

A DFMA Cost Information Management System at Whirlpool



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Presentation Outline

- Overview of the Competitive Cost Analysis Team in China
- Internal Pressures
- Responses
- DFMA Manager Technical Solution Overview
- Lessons Learned & Benefits



Competitive Cost Analysis (CCA) Group

- Charter – Develop & Standardize a competitive comparison method that is repeatable and reliable
- DFMA is the foundation of this process
 - DFA is used for labor estimates and BOM
 - DFM is used for Cost Modeling with custom libraries
 - Process standardized, documented and communicated
- Principal customers
 - Engineering
 - Existing product comparisons (cost gap, materials used, design solutions)
 - New product development (value optimization, market comparison)
 - Procurement
 - Current spend analysis (Model to PO comparison)
 - Target Costing input (identification & setting)



CCA is the global teardown & analysis group based in China

- Started in 2008
- From 6 to 64 people
- From 10 to 212 reports / yr
- Average \$10/unit in savings ideas per report
- \$15M in procurement spend analysis savings in 2011

Competitive Cost Analysis Reports

--Report Overview--

Sub-System Cost Gaps

WHR WED97HEXW0 vs. ACME XYZ4567 Designed Cost Comparison								
Media Set	WHR WED97HEXW0			ACME XYZ4567			Difference	
	Material	Cost	Totals	Material	Cost	Totals	Material	Cost
MS-CABINET ENCLOS	27,583	0,898	28,481	28,555	1,429	29,984	0,981	0,431
MS-DOOR	10,239	1,293	11,532	10,451	1,024	11,475	(780)	(0,331)
MS-DOOR/VENTILATION	0,963	0,404	1,367	1,247	0,814	2,061	0,284	0,411
MS-PAVILION	8,114	0,434	8,548	11,797	1,861	13,757	3,683	1,887
MS-W/CONDENS	12,951	0,555	13,506	12,455	0,751	13,206	(485)	(0,196)
MS-CONTROL	106,913	1,052	107,965	79,914	3,119	83,033	(28,400)	(1,407)
MS-CABINET SHEETPL	31,888	1,861	33,749	40,133	1,821	41,954	8,245	0,180
MS-DRIVE SYSTEM	20,180	3,376	23,556	24,446	3,816	28,262	4,266	0,240
MS-DEPENDENT SYS	2,216	0,461	2,677	7,762	0,373	8,135	(4,446)	(0,088)
MS-DRIVE DRIVE	40,924	1,999	42,923	41,293	1,789	43,082	(4,371)	(0,197)
MS-WATER	9,705	0,900	10,605	10,330	0,910	11,240	0,531	(0,067)
MS-RECOVER	7,078	0,883	7,961	17,380	1,807	19,187	10,272	1,014
MS-VALVE/CONTROL E	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Sales Total, \$	284,747	11,367	296,114	288,762	15,841	304,603	(19,745)	(2,465)

\$3,531 represents the difference between WHR and ACME designed cost with feature reconciliation

Observations

Item	Key Observations	Designed Cost	Page
Washer Motor	Washer motor is ACME part and is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1
ACME Door Hinge	ACME door hinge is more expensive than WHR	\$1,201	1

Pictures with Cost Details

Item	Designed Cost	ACME Cost	Design
Inner Door Assembly	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	
Door hinge	\$1,201	\$1,201	

WHR uses curve glass vs. ACME flat; ACME uses more parts for door assembly than WHR

--Report Complexity--

High Volume

- More than 200 reports / year
- 2500 files / ~2GB of data per report
- Global customers, 12 design centers
- Increasing customer requests for additional data.

Varied Use Cases

- Driving design teams
- Leveraged by purchasing
- Incorporated in launch efforts
- Utilized by Cost Reduction teams

Changing Environment

- Rapid cost input changes
- Increasing modeling by other teams
- Increasing use cases
- Pushed to the limits of productivity

Challenges in path to increased user access and accuracy

Goals – Manage access and updating of existing CCA data

- Report and file access is limiting
 - Prior managed distribution system. Need global access
 - Quantity and size of files make search difficult
- Manual updating process is too burdensome
 - Users can not compare cost results across reports because of different libraries in each comparison.
 - Process takes the same amount of time to update past analysis to today's cost libraries
- Whirlpool wanted to leverage existing technologies: DFMA, DFR and Windchill PLM. No other solution met their needs.
 - DFMA – BDI costing tools
 - DFR – Whirlpool's database of classified part metadata
 - Windchill – Whirlpool's new PDM system



Its like comparing "apples to oranges" if your library inputs are different

“DFMA Manager Tool” addresses many pain points

--Issue Summary--

- Reduce cost modeling and file errors as activity increases and new hires come onboard.
- Reduce manual effort and time of assembling reports to customers
- Reduce the effort required to refresh packages of DFMA models for internal customers
- Reduce the number of errors tied to input cost libraries
- Reduce time spent duplicating cost models already in existence

--Technology Response*--

- Automated DFMA **model validation** and error reporting
- DFMA **report publisher** to package up libraries, files, and DFMA data
- DFMA **automated model refresh** capability to update models with new input data
- DFMA **library management** standardizes usage and refresh
- **Search capability** to enable model reuse whenever possible

*Other responses beyond technology include RACI, process, KPI's, and others

CDS DFR / DFMA Integration Solution Capabilities – Augmenting the Parts Catalog

- Creates and Maintains a Consolidated, Centralized Repository of DFMA Data, Files, Libraries, & Projects
 - Validates DFMA® data and files
 - Publishes data, files and libraries in a centralized database
 - Enables automated refreshes of DFMA® data against selected DFMA libraries
- Provides Analytical Query, Search, and Reporting Tools
 - Should-Cost Reports
 - Cost Comparisons
 - Cost Roll-ups

Search, Navigate,
Roll-up &
Compare Cost
Analysis Results

Query /
Report

SMARTFIND
BY CONVERGENCE DATA SERVICES

Consolidated,
Centralized
Repository of
Cost Data,
Files,
Libraries &
Projects

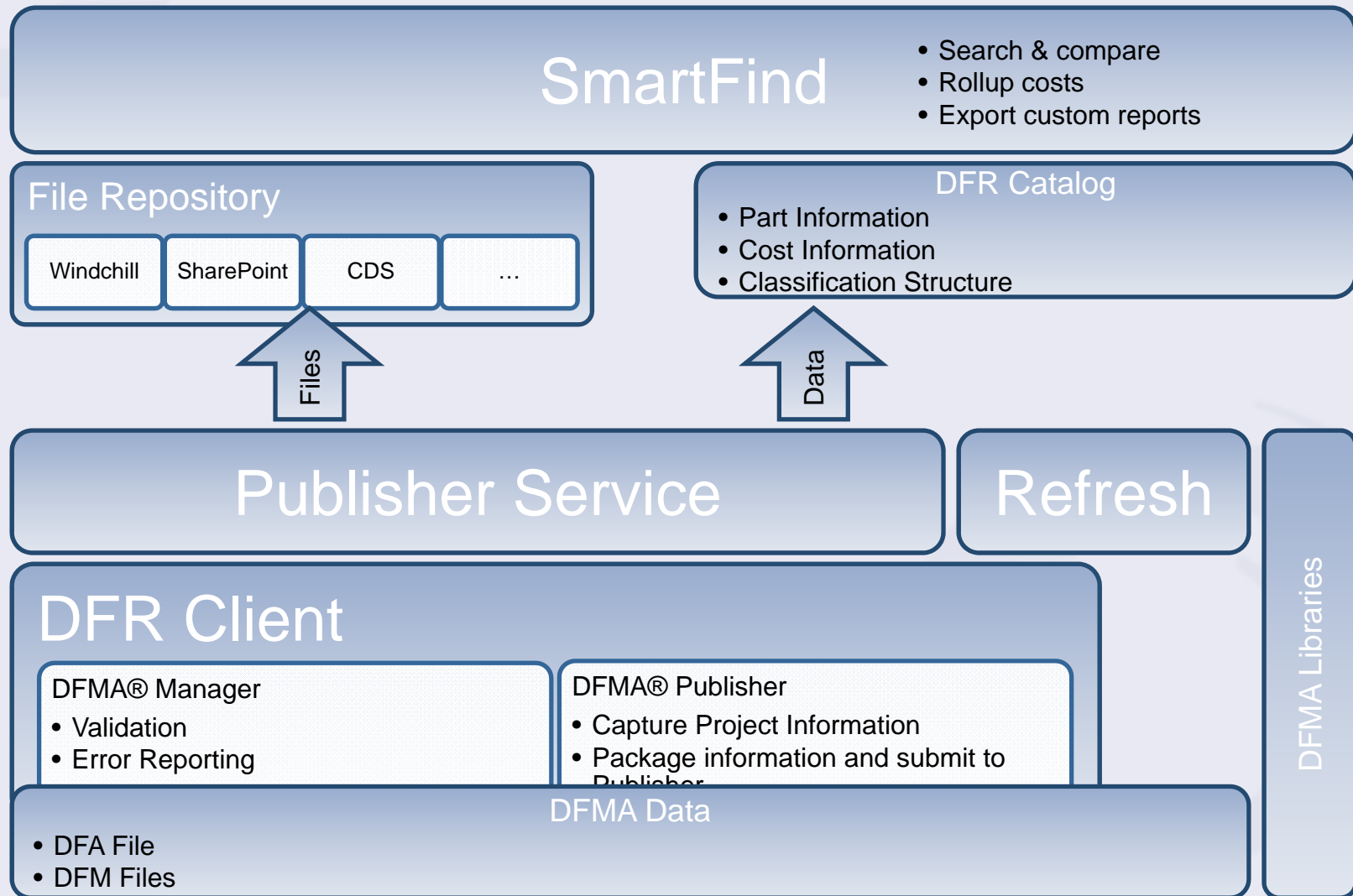
Validate

Refresh

Publish

DESIGN FOR RETRIEVAL
BY CONVERGENCE DATA SERVICES

Technical Solution Architecture



Validate

The DFMA[®] Manager Validation establishes and enforces standardization of DFMA analyses across the enterprise.

- Validations ensure DFMA[®] files are correct prior to publishing
 - Checks for missing data and ensures all required information is provided, e.g. part numbers, weights, etc.
 - Ensures better quality data will be available for analysis and that comparisons will be enabled
- Provides a diagnostic report for errors found
- Repairs data issues

Design For Retrieval - [DFMA[®] Manager]

File Edit View Reports Tools Window Help

Settings File / Target Folder
To create a new settings file, use the [...] button. Navigate to your target folder, and type in the settings file name.
Z:\Whirlpool\TestVal\DFM Cost Models\MaytagMDB7609AWB2.dfs.xml

Library Folder
C:\Users\dtaraboletti\My Business Documents\5Points\ConvergenceData\Whirlpool\TestVal\Libraries\Common Libraries

Name	File	Description
DFM Material Library	nar_material_201001r2.mtl	The common DFM material library
DFM Operations Library	nar_supplier_v0r2.opr	The common DFM operation library
DFM Machine Library	nar_supplier_v0-1r3.mcl	The common DFM machine library
DFA Material Library	nar_material_201001r2.mtl	The common DFA material library
DFA Operations Library	dfaoperation_nar_sz_v0r2.dfo	The common DFA operation library
Main Assembly / Folder	maytag mdb 7609awb2 dfa 080510.dfa	The main dfa file
Whirlpool Reference Assembly / Folder		The main dfa file for the Whirlpool Reference Assembly

Check Refresh

Run v46

Show Error Log 0/0

Show Warning Log Show Info Log

Show Repair Log Show Diagn Log

Only DFM Ignore library overrides

Unlock Cost Fields

Repair DFM Component Paths

Repair Part Names

Skip check of part numbers vs DFR

Logged in at 3/4/2011 10:00:15 AM / /-/ dtaraboletti / WP_REL_WP_C 3.6.862.0 Oracle

- Assures that the DFM component files referenced by the DFA files are present
- Conducts validations on DFM parts and DFA model subassemblies
- Verifies the DFMA[®] version last used to calculate cost
- Verifies that materials, machines, and operations referenced by the DFMA[®] files are present in the referenced libraries
- Currently over 60 validation checks are done (see examples)

Sample DFMA[®] Validation Checks

Exception Level	Exception Code	Exception Note
Error	PNMiss	No part number specified for part name: {part name} – {file name}
Error	NoPrtSpec	No part number specified, name: {Part Number}. Is it an operation?
Error	NoVarData	No variable data for: {item}-{variable}
Error	PartMultFiles	Part: {item number} is defined in multiple files:{file names}
Error	PartMultFilesUsing	Part: {Part Number} is defined in multiple files:{file name 1}, {filename 2}...
Error	WpXrefNotFnd	The comparable equivalent part {cross-reference part number} in {part number} does not exist in the referenced teardown
Error	WpXrefBlank	The equivalent comparable part in {competitor part number} is blank
Error	LckCostFld	The following refresh-managed attributes were edited/overridden by the user:{user id}
Error	PNMissDFM	The part number: {part number} is not in the DFM database
Error	TDFldMiss	The teardown code field is missing

Helps to standardize your DFMA[®] Modeling Practices

Publish

The DFMA Publisher bundles DFMA Data, Files and Libraries into a centralized, consolidated repository.

- Captures key meta-data and related artifacts
 - Creates “Projects” that includes multiple DFMA[®] analyses for roll-up or comparison at multiple levels e.g. Product, Sub-system, Module, Component
 - Indexes DFMA[®] files with legacy document vault(s) or network drives
 - Links related reference material, e.g. summary reports, etc., associated with a DFMA[®] analysis
- Establishes a Refresh Schedule
 - Enables automated, periodic checks against selected Libraries for revisions which would in-turn drive the need for DFMA refresh

Design For Retrieval - [DFA Publisher]

File Edit View Reports Tools Window Help

Applications

Home Page

Classification Manager

Attribute Manager

Item Loader

Data Developer

Allowed Values Manager

DFMA[®] Manager

DFA Publisher

General Products Reference Materials Findings Refresh Settings Summary

Name:

Description: (4000 char max)

Request Date: 1/11/2011

Requested By:

Analysis Start Date: 4/12/2011

Project Type: CCA

CCA Lead:

Analysis End Date: 5/27/2011

Base UOM: English

Project Assumptions:

Assumed Manufacture location to be Mexico

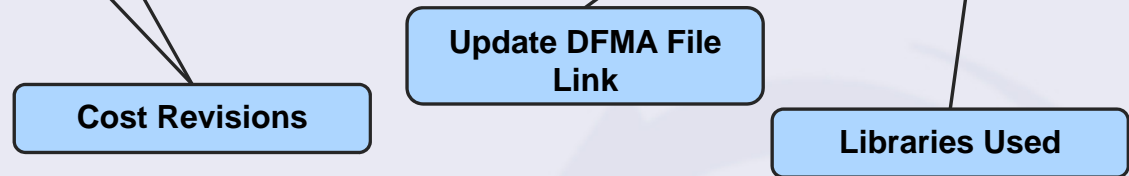
Key Project Meta Data Fields

Refresh

Refresh capabilities ensure the effective reuse and update of DFMA Analysis assets with the most relevant, up-to-date costs.

- Users can manually select projects for refresh, or set automatic refresh schedules in the DFA Publisher
- Refresh triggers use of the latest DFMA libraries, e.g. with updated materials pricing, for the correct region (e.g. China, India, South America, etc.) based on user's selected region
- Upon completion of a Refresh, the new cost data is Published to the repository and user notifications are sent
- The Revision History of costs and related DFM/DFA files are maintained in the repository

Revision	Date	Raw Material	Processing	Margin/Burden	Cost Modeling Cost	Process Type	DFMA File	Libraries
Rev1	4/23/2012	\$0.1237	\$0.1411	\$0.0662	\$0.331	Injection molding	DFMA File	USA_SupplierMachine_v0_u1_r1.mcl USA_Material_2010-07_v0_u2_r2.mtl USA_SupplierOperations_v0_u1_r2.opr
Rev2	1/13/2013	\$0.1337	\$0.1421	\$0.0662	\$0.331	Injection molding	DFMA File	USA_SupplierMachine_v0.mcl USA_Material_2012-07_v0.mtl USA_SupplierOperations_v0.opr

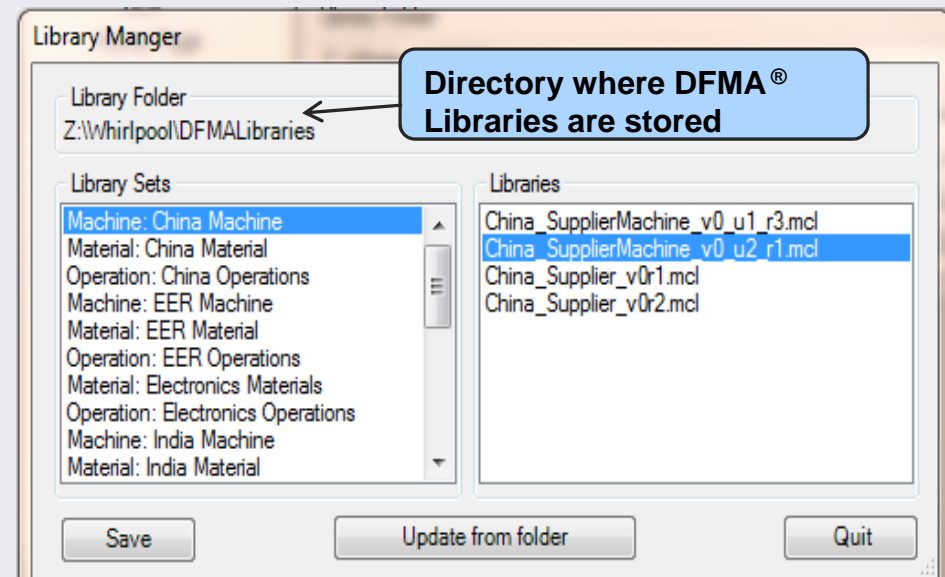


Refresh

DFMA[®] Library Management provides coordination of Dynamic and Complex enterprise-wide Cost Libraries.

- Dynamic Library revisions drive the need for provided Refresh Management capabilities
 - DFMA Manager dynamically recognizes the need for analysis refresh based on Library obsolescence
- DFMA Manager reduces extended enterprise complexity through management of Libraries across various criteria such as by Region of Origin
 - Machines
 - Materials
 - Operations
- DFMA Manager maintains Historical Revisions of cost libraries

Example of Managing DFMA[®] Libraries by Region



Query/ Report

CDS' SmartFind Search tool provides Search, Compare, Navigate and Rollup of DFMA[®] Should-cost Data.

- Search to find product or part cost data

- Use search templates or just add filters manually to search for data

The screenshot displays the CIM SMARTFIND web application interface. At the top, there are navigation links: Home, View Configuration, Release Notes, Help, and CIM Help. The user is logged in as 'cholt' and can click Logout. The main search area includes a 'Search Text' input field, a 'Search Type' dropdown menu set to 'Platform to Products', and a 'List Filter' section with an 'Upload File' link. A blue callout box labeled 'Free Text Search' points to the search text input field. To the right, there are two blue callout boxes: 'Manually Add Filters' pointing to the 'Attribute Filters' section, and 'Use Search Templates' pointing to the 'Templates' dropdown menu. The 'Attribute Filters' section contains a table with columns for Attribute, Operation, Filter, and UOM. The filters are: Brand Name (Equal, Whirlpool), Manufacture Location (Ignore), Model (Equal, B550C), and Platform (Equal, VAW). Below the filters are 'Search' and 'Reset' buttons. The search results section shows a tree view on the left with 'Root (14)', 'CIM (14)', and 'Products (14)'. The main results area shows 'Showing items 1-1 of 1' and a table with columns: Platform, Platform Description, Product Part Number, Product Part Qualif, Product Part Description, Brand Name, Manufacture Location, and Model. The table contains one row: Platform: VAW, Platform Description: VAW, Product Part Number: B550C, Product Part Qualif: CIM.Product, Product Part Description: Whirlpool - B550C, Brand Name: Whirlpool, Manufacture Location: Shanghai, China, Model: B550C. There is an 'Add to Cart' link next to the Platform column. Below the table, there is an 'Export' link. At the bottom left, there is a 'Products' section with 'Developers: AdminF AdminL' and 'Approvers:'. Below that is a 'CIM Product Items' section with 'Attributes: AssemblyLink *', 'Images *', and 'Whirlpool Part Reference *'. An 'Attribute Legend' is also present with 'Key *' and 'Required *'.

Query/ Report

The DFR/DFMA Integration federates technical, commercial and cost data in one view for better decision making.

- Displaying data on DFMA[®] parts from multiple systems

- Links to drawings, DFMA[®] files and images

The screenshot displays the SMARTFIND web application interface. At the top, the logo 'SMARTFIND BY CONVERGENCE DATA SERVICES' is visible. The user is logged in as 'Admin'. The main content area is divided into two sections: 'Item Summary Information' and 'Item Information'.

Item Summary Information:

Item Number	W10298624
Qualifier	Part.0
Revision	
Item Description	UI LOW IMP T3 ECO WSHR ASM WPL
Legacy Part Number	
Update	6/7/2011 8:19:06 AM
Category	Root\Parts\Console Enclosures\Fabric Care\Formed
Status	NEW

Item Information:

Brand	Grey
Color - Standard	Grey
Height (mm)	19
Item Master URL *	http://desrv4.sjtc.whirlpool.com/ebom/servlet/BomItemViewServlet?partNbr=W10298624
Item Type Code *	P
Material - Generic	Plastic
Status Code *	rel
Width (mm)	345
MRP *	WMCS

PDM Data:

Drawing Number *	8565349
Drawing URL *	http://desrv4.sjtc.whirlpool.com/glv/servlet/GlvGetFileServlet?drawing=8565349
Drawing Unavailable *	False
Usage 12 Months *	39788
Usage 12 Months UOM *	EA
Active Item *	True
Variant	False
Windchill URL	http://desrv4.sjtc.whirlpool.com/oss/PartInformation?itemNumber=W10298624
Material Cost *	2.3

ERP Data:

Usage 12 Months *	39788
Usage 12 Months UOM *	EA
Active Item *	True
Variant	False

DFMA Data Including URL's to DFM files in PDM vault:

Usage 12 Months *	39788
Usage 12 Months UOM *	EA
Active Item *	True
Variant	False

Images that Magnify Multiple Views:

Query/ Report

Provides full cost history

- Provides full history of cost summary data
- Provides access to original DFMA file (DFA/DFM)

Home [View Configuration](#) [Release Notes](#) [Help](#) [CIM Help](#)

SMARTFIND
BY CONVERGENCE DATA SERVICES

Logged in as: **Admin** [Logout](#)

[Add To Cart](#) [New Search](#) [Find Similar](#) [XML Export for Clone](#)

Item Summary Information [Legend](#)

Item Number: 8557857_3
 Qualifier: Part.0
 Revision:
 Item Description: 8557857_3 bracket
 Legacy Part Number:
 Update: 2/24/2012 10:52:00 AM
 Category: Root\CIM\To Be Classified - CIM
 Status: NEW

Item Information

Multiple Cost Revisions Due to Refresh

Links to DFMA Files

Libraries Used for Cost Calculations

Revision	Date	Raw Material	Processing	Margin/Burden	Cost Modeling Cost	Process Type	DFMA File	Libraries
Rev1	4/23/2012	\$0.1237	\$0.1411	\$0.0662	\$0.331	Injection molding	DFMA File	USA_SupplierMachine_v0_u1_r1.mcl USA_Material_2010-07_v0_u2_r2.mtl USA_SupplierOperations_v0_u1_r2.opr
Rev2	1/13/2013	\$0.1337	\$0.1421	\$0.0662	\$0.331	Injection molding	DFMA File	USA_SupplierMachine_v0.mcl USA_Material_2012-07_v0.mtl USA_SupplierOperations_v0.opr

Query/ Report

Ability to Navigate the DFMA BOM

■ View Cost Rollups

■ Export Cost Data

View Cost Data of Sub-Assemblies and Components

View/Hide All

Item Information

SubItems Item Details Cost History Competitive Comparison Relationships

Sub Items

Project: FC.Asia.2011.36

Sub-Systems	Cost Modeling Cost	Final Assembly Cost	Total Cost
Cabinet	CNY81.5071	CNY0.5831	CNY82.0902
Top And Lid	CNY53.9226	CNY0.2084	CNY54.1309
Controls	CNY134.667	CNY1.2745	CNY135.9415
Hydraulic System-Inlet	CNY17.1197	CNY0.2459	CNY17.3657
Hydraulic System-Outlet	CNY20.716	CNY0.1632	CNY20.8792
Drive System	CNY200.7823	CNY0.5554	CNY201.3377
Wash Unit	CNY150.2273	CNY1.13	CNY160.4673
Hydraulic System-Recirculation		CNY0	CNY0
Ventilation		CNY0	CNY0
Packaging			CNY46.02
Documentation	CNY0.655		CNY0.7566

Navigate DFA® Assembly Structure

Export Cost Data Into Excel

Export

Query/ Report

Competitive cost reporting with SmartFind Search and Query provides competitive cost “dashboard” capability.

- Compare products by DFMA[®] data
- Navigate the product structure as you compare products at different levels

CIM SMARTFIND
BY CONVERGENCE DATA SERVICES

Home View Configuration Release Notes Help CIM Help

Logged in as: cholt Logout

B550C ← **See where your are in the product structure and navigate**

Competitive Part Comparison: Module System to Sub-System New Search Print Export Page Item Details

Scoped by project: FC.Asia.2011.36_WHR B550C

Whirlpool - B550C
B550C

See Cost Differences

Drill Down Product Structure

	Item Number	DFM Designed Materials Cost	DFM Designed Labor Cost	Item Number	DFM Designed Materials Cost	DFM Designed Labor Cost	Delta
Cabinet	MSV1021	CNY81.5071	CNY0.5831	MSV1032	CNY77.0867	CNY0.765	CNY4.2385
Top And Lid	MSV1022	CNY53.9226	CNY0.2084	MSV1033	CNY48.2233	CNY0.2193	CNY5.6884
Controls	MSV1023	CNY134.667	CNY1.2745	MSV1034	CNY93.6382	CNY0.3958	CNY41.9075
Hydraulic System-Inlet	MSV1024	CNY17.1197	CNY0.2459	MSV1036	CNY17.2642	CNY0.3198	CNY-0.2184
Hydraulic System-Outlet	MSV1025	CNY20.716	CNY0.1632	MSV1037	CNY20.3521	CNY0.2722	CNY0.2549
Drive System	MSV1026	CNY200.7823	CNY0.5554	MSV1038	CNY177.7343	CNY0.6301	CNY22.9733
Wash Unit	MSV1027	CNY159.3373	CNY1.13	MSV1039	CNY150.2907	CNY1.3145	CNY8.8621
Hydraulic System-Recirculation	MSV1028	CNY0	CNY0	MSV1040	CNY0	CNY0	CNY0
Ventilation	MSV1029	CNY0	CNY0	MSV1041	CNY0	CNY0	CNY0
Packaging	MSV1030	CNY45.6854	CNY0.3346	MSV1042	CNY40.1063	CNY0.1991	CNY5.7146
Documentation	MSV1031	CNY0.653	CNY0.1016	MSV1043	CNY1.765	CNY0.1751	CNY-1.1835
Whirlpool - B550C	B550C				CNY597.5771	CNY4.3166	CNY78.8948

View Part/Assembly Details

Green - Negative Deltas indicate Whirlpool cost advantage

SmartFind® 3.6.986.0 Oracle WP_5 - LiveUpdate Convergence Data Services Copyright © 2006-2012

Lessons Learned and Early Benefits

--Lessons--

- Standardization of processes and inputs can yield significant productivity improvements
- Alignment with “consumers” of cost data is critical to reduce misuse/misunderstanding
- Technology can be used to keep data relevant to current decisions
- Program mapping and reviews are keys to success
- Significant savings from cost modeling is obtainable



Comparing “apples to apples” frees time for value driven decision making

--Early Benefits--

- Productivity gains have reduced future resource costs
- The tool will speed up a process that already saves millions of dollars through procurement analysis
- Millions more have been gained through design changes
- Data linkages to other processes are envisioned
- Users are excited about the increased availability and updating of the data