RASSP ENTERPRISE FRAMEWORK APPROACH

FOR WORKFLOW DEVELOPMENT

FOREWORD

This report has been prepared to describe the approach to be taken in development of the Rapid prototyping of Application-Specific Signal Processors (RASSP) workflows. This report was prepared by the Rockwell Aerospace North American Aircraft Division (NAAD) Advanced Information Engineering (AIE) organization under Subcontract No. P.O. TTM 748357 to Martin Marietta and fulfills the requirements of Work Breakdown Structure element number 1.3.1.3.11.1, entitled Workflow Approach and Partitioning.

1 Introduction

Martin Marietta is developing an enterprise information management infrastructure for its Rapid prototyping of Application-Specific Signal Processors (RASSP) Project. Experience at Rockwell NAAD has determined the complexity of enterprise projects requires models and tools for the understanding of existing processes, the development of improved processes, and the identification and documentation of information required for these new improved processes. These processes and information are key componenets in an enterprise information management infrastructure. Martin Marietta has contracted Rockwell NAAD support in the use of a structured methodology for the development of workflow models, information models, information models, and a RASSP model repository. This report describes the workflow development approach.

1.1 Model Development Approach

The modle development approach starts with the creation of the RASSP Methodology Documentation by Martin Marietta (see Figure 1-1). These documents define the processes that a user follows to more rapidly define and implement digital signal processors. Once released, the RASSP Methodology Documents are delivered to Rockwell. The documentation is analyzed to identify activities in the process along with the activities' associated product data. This information is used to develop a time-phased workflow in an extended version of the Integrated Computer Aided Manufacturing DEFinition (IDEF) Number 3 language. The workflow models are then stored in a repository for configuration management purposes. Reports can be generated from the repository for implementing the workflows in Intergraph's Design Methodology Manager workflow tool.

In addition to identifying the activity precedence for a process, the IDEF-3 workflows are also used to identify the product data that will be used to create the information models for RASSP. The information models will describe the meta data about the objects to be configuration managed withing the RASSP program. Following its creation, the information model is stored in the repository for configuraiton management. A relational model is then provided to Intergraph for development of the data

structure to be used in Intergraph's Network File Manager (I/NFM).?

The following three sections of this report go into more detail on the three areas mentioned above: Workflow Modeling, Information Modeling, and Model Repository.

Figure 1-1. Workflow / Information Model / Model Repository Interaction

2 Workflow Defintion Approach

2.1 Workflow Modeling

Workflow modeling in context of the RASSP program is a powerful method for managing the changes needed to improve the process by which complex digital signal processors are specified, designed, documented, manufactured, and supported. From this perspective, the RASSP Workflow models are the starting point for creating the RASSP Enterprise Framework, for the workflows are used to capture the process activities performed within the enterprise.

A workflow model graphically depicts the time-phased actions and object state changes that are performed by a person, object, or system component in performance of a given scenario and serves as the foundation for defining data configuration management and process control requirements. These modles capture the state names, access rules, reviewers and approvers, notifications, and creation and/or receiving organizations for each element of a workflow.

In its most basic sense, a workflow is composed of six basic elements: 1) Units of Behavior, 2) Notifications, 3) State Depictions, 4) Desicion Points, 5) Control Constraints, and 6) Mechanism Identifiers.

1. Unit of Behavior is defined as an individual operation, action, or transformation that occurs over time and produces recognizable results. It is the precedence arrangement of two or more Units of Behavior that defines the core structure of the Workflow.
2. Notificaitons depict what kind of, and to whom, inter- and intra-workflow communications are made.
3. State Depictions denote the object life cycle states associated with the Unit of Behavior inputs, outputs, controls, and mechanisms. The Unit of Behavior's inputs and outputs are the essential components in the workflow for they determine the data requirements for the enterprise.
4. Decision Points identify an approve or reject determination associated with a Unit of Behavior's output flow.
5. Control Constraints indicate the requirements that must be satisfied before the Unit of Behavior is completed.
6. Mechanism Identifiers show the people and or equipment that are utilized in the performance of the particular Workflow Unit of Behavior.

Once the workflow's inputs, outputs, controls, mechanisms, and notifications are identified, they may be considered as data objects. These objects are then modeled from a data perspective in an information model.

2.2 Purpose

A workflow model serves several purposes.

1. It is useful for specifying requirements because it defines, or reflects, a particular application or user point of view. For example, a model can define a design process from the user's perspective (what the system will do), the designer's perspective (how the system will be built), and the operator's

perspective (how the system will be maintained).

2. It facilitates the discovery and validation of data within an organization. For example, a model shows the relationship between an activity and the ICOMs (input, control, output, mechanism) that are used to perform the activity.
3. It provides a useful baseline for other types of analysis. A workflow model can be used to examine product quality, production costs, or scheduling requirements.
4. It is a vehicle for facilitating effective communication between systems professionals and end users about a business area.

2.3 Workflow Creation and Validation

2.3.1 Methodology Documentation

The RASSP Methodolgy Documentation will serve as the foundation for creating the RASSP Methodology Workflows. This documentation, which is an extension of the Martin Marietta EPI process definition, specifies the RASSP-specific scenarios for which individual workflows will be created. Examples of the RASSP-specific scenarios defined in the RASSP Methodology Documentation include Subsystem Design, Module Design, ASIC Design, and Backplane Design.

2.3.2 IDEF Methodology

The techniques applied to Workflow modeling will be based on the Integrated Computer Aided Manufacturing DEFinition language (IDEF). Specifically, an extended version of the IDEF-3 language will be used. The extensions are required to ensure the complete capture of the process requirements for populating the knowledgebase in Intergraph's Design Methodology Manager (DMM), as well as the data requirements needed to facilitate the development of the RASSP Enterprise Data Model (REDM) and the RASSP physical data bases.

2.3.3 Workflow Tool

The workflows will be constructed using TopDown Flowcharter from Kaetron Software. This Macintosh and Microsoft Windows-based tool will be used because it supports both the graphical as well as textual (computer readable export file) description of a workflow.

2.3.4 Workflow Construction

The construction of the RASSP Workflow Models will be a relatively straight-forward endeavor. Each model will be developed by following a structured approach The first step will be to define the scenario that each model is to represent. As stated above, the RASSP Methodology Documentation will be used as the intial source for defining the needed scenarios. The RASSP Methodology Documentation will be analyzed to properly scope the RASSP Workflow scenarios.

2.3.5 Activity Identification

Once each scenario is scoped, the next step will be to identify the appropriate set of activities or Units of Behavior involved in the performance of each specific scenario. The scenario required Units of Behavior will then be arranged in the phased sequence that they occur. From the Workflow Model diagramming perspective, the Units of Behavior will be depicted as boxes (see Figure 2-1).

2.3.6 Unit of Behavior Input and Output Objects

With the boxes arranged in proper sequence, th input and output objects with their proper life cycle state will be added. As shown in Figure 2-1, the input and output objects are represented as arrowheaded lines attached to the Unit of Behavior boxes. All Inputs will be shown entering from the left and all Outputs will

be shown exiting from the right side of a Unit of Behavior box. This has the effect of linking the sequenced Units of Behavior together. Both the Input, Control, Output, and Mechanism arrows will be labeled with the life cycle state and base name of the represented object. The state name is seperated from the base name by the use of an asterik, "*". For example, with the labels of "Released*Drawing" or "First Draft*Trade Study", the state names are "Released" and "First Draft" while the base names are "Drawing" and "Trade Study". The life cycle state and base name provide the basis for the creation fo the enterprise information model.

2.3.7 Workflow Decision Points

After linking the Units of Behavior via object flows, the RASSP Methodology Documentation will be further analyzed to determine where decision points occur in the life cycle of an object's flow. These points will then be designated on the workflow using the decision point symbology of small boxes with either an "&", "O", or "X" inside the box. The "&" means "AND" and the "O"and "X" represent "OR" type decision flow paths.

2.3.8 Unit of Behavior Controls and Mechanisms

The next step in building a workflow model will be to identify and determine each Unit of Behavior's sequence dependent Contols and Mechanisms. Like Inputs and Outputs, the Controls and Mechanisms will be represented by label arrows attached to the Unit of Behavior box. Controls will enter at the top and Mechanisms will be shown entering the bottom of the Unit of Behavior box.

2.3.9 Workflow Notifications

The final step will be to capture the Notification that occur when an object undergoes a Unit of Behavior state transformation. Each Notification or message will be depicted like an Output arrow except it will be labeled with the Notification text. The organizations and/or individuals receiving the Notifications will be defined by enclosing their names within a circle attached to the end of the Notification arrow.

Once the initial workflow model has been created from the RASSP Methodology Documentation, a detail walkthrough of the model will be performed with the RASSP Methodology source experts. The model walkthrough will be required to validate that the RASSP Enterprise Framework Team Members correctly interpreted the concepts and ideas described within the RASSP Methodology Documentation. Any discrepanccies identified will be corrected before the workflow model is released. Specifically, the walkthrough will verify that the workflow has captured the necessary data to the required level of detail. This includes the identification of which tool(s) are required for the execution of a given activity.

Figure 2-1. Workflow Nomenclature

2.4 Workflow Archive Management

Upon workflow release, an ASCII file of the workflow will be generated. This file, which will be created as an export from the TopDown Flowcharter modeling tool, will be parsed to a format as specified by the RASSP Process Modeling Language (PML) Specification. The RASSP PML Specification will define a textual format that captures the complete semantics of a workflow and is being defined as part of the RASSP Enterprise Model Repository (REMR) development effort.?

The generation of a parsable export file is required to enable the loading of the RASSP workflows into the REMR. The REMR will serve as the official repository for all released workflows. In this role, the REMR will be used to store and provide configuration control for various versions of the RASSP workflows that

are to be created during Builds 0, 1, 2, and 3.

2.5 Workflow Enterprise Framework Implementation

The implemenation of the RASSP workflows will be accomplished by Intergraph's Design Methodology Manager (DMM), which is a component of the RASSP Enterprise Framework. The population of the DMM knoledgebase with the RASSP workflows will be performed by extracting the appropriate DMM required information from the RASSP Enterprise Model Repository. This will be achieved by utilizing the REMR's reporting and exporting capabilities. The repository export/report file will be in a comma seperated value (CSV) format and content of the information found within the CSV file will be determined as part of the RASSP DMM development effort.

2.6 Workflow Issue Management and Configuration Control

The tracking of issues and the change control of the RASSP workflows will be acccomplished through the use of a Configuration Control Board (CCB). A request for a change to a workflow shall be submitted as an issue to CCB for review of the change. If approved, the change to the workflow shall be accomplished by an authorized system administrator. When an approved change to a workflow occurs that has been implemented within DMM, the change must be forwarded to Rockwell's REMR system administrator and to Intergraph's DMM system administrator for update of the master files.

2.7 Workflow Definition Approach Summary

Figure 2-2 summarizes the Workflow Defintion Approach to be applied during Builds 0, 1, 2, and 3 of the RASSP Program. The six steps depicted represent the development phases of the Workflow Definition Approach as applied to the creation of new RASSP workflows. Figure 2-3 summarizes the Workflow Defintion Approach as it applies to the issue resolution and mosification of existing (already implemented) RASSP Workflows.

Figure 2-2. Workflow Design Process

Figure 2-3. Workflow Configuration Control Process

2.8 Deliverables

Build 0 - All deliverables are TBD until the RASSP Methodology Documentation Release scedule is available.

Build 1 - All deliverables are TBD Until the RASSP Methodology Documentation Release scedule is available.

Build 2- All deliverables are TBD Until the RASSP Methodology Documentation Release scedule is available.

Build 3- All deliverables are TBD Until the RASSP Methodology Documentation Release scedule is available.

Acronym List

AIE - Advanced Information Engineering
AIM - Application Interpreted Model
AML - Activity Modeling Language
AP - Application Protocol
ARM - Application Reference Model
ASIC - Application-specific Integrated Circuit
BLOB - Binary Large Object
BNF - Backus Naur Form
CALS - Continrous Acquisition and Life-cycle Support
CCB - Configuration Control Board
CSA - Computer System Arcchitecture
CSV - Comma Seperated Value
DBMS - Data Base Management System
DMM - Design Methodology Manager
EPDM - Engineering Product Data Management
EPI - Engineering Process Improvement
ICAM - Integrated Computer Aided Manufacturing
ICOM - Input, Control, Output, and Mechanism
IDEF - ICAM DEFinition
IDL - Interface Definition Language
IDS - Integrated Design Support
I/NFM - Intergraph/Network File Manager
IRCS - Integrated Resource Control System
ISO - International Standards Organization
NAAD - North American Aircraft Division
P.D.I.T. - Product Data Integration Technologies
PDCM - Product Data Control Manager
PDES - Product Data Exchange using STEP
PML - Process Modeling Language
RASSP - Rapid prototyping of Application-Specific Signal Processors
REDM - RASSP Enterprise Data Model
REMR - RASSP Enterprise Model Repository
SML - Semantic Modeling Language
STEP - Standard for the Exchange of Product Model Data
USAF - United States Air Force
UoB - Unit of Behavior