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Systems Requirements Specification (SRS) For The Enterprise Integration Framework (EIF) of the Rapid Development of Application Specific Signal Processors (RASSP)

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1 SCOPE

This Systems Requirements Specification (SRS) details the requirements for the Rapid Prototyping of Application-Specific Signal Processors (RASSP) Enterprise Integration Framework (EIF). This specification is based on the requirements defined for Contract TTM748348. The task description is detailed in item numer 1.3.1.2.1.3 of the Work Breakdown Structure (WBS). The audience for this specification is the RASSP integration team and the Martin Marietta user community.

1.1 Identification of the System

The Rapid Prototyping of Application-Specific Signal Processors (RASSP) project is a large technology demonstration project funded by the Advanced Research Projects Agency (ARPA). The purpose of the project is to advance the technology used in the development of signal processor systems. The project explicitly seeks the commercialization of the technology developed. Intergraph is a sub-contractor to Martin Marietta Corporation (MMC) on the project.

The overall goals of the RASSP project are summarized in the following three quotations from the Martin Marietta technical proposal:

- "...[to] provide a comprehensive solution to developing and fielding cost effective, application-specific signal processing technology."
- "...[to] provide the process for linking all disciplines (engineering, manufacturing, test, computer-aided logistics support, etc.) throughout the design cycle."
- "Our program will demonstrate 4X improvements in cycle time reduction, greater than 4X reduction in cost (development, production, and life cycle), and substantially improved quality (reliability, availability, and maintenance)."

Intergraph's efforts on the project are focused on the design and development of the infrastructure for the RASSP project. Within the infrastructure area Intergraph will play a significant role in the development of the Enterprise Integration Framework (EIF) (which provides a common graphical user interface (GUI) and a work flow management facility), the Enterprise Product Data Manager (EPDM). Two Intergraph organizations will be close working partners on this effort: the Systems Integration organization within the Solutions Engineering Division; and capability. Intergraph Electronics Division will focus on EIF development. Intergraph will work with Rockwell International in specification of the EIF and EPDM.

1.2 System Overview

The RASSP program will create an environment that will reduce cost and schedule while maintaining signal processor quality and capability. To facilitate this, an EIF will be designed and implemented for the RASSP user community. The framework will:

- Facilitate concurrent design and systems engineering

- Provide for the measurement of process performance
- Enhance inter-discipline communication
- Improve engineering quality and capability
- Provide rapid engineering capability and manufacturing support

The RASSP program will also develop the integration infrastructure for enabling the flow and tracking of data throughout the enterprise. This will support the management, review, and communication of information from the initial product requirements specification through product support. The RASSP EIF will be utilized throughout the project design cycle; from product concept to final shipment. It will therfore be utilized by a diverse user community. The user groups defined for RASSP will be:

- **Engineers:** Individuals responsible for the design and implementation of the system. They will include Systems Engineers, Electrical Engineers, Mechanical Engineers, Software Developers, and Signal Processing Algorithm Developers.
- **Engineering Managers:** Individuals responsible for the management of the engineering projects and staff.
- **Financial Administrators:** Individuals responsible for assistance in program planning and tracking.
- **Procurement Support Personnel:** Individuals responsible for the purchase of project items.
- **Documentation Management Personnel:** Individuals responsible for ensuring that the configuration management procedures are adhered to.
- **Material Request Support Personnel:** Individuals responsible for the transition of data to the data management systems.
- **Engineering Release Personnel:** Individuals responsible for the transition of designs to manufacturing while enforcing revision procedures.
- **Technical Assurance Personnel:** Individuals responsible for process management and design reviews.
- **Integration Planning and Test Personnel:** Individuals responsible for product integration and testing.
- **System Administrators:** Individuals responsible for maintenance and configuration of the Enterprise Framework.

The RASSP EIF Graphical User Interface (GUI) will be composed of two major components: Intergraph's Enterprise Desktop Manager (EDM) and Design Methodology Manager (DMM) of Workflow Manager. EDM is a desktop management tool that allows you to define project workspaces through a graphical user interface and ensure that projects follow a defined hierarchy and structure. DMM is a process control tool that allows you to define process flows through a graphical user interface and ensure that your designs follow these flows. The ability to control and monitor the flow of the design process allows you to:

1.3 SRS Overview

The purpose of the SRS is to establish in writing the consensus of Intergraph and Martin Marietta Corporation on the functional requirements of the RASSP EIF. This SRS will describe the essential requirements (functions, performance, user characteristics, design constraints, attributes, and assumptions and dependencies) of the RASSP EIF. This document

will provide the requirements for both portions of the RASSP EIF; EDM and DMM. DMM and EDM are Intergraph commercial off the shelf products (COTS) which are being enhanced for RASSP. In addition to the commercial product enhancements, Intergraph Electronics will be creating the RASSP workflows and working with the various RASSP vendors in the integration of their tools in the RASSP environment. Section 3.2 of the document will describe the COTS requirements, while section 3.5 will describe the integration effort.

This SRS describes what is required in order for EDM to provide a graphical capability to define workspaces within projects, allow users to perform actions utilizing the defined workspaces, provide system processes for managing workspaces, and provide a graphical feedback on project status for workflow productivity management.

This SRS further describes what is required in order for DMM to provide a graphical capability to define workflows for processing, allow users to perform actions against the defined workflows, provide system processes for implementing workflows, and provide a graphical feedback on workflow status for workflow productivity management. The encapsulation process will not be covered in this SRS, but will be covered in the RASSP Encapsulation Definition Document. This document will be updated to reflect any changes required in the RASSP build cycles.

2 Applicable Documents, Reference, and Glossary

Government:

Solicitation DAAL01-93-R3616-RASSP RFP
US Army Research Laboratory
January 1993

Non-Government:

CMDA972-92-R-0017-RASSP[Study Phase]Final Technical Report
GE Aerospace Advanced Technology Laboratories
October, 1992

MDA972-92-C-0057-RASSP Program - Study Phase
Honeywell Systems and Research Center
October, 1992

DAAL01-93-R-3616-RASSP Proposal Volume II, Technology and Processes
GE Aerospace Advanced Technology Laboratories
March, 1993

2.2 References

FSD/SI-I0071/93C - Systems and Software Engineering Process
Intergraph Systems Integration Organization
August, 1993

2.3 Glossary

Access Control List	An Access Control List (ACL) identifies resources or a group of resources that are allowed to initiate a process.
Activity Flow	An Activity Flow is a workflow(s) which has beed defined to process an activity. The Activity Flow contains the states, processes, rules and other activity flows which are necessary for processing an activity.
API	Application Procedural Interface
CLI	Command Line Interface
Command	An executable instruction containing the parameters for execution, types of objects required and other informaiton required to perform an action.
DMM	Design Methodology Manager
Device	A device is either a physical device such as a printer or plotter, or a logical device such as a data extractor or converter.
Encapsulation	Integration; which makes an applicationaccessible within a Framework.
EDM	Enterprise Desktop Manager
EDM Configuration File	A file that specifies the set of EDM functionality that the user cannot access while operating within EDM.
EDM Project	A set of EDM workspaces, and DMM workflows, along with an Access Control List (ACL) specifying what users and user groups have access to the projects workspaces.
EIF	Enterprise Integration Framework
EInet	Enterprise Integration Network
Enterprise Data Base	Consists of all of the pieces of information used within the RASSP system at the enterprise level. It is the term used to refer tot he entirety of the information being controlled at the enterprise level.
EPDM	Enterprise Product Data Manager

File Object	A data element managed by the EPDM. File objects will typically be composed of inividual files. In some instances, however, they may refer ot a collection of data objects, or a collection of relational tables managed by a relational database system.
Form	The basic language element in TES. A form befins with an opening parenthesis and a keyword; this is followed by a list of items ending with a closing parenthesis.
Format	The way the data is arranged in a file. Files in the ASCII format are human-readable (and may be viewed and understood using a common text editor). Files in other formats, such as postscript (for input to laser printers) may need to be translated for certain commands. Formats may be specified for a set of files and also for commands. File formats are used to specify the data arrangement to EDM. Command formats are used to force the files used by that command to be either in that format in EDM or to be translated to that format before the command is executed.
Framework	The Framework is an environment that ties together the user interface, data and tool objects, and the interactions using these objects.
GUI	Graphical User Interface
I/NFM	Intergraph Network File Manager
IDEF	Interation Definition
IDEF0	IDEF Functional Modeling Method
IDEF1x	IDEF Data Modeling Method
IDEF3	IDEF Process Description Modeling Method
INGR	Intergraph Corporation
ISO	International Standards Organization
Loose Integration	Encapsulation where the application is not changed and the communication with the Enterprise Desktop Manager is performed by a wrapper process.
Methodology Management	Methodology Management refers to constructing, showing, and enforcing a flow that is not inherent in the tools themselves.
MMC	Martin Marietta Corporation
MRP	Material Resource Planning
NFM	Network File Manager
NFS	Network file System
Object	An object is an entity such as a document, drawing, software module, hardware component, or file.

Object States	The status of where an object is within an activity flow.
Post-Condition	Is a command which is executed when a process completes. The post-condition must complete successfully for the process to also complete successfully.
Pre-conditiion	Is a command which is executed prior to the task execution. The pre-condition must successfully complete before the task can be executed
Process	A process may represent one application, or a distinct part of an application. The granularity is decided by the application group.
Process Control	Enforcing the users' workflow to ensure that processes are run in order.
Project Control	Project Management; Resource ansd schedule management of design projects. Budgeting time and resources, predicting completion dates, and estimating costs are all functions of project management.
Process States	The status of where a process is within an activity flow.
RASSP	Rapid Prototyping of Application-Specific Processors
Rules	Conditions which must be satisfied before an activity can complete.
Screen	A screen is a single hardware output device.
State	The current condition of the process or object. A checkpoint within an activity flow. The order in which processes are initiated.
State Name	A name given to a state.
TES	Acronym for Tool Encapsulation Specification (TES), the language proposed by the CAD Framework Initiative (CFI), The Tool Encapsulation format is currently a subset of the Version 1.0 CFI TES specification.
TES File	A file containing the definition (written in the tes language) for a tool or a data object.
TCP/IP	Transmission Control Protocol/Internet Protocol
Tight Integration	Encapsulation where the application is modified to make the necessary library calls to communicate with the Enterprise Desktop Manager.
Tool Object	An object that performs actions on data objects. The tool object TES file should contain commands and definitions that apply to that tool and more than one type of data object.

Translation	Converting files in one format to a specified format for command execution. A common example of this is converting all files to postscript before printing on a laser printer.
Transfer From State	Identifies the state as a valid state to transition from.
Transfer To State	Identifies the state as a valid state to transition to.
User	An entity established by the project administer that is given an account login name and password. Users have been established for the pupose of controlling access to project workspaces, and functionality within EDM. The Access Control List maintains the User-to-Project/Workspace access permissions, and the EDM configuration file specifies what EDM funcitonality a user has access to while operating within EDM.
User Group	A user group is a mechanism for the project administrator to manage multiple users as if managing just one. Placing users in a user group essentially means that all users of that group inherit the access permissions of the user group.
Workflow	A workflow consists of the names of the processes and the relationships between them required to describe a given design methodology.
Workspace	Is a set of tools and data types, as defined by the administrator, for the purpose of doing some design task or tasks. The workspace in the content of a project is intended to limit the users access to only the set of tools and data types defined by the project administrator.

3 System Requirements

3.1 System Definition

This section provides an overview of the EIF. The information in this section provides context for the functional and operational requirements captured in the following sections.

3.1.1 System Overview

The focus of this SRS is on the RASSP EIF. This section provides an overview of the EIF and a description of the EIF components for which Intergraph has primary implementation responsiblity. The EIF provides the RASSP users with a common GUI, a common launch manager, and a workflow management capability. It also supports the transfer of information between different applications. Imbedded within the common user interface are the tools (applications) and discipline specific frameworks employed by the users. Figure 3.1.1. below shows the components of the RASSP Enterprise Environment.

The EIF is composed of two Software Conifguration Items (SCI). The SCI's are the top level system functions that make up the EIF. These two functions are DMM and EDM.

EDM is a desktop management tool that provides users an intuitive graphical interface to RASSP tool objects within a given project. Using defined encapsulation rules, EDM allows users to perform specific actions on objects in an efficient manner without haing to remember lengthy keystrokes or commands. EDM does this by providing a configurable toolbar, pull down menus and associative pop up menus for objects in the workspace. EDM enables users to easily access and use tool objects, both on local and remote workstations.

DMM is a process control tool that allows you to define process flows through a graphical user interface and ensure that your designs follow these flows. A given workflow will consist of boxes representing processes or activities and arrows connecting the boxes. Rules and states are applied to the processes. The arrows represent where control will flow when given processes either succeed or fail. Designs may then be assigned a workflow, and the progress through that workflow tracked and displayed by DMM. Applications integrate to DMM through a supplied function library. This library will allow the application to notify DMM of a state change on a design, query the available states for a design, and check to see if a given state is currently permitted.

3.1.2 Activity Flows

The main user interface for performing tasks within the RASSP environment will be DMM, since most tasks will be part of a defined process. However, certain tasks that are performed outside the process must be user-accessible at any time. Since RASSP is a project oriented environment that is intended to be used by a diverse user community, the user interface will be configured to provide the appropriate capabilities to the individual RASSP user groups, as described in section 1.1. Initiation of the EIF will be identical for all users, with the users' group determining the environment.

As shown in figure 3.1.2 below, the RASSP EIF will have two menu configurations for each of the GUI components (EDM and DMM). The RASSP System Administration (ADM) users will have one configuration, while the user community will have another. The user menu configuration will be further configurable based on the group user is contained in and his project access. If the user is an ADM user the Administrator EDM configuration will be displayed otherwise the User EDM configuration will be displayed.

If a user is not a RASSP administrator, the user will either select a project or will select a tool from the tool bar. The project list will display the projects which the user has been assigned to. If a project is selected the user will have the project workflow displayed by the workflow displayer. The workflow displayer (DMM) will be an additional window that will be displayed to the user. Selection of a given task on the workflow will result in the initiation of that process, if the user's group has been assigned to that process block. After the task has been exited the user will be returned to the current workflow. When the workflow is exited the user will be returned to EDM for the selection of another project, the selection of a Tool Icon or the exiting of the RASSP environment. While in the EDM menu, if the user selects a tool, the tool or process will be executed. After completion of the process, control will be returned to EDM.

If the user is a RASSP Administrator, access will be given to the DMM Builder, Tool Encasulator, and Workspace Definition options. After the modificaitons to the EIF have been completed the Administration user will exit the EIF.

3.2 Functional Requirements

This section covers the functional requirements for the EIF system. The functional requirements describe in detail the functions that the system will perform. These requirements are traceable and testable. For this reason they have been seperately enumerated. As the system design progresses, traceability will be provided from these requirements to the separate design elements that will provide the functionality.

In addtion to the enumerated functional requirements there are overall goals that apply to the entire EIF which are designed to minimize the learning curve, maximize user acceptance and productivity. These are as follows:

- The user interface will be as intuitive as possible
- The user interface will use graphical interactions wherever possible
- The user interface will pick lists wherever possible
- The user interface will use cursor invocation of functions wherever possible
- The user interface will be migratable to another GUI (Windows NT, Solaris)
- The user interface will have a Motif look and feel
- The user interface will display intuitive error messages
- The user interface will provide context sensitive help

3.2.1 DMM Overview

Users interact with DMM through two primary interfaces: the workflow builder and the workflow displayer. The workflow builder is the tool which allows you to define process steps and connect these steps into workflows. The Workflow Builder provides a graphical workflow editor which allows the RASSP administrator to place predefined processes into a workflow and connect them to indicate a flow through the design process. The workflow displayer shows which workflow is attached to a given design and at what stage in the workflow that design is. The workflow displayer also indicates where a design has been in the workflow by providing a visual history of the design. Available processes (processes that are ready to begin) are also indicated.

3.2.2 DMM User Requirements

The general user's view of the RASSP environment will be the DMM Workflow Displayer. The functional requirements for the displayer will be described in this section.

3.2.2.1 Monitor Workflows (DMM)

The system will:

3.2.2.1.1 Allow each transition from one workflow step to the next to be performed automatically upon completion of the actions defined in the workflow.

3.2.2.1.2 Use an electronic mail function to notify a user that he or she has work to process.

3.2.2.1.3 When a process block transitions the user will be able to add comments.

3.2.2.1.4 Allow for the specification of one ormore electronic mail lists to be notified upon completion of the action.

3.2.2.1.5 Ensure workflow approvals have been met before advancing to the next process.

3.2.2.1.6 An audit-trail of change history will be maintained within the system.

3.2.2.1.7 Prevent any changes from being made to a process block unless the change is routed through the appropriate workflow.

3.2.2.1.8 Support fully-automatic work flows, not requiring manual intervention.

3.2.2.1.9 Support the triggering of external events upon completion of a workflow.

3.2.2.1.10 Automation of workflow processing based on completion of actions defined in workflow, i.e. once all completion criteria are met in a particular state in the workflow, process the object according to the owrkflow automatically.

3.2.2.1.11 Update the state of a process step in order to indicate that it has been transitioned.

3.2.2.1.12 Prevent the state of a process step from changing once it has transitioned.

3.2.2.1.13 Automatically transition or re-route an approved process step as specified by the data object's workflow definition.

3.2.2.1.14 Automatically re-route a rejected process step as specified in the object's workflow definition.

3.2.2.1.15 Verify that users are authorized to perform actions

3.2.2.2 Notification Process (DMM)

The system will:

3.2.2.2.1 Notify the responsible individual when a process state becomes executable.

3.2.2.2.2 Automatically notify other people (projects, locations) who are affected by a process state transition.

3.2.2.2.3 Will not complete until the specified number of those users have

approved the process step.

3.2.2.2.4 Provide a mechanism for a rejecting reviewer to enter the reasons for rejection.

3.2.2.2.5 Perform user authentication as part of the electonic approval/disapproval process.

3.2.2.3 Approval Process

3.2.2.3.1 Provide a signoff process.

3.2.2.3.2 Allow for the definition of a list of signoff users.

3.2.2.3.3 Will not complete until the specified number of those users have approved the process step.

3.2.2.3.4 Provide a mechanism for a rejecting reviewer to enter the reasons for rejection.

3.2.2.3.5 Perform user authentication as part of the electronic approval/disapproval process.

3.2.2.3.6 Provide ability to capture user ID, date/time stamps upon approval (auditing).

3.2.2.3.7 Provide ability to accept off-line approvals (paper signoffs, etc.).

3.2.2.3.8 Allow an authorized user to display on-screen the name of users who have approved/disapproved a process step with a list of reasons.

3.2.2.3.9 Provide a capability to store a minimum of one alternate for each primary reviewer.

3.2.2.3.10 Maintain a timer for each required reviewer. If hte timer expires without the entry of approval or disapproval, the workflow will provide for notifying and routing the object to an alternate, and provide a notification to the creator (responsible person).

3.2.2.3.11 Provide the capability for each user to establish automatic forwarding to the approved alternate(s).

3.2.2.3.12 Provide an audit trail that identifies the actual user who indicated approval.

3.2.2.3.13 Allow all reviewers in a parallel workflow to review and act upon the submitted process step concurrently.

3.2.2.5 Workflow Sequencing Steps (DMM)

The system will:

3.2.2.5.1 Allow the ability to merge parallel workflows.

3.2.2.5.2 Allow for sequential workflow steps.

3.2.2.5.3 Allow for sequential events within a given step in the workflow.

3.2.2.5.4 Allow for sequential workflows with multi-person interaction at each process in the workflow.

3.2.2.5.5 Allow for nested workflows (similar to parallel) with the parent process having dependencies on related child processes.

3.2.2.5.6 Allow the user to place blocks which represent other workflows.

3.2.2.6 Viewing (DMM)

3.2.2.6.1 Fit: Fit will resize the window to fit the current workflow. If the workflow is too large to fit in the largest window that can appear on the screen, the window is enlarged as much as possible.

3.2.2.6.2 Center: The Center command places the geographical center of the workflow in the center of the viewing window. The user may also select an object, and that object will be centered in the window.

3.2.2.6.3 Overview: The Overview command causes an overview window to be displayed. This window shows a rectangle that indicates the extent of the editing window. Moving the rectangle causes the editing window to show the new region of the workflow.

3.2.2.6.4 Legend: The Legend option will display a box containing a sample of all the connections and all the possible states a process can be in.

3.2.2.6.5 Show success paths: The display of success paths (paths that have been successful) can be turned on or off.

3.2.2.6.6 Show fail paths: The display of fail paths (paths that have failed) can be turned on or off.

3.2.2.6.7 Show status labels: Exit status labels associated with the success or failure paths can be turned on or off.

3.2.2.6.8 Show scheduled start/finish dates.

3.2.2.7 Workflow Status (DMM)

3.2.2.7.1 Provide graphical viewing of a workflow.

3.2.2.7.2 Graphically display the status of an object in the workflow using cosmetic graphics (color changes, etc.).

3.2.2.7.3 Provide the ability to display incomplete actions holding an object in a workflow process.

3.2.2.7.4 Provide the ability to display changes to objects from the audit trail information.

3.2.2.7.5 Any user with access to a workflow will be able to invoke the state display for that workflow. This function will dispaly the workflow audit information.

3.2.2.7.6 Support the on-screen display of current state, previous state, and next state information.

3.2.2.7.7 Indicate where a design has been in the workflow, providing a visual history of the design.

3.2.2.7.8 Graphically indicate process steps that are currently startable.

3.2.2.9 DMM Workflow Help (DMM)

The system will:

3.2.2.9.1 Provide a brief description of what the process block does.

3.2.2.9.2 Provide a brief description of all functions within the workflow displayer and builder.

3.2.3 EDM Overview

The user's initial entry point into the RASSP environment will be through EDM. EDM is a desktop management tool that provides users a graphical interface to RASSP tool objects and active workspace data objects for a given project. EDM provides a configurable toolbar, pull down menus and associative pop up menus. The workspace stores which tools and menus a user will see and which data objects can be manipulated. Each individual group in the RASSP environment will have an assigned workspace which will be defined and assigned by the RASSP administrator. EDM will only manipulate data objects in the users active working area. EDM will not manipulate data objects in EPDM. The user's interface to EPDM will be through DMM and will be transparent. When a process step is selected in the workflow, the data item will be checked out and placed in the user's active working area. EDM's scope will only be in relationship to data in this active working area. For RASSP, tool launch will not be configured from EDM. For Build 1 file printing and viewing will be the allowable options on data objects in the active working area.

The EDM Menu configuration will consist of the following four areas.

- **Menu Bar:** Provides menus of options and actions for the general user.
- **Tool Bar:** The tool bar will display icons for the tools that are currently available to the user. The tools available to a user will be determined from the users group access.
- **Project Overview:** Gives a global view of all of the users available projects. The Project View Outline will show which portion of the Project Space is displayed in the Project View Area. The Projecs availiable and displayed to a user will be determined from the Access Control List. The project view will allow the user to quickly see his current working area in the project view and to also quickly move to a new portion of the project view. This view will be collapsible by the user.
- **Project View:** Will show the user a detailed view of the project in the Project Space. This area will be used for selection of objects. If a project object is double clicked with the left mouse button the appropriate workflow will be displayed. For each project in this view a Project Work Space will be defined. This object structure will be displayed for each project. The project structure and actions allowable on an object will be defined by the RASSP System Administrator. The user will be able to select objects from this view to drop on a selected tool. If the object can be manipulated by the selected tool, the task will be initiated otherwise a Error message will be displayed to the user. If a single left mouse button select is performed on a object a menu list of available actions on the object will be displayed. From the project view the user will be able to print, plot or view any encapsulated object. Application Tool launch from this menu will not be configured. This will be accomplished from the Workflow Displayer (DMM). This menu area will contain scroll bars to allow the user to quickly move to the various projects.

3.2.4 EDM User Requirements

This section will define funcitonal requirements for the EDM user configuration.

3.2.4.1 General Requirements (EDM)

EDM will provide the following:

3.2.4.1.1 Users will have the ability to select the project of interest from a list of available projects. This list will be comprised of projects which the user's group has access to according to the access control list.

3.2.4.1.2 Automatic workspace selection attachment; based upon the project and the user's group.

3.2.4.1.3 A hierarchical display of a project and it's workspaces, including all data and folder objects.

3.2.4.1.4 Context sensitive pop-ups menus listing the available actions associated with the selected object/s.

3.2.4.1.5 Ability to 'drag and drop' objects onto the available tools on the toolbar.

3.2.4.2 EDM Menu Bar (EDM)

The menu bar will provide the following capabilities:

3.2.4.2.1 Allow users to change to another valid project.

3.2.4.2.2 Allow users to set workspace display preferences, i.e. icon style, tree connections, object extensions on/off.

3.2.4.2.3 Allow users to filter the contents of the view window based on object extensions.

3.2.4.2.4 Allow access to on-line help documentation.

3.2.4.3 Tool Bar (EDM) : will allow access to valid tool objects to perform tasks on data in the workspace.

3.2.4.4 Project View (EDM):

The requirements for the project view are as follows:

3.2.4.4.1 Display workspace data objects according to the group defined preferences.

3.2.2.4.2 Allow the user to perform tasks on data objects by way of pop up menus or drag and drop operations.

3.2.4.5 Project Overview (EDM) :

The requirements for the project overview are as follows:

3.2.4.5.1 Allow the user to pan the project view by means of an outline representing the view area. This outline can be dragged to a new location and the project view area will be updated accordingly.

3.2.4.5.2 Allow the user to perform tasks on data objects by way of pop up menus or drag and drop operations.

3.3 Operational Requirements

This section details the operational requirements of the EIF system including; user control and system administration. The RASSP administration functions will include the definition and modification of workspaces and workflows, and the creation of the EIF project data base.

3.3.1 EIF Project Database (EDM)

Within the RASSP environment a central EIF Project Database will exist. The database will define the users and workflows associated with a project. The following functionality will be provided for project definition:

3.3.1.1 Allow for the assignment or removal of users or administrators to a project.

3.3.1.2 Allow for the assignment of users to user groups.

3.3.1.3 Allow for the assignment of a workspace to a user group.

3.3.1.4 Allow for the assignment of workflows to projects.

3.3.1.5 Allow for the assignment of user groups to workflow steps.

3.3.2 Workspace Creation (EDM)

A workspace is a set of tools and data objects (file and folders), as defined by the administrator, for the purpose of doing some design task or tasks. The workspace in the context of a project is intended to limit the users access to only the set of tools and data objects defined by the project administrator. The following functionality will be provided for workspace definition:

3.3.2.1 Allow for the creation, modification and deletion of workspaces.

3.3.2.2 Allow for the definition of the tools available for a given workspace.

3.3.2.3 Allow for the definition of the file types available for a given workspace.

3.3.2.4 Allow for the association of tools to file types.

3.3.3 Workflow Creation

The first step in development of an activity flow is to register processes, states, activities, and applications, customized and user developed, to be used for development of workflows. The information registered will consist of a process id and the possible completion statuses. Examples are "routing succeeded, entry underway, and item being shipped". States are to be used by security to allocate users to object status tracking purposes. The processes and states are entered into the system through a GUI interface driven capability. Processes are displayed to the user with a brief description of what the process does and how to invoke the process. The user selects the appropriate processes needed for development of the workflow.

DMM provides a graphical Workflow Builder with a GUI interface driver which will be used to define the activity flow(s) necessary to implement the designated procedure or activity. The Workflow Builder allows a user to create a new workflow, open an existing workflow, save the current workflow or save the current workflow or save the current workflow under a new name, close the current workflow, and print the current workflow.

As each workflow(s) is being developed, information is entered by the user for defining the steps to implement the workflow(s). These steps consist of defining when a workflow begins,

associating states, processes, and activities with a workflow, defining rules for states and processes, defining how processes are to be triggered (ex. event driven, date/time, automatic, or manual), and assigning objects and resources to the processes. To complete the workflow definition, the user will define the workflow end step and any special completion processing, and define the sequence in which a workflow can be run. Workflow sequencing steps consist of parallel, sequential, hierarchical, finish-to-start, start-to-start, finsih-to-finish, synchronized, cascade, and flow control symbols "and, or, and exclusive or".

The Workflow Builder also allows the user to define the preferences for displaying of workflows, such as "show success paths", "show fail paths", and "show current status" which would be displayed by either object states or process status or both. Workflows consist of the following elements:

- Terminals: boxes that specify the Befin and End points of a workflow
- Connections: Arrows between boxes
- Processes: Boxes that represent tools for performing actions required to completee a design. For example: a schematic editor tool, email notification to a supervisor, management sign-off, etc.
- Operators: Boxes used for branching the workflow into different paths, using AND, OR and XOR

3.3.3.1 General Requirements for the DMM Builder (DMM)

The DMM Builder will:

3.3.3.1.1 Allow creation of a workflow that will be "user friendly" (i.e. menu driven, icons, etc.) so that an authorized user can do it, rather than a systems administrator.

3.3.3.1.2 Provide the ability to define and modify a workflow

3.3.3.1.3 Provide the ability to define fully-automated workflows and workflow steps (non-manual interaction). This ability will allow users to automatically execute a series of processes in the workflow.

3.3.3.1.4 Support the definition of a workflow as a set of discrete states and processes.

3.3.3.1.5 Display a brief description of what the process does and how to invoke the process. The Workflow Builder will be able to show these descriptions to the user on demand. This will help the new users find their way throught the development of a workflow(s).

3.3.3.1.6 Define data used by a process.

3.3.3.1.7 Define the group allowed to perform a given process step.

3.3.3.1.8 Provide the ability to apply an expiration period for completion of a

process in either relative or absolute time.

3.3.3.1.9 Define initiation of a process based on an event.

3.3.3.1.10 Allow the user to place predefined processes into the workflow and connect them, with the connections and special symbols.

3.3.3.1.11 Provide different connection types.

3.3.3.1.12 Provide different flow control options

3.3.3.1.13 Ability to support processes succeeding or failing in several ways. In drawing the workflow, the user must account for each of the statuses defined by the process by drawing a connection to some box in the workflow.

3.3.3.1.14 Define each process preconditions and post conditions. A process will not be started until its preconditions are satisfied. A process will not exit successfully until its post conditions are satisfied, although it can exit with a failure at any time.

3.3.3.1.15 Allow any given workflow to depend on the state of another workflow.

3.3.3.1.16 Provide the ability to apply a set of rules to determine if all the necessary information has been gathered for a particular process and state in the workflow. A notification will be sent if required information is not present or complete.

3.3.31.17 Provide the ability to define processing triggers/events.

3.3.3.1.18 Allow for the triggering of an action in one workflow by an action in a seperate workflow.

3.3.3.1.19 Allow time-based actuation (initiations and expirations), including definition of action upon expiration.

3.3.3.1.20 Allow for the initiation of by-product processes (i.e. Mail notification) for actions in a workflow.

3.3.3.1.21 Provide the ability to modify a previously defined process step.

3.3.3.1.22 Allow an authorized user to select a state that the object is to transition to.

3.3.3.1.23 Allow an authorized user the ability to define and modify the actions required to trigger movement of an object(s) from one step to the next in a workflow(s).

3.3.3.1.25 Provide for the ability to allow for process blocks that do not require

approval.

3.3.3.1.27 Allow an authorized user to allocate user classes to a workflow step.

3.3.3.1.29 Allow cut and paste between workflows.

3.3.3.1.30 Allow undo of any workflow editing operation.

3.3.3.2 DMM Connections (DMM)

Connections connect the processes together into a flow.

3.3.3.2.1 Different types of connections will be visually distinct by color and line style.

3.3.3.2.2 Connections do not have to be straight lines, they can include vertices.

3.3.3.2.3 DMM Connection Types (DMM)

The types of connections between processes may be:

3.3.3.2.3.1 Finish to Start: The dependent process cannot begin until the parent process completes successfully. This type of connection is used to implement a strictly serial workflow.

3.3.3.2.3.2 Start to Start: The dependent process can begin as soon as the parent process begins, but not before. No completion order is implied.

3.3.3.2.3.3 Finish to Finish: The dependent process cannot complete successfully until the parent process completes. Either process may begin first.

3.3.3.2.3.4 Start to Finish: The dependent process cannot complete successfully until the parent process starts. No starting order is implied.

3.3.3.2.3.5 Concurrent: This is an effect a combination of start to start and finish ot finish. The dependent process cannot begin until the parent process begins, and cannot be completed successfully until the parent process completes successfully.

3.3.3.2.3.6 Cascade: The dependent process cannot begin until the parent process completes successfully, and will immediately and automatically be invoked when the parent process completes successfully. Cascade connections are used to automatically trigger processes when the design passes a certain point. They can also be used to make multiple "little" processes appear to be one "big" process by creating a hierarchic node and making all internal connection cascades.

3.3.3.2.3.7 Fail: The dependent process, and any downstream processes, will be marked as never having started when the parent process completes with a status that activates a fail connection.

3.3.3.2.3.8 Fail Cascade: These work just like a combination of fail connections and cascade connections. The dependent process, and any downstream processes, will be marked as never having started when the parent process completes with a status that activates a fail-cascade connection. In addition, the process pointed to by the fail-cascade will immediatedly be launched.

3.3.3.3 Flow Control Symbols (DMM)

3.3.3.3.1 Three types of flow control special symbols will be defined: "Or", "And", and "Xor".

3.3.3.3.2 The "Or" operator lets the workflow builder design alternate paths into a workflow and allows the engineer to choose which paths are appropriate for a given design.

3.3.3.3.3 "And" operators also split the design path, but require the engineer to complete both branches.

3.3.3.3.4 "Xor" operators allow one and only one of a set of a set of alternate paths to be taken.

3.3.3.4 Process Status (DMM)

Processes may succeed or fail in several ways; these ways will be defined by the application development groups. In drawing the workflow, the user must account for each of the statuses defined by the process by drawing a connection to some box in the workflow.

3.3.3.5 DMM Pre and Post Conditions (DMM)

3.3.3.5.1 Each process may have preconditions and postconditions attached.

3.3.3.5.2 A process may not be started until its preconditions are satisfied.

3.3.3.5.3 A process cannot exit successfully until its postconditions are satisfied, although it can exit with a failure at any time.

3.3.4 Overriding the DMM Workflow (DMM)

The RASSP System Administrator will have the ability to force the workflow into any arbitrary state. This is needed in case a process completed successfully but later someone realizes that the work was done wrong, and the design needs to start over. An authorized user can alter the state of process, force the process to start, or force the process to complete. The system will:

3.3.4.1 Provide a capability through which designated personnel may override a workflow including states. This capability will meet the same authentication criteria as normal workflow steps. The audit record on the workflow will indicate that an "override" occurred.

3.3.4.2 Allow authority for override capability to be controlled by an authorized user.

3.3.4.3 Allow authorized users to override a workflow sign-off at any point within the workflow. The audit record on the workflow will indicate that approval occurred by virtue of the override.

3.3.4.4 Bypass DMM Workflow Steps (DMM)

3.3.4.4.1 The RASSP Administrator will be able to use this tool to force a workflow into another state; this is referred to as "bypassing" a process.

3.3.4.4.2 Ordinary users will not be able to bypass a process.

3.3.5 External System Interfaces (DMM)

DMM is able to exchange data with commercially available project management packages in order to facilitate resource management. DMM communicates with project management packages via industry standard CSV (comma-separated value) file format.

3.3.5.1 DMM will be able to create a CSV file which contains the task names, actual start and finish dates, scheduled start and finished dates.

3.3.5.2 DMM will be able to import data via a CSV file which contains the task name, scheduled start date, and scheduled finish date.

3.3.6 User Access and Authorization (EDM)

EIF will provide the following user access and authorization features:

3.3.6.1 Ability to authorize privilege of a user to define or edit a workflow or workspace.

3.3.6.2 Authorization levels for actions in a workflow.

3.3.6.3 Provide a user class that permits workflow or workspace editing.

3.3.6.4 Ability to change access level by system administrator

3.4 Performance Requirements

The EIF will provide reasonable response times to all user initiated requests. Areas in which reasonable response times are critical factors to the usability of the system include:

- time to navigate to a desired tool
- time to launch a desired tool
- time to move to the next task in a workflow upon completion of the current task
- file or data retrieval time.

Further, the system will not experience significant performance degradation when a reasonable number of simultaneous users are active.

3.4.1 Number of users

EIF must be usable by at least four people simultaneously. The number of users supported will be configurable on a site-to site basis.

3.4.2 Machine load

EIF must consume no more than 10 percent of a machine's RAM while supporting two users.

3.4.3 Workflow refresh time

EIF must be able to update the display of all affected workflows within five seconds of a change occuring in that workflow. Users must be able to select a higher time to trade response time off against machine load.

3.4.4 Application response time

EIF must be able to answer application requests for workflow information within five seconds of the initiation of the request.

3.5 External Interface Requirements

3.5.1 External Interface Requirements Overview

The major interfaces discussed in this section are those between the EIF and the following; the EPDM and the workflow modeling procedural interface between Intergraph and Rockwell. This section captures the rationale for the interface, the operational concept behind the interface, and the information flows that will pass across the interface. Detailed information on the implementation of the interfaces will be captured in the SDS.

3.5.2 User Interfaces

The user interface in the RASSP system will be the EIF; with the workflow manager being the primary tool launch mechanism. Secondary interface screens will be provided by the COTS applications and by custom developed code. The interface screens will provide a graphical user interface, with point and click operations.

3.5.3 External System Interfaces

3.5.3.1 DMM Workflow Generation (EIF)

Within the RASSP program Rockwell will be capturing the workflows using extensions to the Integrated Computer Aided Manufacturing Definition Methodology Number 3 (IDEF-3X). The IDEF-3 methodology was developed under the Information Integration for Concurrent Engineering program under contract to Armstrong Laboratories at Wright Patterson Air Force Base. The "X" in the IDEF-3X name denotes extensions that have added to the base IDEF-3 standard.

Rockwell will be creating the IDEF-3X models using the RASSP methodology documents provided by Martin Marietta. From the IDEF-3X model Rockwell will generate a Process Modeling Language (PML) compliant ASCII text file. This file will be a structured, textual description of the complete IDEF-3X model. Rockwell will provide Intergraph Electronics a PML file and a postscript file of the IDEF-3X model for all of the RASSP workflows. This information required for the PML file will be defined in a following section. Using the Rockwell generated data, Intergraph electronics will generate the DMM workflows for the RASSP project. The methodology and scope for the generation of the DMM workflows from IDEF-3X is described in the following sections.

3.5.3.1.1 Workflow Scope (EIF)

For the first Build of the RASSP program, the hardware design methodology will be modeled. As the latter builds are defined the design scope and tools will be added to the document. The following tools will be utilized for the Build 1 design methodology:

Aspect, Mentor Graphics, LMC, SDRC. Zycad, Teradyne, Quickturn, MCC, TSSI, Synopsys

For Build 1 a process block will either be tied to an individual tool launch or to another workflow. Sub-process control will not be supported in Build 1 but will be supported, where practical, in subsequent Builds.

3.5.3.1.2 IDEF-3X to DMM Conversion (EIF)

From the PML file provided by Rockwell, a temporary DMM workflow will be generated. This temporary DMM workflow will contain all the processes defined in the PML file as well as all the links between pairs of processes. These links will have types/relations (Finish-Start, etc.) as specified in the PML file. The PML files for Build 1 will not contain graphical information. The graphical layout of the processes will be automatically placed following certain predefined rules. For example, the links placed between pairs of processes will be straight lines. A manual operation, using the DMM workflow Builder, will then be needed to reorganize the layour of the temporary DMM workflow to the final state. This will include the spreading and movement of the process blocks, and modification of the links, in order to create an easily readable and usable workflow. The hard copy of the original IDEF-3X workflows will be used as a

reference.

For Build 2 it is anticipated that graphical information for the process blcoks and links will be provided in the PML file. When this information is abailable the process blocks and links will be automatically placed in the proper locations, thus eliminating or reducing the manual cleanup step.

After completion of the DMM Workflow, a DMM verification file will be generated from the completed DMM workflow. This DMM verification file will then be compared with the original Rockwell IDEF-3X PML file, in order to find any discrepancies. If any differences are determined, the DMM workflow will be modified. This verificaiton process will be repeated until no differences are found. The process described in this section is graphically depicted below in figure 3.5.3.1.1.

3.5.3.1.4 IDEF-3X File Requirements

Each workflow Units of Behavior (UOB) will be associated with a single tool or task invocation, or the UOB will have an associated sub-workflow. In order to allow for the successful translation of the PML data into a DMM format, the following rules will be adhered to by Rockwell in the creation of the IDEF-3X models:

- Precedence Only links will not be used. (Rockwell IDEF-3 Extension)
- Optional Object State links will not be used. (Rockwell IDEF-3 Extension)
- Intermediate Precedence will not be used. (Rockwell IDEF-3 Extension)
- Synchronous junctions will not be utilized.

3.5.3.1.5 PML File Requirements

The PML file created by Rockwell will be a complete ASCII description of the IDEF-3X workflows. This file will completely describe all UOBs, Junctions and Links, contained on a workflow. The graphical locations for the UOBs, links and junctions will not be provided for Build 1. For each UOB on the IDEF-3X workflow model, the following information will be required in the Rockwell provided PML file:

Items	Comments
Process Flow UOB Name	
Process Flow UOB Description	
Flow Event Number	A distinct number will be assigned to each UOB.
Process Flow UOB Location	Relative coordinate location information
Each Output will require:	
Destination	The UOB number or Junction number
Status	
Object	
Definition	
Location	Relative coordinate locations for all link vertices
Each Control will require:	
Object	
Definition	
Each Mechanism will require:	
Object	The tool used or user groups to perform the task
Definition	

For each Juntion on the IDEF-3X workflow model, the following information will be required in the Rockwell provided PML file:

Items	Comments
Junction Number	A distinct number will be assigned to each Junction
Junction Location	Relative coordinate location information
Junction Type	The junctions types will be either Or, And, or Xor.
Each Output will require:	
Destination	The UOB number or Junction number
Status	
Object	
Definition	
Location	Relative coordinate locations for all link vertices

3.5.3.2 EIF Interface with EPDM

3.5.3.2.1 Purpose

The EPDM will provide an interface to the EIF. The RASSP user will navigate the various RASSP workflows which will interface with EPDM. EPDM will provide all the functions necessary to access the repository such as; Login to the Signal Process Database, create new nodes, check-out or copy-out to existing nodes, check-in to nodes, modify or delete nodes, access the database using SQL, and other administrative operations. These EPDM functions will be integrated from any RASSP workstation.

3.5.3.2.2 Concept of Operations

The RASSP DMM workflows will be generated and integrated by Intergraph's Electronics Division. The EPDM functions will be integrated within the various RASSP workflows through an API.

As each workflow step is initiated an API will exeute the necessary EPDM functions to support the workflow step. The API may typically access the files necessary for the workflow step by checking them out. After the user has completed the workflow step and indicated completion of that step to the workflow manager, the API would check the ifles back in to the repository manager.

3.5.3.2.3 EIF to EPDM API Requirements

The following functionality will be provided by the API interface to EPDM.

3.5.3.2.3.1 The API will have the capability to check-out a file object. Checking our a gile object will copy the file object from the data repository to the users local working storage. No other users will be able to check-out the file (and thus credit it) until it is check back in.

3.5.3.2.3.2 The API will have the capability to check-in a file object that was previously checked-out. Checking in a file object will move the file object from the local working storage back to the data repository, and make it available for check-out by another user.

3.5.3.2.3.3 The API will have the capability to cancel a check-out. Canceling a check-out will make it available for check-out by another user.

3.5.3.2.3.4 The API will have the capability to update a check-out file object. Updating a file object will copy the file object from the local working storage back to the data repository without releasing the check-out state of the file object.

3.5.3.2.3.5 The API will have the capability to modify an item.

3.5.3.2.3.6 The API will have the capability to delete a file object. Deletion will remove the file object from the data repository.

3.5.3.2.3.7 The API will have the capability to change the state of an item.

3.5.3.2.3.8 The API will have the capability to include an entry in the repository audit trail.

3.5.3.2.3.9 The API will have the capability to copy-out an item from the repository database. A copy-out will create a copy of the data from the repository data and place it in the users local working area. A copy-out will not set the data state to checked-out.

3.6 Physical Characteristics and System Architectural Requirements

This section is limited to the definition of the physical characteristics and system architectural requirements needed to support the RASSP EIF system. This includes the definition of software and hardware that will be needed to support the EIF. The software and hardware requirements are focused principally around the RASSP development center environment.

3.6.1 System Overview

This section is devoted to a discussion of the overall architectural concepts that will be in place for the RASSP system as a whole. The intention is to provide contextual information for the requirements that are focused specifically on the EIF.

3.6.1.1 RASSP Architecture

Figure 3.6.1.1-1 shows the overall configuration of network connected members of the RASSP team. It also indicates where demonstration and integration centers exist. The demonstration center at TRW will be active only for the first of four scheduled system deliveries of the enterprise system. The demonstration center at Martin Marietta will be active for all four system deliveries.

The integration center in Huntsville exist to integrate the software builds for the enterprise team. It exists to provide the integrated test facility for the enterprise team. Software from enterprise team members will be installed and tested using the facilities in Huntsville. Once testing is completed, a software build will be generated and installed at the demonstration center(S).

In order to facilitate the development and testing activities, the integration facility will be interactively accessible by the RASSP enterprise team members. Interactive access will also be available between the demonstration centers and the integration center. The commercial Internet will be used as the communications network. TCP/IP will be used as the predominant communications protocol. EInet services will also be used over the network to provide RASSP specific directory services, remote tool launch capabilities, and other RASSP specific services.

3.6.1.2 Hardware Configuration

Figure 3.6.1.2-1 shows the expected hardware configuration for the RASSP project. This is the expected initial configuration for the RASSP development center. The environment is expected to have two server systems, one running Solaris and one running SunOS. Each of the server systems will be multi-processor SUn systems, with extensive memory and disk resources. Approximately 10 client workstations will each be a SparcStation 10, mode 51 or greater. The basic configuration is expected to be 1.0 GB disk and 64 MB RAM, with 19" color monitors. The systems will be connected together with a 10 Mb per second ethernet. The ethernet segment is expected to be connected to the external world via a router that controls access into the subnet. Printing capabilities will exist from the server systems, and also will be located with the

workstations. The EIF database will reside on one of the SUN 4.1.3 server systems. The software associated with EIF (DMM and EDM) will reside on both server and client systems.

3.6.2 System Requirements

This section is devoted to capturing the requirements that describe the environment that the EIF will work within. The requirements captured will take two forms, requirements that the environment is levying on the EIF, and requirements that the EIF is levying on the environment.

3.6.2.1 General Requirements (EIF)

3.6.2.1.1 The EIF functionality will be accessible from Sun workstations using SunOS.

3.6.2.2 Communications Requirements (EIF)

3.6.2.2.1 The EIF will use TCP/IP as the base protocol for network based comunications.

3.6.2.2.2 The RASSP internal network will have sufficient bandwidth to support tool uploads and downloads.

3.6.2.2.3 The RASSP system will support X-windows client access capabilities.

3.6.2.2.4 Thick wire or thin wire Ethernet will be the network cabling standard for systems connected in the RASSP design center.

3.6.2.3 Server System Requirements (EIF)

3.6.2.3.1 The server will provide a minimum of 250 MB of disk storage for the use of the EIF database.

3.6.2.3.2 The server will have a minimum of 32 MB of RAM.

3.6.2.3.3 The server systems will suport SunOS.

3.6.2.3.4 The EIF server will provide support for not less than 5 simultaneous users.

3.6.2.4 Client System Requirements (EIF)

3.6.2.4.1 The client workstation will provide a minimum of 10 MB of disk storage for the use of the EIF software components.

3.6.2.4.2 The client workstation will have a minimum of 32 MB of RAM.

3.7 System Operations Quality Factors

No specific operational quality goals have been specified for the RASSP demonstration center, such as reliability, maintainability, availability, efficiency, correctness, etc. Individual hardware and software product components will perform in accordance with parameters defined in Intergraph and other vendor product specifications.

3.8 Environmental Requirements

The physical environment for both the RASSP integration and demonstration centers is not expected to produce temperature, atmospheric, or any other physical conditions that lie outside the normal operational ranges of the computer and communications equipment to be used in these centers.

3.9 Shipping/Transportability Requirements

There are no special requirements for shipping or transport. The normal handling procedures and delivery vehicles utilized by Intergraph's Systems Support group should suffice for transporting and installing the equipment to be used in the RASSP integration and installation centers.

3.10 Flexibility and Expandability Requirements

RASSP is a pilot and proof of concept that provides for a demonstration capability but does not specify production system requirements. There will be no controls designed into the system that will limit the number of concurrent users. The planned architecture provides the expandability to meet all forseen growth in the use of the RASSP demonstration center.

3.11 Security Requirements

There are no unusual security requirements above and beyond normal security provided by the UNIX operating system and COTS applications.

3.12 Design and Construction Requirements

The Enterprise Framework has no requirements for custom firmware, hardware, or systems software.

3.13 Logistical and Maintenance Requirements

Standard practices for maintaining computer and communications equipment will be employed for equipment within the RASSP Integration and Demonstration Centers. Such practices will be in conformance with vendor prescribed maintenance activities and schedules.

3.14 Personnel and Training Requirements

In the RASSP EIF environment there will be general users and administrators. The administrator will be responsible for workflow maintenance, system configuration, project

definitions, and any forced workflow transitions. The administrator will be required to be proficient in the use of EDM and DMM. The training for these products are available throught the Intergraph Training Center. This training should be taken by the administrator. The administrator should also understand the tools that have been integrated, if modifications are required to the workflow.

The general RASSP users are assumed to have a general familiarity with computers. There are typical interface to the RASSP environment will be the workflow displayer, they will determine what task is to be initiated next, and launch applications on their systems to do the task. Specific product training on this functionality will not be required. the user will be able to learn how to utiliize the product from the standard product documentation. Support on specific usage issues will be provided on these tools as part of the demonstration site implementation support.

3.15 Requirements Precedence

This section will list the requirement numbers that will be associated with the first build of the EIF system. As subsequent builds are better defined the requirement numbers for builds will be defined.

4 Project Quality Assurance and Configuration Management

A high level of software maintainability and expandability will be achieved through adherence to sound systems and software engineering practices as prescribed by the Systems and Software Engineering Process, which is the life cycle development methodology used by Intergraph's Systems Integration group. The SSEP calls for a high level of peer review of the products and by products of all phases ofthe system life cycle. For example, peer code inspections are extensively held during the coding phase of development. During peer detailed design and code reviews, the emergin software architecture will be analyzed for long term maintainability and expandability, and for compliance with design, structured programming, and documentation standards.

Intergraph's Independent Test Group (ITG) will be utilized during all development phases. ITG provides verification and validation services for developed applications software, and also ensures that requirements and design specifications meet quality standards. The utilization of ITG throughout all phases of the development life cycle is a proven method for deliberately engineering a high level of systems operational quality.

4.1 Quality and Change Control

The primary mechanism for ensuring quality on the RASSP project will be the employment of an independent quality assurance and test team. This team will be responsible for quality auditing the products generated as part of the RASSP project. Their efforts will be limited, however, to those items that are RASSP deliverables. The Electronics division will use internal quality assurance provisions for all enhancements made to commercial products as part of the RASSP project.

4.2 Project Quality Control Reviews

Quality Reviews will be employed at each phase of the project life cycle, and for each deliverable that is generated. The quality team takes part in each of the design reviews. They will provide an independent assessment of the quality of the design, and of the quality of the design documentation. Quality reviews of the test plans at each design phase will also be mandatory. These reviews will ensure completeness and accuracy of the test procedures. Quality reviews will also be conducted on each deliverable report. The results of the quality reviews will be incorporated prior to moving to the next step in the process.

Standard life-cycle phase technical reviews will be held for all Intergraph developed Software Configuration Items. the reviews by life cycle phase are listed below.

Phase	**Review**
Define	System Requirements Review
Design:System	Preliminary Design Review
Design:Software/Data Base	Critical Design review
Code & Unit Test	Peer Code Reviews
Integration & System Level Testing	System Verification Test

Program source code listings generated during this phase will be subjected to extensive internal reviews by peers of the code developers. As industry experience has shown that peer reviews are the single most effective development practice for redcing software defects, we will emply this practice during all life-cycle phases -- not simply during code and unit test. We will look to this practice as our primary quality control technique.

4.2.1 Quality Reports

The results of all quality reviews will be made available to the Project Manager within one week of the conclusion of the review. The quality team will be responsible for generating a summary of each item reviewed. This summary should highlight the strengths and weaknesses of the product reviewed. The purpose of the summary is to provide feedback to the project team members concerning the quality of their efforts, emphasizing both strengths and weaknesses. The results of the quality review will be used to correct any errors in the current product, and to enhance the product generation process to prevent repetition of the errors.

4.2.2 Change Control System

The Electronics portion of the RASSP project will emply existing configuration control procedures of the Intergraph Electronics division throughout its life cycle. To assist in the overall RASSP project, the configuration control system will be relied upon for the following services:

- Set up and control of the Project File and the Project Library
- Tracking of discrepancies and request for changes
- Control of changes to baselined system components
- Baselining, and control of baselined customer documentation
- Maintenance of reference versions of the RASSP software builds

The project manager also relies on configuration management processes for the generation of weekly status reports of configuration management controlled activities. These reports summarize software component check outs and check in activity, activity on the project file.

4.2.3 Change Review Meetings

All changes to the Intergraph Electronics baselined RASSP software will be reviewed and approved by the Configuration Change Board. The board meets at the request of the project manager. Technical personnel are responsible for the presentation of change requests at the CCB. The board decides the implementation of the requests. For those change requests with cost or scedule impacts, the Intergraph project manager advises the Martin Marietta Project Manager accordingly.

4.2.4 Variances and Requests For Change Processing

The primary tool for managing variance and change requests will be the Change Request System (CRS) (for documenting and processing deficiencies reported with software, design documentation, etc.). The CRS is an on-line electronic database which is used for the recording and tracking of all change requests and problem reports. All CRS logs are reviewed and evaluated by the appropriate CCB. The CCB will determine if a change is required to the baseline code. The project manager will be responsible for ensuring that the change requests are assembled in a timely fashion. The project manager will work with CM to establish a Configuration Change Board review date for the change request. Existing CM procedures will be employed for all variance reports and request for change. No changes will be made to baselined products except through the appropriate CM procedures. CM will be responsible for the logging and tracking of all change requests.

5 Project Deliverables

5.1 Hardware

There are no explicit hardware deliverables for RASSP. All hardware that Intergraph provides as part of the RASSP effort will be owned by Intergraph and loaned to the RASSP partners. Loaned hardware will be provided only as needed to support functionality that Intergraph is committed to deliver. In addition, Intergraph expects to field a reduced capability copy of the RASSP Design Center configuration in Huntsville for use as an enterprise integration and test site.

5.2 Software

The majority of Intergraph's deliverables under the RASSP program are either standard or custom software products. The expected list of deliverable standard products is captured is section 5.2.1 and 5.2.3, with a description of the custom products being captured in section 5.2.2. Licenses for Intergraph and third party products will be loaned to the RASSP program, but will remain the property of Intergraph.

5.2.1 Intergraph Standard Products

Product Category	Product	Host System	MMC	INGR	TRW	Total Seats
Workflow Manager	DMM	Sun Server	1	1	1	3
Enterprise Desktop Manager	EDM	Sun Server	1	1	1	3

5.2.2 Intergraph Custom Products

The custom products to be provided as part of the Enterprise Framework consist basically of configuring and extending the functionality of the COTS products to meet the requirements for the Enterprise Framework system specified in preceding sections. One extension of the base DMM functionality will be the creaion of the software routine to convert PML data files to DMM workflows. The nature and scoper of the custom products will be better defined during the system design process.

5.2.3 Third Party Products

Not applicable.

5.3 Training

5.3.1 Standard Products

Training on the use of DMM and EDM was provided in March to the Enterprise team. One additional training class will be provided to the vendors which will be integrating into the EIF.

5.3.2 Custom Products

Not applicable.

5.3.3 Third Party products

Not applicable.

5.4 Documentation

5.4.1 System Development Documentation

The following development documents are deliverables under the EIF development effort; Desktop Graphical User Interface Cocepts, Enterprise Integration procedures, EIF System Design Specification, and Enterprise Integration Specification.

5.4.2 Customer/Operations Documentation

Not applicable.

5.4.3 Optional Documentation

5.4.3.1 Programmer's Reference Guide

Not applicable.

5.4.3.2 User's Guide

Not applicable.

5.4.3.3 System Administrator's Guide

Not applicable.

5.4.3.4 Training Manuals

Not applicable.

5.4.3.5 Commercial Product Documentation

Standard commercial product documentation will be available for the commercial products involved in the EIF. The documentation will belong to Intergraph and will be loaned to the RASSP partners along with the commercial products.