FIPS PUB 76

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

GUIDELINE

FOR
PLANNING AND USING A
DATA DICTIONARY SYSTEM

CATEGORY: SOFTWARE
SUBCATEGORY: DATA MANAGEMENT
APPLICATIONS

Foreword

The Federal Information Processing Standards Publication Series of the National Bureau of Standards is the official publication relating to standards adopted and promulgated under the provisions of Public Law 89-306 (Brooks Act) and under Part 6 of Title 15, Code of Federal Regulations. These legislative and executive mandates have given the Secretary of Commerce important responsibilities for improving the utilization and management of computers and automatic data processing in the Federal Government. To carry out the Secretary's responsibilities, the NBS, through its Institute for Computer Sciences and Technology, provides leadership, technical guidance, and coordination of Government efforts in the development of guidelines and standards in t' se areas.

In May 1974, the Comptroller General of the United States, in a report to the Congress, noted that the cost for Federal data collection and data handling activities is estimated to exceed $5 billion annually. With such an investment, Government agencies are striving to reduce redundant data resources, and to improve the utility of existing data resources. A well-developed and properly utilized Data Dictionary System (DDS) will help Federal agencies eliminate unnecessary data gathering, reduce costs, and improve information systems' effectiveness. NBS makes available this guideline to assist Federal agencies in planning and using a DDS.

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Abstract

This guideline provides assistance to Federal ADP Management and technical staff in planning and using Data Dictionary Systems (DDS's). A DDS is a computer software system that is used to assist in organization-wide data management, without restriction to computer data. This document describes the capabilities of a DDS; addresses selection considerations; provides guidance for preimplementation planning, including such management issues as DDS policies and budgeting, data standardization and control, and coordination of the DDS contents. The document also presents initiation and operation considerations for using a DDS.

Key words: Computer program; data dictionary system; data inventory; data management; data standards; database; database management system; documentation; Federal Information Processing Standards Publication; software.

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GUIDELINE FOR PLANNING AND USING A
DATA DICTIONARY SYSTEM

Federal Information Processing Standards Publications are issued by the National Bureau of Standards pursuant to the Federal Property and Administrative Services Act of 1949, as amended, Public Law 89-306 (79 Stat. 1127), Executive Order 11717 (38 FR 12315, dated May 11, 1973) and Part 6 of Title 15 Code of Federal Regulations (CFR).

Name of Guideline: Guideline for Planning and Using a Data Dictionary System.

Category of Guideline: Software, Data Management Applications.

Explanation: This guideline describes the capabilities of a data dictionary system, discusses selection considerations, and provides guidance for preimplementation planning, implementation, and operational use of the DDS.

Approving Authority: U.S. Department of Commerce, National Bureau of Standards (Institute for Computer Sciences and Technology).

Maintenance Agency: U.S. Department of Commerce, National Bureau of Standards (Institute for Computer Sciences and Technology).

Cross Index:

a. Federal Information Processing Standards Publication (FIPS PUB) 28, Standardization of Data Elements and Representation.

b. Federal Information Processing Standards Publication (FIPS PUB) 38, Guidelines for Documentation of Computer Programs and Automated Data Systems.

c. Federal Information Processing Standards Publication (FIPS PUB) 42-1, Guideline for Benchmarking ADP Systems in the Competitive Procurement Environment.

d. Federal Information Processing Standards Publication (FIPS PUB) 45, Guide for the Development, Implementation and Maintenance of Standards for the Representation of Computer Processed Data Elements.

e. Federal Information Processing Standards Publication (FIPS PUB) 64, Guidelines for Documentation of Computer Programs and Automated Data Systems for the Initiation Phase.

f. Federal Information Processing Standards Publication (FIPS PUB) 67, Guideline for Selection of Data Entry Equipment.

g. Federal Information Processing Standards Publication (FIPS PUB) 77, Guideline for Planning and Management of Database Applications.

Applicability: This guideline is a basic reference document for general use by Federal departments and agencies in the implementation and use of a data dictionary system.

Implementation Schedule: This guideline should be consulted when Federal agencies are: considering acquiring or developing data dictionary systems; developing policies and procedures for implementing and using data dictionary systems; or reviewing the current use of data dictionary systems.

Specifications: Federal Information Processing Standard 76 (FIPS PUB 76), Guideline for Planning and Using a Data Dictionary System (affixed).

Definitions: The following definitions are used in this document:

Computer program. A series of instructions or statements, in a form acceptable to a computer, prepared to achieve a certain result.

Software. (ISO) Computer programs, procedures, rules, and possibly associated documentation concerned with the operation of a data processing system.

Data dictionary system. A computer software system used to record, store, and process information about an organization's significant data and associated data processing functions.

Qualifications: This guideline represents recommended practices in planning for and using data dictionary systems. They are not offered as unqualified recommendations. In applying this guideline, it is important to bear in mind that data dictionary systems may serve many different purposes and management objectives. Therefore, no single approach for their application can be recommended for every agency. Each Federal agency, office, or project should investigate the specific circumstances that would warrant the installation and use of a DDS.

Where to Obtain Copies of the Guideline: Copies of this publication are for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161. When ordering, refer to Federal Information Processing Standards Publication 76 (FIPS-PUB-76), and title. When microfiche is desired, this should be specified. Payment may be made by check, money order, American Express Card, or NTIS Deposit Account.

**Federal Information
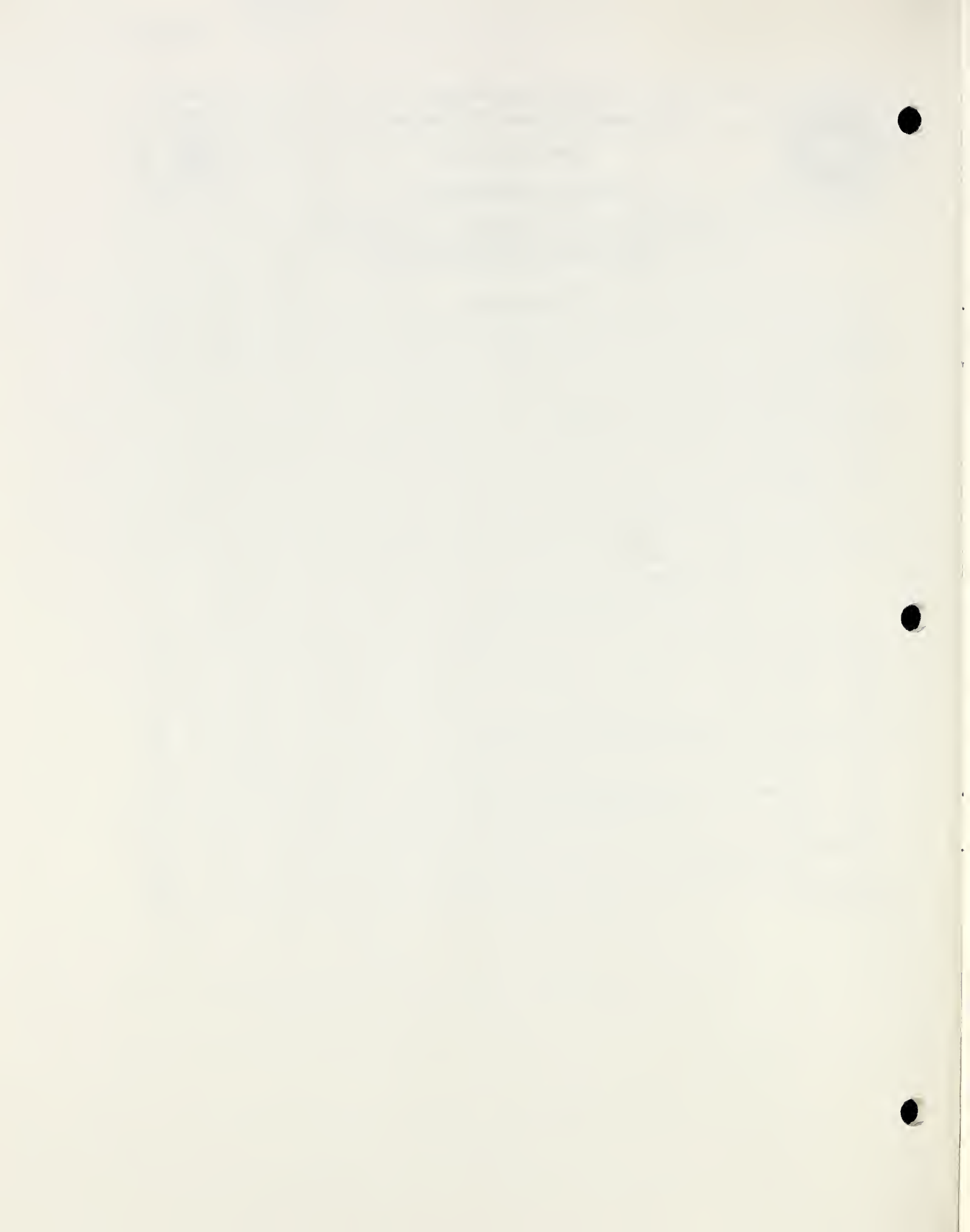Processing Standards Publication 76**

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SPECIFICATIONS FOR

GUIDELINE FOR PLANNING AND USING A
DATA DICTIONARY SYSTEM

CONTENTS

1. INTRODUCTION

1.1 Guideline in Perspective

The purpose of this guideline is to assist Federal ADP management and technical staff in planning and using Data Dictionary Systems (DDS's).

A Data Dictionary System is a computer software system used to record, store, and process information about all of an organization's significant data entities and associated data processing functions. The DDS can benefit an entire Federal agency or an individual project. The DDS provides Federal ADP managers with a central source of information about the organization's data resources, an automated documentation tool, and an aid in system design and development.

The term "data dictionary," which stems from the early applications that simply catalogued and defined data elements, is no longer completely appropriate and descriptive, but nevertheless continues to be widely used, and will be used in this publication.

This publication addresses selection considerations, management issues, and initiation and operation considerations for using a DDS. In applying this guideline, it is important to bear in mind that a DDS may serve many different purposes and management objectives. Therefore, no single approach for its application can be recommended for every agency. Each agency, office, or project should investigate the specific circumstances that would warrant the installation and use of a DDS. This document should be used in conjunction with Federal Information Processing Standards Publication numbers 28 (on data elements and representations), 38 and 64 (on documentation), 42-1 (on benchmarking), 45 (on standard data elements), 67 (on data entry), and 77 (on application management).

This guideline provides recommended practices in planning for and using a DDS. These practices are not offered as unqualified recommendations. Guidelines are not procedural steps that can be followed as a "recipe" with successful results. Instead, they are a discussion of good practices associated with areas of concern. In this sense, guidelines are useful as a checklist, and to some degree, they identify areas where special competence, expertise, or particular attention is indicated.

1.2 Organization of FIPS PUB 76

The remainder of this document is organized as follows:

*   Section 2 describes the capabilities of a DDS, types of DDS's available, and roles of a DDS in the overall information processing environment.

*   Section 3 discusses selection considerations, including technical and economical factors.

*   Section 4 presents preimplementation planning guidelines which address policy considerations, budget, data standardization, control and coordination of DDS contents, technical support, and training.

*   Section 5 provides guidelines for implementing and using a DDS.

2. DATA DICTIONARY SYSTEM CAPABILITIES

2.1 Background

The Federal Government, like all large organizations, collects a very large quantity of data for its operations and decisionmaking. Data collection and handling are expensive, and poor quality data and lack of quality control in data collection and handling can impede Government services and decisionmaking. For example, problems exist when:

*   Data is collected redundantly by different departments, or data is collected anew instead of finding and using equivalent existing data;
*   Data is collected or recorded inconsistently; for example, different measuring units or codes are applied when similar data is collected by two different groups.

The Data Dictionary System (DDS), when consistently and conscientiously used by data management and computing personnel, will reduce problems such as these.

The DDS is itself an information system about all of an organization's significant data and data processing entities [1,2,3]*. Pertinent entities include individual data items or elements (such as client name or parts on hand),

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*Numbers in brackets indicate literature references at the end of this paper.

data groups (such as client's dependents), data collection forms, records, files, databases, programs, systems, reports, user procedures, and users. The content of the DDS, often called "metadata" but usually called simply the "data dictionary," consists of formal descriptions of the pertinent entities. An individual DDS entry, hereafter called an entity description, therefore contains important information about a named entity (for example, the data element CLIENT-NAME), but does not contain actual instances of the entity (that is, all existing client names). Rather, the actual instances exist outside of the DDS; as examples, they are data values stored in a database or on a magnetic tape located in a vault, or they are offices or people within the organization.

A DDS may be used effectively to describe data elements and other entities that do not involve computer processing, as well as to describe entities which involve computer applications. A fully developed data dictionary for an organization or project is a catalog of its data resources. A DDS is also a computer database that fully documents the organization's data collection, processing, handling, and dissemination activities. A DDS is therefore an automated documentation and information retrieval system to support organization-wide data management, without limitation to computer data. A DDS may have more substantial capabilities as an active component of computer applications, as will be described later in this section.

To summarize, a DDS provides capability for:

1. Specifying the type of an entity, such as a form, a data element, or a computer file.

2. Uniquely naming an entity and describing it in appropriate terms, such as the range of values of a data element or a narrative description of its meaning.

3. Specifying the flow and the storage locations of data entities within the organization or within the computer installation.

4. Specifying associations and relationships among the data entities; for example, appearance on the same form, or derivation of an entity from another.

5. Specifying and producing reports about the data dictionary content, such as a listing of all data elements or a cross-reference listing of all entities.

2.2 Types of Entity Descriptions

A DDS provides a prescribed set of different entity types; each type has a prescribed set of attributes. These attributes describe an entity of the given type. An entity description is entered into the data dictionary through the DDS as one or more text lines that name the entity and its type, and give values for the applicable attributes. The entity name, type designation, and other attributes must follow the prescribed conventions of the DDS. For example, an entity name may consist of from 1 to 30 alphanumeric characters only; the type designation must be one of the established codes, such as EL for data element or SD for source document. For some entity types, an available attribute may be a text field, say up to 150 characters, for entering a narrative description pertinent to each entity.

A DDS could also provide the capability for the user to define additional types of entities and their attributes, and to enter entity descriptions according to these user-defined types.

The conventions and attributes of entity descriptions are especially important in assessing a DDS. Data descriptions are essential to almost all computer programs. For example, a COBOL application program requires a DATA DIVISION. A database management system (DBMS) requires a database schema expressed in its Data Definition Language (DDL). Central storage of data descriptions under a DDS can improve data standardization and integrity control considerably, if the DDS can compile and output selected data descriptions in the form and content required by other software. Many DDS packages are specifically designed for this purpose, so their data descriptions do incorporate the necessary information at least for one software system such as a given DBMS or for a category of software such as COBOL programs. However, usually the syntax of the DDS language and entity descriptions differs substantially from the DBMS DDL or the COBOL DATA DIVISION.

2.3 Types of DDS

There are two principal ways to classify the wide range of capabilities and implementations found in present DDS's. One way is according to the DDS capability to provide data entity descriptions to other software. In this respect, the DDS could be called passive or active. Another classification is according to the dependence of the DDS on other software for implementing its functions. On this basis, the DDS may be classified as either stand-alone or dependent.

2.3.1 Passive and Active DDS. A passive DDS is an information management system used only by personnel to enter or retrieve entity descriptions. With a passive DDS, descriptions of the same data will exist concurrently in

other software such as COBOL programs. Changes in the DDS content do not automatically produce corresponding changes in the other data descriptions, and vice versa. Thus a passive DDS does not itself control the organization's data, although it would assist manual procedures to do so.

An active DDS, through software interfaces and computer operating procedures, provides the ONLY source for data descriptions to other processing components such as compilers, assemblers, and DBMS's. The active DDS enforces data standards and usage throughout the organization and its computer applications. For example, an active DDS could produce the DATA DIVISION for any COBOL program from dictionary information and parameters supplied in the job stream. The descriptive text would be interspersed with the program source text and passed to the COBOL compiler; or the descriptive text is placed into a COBOL "Copylib," and then passed to the compiler. Here the DDS is said to be active with respect to the COBOL compiler.

2.3.2 Stand-Alone and Dependent DDS. A stand-alone DDS is self-contained; that is, its functions are performed without relying on any other general purpose software such as a DBMS. A stand-alone DDS may be passive or active. Most of the current stand-alone implementations have available the features that make them active when invoked by a user.

A dependent DDS is specifically tailored to operate in conjunction with another general purpose software system, usually a DBMS. It requires the DBMS facilities to perform DDS functions. In some cases, the dependent DDS is implemented as a DBMS application, using only DBMS facilities. Such an intimate connection does not necessarily mean that a dependent DDS is automatically active with respect to the DBMS. However, it may be easier to invoke facilities that would make the DDS active.

2.4 Roles of the DDS

As the central repository of current and accurate information about an organization's data and its handling, a DDS can assist in a wide range of management and technical tasks. The following indicates different areas where use of a DDS is appropriate.

2.4.1 Data Resource Management. Because of the impact of government-directed data collection on the private sector and also the increasing costs of labor-intensive data handling, government agencies are striving to reduce redundant data collection and to improve the utility of existing data resources [4]. A well-developed DDS provides high visibility to similar data elements, forms, and collection procedures, and reliably identifies current holdings [5,6]. Officials who control data collection projects or data usage can use DDS reports to eliminate unnecessary data gathering and to redirect data management activities to reduce costs and improve overall effectiveness [7,8,9].

2.4.2 Data Standardization. Data collected for one purpose often cannot serve another because inappropriate standards were used in the original collection. NBS is producing selected government-wide data standards under its Data Element and Representation Standards Program, but each agency must also undertake data standardization for its unique needs [10]. A DDS can be used to record the data standards applied to every data element, and to assist auditing to assure that the required standards are in effect. Moreover, an active DDS can be used as the source of established data standards when needed by various activities, and also can participate in computer processes that edit and validate data against the established standards.

2.4.3 System Development and Documentation. The DDS is a valuable documentation tool over the entire life cycle of systems, procedures, and software [11,12,13]. In some cases, the DDS can be used as a security enforcement mechanism.

During the requirements definition of new systems, information is collected about data, processes, and data usage requirements. Descriptions of these requirements can be stored in the DDS, and used in conjunction with analysis and design software to analyze various aspects of the system under development. Subsequent changes to the requirements definitions can be easily made and reported to all affected offices and personnel, thereby minimizing errors due to inadvertent omissions or changes.

Using the current descriptions of the entities and their relationships, an active DDS can produce data descriptions for individual software modules. When used in conjunction with design aids, the DDS can produce descriptions of alternative file or database designs for evaluation.

During development, the DDS can produce data division and documentation for application programs. It can also produce the actual DATA DIVISION for COBOL programs, or the DDL for the DBMS.

During software testing, the DDS can help generate the test data by using the entity descriptions which already exist in the dictionary. During modification and maintenance, the DDS is useful in determining the effect of proposed changes on other entities in the operational environment.

The DDS can assist in producing documentation concurrently with development, rather than after the fact. As applications are designed and programs are written, the pertinent entity descriptions, entered in the DDS, will eliminate the need to divert manpower later for documentation after the application is completed.

2.4.4 Conversion. Lack of documentation is undoubtedly the primary barrier to economical and complete conversion of applications from one computer system to another. Poor documentation can force an agency to redesign a system. Inappropriate or fragmented documentation can impede the use of automated conversion aids. Consistent and thorough use of a DDS can substantially eliminate documentation problems and facilitate conversion. Most important, an active DDS can provide the data descriptions necessary to drive automated file conversion software [14].

2.5 Potential Benefits

The benefits of a DDS do not depend upon its being used government-wide or agency-wide. A DDS can benefit a single bureau, facility, Federal program, or computer application. Using a DDS provides economic and technical benefits. A DDS may provide immediate savings, or it may facilitate a continuing technical process by making it easier or more reliable to perform. To summarize the benefits:

* Better control of the organization's data resources through improved (i.e., centralized, rigorous, and standardized) data definitions, data handling and data collection procedures.

* Improved transportability of data and software between computing environments through standardized data and data definitions.

* Improved documentation for databases, programs, and systems.

* Automatic compilation of data definitions to be included in application programs or in DBMS database definitions.

* Increased security and access control for the database environment.

* Effective aid to software development, modification, and maintenance through configuration management of system components of data and programs.

* Increased cost-effective use of resources throughout the system development life cycle.

3. SELECTION CONSIDERATIONS

Federal procurements are governed by the Federal Procurement Regulations (FPR) published under Title 41 of the Code of Federal Regulations (CFR) as Chapter 1. Government-wide Federal Property Management Regulations (FPMR) applicable to Automatic Data Processing are published as Subchapter F of Chapter 101 of Title 41 CFR. In addition to Government-wide rules, many agencies have their own supplementary regulations and procedures. Consultation with the procurement authority in the particular agency is recommended prior to initiating a procurement action to ensure compliance with all applicable rules, regulations, and procedures.

The purpose of this section is to address the technical and economic issues that Federal agencies must consider when acquiring a DDS. These considerations are not intended to be a rigorous set of evaluation criteria for selection of a DDS. Prior to obtaining a DDS, the following must be addressed:

* Application scope,
* Technical factors, and
* Economic factors.

3.1 Application Scope

A DDS may be used in one program, for a single project, or agency-wide. It may inventory and document only data in automated systems, or it also may describe data that is processed manually. A Federal agency must assess its intended scope of application in preparation for selection of a DDS, because the value of the DDS to the users depends on the quality of the software selected, and on the quality of the DDS contents. This assessment will permit the Federal agency to determine the types of DDS capabilities that are required.

The initial scope of DDS applications within an agency may be selected either by specific applications (training, personnel, procurement, property, etc.) or by specific types of entities (COBOL data elements, COBOL programs, database entities, etc.). Various factors, such as an impending application conversion, management enthusiasm, or available personnel, may determine a preference for one approach over the other.

3.2 Technical Factors

Once the scope of the DDS application has been determined, existing DDS systems need to be reviewed to determine if they meet agency requirements. The most basic consideration for an agency to address is whether or not there is an existing DDS that will operate on the agency's existing or planned hardware and under the existing version(s) of the system software. All existing DDS's which do not satisfy the hardware and system software criteria can be eliminated from further consideration. In some cases, the hardware/software criteria will severely limit the agency's choice.

Technical analysis of the remaining available systems should address capabilities discussed in section 2, including:

* The prescribed set of entity types and associated attributes included in the DDS package. In addition, the agency must determine if it needs the capability to define its own unique entities, attributes, and relationships. If so, the agency must review the DDS system to determine if this facility exists.

* The type of DDS that is needed to satisfy agency needs, e.g., an active or a passive DDS, or a dependent or an independent DDS. This latter consideration will depend on whether the agency has a DBMS and if so which DBMS.

* The DDS data definition facility and input methods in terms of ease of use relative to the skill level of the intended users.

* Reporting, documentation, and ad hoc query capabilities and the ease of using these capabilities.

* Security, edit validation, backup, recovery, and reorganization facilities.

* Enhancement capabilities, e.g., the ability to interface user-written code with the DDS.

* Vendor support in terms of training, DDS software maintenance, and user groups.

3.3 Economic Factors

An agency that is prepared to obtain a DDS has three options:

1. To design and implement its own DDS,
2. To lease or purchase a commercial system, or
3. To obtain a system developed by another Federal agency.

The in-house design and implementation option implies a high initial cost both in terms of time and labor. However, in-house knowledge about the DDS software should reduce subsequent operational and maintenance costs. Some of the drawbacks are: the system is usually tailored to a specific application; it may not be flexible and responsive to changing requirements; and it may not be transportable. However, if none of the existing systems fulfill agency requirements, this is one of the feasible options, if a DDS is deemed desirable.

Although the purchase or lease option requires lead time for the procurement process, the commercial systems generally can be implemented in a shorter period of time than the previous option. Less manpower is usually required to install and maintain a commercial package, thereby enabling more use of personnel resources in problem-oriented analysis and standardization. In addition to the initial outlay of funds to purchase/lease the system, there will also be an annual maintenance fee.

The third option, obtaining a system developed by another agency, may appear to be the most economical. Developer-agencies may consent to provide available programs and documentation to other interested agencies, either free of charge or for a nominal administrative fee [2]. However, it is not likely that the supplying agencies would be prepared to provide maintenance for either "fixes" or enhancements. The acquiring agency will be "on its own," except for informal assistance. Special adaptation of the software to fit specific agency needs would need to be performed by the acquiring agency. Another drawback is that documentation may be sketchy or out of date.

4. GUIDELINES FOR PREIMPLEMENTATION PLANNING

These guidelines describe a general approach that, under normal circumstances, will produce successful DDS applications. They are presented with a view toward agency-wide application of a DDS. Similar steps are involved when DDS use is limited to only one office, program, or project. The modifications necessary in the latter case are rather obvious.

Prior to the installation of a DDS, management must resolve several important issues. The issues discussed in this section are:

* DDS policies and budgeting;
* data standardization;
* control and coordination of DDS contents;
* technical support of the DDS software; and
* training.

4.1 DDS Policies and Budgeting

Because DDS planning, budgeting, and management normally concern and affect various offices and activities within an agency, an integrated and unbiased approach is best produced through a central support group. Its stature or organizational placement must be such that its findings and recommendations are widely accepted.

When developing and using the DDS, particularly if multiple offices are involved, a steering committee should be established to guide and assist the central support group. The formality of the steering committee depends on the organization's policies. At the very least, it should consist of an informal group of user representatives. The steering committee should provide information on the impact—in cost, time, and any interagency reporting requirements—of changing existing data element descriptions. Committee members also should help the central support group to communicate the benefits of the DDS to users.

Steering committee membership should be representative of the envisioned DDS users; at the same time, committee size and composition should foster effective working conditions. Each agency must review the scope of its DDS applications to determine desirable user representation. Each person selected should support the use of the DDS enthusiastically. Each steering committee member can be a key person in minimizing resistance to change and mobilizing support for the DDS by keeping the user organization informed about the DDS and its anticipated benefits. The central support group, with concurrence of the steering committee, should have the authority to:

* develop a budget and cost allocations, if any, for DDS design or acquisition, implementation, operation, and training;

* finalize the initial and long-range scope of DDS application and formulate the associated usage policy; and

* ensure that sufficient staff with appropriate skills are assigned to provide the technical support functions described in section 4.4.

Too often, automated systems fail to produce expected benefits because inadequate resources are allocated to planning, implementation, long-term operation, and training. To ensure that the DDS can be used, and is used in the anticipated manner, sufficient funds and appropriate personnel skills must be devoted to implementing, testing, and maintaining the software so that it operates effectively. Resources must be available for data entry and standardization if the DDS contents are to be up-to-date and reliable. And, resources for training and consultation are required so that users know how to use the DDS. Additional funds and staff may be needed for each new application.

Budget formulation approaches range from developing one central DDS budget to having decentralized budgets for each using group. Costs can be allocated as overhead or as direct costs in specified program areas. Generally, the approach used should be consistent with that which is currently used by an agency to manage its other resources such as equipment and facilities.

The required policy comprises a clear and unambiguous management directive for standardization and management of data and information as a priority agency objective. Agency offices and personnel who will be DDS users must understand the benefits expected from the DDS, and the changes expected in their areas of responsibility, including any cost and personnel allocations for use of the DDS. Users must also be told the procedures that will be used to assure compliance with standard entity descriptions, and to resolve conflicts during the standardization process.

4.2   Data Standardization

Management must establish a data standardization activity, and designate appropriate responsibilities. Data standardization includes all the actions necessary to insure the consistent definition and usage of data. This process determines the naming, meaning, and coding standard for data elements to be followed by all users. Data standardization is largely an intellectual function. The DDS, if properly used, can assist in that function, but the DDS cannot perform the needed analysis and formulation automatically. For example, a DDS cannot automatically distinguish between homonyms: two data elements from different systems with the same name but with different meanings. An example is "rank," meaning either military rank or rank in a series.

A well-defined and well-structured set of data standards ensures that data collected in the DDS for one purpose may be used for another purpose. If the DDS is the source of established standards, it can be used as an enforcement mechanism to ensure that the data standards are being used. This can be done through various DDS-unique functions, e.g., the capability to check the validity of data against a predetermined set of criteria; and to supply standard data definitions to requesting components such as a DBMS or an application program.

The central support group described above normally should have the data standardization responsibility, which includes:

*   determining the entity type that will be standardized;

*   developing entity standards, and modifying standards, if necessary, as requirements change;

*   resolving conflicts that develop in the standardization process; and

*   auditing and enforcing DDS standards.

Depending on the scope of DDS application and the breadth of an agency's mission, some specialized standardization functions may be delegated to concerned program offices. However, the central support group should retain the responsibility for data entities used by more than one organizational unit or program office.

4.3   Control and Coordination of the DDS Contents

A critical factor in the effectiveness of the DDS is the currency and accuracy of the content of the DDS. Ultimately, the principal management goal is to be able to assure that the DDS content is consistent, current, and accurate. The central support group should have the responsibility for the coordination and control of the DDS contents. Designated staff should ensure that additions, deletions, or changes requested by one using organization will not adversely affect another user.

A key management question is: Where should responsibility for formulating new entity descriptions and changing operational entities be located?

Responsibility for adding, changing, and deleting DDS entities could be totally centralized in the central support group. Conversely, if standardization responsibility for program specific entities is delegated to user organizations, the responsibility for the addition and maintenance of these entities could be delegated also. In the latter situation, the central support group would continue to retain the responsibility for DDS entities that are pertinent to more than one program area. In either case, staff resources will be needed to formulate DDS input in the appropriate manner for processing by the DDS software.

In cases where users of the DDS are allowed to change or add entities and their attributes, the control and coordination function is especially critical. This situation may lead to the undesirable possibility that a change was made to an entity that is inconsistent with other entities. To avoid this, users must follow closely the procedures established for using the DDS. They must consult the designated coordinator within the central support group on proposed changes, to ensure that there is no conflict with other entities. The central support group must arbitrate between conflicting proposals and determine the most advantageous course of action for the agency.

4.4   Technical Support of the DDS Software

The DDS is a sophisticated software system. Trained computer personnel, therefore, must be responsible for implementing and maintaining the software, and assisting other personnel to use the DDS most effectively. The range of responsibilities for this technical staff may vary depending on its placement within the organization.

The technical support staff could be part of the central support group. This organizational placement will reduce conflicts in technical priorities, and it will minimize communication barriers between the technical staff and the staff working on DDS policy, budget, and standardization.

Policy and practical considerations may make it more feasible to have the DDS technical support functions performed by system programmers in the ADP division. Such an organizational placement will result generally in more effective utilization of technical personnel. During periods in which the DDS does not require full-time commitment of technical staff, they can work on other ADP systems.

Regardless of organization placement, the technical support staff should have the responsibility for:

* maintaining the DDS software;

* ensuring the reliability, security, and integrity of the DDS software and its associated database;

* ensuring adequate DDS backup and recovery capability;

* developing any special computer programs to interface with the DDS software in response to an agency's unique requirements;

* consulting with users and assisting them in the use of the DDS on an as-needed basis; and

* evaluating new requirements and new software.

4.5 Training

An agency will require training for three distinct types of individuals: management, programmatic and technical users, and data management users. Responsibility for providing training should be assumed by the central support group, although they may be assisted by technical staff and/or training specialists. Training strategies differ for each type because of the different goals.

1. *Management level* presentations are structured as overviews of technical capabilities, with emphasis on the benefits of the DDS to the organization, identification of known system limitations, and examples of potential application areas that would illustrate how the managers can use the DDS to meet their responsibilities. The purpose of these presentations is to promote the use of a DDS in the managers' organizations.

2. *User level* training emphasizes those features that programmatic and technical end-users are likely to utilize, such as the query facility and reporting capability. User training includes detailed instructions on how to input and change entity descriptions in the DDS, and how to obtain specific information from the DDS. This training assists the user in exploiting DDS features and in circumventing associated software operational limitations.

3. *Technical level* training addresses the data management staff, e.g., programmers and systems analysts who must maintain the DDS software. This training presents detailed technical information about the DDS software, its functions, interfaces with other software components, and special DDS software features.

5.   GUIDELINES FOR USING A DDS

These guidelines provide guidance on how to use a DDS once it is acquired. This section discusses both initiation and operational considerations in using a DDS.

5.1 Initiating the DDS

This section presents a suggested scenario on how an agency initiates a DDS. An agency should have reached the following state of readiness:

* The decision to use a DDS has been made.
* The DDS is already in place, or is currently being installed.
* Initial management decisions have been made, including:

    - assessment of costs and benefits for using a DDS,

    - establishment of a central support group,

    - formation of a steering committee,

    - designation of a person with the authority to resolve intra-agency conflicts over DDS entries,

    - designation of person(s) responsible for defining, updating, and maintaining the DDS.

The following represents a reasonable approach to initiating a DDS. The suggested chronology may vary from agency to agency:

1. The central support group, with concurrence of the steering committee, selects the organizational unit or project that will be the pilot application. The application selected should have a high likelihood of success, but should present also a significant need.

2. The central support group defines criteria to confirm successful installation of the DDS—criteria that can be used in acceptance testing in the case of a purchased/leased DDS.

3. The central support group, assisted by user representatives from the steering committee, identifies pertinent data and processing entities for initiating the DDS. Sources of information necessary to define these entities must be collected. These sources include the principal forms, reports, programs, files, and systems that the agency uses. The entity descriptions selected for inclusion in the DDS database should be:

- descriptions of commonly used data elements, records, files, databases, computer programs, and computer reports;

- information identifying forms and their use;

- information identifying source documents, their purpose, type, origin, destination, disposition, and relationship to other entities;

- information on paper records, such as official documents to be submitted to a designated office, e.g., the documents that must be kept to support tax reports.

4. The central support group establishes naming conventions and other standards for all entities, and obtains steering committee review and approval. The central support group then either performs the following tasks or delegates them to the initial user organization:

- Define and describe the types of entities listed above. The descriptions should detail physical characteristics, usages, relationships, ownership, and dates of creation or change.

- Determine and describe relationships among the entities.

- Determine and describe information flow, authority, and security information, etc.

5. The steering committee, which represents the needs of individual user organizations, determines the various reports that users, managers, database administrators, and analysts need from the DDS. These reports are then defined by the central support group for any necessary programming.

6. The technical staff loads the data descriptions into the DDS and starts experimental use. As part of this activity, they:

- Select the most efficient way of loading the data. Each DDS offers different facilities for initial loading of the data. Some offer batch bulk loading mechanisms for start-up situations, while others offer only online transaction-oriented facilities.

- Load pilot applications against the DDS, define sample queries and sample reports to test the DDS.

- Identify redundancy areas, conflicts, and errors for resolution. They work with DDS planners and users to resolve these problems.

7. The central support group ensures that affected end-users (e.g., application specialists, managers, and others) are trained to use the DDS.

8. The steering committee and the central support group jointly develop a priority list for other organizations and projects to initiate advance planning for subsequent application.

Subsequent projects and/or organizational units are added by a similar process. Once initiated, DDS applications may be incrementally expanded to the limit of available resources or the perceived limit of effective automation. Residual entities and applications may be catalogued by simplified manual methods (and also with program library techniques for computer applications).

As additional application areas increase the size of the DDS database, opportunities for redundancy and conflict increase significantly. Resolution of these must be consistent with previously established standards.

5.2 Operational Considerations

After the DDS becomes operational, the central support group and the technical staff must continue to perform the functions described in section 4. In summary, the central support group responsible for managing the DDS must undertake the following tasks:

1. Develop the DDS budget and review the resource utilization for all functions associated with the operation of the DDS.

2. Maintain standardization, control, and coordination procedures to ensure that pertinent and current information is in the DDS.

3. Audit and enforce DDS standards.

4. Propose the new applications that should be admitted to the DDS.

5. With the assistance of the steering committee, resolve conflicts that may arise from new applications such as conflicting usage and/or definition of data.

6. Ensure that the DDS software is adequately maintained, that backup and recovery software function properly, and that any required new capabilities are implemented.

7. Monitor error rates. If they are high, data entry and error correction methods and procedures must be reviewed.

8. Provide advocacy presentations, training, and consultation to the rest of the organization on the use of the DDS.

9. Train new users. Training would include an overview of the capabilities of the DDS, who can benefit from its use, how the DDS is used to formulate queries or to report desired information, and what kind of data already exists.

In addition, the central support group must review DDS usage. Data entry staff, particularly if they are individuals with little ADP experience may require additional technical assistance, or data entry aids. For example, pre-formatted forms and display screens help reduce errors of omission and errors in field size. Likewise, error messages must be easily understood and they must be received in a timely manner in order to ensure that DDS contents are accurate and up-to-date.

Users should be periodically interviewed to assess if DDS's reports are informative, easy to use, and received in time to be useful. The ad hoc query capability also needs to be assessed to determine its usability, and to ascertain whether additional user training and consultation are required.

Finally, the expected benefits that can be achieved from using a DDS must be reviewed to determine if they are being realized. For example, a major potential DDS benefit is its use as a documentation aid during the system development life cycle. Is the DDS being used in the anticipated (recommended) manner? If it is not, the central support group must review such factors as user awareness of DDS existence and capabilities, ease of use, training, and system response time.

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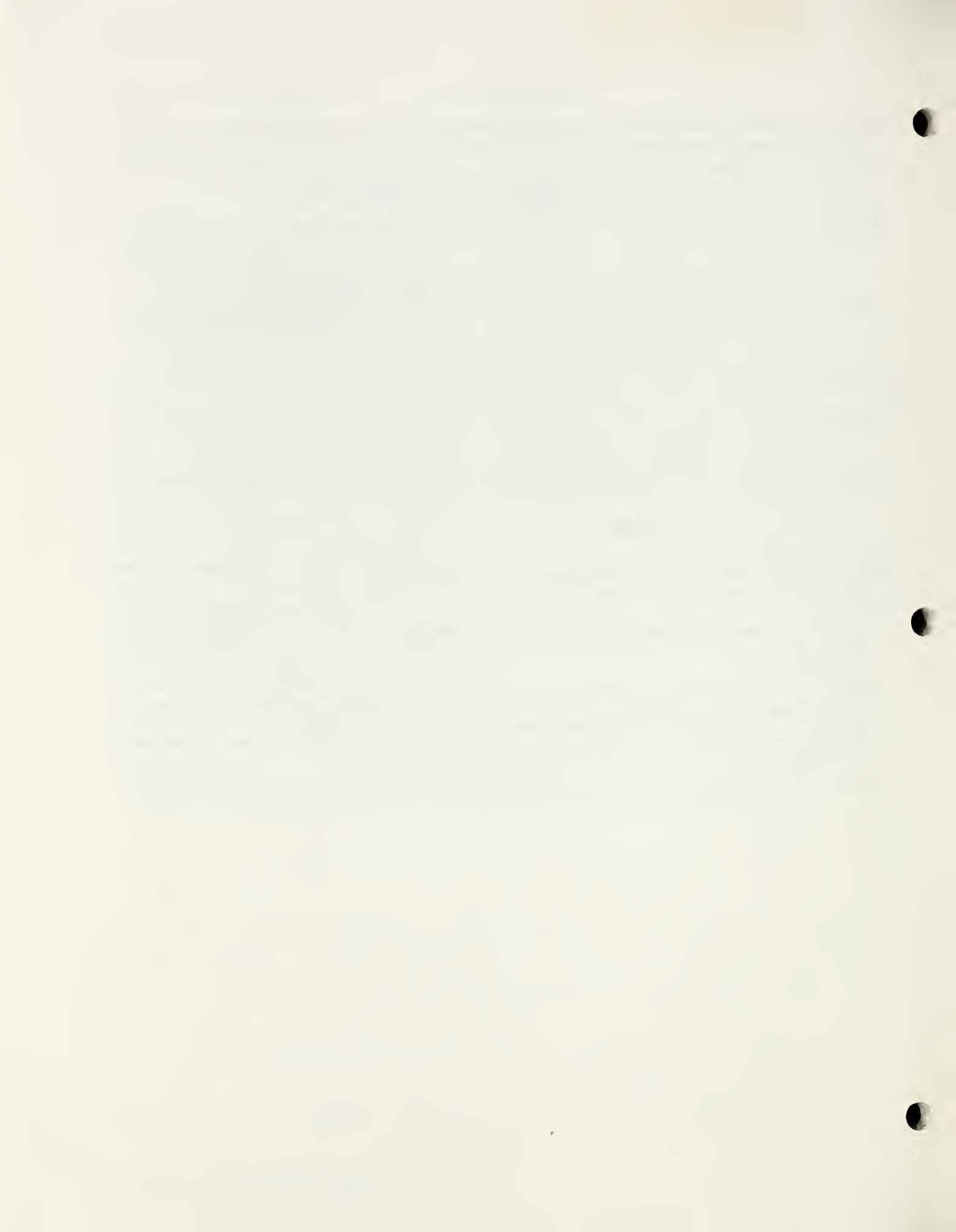
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