



Automated Costing to Identify Opportunities to Reduce Direct Material Spend

May 2014

Today's Agenda

- Intro to Automated Costing
- Product Cost Reduction Case study



aPriori Customers

+ 4 of the Largest Ag & Const Companies in the World



Agricultural & Construction Equipment

+ 1 of the Largest Power & Energy Companies in the World



Industrial Machinery

+ 3 More Global Tier One Auto Mfgs & 1 Global Train Mfg



Automotive/Transportation

+ 4 of the Largest High Tech Companies in the World



Electronics & High Tech Devices

+ The Largest Mfg of Home Appliances in the World



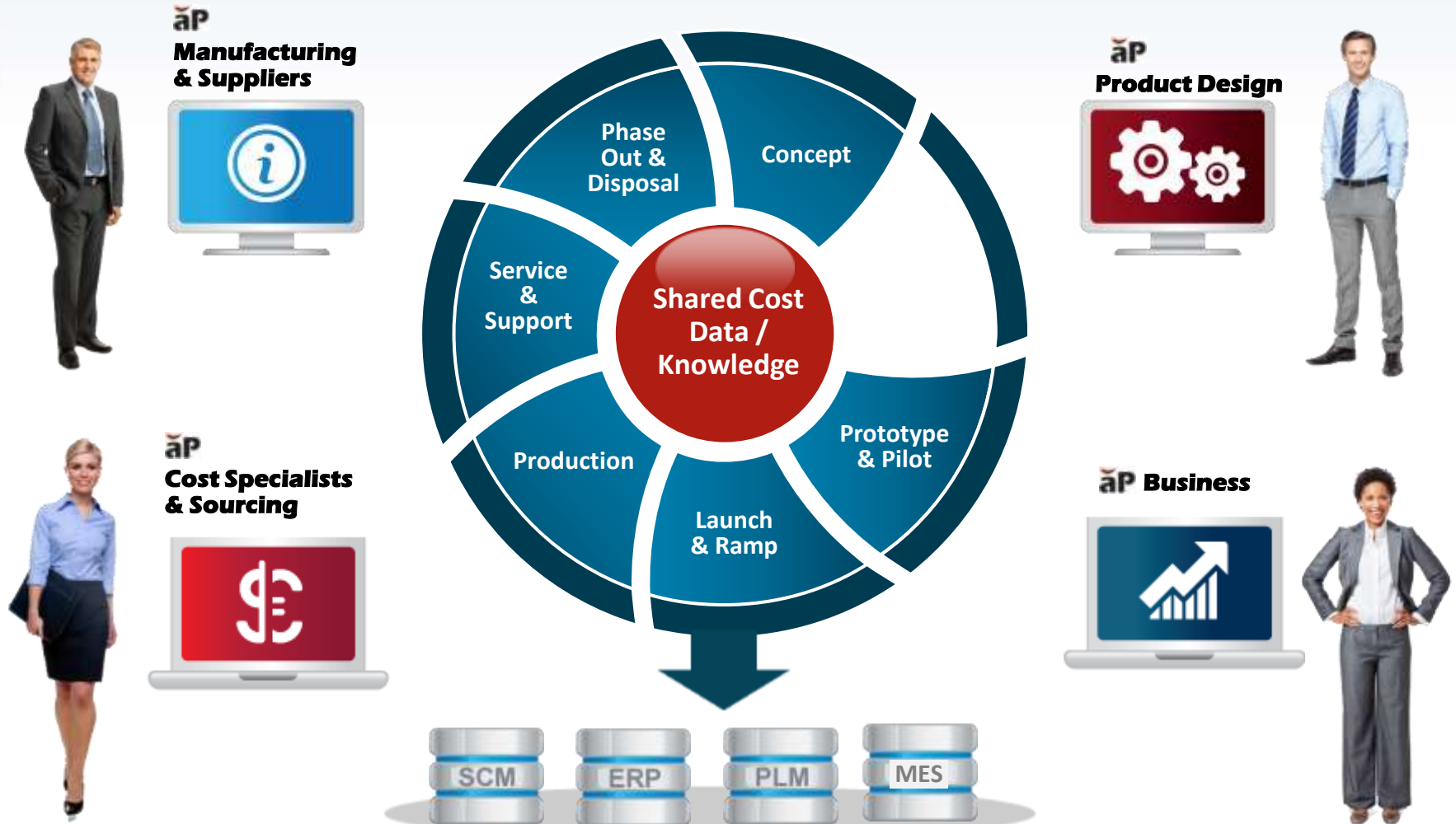
Consumer Durable Goods

+ 4 of the World's Top Defense Contractors



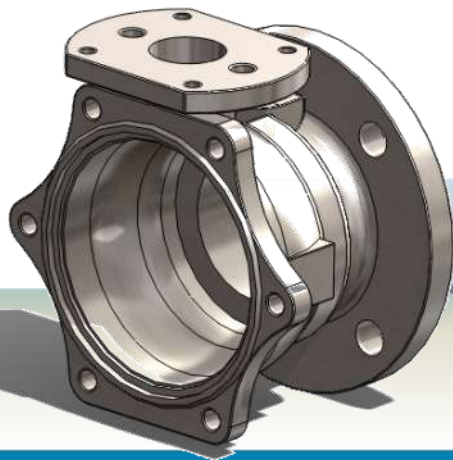
Aerospace & Defense Products

Our Enterprise Product Cost Management Vision



With aPriori you can quickly cost components

Go from a
3D Solid CAD Model...



...to a detailed cost estimate

aPriori

Part Cost Report

Date: 01/28/2011

User: pvesesly

Part Name: user library-md52c150dn80-
 Description:
 Scenario: DC
 Process Group: Casting
 VPE: aPriori USA

Fully Burdened Cost: 24.87 Total Planned Volume: 27,500
 Cost Target: Not specified Material: Aluminum AL350
 Amount Variance: - Approx. CAD RevVer: -10
 Percent Variance: - Date part was coated: 01/28/2011
 Projected Savings: - Date GCDs saved: 01/28/2011

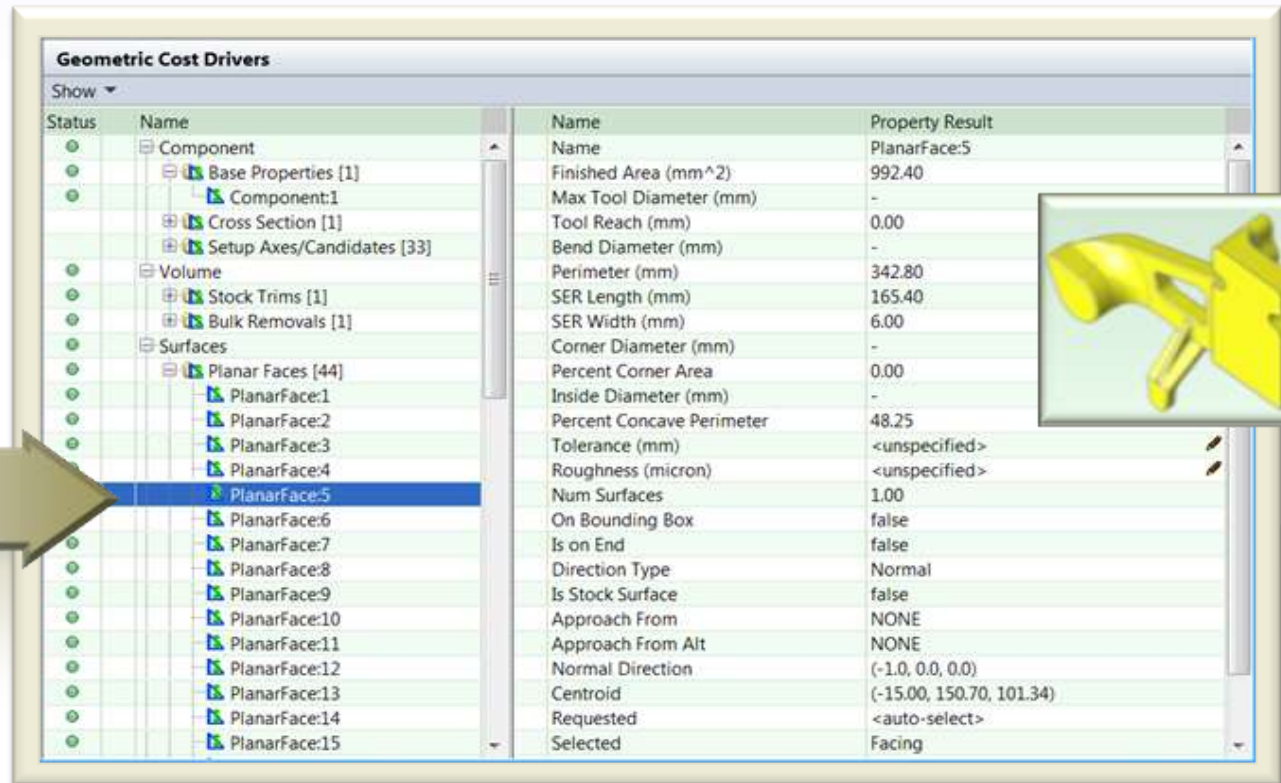
		Processes				
		Part	Die Casting	3 Axis Lathe	Standard Temper	Send Blast
Manufacturing Times:		sec	sec	sec	sec	sec
Labor Time		443.73	95.85	311.88	36.00	0.00
Cycle Time		407.73	95.85	311.88	0.00	0.00
Variable Costs:		(USD)	(USD)	(USD)	(USD)	(USD)
Material Cost		7.55	7.55	0.00	0.00	0.00
Labor		3.39	0.88	2.47	0.26	0.00
Direct Overhead		5.48	1.71	3.52	0.25	0.00
Amortized Batch Setup		0.85	0.78	0.08	0.00	0.00
Logistics		0.00	0.00	0.00	0.00	0.00
Expendable Tooling		0.38	0.00	0.38	0.00	0.00
Additional Direct Costs		4.88	0.00	0.00	3.77	1.12
Extra Costs		0.00	0.00	0.00	0.00	0.00
Other Direct Costs		5.26	0.00	0.38	3.77	1.12
Total Variable Costs		22.53	10.89	6.45	4.28	1.12
Period Overhead Allocations		0.00	0.00	0.00	0.00	0.00
Margin		0.00	0.00	0.00	0.00	0.00
Piece Part Cost		22.53	10.89	6.45	4.28	1.12

Fixed Costs:						
Hard Tooling (amortized)		2.33	2.33	0.00	0.00	0.00
Fixture Cost (amortized)		0.00	0.00	0.00	0.00	0.00
Programming Cost		0.00	0.00	0.00	0.00	0.00
Additional Amortized		0.00	0.00	0.00	0.00	0.00
Total Amortized		2.34	2.33	0.00	0.00	0.00
Fully Burdened Cost		24.87	13.02	6.45	4.28	1.12
Hard Tooling		64,207.35	64,207.35	0.00	0.00	0.00
Fixture Cost		0.00	0.00	0.00	0.00	0.00
Programming Cost		98.43	0.00	98.43	0.00	0.00
Total Capital Investments		64,305.78	64,207.35	98.43	0.00	0.00

How aPriori Works

Automated Geometric Cost Driver Extraction

- ✓ Ease of Use
- ✓ Speed
- ✓ Minimizes Errors Associated with Manual Input
- ✓ Drives detailed cost models



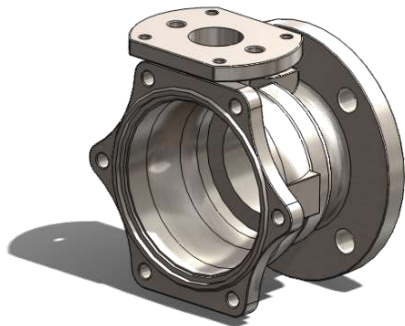
Name	Property Result
Name	PlanarFace:5
Finished Area (mm^2)	992.40
Max Tool Diameter (mm)	-
Tool Reach (mm)	0.00
Bend Diameter (mm)	-
Perimeter (mm)	342.80
SER Length (mm)	165.40
SER Width (mm)	6.00
Corner Diameter (mm)	-
Percent Corner Area	0.00
Inside Diameter (mm)	-
Percent Concave Perimeter	48.25
Tolerance (mm)	<unspecified>
Roughness (micron)	<unspecified>
Num Surfaces	1.00
On Bounding Box	false
Is on End	false
Direction Type	Normal
Is Stock Surface	false
Approach From	NONE
Approach From Alt	NONE
Normal Direction	(-1.0, 0.0, 0.0)
Centroid	(-15.00, 150.70, 101.34)
Requested	<auto-select>
Selected	Facing



Change any design parameter, GCDs are re-assessed in seconds

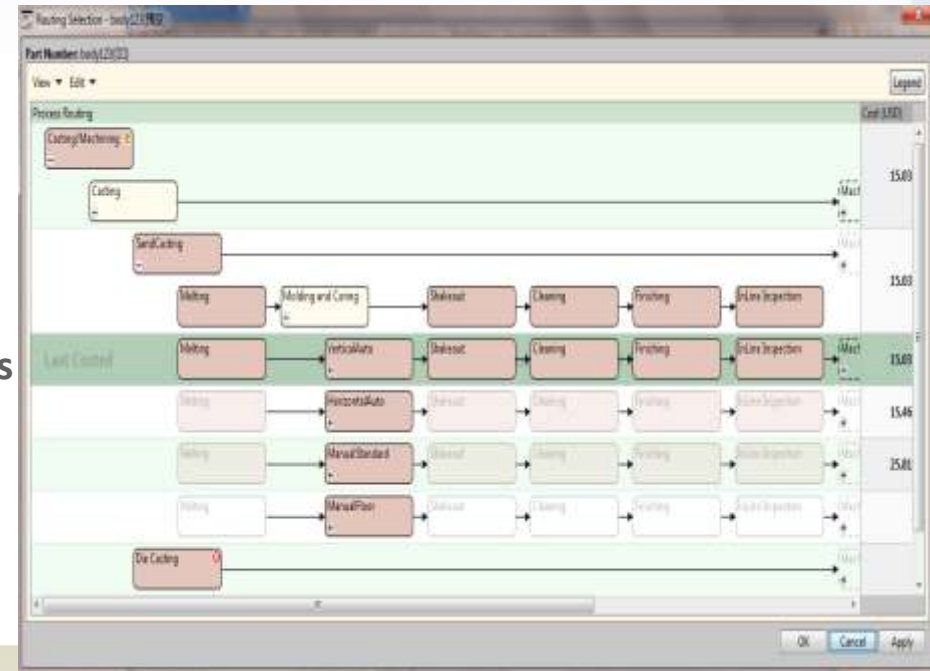
How aPriori Works

Rules Based Engine Drives Intelligent Routing Selection



aPriori Evaluates:

- ✓ Design Geometry
- ✓ Material Type
- ✓ Production Volume
- ✓ Manufacturing Process
- ✓ Machine Rules
- ✓ Facility Rules



Change from Cast Iron to Aluminum...

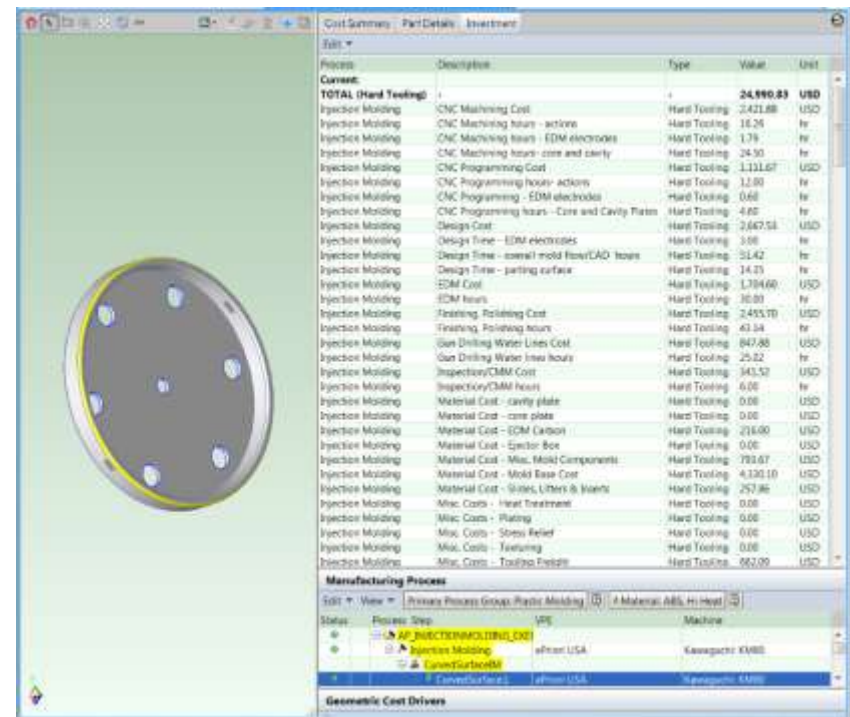
Change Volume from 10 to 10,000...

aPriori automatically recommends switch from Sand Casting to Die Casting

How aPriori Works

Robust Baseline Cost Models and Regional Cost Data

- aPriori automatically derives detailed piece part **AND** tooling costs based on inputs
- Users can edit/override system generated data
- Leverage the experience & expertise of your Cost Engineering team to easily add your own
 - Cost Models
 - Machine, Material & Rate Data
 - Routings & Routing Rules



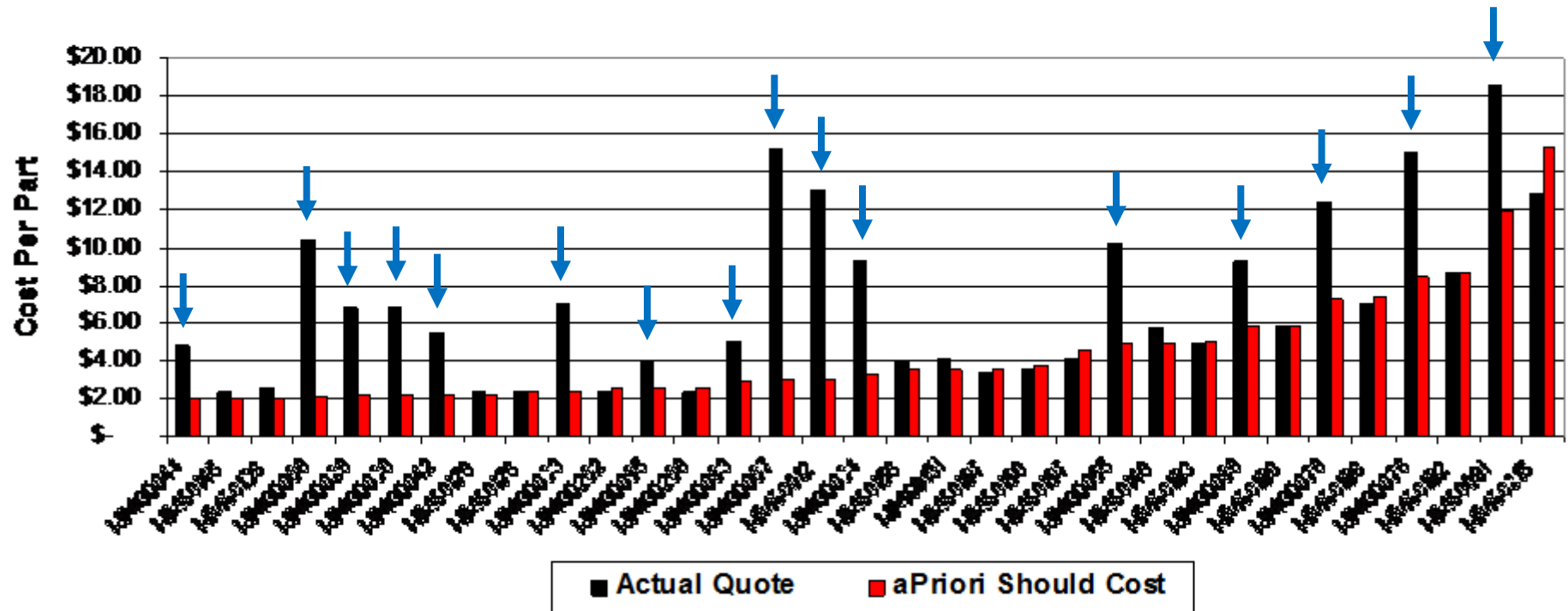
The screenshot displays the aPriori software interface. On the left, a 3D model of a circular part with several holes is shown. On the right, a 'Cost Summary' window is open, displaying a detailed cost breakdown table. The table includes columns for Process, Description, Type, Value, and Unit. The total cost is listed as 24,990.83 USD. Below the cost table, there is a 'Manufacturing Process' section showing a tree view of the manufacturing steps, including 'Injection Molding' and 'CNC Machining'. At the bottom, a 'Geometric Cost Drivers' section is visible.

Process	Description	Type	Value	Unit
TOTAL (Hard Tooling)				
			24,990.83	USD
Injection Molding	CNC Machining Cost	Hard Tooling	2,421.88	USD
Injection Molding	CNC Machining hours - actions	Hard Tooling	16.24	hr
Injection Molding	CNC Machining hours - EDM electrodes	Hard Tooling	1.79	hr
Injection Molding	CNC Machining hours - core and cavity	Hard Tooling	24.30	hr
Injection Molding	CNC Programming Cost	Hard Tooling	1,131.67	USD
Injection Molding	CNC Programming hours - actions	Hard Tooling	12.80	hr
Injection Molding	CNC Programming - EDM electrodes	Hard Tooling	0.68	hr
Injection Molding	CNC Programming hours - Core and Cavity	Hard Tooling	4.85	hr
Injection Molding	Design Cost	Hard Tooling	2,647.54	USD
Injection Molding	Design Time - EDM electrodes	Hard Tooling	3.98	hr
Injection Molding	Design Time - external mold flow/CAD	Hard Tooling	51.42	hr
Injection Molding	Design Time - parting surface	Hard Tooling	14.23	hr
Injection Molding	EDM Cost	Hard Tooling	1,784.60	USD
Injection Molding	EDM hours	Hard Tooling	36.80	hr
Injection Molding	Finishing, Polishing Cost	Hard Tooling	43.34	USD
Injection Molding	Finishing, Polishing hours	Hard Tooling	43.34	hr
Injection Molding	Gun Drilling Water Lines Cost	Hard Tooling	847.88	USD
Injection Molding	Gun Drilling Water Lines hours	Hard Tooling	25.22	hr
Injection Molding	Inspection/CMM Cost	Hard Tooling	343.52	USD
Injection Molding	Inspection/CMM hours	Hard Tooling	6.88	hr
Injection Molding	Material Cost - cavity plate	Hard Tooling	0.06	USD
Injection Molding	Material Cost - core plate	Hard Tooling	0.06	USD
Injection Molding	Material Cost - EDM Carbon	Hard Tooling	216.00	USD
Injection Molding	Material Cost - Ejector Box	Hard Tooling	0.06	USD
Injection Molding	Material Cost - Misc. Mold Components	Hard Tooling	783.67	USD
Injection Molding	Material Cost - Mold Base Cost	Hard Tooling	4,130.10	USD
Injection Molding	Material Cost - Gates, Lifters & Inserts	Hard Tooling	257.86	USD
Injection Molding	Misc. Costs - Heat Treatment	Hard Tooling	0.06	USD
Injection Molding	Misc. Costs - Plating	Hard Tooling	0.06	USD
Injection Molding	Misc. Costs - Stress Relief	Hard Tooling	0.06	USD
Injection Molding	Misc. Costs - Tooling	Hard Tooling	0.06	USD
Injection Molding	Misc. Costs - Tooling Fixtures	Hard Tooling	662.09	USD

aPriori for Cost Engineering & Sourcing

What if you could quickly identify which initial quotes are unreasonably high based on comparison to the should cost?

Quote v. Should Cost



Case Study:

Leading global manufacturer of agricultural and construction equipment

Challenge

The cost management team needed to help them more rapidly reduce the cost on a high volume of components and help the company launch a new product at target cost.

Solution

The company used aPriori to:

- Identifying parts with the greatest cost-savings potential
- Evaluate lower-cost manufacturing and sourcing alternatives for those parts
- Examining re-design opportunities to maximize cost savings

Results

- Analyzed \$20 million of annual spend
- Evaluated 21 Major Components Consisting of 230 Parts
- Identified \$1.2 Million in Annual Savings
- **Realized \$700K** in annual savings

Using aPriori to Support Cost Reduction Goals



Methodology:

1. Quickly cost hundreds or thousands of parts and analyze results to identify outliers (parts with the most savings opp.)
2. Examine parts for sourcing and manufacturing alternatives
3. Evaluate parts for re-design alternatives

The screenshot displays the aPriori software interface. On the left, a 3D model of a mechanical part is shown. The main window features a table with the following columns: Item, Name, Quantity, Fixed Costs, Total Assembled Costs, Variable in Fund, Total Fixed and Variable Costs, Fixed Costs, Fully Assembled Cost, Capital, Total Capital, and Analysis. The table lists various components like TAPE_HUB, LOCK_HUB, TAPE_COIL, HARD_SEARING, RUT, TAPE_COIL_PHS, SPRING, WASH_BOLT, TAPE_CAP, and SCAL. At the bottom, there are sections for 'Geometric Cost Drivers' and 'Manufacturing Process'.

Item	Name	Quantity	Fixed Costs	Total Assembled Costs	Variable in Fund	Total Fixed and Variable Costs	Fixed Costs	Fully Assembled Cost	Capital	Total Capital	Analysis
			(USD)	(USD)	(USD)	(USD)	(USD)	(USD)	(USD)	(USD)	
1	TAPE_HUB	1	0.30	0.30	0.00	0.30	0.30	0.30	18,560.07		
2	LOCK_HUB	1	0.30	0.30	0.00	0.30	0.30	0.30	8,888.88		
3	TAPE_COIL	1	0.00	0.00	0.00	0.00	0.00	0.00	18,710.81		
4	HARD_SEARING	1	0.30	0.30	0.00	0.30	0.30	0.30	8,576.80		
5	RUT	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
6	TAPE_COIL_PHS	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
7	SPRING	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
8	WASH_BOLT	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
9	TAPE_CAP	1	0.30	0.30	0.00	0.30	0.30	0.30	8,041.82		
10	SCAL	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	Component Subtotal		3.30	3.30	0.00	3.30	3.30	3.30	193,076.21		4.00
	Assembly Process		6.00	6.00	0.00	6.00	6.00	6.00			
	GRAND TOTAL		9.30	9.30	0.00	9.30	9.30	9.30	193,076.21		13.00

Step 1: Bulk Costing & Outlier Analysis

Two Methods of Outlier Analysis

- **Cost per Mass** - Compare the \$/kg of a part to the average \$/kg for a group of similar parts.

Edit ▾ View ▾ Table View ▾				Outlier Analysis			
Cost Object		Fully Burdened	Quote Info	Quote Cost Per Mass		Cost Comparison	
Name	Fully Burdened Cost (USD)	Quoted Total Cost (USD)	Quote Cost Per Finish Mass (\$ / kg)	Est. Annual Savings Based On Avg. Quote Cost Per Mass (USD)	aPriori vs. Quoted Cost (% Diff)	Est. Annual Savings Based on Var. Between aPriori & Quoted Cost (USD)	
2980123_CLAMP.Initial	0.50	0.26	15.63	3,305	-95	-	
2840020_BRACKET.Initial	0.52	0.59	3.53	3,188	12	1,043	
1684402WEARPAD.Initial	0.42	0.71	2.89	2,340	41	4,338	
1684402BOT_BRACKET.Initial	0.84	0.91	2.63	1,988	8	1,064	
2980123_LINK.Initial	0.38	0.35	2.91	1,173	-11	-	
1684402TOP_BRACKET.Initial	0.36	0.40	2.36	265	8	480	
3575136.Initial	134.11	38.06	1.11	-	-252	-	
3575137.Initial	134.11	38.45	1.12	-	-249	-	
3575760.Initial	54.30	20.99	1.14	-	-159	-	
3574718.Initial	55.28	30.26	1.48	-	-83	-	
3574688.Initial	54.53	30.59	1.18	-	-78	-	
3574719.Initial	13.50	11.59	1.36	-	-16	-	
3574908.Initial	10.29	10.05	1.67	-	-2	-	
3574855.Initial	3.28	3.24	1.09	-	-1	-	
3575362.Initial	1.61	1.60	1.87	-	-0	-	
3574715.Initial	31.84	31.86	0.69	-	0	263	
3574721.Initial	13.50	13.63	1.60	-	1	1,995	
3574854.Initial	3.24	3.28	1.42	-	1	653	
0903237.Initial	0.91	0.94	1.85	-	2	350	
3574707.Initial	41.16	42.95	1.27	-	4	26,848	
2551580.Initial	0.54	0.58	1.91	-	7	600	

Step 1: Bulk Costing & Outlier Analysis

Two Methods of Outlier Analysis

- **Cost per Mass** - Compare the \$/kg of a part to the average \$/kg for a group of similar parts.

Edit View Table View Outlier Analysis						
Cost Object	Fully Burdened	Quote Info	Quote Cost Per Mass		Cost Comparison	
Name	Fully Burdened Cost (USD)	Quoted Total Cost (USD)	Quote Cost Per Finish Mass (\$ / kg)	Est. Annual Savings Based On Avg. Quote Cost Per Mass (USD)	aPriori vs. Quoted Cost (% Diff)	Est. Annual Savings Based on Var. Between aPriori & Quoted Cost (USD)
2980123_CLAMP.Initial	0.50	0.26	15.63	3,305	-95	-
2840020_BRACKET.Initial	0.52	0.59	3.53	3,188	12	1,043
1684402WEARPAD.Initial	0.42	0.71	2.89	2,340	41	4,338
1684402BOT_BRACKET.Initial	0.84	0.91	2.63	1,988	8	1,064
2980123_LINK.Initial	0.38	0.35	2.91	1,173	-11	-
1684402TOP_BRACKET.Initial	0.36	0.40	2.36	265	8	480
3575136.Initial	134.11	38.06	1.11	-	-252	-
3575137.Initial	134.11	38.45	1.12	-	-249	-
3575760.Initial	54.30	20.99	1.14	-	-159	-
3574718.Initial	55.28	30.26	1.48	-	-83	-
3574688.Initial	54.53	30.59	1.18	-	-78	-
3574719.Initial	13.50	11.59	1.36	-	-16	-
3574908.Initial	10.29	10.05	1.67	-	-2	-
3574855.Initial	3.28	3.24	1.09	-	-1	-
3575362.Initial	1.61	1.60	1.87	-	-0	-
3574715.Initial	31.84	31.86	0.69	-	0	263
3574721.Initial	13.50	13.63	1.60	-	1	1,995
.....						
Total	611.22					
Rollup Target Cost						
Averages						
2331300.Initial	0.34	0.36	1.55	-	-	800
0903238.Initial	0.94	1.03	1.55	-	8	1,275
			Ave. Cost Per Mass for Group Auto Calculated			
			2.25			

Step 1: Bulk Costing & Outlier Analysis



Two Methods of Outlier Analysis

- Cost per Mass - Compare the \$/kg of a part to the average \$/kg for a group of similar parts.
- Comparison of aPriori Cost vs. Current Cost

Edit ▼ View ▼ Table View ▼			Outlier Analysis			
Cost Object	Fully Burdened	Quote Info	Quote Cost Per Mass		Cost Comparison	
Name	Fully Burdened Cost (USD)	Quoted Total Cost (USD)	Quote Cost Per Finish Mass (\$ / kg)	Est. Annual Savings Based On Avg. Quote Cost Per Mass (USD)	aPriori vs. Quoted Cost (% Diff)	Est. Annual Savings Based on Var. Between aPriori & Quoted Cost (USD)
2840020_JACK_WHEEL_ATTACH_TR50.Initial	1.94	2.83	2.56	20,253	31	52,948
1271576.Initial	9.91	12.58	0.72	-	21	40,040
3574707.Initial	41.16	42.95	1.27	-	4	26,848
3575085.Initial	2.52	3.15	1.59	-	20	9,496
1684402WEARPAD.Initial	0.42	0.71	2.89	2,340	41	4,338
2980123_MT_BRACKET.Initial	0.29	0.33	1.82	-	12	2,455
1684443_OUTRIGGER_CAM.Initial	1.06	1.19	1.86	-	11	1,999
3574721.Initial	13.50	13.63	1.60	-	1	1,999
1100149.Initial	1.15	1.27	1.88	-	9	1,733
0903238.Initial	0.94	1.03	1.55	-	8	1,279
1684402BOT_BRACKET.Initial	0.84	0.91	2.63	1,988	8	1,064
2840020_BRACKET.Initial	0.52	0.59	3.53	3,188	12	1,043
3574854.Initial	3.24	3.28	1.42	-	1	653
2551580.Initial	0.54	0.58	1.91	-	7	600
1684402TOP_BRACKET.Initial	0.36	0.40	2.36	265	8	480
0903237.Initial	0.91	0.94	1.85	-	2	350
3574715.Initial	31.84	31.86	0.69	-	0	263

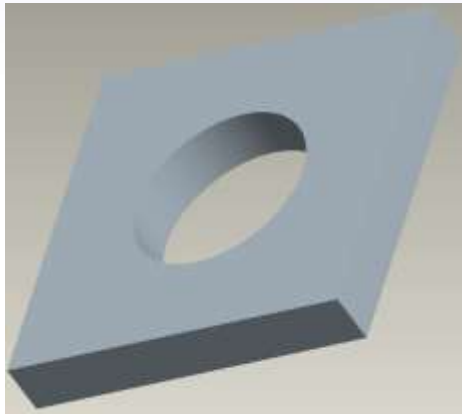
Step 2. Examine Parts for Manufacturing & Sourcing Alternatives

Part	Current Cost	Annual Volume	Total Spend	Cost Reduction @ 50%	aPriori Cost	Dif. aP vs. Current	Potential Opportunity
Lower Chassis	\$280	5,400	\$1,512,000	\$756,000	\$240	14%	\$ 216,000
Cab Top	\$149	5,400	\$804,600	\$402,300	\$135	9%	\$ 75,600
Engine Block	\$72	5,400	\$388,800	\$194,400	\$70	3%	\$ 10,800
Bracket Assembly	\$41	5,400	\$221,400	\$110,700	\$22	46%	\$ 102,600
Valve Body	\$20	10,000	\$200,000	\$100,000	\$21	-5%	\$ (10,000)
Battery box	\$10	20,000	\$200,000	\$100,000	\$7	30%	\$ 60,000
Ladder step	\$7	20,000	\$140,000	\$70,000	\$12	-71%	\$ (100,000)
Hand rail	\$12	5,400	\$66,420	\$33,210	\$11	11%	\$ 7,020
Plastic Housing	\$3	20,000	\$60,000	\$30,000	\$4	-33%	\$ (20,000)
Kick plate	\$10	5,400	\$52,380	\$26,190	\$11	-13%	\$ (7,020)
Rear mount	\$9	5,400	\$48,600	\$24,300	\$7	22%	\$ 10,800

-  aP Cost < Current Cost, the part is a candidate for resourcing or rerouting
 - aP Routing = Current routing – Part is a candidate for requoting/ rebidding
 - aP Routing /= Current routing -- Examine for routing / manuf. alternatives
-  If aP Cost s greater than or equal to Current Cost, the part is a candidate for redesign

Step 2. Examine Manufacturing & Sourcing Alternatives

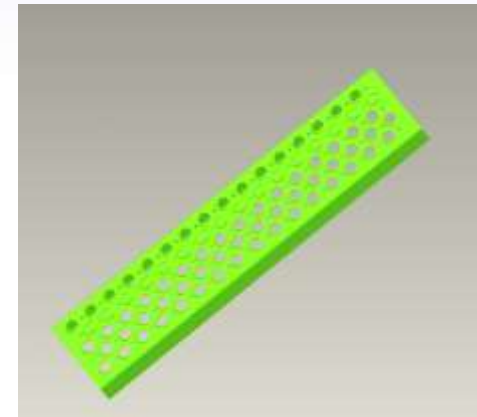
Example: Re-Routing & Re-quoting)



Annual Savings: = \$80,000

- Original Part - Cost \$4.80 / Process: Cut & Drill
- aPriori - Cost: \$0.85 / Process: Laser
- Supplier - New quote: \$0.80 / Process: Laser

Example: Re-quoting



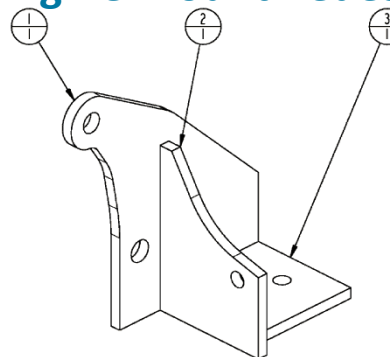
Annual Savings: = \$80,000

- Current part cost: \$40
- aPriori cost: \$27.50

Step 3. Evaluate Re-Design Alternatives

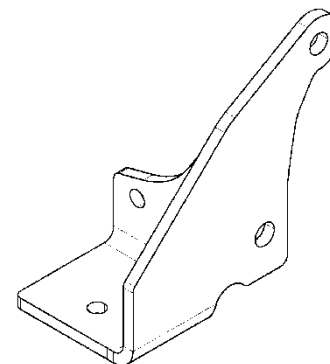
- ☞ Reducing part complexity
 - Number of parts
 - Material
 - Eliminating a manufacturing process
- ☞ Converting weldments to castings
- ☞ Investigating stamping

Example: Engine Mount Redesign



SCALE 1/2

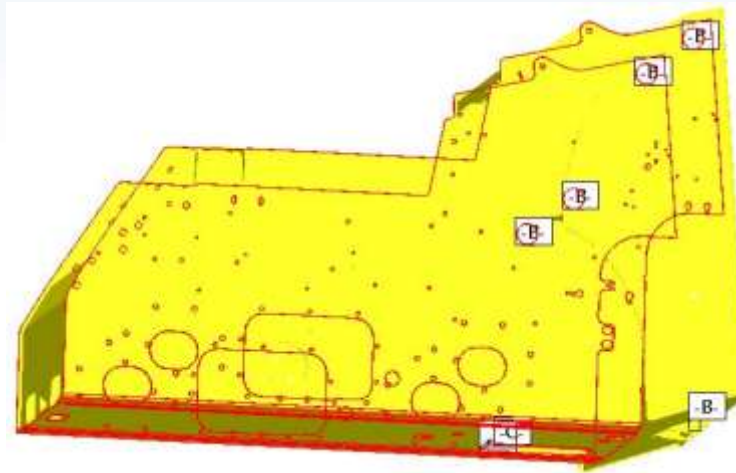
1-piece
formed part
aPriori = \$9.89



SCALE 1/2

**Annualized
Savings
= \$45,199**

Main Frame Sides and Floor



Existing Cutting Process
[Laser]

Process Cost: **\$75.54**

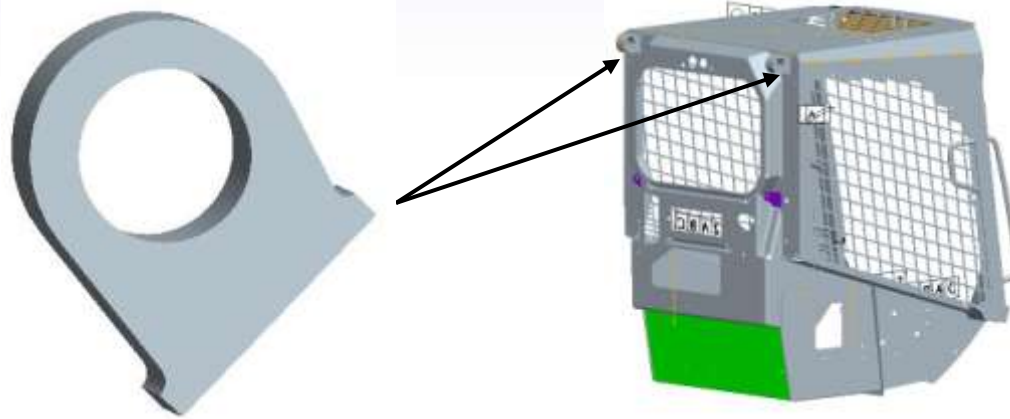
Proposed Manufacturing Change
[Laser / NC punch]

Process Cost: **\$33.29**

Laser perimeter + large holes; punch other cutouts

Identified savings: \$42.25 per machine and **\$591,500 per year**
Laser cycle time savings: 14 min per machine and **145 days per year**

Cage Rear Pivot



Existing Process
[Machined casting w/x-ray]

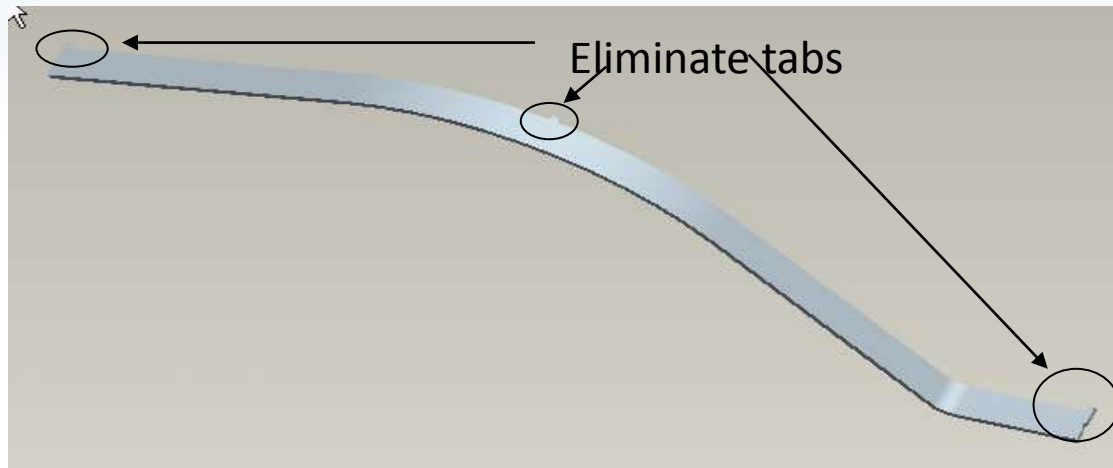
Cost: **\$16.56**

Proposed Manufacturing Change
[Burn from plate then machine hole]

Cost: **\$10.05**

Identified savings: \$13 per machine and **\$143,000 per year**

Upper Link Spanner Plates



Existing Design

Total: \$17.60

- Part 1 (2x\$4.41): \$8.82
- Part 2 (2x\$4.39): \$8.78

Proposed Design

[Eliminate tabs and make part from bar instead of laser cut sheet]

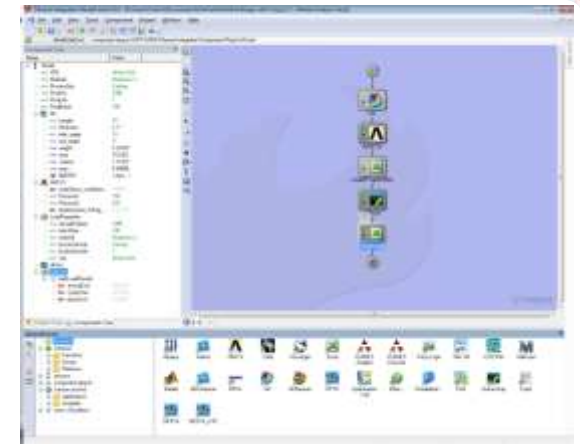
Total: \$10.90

- Part 1 (2x\$2.61): \$5.22
- Part 2 (2x\$2.84): \$5.68

Projected savings: \$6.70 per machine and **\$73,700 per year**

Fortune 25 Manufacturer Integrating Design and Costing

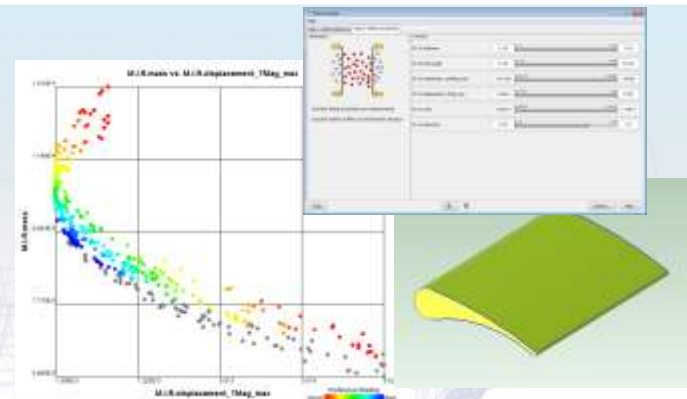
Challenge: Costing of designs was not integrated with the development of new products. As a result, cost was not considered Critical To Quality and was not factored into design trade-offs.



Solution: Through the use of aPriori's Bulk Costing and Analysis capabilities, cost was integrated with the use of NX/ANSYS to provide robust design models from Design of Computer Experiments that enabled engineers to perform cost/performance trade-offs and meet CTQ requirements

Results

- Articulated cost impacts to design
- ~30X increase in part design studies
- 15-25% reduction in design cycle time



Summary

- aPriori provides **quick, precise and consistent** part and tooling cost estimates that allow you to attack cost at the point of origin in engineering & sourcing
- The solution allows cost engineers to **spend less time costing and more time analyzing** and consulting on strategic issues
- aPriori's **flexible cost management platform** provides hundreds of out-of-the-box baseline cost models and the capability to **quickly configure** custom inputs, outputs and cost models to meet your unique requirements
- **Leverage aPriori in Cost Engineering & Sourcing** to meet your cost reduction goals by analyzing hundreds or even thousands of parts and identify outliers where you may be paying too much



Thank you

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