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Summary

The purpose of these upgrades is to increase product output while reducing the required manpower to process the additional load. The additional products will include all of the products from the TR facility and the addition of the Mine truck hood and fenders which will also receive a final basecoat processed through the same paint system as the current primer.

In order to achieve these goals, we propose to move all repairs, sanding, finesse, and touch up painting from segregated offline workstations located in the unload area to an online deck located after the paint system. The addition of online finesse will dramatically increase productivity by utilizing all available manpower on each product. This is in contrast to the existing system in which manpower is only utilized when a designated part enters a segregated workstation.

Another important goal is to reduce or eliminate paint and utility use associated with empty racks through the paint system. We propose to install a bypass loop to route empty racks to the press area. The reduction of empty racks will reduce paint and utility use (oven heaters, conveyor up-time, etc.) which can be directly attributed to cost.

These productivity gains, manpower reductions, and utility and paint use reductions result in significant cost savings which in turn results in a high rate of return. Below are the contributing factors to cost reduction which are analyzed.

CONTRIBUTING FACTORS TO COST REDUCTION

1) Manpower reduction due to conversion to an online system
2) Paint and utility use reduction by eliminating empty racks

In this report we analyze the existing facility operations and associated costs and compare it to our proposed improvements and associated costs.

Manpower Reduction

A major contributing factor to operating expenses is manpower. In this section we compare manpower requirements for the new proposed online operation to the existing offline operation. In both cases, we do not account for forklift operators, shipping and warehouse, etc. as this process will not change.

Online Operations Manpower

The following “Online Operations Manpower Data Table” depicts the manpower required to process the current and future parts from both the PR and TR facilities. As indicated, conversion to an online system will require approximately twelve (12) persons in the Inspect and Finesse Deck and six (6) persons in the packing and unload area for a total of eighteen (18) persons.

As outlined in this and the following section, the inefficiencies of the offline method (compared to the efficiencies of the online method) result in considerable costs due to excessive labor. We propose to reduce manpower by converting to an online operation which will result in substantial cost savings.

Online Operations Manpower Data Table – New Proposed Process

Area Location	Operation/Description	Operation/Description	Manpower
Repair and Finesse Enclosure	Repair	Low Level	4
Repair and Finesse Enclosure	Repair	High Level	4
Repair and Finesse Enclosure	Paint	High Level	1
Repair and Finesse Enclosure	Paint	Low Level	1
Repair and Finesse Enclosure	Audit	Low Level	1
Repair and Finesse Enclosure	Audit	High Level	1
Unload and Pack	Unload and pack		6
Total			**18**

Offline Operations Manpower

The current facility operation utilizes an offline method to process parts after the paint shop. Parts are routed to segregated lanes, based on part type, where teams of personnel perform repair and finesse operations. Parts that require additional repairs or a second coat of primer are manually reloaded onto the conveyor system and sent back through the paint shop.

This offline method does not utilize all available manpower to the fullest extent. Operators spend a considerable amount of time waiting for a part to enter a workstation before work can begin. In addition some workstation operators walk up to forty feet to retrieve a part, perform finesse operations, and return the part to the conveyor for a second coat of primer. Also, since teams are working on several different tasks within a part group, a significant amount of time is spent switching tools and handling parts. These inefficiencies are evident by comparing the MMM500 hoods processed per day (96) to the new production output of 75 jobs per hour. This is equivalent to less than one and a half hours of production per day – currently a team of nine persons work an eight hour shift to process these parts.

The following table depicts the manpower required to process current and future parts from both the PR and TR facilities. As indicated, continuing to use an offline process will require a considerable number of personnel to process parts.

The annual product output data listed in the table is from the 08 Facility Optimization document; the manpower data is actual manpower as observed during our time study, manpower data collected from the TR facility, and estimated manpower based on similar parts. In all cases, the data does not include forklift operators, shipping and warehouse etc. as this process will not change.

Note that care has been taken not to overstate the manpower requirements. This is done by combining similar parts within stations and shifting personnel out of low or zero production products. Finally, manpower requirements have been stated over the next three year period and broken down by part; this allows for an accurate accounting during these periods.

Offline Operation Manpower Data Table – Current Process

Part Description	2008 Parts / 1,000	2008 Man-power	2009 Parts / 1,000	2009 Man-power	2010 Parts / 1,000	2010 Man-power	Notes
MMM500 Hood	20	9	20	9	20	9	Actual
CC Hood	35	9	35	9	15	9	Actual
RRR Hood	1.5	0	1.5	0	0.7	0	Process with CC Hood
MMM500 F2 and F3 Cowl	20	2	20	2	20	2	Actual
Mine Hood	3	6	13	6	20	6	Sim to MMM500 hood
Mine Fenders	0	0	0	0	11	2	Sim to MMM500 cowl
Angme G350 Hood	0	0	7	6	15	6	Sim to MMM500 hood
Angme G350 Fender	0	0	7	0	15	0	Process w/ Mime fender
Truck X Fenders	20	2	0	0	0	0	Actual
R555 Fenders	24	4	4	4	0	4	Actual
CC Rear Quarters	35	6	35	6	15	6	Actual
CC Door Surround	35	4	35	4	15	4	Actual
R555 Fender	25	6	25	6	25	6	Actual
L350 Deck Lid	49	5	49	5	49	5	Actual
Mine GOP	40	2	0	0	0	0	Estimate
Mine 2GOP	3	0	0	0	0	0	Process w/ L350 GOP
R300 Box	24	1	4	1	0	0	Estimate
R300 Floor	24	1	4	1	0	0	Estimate
R300 Headboard	24	1	4	1	0	0	Estimate
R300 Frt Door	24	1	4	1	0	0	Estimate
R300 Rr Door	24	1	4	1	0	0	Estimate
R300 Tonneau	10	1	1.2	1	0	0	Estimate
RRR Quarters	1.5	0	1.5	0	0.7	0	Process w/ another part
RRR Surround	1.5	0	1.5	0	0.7	0	Process w/ another part
ZZ Hood	20	6	20	0	19	0	Process w/ Magna Hood
MM500 Fender	0	0	4.3	0	4	0	Process w/ another part
L350 Hood	4.5	0	6	0	6	0	Process w/ Lincoln Roof
L350 Fender	45	1	6	1	6	1	Estimate
L500 Roof Fill Panel	20	2	30	2	30	2	Estimate
Total Manpower		**70**		**66**		**62**	
Salary and Bennefits per Man		$60,000		$62,400		$64,896	
Total Cost (millions of dollars)		**$4.20**		**$4.12**		**$4.02**	

Note:
Salary assumes a four percent increase annually to account for inflation

Data assumes no new product are introduced during this period. Additional products will increase existing manpower requirements.

Existing Offline vs. Proposed Online Operations

By comparing the new proposed online operations to the existing offline operations, we will realize a manpower reduction of forty-four (44) to fifty-two (52) persons. Assuming an average annual salary and overhead associated with each person, we arrive at an annual cost savings attributed to manpower reduction.

Description	2008 Manpower	2009 Manpower	2010 Manpower
Offline Manpower Requirment by Year	70	66	62
Online Manpower Requirement (constant)	18	18	18
Manpower Reduction by Year	**52**	**48**	**44**
Salary and Bennefits per Man	$60,000	$62,400	$64,896
Offline Manpower Annual Cost (millions)	$4.20	$4.12	$4.02
Online Manpower Annual Cost (millions)	$1.08	$1.12	$1.17
Percent Change in Manpower Costs	-74%	-73%	-71%
Annual Cost Reduction (millions)	**$3.12**	**$3.00**	**$2.86**

Note:

Salary assumes a four percent increase annually to account for inflation

Data assumes no new product are introduced during this period. Additional products will increase exist manpower requirements.

Paint and Utility Use Reduction

In the existing system, a significant number of empty racks are delivered to the paint shop. Empty racks within the existing facility are processed like full racks: washer chemicals are used to clean the parts, heat is used to evaporate the washer solution, excess heat is carried out of the dry-off oven, paint is applied to the parts, heat is used to raise the part and rack temperature to cure the paint, and again excess heat is carried out of the bake oven. This in addition to power consumption attributed to the work the conveyor must perform in order to move racks through the system and the power used by the robots to perform the painting operations can be directly linked to cost.

The paint shop total operating expense is the sum of the utility operating expenses and the paint consumption expense. The utility operating expense associated with each part is nine dollars and fort- two cent ($9.42) while the paint consumption costs vary by part as indicated in the following table. Since

in this case we are evaluating empty racks or empty rack spaces, over $9.42 is spent on each empty space within a rack.

This total expense is multiplied by the annual part output to reach the total annual costs associated with painting parts within the paint shop. Finally, the total cost of painting is multiplied by the empty rack throughput (1 – rack load efficiency) to determine the cost of processing empty racks or partially empty racks within the paint shop.

Paint and Overhead Costs Associated with Empty Racks

Part Description	Paint Cost / Part	Parts / Rack	2008 Parts / 1,000	2008 Cost / mil	2009 Parts / 1,000	2009 Cost / mil	2010 Parts / 1,000	2010 Cost / mil	Cost Notes
MMM500 Hood	$4.70	1	20	$0.28	20	$0.29	20	$0.31	Actual
CC Hood	$2.73	2	35	$0.43	35	$0.44	15	$0.20	Actual
RRR Hood	$2.73	2	1.5	$0.02	1.5	$0.02	0.7	$0.01	Actual
MMM500 F2 and F3 Cowl	$1.13	6	20	$0.21	20	$0.22	20	$0.23	Actual
Mine Hood	$4.70	1	3	$0.04	13	$0.19	20	$0.31	Sim to MMM500 hood
Mine Fenders	$1.13	6	0	$0.00	0	$0.00	11	$0.13	Sim to MMM500 cowl
Angme G350 Hood	$4.70	1	0	$0.00	7	$0.10	15	$0.23	Sim to MMM500 hood
Angme G350 Fender	$1.13	6	0	$0.00	7	$0.08	15	$0.17	Process w/ Mime fender
Truck X Fenders	$1.13	8	20	$0.21	0	$0.00	0	$0.00	Sim to MMM500 hood
R555 Fenders	$0.00	X	24	$0.23	4	$0.04	0	$0.00	Need production data
CC Rear Quarters	$1.13	8	35	$0.37	35	$0.38	15	$0.17	Estimated paint cost
CC Door Surround	$1.41	4	35	$0.38	35	$0.39	15	$0.18	Actual
R555 Fender	$1.13	1	25	$0.26	25	$0.27	25	$0.29	Estimated paint cost
L350 Deck Lid	$4.70	4	49	$0.69	49	$0.72	49	$0.75	Sim to CC Hood
Mine GOP	$1.00	14	40	$0.42	0	$0.00	0	$0.00	Actual
Mine 2GOP	$0.38	14	3	$0.03	0	$0.00	0	$0.00	Actual
R300 Box	$2.00	4	24	$0.27	4	$0.05	0	$0.00	Estimated paint cost
R300 Floor	$2.00	4	24	$0.27	4	$0.05	0	$0.00	Estimated paint cost
R300 Headboard	$2.00	4	24	$0.27	4	$0.05	0	$0.00	Estimated paint cost
R300 Frt Door	$3.00	8	24	$0.30	4	$0.05	0	$0.00	Estimated paint cost
R300 Rr Door	$3.00	16	24	$0.30	4	$0.05	0	$0.00	Estimated paint cost
R300 Tonneau	$3.00	2	10	$0.12	1.2	$0.02	0	$0.00	Estimated paint cost
RRR Quarters	$1.41	2	1.5	$0.02	1.5	$0.02	0.7	$0.01	Actual
RRR Surround	$1.41	2	1.5	$0.02	1.5	$0.02	0.7	$0.01	Actual
ZZ Hood	$2.73	2	20	$0.24	20	$0.25	19	$0.25	Actual
MM500 Fender	$1.13	2	0	$0.00	4.3	$0.05	4	$0.05	Estimated paint cost
L350 Hood	$4.70	2	4.5	$0.06	6	$0.09	6	$0.09	Estimated paint cost
L350 Fender	$1.13	8	45	$0.47	6	$0.07	6	$0.07	Estimated paint cost
L500 Roof Fill Panel	$2.00	16	20	$0.23	30	$0.36	30	$0.37	Estimated paint cost
Total Annual Cost				$6.15		$4.26		$3.79	
Empty rack throughput (1 - load eff)				10%		10%		10%	
Cost associated with empty racks in millions of dollars				**$0.62**		**$0.43**		**$0.38**	

Notes:

Cost/mil = (paint cost per part + paint shop operating cost per part) * parts per year
Paint cost per part provided by CC facility personnel.
Parts per year and parts per rack provided in "08 Facility Optimization".
Operting cost associated to each part provided by CC facility personnel. $9.42 per part.
Paint overhead cost are increased by 4% per year to account for inflation
Rack load efficiency provided in "08 Facility Optimization". 90%

Conclusion

As illustrated, a considerable cost savings may be realized by implementing the proposed improvements. Below we summarize the cost data associated with these improvements and compare that to the capital investment required to implement the changes.

Combined Return on Investment

Below we analyze the rate of return of this investment over the next three years. This term was chosen since it is the mean life cycle of the products discussed in this report. However, it should be noted that additional products will extend the life of this investment over the next ten years and beyond which significantly increases the return on the investment.

$$ROI = \sum_{i=0}^{nPer-1} \frac{Cost_{manpower} + Cost_{paint\ /over\ head}}{(1+Rate)^i} / Initial\ Investment$$

$$Or$$

$$ROI = Cost_{PV-Total} / Invest_{Total}$$

$$nPer = 3$$

Note the investment will be distributed over the construction period after which time costs savings will immediately begin. Therefore, the present value of the cost reduction in the first year is equal to the actual value.

Combined Rate of Return Data

Description	2008	2009	2010	Total
Manpower Cost Reduction (millions)	$3.12	$2.97	$2.80	$8.89
Empty Rack Cost Reduction (millions)	$0.62	$0.43	$0.38	$1.42
Total Cost Reduction (millions)	$3.74	$3.39	$3.18	$10.31
Present Value assuming 8% discount rate	**$3.74**	**$3.14**	**$2.73**	**$9.60**

Total Investment (in millions of dollars)	$2.50
Total Present Value Cost Reduction (in millions of dollars)	$9.60
Total Gain from Investment (in millions of dollars)	$7.81
Break Even Analysis on Initial Investment (time in years)	0.67
Total Three Year Retrun on Investment	**384%**