9.1.6. Scientific User Community Scenario

9.1.6.1. *Scientific User Community*

The Scientific User Community is the end user of EOSDIS and is permitted access to view EOSDIS development documentation that is maintained or accessible via the ISE. The community will utilize the ISE in the following scenarios:

1. **Review Documentation and Metrics**
   - The Scientific User Community will have access to the EOSDIS project documentation and the IV&V project documentation located in the IIR. This documentation will provide the scientific users with an understanding of the EOSDIS development and IV&V efforts.

2. **Submit And Review Issues**
   - A technical exchange forum will be established within the ISE Toolbox. The scientific users can report problems they are encountering with EOSDIS. Example problems include failure/recovery, scheduling, performance, and response times.
   - Via a tool in the ISE toolbox, the Scientific User Community will be able to review the issues and problems they submitted to determine if any responses or notes were logged.

NASA Project Personnel are responsible for keeping informed of the IV&V project progress. The NASA personnel will use the ISE in the following scenarios:

1. **Review Project Progress**
   - The NASA Project Personnel will maintain management overview of the IV&V project by reviewing project status.
   - NASA personnel will have access to task and project status reports, monthly status reports, presentation materials, deliverables, and risk assessments.
   - NASA personnel can provide comments and concerns regarding status information via an information exchange tool in the ISE's Toolbox.

2. **Review IV&V Findings And Information**
   - The NASA Project Personnel will gain insight into the EOSDIS, by reviewing findings from the IV&V effort.
   - NASA personnel will be granted access to databases established for performing IV&V activities.
   - NASA personnel will have access to test results, test discrepancies, performance metrics, non-compliance reports, statistical analysis results (e.g., number of test passed vs. number of tests).
   - NASA personnel can provide comments and concerns regarding these findings via an information exchange tool in the ISE's Toolbox.

9.1.5. EOSDIS Developers' Scenario

9.1.5.1. *EOSDIS Developers*

The EOSDIS Developers are responsible for the design and implementation of the components of EOSDIS. The developers will use the ISE in the following scenarios:

1. **Review Discrepancies**
   - EOSDIS Developers will retrieve and review discrepancy reports and IV&V summary reports via the ISE.

2. **Support The IV&V Process During The Discrepancy Resolution, Implementation, And Testing**
   - EOSDIS Developers will have access to the documents and data, referenced by the discrepancy reports and IV&V summary reports to support their resolution process.

2. **Develop Test Procedures**
   - Define scenarios to implement test cases.
   - Develop test procedures for these scenarios using a tool that includes provisions for:
     - recording test attributes
     - annotating real-time corrections to the procedures
     - recording variations in executing the procedures
     - capturing real-time results for quick-look reports
     - placing the procedures under CM

3. **Execute The Scheduled Tests**
   - Enter appropriate site specific information for test initiation.
   - Confirm test setup is ready for test.
   - Initiate testing and proceed through the test steps sequentially.
   - Record results of each test which is observable in real-time.
   - Annotate any variations in the execution of the test procedures.
   - Annotate any anomalies in test execution.

4. **Perform Post-Test Activities**
   - Save (automatically, if possible; manually, if required) the test case procedures with test results and annotations .
   - Review test and any readily available recorded data to determine if the test needs to be rerun due to improper test configuration, unacceptable execution of test procedures, system anomalies, etc.
   - Prepare Quick Look Report to summarize test case highlights and results; note whether test was acceptable or whether it must be rerun and, if so, why.
   - Prepare for rerun or next test case on the schedule.
   - Summarize days testing in memo form including copies of Quick Look Reports

9.1.3. West Virginia University Faculty and Students

West Virginia University's (WVU) EOSDIS IV&V role has not been formally documented in a Memorandum of Understanding (MOU). A draft MOU between WVU and Intermetrics is in the formulative stages. Completion of the MOU is anticipated by 30 November 1994. This agreement focuses on collaborative efforts to improve IV&V processes, to recommend development methods which will produce systems that can be more readily traced and tested, and to quantify the value of IV&V for large development programs.

9.1.4. NASA Project Personnel Scenario

9.1.4.1. *NASA Project Personnel*

- Using the requirements analysis rationale data, the ARDB will be populated to allow for status tracking and reporting.

4. **Document And Maintain Instrument Data Flows Through The EOSDIS**
   - Analysts will use tools to measure data flows through the EOSDIS. These analyses and metrics will identify data flow bottle necks and inadequate storage capabilities.
   - Analysts can then document these discrepancies and problems.

9.1.2.3. *IV&V Task Team Testers*

The IV&V Task Team Testers are responsible for developing and executing functional and performance tests with ISE tools on components and interfaces of the EOSDIS. This activity includes the planning, test case development, execution, analysis, and reporting of EOSDIS system level and key interface tests. The IV&V contractor will perform independent tests to verify that ECS Release A meets requirements established for that phase of the EOSDIS. This effort will follow the analysis of the Release A software requirements, design, and code, and it will produce a test plan, test cases, test procedures, and test reports. Tests will be conducted at selected sites representative of the various users of the EOSDIS.

The test team will rely on the ISE toolkit and portable lap-top computers to develop and execute these tests and to report the test results. Currently, four ISE tools have been identified to support testing: the EOSDIS Test System (ETS), high fidelity spacecraft simulators, Requirements Traceability Management (RTM), and the Block Oriented Network Simulator (BONeS). Specifics on these tools can be found in the White Paper titled, IV&V Approach to the EOSDIS Certification Program.

The IV&V testers will use the ISE to support them in the following scenarios:

1. **Develop Test Plan For Release Testing**
   - System analysis to develop plans to test multiple functional threads implementing a specific set of related components. The functional thread is a ‘end-to-end’ test of a logical grouping of components using known inputs and expected outputs.
   - Develop key interface IRD tests plans to verify well-defined and testable physical interfaces.
   - Evaluate the CARA reports to target the most critical processes.
   - Review developer test plans, test cases, and test results to aid in focusing the development of test cases.
   - The IV&V test leads will develop a test plan to:
     - test ECS Release A functional requirements as they will be exercised by the users at various sites focusing on critical software and key interfaces,
     - cover requirements of particular interest to the scientific users,
     - avoid duplicating developer’s testing unless there is reason to do so,
     - exercise functions that exhibited problems during the developer’s testing.

- Task Leaders maintain an integrated schedule of key IV&V and development activities. The IV&V milestones are extracted from the individual IV&V task plans and the development activity milestones are specified by the EOS and ESDIS Projects.

2. **Track Issues**
   - Task Leaders use a tracking tool, from the ISE Toolbox, to document and track issues and associated action items. The tool facilitates the entry, assignment, and the tracking of status for management-related issues such as resource needs and conflicts.

3. **Produce Task Status Information And Presentation Material**
   - Task Leaders generate monthly progress reports from the project and issue tracking files. Note that the ISE will be independent and separate from the financial tracking and reporting system used to generate 533Ms and 533Qs, as well as the financial portion of the Program Status Review.
   - The Project Manager extracts the programmatic and technical parts of the monthly contract reviews from the task progress reports. The result is incorporated in a presentation using a predefined template for the status review.

4. **Assess Task Productivity**
   - Task Leaders will access productivity metrics documenting total hours spent on various subtasks, enabling them to identify potential problem areas as well as outstanding performance achieved through the use of productivity-enhancing tools and processes.

5. **Respond To NASA Project Personnel's And The Scientific User Community's Issues**
   - Task Leaders will address questions, issues, and concerns raised by NASA personnel and the scientific users. This could be achieved through the use of a technical exchange forum established within the ISE.

9.1.2.2. *IV&V Task Team Analysts*

IV&V Task Team Analysts are responsible for ensuring requirements are correct, complete, consistent, and traceable for their respective tasks. The ISE tools will be used by the IV&V Task Team Analysts in the following scenarios:

1. **Perform Criticality Analysis And Risk Assessment (CARA)**
   - Analysts will assess the criticality of aspects of EOSDIS. Results of CARA application will allow for focusing IV&V efforts in the areas most needed.

2. **Analyze Requirements**
   - Analysts will access EOSDIS documents via the IIR.
   - Analysts can review this documentation and then document discrepancies or problems.

3. **Populate The Automated Requirements Database (ARDB)**

- Administrators verify that adequate regression testing is performed for modified tools.

5. **Update The User's Guide To Reflect Changes Made For The ISE**
   - Once an ISE tool has formally been accepted into the ISE toolbox and a change to the tool is made, changes to the ISE User's Guide will be made using the word processor or desktop publishing system used to generate the original document.

6. **Tune Tools And Administer Databases**
   - Performance measurement tools are used to determine usage characteristics of the ISE. When performance is deemed to be unacceptable to the end user or when an Administrator determines optimization alternatives, action will be taken to enhance system performance.
   - Database monitoring and database diagnostic tools will be used to track database performance. Database tuning and partitioning actions will be taken when appropriate.
   - Other ISE resource monitoring tools will be used to monitor resource utilization thresholds to reduce the probability of system failures. When thresholds limits are approached (e.g. file server utilization greater than 80%), risk mitigation actions will be initiated to circumvent system failure.

7. **Perform Backup Tasks**
   - Backup tasks are performed by the ISE Administrators to insure that the integrity of the ISE can be maintained in the event of a system or hardware failure. Mass storage devices (e.g. file servers) will be backed up daily using ISE backup devices and media.

9.1.2. IV&V Task Teams

The IV&V Task Teams are responsible for producing the deliverables required by their specific task. In order to complete these tasks the teams will consist of the following types of users:

- IV&V Task Team Leaders
- IV&V Task Team Analysts
- IV&V Task Team Testers

Provided below are the user scenarios for these three user groups.

9.1.2.1. *IV&V Task Team Leaders*

IV&V management will rely on the tools in the ISE toolbox to support them in their management of activities. The ISE tools will be used by the IV&V Task Team Managers in the following scenarios:

1. **Complete Task Planning and Scheduling**
   - Task Leaders build and maintain project plans using spreadsheets, word processors, and project schedulers. Tools from the ISE Toolbox are used to support this activity.

- The ISE Developers will maintain control and maintenance of the developmental configuration via adherence to the documented CM plan using an ISE CM tool.
- The ISE Developers will maintain version control of the Commercial-Off-The-Shelf (COTS) and Government-Off-The-Shelf (GOTS) products so that version description information is available for the active ISE. Version description information will be maintained in one of the ISE databases using an ISE database tool.
- The ISE Developers will adhere to a documented change or corrective action process. Various steps of this process will involve the use of an ISE CM tool to check-in and check-out ISE design/development modules.
- The ISE Developers will follow baseline identification approaches for both documents and software. A baseline of a document will either involve a postscript snapshot or a snapshot of the versions of each file used to produce the deliverable document. A software baseline will consist of a baseline release performed using an ISE CM tool. The baseline report should be maintained keeping the version identifier for each design/development module maintained in the CM database.

9.1.1.3. *ISE Administrators*

The ISE Administrators initially focus on hardware and software tool acquisition and installation and as the ISE matures their focus turns to maintain the ISE and keeping it operational. The ISE tools will be used by the ISE Administrators in the following scenarios:

1. **Document Tool Acquisition Requests**
   - A word processor or desktop publishing system will be used to document tools needs.
   - Actual acquisition requests will be logged into an ISE database so that status may be recalled by an ISE Administrator.

2. **Configure Newly Received COTS/GOTS Tools Into The ISE**
   - The ISE network and file servers will be used to install and configure COTS/GOTS products in accordance to the installation procedures.
   - Access rights to these products will be constrained when necessary to the groups requiring use.

3. **Train IV&V Engineers And Other End Users On The Use Of The Tools**
   - As appropriate for certain ISE tools, the ISE Administrators will formulate the necessary training material and data to educate IV&V engineers and end users on the use of ISE tools. This use of the ISE may involve the utilization of numerous ISE tools.

4. **Maintain Configuration Control Of The ISE**
   - Administrators are given the responsibility of insuring revisions are made in accordance to the documented change process once a tool has formally be accepted into the ISE toolbox. Information from a CM tool within the ISE environment can be accessed to acquire change history information.

1. **Document Requirements, Architecture, And Other ISE Deliverables**
   - Automatic document generation capabilities will be considered for the generation of software requirement and software design documentation. Generated data may then be ported into other word processing or desktop publishing tools within the ISE to enhance readability and presentation quality.
   - A word processor or desktop publishing system will be used to generate the majority of the technical deliverables including requirements, architecture, design, test, and user's guide documentation.

2. **Graphically Depict Analysis/Design Information**
   - A CASE tool or reverse engineering tool will be utilized to produce graphical representations of the ISE architecture and design.

3. **Develop And Test New Tools For Inclusion In The ISE**
   - Development tools such as compilers, linkers, debuggers, and GUI builders will be used to create new tools and to integrate ISE office automation and information management tools to the extent feasible to meet end user needs.

4. **Tailor Or Customize Existing ISE Tools To Better Fit User Needs**
   - Groupware tools will be customized using tool macros and the associated Application Programming Interface (API) to the extent feasible to meet end user needs.
   - GUI front-end software interfaces to other ISE COTS/GOTS products will be developed using the associated APIs to the extent feasible to satisfy end user needs.

5. **Configure A Requirements Traceability Database**
   - The ISE Developers will prepare a requirements traceability database for data entry/submittals and use by the end user.
   - A similar requirements traceability database will be established for ISE requirements tracking during the Software Requirements Analysis phase of the ISE development effort. At that time, the ISE Element software requirements will be mapped back to the parent system requirements. The ISE requirement database will be maintained through system acceptance. The use of this requirements traceability database will provide a knowledge basis for refining the way the requirements traceability product is used on the EOSDIS IV&V effort by the IV&V Task Team and other end users.

6. **Define An Information Management Schema For The IIR**
   - The ISE Developers will use the ISE CASE tools to analyze data received from the IV&V Task Leads and other end users. An analysis model will be generated reflecting the ISE Support Staff understanding of how the ISE will be used by the end users.
   - Based upon the generated models, the ISE developers will document the information management schema for the IIR. This information will aid end users in efficiently retrieving needed IIR data through the ISE.

7. **Perform Configuration Management Functions**

- A DM procedure will be documented using a word processor or desktop publishing system to define mechanisms for logging, labeling, and controlling CFE/GFE, COTS/GOTS, and ISE task deliverables.
- A DM database will be established using a database within the ISE.

4. **Define A Configuration Management (CM) Approach**
   - A CM procedure will be documented using a word processing or desktop publishing system. The purpose of CM is to establish and maintain the integrity of the products of the ISE development project throughout the project's life-cycle.
   - A CM configuration will be established using an ISE CM tool.

5. **Document And Report Technical Status**
   - The monthly status report deliverable will be documented using a word processor or desktop publishing system.
   - Monthly status presentations will be generated using a slide presentation tool.

6. **Produce Review Presentation Material**
   - Formal review presentations required during the ISE development effort will be produced using a slide presentation tool.
   - Data for the formal reviews will be imported from CASE tools, word processor documents, and other tools containing analysis, design, and test information.

7. **Facilitate Information Exchange With The Engineering Staff**
   - Groupware tools included in the ISE will be used to transfer messages regarding tasking, upcoming milestones, meetings, .etc. The use of these tools will better define how they may be used by other ISE end users.

8. **Track Development Issues**
   - Groupware tools and CM based tools will be used to track various types of development issues. Groupware tools will be used to track meeting action items that do not effect ISE deliverables. When issues arise which are associated with ISE deliverables, the documented corrective action process will be followed and a CM tool will be used to capture change deltas.

9. **Document ISE Training Guidelines And Requirements**
   - A word processor or desktop publishing system will be used to document anticipated training guidelines and requirements for both the ISE Support Staff and the end users of the ISE. For ISE tools that the ISE Support Staff lacks experience with, training requirements will be determined and presented for consideration.

9.1.1.2. *ISE Developers*

The ISE Developers perform the analysis, design, development, and test activities required to establish the ISE. The ISE tools will be used by the ISE Developers in the following scenarios:

9. APPENDICES

9.1. Appendix A User Scenarios

The ISE will support multiple classes of users involved in both managerial and technical aspects of the development, verification, and validation of the EOSDIS. The following subsections provide examples of how the user community will interact with the ISE.

9.1.1. ISE Support Staff

The ISE Support Staff is responsible for the development and maintenance of the ISE. In order to support this effort, the staff is composed of three types of personnel:

- ISE Technical Leads
- ISE Developers
- ISE Administrators

Provided below are the user scenarios for these three user groups.

9.1.1.1. *ISE Technical Leads*

The ISE Technical Leads assume overall responsibility for the establishment, operation, and maintenance of the ISE. The ISE tools will be used by the ISE Technical Leads in the following scenarios:

1. **Identify Manageable Subtasks**
   - Analysis will be performed by ISE Technical Leads using CASE tools to define data stores, data flows, and processes which must be supported by the ISE.
   - Based upon preliminary analysis, task plans with high level task descriptions will be generated using a word processor or desktop publishing tool.

2. **Perform Task Scheduling And Tracking Functions**
   - Based upon task plans and subtasks identified, milestones will be established.
   - Subtasks and subtask milestones will provide the input necessary to define an ISE schedule using a project management tool.
   - The ISE schedule will be baselined so that performance can be measured against the planned milestones.
   - Schedule data will be exported to the word processing or desktop publishing tool used for monthly status reporting.

3. **Define A Data Management (DM) Approach**

8. NOTES

[This page intentionally left blank]

7. GLOSSARY

[This page intentionally left blank]

MOU	-	Memorandum Of Understanding
MSFC	-	Marshall Space Flight Center
NASDA	-	National Space Development Agency (Japan)
NASA	-	National Aeronautics And Space Administration
NMC	-	National Meteorological Center
NOAA	-	National Oceanographic and Atmospheric Administration
NMC	-	National Meteorological Center
NSIDC	-	National Snow and Ice Data Center
OLE	-	Object Linking and Embedding
PAR	-	Performance Assurance Requirements
PERT	-	Program Evaluation Review Technique
PFR	-	Problem Failure Reports
Proc	-	Procedure
RID	-	Review Item Discrepancy
RTF	-	Rich Text Format
SOW	-	Statement Of Work
SSEC	-	Space Science and Engineering Center
SSIM	-	Spacecraft Simulation
STD	-	Standard
TAR	-	Technical Analysis Report
TRMM	-	Tropical Rainfall Measuring Mission
UAF	-	University of Alaska
V&V	-	Verification and Validation
WAN	-	Wide Area Network
WBS	-	Work Breakdown Structure
WVU	-	West Virginia University

6. ABBREVIATIONS AND ACRONYMS

Below are a list of the abbreviations and acronyms used in this document.

API	-	Application Programming Interface
ARDB	-	Automated Requirements Database
BONeS	-	Block Oriented Network Simulator
CARA	-	Criticality Analysis and Risk Analysis
CASE	-	Computer Aided Software Engineering
CM	-	Configuration Management
COTR	-	Contracting Officers Technical Representative
COTS	-	Commercial Off-The-Shelf
DAAC	-	Distributed Active Archive Center
DDE	-	Dynamic Data Exchange
DM	-	Data Management
Doc	-	Document
DR	-	Discrepancy Report
Ecom	-	EOS Communication System
ECS	-	EOSDIS Core System
EDOS	-	EOS Data and Operations System
EICP	-	EOSDIS Integration and Certification Plan
EOS	-	Earth Observing System
EOSDIS	-	Earth Observing System Data Information System
ESDIS	-	Earth Science Data Information System
GFD	-	Government Furnished Data
GFE	-	Government Furnished Equipment
GOTS	-	Government Off The Shelf
GS	-	Ground System
GSFC	-	Goddard Space Flight Center
GUI	-	Graphic User Interface
HAIS	-	Hughes Automated Information Systems
ICD	-	Interface Control Documents
IIR	-	Interactive Information Repository
ISE	-	Integrated Support Environment
IRVVP	-	Independent Release Verification and Validation Plan
ISVVP	-	Independent System Verification and Validation Plan
IV&V	-	Independent Verification and Validation
IVVMP	-	Independent Verification and Validation Management Plan
IRD	-	Interface Requirement Document
IRIS	-	Incorporated Research Institutions for Seismology
ISVVP	-	Independent System Verification and Validation Plan
ISE	-	Integrated Support Environment
JPL	-	Jet Propulsion Lab
LAN	-	Local Area Network
LaRC	-	Langley Research Center
MITI	-	Ministry of International Trade and Industry

5. DESIGN GOALS

The development of the ISE will maintain focus on certain high level design goals in an effort to satisfy end user needs for the duration of the EOSDIS IV&V life-cycle. These design goals include:

1. Developing a reliable and maintainable system to support the EOSDIS IV&V program

2. Providing the necessary infrastructure that meets the needs of IV&V analysts

3. Incorporating a consistent and simplified means for accessing and obtaining IV&V data

4. Enabling a distributed community of ISE users to interact with data sources and tools from their home facilities

5. Promoting an open communication forum for efficient information exchange

6. Implementing capability for evolution, growth, and adaptation to new data and new data system technologies

4.6. Implementation Constraints

In order to satisfy identified ISE requirements, Commercial Off-The-Shelf (COTS) solutions should first be considered in order to minimize development. In the absence of COTS support for specific IV&V task needs, the implementation of ISE tools will be undertaken when the development is deemed feasible given the following constraints:

1. Availability of ISE development staff personnel
2. Attainable schedule milestones based upon identified needs and staff availability
3. Timely government approval for purchasing needed development tools

4.5. Security and Privacy Requirements

The ISE will address security and privacy issues at a high level by establishing access privileges based upon user logon information as depicted by Exhibit 4.5-1, ISE Access Control. User logon information will also be used to establish an appropriate user view of the ISE so that tools and documents delineated for use by the associated user group are accessible through the displayed GUI.

ISE-SEC-0010 The ISE shall provide a password system that controls access to the ISE.

ISE Component/ Information	ISE Support Staff	IV&V Task Teams	WVU Faculty & Students[1]	NASA Project Personnel	EOSDIS Developers	Scientific User Comm.
IIR						
EOSDIS Development & Integration Docs.	R	R	R	R	R	R
EOSDIS IV&V Products						
• Formal Documents	R,W	R,W	R	R	R	R
• Presentations	R,W	R,W	R	R	R	R
• Project Status	R,W	R,W		R		
• Test Documents	R	R,W	R	R	R	R
• Requirements Traceability Data	R	R,W	R	R	R	
• Performance Metrics	R	R,W	R	R		
EOSDIS Metadata	R,W	R	R	R	R	R
NASA Support Material	R,W	R	R			
Toolbox						
Front-End Tools	X	X	X	X	X	X
IV&V Tools	X	X	X			
ISE Development & Maintenance Tools	X					
Test Buddy	X	X				

R - Read **W** - Write **X** - Execute

Exhibit 4.5-1 ISE Access Control

[1] West Virginia University's (WVU) EOSDIS IV&V role has not been formally documented in a Memorandum of Understanding (MOU). A draft MOU between WVU and Intermetrics is in the formulative stages. Completion of the MOU is anticipated by 30 November 1994. This agreement focuses on collaborative efforts to improve IV&V processes, to recommend development methods which will produce systems that can be more readily traced and tested, and to quantify the value of IV&V for large development programs.

.

ISE-T11-0080	The ISE shall enable the ranking of possible tests based upon the criticality of the requirements to be verified and/or the number of other tests that would be enabled.
ISE-T11-0090	The ISE shall support the step-by-step execution of test procedures and the capture of test results.
ISE-T11-0100	The ISE shall support the generation and distribution of interface test reports.
ISE-T11-0110	The ISE shall support the generation and distribution of discrepancy reports based upon test reports.
ISE-T11-0120	The ISE shall support the generation of test tool inputs, and procedures to manage tool input and output data.

4.4. Performance and Quality Engineering Requirements

No specific performance and quality requirements have been levied against ISE development. Since much of the ISE development effort will entail configuration and customization of COTS products, deviation from the NASA-STD-2100 will be requested when it makes sense to do so. Deviation requests will include justification for not following the NASA-STD-2100. When new development activities are undertaken, the general rule will be to adhere to the NASA-STD-2100 or a tailored version of the standard.

The requirements detailed below define needs imposed upon the ISE so that the EICP can be produced detailing the various test approaches to be employed.

ISE-T10-0010 The ISE shall provide some means of reporting and tracking issues and open action items.

ISE-T10-0020 The ISE shall enable the management of test configurations required for certification testing.

ISE-T10-0030 The ISE shall provide access to tools required for certification testing.

4.3.10. Key Interface Testing Task

The purpose of the Key Interface Testing Task is to provide independent testing of various levels of the EOSDIS system. This testing will be performed by the IV&V contractor with direct reporting to the NASA project personnel.

The requirements detailed below define needs imposed upon the ISE so that the IV&V Key Interface Testing task can be effectively executed.

ISE-T11-0010 The ISE shall enable the analysis of interface requirements based upon their criticality.

ISE-T11-0020 The ISE shall enable generation of plans and procedures for interface testing, based upon the criticality of the interface requirements.

ISE-T11-0030 The ISE shall enable linkage of test procedures with the requirements to be verified by them.

ISE-T11-0040 The ISE shall enable the specification of the equipment, personnel, communications links, test data sets, configurations, and other resources required for each test.

ISE-T11-0050 The ISE shall enable the specification of which requirements must be verified for each participating component, system or interface prior to conducting a given interface test.

ISE-T11-0060 The ISE shall support reuse of test plans and procedures by identifying potentially related tests, based upon relationships between the requirements to be verified.

ISE-T11-0070 The ISE shall enable the scheduling and rescheduling of tests, based upon the availability schedules and status for required resources, and verification schedules and status for the requirements upon which each test depends.

ISE-T9-0110	The ISE shall distinguish data flow specifications originating from IRD requirements and/or ICDs as the baseline set of interface definitions.
ISE-T9-0120	The ISE shall identify discrepancies between the baseline set of interface specifications and specifications from other documents with respect to which data flows are defined for each interface.
ISE-T9-0130	The ISE shall identify discrepancies between the baseline interface specifications and specifications from other documents with respect to parameter values (e.g., transfer rate, protocol) associated with each data flow.
ISE-T9-0140	The ISE shall identify missing parameter values within the baseline set of interface specifications.
ISE-T9-0150	The ISE shall support consistency and completeness analysis of a component's or element's baseline interface specifications relative to its functional and performance requirements.
ISE-T9-0160	The ISE shall support the detection and management of data flow naming inconsistencies between sources.
ISE-T9-0170	The ISE shall enable the manual entry of requirements, interfaces, data flows, and data flow specifications.
ISE-T9-0180	The ISE shall generate reports in hard or soft copy summarizing the results of the consistency and completeness analyses.
ISE-T9-0190	The ISE shall support generation and distribution of Review Item Discrepancies based on consistency and completeness analysis reports.
ISE-T9-0200	The ISE shall support verification of compliance of revised interface specifications with previously submitted RIDs.
ISE-T9-0210	The ISE shall enable the generation of interface verification schedules in hard or soft copy.

4.3.9. Development of EOS Ground System Certification Plan Task

This task involves the generation of EOSDIS Integration and Certification Plan (EICP) for:

- Component Certification
- Key Interface Testing
- System Certification

ISE-T5-0080 The ISE shall enable access to requirement text and analysis rationale from the metrics database report for a specific system.

4.3.8. Key Interface Analysis Task

The EOS GS will be developed by many different organizations. The EOS GS integration process is governed through the use of Interface Requirements Documents (IRDs) and Interface Control Documents (ICDs) which are generated by various EOS GS organizations. The purpose of this task is to independently verify and validate the efforts undertaken by the applicable development contractors and includes, but is not limited to, evaluation of key interface requirements and control documentation during the development processes, and development and execution of test plans and procedures.

The requirements detailed below define needs imposed upon the ISE so that the IV&V Key Interface Analysis task can be effectively executed.

ISE-T9-0010 The ISE shall enable the ingest of interface and related requirements from structured databases and files, including RTM.

ISE-T9-0020 The ISE shall enable the ingest of interface and related requirements from electronic word processing files.

ISE-T9-0030 The ISE shall support integrity analysis of IRD requirements.

ISE-T9-0040 For each IRD requirement, the ISE shall enable traceability analysis to other requirements, IPAs, MOUs, SOWs, or other sources.

ISE-T9-0050 The ISE shall support the generation of reports summarizing the status and results of the interface requirements integrity analysis.

ISE-T9-0060 The ISE shall enable the specification of a hierarchy of source documents, document sections (for IRDs), interfaces, and data flows.

ISE-T9-0070 For each data flow specification, the ISE shall accommodate the name of the data item, transfer rate, volume, frequency, archival period, medium, format, and protocol.

ISE-T9-0080 Each data flow specification shall be traceable to multiple requirements.

ISE-T9-0090 The ISE shall identify discrepancies between sections within an IRD with respect to which interfaces are defined.

ISE-T9-0100 The ISE shall identify discrepancies between sections within an IRD with respect to which data flows are defined for each interface.

ISE-T4-0060	The ISE shall enable the creation of ISE review presentation material.
ISE-T4-0070	The ISE shall include a client/server development tool to promote information exchange.
ISE-T4-0080	The ISE shall include issue tracking capabilities used for tracking ISE development issues.
ISE-T4-0090	The ISE shall enable access to ISE training guidelines and material.
ISE-T4-0100	The ISE shall enable the production of ISE requirements, design, test, and user's guide documents.
ISE-T4-0110	The ISE shall include the development tools necessary to build applications to satisfy end user needs.

4.3.7. Requirements Analysis and Traceability Task

The development and integration of the EOS Ground System (EOS GS) requires constant monitoring and requirements management of the ground system elements such as ECS, EDOS, and Ecom, etc. The purpose of this task is to perform a systematic requirements analysis of the requirements documents produced by the various organizations and supporting contractors, and to define the links between the requirements and the specific integration, verification, and validation tests which will be performed on the EOS GS.

The requirements detailed below define needs imposed upon the ISE so that the IV&V Requirements Analysis and Traceability task can be effectively executed.

ISE-T5-0010	The ISE shall provide a means of storing and managing requirement traceability information for the various levels of EOS GS requirements.
ISE-T5-0020	The ISE shall provide storage capabilities for technical integrity data.
ISE-T5-0030	The ISE shall provide storage capabilities for criticality data.
ISE-T5-0040	The ISE shall provide storage capabilities for developmental risk data.
ISE-T5-0050	The ISE shall provide capabilities to accumulate statistical information and metrics data.
ISE-T5-0060	The ISE shall enable the reporting of requirements evaluation summary information.
ISE-T5-0070	The ISE shall enable summary reporting capabilities for a specified system.

ISE-T2-0020 The ISE shall enable the Program Status Reporting function with the ability to generate presentation material.

ISE-T2-0030 The ISE shall enable the management of physical property, including tool management oversight, and support for any hardware and software procured under the IV&V contract.

4.3.5. IV&V Plans Task

This task involves the generation of two distinct IV&V plans. The first plan delivered will be the IV&V Management Plan (IVVMP) followed by the delivery of the Independent System V&V Plan (ISVVP). The requirements detailed below define needs imposed upon the ISE so that the IV&V plans can be professionally produced in an effective and timely manner.

ISE-T3-0010 The ISE shall enable generation of the IVVMP document.

ISE-T3-0020 The ISE shall enable generation of the ISVVP document.

4.3.6. IV&V Infrastructure and Tool Development Task

Efforts under this task include the responsibility for the establishment and maintenance of the EOSDIS IV&V infrastructure which is to be located at the WVU/NASA Software IV&V Facility in Fairmont, WV. The established infrastructure will be accessible by IV&V analysts, the NASA customer, and other organizations regardless of geographic location. The requirements detailed below define needs imposed upon the ISE so that the IV&V infrastructure can be successfully established.

ISE-T4-0010 The ISE shall include a Computer-Aided Software Engineering (CASE) tool for:

a. graphically representing analysis and design models, and
b. defining and generating database schemas.

ISE-T4-0020 The ISE shall enable the generation of plans and procedures for developing the ISE.

ISE-T4-0030 The ISE shall enable the generation of ISE development schedules.

ISE-T4-0040 The ISE shall enable the generation of ISE status reports.

ISE-T4-0050 The ISE shall include a tool for maintaining configuration control of ISE design and development modules.

ISE-TB-0110 The ISE shall include a project management tool capable of:
a. exporting data to Artemis Prestige,
b. producing PERT and Gannt charts,
c. baselining schedule data for plan versus actual tracking, and
d. scheduling tasks based upon level of effort or duration.

ISE-TB-0120 The ISE shall include a configuration management tool.

ISE-TB-0130 The ISE shall include E-Mail and File Transfer network communication tools.

ISE-TB-0140 The ISE shall provide tools capable of archiving server data.

ISE-TB-0150 The ISE shall include X-term capabilities on PC and Mac network nodes for executing X-Windows applications.

4.3.3. IV&V Project Management Task

This task provides for ongoing overall IV&V project level management and support. The requirements detailed below define needs imposed upon the ISE so that the IV&V program management activities can be effectively executed.

ISE-T1-0010 The ISE shall enable the generation of project management documentation.

ISE-T1-0020 The ISE shall enable the generation of IV&V organization charts.

ISE-T1-0030 The ISE shall enable storing and tracking risk mitigation data.

ISE-T1-0040 The ISE shall enable production of IV&V business planning reports.

ISE-T1-0050 The ISE shall enable the production of a project-level schedule.

ISE-T1-0060 The ISE shall provide the Program Management function with a forum for electronic information exchange.

4.3.4. IV&V Facilities, Operations, and Program Reporting Task

A key objective of this task is to provide for the documentation and presentation of IV&V project status. The requirements detailed below define needs imposed upon the ISE so that IV&V program status reporting can be effectively executed.

ISE-T2-0010 The ISE shall enable the Program Status Reporting function with the ability to generate status reports.

ISE-IIR-0140 The ISE shall include or provide access to Tool Acquisition, Integration and Maintenance Information.

4.3.2. Toolbox Requirements

The ISE includes a suite of tools referred to as the ISE Toolbox. This toolbox contains tools essential to performing IV&V activities, storing IV&V data in the IIR, and browsing. The following requirements have been levied against the ISE Toolbox.

ISE-TB-0010 The ISE shall include a discrepancy/issue tracking tool.

ISE-TB-0020 The ISE shall include interface analysis tools.

ISE-TB-0030 The ISE shall include the Requirements Traceability Management (RTM) tool to support requirements traceability.

ISE-TB-0040 The ISE shall include a Mosaic Home Page for information browsing.

ISE-TB-0050 The ISE shall include the Block Oriented Network Simulator (BONeS) tool for performing system modeling.

ISE-TB-0060 The ISE shall include a word processing tool which:

a. executes in the PC Windows and Macintosh environments,
b. imports and exports data in various formats,
c. supports text/graphics integration,
d. supports multi-file documents, and
e. provides on-line templates.

ISE-TB-0070 The ISE shall include spreadsheet capabilities that executes in the PC Windows environment.

ISE-TB-0080 The ISE shall include a tool for creating presentations.

ISE-TB-0090 The ISE shall include a groupware tool which:

a. allows for network information exchange between end users,
b. supports Dynamic Data Exchange (DDE),
c. supports Object Linking and Embedding (OLE),
d. supports tool launching capabilities, and
e. provides a Graphical User Interface (GUI).

ISE-TB-0100 The ISE shall include a Relational Database Management System (RDBMS) for IV&V data integration and ISE development.

ISE-OPS-0060 The ISE shall allow data transfer between geographically dispersed users.

4.3. Functional Requirements

The functional requirements for the ISE are subdivided into the major components of the ISE as well as the active EOSDIS IV&V Tasks.

4.3.1. IIR Requirements

The IIR encompasses all EOSDIS data stored at the WVU/NASA Software IV&V Facility in Fairmont, WV. This data is accessible by the end user community. The storage requirements levied against the IIR are detailed below.

ISE-IIR-0010 The ISE shall include or provide access to IV&V Plans.

ISE-IIR-0020 The ISE shall include or provide access to IV&V Task Information.

ISE-IIR-0030 The ISE shall include or provide access to EOSDIS Documentation.

ISE-IIR-0040 The ISE shall include or provide access to EOSDIS Requirements.

ISE-IIR-0050 The ISE shall include or provide access to Requirements, Design, Code, and Testing Traceability Information.

ISE-IIR-0060 The ISE shall include or provide access to CARA information.

ISE-IIR-0070 The ISE shall include or provide access to EOSDIS IV&V Issues and Concerns.

ISE-IIR-0080 The ISE shall include or provide access to EOSDIS IV&V Discrepancy Reports.

ISE-IIR-0090 The ISE shall include or provide access to Technical Analysis Reports.

ISE-IIR-0100 The ISE shall include or provide access to Review/Action Items.

ISE-IIR-0110 The ISE shall include or provide access to EOSDIS IV&V Certification Testing Plans, Procedures, Results, and Reports.

ISE-IIR-0120 The ISE shall include or provide access to Installation and Checkout Information.

ISE-IIR-0130 The ISE shall include or provide access to Operations and Management Information.

The first process in the Requirements Engineering Approach is to define the ISE, using the task statements of work (SOW) and proposal. By developing and more importantly, documenting this concept, the ISE Support Staff creates a foundation and contextual understanding for all users and reviewers. The definition provides the ground work from which all other ISE deliverables will evolve. All users must agree on the basic objectives and operations of the ISE so that the ISE fielded parallels end user expectations.

As the concept begins to stabilize, it along with the task SOWs are provided to the next process, Identify Broad System Level Capabilities. This process results in again, laying ground work for the users and reviewers by providing broad system level capabilities. These broad system level capabilities are an extension of the concept.

The Develop User Scenarios process is responsible for identifying the ISE user community and providing examples of ways end users will use the ISE to facilitate their everyday activities. The identification of the ISE user community is provided in Section 3.2, User Description, and defines the users, their role in the EOSDIS community, and how they will use the ISE, at a system level, to support their role. Examples of ways users will use the ISE help identify requirements because it forces users to walk through their everyday tasks. These scenarios are provided in Appendix A.

The Interview Users process is the last step in the Requirements Engineering Approach. These interviews lead to the definition of the system level requirements needed so that the ISE architecture can be defined. The interviews allow users to comment on the previous products, ISE definition, ISE capabilities, User Scenarios, and serves as a guide to the ISE Support Staff in understanding their needs. The interviews also provide the ISE Support Staff with an opportunity to walk through user scenarios to identify requirements. This process produces refined user scenarios and detailed system level requirements which are documented in the following subsections.

4.2. Operational Requirements

The operational requirements coincide to administrative and high level environment requirements levied against the ISE. The following requirements have been classified as operational requirements.

ISE-OPS-0010	The ISE shall be accessible to geographically dispersed users via modem or Wide Area Network (WAN).
ISE-OPS-0020	The ISE shall provide capabilities for the establishment of user accounts.
ISE-OPS-0030	The ISE shall perform user authentication upon user login.
ISE-OPS-0040	The ISE shall implement user access control based upon user login.
ISE-OPS-0050	The ISE shall provide a tailored Graphical User Interface (GUI) for accessing tools and data that is based upon user login information.

4. REQUIREMENTS

4.1. Requirements Approach and Tradeoffs

The contents of this document are the result of a requirements engineering approach that is illustrated in Exhibit 4.1-1.

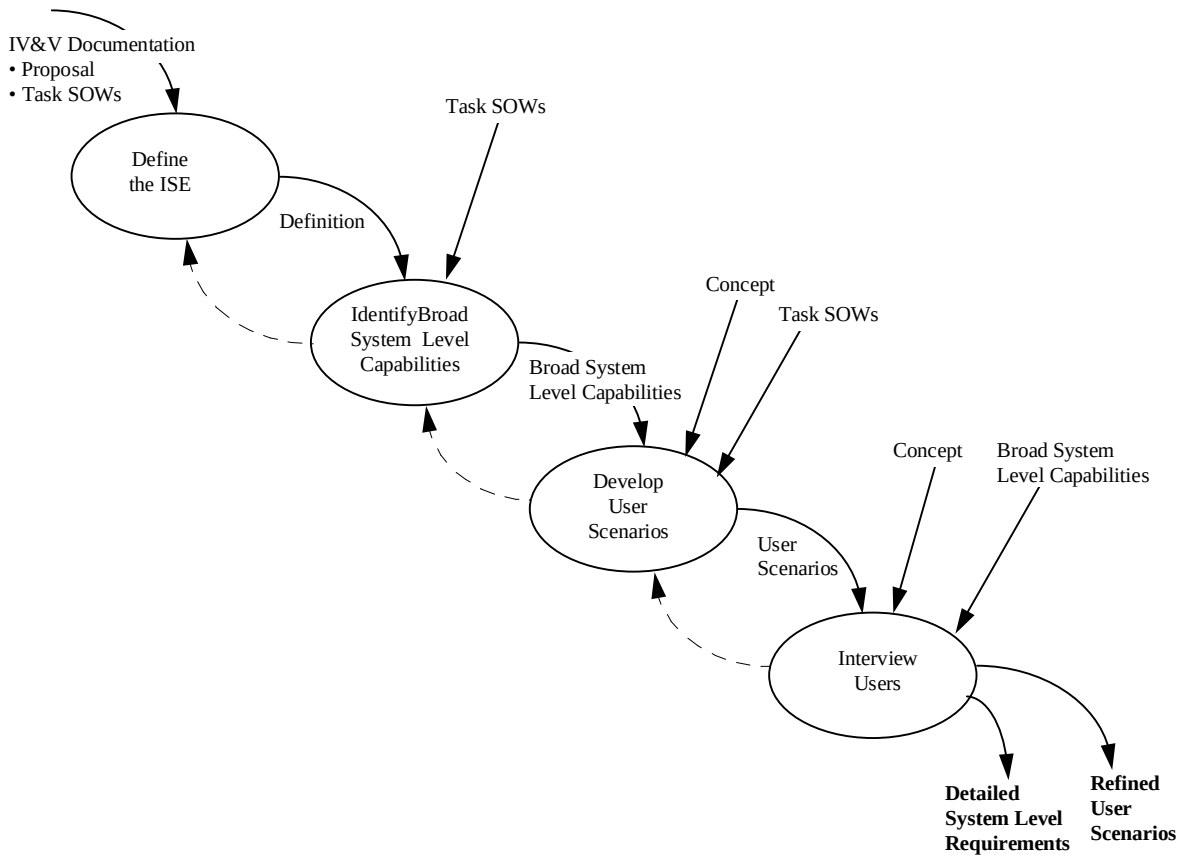

Exhibit 4.1-1 ISE Requirements Engineering Approach

As denoted by the dashed lines, the process is not waterfall, but rather spiral and incremental. Spiral, in the sense that products are slowly refined over the entire process life-cycle and incremental, in the sense that some areas of the system may have broad system level capabilities defined and other areas may have detailed system level requirements defined. This approach enables ISE users and management the opportunity to review the concept and requirements in smaller more comprehensible pieces, as opposed to reviewing all the requirements in one short span of time. This allows the ISE Support Staff to identify and mitigate risks and to assure clear, concise, and attainable requirements.

the ISE to view the information stored in the IIR. In order to support this diverse user group and their needs, the ISE must:

- Provide geographically dispersed users access to this information
- Provide centralized control over the information
- Be accessible via modem or through the NASA wide-area network (WAN)
- Provide a standard user interface to access this information
- Provide security, supplying access to data as the user's needs require

Finally, the ISE *must provide a remote site IV&V test support capability.* This will be supported mainly through the Test Buddy, a stand-alone, portable platform with access to the ISE. However, just providing the platform is not enough. The ISE, specifically the Test Buddy, must:

- Provide the remote tester with the capability to submit test results quickly and efficiently
- Have the capability to access test information (i.e. plans, procedures, resource requirements, previously recorded results, etc.) stored in the IIR
- Be flexible enough to support changes in test scenarios due to unforeseen circumstances

3.4. Policies

The documentation for the IV&V software, including IV&V tools is controlled by NASA-STD-2100-91. ISE infrastructure development will also adhere to the guidelines specified in the Tool Management appendix of the IV&V Management Plan.

team will measure the satisfaction of the user requirements. Analysis data and whatever metrics data is accumulated from IV&V activities will be placed in the IIR for viewing by the scientific user community. Once the scientific users review the IV&V result data, they can provide comments to IV&V management through a tool provided by the ISE's Toolbox. Using the same tool, or one similar in functionality, the scientific users can report to IV&V management any problems they are encountering with the system (e.g., scheduling, failure/recovery), as well as provide user evaluations on system performance.

3.3. Capabilities and Characteristics

The IV&V ISE is designed to provide consistent, accessible, and controlled use and availability of tools and data to support the ISE user community. The ISE components, as described in Section 3.1, consists of the IIR, a central repository that houses all of the IV&V data, the Toolbox, a tool suite that supports the IV&V effort for EOSDIS, and the Test Buddy, a stand-alone portable testing platform. Together these components support the specific needs of the aforementioned users, independent of their location. Section 3.1 identified the objectives of the ISE; this section expands on those four objectives, by providing the capabilities and characteristics of the ISE.

The ISE *must provide required IV&V tool support capabilities.* The tools reside in the ISE's Toolbox and will be sufficiently robust to support the IV&V effort in day to day activities. Products of the IV&V effort will be placed into the IIR for review by the ISE user community, provided they have the proper access. ISE tool support capabilities will include:

- System Design Analysis
- Requirements Analysis
- Requirements Traceability
- Interface Analysis
- Static and Dynamic Code Analysis
- Software Design Analysis
- Communication Design Analysis
- Development Analysis
- Performance Analysis
- Test Preparation
- Test Analysis
- Test Execution
- Metrics Capturing
- Discrepancy/Issue Tracking
- Office Automation
- Program Management
- Configuration Management

The ISE *must provide visibility to EOSDIS development and integration documentation* and *visibility to EOSDIS IV&V products.* Many different users, from different locations, will access

The EOSDIS Developers are, as their name implies, responsible for designing and implementing the components of EOSDIS. This user group consists of:

- The ECS Developer (Hughes)
- The Ecom developer (NASA Code 540)
- The EDOS developers (TRW)
- Spacecraft and Instrument developers (Martin Marietta, etc.)

The developers will rely on the ISE to keep them informed about software problems identified by the IV&V contractor and to help them resolve these problems. The IV&V contractor will document these problems as Review Item Discrepancies (RIDs) or Discrepancy Reports (DRs), archive them in the IIR, and formally notify NASA's EOSDIS project office and the software developer's management via periodic summary reports.

3.2.6. Scientific User Community

The Scientific User Community are the end users of the data captured by EOSDIS. They represent a variety of disciplines including atmospheric sciences, oceanography, geophysics, biology, and chemistry and are associated with institutions having different missions, institutional cultures, and training. The community consists of:

- Distributed Active Archive Centers (DAACs)
  - Goddard Space Flight Center (GSFC), Greenbelt , MD
  - Earth Resources Observation System (EROS), Sioux Falls, SD
  - Jet Propulsion Laboratory (JPL), Pasadena, CA
  - Langley Research Center (LaRC), Hampton, VA
  - University of Alaska (UAF), Fairbanks, AK
  - National Snow and Ice Data Center (NSIDC), Boulder, CO
  - Marshall Space Flight Center (MSFC), Huntsville, AL
- National Oceanographic and Atmospheric Administration (NOAA)
  - Affiliated Data Centers
    - National Meteorological Center (NMC) and Climate Analysis Center
  - University of Wisconsin
    - Space Science and Engineering Center (SSEC)
    - GOES Science Computing Facility
  - Incorporated Research Institutions for Seismology (IRIS)
- International Partners
  - European Space Agency (ESA)
  - Ministry of International Trade and Industry (MITI)
- Tropical Rainfall Measuring Mission (TRMM)
- EOS Data and Operations System (EDOS)

As the end user of the EOSDIS, the scientific user community's requirements are of utmost importance. To ensure that their requirements are captured and implemented correctly, the IV&V

usage scenarios, prototype information and model data to prepare for testing. Test plans and schedules will be generated and testing information will be accessible to the ISE's Test Buddy. Once testing is complete, test results and discrepancies will be documented, via tools supplied by the Toolbox, and reported to the appropriate personnel.

For more detailed information regarding IV&V activities performed, refer to the IV&V Management Plan.

3.2.3. West Virginia University Faculty and Students

West Virginia University's (WVU) EOSDIS IV&V role has not been formally documented in a Memorandum of Understanding (MOU). A draft MOU between WVU and Intermetrics is in the formulative stages. Completion of the MOU is anticipated by 30 November 1994. This agreement focuses on collaborative efforts to improve IV&V processes, to recommend development methods which will produce systems that can be more readily traced and tested, and to quantify the value of IV&V for large development programs.

3.2.4. NASA Project Personnel

NASA Project Personnel and in particular the contracting officer's technical representative (COTR) monitor the IV&V project progress. NASA Project Personnel include:

- NASA HQ (Code S)
- NASA HQ (Code O)
- ESDIS Project
- EDOS Project,
- Ecom Project
- EOS-AM Project
- EOS-PM Project
- Aerosols/Altimeter/Chemicals Project
- NASDA Institutional

The NASA Project Personnel will use the ISE to access a wide variety of technical and management-related products to inform them of project status and potential risk items. The project personnel will also access the IIR to view the IV&V products such as documents, test results, discrepancies, and performance metrics to gain insight into the IV&V process. Once NASA personnel review the IV&V information, they can provide their thoughts and comments to IV&V management through an information exchange tool provided by the ISE's Toolbox.

3.2.5. EOSDIS Developers

ensuring that capabilities exist as expeditiously as possible following contract award. First, a Local Area Network (LAN) will be established with the proposed file servers and the readily available office automation software. As the ISE matures, additional hardware, communications software, and ISE tools will be added. The primary responsibility of the ISE Administrators is to keep the ISE operational and to maintain it as it evolves during the EOSDIS IV&V contract.

3.2.2. IV&V Task Teams

The IV&V Task Teams are responsible for producing the deliverables required by their specific task. These deliverables range from formally documented plans (e.g., IV&V Management Plan) to requirements and interface analyses yielding Technical Analysis Reports. Normal office automation tools such as graphics packages, program management tools, and word processors will be used to package these deliverables. However, a wide variety of tools will be needed to generate the data that goes into these deliverables. Requirements traceability tools, data flow analyzers, source code analyzers, and test tools are just a small sampling of the tools that are required. Refer to Section 4.0, Requirements, for a detailed listing of the requirements. Because each task has its own set of objectives and deliverables, each has its own staff. The IV&V Task Teams include:

- IV&V Task Team Leaders
- IV&V Task Team Analysts
- IV&V Task Team Testers

IV&V Task Team Leaders are responsible for overseeing their respective task(s). In order to accomplish this, leaders will use project schedulers, issue tracking tools, and productivity measuring tools. The leaders will also use various office automation tools to produce reports and presentations showing task status and progress. The leaders are ultimately responsible for responding to issues raised by the NASA Project Personnel and the Scientific User Community in a timely manner. These three user groups will use an information exchange tool from the ISE's Toolbox to communicate to one another.

The ***IV&V Task Team Analysts*** assure EOSDIS requirements and interfaces are correct, complete, consistent, and traceable for their respective tasks. Analysts will validate the requirements for elements of the EOS GS and trace the top-level (Level 1) requirements in the EOS Project Plan down to the detailed requirements (Level 3 & 4) of each element. As the analysts review the requirements, they will use the relational capabilities of the IIR to capture and maintain links between requirements and other affiliated data. Analysts also verify correctness of interface requirements and interface definitions specified by Interface Control Documents (ICDs). Any discrepancies found will be documented, via office automation tools supplied by the Toolbox, and reported to the appropriate personnel. Analysts will also capture metrics (e.g., instrument data flow metrics, user response times) to place into the IIR for other users to review.

The ***IV&V Task Team Testers*** are responsible for developing and executing functional and performance tests of EOSDIS components and interfaces. The testers will use the ISE to access

The following subsections provide a description of each user and an overview of their interaction with the ISE. For specific scenarios on how the user will utilize the ISE, refer to Appendix A, User Scenarios.

3.2.1. ISE Support Staff

The ISE Support Staff is responsible for the development and maintenance of the ISE. The staff will use many of the tools included in the ISE Toolbox in a manner which parallels that of other end users. The products produced by the ISE Support Staff will be associated with the establishment and control of the ISE.

Specific tools the ISE Support Staff will need include Computer Aided Software Engineering (CASE) tools, compilers, debuggers, language sensitive editors, code portability tools, configuration management (CM) tools, code generation tools, reverse engineering tools, and graphical user interface (GUI) development tools. These tools will provide the foundation for new tool development and tool tailoring activities deemed necessary to satisfy other end user needs. Like other end users, the ISE Support Staff will use office automation tools to develop schedules, prepare presentations, and to document plans. Issue tracking and information exchange capabilities supported by ISE tools will be used by the ISE Support Staff to enhance communications during ISE engineering activities and to automate various aspects of a documented corrective action process.

The ISE Support Staff is composed of personnel with different roles and responsibilities. The staff is divided into three staffing classifications:

- ISE Technical Leads
- ISE Developers
- ISE Administrators

The ***ISE Technical Leads*** assume overall responsibility for the establishment, operation, and maintenance of the ISE. They will provide the technical leadership necessary to:

- Identify needed tools and resources
- Analyze and define a feasible implementation plan
- Isolate and mitigate risks
- Manage and track progress against an established baseline

The ***ISE Developers*** will perform the majority of the analysis, design, development, and test activities required for the establishment of the ISE. In order to choose the proper tools for the ISE development, the ISE Developers will access EOSDIS documentation, IV&V plans, and interview end users to gain insight into desired capabilities for the ISE.

The initial focus of the ***ISE Administrators*** is both hardware and software tool acquisition, management, and installation. They are responsible for establishing the proposed ISE architecture

support staff to develop new tools, manage, monitor and maintain computational resources, and perform configuration management of tools and data.

The third and final component of the ISE, the Test Buddy, is a portable platform that will enable IV&V task team members to obtain remote site access to the ISE during test activities. The Test Buddy is self-contained, housing many of the tools required for remote users to conduct tests, capture the results, and rapidly distribute debriefing messages and "quick-look" reports directly to IV&V and NASA managers. The Test Buddy comes equipped with a modem and communication software enabling remote testers to upload and download information and data to/from the IIR.

3.2. User Description

The ISE users hold a variety of positions, from system developer to NASA executive, each with their own unique set of needs. Exhibit 3.2-1 introduces the categorization of the user community and characterizes their interaction with the ISE.

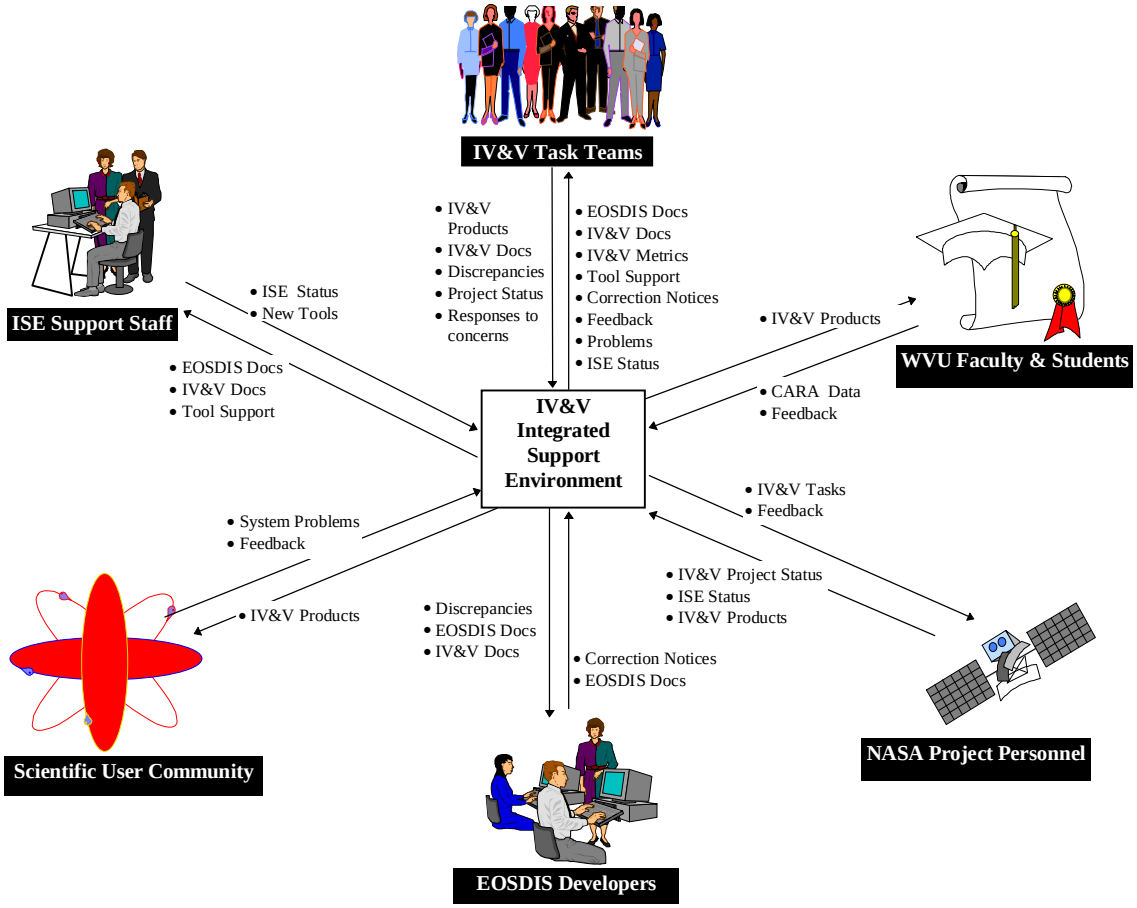

Exhibit 3.2-1 ISE User Community

- Presentations (e.g., Status Reviews, NASA Briefings)
- Project Status (e.g., Schedules, Project Risks, Management Reports, Staffing Profiles)
- Test Documentation (e.g., Test Scenarios, Test Results)

IV&V data products consist of:

- Requirements Traceability Data
- Requirements Analysis Database
- Performance Metrics
  - EOSDIS Performance Metrics (e.g., Query Response Time)
  - Analysis Metrics (e.g., Source Code Analysis, Database Analysis)
  - User Satisfaction Metrics (e.g., Number of Discrepancies, Percentage of Tests Passed)
- Interface Analysis Database
- Discrepancy Reports Database

The final type of information located in the IIR will be NASA Support Material. This is documentation (e.g., standards, guidelines) that can be placed on-line to expedite the IV&V process.

Because of the variety of information that will exist in the IIR, not all users will be privy to all information. Security will exist and access will be provided on a need to know basis. Although the type of user matters, the location of the user does not. The IIR will be located at the WVU/NASA Software IV&V Center in Fairmont, West Virginia and accessible to the IV&V user community, regardless of their location, via the established communication architecture.
The user interface to the IIR will be provided by front-end tools located in the ISE Toolbox. The Toolbox compartmentalizes all of the tools to meet the diverse needs of the ISE users. The ISE tools can be broadly characterized to include:

- Information browsing tools
- Database application tools
- Analysis tools
- Tracking tools
- Testing tools
- Development tools
- Office automation tools

Front-end tools enable users to access the data and products stored in the IIR while providing a standard look and feel for navigating through the IIR. The Toolbox will also contain office support tools, project management tools, test tools, performance and code analyzing tools, and interface analysis tools to support the daily needs of the IV&V task members. Where feasible, these tools will be integrated to facilitate the sharing of data, enabling information to progress through the IV&V project life-cycle. Additionally, the Toolbox will house the tools necessary for the ISE support staff to establish and maintain the ISE. These tools will be used to allow ISE

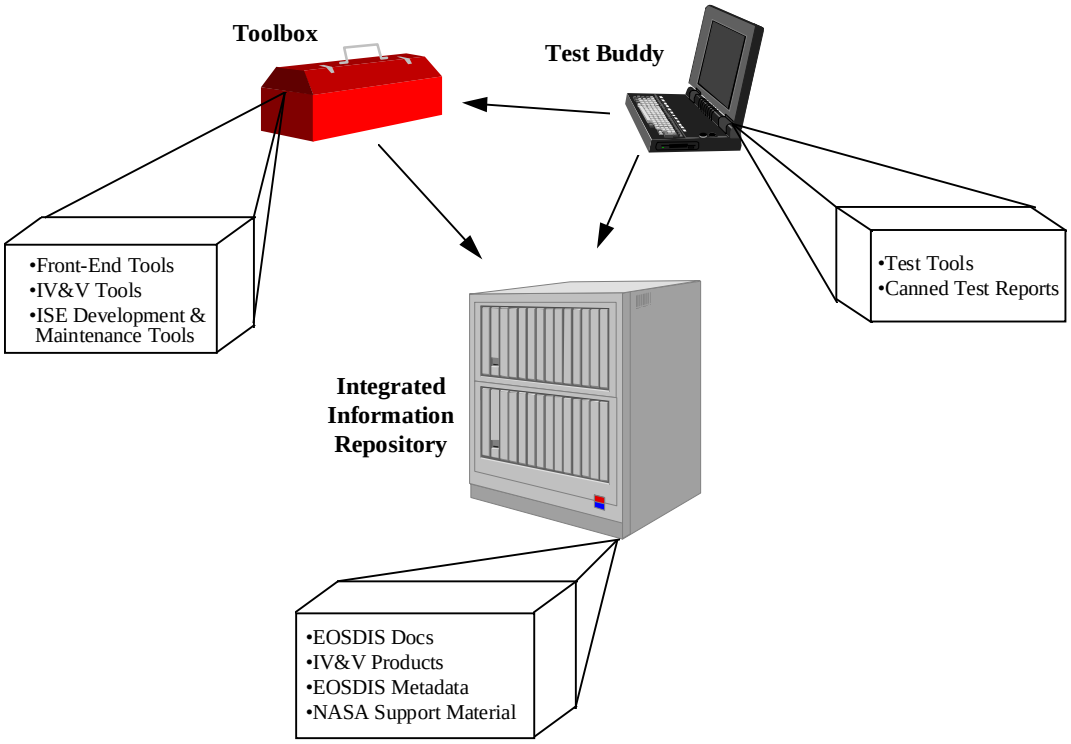

Exhibit 3.1-2 ISE Components

The IIR serves a role as a library, storing:

- EOSDIS Development and Integration Documentation
- EOSDIS Metadata
- EOSDIS IV&V Products and Results
- NASA Support Material

By storing this information, the IIR assists its entire user community in their daily activities. The EOSDIS development and integration documentation provides IV&V analysts with on-line, up-to-date EOSDIS documentation pertinent to the IV&V effort (e.g., requirements, design and implementation specifications, system design and development metrics, management and test plans, schedules and other reference material). In cases where the documentation cannot be retained on-line, metadata will direct the user to where the documentation can be found. The IV&V products that are stored in the IIR fall under two categories -- information and data. IV&V informational products consist of :

- Formal Documents (e.g., IV&V Management Plan, Discrepancies)
- Reports (e.g., Analysis Reports, White Papers)

aspects of the IV&V processes. Significant benefits will be realized by the integration. Each benefit realized from the automation and integration of IV&V task processes, tools, and data can be attributed to one or more of the following:

- Information sharing,
- Increased productivity,
- Analysis repeatability,
- Data integrity,
- Completeness,
- Consistency,
- Product quality, and
- Product integrity.

The IIR is the heart of the ISE, holding all the IV&V project data and results, as well as the EOSDIS development information. This repository is accessible to the user community via front-end tools provided by the Toolbox. Along with the front-end tools, the Toolbox contains all of the IV&V tools necessary for the IV&V task team to complete their day to day jobs. The output products and data generated or utilized by the tools will be stored in the IIR. The third and final component, the Test Buddy, is a self-contained, portable platform with accessibility to the ISE. The Test Buddy enables IV&V testers to complete test scenarios and cases on site with the ability to access information in the IIR and to rapidly submit test results. Exhibit 3.1-2 illustrates these three components of the ISE and their relationships.

3. CONCEPT

3.1. Definition

The purpose of the EOSDIS IV&V Integrated Support Environment (ISE) is to ***provide consistent, accessible, and controlled use and availability of tools and information to the ISE user community independent of user location***. By maintaining the focus of this purpose, the ISE will provide virtually all IV&V and other COTR-authorized personnel access to EOSDIS/IV&V data and information to support their full range of activities. The primary objectives of the ISE are as follows:

- To provide tool support for IV&V tasks
- To provide visibility to EOSDIS development and integration documentation
- To provide visibility to EOSDIS IV&V products, results, and data
- To provide remote site access to IV&V test information

Exhibit 3.1-1 maps these objectives to the components of the ISE which provide a basis for satisfaction.

OBJECTIVE	COMPONENT	OBJECTIVE SATISFACTION
• Provide required IV&V tool support	Toolbox	• The Toolbox houses IV&V tools to support daily needs
• Provide visibility to EOSDIS development and integration documentation	Integrated Information Repository and Toolbox	• The IIR archives all EOSDIS products and data relevant to the IV&V effort • The Toolbox provides front-end tools to access these products and data
• Provide visibility to EOSDIS IV&V products, results, and data	Integrated Information Repository and Toolbox	• The IIR archives all EOSDIS IV&V products and data • The Toolbox provides front-end tools to access these products and data
• Provide remote site access to IV&V test information	Test Buddy	• The Test Buddy is a standalone, portable platform providing access to ISE tools and data.

Exhibit 3.1-1 ISE Objective/Component Mapping

3.1.1. ISE Components

As introduced in Exhibit 3.1-1, the ISE consists of the **Integrated Information Repository (IIR),** the **Toolbox,** and the **Test Buddy.** Together these components support the ISE user community by providing an integrated environment which automates and integrates various

14. “EOSDIS IV&V Task 11 Key Interface Testing Statement of Work”, dated 11 October 1994.

15. “EOSDIS IV&V Task 12 EDOS IV&V Statement of Work”, dated 17 October 1994.

2.2. Applicable Documents

The following documents are referenced herein and are directly applicable to this volume:

1. "Statement of Work for the Independent Verification and Validation (IV&V) of the EOS Data and Information System and Key EOS Ground System Interfaces", dated April 19, 1993

2. "NASA Software Documentation Standard Software Engineering Program" NASA-STD-2100-91, dated July 29, 1991

2. RELATED DOCUMENTATION

2.1. Parent Documents

The following documents are parents to this document:

1. "Earth Observing System (EOS) Performance Assurance Requirements (PAR) for the Independent Verification and Validation (IV&V) of the EOS Data and Information System (EOSDIS)", GSFC 420-05-05, dated March 23, 1993

2. "Independent Verification and Validation Management Plan (IVVMP)", dated 15 August 1994.

3. "Independent System Verification & Validation Plan (ISVVP)", dated 17 October 1994.

4. "EOSDIS IV&V Task 1 IV&V Project Management Statement of Work", dated 11 October 1994.

5. "EOSDIS IV&V Task 2 Facilities, Operations, and Program Reporting Statement of Work", dated 17 October 1994.

6. "EOSDIS IV&V Task 3 Independent Verification and Validation Plans Statement of Work", dated 11 October 1994.

7. "EOSDIS IV&V Task 4 IV&V Infrastructure and Tool Development Task Statement of Work", dated 11 October 1994.

8. "EOSDIS IV&V Task 5 Requirements Analysis and Traceability Task Statement of Work", dated 11 October 1994.

9. "EOSDIS IV&V Task 6 ECS Interim Release 1 Development Analysis Task Statement of Work", dated 11 October 1994.

10. "EOSDIS IV&V Task 7 ECS Release A Development Analysis Task Statement of Work", dated 11 October 1994.

11. "EOSDIS IV&V Task 8 ECS Release A IV&V Test and Test Scenario Generation Statement of Work", dated 11 October 1994.

12. "EOSDIS IV&V Task 9 Key Interface Analysis Statement of Work", dated 11 October 1994.

13. "EOSDIS IV&V Task 10 Development of EOS Ground System Certification Plan Statement of Work", dated 11 October 1994.

Section 4 details the ***system requirements*** for the initial set of ISE requirements relative to active IV&V tasks. As new tasks are initiated, new system requirements will be identified, captured and documented.

Section 5 explains the ***design goals*** in terms of correctness, reliability, efficiency, maintainability, and transparency.

Section 6 contains a list of ***abbreviations and acronyms*** used in this document.

Section 7 contains a ***glossary*** of terms used in this document.

Section 8 contains ***notes*** pertaining to material in this document.

Section 9 contains an appendix containing ***sample user scenarios.***

1. INTRODUCTION

1.1. Identification of Document

This is the Earth Observing System Data and Information System (EOSDIS) Independent Verification and Validation (IV&V) System Requirements Document for the Integrated Support Environment (ISE) IV&V Infrastructure and Tools.

1.2. Purpose and Scope of Document

This document states the high level system requirements for the ISE developed under the EOSDIS IV&V Infrastructure and Tools Task. The initial release of the ISE will be fielded in February 1996 and will evolve as additional IV&V needs are defined during the span of the ten year project.

Definition of the requirements for the ISE reflects an understanding of the scope of the IV&V technical and managerial activities, where these activities are to be performed, the IV&V products and the input information provided by the users of the system. These requirements will be used to develop the more detailed or element level requirements for the ISE.

1.3. Document Status and Schedule

This revision of the ISE Systems Requirements document represents the first official release since the draft of 29 August 1994. This document will be updated as necessary to accurately reflect the evolving needs of the EOSDIS IV&V Tasks.

1.4. Documentation Overview and Organization

This document presents the high level System requirements for the ISE. In addition it contains a conceptual overview of the software that provides the context in which the requirements should be read.

Section 1 establishes the context of the document through an ***introduction***. This identifies the document, the scope and purpose of the document, and the status of the document.

Section 2 lists the ***related documentation*** including parent documents and applicable documents.

Section 3 describes the ***concept***. This provides an overview of the system.

TABLE OF EXHIBITS

Exhibit		***Page***
Exhibit 3-1	ISE Objective/Component Mapping	3-1
Exhibit 3-2	ISE Components	3-3
Exhibit 3-3	ISE User Community	3-5
Exhibit 4-1	ISE Requirements Engineering Approach	4-1
Exhibit 4-2	ISE Access Control	4-12

4.3.6. IV&V Infrastructure and Tool Development Task 4-6

TABLE OF CONTENTS (cont.)

Section ***Page***

4.3.7. Requirements Analysis and Traceability Task 4-7
4.3.8. Key Interface Analysis Task 4-8
4.3.9. Development of EOS Ground System Certification Plan Task 4-9
4.3.10. Key Interface Testing Task 4-10

4.4. Performance and Quality Engineering Requirements 4-11

4.5. Security and Privacy Requirements 4-12

4.6. Implementation Constraints 4-13

5. DESIGN GOALS 5-1

6. ABBREVIATIONS AND ACRONYMS 6-2

7. GLOSSARY 7-1

8. NOTES 8-1

9. APPENDICES 9-1

9.1. Appendix A User Scenarios 9-1
9.1.1. ISE Support Staff 9-1
9.1.1.1. ISE Technical Leads 9-1
9.1.1.2. ISE Developers 9-2
9.1.1.3. ISE Administrators 9-4
9.1.2. IV&V Task Teams 9-5
9.1.2.1. IV&V Task Team Leaders 9-5
9.1.2.2. IV&V Task Team Analysts 9-6
9.1.2.3. IV&V Task Team Testers 9-7
9.1.3. West Virginia University Faculty and Students 9-8
9.1.4. NASA Project Personnel Scenario 9-8
9.1.4.1. NASA Project Personnel 9-8
9.1.5. EOSDIS Developers' Scenario 9-9
9.1.5.1. EOSDIS Developers 9-9
9.1.6. Scientific User Community Scenario 9-10
9.1.6.1. Scientific User Community 9-10

TABLE OF CONTENTS

Section ***Page***

1. INTRODUCTION 1-1

1.1. Identification of Document 1-1

1.2. Purpose and Scope of Document 1-1

1.3. Document Status and Schedule 1-1

1.4. Documentation Overview and Organization 1-1

2. RELATED DOCUMENTATION 2-1

2.1. Parent Documents 2-1

2.2. Applicable Documents 2-2

3. CONCEPT 3-1

3.1. Definition 3-1
3.1.1. ISE Components 3-1

3.2. User Description 3-5
3.2.1. ISE Support Staff 3-6
3.2.2. IV&V Task Teams 3-7
3.2.3. West Virginia University Faculty and Students 3-8
3.2.4. NASA Project Personnel 3-8
3.2.5. EOSDIS Developers 3-8
3.2.6. Scientific User Community 3-9

3.3. Capabilities and Characteristics 3-10

3.4. Policies 3-11

4. REQUIREMENTS 4-1

4.1. Requirements Approach and Tradeoffs 4-1

4.2. Operational Requirements 4-2

4.3. Functional Requirements 4-3
4.3.1. IIR Requirements 4-3
4.3.2. Toolbox Requirements 4-4
4.3.3. IV&V Project Management Task 4-5
4.3.4. IV&V Facilities, Operations, and Program Reporting Task 4-5
4.3.5. IV&V Plans Task 4-6

CONTRACT NAS5-32605
EOSDIS IV&V

INTEGRATED SUPPORT ENVIRONMENT (ISE) SYSTEM REQUIREMENTS

(Deliverable 0405)

October 28, 1994

PREPARED BY:

Randy Hefner
Technical Lead

PREPARED BY:

Llew Williams
Task Member

REVIEWED BY:

Dan McCaugherty
Task Leader

RECEIVED BY:

Lee LaCoste
Document Log Manager

APPROVED BY:

Ron Cariola
Program Manager

INTERMETRICS
WVU/NASA Software IV&V Facility
100 University Drive
Fairmont, WV 26554

CONTRACT NAS5-32605
EOSDIS IV&V

INTEGRATED SUPPORT ENVIRONMENT (ISE) SYSTEM REQUIREMENTS

(Deliverable 0405)

October 28, 1994

Prepared by:

INTERMETRICS
WVU/NASA Software IV&V Facility
100 University Drive
Fairmont, WV 26554

Prepared for:

NASA Goddard Space Flight Center
EOSDIS Project, Code 505
Greenbelt, MD 20770