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The Development of Selected Data Base Applications for the Crustal Dynamics Data Information System

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ABSTRACT

This document describes the development of a data base and its accompanying software for the Data Information System (DIS) of the National Aeronautics and Space Administration's (NASA) Crustal Dynamics Project. Background information concerning this project, and a definition of the techniques used in the implementation of an operational data base, are presented. Examples of key applications are included and interpreted.

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ILLUSTRATIONS

ACRONYMS

DBMS	Data Base Management System
DIS	Data Information System
GSFC	Goddard Space Flight Center
HLI	Host Language Interface
IAF	Interactive Applications Facility
IAG	Interactive Application Facility
IAP	Interactive Applications Generator
JPL	Jet Propulsion Laboratory
LSG	Laser Support Group
MC	minimum code
MOBLAS	mobile laser systems
NASA	National Aeronautics and Space Administration
NGS	National Geodetic Survey
RSI	Relational Software, Inc.
SAO	Smithsonian Astrophysical Observatory
SQL	structured query language
TLRS	transportable laser ranging systems
VLBI	very long baseline interferometry

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1. INTRODUCTION

This Technical Memorandum represents an outline of the development of a data base and its accompanying software for the Data Information System (DIS) of the National Aeronautics and Space Administration's (NASA) Crustal Dynamics Project. Background information concerning this project, as well as a definition of the techniques used in the implementation of an operational data base, is also presented. Examples of key applications are included and interpreted.

2. BACKGROUND

2.1 PROJECT OVERVIEW

The Crustal Dynamics Project was formed by NASA in 1976 to study Earth dynamics. This function is accomplished by employing space technology to determine the motion of the Earth's outer crust and the variations in the rotation rate and position of its polar axis. By studying these phenomena, the project hopes to aid in research involving earthquake prediction and hazard reduction. The project supports this investigation program in global geodynamics on a national and international level of research. The Crustal Dynamics Project is responsible for collecting and organizing the space measurements used in this research, analyzing these data, and aiding in the interpretations of these analyses in reference to crustal movement.

2.2 SCIENTIFIC OBJECTIVES

The Earth's outer crust is composed of 12 large "tectonic" plates. These plates move relative to one another (on a several centimeter per year basis) and, as a result, earthquakes occur near the plate boundaries--the area of movement. The Crustal Dynamics Project hopes to aid in the determination of the forces that propel these plates and how the plates deform as a result of this motion. Figure 1 illustrates the plate boundaries of the Earth's crust.

The five main scientific objectives of the Crustal Dynamics Project are to improve the understanding of the following phenomena:

a. Regional deformation and strain accumulation related to earthquakes at the plate boundary in the western United States.

b. Contemporary relative plate tectonic motions of the North American, Pacific, Nazca, South American, Eurasian, and Australian plates.

c. Internal deformation of the continental and oceanic lithospheric plates with particular emphasis on North America and the Pacific.

d. Rotational dynamics of the Earth and its possible correlation to earthquakes, plate motions, and other geophysical phenomena.

e. Motions and deformation occurring in regions of high earthquake activity.

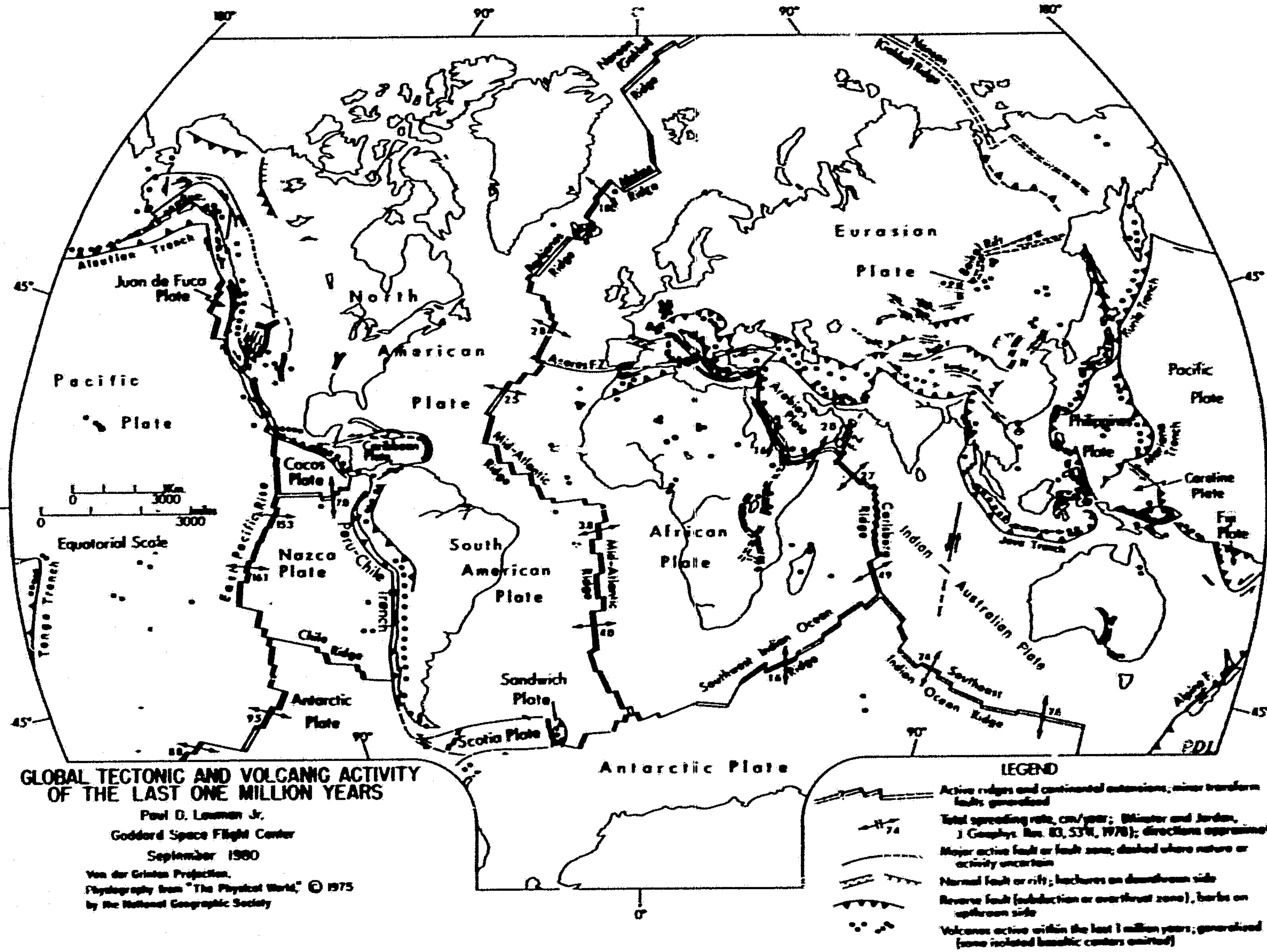

Figure 1. Plate Boundaries of the Earth

By using the more precise measurements gained from the use of space technology, the necessary information concerning plate motion is expected to be obtained.

2.3 SCIENTIFIC TECHNIQUES

A major tool in the study of plate motion is the determination of a distance measurement, or "baseline," between a point located on one plate to another point on a different plate. The project plans to implement a network of 50 to 60 such locations (at least three sites located on each plate) for these baseline determinations. There are two major space technologies employed by the project for baseline calculation: laser ranging techniques, and very long baseline interferometry (VLBI).

Laser ranging requires a high altitude satellite (either an artificial satellite, such as the spherical, reflector-covered, 60 centimeters in diameter Lageos satellite, or the Moon, equipped with reflectors placed by American and Russian lunar missions) to reflect a laser beam off of in a manner similar to radar. A laser pulse is fired to the satellite from a stationary laser site and the time delay of the reflected beam back to the station is measured. Thus, the distance from station to satellite is determined. Figure 2 presents a pictorial view of the process. When several stations perform a series of these measurements over a period of 3 to 4 weeks, the precision orbit of the satellite can be calculated. Through a complex sequence of mathematical calculations, the three-dimensional Earth coordinates of the participating laser stations are determined relative to the calculated orbit of the satellite. As a result, the baseline length between any two of these stations can be calculated to a precision of better than 5 centimeters. Thus this method of distance determination is much more accurate than a ground-based, survey-type measurement.

Currently, the Crustal Dynamics Project makes use of six fixed laser stations, eight mobile laser systems (MOBLAS units), and two highly transportable laser ranging systems (TLRS units). The TLRS systems usually relocate on a monthly basis. The 10 non-fixed MOBLAS systems can be at many different stations in the United States, South America, Australia, Carribean, and the Pacific.

The second procedure employed by the project is the VLBI technique. Figure 3 shows this process. This method involves two separate radio antennas that simultaneously receive radio emissions from a distant quasar. Since the two antennas are focused on the same source, the signals received at each station are identical in "signature." This type of measurements session is performed over a 2- to 4-day time period. The recorded signals are processed through a correlator and the amount of delay necessary to bring the two signals into "time phase" is determined. The delay is dependent upon the quasar position relative to the two antennas (since the Earth is rotating as the signals are recorded). Thus, the delay is dependent upon the Vector S (which is constant in an inertial coordinate system for the particular radio source) and the Vector B (which is variant because of the motion of the sites, the Earth's rotation, and other processes). Since the ultimate result is to determine the baseline (B) vector, it can be solved for after the time delay is calculated.

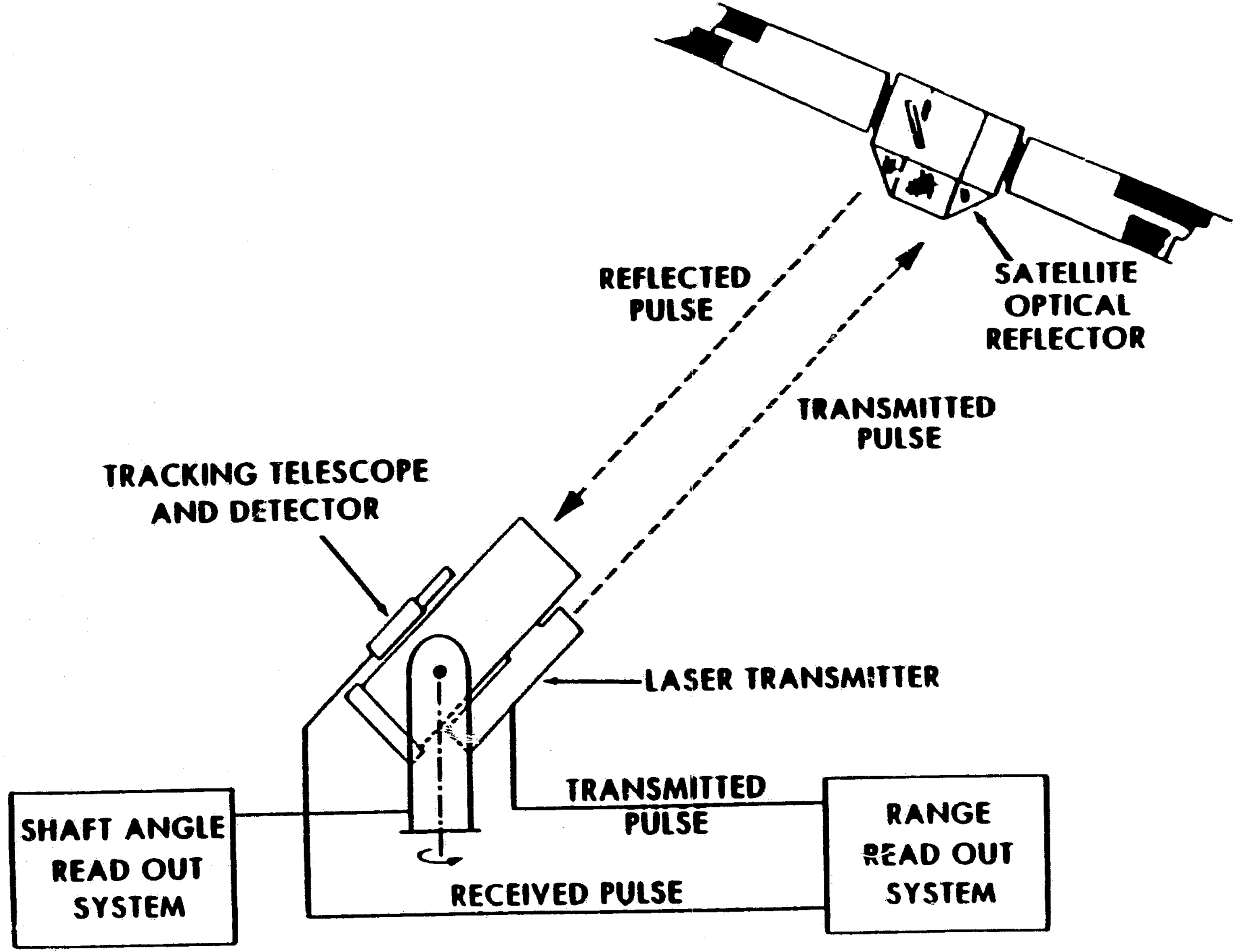

Figure 2. Satellite Laser Ranging Process

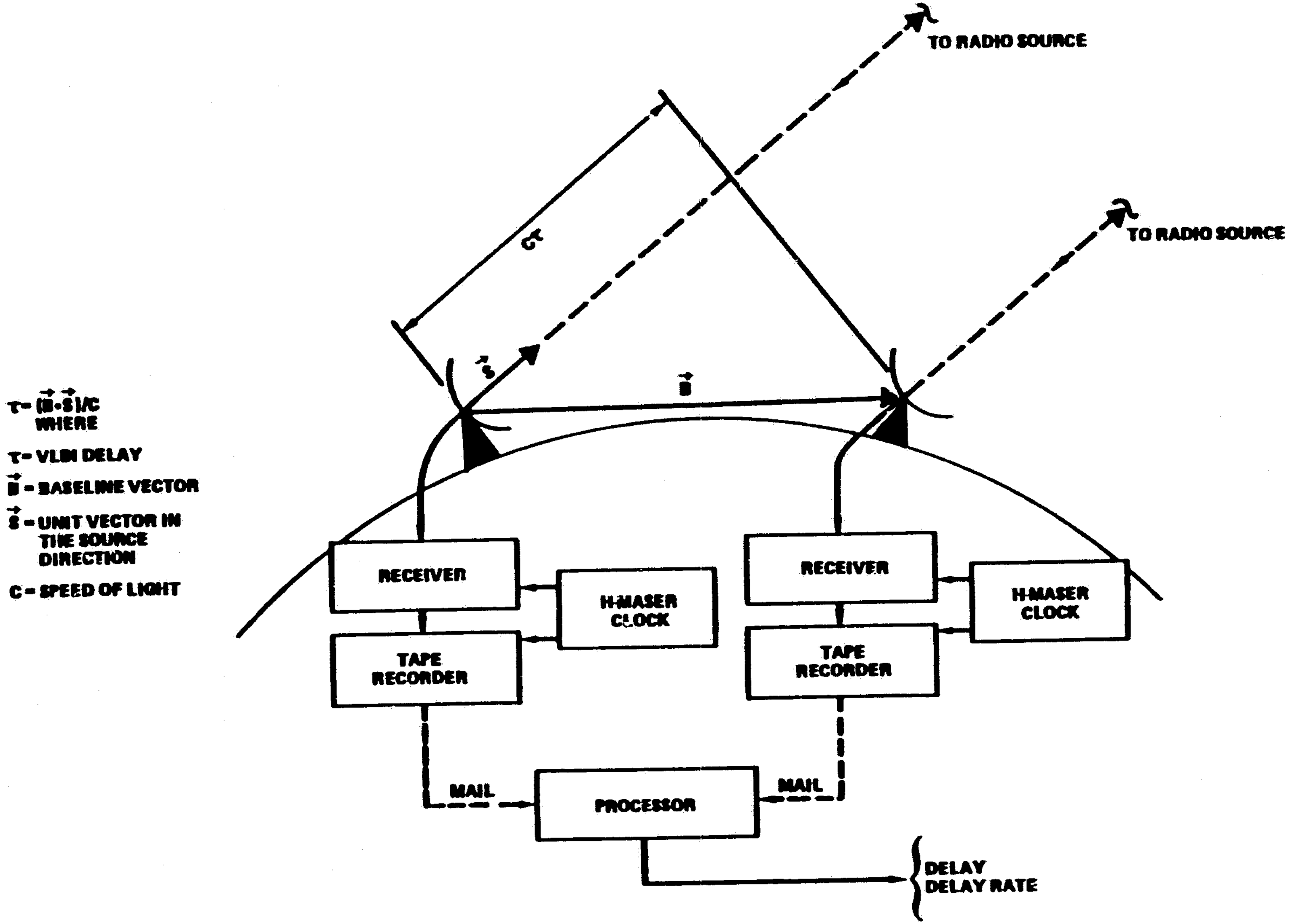

Figure 3. Very Long Baseline Interferometry Process

The project employs the end-to-end VLBI Mark-III system, which includes the electronics for acquiring and recording the data, the cross-correlator system and a data base handler.

Currently, the project uses several (nine) fixed VLBI Mark-III stations (with twelve available by 1984) as well as one transportable system (with two more available by 1982) that connects to a fixed antenna, and one mobile VLBI system developed by JPL (with two more available by 1982), equipped with the antenna and that can be located on any one of seven different sites.

Although the laser ranging technique does not require the simultaneous measurements for the determination of a baseline that the VLBI process does, it is affected by other phenomena. Weather conditions (e.g., cloud cover) prevent useful operation of the laser equipment. Another restriction on laser ranging is the visibility of the individual satellites. Lageos, for example, is accessible for less than an hour during each satellite pass with approximately two visible passes per day. Also, in order to calculate a proper model for the orbit of the satellite, several parameters (which often must be updated), such as the Earth's gravitational constant, are required. Conversely, VLBI measurements are affected by water vapor present in the atmosphere that does not deter laser operation.

The common element between the laser ranging and the VLBI techniques is the ability to make a more precise three-dimensional determination of the rate of change in position between two locations separated by several hundred or several thousand kilometers. In addition to the baseline measurements that result from the use of these space techniques, estimates on the changes in the rate of rotation of the Earth as well as the location of the pole of rotation can be determined. The fluctuations in the motion of the Earth's pole of rotation are due to mass shifts resulting from earthquakes, tides, and other phenomena.

2.4 CRUSTAL DYNAMICS DATA INFORMATION SYSTEM

2.4.1 General

Because of the large amount of data that has been and will be acquired by the Crustal Dynamics Project, there is a need for a centralized data bank. Presently, data are widely distributed between project personnel at Goddard, National Geodetic Survey (NGS), Jet Propulsion Laboratory (JPL), Smithsonian Astrophysical Observatory (SAO) and elsewhere. Since investigators located worldwide have been selected to participate in the project, the data acquired, as well as their analyses, must be readily available. Therefore, the DIS for the Crustal Dynamics Project has been formed with the intent of not only providing data in a useful form to project personnel and investigators, but also to act as an archive of these data for the lifetime of the project. Hence, after project termination, the DIS archive will be preserved and available for any follow-on projects, such as the envisioned National Geodetic Data Bank. The DIS will consist of a dedicated minicomputer system equipped with dial-up facilities and an on-line data base management system. The DIS will be located at the Goddard Space Flight Center (GSFC) and will be operational in September 1982.

2.4.2 Contents

The DIS will serve project personnel and investigators by providing the following items:

a. Catalogue of all acquired and available data

b. Ancillary data (site surveys, station coordinates, etc.)

c. Text data (user comments concerning data, etc.)

d. Archive of processed laser and VLBI data

e. Archive of analyzed laser and VLBI data

f. Newsletter and message exchanges

g. Laser and VLBI data requests

h. Project management data (scheduling of sites, etc.)

i. Graphics data

j. Intercomparisons of analyzed laser and VLBI data

Many of the foregoing items will be provided through a data base management system, while others will be displayed via specially designed computer software packages. The large archive of processed laser and VLBI data will be kept off-line on magnetic tape. Much of the VLBI data will continue to be provided through the already developed Mark-III VLBI data base handler that will be run on the DIS minicomputer.

2.4.3 User Interface

When a potential investigator wishes to examine or obtain information concerning project acquired data, he may gain access to the DIS through an alphanumeric terminal equipped with a modem and a dial-up telephone line. Following a successful sign-on procedure, the general description of the DIS is displayed and the user is prompted to make a selection of one of the 10 previously mentioned items for viewing the interrogation. His selection will determine the need for accessing the data base management system, a particular software package, or both. After proceeding through a series of these user-oriented menus, the investigator can obtain the desired information in an efficient and timely manner. If the particular data item cannot be displayed via the alphanumeric terminal (due to volume or nature of the data), or the user wishes a copy of his display, a data tape will be prepared and delivered from the user's order, which was placed in a particular file. This order will be annotated with ancillary data where appropriate, and a record of the order will be retained for inventory and update purposes.

2.4.4 Methods of Implementation

As stated previously, two major methods will be employed to perform the functions required by the DIS. The first method is a commercially available data base management system (DBMS). The major advantage of employing a commercial DBMS package is its flexibility, because such a system eliminates the need to continually develop software packages for display of data to the user community. For example, in order to allow the user to view the catalogue of available data for the Lageos satellite during a certain month and year, a program would have to be developed that would accept input parameters from the user and display the appropriate rows and columns. This is also true when the site coordinate information for a particular station is needed. However, by carefully and efficiently loading data into a data base management system, no programming effort is necessary to display data from the catalogue or for obtaining station coordinate information. Through the use of a series of commands, known as a query, any user has direct access to the data itself and does not need to be concerned about the computer program that handles the information for him. The user can include in the query input parameters that will specify how many rows are to be listed, and what columns are outputed. In other words, his display of data is not limited to the computer programmer's concept of the strict format for the output. The scientific user no longer has to rely on a team of computer programmers; he can get the information he requires not only in a desirable format, but also in a timely manner.

Although most of the data in the DIS can be obtained through the use of a data base management system, many current DBMS packages cannot handle the display of the text data as required by the project. Therefore, additional software packages have been developed to fulfill this need in the areas of analyzed data outputs and news exchanges among investigators. The archive of analyzed data can be viewed on a monthly or yearly basis through a user-interactive selection process. The news exchange and newsletter is displayed in a similar manner and news for eventual compilation can be contributed from the investigator via this software package.

3. RESEARCH AND DEVELOPMENT

3.1 GENERAL

When the need for a data base management system was presented, ORACLE, a product of Relational Software Inc., (RSI), was chosen from several candidate systems as a final testing model and has since proven to completely fulfill the requirements. The relational model transforms a normally complex data network (or "tree" structure found in the hierarchical and network DBMS's) into a relatively simple, easy-to-use, two-dimensional relation, or in more basic terms, a table. These tables consist of a series of columns. A row of the table is unique and is composed of the entries in the columns (not necessarily all). Thus, the relational system employs the data itself to establish relationships among data items rather than series of chain pointers as found in hierarchical and network systems. Due to the tabular nature of much of the different data sets in the DIS (i.e., data catalogues, ancillary data, order files, etc.), the relational system proved to be the most feasible method of managing these types of data.

In addition to the tabular structure, the relational model also offers increased flexibility in expanding individual tables as well as the data base itself without the need for the reloading of a particular table or the entire data base. With a network or hierarchical system, these additions are difficult to make due to the complex nature of the links in the data structure. In other words, additional columns can be appended to existing tables as needed, new tables may be created, and old tables in a relational DBMS may be deleted without the need to recreate or reconfigure the entire data base.

The typical relational data base management system also possesses an online, integrated data dictionary. On the user level, this feature can be thought of as a table of contents to the data base itself. The tables comprising the data dictionary are part of the relational system and are automatically updated as new relations are created or deleted and as old ones are modified by the users. In other words, all data managed by the DBMS must possess a definition in the data dictionary that can be ascertained by any valid user of the data base.

3.2 ORACLE DBMS

3.2.1 Query Language

ORACLE employs the English-like structured query language (SQL-2) for the query, manipulation, definition, and control of the data in the data base. This language was developed and extensively documented by IBM in 1976 for use in its own relational DBMS. Through the use of this language, the user may request data from a particular table under certain parameters, insert and delete data from tables, create new tables, and grant or revoke privileges to new users.

Two illustrations of typical SQL queries are presented in Figure 4. In the first example, a selection is made from the ORACLE table TABLE_COM, a relation composed of all tables created in this particular data base, annotated with comments about their contents. The two clauses 'SELECT *' and 'FROM TABLE_COM' instruct ORACLE to output data from all ('*') columns in the table TABLE_COM. The 'ORDER BY TABLE' clause specifies that the rows are to be displayed in alphabetical order according to those entries in the 'TABLE' column. In the second example, the 'SELECT *' and 'FROM COL' clauses requests all columns to be displayed from the ORACLE data dictionary table COL. The additional 'WHERE TABLE = 'OCCUPANCY'' clause specifies that only those rows in COL that have entries in the TABLE column equal to 'OCCUPANCY' should be outputed.

In the first example, since no WHERE clause accompanied the query block, all rows were listed; however, by using the WHERE clause in the second example, only the few rows possessing the restriction will be returned. In other words, a typical SQL query block consists of two or more statements: a SELECT clause listing column names to be returned, a FROM clause listing the table(s) involved in the query, and other optional clauses, such as a WHERE clause specifying any criteria (i.e., <, >, =, etc.) to select rows from the table. Thus, the SQL query language is relatively easy to master, yielding results in a meaningful manner.

```
SQL>#COMMENT
COM>
COM>***     DISPLAY A LISTING OF ALL TABLES IN THE DATA BASE
COM>
COM>#
SQL>SELECT *
SQL>FROM TABLE_COM
SQL>ORDER BY TABLE;
SQL>/

TABLE            DESCRIPTION
---------------  -------------------------------------------------------------------------------
ACTION           INDEX OF ALL ACTION ITEMS ASSIGNED TO PROJECT PERSONNEL
AP_LIBRARY       INDEX OF PUBLISHED PAPERS BY PERSONNEL IN THE APPLICATIONS DIRECTORATE
BASELINE_76      BASELINE DATA RECEIVED FROM LSG FOR 1976
BASELINE_77      BASELINE DATA RECEIVED FROM LSG FOR 1977
BASELINE_78      BASELINE DATA RECEIVED FROM LSG FOR 1978
BASELINE_79      BASELINE DATA RECEIVED FROM LSG FOR 1979
BASELINE_80      BASELINE DATA RECEIVED FROM LSG FOR 1980
CALIBRATION      CALIBRATION INFORMATION FOR EACH SYSTEM OCCUPATION EXTRACTED FROM SURVEY SHEETS
CD_LIBRARY       INDEX OF PUBLISHED PAPERS BY CRUSTAL DYNAMICS PROJECT PERSONNEL
COORDINATES      STATION COORDINATE INFORMATION COMPILED FROM SITE SURVEY SHEETS
DATA_COM         CODE REFERENCED IN DATA CATALOGUE VERSUS COMMENTS CONCERNING VALIDITY OF DATA
FILE_INFO        FILE INFORMATION FOR EACH TAPE IN DIS ARCHIVE
LAGEOS_76        LAGEOS LASER DATA CATALOGUE FOR 1976
LAGEOS_77        LAGEOS LASER DATA CATALOGUE FOR 1977
LAGEOS_78        LAGEOS LASER DATA CATALOGUE FOR 1978
LAGEOS_79        LAGEOS LASER DATA CATALOGUE FOR 1979
LAGEOS_80        LAGEOS LASER DATA CATALOGUE FOR 1980
LUNARN_T1        LUNAR LASER CATALOGUE OF NORMAL POINT DATA FOR 1969 THROUGH 1975
LUNARN_T2        LUNAR LASER CATALOGUE OF NORMAL POINT DATA FOR 1976 THROUGH 1981
LUNARZ_T1        LUNAR LASER CATALOGUE OF ANCILLARY DATA FOR 1976 THROUGH 1975
LUNARZ_T2        LUNAR LASER CATALOGUE OF ANCILLARY DATA FOR 1976 THROUGH 1981
MAPS             INDEX OF MAPS AVAILABLE TO THE CRUSTAL DYNAMICS PROJECT
OCCUPANCY        LISTING OF STATIONS AND THEIR SUCCESSIVE OCCUPYING SYSTEMS
PMOTION_76       POLAR MOTION DATA RECEIVED FROM LSG FOR 1976
PMOTION_77       POLAR MOTION DATA RECEIVED FROM LSG FOR 1977
PMOTION_78       POLAR MOTION DATA RECEIVED FROM LSG FOR 1978
PMOTION_79       POLAR MOTION DATA RECEIVED FROM LSG FOR 1979
PMOTION_80       POLAR MOTION DATA RECEIVED FROM LSG FOR 1980
STATIONS         STATION NUMBERS VERSUS STATION LOCATIONS
SUMMARY_76       MONTHLY SUMMARY INFORMATION COMPILED FROM LAGEOS_76
SUMMARY_77       MONTHLY SUMMARY INFORMATION COMPILED FROM LAGEOS_77
SUMMARY_78       MONTHLY SUMMARY INFORMATION COMPILED FROM LAGEOS_78
SUMMARY_79       MONTHLY SUMMARY INFORMATION COMPILED FROM LAGEOS_79
SUMMARY_80       MONTHLY SUMMARY INFORMATION COMPILED FROM LAGEOS_80
TAPE_INFO        CATALOGUE OF TAPES IN DIS ARCHIVE

35 RECORDS SELECTED.

SQL>#COMMENT
COM>
COM>***     DISPLAY A LISTING OF THE COLUMNS IN THE OCCUPANCY TABLE
COM>
COM>#
SQL>SELECT *
SQL>FROM COL
SQL>WHERE TABLE='OCCUPANCY';
SQL>/

TABLE                           COLUMN
------------------------------  ------------------------------
OCCUPANCY                       STATION
OCCUPANCY                       NAME
OCCUPANCY                       SYSTEM
OCCUPANCY                       S_DATE
OCCUPANCY                       E_DATE
```

Figure 4. Examples of SQL Queries

3.2.2 Operations

ORACLE offers four major operations for displaying data from specified tables. The first is a permutation or reordering of all the columns of a particular table. Columns are normally ordered in the manner in which the table was originally created and expanded. The second operation is a projection or selection of a subset of columns from the table. Often, all columns in a table are not needed for a particular application, so extraneous ones need not be specified. The third operation is a joining of two or more relations with the one or more columns that they have in common (i.e., these columns contain identical data elements). This join function is a powerful tool for data manipulation and it eliminates much of the redundant storage that can occur. Figure 5 depicts the joining of the LAGEOS_78 table and the STATIONS table in order to annotate the station number (in the LAGEOS_78 table) with its location (from the STATIONS table). The clause 'WHERE LAGEOS_78.STATION-STATIONS.NUMBER' instructs ORACLE that these two columns contain identical information and are to be equated. The last type of operation is called a composition. This is identical to the join but the common domains are not specified for display in the query. If the STATION column of Figure 5 were not specified in the SELECT clause, the query would then be termed a composition. The fields referenced in both the join and composition operations should be imaged (indexed) to allow for a faster query response.

3.2.3 Utilities

ORACLE offers several useful utilities for ease in display and input of data. These utilities can be used by personnel with a good knowledge of ORACLE to aid others who do not possess such training. An example of one such utility is the Interactive Applications Facility (IAF). This feature allows a user to enter, retrieve, or modify data base tables via a screen display. The display may consist of several screen pages. These pages can be enhanced with text data for readability and instructional purposes. Through the use of the terminal keypad (available on DEC VT100 and VT52 terminals), the user may view or enter data without knowledge of the SQL query language. Screen pages can be designed to reflect the formats of input documents to facilitate the entry procedure by a data clerk.

A second ORACLE utility is the Report Writer and Text Formatter. This feature allows personnel to use the data base information (through SQL queries imbedded in a set of instructions) to construct formatted reports. These reports can be enhanced with text information, tabular and columnar headings, summary information, et cetera, not easily acquired from a simple query in the SQL mode.

A third ORACLE utility is the Host Language Interface (HLI). Here, SQL is used as a sub-language in a host programming language, such as FORTRAN, COBOL, Language C, PL/1, or Assembly language. This interface is accomplished through a series of program calls that allow the user to make any valid SQL query. The HLI programs employ these program calls to log on to the ORACLE data base, open buffer areas to accept information from the SQL calls to the data base tables, make and execute SQL calls, obtain descriptions of the

ORIGINAL PAGE IS OF POOR QUALITY

```
SQL>#COMMENT
COM>
COM>***      QUERY AND DISPLAY THE JOINING OF THE LAGEOS_78 TABLE WITH THE
COM>         STATIONS TABLE
COM>
COM>#
SQL>SELECT STATION,LOCATION,S_DATE,NUM_OBS
SQL>FROM LAGEOS_78,STATIONS
SQL>WHERE (LAGEOS_78.STATION=STATIONS.NUMBER)
SQL>  AND (S_DATE >= 780210 AND S_DATE <= 780220);
SQL>/

                                                   S_DATE    NUM_OBS
   STATION LOCATION
---------- ------------------------------------ ---------- ----------
      9921 MT. HOPKINS, ARIZONA                     780210        212
      9921 MT. HOPKINS, ARIZONA                     780210        104
      9943 ORRORAL, AUSTRALIA                       780211         75
      9907 AREQUIPA, PERU                           780212         10
      7084 OWENS VALLEY, CALIFORNIA                 780214        646
      7084 OWENS VALLEY, CALIFORNIA                 780214         14
      7084 OWENS VALLEY, CALIFORNIA                 780215        162
      7084 OWENS VALLEY, CALIFORNIA                 780216       1008
      7084 OWENS VALLEY, CALIFORNIA                 780216        238
      7084 OWENS VALLEY, CALIFORNIA                 780216        205
      9921 MT. HOPKINS, ARIZONA                     780216         13
      9929 NATAL, BRAZIL                            780216        110
      9921 MT. HOPKINS, ARIZONA                     780217         92
      9921 MT. HOPKINS, ARIZONA                     780217         40
      7091 HAYSTACK OB., MASS.                      780218         22
      9921 MT. HOPKINS, ARIZONA                     780218         43
      9921 MT. HOPKINS, ARIZONA                     780218         12
      9921 MT. HOPKINS, ARIZONA                     780218         59
      9921 MT. HOPKINS, ARIZONA                     780219        121
      9943 ORRORAL, AUSTRALIA                       780219         45
      9921 MT. HOPKINS, ARIZONA                     780220        165
      9921 MT. HOPKINS, ARIZONA                     780220         46

 22 RECORDS SELECTED.
```

Figure 5. Example of the Joining of Two Tables

fields and "bind" them from SQL statements to program variables, fetch appropriate rows after a successful SQL call, and close the buffer area and log off the ORACLE data base.

Examples of uses for each of these utilities in DIS applications follow.

4. IMPLEMENTATION

4.1 DBMS APPLICATIONS

4.1.1 General

As discussed earlier, many of the different categories to be managed by the DIS can be handled efficiently through the use of a data base management system such as ORACLE. These categories include the data catalogues, both laser and VLBI, project management data, for the use of scheduling and performance evaluation, and ancillary data concerning information about both laser and VLBI sites and systems. Examples of each of these items follow. Since the majority of the preliminary work on the DIS was conducted using data available from laser measurements, the examples will indicate applications in this area.

4.1.2 Data Catalogues

The data catalogues available in the DIS give the investigator a listing of the available laser data for each satellite used by the project. From these catalogues, an investigator can select data to be ordered that will be most useful to his particular application. For example, the laser data catalogues for the Lageos satellite are organized on a one catalogue per year basis. Because of the simple tabular format of the existing catalogues, they may be easily inputed to the ORACLE data base. Through a host language interface program each yearly catalogue was loaded into a table in the data base. For example, the Lageos catalogue for 1979 is contained in the table LAGEOS_79, and is composed of the columns presented in Figure 6. The CODE column contains a one or two character code, in reference to the quality of the data, which can be referenced in the table DATA_COM (or the tables may be joined). This column is initialized to 'A' (for 'No comments received at this time concerning this data') when the catalogue is loaded. As scientists and investigators use the data, or as new versions of the data are issued, they can inform the data manager about its quality and the code can be reset to reflect this update. In other words, the data presented in the catalogue are expected to be useful, until information returns from investigators stating otherwise. A sample query to the data catalogue (for Lageos in 1979) is presented in Figure 7. A query to the DATA_COM table is also presented to illustrate the data quality flag feature.

After an investigator views the results of a query, such as the one presented in Figure 7, he may decide to order selected passes from the list. He may do this in one of two ways. The first method is to use another SQL query that will insert lines into an order-file table (ORDER_FILE) also present in the data base. A listing of the columns in the table, as well as a sample query for insertion are presented in Figures 8 and 9. In order to ensure that the

LAGEOS_79 TABLE

STATION*	S_DATE*	S_TIME	S_SEC	E_DATE*	E_TIME	E_SEC	NUM_OBS*	SAT_NO	CODE*	TAPE_NO*	FILE_NO
NUMBER	NUMBER	NUMBER	CHAR(7)	NUMBER	NUMBER	CHAR(7)	NUMBER	NUMBER	CHAR(4)	CHAR(8)	NUMBER

COLUMN	DESCRIPTION
STATION	FOUR-DIGIT STATION NUMBER
S_DATE	START DATE OF LASER OBSERVATION (YYMMDD)
S_TIME	START TIME OF OBSERVATION (HHMM)
S_SEC	STARTING SECONDS OF OBSERVATION (TEN THOUSANDTHS OF A SECOND)
E_DATE	END DATE OF LASER OBSERVATION (YYMMDD)
E_TIME	END TIME OF OBSERVATION (HHMM)
E_SEC	ENDING SECONDS OF OBSERVATION (TEN THOUSANDTHS OF A SECOND)
NUM_OBS	NUMBER OF LASER POINTS RECEIVED DURING OBSERVING SESSION
SAT_NO	SATELLITE IDENTIFICATION NUMBER (7603901 FOR LAGEOS)
CODE	DATA QUALITY CODE (EXPLANATION IN DATA COM TABLE)
TAPE_NO	TAPE IDENTIFICATION NUMBER OF ACTUAL LASER DATA
FILE_NO	FILE NUMBER ON TAPE OF DATA

*INDICATES INDEXED (OR IMAGED) FIELDS

Figure 6. Format of the Table Containing the Lageos Data Catalogue

```
SQL>#COMMENT
COM>
COM>***     QUERY AND DISPLAY A SELECTION FROM THE 1979 LAGEOS LASER
COM>        CATALOGUE
COM>
COM>#
SQL>SELECT STATION,S_DATE,S_TIME,S_SEC,NUM_OBS,CODE
SQL>FROM LAGEOS_79
SQL>WHERE [S_DATE >= 791001 AND S_DATE <= 791005]
SQL>  AND NUM_OBS >= 100;
SQL>/

   STATION      S_DATE       S_TIME S_SEC       NUM_OBS CODE
---------- ---------- ---------- ------- ---------- ----
      7086     791001       1057 44.0310       1170 A
      7091     791003        149 16.0280        440 B
      7114     791003        511 39.0294        592 A
      7114     791003       1150 20.0293       1340 A
      7063     791004        655 56.0371        675 B
      7063     791004       1030 22.0303        276 B
      7091     791004        654 46.0320       1542 B
      7091     791004       1032 12.0303        985 B
      7096     791004        458 29.0250        550 2
      7102     791004       1038 19.0293        540 A
      7114     791005       1244 40.0260        432 A

11 RECORDS SELECTED.

SQL>#COMMENT
COM>
COM>***     QUERY AND DISPLAY THE CODE DEFINITIONS FROM THE DATA SELECTION
COM>
COM>#
SQL>SELECT CODE,COMMENT1
SQL>FROM DATA_COM
SQL>WHERE CODE =
SQL>          SELECT UNIQUE CODE
SQL>          FROM LAGEOS_79
SQL>          WHERE [S_DATE >= 791001 AND S_DATE <= 791005]
SQL>            AND NUM_OBS >= 100;
SQL>/

CODE COMMENT1
---- ---------------------------------------------------
A    NO COMMENTS RECEIVED AT THIS TIME CONCERNING DATA
B    DATA CONSIDERED ACCEPTABLE
2    RANGE-DEPENDENT BIAS ON JUNE THRU NOV. 1979
```

Figure 7. Query to the Lageos Data Catalogue

ORDER_FILE TABLE

TAPE_NO *	FILE_NO *	TABLE	STATION *	S_DATE *	S_TIME	NUM_OBS	USER_ID
CHAR(8)	NUMBER	CHAR(15)	NUMBER	NUMBER	NUMBER	NUMBER	CHAR(6)

COLUMN	DESCRIPTION
TAPE_NO	TAPE IDENTIFICATION OF ORDERED DATA
FILE_NO	FILE NUMBER ON TAPE OF ORDERED DATA
TABLE	TABLE NAME (CATALOGUE) WHICH DATA WAS CHOSEN FROM
STATION	STATION NUMBER WHICH GATHERED CHOSEN DATA
S_DATE	START DATE OF SELECTED OBSERVATION
S_TIME	STARTING TIME OF SELECTED OBSERVATION
NUM_OBS	NUMBER OF DATA POINTS FOR SELECTED OBSERVING SESSION
USER_ID	SIX-CHARACTER USER IDENTIFING CODE

*INDICIATES INDEXED (OR IMAGED) FIELDS

Figure 8. Format of the Order File Table for the Lageos Data Catalogue

correct passes are chosen from the proper data tape when fulfilling the order, the station, and start date and time, as well as the table name (i.e., satellite and year) and tape and file numbers, are necessary information to be stored in the ORDER_FILE relation. The user's identification code is used for accounting, shipping, and archiving purposes.

The second method for ordering data does not involve a user's direct queries to the table through the SQL mode. By invoking the host language interface program DATALOOK, the investigator can view selected records from the data catalogue with his own input parameters and order specific passes from this display. The user is prompted to submit the satellite, year, start and end dates, and a minimum number of observations. After viewing the records pertaining to these parameters (twenty lines at a time), the user is then prompted to select specific passes for an order (if he so desires). This entire process, both retrieval and insertion of data into the ORDER_FILE table, is performed through the DATALOOK program thus the investigator has no need to possess a knowledge of the SQL language to query the data base. An example of the DATALOOK process is illustrated in Figure 10.

The data catalogues in the ORACLE data base serve a second useful purpose in that they can be employed to create monthly summary information for each year of data present in the DIS. For the laser catalogues reflecting data from the Lageos satellite, this summary information is calculated on a monthly basis for each catalogue table in the data base. Figure 11 illustrates the format of a typical yearly summary table. An example of a query to the LAGEOS_79 summary table (SUMMARY_79), as well as a typical query to insert a record into the table, are shown in Figures 12 and 13. A second use for these tables is presented in the next section.

```
SQL>#COMMENT
COM>
COM>***     DISPLAY THE INSERTION OF ITEMS INTO THE ORDER FILE FOR DATA IN THE
COM>        1979 LAGEOS LASER DATA CATALOGUE
COM>
COM>
COM>#
SQL>INSERT  INTO ORDER_FILE(TAPE_NO,FILE_NO,STATION,S_DATE,S_TIME,NUM_OBS):
SQL>        SELECT TAPE_NO,FILE_NO,STATION,S_DATE,S_TIME,NUM_OBS
SQL>        FROM LAGEOS_79
SQL>        WHERE (S_DATE >= 791102 AND S_DATE <= 791107)
SQL>          AND NUM_OBS >= 500;
SQL>/
8 RECORDS CREATED.

SQL>UPDATE ORDER_FILE
SQL>SET TABLE='LAGEOS_79' WHERE TABLE=NULL;
SQL>/
8 RECORDS UPDATED.

SQL>UPDATE ORDER_FILE
SQL>SET USER_ID='CEN123' WHERE USER_ID=NULL;
SQL>/
8 RECORDS UPDATED.
```

Figure 9. Insertion Procedure for the Lageos Order File

```
ENTER USER ID USING FORMAT ______ :  CCH123

ENTER SATELLITE NAME:  LAGEOS

ENTER YEAR TO BE VIEWED USING FORMAT YY:  79

ENTER FIRST DATE USING FORMAT YYMMDD:  791102
ENTER SECOND DATE USING FORMAT YYMMDD:  791107

ENTER MINIMUM NUMBER OF OBSERVATIONS DESIRED:    10
```

LINE	SATELLITE	STATION	DATE	NUM. OBS.
1	7603901	7114	791102	381
2	7603901	7096	791102	216
3	7603901	7086	791102	31
4	7603901	7907	791102	106
5	7603901	7096	791102	169
6	7603901	7096	791103	82
7	7603901	7091	791105	710
8	7603901	7115	791105	1114
9	7603901	7096	791105	44
10	7603901	7115	791105	166
11	7603901	7091	791105	1412
12	7603901	7086	791105	385
13	7603901	7115	791105	1249
14	7603901	7091	791105	893
15	7603901	7063	791105	44
16	7603901	7091	791106	1524
17	7603901	7091	791106	1193
18	7603901	7063	791106	97
19	7603901	7907	791106	27
20	7603901	7086	791106	318

```
ENTER DESIRED LINE NUMBERS, "0" WHEN ORDER IS COMPLETE FOR THIS SET
ENTER LINE NUMBER:    1
ENTER LINE NUMBER:    7
ENTER LINE NUMBER:    8
ENTER LINE NUMBER:   11
ENTER LINE NUMBER:   13
ENTER LINE NUMBER:   16
ENTER LINE NUMBER:    0
```

LINE	SATELLITE	STATION	DATE	NUM. OBS.
21	7603901	7114	791106	43
22	7603901	7907	791107	90
23	7603901	7063	791107	68
24	7603901	7063	791107	128

```
ENTER DESIRED LINE NUMBERS, "0" WHEN ORDER IS COMPLETE FOR THIS SET
ENTER LINE NUMBER:   24
ENTER LINE NUMBER:    0
```

Figure 10. Browsing and Selection Procedure for Data in the Lageos Data Catalogue Through the DATALOOK Process

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SUMMARY_80 TABLE

STATION*	PASSES*	POINTS*	MO*	PC*	MC*
NUMBER	NUMBER	NUMBER	CHAR(2)	CHAR(2)	CHAR(2)

COLUMN	DESCRIPTION
STATION	FOUR-DIGIT STATION NUMBER
PASSES	NUMBER OF OBSERVED SATELLITE PASSES DURING MONTH (NUMBER OF OCCURANCES OF STATION NUMBER IN CATALOGUE FOR THE PARTICULAR MONTH)
POINTS	NUMBER OF LASER DATA POINTS RECEIVED DURING MONTH (SUM OF THE NUMBER OF OBSERVATIONS FOR A STATION IN CATALOGUE FOR THE PARTICULAR MONTH)
MO	MONTH OF STATION OPERATION (MM)
PC	PLATE CODE OF STATION (i.e. 'NA' ⇒ NORTH AMERICA)
MC	MINIMUM CODE CORRESPONDING TO NUMBER OF POINTS RECEIVED FOR PARTICULAR MONTH (i.e. 'L' ⇒ LESS THAN NUMBER REQUIRED, 'G' ⇒ SUFFICIENT NUMBER OF POINTS OBTAINED FOR MONTH)

*INDICATES INDEXED (OR IMAGED) FIELDS

Figure 11. Format of the Table Containing the Summary Information for the Lageos Data Catalogue

```
SQL>#COMMENT
COM>
COM>***      QUERY AND DISPLAY INFORMATION IN THE 1979 LAGEOS SUMMARY TABLE
COM>
COM>#
SQL>SELECT *
SQL>FROM SUMMARY_79
SQL>WHERE MO='01' OR MO='02';
SQL>/
```

STATION	PASSES	POINTS	MO	PC	MC
7062	3	196	01	PC	L
7063	1	29	01	NA	L
7833	2	59	01	EU	L
7907	10	268	01	SA	L
7921	5	80	01	NA	L
7929	6	138	01	SA	L
7943	16	1215	01	AU	C
7062	10	2480	02	PC	C
7063	8	1741	02	NA	C
7101	3	469	02	NA	L
7103	3	226	02	NA	L
7104	1	698	02	NA	L
7834	3	662	02	EU	C
7907	18	602	02	SA	C
7921	8	137	02	NA	L
7929	7	252	02	SA	L
7943	24	3597	02	AU	C

17 RECORDS SELECTED.

Figure 12. Query to the Lageos Summary Table

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```
SQL>#COMMENT
COM>
COM>***     DISPLAY THE INSERTION OF ITEMS INTO THE 1979 CATALOGUE SUMMARY
COM>        TABLE FOR SEPTEMBER
COM>
COM>#
SQL>INSERT INTO SUMMARY_79(STATION,PASSES,POINTS):
SQL>        SELECT STATION,COUNT(STATION),SUM(NUM_OBS)
SQL>        FROM LAGEOS_79
SQL>        WHERE [S_DATE >= 790901 AND S_DATE <= 790930]
SQL>        GROUP BY STATION;
SQL>/
9 RECORDS CREATED.

SQL>UPDATE SUMMARY_79
SQL>SET MO='09'
SQL>WHERE MO=NULL;
SQL>/
9 RECORDS UPDATED.

SQL>SELECT STATION,PASSES,POINTS,MO
SQL>FROM SUMMARY_79
SQL>WHERE MO='09';
SQL>/

   STATION     PASSES     POINTS MO
---------- ---------- ---------- --
      7063         24      10477 09
      7069          2        171 09
      7086          1       1061 09
      7091         16       7990 09
      7096          2        986 09
      7114         22       9293 09
      7115          1          9 09
      7907         22        905 09
      7943          5        350 09

9 RECORDS SELECTED.
```

Figure 13. Insertion Procedure for Lageos Summary Table

These laser catalogues for 1976 through 1980 for the Lageos satellite were inputed on a yearly basis and their respective summary tables were created after the tables were loaded and interrogated to ensure validity. The catalogues for 1981 and later years will be inputed each month and records will be inserted into the appropriate summary information table. Since the Lageos satellite is the prime target for the laser stations employed by the project, it was necessary to store these catalogues in yearly increments. However, other satellites (e.g., Starlette, BE-C, and GEOS-3) do not collect as much data, and thus their catalogues can span greater time intervals. This is also true of data acquired from the lunar laser observations.

When data are to be requested from the data base for examination, it is often necessary to gather ancillary information, e.g., station coordinates, site calibrations, et cetera, in order to carry out the appropriate computations using the data. Figure 14 illustrates a query to the tables COORDINATES and CALIBRATION to gather this information for the results presented in Figure 7. This information was inputed into the system from survey sheets completed after a new laser system occupies a particular station. Although the station coordinates do not change, the calibration information must be ascertained each time a particular MOBLAS or TLRS system occupies a new site.

4.1.3 Project Evaluation Information

4.1.3.1 Baseline Results. An important function of the project is to evaluate and present information on past performance, as well as information on future scheduling of laser and VLBI sites and systems. Although many investigators may be satisfied with the knowledge of what data are available (i.e., by interrogating the data catalogues), others may be interested in viewing data availability on an "end product" level. In other words, gathering data from an analyzed point of view--determining what data can and should be used to extract a final, analyzed measurement. This would be a logical step to be performed prior to querying the data catalogues. For example, an investigator may wish to know what Lageos laser data are available to determine a baseline between two specific plates, or stations, during a particular time interval. Since the baselines from laser measurements are (or can be) calculated on a monthly basis, the data base summary tables would indicate what data are available to determine a baseline between stations. Thus, the question can be answered through a query to the data base. An example of such a query is shown in Figure 15. This query uses the ORACLE operation of a "self-join" in which one table is "divided" into two tables and a join is performed using the MO, or month column. In other words, the information that these two "tables" share is contained in the MO domain; the 2 months must be the same in order to establish a baseline.

However, not all of the prospective baselines listed here can be calculated. Due to the data requirements of much of the software that performs the data reduction, orbit determination, and final baseline calculations, a minimum number of points (values that are dependent upon the laser system pulse rates) is required for a month. This minimum number depends on the type of laser system being used at the station; i.e., whether it is an SAO, GSFC, or TLRS system, and during what time period the measurement was performed, since the systems have been upgraded over the years. More precisely, at the present

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```
SQL>#COMMENT
COM>
COM>***     DISPLAY THE STATION COORDINATES AND SYSTEM CALIBRATION INFORMATION FOR
COM>        THE DATA SELECTION
COM>
COM>#
SQL>SELECT STATION,LOCATION,LATITUDE,LONGITUDE,S_DATE
SQL>FROM COORDINATES
SQL>WHERE STATION =
SQL>        SELECT UNIQUE STATION
SQL>        FROM LAGEOS_79
SQL>        WHERE [S_DATE >= 791001 AND S_DATE <= 791005]
SQL>          AND NUM_OBS >= 100;
SQL>/

   STATION LOCATION              LATITUDE                 LONGITUDE                S_DATE
---------- --------------------- ------------------------ ------------------------ ------
      7086 FORT DAVIS, TEXAS     N  30  40  36.7433       E 255  59  04.3305        8/79
      7091 HAYSTACK OBS., MASS.  N  42  37  21.3420       E 288  30  42.7270       11/77
      7114 OWENS VALLEY, CA.     N  37  13  57.4451       E 241  42  25.7015        8/79
      7063 NASA/GSFC-GORF, MD.   N  39  01  12.9517       E 283  10  18.0329        1/73
      7096 AMERICAN SAMOA        S  14  20  25.3652       E 189  16  34.9344        7/79
      7102 NASA/GSFC-GORF, MD.   N  39  01  13.9678       E 283  10  17.0323        7/78

6 RECORDS SELECTED.

SQL>SELECT STATION,NAME,DIRECTION,UP
SQL>FROM CALIBRATION
SQL>WHERE STATION =
SQL>        SELECT UNIQUE STATION
SQL>        FROM LAGEOS_79
SQL>        WHERE [S_DATE >= 791001 AND S_DATE <= 791005]
SQL>          AND NUM_OBS >= 100;
SQL>/

   STATION NAME    DIRECTION                UP
---------- ------- ------------------------ ----------
      7086 TL0106  S 1.580    W 0.180       3.530
      7086 ML0109  N 0.007    W 0.007       3.748
      7091 ML0305    0.000    E 0.003       3.746
      7091 ML0702  S 0.016    W 0.003       3.341
      7114 ML0211  S 0.003    W 0.008       3.622
      7063 STALAS    0.000      0.000       3.046 X
      7063 STALAS    0.000      0.000       3.640 Y
      7096 ML0602    0.000      0.000       3.140

8 RECORDS SELECTED.
```

Figure 14. Queries to Coordinates and Calibration Information Tables

```
SQL>#COMMENT
COM>
COM>***      QUERY AND DISPLAY THE POSSIBLE BASELINES IN 1979 FOR STATIONS IN THE
COM>         PACIFIC TO STATIONS IN AUSTRALIA
COM>
COM>#
SQL>SELECT PACIF.STATION,P.LOCATION,PACIF.POINTS,AUS.STATION,A.LOCATION,
SQL>         AUS.POINTS,PACIF.NO
SQL>FROM SUMMARY_79 PACIF,SUMMARY_79 AUS,STATIONS P,STATIONS A
SQL>WHERE (PACIF.STATION=P.NUMBER AND AUS.STATION=A.NUMBER)
SQL>  AND (PACIF.PC='PC' AND AUS.PC='AU')
SQL>  AND PACIF.NO=AUS.NO
SQL>ORDER BY PACIF.NO;
SQL>/

   STATION LOCATION                          POINTS    STATION LOCATION                          POINTS NO
---------- ------------------------------ ---------- ---------- ------------------------------ ---------- --
      7062 SAN DIEGO, CALIFORNIA                 196       7943 ORRORAL, AUSTRALIA                   1215 01
      7062 SAN DIEGO, CALIFORNIA                2480       7943 ORRORAL, AUSTRALIA                   3597 02
      7062 SAN DIEGO, CALIFORNIA                 765       7943 ORRORAL, AUSTRALIA                   3296 03
      7062 SAN DIEGO, CALIFORNIA                7051       7943 ORRORAL, AUSTRALIA                   1099 04
      7210 MAUI, HAWAII                           34       7943 ORRORAL, AUSTRALIA                   1099 04
      7062 SAN DIEGO, CALIFORNIA                1201       7943 ORRORAL, AUSTRALIA                   2060 05
      7210 MAUI, HAWAII                          285       7943 ORRORAL, AUSTRALIA                   2060 05
      7210 MAUI, HAWAII                           78       7943 ORRORAL, AUSTRALIA                   1610 06
      7210 MAUI, HAWAII                          791       7943 ORRORAL, AUSTRALIA                   2432 07
      7096 AMERICAN SAMOA                       1966       7943 ORRORAL, AUSTRALIA                   2684 08
      7210 MAUI, HAWAII                          814       7943 ORRORAL, AUSTRALIA                   2684 08
      7096 AMERICAN SAMOA                        966       7943 ORRORAL, AUSTRALIA                    350 09
      7096 AMERICAN SAMOA                       1463       7090 YARRAGADEE, AUSTRALIA                3115 10
      7210 MAUI, HAWAII                          125       7090 YARRAGADEE, AUSTRALIA                3115 10
      7096 AMERICAN SAMOA                       1463       7943 ORRORAL, AUSTRALIA                    164 10
      7210 MAUI, HAWAII                          125       7943 ORRORAL, AUSTRALIA                    164 10
      7096 AMERICAN SAMOA                       1228       7943 ORRORAL, AUSTRALIA                    233 11
      7210 MAUI, HAWAII                         1009       7943 ORRORAL, AUSTRALIA                    233 11
      7096 AMERICAN SAMOA                       3403       7090 YARRAGADEE, AUSTRALIA                4715 12
      7210 MAUI, HAWAII                         3341       7090 YARRAGADEE, AUSTRALIA                4715 12
      7096 AMERICAN SAMOA                       3403       7943 ORRORAL, AUSTRALIA                    963 12
      7210 MAUI, HAWAII                         3341       7943 ORRORAL, AUSTRALIA                    963 12

22 RECORDS SELECTED.
```

Figure 15. Query Display of the Possible Baselines Between Two Plates

time at least 1000 points are required from GSFC systems, 600 points from TLRS systems, and 400 points from SAO systems. The column MC (minimum code) contains values of 'L' (less than) or 'G' (greater than or equal to) to indicate whether the conditions were satisfied for the respective system. A sequence of SQL queries (Figure 16) is used to update this column in the summary tables. A query employing this indicator is illustrated in Figure 17. Here only those baselines in which both stations have the required minimum number of observations (i.e., MC column values equal to 'G') are selected.

In addition to the SQL queries, the ORACLE Report Writer has been used to format these results into a concise, informative report. A set of SQL queries similar to those discussed previously were imbedded into a set of instructions to create the more visually appealing report shown in Figure 18. Through the Report Writer, the basic queries were annotated with titles and columnar headings and sub-headings. As in the SQL query, this report presents the number, location, and number of points taken for each station during the specified month. By once again using the MC field, the stations not having the required number of points to compute a baseline were excluded. An additional query was added to Report Writer instructions to provide summing information on the outputed table. Although all of the information presented in this dual-table report can be extracted from queries while in the SQL mode, they can be displayed in a more informative fashion through the use of this utility. Also, these reports can be generated for subsequent years as well as between varying plates and stored in separate fields. In other words, the report need not be "generated" every time an investigator wishes to view data on baselines between two plates during a particular year; he need only list the contents of a specified file.

A third mode for presenting information on available data for baseline and other analyzed data applications is the calendar-type formats presented in Figures 19, 20, and 21. These tables were constructed from the ORACLE summary table SUMMARY_79 through the use of the Host Language Interface programs CALENX, CALENDAR, and CALENED. Figure 19 represents all monthly data available for 1979 by a series of XX's in the appropriate station and month cross-location as well as a total column for listing number of months a particular station was operational. Figure 20 represents the data in a similar manner but lists the actual number of points taken from a particular station during its respective months of operation. Figure 21 also uses this format, but the minimum-number-of-points requirement was appended to the SQL statement in the program call. Charts such as these give the project scientist and investigators an overall view of the laser network observations during a particular year. After generating calendars such as these over a several year period, patterns of non-operation may be detected for certain stations during specific months of the year. This type of information would probably indicate periods of inclement weather for laser operation. Hence, TLRS and MOBLAS units should not be scheduled for visitation to the sites displaying such patterns during those months. Also, charts like Figure 21 give the investigator another method of determining what data are available to compute baselines. For example, by scanning the month of October (10) column, seven stations with the appropriate number of points for baseline calculation are located. In addition, these charts present the possible baselines for the entire network,

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```
SQL>#COMMENT
COM>
COM>***      DISPLAY THE UPDATE TO THE MINIMUM NUMBER OF POINTS COLUMN
COM>         (MC) FOR THE 1979 LAGEOS SUMMARY TABLE
COM>
COM>#
SQL>UPDATE SUMMARY_79
SQL>SET MC='L'
SQL>WHERE [POINTS < 400 AND STATION >= 7900]
SQL>   OR [POINTS < 1000 AND STATION < 7900];
SQL>/
47 RECORDS UPDATED.

SQL>UPDATE SUMMARY_79
SQL>SET MC='G'
SQL>WHERE MC=NULL;
SQL>/
70 RECORDS UPDATED.

SQL>SELECT *
SQL>FROM SUMMARY_79
SQL>WHERE MO='09';
SQL>/

   STATION     PASSES      POINTS MO PC MC
---------- ---------- ---------- -- -- --
      7063         24      10477 09 NA G
      7069          2        171 09 NA L
      7086          1       1061 09 NA G
      7091         16       7990 09 NA G
      7096          2        986 09 PC L
      7114         22       9293 09 NA G
      7115          1          9 09 NA L
      7907         22        905 09 SA G
      7943          5        350 09 AU L

9 RECORDS SELECTED.
```

Figure 16. Procedure to Update the Lageos Summary Information Table

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```
SQL>#COMMENT
COM>
COM>***     QUERY AND DISPLAY THE POSSIBLE BASELINES IN 1979 FOR STATIONS IN THE
COM>        PACIFIC TO STATIONS IN AUSTRALIA WHICH HAVE ENOUGH POINTS FOR COMPUTATION
COM>
COM>#
SQL>SELECT PACIF.STATION,P.LOCATION,PACIF.POINTS,AUS.STATION,A.LOCATION,
SQL>        AUS.POINTS,PACIF.NO
SQL>FROM SUMMARY_79 PACIF,SUMMARY_79 AUS,STATIONS P,STATIONS A
SQL>WHERE (PACIF.STATION=P.NUMBER AND AUS.STATION=A.NUMBER)
SQL>  AND (PACIF.PC='PC' AND AUS.PC='AU')
SQL>  AND PACIF.NO=AUS.NO
SQL>  AND (PACIF.MC='G' AND AUS.MC='G')
SQL>ORDER BY PACIF.NO;
SQL>/

   STATION LOCATION                            POINTS    STATION LOCATION                            POINTS NO
---------- ------------------------------ ---------- ---------- ------------------------------ ---------- --
      7062 SAN DIEGO, CALIFORNIA                2400       7943 ORRORAL, AUSTRALIA                   3597 02
      7062 SAN DIEGO, CALIFORNIA                7851       7943 ORRORAL, AUSTRALIA                   1099 04
      7062 SAN DIEGO, CALIFORNIA                1201       7943 ORRORAL, AUSTRALIA                   2060 05
      7096 AMERICAN SAMOA                       1966       7943 ORRORAL, AUSTRALIA                   2604 08
      7096 AMERICAN SAMOA                       4463       7090 YARRAGADEE, AUSTRALIA                3115 10
      7096 AMERICAN SAMOA                       3403       7090 YARRAGADEE, AUSTRALIA                4715 12
      7210 MAUI, HAWAII                         3341       7090 YARRAGADEE, AUSTRALIA                4715 12
      7096 AMERICAN SAMOA                       3403       7943 ORRORAL, AUSTRALIA                    963 12
      7210 MAUI, HAWAII                         3341       7943 ORRORAL, AUSTRALIA                    963 12

9 RECORDS SELECTED.
```

Figure 17. Query Using the Point Number Indicator in the Lageos Summary Table

whereas the tables generated from the Report Writer utility were constructed to provide information on only those baselines available between two specified plates.

4.1.3.2 Project Management Data

4.1.3.2.1 Crustal Dynamics Library Index. There are several other areas in which the ORACLE data base can serve the project. An example is in the area of project management. Since many scientists are involved with the Crustal Dynamics Project, a library of all published papers is being maintained by administrative personnel. In addition to scientific papers, this library also includes any other papers and memoranda relative to project management. After discussion with the personnel involved in the maintenance of this library, it was felt that a table in the ORACLE data base could easily and efficiently house an index of items contained in the Crustal Dynamics Project Library. A listing of the columns in the table CD_LIBRARY is presented in Figure 22. Each item is uniquely identified by a control number, which has the format 'CD####'. Thus, this column was a logical choice for a primary key, or rather, the first indexed field. Since the title of the library item can tend to be rather lengthy, it was split into three separate, fifty-character fields; the later two may be null (empty). A sample query to the library index is illustrated in Figure 23.

Since the entries in the library index tend to consist of relatively lengthy character fields, inserting data to the table through the SQL query language can be rather tedious. Therefore, a screen form was created through the use of ORACLE's Interactive Application Facility (IAF). The creator of the application form invokes the Interactive Applications Generator (IAG) and responds to a series of questions for each field that is present in the data base table

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GLOBAL PLATE MOTION FOR 1979

BASELINES FROM STATIONS IN THE PACIFIC TO STATIONS IN AUSTRALIA
DERIVABLE FROM OUR MEASUREMENTS

FROM PACIFIC		TO AUSTRALIAN		DURING
STATION	LOCATION	STATION	LOCATION	MONTH
7062	SAN DIEGO, CALIFORNIA	7943	ORRORAL, AUSTRALIA	02
7062	SAN DIEGO, CALIFORNIA	7943	ORRORAL, AUSTRALIA	04
7062	SAN DIEGO, CALIFORNIA	7943	ORRORAL, AUSTRALIA	05
7096	AMERICAN SAMOA	7090	YARRAGADEE, AUSTRALIA	10
7096	AMERICAN SAMOA	7090	YARRAGADEE, AUSTRALIA	12
7096	AMERICAN SAMOA	7943	ORRORAL, AUSTRALIA	08
7096	AMERICAN SAMOA	7943	ORRORAL, AUSTRALIA	12
7210	MAUI, HAWAII	7090	YARRAGADEE, AUSTRALIA	12
7210	MAUI, HAWAII	7943	ORRORAL, AUSTRALIA	12

TOTALS

FROM PACIFIC STATION	TO AUSTRALIAN STATION	NUMBER OF MONTHS OF MEASUREMENTS
7062	7943	3
7096	7090	2
7096	7943	2
7210	7090	1
7210	7943	1

TOTAL NUMBER OF MONTHLY MEASUREMENTS PERFORMED: 9

TOTAL NUMBER OF POSSIBLE BASELINES: 5

Figure 18. Report Formatting the Baseline Display Between Two Plates

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MONTHS OF OPERATION FOR LASER STATIONS IN 1979

STATION NUMBER	LOCATION	MONTHS OF OPERATION 01	02	03	04	05	06	07	08	09	10	11	12	NO. OF MONTHS
7051	QUINCY, CALIFORNIA			XX	XX	XX								3
7062	SAN DIEGO, CALIFORNIA	XX	XX	XX	XX	XX								5
7063	GREENBELT, MARYLAND	XX	XX	XX	XX	XX				XX	XX	XX	XX	9
7069	PATRICK AFB, FLORIDA			XX	XX				XX	XX	XX			5
7082	BEAR LAKE, UTAH			XX	XX	XX		XX	XX					5
7086	FORT DAVIS, TEXAS									XX	XX	XX	XX	4
7090	YARRAGADEE, AUSTRALIA										XX		XX	2
7091	HAYSTACK OB., MASS.								XX	XX	XX	XX	XX	5
7096	AMERICAN SAMOA								XX	XX	XX	XX	XX	5
7101	GREENBELT, MARYLAND		XX	XX	XX									3
7102	GREENBELT, MARYLAND			XX	XX						XX	XX	XX	5
7103	GREENBELT, MARYLAND		XX	XX	XX									3
7104	GREENBELT, MARYLAND		XX		XX	XX								3
7114	OWENS VALLEY, CALIFORNIA									XX	XX	XX	XX	4
7115	GOLDSTONE, CALIFORNIA									XX	XX	XX	XX	4
7210	MAUI, HAWAII				XX	XX	XX	XX	XX		XX	XX	XX	8
7833	KOOTWIJCK, NETHERLANDS	XX		XX	XX									3
7834	WETTZELL, WEST GERMANY		XX	XX										2
7907	AREQUIPA, PERU	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	12
7921	MT. HOPKINS, ARIZONA	XX	XX	XX	XX	XX								5
7929	NATAL, BRAZIL	XX	XX	XX	XX	XX	XX		XX		XX	XX	XX	10
7943	ORRORAL, AUSTRALIA	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	12

Figure 19. Calendar Report of the Monthly Lageos Data Using The 'XX' Format

MONTHS OF OPERATION FOR LASER STATIONS IN 1979

STATION NUMBER	LOCATION	MONTHS OF OPERATION 01	02	03	04	05	06	07	08	09	10	11	12
7051	QUINCY, CALIFORNIA			171	2808	2490							
7062	SAN DIEGO, CALIFORNIA	196	2400	765	7851	1201							
7063	GREENBELT, MARYLAND	29	1741	8102	14561	3962				10477	16083	6878	12747
7069	PATRICK AFB, FLORIDA			468	304				54	171	125		
7082	BEAR LAKE, UTAH			359	2620	2466		6931	7799				
7086	FORT DAVIS, TEXAS									1061	8461	6407	6199
7090	YARRAGADEE, AUSTRALIA										3115		4715
7091	HAYSTACK OB., MASS.								1238	7990	22810	23935	20280
7096	AMERICAN SAMOA								1966	986	4463	1228	5403
7101	GREENBELT, MARYLAND		469	1045	821								
7102	GREENBELT, MARYLAND			2509	1018						580	6990	17373
7103	GREENBELT, MARYLAND		226	2408	3275								
7104	GREENBELT, MARYLAND		698		7416	639							
7114	OWENS VALLEY, CALIFORNIA									9293	26516	17262	15641
7115	GOLDSTONE, CALIFORNIA									9	11914	30082	18957
7210	MAUI, HAWAII				54	285	78	791	814		125	1089	3341
7833	KOOTWIJCK, NETHERLANDS	59		667	64								
7834	WETTZELL, WEST GERMANY		662	830									
7907	AREQUIPA, PERU	260	602	202	1304	1317	3001	675	1459	905	162	754	893
7921	MT. HOPKINS, ARIZONA	80	137	107	184	109							
7929	NATAL, BRAZIL	130	250	39	65	22	23		55		21	41	48
7943	ORRORAL, AUSTRALIA	1215	3597	3296	1099	2060	1610	2432	2684	350	164	233	963

Figure 20. Calendar Report of the Monthly Lageos Data Using the Number-of-Points Format

MONTHS OF OPERATION FOR LASER STATIONS IN 1979

STATION NUMBER	LOCATION	MONTHS OF OPERATION 01	02	03	04	05	06	07	08	09	10	11	12
7051	QUINCY, CALIFORNIA				2808	2490							
7062	SAN DIEGO, CALIFORNIA		2480		7851	1201							
7063	GREENBELT, MARYLAND		1741	8182	14501	5962				10477	16083	6878	12747
7069	PATRICK AFB, FLORIDA												
7082	BEAR LAKE, UTAH				2620	2466		6931	7794				
7086	FORT DAVIS, TEXAS									1061	8461	6407	6199
7090	YARRAGADEE, AUSTRALIA										3115		4715
7091	HAYSTACK OB., MASS.								1236	7990	22810	23935	20280
7096	AMERICAN SAMOA								1966		4463	1228	5403
7101	GREENBELT, MARYLAND			1045									
7102	GREENBELT, MARYLAND			2509	1016							6990	17373
7103	GREENBELT, MARYLAND			2408	5275								
7104	GREENBELT, MARYLAND				7416								
7114	OWENS VALLEY, CALIFORNIA									9293	26516	17262	15641
7115	GOLDSTONE, CALIFORNIA										11919	30882	18957
7210	MAUI, HAWAII											1009	3341
7833	KOOTWIJCK, NETHERLANDS			667									
7834	WETTZELL, WEST GERMANY		662	830									
7907	AREQUIPA, PERU		602		1304	1317	3001	675	1459	905		754	893
7921	MT. HOPKINS, ARIZONA												
7929	NATAL, BRAZIL												
7943	ORRORAL, AUSTRALIA	1215	3597	3296	1099	2060	1610	2432	2684				963

Figure 21. Calendar Report of the Monthly Lageos Data Using the Minimum Number-or-Points Format

is to be displayed on the screen. After a screen form was created in this manner, any valid user can invoke the Interactive Applications Processor (IAP) and display the form. If desired, this user may also query the data base by using this utility. An illustration of the form used for the library index table as well as a sample of data to be inserted is shown in Figure 24. In addition to the appealing format of an IAF screen, this utility can be used by personnel who have little or no knowledge of the ORACLE data base or the data that is to be inserted. This is due to the fact that one is not entering a series of commands, but rather the data itself. The IAF has a useful help function mode in which the user can inquire as to the function of the keypad keys, the attributes of a particular enterable field, or a creator-supplied message pertinent to any field. When the form has been filled out and inserted, a check is made to ensure proper data types, lengths and completion of all appropriate fields.

4.1.3.2.2 Crustal Dynamics Action Item Index. In addition to the library index, a second project application was introduced to the ORACLE data base--an archive of past and present action items assigned by project personnel during status meetings. An illustration of the fields of the table ACTION is shown in Figure 25. Once again, the action item description, as well as the comment entry, were divided into several fields to facilitate both entry and display of the data. A typical query to this table would ask for all "open" action items for one person, ordered by due date. An illustration of a query of this type is presented in Figure 26.

The action item table was also loaded via an IAF screen form. Figure 27 depicts a blank form as well as a completed form, ready for insertion.

Two types of reports were created to display the information contained in the ACTION table. The first type, shown in Figure 28, is a useful summary of all personnel responsible for action items, listed with the appropriate information about each item. This type of report was designed to be generated prior

CD_LIBRARY TABLE

NUMBER	SUBJECT	REFERENCE	CR_REF	TITLE1	TITLE2	TITLE3	AUTHOR	ACTIVITY	WBS NUM	DATE	LOCATION
CHAR(6)	CHAR(20)	CHAR(15)	CHAR(6)	CHAR(50)	CHAR(50)	CHAR(50)	CHAR(30)	CHAR(10)	CHAR(10)	NUMBER	CHAR(15)

COLUMN	DESCRIPTION
NUMBER	IDENTIFICATION NUMBER OF LIBRARY ITEM (CD####)
SUBJECT	SUBJECT OF LIBRARY ITEM
REFERENCE	REFERENCE NUMBER/CODE OF ITEM
CR_REF	CROSS REFERENCE NUMBER (IN APPLICATIONS DIRECTORATE LIBRARY INDEX) OF ITEM (AD####)
TITLE1	FIRST FIFTY CHARACTERS OF TITLE OF ITEM
TITLE2	SECOND FIFTY CHARACTERS IN TITLE (IF NEEDED)
TITLE3	THIRD FIFTY CHARACTERS IN TITLE (IF NEEDED)
AUTHOR	AUTHOR(S) OF LIBRARY ITEM
ACTIVITY	ORGANIZATION RESPONSIBLE FOR AUTHOR(S) AND/OR PUBLICATION OF ITEM
WBS NUM	WORK BREAKDOWN STRUCTURE ELEMENT IN REFERENCE TO THE AUTHOR(S) OF ITEM
DATE	DATE OF PUBLICATION OF ITEM
LOCATION	PHYSICAL STORAGE LOCATION OF DOCUMENT

*INDICATES INDEXED (OR IMAGED) FIELDS

Figure 22. Format of the Table Containing the Crustal Dynamics Library Index

```
SQL>#COMMENT
COM>
COM>***     QUERY AND DISPLAY INFORMATION IN THE CRUSTAL DYNAMICS LIBRARY INDEX
COM>
COM>#
SQL>SELECT NUMBER,SUBJECT,AUTHOR,TITLE1
SQL>FROM CD_LIBRARY;
SQL>/

NUMBER SUBJECT              AUTHOR                          TITLE1
------ -------------------- ------------------------------- ------------------------------------------------------
CD0002 VLBI                 LAWRENCE, ALLENBY, FREY         PROPOSED SATELLITE LASER RANGING AND VLBI SITES
CD0003 MOBLAS               FREY                            CDP OBSERVING PLAN FOR HIGHLY MOBILE SYSTEMS
CD0004 MOBLAS               KAHN,VONBUN,SMITH,ENGLAR,GIBBS  PERFORMANCE ANALYSIS OF THE SPACE BORNE LASER
CD0017 VLBI                 CLARK                           TECHNICAL PERFORMANCE SPECIFICATIONS FOR THE DATA
CD0018 MOU, IIOA, PP, AU    GSFC/NASA                       EXECUTION PHASE PROJECT PLAN FOR CRUSTAL DYNAMICS
CD0019 MISCELLANEOUS        ALLENBY, WEBSTER, PAINTER       SATELLITE RELAYING OF GEOPHYSICAL DATA
CD0020 MISCELLANEOUS        GEODYNAMICS BRANCH              LASER SYSTEM DEVELOPMENT PLAN
CD0021 MISCELLANEOUS        WEBSTER                         MODERN RADIO ASTRONOMY IN GEOPHYSICS
CD0024 MISCELLANEOUS        AMERICAN GEOPHYSICAL UNION      REVIEWS OF GEOPHYSICS AND SPACE PHYSICS
CD0026 SITE MEETING         FLOYD                           GEODETIC BENCH MARKS

10 RECORDS SELECTED.
```

Figure 23. Query to the Crustal Dynamics Library Index

to the biweekly project status meeting so that the project manager can view the current state of business for key personnel. The second report, a segment of which is presented in Figure 29, prints all action items for each person on a separate page. This concept allows each responsible party to view the action items that he is currently assigned.

4.2 SOFTWARE PACKAGE APPLICATIONS

4.2.1 Analyzed Data Display

Although many of the requirements of the DIS can be fulfilled via a data base management system such as ORACLE, there are still some additional services that must be performed through the use of the conventional software package. An example of such a need is the display of the analyzed laser data, i.e., polar motion and baseline distance tables. These tables are present in large listings (usually generated on a monthly basis) that result from a series of mathematically complicated computer runs. Although these tables can be extracted from the outputs and eventually stored separately in tables in the data base, many other useful items present in the listing, such as parameters for the Earth's gravity field, et cetera, that were incorporated to yield those particular results, could not be extracted for use with the data tables. Therefore, a method that would read these multi-page, 132-character per line reports and display them to a typical user via an average eighty-character per line terminal was needed. Since the ORACLE data base cannot handle text data in such a form at the present time, a FORTRAN software package was developed to fulfill the requirement. The ORACLE DBMS will be enhanced with text processing capabilities in the future and these additions should perform the required services.

The first problem addressed and resolved was that of a search function that would locate a particular user-specified table. It was assumed that the typical viewer of analyzed data would have some familiarity with the data and

CRUSTAL DYNAMICS PROJECT LIBRARY INDEX

NUMBER: CD___

REFERENCE: ____________ CROSS-REFERENCE: AD___

SUBJECT: ________________ DATE: MM/DD/YY

TITLE: ____

AUTHOR(S): ____________________________

ACTIVITY: ________ WBS NUMBER: ________

LOCATION OF LIBRARY ITEM: ____________

PREVIOUS PAGE: APPLICATIONS DIRECTORATE LIBRARY INDEX

CHAR MODE: REPLACE PAGE 2 MODE: INSERT COUNT: *0

CRUSTAL DYNAMICS PROJECT LIBRARY INDEX

NUMBER: CD0004

REFERENCE: TM 80330 CROSS-REFERENCE: ______

SUBJECT: MODLAS DATE: 10/01/79

TITLE: PERFORMANCE ANALYSIS OF THE SPACE BORNE LASER RANGING SYSTEM

AUTHOR(S): KAHN, VONBUN, SMITH, ENGLAR, GIBBS

ACTIVITY: GSFC/NASA WBS NUMBER: 21-04

LOCATION OF LIBRARY ITEM: BLDG. 16, RM 206

PREVIOUS PAGE: APPLICATIONS DIRECTORATE LIBRARY INDEX

CHAR MODE: REPLACE PAGE 2 MODE: INSERT STORED COUNT: 3

Figure 24. Screen Forms for the Crustal Dynamics Library Index

ACTION TABLE

NUMBER*	RESP_OF*	RESP_TO	D_DATE*	C_DATE*	DESCR1	DESCR2	DESCR3	DESCR4	COMMNT1	COMMNT2	COMMNT3	COMMNT4	COMMNT5	COMMNT6
NUMBER	CHAR(20)	CHAR(20)	NUMBER	NUMBER	CHAR(50)	CHAR(50)	CHAR(50)	CHAR(50)	CHAR(50)	CHAR(50)	CHAR(50)	CHAR(50)	CHAR(50)	CHAR(50)

COLUMN	DESCRIPTION
NUMBER	SIX-DIGIT IDENTIFICATION NUMBER OF ACTION ITME (YYMM###)
RESP_OF	PARTY RESPONSIBLE FOR COMPLETION OF ACTION ITEM
RESP_TO	PARTY TO BE REPORTED TO CONCERNING ACTION ITEM UPON ITS COMPLETION
D_DATE	DUE DATE OF ACTION ITEM
C_DATE	COMPLETION DATE OF ACTION ITEM
DESCR1	FIRST FIFTY CHARACTERS OF A DESCRIPTION OF ACTION ITEM
DESCR2, 3, 4	FIFTY-CHARACTER CONTINUATION COLUMNS FOR ACTION ITEM DESCRIPTION (IF NEEDED)
COMMNT1	FIRST FIFTY CHARACTERS OF ANY COMMENTS CONCERNING ACTION ITEM
COMMNT2, 3, 4, 5, 6	FIFTY-CHARACTER CONTINUATION COLUMNS FOR COMMENTS ON ACTION ITEM (IF NEEDED)

*INDICATES INDEXED (OR IMAGED) FIELDS

Figure 25. Format of the Table Containing the Crustal Dynamics Action Item Index

ORIGINAL PAGE IS OF POOR QUALITY

```
SQL>#COMMENT
COM>
COM>***     QUERY AND DISPLAY INFORMATION IN THE CRUSTAL DYNAMICS ACTION ITEM INDEX
COM>
COM>#
SQL>SELECT NUMBER,RESP_OF,C_DATE,DESCR1
SQL>FROM ACTION
SQL>WHERE C_DATE=NULL
SQL>ORDER BY RESP_OF;
SQL>/

    NUMBER RESP_OF                 C_DATE DESCR1
---------- -------------------- -------- ----------------------------------------
    104010 ALLENBY              11/30/81 IDENTIFY WHAT ADDITIONAL SITES ARE RECOMMENDED FOR
    110003 ALLENBY              10/29/81 ARRANGE MEETINGS WITH JPL AND NGS TO REVIEW THE
    110001 BOSWORTH             11/04/81 PREPARE WITH C. STRANGE A PLAN ON THE TLRS/MOBLAS
    108009 CLARK                10/20/81 DETERMINE WHEN THE NOAA CONTRACT TO NASA FOR THE
    108009 CLARK                10/30/81 PREPARE MEMO TO HQ STATING THE STATUS OF THE
    109009 CLARK                12/09/81 SET UP WITH D. ROGSTAD THE CORRELATOR DESIGN
    109004 CLARK                10/01/81 MEET WITH C VEGOS ON THE MV-3 RECEIVER AND THE
    109008 CLARK                10/21/81 INITIATE WITH C COHEN THE COORDINATION ON THE
    109012 CLARK                11/01/81 DEVELOP A PLAN FOR MARK-III TAPE RECORDER
    110004 CLARK                10/20/81 DISCUSS WITH C. TRASK THE DETAILS OF WHAT JPL IS
    110006 CLARK                10/01/81 CONDUCT DISCUSSION WITH VANDENBERG,DAVIDSON,
    108012 COATES               10/28/81 MEET WITH J. MURPHY ON PLANS FOR THE ANNUAL REVIEW
    108007 FREY                 10/28/81 GENERATE A DETAILED PLAN WHICH PROVIDES ESTIMATED
    108010 LIEBRECHT            01/01/82 REPORT ON THE FINAL RESULTS OF THE SESSION V
    110007 LIEBRECHT            10/01/81 COORDINATE WITH FLIEGEL THE REQUIRED INFORMATION
    110008 LIEBRECHT            11/01/81 COORDINATE WITH J. PETTY AND FLIEGEL THE
    108013 LINDER               10/28/81 PROVIDE A SUMMARY OF THE DATA HANDLING FACILITIES
    105002 LINDER               11/15/81 GET THE EUROPEAN LASER DATA FLOW IN OPERATION
    108011 MEAD                 10/28/81 PROVIDE SCHEDULES FOR PI CONTRACTS AND AGREEMENTS
    110009 RENZETTI             11/01/81 PROVIDE COMMENTS ON THE BERKELEY FET'S PROPOSAL.
    109013 ROGSTAD              12/01/81 SET-UP REVIEW MEETING WITH T. CLARK ON HIGH
    108014 STEPHANIDES          10/28/81 STATUS OF LASER AND VLBI FACILITIES IN OTHER
    109011 STEPHANIDES          10/20/81 RESOLVE THE M7 AND STALAS COLLOCATION PROBLEM.
    110002 STEPHANIDES          11/01/81 VERIFY THAT THE MOBLAS RANGE GATE CAN ACCOMODATE
    109001 TRASK                10/01/81 CONTACT D ALLENBY CONCERNING THE VAFB SITE
    110005 TRASK                10/01/81 CONTACT V. REINHARDT FOR ADDITIONAL INFORMATION

26 RECORDS SELECTED.
```

Figure 26. Query to the Crustal Dynamics Action Item Index

ORIGINAL PAGE IS
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CRUSTAL DYNAMICS PROJECT ACTION ITEMS

NUMBER: ______ DATES: DUE: MM/DD/YY
COMPLETED: MM/DD/YY

RESPONSIBILITY OF: ________________
RESPONSIBILITY TO: ________________

DESCRIPTION: ________________

COMMENTS: ________________

CHAR MODE: REPLACE PAGE 1 MODE: INSERT COUNT: 40

CRUSTAL DYNAMICS PROJECT ACTION ITEMS

NUMBER: 107007 DATES: DUE: 10/27/81
COMPLETED: ________

RESPONSIBILITY OF: FREY
RESPONSIBILITY TO: COATES

DESCRIPTION: GENERATE A DETAILED PLAN WHICH PROVIDES ESTIMATED DATES AND PRECISION LEVELS FOR RELATIVE PLATE MOTION

COMMENTS: NONE

CHAR MODE: REPLACE PAGE 1 MODE: INSERT STORED COUNT: 2

Figure 27. Screen Forms for the Crustal Dynamics Action Item Index

ORIGINAL PAGE IS
OF POOR QUALITY

CRUSTAL DYNAMICS PROJECT ACTION ITEM LISTING

AS OF 10/19/81

RESPONSIBILITY OF	ITEM NUMBER	RESPONSIBILITY TO	DATE DUE	DATE COMPLETED	DESCRIPTION AND COMMENTS
ALLENBY	110003	COATES	10/29/81		ARRANGE MEETINGS WITH JPL AND NGS TO REVIEW THE MYLAR OVERLAY AND DEVELOP A PLAN TO IMPLEMENT THEM INTO THE ARIES SYSTEM MET AT NGS 10/29/81
ALLENBY	109010	COATES	11/30/81		IDENTIFY WHAT ADDITIONAL SITES ARE RECOMMENDED FOR OCCUPATION NEXT YEAR AND GET RECONING AND MONUMENTING INTO FIELD PLANS MEMO TO NGS REQUIRED
BOSWORTH	110001	COATES	11/04/81		PREPARE WITH R. STRANGE A PLAN ON THE TLRS/MOBLAS HORIZONTAL RANGING CAMPAIGN AT OTAY MTN/MONUMENT PEAK NONE
CLARK	109004	VEGOS	10/01/81		MEET WITH C. VEGOS ON THE MV-3 RECEIVER AND THE NEW GSFC RECEIVER DESIGN (9/16/81-4) NONE
CLARK	110006	TRASK	10/01/81		CONDUCT DISCUSSION WITH VANDENBERG, DAVIDSON, AND TRASK TO RESOLVE PROBLEMS CONNECTED WITH THE NOV. BURST HELD TELECONS AND MEETINGS
CLARK	110004	TRASK	10/28/81		DISCUSS WITH D. TRASK THE DETAILS OF WHAT JPL IS RECOMMENDING FOR THE NOVEMBER BURST AT OVRO HELD DISCUSSIONS AT GSFC ON 10/28/81
CLARK	108009	COATES	10/30/81		PREPARE MEMO TO HQ STATING THE STATUS OF THE CONTRACT AND THE WORK UNDER THE MOU (RICHMOND) NONE
CLARK	109012	COATES	11/01/81		DEVELOP A PLAN FOR MARK-III TAPE RECORDER IMPLEMENTATION NONE

Figure 28. Portion of a Report Listing all Active Action Items

ORIGINAL PAGE IS OF POOR QUALITY

CRUSTAL DYNAMICS PROJECT ACTION ITEMS AS OF 10/19/81

RESPONSIBILITY OF: CLARK

-- ITEM 1 --

NUMBER: 109004 DATE DUE: 10/01/81

RESPONSIBILE TO: VEGOS DATE COMPLETED:

DESCRIPTION

MEET WITH C. VEGOS ON THE MV-3 RECEIVER AND THE NEW GSFC RECEIVER DESIGN (9/16/81-4)

COMMENTS

NONE

-- ITEM 2 --

NUMBER: 110006 DATE DUE: 10/01/81

RESPONSIBILE TO: TRASK DATE COMPLETED:

DESCRIPTION

CONDUCT DISCUSSION WITH VANDENBERG, DAVIDSON, AND TRASK TO RESOLVE PROBLEMS CONNECTED WITH THE NOV. BURST

COMMENTS

HELD TELECONS AND MEETINGS

-- ITEM 3 --

NUMBER: 110004 DATE DUE: 10/28/81

RESPONSIBILE TO: TRASK DATE COMPLETED:

DESCRIPTION

DISCUSS WITH D. TRASK THE DETAILS OF WHAT JPL IS RECOMMENDING FOR THE NOVEMBER BURST AT OVRO

COMMENTS

HELD DISCUSSIONS AT GSFC ON 10/28/81

Figure 29. Example of a Report to Personnel Responsible for the Completion of an Action Item

parameters that are available in these computer runs, i.e., the general format of these listings. Typically, two types of listings having the same general format will be received from the Laser Support Group (LSG) and stored on disk in the DIS. The first type includes computed baselines and station positions, the second contains the polar motion data, each spanning monthly intervals. Figure 30 illustrates the sign-on and selection process for the analyzed data viewing. After the user has chosen a particular table (options one or two) the search function locates the first page in which the title (or other key-word associated with the data table) occurs, and scans for any additional occurrences on subsequent pages. After the last page of the table is detected, the beginning and ending locations (line numbers) of each page of the table are stored. Then, all lines between these locations are outputed via a display function that will be described later. However, if the user has viewed enough of the data in a multi-page table, he may terminate the display of the pages that follow. He then has the option to scan the table again or view another table. If he does not wish to re-examine data in this particular listing, he may select another to interrogate.

Another option open to the user is to examine the entire computer run (option three), one page at a time. This feature is especially useful if the viewer does not know which data table to select for interrogation. Under this option, the user views the first few lines of a page (starting with page one) and then types in one of the codes illustrated in Figure 31. This way, he can quickly scan through the entire file if desired.

Since polar motion and baseline data tables are likely to be those most accessed, separate routines were developed that select particular entries in these tables and allow the viewing of the entire table. For a typical polar motion table, data can be chosen for a particular date or range of dates. For a baseline distance table, data can be selected for a specific station or pair of stations. Examples of these selections are presented in Figures 32 and 33. Once the proper selection (whether only a few lines or the entire table) has been made, the appropriate internal line locations are transferred to the display function created for proper terminal formatting of the analyzed data.

This terminal size constraint was a second problem addressed. Four methods were designed, tested, and implemented in the software to display the information contained in the 132-character lines on an eighty character per line basis. When the user invokes the software on a particular analyzed data run and selects his desired table, he views the leftmost 79 characters of the first twenty lines of the table's first page. He then has the option to view the rightmost 53 columns (i.e., the remainder of this particular portion of the table). After completing this sampling exercise, he is prompted to choose one of four different viewing methods. One method is to continue to examine the table by only viewing the leftmost 79 columns, as first displayed. A second method is to view only the rightmost 53 columns for the entire table. A third option is to examine first the left side of the table-page (first 79 columns) then the right side (last 53 columns), alternately, for all of the pages comprising the selected table. The fourth viewing method is to span the entire page in one display by "deleting" or masking out unnecessary columns or fields (as deemed by the user) within the page itself. This is accomplished by creating a series of user-specific, table-specific mask lines. These lines

ORIGINAL PAGE IS OF POOR QUALITY

USER WISHES TO VIEW ANALYZED LASER DATA VIA A SOLVE RUN
DO YOU WISH TO VIEW DATA ON A MONTHLY BASIS? (YES/NO): YES

ENTER YEAR FOR DATA: 1981
ENTER MONTH FOR DATA (USING FORMAT MM): 05

DO YOU WISH TO VIEW POLAR MOTION OR BASELINE DATA? (P/B): B

SELECT FROM THE FOLLOWING OPTIONS:

OPTION 1--EXAMINE BASELINE DATA
OPTION 2--EXAMINE OTHER DATA (BY TABLE TITLE)
OPTION 3--EXAMINE THE ENTIRE SOLVE RUN, PAGE BY PAGE

ENTER OPTION NUMBER: 1

USER WISHES TO VIEW BASELINE DATA
THERE ARE 11 PAGES IN THIS TABLE

SELECT FROM THE FOLLOWING OPTIONS:

OPTION 1--DISPLAY ENTIRE BASELINE TABLE
OPTION 2--DISPLAY BASELINE DATA FOR A PARTICULAR STATION NUMBER
OPTION 3--DISPLAY BASELINE DATA FOR A PAIR OF STATION NUMBERS

ENTER OPTION NUMBER: 1

LAGEOS MAY 1981 (810428 - 810528) BASELINES GEM10

STATION BASELINE CONFIGURATION

STATIONS FIRST	SECOND	BASELINE COMPONENTS (METERS) X	Y	Z
7063	7064	24.30904	-25.90290	-35.34594
7063	7065	21.99977	-16.51059	-24.21047
7063	7069	212753.58059	717003.47044	995313.49526
7063	7092	7274159.06633	-6196078.24648	2959924.66793
7063	7100	-641.99050	-199.43033	-43.77850
7063	7101	-526.83001	-187.61740	-60.74950
7063	7102	26.91206	-14.66634	-22.93272
7063	7103	27.88280	-19.00464	-28.38015
7063	7104	-382.28214	-170.80249	-82.71840
7063	7105	-6.17724	-17.25031	-18.43073

DO YOU WISH TO VIEW THE RIGHT SIDE OF THE TABLE AT THIS TIME? (YES/NO)
(IF NO, USER FORMS A SERIES OF MASK LINES.): YES

PAGE 13

SOLV8101

BASELINE DISTANCE	BASELINE SIGMAS X	Y	Z	TOTAL SIGMA
50.11213				
36.64337				
1244992.78231				
10003295.94650				
673.67716				
562.53058				
38.27885				
44.09155				
426.79674				
25.98891				

Figure 30. Sign-on and Selection Process for Viewing of the Analyzed Data

ORIGINAL PAGE IS
OF POOR QUALITY

```
USER WISHES TO VIEW ANALYZED LASER DATA VIA A SOLVE RUN
DO YOU WISH TO VIEW DATA ON A MONTHLY BASIS?  (YES/NO):  YES

ENTER YEAR FOR DATA:  1981
ENTER MONTH FOR DATA (USING FORMAT MM):  05

DO YOU WISH TO VIEW POLAR MOTION OR BASELINE DATA?  (P/B):  B

SELECT FROM THE FOLLOWING OPTIONS:

        OPTION 1--EXAMINE BASELINE DATA
        OPTION 2--EXAMINE OTHER DATA (BY TABLE TITLE)
        OPTION 3--EXAMINE THE ENTIRE SOLVE RUN, PAGE BY PAGE

ENTER OPTION NUMBER:  3

USER WISHES TO PAGE THRU THE ENTIRE ANALYZED DATA FILE
THERE ARE  28 PAGES IN THE FILE

*** PAGE   1 ***

               SOLVE PROGRAM INPUT DATA(UNIT5)

COLUMNS(RIGHT) 0000000001111111111222222222233333333334444444444555555555566666
CARDS  (UNDER) 1234567890123456789012345678901234567890123456789012345678901234
            1  TITLE  2        LAGEOS   MAY 1981     (810428 - 810528)  BASELINE
            2
            3  CPRINT     1
            4  CSTAT      1   1
            5  CDIT        1
            6  GEOID                            6378144.11
            7  PROCES        11      1   5    5
            8  DATA
            9  CMATRIX 10001605                     111
           10  CMATSUP    276039016      30090 700000000 600100002 600300002109
           11  MATRIX 3900105
           12  END


END OF UNIT 5 INPUT


ENTER RESPONSE CODE (ENTER "L" TO VIEW LIST OF CODES):  L

ENTER ONE OF THE FOLLOWING RESPONSES:

        <CR> (RETURN) TO CONTINUE TO VIEW FIRST 79 COLUMNS OF THIS PAGE
        "R" TO VIEW THE "RIGHT" 53 COLUMNS OF THIS PAGE
        "N" TO VIEW THE "NEXT" PAGE
        "S" TO "STOP" VIEWING THE ENTIRE RUN

ENTER RESPONSE CODE:  N

*** PAGE   2 ***


PARAMETER SIGMAS
 P042801  0.0          P042802  0.0          P042803  1.00000D-08 P050301  0.0
 P050801  0.0          P050802  0.0          P050803  0.0         P051301  0.0
 P051801  0.0          P051802  0.0          P051803  0.0         P052301  0.0

COVARIANCE CONSTRAINED MATRICES FOR STATIONS

    NO.  ID       COORDINATES       A**2            A * B          A * C

     1  7063  GEODETIC        1.00000D 14   0.0            0.0            1.00
     2  7064  GEODETIC        1.00000D 14   0.0            0.0            1.00
     3  7065  GEODETIC        1.00000D 14   0.0            0.0            1.00
     4  7069  GEODETIC        1.00000D 14   0.0            0.0            1.00
     5  7092  GEODETIC        1.00000D 14   0.0            0.0            1.00
     6  7100  GEODETIC        1.00000D 14   0.0            0.0            1.00
     7  7101  GEODETIC        1.00000D 14   0.0            0.0            1.00
     8  7102  GEODETIC        1.00000D 14   0.0            0.0            1.00
     9  7103  GEODETIC        1.00000D 14   0.0            0.0            1.00
    10  7104  GEODETIC        1.00000D 14   0.0            0.0            1.00
```

Figure 31. Example of Browsing Procedure for an Analyzed Data File

```
ENTER RESPONSE CODE (ENTER "L" TO VIEW LIST OF CODES):  N


        P050302  0.0           P050303  0.0
        P051302  0.0           P051303  0.0
        P052302  0.0           P052303  0.0


B**2          L * C          L**2

000D 14   0.0            1.00000D 14
000D 14   0.0            1.00000D 14
000D 14   0.0            1.00000D 14
000D 14   0.0            1.00000D 14
000D 14   0.0            1.00000D 14
000D 14   0.0            1.00000D 14
000D 14   0.0            1.00000D 14
000D 14   0.0            1.00000D 14
000D 14   0.0            1.00000D 14
000D 14   0.0            1.00000D 14
ENTER RESPONSE CODE (ENTER "L" TO VIEW LIST OF CODES):  N

*** PAGE   3 ***


*******************************
***** EDIT OF CE MATRIX  *****
***** DIMENSION -   134 ******
*******************************


 10001605 CE MATRIX A'PRIORI PARAM (DIMENSION -    134 )
  LABEL     PRMTR       LABEL     PRMTR       LABEL     PRMTR       LABEL     PRMTR

 P042801  4.2152D-07 P042802  1.2782D-06 P042803  1.9529D 01 P050301  4.1672D
 P050801  4.1694D-07 P050802  1.2440D-06 P050803  1.9556D 01 P051301  4.1694D-
 P051801  4.1694D-07 P051802  1.2050D-06 P051803  1.9580D 01 P052301  4.1667D-
 LA07063  6.8103D-01 LO07063  4.9423D 00 HT07063  1.5200D 01 LA07064  6.8104D-
 LA07065  6.8104D-01 LO07065  4.9423D 00 HT07065  1.4343D 01 LA07069  4.9267D-
 LA07092  1.6395D-01 LO07092  2.9230D 00 HT07092  2.8793D 01 LA07100  6.8104D-
 LA07101  6.8105D-01 LO07101  4.9424D 00 HT07101  5.1000D 00 LA07102  6.8104D-
ENTER RESPONSE CODE (ENTER "L" TO VIEW LIST OF CODES):  S

DO YOU WISH TO EXAMINE THIS SOLVE LISTING AGAIN?  (YES/NO):  NO

DO YOU WISH TO EXAMINE POLAR MOTION DATA FOR THIS TIME PERIOD?  (YES/NO):  NO

DO YOU WISH TO VIEW DATA FOR ANOTHER MONTH AND/OR YEAR?  (YES/NO):  NO

DO YOU WISH TO VIEW DATA FOR A ONE OR FIVE PERIOD NOW?  (YES/NO):  NO
```

Figure 31. (Continued)

```
DO YOU WISH TO VIEW POLAR MOTION OR BASELINE DATA?  (P/B):  P

SELECT FROM THE FOLLOWING OPTIONS:

        OPTION 1--EXAMINE POLAR MOTION DATA
        OPTION 2--EXAMINE OTHER DATA (BY TABLE TITLE)
        OPTION 3--EXAMINE THE ENTIRE SOLVE RUN, PAGE BY PAGE

ENTER OPTION NUMBER:  1

SELECT FROM THE FOLLOWING OPTIONS:

        OPTION 1--DISPLAY ENTIRE POLAR MOTION TABLE
        OPTION 2--DISPLAY POLAR MOTION DATA FOR A PARTICULAR DATE
        OPTION 3--DISPLAY POLAR MOTION DATA FOR A RANGE OF DATES

ENTER OPTION NUMBER:  3

ENTER FIRST DATE USING FORMAT YYMMDD:  810501
ENTER SECOND DATE USING FORMAT YYMMDD:  810515

***** POLAR MOTION (IN ARCSECONDS) *****

PARM.    YYMMDDHH(S) YYMMDDHH(E)  ORIGINAL                  DELTA


X        81050300    81050300     8.59549560000000D-02      3.18450283585535D-02
Y        81050300    81050300     2.60644580000000D-01      1.12360272862373D-02
A1-UT1   81050300    81050300     1.95442070000000D 01      3.29082343996801D-04
X        81050800    81050800     8.60000030000000D-02      5.73307550501054D-03
Y        81050800    81050800     2.56599540000000D-01     -1.27731596495790D-03
A1-UT1   81050800    81050800     1.95563540000000D 01     -4.12570470592794D-04
X        81051300    81051300     8.60000030000000D-02      2.77300364499782D-02
Y        81051300    81051300     2.52599540000000D-01      2.25100874575168D-03
A1-UT1   81051300    81051300     1.95685100000000D 01     -1.86045270314587D-03
DO YOU WISH TO VIEW THE RIGHT SIDE OF THE TABLE AT THIS TIME?  (YES/NO)
     (IF NO, USER FORMS A SERIES OF MASK LINES.):  YES


     UPDATE                        COND. NO.  STD. DEV.


     1.17799984358553D-01               2.2  0.1303E-02
     2.71880607266237D-01               1.3  0.6886E-03
     1.95445360823440D 01               3.9  0.1028E-03
     9.17330785850185D-02               1.0  0.1233E-02
     2.55322224035040D-01               1.4  0.6140E-03
     1.95559414295214D 01               3.9  0.9819E-04
     1.13730039449770D-01               2.4  0.1276E-02
     2.54850548074575D-01               1.5  0.6302E-03
     1.95666475472966D 01               3.6  0.1146E-03

ENTER DISPLAY METHOD NUMBER (ENTER "0" TO VIEW A LIST OF DISPLAY METHODS):  0

CHOOSE FROM THE FOLLOWING DISPLAY METHODS:

        METHOD 1--VIEW ENTIRE TABLE USING A SERIES OF "MASK" LINES
        METHOD 2--VIEW ONLY FIRST 79 COLUMNS OF ENTIRE TABLE

        METHOD 3--VIEW ONLY LAST 53 COLUMNS OF ENTIRE TABLE
        METHOD 4--VIEW FIRST 79 COLUMNS THEN LAST 53 COLUMNS, ETC.

ENTER METHOD NUMBER:  4
```

Figure 32. Selection Process for Polar Motion Data From an Analyzed Data File

PAGE 1 OF TABLE

***** POLAR MOTION (IN ARCSECONDS) *****

PARM.	YYMMDDHH(S)	YYMMDDHH(E)	ORIGINAL	DELTA
X	81050300	81050300	3.595475000000000D-02	3.1845023505535D-02
Y	81050300	81050300	2.606445000000000D-01	1.1236027280237 3D-02
A1-UT1	81050300	81050300	1.954420700000000D 01	3.290823439968010D-04
X	81050800	81050800	8.600000300000000D-02	5.733075505018540D-03
Y	81050800	81050800	2.565995400000000D-01	-1.277315964059900D-03
A1-UT1	81050800	81050800	1.955635400000000D 01	-4.125704705927940D-04
X	81051300	81051300	8.600000300000000D-02	2.773003614997820D-02
Y	81051300	81051300	2.525995400000000D-01	2.251000743575168D-03
A1-UT1	81051300	81051300	1.956831600000000D 01	-1.360450703447870D-03

UPDATE	COND. NO.	STD. DEV.
1.177999843585530D-01	2.2	0.1303E-02
2.718806072662370D-01	1.3	0.6886E-03
1.954453606234400D 01	3.9	0.1028E-03
9.173307858501650D-02	1.6	0.1233E-02
2.553222240350400D-01	1.4	0.6140E-03
1.955594142952140D 01	3.9	0.9819E-04
1.137300394499700D-01	2.4	0.1276E-02
2.548505987457520D-01	1.5	0.6302E-03
1.956664754727060D 01	3.6	0.1146E-03

Figure 32. (Continued)

```
DO YOU WISH TO VIEW POLAR MOTION OR BASELINE DATA?  (P/B):  B

SELECT FROM THE FOLLOWING OPTIONS:

        OPTION 1--EXAMINE BASELINE DATA
        OPTION 2--EXAMINE OTHER DATA (BY TABLE TITLE)
        OPTION 3--EXAMINE THE ENTIRE SOLVE RUN, PAGE BY PAGE

ENTER OPTION NUMBER:  1

USER WISHES TO VIEW BASELINE DATA
THERE ARE  11 PAGES IN THIS TABLE

SELECT FROM THE FOLLOWING OPTIONS:

        OPTION 1--DISPLAY ENTIRE BASELINE TABLE
        OPTION 2--DISPLAY BASELINE DATA FOR A PARTICULAR STATION NUMBER
        OPTION 3--DISPLAY BASELINE DATA FOR A PAIR OF STATION NUMBERS

ENTER OPTION NUMBER:  2

ENTER STATION NUMBER USING FORMAT "#####":   7063
STATION BASELINE CONFIGURATION
------- -------- -------------
```

STATIONS FIRST	- SECOND	BASELINE COMPONENTS (METERS) X	Y	Z
7063	7064	24.30908	-25.90290	-35.34594
7063	7065	21.99977	-16.51059	-24.21047
7063	7069	212753.58059	717003.47044	995313.49526
7063	7092	7274159.06633	-6195078.24040	2459924.66703
7063	7100	-641.99058	-199.43033	-43.77850
7063	7101	-526.83001	-187.61740	-60.74950
7063	7102	26.71206	-14.66634	-22.93272
7063	7103	27.88288	-19.00464	-28.38015
7063	7104	-382.28219	-170.80249	-82.71840
7063	7105	-6.17724	-17.25031	-10.43073
7063	7112	2371393.64876	-119906.38626	-100393.33745
7063	7120	6596713.75369	-2426965.35590	1751060.27312
7063	7210	6597140.88609	-2427278.72217	1752526.02944
7063	7805	-1761087.94743	-6143179.11080	-1518519.00291
7063	7833	-2768511.95052	-5221112.03352	-1020904.96958

```
DO YOU WISH TO VIEW THE RIGHT SIDE OF THE TABLE AT THIS TIME?  (YES/NO)
     (IF NO, USER FORMS A SERIES OF MASK LINES.):  YES
```

BASELINE DISTANCE	BASELINE SIGMAS X	Y	Z	TOTAL SIGMA
50.11213				
36.64337				
1244992.78231				
10003295.94650				
673.67716				
562.53058				
38.27885				
44.09155				
426.79674				
25.98891				
2376107.50727				
7244018.75159				
7244673.76982				
6568774.53805				
6003351.07780				

```
ENTER DISPLAY METHOD NUMBER (ENTER "0" TO VIEW A LIST OF DISPLAY METHODS):  0

CHOOSE FROM THE FOLLOWING DISPLAY METHODS:

        METHOD 1--VIEW ENTIRE TABLE USING A SERIES OF "MASK" LINES
        METHOD 2--VIEW ONLY FIRST 79 COLUMNS OF ENTIRE TABLE
        METHOD 3--VIEW ONLY LAST 53 COLUMNS OF ENTIRE TABLE
        METHOD 4--VIEW FIRST 79 COLUMNS THEN LAST 53 COLUMNS, ETC.

ENTER METHOD NUMBER:  2
```

Figure 33. Selection Process for Baseline Data From an Analyzed Data File

PAGE 1 OF TABLE

STATION BASELINE CONFIGURATION

STATIONS FIRST	- SECOND	BASELINE COMPONENTS(METERS) X	Y	Z
7063	7064	24.30900	-25.90290	-35.34594
7063	7065	21.99977	-16.51059	-24.21047
7063	7069	212753.58059	717003.47844	995313.49526
7063	7092	7274159.06635	-6195078.24640	2959924.66793
7063	7100	-641.99050	-199.43033	-43.77850
7063	7101	-526.83001	-107.61740	-60.71950
7063	7102	26.91206	-14.66634	-22.93272
7063	7103	27.88282	-19.00464	-20.30015
7063	7104	-382.28210	-170.80249	-62.71810
7063	7105	-6.17728	-17.25031	-18.43073
7063	7112	2371393.64876	-119906.30626	-100393.33745
7063	7120	6596713.75369	-2426965.35590	1751060.29312
7063	7210	6597140.88609	-2427278.92217	1752526.02944
7063	7805	-1761887.94742	-6143179.11080	-1518519.00291
7063	7833	-2768511.95052	-5223112.03352	-1020904.90958
7063	7834	-2944070.09986	-5763127.59455	-807509.05946
7063	7835	-3450985.92852	-5367527.41945	-395273.93690
7063	7892	2762198.40171	-242236.09550	-112662.17471
7063	7896	3623926.97642	-176141.95213	428512.26747
7063	7907	-812076.78686	973797.64760	5791007.96398
7063	7921	3067473.98142	245334.14704	662167.46832
7063	7929	-4055754.31147	-1177511.84644	4648411.23909
7063	7943	5578256.83382	-7503508.30111	7609006.62313
7063	97051	3647607.00482	-632520.40301	-82321.41039
7063	97062	3559539.56850	-31621.92223	576017.53619
7063	97067	-1177024.39743	42710.37357	600460.94913
7063	97068	-709768.01286	788108.39330	1675175.39211
7063	97082	2066711.44241	-406324.51140	-247340.88451
7063	97084	3541303.84004	-353627.41345	155441.56506
7063	97085	3484107.66860	-187043.47185	317191.04255
7063	97086	2460039.99604	497194.05271	757939.27153
7063	97090	3519712.27844	-9871702.21183	7072614.64329
7063	97091	-361739.65603	-374092.00925	-302725.26713
7063	97096	7230757.32624	-3833172.98062	5563065.77139
7063	97114	3541136.30810	-353570.55195	155402.70741
7063	97115	3401575.80690	-173826.49763	333091.25872
7063	97890	1804876.66011	627688.49681	793345.01272
7063	97899	-650.48532	-200.51446	-37.57031

Figure 33. (Continued)

consist of a string of blanks, indicating unwanted columns, and other characters (e.g., dashes), indicating columns to be retained and displayed. Figure 34 illustrates this creation process of the series of mask lines.

After enough columns have been deleted or the user indicates the table is in a suitable form (by typing "@STOP" instead of a mask line) the entire table will be displayed in the user's chosen format. Figure 35 shows a portion of the polar motion table before and after this editing process. If desired, the user has the option to save this series of lines in a designated file and recall it by name the next time he wishes to view a table having this identical structure.

4.2.2 Crustal Dynamics Project Newsletter

A second area to be managed by a specially constructed software package is the news exchange process for the DIS. It was determined that the scientists, investigators, and other personnel need to be updated on the status of the project and other information pertinent to their respective endeavors. The concept of a news exchange that would accept news from any authorized user and upon clearance (to validate its accuracy and appropriateness) assemble these news items into a newsletter was devised. This restriction ensures that only scientifically valid information is disseminated to the investigator public. The document would be available on-line to the DIS user and could also be used as input to the Crustal Dynamics Newsletter published by project personnel and distributed to the investigators on a quarterly basis.

Once again, this application required the handling of text data, a feature not currently supported by the ORACLE data base management system. Therefore, a FORTRAN software package was designed that allows the user to browse the inputs to the newsletter, both final and preliminary, and contribute his own news for eventual inclusion.

If the user chooses to browse the news exchange, he may do this in one of two ways: first, by viewing the entire newsletter, or second, by selecting one of the six subjects of which it is composed. If he chooses the first method, the complete news exchange is presented, one subject at a time. If the second method is chosen, the user selects a subject to be viewed and then has the option of viewing the entire contents of this subject, or searching it for particular news items containing the keywords and/or keydates. An example of this menu selection is shown in Figure 36. This figure also illustrates the four search methods open to the user. After the user has completed this browsing exercise, he may then view any other recently-inputed news items, which have not yet been examined by the appropriate project personnel, under the same subject.

After viewing the selected news items, the user may view another (or all) subject(s) or he may contribute information of his own. If he decides to input his own information, he selects an appropriate news subject, inputs his name and location, and a pair of dates referring to his news, and then follows with the text itself. When he has completed his input, his entry of "@RETURN" signals this fact. The news text is annotated with the date and time of

```
USER WISHES TO VIEW ANALYZED LASER DATA VIA A SOLVE RUN
DO YOU WISH TO VIEW DATA ON A MONTHLY BASIS?  (YES/NO):  YES

ENTER YEAR FOR DATA:  1981
ENTER MONTH FOR DATA (USING FORMAT MM):  05

DO YOU WISH TO VIEW POLAR MOTION OR BASELINE DATA?  (P/B):  P

SELECT FROM THE FOLLOWING OPTIONS:

        OPTION 1--EXAMINE POLAR MOTION DATA
        OPTION 2--EXAMINE OTHER DATA (BY TABLE TITLE)
        OPTION 3--EXAMINE THE ENTIRE SOLVE RUN, PAGE BY PAGE

ENTER OPTION NUMBER:  1

USER WISHES TO VIEW POLAR MOTION DATA
THERE ARE   1 PAGES IN THIS TABLE


SELECT FROM THE FOLLOWING OPTIONS:

        OPTION 1--DISPLAY ENTIRE POLAR MOTION TABLE
        OPTION 2--DISPLAY POLAR MOTION DATA FOR A PARTICULAR DATE
        OPTION 3--DISPLAY POLAR MOTION DATA FOR A RANGE OF DATES

ENTER OPTION NUMBER:  1

***** POLAR MOTION (IN ARCSECONDS) *****

PARM.   YYMMDDHH(S) YYMMDDHH(E)  ORIGINAL                 DELTA


X        81042800    81042800    8.694493200000000D-02    1.092371106825650D-02
Y        81042800    81042800    2.636546100000000D-01    1.289420200082580D-02
A1-UT1   81042800    81042800    1.952938600000000D 01   -9.551441004924800D-15
X        81050300    81050300    8.595495600000000D-02    3.184502835855350D-02
Y        81050300    81050300    2.606445800000000D-01    1.123602728623730D-02
A1-UT1   81050300    81050300    1.954420700000000D 01    3.290823439960010D-04
X        81050800    81050800    8.600000300000000D-02    5.733075505010540D-03
Y        81050800    81050800    2.565995400000000D-01   -1.277315904959900D-03
A1-UT1   81050800    81050800    1.955635400000000D 01   -4.125704705927940D-04
X        81051300    81051300    8.600000300000000D-02    2.773003604997820D-02
Y        81051300    81051300    2.525995400000000D-01    2.251008745751680D-03
A1-UT1   81051300    81051300    1.956851600000000D 01   -1.868452703445870D-03
X        81051800    81051800    8.600000300000000D-02    3.453399003346220D-02
Y        81051800    81051800    2.485444600000000D-01   -9.110680267416080D-03
A1-UT1   81051800    81051800    1.957972400000000D 01   -1.882502442827090D-03

DO YOU WISH TO VIEW THE RIGHT SIDE OF THE TABLE AT THIS TIME?  (YES/NO)
     (IF NO, USER FORMS A SERIES OF MASK LINES.):  NO


THE USER HAS CHOSEN TO INPUT A SERIES OF "MASK" LINES IN ORDER TO VIEW
     THE ENTIRE TABLE.

THESE LINES CONSIST OF A STRING OF DASHES ("-") AND BLANKS (" ").
DASHES DEFINE DESIRED COLUMNS, BLANKS DEFINE UNWANTED COLUMNS.

DO YOU HAVE A MASK FOR THIS TABLE?  (YES/NO):  NO
```

Figure 34. Creation and Display of Masking Process for Analyzed Data Viewing

ORIGINAL PAGE IS
OF POOR QUALITY

***** POLAR MOTION (IN ARCSECONDS) *****

PARM.	YYMMDDHH(S)	YYMMDDHH(E)	ORIGINAL	DELTA
X	81042800	81042800	8.69449320000000D-02	1.09237115602565D-02
Y	81042800	81042800	2.63654610000000D-01	1.28942023008258D-02
A1-UT1	81042800	81042800	1.95293060000000D 01	-9.55144100492400D-17
X	81050300	81050300	8.59549560000000D-02	3.18450283505935D-02
Y	81050300	81050300	2.60644580000000D-01	1.12360272862373D-02
A1-UT1	81050300	81050300	1.95442070000000D 01	3.29062343996601D-04
X	81050800	81050800	8.60000030000000D-02	5.73307550501154D-03
Y	81050800	81050800	2.56599540000000D-01	-1.27731590495990D-03
A1-UT1	81050800	81050800	1.95563540000000D 01	-4.12570473592794D-04
X	81051300	81051300	8.60000030000000D-02	2.77300361499782D-02
Y	81051300	81051300	2.52599540000000D-01	2.25190074575168D-03
A1-UT1	81051300	81051300	1.95605160000000D 01	-1.06845270344587D-03
X	81051800	81051800	8.60000030000000D-02	3.45339903334622D-02
Y	81051800	81051800	2.48544460000000D-01	-9.11060020741608D-03
A1-UT1	81051800	81051800	1.95797240000000D 01	-1.08250243202709D-03

ENTER MASK LINE (TYPE 'JSTOP' TO TERMINATE EDITING PROCESS)

***** POLAR MOTION (IN ARCSECONDS) *****

PARM.	YYMMDD	ORIGINAL	UPDATE	COND. NO.	ST
X	810428	8.69449320000000D-02	9.78684435682565D-02	6.0	
Y	810428	2.63654610000000D-01	2.76548692800826D-01	1.8	
A1-UT1	810428	1.95293060000000D 01	1.95293060000000D 01	1.0	
X	810503	8.59549560000000D-02	1.17799843585530D-01	2.2	
Y	810503	2.60644580000000D-01	2.71880607286237D-01	1.3	
A1-UT1	810503	1.95442070000000D 01	1.95445360823440D 01	3.9	
X	810508	8.60000030000000D-02	9.17330785850185D-02	1.9	
Y	810508	2.56599540000000D-01	2.55322224035040D-01	1.4	
A1-UT1	810508	1.95563540000000D 01	1.95559414295214D 01	3.9	
X	810513	8.60000030000000D-02	1.13730039449978D-01	2.4	
Y	810513	2.52599540000000D-01	2.54850540745752D-01	1.5	
A1-UT1	810513	1.95605160000000D 01	1.95606475472966D 01	3.6	
X	810518	8.60000030000000D-02	1.20533993833462D-01	2.4	
Y	810518	2.48544460000000D-01	2.39433779732584D-01	1.6	
A1-UT1	810518	1.95797240000000D 01	1.95778414175572D 01	3.6	

ENTER MASK LINE (TYPE 'JSTOP' TO TERMINATE EDITING PROCESS)

***** POLAR MOTION (IN ARCSECONDS) *****

PARM.	YYMMDD	ORIGINAL	UPDATE	STD. DEV.
X	810428	8.69449320000000D-02	9.78684435682565D-02	0.1349E-02
Y	810428	2.63654610000000D-01	2.76541892800826D-01	0.7115E-03
A1-UT1	810428	1.95293060000000D 01	1.95293060000000D 01	0.1000E-07
X	810503	8.59549560000000D-02	1.17799843585530D-01	0.1303E-02
Y	810503	2.60644580000000D-01	2.71880607286237D-01	0.6006E-03
A1-UT1	810503	1.95442070000000D 01	1.95445360823440D 01	0.1028E-03
X	810508	8.60000030000000D-02	9.17330785850185D-02	0.1233E-02
Y	810508	2.56599540000000D-01	2.55322224035040D-01	0.6140E-03
A1-UT1	810508	1.95563540000000D 01	1.95559414295214D 01	0.9019E-04
X	810513	8.60000030000000D-02	1.13730039449978D-01	0.1276E-02
Y	810513	2.52599540000000D-01	2.54850540745752D-01	0.6302E-03
A1-UT1	810513	1.95605160000000D 01	1.95606475472966D 01	0.1146E-03
X	810518	8.60000030000000D-02	1.20533993833462D-01	0.1675E-02
Y	810518	2.48544460000000D-01	2.39433779732584D-01	0.7069E-03
A1-UT1	810518	1.95797240000000D 01	1.95778414175572D 01	0.1133E-03
X	810523	8.59449320000000D-02	9.72397128602590D-02	0.9034E-02
Y	810523	2.43499420000000D-01	2.36443509538950D-01	0.3608E-02
A1-UT1	810523	1.95897090000000D 01	1.95897479263652D 01	0.2031E-03

DO YOU WISH TO SAVE THIS SERIES OF MASK LINES FOR FUTURE USE? (YES/NO): YES

ENTER USER ID: CEN
ENTER A NAME FOR THIS SERIES OF MASK LINES (UP TO 10 CHARACTERS IN LENGTH)
PMMASK8

DO YOU WISH TO VIEW THE POLAR MOTION DATA AGAIN? (YES/NO): NO

DO YOU WISH TO EXAMINE THIS SOLVE LISTING AGAIN? (YES/NO): NO

DO YOU WISH TO EXAMINE BASELINE DATA FOR THIS TIME PERIOD? (YES/NO): NO

DO YOU WISH TO VIEW DATA FOR ANOTHER MONTH AND/OR YEAR? (YES/NO): NO

DO YOU WISH TO VIEW DATA FOR A ONE OR FIVE PERIOD NOW? (YES/NO): NO

Figure 34. (Continued)

ORIGINAL PAGE IS
OF POOR QUALITY

PAR.	YYMMDDHH(S)	YYMMDDHH(C)	ORIGINAL	DELTA	UPDATE	CUMU. NO.	STD. DEV.
X	78090100	78090100	1.771563300000000D-01	-2.366511830201246D-02	1.534912119179180D-01	3.1	0.4814E-02
Y	78090100	78090100	4.198537200000000D-01	1.289727963481452D-02	4.327509996340440D-01	4.8	0.5194E-02
X	78090600	78090600	1.892564400000000D-01	6.446388735859580D-05	1.893209030473590D-01	2.5	0.5488E-02
Y	78090600	78090600	4.088937600000000D-01	1.037101435492190D-02	4.192705743549220D-01	5.8	0.4178E-02
A1-UT1	78090600	78090600	1.709769200000000D 01	2.349940717451640D-04	1.709792699407470D 01	1.5	0.1877E-03
X	78091100	78091100	2.021913500000000D-01	-1.346170135596500D-02	1.887296486440350D-01	2.6	0.5217E-02
Y	78091100	78091100	3.978436900000000D-01	-5.443632513507350D-03	3.924000574864940D-01	3.4	0.3881E-02
A1-UT1	78091100	78091100	1.711030700000000D 01	8.290819649740940D-04	1.711113608196500D 01	2.0	0.1987E-03
X	78091600	78091600	2.130461900000000D-01	-8.145479921369320D-03	2.049007100706350D-01	4.7	0.4909E-02
Y	78091600	78091600	3.857435800000000D-01	1.563126857396120D-02	4.013748485739610D-01	4.6	0.3540E-02
A1-UT1	78091600	78091600	1.712464400000000D 01	1.310822002644370D-03	1.712595482206260D 01	2.5	0.1900E-03
X	78092100	78092100	2.229460800000000D-01	-7.789870362030550D-03	2.151561096371610D-01	7.0	0.4403E-02
Y	78092100	78092100	3.726985300000000D-01	2.691833107262740D-02	3.996128610726270D-01	3.7	0.3262E-02
A1-UT1	78092100	78092100	1.713820000000000D 01	1.049175609600740D-03	1.714004919569680D 01	3.8	0.1942E-03
X	78092600	78092600	2.318459700000000D-01	1.002020598047420D-03	2.336479965948470D-01	6.0	0.4438E-02
Y	78092600	78092600	3.596985300000000D-01	9.654835201739650D-03	3.693533365251739D-01	4.8	0.3132E-02
A1-UT1	78092600	78092600	1.715070400000000D 01	3.193125204030140D-03	1.715409712526400D 01	3.0	0.1987E-03

PAR.	YYMMDD	ORIGINAL	UPDATE	STD. DEV.
X	780901	1.771563300000000D-01	1.534912119179180D-01	0.4814E-02
Y	780901	4.198537200000000D-01	4.327509996340440D-01	0.5194E-02
X	780906	1.892564400000000D-01	1.893209030473590D-01	0.5488E-02
Y	780906	4.088937600000000D-01	4.192705743549220D-01	0.4178E-02
A1-UT1	780906	1.709769200000000D 01	1.709792699407470D 01	0.1877E-03
X	780911	2.021913500000000D-01	1.887296486440350D-01	0.5217E-02
Y	780911	3.978436900000000D-01	3.924000574864940D-01	0.3881E-02
A1-UT1	780911	1.711030700000000D 01	1.711113608196500D 01	0.1987E-03
X	780916	2.130461900000000D-01	2.049007100706350D-01	0.4909E-02
Y	780916	3.857435800000000D-01	4.013748485739610D-01	0.3540E-02
A1-UT1	780916	1.712464400000000D 01	1.712595482206260D 01	0.1900E-03
X	780921	2.229460800000000D-01	2.151561096371610D-01	0.4403E-02
Y	780921	3.726985300000000D-01	3.996128610726270D-01	0.3262E-02
A1-UT1	780921	1.713820000000000D 01	1.714004919569680D 01	0.1942E-03
X	780926	2.318459700000000D-01	2.336479965948470D-01	0.4438E-02
Y	780926	3.596985300000000D-01	3.693533365251739D-01	0.3132E-02
A1-UT1	780926	1.715070400000000D 01	1.715409712526400D 01	0.1987E-03

Figure 35. Portion of the Polar Motion Data Table Before and After the Masking Process

```
     THIS IS THE NEWS EXCHANGE OF THE CRUSTAL DYNAMICS PROJECT.
THIS NEWS EXCHANGE GIVES THE USER THE OPPORTUNITY TO BROWSE IN THE EXISTING
NEWS OR TO CONTRIBUTE HIS OWN NEWS FOR INCLUSION IN THE NEWS EXCHANGE.


SELECT FROM THE FOLLOWING CATEGORIES:

        CATEGORY 1--BROWSE THE NEWSLETTER
        CATEGORY 2--CONTRIBUTE TO THE NEWSLETTER

ENTER CATEGORY NUMBER:  1

USER WISHES TO BROWSE THE NEWS EXCHANGE
SELECT FROM THE FOLLOWING BROWSE METHODS:

        METHOD 1--BROWSE THE ENTIRE NEWS EXCHANGE
        METHOD 2--BROWSE A PARTICULAR NEWS SUBJECT OF THE NEWS EXCHANGE

ENTER METHOD NUMBER:  2

USER WISHES TO BROWSE A PARTICULAR NEWS SUBJECT
SELECT FROM THE FOLLOWING OPTIONS:

        OPTION 1--BROWSE THE ENTIRE NEWS SUBJECT
        OPTION 2--SEARCH THE NEWS SUBJECT FOR A PARTICULAR WORD OR
                  DATE

ENTER OPTION NUMBER:  2

SELECT SUBJECT OF NEWS FROM THE FOLLOWING LIST

POSSIBLE SUBJECTS:

         SUBJECT 1--NEWS ABOUT PROCESSED LASER DATA
         SUBJECT 2--NEWS ABOUT PROCESSED VLBI DATA
         SUBJECT 3--NEWS ABOUT ANALYZED LASER DATA
                    (E.G., BASELINES, ETC.)
         SUBJECT 4--NEWS ABOUT ANALYZED VLBI DATA
                    (E.G., BASELINES, POLAR MOTION, ETC.)
         SUBJECT 5--TLRS SCHEDULE, NEWS RELATED TO OCCUPANCY OF SCHEDULED SITES
         SUBJECT 6--OTHER GENERAL NEWS
                    (NEWS THAT DOES NOT EXPLICITLY FIT INTO ABOVE
                     NAMED SUBJECTS; E.G., NEWS ABOUT MEETINGS INTER-
                     COMPARISONS, ETC.  ALSO, ANY SUGGESTIONS FROM
                     USERS FOR IMPROVING THE NEWS EXCHANGE.)

END OF LIST

ENTER SUBJECT NUMBER:  1


     THIS IS THE SEARCH FUNCTION FOR THE NEWS EXCHANGE OF THE CRUSTAL
DYNAMICS PROJECT.  THE SELECTED NEWS SUBJECT WILL NOW BE SEARCHED FOR
A PARTICULAR KEYWORD, KEYDATE, OR KEYWORD IN A RANGE OF DATES, DEPENDING
ON THE PREFERENCE OF THE USER.


SELECT FROM THE FOLLOWING OPTIONS:

        OPTION 1--SEARCH TEXT FOR KEYWORD
        OPTION 2--SEARCH TEXT FOR DATE
        OPTION 3--SEARCH TEXT FOR KEYWORD IN A RANGE OF INPUT DATES
        OPTION 4--SEARCH TEXT FOR KEYWORD IN A RANGE OF DATA-REFERENCE
                  DATES

ENTER OPTION NUMBER:  4

SELECT FIRST DATE USING THE FORMAT MM/DD/YY:  06/01/80

SELECT SECOND DATE USING THE FORMAT MM/DD/YY:  12/31/80

TYPE KEYWORD TO SEARCH TEXT FOR (UP TO 20 CHARACTERS IN LENGTH)
KEYWORD MAY BE EXPRESSIONS SUCH AS:  LASER DATA, VLBI, JULY 1982, ETC.
THE ENTIRE KEYWORD SHOULD BE TYPED IN UPPER CASE LETTERS.

MOBLAS


THE DATE AND TIME COMMENTS WERE RECEIVED:  3 12 81  10:51:34
COMMENTS SENT BY USER D. SMITH
           AT LOCATION GSFC
COMMENTS IN REFERENCE TO START DATE        10  1 80
                         AND END DATE      10 30 80
MODIFICATIONS CURRENTLY UNDER TEST AT GSFC ARE EXPECTED TO PROVIDE A
SIGNIFICANT IMPROVEMENT TO DATA FROM MOBLAS UNITS 4 THROUGH 8.  MOBLAS 4
IS UNDERGOING FINAL CHECK-OUT ON A CAVITY DUMP MODIFICATION WH. H IS
EXPECTED TO REDUCE BIAS TO LESS THAN 10 CM.  IF SUCCESSFUL, THE SAME
MODIFICATION WILL BE EMPLOYED ON MOBLAS UNITS 5-8.
```

Figure 36. Selection Process for the Crustal Dynamics News Exchange

input, the data reference dates and investigator's information, and then stored in the appropriate subject file. Figure 37 illustrates the entry process as well as a listing of the stored news item.

5. SUMMARY

This work has discussed several aspects of the Data Information System that will be incorporated into NASA's Crustal Dynamics Project. It was intended to serve as an illustration of the methods of implementation of such a system, not as a final draft of the resulting applications. Although the majority of the formats presented here will be employed in the final, operational DIS, several will be updated to reflect new features, as they are presented to project personnel for review, and enhancements to the current technology (such as the text processing capabilities in the next version of the ORACLE DBMS) as they become available.

```
     THIS IS THE NEWS EXCHANGE OF THE CRUSTAL DYNAMICS PROJECT.
THIS NEWS EXCHANGE GIVES THE USER THE OPPORTUNITY TO BROWSE IN THE EXISTING
NEWS OR TO CONTRIBUTE HIS OWN NEWS FOR INCLUSION IN THE NEWS EXCHANGE.


SELECT FROM THE FOLLOWING CATEGORIES:

        CATEGORY 1--BROWSE THE NEWSLETTER
        CATEGORY 2--CONTRIBUTE TO THE NEWSLETTER

ENTER CATEGORY NUMBER:  2

SELECT SUBJECT OF NEWS FROM THE FOLLOWING LIST

POSSIBLE SUBJECTS:

          SUBJECT 1--NEWS ABOUT PROCESSED LASER DATA
          SUBJECT 2--NEWS ABOUT PROCESSED VLBI DATA
          SUBJECT 3--NEWS ABOUT ANALYZED LASER DATA
                 (E.G., BASELINES, ETC.)
          SUBJECT 4--NEWS ABOUT ANALYZED VLBI DATA
                 (E.G., BASELINES, POLAR MOTION, ETC.)
          SUBJECT 5--TEMS SCHEDULE, NEWS RELATED TO OCCUPANCY OF SCHEDULED SITES
          SUBJECT 6--OTHER GENERAL NEWS
                 (NEWS THAT DOES NOT EXPLICITLY FIT INTO ABOVE
                  NAMED SUBJECTS; E.G., NEWS ABOUT MEETINGS INTER-
                  COMPARISONS, ETC.  ALSO, ANY SUGGESTIONS FROM
                  USERS FOR IMPROVING THE NEWS EXCHANGE.)

END OF LIST

ENTER SUBJECT NUMBER:  6

YOUR USER ID:  DES
YOUR NAME:  D. E. SMITH
YOUR LOCATION:  CODE 921, GSFC

INDICATE THE RANGE OF DATES FOR WHICH YOUR FOLLOWING COMMENTS WILL APPLY
START DATE (USING FORMAT MM/DD/YY):  09/01/81
END DATE (USING FORMAT MM/DD/YY):  09/03/81

TYPE COMMENTS TO BE USED IN THE NEWS EXCHANGE.
EACH LINE MAY BE UP TO 72 CHARACTERS IN LENGTH.
IT IS RECOMMENDED (FOR PROPER FUNCTIONING OF THE SEARCH ROUTINE) THAT WORDS
     NOT BE HYPHENATED AT THE END OF A LINE
SIGNIFY THE END OF THE NEWS TEXT BY TYPING THE EXACT EXPRESSION "@RETURN".

THE 55 TENTATIVELY SELECTED CRUSTAL DYNAMICS PROJECT INVESTIGATORS WILL JOIN
WITH THE LAGEOS INVESTIGATORS FOR A 3-DAY WORKING SESSION SEPTEMBER 1 THROUGH
3 AT GSFC.
THIS WILL BE THE FIRST MEETING OF THE NEWLY FORMED CRUSTAL DYNAMICS WORKING
GROUP.  NASA HEADQUARTERS HAS TENTATIVELY SELECTED THE DOMESTIC AND FOREIGN
INVESTIGATORS FROM APPROXIMATELY 90 PROPOSALS SUBMITTED IN RESPONSE TO THE
CRUSTAL DYNAMICS ANNOUNCEMENT OF OPPORTUNITY.
THE FIRST DAY AND A HALF OF THE MEETING WILL BE DEVOTED TO REPORTS FROM LAGEOS
INVESTIGATORS ON THE PROGRESS OF THEIR RESEARCH.

THE AFTERNOON OF THE SECOND AND ALL DAY ON THE THIRD HAVE BEEN SCHEDULED
TENTATIVELY FOR DISCUSSION OF THE PROJECT'S STATUS, OBSERVING PROGRAM, DATA
AVAILABILTY, CONTRACT ARRANGEMENTS AND A REVIEW OF THE ACCEPTED PROPOSALS.
@RETURN

NEWS SUCCESSFULLY INPUTED UNDER SUBJECT 6

DO YOU WISH TO CONTINUE TO BROWSE OR CONTRIBUTE TO NEWS EXCHANGE?  (YES/NO):  YES
SELECT FROM THE FOLLOWING CATEGORIES:

        CATEGORY 1--BROWSE THE NEWSLETTER
        CATEGORY 2--CONTRIBUTE TO THE NEWSLETTER

ENTER CATEGORY NUMBER:  1

USER WISHES TO BROWSE THE NEWS EXCHANGE
SELECT FROM THE FOLLOWING BROWSE METHODS:

        METHOD 1--BROWSE THE ENTIRE NEWS EXCHANGE
        METHOD 2--BROWSE A PARTICULAR NEWS SUBJECT OF THE NEWS EXCHANGE

ENTER METHOD NUMBER:  2

USER WISHES TO BROWSE A PARTICULAR NEWS SUBJECT
SELECT FROM THE FOLLOWING OPTIONS:

        OPTION 1--BROWSE THE ENTIRE NEWS SUBJECT
        OPTION 2--SEARCH THE NEWS SUBJECT FOR A PARTICULAR WORD OR
                DATE

ENTER OPTION NUMBER:  1
```

Figure 37. Entry Process for the Crustal Dynamics News Exchange

```
SELECT SUBJECT OF NEWS FROM THE FOLLOWING LIST

POSSIBLE SUBJECTS:

          SUBJECT 1--NEWS ABOUT PROCESSED LASER DATA
          SUBJECT 2--NEWS ABOUT PROCESSED VLBI DATA
          SUBJECT 3--NEWS ABOUT ANALYZED LASER DATA
                  (E.G., BASELINES, ETC.)
          SUBJECT 4--NEWS ABOUT ANALYZED VLBI DATA
                  (E.G., BASELINES, POLAR MOTION, ETC.)
          SUBJECT 5--TLRS SCHEDULE, NEWS RELATED TO OCCUPANCY OF SCHEDULED SITES
          SUBJECT 6--OTHER GENERAL NEWS
                  (NEWS THAT DOES NOT EXPLICITLY FIT INTO ABOVE
                   NAMED SUBJECTS; E.G., NEWS ABOUT MEETINGS INTER-
                   COMPARISONS, ETC.  ALSO, ANY SUGGESTIONS FROM
                   USERS FOR IMPROVING THE NEWS EXCHANGE.)

END OF LIST

ENTER SUBJECT NUMBER:  6


THE DATE AND TIME COMMENTS WERE RECEIVED:  3 31 81  13:01:16
COMMENTS SENT BY USER D. SMITH
           AT LOCATION GSFC
COMMENTS IN REFERENCE TO START DATE        10  1 80
                         AND END DATE      10 31 80
THE "LAGEOS TECHNICAL BULLETIN" WILL PROVIDE NEWS OF INTEREST TO LAGEOS

INVESTIGATORS:  INFORMATION ABOUT THE AVAILABILITY, QUALITY, AND QUANTITY
OF DATA, SUMMARIES OF IMPORTANT RESULTS FROM PROGRAM INVESTIGATIONS, AND
ANNOUNCEMENTS OF RELEVANT MEETINGS AND WORKSHOPS.  THE EDITORS EXPECT TO
PUBLISH THE ISSUES ON A QUARTERLY BASIS.
THE NEWS TEXT CONSISTS OF  5 LINES

THE DATE AND TIME COMMENTS WERE RECEIVED:  3 23 81  13:03:23
COMMENTS SENT BY USER D. SMITH
           AT LOCATION GSFC
COMMENTS IN REFERENCE TO START DATE        10  1 80
                         AND END DATE      10  2 80
THE THIRD LAGEOS WORKING GROUP SESSION WILL BE HELD AT GSFC ON WEDNESDAY
AND THURSDAY, OCTOBER 1 AND 2, 1980.
MAJOR SUBJECTS TO ADDRESSED AT THE SESSION INCLUDE THE MOST RECENT STATUS
OF THE CURSTAL DYNAMICS PROJECT, DATA AVAILABILITY AND NETWORK STATUS FOR
GSFC AND SAO LASER NETWORKS, AS WELL AS DETAILED DISCUSSION ON THE
EUROPEAN LASER NETWORK IN THE U.K., FRANCE, THE NETHERLANDS AND GERMANY.
THE NEWS TEXT CONSISTS OF  6 LINES

END OF NEWS TEXT FOR SUBJECT  6

DO YOU WISH TO SEARCH NEWS SUBJECT  6 NOW?  (YES/NO):  NO

DO YOU WISH DO VIEW UN-EDITED NEWS FOR SUBJECT 6?  (YES/NO):  YES

THE DATE AND TIME COMMENTS WERE RECEIVED: 03  5 81  09:13:32
COMMENTS SENT BY USER D. E. SMITH
           AT LOCATION CODE 921, GSFC
COMMENTS IN REFERENCE TO START DATE         9  1 81
                         AND END DATE       9  3 81
THE 55 TENTATIVELY SELECTED CRUSTAL DYNAMICS PROJECT INVESTIGATORS WILL JOIN
WITH THE LAGEOS INVESTIGATORS FOR A 3-DAY WORKING SESSION SEPTEMBER 1 THROUGH
3 AT GSFC.
THIS WILL BE THE FIRST MEETING OF THE NEWLY FORMED CRUSTAL DYNAMICS WORKING
GROUP.  NASA HEADQUARTERS HAS TENTATIVELY SELECTED THE DOMESTIC AND FOREIGN
INVESTIGATORS FROM APPROXIMATELY 90 PROPOSALS SUBMITTED IN RESPONSE TO THE
CRUSTAL DYNAMICS ANNOUNCEMENT OF OPPORTUNITY.
THE FIRST DAY AND A HALF OF THE MEETING WILL BE DEVOTED TO REPORTS FROM LAGEOS
INVESTIGATORS ON THE PROGRESS OF THEIR RESEARCH.
THE AFTERNOON OF THE SECOND AND ALL DAY ON THE THIRD HAVE BEEN SCHEDULED
TENTATIVELY FOR DISCUSSION OF THE PROJECT'S STATUS, OBSERVING PROGRAM, DATA
AVAILABILTY, CONTRACT ARRANGEMENTS AND A REVIEW OF THE ACCEPTED PROPOSALS.
THE NEWS TEXT CONSISTS OF 12 LINES


END OF UN-EDITED NEWS FOR SUBJECT 6

DO YOU WISH TO BROWSE ANOTHER NEWS SUBJECT?  (YES/NO):  NO

DO YOU WISH TO CONTINUE TO BROWSE OR CONTRIBUTE TO NEWS EXCHANGE?  (YES/NO):  NO
```

Figure 37. (Continued)

REFERENCES

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2. "VLBI: Extragalactic Radio Sources Used To Measure Crustal Dynamics." LAGEOS Technical Bulletin. Vol. 1, No. 4. NASA/GSFC. Sept. 1981.

3. Lowman, P. D. Jr. "A Global Tectonic Activity Map." Bulletin of The International Association Of Engineering Geology No. 23. Krefeld, 1981.

4. NASA Execution Phase Project Plan for Crustal Dynamics. NASA/GSFC. September 1981.

5. Linder, H. G. Data Management Plan for Crustal Dynamics Project. NASA/GSFC X-931-81-81. July 1981.

6. ORACLE User's Guide Version 2.3. Relational Software Inc.. April 1981.