



# Cost Reduction by Improving the Engineering and Operation Design Department

Julian Moreno Villegas  
 Master of Engineering Management Program  
 Advisor: Hector J. Cruzado, Ph.D., PE  
 Polytechnic University of Puerto Rico

## ABSTRACT

This research paper focused on how reducing the lower expenses instead of one of the largest expenses provide the most cost reduction in Bechtel Plan Machinery, Inc. (BPMI). The fundamental objective of this research is the improvement of the use of the resource BPMI specifically in the area of Engineering and Operation Design Department to have the maximum cost reduction. Different techniques were applied to investigate the sources of cost. As a result of the investigation and the major findings, some cost reduction recommendations and business plan were provided, which are predicted to aid in the improvement and monitoring of the right use of resources of this department.

## INTRODUCTION

Bechtel Plan Machinery, Inc. (BPMI) is responsible of supporting the US fleet and its sailors. BPMI works with many partners to deliver and maintain safe, reliable, cost-effective products to ensure the long-term viability of Naval Nuclear Propulsion. BPMI is a Bechtel-owned division under contract with the Navy. Bechtel is built upon time-tested values of excellence and integrity.



## PROBLEM

In the 2013 CRM, BPMI did not meet their desired cost improvement. This information was documented in the 2013 CRM. The intent of this CRM is to drive the identification of problems earlier in the process and to use this indicator to improve or reduce the cost of ongoing products. As part of the effort to identify the problem(s), BPMI provided an overall programmatic cost reduction associated with each department, as shown in Figure 1, that indicate a less saving than previous years.

A more detailed tracking of costs, during an internal audit in each department identified the design (Engineering and Operation Design) department as the most crucial department with less cost saving.

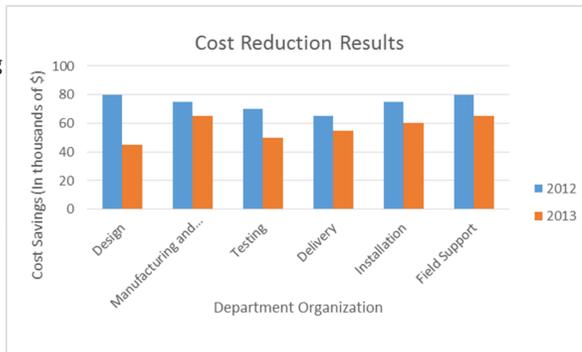


Figure 1: Cost Reduction Results of 2012 vs 2013

## PROJECT OBJECTIVE

The general objective of this research is to identify the phase(s) and the major factor(s) of the Engineering and Operation Design (E-OD) department that contribute to cost increase in BPMI. This will aid to clearly identify which improvements could provide the best cost reduction for ongoing goods.

## METHODOLOGY

The methodology presented in this research and showed in Figure 2, uses the Project Management Methodology (PMM) that help in the process for managing the project. The PMM is a technique to tell the team what has to be accomplished, how it should be completed, in which order and by when

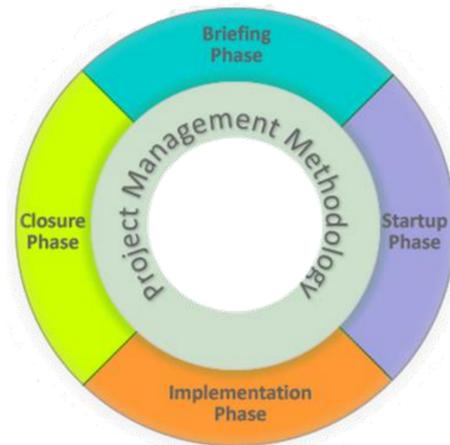


Figure 2: Project Management Methodology Steps

### Briefing Phase – Initiation

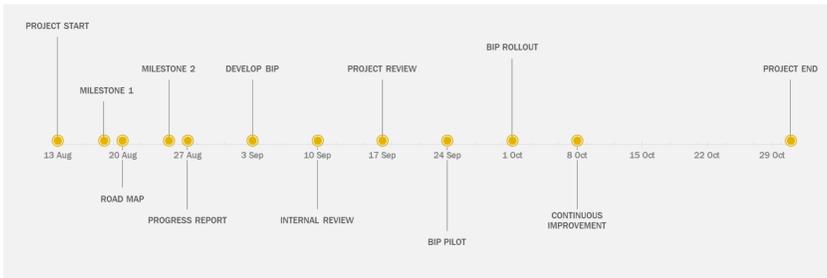


Figure 3: Project TimeLine

### Startup Phase – Planning and Design

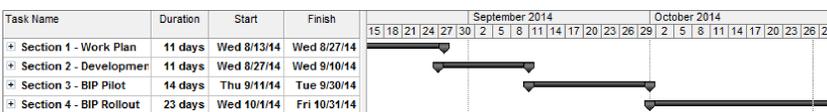


Figure 4: Gantt Chart

### Implementation Phase – Executing

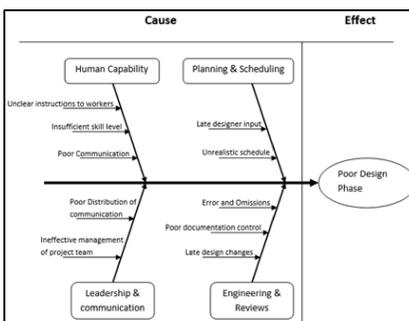


Figure 5: Fishbone Diagram of Cause & Effect

### Closure Phase – Monitoring and Controlling

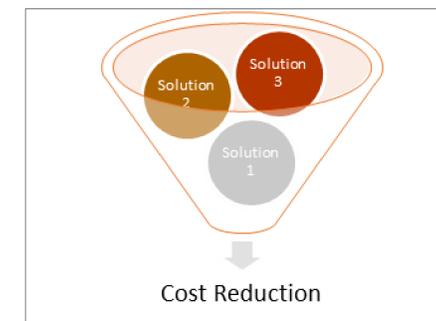


Figure 6: Controlling Resources Management

## RESULTS

The main problem of the increase in cost is caused by three areas in the design phase in the E-OD department. These three main problems are the following:

- The cost of rework throughout the process of improvement
- The amount of non-conforming part and un-reuse material
- The increase in cost of custom part in each ongoing goods.

## DISCUSSION AND RECOMMENDATION

- **Cost of Rework Recommendation:** The implementation of an Up-front Plan and periodic revision of the upfront plan and schedule (Gantt chart) will allow the engineer to receive peer review, management review, prime contractor review and customer review, which will provide comments and catch any problems or concerns early in the process before the engineer start the planning stage.
- **Scrap and Waste of Material Recommendation:** Use of 3D digital models and animations during the customers or stakeholder presentation is the cheapest way to show a final design product. However, nothing beats the visual communication and benefits from standing around a 3D physical model. Therefore, an alternative can be the use of Biodegradable or Paper-based 3D physical model that are more cost-effective and affordable, since the build material is recyclable (paper) and the company don't have to worry about material cost as it would if the company had selected other 3D printers that require expensive plastics or powders.



Figure 7: Paper-base 3D Printer QR Barcode



Figure 8: Biome 3D Printer QR Barcode

- **Custom Part Recommendation:** Use of standard components makes easier the management of inventories and helps facilitate the analysis of the part and limit the risk of not completing the project on time. To support the recommendation, below are two drill model with detail costs and potential savings associated with reuse some of existing parts.

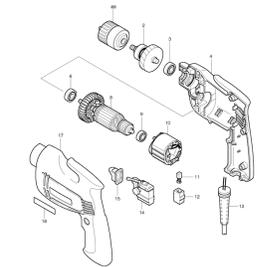


Figure 9: Milwaukee Electric Tool Drill

Model	Material	Labor	Total Cost
Milwaukee Electric Tool 0238-1 model drill			
0238-1	52.26	41.38	93.64
Milwaukee Electric Tool 0299-20 model drill			
0299-20a	47.70	30.16	77.86
0299-20	61.25	31.34	92.59
			Savings
			14.73
			7.43

## CONCLUSIONS

The research has provided sufficient information and proof to predict that a pilot program using the recommendations above will reduce the cost of improvement of ongoing products and increase in cost savings.