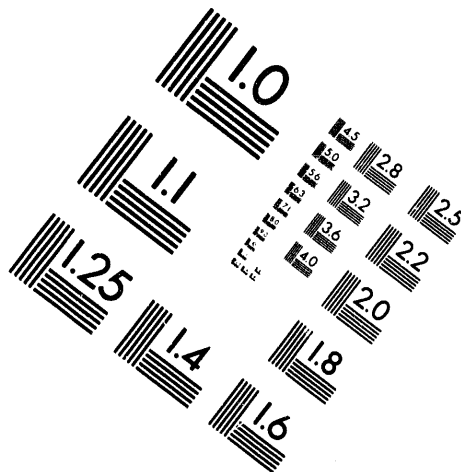
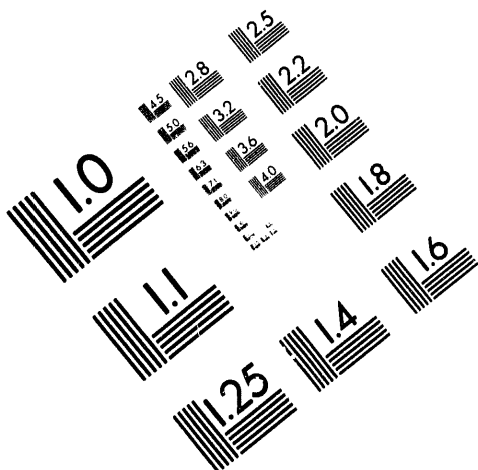




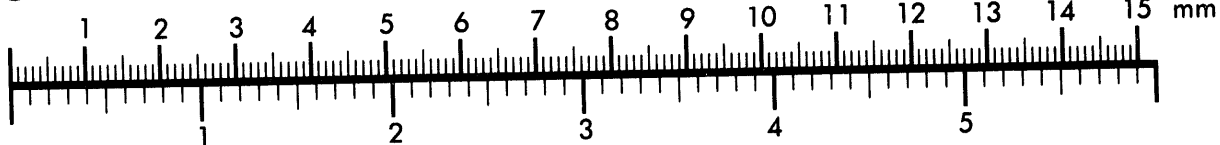
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Association for Information and Image Management

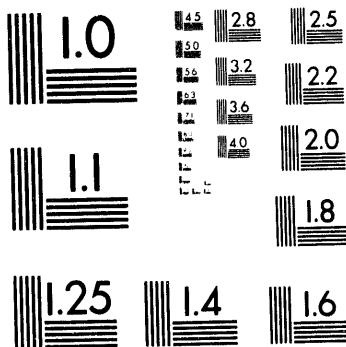
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Silver Spring, Maryland 20910
301/587-8202



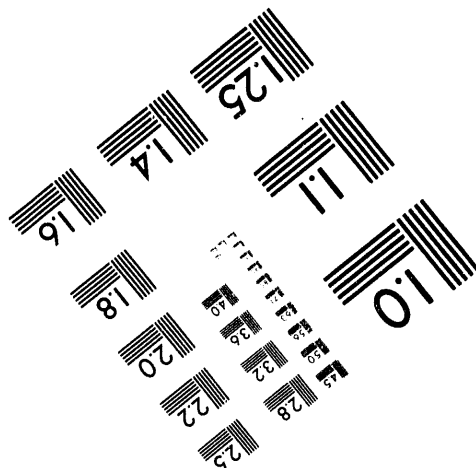
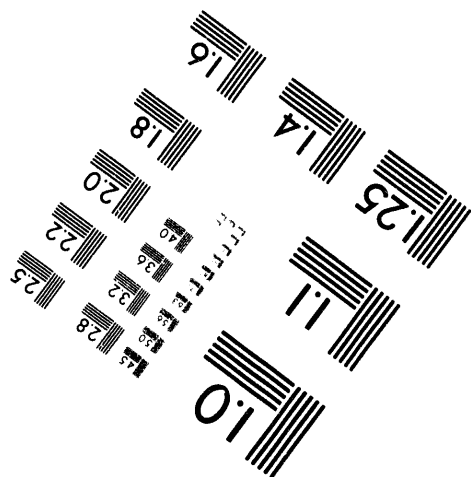
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Yucca Mountain Project
INTEGRATED DATA SYSTEM (IDS)

Computer Applications Group, Inc

**LANL Subcontract 9-XS8-2604-1
Final Report**

**This report covers the period
October 1, 1989 – December 31, 1990**

Prepared By

Computer Applications Group, Inc.
13800 NE Merchant Road
Carlton, OR 97111
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May 23, 1991

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Section 1

Functional Requirements Document (FRD)

Summary

This final report for LANL Subcontract 9-XS8-2604-1 includes copies of all formal letters, memorandums, and reports provided by CAG to support the IDS effort in the LANL Test Managers Office, Las Vegas, Nevada from October 1, 1989 through the end of the contract on December 31, 1990. The material is divided into two sections; the Functional Requirements Document (FRD) and other reports, letters, and memorandums. All documents are arranged in chronological order with most recent last. Numerous draft copies of the FRD were prepared and cover sheets for all drafts are included. The complete text of only the last version supplied (July 27, 1990) is included in this document.

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Section 1 Functional Requirements Document

Section 2 Reports, Letters, and Memorandums

**Yucca Mountain Project
INTEGRATED DATA SYSTEM (IDS)**

**IDS
FUNCTIONAL
REQUIREMENTS
DOCUMENT**

Revision 1.1

Prepared By

**Los Alamos National Laboratory
Test Manager's Office
Las Vegas, Nevada**

Effective Date

H.N. Kalia
Preparer

Date

F.R. Oblad
Reviewer

Date

D. Hall
Reviewer

Date

R.A. Morley
TMO QAL

Date

DRAFT v1 0.1

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1.0 INTRODUCTION

1.1 Purpose of the Functional Requirements Document

This Functional Requirements Document (FRD) defines the functional requirements necessary for design of the Integrated Data System (IDS). The FRD (and latest revisions) provides or identifies other source documents providing IDS functional design requirements to the IDS contractor in support of IDS design activities. The FRD is an approved Los Alamos National Laboratory (LANL) document controlled by the LANL Test Managers Office (TMO). Control and updates to the FRD will be managed under appropriate sections of the LANL Quality Assurance (QA) program. Only LANL reviewed and approved input from participants shall be incorporated into this document. At this time only a portion of participant requirements have been finalized. FRD revisions are anticipated as additional requirements are approved to maintain a timely record of current requirements. As new requirements are identified, interim LANL TMO approved requirements designated as changes to the FRD, but not yet incorporated into the document, shall be supplied to the IDS contractor by the TMO and used by the IDS contractor as functional requirements. The FRD will be revised to incorporate these requirements annually or more often as required to reflect significant changes in requirements.

1.1.1 Documented Requirements

IDS requirements originate from approved Yucca Mountain Project (YMP) and participant documents specifically concerned with defining IDS functionality or from best engineering judgments by the TMO. Specific references to approved program documents are included in the FRD.

1.1.2 Documented Incorporation of FRD Requirements Into the IDS Design

YMP test program participants are the source of IDS functional requirements. As these functional requirements are formally approved and distributed by participants, they are incorporated into the FRD to be used by the IDS contractor as the basis for IDS design. The IDS contractor shall review, approve, and incorporate all FRD requirements into the IDS design. The design process shall generate documented design requirements with specific references to FRD requirements incorporated into detailed design elements. These design requirement documents shall be developed and revised, as necessary, to reflect the contents of this FRD and subsequent revisions in a timely manner. The design requirement documents shall be reviewed and approved by the TMO prior to incorporation into the IDS design.

2.0 GENERAL REQUIREMENTS FOR IDS DESIGN

2.1 General Functional Requirements

General functional requirements for the IDS design shall support the following capabilities:

- Collect data from tests located at identified participant test sites, participant computers, data loggers, and other portable instrument readouts.
- Record and store the collected data in the IDS test database.
- Transfer the stored data from the IDS to program data centers and users following applicable LANL and YMPO procedures.

The IDS is a critical facility for collecting data from ESF site characterization tests. The continuous nature of the testing program requires particular attention to the following issues:

- *Data collection shall be independent of test location* and other physical or management issues and determined only by programmed operating characteristics of the IDS.
- *Collected data shall be recorded* in on-line storage for participant access *and stored* in IDS data archives pending transfer to YMP record centers.
- *Data transfers* are limited to TMO approved source data and recipients.
- *Continuous 24 hours-per-day operation* shall be provided with automatic data collection from all designated sensors without operator intervention for normal operation.
- *Operational life of the IDS* is determined by ESF testing requirements as specified by participants in testing requirements or facility maintainable life specified in the SDRD (5 years).
- *High system reliability* is essential to meet testing and operational goals and provide user confidence in the credibility of the collected data.
- *System redundancy* shall be considered to protect the system from catastrophic loss of data. Surface, shaft, and main test level disruptions shall be studied to develop cost effective solutions to identified equipment malfunction and accidental destruction scenarios.
- *Maintenance and operating issues shall be considered* to provide a modular design that can be expanded and installed according to future requirements and construction and testing schedules without disruption of existing data acquisition activities and subsequent loss of data.

2.2 Project Office Requirements

Direction from the Project Office pertaining to content and implementation of the YMP technical program that may effect IDS functional requirements shall be directed to participant organizations. Specific Project Office issues relating to design and implementation of the IDS shall be directed to the LANL TMO. These items shall be reviewed and approved by the TMO, with the concurrence of the Project Office, for inclusion in the design prior to incorporation.

2.3 Program Requirements

The purpose and scope of this document is to provide additional detail for IDS design requirements contained in YMP design requirements documents. Certain DOE and YMP technical requirements shall be incorporated into the design and operational planning effecting the design. Specific requirements identified for inclusion in design shall be reviewed and approved by the TMO prior to incorporation. As directed by the TMO, the IDS design shall be in compliance with the current revision of the following orders, requirements, and procedures:

DOE orders:

1. 4700.1A Project Management System.
2. 1330 1C Acquisition and Management of Computer Software.
3. 1360.1A Acquisition and Management of Automatic Data Processing Equipment and Resources.
4. 1360.2A Unclassified Computer Security Program.
5. 1360.3A Automatic Data Processing Standards.
6. 1360.4A Scientific and Technical Computer Software.
7. 1450.1C Acquisition, Utilization, and Administration of Teleprocessing Services.
8. 1450.2 Teleprocessing Services Program Points of Contact.
9. 5300.1B Telecommunications.

YMP requirements:

YMP/CM-0006 Exploratory Shaft Facility Subsystem Design Requirements Document (SDRD) for Title 2, rev. 1, 3-22-90 or current revision.

YMP QA procedures:

AP-5.1Q Control and Transfer of Technical Data on the Yucca Mountain Project, rev. 0, 3-29-90 or current revision.

2.4 Technical Specifications and Standards

Certain technical requirements referenced in the FRD and defined by existing specifications and standards shall be incorporated into the design. Specific requirements identified for inclusion in design shall be reviewed and approved by the TMO prior to incorporation. As directed by the TMO, the IDS design shall be in compliance with the current revision of the following specifications and standards:

1. IEEE 488.1-1987 Standard Digital Interface for Programmable Instrumentation.
2. IEEE 488.2-1987 Standard Codes, Formats, Protocols, and Common Commands for Use with ANSI/IEEE 488.1-1987, IEEE Standard Digital Interface for Programmable Instrumentation.
3. EIA-422-A Electrical Characteristics of Balanced Voltage Digital Interface Circuits.
4. EIA-232-D Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.

3.0 SPECIFIC REQUIREMENTS FOR IDS DESIGN

3.1 Functional Analysis

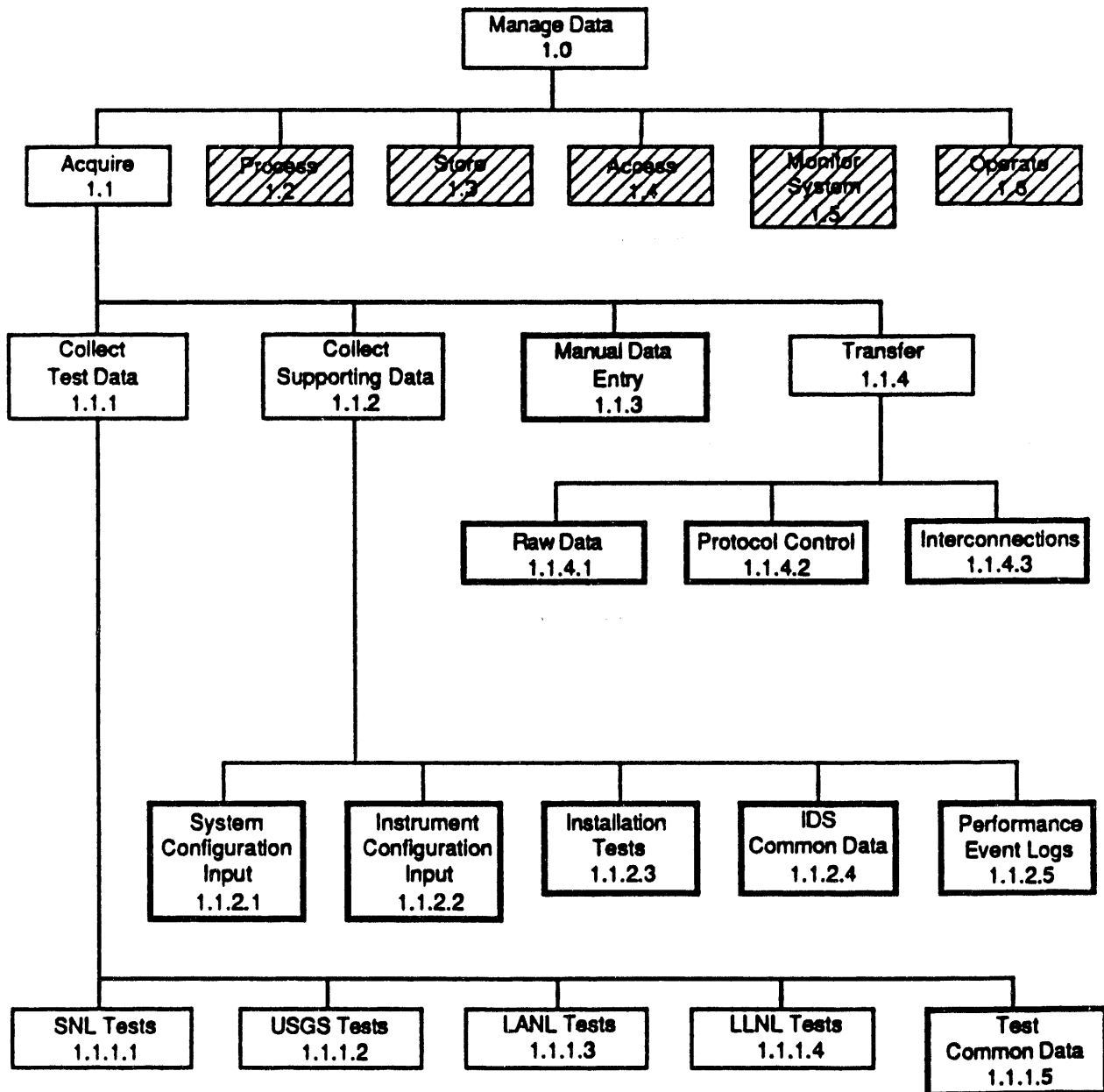
This analysis characterizes the Exploratory Shaft Facility (ESF) IDS as a data management function providing participant testing organizations and the Yucca Mountain Project Office (YMPO) with high quality, defensible test data supporting ESF licensing. The analysis is based on the mission of the IDS to acquire, record, control, and distribute site characterization test data.

The functional analysis is composed of an annotated graphical representation of logical and essential elements of the overall IDS requirements for design. Elements are displayed in an inverted tree with the highest level activity (or most general concept) located in the top-most position in the diagram. In some cases there is insufficient information to generate further analysis or specific system requirements. In this case, the analysis is terminated awaiting further details to be included in a later FRD revision.

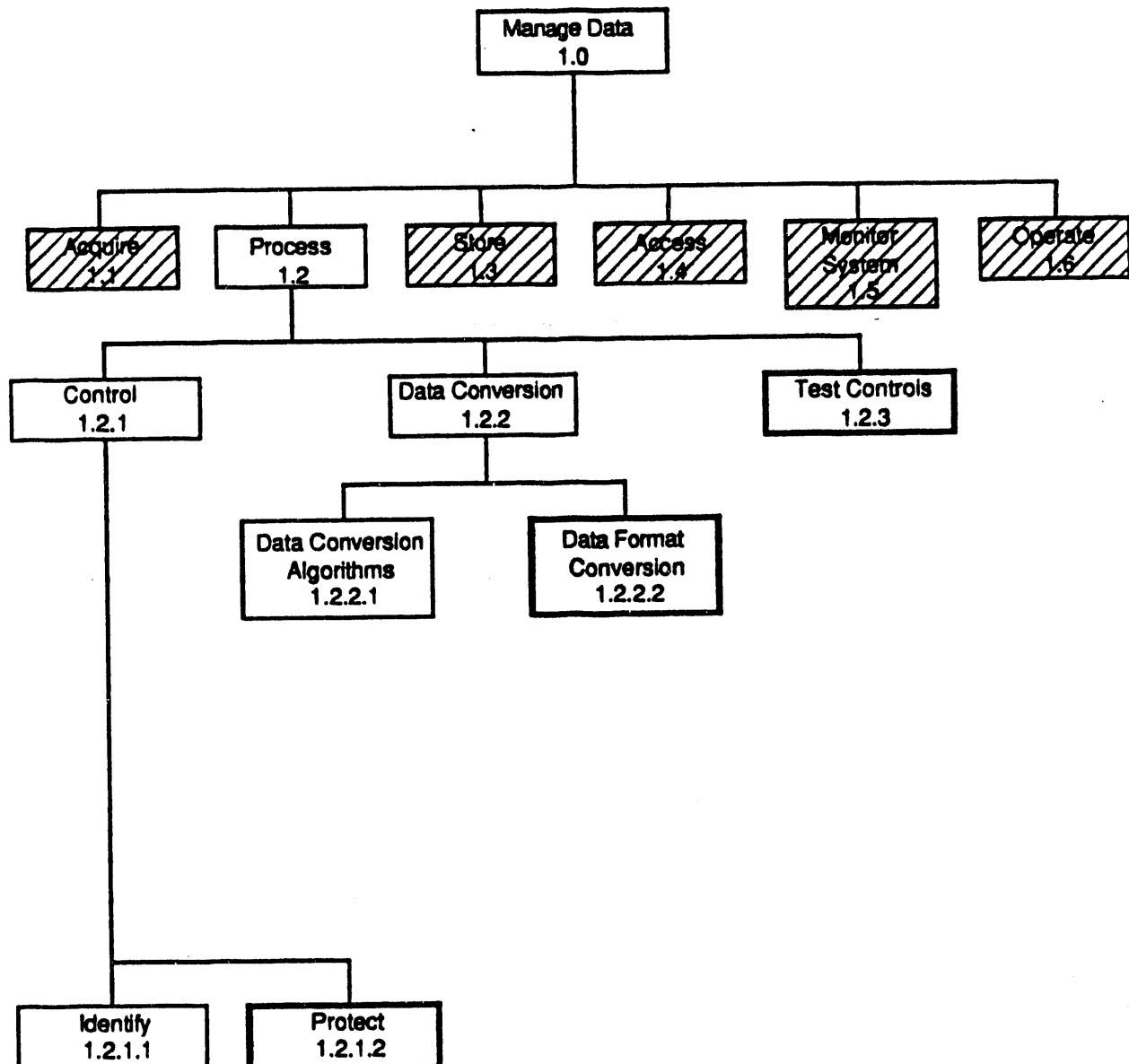
Each element is graphically represented to indicate function and the position of the element in the analysis as follows:

- *Heavily outlined boxes* are terminal elements of this analysis. The text description of the function usually includes additional information to supplement the single word or phrase contained in the box.
- *Rounded corner boxes* are the lowest level descriptive element and always have additional text information to supplement the single word or phrase contained in the box.
- *Shaded boxes* are not included in the representation of the identified analysis tree segment.
- *Graphic blocks are numbered* in a unique sequence not related to FRD document section numbering. This graphic numbering system is used throughout the document to maintain a consistent graphic block reference.

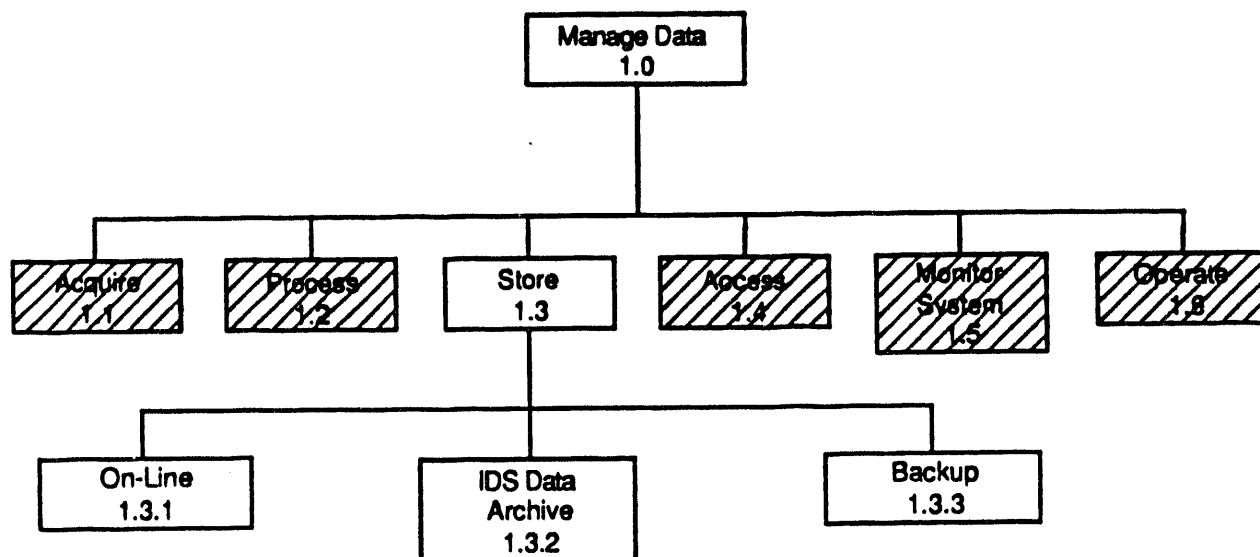
3.1.1 Acquire



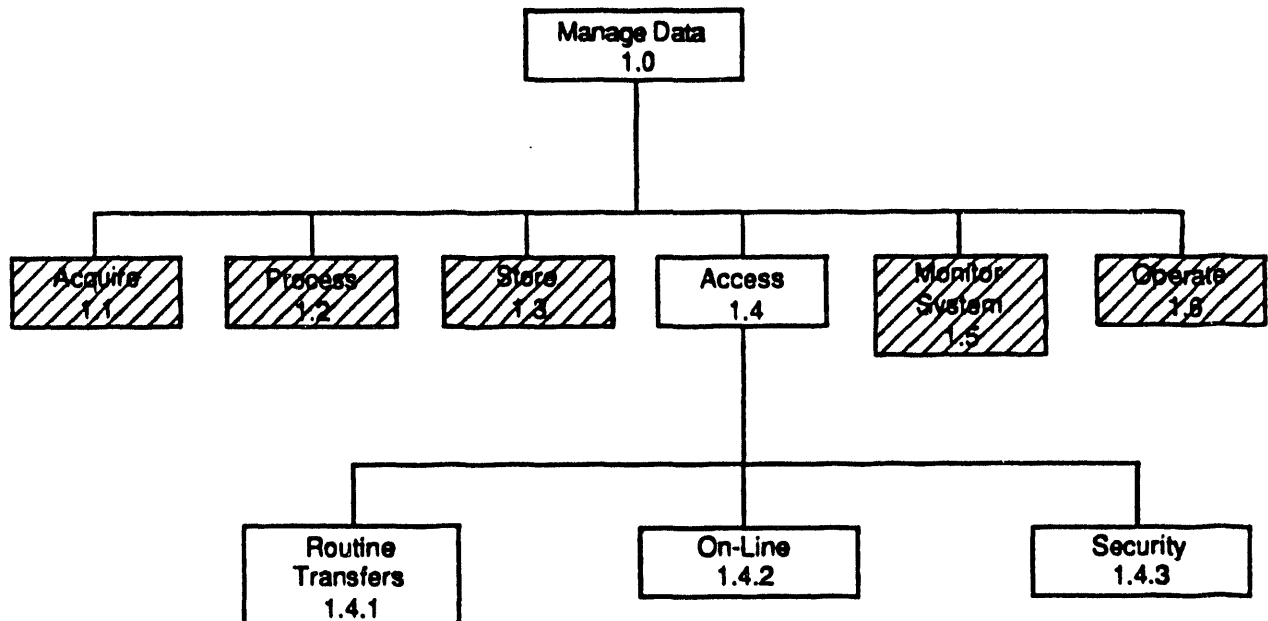
3.1.2 Process



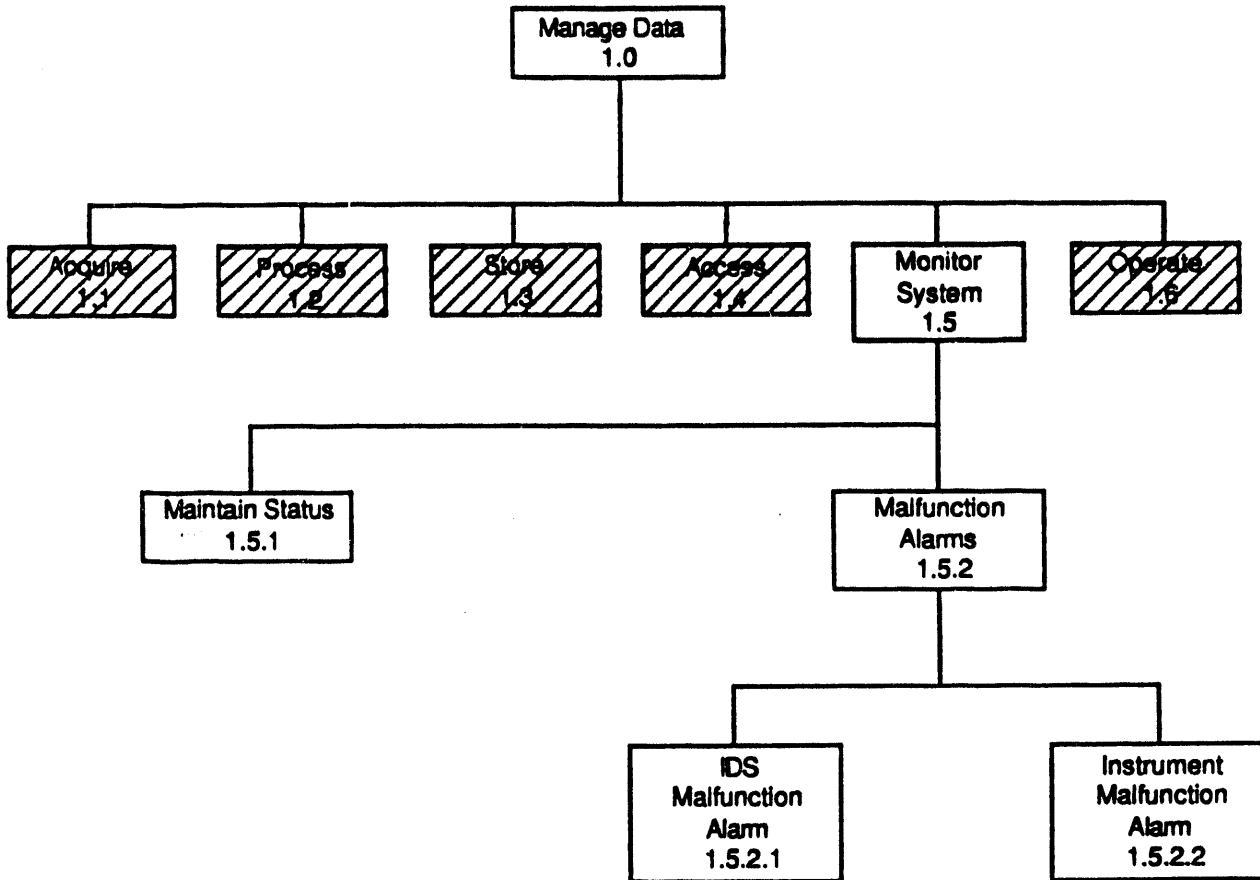
3.1.3 Store



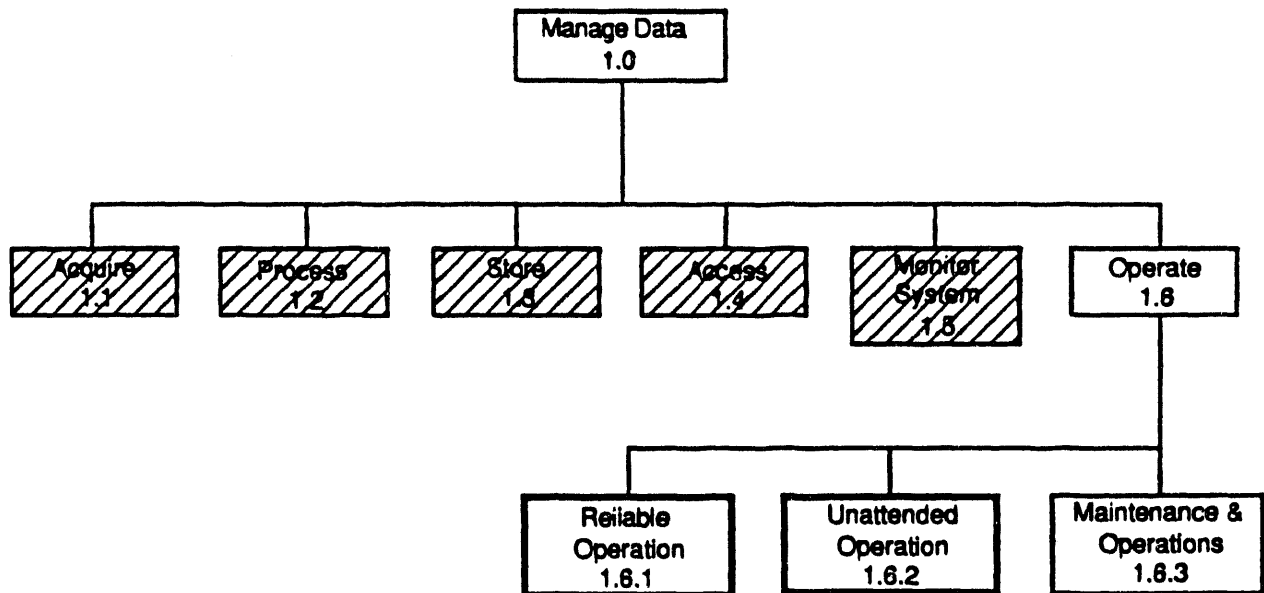
3.1.4 Distribute



3.1.5 Monitor System



3.1.6 Operate



3.2 Detailed Analysis

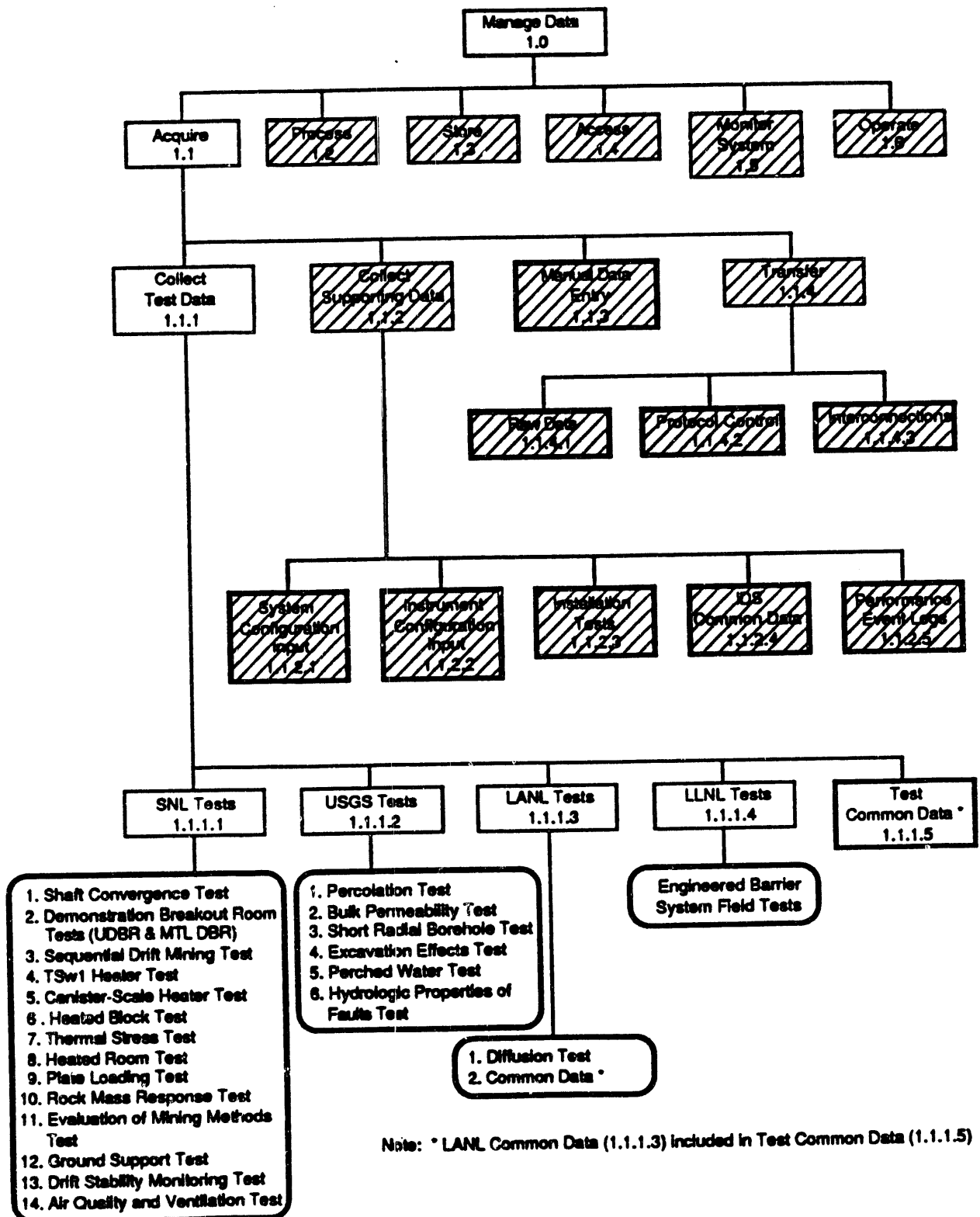
Detailed analysis continues the expansion of the high level conceptual elements into more specific concepts and categories. In this phase of the analysis, all branches of the tree diagrams terminate, indicating that this branch of the analysis is complete or there is insufficient information to continue. Specific requirements, resulting from the analysis, are included in the text portion of this section.

Each element is graphically represented to indicate function and the position of the element in the analysis as follows:

- *Lightly outlined boxes* are subject to continued expansion throughout the analysis to produce more fundamental functional requirements. The text description of the function is often limited to the single word or phrase contained in the box.
- *Heavily outlined boxes* are terminal elements of this analysis. The text description of the function usually includes additional information to supplement the single word or phrase contained in the box. Further expansion of these elements will be part of IDS contractor design activities.
- *Rounded corner boxes* are the lowest level descriptive element and always have additional text information to supplement the single word or phrase contained in the box. Further expansion of these elements will be part of IDS contractor design activities.
- *Shaded boxes* are not included in the representation or description of the identified analysis tree segment.
- *Italic text section headings* indicate specifications related to terminal boxes in the analysis.
- *Graphic block number references* in parenthesis follow each document section title. These graphic numbering references are used to maintain a consistent graphic numbering system in each section of the FRD.

Figure 3.2.1

Acquire
Collect Test Data



3.2.1 Acquire (1.1)

The IDS shall acquire data from participant tests and supporting data sources to document YMP testing activities. To support data acquisition, the IDS design shall provide for an expansion of monitored channels, processing, and storage capabilities by 200% to accommodate possible increased requirements later in the testing program. The actual number of data, excitation, digital I/O, and communications channels implemented shall be determined from testing requirements and increased by a fixed percentage determined from cost benefit studies to account for needed spare and contingent on-line excess capacity. IDS components shall make analog-to-digital conversion of test instrument analog output signals. Instrument excitation shall be provided by digital-to-analog conversion components as required. All measurements shall be traceable to the National Institute of Standards and Technology (NIST) and shall maintain participant requirements for accuracy and resolution.

Provision for formatted data entry from IDS compatible tapes and disks and networked participant computers shall be provided. Data transfer from terminals (manual data entry), communications networks, computer systems, control I/O equipment, and participant data loggers and portable data acquisition equipment shall be supported by appropriate network interfaces and IEEE-488, RS-232, and/or RS-422 data communication ports as needed. Communication requirements for participant data logger and portable data acquisition equipment shall be specified after participant equipment and software has been identified. All digital data interfaces and transmission protocols shall be specified by the IDS contractor unless they are an integral part of participant equipment hardware and/or software.

3.2.1.1 Collect Test Data (1.1.1): The IDS shall collect and process all required data from the participant testing programs including checkout tests, installation/acceptance tests, and operational tests in Exploratory Shaft #1 (ES1) and Exploratory Shaft #2 (ES2), Upper Demonstration Breakout Room (UDBR), Main Test Level Demonstration Breakout Room (MTLDBR), Main Test Level (MTL), and other ESF testing areas identified as the testing program develops.

3.2.1.1.1 SNL Tests (1.1.1.1): Detailed test requirements for SNL tests are shown in Section 3.3.1.

3.2.1.1.2 USGS Tests (1.1.1.2): Detailed test requirements are for USGS tests are shown in Section 3.3.2.

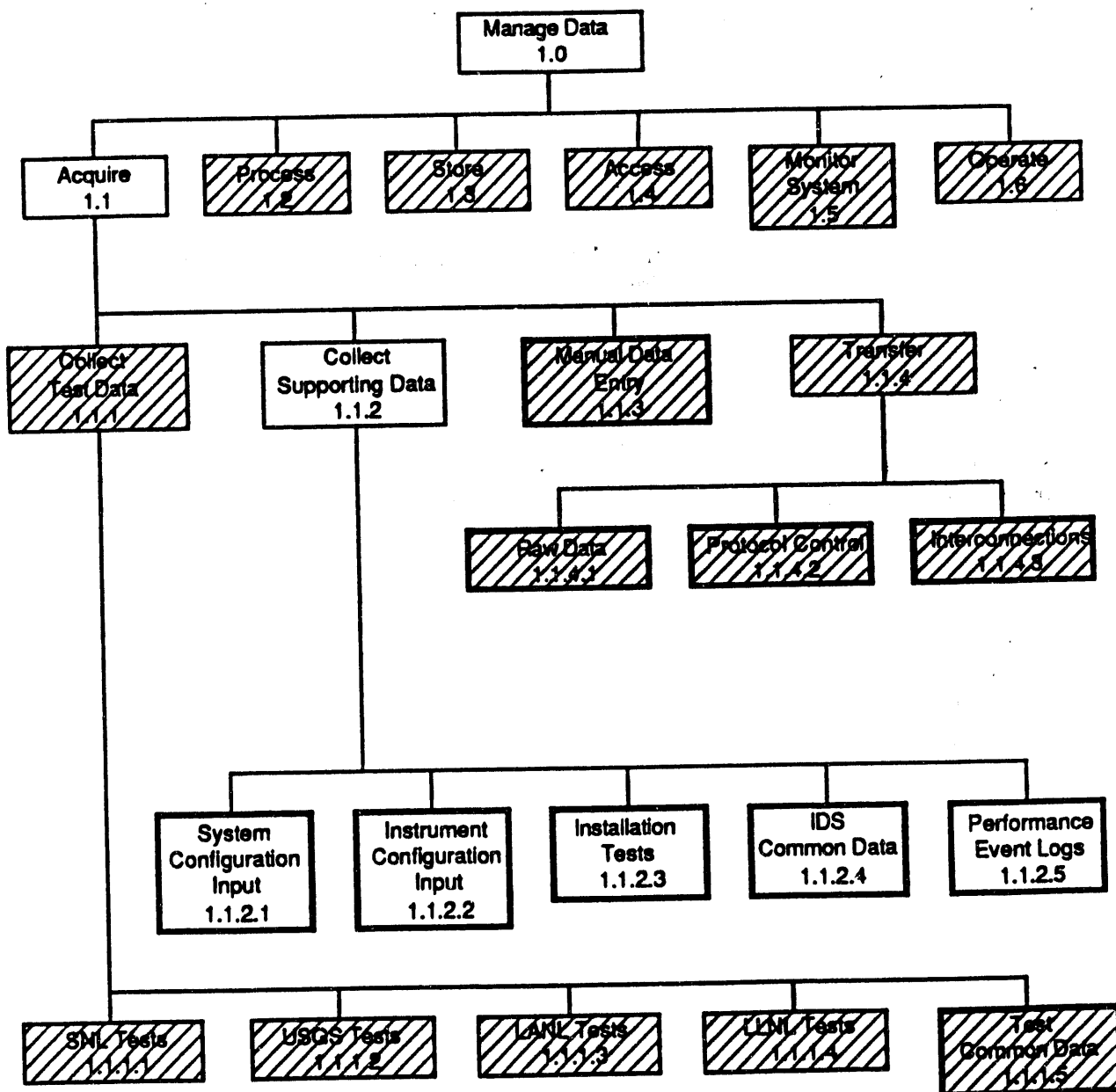
3.2.1.1.3 LANL Tests (1.1.1.3): Detailed test requirements are for LANL tests are shown in Section 3.3.3.

3.2.1.1.4 LLNL Tests (1.1.1.4): Detailed test requirements are for LLNL tests are shown in Section 3.3.4.

3.2.1.1.5 Test Common Data (1.1.1.5): Test common data consists of environmental measurements for support of all participant testing programs. LANL Common Data Tests will include drift temperature and humidity and rock background temperatures, in and/or out of the ESF. These tests are referenced in Section 3.3.4. In addition the IDS shall store participant supplied surface weather data.

Figure 3.2.2

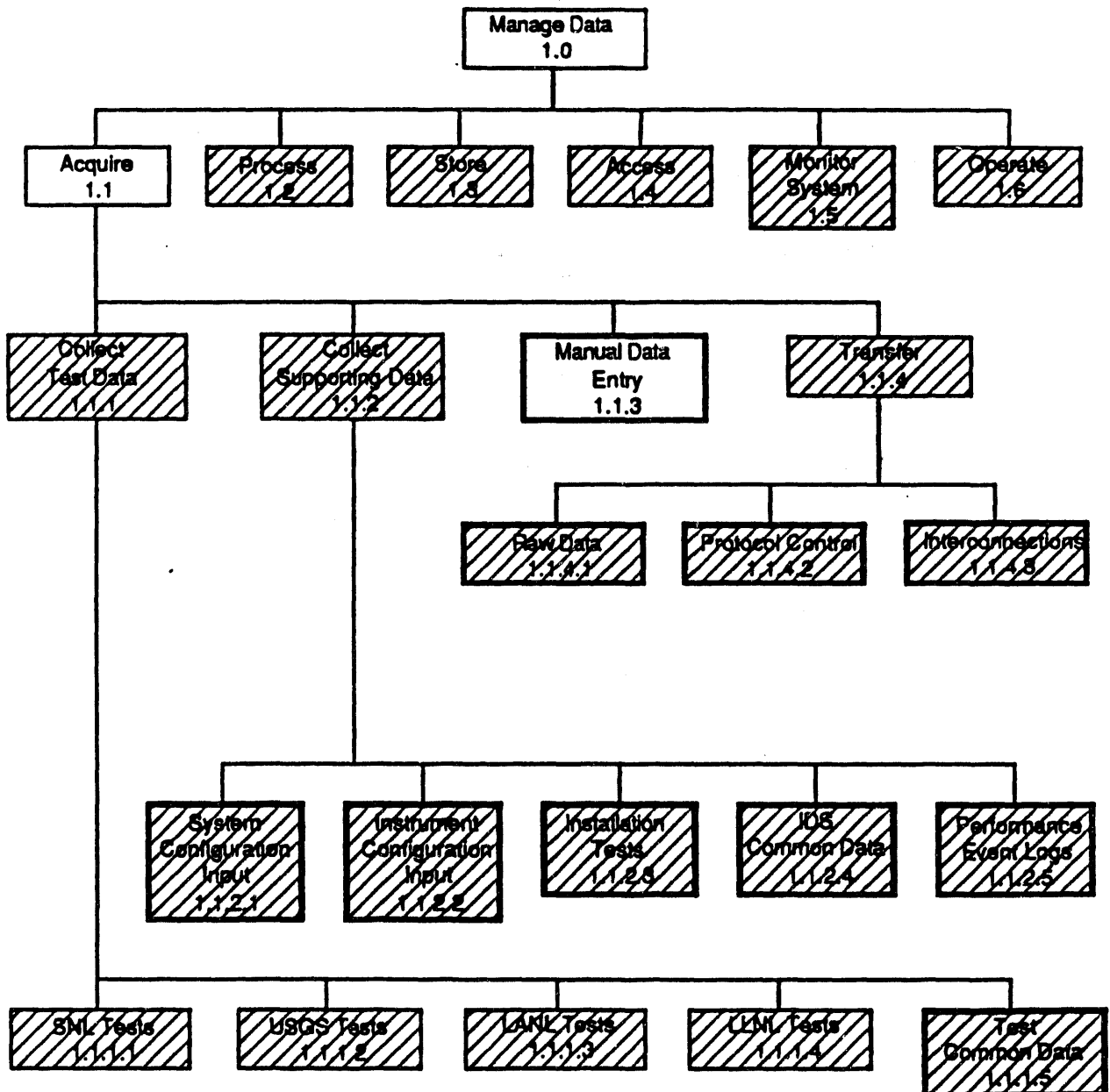
Acquire
Collect Supporting Data



- 3.2.1.2 Collect Supporting Data (1.1.2):** The IDS shall collect and process all required data from supporting data sources including IDS configurations and test configurations, including instruments, configurations for participant computers, controllers, and auxiliary equipment located in Exploratory Shaft #1 (ES1) and Exploratory Shaft #2 (ES2), Upper Demonstration Breakout Room (UDBR), Main Test Level Demonstration Breakout Room (MTLDBR), Main Test Level (MTL), and other ESF testing areas that may be identified in the testing program.
- 3.2.1.2.1 *System Configuration Input (1.1.2.1):*** IDS system configuration change information including IDS status, equipment lists, location, removal or replacement, calibration, input channel assignments, measurement range, wiring information, and comments shall be entered from data tapes or disks or manual data entry.
- 3.2.1.2.2 *Instrument Configuration Input (1.1.2.2):*** Test instrument configuration change information including test identification, status, start and stop times, instrument and equipment lists, relocation, removal or replacement, instrument scan time, scan rate, calibration history, measurement range, alarm level, and comments shall be loaded from tape or disk, or from data logger and portable equipment interfaces, or manual data entry.
- 3.2.1.2.3 *Installation Tests (1.1.2.3):*** The IDS shall be capable of collecting all data from checkout tests, in-situ calibration, installation/acceptance tests, and test instrument data during initial installation and operations and maintenance activities prior to the start of routine data collection.
- 3.2.1.2.4 *IDS Common Data (1.1.2.4):*** IDS common data provides verification of IDS performance. The IDS shall be capable of collecting all common data items from IDS equipment and resources including AC mains power supply, standby power supply, processor power supplies, processing equipment status, equipment housing temperature and humidity, thermocouple references, and standard IDS I/O reference signals.
- 3.2.1.2.5 *Performance Event Logs (1.1.2.5):*** Malfunction occurrences and all system diagnostic analysis results shall be entered into system performance event logs from IDS processors or as manual data entry. The data shall be identified by time, date, system interface or component identifier and contain sufficient descriptive information to identify a specific event from other similar occurrences.

Figure 3.2.3

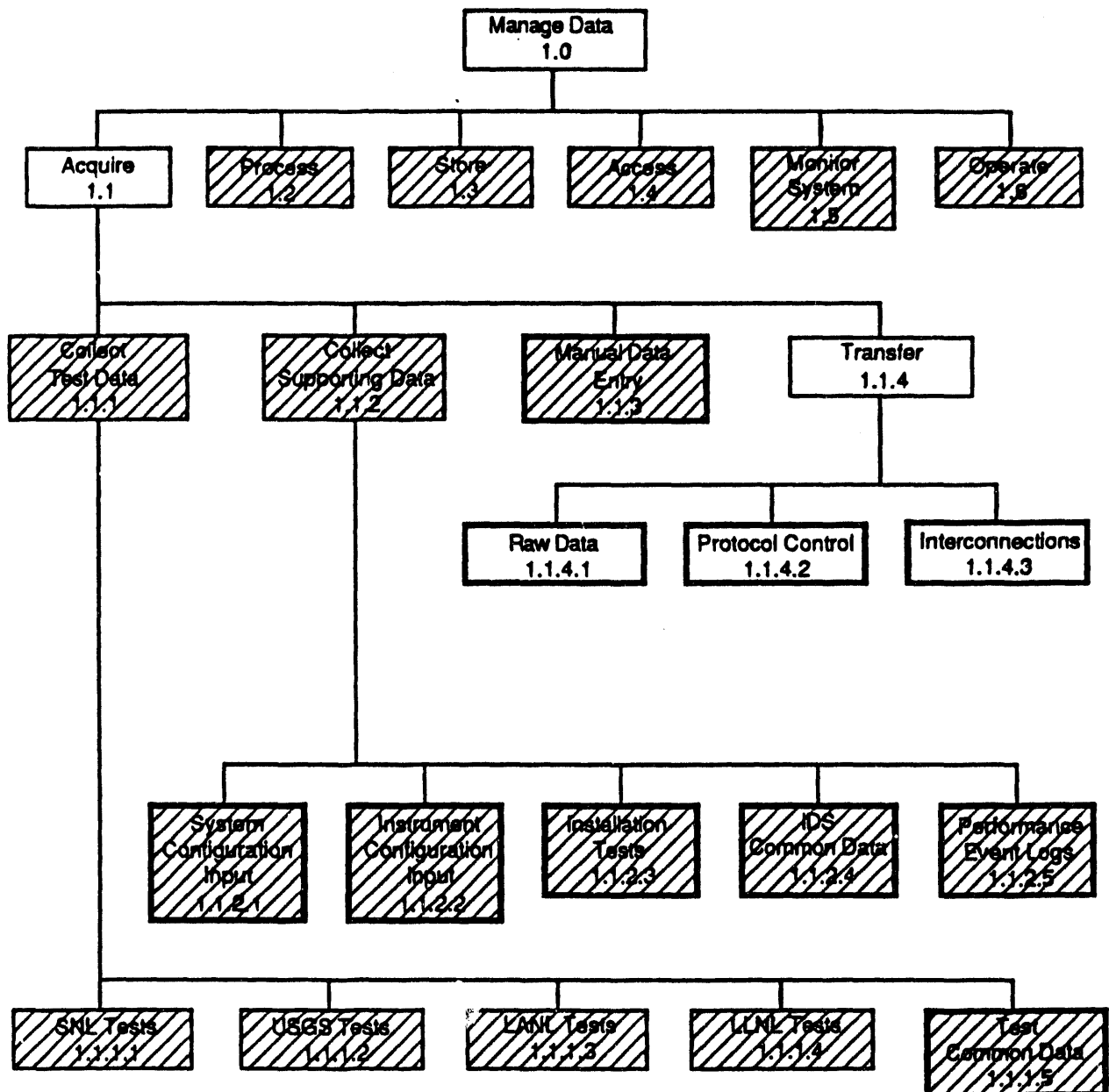
Acquire
Manual Data Entry



3.2.1.3 *Manual Data Entry (1.1.3):* The IDS shall support manual input of test data, configuration data, and text items from terminals located near test sites, in participant user areas, IDS operations and maintenance areas, remote computers, data logger interfaces, and other portable instrument readouts for tests. Manual data entry shall be subject to user access restrictions established by the TMO and/or participants. Manually entered data and/or data files shall include data value, acquisition time and date, and source ID (see Section 3.2.2.1.1 for source ID description). The IDS shall store manually entered data files as-is for data entry records and organize the data in standard IDS format based on acquisition time, date and originating test. Verification of manually entered data shall be provided by participants and stored with the data. Manual data entry activity records shall be maintained in IDS data storage to document manual data entry during the life of the system.

Figure 3.2.4

Acquire
Transfer



3.2.1.4 Transfer (1.1.4): Digital data transfer from terminals, communications networks, computer systems, control I/O equipment, data loggers, and portable data acquisition equipment shall be supported by computer network interfaces, IEEE-488, RS-232, and/or RS-422 data communication ports as needed. Connection requirements for data logger and portable data acquisition equipment to IDS I/O interfaces shall be specified after the participant equipment and software has been identified. All digital data transmission protocols shall be specified by the IDS contractor unless they are an integral part of participant equipment hardware and/or software.

3.2.1.4.1 Raw Data (1.1.4.1): The IDS shall provide for the transfer of raw data from participant equipment interfaces to IDS I/O interfaces and subsequently to IDS processing equipment and finally to storage. Processing generates raw digital data from participant analog input signals producing a scaled engineering unit often unrelated to the parameter of interest. Raw data may also be in the form of digital data (conversion from analog to digital data and/or processing, if any, occurred outside of the IDS) representing the first occurrence of this data item in the IDS.

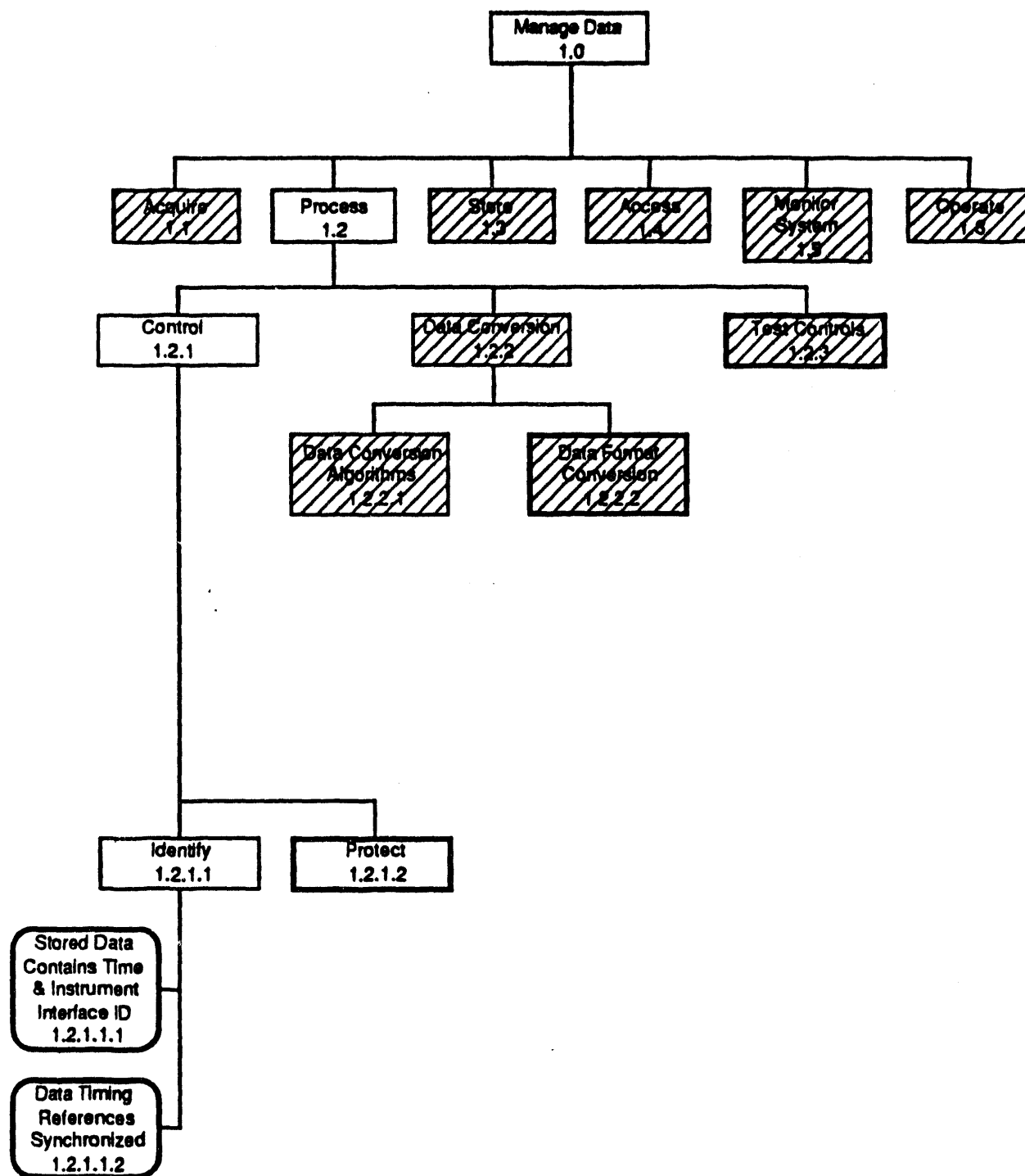
3.2.1.4.2 Protocol Control (1.1.4.2): The IDS shall provide data transfer protocols or methods that insure successful, error free data transfers between IDS modules, subsystems, and across data communication networks. Transmitted data shall be retained in the transmitting module or subsystem until an error free data transfer has been confirmed.

3.2.1.4.3 Interconnections (1.1.4.3): Participant data signals routed to the IDS shall originate at specifically identified participant equipment interface wiring connections. Transfer of analog signals from IDS to test equipment (instrument power and sensor excitation) and analog signals from test equipment interfaces to IDS equipment shall utilize wiring characterized for cable type, shielding, routing, and protection to maintain specified signal accuracy and resolution requirements. Wiring and equipment on the participant side of this interface are the responsibility of the participant. Routing of data and instrument signals to and from the IDS shall be accomplished as follows:

- Participants shall provide test equipment including instruments, placement and/or installation, connection, and wiring from participant equipment to the participant equipment interface. Each signal connection point in the interface shall be uniquely identified in participant documentation with designator and functional description.
- IDS shall provide the participant equipment interface equipment unless the interface is an integral part of participant equipment.
- IDS shall specify wiring connections, routing, protection, cable type, and shielding from the participant equipment interfaces to IDS I/O interface equipment and subsequent IDS equipment.

Figure 3.2.5

Process
Control



3.2.2 Process (1.2)

3.2.2.1 Control (1.2.1)

3.2.2.1.1 Identify (1.2.1.1): The IDS shall provide for automatic source identification (source ID) of test related data prior to storage. The source ID shall be used to reference related configuration information needed to identify associated tests, data conversion factors, IDS system and instrument configurations, measurement equipment calibration history, performance event logs, and data processing history.

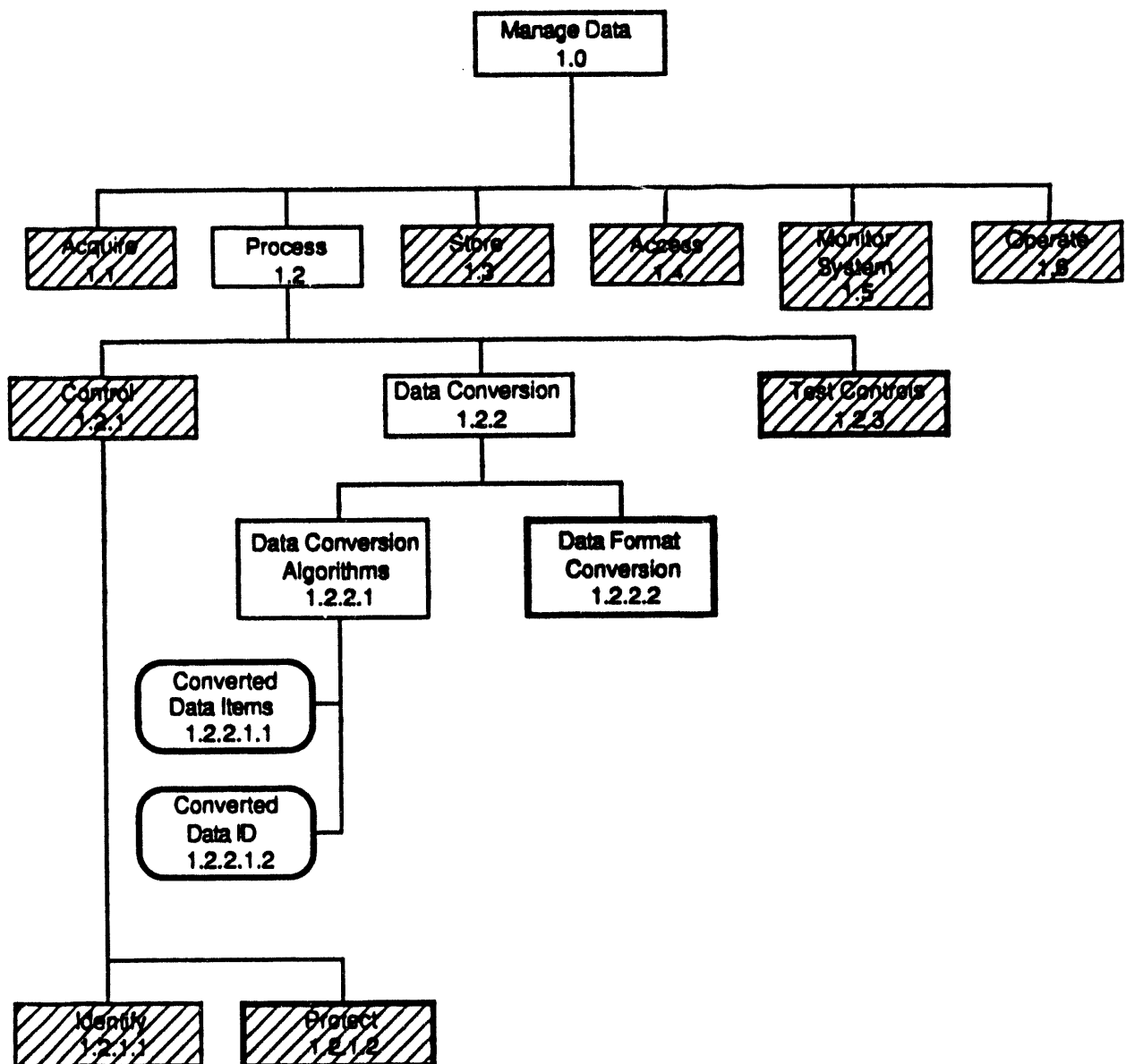
3.2.2.1.1.1 *Stored Data Contains Time & Instrument Source ID (1.2.1.1.1):* Stored data shall include data value, time and date, and source ID. The IDS shall logically organize acquired data based on acquisition time, date and originating test.

3.2.2.1.1.2 *Data Timing References Synchronized (1.2.1.1.2):* All IDS system and sub-system clocks shall be synchronized. Data timing references shall be traceable to NIST, recorded to the nearest 0.1 second with an accuracy of ± 1.0 second between all data items. IDS time standard synchronizing signals shall be distributed to surface, shaft, and MTL IDS equipment. Coded timing signals in RS-232 and/or RS-422 format (year, month, day, hour, second, and tenths-of-second) and IRIG-B format (1-KHz tone modulated at 100pps) shall be distributed to ESF participants at the surface and MTL for their use as event timing standards.

3.2.2.1.2 Protect (1.2.1.2):. Access to all IDS test data shall be read-only and subject to user access restrictions established by the TMO and/or participant PIs. Verification of manually entered data shall be provided by participants and stored with the data.

Figure 3.2.6

Process
Data Conversion



3.2.2.2 Data Conversion (1.2.2): The IDS will provide QA Level 1 data conversion for IDS common data only. The IDS shall provide processor capacity and storage to accommodate data conversion processes and converted data items on-line and in permanent archive storage. Participant requirements for alarm monitoring and test evaluation at the ESF may require additional data conversions not yet identified. All converted data shall be clearly marked and noted in data files.

3.2.2.2.1 Data Conversion Algorithms (1.2.2.1): Data conversion algorithms shall be incorporated in IDS software as required to meet specific conversion requirements. Data conversion algorithms shall be provided by IDS and/or participants and approved by the TMO before being installed and used. Once approved, such algorithms shall be installed in non-volatile memory (i.e., write protected hard disk) on the appropriate processor.

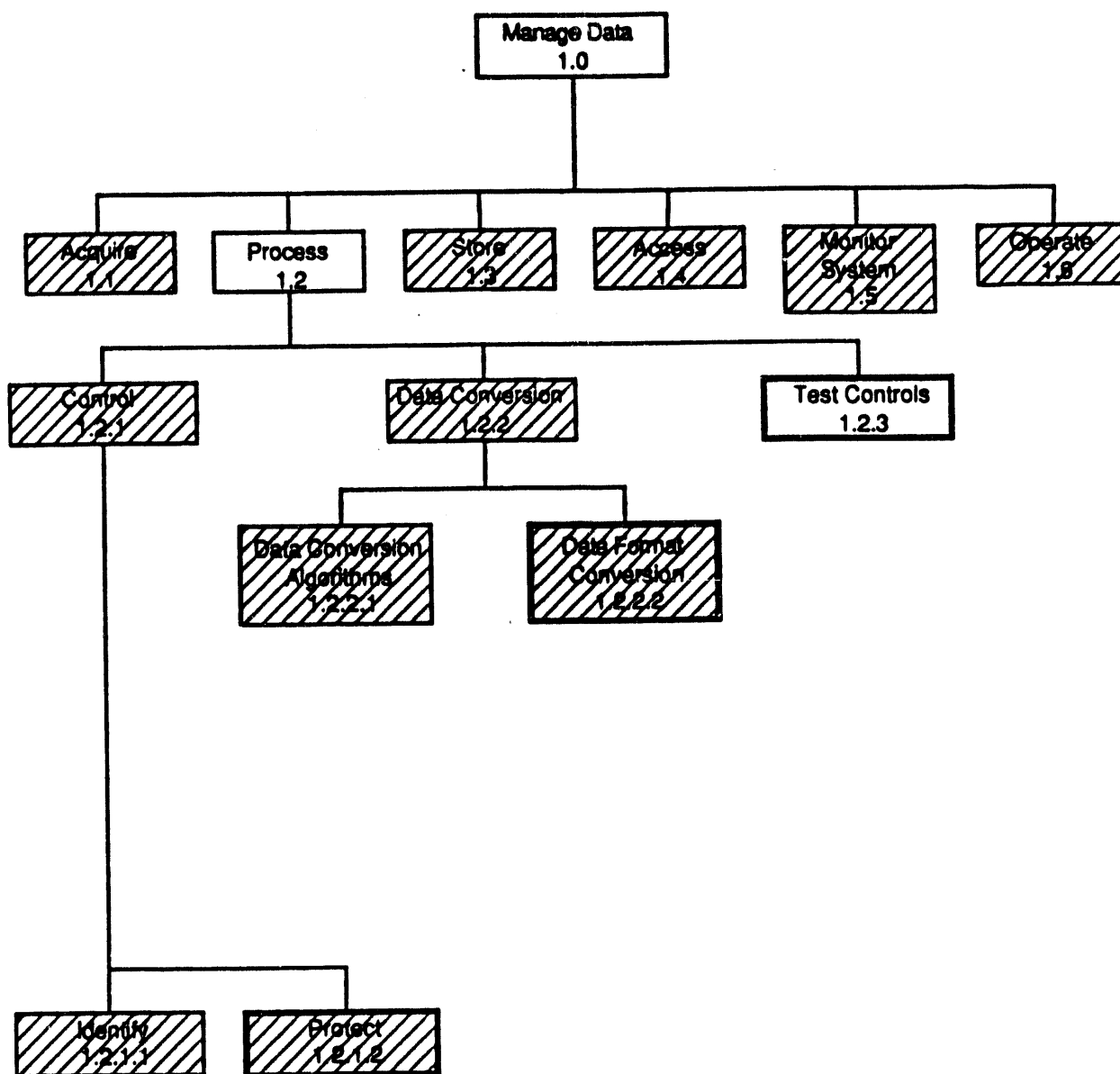
3.2.2.2.1.1 *Converted Data Items (1.2.2.1.1):* Data conversion shall utilize copies of raw data as input to algorithmic procedures and produce new data items and files. The IDS shall automatically convert raw data to new data items with units, accuracy, and processing extent specified by participant requirements, test procedures [TBD by participants as test designs are completed], and by the IDS contractor for IDS common data.

3.2.2.2.1.2 *Converted Data ID (1.2.2.1.2):* Converted data shall be identified with acquisition time, date, converted value, source identification, and a converted data flag.

3.2.2.2.2 *Data Format Conversion (1.2.2.2):* Data generated external to the IDS and supplied for inclusion in the IDS test database shall be entered into the IDS in an IDS specified format. When the IDS must modify the format of the entered data to meet IDS data storage format requirements, the data format conversion shall use participant and/or IDS contractor supplied format conversion algorithms approved by the TMO prior to inclusion into the IDS.

Figure 3.2.7

Process
Test Controls



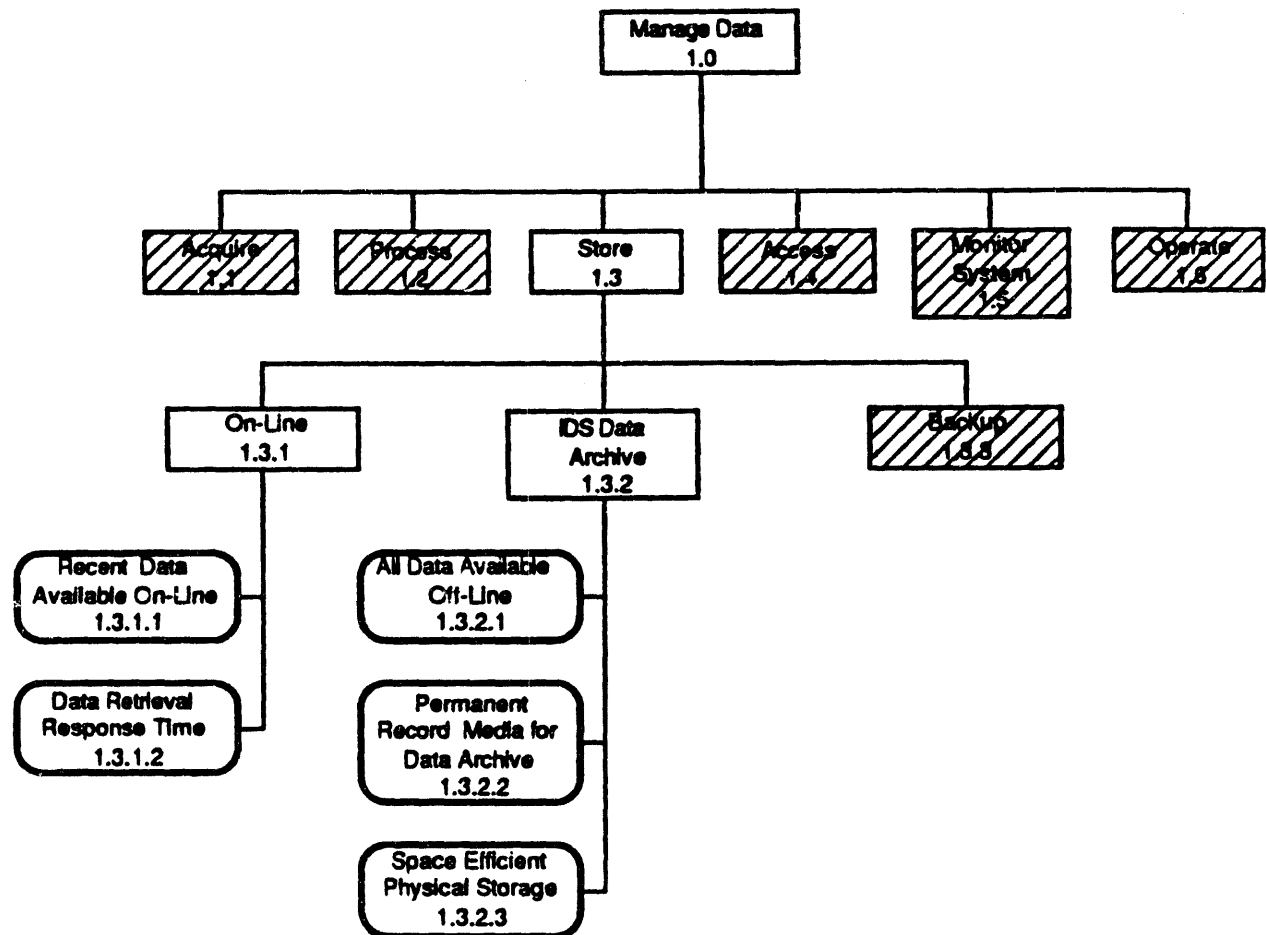
3.2.2.4 Test Controls (1.2.3): No requirements for IDS control of test parameters are currently identified. IDS test control functions shall be defined by participant requirements. Adequate system flexibility shall be incorporated into the design to allow test controls to be added to the IDS later in the testing program. Three control modes have been identified:

- IDS supplies on-line and/or stored data to participant equipment. Participant equipment processes this data to generate test data that is passed back to the IDS. The IDS applies the control data to test controllers.
- IDS processes on-line and/or stored data and/or participant supplied data to generate test control data that IDS applies to test controllers.
- A combination of the first two control modes.

IDS control signals shall be generated with a minimum specified delay between the recognition of a control function requirement and transmission of the test control data to the test controller. IDS data entry effecting test controls shall be restricted to that received from participant equipment interfaces or manual data entry subject to user access restrictions. Test control algorithms used by the IDS shall be provided by participants and/or the IDS contractor and approved by the TMO prior to inclusion into the IDS.

Figure 3.2.8

Store
On-Line
IDS Data Archive



3.2.3 Store (1.3)

3.2.3.1 On-Line (1.3.1)

3.2.3.1.1 *Recent Data Available On-Line (1.3.1.1):* The IDS shall provide storage for a minimum of the most recent 30 days of test data, configuration status, IDS component and instrument calibration data, and performance event logs in the on-line database. Data shall be retained in on-line storage for a minimum of 30 days after test completion. Removal of data from the on-line database shall be approved by the test manager and be determined by available storage requirements and participant needs for continued on-line data access. Copies of all data removed from the on-line database shall be part of a preexisting archive data set.

3.2.3.1.2 *Data Retrieval Response Time(1.3.1.2):* Data retrieval response time is of primary importance. On-line data shall organized in an efficient manner for data access using natural-language, query-by-example, graphical interfaces, and/or menu inquiry functions.

3.2.3.2 IDS Data Archive (1.3.2): IDS shall provide an archive database including raw and converted data, system performance logs, system and instrument configuration, calibration records, and performance event logs for the operational life of the IDS. The archive will provide continuity for IDS operations and participant data access during IDS operation at the ESF. IDS archive data storage on non-volatile media shall be accomplished within 2 hours of acquisition during normal operation. In the case of computer or system failure prohibiting normal archive functions, subsystem backup data shall be archived on a priority basis when normal operation resumes. Archived data files shall be organized in an efficient manner for data access using space efficient methods and algorithms.

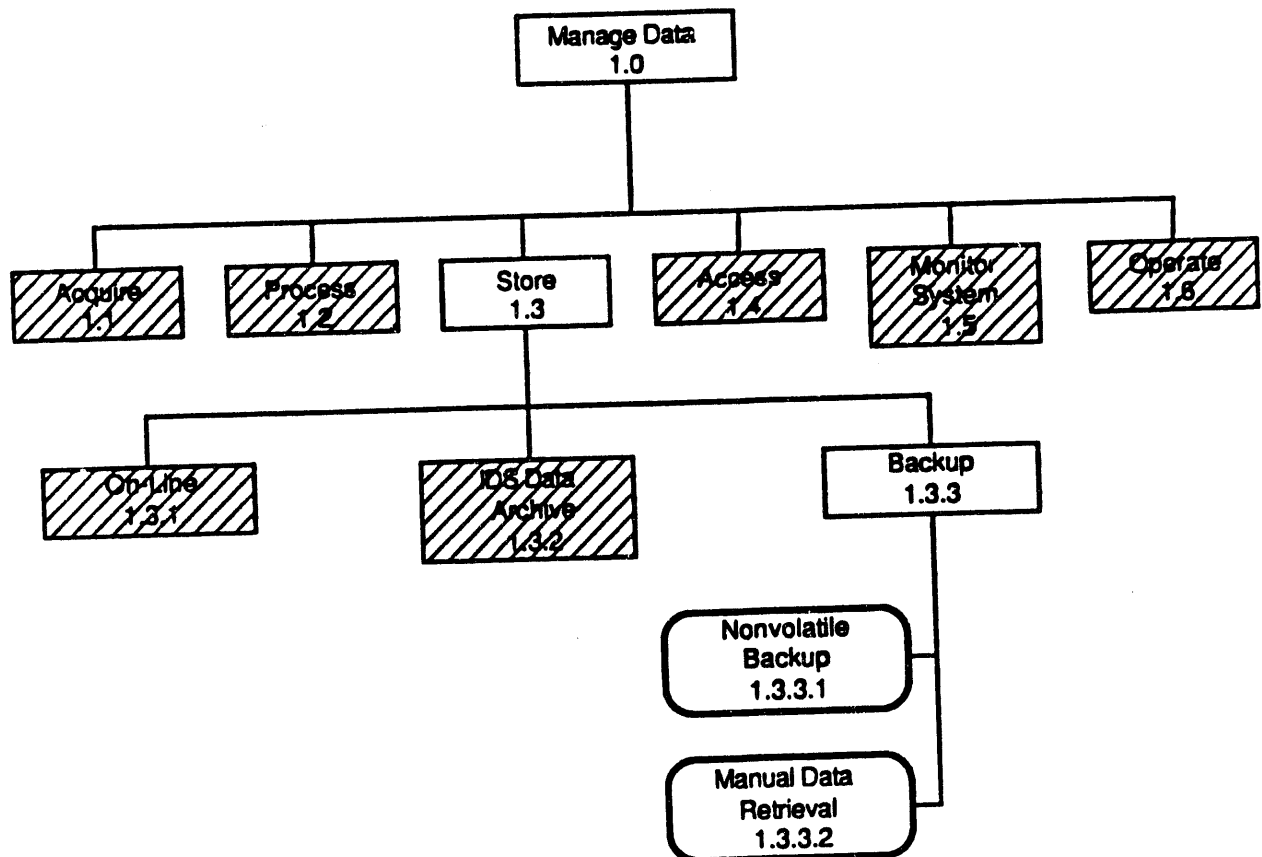
3.2.3.2.1 *All Data Available Off-Line (1.3.2.1):* The IDS shall provide physical storage for archive database media at the test site, readily accessible to the surface IDS computer facility for timely retrieval of archive data.

3.2.3.2.2 *Permanent Record Media for Data Archive (1.3.2.2):* Of primary importance is the production of permanent archive records using storage media particularly suitable for long term data storage with minimum maintenance. Appropriate media storage management shall be provided to prevent corruption or loss of data.

3.2.3.2.3 *Space Efficient Physical Storage (1.3.2.3):* A secondary consideration is that the archive media itself be compact to minimize on-site physical storage requirements and aid in efficient and prompt retrieval of archived data.

Figure 3.2.9

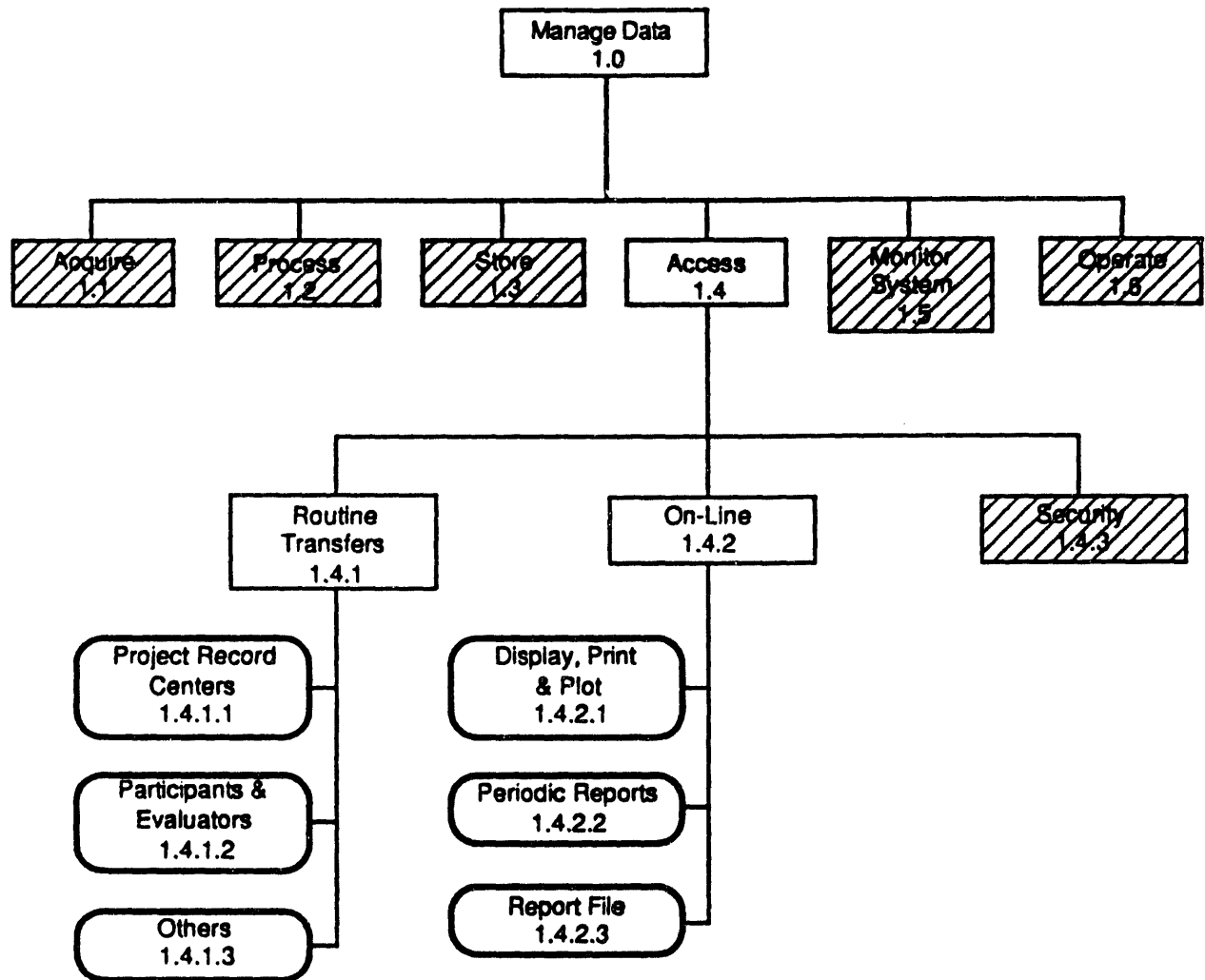
Store
Backup



- 3.2.3.3 Backup (1.3.3): The IDS including all subsystems shall provide storage of all data files on non-volatile media (i.e., magnetic disk drive or battery backed RAM memory) as a routine part of data processing. I/O data files shall be processed to this nonvolatile media without delay or undue accumulation in volatile storage (ordinary RAM memory).
- 3.2.3.3.1 *Nonvolatile Backup (1.3.3.1)*: To protect against loss of critical data due to mass storage failure, data files shall be written to a non-volatile backup unit (i.e., another "shadow" drive, tape, or other suitable media) as often as practical and no less than once per day.
- 3.2.3.3.2 *Manual Data Retrieval (1.3.3.2)*: The IDS shall provide for manual data retrieval from subsystems during a system network failure or for diagnostic purposes. Each subsystem shall provide a removable secondary backup unit or backup media and/or provisions for writing the contents of backup storage to a portable tape or disk drive. Inaccessible or limited access subsystems (i.e., in the shaft) shall have backup capacity to store data for a minimum of 30 days before the oldest data is overwritten with new data.

Figure 3.2.10

Distribute
Routine Transfers
On-Line



3.2.4 Access (1.4)

User access to on-line and archive data shall be read-only to protect data integrity. Data shall be organized in an efficient manner for data access and use natural-language, query-by-example, graphical interfaces, and/or menu inquiry functions. All data access shall be subject to user access restrictions.

3.2.4.1 Routine Transfers (1.4.1)

3.2.4.1.1 *Project Record Centers (1.4.1.1)*: A copy of the archive test database or the current update to the database shall be distributed to project record centers identified by the TMO for validation and storage as part of permanent project records. This distribution shall occur within 10 days of acquisition. The data format shall be LANL data transfer format. Transfers to YMPO shall be in compliance with QA procedure AP-5.1Q

3.2.4.1.2 *Participants & Evaluators (1.4.1.2)*: A copy of archive test database information shall be distributed to participants and/or technical evaluators as directed by the TMO. Distribution shall be accomplished through physical delivery of storage media and/or printed text as required. The records shall be LANL data transfer format or participant requested formats where they are available on IDS equipment. Unless approved by the TMO and participants, each participant or PI receives only their test data.

3.2.4.1.3 *Others (1.4.1.3)*: The system shall accommodate controlled distribution of archive test database information to specified other agencies as authorized by the TMO. Distribution shall be accomplished through physical delivery of storage media and/or printed text as required by participants. The records shall be LANL data transfer format or participant requested formats where they are available on IDS equipment. Uncontrolled distribution of data shall be accomplished by methods listed above and IDS network access, modem, and/or other telecommunication links specifically identified by YMPO.

3.2.4.2 On-Line (1.4.2)

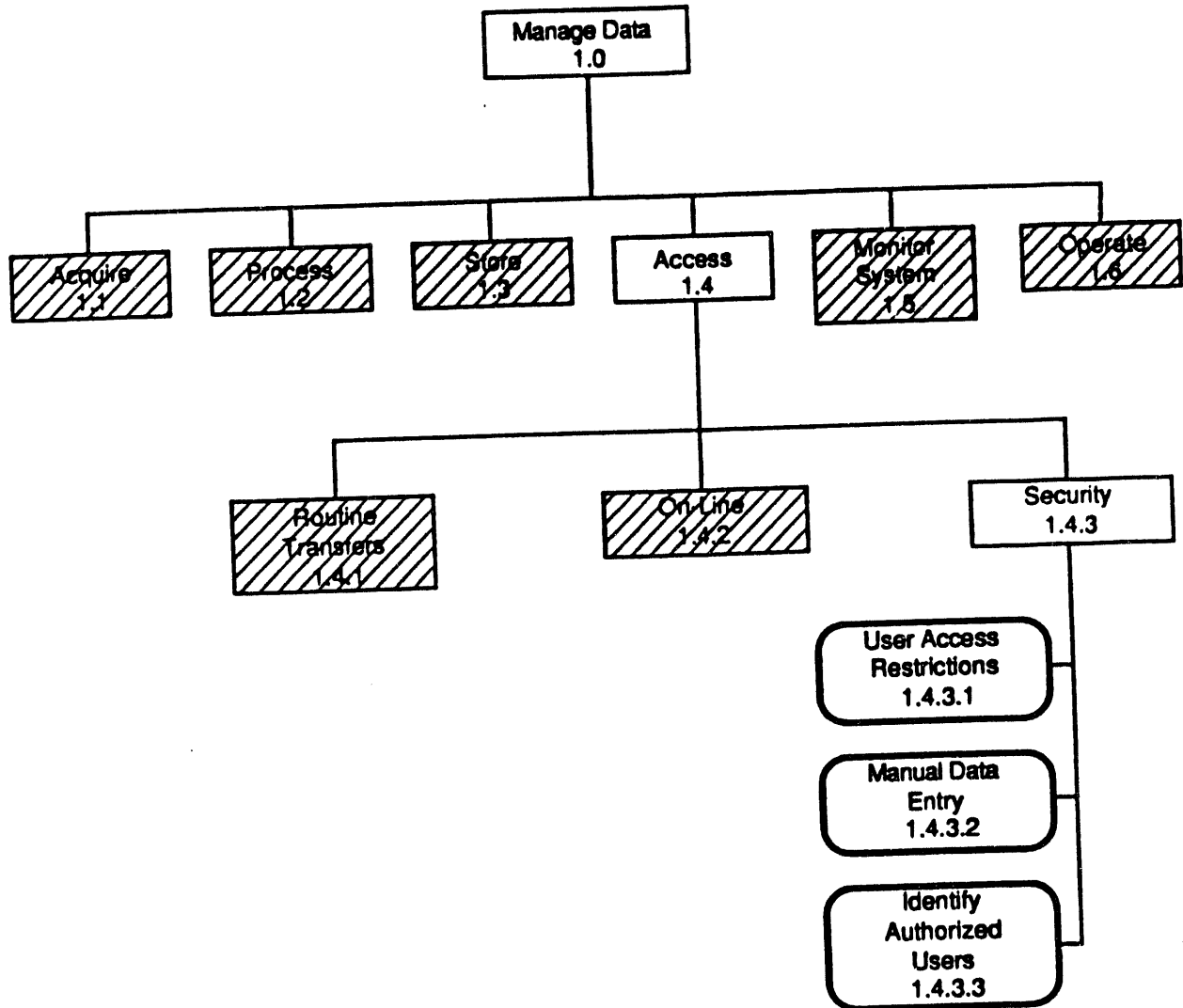
3.2.4.2.1 *Display, Print, & Plot (1.4.2.1)*: The IDS shall respond to on-line monitoring inquiries related to tests in progress and completed tests including on-line test database and archive test database information. The IDS shall provide software, printers, and plotters to display, print, or plot user-defined reports in response to on-line inquiries related to on-line or archive database information, or IDS periodic reports. Plots shall be generated in a timely manner using black-and-white and color 300 dot-per-inch resolution laser printers and multi-color pen plotters with a resolution of 0.002 inch.

3.2.4.2.2 *Periodic Reports (1.4.2.2)*: At monthly intervals, the IDS shall automatically prepare permanent record summaries of calibration, maintenance, configuration status, and instrument status and distribute to IDS archive storage, the TMO, and requesting participants.

3.2.4.2.3 *Report File (1.4.2.3)*: The IDS shall route the summary reports discussed in 3.2.4.2.2 to TMO identified project record centers on a monthly basis for validation and filing as permanent project records.

Figure 3.2.11

Access
Security



3.2.4.3 Security (1.4.3) Computer security measures shall be used to insure that unauthorized personnel cannot gain access to IDS computers for any purpose. Access to IDS computers shall be controlled to prevent authorized or unauthorized users from gaining access to computers and data files and willfully and/or negligently altering or destroying data. Computer access security procedures shall be consistent for all local (ESF user and O&M terminals) and remote (modem and other telecommunication links) communication.

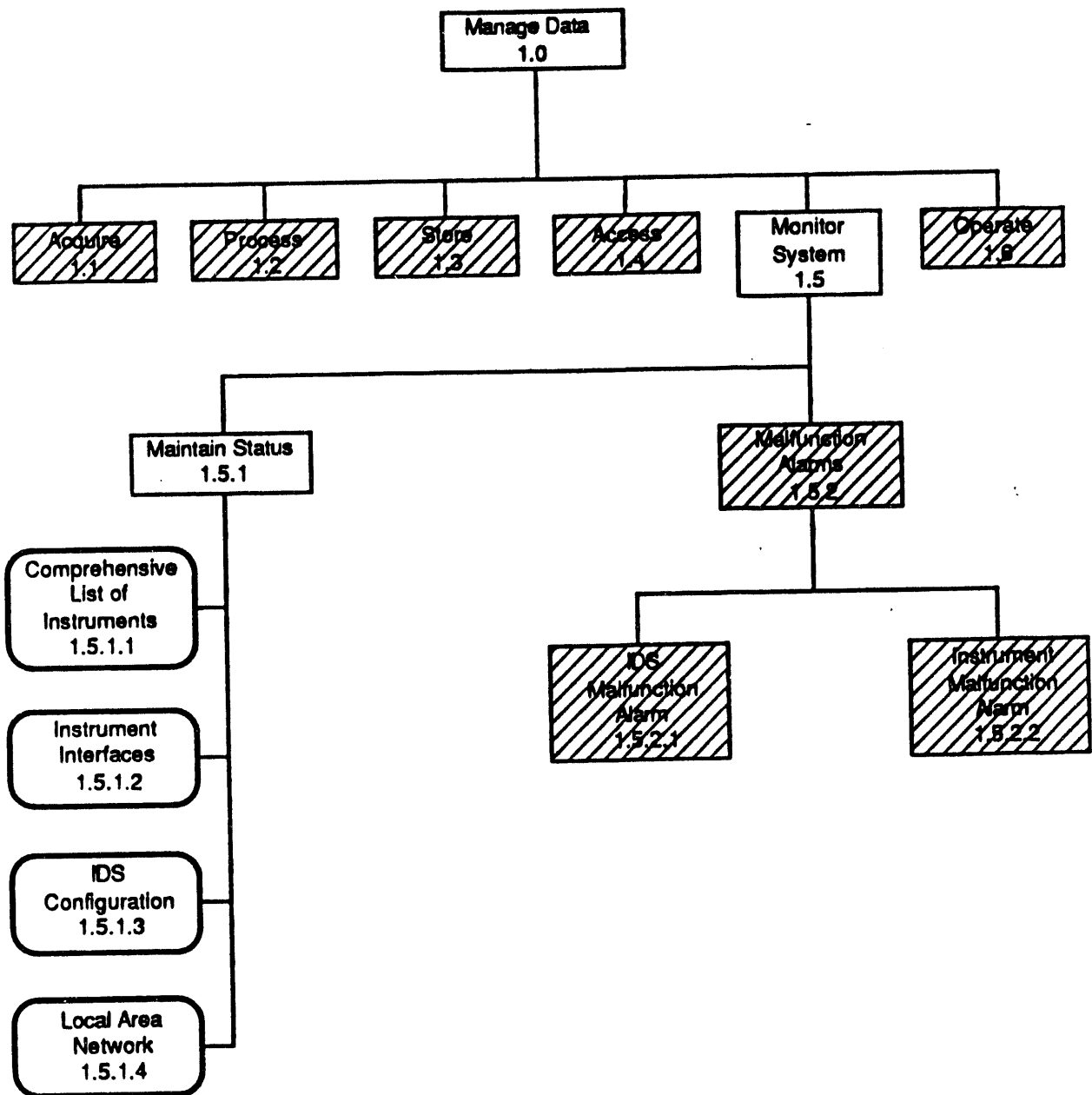
3.2.4.3.1 User Access Restrictions (1.4.3.1): Authorized users of the IDS shall include participant personnel, IDS design personnel, and IDS maintenance and operations (O&M) personnel. User access levels shall be assigned by the O&M system manager after approval by the TPO. Participant access to all IDS data shall be read-only for existing data files. Data entry shall be in the form of records, files, or data set transfers. All IDS access shall be subject to individual user access restrictions including "access group" that identifies data sets available to a particular user and "access level" that limits accessible files in a particular data set. Access group and levels shall be established and approved by the TMO and in cooperation with participant PIs for participant personnel. User access activity records shall be maintained in IDS data storage to document data I/O during the life of the system.

3.2.4.3.2 Manual Data Entry (1.4.3.2): Manual data entry shall be subject to user access restrictions.

3.2.4.3.3 Identify Authorized Users (1.4.3.3): Computer access procedures shall utilize effective techniques for identifying authorized users and preventing unauthorized connections. Methods selected shall be consistent with efficient, semi-automatic log-on processes involving minimal user interaction. Traditional methods utilizing simple authorization checks, passwords, and/or dial-back to authorized telephone numbers as primary security measures are not acceptable for this task. An example of an acceptable secure access method incorporates user identification hardware including active personal number generating cards and interfaces. Users gain access to the computer system for regular sign-on when the correct personal identification number is entered at the remote terminal card reader interface. These numbers are generated periodically (on the order of one per minute) by the active card in the possession of the user desiring remote access. The entered number is checked by interface equipment at the computer site that duplicates the numbers generated by the user card. If a match occurs, access is allowed and the regular sign-on process begins. Repeated identification number mismatches lock out the attempted access.

Figure 3.2.12

Monitor System
Maintain Status



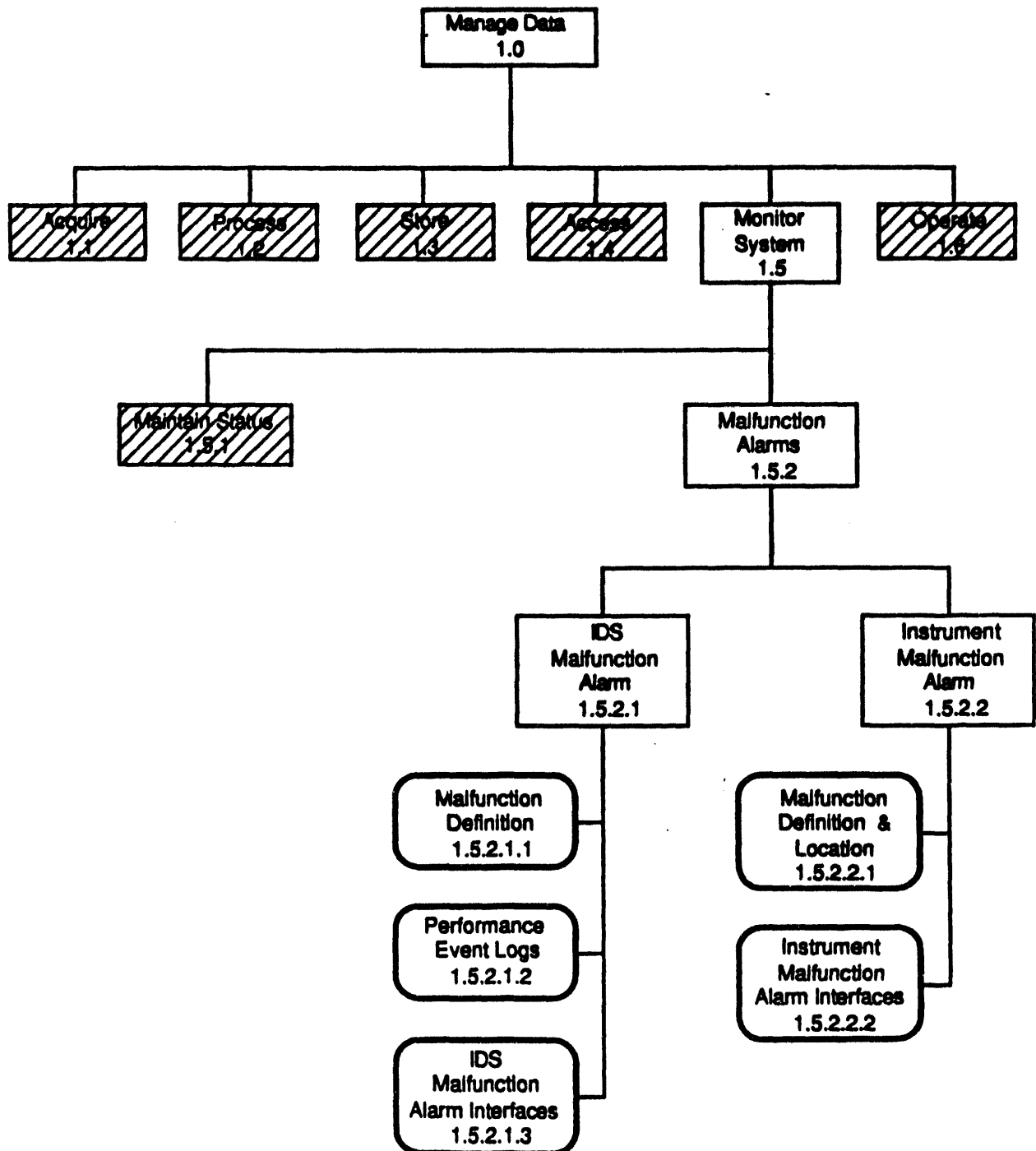
3.2.5 Monitor System (1.5)

3.2.5.1 Maintain Status (1.5.1)

- 3.2.5.1.1 *Comprehensive List of Instruments (1.5.1.1)*:** The IDS shall maintain a current and historical listing, by part number and serial number or unique identifier, of all instruments monitored by the IDS. Identical requirements apply to checkout tests, installation/acceptance tests, and operational tests. All test instruments shall be cross-referenced to applicable test activities. Test instrument status information shall be accessible on read-only basis using natural-language database inquiry functions. Access to instrument list input, updates, and status shall be subject to user access restrictions.
- 3.2.5.1.2 *Instrument Interfaces (1.5.1.2)*:** The IDS Shall maintain a current list of uniquely identified instrument interface or IDS input/output channel numbers or other identifiers, for all system interfaces. Identical requirements apply to checkout tests, installation/acceptance tests, and operational tests. IDS instrument interfaces shall be cross-referenced to associated tests. The time and date of IDS instrument interface change of status from inactive-to-active and active-to-inactive and associated user comments shall be recorded. Test instrument interface lists associated with individual tests shall be accessible on read-only basis using natural language database inquiry functions. Access to interface lists, updates, comment input, and status shall be subject to user access restrictions.
- 3.2.5.1.3 *IDS Configuration (1.5.1.3)*:** The IDS shall maintain an actively updated listing of all IDS instrument interface and data conversion components, external interconnections, and operating software version. Change input to IDS configuration data shall be subject to user access restrictions.
- 3.2.5.1.4 *Local Area Network (1.5.1.4)*:** The IDS shall maintain an actively updated listing of IDS local area network (LAN) activity including the status of archive processors, data acquisition nodes, participant nodes, user access, and interfaces to other networks. Change input to IDS LAN configuration shall be subject to user access restrictions.

Figure 3.2.13

Monitor System
IDS Malfunction Alarm
Instrument Malfunction Alarm



3.2.5.2 Malfunction Alarms (1.5.2)

3.2.5.2.1 IDS Malfunction Alarm (1.5.2.1): The IDS shall include diagnostics capable of detecting malfunctions in I/O signal converters and critical processor functions and shall provide an alarm at specified system interfaces to alert users and IDS operations and maintenance personnel.

3.2.5.1.2.1 Malfunction Definition (1.5.2.1.1): The IDS shall monitor signal converter I/O hardware and provide standardized converter input signals to determine converter performance. Processor hardware and software diagnostics shall be run at prescribed intervals as appropriate to verify system performance. The resultant data from these tests shall be screened against established reference values approved by the TMO to detect errors or malfunctions.

3.2.5.1.2.2 Performance Event logs (1.5.2.1.2): Malfunction occurrences and all system diagnostic analysis results shall be entered into system performance event logs identified by time, date, interface or component identifier and containing sufficient descriptive information to identify a specific event from other similar occurrences. Performance event log information shall be accessible on read-only basis.

3.2.5.1.2.3 IDS Malfunction Alarm Interfaces (1.5.2.1.3): The IDS shall automatically print and provide on-screen malfunction alarm messages at selected terminals and printers. The alarm message shall include time and date and shall identify the effected equipment or software. Historical alarm messages shall be available on demand from any system terminal.

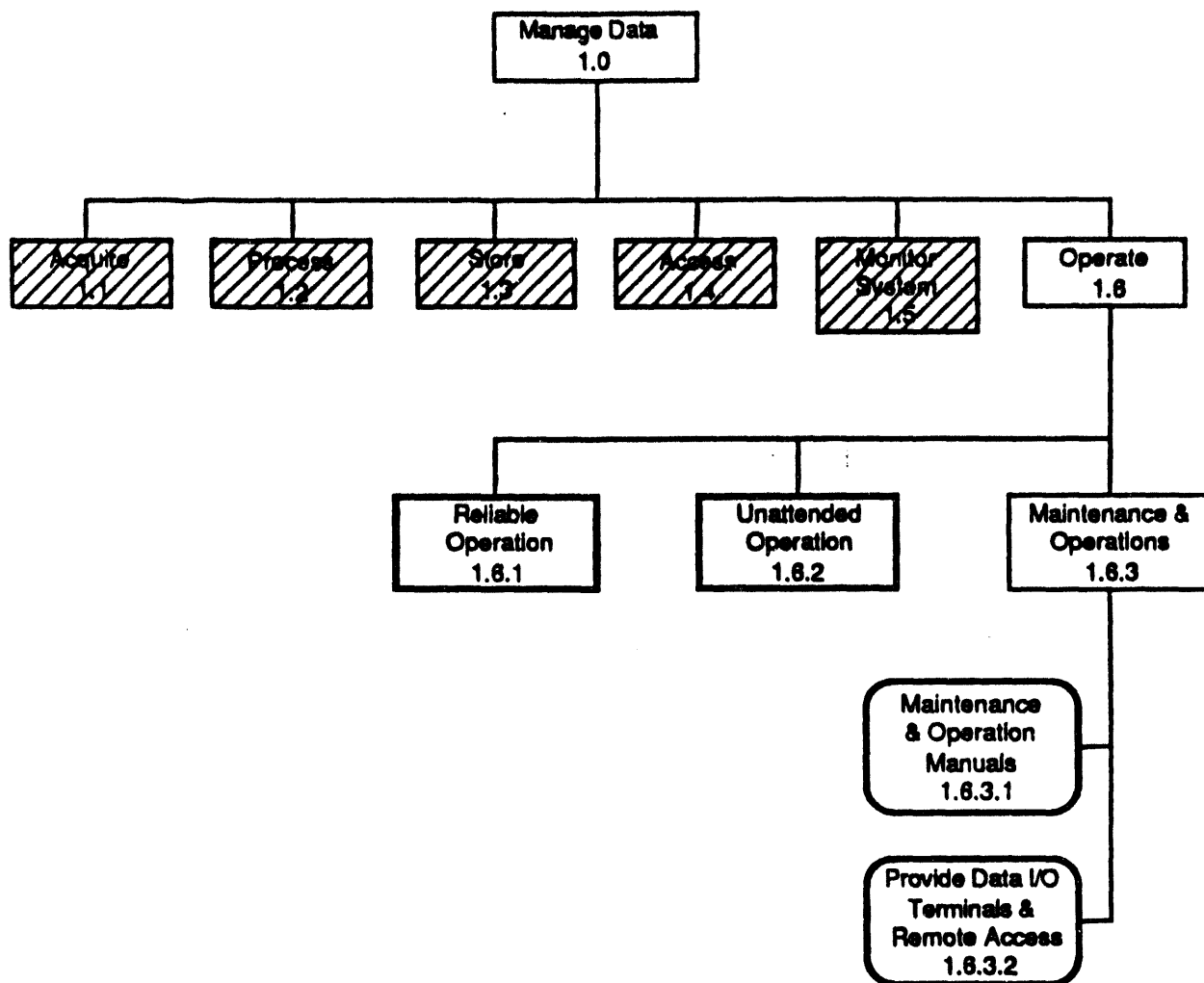
3.2.5.2.2 Instrument Malfunction Alarm (1.5.2.2): The IDS shall detect gross instrument malfunction (i.e., open or shorted instrument wiring, no response, and/or out-of-range data) as required by PIs and provide an alarm whenever such malfunctions are detected. Identical requirements apply to checkout tests, installation and acceptance tests, and operational tests.

3.2.5.2.2.1 Malfunction Definition and Location (1.5.2.2.1): The IDS shall monitor instrument output and screen it against reference values provided by participants as an indicator of gross instrument malfunctions. The IDS shall identify specific instruments, test identification, and location by association with a particular instrument source ID.

3.2.5.2.2.2 Instrument Malfunction Alarm Interfaces (1.5.2.2.2): Instrument malfunction events shall be recorded in a performance event log. Entries shall be identified by instrument identifier, time, date, and malfunction identifier. The IDS shall automatically print and provide an on-screen instrument malfunction alarm message at Maintenance, system operator, and effected test terminal interfaces. The alarm message shall include instrument identifier, time, date, malfunction identifier, and the associated test identifier.

Figure 3.2.14

Operate



3.2.6 Operate (1.6)

3.2.6.1 *Reliable Operation (1.6.1)*: The IDS shall provide a reliable, cost effective data acquisition system. A detailed study shall be made and approved by the TMO to determine the most effective trade off for reliability, user requirements, and cost effectiveness. This study must investigate basic reliability requirements based on participant requirements, reliability and time for repairs of standard commercial equipment, the use of highly reliable components, preventive maintenance schedules, redundant sub-systems, operating life of the IDS, and other relevant issues as they are identified during development of the YMP test program. Reliability studies shall be performed to characterize operational IDS modules based on testing requirements. Of primary importance is the quality of the data produced by the IDS. Operational reliability shall be related to individual testing requirements. For example;

- tests with high data rates (i.e., 1 sample per minute) have different operational reliability requirements than lower data rate tests (i.e., 1 sample per day),
- recording data in the archive could be delayed for days (due to system failure) with no functional impact if a complete data set existed in subsystem storage.

3.2.6.2 *Unattended Operation (1.6.2)*: The basic design of the IDS shall provide unattended automatic data collection under normal operating conditions. Abnormal conditions shall initiate an automatic set of procedures to detect, report, and log the abnormal conditions in the operation performance event logs. Where operator intervention or assistance is needed, automatic annunciators and telephone dialing equipment will deliver prerecorded messages to identify the level of the abnormality and alert on-call maintenance and testing personnel.

3.2.6.3 *Maintenance and Operations (1.6.3)*: The basic design of the IDS shall consist of sub-systems, components, and functional elements that can be maintained on a regularly scheduled basis. Maintenance strategies shall be studied to provide the most useful and cost effective program consistent with system reliability goals. Based on cost effectiveness and reliability goals, components shall be serviced by on-site repair and/or exchange for an identical functional unit that has been accepted into the IDS configuration as an available replacement. Mainframe and mini-computers shall be maintained by on-site vendor service personnel with a guaranteed response time consistent with the system reliability goals. All equipment calibration shall be traceable to NIST.

3.2.6.3.1 *Maintenance & Operation Manuals (1.6.3.1)*: Maintenance and operations manuals shall be provided for all IDS equipment during development acceptance testing. After final approval, these manuals shall be controlled documents updated as necessary to provide current information to operators, maintenance personnel, testing teams and other participants.

3.2.6.3.2 *Provide Data I/O Terminals and Remote Access (1.6.3.2)*: Data I/O terminals shall be provided for participant and IDS personnel use as needed throughout the ESF. Locations shall be determined by participant and IDS maintenance and operations requirements. The system shall support 32 simultaneous local user terminals or compatible connections with maximum data transfer rates of 9600 baud. The system shall support two high speed (≥ 9600 baud) and two low speed (2400 baud) modem based communications links including data error correction. Remote, modem based data communications shall be restricted to data transmitted to and/or received from specific user originating locations, subject to user access restrictions.

3.3 Participant Test Functional Requirements

IDS functional requirements in this section are derived from participant test documentation detailed in Appendix A, *References*. Specific documented sources of requirements for each test are included as references to Appendix A item numbers. These Appendix A item numbers (and additional details) are shown in parenthesis following "Requirement Source Document" located below each test title. Additional information and constraints related to listed requirements for each test are included as references to Section 3.3.5, *Participant Requirement Notes* item numbers. These Section 3.3.5 item numbers are shown in parenthesis following "See Notes" located at the end of each test requirement section.

3.3.1 SNL Tests

1. SHAFT CONVERGENCE TEST (3 tests In-Shaft)

Requirement Source Document (2, Enclosure pp. 2-3):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Multipoint Borehole Extensometer	Thermocouple	108	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	108	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	108	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Borehole Deformation Gage	Excitation Voltage	2	0 to 3 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	2	0 to 200 μVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Tape Extensometer	Logging File	18	N/A	N/A	N/A	N/A
Hydraulic Pressure Cells	Logging File	18	N/A	N/A	N/A	N/A
Controls		2				
Total Channels for 3 Tests:		366				

See Notes [1], [2]

2. DEMONSTRATION BREAKOUT ROOMS TEST (2 tests, 1 each in the UDBR & MTLDBR)

Requirement Source Document (2, Enclosure pp. 4-5):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Rock Bolt Load Cell	Thermocouple	70	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	66	0 to 5 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	66	0 to 12 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Multipoint Borehole Extensometer	Thermocouple	90	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	180	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	180	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Tape Extensometer	Logging File	22	N/A	N/A	N/A	N/A
Seismic Refraction	Logging File	13	N/A	N/A	N/A	N/A
Redundancies		100				
Total Channels for 2 Tests:		787				

See Notes [1], [2]

3. SEQUENTIAL DRIFT MINING TEST (MTL)

Requirement Source Document (2, Enclosure pp. 6-7):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Multipoint Borehole Extensometer	Thermocouple	128	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	252	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	252	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Borehole Stress Meter	Thermocouple	36	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	36	0 to 15 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	36	0 to 1 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Borehole Deflectometer	Logging File	1	N/A	N/A	N/A	N/A
Rod Extensometer	Logging File	1	N/A	N/A	N/A	N/A
Fracture Permeability Apparatus-Water	Logging File	1	N/A	N/A	N/A	N/A
Fracture Permeability Apparatus-Air	Logging File	1	N/A	N/A	N/A	N/A
Rock Bolt Load Cell	Thermocouple	36	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	36	0 to 5 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Output Voltage	136	0 to 12 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Seismic Refraction	Logging File	13	N/A	N/A	N/A	N/A
Total Channels for 1 Test:		965				

See Notes [1], [2]

4. TS w1 HEATER TEST (UDBR)

Requirement Source Document (2, Enclosure pp. 8-9):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Multipoint Borehole Extensometer	Thermocouple	12	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	12	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	12	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Thermocouple	Thermocouple	58	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Neutron Probe	Logging File	1	N/A	N/A	N/A	N/A
Relative Humidity	Excitation Voltage	2	TBD	TBD	TBD	TBD
	Output Voltage	2	TBD	TBD	TBD	TBD
Pressure Transducer	Excitation Voltage	2	5 to 32 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	2	0.5 to 5 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Heater	TBD	1	TBD	TBD	TBD	TBD
Controls	TBD	2	TBD	TBD	TBD	TBD
Total Channels for 1 Test:		106				

See Notes [1], [2]

5. CANISTER-SCALE HEATER TEST (MTL)

Requirement Source Document (2, Enclosure pp. 10-11):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Thermocouple	Thermocouple	89	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Multipoint Borehole Extensometer	Thermocouple	36	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	36	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	36	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Borehole Deformation Gage	Excitation Voltage	3	0 to 3 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	3	0 to 200 μVdc	$\pm 5 \mu\text{Vdc}$	10 μVdc	1/180 sec
Neutron Probe	Logging File	1	N/A	N/A	N/A	N/A
Relative Humidity	Logging File	2	N/A	N/A	N/A	N/A
Radon Monitoring	Logging File	4	N/A	N/A	N/A	N/A
Heater	Volt/Current	1	TBD	TBD	TBD	TBD
Heater Control	Volt/Current	2	TBD	TBD	TBD	TBD
Acoustic Emission	Logging File	8	N/A	N/A	N/A	N/A
Total Channels for 1 Test:		221				

See Notes [1], [2]

6. HEATED BLOCK TEST (MTL)

Requirement Source Document (2, Enclosure pp. 12-13):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Multipoint Borehole Extensometer	Thermocouple	6	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	12	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	12	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Thermocouple	Thermocouple	111	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Borehole Deformation	Thermocouple	8	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	8	0 to 3 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	8	0 to 200 μVdc	$\pm 5 \mu\text{Vdc}$	10 μVdc	1/180 sec
Horizontal Surface Extensometer	Thermocouple	8	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	8	0 to 5 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	8	0 to 12 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Heater	Volt/Current	14	TBD	TBD	TBD	TBD
Heater Controller	Volt/Current	14	TBD	TBD	TBD	TBD
Strain Gauges/Rosettes	Thermocouple	35	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	35	5 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	35	15 to 60 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
Tilt Meter	Thermocouple	12	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
	Excitation Voltage	12	TBD	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output	12	TBD	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Neutron Probe	Logging File	1	N/A	N/A	N/A	N/A
Ultrasonic Probe	Logging File	1	N/A	N/A	N/A	N/A
Flatjacks	Logging File	16	N/A	N/A	N/A	N/A
Piezometer	Output Voltage	8	TBD	TBD	TBD	TBD
Controls/Redundancies	TBD	100	TBD	TBD	TBD	TBD
Total Channels for 1 Test:		484				

See Notes [1], [2]

7. THERMAL STRESS TEST (2 tests, 1 each in the UDBR & MTL)

Requirement Source Document (2, Enclosure pp. 15-16):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Multipoint Borehole Extensometer	Excitation Voltage	4	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	24	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Long Gauge Surface Extensometer	Excitation Voltage	18	0 to 5 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	18	0 to 12 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Thermocouple	Thermocouple	132	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Heater	TBD	48	TBD	TBD	TBD	TBD
Controls	Controls	20	TBD	TBD	TBD	TBD
Wattmeter	Voltage Monitor	2	TBD	TBD	TBD	TBD
	Current Monitor	2	TBD	TBD	TBD	TBD
Voltmeter	Voltage Monitor	6	TBD	TBD	TBD	TBD
Total Channels 2 Tests:		274				

See Notes [1], [2]

8. HEATED ROOM TEST (MTL)

Requirement Source Document (2, Enclosure pp. 17-18):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Multipoint Borehole Extensometer	Excitation Voltage	24	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	144	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Long Gauge Surface Extensometer	Excitation Voltage	72	0 to 5 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	72	0 to 12 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Thermocouple	Thermocouple	402	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Heater	TBD	48	TBD	TBD	TBD	TBD
Wattmeter	Voltage Monitor	24	TBD	TBD	TBD	TBD
	Current Monitor	24	TBD	TBD	TBD	TBD
Voltmeter	Voltage Monitor	12	TBD	TBD	TBD	TBD
Control/Contingency	TBD	148	TBD	TBD	TBD	TBD
Total Channels for 1 Test:		970				

See Notes [1], [2]

9. PLATE LOADING TEST (10 to 20 tests at general locations of UDBR, MTL, and long drifts)

Requirement Source Document (2, Enclosure pp. 19-20):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Rock Bolt Load Cell	Excitation Voltage	24	0 to 5 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	24	0 to 12 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Multipoint Borehole Extensometer	Excitation Voltage	20	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	120	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Acoustic Emission	Logging File	8	N/A	N/A	N/A	N/A
Total Channels All Tests:		196				

See Notes [1], [2]

10. ROCK MASS RESPONSE TEST (2 tests, UDBR & MTLDBR)

Requirement Source Document (2, Enclosure pp. 21-22):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Multipoint Borehole Extensometer	Excitation Voltage	15	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	15	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Borehole Stress Meter	Excitation Voltage	5	0 to 15 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	5	0 to 1 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Thermocouple	Thermocouple	20	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Displacement Transducers	Excitation Voltage	25	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	25	0 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Acoustic Emissions	Logging File	10	TBD	TBD	TBD	TBD
Pressure Transducers	Excitation Voltage	7	5 to 32 Vdc	N/A	N/A	Continuous
	Output Voltage	7	0.5 to 5 Vdc 1 to 11 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Controls	TBD	4	TBD	TBD	TBD	TBD
Total Channels for 2 Tests:		138				

See Notes [1], [2]

11. EVALUATION OF MINING METHODS TEST (Long drifts)

Reference Source (2, Enclosure pg. 23): Seismic Refraction (MicroVAX II Entry) 39 Channels

See Note [1]

12. GROUND SUPPORT TEST (Long drifts)

Requirement Source Document (2, Enclosure pp. 25-26):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Rock Bolt Load Cell	Excitation Voltage	40	0 to 5 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	40	0 to 12 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Strain Gauges	Excitation Voltage	50	5 to 20 Vdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	Continuous
	Output Voltage	50	15 to 60 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Total Channels for 1 Test:		180				

See Notes [1], [2]

13. DRIFT STABILITY MONITORING TEST (Long drifts)

Requirement Source Document (2, Enclosure pp. 27-28):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Multipoint Borehole Extensometer	Excitation Voltage	52	N/A	N/A	N/A	Continuous
	Output Voltage	312	0 to 20 Vdc	$\pm 5 \mu\text{Vdc}$	10 μVdc	1/180 sec
Borehole Stress Meter	Excitation Voltage	26	N/A	N/A	N/A	Continuous
	Output Voltage	26	0 to 20 Vdc	$\pm 5 \mu\text{Vdc}$	10 μVdc	1/180 sec
Tape Extensometer	TBD	236	TBD	TBD	TBD	TBD
Total Channels for All Tests:		652				

See Notes [1], [2]

14. AIR QUALITY AND VENTILATION TEST (Long drifts)

Requirement Source Document (2, Enclosure pp. 29-30):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate
Hot Wire Anemometer	Excitation Voltage	1	TBD	TBD	TBD	TBD
	Output Voltage	1	TBD	TBD	TBD	TBD
Atmospheric Pressure	TBD	2	TBD	TBD	TBD	TBD
Drift Temperature	Thermocouple	2	0.05 to 70 mVdc	$\pm 50 \mu\text{Vdc}$	100 μVdc	1/180 sec
Humidity	Excitation Voltage	1	TBD	TBD	TBD	TBD
	Output Voltage	1	TBD	TBD	TBD	TBD
Radon Concentrations	TBD	4	TBD	TBD	TBD	TBD
Radon Working Level	TBD	4	TBD	TBD	TBD	TBD
Total Channels for All Tests:		16				

See Notes [1], [2]

3.3.2 USGS Tests

1. PERCOLATION TEST (MTL): Estimated 60 channels, details TBD.

See Note [3]

2. BULK PERMEABILITY TEST (4 tests on MTL): Estimated 20 channels each test (80 Channels Total), details TBD.

See Note [3]

3. SHORT RADIAL BOREHOLE TESTS (7 pairs of boreholes in-shaft):

Reference Source Document (3):

Channel Requirements per borehole pair:

Instrument	Channel Type	Number of Channels
Thermocouple Psychrometer (Water Potential)	Dry Bulb reading	8
	Wet Bulb excitation	8
	Wet Bulb reading	8
Pressure Transducer (Pore Atmospheric Pressure)	Excitation	10
	Reading	10
Pressure Transducer (Gland Inflation Monitor)	Excitation	8
	Reading	8
Thermistor (Temperature)	Excitation	10
	Reading	10
Total Channels per Borehole Pair:		80
Total Channels for all 7 Borehole Pairs		560

For details on electrical equipment specification and wiring, see reference (3). Reference (3) also provides task durations and sequencing for test activities at the first short radial borehole pair.

PI requirements at user workstations include such items as graphics output, conversion mechanisms, and data integration methods for the ability to scan and plot engineering values during actual tests or re-calibration exercises; needed also are common data items such as surface weather information, shaft ventilation and humidity information, ambient rock temperature, and other testing schedules. At least the most recent 30 days of data recorded for a particular sensor or set of sensors shall be available upon demand during, or prior to, a testing period or re-calibration exercise. An IEEE-488 standard communication link is required to support interface with portable data acquisition equipment used during calibrations.

4. EXCAVATION EFFECTS TEST (2 tests, 1 each in the UDBR & MTLDBR)

Requirement Source Document (1, Table 1-7, pp. 1-23):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate	Scan Interval
Pressure Transducer	Output Voltage	30	0 to 100 mVdc	TBD	10 μ Vdc	30/min	Continuous
	Thermocouple	30	0.79 to 1.4 mVdc	TBD	50 μ Vdc	30/min	Continuous
Mass Flow Meter	Output Voltage	6	0 to 5 Vdc	TBD	50 mVdc	30/min	Continuous
	Excitation Current	6	TBD	TBD	TBD	30/min	Continuous
	Thermocouple	6	0.79 to 1.4 mVdc	TBD	50 μ Vdc	30/min	Continuous
Thermocouple Psychrometer	Thermocouple	30	0.79 to 1.4 mVdc	TBD	TBD	1/5 min	Continuous
	Thermocouple	30	0 to 100 μ Vdc	TBD	2 μ Vdc	1/5 min	Continuous
	Excitation Current	30	5 mA	TBD	TBD	1/5 min	Continuous
Thermocouple	Thermocouple (T)	30	0.79 to 1.4 mVdc	TBD	50 μ Vdc	30/min	Continuous
TBD (Stress Meter)	TBD	720	0 to 100 mVdc	TBD	10 μ Vdc	1/hr	Continuous
Borehole Extensometer	TBD	108	0 to 10 Vdc	TBD	10 mVdc	1/hr	Continuous
Solenoid Valve	Digital Output	4	TBD	N/A	N/A	N/A	15 sec
Total Channels for 2 Tests:		1030					

See Note [4]

5. PERCHED WATER TEST (Only conducted if perched water is encountered; information is for scoping purposes.)

Requirement Source Document (1, Table 1-8, pp. 1-24):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Rate	Scan Interval
Piezometer	Output Voltage	5	0 to 100 mVdc	TBD	0.1 mVdc	100/min	TBD
	Excitation Current	5	0 to 20 mA	TBD	1 mA	N/A	N/A
Thermocouple	Thermocouple	5	0.79 to 1.4 mVdc	TBD	TBD	100/min	15-60 sec
Psychrometer	Thermocouple	5	0 to 100 μ Vdc	TBD	2 μ Vdc	100/min	15-60 sec
	Excitation Current	5	0 to 6 mA	TBD	TBD	TBD	15-60 sec
Total Channels for 1 Test:		25					

See Note [4]

6. HYDROLOGIC PROPERTIES OF FAULTS (Long drifts): Test Details and Requirements TBD.

3.3.3 LANL Tests

1. DIFFUSION TEST (MTL)

Requirement Source (1, Table 1-18, pp. 1-35):

Instrument	Channel Type	Channels	Range	Accuracy	Resolution	Scan Scan	Scan Interval
Pressure Transducer	Output Current	4	4 to 20 mA	TBD	TBD	1/hr	Continuous
Monitor	Dry Contact	12	N/A	N/A	N/A	1/hr	Continuous
Total Channels for 1 Test:		16					

2. COMMON DATA TESTS:

Reference (1), Table 1-19, pp. 1-36--1-37 lists measurement types for common ESF environmental data and IDS internal monitoring information. IDS requirements and channels details TBD.

3.3.4 LLNL Tests

1. ENGINEERED BARRIER SYSTEM FIELD TESTS (3 tests at MTL): Estimated 800 channels per test (2400 channels total for 3 tests); see reference (1, Table 1-18, pp. 1-37) for channel types.

See Note [3]

3.3.5 Participant Requirement Notes

- [1] This information represents requirements contained in the Title I Design Report, reference (1). Minor corrections have been included where appropriate.
- [2] TAR comments 25, 48, 49, 50, and 54 apply from reference (4). These comments identify problems with the given accuracy and resolution, and note insufficient specification of other information. The TAR comment resolutions acknowledge the problems, and commit to providing complete and correct information in support of Title II design.
- [3] Definitive IDS requirements not available. Engineering estimates based on informal PI requirements are provided for planning purposes only.
- [4] TAR comments 27, 28, 29, 30, 34, 35, 49, and 50 apply from reference (4). These comments identify problems with the given accuracy and resolution, and note insufficient specification of other information. The TAR comment resolutions acknowledge the problems, and commit to providing complete and correct information in support of Title II design.

APPENDICES

Appendix A

References

Documented sources of IDS requirements are being developed as the testing program is finalized. The sources used to develop this FRD are listed below.

- (1) EG&G Document IDS-1011-007-00, *Integrated Data System Title I Preliminary Design*, Revision 0, dated March 2, 1988

This document is generally accepted to be the most complete compilation of technical requirements for the IDS. The position of the YMPO QA staff is "that the Title I report can only be used as design input for further Title II design activities if it is used in conjunction with and as modified by the comment resolutions resulting from the TAR (IDS Technical Assessment Review)."

- (2) Letter, J.T. George (SNL) to R. Crowley (LANL), no subject given, dated March 9, 1988

This letter provides measurement types and channel counts for SNL tests, and some other general information. Some accuracy and resolution requirements are outlined.

- (3) Letter, Barney Lewis (USGS) to H. Kalia (LANL), "USGS PI Requirements for IDS Phase 1A Title II Design", dated March 10, 1989.

This letter provides measurement types and channel counts for the short radial borehole tests, some test duration information, and specifies IDS interfacing equipment (by make and model, including catalog cuts). It also confirms an overall channel count for the excavation effects test of the UDBR.

- (4) Unnumbered document, *Yucca Mountain Project Technical Assessment Review of the Integrated Data System Title I Preliminary Design Review Record Memorandum*, dated February 24, 1989

Documents reviewed as supplemental material for preparation of this FRD are as follows:

- (5) SDRD *Exploratory Shaft Facility Subsystem Design Requirements Document (SDRD) for Title 2*, YMP/CM-0006, rev. 1, dated 3-22-90

The SDRD is a formal source of information without further backup documentation.

- (6) Study Plans

The study plans being issued for the YMP are a limited source of IDS requirements. They provide test requirements directly from the responsible testing organizations. Their use is currently limited for the following reasons:

- Study plans are insufficiently detailed to provide the specific test information needed for IDS implementation.
- Study plans vary in the level of information they provide. For example, study plans by SNL include discussion of the instrument types to be used and numbers of required channels. Study plans by other participants report that instrumentation will be determined later.

- Study plans are a sufficiently high level document that details needed for this FRD are not included. Currently listed details (such as SNL listing the number of instrument channels required) must be considered as approximate. It is unlikely that study plans will be revised often enough to provide IDS requirements in a timely manner.

Appendix B

List of Acronyms

AC	Alternating Current
ANSI	American National Standards Institute
dc	Direct Current
DOE	US Department of Energy
EIA	Electronic Industries Association
ESF	Exploratory Shaft Facility
FRD	Functional Requirements Document
ID	Identification
IDS	Integrated Data System
IEEE	Institute of Electrical and Electronic Engineers
I/O	Input/Output
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
MTLDBR	Main Test Level Demonstration Breakout Room
MTL	Main Test Level
mA	Milliamps
mV	Millivolts
N/A	Not Applicable
NIST	National Institute of Standards and Technology
PI	Principal Investigator
QA	Quality Assurance
sec	Second
SRBT	Short Radial Borehole Test
SNL	Sandia National Laboratory
TAR	Technical Assessment Review
TBD	To Be Determined
TMO	Test Manager's Office
UDBR	Upper Demonstration Breakout Room
USGS	United States Geological Survey
Vdc	Volts Direct Current
YMP	Yucca Mountain Project
YMPO	Yucca Mountain Project Office or Project Office
μV	Microvolts

Appendix C

Glossary of Terms

Checkout tests: Low level tests to determine that test equipment is working.

Data conversion: Data conversion is the process of combining and/or altering existing data items according to a predictable, prescribed procedure (algorithm) to produce new data items.

Data item: Data item describes one or more data values combined in a prescribed manner to convey one or more items of information. For example, thermocouple output voltage could be combined with the values of acquisition date, time, and channel number to produce a data item containing four separate pieces of information.

Data I/O interfaces: Data I/O interfaces are analog-to-digital converters, digital-to-analog converters, terminal interfaces, data logger interfaces, and processor link I/O interfaces.

Instrument configuration: All identified instruments that in totality make up a test.

IDS archive: Permanent data storage of all identified IDS data for the operational life of the IDS.

Installation/acceptance tests: High level tests to verify equipment installed in final ESF configurations and accept the test installation as completed.

In-situ calibration: Instrument calibration accomplished after an instrument has been installed in a test configuration.

Instrument interfaces: Instrument interfaces are composed of I/O hardware used for termination, signal conditioning, routing, and/or signal conversion.

IRIG-B time code: Industry standard coded time signal (1-KHz tone modulated at 100pps) synchronized to NTIS standard time broadcasts on radio station WWVB.

Off-line: Not directly accessible by the processor. Must be brought on-line before it is accessible.

On-line: Directly accessible from the processor.

Operational Tests: On-going testing after installation tests are completed.

Raw data: Raw data is digital data derived from an IDS input I/O interface or other source and is the first occurrence of this data item in the IDS. Raw data may or may not be interpretable directly in engineering units (i.e., thermocouple output raw data is in units of μVdc).

Sensor: Electronic sensors include the thermocouple, strain gage, linear variable differential transformer, RTD, and potentiometer among others. Often sensors are used with additional protection or in an assembly providing a convenient interface with the media being measured.

System configuration: All identified hardware and software systems, sub-systems, modules, and components that in totality make up the IDS.

Test instrument: A test instrument is a measurement device composed of or containing one or more sensors. The instrument some times provides a convenient physical interface to the media being measured (i.e., a particular stainless steel sheathed thermocouple instrument contains a thermocouple sensor electrically isolated from the sheath and uses magnesium oxide insulation).

Section 2

Reports, Letters, and Memorandums

Computer Applications Group, Inc. MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Date: Mon, Oct 30, 1989
From: JN Hall
To: FR Oblad

CAG Doc. 75-8930502

Subject: Recommended TAR comment resolution for EG&G Title 2 Readiness Review

Ref: *YMP TAR of the IDS Title 1 Preliminary Design, Review Record Memorandum, Feb 24, 1989, 3-pps.*

Current Title 1 TAR comment resolution has been completed (Ref pg 2, Para 3). The only recognized source of IDS requirements is the LANL controlled Title 1 design document. The requirements themselves are not subject to Project Office approval or control (Ref pg 3, bullet 2, "CONCLUSIONS"). The Ref does not direct that TAR technical issues be resolved prior to start of Title 2 design. Significant interface issues do need to be resolved before Title 2 design can proceed (Ref, pg 3, bullets 5-7, "RECOMMENDATIONS"). Our suggested response to Readiness Review TAR issues should be:

TAR technical comment resolutions will be included in on-going design efforts as appropriate. All TAR issues shall be resolved by the completion of Title 2 design. Design documents generated by the IDS contractor shall indicate TAR technical issue resolution items impacted by that design activity. Comprehensive summaries of TAR issue resolution will be periodically compiled by the TMO to provide an ongoing record of the progress in resolving TAR issues and incorporating TAR technical issues into the IDS design.

No attempt should be made to resolve specific TAR technical issues to meet Readiness Review requirements. The purpose of the readiness review is to assess the appropriateness of proceeding with the Title 2 design work. This work includes incorporating TAR issues into Title 2 designs as part of suitably justified evaluations, studies, etc. Much of the work required for TAR technical issue resolution could be accomplished prior to starting Title 2. That is not the issue here. Resolving TAR technical issues during Title 2 design will not compromise the design in any way and will meet TAR review recommendations (Ref, pg 3, bullet 1, 3, and 4, "RECOMMENDATIONS"). Delaying approval of the start of Title 2 because of unresolved TAR issues is artificial and will lead to confusion at EG&G since certain issues can only be resolved during Title 2 design. If Title 2 work is postponed during FY90, EG&G can continue to work on appropriate TAR issues as part of the continuing G-Tunnel support and conceptual design studies. Again this will not compromise the Title 2 design and will allow TAR resolution to proceed in an orderly and logical manner as impacted design issues are developed.

Computer Applications Group, Inc.

MEMO

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Doc: CAG 75-8933301

Subcontract: 9X58-2604R-1

Wed, Nov 29, 1989

To: Ross Oblad
From: Jim Hall
Subj: IDS Design Meeting Wed, Nov 29, 1989

Meeting attendees represented LLNL, SNL, and USGS testing activities and LANL IDS management. No LANL PI representative was present. The primary emphasis of the TMO presentation was a re-statement of IDS need to serve the PIs as a responsive, collaborative design effort. IDS is primarily a PI data utility and must accurately reflect all PI requirements to be useful. The following agenda items were discussed:

- Planned TMO IDS activities for FY90.
- PI IDS reliability requirements.
- Providing input to the design team.
- Communications links to participant facilities.
- Open issues for resolution in the FRD (TBDs and other unknowns).
- Informal comments and discussion of the FRD.

In addition the following items were included in the discussion:

- IDS requirements must be determined by the PI needs. PI requirements need to be re-evaluated based on the new schedule and TMO responsibility for alternate studies test planning.
- IDS and program data management issues.
- Realistic PI data rates for test turn-on and exceptional transients and steady state monitoring.
- Identification of generic instrument types and anticipated measurement ranges for tests not now completely characterized.
- Requirements for common data items.

The planned IDS activities for FY90 include updating the FRD, preparation of supplementary IDS technical specifications, and preparation of an IDS subcontractor bid package. To support preparation of these documents defining information will be needed from the PIs to define reliability and functional requirements. IDS functional reliability requirements can be presented in a form most useful to the PIs such as:

- MTBF requirements (with accompanying analysis)
- A redundant subsystem design to be incorporated into the IDS.
- Instrument redundancy.
- An unresolved requirement needing collaborative effort between the PI and IDS staff to resolve.

There was an observation that QA constraints on data integrity would probably make the use of complex hardware discriminators undesirable. Simpler, unfiltered input multiplexers and converters should be used and any data filtering performed on copies of archived raw data. The question of data manipulation led to a more general discussion of IDS data processing requirements that included the following items:

- The YMP data repository Records Processing Center (the RPC) will be the primary facility archiving IDS data. Current IDS strategy is to send all data to the RPC weekly. The IDS would only "archive" site characterization level data for this one week period plus the time to

receive the receipt acknowledgement from the RPC. The IDS will maintain a complete local data archive not suitable for use in data characterization. On-line IDS data will be retained for 30 days with all prior data available as a tape or disk mount from local IDS archives. Our understanding is that RPC data is public.

- All raw instrument data, available PI instrument calibration data, data conversion algorithms, IDS calibration data, IDS configuration files, and IDS performance data would be included in RPC transfers. Potential problems of data misuse at the RPC level need to be worked out by the PIs.
- Data manipulated or reviewed and notated as "good" or "bad" by PIs will be transferred to the RPC. The IDS does not expect to maintain program data records or PI manipulated data beyond the defined data acquisition and information related to data traceability requirements. PI requirements for data processing at the site using IDS related equipment has not been defined.
- There was some PI interest in having all instrument data calibrations and reduction algorithms available on-line for use in checking anomalous test results.

Common data issues were discussed. There is not a uniform requirement for common data from all participants, however, there is a clear need to handle the common data issue. There is not now a common data PI. Common data issues need to be better defined by participants.

Informal responses including needed functional requirements will be useful, however, only formally documented information can be included in the FRD or other IDS definition documents. Specific details needed for documenting PI requirements include:

- Reliability or risk issues for specific instruments or control functions.
- Data rates and transient data rates ending in long term steady state rates.
- Special case (i.e., data rate increases in response to a measurement or preprogrammed sequence.
- Revised channel counts for current tests.
- Instrument types with operating range.

There was a limited discussion of the FRD with the following results:

- The organization of the graphical elements is not strictly logical. Some revisions should be made (i.e., include *Process* under *Acquire*).
- It was suggested that DOE orders referenced in the FRD be available in the TMO for use and review.
- Better definition of terms should be included in the FRD text.
- Many of the test requirements are incomplete and out of date as a result of limited formal input from from PIs for the current test configurations.

Computer Applications Group, Inc.

MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Doc: CAG 75-8933501
Subcontract: 9X58-2604R-1

Fri, Dec 1, 1989

To: Ross Oblad
From: Jim Hall
Subj: Comments on the EG&G Termination Tasks
Ref: R Oblad *EG&G Termination Tasks* list, no date.

EG&G termination tasks are correctly targeted in your list to document their work over the past 2 years. After reviewing the list we have the following comments:

- | Item | Comment |
|------|---|
| 1 | OK |
| 2 | Preparation of commercial software for transfer includes all manuals, original media, registration materials, and other related information. EG&G developed software should include media, listings, at least a brief description of the purpose of the software and instructions for use. Copies (or originals as appropriate) of the development documentation should also be included. |
| 3 | Please clarify "amount". Check with A Burningham and R Morley for the exact details needed by the file librarian, QA, and contract requirements. Write a new memo to EG&G with these details ASAP. |
| 4 | Supply media copies of all computer files not covered in item 2. These copies will include working text and engineering information. Provide hardcopy directories of each separate disk, tape, etc. and label with creators name and purpose. |
| 5 | OK. What kind of tape? Do you want to read it from their microVAX or your PC? Write a new memo clarifying the exact details of tape storage (i.e., DEC TK50, CT-600N, etc.). |
| 6 | There will need to be a second memo describing the exact method of transfer and to whom. Check with R Morley for details of how this is to be done and document the process to EG&G ASAP. |
| 7 | Delete. Of minor importance if any unless you have some special need to document EG&G's last minute, and necessarily limited version, of CM. |
| 8 | Delete "what needs to be done to complete work" and EXCEPTION section. |
| 9 | Use less than 1 <i>man</i> -week of effort. |
| 10 | Delete. |
| 11 | Provide a copy of the current Grounding and Shielding Plan to the TMO within 2 working days. The TMO will promptly review the work-to-date and determine the need for additional effort. |

Based on comments in the IDS technical meeting Wed, Nov 29, 1989 by R Troncoso (SNL) and M Brodie (USGS) additional information on preliminary IDS design planning may be useful. I would suggest asking EG&G to provide the following items:

- 12 Provide a complete documentation package on all work pertaining to thermocouple psychrometers including references, notes, notebook entries, studies, plans, test setup descriptions, and software.
- 13 Provide a complete documentation package on all work pertaining to planned IDS test data storage formats and methods.

Computer Applications Group, Inc.

MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Doc: CAG 75-9002801
Subcontract: 9X58-2604R-1

Sun, Jan 28, 1990

To: Ross Oblad
From: Jim Hall
Subj: CAG Draft IDS RFP Outline

This annotated outline is the preliminary Scope of Work (SOW) as part of the IDS RFP. Three primary issues seem most important for eliciting useful responses:

1. The emphasis here is on developing an SOW for the RFP that will closely parallel the final SOW included by LANL in the IDS development contract. This approach will result in minimum misinterpretation and confusion about LANL's intentions and expectations for the actual work to be performed. It will also provide the necessary framework to resolve internal LANL issues relating to Contractor direction and requirements (technical and management) before the contract award.
2. The bidders need to have detailed instructions on how to respond to ensure that LANL gets meaningful and complete information from each respondent.
3. QA issues have been a particular problem for YMPO, LANL, and EG&G in the past. The RFP should require a detailed response from respondents outlining their QA structure and procedural support for this specific job. This goes beyond referencing existing QA program(s). It is common DOE practice to ask for a preliminary QAPP as part of the bidders submittal package as an indication that the respondent understands the requirements and can develop a credible program that addresses program QA issues. The actual required content from the IDS RFP respondents will be determined in part by the overall LANL QA requirements imposed on bidders.

In general this outline represents a reorganization of your topics with a strong reference to QA controlled aspects of the work.

Preliminary Draft

SCOPE OF WORK

OUTLINE

**INTEGRATED DATA SYSTEM DEVELOPMENT
YUCCA MOUNTAIN PROJECT**

1.0 TECHNICAL REQUIREMENTS

1.1 General Project Description

- briefly define purpose of YMP
- briefly define regulatory constraints on ESF development

1.2 Conceptual Model

- provide general description of IDS conceptual model including details of IDS locations in ESF
- provide discussion of construction and operation impacts on IDS
- includes RO 1-19-90 Sect I.F & Sect II.A.1 & 2.

1.3 Functional Requirements

- describe purpose of FRD
- includes RO 1-19-90 Sect II.A.3, 4, 5, 6, 7, & 8.
- attach or provide truncated summary of expected content of proposal in sufficient detail to permit a meaningful response to the RFP

1.4 Schedule Requirements

- define the period of performance addressed by the terms of the SOW for development, operation, and maintenance
- provide draft schedule with major deliverable milestones identified
- provide instructions for Contractor definition of secondary milestones, requirements for submittal of definitive Contractor schedule, and routine updates in scope, schedule, and budgets as part of the Project Management Plan (see Sections 2.4 and 3.0)

1.6 Buyer Furnished Items and Equipment

- reference Appendix A for a list of Buyer-furnished equipment (i.e., hardware and software procured under the previous contract that will be assigned to the Contractor)

- define specific Contractor responsibilities related to identification, inventory management, storage, and use of Buyer-furnished items and equipment

2.0 DELIVERABLES

2.1 Budget and Cost Plan

- cross reference Section 5.0 for content and level of detail required for detailed budget and spending plan
- define submittal date requirement

2.2 Quality Assurance Program Plan and Procedures

- briefly define general requirements for content and format; make specific references to ASME NQA-1, DOE Order 1330.1B, NUREG 0856, and other applicable requirements (DOE Orders) contained in Contractor available documents
- define submittal date requirements for plan and implementing procedures
- provide a cross reference to Section 4.0 for detailed requirements

2.3 Project Management Plan

- define submittal date requirements
- provide a cross reference to Section 3.0 for detailed requirements

2.4 Monthly Progress Reports

- define requirements for format, content, and distribution of reports
- establish routine submittal date requirements for monthly progress reports

2.5 Design and Procurement Status Reports

- define requirements for format, content, and level of detail of reports
- define frequency and routine submittal date requirements for design and procurement status reports

2.6 IDS Deliverables

- define IDS deliverables
- define requirements for delivery of each completed and tested IDS elements or modules that are expected during the term of performance specified in Section 1.4

3.0 PROJECT MANAGEMENT REQUIREMENTS

3.1 General Performance Requirements and Acceptance of Work

- briefly define the performance requirements and inspection or acceptance methods that LANL will use to accept the work

3.2 Project Organization

- define minimum requirements for the Contractor's project organization (location, personnel qualification requirements, identification of key personnel, notification of personnel changes, etc.)
- identify name, address, telephone/fax numbers of LANL contract officer and generally describe requirements for routine communications and reporting of contract related issues
- identify name, address, telephone/fax numbers of LANL TMO/TPO and generally describe requirements for routine communications and reporting of technical and management issues

3.2 Project Management Plan

- define requirements for format, content, and level of detail; require development as a controlled document under QA program requirements. PMP should include detailed schedule, WBS structure, key personnel assignments, primary contractual and technical liaison contacts
- define submittal date requirements

3.3 Work Breakdown Structure

- define WBS organization
- provide WBS structure description (detailed WBS in Appendix A) with instructions for Contractor definition of lower order WBS numbers
- define submittal date for detailed WBS as part of PMP

4.0 QUALITY ASSURANCE REQUIREMENTS

4.1 Quality Level Assignment

- discuss Level 1 quality level assignment

4.2 Quality Assurance Program Plan and Procedures Preparation

- define general requirements for content and format; make specific references to basic ASME NQA-1 format and content, required elements of DOE Order 1330.1B, NUREG 0856, and the LANL/DOE QAPPs, to the extent that LANL will expect to see such requirements incorporated in the Contractor's QA program

4.3 Design Control Considerations

- define design interface between LANL TPO/TMO and Contractor; provided specific details on following items:

4.3.1 Configuration Management

- specify CM system requirements applicable to all elements of the IDS (software and hardware)

4.3.2 Design Input and Design Interface Control

- define LANL role in approving design input generated by the Contractor or provided by other project participants

4.3.3 Detailed Design Specification Preparation

- define Contractor responsibilities for preparation of Detailed Design Specifications; discuss LANL approval role

4.3.4 Design Verification

- define Contractor responsibilities for design verification, identify levels and/or hold points at which LANL approval will be required

4.3.5 Software Design, Development, Verification, and Configuration Management

- Define Contractor use of LANL SQAP (details in Appendix B)
- define specific LANL requirements, such as software "life cycle" considerations and documentation requirements that must be considered in the preparation of the Contractor QAPP and software related design procedures

4.3.6 Configuration Baseline Document Preparation

- define Contractor responsibilities for preparing and updating a Configuration Baseline Document

4.4 Project Quality Assurance Records

- reference Appendix C for a list of potential QA records
- classify records as "permanent or "non permanent"
- define Contractor responsibilities relative to records management under NQA-1 guidelines; define records submittal requirements if management responsibility is retained by LANL. If not, define records turnover requirements and required retention times

4.5 Quality Assurance Audits

- define reservation of LANL rights to perform surveillance inspections and audits in the Contractor's facilities; define reasonable advance notice requirements

- restate Contractor's obligations regarding implementing effective corrective action
- require submittal of all internal Contractor audit documentation

4.6 Nonconformances and Incident Reporting

- define requirements for reporting of nonconformances and incidents

4.7 LANL Supplier QA Representative

- reserve rights of assigning a resident QA representative in Contractor's facilities; separately identify costs of providing reasonable facilities and support in the Cost Proposal

4.8 Source Inspection, Acceptance Testing, and Physical Configuration Audits

- define minimum LANL hold points for source inspection, acceptance testing, and Physical Configuration Audit performance purposes
- require 30 day advance notice for all identified hold points

5.0 BUDGET CONSIDERATIONS AND SPENDING PLAN SUBMITTAL

5.1 Budget

- define proposed budget ceilings in terms of labor hours, manhours, and hardware costs
- define requirements for format and level of detail for submittal of detailed program budgets

5.2 Spending Plan

- provide detailed instructions for preparation and submittal of spending plan based on the proposed budget required under item 5.1; cross reference deliverable list included under item 2 above.

5.3 Invoicing Instructions

- provide detailed invoicing instructions

6.0 STANDARD TERMS AND CONDITIONS

- reference inclusion of standard University of California terms and conditions as Appendix D

LIST OF APPENDICES

Appendix A: Work Breakdown Structure

Appendix B: LANL Software Quality Assurance Plan (SQAP)

Appendix C: Typical Project Quality Assurance Records

Appendix D: Standard Terms and Conditions

Appendix E: List of Acronyms

Computer Applications Group, Inc.

MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Date: Mon, Jan 29, 1990
Doc: CAG 75-9002902
Subcontract: 9X58-2604R-1

To: Ross Oblad
From: Jim Hall
Subj: IDS Historical Files Retained in the TMO
Attachment:

CAG Memo 75-8929101, to A Burningham (LANL TMO) from R Snow (CAG),
LANL WX-4 Group Files Pertaining to the IDS, 2-pp.

Distribution:
H Kalia, R Morley

CAG earlier recommended that the TMO retrieve WX-4 IDS files that were sent to Los Alamos storage after the termination of WX-4 IDS activities. Changes in personnel and new requirements for IDS documentation make it essential to retrieve at least a minimum set of IDS background documents from storage for use by the TMO. Our recommendations remain as stated in the attached Memo to A Burningham (LANL TMO) from R Snow (CAG) dated Oct 18, 1989. There is even more urgency now to implement this action in a timely manner.

ACTION:

CAG recommends that the TMO review the requirements for WX-4 IDS Group Files in the TMO immediately and proceed to transfer:

- all WX-4 IDS Group Files (there are about 3-boxes of documents) or alternatively
- a minimum of the 23 files listed in the attached CAG memo.

Computer Applications Group, Inc.

MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Date: Mon, Feb 5, 1990
Doc: CAG 75-9003601
Subcontract: 9X58-2604R-1

To: Ross Oblad
From: Jim Hall
Subj: CAG Proposed RFP Outline

Copy: H Kalia, R Morley

The attached Draft RFP is a brief outline of the RFP itself for prospective IDS contractors. The intent of this format is to separate items not appropriate for the Scope of Work (SOW) from the SOW that we hope to carry along more-or-less intact through this RFP and into the final contract without major changes in appearance and content. This will enable the draft RFP SOW to closely resemble the contract version. This consistency will provide the following benefits for LANL:

- with a commitment to prepare a final version of the SOW early LANL will address key SOW issues in time to develop proactive positions and solutions
- potentially fewer errors in preparation of the final contract SOW by exposing the preliminary SOW draft to the bidding process
- bidders will see essentially the same SOW in the RFP and contract documents raising fewer questions about LANL's intent for the job
- since the draft final SOW is available when the RFP goes out to bidders, all LANL concerned parties (i.e., TMO, TPO, MAT) have time during the bidding process to review and comment on the proposed SOW without impacting the overall contract award schedule

The outline is not meant to be exhaustive in any section and certainly needs more discussion and your comments. We would probably benefit from review and ongoing comments from R Morley and C Milligan as well. We will continue to flesh out portions of the SOW.

DRAFT OUTLINE
REQUEST FOR PROPOSAL
INTEGRATED DATA SYSTEM (IDS) SUPPORT SERVICES
FOR THE
YUCCA MOUNTAIN PROJECT EXPLORATORY SHAFT FACILITY

Los Alamos National Laboratory (LANL)

Request for Proposal (RFP) No. _____

Ref: DOE/NV Contract No. _____

1.0 SCOPE

1.1 General Description of Project

- provide a general description of the IDS, the IDS relationship to YMP ESF; cross reference Section 1.0 of draft Scope of Work (SOW)

1.2 Period of Contract

- define proposed period of the contract and any reserved options for renewal or extension

1.3 Buyer-Furnished Items and Equipment

- reference Section 1.6 of attached draft SOW

2.0 INSTRUCTIONS TO BIDDERS

2.1 Pre-proposal Conference

- state specific time and location of pre-proposal conference; define limitations on type and numbers of questions that will be answered; required confirmation of intent to attend conference

2.2 Notice of Intent to Propose and Proposal Due Date

- define requirements for formal notification of bidders' intent to propose
- define proposal due date

2.3 Point of Contact

- provide name, address, telephone number, and fax number of LANL proposal contact

2.4 Questions Regarding Request for Proposal

- define conditions under which questions will be answered; all requests must be written; responses to questions will be routed to all bidders and will be considered a formal modification to the proposal

2.5 Amendments to Request for Proposal

- state the reserved LANL rights for amending the proposal; discuss format of all proposal amendments; all amendments will be transmitted to all bidders

2.6 Late Proposals, Modifications, and Withdrawals

- discuss precise conditions for LANL consideration of late proposals, bidder-initiated modifications, and withdrawals

2.7 Expenses Related to Proposals

- advise that LANL is under no obligation for expenses incurred in preparation of proposals

2.8 Preparation of Proposals

- provide detailed instructions for format and content of proposals; discourage unnecessarily elaborate presentations; specify number of required copies

2.8.1 Technical Proposal

- must address management approach, key personnel, proposed project organization; as an option, LANL may require draft WBS development by the bidder based on the higher-level WBS structure provided in the draft SOW
- must include conceptual outline and description of the key elements of the bidder proposed IDS design. These descriptions should include system configuration, computer types and capacity, communication links, measurement equipment type, storage, and special features (i.e., proprietary items, environmentally resistant hardware, maintainability)
- should include a discussion of the key RFP issues (i.e., IDS reliability issues, operations and maintenance issues, and special issues identified by the bidder)
- should include commitment or certification from upper management confirming the level of support that will be provided to the prospective project in terms of personnel and other resources

2.8.2 Quality Assurance Proposal

- request development of a draft QA program plan based on the specific requirements included in the draft SOW; the draft QAPP should include a list of existing procedural resources and identify any procedures that will require development or modification. As an option, LANL could also request copies of any existing procedures that are proposed for use in implementing the QA program

2.8.3 Cost Proposal

- provide the required format and content of the cost proposal

3.0 EVALUATION CRITERIA

- provide a general discussion of weighting for individual proposal sections

3.1 Technical Proposal

- define weighting criteria of individual elements of technical proposal

3.2 Quality Assurance Proposal

- define weighting criteria for individual elements of the bidder QA proposal; e.g., QA program approach, existing resources, responsiveness to needs of draft SOW, compatibility of design control and software control procedures, etc.

3.3 Cost Proposal

- define weighting criteria for individual elements of the bidder cost proposal

Attachment A: Draft Scope of Work

Attachment B: Standard Terms and Conditions (standard LANL procurement document with TMO modifications as required)

Attachment A

**STATEMENT OF WORK
INTEGRATED DATA SYSTEM (IDS) SUPPORT SERVICES
FOR
THE YUCCA MOUNTAIN PROJECT EXPLORATORY SHAFT FACILITY**

Mon, Feb 5, 1990

6

75-9003601

Attachment B

STANDARD TERMS AND CONDITIONS

Computer Applications Group, Inc.

MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Date: Fri, Feb 16, 1990
Doc: CAG 75-9004701
Subcontract: 9X58-2604R-1

To: Ross Oblad, LANL TMO
From: Jim Hall, CAG

Subject: CAG Comments on Second Draft RFP (dated 02-05-90)

Copy: H Kalia, LANL TMO
R Morley, LANL TMO

General Comments

The draft outline splits the RFP into two sections: instructions for the bidders and a draft Scope of Work (SOW). This approach seems generally appropriate; however the detailed organization of each section is not well focused and in some cases works in cross purposes to the objectives of the RFP. We strongly recommended that the instructions for the bidders focus on exactly what LANL expects in the way of format, level of detail, and the general conditions affecting the bid response. In every way possible, the draft SOW should be written in the exact format and level of detail that it will have as part of the final contract. Where technical detail is required in the RFP bid response instructions, it should be provided by reference to this draft SOW in order to preclude any possible confusion in interpretation of requirements and to ensure that the cost estimates received from bidders realistically address the actual LANL defined conditions of the work.

CAG provided a draft RFP outline (01-28-90) and a draft SOW outline (02-05-90) in response to an earlier preliminary draft RFP outline from the TMO. A full text version of the draft CAG SOW is in preparation. Revisions to the TMO preliminary draft RFP outline represented in this second draft version are reviewed in this memorandum. Significant weaknesses in organization and content still exist. Where useful information has been added, it will be acknowledged in the comments provided below and will be incorporated into the full text of the draft CAG SOW. In addition, we have reviewed the University of California's *General Provisions for Research and Development Subcontracts*, dated January 1987. It is not clear that the YMP IDS represents an R&D contract, nor is it clear that the reviewed *UC General Provisions* document is totally up-to-date with current FAR practices. Although there may be a few contractual problems lurking in the background, the *UC General Provisions* (latest edition) should definitely be incorporated verbatim as an Appendix to the draft SOW.

As a minimum, the instructions to bidders section of the RFP should require that each bidder provide:

1. a letter demonstrating the level of commitment of resources to the project by the bidder's upper management (signed by the company president or manager of the division), with attachments summarizing the bidder's previous experience in work of this type and other details;
2. a technical proposal responding to the functional requirements contained in the draft SOW;
3. a draft project-specific QA Program Plan, with implementing procedures; and

4. a management proposal, which should describe the overall management approach to the project within the context of the draft QA Program Plan, identify key personnel, provide current resumes, and provide an estimate of project costs correlated to the schedule provided by LANL in the draft SOW.

We recommend the CAG draft RFP and SOW outlines be adopted as the basic organizational frameworks for the proposed IDS RFP.

Editorial Comments

1. It would be useful to follow the standard all numeric YMP model for document section numbering rather than the traditional alpha-numeric one used here.
2. For clarity and to promote bidder comprehension of the IDS project, the RFP document should be as simple as possible. This can be achieved by referencing the SOW, FRD, diagrams, tables, and other materials included as separate documents or appendices to the RFP for detailed requirements.

Suggested Revisions to Section I

Section I: Instructions to Offerors

1.0 Introduction

Discuss the purpose of Section I and its relationship to the draft SOW in Section II. Note inclusion of the University of California's *General Provisions for Research and Development Subcontracts*, dated January 1987 (latest edition) in Appendix A of the draft SOW.

2.0 Content Requirements

2.1 Letter of Commitment

Each bidder should provide a letter demonstrating the level of commitment of resources to the project by the bidder's senior management. The letter should summarize the bidder's previous experience in work of this type, and identify the physical location of the work place proposed for this task. Limit length to 10 pages.

2.2 Technical Proposal

Each bidder should provide a technical proposal, in which the proposed technical approach meeting the functional requirements contained in the draft SOW is defined in detail. Limit length to 35-40 pages.

2.3 Draft QA Program Plan

Each bidder should submit a draft project-specific QA Program Plan, with implementing procedures, that is based on the requirements described in the draft SOW. Unnecessarily elaborate plans should be discouraged, but no page limit should be specified.

2.4 Management Proposal

Each bidder should submit a management proposal, which should describe the overall management approach to the project within the context of the draft QA Program Plan, identify key personnel, provide current resumes, identify proposed subcontractors or suppliers, and provide a draft detailed schedule and an estimate of manpower allocations and project costs based on the schedule provided by LANL in the draft SOW. Limit length to 15-20 pages.

3.0 RFP Administration

3.1 Pre-Proposal Meeting

Discuss the time, location, and conditions of any pre-proposal meeting. Define limitations on the number and type of questions that will be answered.

3.2 Notice of Intent to Propose

Require verbal, facsimile, or letter notice of intent to propose within one week after the pre-proposal meeting. Identify name, address, telephone number and facsimile number of a single LANL contact for bidder response.

3.3 Proposal Due Dates and Submittal Requirements

Define the latest date that proposals will be accepted; define the number of copies that must be provided; identify the name and address of the LANL contracts representative that the proposals must be submitted to. Advise that proposals will not be returned.

3.4 Proposal Evaluation Criteria

Discuss the relative evaluation weights that will be assigned to each section of the proposal. Advise that detailed evaluation information will not be provided to bidders.

3.5 RFP Changes and Requests for Clarification

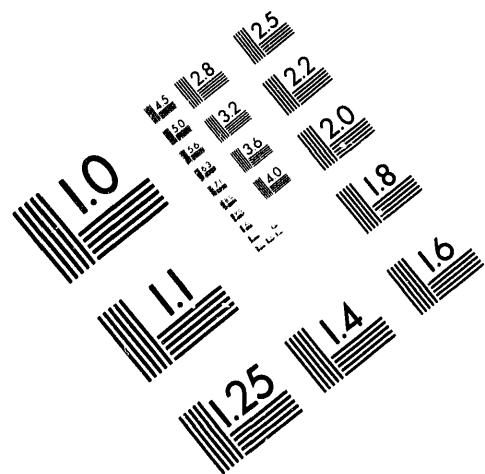
Advise that LANL may revise the conditions, content, or submittal dates of the RFP at any time. Discuss the conditions under which requests for clarification may be made.

3.6 Protection of Proposal Materials

Advise that proposals are submitted for the exclusive private use of LANL and its client (DOE - Nevada Operations Office), and guarantee that the information will not be distributed among other bidders or project participants.

3.7 Proposal Costs

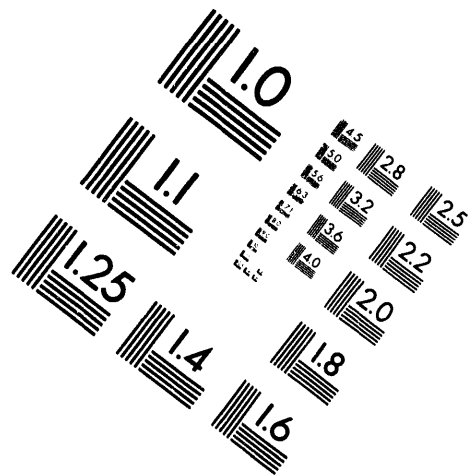
LANL should emphasize that it will accept no responsibility for costs incurred by bidders responding to the RFP.



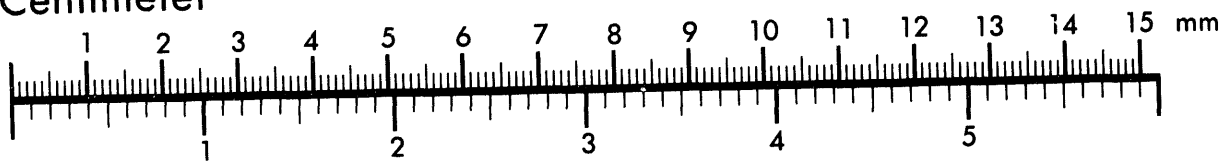
AIM

Association for Information and Image Management

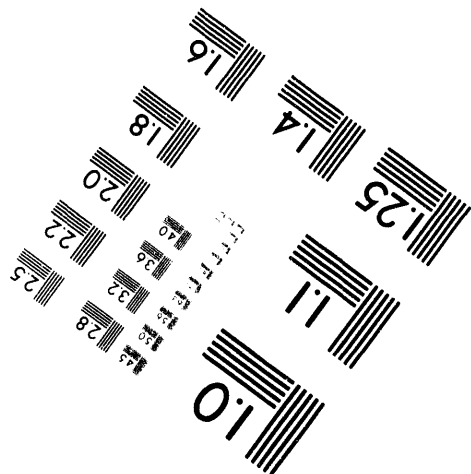
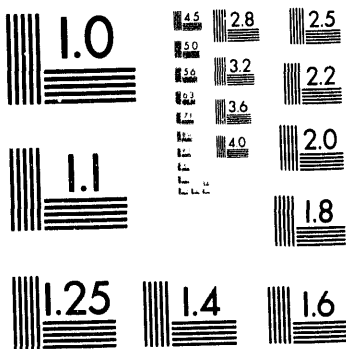
1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202



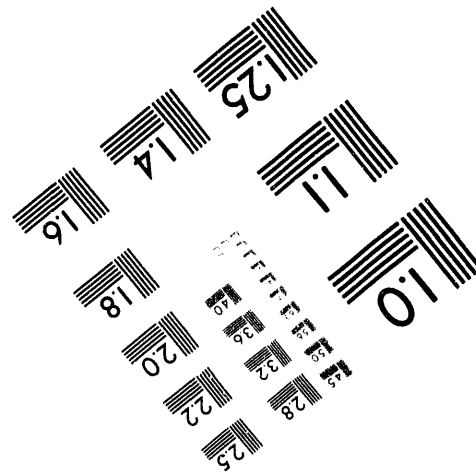
Centimeter



Inches



MANUFACTURED TO AIM STANDARDS
BY APPLIED IMAGE, INC.



2 of 2

SPECIFIC COMMENTS

Comments are included on a section-by-section basis with the fragment of the subject draft RFP section preceding CAG comments.

I. Instructions to the Offerors

A. Demonstration of Qualifications

Offeror will be required to itemize why he is qualified to take the job.

I.A, "Demonstration of Qualifications"; In our opinion, this will not result in useful information unless incorporated into a detailed description of the proposed project management approach. A requirement for a detailed management proposal is recommended; see the general comments above and item IE below.

B. Past Projects

A description of similar past projects with at least addresses of previous customers who can be contacted for reference.

I.B, "Past Projects"; It is recommended that such information be attached to the letter of commitment; see the general comments made above.

C. Demonstration of QA Qualifications

Offeror will be required to describe his QA process and show how it meets NQA-1.

I.C, "Demonstration of QA Qualifications"; Much more specific direction is recommended. LANL has several options in providing such direction; they may:

1. require a detailed description of the bidder's approach to developing a project specific QA program;
2. require examples of project specific QA program plans developed for similar projects;
3. require submittal of a draft of the proposed QA program plan and implementing procedures that would be used for this project.

The third option will obviously provide the most useful information in determining whether or not the bidder has the systems in place to handle the work. Although is a substantial requirement at the RFP stage, it will definitely weed out unqualified bidders. In our opinion, the QA program and QA management constraints for this project are so complex that the third option is absolutely necessary in order to reduce the likelihood of contractor QA program problems after contract award. It must be emphasized that LANL must define the QA program requirements explicitly at the RFP stage in order to get a meaningful response. These QA requirements must be defined well enough that little or no change is required in the transition from RFP to contract.

D. Demonstration of Personnel Qualifications
Resumes of key personnel.

1. Project Manager
2. Supervisors
3. Lead Technical Contributors

I.D, "Demonstration of Personnel Qualifications"; The QA manager must be considered part of key personnel. We also recommended that key personnel requirements be included for the senior management representative (President, Project Director, Vice-President, or whatever) that the Project Manager and QA Manager both report to, and who is ultimately responsible for the success of the project and resolving those quality issues that cannot be settled at the manager level. It is recommended that LANL not mince words when it comes to letting a potential contractor know what kind of upper management support it expects. Our observation is that the lack of contractor upper management commitment, as a contractually understood condition, contributed to the pronounced lack of performance observed with the previous IDS contractor.

E. Demonstration of Project Understanding

Offeror will be required to demonstrate that he understands the project by discussing his approach to managing and completing the project.

I.E, "Demonstration of Project Understanding"; In our opinion, this section should explicitly require a management proposal describing the contractor's overall management approach to the project within the context of the draft QA Program Plan including personnel, suppliers, schedules, and costs based on information provided in the draft SOW. See the general comments and suggested revisions above.

F. Demonstration of Sample System Understanding

Offeror will be required to briefly describe his approach to designing an acquisition station with the specifications supplied. The specifications will be generated by sampling the known IDS requirements of all participants. Cost and time estimates will be required. This is a test case, not a real system.

I.F, "Demonstration of Sample System Understanding"; In our opinion, this section should be scaled back to a requirement for a general discussion of the bidder's technical approach to the particular design considerations of the YMP IDS. Such a technical approach should be based on a concise functional requirements description provided in a draft Scope Of Work included in the RFP package, and warrants separate treatment in the technical proposal section of the RFP response. See the general comments made above.

G. Subcontract Award Basis

1. Relative Weight

Relative weights of importance of the various sections of the proposals will be described in general terms. The actual evaluation team weighting will be provided to MAT only.

2. Proposal Page Count

Limitations of proposals in maximum pages will be given.

I.G, "Subcontract Award Basis"; Inclusion of weighting criteria and a page count limitation will be appropriate. It should be made clear that page count will not be an evaluation criteria. LANL should also reserve rights to perform on-site evaluation of the the potential subcontractor's facilities and QA program prior to making final award decisions.

H. Subcontract Phases

Descriptions of the various contract phases will be given.

1. Design
2. Development, Manufacturing, Testing, and Delivery
3. Installation and Testing
4. Operation and Maintenance
5. Decommissioning

I.H, "Subcontract Phases"; Regardless of whether or not this is a multi-year contract, the various phases of the project should be stated in terms of deliverables or completion requirements. The bidders must clearly understand exactly what activities must be completed within a specific time frame in order to properly estimate manpower requirements and project costs for the proposed contract period (i.e., 1-year renewable). For the first annual contract only items 1, 2, and possibly 3 would occur. Items 4 and 5 should be identified as options to be exercised at LANL's discretion.

I. Place of Delivery and/or Performance

I.I, "Place of Delivery and/or Performance"; Unless it is necessary for LANL to dictate the physical location of the activity, we suggest that the bidder be requested to identify the physical location(s) where the design, procurement, assembly, and testing of the IDS will be accomplished. If multiple locations will be used, specific activities to be performed in each location should be identified and related to the proposed project management structure.

J. Documents for Review

Additional Documents to be Supplied by the Offerors.

1. Description of Software Development Process
2. QAPP

I.J, "Documents for Review"; The RFP should require that the bidder provide the following items as part of their response:

1. a technical proposal responding to functional requirements contained in the draft SOW;

2. a draft project-specific QA Program Plan (see item I.C above);
3. a management proposal describing the bidder's overall management approach within the context of the draft QA Program Plan. This plan must identify key personnel with current resumes, identify needed manpower, and provide an estimate of costs all correlated to the schedule provided by LANL in the draft SOW.

See general comments above.

K. Travel

A discussion of the need for travel to attend meetings and to give briefings will be in this section. On site representation will also be discussed.

I.K, "Travel"; Specific requirements for frequency, location, and contractor participation requirements should be provided in the RFP to the extent known or anticipated in order for the bidders to properly estimate travel costs. On-site representation should be discussed as a potential option under the draft SOW. See general comment 1 above.

L. Project Philosophy and Management

This section will attempt to give a flavor of the project approaches taken by the participants. The review process and the unknown or changing requirements climate will be stressed,

I.L, "Project Philosophy and Management"; In our opinion, philosophical discussions have no place in an RFP. If the project will be subject to "unknown or changing requirements", then LANL must explicitly define how those changes are going to be communicated to the contractor, which type of changes should be anticipated in the bidding process, and exactly what the change control and cost revision protocol between LANL and the contractor will be. It would be appropriate to provide a brief summary of the purpose of the IDS in relationship to the goals of the YMP in the draft SOW, but to the extent possible, LANL should insulate their subcontractor from any all all issues related to the YMP that do not directly relate to the timely and successful completion of the IDS contract. Project management needs should be focused on a precise definition of the role LANL will play in the design review and approval process, system and subsystem acceptance inspection, Physical Configuration Audits (PCAs), and other critical areas. The sub-items in this section should be included in the draft SOW. See the general comments made above.

1. Review Process

- a. Design Traceability To Requirements
- b. Design Evaluation
- c. Peer Review

I.L.1.c, "Peer Review"; We strongly feel that peer review (as defined by NUREG 1297) is inappropriate as a design acceptance technique for this type of activity, certainly if applied between LANL and the IDS contractor. The peer review process works fine if a consensus exists, but it does not necessarily require or facilitate resolution of observed problems or weaknesses, especially

when the peer review group produces a range of opinions. In our judgment, when applied to a design control process, review processes must actively involve the reviewer in the resolution and acceptance processes. Peer review may be appropriate at the conceptual design stage, or if the degree of uncertainty related to a technical approach or a particular aspect of a design needs to be estimated. LANL should take responsibility for such reviews, however, and should not invoke such procedures as a contractor QA program requirement.

d. Participating Organizations Review

I.L.1.d, "Participating Organizations Review"; It is recommended that LANL specifically define its role in managing design review and design input interfaces that may involve other YMP participants. In no case should it be implied that the contractor will have any direct interface with other participants that is not regulated by LANL.

2. Phased Delivery

a. First system Due 2 months before the first test begins

I.L.2, "Phased Delivery" Please see comment I.H above; system deliverables must be well defined, both in terms of the technical requirements that they must meet and in terms of acceptance inspection and Physical Configuration Audit (PCA) requirements.

3. Changes to System

I.L.3, "Changes to System"; Please see comment I.L above; LANL and contractor responsibilities regarding both IDS design changes and subsequent or concurrent contract changes must be defined in no uncertain terms in the draft SOW.

4. Documentation Requirements

I.L.4, "Documentation Requirements"; Documentation requirements should be explicitly addressed in the draft SOW through definition of deliverable plans, reports, design change requests, and the other related documents. Specific documentation generated as a result of the contractor's QA program would be expected to be identified within the draft QA Program Plan and implementing procedures.

Section II "Statement of Work"

II. Statement of Work

A. Technical Requirements

1. General Project Description

Brief description of purpose of YMP. Current status of overall project.

2. Purpose of the Subcontract

II.A.2; As a general comment, contract phases must be defined in terms of deliverables and completion requirements, cross referenced to LANL-defined schedule milestones. If certain

phases of the activity are not funded by this contract, but are retained as options, then they should be identified. If a phased delivery approach is used, it should be addressed in a discussion of the IDS conceptual model and, in more detail, in the summarized functional requirements description. It is important that the phases of IDS development track or relate well to discrete deliverables.

a. General

IDS background and purpose of subcontract.

Stress that the design effort will incorporate off the shelf hardware and software wherever possible. Special review and permission will be required to develop new hardware and software. This is not to be a state of the art system.

II.A.2.a; The restriction included here appears to be in conflict with DOE Order 1330.1B which requires that "the utilization of the most modern software development and maintenance technologies and methodologies available, which have been shown to be effective during all phases of the life of the software, is encouraged." This is not an outline issue, but a content issue.

b. Design Phase

More detailed description of work required under each subcontract phase.

c. Development, Manufacturing, Testing, and Delivery Phase

d. Installation and Testing

e. Operation and Maintenance

(1) Spares

(2) Maintenance

(a) On-Site

(b) Problem Support from Factory

(3) Operation

f. Decommissioning

This phase is just in case it is needed. This will negotiated later.

II.A.2.f; "Decommissioning" is not a "just in case it is needed" portion of the work. It represents the end of the site characterization testing activities involving IDS when the system is "turned off".

3. Conceptual Model of IDS

Brief overview of the IDS.

a. Distributed Data Acquisition System

(1) Acquire, Store, Disseminate

- (2) Central Systems
- (3) Acquisition Systems
- b. Modular Construction
- c. Reliability

II.A.3; The conceptual model should be expanded to recognize certain system modules or subassemblies as discrete deliverables. The system must be produced in phases that result in deliverable elements that will adequately support particular testing and construction activities at the ESF. These construction and testing schedules will determine, to some degree, the modularity of the IDS as perceived by the bidders and determine production and delivery schedules for functional portions of the overall system to meet LANL scheduled milestones in the draft SOW.

- 4. Functional Requirements of IDS
 - This will be a high level description of the system.
 - a. Central systems
 - (1) Acquisition Manager
 - (2) Data Archive and PI Interface System
 - (3) Surface Based Operations Console
 - b. Data Acquisition Stations
 - (1) Data Channels
 - (2) Storage of Data
 - (a) Time Stamp
 - (b) Storage Requirements
 - (c) Unusual Occurrence Reporting
 - (3) Acquisition Rates
 - (a) Basic Rates
 - (b) Unusual Occurrence Rates
 - (c) User Control of Rates

c. Reliability Issues

- (1) Failure Modes
- (2) Recovery From Component Failure
- (3) Data Integrity

d. Expected Operational Issues

- (1) User Control Software Interface
- (2) User Data Inspection
- (3) Tools for User Data Reduction
 - (a) Requirements for Data Reduction
 - (b) Mathematical Tools
 - (c) Graphical Tools

e. Networking and Communications Issues

- (1) Required Networks
 - (a) Between Data Acquisition Stations and Acquisition Manager
 - (b) Between AM and Archive System
 - (c) Between Archive System and the Outside World
- (2) Protocols

f. Alarms

- (1) Range Alarms
- (2) Malfunction Alarms

g. Control

- (1) Automatic
 - (a) Range Possible
 - (b) Recording of Changes
- (2) User Directed

- (a) Range Possible
- (b) Recording of Changes

II.A.4; The level of detail provided in this section must be sufficient for bidders to produce a realistic proposal, and to the extent possible should represent a close approximation of what will be included in the contract. There seems no reason not to simply invoke the latest revision of the IDS FRD to cover functional requirement issues. It should be noted that the full text of the CAG-produced draft SOW will incorporate all of the items described here.

5. DOE Orders

- a. Environment, Safety, & Health
- b. Project Management and Reporting
- c. Information systems

II.A.5; DOE Orders applicable to the technical and quality management of the project are not technical requirements and should be defined within individual sections defining requirements for the Project Management Plan and QA Program Plan. We recommend the interpretations of Order applicability provided by R. Snow's recent memorandum (CAG 75-9003704, February 6, 1990) be followed in the preparation of the draft full text version of the SOW. It is important that LANL understand exactly which DOE Orders are applicable to IDS development and operation and, in detail, how LANL proposes to meet the requirements of the applicable orders. Meeting the requirements of the orders is a LANL responsibility. Those portions of the orders that apply to the IDS contractor should be identified by LANL and included in the draft SOW as an unambiguous requirement.

6. Schedule Requirements

- a. Period of Performance for Each Phase
- b. Draft Schedule with Milestones
 - (1) Include Procurement Cycles
 - (2) Include software Development cycle

II.A.6, "Schedule Requirements"; These are not technical requirements and should be defined within individual sections defining requirements for the Project Management Plan and QA Program Plan. Also see comment II.A.2 above; LANL-furnished items must be listed in detail in order for bidders to estimate procurement schedules and costs. The SOW should request a detailed schedule based on LANL-established deliverable milestones.

B. Deliverables

1. General

Describe in this section the deliverables common to each phase.

II.B.1, "General"; The descriptions should include items common to all phases or specific to each phase.

- a. Project Status Reports
- b. Project Management Plans and Budgets
- c. cost Reports
- d. Quality Assurance Program Plan

II.B.1.d, "Quality Assurance Program Plan"; The implementing procedures invoked by the contractor's QA Program Plan should be identified as deliverables, subject for LANL review and approval prior to use.

2. Phase Specific

- a. Design
 - (1) Design Documents
 - (2) Design Diagrams
- b. Development, Manufacturing, Testing, and Delivery
- c. Installation and Testing
- d. Operations and Maintenance
 - (1) Operations Procedures
 - (2) User Training
- e. Decommissioning

II.B.2, "Phase Specific"; "Design documents" and "design diagrams" will be routine deliverables throughout the project. To avoid bidder confusion clarification is needed to identify the various steps required to design and build a discrete deliverable separately from the overall project phases required to complete the IDS. The deliverable production phase involves design, procurement, assembly, testing, and delivery. Post-installation testing support may be included as an option. The overall phases of the project, on the other hand, will involve the periodic delivery of certain components of the system to support ESF construction testing needs. Different phases of the design and production processes necessary for different IDS modules or components may be occurring at different times. As an example, the data acquisition software and system hardware

necessary to support radial borehole testing may need to be delivered and installed long before the system software needed to monitor operational status of at-depth test instrumentation is even designed.

C. Project Management Requirements

1. General Performance Requirements and Acceptance of Work
2. Project Management Plan
3. Schedule Control
4. Cost Control
5. Manpower Allocation
6. Work Breakdown Structure

II.C; As a general comment, these items will be addressed in the full text of the draft SOW base, although the organization provided in the CAG draft SOW outline is preferred.

D. Quality Assurance Requirements

1. Quality Assurance Plan
 - a. QA Program Requirements
 - b. Right-of-Access Provision
 - c. subcontracting Requirements
 - d. Documentation Requirements
 - e. Interface Measures
2. Nonconformance
3. Calibration Requirements

II.D.3, "Calibration Requirements"; This is a technical not a QA item, although QA will have some impact on its conduct just like all other technical work. This item should be moved to section II.A or section II.C.

4. Testing Requirements

II.D 4, "Testing Requirements"; This is a technical not a QA item, although QA will have some impact on its conduct just like all other technical work. This item should be moved to section II.A.

a. Factory Test Requirements

- (1) Review and Approval of Factory Test Plan
- (2) Witnessed Factory Tests

b. Acceptance Test Requirements

- (1) Acceptance Test Plan
- (2) On-Site Acceptance Test
- (3) Acceptance Testing Schedule

5. Configuration Management and Change Control

II.D; The organizational approach in the CAG draft SOW is much preferred. It is absolutely necessary that the following items are included in the final SOW:

1. quality levels defined;
2. governing DOE Orders and other regulatory requirements affecting QAPP organization and content provided;
3. the design control interface with LANL be clearly defined;
4. records management responsibilities defined;
5. contractor audit responsibilities emphasized;
6. nonconformance reporting protocols be established;
7. LANL needs related to acceptance testing and Physical Configuration Audits (PCAs) be defined in detail.

Of all these items, particular emphasis should be placed on any design control considerations that involve routine interfaces with LANL. Configuration management issues are critical to the success of the IDS. LANL requirements for configuration management should be expressed in the plainest possible language and should be an integral consideration in establishing design control, acceptance testing, and PCA interfaces. If LANL has other unique requirements related to design control, such as particular software life cycle considerations, software QA methods, and documentation requirements, they must be understood and documented in detail by LANL and then stated precisely for the bidder.

Computer Applications Group, Inc.

MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Doc: CAG 75-9005401
Subcontract: 9X58-2604R-1

Fri, Feb 23, 1990

To: Ross Oblad, LANL TMO
From: Jim Hall, CAG
Subj: Comments on FY90 IDS issues

Copy: H Kalia, LANL TMO

Ross, these thoughts have been brewing for a while. This is the latest version. Based on the IDS Technical Meeting Wed, Nov 29, 1989 and subsequent discussions with TMO personnel CAG has identified issues for TMO action or discussion during FY90. These issues are directed at developing a logical and effective IDS program based on detailed planning and completing necessary outstanding tasks to support the TMO.

1. *Statement of TMO IDS goals and purpose:* During the course of the IDS Technical Meeting several issues were discussed that need to be followed up by the IDS Technical Manager. TMO IDS goals have altered dramatically with the arrival of the new IDS Technical Manager and the termination of the EG&G design contract. The TMO must originate a position statement directed at the PIs and testing task leaders that redefines IDS purpose and goals. The statement should reiterate that collaborative efforts with the participants will be necessary to accomplish fielding a useful IDS. This approach will help users understand (and believe) that this newly defined IDS will support their needs. The following points should be included in this statement:

- A new IDS Technical Manager has taken over the program in the TMO.
- The EG&G IDS design and build development contract has been terminated.
- The EG&G conceptual design will be reviewed for current program needs.
- TMO IDS goals for FY90.

2. *Participant support of IDS design:* User support for IDS has been weak in the recent past. A new direction needs to be defined that will encourage the participants that the TMO is interested in their needs and has a goal to involve them in future decision making on IDS design issues. The following points should be included in the statement of this goal:

- User design input is an important part of developing a successful IDS that meets users needs.
- User design solutions for specific test requirements will be accepted for inclusion into the IDS. Data acquisition component designs and system concepts (hardware and software) are actively solicited as design input suggestions and/or functional requirements for the the IDS.
- Basic IDS design strategies and specific implementations that effect participant activities will be reviewed with participants for consensus before designs are finalized.
- A clear statement of the TMO position on minimizing organizational computers and a strategy to integrate them into the IDS. This will help clarify the scope of the planned IDS design and the role of participant organizational computers in testing activities.

2. *FRD development:* The purpose of the FRD as the single functional requirements document for IDS development needs to be made clear. The TMO strategy for developing the FRD should be explained and the role of participants developed. These items will be important to a timely and successful completion of the FRD.

- A description of the FRD.
 - The tentative schedule for completing the working version for start of Title 2 IDS design.
 - A general statement of required information from participant programs with a description of the TMO strategy for developing preliminary IDS functional requirements.
 - Identify specific tests that will have to be fully characterized by participants to provide IDS functional requirements for the first two years of the new Title 2 IDS development contract.
 - Each test identified by the TMO for participant response should be developed in enough detail to include TMO intent, specific information required from the PI or participant organization, and required date of response. Segregating each test or specific item into a separate formal request will simplify response tracking and reporting.
3. *IDS supporting documentation:* Current detailed costs, resource requirements, and scheduling for IDS development are based on estimates made years ago and repeatedly modified to fit prevailing political and fiscal constraints. To provide defensible and authentic information for TMO decision making these items must be re-evaluated for correct assumptions, completeness of concept, and impact of more up-to-date knowledge of the ESF testing and construction program. To be useful this documentation should include the following items:
- A description of the basic functional elements of the installed IDS
 - A high level planning schedule for IDS activities based on TMO and IDS Contractor annual activities.
 - Detailed descriptions of assumptions made in the estimating process.
 - Documented references used in developing functional elements and estimating costs and schedules.
4. *Scheduled activities for FY90:* Current schedules for FY90 IDS activities are responses to YMPO goals developed in early FY90. Lack of headquarters response to YMPO ESF contracting proposals and uncertain M&O contractor responsibilities, among other issues, make the current restart of Title 2 IDS design date uncertain. Based on these observations, we suggest that the TMO does not work to produce the IDS development RFP on a fast track schedule. Instead the schedule for the RFP should be a floating schedule with the start time triggered by some positive YMPO action. The decision to fast track the RFP would be made at the YMPO trigger time to start Title 2 activities. In the meantime background tasks should be initiated to assemble the required parts of the RFP and supporting documentation. This would allow the necessary time for the TMO to prepare solid, well thought out documents (even make a few mistakes and start over where necessary) that would include portions of the RFP, an updated FRD and supporting documentation, develop a program for PI test requirement input, develop strategies for functional requirements, make new LANL estimates of the scope of the IDS task, and review existing schedules. All of these activities will contribute to a well managed and responsive IDS program that includes appropriate support for the IDS manager to become fully acquainted with the background of the existing LANL program, make and evaluate new plans for future activities, and develop a logical and considered implementation of those plans.

Our goal should be to complete these items as well as preliminary RFP preparation discussed above during FY90. Resolution of certain sub-elements of the overall design concept such as organizational computer use would be expected to extend into FY91 or beyond as the participant testing groups re-evaluate their programs as part of Title 2 design.

Computer Applications Group, Inc.

MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Doc: CAG 75-9006401
Subcontract: 9X58-2604R-1

Date: Mon, Mar 5, 1990

To: Ross Oblad, LANL TMO
From: Jim Hall, CAG
Subj: Draft CAG IDS RFP Rev. 1

Copy: H Kalia, LANL TMO

Attached is the first full draft (pretty rough in spots) of the CAG IDS RFP for FY91 IDS development services. The RFP is divided into two sections:

1. instructions to offerors.
2. a draft Statement of Work (SOW).

The LANL Functional Requirements Document (FRD) and the University of California's terms and conditions are included by reference.

REQUEST FOR PROPOSAL
FOR
YUCCA MOUNTAIN PROJECT EXPLORATORY SHAFT FACILITY
INTEGRATED DATA SYSTEM DEVELOPMENT

LOS ALAMOS NATIONAL LABORATORY
RFP NO. _____

REF: DOE-NV CONTRACT NO. _____

Section I: Instructions to Offerors

1.0 Introduction

This Request for Proposal (RFP) is issued by Los Alamos National Laboratory (LANL) for purposes of selecting a qualified subcontractor for the provision of services related to the design, procurement, assembly, testing, delivery, and post-installation support of an integrated data system (IDS) to support the underground geotechnical testing that will be performed during construction and after completion of the Exploratory Shaft Facility (ESF) at the U.S. Department of Energy's (DOE) Yucca Mountain Project (YMP) in the state of Nevada. Section I of this proposal provides instructions to offerors in preparing an acceptable response to this RFP; Section II is a draft Statement of Work (SOW) that contains a brief description of the goals of the IDS in supporting YMP ESF data acquisition needs, and presents the technical and quality requirements of the IDS project in essentially the same format and level of detail that will be provided in the final contract. Please note that the primary source of technical requirements for the IDS is found in Appendix A of the draft SOW, which contains Revision 1.0 of the IDS Functional Requirements Document (LANL, 1989). Please also note that Appendix C of the draft SOW contains the University of California's General Provisions for Research and Development Subcontracts, dated January 1987, which are the terms and conditions that will govern contractual performance.

2.0 Content Requirements

The offeror's response shall be divided into four sections as described below.

2.1 Letter of Commitment

The offeror shall provide a letter from the offeror's senior management demonstrating the level of commitment and the extent of resources that will be provided to the IDS project. The letter shall summarize the offeror's previous experience in provision of data acquisition systems with similar functions, and shall identify the physical location or locations at which the work will be performed. The letter shall be limited to 10 pages in length.

2.2 Technical Proposal

The offeror shall provide a technical proposal that describes, in detail, the technical approach that the offeror will use in fulfilling the functional and other technical requirements contained in the draft SOW. The technical proposal shall be focused on the technical issues involved in IDS design, procurement, assembly, testing, delivery, and post-installation support. Unnecessarily elaborate technical proposals are discouraged; length shall be limited to 40 pages.

2.3 Draft QA Program Plan

Each offeror shall submit a draft project-specific QA Program Plan, with all required implementing procedures, designed to address the requirements described in the draft SOW. The draft QA Program Plan should be written at the same level of detail that the offeror would normally use in an actively implemented plan. No page limit is specified, but unnecessarily elaborate presentations are discouraged.

2.4 Management Proposal

Each offeror should submit a management proposal, which should describe the overall management approach to the project within the context of the draft QA Program Plan, identify key personnel, provide current professional resumes of key personnel, identify proposed subcontractors or suppliers, and provide a draft detailed schedule, estimated manpower allocations, and estimated project costs based on the schedule considerations provided in the draft SOW. Page length is limited to 15 pages.

3.0 RFP Administration

3.1 Pre-Proposal Meeting

Potential offerors may attend a pre-proposal meeting on [insert date, time] at the following location:

Los Alamos National Laboratory
[insert address]
Room [insert room number]

The pre-proposal meeting shall consist of a presentation of the requirements of the SOW by LANL representatives, and shall be followed by a 30 minute period in which questions from potential offerors will be sequentially entertained. Meeting minutes will be recorded and distributed to all attendees.

3.2 Notice of Intent to Propose

Each potential offeror shall notify the LANL contracts representative in writing of their intent to prepare a detailed proposal within one week after the pre-proposal meeting. Facsimile notices will be accepted. All such notices shall be sent to the following address:

[insert name of LANL representative]
Los Alamos National Laboratory
[insert address]
[insert telephone and facsimile number]

3.3 Proposal Due Dates and Submittal Requirements

Offerors shall submit five bound copies of their proposal to the the LANL contract representative identified in Section 3.2. Unnecessarily elaborate bindings and artwork are discouraged. Proposals shall be received no later than 5:00 PM, [insert date]; late proposals will not be accepted and will be returned unopened.

3.4 Proposal Evaluation Criteria

Proposals will be evaluated for technical content and for compliance with the directions provided by both sections of this RFP. Proposals will be evaluated section by section; the weighting factors assigned to each section relative to their importance in determining a final rating are as follows:

- | | |
|---|-----|
| • Letter of Commitment | 10% |
| • Technical Proposal | 35% |
| • Draft Quality Assurance Program Plan
and implementing procedures | 35% |
| • Management Proposal | 20% |

Detailed information regarding the evaluation processes applied within each section will not be provided to offerors.

3.5 RFP Changes and Requests for Clarification

LANL reserves the rights to cancel or revise any or all of the conditions, content, or submittal dates of this RFP at any time. Only those RFP modifications authorized by the LANL contract representative identified in 3.2 above shall be considered by the offerors. One written request for clarification from each offeror will be accepted within the first three weeks after the pre-proposal meeting. Requests for clarification will be compiled and answered by LANL in letter format, and will be distributed to all offerors; sources of individual questions or requests for clarification will not be identified in the LANL letter response.

3.6 Protection of Proposal Materials

The proposals submitted by offerors are for the exclusive private use of LANL and its client, the U.S. Department of Energy - Yucca Mountain Project Office (YMPO) in facilitating the process of selecting an IDS subcontractor. All proposals will be considered confidential, and proposal information will not be divulged to other offerors or project participants. All proposals will be considered LANL property upon receipt, and will not be returned.

3.7 Proposal Costs

All proposal costs shall be borne by the offerors; LANL and YMPO accept no responsibility for costs that may be incurred by offerors in the process of proposal preparation, or that may result from the modification or cancellation of this RFP.

SECTION II: DRAFT STATEMENT OF WORK:
INTEGRATED DATA SYSTEM DEVELOPMENT
FOR THE
YUCCA MOUNTAIN PROJECT EXPLORATORY SHAFT FACILITY

1.0 GENERAL AND TECHNICAL REQUIREMENTS

1.1 General Project Description

The Yucca Mountain Project Office (YMPO) of the U.S. Department of Energy is tasked with the design, construction, and operation of an Exploratory Shaft Facility (ESF) at Yucca Mountain, Nevada for purposes of detailed characterization of the Yucca Mountain site for a mined geologic repository for permanent disposal of high-level nuclear waste from commercial reactors and other nuclear facilities. Detailed characterization of the geologic and hydrogeologic properties of the site will be conducted through a wide variety of short-term and long-term in-situ tests that will be conducted during ESF construction and after completion of the facility. Test methods will require the installation of a large number of test instruments and sensors with a variety of functions, which will produce analog and digital data that must be collected, processed, stored, and evaluated in an attempt to determine the probable performance of the geologic repository. Before the ESF can receive waste for emplacement, it must receive a facility license from the U.S. Nuclear Regulatory Commission (NRC), analogous to the licenses required for commercial reactors and other nuclear facilities. Consequently, the construction and operation of the ESF is subject to strict regulatory constraints on the design, construction, and management practices that are implemented on the project. Precise, complete, and comprehensive documentation demonstrating project compliance with all regulatory requirements is a major consideration at all levels of the project.

1.2 Conceptual Model

Briefly described, the Integrated Data System (IDS) must acquire, store, protect, and transfer (to users) all data from test instrumentation and various associated manual data entry points within the ESF. The IDS must be capable of being installed in modules that can effectively manage test data produced during each stage of ESF construction through the completion of the facility. The IDS design, therefore, must be flexible enough to accommodate additional modules, data channels, and increasing numbers and types of testing requirements as ESF construction progresses, and must be capable of being modified as necessary to accommodate changes in ESF design without any loss of function or risk to acquired data from previously installed modules. IDS development and installation must keep pace with the testing needs that coincide with ESF construction schedules. The first deliverable IDS module will be required to support radial borehole testing that will be performed during the sinking of the ESF access shaft, and is the primary deliverable addressed by this Statement of Work (SOW).

1.3 Functional Requirements

The IDS shall be designed to meet the functional requirements for design defined by Appendix A, IDS Functional Requirements Document, Revision 1.0 (LANL, 1989), and shall comply with applicable portions of the following DOE Orders:

- 1330.1B, "Management of Automated Data Systems and Data Resources"
- 1360.2A, "Unclassified Computer Security Program"

- 1360.3A, "Automatic Data Processing Standards"
- 1360.4A, "Scientific and Technical Computer Software"
- 1360.6, "Automatic Data Processing Equipment/Data Systems"
- 6430.1A, "General Design Criteria"

1.4 Identification of Buyer

Los Alamos National Laboratory (LANL) is the Buyer of the services required by this SOW on behalf of the YMPO, and will administer the contract through its Technical Project Office (TPO). The Buyer's primary contractual representative is identified below:

[insert name of LANL representative]
Los Alamos National Laboratory
[insert address]
[insert telephone and facsimile number]

1.5 Period of Performance

The period of performance addressed by this Statement of Work (SOW) is confined to Fiscal Year 1991 (FY91);.

1.6 Buyer Furnished Items and Equipment

Certain hardware and software items, required both for IDS design purposes and for integration into deliverable IDS support modules, will be provided by LANL; a complete list is included in Appendix B. The Contractor shall be responsible for maintaining Buyer-furnished items and equipment in a controlled inventory, shall perform quarterly inspections to verify physical condition of such items and equipment, and for providing quarterly condition and usage status reports to the LANL Technical Project Office (TPO). Buyer-furnished equipment shall be used for IDS project support purposes only. Property management responsibilities shall be assigned and identified within the Contractor's Project Management Plan; see Section 3.2 below.

1.7 Standard Terms and Conditions

All work performed under the requirements of this Statement of Work (SOW) is subject to the standard terms and conditions of the University of California's General Provisions for Research and Development Subcontracts (UC, January 1987), which is included as Appendix C to this SOW.

2.0 DELIVERABLES

Project deliverables are described in the following sections; the data deliverables are summarized in Figure 2-1.

2.1 Budget and Cost Plan

A cost plan meeting the requirements of Section 5.0 below shall be submitted to the LANL TPO for review and approval within 30 days after acceptance of this SOW, and shall be updated on at least a monthly basis thereafter.

2.2 Quality Assurance Program Plan and Procedures

The QAPP and implementing procedures described in 4.2 below shall be submitted to the LANL TPO for approval within 30 days after acceptance of this SOW. All revisions shall be submitted for LANL review and approval prior to use.

2.3 Project Management Plan and Detailed Schedule

The Project Management Plan (PMP) described in Section 3.2 below shall be submitted to the TPO for approval within 30 days after acceptance of this SOW. All revisions shall be submitted for review and approval prior to use.

2.4 Monthly Progress Reports

Progress reports summarizing all activities (including status of all design and procurement activities) and identifying outstanding issues or quality problems shall be submitted to the LANL TPO between the first and tenth day of each month, with copies to the LANL Test Manager's Office (TMO) and the LANL QA Liaison Officer. Progress reports shall provide a comparison of actual expenditures against target values defined in the spending plan (see Sections 2.2 and 5.0 below), shall provide detailed justification for disparities greater or less than 15 percent of target values, and shall include any subsequent revisions or updates to the spending plans. Any significant quality problems or changes in key personnel assignments defined by the Project Management Plan (PMP, see Section 3.2 below) shall be noted in the report.

2.5 Quarterly BFE Condition and Status Reports

The Contractor shall perform quarterly inspections to verify physical condition of Buyer-Furnished items and Equipment (BFE), and for providing quarterly condition and usage status reports to the LANL Technical Project Office (TPO) by the tenth day of each quarter.

2.6 IDS RBT Data Acquisition Modules

A fully operational data acquisition system capable of supporting all Radial Borehole Tests (RBTs) planned during sinking of the ESF access shaft shall be completed, documented by completed configuration baseline documents and design specifications (including completed detail drawings, assembly drawings, operating software, and user documentation) and presented for formal acceptance testing by [insert date]. Acceptance test plans shall be submitted to the LANL TPO for approval at least 60 days prior to the planned acceptance test date. The LANL TPO shall be advised 30 days prior to system completion in order to facilitate planning for test witnessing and scheduling of Physical Configuration Audits (PCAs) by DOE Yucca Mountain Project Office (YMPO) CM personnel. Acceptance test reports shall be prepared in compliance with approved procedures and submitted to the LANL TPO within 30 days after completion of all testing activities. Other requirements related to physical delivery, shipment, storage, and/or installation will be provided at the direction of the LANL TPO.

2.7 Design and Procurement Status Report (Year End)

A comprehensive report summarizing the design and procurement status of follow-on IDS support modules shall be submitted to the LANL TPO within 30 days after the end of FY91.

FIGURE 2-1
FY91
IDS DATA DELIVERABLES

Item	Initial submittal date	Routine submittal date
Budget and Cost Plan	30 days ARO*	monthly, with monthly report
QAPP and procedures	30 days ARO	update annually or prior to use of any revisions
PMP and schedule	30 days ARO	update annually or prior to use of any revisions
Monthly progress reports	by 10th of first month	by 10th of each month
Quarterly BFE** Condition and Status Reports	by 10th day of each	by 10th day of each quarter quarter
Acceptance Test Plans	60 days prior to test date	60 days prior to test date
Acceptance Test Reports	30 days after test completion	30 days after test completion
Design and Procurement Status Report	30 days after end of FY91	N/A
Contractor Audit	N/A	10 days after completion or closure
Nonconformance Reports	N/A	10 days after completion or closure
Surveillance Reports	N/A	10 days after completion or closure

* ARO = After Receipt of Order

** BFE = Buyer Furnished items and Equipment

3.0 PROJECT MANAGEMENT REQUIREMENTS

3.1 General Performance Requirements and Acceptance of Work

3.1.1 Technical and Contractual Liaison with LANL

The primary LANL organizational contact for this project is the LANL Technical Project Office. All technical or contractual correspondence shall be routed through the LANL Technical Project Officer (TPO) or designee, at the following address:

[insert name of LANL representative]
Los Alamos National Laboratory
[insert address]
[insert telephone and facsimile number]

3.1.2 Performance Requirements

Acceptable performance on this project is defined as compliance with the following:

- current versions of this Statement of Work and its Appendices;
- current LANL-approved versions of the Contractor's Project Management Plan, QA Project Plan, and implementing procedures; and
- current LANL-approved versions of all design specifications and drawings;

Acceptable performance will also constitute completion of all required data deliverables and hardware/software deliverables, and will include:

- system acceptance testing and delivery of the IDS data acquisition modules developed to support radial borehole testing; and
- successful completion of Physical Configuration Audits (PCAs) for delivered hardware and software.

3.1.3 Acceptance of Work

Acceptance of work will be based on LANL review and approval of all required deliverables, LANL witnessing and approval of acceptance testing for the IDS modules developed to support radial borehole testing, LANL receiving inspection and acceptance of delivered hardware, and successful completion of all required PCAs.

3.2 Project Organization

All IDS development activities conducted by the Contractor shall be performed by a single central project organization under the direct management of a senior Project Manager, who shall be directly responsible to the LANL TPO for overall project performance. The project organization shall include all functional groups within the Contractor's organization that participate in, contribute to, or monitor the technical quality of the IDS. The specific project planning, management, and quality requirements defined by this SOW shall apply to all functional elements of the project organization. The location of the Contractor's facility or facilities in which all aspects of the project activity will be performed shall be identified in the Project Management Plan discussed in Section 3.3 below.

3.3 Project Management Plan

A Project Management Plan (PMP) shall be prepared and submitted to the LANL TPO for approval within 30 days after contract award. At a minimum, the PMP shall address the following items:

- a description of the project organizational structure, including an organizational chart;
- identification of key personnel, with a description of qualifications and project responsibilities;
- a discussion of total available personnel resources;
- a description of the general management approach to FY91 IDS development activities;
- a detailed schedule based on the deliverable milestones identified in Section 2.0 above;
- a detailed project Work Breakdown Structure (WBS), based on the headings provided in Appendix C, which subdivides the contractually specified WBS headings into the lowest levels required for manageability, and including descriptions for each project WBS element developed;
- references to instructions or procedures for controlling distribution of work to project personnel; and
- guidelines for the preparation of the cost plan based on cost and manpower considerations for each developed WBS element, along with procedures for routine monthly review, update, and submittal.

The Project Management Plan shall be considered a controlled document, subject to the preparation, review, approval, distribution, and revision controls described in the contractor's QA Program Plan.

3.3 Work Breakdown Structure

The Work Breakdown Structure (WBS) for IDS development is provided in Appendix D to this Statement of Work. Project Management Plan (PMP) requirements discussed in section 3.2 above require the development and submittal of additional WBS detail as necessary to adequately manage project activities, but shall be developed at least one level beyond that specified in Appendix D.

4.0 QUALITY ASSURANCE REQUIREMENTS

4.1 Quality Level Assignment

With the exception of design support procurement activities only, all work under this contract is designated Quality Level 1 in consideration of the criticality of the IDS in the defensibility of site characterization data for the YMP. In the terminology of the high-level nuclear waste repository program, Quality Level 1 refers to those items or activities with a direct affect on or relationship to the reliability or performance of the repository in protecting the short- and long-term radiological health and safety of the public. Design support hardware and software, support procurements, and other activities that do not have a direct relationship to the quality of a deliverable data acquisition system are designated Quality Level III. Hardware or software procured or developed under Level

III controls shall not be integrated into Level 1 IDS systems without first successfully completing documented Level 1 qualification in compliance with LANL-approved procedures.

4.2 Quality Assurance Program Plan and Procedures Preparation

The Contractor shall prepare a Quality Assurance Program Plan (QAPP) that defines a quality program appropriate for Quality Level 1 activities, and shall be supported by implementing procedures to the extent and level of detail appropriate for the technical activities defined in this SOW. The QAPP and all procedures shall be submitted to the LANL TPO for approval prior to use. The QAPP shall be structured to address the following regulatory requirements:

- ASME NQA-1, Quality Assurance Program Requirements for Nuclear Facilities (ANSI/ASME, 1989)
- The QAPP shall address Basic Requirements 1 through 18 inclusive, and all Supplemental Requirements as appropriate for the technical activities defined in Section 1.0 of this SOW.
- US NRC, Review Plan for High-Level Waste Repository Quality Assurance Program Descriptions (NRC, 1988)
- The QAPP shall address Sections 1 through 17 inclusive, as appropriate for the technical activities defined in Section 1.0 of this SOW.

Within the context of the plan structure defined by these specifications, the QAPP shall address the specific requirements of Sections 4.3 through 4.8 below.

4.3 Design Control Considerations

4.3.1 Configuration Management

Configuration Management (CM) plans or procedures shall be prepared, either as QAPP appendices or as separate controlled documents, that provide a methodology for the detailed management of the design documents that collectively define all of the hardware and software items that compose each data acquisition system configuration. The revision level and acceptance status of each item of a particular configuration shall be controlled from the point of initial acceptance or qualification, through system development and all associated modifications, through acceptance testing, preparation of CM baseline documentation, and LANL approval. CM plans or procedures shall be capable of identifying and documenting all currently approved configuration items at any given point in the process of system development, and for documenting and controlling changes to individual configuration items in ways that shall ensure the proper consideration of all other affected or potentially affected elements of the system. All configuration items shall be individually controlled and defined through QAPP-defined procedures governing their preparation, review, approval, and modification.

4.3.2 Design Input and Design Interface Control

All design input provided by external project participants or by the Contractor shall be reviewed and approved by LANL prior to use. Approved design input shall be transmitted to the Contractor through the IDS Functional Requirements Document (FRD) or other LANL design directives. All additions or modifications to design input, including requests originating with the Contractor, shall be reviewed by LANL and, if approved, will be incorporated into revisions of the FRD. Design input or change requests provided directly to the Contractor by other project participants shall be documented and referred directly to the LANL TMO for appropriate action.

4.3.3 Detailed Design Specification Preparation

The Contractor shall prepare procedures to control the preparation, review, and approval of comprehensive engineering specifications and/or drawings that shall completely define the design of all system hardware and software. Such documents shall be submitted to the LANL TMO for formal design review and approval prior to entry into the Contractor's CM system. The Contractor shall provide technical support for LANL design reviews at the TMO's request. Modifications to detailed design specifications shall be reviewed in the same manner as the originals, and shall be controlled and updated as necessary throughout the process of design development, verification or qualification, acceptance testing, and final LANL approval of the complete system configuration.

4.3.4 Design Verification

Verification of the completed data acquisition system design for the IDS modules developed to support radial borehole testing shall be accomplished through successful completion of final acceptance testing as discussed in Section 4.8 below. Acceptance testing procedures shall be developed in accordance with procedure requirements defined within the Contractor's QAPP, and shall be submitted for review and approval by the LANL TMO prior to use. Software shall be separately verified in compliance with the requirements of Section 4.3.5 below, prior to entry into the Contractor's CM system and prior to final acceptance testing. All configuration items developed or procured without Quality Level 1 controls shall successfully complete qualification testing, inspection, or (if software) verification, prior to entry into the Contractor's CM system, and prior to the initiation of acceptance tests. Qualification test procedures shall be developed in compliance with procedures specified in the Contractor's QAPP. Qualification test procedures and/or qualification inspection plans shall be submitted for review and approval by the LANL TMO prior to use.

4.3.5 Software Design, Development, Verification, and Configuration Management

All system software procured, developed, or obtained from other YMP participants shall be verified in order to ensure that it correctly performs all intended user functions and mathematical calculations as defined by its user documentation. Software verification shall be required as a condition of acceptance and entry into the Contractor's CM system. Software procured, developed, or obtained without Quality Level 1 controls shall be subject to full verification prior to entry into the CM system. Software verification procedures shall be developed and controlled as part of the QAPP, and at a minimum shall require the following items:

- definition of an adequate number and type of test cases or sample problems, in order to completely exercise the features of the software;
- acceptance criteria;
- definition of test case input data;
- requirements for a comprehensive verification report;
- requirements for addressing the applicable requirements of DOE Orders 1330.1B, 1360.2A, 1360.3A, 1360.4A, and 1360.6; and
- requirements for documented independent technical reviews of the verification report, users' manuals, and supporting calculations and documentation.

4.3.6 Configuration Baseline Document Preparation

Upon successful completion of system acceptance testing, individual system configurations shall be considered complete. As-tested and as-accepted configurations shall be documented in a compiled and controlled format that shall permit LANL to readily prepare Product Configuration Baseline (PCB) documents for individual accepted systems. Once the PCB has been prepared, LANL will request performance of a Physical Configuration Audit (PCA) by DOE YMP O CM personnel. Upon successful completion of the PCA, the system will be considered formally baselined and will be entered into the YMP Baseline in compliance with LANL procedures. At the direction of the LANL TPO, Contractor personnel may be requested to assist in the PCB and PCA processes and in the resolution of any observed configuration discrepancies.

4.4 Project Quality Assurance Records

The contractor shall maintain project QA records files in compliance with Basic Requirement 17 and Supplement 17S-1 of ANSI/ASME NQA-1. Project QA records shall be considered to include all documents (in paper, microfilm, or magnetic media) that have been properly executed, completed, or approved and that furnish evidence of the quality and completeness of data, items, and activities performed in support of this SOW. All records shall be considered "permanent" as defined by Supplement 17S-1, and shall be subject to turnover to LANL at the direction of the TPO. The Contractor's QA organization shall verify completeness of records turnover packages prior to submittal to LANL. A list of typical project records is included for information as Appendix E.

4.5 Quality Assurance Audits and Surveillances

4.5.1 Buyer-initiated Audits and Surveillances

LANL reserves the right to conduct periodic QA audits and surveillances in the Contractor's facilities to determine compliance with the requirements of this SOW and the overall adequacy of QA program implementation. The Contractor shall be advised in writing at least 30 days in advance of all proposed QA audits or surveillances, and shall provide reasonable facilities and access to project records and personnel as necessary for the conduct of audit and surveillance activities. The Contractor shall formally respond to LANL corrective action requests resulting from audit findings or observations or surveillance -related action items within 30 days after receipt.

4.5.2 Contractor Audits and Surveillances

Contractor QA personnel shall conduct periodic surveillances and audits of project activity; minimum schedules shall be established in the Contractor's QAPP. All audits and surveillances shall be performed by qualified personnel in compliance with approved procedures. All internal surveillance and audit reports and associated nonconformance and/or corrective action documentation shall be submitted to the LANL TPO for information within ten working days after completion or closure.

4.6 Nonconformances Reporting

The Contractor shall summarize all nonconformance activity in monthly progress reports, and shall provide copies of all information related to nonconformances within ten days of completion or closure. All nonconforming situations requiring a stop-work order or that have a serious or catastrophic effect on project quality, safety, or schedule considerations shall require immediate

notification of the LANL TPO with full documentation of the situation required within two working days.

4.7 LANL Supplier QA Representative

At the LANL QA Manager's or TPO option, LANL may assign a resident LANL Supplier QA Representative to the Contractor's facilities. Security clearances, reasonable working facilities, secretarial support, and access to the Contractor's project personnel at all levels will be required. LANL will exercise such an option through a formal modification to this SOW.

4.8 Source Inspection, Acceptance Testing, and Physical Configuration Audits

LANL reserves the right to conduct source inspections of all activities and to witness acceptance testing of the IDS modules supporting radial borehole testing. Rights are also reserved, on behalf of DOE YMPO, to perform Physical Configuration Audits (PCAs) in conjunction with LANL source inspection and acceptance test witnessing. The Contractor shall advise the LANL TPO at least 30 days prior to the start of final system acceptance tests.

5.0 BUDGET, SPENDING PLAN, AND INVOICING CONSIDERATIONS

5.1 Budget

The overall operating budget for FY91 is established at [insert \$ figure] for labor and direct costs, less [insert \$ figure] separately identified for capital equipment procurement. The manhour ceiling for FY91 is fixed at [insert number of manhours]. Proposed allocation of budget and manhours on a monthly basis shall be submitted in the budget and cost plan, as discussed in 5.2 below.

5.2 Budget and Cost Plan

As noted in Section 2.1 and Figure 2-1, the Contractor shall, on a monthly basis, provide a detailed cost plan that specifically provides target operating and procurement expenditures on a WBS element basis. The spending plan shall be submitted with the monthly progress reports for LANL review and approval. Monthly progress reports shall provide a comparison of actual expenditures against target values, shall provide detailed justification for significant disparities, and shall include any subsequent revisions or updates to the spending plans.

5.3 Invoicing Instructions

Project invoices shall be submitted within [insert number] days after the end of each month. Costs shall be broken down by the detailed WBS numbers identified in the Contractor's Project Management Plan.

LIST OF APPENDICES

Appendix A: Functional Requirements Document

Appendix B: List of Buyer-furnished Items and Equipment

Appendix C: Standard Terms and Conditions

Appendix D: Work Breakdown Structure

Appendix E: Typical Project Quality Assurance Records

Appendix F: List of Acronyms

Appendix A:

Functional Requirements Document

[insert FRD Current Revision]

Appendix B:

Buyer-furnished Items and Equipment

[LANL to provide]

Appendix C:

Standard Terms and Conditions

[insert General Provisions for Research and Development Subcontracts (UC, January 1987)]

Appendix D:

Work Breakdown Structure

[LANL to provide]

Appendix E:

Typical Project Quality Assurance Records

[LANL to provide]

Appendix F: List of Acronyms

BFE	Buyer Furnished Items and Equipment
CM	Configuration Management
DOE	U.S. Department of Energy
ESF	Exploratory Shaft Facility
IDS	Integrated Data System
LANL	Los Alamos National Laboratory
PCA	Physical Configuration Audit
PMP	Project Management Plan
RBT	Radial Borehole Test
TPO	(LANL) Technical Project Office
QA	Quality Assurance
QAPP	Quality Assurance Program Plan
WBS	Work Breakdown Structure
YMP	Yucca Mountain Project
YMPO	(DOE) Yucca Mountain Project Office

Computer Applications Group, Inc.

MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Doc: CAG 75-9010301
Subcontract: 9X58-2604R-1

Date: Fri, Apr 13, 1990

To: Ross Oblad, LANL TMO

From: Jim Hall, CAG

Subj: CAG comments on the LANL Draft SQAP as applied to an IDS subcontractor.

Copy: H Kalia, LANL TMO
R Morely, LANL TMO
G Cort, LANL
H Nunes, LANL

Attached are CAG comments on G. Cort's Draft SQAP. The comments are focused on those problems related to the potential application of these procedures to an IDS subcontractor. A detailed evaluation of whether or not the SQAP meshes with or meets all of the applicable requirements of the LANL QAPP, YMP 88/9, or DOE orders is NOT included. Where appropriate, it is implied that there are at least some questions in that area that bear investigation.

**COMMENTS ON THE POTENTIAL APPLICATION
OF THE LANL SOFTWARE QA PLAN
AND IMPLEMENTING PROCEDURES
TO INTEGRATED DATA SYSTEM DEVELOPMENT**

1.0 General Comments

As a part of ongoing efforts by Computer Applications Group, Inc. (CAG) in support of the development of a detailed Request for Proposal (RFP) for Integrated Data System (IDS) development for the Yucca Mountain Project, we have noted LANL's intentions of invoking the LANL Software QA Plan (SQAP) and its implementing procedures on the prospective subcontractor, without modification or adaptation. We have therefore reviewed current drafts of the SQAP and associated procedures in light of the needs of the IDS development project. As a result of this informal review, we have come to the conclusion that these documents are not designed to accommodate implementation by subcontractors; moreover, the management controls implied by the SQAP and its implementing procedures do not accommodate the technical needs of IDS development relative to software. The layers of documentation, level of detail, and numbers and types of review/approval cycles are excessive and unnecessarily elaborate. They may be appropriate for control of the development of complex computer models within LANL's own organization, however they have little applicability to data acquisition software, especially when that software must be developed as part of a data acquisition system that must be responsive to developing PI requirements and changing Exploratory Shaft Facility (ESF) construction and testing needs. The software QA program implied by these documents would almost certainly be unresponsive in terms of providing necessary approvals in a timely fashion, and could not easily accommodate the construction schedule-driven, iterative, integrated hardware/software approach required for IDS development. It is suggested that IDS software development must be managed as part of the process of total system design, not as a separate entity controlled by a separate management group. Moreover, the level of control being invoked for software is well beyond that which is required for other aspects of the design, which can only mean that the software aspects of the project will have the most critical impact on schedule requirements. We strongly suggest that LANL's needs will be better served by a more flexible approach to software development that assumes a high level of subcontractor capability that is integrated with the overall design control and configuration management needs of the entire data acquisition system.

We also suggest that the actual implementation of the system implied by the SQAP and its associated procedures, regardless of the type of software involved, would be extremely difficult in actual practice, and is likely to expose LANL to significant QA program management problems. LANL should consider that the large numbers of discrete requirements invoked by these documents also represent large numbers of individual auditable data points. Human nature being what it is, no QA program plan or procedure can be developed without flaws, or be perfectly implemented. It is suggested that LANL's needs for IDS development will be best served by the simplest, most direct approach possible that still meets regulatory and technical needs. A software QA management system must be created that has the minimum possible numbers of documentation requirements, boards, review cycles, and similar details. Again, we must emphasize that each additional management layer, definition of responsibility, or documentation requirement only provides additional data points that are subject to formal verification by external auditing processes that are beyond LANL's control.

One other problem associated with the imposition of the program implied by the SQAP and its implementing procedures has to do with the basic qualification of a subcontractor to perform IDS

development. We assume that LANL will wish to employ a subcontractor who can demonstrate successful experience in data acquisition system development. We doubt that such success will have been achieved without the subcontractor having had workable QA program plans and procedures of their own, particularly in the areas of design control, software development, and data system configuration management. We suggest, therefore, that the more qualified respondents to the RFP will have existing systems and proven procedures that could be adapted to the needs of the IDS project. By invoking the controls represented by the SQAP and its implementing procedures, LANL may well alienate the most qualified respondents (who are unlikely to be amenable to throwing over existing systems for the purposes of one project) and may in fact attract less qualified respondents with weaker programs or no real experience in this area (i.e., EG&G). In other words, the use of the SQAP and associated procedures at the project level increases LANL's responsibilities with regard to the day-to-day progress of IDS development. LANL would assume a proportionately greater risk in the success of the project and in the responsibility for (and resolution of) quality problems; the subcontractor's responsibilities and risks would be proportionately less. If LANL pursues this approach with the subcontractor, then the procedures invoked and the corresponding definition of LANL/subcontractor interface responsibilities must be absolutely precise and perfectly understood. As stated previously, it is our opinion that these procedures could not be effectively implemented by a subcontractor, would require extensive effort and involvement on the part of LANL, and would place the project at considerable risk in terms of meeting schedule and budgetary requirements.

2.0 Specific Comments

Specific comments are listed below, cross referenced to SQAP and procedure sections as appropriate.

2.1 Ref: Software QA Plan, Section 1; The purpose of including "computational data" within the scope of this plan is unclear. Specific software applications (e.g., models) may require documentation of the application by the user and independent review of the results. IDS software would be continuously in use, however, and should not be subject to the same type of documentation controls. An interpretation that the data gathered and processed by the IDS is "computational data" would prevent effective development and operation of the system.

2.2 Ref: Software QA Plan, Section 2.0, and References Section; It is noted that references to the DOE Orders affecting software QA are absent. It is suggested that collectively, the applicable DOE orders and applicable sections of the YMP and LANL QAPs must drive development of the SQAP and all software QA procedures. These directives represent the regulatory requirements that must be complied with, and the links from the Draft SQAP and supporting procedures with specific reference requirements should be plainly stated.

It is unclear how the Technical Software Manager can report to the QA Project Leader, as implied by Figure 1, and still comply with the general separation of responsibilities for verification of and achievement of quality defined in Section 1.3 of the LANL QAPP.

2.3 Ref: Software QA Plan, Section 3.2; Please see the general comments made in Section 1.0 above. In terms of its potential involvement in the review of IDS software, the Configuration Control Board (CCB) approach to software approval seems inappropriate. Whoever approves IDS software must understand it in the context of the overall system as well as the phase of Exploratory Shaft Facility (ESF) construction that it is meant to support, and must be prepared to respond in a much more timely manner than is possible with the approach discussed here.

2.4 Ref: Software QA Plan, Section 4.2.5, 5.2.2, procedure TWS-QAS-QP-03.12, Software Life Cycle, and elsewhere; We note that LANL requires software baseline definition at each life cycle phase, and has the CCB specifying the "components within each baseline, which must be produced at each stage of the life cycle." This seems to be an inappropriate interference in the design process, particularly if the design is subcontracted or is based on commercially available software. If the SQAP and its implementing procedures are invoked, the CCB must understand the purpose of data acquisition software within the context of the overall system and the particular phase of ESF construction that it is meant to support. In other words, the CCB would have to be at least as familiar with the project as, or actually include, the TPO/TMO personnel responsible for all other aspects of IDS design review and approval. It is recommended that the SQAP be revised to set minimum requirements or general conditions for what must be included in the software baseline; those minimum requirements will vary depending on the type and purpose of the software, and may in fact have to be specified on a case by case basis. Where data acquisition software is concerned, it is recommended that the role of the CCB should be limited to providing review support to the TPO/TMO to ensure that software packages submitted as part of the system baseline meet minimum requirements.

The purpose of establishing individual life cycle phase baselines before the testing phase is unclear; it is suggested that the software baseline should be established at the successful completion of the testing phase for the first working version. Documentation of design specifications, development requirements, and all other features of software development leading up to the successful

completion of the testing of each version should certainly be maintained under configuration control, but to establish a high level of formal review, approval, and change control requirements prior to the successful completion of testing seems to serve no useful purpose, especially if baseline approvals across organizational boundaries are required at each phase of development.

2.5 Ref: Software QA Plan, Section 5.2.4; It is noted that requirements are invoked for testing or re-engineering existing or acquired software to meet SQAP life-cycle requirements. If taken at face value, this would require that the CCB go through the exercise of defining the developmental stage baseline components for software packages that are essentially ready for verification testing and implementation.

2.6 Ref: Software QA Plan, Section 5.4; The definition of computational data used here implies that any information input to or output from IDS software would be subject to the requirements of the SQAP. This is wholly unworkable; controls on "computational data" should be confined to documenting applications of modeling or computational software and should not apply to the routine operation of data acquisition software after acceptance into the system baseline.

2.7 Ref: Software QA Plan, Section 6.0; We note that three tiers of "audits" would be required for each life-cycle component baseline prior to formal review, which would require the development of "an issue resolution plan and schedule" in order to resolve any problems. From the point of view of the IDS subcontractor, this process would be inappropriately time-consuming and over documented, and still would not pin down the responsibilities for approving the software baseline. It is also suggested that the use of the term Physical Configuration Audit (PCA) conflicts with the definition in the DOE's configuration management procedures. In the sense intended by the DOE, PCAs are performed as a condition of acceptance of a designed component (be it hardware, software, or an integrated data system module) into the YMP CM system, and should not be performed until all internal checks performed by the developing organizations are complete.

2.8 Ref: Software QA Plan, Section 12.0; It is noted that procedure TWS-QAS-QP-03.11, Software Configuration Management, is referenced for control of subcontractors. In Section 6.2.11.3 of the procedure, we note that compliance with all provisions of the SQAP and its implementing procedures are required for subcontractors unless authorized by the CCB on an SVA (Software Configuration Management Variance Authorization) form. The methodology for obtaining an SVA is not well defined, either in this procedure or in procedure TWS-QAS-QP-03.10, Documentation of Software and Computational Data. Use of the SVA seems to be the only avenue for obtaining relief from or modification of these requirements as appropriate for data acquisition system software or other non-modeling types of software. It is suggested that LANL's needs will be better served by designing these procedures to accommodate all of the anticipated types of software development that LANL will be responsible for, and to recognize, in the development and selection of procedural controls, that different types of software will require different levels of control.

2.9 Ref: TWS-QAS-QP-03.8, Reviews of Software and Computational Data; The procedure is written to apply entirely to the LANL organization. If it is meant to also accommodate subcontractor participation, the implication is that subcontractor representatives would assume particular project review responsibilities as defined in this procedure. If this is intended, the definition of subcontractor responsibilities in procurement documentation must be defined extremely carefully, and LANL will have to assume responsibilities for subcontractor training. Please see the general comments made in Section 1.0 above.

2.10 Ref: TWS-QAS-QP-03.8, Reviews of Software and Computational Data, Section 6.2; In

our opinion, formal in-process reviews requiring essentially the same level of detail as required for a "baseline closure review" is an unnecessary layer of review, particularly in application to the development of data acquisition software. The IDS does not have the schedule luxury that may be usual for other research projects. IDS development is tied to the physical construction schedules established for the ESF. The IDS absolutely must support ESF construction and test schedules; therefore, the design review processes (including software review processes) required to support the IDS must be designed to be as responsive as possible. Please see the general comments made in Section 1.0 above.

2.11 Ref: TWS-QAS-QP-03.8, Reviews of Software and Computational Data, Section 6.4; In our opinion, the CCB meeting forum for performance of reviews is one of the least responsive ways to complete a review. Where IDS software is concerned, we suggest that approval responsibilities be assigned to single individuals with the qualifications and program knowledge necessary to make informed, responsive decisions. Please see comment 2.10 above.

2.12 Ref: TWS-QAS-QP-03.8, Reviews of Software and Computational Data, Section 6.7.2; The definition of PCA provided here conflicts with the use of the term in DOE CM procedures; see comment 2.7 above.

2.13 Ref: TWS-QAS-QP-03.9, Creation, Management and Use of Computational Data; The applicability of this procedure to IDS development is extremely unclear; please see comment 2.1 above. We note that the procedure itself, in Section 6.3.1.1, recognizes that data acquisition system software does not produce interface tables. We suggest that this procedure be replaced by a set of minimum programming standards for data acquisition system software that can be included in the Functional Requirements Document (FRD) or as a specific clause in the Scope of Work appended to the IDS contract. Please see the general comments included in Section 1.0 above.

2.14 Ref: TWS-QAS-QP-03.10, Documentation of Software and Computational Data, Section 6.1; We suggest that LANL consider the extent to which it is creating auditable information in excess of that which may actually be required by governing specifications. It is our experience that more audit problems can arise from over-elaborate documentation requirements than from any other source. We note the inclusion of 19 separate supplemental documentation forms in Section 9.0. If one adds the number of data points represented by these forms, as applicable within the individual software element baseline review cycles required for each software package by these procedures, and then multiplies by the total number of software packages that LANL or its subcontractors are responsible for developing, it is not long before truly astronomical numbers of auditable data points are reached. Even if flaws in implementation are minor (e.g., missed signatures, missing dates, missing information), the sheer number of situations in which such errors can appear is so large that it will appear as a significant QA program control problem to an external auditor. Moreover, if LANL expects the IDS subcontractor to participate in the documentation processes described here, we suggest careful consideration of the training burden that LANL would thereby assume, and the potential schedule impacts related to the completion of paperwork across organizational boundaries. We strongly suggest that the approach to documentation taken by these procedures be redesigned to represent the minimum necessary to comply with the actual technical and regulatory requirements, and to represent the minimum possible impact on subcontracted activities.

2.15 Ref: TWS-QAS-QP-03.11, Software Configuration Management; As noted in the general comments included in Section 1.0 above, it is our opinion that the configuration of IDS software must be managed as part of the development of the total system configuration, not as a separate entity controlled by a separate management group. We strongly suggest that LANL's needs will be

better served by a more flexible approach to software development that can accommodate consideration of software configuration as just one feature of the overall system configuration.

2.16 Ref: TWS-QAS-QP-03.11, Software Configuration Management, Section 6.2.11.3; We assume that the only vehicle within these procedures for obtaining the exemptions necessary to accommodate IDS software needs is the SVA process. We suggest initiating a categorical exemption for data acquisition system software, which, as part of justification documentation, would include a listing of the minimum requirements for software QA that the subcontractor must meet with their own program and procedures, subject to LANL approval, and specific definition of LANL/subcontractor interface requirements relative to software QA. We suggest that once approved, the minimum requirements so described be included verbatim in the Scope of Work included in the IDS contract.

2.17 Ref: TWS-QAS-QP-03.12, Software Life Cycle; As noted in Section 2.4 above, the purpose of establishing individual life cycle phase baselines before the testing portion of the implementation phase is unclear. We concur absolutely with the need to document all historical features of software development from the initiation of design activity through the successful completion of testing; all such documentation should be retained as project QA records. We believe, however, that as far as data acquisition system software is concerned, the imposition of such a multiplicity of formal review, approval, documentation, and change control requirements prior to the successful completion of testing will not have a positive effect on software quality. On the contrary, we believe that this approach to baselining will prove to be unworkable across organizational boundaries, especially for such a schedule-driven project as the IDS. It is suggested that the software baseline should be established at the successful completion of the testing phase for the first working version, at which point it should become part of the IDS system baseline. Updates to the software baseline should be managed as part of the configuration management procedures applicable to each deliverable IDS module, pending successful completion of LANL-witnessed system acceptance testing and DOE PCAs. Please see comments 1.0 and 2.4 above.

2.18 Ref: TWS-QAS-QP-03.13, Verification and Validation of Software and Computational Data; IDS subcontractor responsibilities under this procedure are unclear, but we assume that only the "operation-based" verification criteria described in Section 6.1.2.3 would apply. It is suggested that such criteria be presented to the IDS subcontractor as part of the minimum contractual requirements discussed in comment 2.16 above.

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TRIP REPORT

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Doc: CAG 75-9011001
Subcontract: 9X58-2604R-1

Date: Fri, Apr 20, 1990

To: Ross Oblad, LANL TMO
From: Jim Hall, CAG
Subj: CAG Los Alamos Trip 9008
Discussions with G Cort concerning the impact of the LANL Draft SQAP on IDS.

Copy: H Kalia, LANL TMO
G Cort, LAN
K West, LANL

Meeting Location:
Los Alamos National Laboratory
YMP Project Offices, EES-13
Los Alamos, NM

Meeting Date: Tue, Apr 17, 1990
Attendees: R Oblad (LANL TMO), J Hall (CAG), G Cort (LANL), D Hines (LANL)

Summary:

Discussions were started with J Hall reviewing issues detailed in CAG 75-9010301 (dated 04-13-90) and R Oblad presenting TMO issues. The main items of concern for impact on IDS development contractor performance were identified as follows:

1. Documentation contents are quite comprehensive. However, there is no single source of program content and organization that allows an overview of the goals and methods. A complete reading of all the documents is required to understand the intent of the program. A high-level flow chart of the software QA process might help.

Resolution: G Cort informed us that a later version of the documents had been prepared that expanded the SQAP to include more details and simplified the procedures by moving concepts and planning issues into the SQAP.

- ◊ CAG suggested a high-level "managers" manual for the program at a detail that could be used by a stand-in or replacement for G Cort in the QA group and alternatively used to help other managers understand the purpose of the program. In addition to required ESS-13 management issues his manual should emphasize the following SQA program issues:

- What is important in this SQA program?
- What are the functional management goals for this program?
- What are the strategies for accomplishing these goals?
- What are the weaknesses of the program?
- Do these weaknesses require any special attention?
- What are the strengths of this program?
- Are there special strategies for utilizing these strengths that need to be pursued?
- What are the management issues that need regular attention to keep this program on-track?

2. CAG has come to the conclusion that these documents are not designed to accommodate implementation by subcontractors; moreover, the management controls implied by the SQAP and its implementing procedures do not accommodate the technical needs of IDS development

relative to software. The layers of documentation, level of detail, and numbers and types of review/approval cycles are excessive and unnecessarily elaborate. They may be appropriate for control of the development of complex computer models within LANL's own organization, however they have little applicability to data acquisition software, especially when that software must be developed as part of a data acquisition system that must be responsive to developing PI requirements and changing Exploratory Shaft Facility (ESF) construction and testing needs. The software QA program implied by these documents would almost certainly be unresponsive in terms of providing necessary approvals in a timely fashion, and could not easily accommodate the construction schedule-driven, iterative, integrated hardware/software approach required for IDS development.

Resolution: G Cort recognized the facts as stated. He felt that the SQAP and supporting procedures will provide a complete program for LANL control of software development by the subcontractor. Initial software development is intended to be an informally monitored process (from the QA until final testing and baselining. This should allow the subcontractor adequate flexibility to iterate on the final product without cumbersome configuration management controls. The CM controls would come into action after the initial product was baselined to control the change process.

3. The actual implementation of the system implied by the SQAP and its associated procedures, regardless of the type of software involved, would be extremely difficult in actual practice, and is considered that the large numbers of discrete requirements invoked by these documents also represent large numbers of individual auditable data points. Human nature being what it is, no QA program plan or procedure can be developed without flaws, or be perfectly implemented. It is suggested that LANL's needs for IDS development will be best served by the simplest, most direct approach possible that still meets regulatory and technical needs. A software QA management system must be created that has the minimum possible numbers of documentation requirements, boards, review cycles, and similar details. Again, we must emphasize that each additional management layer, definition of responsibility, or documentation requirement only provides additional data points that are subject to formal verification by external auditing processes that are beyond LANL's control. If an auditor detected a "significant" number of errors, even though they were minor and a small number compared to the actual volume of QA items, this could be interpreted as a trend toward loss of control with potentially serious program impacts.

Resolution: G Cort recognized the facts as stated. He felt that the LANL software QA group will be able to adequately handle the volume of QA items. The proposed program has been developed to concentrate QA items in the QA group and minimize user generated items. Furthermore there is a possibility that user generated items will be computer readable forms or files that will reduce the need for error prone transcriptions and manual record filing. The potential for a "significant" number of errors is recognized but not considered a problem at this time by LANL.

⇒ CAG considers this to be an important issue with potential impact on IDS schedules.

4. The requirement by LANL that all IDS software development be performed under the LANL SQAP would mean that the contractor would perform all work except software QA according to their internal QAPP and software according to the LANL plan. This seems like a very cumbersome QA control structure, prone to problems.

Resolution: G Cort recognized the facts as stated. He felt that the subcontractor should be able to accomplish their task with two QA plans.

⇒ CAG considers this to be an important issue with potential impact on IDS schedules. One option

tasks under the LANL QAP (including the SQAP). This would require revisions in the existing LANL QAP and supporting procedures to include the IDS development task.

5. An expanded description of computational data and data interface tables applied to IDS development and operations is required. TWS-QAS-QP-03.9, R0, Section 6.3.1.1 states that data acquisition systems do not produce interface tables. This seems contradictory to IDS goals.

Resolution: G Cort recognized that the referenced section is in error. The data acquisition system reference was meant to apply to small scale purchased systems, not the IDS. The IDS will not use input data interface tables. It will, however, produce data exclusively in data interface table format in tests and in operation in the ESF. The format and complexity of the LANL data interface tables has not been fixed yet. A program is currently being evaluated by LANL that provides all required data interface functions needed for all of LANLs work (including IDS) and possibly all testing data tables from other labs. The program is named netCDF and is available at no licensing fees from the Unidata Program Center.

- ↳ The adoption of the netCDF data interface table utility is very important to the IDS and the YMP data management program. The TMO should support LANLs efforts to establish this or some alternate standard for data interface formats used by all participants, the RIB, and other program databases.

6. A clarification of In-Process Reviews and "open baselines" is needed to understand the controls during initial development of IDS software and formal baseline activities impact on development methods and schedules.

Resolution: See item 2 above. In-Process Reviews will be used to monitor subcontractor activities related to approved changes in existing baselines. No formal SQAP reviews are provided for during the initial development process prior to baselining a product.

- ↳ The TMO will have to provide subcontractor monitoring and control during initial product development (prior to baselining) via management (schedule and cost) and engineering (scope and content) reviews as part of SOW requirements.

7. IDS software classification needs to be determined.

Resolution: G Cort suggested that IDS software be classified as RTS (Real Time Software). This was acceptable.

8. References to relevant DOE Orders are missing.

Resolution: DOE Orders references will be included in the final approved version of the SQAP.

9. The following detailed issues were resolved as being part of an overall SQAP strategy and are correct as stated for the LANL YMP QA group purposes:

- TSM group organization as presented in SQAP Fig. 1 is not consistent with the LANL QAPP organizational requirements.
- The SQAP definition of Physical Configuration Audit (PCA) does not conform to the YMP PCA definition.
- The approach taken in the LANL SQAP is radically different than previous YMPO/SAIC interpretations of Appendix-H software QA as demonstrated in presentations and other YMPO software QA related documents.

- ↳ These and similar items at odds with "conventional" YMPO QA interpretations may lead to

Computer Applications Group, Inc.

MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Doc: CAG 75-9013201
Subcontract: 9X58-2604R-1

Date: Sat, May 12, 1990

To: Ross Oblad, LANL TMO

From: Jim Hall, CAG

Subj: CAG suggested contents for IDS related MOUs and a new WBS for LANL IDS activities

Copy: H Kalia, LANL TMO
K West, LANL EES-13

As a general premise, it is suggested that memoranda of understanding (MOUs) are needed between LANL and Raytheon and YMPO and Raytheon, and also between YMPO and LANL. The YMPO/LANL MOU is needed to redefine LANL's role in the program, general IDS responsibilities, YMPO/LANL IDS interface goals, and provide the basis for new LANL WBS assignments. WBS assignments should track with the basic understandings outlined in the MOUs, and assignments of responsibilities should be presented in a manner in each MOU that portrays consistent responsibilities for each organization. Suggested MOUs are outlined briefly below followed by a suggested LANL WBS revision.

1. Memorandum of Understanding, LANL/Raytheon

- LANL retains full responsibilities for managing the IDS design interface between Raytheon and the system users; the output from LANL's interface activity will be the Functional Requirements Document (FRD) and its subsequent updates, which will serve to define approved design input to Raytheon.
- Raytheon shall work under their own QA Program Plans/Project Management Plans and implementing procedures, subject to DOE approval. Plan and procedure requirements shall be as defined in DOE procurement documents. Raytheon plans shall include design control features to accommodate LANL management of the user requirement design interface as defined above.
- Raytheon shall develop detailed design specifications and subsequent updates to the specifications in response to the requirements of the FRD and its revisions. LANL approval of design specifications are required prior to development, procurement, or testing activities.
- Raytheon shall develop detailed acceptance testing plans for all deliverable system modules. LANL shall approve such plans prior to use, and shall witness acceptance testing. At DOE's option, LANL may participate in or perform Physical Configuration Audits (PCAs) on DOE's behalf, in compliance with DOE procedures. PCAs shall be performed after successful completion of testing; successful completion of PCAs shall constitute DOE acceptance of the affected deliverable system module.
- LANL will be the eventual operator of the system.
- Except for the design interface management responsibilities assigned to LANL, Raytheon is responsible to DOE for all facets of IDS design, procurement, development, testing, delivery, and installation.

2. Memorandum of Understanding, YMPO/LANL

- LANL will be the eventual operator of the IDS system, and shall retain full responsibilities for managing the IDS design interface between Raytheon and the system users. The output from LANL's interface activity shall be the Functional Requirements Document (FRD) and its subsequent updates, which will serve to define approved design input to Raytheon.
- Raytheon shall work under their own QA Program Plans/Project Management Plans and implementing procedures, subject to DOE approval. As it relates to IDS system development, LANL's QA Program Plan and procedures shall apply only to those activities directly under its contractual purview, i.e., those related to:
 - 1) the development, review, approval, and periodic update of the FRD;
 - 2) design interface management;
 - 3) review and approval of detailed Raytheon design specifications;
 - 4) review and approval of Raytheon acceptance testing plans;
 - 5) acceptance test witnessing; and
 - 6) at DOE's option, performance of PCAs in compliance with DOE procedures.
- LANL shall approve Raytheon acceptance testing plans prior to use, and shall witness acceptance testing. At DOE's option, LANL may participate in or perform Physical Configuration Audits (PCAs) on DOE's behalf, in compliance with DOE procedures. PCAs shall be performed after successful completion of testing; successful completion of PCAs shall constitute DOE acceptance of the affected deliverable system module. All subsequent changes to accepted system modules shall be initiated through DOE Configuration Management (CM) procedures.

3. Memorandum of Understanding, YMPO/Raytheon

- Raytheon is responsible to DOE for all facets of IDS design, procurement, development, testing, delivery, and installation, with the exception that LANL will be responsible for managing the IDS design interface between Raytheon and the system users. LANL will define approved design input to Raytheon through the Functional Requirements Document (FRD) and its subsequent updates.
- Raytheon shall work under their own QA Program Plans/Project Management Plans and implementing procedures, subject to DOE approval. Plan and procedure requirements shall be as defined in DOE procurement documents. The design control features of such plans shall accommodate the requirements for design interface requirements through LANL as defined above.
- Raytheon shall develop detailed design specifications and updates thereto in response to the requirements of the FRD and its revisions. LANL approval of the design specifications is required prior to development, procurement, or testing.
- Raytheon shall prepare acceptance testing plans for each deliverable system module and submit them to LANL for review and approval prior to use. LANL shall witness acceptance testing and may, at the DOE's option, participate in or perform Physical Configuration Audits (PCAs) on DOE's behalf, in compliance with DOE procedures. PCAs shall be performed after successful completion of testing; successful completion of PCAs shall constitute DOE acceptance of the affected deliverable system module. All subsequent changes to accepted system modules shall be initiated through DOE Configuration Management (CM) procedures.
- All changes to accepted system modules shall be initiated through DOE CM procedures.

4. Revised WBS Assignments

4.1 YMPO/LANL

X.X.1 IDS design interface management services

X.X.1.1 IDS design interface management

X.X.1.1.1 FRD development and maintenance

X.X.1.1.2 Detailed design specification review and approval

X.X.1.1.3 Configuration change initiation (DOE-approved modules, through DOE CM procedures)

X.X.1.2 IDS acceptance test witnessing

X.X.1.2.1 Acceptance test plan review and approval

X.X.1.2.2 Acceptance test witnessing

X.X.1.3 PCA performance (optional)

X.X.1.4 Project management

X.X.1.4.1 Management planning (includes scheduling, QAPP, procedures development)

X.X.1.4.2 Cost management and reporting

X.X.1.5 Operations and Maintenance

X.X.1.5.1 Management planning (includes planning, QAPP, procedures development)

X.X.1.5.2 Cost management and reporting

4.2 YMPO/Raytheon

Y.Y.1 ESF IDS design, development, procurement, testing, and installation

Y.Y.1.1 IDS design and development

Y.Y.1.1.1 Detailed design specification preparation (includes user interface activity)

Y.Y.1.1.1 Software development, verification

Y.Y.1.1.2 Developmental testing

Y.Y.1.1.3 Internal CM and design baseline preparation

Y.Y.1.2 IDS procurement

Y.Y.1.2.1 Material control

Y.Y.1.2.1.1 Buyer furnished equipment management

Y.Y.1.2.1.2 Warehousing

Y.Y.1.2.2 Procurement cost reporting

Y.Y.1.3 IDS module testing

Y.Y.1.3.1 Acceptance test plan preparation

Y.Y.1.3.2 Acceptance testing

Y.Y.1.4 IDS module installation

Y.Y.1.4.1 Installation plan preparation

Y.Y.1.4.2 Installation

Y.Y.1.4.3 Installation testing

Y.Y.1.4.4 Operations and maintenance plan preparation

Y.Y.1.5 Management

Y.Y.0.5.1 Management planning (includes scheduling, QAPP and procedures development)

Y.Y.0.5.2 Cost management and reporting

Y.Y.1.6 Configuration change initiation (DOE-approved modules, through DOE CM procedures)

Y.Y.2 Post-installation technical support (optional)

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13800 NE Merchant Road, Carlton, OR 97111

MEMORANDUM

(503) 852-7214 (Voice & FAX)

CAG ref: 77-9015602

LANL Contract: 9X58-2604R-1

Date: Tue, Jun 5, 1990
To: Hemi Kalia, LANL TMO
From: Jim Hall
Subject: Budget planning for FY90 and FY91 IDS tasks

Summary:

Uncertainty in the choice of a new AE for YMP and the status of the IDS contractor precludes detailed planning involving the IDS designers at this time. Whether the IDS contractor works directly for LANL or YMPO, LANL will be the project technical manager. These factors should focus the TMO's attention on IDS management planning for the near future. Most of the tasks proposed below for the remainder of FY90 and for FY91 involve developing technical management plans and strategies. The identified topics are a restatement of your suggestions from our conversation earlier today and CAG identified topics.

Specific Topics

1.0 FY91

- 1.1. Develop an IDS requirements document (RD)
 - resolve the use of the FRD and RD
 - resolve the TMO strategy for organizational computers and related systems
- 1.2. Review the IDS designer's engineering plans and basis for design (BFD) document
- 1.3. Develop SDRD revisions
 - incorporate the new IDS design into the SDRD
 - review the methods of incorporating design material into the SDRD to provide adequate high level detail without copious amounts of potentially obsolete design details
 - review all pertinent IDS related sections for consistency and appropriateness
 - provide a specific list of DOE orders covering the IDS design and provide a well developed backup document suitable for audit review and designer guidance
- 1.4. Continue to develop and refine PI requirements
 - Investigate IDS and program data management issues
 - Develop realistic PI data rates for test turn-on, exceptional transients, and steady state monitoring
 - Identify generic test instrument types and anticipated measurement ranges for tests not now completely characterized
 - Develop requirements for common data items
- 1.5. Develop strategies and formal methods for IDS design integration into ESF and participant test designs
- 1.6. Develop strategies, requirements, and formal methods for IDS design reviews

-
- 1.7 Develop a high level plan for IDS installation in the ESF for AE and operations planning and realistic IDS implementation and schedule development
 - 1.8 Continue to review and develop this list of tasks on a regular basis
 - 2.0 **FY90 & FY91**
 - 2.1. Develop and refine Memo of Understanding (MOU) documents defining TMO IDS responsibilities between LANL and YMPO, the IDS contractor, the AE, and participant organizations and suggest wording for MOUs between participant organizations indirectly effecting TMO IDS responsibilities (i.e., the YMP AE and YMPO)
 - 2.2. Integrate the results of the ESF alternative design study into IDS design activities
 - provide a high level analysis
 - identify potential impacts on IDS development and schedule
 - identify potential impacts on IDS/ESF design and construction interfaces
 - 2.3. Develop IDS budget reporting and analysis methods to be used by the TMO and IDS contractor to support consistent TMO planning, reporting, and task budget analysis
 - 2.4. Plan the IDS contractor scope of work (SOW) details including critical technical and management issues
 - 2.5. Develop conceptual level IDS documentation to be used for communicating IDS concepts to YMPO, LANL staff, and participants in a simple and effective manner
 - resolve the TMO strategy for organizational computers and related systems
 - provide a tentative list of planned data acquisition monitoring capabilities that participants can regard as standards
 - provide a very high level conceptual sketch of the planned IDS for each test or testing location
 - 2.6. Begin working with the AE to develop a set of ESF drawings that specifically illustrate the IDS conceptual design (Title 1) and provide a starting place for illustrating the Title 2 design as developed
 - 2.7. Attempt to salvage LLNL IDS design information including requirements in any form (documents, meetings, copies of notebooks, etc.) from knowledgeable individuals (A Ramirez or D Wilder and G Ziegler)

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MEMORANDUM

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Doc: CAG 75-9016101

Subcontract: 9X58-2604R-1

Date: Mon, Jun 11, 1990

To: Ross Oblad, LANL TMO

From: Jim Hall, CAG

Subj: Additional development of IDS related MOUs and a new WBS for LANL IDS activities

Copy: H Kalia, LANL TMO

K West, LANL EES-13

General Comments

1.0 Introduction

In a meeting at LANL on May 2, 1990 (attended by R. Oblad, J. Hall, H. Kalia, R. Morley, K. Bujard, and J. Herbst), the anticipated role of Raytheon Corporation in the development of the YMP IDS was discussed, along with redefinition of LANL and YMPO needs and responsibilities relative to IDS development. As a result of these discussions, it was determined that memoranda of understanding (MOUs) would need to be developed in order to redefine the general responsibilities of each organization relative to IDS development, and to identify all primary organizational interface considerations. Subsequent to this meeting, CAG developed draft outlines for MOUs between YMPO and LANL, YMPO and Raytheon, and LANL and Raytheon; a revised WBS structure for LANL and Raytheon was also prepared to support the draft MOUs.

CAG has reviewed the June 8, 1990 draft MOUs prepared by LANL; although certain elements of these documents may be useful if incorporated as part of detailed statements of work (SOWs) in individual contracts, it will be necessary to revise and develop these documents in a number of areas if they are to serve their intended purpose as discussed in the May 2 meeting. Towards that end, this memorandum has been prepared to review the purpose of MOUs relative to the separate contractual relationships between YMPO and LANL and Raytheon, and to present updated draft outlines for all three MOUs and their related WBS structures.

2.0 *Memoranda of Understanding*: Requirements and contractual considerations

MOUs will be required primarily because IDS development activities will be divided between two YMPO contractors: LANL and Raytheon. LANL will be the eventual operator of the system, and, on YMPO's behalf, will function as the manager of the design interface between Raytheon and the system users. Raytheon will be responsible for design, procurement, assembly, testing, delivery, and (potentially) post-installation support of the IDS. LANL and Raytheon will have no direct contractual relationship; interactions between the two contractors will be limited to those defined by their individual contracts with YMPO. The purpose of the MOUs will be to define, in very general terms, the highest-level functional responsibilities and interface requirements applicable to LANL and Raytheon with regard to the full range of IDS development and support activities. The LANL and Raytheon contracts would each include an MOU from YMPO; because of the criticality of interface considerations between LANL and Raytheon, however, an additional MOU would be developed between these organizations in order to preclude any potential misinterpretation of responsibilities or organizational jurisdiction regarding IDS development. When endorsed by YMPO, the LANL/Raytheon MOU would also be integrated into the YMPO contracts with each

organization. It must be emphasized, however, that the LANL/Raytheon MOU would not represent any sort of contractual relationship between the two YMPO contractors, would be prepared purely to support the governing YMPO MOUs, and would appear in identical form in each contract (or contract reference). In no case would the LANL/Raytheon MOU take precedence over the primary YMPO MOU. MOU requirements would drive the development of detailed SOWs for both contracts, which would include the level of detail necessary to guide each contractor in implementing the responsibilities and requirements defined by the MOUs. It will be critical to present assignments or discussions of organizational responsibilities consistently from MOU to MOU.

In summary, each YMPO contract would be expected to contain an appropriate MOU or MOU reference, which will be supported by a secondary MOU between the two contractors. SOWs developed for each contract that would provide detailed requirements for ensuring compliance with the governing MOUs. A WBS structure will be developed for each contractor that would correspond with the basic understandings outlined in the MOUs and the more detailed requirements provided by the SOWs.

3.0 Draft Memorandum of Understanding

The following outlines are proposed to assist in the development of the scope and content for individual IDS MOUs:

3.1 MOU: YMPO/LANL

- LANL will be the eventual operator of the system, and shall retain full responsibilities for managing the IDS design interface between Raytheon and the system users; the output from LANL's interface activity shall be the Functional Requirements Document (FRD) and its subsequent updates, which will serve to define approved design input to Raytheon.
- Raytheon shall work under their own QA Program Plans/Project Management Plans (QAPPs/PMPs) and implementing procedures, subject to DOE approval.
- As it relates to IDS system development, LANL's QA Program Plan and procedures shall apply only to those activities directly under its contractual authority, i.e., those related to the following items:
 1. the development, review, approval, and periodic update of the FRD;
 2. design interface management;
 3. review and approval of detailed Raytheon Design Requirements Documents (DRDs), design specifications, and drawings;
 4. review and approval of Raytheon acceptance testing plans;
 5. acceptance test witnessing;
 6. at DOE's option, performance of Physical Configuration Audits (PCAs) in compliance with DOE procedures.
- LANL shall approve Raytheon acceptance testing plans prior to use, and shall witness acceptance testing. At DOE's option, LANL may participate in or perform PCAs on DOE's behalf, in compliance with DOE procedures. PCAs shall be performed after successful completion of testing; successful completion of PCAs shall constitute DOE acceptance of the affected deliverable system module. All subsequent changes to accepted system modules shall be initiated through DOE Configuration Management (CM) procedures.

3.2 MOU: YMPO/Raytheon

- Raytheon is responsible to DOE for all facets of IDS design, procurement, development, assembly, testing, delivery, and installation, with the exception that LANL will be responsible for managing the IDS design interface between Raytheon and the system users. LANL will define approved design input to Raytheon through the Functional Requirements Document (FRD) and its subsequent updates.
- Raytheon shall work under their own QA Program Plans/Project Management Plans and implementing procedures, subject to DOE approval. Plan and procedure requirements shall be as defined in the DOE SOW and other sections of the procurement documents. Design control features of such plans shall accommodate the requirements for design interface requirements through LANL as defined in the YMPO/LANL MOU above.
- Raytheon shall develop DRDs, detailed design specifications, and updates to these documents in response to the requirements of the FRD and its revisions. LANL approval shall be required prior to development, procurement, or testing.
- Raytheon shall prepare acceptance testing plans for each deliverable system module and submit them to LANL for review and approval prior to use. LANL shall witness acceptance testing and may, at the DOE's option, participate in or perform Physical Configuration Audits (PCAs) on DOE's behalf, in compliance with DOE procedures. PCAs shall be performed after successful completion of testing. Successful completion of PCAs shall constitute DOE acceptance of the affected deliverable system module. All subsequent changes to accepted system modules shall be initiated through DOE CM procedures.
- All changes to accepted system modules shall be initiated through DOE CM procedures.

3.3 MOU: LANL/Raytheon

- LANL retains full responsibilities for managing the IDS design interface between Raytheon and the IDS system users. Output from LANL's interface activity will be the Functional Requirements Document (FRD) and its subsequent updates, which will serve to define approved design input to Raytheon.
- Raytheon shall work under their own QA Program Plans/Project Management Plans and implementing procedures, subject to DOE approval. Plan and procedure requirements shall be as defined in DOE procurement documents. Design control features of such plans shall accommodate the requirements for design interface requirements through LANL as defined in the YMPO/LANL MOU above.
- Raytheon shall develop DRDs, specifications, and updates to these documents in response to the requirements of the FRD and its revisions. LANL approval of all such documents is required prior to IDS development, procurement, or testing.
- Raytheon shall develop detailed acceptance testing plans for all deliverable system modules. LANL shall approve such plans prior to use, and shall witness all acceptance testing. At DOE's option, LANL may participate in or perform Physical Configuration Audits (PCAs) on DOE's behalf, in compliance with DOE procedures. PCAs shall be performed after successful completion of testing. Successful completion of PCAs shall constitute DOE acceptance of the affected deliverable system module.
- LANL will be the eventual operator of the system.
- Except for the design interface management responsibilities assigned to LANL, Raytheon is responsible to DOE for all facets of IDS design, procurement, development, assembly,

testing, delivery, and installation.

4.0 Revised WBS Assignments

Based on the proposed MOUs discussed in Section 3.0 above, the following outlines are suggested for revised WBS assignments that would be applicable to YMPO/LANL and YMPO/Raytheon contracts:

4.1 YMPO/LANL

X.X.1 IDS design interface management services

X.X.1.1 IDS design interface management

X.X.1.1.1 FRD development and maintenance

X.X.1.1.2 Design Requirements Document (DRD) and design specification review and approval

X.X.1.1.3 Configuration change initiation (for DOE-approved modules, through DOE CM procedures)

X.X.1.2 IDS acceptance test witnessing

X.X.1.2.1 Acceptance test plan review and approval

X.X.1.2.2 Acceptance test witnessing

X.X.1.3 PCA performance (optional)

X.X.1.4 Project management

X.X.1.4.1 Management planning (includes scheduling, PMP, QAPP, procedures development)

X.X.1.4.2 Cost management and reporting

4.2 YMPO/Raytheon

Y.Y.1 ESF IDS design, development, procurement, assembly, testing, and installation

Y.Y.1.1 IDS design and development

Y.Y.1.1.1 DRD and design specification preparation (includes user interface activity)

Y.Y.1.1.1 Software development, verification

Y.Y.1.1.2 Developmental testing

Y.Y.1.1.3 Internal CM and design baseline preparation

Y.Y.1.2 IDS procurement

- Y.Y.1.2.1 Material control
 - Y.Y.1.2.1.1 Buyer furnished equipment management
 - Y.Y.1.2.1.2 Warehousing
- Y.Y.1.2.2 Procurement cost reporting
- Y.Y.1.3 IDS module testing
 - Y.Y.1.3.1 Acceptance test plan preparation
 - Y.Y.1.3.2 Acceptance testing
- Y.Y.1.4 IDS module installation
 - Y.Y.1.4.1 Installation plan preparation
 - Y.Y.1.4.2 Installation
 - Y.Y.1.4.3 Installation testing
 - Y.Y.1.4.4 Operations and maintenance plan preparation
- Y.Y.1.5 Management
 - Y.Y.1.5.1 Management planning (includes scheduling, QAPP and procedures development)
 - Y.Y.1.5.2 Cost management and reporting
- Y.Y.1.6 Configuration change initiation (for DOE-approved modules, through DOE CM procedures)
- Y.Y.2 Post-installation technical support (optional)

ACRONYMS

CM; Configuration Management

DOE; Department of Energy

DRD; Design Requirements Document

FRD; Functional Requirements Document

IDS; Integrated Data System

LANL; Los Alamos National Laboratory

MOU; Memorandum of Understanding

PCA; Physical Configuration Audit

PMP; Project Management Plan

QAPP; Quality Assurance Program Plan

SOW; Statement of Work

YMPO; (DOE) Yucca Mountain Project Office

Computer Applications Group, Inc. **TRIP REPORT**

13800 NE Merchant Road, Carlton, OR 97111 (503) 852-7214 (Voice and FAX)

Date: Mon, Jun 11, 1990
Doc: CAG 75-9016102
Subcontract: 9X58-2604R-1
To: Ross Oblad, LANL TMO
From: Jim Hall, CAG
Subj: CAG Los Alamos Trip 9010, May 11-13, 1990
Meeting with RE/SPEC, a prospective IDS contractor, preparation of IDS MOUs, a review of the current version of the IDS RFP, and comments on the current draft of the TMO IDS statement of work (SOW)
Copy: H Kalia, LANL TMO
K West, LANL

RE/SPEC Meeting

Meeting Date: Mon, Jun 11, 1990
Location: LANL TMO, Las Vegas, NM
Attendees: J Ball (RE/SPEC), T Webster (RE/SPEC), F Hemmes (DOE), Terry Prater (Mactech), Hank Beers (SAIC), R Oblad (LANL TMO), J McConnville (TMSS), J Hall (CAG)

Conclusion and recommendation:

RE/SPEC identified itself as a high-level system designer and software developer working in cooperation with Raytheon the hardware designer to provide a complete IDS. They demonstrated no expertise in system conceptual design, IDS operating software, complete system development expertise with or without a partner. Close questioning about the exact role they would play in a cooperative team did not develop any definite responsibilities. RE/SPEC seems to have a very good and up-to-date working knowledge of the requirements for repository data management and the necessary considerations for identifying ancillary and supporting information critical for correct interpretation of test data from their current WIPP experience. This data management expertise and recent field experience could be valuable input to LANL's IDS development.

CAG comment and recommendation: RE/SPEC has valuable and timely experience at WIPP designing and implementing repository study data management. They would be useful as a subcontractor to LANL to provide IDS software design review and IDS software conceptual planning for ancillary user needs and requirements not completely defined in the FRD.

Meeting Summary:

Copies of RE/SPEC's solicitation letter from Tim Webster (RE/SPEC) to Dave Delaney (MAT) were distributed to those present who had not previously received a copy. RE/SPEC distributed a promotional document *The Integrated Data System*, June 1990, 29 pps made up principally of view-graphs. Tim Webster delivered the RE/SPEC presentation based on the handout detailing their experiences in developing a data management program for SNL at WIPP. His discussion identified particular details of their WIPP work experience applicable to the YMP IDS in the following areas:

- An understanding that "processing repository data is fundamentally different from that of other data acquisition projects". This difference stems from poorly defined requirements, a changing set of testing specification as tests are changed and new tests are identified. The IDS itself may evolve over years of operation and data processing. QA requirements impact all aspects of the IDS and data management task.

- Retrofitting existing software not developed under a credible QA program takes longer and is more expensive than doing it over.
- Development of new database management software (runs on a VAX under VMS) including software filters to eliminate bad and unchanging data, data archiving support, and charting routines to support report production.
- The SNL WIPP data management application is named WISDAAM.
- WISDAAM accepts input of raw data from >16,000 data channels, applies data reduction algorithms (data conversion, filters, sorts, and archive), supports data reports, provides an on-line test database.
- WISDAAM provides support for users accessing the test database from user terminals (PCs, workstations, or minicomputers) and via dialup networks.
- Other database development and data management projects were mentioned including a recent contract with LATA to provide general services. One of their first tasks under this contract has been to provide computer networking for the YMP QA group at Los Alamos. Other tasks include supporting G Cort's new SQAP with software tools to implement his program.

RE/SPEC seems to have a good grasp of the overall IDS conceptual limitations and problems and a very good insight into the necessary requirements for ancillary supporting information needed to support and interpret the acquired data. Their implementation of WISDAAM seems well considered and complete from the brief descriptions presented. No mention was made of their hardware or system design capabilities although they gave verbal reassurances that "they could do the whole system but didn't want to". No proposals for a conceptual IDS design were presented or developed during the meeting although this was identified as something RE/SPEC wanted to do in the letter to D Delaney. Based on a limited knowledge of RE/SPEC activities on other repository tasks, their presentation, and discussion of their actual responsibilities at WIPP, it seems that they do not have sufficient background and experience to qualify as the IDS designer or as a team leader in conceptual and software design. RE/SPEC does have software design and field experience in data management that could be very useful in the IDS development program.

MOU Preparation

Discussion with H Kalia and R Oblad led to a strategy for the LANL/Raytheon MOU that included providing a document with an overview and a highly detailed section. A draft copy was completed by R Oblad and J Hall.

IDS SOW

J Hall provided mark-up comments to R Oblad on the current version of the IDS SOW.

TO: E. Petrie

**Revision #1, Mon, Nov 5, 1990
Jim Hall, CAG**

FROM: R. Herbst

SUBJECT: INTEGRATED DATA SYSTEM DESIGN CONTRACTOR EVALUATION

Los Alamos in cooperation with F. Hemmes and others at the Project Office and IDS user Liaisons determined the need to have Raytheon Services Nevada (RSN) present their initial concepts for the IDS project to the YMP community. Since RSN Yucca Mountain personnel and participating personnel from other RSN offices have had no previous experience with the IDS, the presentation was a particularly important demonstration of the RSN understanding of the task and their qualifications to participate.

The presentation took place on October 17, 1990. RSN presenters covered project management, software design, hardware design, and quality assurance issues. Previous RSN experience with similar projects was demonstrated. RSN presented a well thought out conceptual IDS design and described appropriate management and QA support for the project. Discussion between participants and the RSN helped clarify a number of issues with RSN providing good technical and management responses. Los Alamos is particularly concerned with the IDS contractors ability to perform under the YMP QA requirements. RSN demonstrated how their software development facility provides a structured software development environment as required by the DOD. Their present practices seem to be compatible with Project Office software QA requirements and would seem able to be brought into compliance with the YMP Software Quality Assurance Plan in a timely manner.

The hardware concepts demonstrated by RSN were satisfactory. During discussions RSN was reminded that specific hardware choices will be made after appropriate design studies. Concern was expressed to RSN about their plan to utilize two geographically separate groups for software development. RSN felt they had adequate management and technical skills to handle the needed coordination to insure that the separate groups produce a satisfactory product. This coordinated software development will be a critical issue closely monitored by Los Alamos.

IDS users expressed their interest in closely monitoring and reviewing RSN's work on a regular basis during the design and fabrication activities. Regular status reports and briefings as well as technical reviews of intermediate design steps are planned.

Based on the presentation and discussions with RSN staff we recommend RSN as the IDS contractor and that RSN be immediately authorized to begin work on IDS issues preparatory to the start of Title II design.

If you have further questions contact Ross Oblad at FTS 544-7156.

cc: F. Hemmes
R. Craig, USGS
R. Troncoso, SNL
D. Wilder, LLNL
.W. Morris
H. Halia, LANL

Computer Applications Group, Inc.

13800 NE Merchant Road, Carlton, OR 97111

MEMORANDUM

(503) 852-7214 (Voice & FAX)

CAG ref: 82-9031301

LANL Contract: 9X58-2604R-1

Date: Fri, Nov 9, 1990
To: Ross Oblad, LANL TMO
From: Jim Hall
Subject: CAG Comments on Gary Cort FRD Review Comments and Ross Oblad Responses

Summary:

I have reviewed G. Cort's FRD review comments and R. Oblad's partial responses. I have provided a brief commentary on each review item, prefaced by some general comments.

General Comments

The technical basis of the document is appropriate and in good order, and, Cort's comments to the contrary, contains much of the detailed information needed by the IDS contractor to develop meaningful detailed design specifications. I am concerned, however, about several items:

- *QA program considerations:* Having RSN provide IDS engineering services to YMPO directly brings up several important IDS and FRD related QA issues. For LANL to provide meaningful technical guidance to RSN the FRD must be the primary design requirements document. Compliance with the FRD should be a specific requirement of procurement documentation provided to the IDS contractor (RSN). As such, interfaces with QA program requirements are significant and should be identified. The FRD's role in the control of the IDS design should be stated in no uncertain terms. Change control requirements applicable to the FRD must be developed and stated explicitly. Requirements for the contractor to respond to FRD requirements and changes with new or revised detailed design specifications ought to be clear. Since contract, QA, and SOW documents will originate and be controlled by the Project Office, some requirements should be included in the FRD to emphasize LANL's role and define critical issues. I don't mean to imply that the FRD should contain the same level of detail in this area as the QAPP or the SOW might have; my main concern is that the FRD be used to actively direct the course of the design and development of the IDS, concurrent with changing project needs. The role of the FRD within the applicable requirements document hierarchy should be clearly explained in the FRD document in an early section.
- *Configuration Management considerations:* The FRD's role in defining the configuration baseline of the IDS should be developed more fully, along with its role in the initiation of system configuration changes. G. Cort's comments on the Monitor System function of the FRD (see Comment 55 and Section 3.2.5 of the FRD) seem to indicate a surprising lack of acknowledgement of IDS configuration management needs. R. Oblad clearly understands the need to be able to document the pedigree of the system at any given point in time. The fact those needs can be unrecognized by anyone in LANL at this point in time is alarming.

- *Definition of SQAP Applicability:* G. Cort's comment 20 made me wonder if another old issue is still unresolved, namely the extent to which LANL's software QAP and its attendant suite of procedures must apply to IDS software. RSN is clearly a DOE contractor and will sort out their QA issues directly with the Project Office and operate under their own approved QA plans. Any special LANL conditions for software development should be stated explicitly in the text of the FRD or by reference to whatever documents that have been determined to be applicable. If the IDS contractor followed the DOE Orders and the technical specifications presented in 2.3 and 2.4, they would not necessarily comply with LANL requirements.

Specific Comments

1 & 2

G. Cort Comments Agree The purpose could be better stated. It would be highly useful if a discussion of scope included a clear description of exactly where the FRD fit in terms of the hierarchy of documents controlling IDS design activities. Regarding interim change protocols applicable to the FRD, I think that such requirements ought to be defined explicitly, by reference to applicable LANL procedures or by including all necessary detail in an appendix to the FRD. The FRD should be maintained as a actively updated design control document, subject to precise change control requirements; nothing should be left up to the imagination where change control is concerned.

3

G. Cort Comment Agree. The text be screened for all acronyms, and that the acronym list be inserted at the beginning of the document.

R. Oblad Response Not all terms should be defined in the text, just those that the primary users of the document must understand; other terms perhaps unfamiliar to reviewers should be included in a glossary. Again, the review process will be facilitated if the glossary is inserted at the beginning of the document.

4

G. Cort Comment A nit.

R. Oblad Response Agree.

CAG Comment There is a lack of commentary on missing QA documents, such as DOE Order 5700.6.B, the YMP QAP, the LANL QAP, and supporting QA procedures. The FRD is a primary design control document, and as such must be supported by, and/or interface with, design control, procurement, inspection, testing, records management, and other requirements defined within the QA program. The link to plans and procedures that implement Configuration Management requirements (invoked by Order 4700.1A) is missing. The solution is to place the FRD within a controlling requirements document hierarchy, and identifying necessary interfaces with other elements of the overall project management system. I don't think such a discussion needs to be elaborate, but should be briefly stated before getting into the details of the design requirements description.

5

G. Cort Comment Agree.

R. Oblad Response Agree.

6,7,8, & 9

G. Cort Comment All nits, see comment 3 above.

R. Oblad Response Agree. See comment 3 above.

10

G. Cort Comment Agree.

R. Oblad Response Agree.

11

G. Cort Comment Agree. Destination considerations seem to be adequately addressed in 3.2.1.4.1 and other subparagraphs; suggest revising the first sentence to read "...and portable data acquisition equipment to processing and storage devices shall be..."

R. Oblad Response Agree.

12

G. Cort Comment Agree. Some clarification is in order.

R. Oblad Response Agree.

13

G. Cort Comment Agree. Error-free transfers are the goal here, and the system should be designed to detect and facilitate the correction of transfer errors.

R. Oblad Response Agree; see above.

14

G. Cort Comment Agree. The phrase "instrument power and sensor excitation" does in fact refer to types of analog signals. The sentence should be rewritten to clarify this distinction.

R. Oblad Response Agree.

15

G. Cort Comment Disagree. The reviewer is reading too much into the statements made in this section. How the IDS meets this requirement is the system designer's business.

R. Oblad Response Agree.

16

G. Cort Comment Disagree. Unless the inclusion of this level of detail in the FRD hamstrings the design process, I don't think that it's a problem. This document is not meant to be a system analysts model of a classic functional analysis. The issue here is to provide a single document that includes the information necessary for the designer to proceed from the IDS Title 1 design to Title 2 design. The format chosen is a modified functional analysis type document. I assume that the "functional specifications" referenced by Cort are the detailed design specifications prepared by the system designer in response to the general requirements of the FRD.

17

G Cort Comment about NIST traceability Disagree. All IDS measurements must be calibrated to standards referenced to national standards. All labs performing work at the site will calibrate their measurements to similar standards directly or indirectly through a calibration lab certification referenced to NIST.

G Cort Comment about timing accuracy Agree. There should only be one timing accuracy requirement for all IDS clocks. The IDS will be a distributed system of local (to each test or group of tests) autonomous data acquisition stations connected by a network(s) to a central computer and test database. Each data acquisition station and the central computer will have a precise internal clock. The accuracy of individual clocks will be ± 0.1 s. All clocks will be synchronized sufficiently often to maintain a relative timing accuracy of $< \pm 0.1$ s between any combination of clocks. The actual accuracy of the individual clocks can easily exceed this requirement. The value of any recorded time shall be absolutely referenced to NIST time standards

18

G. Cort Comment A nit; "verification" is one of those dangerous buzzwords that should be used only when meant to apply to software verification. Verification is really an item for the test procedures themselves. The IDS should accept the output from the test, which should have been cross-checked, certified, reviewed, approved, or what have you in the context of the individual test procedure. "Verification" will be changed to "Approval".

R. Oblad Response See above.

19

G. Cort Comment Agree.

R. Oblad Response Agree.

20

G. Cort Comment Disagree. The software QA procedures in effect for various participants, including LANL, should govern the testing and acceptance of individual algorithms prior to their release to the IDS contractor for incorporation into IDS software. IDS software will not be developed under the auspices of the LANL SQAP. It will be developed under the RSN SQAP. As an IDS management issue, the TMO receives, reviews (for systematic integrity, consistency with existing IDS functional requirements, and inclusion in the FRD), approves, and forwards PI functional and/or technical requirements to the IDS contractor.

R. Oblad Response Agree in principal, see above.

21

G. Cort Comment Disagree. Measurement accuracy refers to a comparison with accepted standards for the quantity. Precision refers to the number of significant digits associated with the measurement itself. Computer processing is commonly characterized by the number of bits of precision required for a particular operation to generate output that meets the users accuracy requirements. All participant data measurement and conversion requirements listed in the FRD are characterized with accuracy requirements (and perhaps precision in addition). The required precision of computer operations to meet user reporting accuracy requirements is left to the designers.

R. Oblad Response See above.

22

G. Cort Comment Disagree. The discussion of the extent of processing seems adequately addressed.

R. Oblad Response Agree.

23

G. Cort Comment Disagree. See comment 20 above.

R. Oblad Response Agree. See comment 20 above.

24

G. Cort Comment Disagree. Although the modes described are simplistic, the control modes described in the first two bullets are important conceptual definitions for developing the IDS role in future control scenarios. The third bullet is superfluous and will be eliminated.

R. Oblad Response Disagree. See above.

25

G. Cort Comment Disagree.

R. Oblad Response Agree.

26

G. Cort Comment Agree. Reword to read "IDS test control functions shall be initiated only from data received from participant test equipment and/or access-controlled user interfaces."

27

G. Cort Comment Disagree; see Comment 20 above.

R. Oblad Response Agree. See comment 20 above.

28

G. Cort Comment Agree. The text seems clear to me, and additional clarification would do no harm.

R. Oblad Response Agree.

29

G. Cort Comment Agree. See Comment 28 above.

R. Oblad Response Agree. See Comment 28 above.

30

G. Cort Comment Disagree. See Comments 16 and 17 above.

R. Oblad Response Agree. Probably too terse a response. See Comments 16 and 17 above.

31

G. Cort Comment Agree. The text should be clarified to indicate that the clock begins when data are first collected.

R. Oblad Response Agree. However, it would be more appropriate to accept the response as a goodwill gesture, with qualifiers.

32

G. Cort Comment Agree. Clarification is necessary.

R. Oblad Response Agree. However, it would be more appropriate to accept the response as a goodwill gesture, with qualifiers.

33

G. Cort Comment Disagree. Considering where the system is going to be installed, size constraints and other physical criteria are valid and significant functional requirements.

R. Oblad Response Agree.

34, 35, & 36

G. Cort Comments Disagree. I don't think this level of detail is inappropriate; see Comments 16 and 17 above.

R. Oblad Responses Agree.

37

G. Cort Comment Agree reluctantly. A command language interface would be a definite step down for an "easily" accessible database. The ultimate decision should be the designers. The text should be changed to include a command language reference.

38 & 39

G. Cort Comments Agree.

R. Oblad Responses Agree.

40 & 41

G. Cort Comment Disagree. I don't think this level of detail is inappropriate; see Comments 16 and 17 above.

42

G. Cort Comment Agree; but obvious.

R. Oblad Response Agree.

43

G. Cort Comment Disagree. FRD functional requirements do not extend to RIB or SEPDB functions. The IDS will accommodate limited online access to certain classes of data through remote printers, data terminals and user computers. Uncontrolled data distribution to participants of their data only will be supported. At the Project Office direction, controlled data distribution may be required to participants and must be provided for. Controlled data distribution to the RIB will be developed, however, data input to the SEPDB will probably be initiated at SNL or by the participants themselves. Physical storage media requirements must be such that manual access to all archive data in the IDS facility will be possible.

44

G. Cort Comment Agree.

R. Oblad Response Agree. Participant/user data format requirements may be integral to the system design, and, where they exist, should take precedence over any LANL standard.

45

G. Cort Comment A micronit. See Comment 3 above.

R. Oblad Response Agree. See Comment 3 above.

46

G. Cort Comment Agree.

R. Oblad Response Agree.

47

G. Cort Comment Disagree. The most appropriate system security measures would seem to be those which are the least burdensome to both the system and the users. A password system would seem to be difficult to administer with a large and changeable user community. Dialback modems are useful, meet the intent of the proposed security, and could be included for review by the designer.

Incidentally, Cheyenne Mountain would make a great high-level waste repository...

48

G. Cort Comment Disagree. I think the section could be better written to focus on the actual minimum requirements for the security features of the system.

R. Oblad Response Agree.

49

G. Cort Comment Disagree.

R. Oblad Response Agree. See Comment 48 above.

50

G. Cort Comment Disagree. See Comments 16 and 17 above.

R. Oblad Response Agree.

51

G. Cort Comment Agree/Disagree. Natural language inquiry is a well-developed feature of most commercial database software and I'm not convinced that it's all that hard to engineer. Given the variability in the computer skills of the user community, and number of users of the completed system, it seems that the best system will also be the one that is easiest to use. There should probably be a single FRD reference defining the inquiry mode.

52

G. Cort Comment Agree.

R. Oblad Response Agree.

53

G. Cort Comment Disagree. See Comments 16 and 17 above.

R. Oblad Response Agree.

54

G. Cort Comment Disagree. See Comment 51 above.

55

G. Cort Comment Disagree. It's astounding to me that Cort hasn't been sensitized to the configuration management needs of the IDS.

R. Oblad Response Agree.

56

G. Cort Comment Agree. See rewording suggested in Comment 25 above.

57

G. Cort Comment Disagree. Alarm information could be an important diagnostic tool in many situations and must be available to any system user. The entire IDS system will have basic user-access restrictions. Alarm information is read-only and does not require access restriction beyond basic user-access requirements.

58

G. Cort Comment Agree.

R. Oblad Response Agree. Suggest deleting reference to PIs.

59

G. Cort Comment Agree. Authentication will be internal to the participant organizations.

R. Oblad Response Agree.

60

G. Cort Comment Agree. See rewording suggested in Comment 25 above.

61 & 62

G. Cort Comments Disagree. I don't think this level of detail is inappropriate. See Comments 16 and 17 above.

R. Oblad Responses Agree. See Comments 16 and 17 above.

63

G. Cort Comment Disagree.

R. Oblad Response Agree.

64

G. Cort Comment Disagree. The FRD should contain at least a first cut at system maintenance requirements to alert the designer to issues that must be factored into the equipment selection and procurement process.

R. Oblad Response Disagree. See above.

65

G. Cort Comment Disagree. I don't think this level of detail is inappropriate, and has a direct relationship to basic system reliability considerations. Baud rate references could be reduced, however, some reference to baud rates is appropriate to alert the designer to the expected level of complexity. See Comments 16, 17, and 64 above.

R. Oblad Responses Agree. See Comments 16 and 17 above.

66

G. Cort Comment Disagree. The level of detail provided here is critical, and as Oblad has noted, no secondary requirements document will be provided. See Comments 16 and 17 above.

R. Oblad Response Agree. See Comments 16 and 17 above.

67

G. Cort Comment Disagree. Accuracy is the appropriate term.

68

G. Cort Comment Agree. The tables should be modified to use a uniform notation (i.e., readings per second, minute, or hour).

69

G. Cort Comment Disagree. See Comment 67 above. Accuracy and resolution requirements are from the PIs. Discrepancies must be resolved through new information gathered and reviewed by LANL and resolved with the PIs.

70

G. Cort Comment Agree.

R. Oblad Comment Agree.

71

G. Cort Comment Agree. See Comment 3 above.

R. Oblad Response Agree. See Comment 3 above.

72

G. Cort Comment Agree. Woefully?

R. Oblad Comment Agree.

73

G. Cort Comment Agree.

R. Oblad Comment Agree.

74

G. Cort Comment Agree.

75

G. Cort Comment Disagree. See comment 16, 17 and 61 above.

R. Oblad Comment Agree.

**DATE
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9 / 13 / 94

END

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