Chapter

1

Getting Started

Chapter 1

This chapter describes the procedure and files you will need to configure RDD-100 for Integrated Systems Engineering (ISE) operations.

RDD- 100 ISE FILES

The following is a list of files you will need to configure RDD-100 for use with the ISE process:

Schema

ISE.sct

Consistency Checks

Cost_RAM_FMEA.cct

Task Visibility

ISEvis.tbv

MEV Templates

CompHier_Cost_RMA_Life.tpt

DupCompAndTgts.tpt

Utility and Export Reports

Add_Cost_RMA.rpt

Calc_Total_Sys_Qty.rpt

Delete_Cost_RMA.rpt

Export_to_Cost.rpt

Export_to_JRS.rpt

Export_to_RAM_ILS.rpt

Print_3_Elements_4_1.rpt (for use with RDD-100 R4.1 only)

Print_3_Elements.rpt

Print_Dup_Tgts_4_1.rpt (for use with RDD-100 R4.1 only)

Print_Dup_Tgts.rpt

Reconcile_Dup.rpt

Set_Dup_Attribute.rpt

Set_MainCncptReq_nil.rpt

Mil Std Report (DGR)

DGR-Reports.rpt

DGR-Reports_4_1.rpt (for use with RDD-100 R4.1 only)

Category and Report Document and Section Elements

DGR490-B1Categories.rdt

DGR490-B1Doc.rdt

DGR490-B2Categories.rdt

DGR490-B2Doc.rdt

DGR490-IRSCategories.rdt

DGR490-IRSDoc.rdt

DGR490-SRSCategories.rdt

DGR490-SRSDoc.rdt

DGR490-SSDDCategories.rdt

DGR490-SSDDDoc.rdt

DGR490-SSS-ASpecDoc.rdt

DGR490-SSSCategories.rdt

DGR498-IRSCategories.rdt

DGR498-IRSDoc.rdt

DGR498-SRSCategories.rdt

DGR498-SRSDoc.rdt

DGR498-SSDDCategories.rdt

DGR498-SSDDDoc.rdt

DGR498-SSSCategories.rdt

DGR498-SSSDoc.rdt

RDD-100 SETUP

Starting with the delivered RDD-100 blank image:

1. Import the ISE schema file (`ISE.sct`).
   Click **Main Menu>Special>import user extensions**.
   After import is completed, **deactivate extender**.
2. Import the consistency checks file (`Cost_RAM_FMEA.cct`).
3. Import the task visibility file (`ISEvis.tbv`).
4. In the Main Menu, under Session, set the visibility to ISE Full.
5. Import the MEV templates (`---.tpt` files).
6. Optional: Import utility and export reports and/or DGR reports, categories and documents. This depends on whether or not you are using the MilStd reports and whether or not you want to have reports run as internal versus external reports.
7. Save the image with a new name for use as the ISE master copy.
8. You may now add any other extensions or start to populate the database.

PRICE and Reality

Minimum requirements for automated ISE costing and RAM-ILS are:

- Lockheed Martin PRICE E with an import and export template (`---.cde` files).
- Management Sciences, Inc., Integrated RAM-ILS Toolset 4.1, which requires a Mentor Graphics license.

Do

Chapter

2

Integrated Systems Engineering

Chapter

2

Integrated Systems Engineering

This chapter describes how to use RDD-100® with the MSI and Lockheed-Martin PRICE toolsets for systems engineering.

INTEGRATED SYSTEMS ENGINEERING (ISE)

Introduction

Costing

The PRICE toolset will generate and back-populate a system's development, production, support, amortized unit production, and unit production costs based on the component architecture and data modeled in RDD-100.

Part of the systems engineering design process using RDD-100 is the creation of the physical system architecture, which is embodied in the generation of *Component* elements and establishing the **built from** relations between these *Components*. PRICE uses this component hierarchy to generate an Equipment Breakdown Structure (EBS) within the PRICE toolset. In addition, it uses the attribute data from the bottom-most *components* (leaf level) as its primary data for conversion to PRICE internal variables.

Converting RDD-100 data to PRICE internal variables is done through the use of software using PRICE Import and Report Language (PIRL) code. This software is part of PRICE E and is contained in files with a `.cde` suffix. Two files are required: one controls the RDD-100 to PRICE conversion, and the other converts PRICE output to RDD-100 format. The PRICE files baselined on the RASSP program are `rddtest.cde` (RDD-100 to PRICE) and `rddexp.cde` (PRICE to RDD-100).

There are many more variables that may be directly entered into PRICE than are available from RDD-100. Therefore, several algorithms have been employed to interpret data, perform curve fitting and determine percentages. These have been slightly biased to the design of signal processors, but have been found to be applicable to general electronics design. The PIRL code and RDD-100 attributes can be tailored to most industries. Consulting support from both Ascent Logic and Lockheed Martin PRICE is recommended for this activity.

Two additional files are required for the RDD-100/PRICE integration; these are the Cost Analyst File and Synchronization file (CAfile, Syncfile). The CAfile is used to supply data required by the PRICE toolset that is neither supplied by the RDD-100 data nor can be derived from it. This file also supplies default data for variables that may be derived from RDD-100 data. This data is supplied by the PRICE user and contains financial and company-specific data. The Syncfile is used to override, on a component-by-component basis, variables that would have been generated by the PIRL code. This allows fine tuning of the costing operations. In addition, the Syncfile contains Locking masks, which are used in conjunction with Syncfile data to determine which variables to override.

In general the data used by PRICE is generated as follows:

CAfile—>RDD-100 interpreted data—>Syncfile—>by Lock Name—>PRICE Models

RAM-ILS

The MSI Reality toolset is used to perform MTBF, MTTR, Reliability/Availability assessments, MTBCF partitioning, Reliability/Availability sensitivity analysis, Failure Modes and Effects/Failure Mode and Effects Criticality Analysis (FMEA/FMECA) and Derating assessments.

The primary source of RDD-100 data is the leaf-level components of the component architecture. The Reality toolset may be used to determine the initial MTBF budgeting, periodically assess MTB(C)F partitioning against budgeted values and reliability/availability requirements, make redundancy recommendations where current values exceed budgeted or required values, assess MTTR and availability budgets and requirements, aid in the FME(C)A, and perform derating analysis on detailed design data.

Reality uses data from RDD-100, its internal database, CAD data (in conjunction with stored handbooks), and Reality user-generated block diagrams (for more accurate redundancy depiction). In general, the data used by MSI is as follows:

MSI BDE diagram—>MSI catalog data—>CAD data/Handbook data —>RDD-100 data

There are four basic operations using the Reality toolset:

- Assessment [MTB(C)F, MTTR and Reliability/Availability].
- Sensitivity Analysis [Reliability/Availability optimization, Reliability/Availability redundancy recommendation].
- FME(C)A.
- Derating analysis.

The assessment operations are performed together to ensure that the interrelated output data is based on the same input data.

Engineering Process

The following operations may be performed at any point in the systems engineering design process using the current leaf-level components. The principal benefit is to aid in the synthesis of transforming a functional design to a physical design of software, hardware and human actions, represented in RDD-100 as components. This is also

known as the system level partitioning process. These operations give the user visibility on the impact of direct and lifecycle cost values of different partitioning schemes early in the design process, where 80 to 90 percent of project costs are committed.

Typically, after a component architecture is generated and the component's attributes are populated, a costing operation is performed. This operation uses default values for the RAM-ILS attributes, unless budgeted numbers have been entered. This is generally a good starting point, since RAM-ILS optimization (sensitivity analysis) is dependent on cost.

➤ **Note:** This assumes the PRICE tool has been calibrated to your organization and project.

Next, the initial run on MSI's Reality can be made to generate MTBF values for budgeting. These values are populated in the Optimized MTBF attributes and are the result of a Reliability/Availability sensitivity operation. The RDD-100 user may accept all or some of these values by making the appropriate entries into the budgeted attributes. This assumes that the budgeted values of MTBF are not populated and that there is data available in the MSI catalog or similar to designs in the CAD database.

The initial MSI run is also the time for the user to make a first cut on MTTR values. This includes the RDD-100 hidden values for MTTR at Org, IL and Depot as well as visible line level MTTR. Use of these values will replace the default PRICE values for costing.

A costing operation should always be performed after running MSI when values have changed. This will ensure that cost values are based on the currently populated RAM-ILS predicted values.

As design progresses and more data becomes available to the MSI tool, MTBF, MTBCF, MTTR, and R/A assessments should be periodically made and costing updated.

Sensitivity analysis may be done at any time and compared with current design, giving the user early warning of potential tight tolerance constraints in RAM values.

FME(C)A analysis may be accomplished at any point in the design process where ItemLinks exist and the **executed on** relation has been established between software and hardware components.

Derating analysis may also be done at any time detailed design information is available from the CAD databases.

Component Architecture

A closed modeling space is used in generating the Component architecture in RDD-100. That is, a top level *Component* is created that contains the system under design as well as all systems and environments that affect the operation of the system under design.

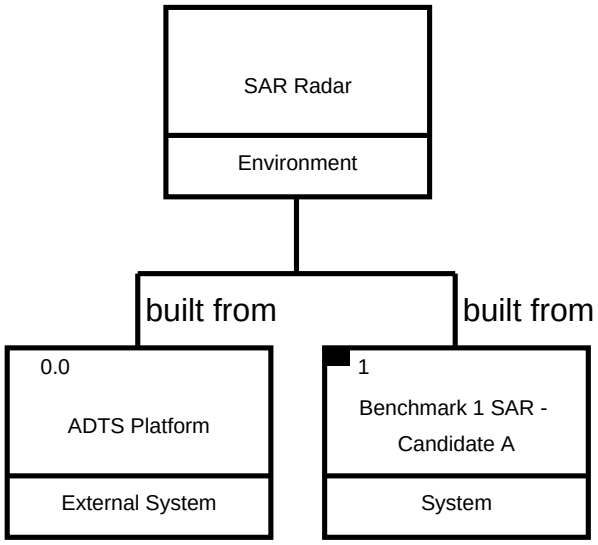

Figure 2-1 Component Architecture model (Component Hierarchy)

The type of *Component* is determined by the user-selected value of the attribute Component Type. To perform Integrated Systems Engineering (ISE) a *Component* must be related to *Cost* and *RMA* elements and the *Component*, with the Component Type set to System, must also have a relation to a *LifeCycleParameter* element. A utility report

is provided to facilitate creation of these relations and elements. *Components* with Component Type set to Environment, External System, Task or Human do not require these relations.

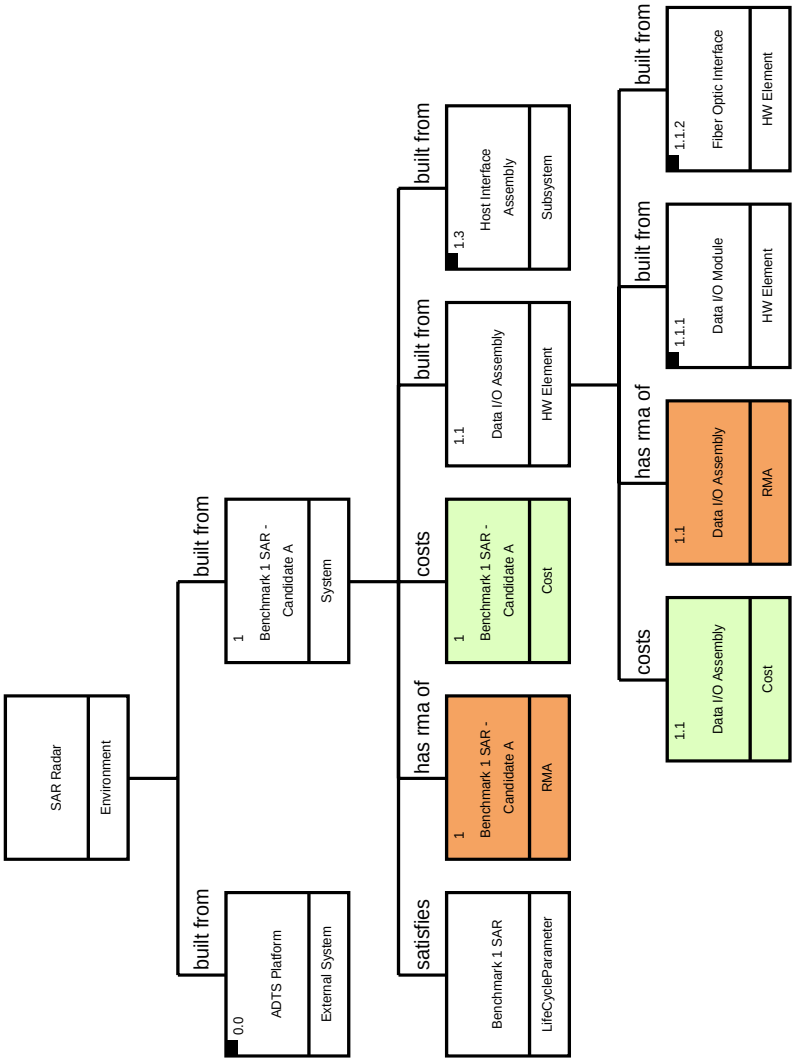

Figure 2-2 Component Architecture with Cost, RMA and LifeCycleParameter elements

The Integrated Systems Tools (IST) assumes a system design. Therefore, when running an export report template, the starting component must have a related *LifeCycleParameter* element.

In summary, a top level *Component*, a *Component* with Component Type set to System, and a *LifeCycleParameter* element are to be included in the Component Hierarchy. Each *Component* starting with the component of type System must have a related *Cost* and *RMA* element, and finally, an *ExternalToolFiles* element must be included in the RDD-100 database.

Populating the RDD-100 Elements for ISE

The following tables list the minimum elements, attributes and relations the user must create to perform the ISE functions.

The first column of the table is the element's attribute or relation name.

The second column indicates whether an entry is required (bolded) and includes explanatory information about the attribute and how each tool uses the information.

The last column lists the type of operations the attribute is used for: Cost (all costs), Development, Production, etc.; Assessment, including MTBF, MTBCF, MTTR, and R/A; Sensitivity, including MTBF optimization and Redundancy recommendations; FME(C)A, and Derating. In addition, if the attribute can be supplied by one of the integrated tools, the tool name is listed in the last column.

ExternalToolFiles

This element has two purposes. First, it is the means for the RDD-100 user to select the PRICE set of files to be used for the cost run, and second, PRICE back-populates the actual files used. The files named by RDD-100 may be overridden by the PRICE user.

MSI back-populates the directory pathname containing lists of files for catalogs and CAD data.

There must be at least one instance of this element in the RDD-100 database for ISE operations to be performed.

ExternalToolFiles

Cost Analyst File Requested	Enter the pathname where this file can be located. PRICE: Optional. When supplied, a manual entry is not required for input to PRICE.	Cost

ExternalToolFiles

Cost Analyst File Used	PRICE populates the pathname of actual file used.	PRICE
Sync. File Requested	Enter the pathname where this file can be located. PRICE: Optional. When supplied, a manual entry is not required for input to PRICE.	Cost
Sync. File Used	PRICE populates the pathname of actual file used.	PRICE
Lock Name Requested	Enter mask name. PRICE: Optional. Lock names are created by the PRICE user in the Sync file.	Cost
Lock Name Used	PRICE populates the mask name used. "Default" is used when the PRICE user has not input a name in the Sync file.	PRICE
RAM_ILS Directory Used	MSI populates the directory pathname used. The directory is determined by the location of the exported RDD-100 file.	MSI

LifeCycleParameter

This element must be related by the **satisfied by** relation to the *Component* with the Component Type attribute set to System. The attributes in this element apply to the entire system under design.

There must be at least one instance of this element in the RDD-100 database for ISE operations to be performed.

LifeCycleParameter

Operating Environment	**Select** a value. PRICE: **Required**. Used to establish specification and testing level, operating environment and reliability requirements of the system. Value range 8 to 2.5 MSI: **Required.** Used for handbook predictions	Cost Assessment
Operational Environment Temperature Max.	**Enter** a value. MSI: **Required**. Used for calculating ambient temperature and as is for handbook derating if CAD data is not available. Included in report.	Assessment Derating
Operational Environment Temperature Min.	**Enter** a value. MSI: **Required**. Used for calculating ambient temperature. Included in tool report.	Assessment
Availability (operational) Availability (inherent) Reliability	**Enter** a value in at least one of these attributes. MSI: **Required**. Uses these attributes as the system level requirement. The Availability/Reliability attributes of the Component of type System are compared to these values to determine out-of-spec conditions.	Assessment Sensitivity
Deployment Quantity	**Enter** a value > 0. PRICE: **Required**. The number of systems produced. Affects all production and support costs. MSI: **Required**. Affects sparing and MTTR (Availability)	Cost Assessment Sensitivity
Prototype Quantity	Enter a value > 0. PRICE: Optional. The number of system prototypes produced. Affects development costs.	Cost

LifeCycleParameter

Mission Period	**Enter** a value > 0. Equipment operating time in hours per mission for the system. PRICE: **Required**. Used to calculate actual MTBF in conjunction with On Time Factor. MSI: **Required**. Used for MTTR, MTBCF, R/A calculations	Support Cost Assessment Sensitivity
Duration of Lifecycle	**Enter** a value > 0. System's operational life, deployment to disposal in years. PRICE: **Required**. Used for support cost. MSI: **Required**. Used for MTTR, MTBCF, R/A calculations	Support Cost Assessment Sensitivity
On Time Factor	**Enter** a value > 0. Total average operating hours per month for the system. Maximum 730.5 hrs. PRICE: **Required**. Used to calculate actual MTBF in conjunction with Mission Period. MSI: **Required**. Used for MTTR, MTBCF, R/A calculations	Support Cost Assessment Sensitivity
Volume sensitivity Weight sensitivity Power sensitivity Production Cost sensitivity Operational Cost sensitivity Support Cost sensitivity	Defaults to a value of 10, most sensitive. These values are used unless overridden by values in leaf-level Components or their related Cost. **Note:** The *Component* of type System must have values for the applicable attributes these sensitivities represent. MSI: Used to weight relative importance of these parameters when recommending redundancy and optimizing MTBF.	Sensitivity

Component

This element is the basic building block for the Component Architecture. It contains attributes that characterize most aspects of either software or hardware entities and high-level assemblies.

Except for *Components* of type Environment, External System, Task or Human, all *Components* must have a *Cost* element related by the **costs** relation and an *RMA* element related by the **has rma of** relation. Together these elements characterize the components being designed.

The *Component* of type System is unique and requires the **satisfies** relation to a *LifeCycleParameter* element. In addition, the attribute values in both of these elements should represent the system requirements. These values in many cases are used to compare with calculated values to determine out-of-specification conditions.

Components of type System, Segment, Facility and Subsystem must be further decomposed (have children), should not be the bottom-most (leaf-level) components.

Components that contain both software and hardware should be decomposed. This allows PRICE to account for the cost of integration and test.

COTS, *Furnished* and *Reuse* components require no decomposition and should be at the leaf level.

Budgeted values are those estimated and/or partitioned to lower-level components while **predicted** represents the actual design or latest calculated values. When both values are exported, the receiving tool will use predicted values if they exist.

Component

Component Type	**Select** a value. **Required for all components.** **HW**: HWCI, HW element & Part **SW**: CSCI, CSC, CSU, FWCI, FWC & FWU. PRICE: Determines type of node in EBS, HW, SW, Assembly, etc., in conjunction with Design Source. MSI: Identifies HW. SW isn't used.	All

Component

Component Sub Type	**Select** a value. PRICE: **Required for leaf-level HW** Used in calculating structure and electrical integration, manufacturing complexity and design repeat. MSI: Optional, included in reports	Cost
Design Source	**Select** a value PRICE: **Required for leaf-level components.** In conjunction with Component Subtype, determines type of node in EBS, New, Furnished, Purchased or Reuse. Used in calculating integration factors and engineering complexity. **Note:** If COTS or modified COTS is selected, a value > 0 is required in the Purchased Item attribute of the *Cost* element.	Cost
Percent new design	**Enter** a value > 0 ≤ 100. PRICE: **Required for leaf-level components.** The amount of new unique design. Used in calculating design effort.	Cost
Duplicate—Used in Other Assemblies	Select a value. May be set by report. Visual indication that this component is used in other assemblies. When set to Yes, the attribute settings should refer only to the way this component is operated in the context of its parent. The related *Cost* element will reflect the quantity used for only this component in the Total Production Quantity attribute. The composite information for this component can be seen in the related *DuplicateComponents* element and its related RMA and Cost elements.	All

Component

Quantity in Next Higher Assembly	**Enter** a value > 0. **Required for all components except those of type Environment, External System, Task or Human.** The quantity of this component used in the parent component.	All
Quantity Requested for RMA	A value is populated by MSI if the Allow RMA Quantity Request attribute of the related *RMA* element is set to Yes, the Sensitivities operation is performed and the MTBF budget or system R/A requirements are exceeded. When a recommendation is made, a *Comment* element is created and related to this component.	MSI
Quantity Reqd for Operation	Enter a value. For leaf-level HW. A value is required only if the Quantity in Next Higher Assembly is >1 and if the additional components have been implemented for redundancy. If a value > 0 is entered, an entry is required in the Redundancy Mode attribute. PRICE: Optional. Used in calculating the number of spares and to adjust Availability and MTBF if PRICE defaults are used. MSI: Optional. Used in MTBCF and R/A assessment and sensitivity.	Production Support Assessment Sensitivity FME(C)A

Component

Redundancy Mode	Select a value. For leaf-level HW. Required if Quantity Required for Operation has a value > 0. PRICE: Optional. Used with or without Quantity Required for Operation to adjust Availability and MTBF if PRICE defaults are used. MSI: Optional. Used in MTBCF and R/A assessments. When Quantity Required for Operation > 0, this attributes reflects the actual mode. When Quantity Required for Operation is nil or 0, the mode is used to bias the optimization.	Support Cost Assessment
Length Width Depth	**Enter** a value > 0. PRICE: **Required for leaf-level HW**. Used to calculate volume which is used to calculate the manufacturing complexity of electronics. MSI: **Required for Component of type System.** Optional for leaf-level HW. Used for sensitivity analysis if this *Component* or the *LifeCycleParameter* element's Volume Sensitivity attribute is >1.	Cost Sensitivity
Volume Sensitivity	Enter a value for leaf-level HW. MSI: Optional. Used to override the *LifeCycleParameter* element's setting for this component.	Sensitivity

Component

Weight	**Enter** a value > 0. PRICE: **Required for leaf-level HW**. Used to calculate weight of structure and electronics. These are used in calculating complexity. Weight of structure is also used to determine design integration of COTS and furnished components. MSI: **Required for Component of type System.** Optional for leaf-level HW. Used for sensitivity analysis if this *Component* or the *LifeCycleParameter* element's Weight Sensitivity attribute is >1	Cost Sensitivity
Weight Sensitivity	Enter a value for leaf-level HW. MSI: Optional. Used to override the *LifeCycleParameter* element's setting for this component.	Sensitivity
Power (avg) Power(max)	**Enter** a value > 0. MSI: **Required for the Component with Type System** Optional for leaf-level HW. Used for sensitivity analysis if this Component or the *LifeCycleParameter* element's Power Sensitivity attribute is >1	Sensitivity
Power Sensitivity	Enter a value for leaf-level HW. MSI: Optional. Used to override the *LifeCycleParameter* element's setting for this component.	Sensitivity
Technology Maturity	**Select** a value. PRICE: **Required for leaf-level HW**. Used to calculate engineering complexity, and to determine design integration of COTS and Furnished components. MSI: Optional, included in tool reports.	Cost

Component

Technology Type 1-5 Equipment Type 1-5 Percent of Tech & Equip 1-5	**Select and enter** a value in the attributes of at least one group. PRICE: **Required for leaf-level HW**. These attributes characterize the mix of technologies and equipment types that are part of this leaf-level component. The number of attribute groups needed is determined by the complexity of this component. A drawer of electronics would typically need values in more groups than a circuit board. Used to calculate weight of structure, electronic package density, manufacturing complexity and electronic integration factor. **Note:** The values in the percent 1 through 5 attributes must add up to 100. If Technology Type = None, then Equipment Type must = Structure. If Technology Type = VLSI, then Equipment Type ≠ Analog/RF If Technology Type = VHSIC, then Equipment Type ≠ Analog Audio, Analog/RF, Transmitter, or Power Conditioning.	Cost
SLOC, Source Lines of Code	**Enter** a value > 0. PRICE: **Required for leaf-level SW**. Total number of source lines of code, not counting comments. Determines engineering effort and is used to calculate test and integration effort.	Cost

Component

Percent of Memory Utilization	**Enter** a value > 0 ≤ 100. PRICE: **Required for leaf-level SW**. Percent of total memory capacity used. Used in calculating engineering effort in conjunction with processor utilization. Values of greater than 50 have the greatest impact.	Cost
Percent of Processor Utilization	**Enter** a value > 0 ≤ 100. PRICE: **Required for leaf-level SW**. Percent of machine cycle time used. Used in calculating engineering effort in conjunction with memory utilization. Values of greater than 50 have the greatest impact. This attribute is weighted more heavily than memory utilization.	Cost
Language	**Select** a value. PRICE: **Required for leaf-level SW**. Used in calculating engineering effort.	Cost
Percent of New Code	**Enter** a value > 0 ≤ 100. PRICE: **Required for leaf-level SW** The amount of new, unique code. Used in calculating engineering effort.	Cost
Mathematics String Manipulation Store and Retrieve Online Communications Real Time Operating System and Interactive User Defined Type Design Difficulty Value for User defined type	**Enter** a value > 0 ≤ 100. PRICE: **A value is required for at least one of these attributes for leaf-level SW.** The total percentage for these seven attributes must equal 100. They represent the mix of code types used in this component. Each attribute also represents a different degree of implementation difficulty. The User Defined Type has its degree of difficulty assigned by selecting a value in the Design Difficulty attribute. Together these attributes are used in calculating engineering effort.	Cost

Component

Relations: **input from** and **output to** *ItemLinks*	**Create** *ItemLinks* and relations. MSI: **Required for leaf-level HW.** In most cases components require both an input and output to contribute to system functionality. This connectivity is essential for FME(C)A analysis.	FME(C)A
Relation: **executed on**	**Create** relations. MSI: **Required for leaf-level SW** Relates SW component to the HW component it is executed on. Used to complete the functionality of the HW component.	FME(C)A
Relation: **allocates Function**	Create relations. MSI: Optional for leaf-level HW. Typically, new design evolves from requirements to functions to components. In this case functions would normally be allocated to the components at the leaf-level. These functions have an attribute, Critical Path, which defaults to Yes. In addition, MSI assumes that all components are critical unless all functions allocated to the component have their Critical Path attribute set to No. A component that has 100% test functionality would be considered non-critical.	FME(C)A

Component

Comment	Generated and related to this component when the attribute Quantity Requested for RMA is populated.	MSI Assessment
CriticalIssue	When a derating violation is detected. Derating Assessment operations require that the offending component and temperature data exist in the RDD-100 The assessment is based on CAD data in conjunction with handbooks. The interaction with RDD-100 is in the form of a *CriticalIssue* related to the offending component.	Derating

Cost

This element must be related to all components by the **cost for** relation, except those components that have the Component Type attribute set to Environment, External System, Task or Human.

Budgeted values are those estimated and/or partitioned to lower-level components while **predicted** represents the latest calculated values imported from PRICE. When both values are exported, the receiving tool will use predicted values if they exist.

Comment elements may be generated by the PRICE user by making an entry in any of the PRICE screens that offer the Notebook option. These screens are associated with a particular node (component); the *Comment* element is automatically generated and related to the *Cost* element.

Cost

Purchased Item	**Enter** a value. PRICE: **A value is required for components with the Design Source = COTS and Modified COTS**. An entry may be desired for components with the Design Source = Reuse or Modified Reuse. Used for the cost of purchased items or the purchased portions of modified items. The decision to enter a cost for items that are reused in whole or part is dependent on an organization's accounting practices.	Cost
Development predicted	A value is populated by PRICE at all levels for all components. Includes: Drafting, Design, System Engineering, Project Mgmt, Data, Prototype, Tooling and Test Equipment costs (Non-recurring). **Note:** If this component is used in other assemblies, the cost represents this component's contribution. The total cost can be viewed in the related *DuplicateComponents*, *Cost* element after the Reconcile Dup report is run.	PRICE
Amortized Unit Production predicted	A value is populated by PRICE for all levels except SW. Total production cost (Engineering, Manufacturing, Tooling and Test) divided by initial quantity (without spares).	PRICE

Cost

Unit Production predicted	A value is populated by PRICE for all levels except SW. Manufacturing production cost (does not include engineering tooling or test) divided by initial quantity (without spares).	PRICE
Total Production Quantity	A value is populated by PRICE at all levels for all components. Total number of units produced during initial production. Includes spares for leaf-level Line Replaceable HW.	PRICE
Production predicted	A value is populated by PRICE at all levels for all components. All costs associated with production. Recurring, non-recurring spares, life cycle and field support. **Note:** If this component is used in other assemblies, the cost represents this component's contribution. The total cost can be viewed in the related *DuplicateComponents*, *Cost* element after the Reconcile Dup report is run. MSI: **Required for Components of Type System.** Optional for leaf-level HW. Used for sensitivity analysis if this *Component* or the *LifeCycleParameter* element's Production Cost Sensitivity attribute is >1.	Sensitivity
Production sensitivity	**Enter** a value for leaf-level HW. MSI: Optional. Used to override the *LifeCycleParameter* element's setting for this component.	Sensitivity

Cost

Operational	**Enter** a value > 0. MSI: **Required for the Component of Type System.** Optional for leaf-level HW. Used for sensitivity analysis if this *Component* or the *LifeCycleParameter* element's Operational Sensitivity attribute is >1.	Sensitivity
Operational sensitivity	**Enter** a value for leaf-level HW. MSI: Optional. Used to override the *LifeCycleParameter* element's setting for this component.	Sensitivity
Support predicted	A value is populated by PRICE at all levels for all components. Life cycle costs, associated with supply and field support. **Note:** If this component is used in other assemblies, the cost represents this component's contribution. The total cost can be viewed in the related *DuplicateComponents*, *Cost* element after the Reconcile Dup report is run. MSI: **Required for Components of Type System.** Optional for leaf-level HW. Used for sensitivity analysis if this *Component* or the *LifeCycleParameter* element's Support Cost Sensitivity attribute is >1.	PRICE Sensitivity
Support sensitivity	Enter a value for leaf-level HW. MSI: Optional. Used to override the *LifeCycleParameter* element's setting for this component.	Sensitivity

RMA

This element must be related to all components by the **rma for** relation, except those components that have the Component Type attribute set to Environment, External System, Task or Human.

Budgeted values are those estimated and/or partitioned to lower-level components while **predicted** represents the latest calculated values imported from MSI. When both values are exported, the receiving tool will use predicted values if they exist.

➤ **Note:** MSI Reality uses data from RDD-100, its internal database, CAD data (in conjunction with stored handbooks), and Reality user-generated block diagrams (for more accurate redundancy depiction). In general, the data used by MSI is as follows:

MSI BDE diagram—>MSI catalog data—>CAD data/Handbook data —>RDD-100 data

RMA

Allow RMA Quantity Request	**Select** a value. MSI: **Required to control redundancy recommendations for HW.** Controls whether an entry in the related component's Quantity Requested for RMA attribute is made when a sensitivity analysis is performed. An entry is made if sensitivity settings indicate a cost-effective solution to the set of components that have this attribute set to Yes. Leaf-level components are assumed to be Yes, unless this attribute is set to No. A recommendation is made only if a budgeted MTBF value is exceeded or R/A requirements cannot be met.	Sensitivity

RMA

Availability	A value is populated by MSI for all levels except SW. This value is updated for any assessment operation (MTBF, MTBCF, MTTR, or R/A). PRICE: Used when available, otherwise defaults in PRICE are used.	MSI Assessment Cost
Reliability	A value is populated by MSI for all levels except SW. This value is updated for any assessment operation (MTBF, MTBCF, MTTR, or R/A)	MSI Assessment
MTBCF budgeted	Enter a value. MSI: Optional for leaf-level HW. Used for MTBCF assessment when no other data is available. Used as the criteria for generating a *Comment* related to this element. Higher-level components that have this or the system level R/A values populated are used as the exceeded requirements criteria when this value is omitted. PRICE: Used when available, otherwise defaults in PRICE are used.	Assessment Cost
MTBCF predicted	A value is populated by MSI for all levels except SW. This value is updated for any assessment operation (MTBF, MTBCF, MTTR, or R/A) PRICE: Used when available, otherwise defaults in PRICE are used.	MSI Assessment Cost

RMA

MTBF budgeted	Enter a value. MSI: Optional for leaf-level HW. Used for MTBF, MTTR, MTBCF, R/A assessment and R/A sensitivities when no other data is available. This value is returned as predicted for MTBF assessment when no other data is available. Used as the criteria for generating a *Comment* related to this element. Higher level components that have this or the system level R/A values populated are used as the exceeded requirements criteria when this value is omitted. PRICE: Used when available, otherwise defaults in PRICE are used.	Assessment Sensitivity Cost
Optimized MTBF	A value is populated by MSI for all levels except SW. When there is no data available and MTBF budgeted values are all 0, this can be used for initial budgeting. Those values that are acceptable should be entered into the budgeted attributes. When data becomes available, these values can used to continually optimize MTBF and MTBCF.	MSI Sensitivity
MTBF Optimization Criteria	A value is populated by MSI for all levels except SW. Indicates what source values or method was used for generating Optimized MTBF values.	MSI Sensitivity

RMA

MTBF predicted	A value is populated by MSI for all levels except SW. This value is updated for any assessment operation (MTBF, MTBCF, MTTR, or R/A) PRICE: Used when available, otherwise defaults in PRICE are used.	MSI Assessment Sensitivity Cost
Method used for MTBF predicted	A value is populated by MSI for all levels except SW. Indicates what source values or method was used for generating MTBF predicted values.	MSI Assessment Sensitivity
LRU	**Select** a value at any level HW. MSI: **Required**. Used for MTTR, MTBCF, R/A assessment and sensitivities. Used to indicate that this component is a Line Replaceable Unit. PRICE: Optional. Valid for leaf-level HW. When set to Yes, restricts Maintenance Concepts to choices applicable to LRU's. When set to nil or No, PRICE selects the most cost-effective Maintenance concept.	 Assessment Sensitivity Cost
Maintenance Procedure	A value is populated by MSI for all levels except SW. This value is updated for any assessment operation (MTBF, MTBCF, MTTR, or R/A)	MSI Assessment

RMA

Maintenance Concept Requested for Costing	Select a value for leaf-level HW. PRICE: Optional. Used to determine MTTR at all maintenance levels. PRICE will choose a different concept if the LRU attribute is set to Yes and the selected concept is invalid. PRICE will select the most cost-effective concept when this attribute is nil.	Cost
Maintenance Concept Used for Costing	A value is populated by PRICE for leaf-level HW. Indicates the Maintenance Concept used, whether by default or attribute values.	PRICE
MTTR budgeted	Enter a value. MSI: Optional for leaf-level HW. Used for MTTR, MTBCF, R/A assessment and R/A sensitivities when no other data is available. This value is returned as predicted for MTTR assessment when no other data is available. Used as the criteria for generating a *Comment* related to this element. Higher-level components that have this or the system level R/A values populated are used as the exceeded requirements criteria when this value is omitted. PRICE: Used when available, otherwise defaults in PRICE are used.	Assessment Sensitivity Cost
MTTR predicted	A value is populated by MSI. This value is updated for any assessment operation (MTBF, MTBCF, MTTR, or R/A)	MSI Assessment

RMA

MTTR LRU ORG MTTR Module ORG MTTR LRU IL MTTR Module IL MTTR LRU Depot MTTR Module Depot	A value is populated by MSI for HW at all levels MSI: Optional. MSI has capabilities to characterize the ILS activities in detail. These values are populated when the user takes advantage of this operation. PRICE: Used when available, otherwise defaults in PRICE are used.	MSI Assessment Cost

Components used in Multiple Assemblies

In RDD-100 each instance of a *Component* element type must have a unique name. To determine the development, production and support costs of these *Components,* a means of identifying which *Components* are identical is needed. The *DuplicateComponents* element is used to identify families of *Components* that are identical and are **built from** different parent *Components*.

The relationship **includes duplicate** is made from the *DuplicateComponents* element to all identical *Components* within a family. The inverse relationship **duplicates included by** can be established from the *Component* element. A *Component* can have only one **duplicates included by** relationship.

When multiple components have the same parent in an architecture used for costing, the attribute Quantity used in Next Higher Assembly (QNHA) reflects the number of *Components* used in the parent. In this case the component is not considered a duplicate component.

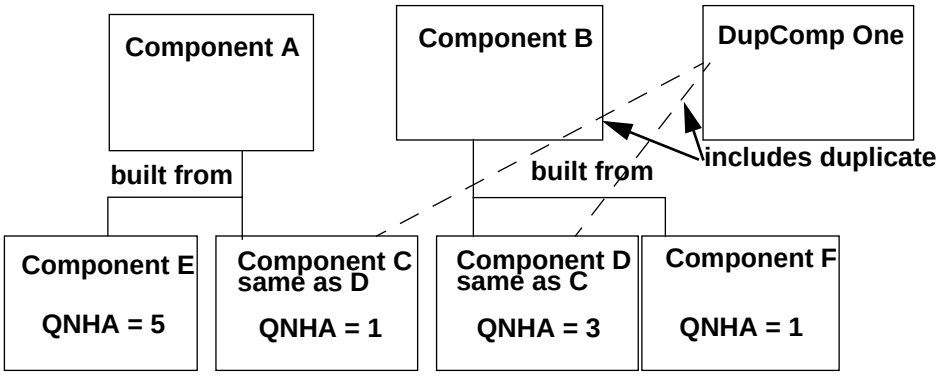

Figure 2-1 Components used in different assemblies

When identical *Component*s have the same parent and *ItemLink* elements are being used to model different sources and destinations, different instances of the component are created and the collection of components is treated as *DuplicateComponents*. Each instance of the component would then have its QNHA attribute set to one.

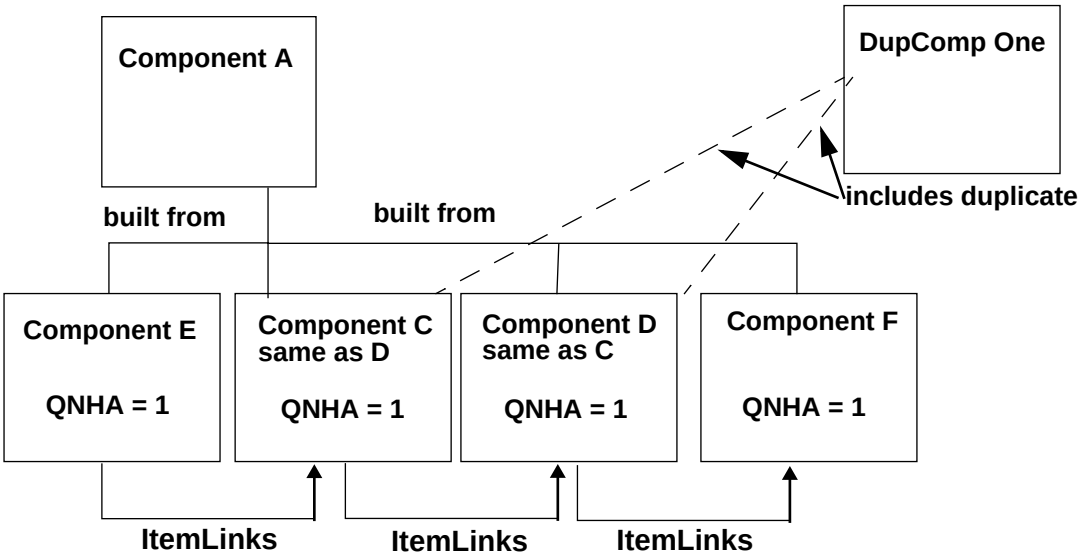

Figure 2-2 Components used in the same assembly with ItemLinks

Two indications that a *Component* is part of a family of duplicates are used. One indication is that the **duplicates included by** relationship exists, the other is that the *Components* attribute Duplicate—used in other assemblies is set to Yes.

To ensure that the database is valid, a utility report and consistency check report are provided. The utility report Set Duplicate Attribute will check *Components* for the **duplicates included by** relationship and set the Duplicate—used in other assemblies attribute to Yes. The Consistency check will report an inconsistency if the Duplicate—used in other assemblies attribute is Yes and the **duplicates included by** relationship is not present. Additionally, an inconsistency is reported if a *DuplicateComponents* element has less than two target Components.

Cost and Quantity Data in Duplicates

When *DuplicateComponents* are used, PRICE needs the total number of identical components included in the delivered system to accurately assess costs. The *DuplicateComponents'* attribute Total System Quantity (calculated) is used to hold this value.

The report Calculate Total System Quantity is executed to calculate and populate this attribute. This report will calculate the quantity by rolling up the quantities of each *Component* related to a *DuplicateComponents* element. The rollup follows the Component hierarchy to the *Component* of Component Type System. The result is then multiplied by the Deployment Quantity in the *LifeCycleParameter* element.

PRICE returns proportional Development, Production, and Support costs for each identical *Component*. The Reconcile DupComp report is executed to sum these values and deposit the totals in the *DuplicateComponents'* related *Cost* element. In addition, this report compares all other attributes in the families' *Component*, *Cost,* and *RMA* elements. If the values are identical, the *DuplicateComponents*, and its related *Cost* and *RMA* elements attributes are populated, otherwise the attributes are set to `nil or zero`. To aid in data comparison, a Multi-Element View and report are provided to view and print *DuplicateComponents* with related *Components'* attributes including the attributes of related *Cost* and *RMA* elements.

The *DuplicateComponents* element and its related Cost and RMA elements now contain the deployed system-wide development, production and support costs. The other attributes of these elements reflect only those values that are identical in all the target *Components*. The development, production, and support costs in each of the target *Components* reflect that component's contribution to the total costs.

➤ **Note:** When using *Components* as duplicates, the Autocreate Reports for producing MIL-STD specifications will contain sections having duplicate data. These sections can be manually deleted before printing the specification.

User Operations for Data Exchange

When data has been populated in RDD-100 and a Cost or RAM_ILS operation is desired, the following is the preferred sequence of operations.

1. Run the Set Duplicate report (when *DuplicateComponent*s are used).
2. Run the Calculate Total Sys Qty report (when *DuplicateComponents* are used).
3. Run the appropriate Consistency checks.
4. Run the appropriate Export report.

5. Run the desired tool and generate its output report, an `.rdt` file.
6. Run RDD-100's standard Version Compare report for a hard copy of changes.
7. Import the `.rdt` file.
8. Run the Reconcile DupComp report (when *DuplicateComponents* are used).

Do

Chapter

3

Support Templates and Reports

Chapter 3

This chapter describes the different RDD-100 Multi-Element View, Consistency Checks, and Reporting templates supplied with the ISE (RASSP) schema.

SUPPORT TEMPLATES AND REPORTS

Multi-Element View (MEV) templates display elements, relationships, targets and attributes. The following MEVs come with the ISE (RASSP) schema.

- Component Hierarchy, Cost, RMA, & Life.
- Duplicate Components andTargets.

Consistency Check Reports are provided to help verify that required relationships and attributes exist in the SDD. The following Check Sets come with the ISE (RASSP) schema.

- Common.
- Cost.
- RAM Assessment.
- R/A Optimization.
- FMEA.

RDD-100 reports (report templates) are tools that you can use to modify or print data in the SDD. The following reports come with the ISE (RASSP) schema.

- Add Cost/RMA.
- Calculate Total Sys Qty.
- Delete Cost RMA.
- Print 3 Elements.
- Print Dup Targets.
- Reconcile DupComp.
- Set Duplicate.
- Set MainConcept nil.

MULTI-ELEMENT VIEW

Multi-Element View (MEV) templates display elements, relationships, targets, and attributes.

Component Hierarchy, Cost, RMA & Life

Displays the selected *Component* and its hierarchy (based on the **built from** relation) with all engineering attribute names and values for each *Component* and the related *Cost* and *RMA* elements.

Component: Benchmark 1 SAR - Candidate A
- [1] *costs* Cost: Benchmark 1 SAR - Candidate A
- [1] *has rma of* RMA: Benchmark 1 SAR - Candidate A
- [1] satisfies LifeCycleParameter: Benchmark 1 SAR
- [1] *built from* Component: Backplane Assembly
  - [2] *costs* Cost: Backplane Assembly
  - [2] *has rma of* RMA: Backplane Assembly
  - [2] *built from* Component: Interlink Module
    - [3] *costs* Cost: Interlink Module
    - [3] *has rma of* RMA: Interlink Module
  - [2] *built from* Component: VME Backplane
    - [3] *costs* Cost: VME Backplane
    - [3] *has rma of* RMA: VME Backplane

Follow *DuplicateComponents* **includes duplicate** relationship and display all engineering attribute values for each *DuplicateComponents*, *Component,* and the related *Cost* and *RMA* elements.

DuplicateComponents and Targets

DuplicateComponents: Fam 1
- [1] *includes duplicate* Component: PE Daughterboard
  - [2] *costs* Cost: PE Daughterboard
  - [2] *has rma of* RMA: PE Daughterboard
- [1] *includes duplicate* Component: PE Motherboard
  - [2] *costs* Cost: PE Motherboard
  - [2] *has rma of* RMA: PE Motherboard

New MEVs can be generated by editing the supplied templates. Typically you would delete selected attributes, leaving only the attributes of interest to you.

The displayed elements, relationships and attributes of the existing MEV's may also be changed through Task Visibilities.

Consistency Check Report Templates

Consistency check report templates are provided to help you verify that you have correctly entered the necessary relationship and attribute information without conflicts. Checksets and the tests to be performed are listed below.

COMMON Checkset

This checkset should be performed before you run an Export Report.

ExternalToolFiles
At least one instance of the element type *ExternalToolFiles* exists.

LifeCycleParameter
At least one instance of the element type *LifeCycleParameter* exists and has the **satisfied by** relation to a *Component* element with Component Type = System.

All instances of a *LifeCycleParameter* element have a value in Operating Environment, Deployment Quantity, Mission Period, On Time Factor and Duration of Lifecycle attributes. In addition, Deployment Quantity must be greater than zero.

DuplicateComponents
All instances of *DuplicateComponents* elements have the **costs** relation to a *Cost* element, the **has rma of** relation to an *RMA* element, and each *DuplicateComponents* is related to more than one *Component*.

Components
All Components have a value for the Component Type attribute

All Components that have the Duplicate—Used In Other Assemblies attribute set to Yes must have the **duplicates included by** relation to a *DuplicateComponents* element.

Components with Component Type attribute set to System, Segment, Facility and Subsystem must be decomposed.

Components with the Component Type attribute not equal to Environment, External System, Task or Human:

1. Are required to have *Cost* elements related by the relation **costs**.
2. Are required to have *RMA* elements related by the relation **has rma of**.
3. Are required to have a Quantity In Next Higher Assembly attribute value > zero.

Components at the lowest level with the Component Type attribute set to HWCI, HW Element or Part and that have the Quantity Required for Operation attribute > 0 are required to have a value in the Redundancy Mode attribute.

COST Checkset

This checkset should be performed before you run an Export to Cost Report.

DuplicateComponents
All *DuplicateComponents* must have a value > 0 in the Total System Quantity attribute (achieved by execution of the Calculate Total System Quantity report.)

Cost
Purchased Item attribute must be > 0 when Design Source attribute is set to COTS or Modified COTS for the lowest level *Components*.

Component
Components at the lowest level with the Component Type attribute not equal to Environment, External System, Task or Human:

1. Are required to have a value for the Design Source attribute.
2. When the Cost, Purchased Item attribute is > 0, Design Source must be set to COTS or Modified COTS.
3. A value > 0 is required in the Percent of New Design attribute when Design Source is not equal to COTS, Reuse or Furnished.

Components at the lowest level with the Component Type attribute equal to HWCI, HW Element or Part:

1. Component Sub Type and Technology Maturity attributes must have a value other than n/a.
2. Budgeted or predicted values of Length, Width, Depth and Weight attributes must be > 0.
3. One of the five Technology/Equipment groups must have a value.
4. When there is a value in one attribute of a Technology/Equipment group, all three must have values.
5. If Equipment Type equals Structure, then Technology Type must equal None in any Technology/Equipment group.
6. If Technology Type equals None, then Equipment Type must equal Structure in any Technology/Equipment group.
7. If Technology Type equals VLSI, then Equipment Type cannot equal Analog/RF, in any Technology/Equipment group.
8. If Technology Type equals VHSIC, then Equipment Type cannot equal Analog Audio, Analog/RF, Transmitter, or Power Conditioning in any Technology/Equipment group.

Components at the lowest level with the Component Type attribute equal to CSCI, CSC, CSU, FWCI, FWC or FWU:

1. SLOC, Software Lines of Code, Percent of Memory Utilization, Percent of Processor Utilization, and Language attributes must have values > 0.
2. At least one of the Types of Code attributes has a value > 0.
3. If User Defined Type attribute has a value > 0, then Design Difficulty must have a value > 0.
4. A value > 0 is required for Percent of New Code, when Design Source is not equal to COTS, Furnished or Reuse.

RAM Assessment Checkset

This CheckSet should be performed prior to running the Export to RAM_ILS report.

LifeCycleParameter
All instances of a *LifeCycleParameter* element have a value > 0 in Operational Environmental Temperature min and max attributes.

All instances of *LifeCycleParameter* have a value in at least one of Availability (inherent), Availability (operational), or Reliability attributes.

RAM Optimization Checkset

This CheckSet should be performed in addition to the RAM Assessment Check Set before running the Export to RAM_ILS report.

Cost
All *Cost* elements that have Production, Operational, or Support sensitivity values > 1 require values > 0 in the corresponding cost attributes.

Budgeted or predicted Production, Operational and Support costs are required for the *Cost* element related to the *Component* with Component Type set to System.

Component
All *Component* elements that have Volume, Weight, or Power sensitivity values > 1 require values > 0 in the corresponding attributes.

For the *Component* with Component Type set to System:

1. Budgeted or predicted Power (max) or (avg) are required.
2. Budgeted or predicted Length, Width, Depth and Weight are required

FMEA Checkset

This CheckSet should be performed before running the Export to RAM -ILS report .

ItemLinks
All *ItemLinks* are required to **output from** and **input to** *Components*.

Utility Report Templates

Add Cost and RMA Elements

The Add Cost and RMA Elements report template, when executed, creates *Cost* and *RMA* elements for existing *Component* and *DuplicateComponents* elements. In addition, the appropriate relationships are made from each *Component* and *DuplicateComponents* element to the newly created *Cost* and *RMA* elements.

This report template may also be used to reset the names of *Cost* and *RMA* elements to the same name as the associated *Component*/*DuplicateComponents* element.

The report template is in the file `Add_Cost_RMA.rpt` in the UNIX environment.

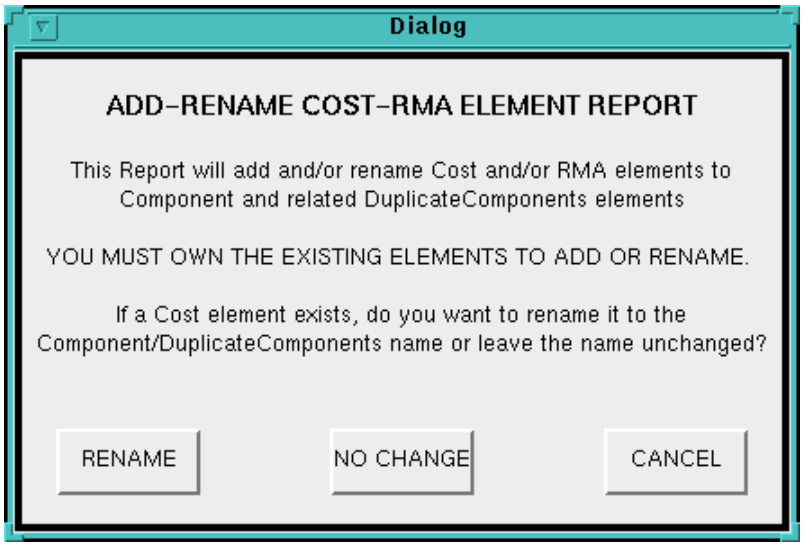

Figure 3-1 Rename dialog

Existing names are unchanged unless you choose the option to **rename** existing *Cost* and/or *RMA* elements from the displayed dialog box. You must own the existing elements before you can add or rename them.

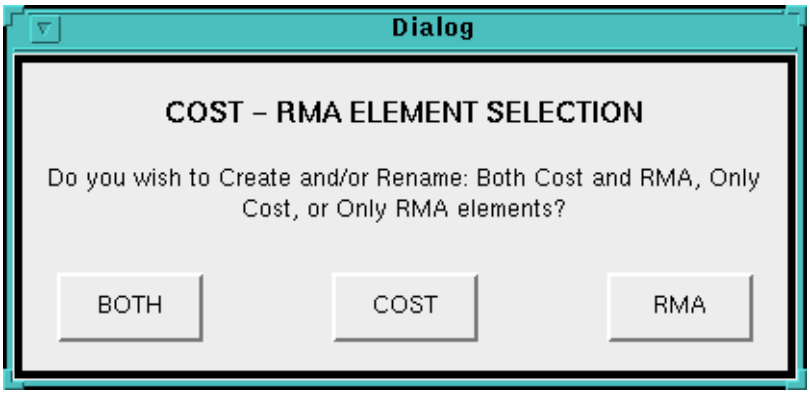

Figure 3-2 You can select only *RMA* elements, only *Cost* elements, or both elements to be created.

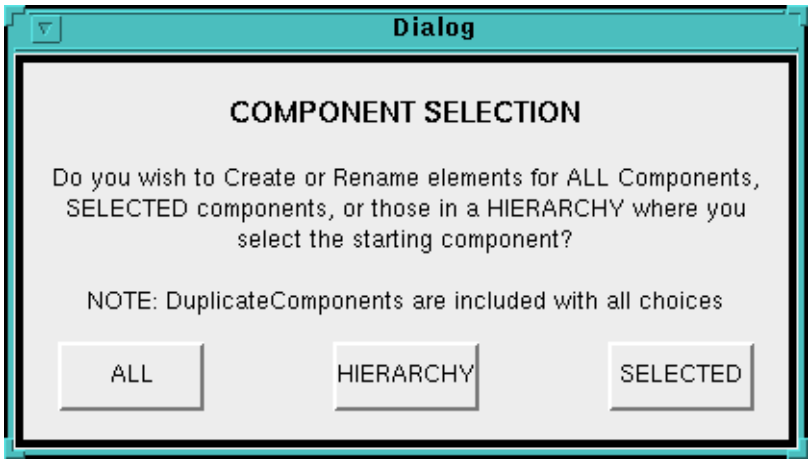

Figure 3-3 You can select all *Component/DuplicateComponents* in the System Design Data, selected instances of *Component/DuplicateComponents* elements, or the starting *Component* of a hierarchy

If you choose to run this report template with other than **All** selected, a dialog box opens to allow you to choose the desired elements for processing.

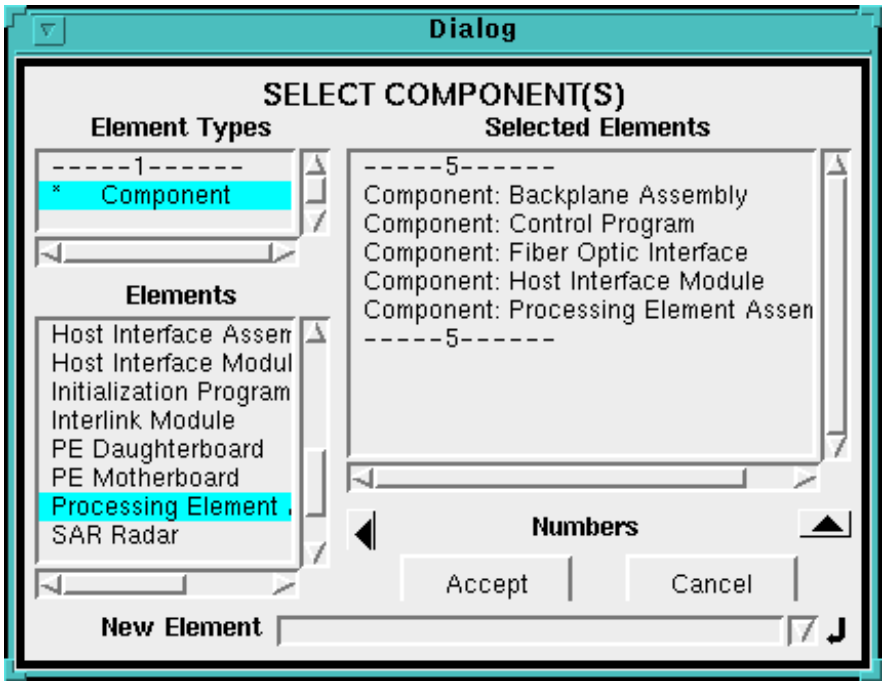

Figure 3-4 Element Selection dialog

After you have selected the elements you want, the report template processes your data.

If you have chosen to run the report template on a hierarchy, a dialog box displays where you can select the starting, top-level component upon which the report template will run.

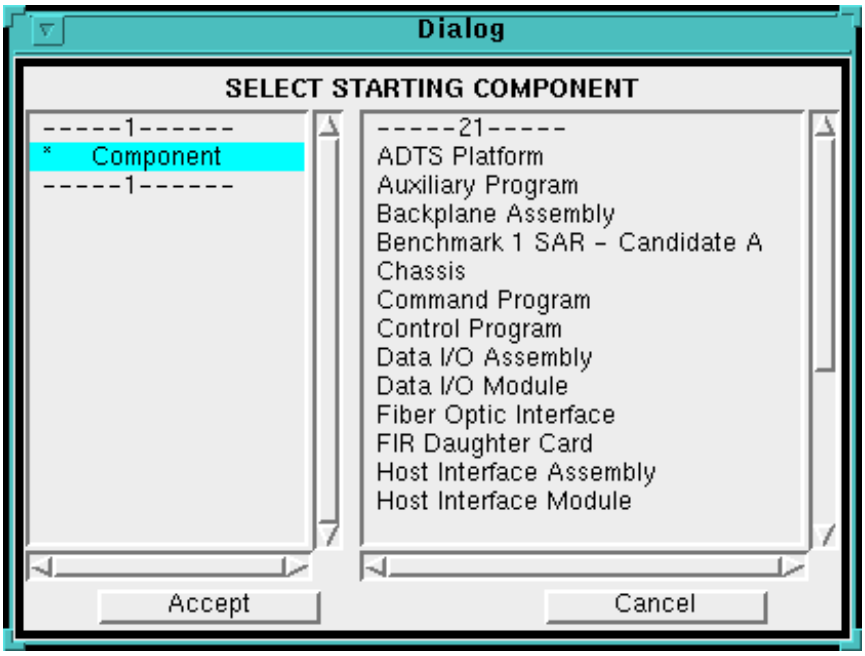

Figure 3-5 Dialog box showing a list of components to choose from.

➤ **Note:** *Cost* and/or *RMA* elements will be created and/or renamed for all related *Duplicate-Components* elements.

Calculate Total System Quantity

When *DuplicateComponents* are used, this report template **must** be executed before exporting data to PRICE for accurate costing.

This report template, when executed, calculates the value for the Total System Quantity attribute of the *DuplicateComponents* element. The calculation reflects the total quantity used in the system determined as follows:

For all *Component* elements related to a *DuplicateComponents* element, the sum of each *Component's* Quantity in Next Higher Assembly attribute is multiplied by that *Component's* parent's Quantity in Next Higher Assembly attribute, This continues until a *Component* element with its Component Type attribute set to System and having a relationship to a *LifeCycleParameter* element is encountered. The Deployment Quantity attribute of the *LifeCycleParameter* element is used as the last multiplier.

When all hierarchical branches containing a *Component* related to a specific *DuplicateComponents* element have been calculated and summed, the value is entered into the *DuplicateComponents* element's Total System Quantity attribute.

Zero and missing quantities are invalid, the total system quantity is set to 0, the user is notified, and the errors are listed in the report output file.

If the *LifeCycleParameter* element's Deployment Quantity is nil or zero or the *Component* with the Component Type attribute set to System is not related to a *LifeCycleParameter*, the user is notified, an error is listed in the report output file, and a Deployment Quantity of 1 is assumed.

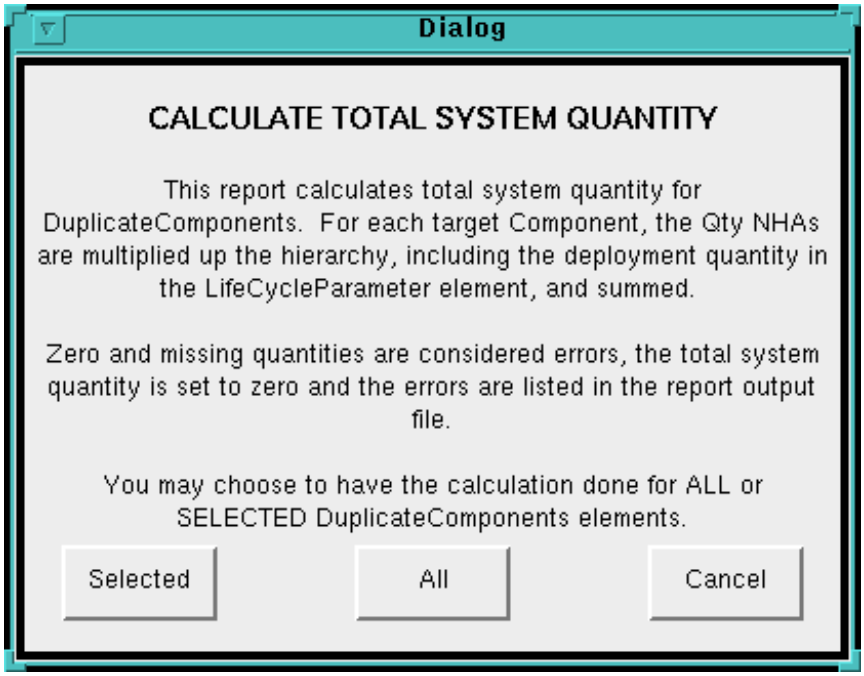

Figure 3-6 You can select whether the calculation is done for selected of for all *DuplicateComponents* element(s), or cancel the report.

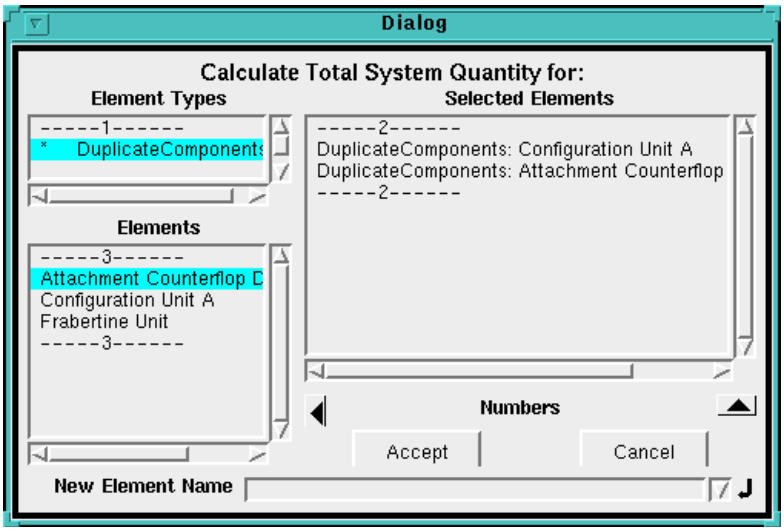

Figure 3-7 Element Selection Dialog

Delete Cost and RMA Elements

This report template when executed will delete *Cost* and *RMA* elements that are not related to a *Component* or *DuplicateComponents* element. All *Cost* and *RMA* elements in the SDD are checked.

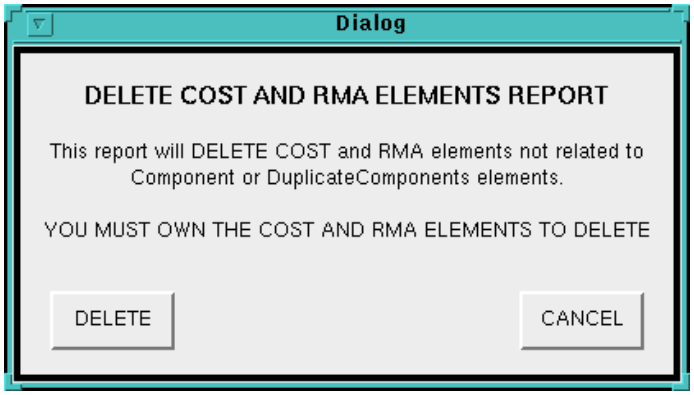

Figure 3-8 On initiating the report template, you can proceed with the deletions or cancel the report without making any changes.

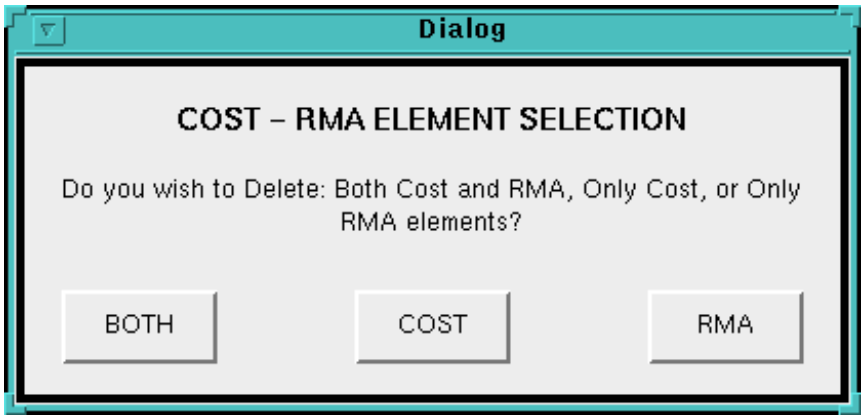

Figure 3-9 You can delete only *Cost*, only *RMA*, or both element types.

Print DuplicateComponents Targets

This report template when executed will print all attributes of a selected set of *DuplicateComponents* element(s) with up to five related *Component* element attributes on a single page (RDD version 4.1.1). The report also prints all attributes of the related *Cost* and *RMA* elements for the *DuplicateComponents* and the five *Component* elements on the two following pages. If there are more than five related *Components*, this report prints the attributes on the following pages, one each for *Component*, *Cost* and *RMA* elements. In all cases the *DuplicateComponents* element or its related *Cost* or *RMA* element is printed in column one of each page.

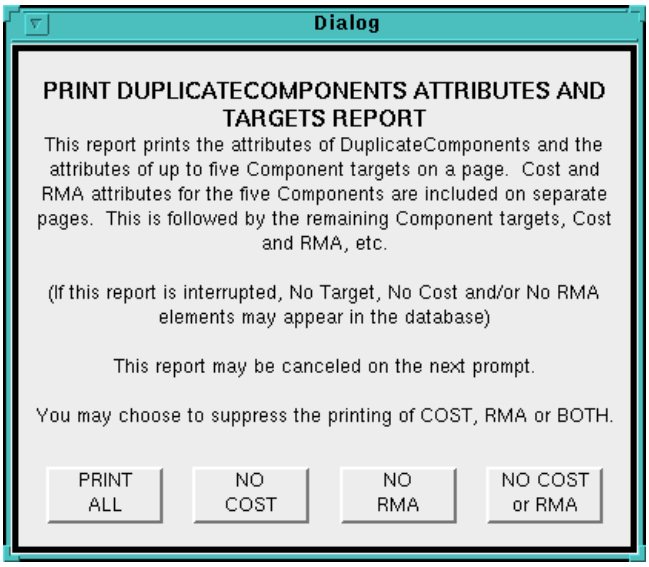

Figure 3-10 You can select printing of all *Component* attributes and related *Cost* and *RMA* attributes or *Components* attributes and related *Cost* attributes or *Component* attributes and related *RMA* attributes or just *Component* attributes.

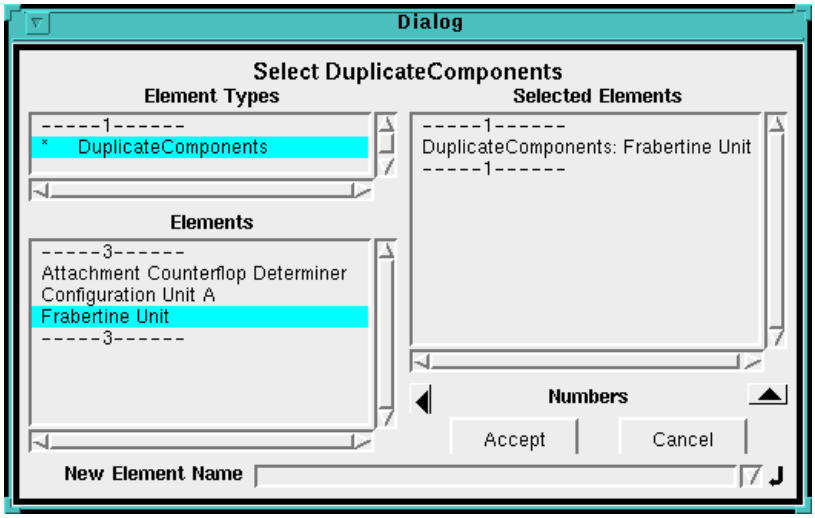

Figure 3-11 Element Selection dialog

➤ **Note:** If this report is canceled by the user typing <`Control C`> during execution, *Component*, *Cost* and/or *RMA* elements with the names No Targets, No Cost or No RMA may appear in the database.

Print Three Element Attributes

This report template when executed prints all attributes of a *Component* or *DuplicateComponents* element with all attributes of the related *Cost* and *RMA* elements on a single page (RDD version 4.1.1).

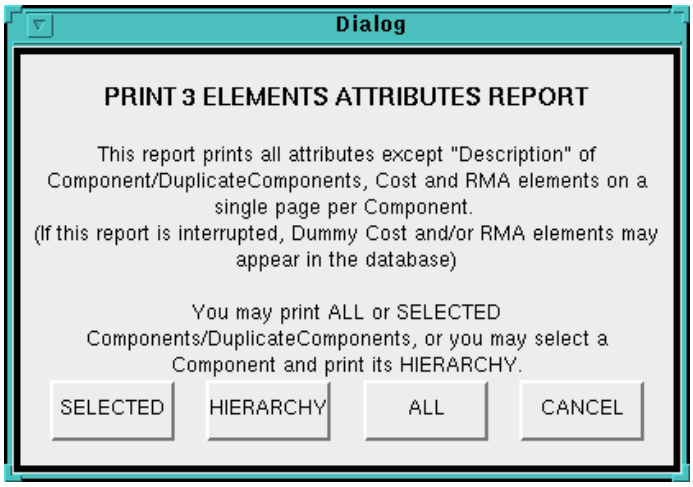

Figure 3-12 You can select All, a selected mix of *Components* and *DuplicateComponents*, or the starting *Component* of a hierarchy.

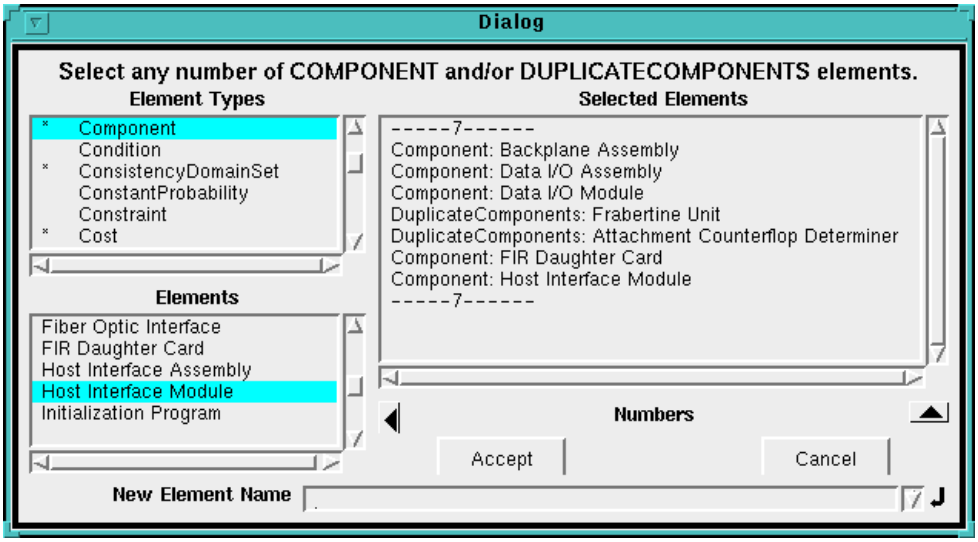

Figure 3-13 Element Selection Dialog for Print 3 Elements Attributes Report

➤ **Note:** If this report is cancelled by the user typing <Control C> during execution, *Cost* and/or *RMA* elements with the names Dummy Cost or Dummy RMA may appear in the database.

Reconcile Duplicates

When *DuplicateComponents* are used, this report template **must** be executed after importing data from PRICE. The total cost of each family of *DuplicateComponents* will be contained in the values of the *DuplicateComponents* element's related *Cost* element attributes.

This report template when executed will compare attributes of *Components* that are targets of *DuplicateComponents*. If the attributes are equal, the attribute is entered into the *DuplicateComponents* element or its related *Cost* or *RMA* elements.

"Nil" is entered into the *DuplicateComponents* element or its related *Cost* or *RMA* elements if any attribute is not equal.

Development, Production, Support Costs, and Total Production Quantity are summed and the total entered in the *DuplicateComponents* element's related *Cost* element.

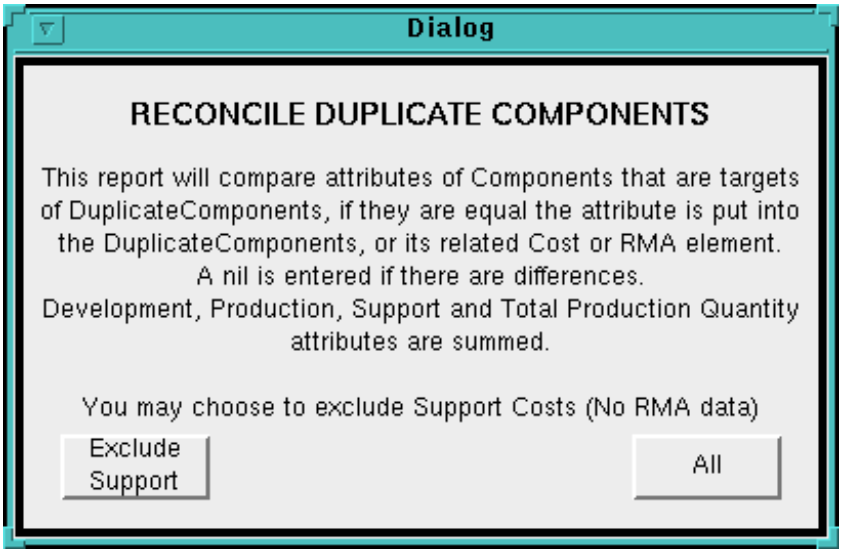

Figure 3-14 You can choose to exclude Support Costs **(to suppress cost data based on defaults).**

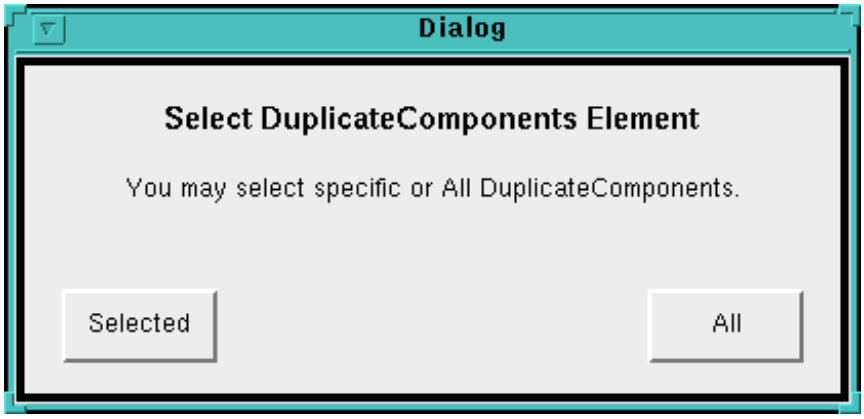

Figure 3-15 You can select all or a subset of *DuplicateComponents* **elements.**

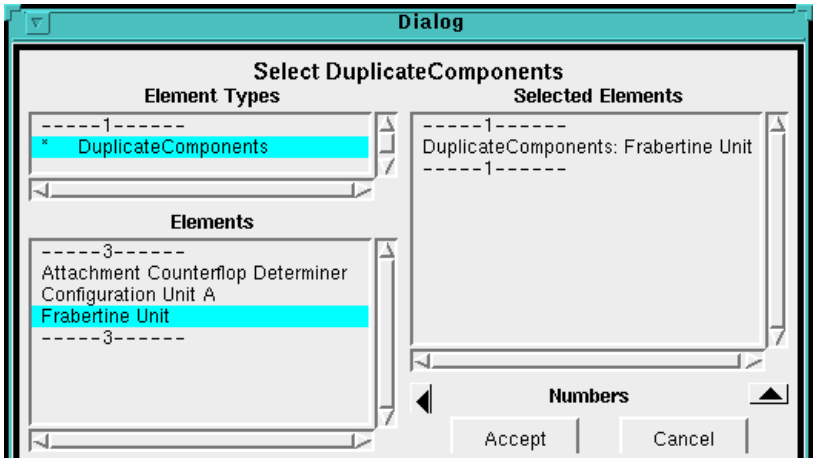

Figure 3-16 Element Selection Dialog for Reconcile Duplicates Report

The intended result is that *DuplicateComponents* and related *Cost* and *RMA* elements will contain values for only those attributes that are identical in all its target *Components* and related *Cost* and *RMA* elements. The exceptions are Development, Production, and Support predicted costs and Total Production Quantity, which will contain the sum of all the target *Component's Costs* attributes.

This report also detects and outputs the following error conditions:

- *DuplicateComponents* that have less than one target *Component*, no *Cost* or no *RMA* targets
- Target *Components* that have no *Cost* or *RMA* targets.

Chapter

4

Data Exchange

Chapter

4

Data Exchange

This chapter describes the report templates used for exporting data to other tools and lists the data exported and imported to and from these tools.

The following export reports come with the ISE (RASSP) schema:

- Export to Cost
- Export to JRS
- Export to RAM-ILS

DATA EXPORT/IMPORT

Report templates are used to produce files containing the elements, relationships and attributes listed in the tables in the following sections.

➤ **Note:** You must select the **ASCII with no linefeeds** option in the Report Output Setup dialog when initiating all export reports.

We recommend that you run the Version Compare Report found in the `RDD-100>Support Info>General>Utilities` directory before you import files. This will allow you to obtain hard copy of the changes going to be made to your data before the changes are actually made.

DATA EXPORT TO PRICE

The Common and Cost consistency checks should be completed before running the Export to Cost report to ensure that meaningful data is available to the PRICE toolset.

When *DuplicateComponents* have been used, the Set Duplicate Attribute and Calculate Total System Quantity reports should be run before the consistency checks.

The Calculate Total System Quantity report must be run before exporting data to ensure accurate costing for components used in multiple assemblies.

Export to Cost Report Template

When executing this report (**Print** menu selection), the **ASCII with no linefeeds** option in the Report Output Setup dialog must be selected.

The file pathname should point to the directory used for invoking the PRICE E toolset, and the file extension should be set to `.txt.` This allows the file to be displayed with the default PRICE Engineer Import file filters.

The File button initiates report execution.

The user is then presented with a dialog requesting a description or identifier. The image name and current date are automatically supplied; therefore, it is recommended that the data entered should reflect something related to data content. This entry is optional.

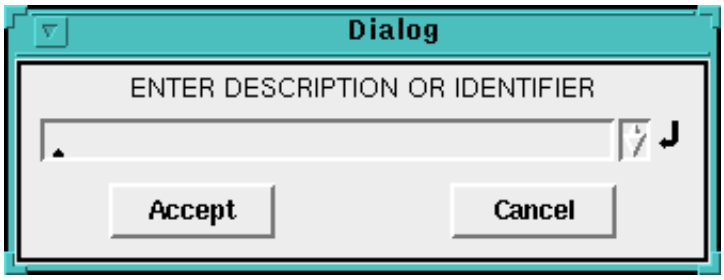

Figure 4-1 Enter the description or identifier in this dialog.

Next the user is requested to select the *ExternalToolFiles* element to use for this export. This element contains the names of the Cost Analyst, Sync file and Lock names to use for the PRICE import.

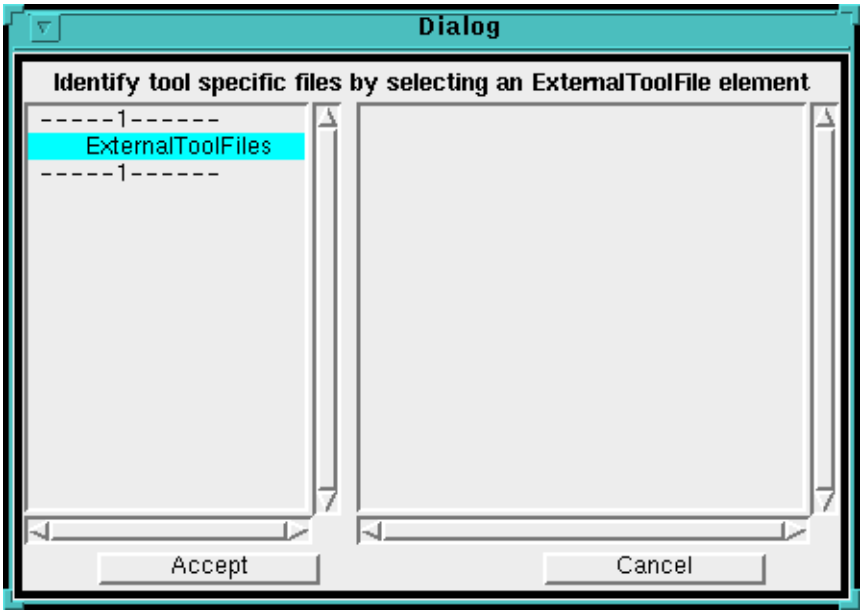

Figure 4-2 Select the ExternalToolFiles element in this dialog box.

Selection of the starting *Component* is the next operation. The *Component* selected must have the Component Type attribute set to System, and a *LifeCycleParameter* element must be related.

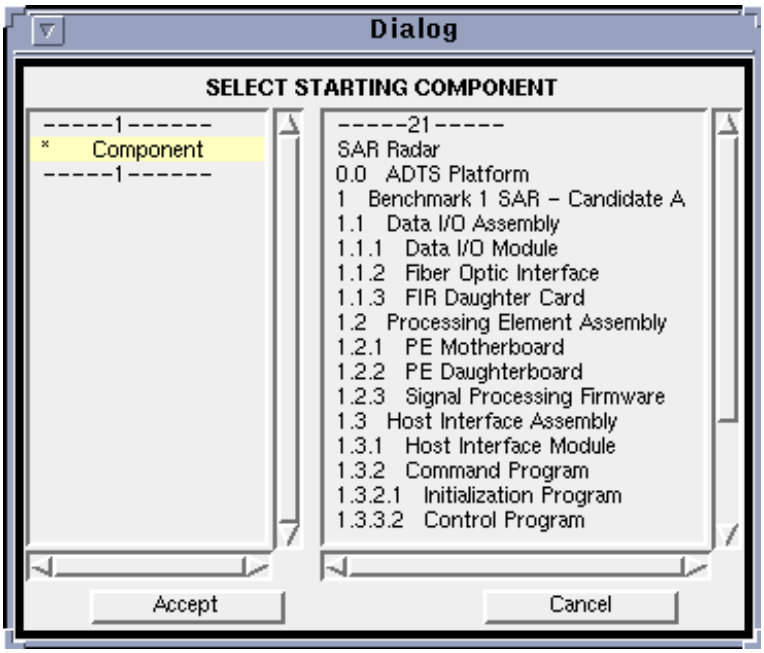

Figure 4-3 Select the starting component in this dialog box.

DATA EXPORTED TO PRICE

The following table shows the data exported from RDD-100 to the PRICE toolset. Element types are shown on the left, and their attribute names or data descriptions are shown in the right column.

Data Exported to the PRICE Toolset

Element Type	Attribute Name or Data Description (The file content contains the attribute values)
n/a	Image name, Export date and User entered description
ExternalToolFiles	ExternalToolFiles name
	Cost Analyst File Requested
	Sync File Requested
	Lock Name Requested
n/a	Column titles; these are the RDD internal attribute names listed in the order presented in the following rows.
Component	Component Name
	Component
	Component Type
	Component Sub Type
	Design Source
	Percent of New Design
	Duplicate - Used in other assemblies
	Total System Quantity (calculated) ONLY IF DUPLICATES EXIST
	Quantity in Next Higher Assembly
	Quantity Required for Operation
	Redundancy Mode
	Length predicted (ft)
	Length budgeted (ft)
	Width predicted (ft)
	Width budgeted (ft)
	Depth predicted (ft)
	Depth budgeted (ft)

Data Exported to the PRICE Toolset (Continued)

Element Type	Attribute Name or Data Description (The file content contains the attribute values)
Component	Weight predicted (lb)
	Weight budgeted (lb)
	Technology Maturity
	Technology Type 1
	Equipment Type 1
	Percent of Technology and Equipment 1
	Technology Type 2
	Equipment Type 2
	Percent of Technology and Equipment 2
	Technology Type 3
	Equipment Type 3
	Percent of Technology and Equipment 3
	Technology Type 4
	Equipment Type 4
	Percent of Technology and Equipment 4
	Technology Type 5
	Equipment Type 5
	Percent of Technology and Equipment 5
	SLOC, Source Lines of Code
	Percent of Memory Utilization
	Percent of Processor Utilization
	Language
	Percent New Code
	Mathematics (1)
	String Manipulation (2)
	Store and Retrieve (4)
	Online Communications (6)
	Real Time (8)
	Operating System or Interactive (10)

Data Exported to the PRICE Toolset (Continued)

Element Type	Attribute Name or Data Description (The file content contains the attribute values)
Component	User Defined Type (value below)
	Design Difficulty Value for User Defined Type
	Component Target of the built in relation
	Determined by testing for built from relation
Cost	Cost Element Name
	Purchased Item cost
	Development cost budgeted
	Production cost budgeted
	Support cost budgeted
RMA	RMA Element Name
	Availability predicted
	MTBCF predicted (hr)
	MTBCF budgeted (hr)
	MTBF predicted (hr)
	MTBF budgeted (hr)
	LRU, Line Replaceable Unit
	Maintenance Concept Requested for Costing
	MTTR, line predicted (hr)
	MTTR, line budgeted (hr)
	MTTR, LRU ORG (Tf)
	MTTR, Module ORG (Tmo)
	MTTR, LRU IL (Ti)
	MTTR, Module IL (Tmi)
	MTTR, LRU Depot (Td)
	MTTR, Module Depot (Tmd)
LifeCycleParameter	LifeCycleParameter Element Name
	Operating Environment
	Deployment Quantity
	Prototype Quantity

Data Exported to the PRICE Toolset (Continued)

Element Type	Attribute Name or Data Description (The file content contains the attribute values)
LifeCycleParameter	Mission Period (hrs)
	Duration of Lifecycle (years)
	On Time Factor (hrs per month)

DATA IMPORTED FROM PRICE

The following table shows the data imported from PRICE into RDD-100. Element type names are on the left and their attribute names are on the right.

Data imported from PRICE

Element Type	Attribute User Entry Name (Values populated by PRICE)
Cost	Element name
	Development cost predicted
	Amortized Unit Production Unit predicted
	Unit Production predicted
	Total Production Quantity
	Production cost predicted
	Support cost predicted
ExternalToolFiles	Cost Analyst File Used
	Sync File Used
	Lock name Used
RMA	Element name
	Maintenance Concept Used for Costing
Optional	
CriticalIssue	Element name
	Description
	Relation = **traces from**
Comment	Element name
	Description
	Relation = **annotates**

DATA EXPORT TO MSI REALITY

The Common and RAM Assessment, RAM Optimization or FMEA consistency checks should be completed before running the Export to RAM_ILS report to ensure that meaningful data is available to the Reality toolset.

The costing operations should be performed prior to running an optimization or sensitivity analysis.

Export to RAM-ILS Report Template

When executing this report (**Print** menu selection), the **ASCII with no linefeeds** option in the Report Output Setup dialog must be selected.

The file pathname should point to the directory previously used for invoking the Reality toolset. If this is the initial run, the MSI Reality toolset uses the directory where the exported RDD file resides as the repository for files generated by Reality.

The File button initiates report execution.

The user is requested to select the *ExternalToolFiles* element to use for this export. This is used by Reality to populate the name of the directory used as a file repository.

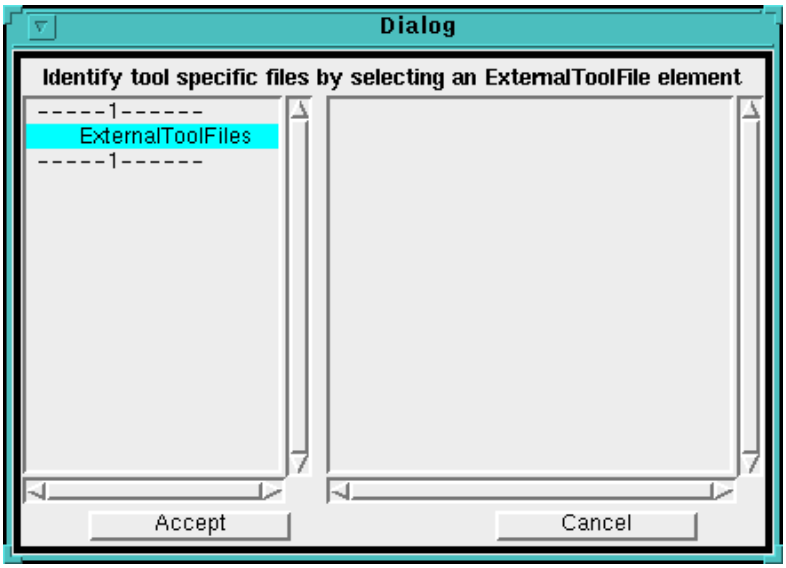

Figure 4-1 Element selection dialog for Export to RAM-ILS Report

The user is then presented with a dialog requesting a description or identifier. The image name and current date are automatically supplied; therefore, it is recommended that the data entered should reflect something related to data content. This entry is optional.

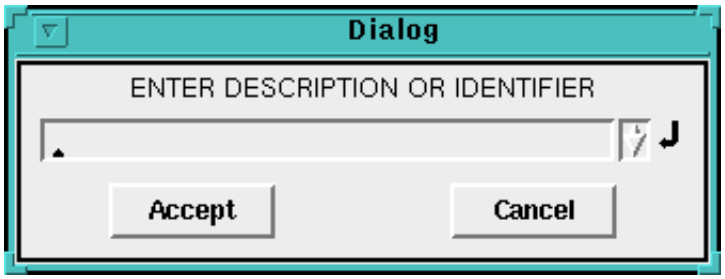

Figure 4-2 Description entry dialog

Selection of the starting *Component* is the next operation. The *Component* selected must have the Component Type attribute set to System, and a *LifeCycleParameter* element must be related.

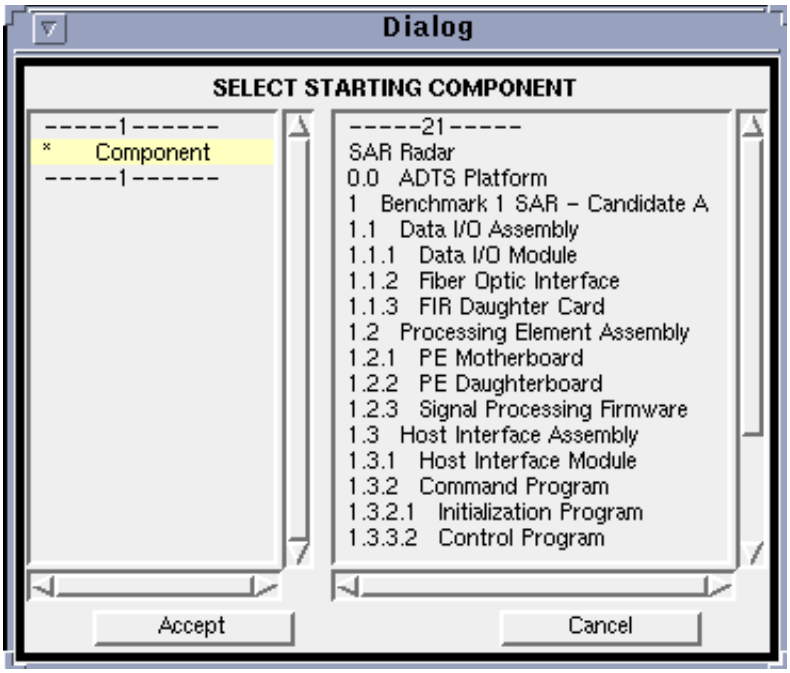

Figure 4-3 Element selection dialog for starting Component

DATA EXPORTED TO REALITY (RAM-ILS)

The following table shows the data exported from RDD-100 to the MSI toolset. Element types are shown on the left, and their attribute names or data descriptions are shown in the right column.

Data Exported to Reality Toolset

Element Type	Attribute Name or Data (The file content contains the attribute values)
n/a	Image Name
n/a	Current date
n/a	User entered description
ExternalToolFiles	Element Name
Component	Component name
	Component Type
	Component Sub Type
	Quantity in Next higher Assembly
	Quantity Requested for RMA
	Quantity Required for Operation
	Redundancy mode
	Length predicted (ft)
	Length budgeted (ft)
	Width predicted (ft)
	Width budgeted (ft)
	Depth predicted (ft)
	Depth budgeted (ft)
	Volume Sensitivity
	Weight predicted (lb)
	Weight budgeted (lb)
	Weight Sensitivity
	Power maximum predicted (watts)
	Power maximum budgeted (watts)
	Power average predicted (watts)
	Power average budgeted (watts)

Data Exported to Reality Toolset

Element Type	Attribute Name or Data (The file content contains the attribute values)
	Power Sensitivity
	Technology Maturity
Component	*DuplicateComponents* name (if there is a relation to a *DuplicateComponents* element.)
	Finds Component Target for each *ItemLink* **input to** this *Component* Outputs “input from”=[“Target Component Name”,”ItemLink Name”].
	Finds Component Target for each *ItemLink* **output from** this *Component.* Outputs “output to”=[“Target Component Name””,”ItemLink Name”].
	Finds Component Target of **executed on** relation. Outputs “executes” = “Target Component Name”.
	Points to the components the current component is built from (the next lower assemblies)
	Checks Functions’ Critical Path attribute. If any allocated function is set to Yes, outputs “Yes”. Also lists the name of every function allocated to this *Component.*
Cost	Amortized Unit Production predicated
	Amortized Unit Production budgeted
	Unit Production predicted
	Unit Production budgeted
	Total Production Quantity
	Production cost predicted
	Production cost budgeted
	Production cost sensitivity
	Operational cost predicted
	Operational cost budgeted
	Operational cost sensitivity
	Support cost predicted
	Support cost budgeted
	Support cost sensitivity

Data Exported to Reality Toolset

Element Type	Attribute Name or Data (The file content contains the attribute values)
LifeCycleParameter These attributes are included only at the highest assembly of interest.	Operating Environment
	Operational Environment Temperature Max (F)
	Operational Environment Temperature Min (F)
	Availability (operational)
	Availability (inherent)
	Reliability
	Deployment Quantity
	Mission Period (hrs)
	Duration of Lifecycle (years)
	On Time Factor (hrs per month)
	Volume sensitivity
	Weight sensitivity
	Power sensitivity
	Production Cost sensitivity
	Operational Cost sensitivity
	Support Cost sensitivity
RMA	Allow RMA Quantity Request
	Availability predicted
	Reliability predicted
	MTBCF budgeted (hr)
	MTBF budgeted (hr)
	LRU, Line Replaceable Unit
	MTTR, line budgeted (hr)

DATA IMPORTED FROM REALITY (RAM-ILS)

The following table shows the data imported from MSI into RDD-100. Element type names are on the left and their attribute names are on the right.

Data imported from Reality

Element Type	Attribute Name
Component	Element name2
	Quantity Requested for RMA
ExternalToolFiles	Element name
	RAM-ILS Directory Used
RMA	Element name
	Availability predicted
	Reliability predicted
	MTBCF predicted (hr)
	Optimized MTBF (hr)
	MTBF Optimization Criteria
	MTBF predicted (hr)
	Method used for MTBF predicted
	Maintainability Procedure
	MTTR, line predicted (hr)
	MTTR, LRU ORG (Tf)
	MTTR, Module ORG (Tmo)
	MTTR, LRU IL (Ti)
	MTTR, Module IL (Tmi)
	MTTR, LRU Depot (Td)
	MTTR, Module Depot (Tmd)
Optional	
CriticalIssue	Element name
	Description
	Relation = **traces from**
Comment	Element name
	Description
	Relation = **annotates**

DATA EXPORT TO JRS

Only one component is exported to JRS for each report execution.

Export to JRS Report Template

When executing this report (**Print** menu selection), the **ASCII with no linefeeds** option in the Report Output Setup dialog must be selected. The File button initiates report execution.

Select a *Component*.

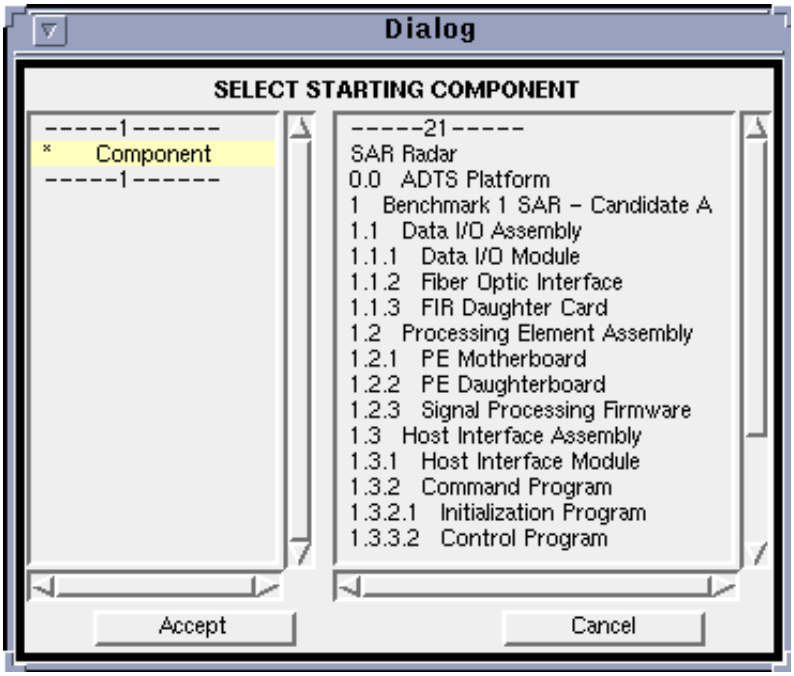

Figure 4-1 Component selection dialog

The user is then presented with a dialog requesting a description or identifier. The image name and current date are automatically supplied; therefore, it is recommended that the data entered should reflect something related to data content. This entry is optional.

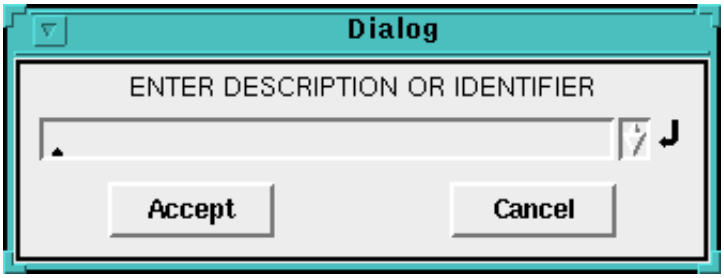

Figure 4-2 Description or identifier entry dialog

DATA EXPORTED TO JRS

The following table shows the data exported to JRS.

Data Exported to JRS

Component Element Type Attribute Name
Component name
Length predicted (ft)
Length budgeted (ft)
Width predicted (ft)
Width budgeted (ft)
Depth predicted (ft)
Depth budgeted (ft)
Volume sensitivity
Weight predicted (lb)
Weight budgeted (lb)
Weight sensitivity
Power maximum predicted (watts)
Power maximum budgeted (watts)
Power average predicted (watts)
Power average budgeted (watts)

Data Exported to JRS

Power sensitivity
Development cost predicted
Development cost budgeted
Production cost predicted
Production cost budgeted
Production cost sensitivity
Operational cost predicted
Operational cost budgeted
Operational cost sensitivity
Support cost predicted
Support cost budgeted
Support cost sensitivity
MTBCF predicted (hr)
MTBCF budgeted (hr)
MTBF predicted (hr)
MTBF budgeted (hr)
Data input Name for each input
Arrival Rate average (words/sec) for each input
Arrival Rate peak (words/sec) for each input

DATA IMPORTED FROM JRS

Data Imported from JRS

Element Type	Attribute User Entry Name
Optional	
CriticalIssue	Element name
	Description
	Relation = **traces from**

DATA EXCHANGE QUICK REFERENCE

Data Exchange Quick Reference

ELEMENTS	ATTRIBUTES	TO	FROM
Component	Component Type	PRICE MSI	
	Component Sub	PRICE MSI	
	Design Source	PRICE	
	Percent of New Design	PRICE	
	Duplicate - Used in other assemblies	PRICE	
	Quantity in Next higher Assembly	PRICE MSI	
	Quantity Requested for RMA		MSI
	Quantity Required for Operation	PRICE MSI	
	Redundancy mode	PRICE MSI	
	Length predicted (ft)	PRICE MSI JRS	
	Length budgeted (ft)	PRICE MSI JRS	
	Width predicted (ft)	PRICE MSI JRS	
	Width budgeted (ft)	PRICE MSI JRS	
	Depth predicted (ft)	PRICE MSI JRS	
	Depth budgeted (ft)	PRICE MSI JRS	
	Volume sensitivity	MSI JRS	
	Weight predicted (lb.)	PRICE MSI JRS	
	Weight budgeted (lb.)	PRICE MSI JRS	
	Weight sensitivity	MSI JRS	
	Power maximum predicted (watts)	MSI JRS	
	Power maximum budgeted (watts)	MSI JRS	
	Power average predicted (watts)	MSI JRS	
	Power average budgeted (watts)	MSI JRS	
	Power sensitivity	MSI JRS	
	Technology Maturity	PRICE MSI	
	Technology Type 1	PRICE	
	Equipment Type 1	PRICE	
	Percent of Technology and Equipment 1	PRICE	
	Technology Type 2	PRICE	
	Equipment Type 2	PRICE	
	Percent of Technology and Equipment 2	PRICE	

Data Exchange Quick Reference

ELEMENTS	ATTRIBUTES	TO	FROM
	Technology Type 3	PRICE	
	Equipment Type 3	PRICE	
	Percent of Technology and Equipment 3	PRICE	
	Technology Type 4	PRICE	
	Equipment Type 4	PRICE	
	Percent of Technology and Equipment 4	PRICE	
	Technology Type 5	PRICE	
	Equipment Type 5	PRICE	
	Percent of Technology and Equipment 5	PRICE	
	SLOC, Source Lines of Code	PRICE	
	Percent of Memory Utilization	PRICE	
	Percent of Processor Utilization	PRICE	
	Language	PRICE	
	Percent New Code	PRICE	
	Mathematics (1)	PRICE	
	String Manipulation (2)	PRICE	
	Store and Retrieve (4)	PRICE	
	Online Communications (6)	PRICE	
	Real Time (8)	PRICE	
	I Operating System or Interactive (10)	PRICE	
	User Defined Type (value below)	PRICE	
	Design Difficulty Value for User Defined Type	PRICE	
Cost	Purchased Item	PRICE	
	Development predicted	PRICE JRS	PRICE
Cost (continued)	Development budgeted	PRICE JRS	
	Amortized Unit Production predicted	MSI	PRICE
	Amortized Unit Production budgeted	MSI	PRICE
	Unit Production predicted	MSI	PRICE
	Unit Production budgeted	MSI	PRICE
	Total Production Quantity	MSI	PRICE
	Production predicted	PRICE MSI JRS	PRICE
	Production budgeted	PRICE MSI JRS	
	Production sensitivity	MSI JRS	
	Operational predicted	MSI JRS	
	Operational budgeted	MSI JRS	
	Operational sensitivity	MSI JRS	
	Support predicted	PRICE MSI JRS	

Data Exchange Quick Reference

ELEMENTS	ATTRIBUTES	TO	FROM
	Support budgeted	PRICE MSI JRS	PRICE
	Support sensitivity	MSI JRS	
Comment	Description		PRICE MSI
CriticalIssue	Description		PRICE MSI JRS
DuplicateComponents	Total System Quantity (calculated)	PRICE MSI	
DiscreteItem	Arrival Rate average (words/sec)	JRS	
	Arrival Rate peak (words/sec)	JRS	
DiscreteFunction	Critical path	MSI	
LifeCycleParameter	Operating Environment	PRICE MSI	
	Operational Environment Temperature Max (F)	MSI	
	Operational Environment Temperature Min (F)	MSI	
	Availability (operational)	MSI	
	Availability (inherent)	MSI	
	Reliability	MSI	
	Deployment Quantity	PRICE MSI	
	Prototype Quantity	PRICE	
	Mission Period (hrs)	PRICE MSI	
	Duration of Lifecycle (years)	PRICE MSI	
	On Time Factor (hrs per month)	PRICE MSI	
	Volume Sensitivity	MSI	
	Weight Sensitivity	MSI	
	Power Sensitivity	MSI	
	Production Cost Sensitivity	MSI	
	Operational Cost Sensitivity	MSI	
	Support Cost Sensitivity	MSI	
ExternalToolFiles	Cost Account File Requested	PRICE	
	Cost Account File Used		PRICE
	Sync. File Requested	PRICE	
	Sync. File Used		PRICE
	Lock Name Requested	PRICE	
	Lock Name Used		PRICE
	RAM-ILS Directory Used		MSI
RMA	Allow RMA Quantity Request	MSI	
	Availability predicted	PRICE	MSI
	Reliability predicted		MSI
	MTBCF budgeted (hr)	PRICE MSI JRS	

Data Exchange Quick Reference

ELEMENTS	ATTRIBUTES	TO	FROM
	MTBCF predicted (hr)	PRICE JRS	MSI
	MTBF budgeted (hr)	PRICE MSI JRS	
	Optimized MTBF (hr)		MSI
	MTBF Optimization Criteria		MSI
	MTBF predicted (hr)	PRICE JRS	MSI
	Method used for MTBF predicted		MSI
	LRU, Line Replaceable Unit	PRICE MSI	
	Maintenance Procedure		MSI
	Maintenance Concept Requested for Costing	PRICE	
	Maintenance Concept Used for Costing		PRICE
	MTTR, line, predicted (hr)	PRICE MSI	MSI
	MTTR, line, budgeted (hr)	PRICE MSI	
	MTTR, LRU ORG (Tf)	PRICE	MSI
	MTTR, Module ORG (Tmo)	PRICE	MSI
	MTTR, LRU IL (Ti)	PRICE	MSI
	MTTR, Module IL (Tmi)	PRICE	MSI
	MTTR, LRU Depot (Td)	PRICE	MSI
	MTTR, Module Depot (Tmd)	PRICE	MSI
TimeFunction	Critical path	MSI	