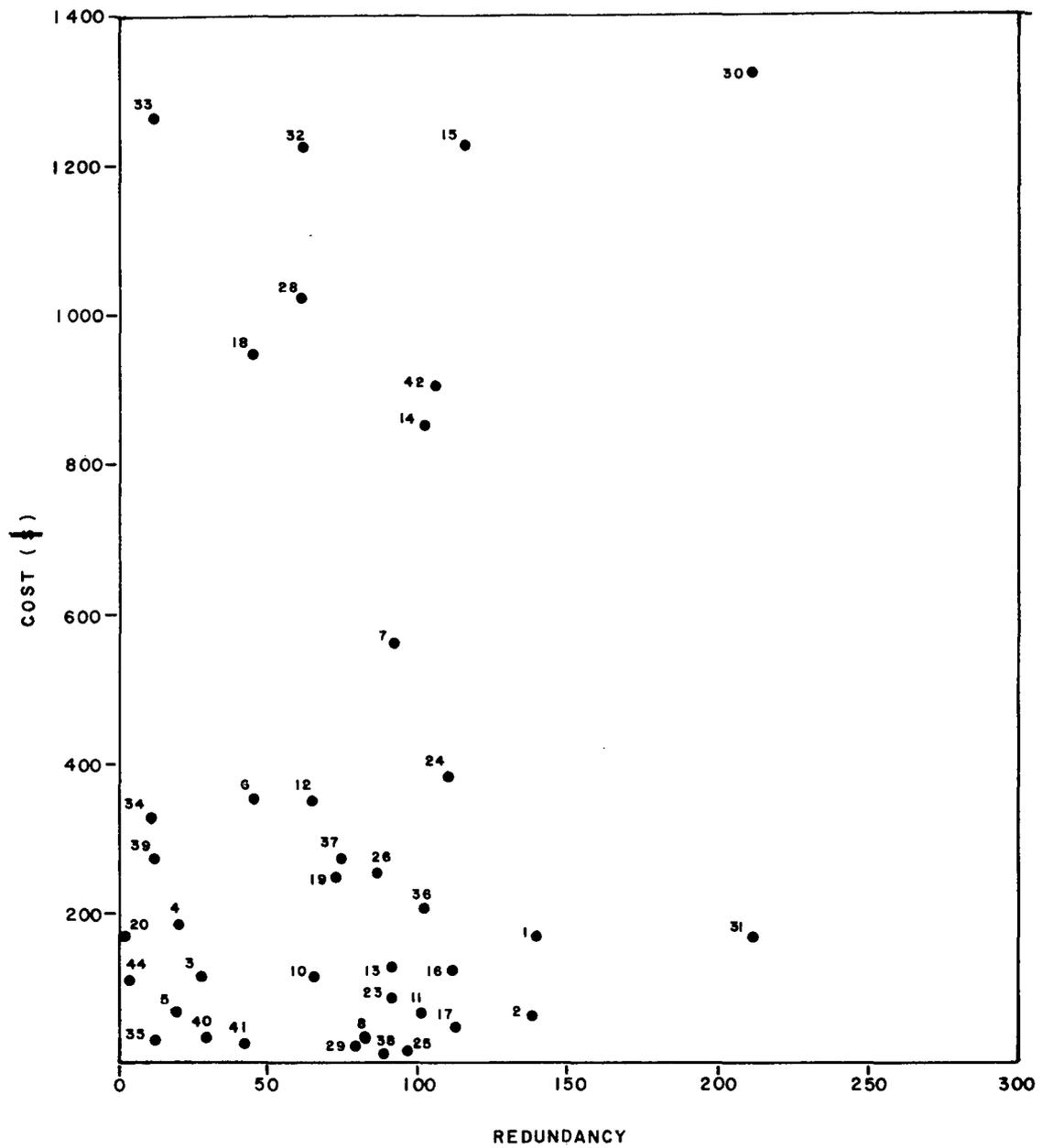
Figure 3. Cost vs. Redundancy
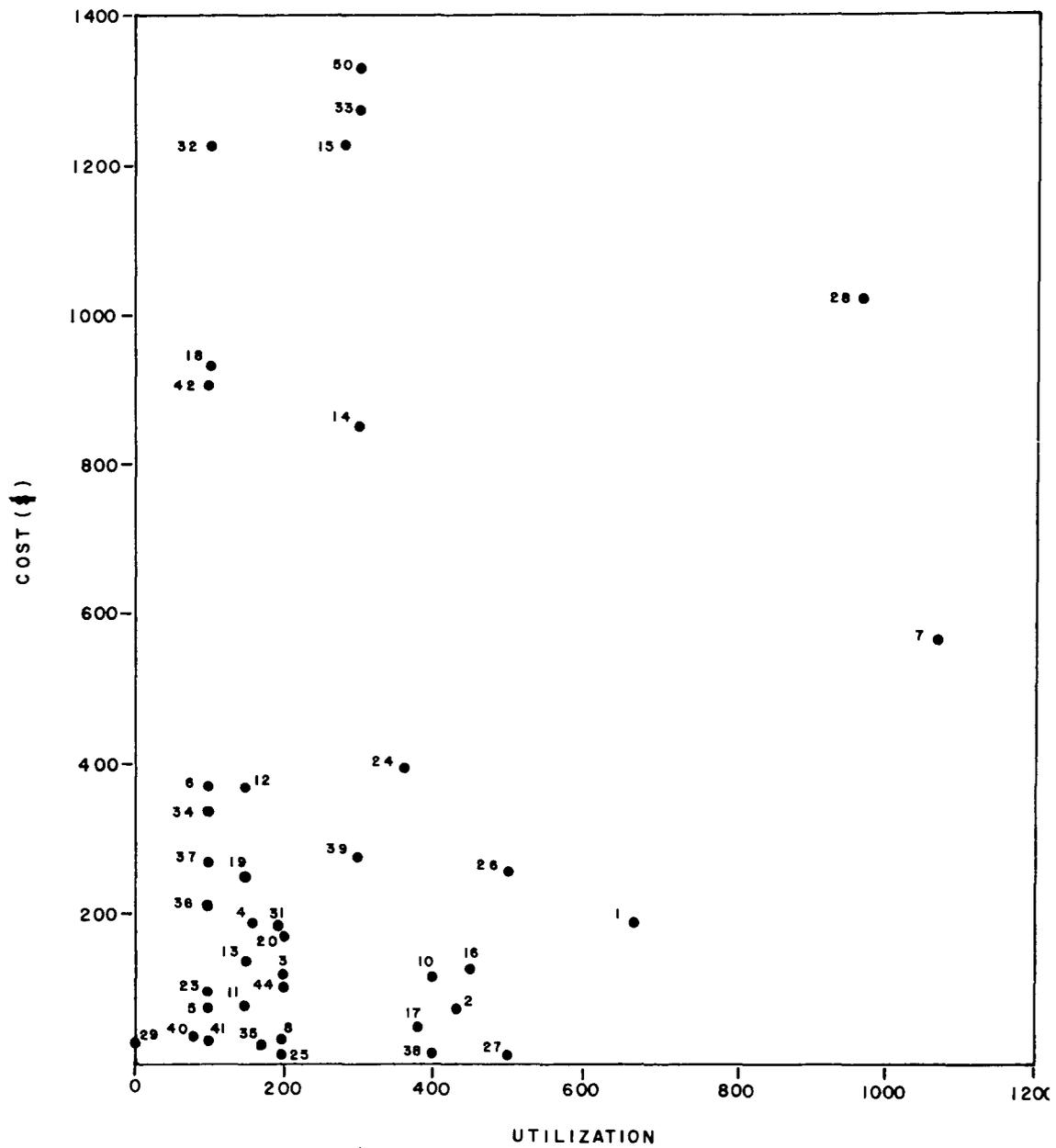
Figure 4. Cost vs. Utilization

The ideal document from an information system point of view, should have a lost cost, low redundancy, and high utilization. Special attention should be given to those reports that exhibit the opposite composite characteristics, i.e., high cost, high redundancy, and low utilization. By correlating the data plotted in Figures 2, 3 and 4 the following sets of reports were found to possess the combined set of unfavorable characteristics. These therefore would normally be the prime candidates for follow-up action. As noted in the next section, changes to these reports were in-process during the period of this study. These changes are at least partially attributable to the questions and discussions which took place in connection with this study.

TSS Analog Library Reports
TDAS Reports
Utilization Reports
Dispatch Reports

FURTHER OBSERVATIONS

Concurrent with the collection of data to provide the above measurements, attention was also given to the data handling aspects of the production cycle.

Some pertinent observations regarding these operations are discussed here.

● It was readily apparent that the branch information system has been constantly expanding and subject to frequent change. Most of the information is basically of a historical nature; some, of course is used for operations and management control and includes substantial manual effort, primarily for the maintaining and reporting of work status.

● For some of those activities which scored high redundancy ratings or low utilization/satisfaction ratings — revision is currently underway: The Edit Release Form is being modified; a new Tape Evaluation form is being designed to avoid the duplicating transcription of data; a new Quality Analysis Report and Reporting Procedure is in the design stage. It will replace five reports and do away with copying from one form to another. A new Equipment Utilization Report System has been designed; it will simplify the current procedures and combine the several separate reports into one output document. In each of these situations the changes will result in significant reduction in the redundancy measured in this study.

- As one would expect management's expressed interests are trends, status, and unusual circumstances. Within the DPB some exception reports have tended to fit into the normal report cycle and become regular activity reports. Summary reports of a section's activities over a period often contain more detail than management is interested in.

- Bootleg (unregistered) forms do exist within the branch, often as personal work tools. These forms are not bad in themselves, although other similar forms may serve the same purposes. Unless the form is known to exist by the appropriate individual, such determinations cannot be made.

- At the interface between the functional groups within the production cycle, similar statistics are maintained by each of the groups. What one group measures in output units another group measures in input units; each maintains very similar activity and status (work in process) records. Some of these recordings find their way into the daily worksheet of the various sections and serve as a type of cross check on the activity of the individual sections.

- DPE's showed an interest in receiving discrepancy statistics (by station) in some regular report. They are interested in sequence gaps between Digitization Figures and Release Figures. They are interested in any problems with the Quality of data and in trends indicating changes in the Quality of the Data.

- There are several situations in which forms are copied to other forms for an accumulation or rearrangement for data capture or preparation of another report. Other situations involve collection of data that is identical to data being collected in other sections. These include:

> Edit Release Form
> Tape Transaction Request
> Line Test Information
> Quality Bookkeeping
> Digital Tape Assignment
> TDAS Updates

- Some manually prepared reports contain information which is wholly available in automated data files and therefore could readily be generated automatically. These are:

> Monthly Comprehensive Report
> Facility Status Report
> Summary of Repro's

- Buffer A/D Summary is a key document within the Production Facility. With minor revision it could do away with several other documents and reduce the amount of transcription now taking place.

- Duplicate records of production results are being accumulated and permanently saved. For some of these forms and reports more than one copy of each is being microfilmed for permanent retention. A requirement for retrieval of an item from this storage is almost non-existent.

- Quality and Slant Range Card Status Report was determined to be of no further need. Additionally, the requirement to maintain the Slant Range Card File was determined to be no longer needed.

- EAM usage by user code is prepared monthly but very little use is made of the information contained therein.

- The Manual Daily Status Activity Report System is an assurance that the C&S supervisors are aware of the status of their respective charges; this group of reports also contains the nucleus of a major portion of the branch's information requirements.

APPENDIX I

REDUNDANCY TABLE

Item Ident.	No. of Fields	No. of ID Fields	Total Redund.	Redund. at Recording Level	Record. overlap Distribution[1]		Redund. at Report Level	Report overlap Distribution[1]	
					Total	Greater Than 1		Total	Greater Than 1
Line Status Rep.	18	4	140	53	27	15	87	38	17
Proj. St. Rep.	12	2	138	51	27	14	87	38	20
DAO Worksheet	4	2	27	5	2	2	22	10	8
EAM Daily	4	2	22	-	-	-	22	8	8
EAM Wkly by Func.	4	1	20	7	3	2	13	4	4
Digital Sup.	3	2	45	27	27	0	18	9	5
Dispatch Anal.	3	2	47	30	28	1	17	10	5
Analog. Supp.	4	1	14	-	-	-	14	7	3
D30 on Line Wksht.	13	3	88	43	25	7	45	25	10
D52 Lines Sum.	4	1	75	35	25	10	40	31	6
On Line Copy	5	2	64	28	26	2	36	25	5
D51 Proj. Sum.	6	4	83	32	26	6	51	32	6
Prod. Anal. Sum.	23	4	77	-	-	-	77	31	14
TDAS Listings	18	4	171	77	22	13	94	34	19
Phase II Sched.	5	1	64	33	27	6	31	17	8
Sat. Sum. Rep.									
Sta. Tel. Rep.	10	2	65	34	22	5	31	27	4
Mag. Tape Sum.	8	2	101	38	27	8	63	35	18
L.T. Eval. Rep.	6	2	66	27	20	3	39	26	9
Data An. St. Rep.	18	12	92	31	22	8	61	26	14
Repro. Rep.	24	2	103	40	7	7	63	27	13
Wkly. Line Prod. Sum. Rep.	13	3	116	61	24	8	55	31	6
M. Line Prod. Sum.	13	3	111	61	24	8	50	28	6
Q. Line Prod. Sum.	13	3	111	61	24	8	50	28	6

Item Ident.	No. of Fields	No. of ID Fields	Total Redund.	Redund. at Recording Level	Record. overlap Distribution[1]		Redund. at Report Level	Report overlap Distribution[1]	
					Total	Greater Than 1		Total	Greater Than 1
Daily UTE	4	1	44	12	3	3	32	19	9
Bad Dig. Tape	7	1	3	3	1	1			
TDAS Chrono	27	7	150	67	26	9	83	35	16
TDAS Station	41	7	151	72	26	13	79	34	11
Redigitize Rep.	10	3	86	6	3	3	80	32	21
Prod. Fac. Prob.									
Report	16	2	110	56	27	15	54	23	13
Tapes Rec. & Ev.	5	3	96	39	26	10	57	32	16
Sat. Anal. Ship/Stor.	14	5	87	31	25	4	56	30	12
Edit Release	9	3	62	20	13	2	42	28	10
Sum of Line Bklg.	6	2	80	31	24	7	49	30	12
W. Utilization	8	1	118	44	24	5	74	36	10
M. Utilization	8	1	118	44	24	5	74	36	10
Q. Utilization	8	1	118	44	24	5	74	36	10
W. Prod. Status	11	3	94	35	23	5	59	33	9
M. Prod. Status	11	3	94	35	23	5	59	33	9
Q. Prod. Status	11	3	94	35	23	5	59	33	9
TSSF Master List	16	5	101	42	25	9	59	44	11
TSSF Expired Tps.	11	3	93	40	25	9	53	44	7
TSSF Prog. Rep.	12	3	62	27	12	4	35	18	14
Dig. Tapes Rel.	4	1	42	15	12	2	27	23	15
Dispatch Act.	4	1	12	5	2	2	7	5	2
EAM Downtime (M)	4	1	13	4	1	1	9	4	3
Dispatch Tapes Released	4	1	57	27	22	4	30		8

Item Ident.	No. of Fields	No. of ID Fields	Total Redund.	Redund. at Recording Level	Record. overlap Distribution[1]		Redund. at Report Level	Report overlap Distribution[1]	
					Total	Greater Than 1		Total	Greater Than 1
M Comp.	10	2	108	48	24	12	60	34	20
Fac. Status Rep.	14	4	178	65	24	12	113	37	27
% Repro	6	2	108	38	22	8	70	30	10
Summ. of Repro's	10	2	134	35	20	6	99	30	15
Act/Inact. Sat. List	9	3	91	39	25	9	52	28	12
EAM Downtime	4	1	13	4	1	1	9	4	3
EAM Usage	6	2	29	11	2	2	18	7	7
Q&S Card Stat.	9	2	64	20	14	3	44	27	4
C. Phase II Rep.			75						
Tapes to Ship			100						
Lib. Reports			5						
AS&R			50						
Correction Sheet for									
TDAS	8	4	83	26	24	4	57	38	11
TSFF GP Form	12	3	83	39	26	9	44	35	3
Line Test Evaluation									
Record	12	1	96	46	26	5	50	36	9
Tape Sum. List									
From Netcon	12	7	170	72	26	17	98	40	18
A-Tape L.B.									
Shipping List	7	14	98	44	26	11	54	36	7
TDAS Updates	18	7	133	42	25	6	91	38	13
Q File Update Record	8	1	57	25	24	1	32	24	5
Priority List Memo	6	3	29	28	21	5	1	1	1
EAM Request CD	8	0	14	8	1	1	6	1	1

Item Ident.	No. of Fields	No. of ID Fields	Total Redund.	Redund. at Recording Level	Record. overlap Distribution[1]		Redund. at Report Level	Report overlap Distribution[1]	
					Total	Greater Than 1		Total	Greater Than 1
Dispatch D–Tape As-signment Sheet	9	5	72	32	23	6	40	21	6
TTY Copy	7	3	89	36	25	9	53	37	13
T Card Form	17	7	142	87	25	13	55	37	8
Log Sheet for Experimenters	6	2	78	33	25	8	45	35	6
DTUTF	15	0	5	–	–	–	5	3	1
NetCon T&C Schd.	12	5	98	48	26	12	50	36	11
TAS Transact.	12	3	95	35	22	12	60	42	20
DREUL	14	2	202	68	27	12	134	40	20
Leadman's Log	24	2	150	72	27	11	122	40	18
Line Log	8	2	144	66	26	12	78	40	18
Buffer A/D Log	15	5	208	96	27	23	112	40	27
Stars II Job CD	9	1	51	20	14	4	31	14	9
Line Test Control Record	15	2	71	37	24	6	34	28	2
Tape Transaction Request	9	2	78	36	25	7	42	32	8
T. E. Log	25	5	115	59	25	9	56	34	10
Post Pass Sum.	15	7	180	74	26	14	106	39	24
Spec. Req. App.	23	5	94	56	24	17	38	29	4
Questionnaire Data Report	11	2	87	50	25	8	37	33	4
ALTR	15	4	112	52	26	17	60	43	15
EAM Log Sheet	8	–	13	8	1	1	5	1	1

Item Ident.	No. of Fields	No. of ID Fields	Total Redund.	Redund. at Recording Level	Record. overlap Distribution[1]		Redund. at Report Level	Report overlap Distribution[1]	
					Total	Greater Than 1		Total	Greater Than 1
Prod. Request	10	2	88	49	27	9	39	35	4
Proc. Ops. Prod. Control Vol.	7	3	83	40	26	9	43	35	7
TSSF Analog Receiving From	6	3	112	44	23	16	68	39	14

[1]Under the 'Total' column, the total number is given of recording documents or reports which have one or more fields that are redundant with the given item. Under the 'Greater Than 1' column, a count is given of only the recording documents or reports which have more than one field redundancy with the given item.

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APPENDIX II

UTILIZATION TABLES

Identif.	Freq.	No. of Resp.	No. Satis. W/Freq.	No. Satisf. W/Format	Total Usefulness[1]	No. Indicating No Need	No. Indicating Usefulness ≥ (80%)
Daily Line St.	D(9)	9	7	7	675	2	7
Proj. Status	W(9)	6	5	5	427	1	4
AO Wksheet	W(2)	2	2	2	200	0	2
AM Daily	D(1)	1	1	1	160	0	1
AM Act. Rep.	W(1)	1	1	1	100	0	1
Dispatch Daily	D(1)	1	1	1	100	0	1
Daily on Line Worksheets	D	11	11	10	1075	0	10
D52 Daily	D	1	1	1	100	0	1
D51 Proj. Sum.	W	2	2	2	200	0	2
Prod. Anal. Rep	W(4)	4	3	3	300	1	3
Proj. Summ.	D	1	1	1	100	0	1
07 Listing	D	9	9	9	900	0	9
Ops/Dev Sche.	W(12)	5	5	4	460	0	9
St. Tel. Rep.	W(7)	2	2	2	150	0	1
Mag. Tape Sum.	W(6)	3	3	3	150	0	1
L.T. Eval., Res.	W(6)	6	4	4	400	2	4
Data Anal. St. Rep.	W(5)	4	2	1	150	2	1
Repro Files Rep.	W(4)	3	3	3	300	0	3
Line Prod. Sum. Rep.	W(8)	6	4	3	280	2	2
Line Prod. Sum. Rep.	Q(8)	7	5	4	380	2	2
Line Prod. Summ. Rep.	M(8)	7	5	5	455	1	3
Time Acct. for Phase II	D(1)	1	1	1	100	0	1
Condensed Phase II	W(4)	3	2	2	150	1	1
Bad Tape Rep.	W(7)	4	1	2	200	2	2
TDAS Chrono	M/W	15	8	9	900	6	9
TDAS Station	W/M	11	3	4	350	7	3

[1]See page 37.

Identif.	Freq.	No. of Resp.	No. Satis. W/Freq.	No. Satisf. W/Format	Total Usefulness[1]	No. Indicating No Need	No. Indicating Usefulness ≥ (80%)
Redigitization Report	M(3)	3	2	2	100	1	2
Prod. Fac. Prob. Rep.	M(5)	4	4	4	360	0	3
Mag. Tapes Rec. & Eval.	M	2	2	2	200	0	2
Active A. Shp. Storage	M(14)	8	5	3	500	3	5
Inactive	M(14)	8	5	3	500	0	5
Edit Release	D(4)	11	10	2	970	0	9
Sum. Line Bklg	M(1)	1	0	0	0	1	0
Util. Report	W(3)	3	1	2	175	1	1
Prod. St. Rep.	W(3)	2	2	2	130	0	1
Prod. Status	M(3)	3	2	2	120	1	1
Util. Rep.	M(3)	2	1	1	75	1	0
Util. Rep.	Q(3)	2	1	1	75	1	1
Prod. Stat.	Q(3)	3	1	1	100	2	1
TSSF Act. Rep.	W(5)	4	2	0	100	2	0
Dispatch Tapes Released Line	M(10)	6	2	0	300	3	3
Dispatch Act.	Q(2)	2	2	0	100	0	1
EAM Downtime	Q(2)	2	1	1	175	0	1
Comp.	Q	2	2	2	100	0	2
Comp.	M	2	2	2	100	0	2
Dispatch Wkly Act. Report	W	1	1	1	100	0	1
Fac. Stat. Rep.	W	9	7	7	700	2	9
Repro Chart	D(1)	1	1	1	100	0	2
Phase II Util. Chart	W	2	1	1	100	1	1
Act/Inact. Sat. List	M(5)	4	4	4	400	0	4

[1]See page 37.

Identif.	Freq.	No. of Resp.	No. Satis. W/Freq.	No. Satisf. W/Format	Total Usefulness Total Usefulness[1]	No. Indicating No Need	No. Indicating Usefulness ≥ (80%)
EAM Downtime	M(3)	3	3	3	300	0	3
EAM Usage by User Code	M(2)	1	1	0	80	0	1
DPS Reps. to DPE	W	2	2	1	180	0	2
Lib. Reports	M	2	1	1	200	0	2
A/D Summ.	D	6	6	6	600	0	6
DREUL	D	2	2	0	200	0	2
Questionable Data	1	1	1	0	100	0	1
Proc. Ops. Control Weekly Prod.	W	1	1	0	100	0	1
Power Fail.	W	2	1	0	100	1	1
Repeat. Tests	W	1	1	1	100	0	1
ATS Station Error Rep.	E(3)	2	1	· 1	100	1	1
Benson Wkly	W(4)	4	2	1	150	1	1
TDAS Update	W	3	3	2	300	0	3
Unpro Files Rep	W(3)	2	1	0	100	0	1
TDAS Gap	occ	1	1	1	100	0	1
ATO Reports		1	1	1	100	0	1
TDAS Phase II Act.	W	2	0	0	100	1	1
FOM Report	W	1	1	1	100	0	1
A/D Convers. Update List	D	1	1	0	100	0	1
TSFF Reports	W	1	1	1	100	0	1
Proj. Summ.	M	1	1	1	100	0	1
TSSF Master List	M	2	0	0	0	2	0
TSSF Expired Tapes	M	1	0	0	0	1	0
Repro Summ.	Q	1	1	1	100	0	1

[1]See page 37.

Identif.	Freq.	No. of Resp.	No. Satis. W/Freq.	No. Satisf. W/Format	Total Usefulness [1]	No. Indicating No Need	No. Indicating Usefulness $\geq$ (80%)
Tapes to Ship List	Q	1			100	0	1
Proj. Summ. TSSF Update	Q	1	1	1	100	0	1
Transactions Sum. of Withdr	W	1	1	1	100	0	1
Tapes	W	1	1	1	100	0	1
T&S Card Rep.	M	2	0	0	0	2	0

[1] A 'Usefulness' factor was calculated for each respondent based on the % the report content utilized and the frequency of use vs receipt. Each respondents' utilization factor was summed to arrive at the Total Usefulness.

APPENDIX III

COST OF DOCUMENTS/REPORTS

Document Identification	Freq. at which Produced	Manhours of Preparation	Computer Time per Issue	Total Cost per Issue	No. of Issues per Month	Total Cost per Month	Percent of Total System Cost
Daily Line Status Rep.	D	1.0	0	8.5	22	187.0	.4
Project Status Rep.	W	2.0	0	17.0	4	68.0	.15
TDAO Weekly Activities	W	3.5	0	29.7	4	118.0	.27
EAM Activ.	D	1.0	0	8.5	22	187.0	.4
EAM Activ.	W	2.0	0	17.0	4	68.0	.15
Dispatch Daily	D	2.0	0	17.0	22	374.0	.8
On Line Data Worksheet	D	3.0	0	25.5	22	561.0	1.2
On Line Data Worksheet	W	1.5	0	12.7	22	279.0	.6
Project Status Report	W	1.0	0	8.0	4	34.0	.075
Prod. Anal. Report	D	8.0	0	68.0	22	1496.0	3.5
Prod. Analysis Report	W	8.0	0	68.0	4	272.0	.6
D52 Line Summ. Worksheet	W	1.0	0	8.5	4	34.0	.08
Station Tel. Report	W	11.0	0	93.5	4	374.0	.8
Summ. of Mag. Tapes Recvd. and Tapes Evaluated	W	2.0	0	17.0	4	68.0	.15
Data Analysis Status Rep.	W	4.0	0	34.0	4	136.0	.3
Reprocess Files Report	W	25.0	0	212.5	4	850.0	2.0
Line Prod. Summ. Report	W	30.0	1.0	306.0	4	1224.0	2.8
Line Prod. Summ. Report	M	5.5	1.5	123.2	1	123.0	.28
Line Prod. Summ. Report	Q	5.5	1.5	123.2	1/3	41.0	.09
UTE Phase II Util. Rep.	D	1.0	.5	42.5	22	935.0	2.0
Condenses Phase II Util. Report	D	.5	.1	11.0	22	242.0	.5
Bad Tape Report	W	5.0	0	42.5	4	170.0	.4
TDAS Chronological Report	W/M	130.0	20.0	2125.0	4	8500.0	20.0
TDAS Station Report	W/M	130.0	10.0	1615.0	4	6460.0	15.0
Redigitization Report	M	10.0	0	85.0	1	85.0	.2
Prod. Fac. Prob. Report	M	46.0	0	391.0	1	391.0	.9
Tapes Rec. & Evaluated	M	1.5	0	12.7	1	12.0	.03
Active Stor/Shipment	M	30.0	0	255.0	1	255.0	.58

Document Identification	Freq. at which Produced	Manhours of Preparation	Computer Time per Issue	Total Cost per Issue	No. of Issues per Month	Total Cost per Month	Percent of Total System Cost
Inactive Storage/Ship. A/I Sat. An. Shipment	M	1.5	0	12.7	1	12.0	.03
Storage-STARS	M	3.0	0	25.5	1	25.0	.06
Edit Release Form	W	25-35	0	255.0	4	1020.0	2.1
Monthly Sum. of Line Bklg.	M	2.5	0	21.2	1	21.0	.05
W. UR. & Prod. Status	W	30.0	1.5	331.5	4	1326.0	3.0
W. UR. & Prod. Status	M	6.0	2.5	178.5	1	178.0	.4
W. UR. & Prod. Status	Q	(irregular)					
Tape Stor. Reports	M	200.0	5.0	1955.0	1	1955.0	4.5
Activity Report, TSS	W	36.0	0	306.0	4	1224.0	2.8
Dispatch Report	M	150.0	0	1275.0	1	1275.0	3.0
Dispatch Report	Q	120.0	0	1020.0	1/3	337.0	.8
EAM Downtime	Q	8.0	0	68.0	1/3	22.0	.05
% Repro. Files Rep.	D	1.1	0	9.3	22	205.0	.5
Phase II Util. Chart	W	6.0	.3	66.3	4	265.0	.6
Tape Ship. Report	W	20	0	170.0	4	680.0	1.5
Act./Inact. Sat. List	M	2.0	0	17.0	1	17.0	.6
EAM Downtime	W	8.0	0	68.0	4	272.0	.6
EAM Usage by User Code	M	4.0	0	34.0	1	34.0	.08
ALTRs	D	5.0	0	42.5	22	935.0	2.0
PCM Line Rel. Test	B.W.	1.0	0	8.5	2	17.0	.04
Tape Deck Speed Tests	W	4.0	0	34.0	4	136.0	.3
Quarterly SAP	Q	50-90	15.0	1402.5	1/3	467.0	1.0
Syst. Maint. Wkly Act. Rep.	W	8.0	0	68.0	4	272.0	.6
Daily Far Log	M	13.0	0	110.5	1	110.0	.25
Sys. Maint. Daily	D	1.0	0	8.5	22	187.0	.4
Purchase Req. Ord. Rec. Rep.	D	2.0	.6	47.6	22	1047.0	2.1
Act. Total Property	W	1.0	.5	34.0	4	136.0	.3

Document Identification	Freq. at which Produced	Manhours of Preparation	Computer Time per Issue	Total Cost per Issue	No. of Issues per Month	Total Cost per Month	Percent of Total System Cost
Total Prop. by Location	W	1.0	1.0	59.5	4	238.0	.55
Stock Inv. Report	W	11.0	1.0	144.5	4	578.0	1.2
Stock Ord. Report	W	1.5	.2	22.9	4	92.0	.2
Req. for Sup/Forms	W	2.2	0	18.7	4	75.0	.17
TAMS Status Report	W	2.0	.2	27.2	3	72.0	.19
TAMS Status Report	M	2.0	.3	32.3	1	32.0	.7
Rep. of Tr.	M	1.0	.5	34.0	1	34.0	.7
FAR Anal: Rep.	M	6.1	.6	82.4	1	82.0	.19
FAR Anal. Report	Q	.3	.5	28.0	1/3	9.0	.08
FAR Anal. Rep.	Y	.4	.5	28.9	1/12	2.0	.03
Cumul. FAR	Q	.4	1.0	54.4	1/3	18.0	.04
M/W Location Usage	M	6.1	.6	82.4	4	330.0	.8
TDAO Proj. Status	W	20.0	0	170.0	4	680.0	1.5
Qual. Cat.	M	120.0	17.0	1887.0	1	1887.0	4.5
TDAS Susp. Work	W	40.0	0	340.0	4	1360.0	3.0
PMIC (TSS)	Q	16.0	0	136.0	1/3	45.0	.1
PMR	M	8.0	0	68.0	1	68.0	.15
Exp. Ship. Rep.	Q	16.0	.1	1411.0	1/3	470.0	.1
Dig. Tapes Shipped	M	2.0	.2	27.2	1	27.0	.06
IPD Digital Tape Inv. Rep.	M	106.0	.1	906.1	1	906.1	2.0
GSFC Records Dep. Status	M	1.0	0	8.5	1	8.0	.02
AS&R Lib. Inv.	M	250.0	0	2125.0	1	2125.0	5.0
Lib. Rep.	M	12.0	0	102.0	1	102.0	.24