Case studies in supplier costing within a low volume medical device manufacturing environment.

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Introduction

Ortho Clinical Diagnostics designs and produces equipment and supplies to test blood for diseases, conditions and infections. We are a global leader of in vitro diagnostics and our high-quality products and services enable health care professionals to make better informed treatment decisions to improve and save lives throughout the world.

We've been in this business for 75 years and we have customers in more than 120 countries throughout the world. We make more than 250 different products and have more than 4200 employees and we generate approximately 1.7 billion dollars in revenue yearly.

Recently, we were spun off from Johnson & Johnson and became an independent company. Since becoming independent we've had renewed focus on our core business and the cost of our equipment and consumables has taken on a new focus as well.

Like many medical device manufacturers we have two types of product lines. We sell non-disposable machinery products that are used to conduct medical tests on blood. We also sell disposable products which support our machinery with the supplies necessary to perform those tests. Our non-disposable machinery products are produced in low production volumes and have a higher production cost than our disposable supplies products that are produced in much higher production volumes and are, comparatively, less expensive to produce. A typical annual volume for our low-volume machinery products range in the thousands of products per year while a typical annual volume for our high-volume consumables range in the millions of products per year.

This paper discusses the process I went through to select and set up costing tools that would be useful for my work at Ortho Clinical Diagnostics and it also discusses some of the projects I've worked on during the year and a half I've been employed at Ortho Clinical Diagnostics. Many of these earliest projects have focused primarily on supplier costing where I generate a cost estimate using the DFMA software and then use that estimate to negotiate the price we pay for a currently produced item. In some cases, I've also helped redesign currently produced items so they could be produced more efficiently and cost effectively. In some cases, we've had to re-source currently produced items to suppliers that were more cost effective. Now that I have gained cost credibility within our organization, I've become much more involved with our design team and some designers have actively requested my help to reduce the cost of their designs. One of these conceptual design projects is illustrated towards the end of the present paper.

Selecting a useful costing tool

The process of selecting a costing tool useful for my work went very quickly. I briefly considered a few different costing tools, with the two largest being the aPriori software and Boothroyd Dewhurst's DFMA. I considered aPriori primarily because my predecessor at Ortho Clinical Diagnostics had considered their software for his use in supplier costing and negotiation. That consideration was based on an assumption that aPriori is an automatic system which requires very little time or effort to develop cost estimates. Fairly quickly, I decided against the aPriori models because of the alignment procedure necessary to make the aPriori software accurate. Any costing tool which requires alignment to supplier quotes is not useful for this type of work because alignment of the software to the data being questioned invalidates the software's ability to question that very same data. I required an independent estimate of cost and the aPriori alignment procedure eliminates that independence so it was very quickly removed from consideration.

In my previous costing work, I've used many different types of costing tools and I've always been impressed with Boothroyd Dewhurst's DFMA software. I was experienced with the capabilities and accuracy of the DFMA software and, for this reason, Boothroyd Dewhurst's DFMA was selected as the primary costing tool we would use in my work at Ortho Clinical Diagnostics.

Set up of the DFMA software

While a procedure to align cost models to supplier quotes is not appropriate for an independent costing tool, Boothroyd Dewhurst's DFMA software still required some setup and modification to make it suitable for my use. In particular, I required appropriate hourly rates for men and machinery as well as vendor to vendor and profit adjusted material prices within the DFMA software.

The approach I take towards cost estimating and supplier price negotiation is to base the labor portion of my estimates on supplier chargeout rates, which include appropriate profits for a supplier. For example, a 120 dollar per hour chargeout rate for a supplier's stamping press means my company rents time on that stamping press at a cost of 120 dollars per hour and that hourly rate includes all the supplier's cost and profit for all operations done on that press. Similarly, the material prices my estimates are based upon include all costs associated with buying and handling the material as well as any profit a supplier should expect for buying and handling that material.

This approach simplifies my cost estimates and it also simplifies the negotiation process that follows because the hourly rates and material prices used in my estimates are market prices that are well known and can be compared between suppliers. It also means that profits for a supplier are applied differently to the value added labor and the purchased material.

I contacted Boothroyd Dewhurst to ask for help in setting up the DFMA software and I provided them with my hourly rate and material price database. I worked with Brian Rapoza, the Director of Engineering at Boothroyd Dewhurst, and he incorporated my database into the DFMA software.

First costing project - Fabricated Tables

My first project at Ortho Clinical Diagnostics was a set of fabricated tables used to support, transport, level and secure our blood analysis machinery. The tables, one example of which is shown in Fig. 1, are available in two different lengths and the annual production volume for each length is low with less than 1000 produced yearly. The price paid to the current supplier when I started the project for each table is shown in Figs. 2 and 3. Management at Ortho Clinical Diagnostics had originally set a 10 percent cost reduction target for each table. As shown in Figs. 2 and 3, my estimates completed with the Boothroyd Dewhurst DFMA software showed that a much more significant cost reduction opportunity existed.

Figure 1 - One example of fabricated table

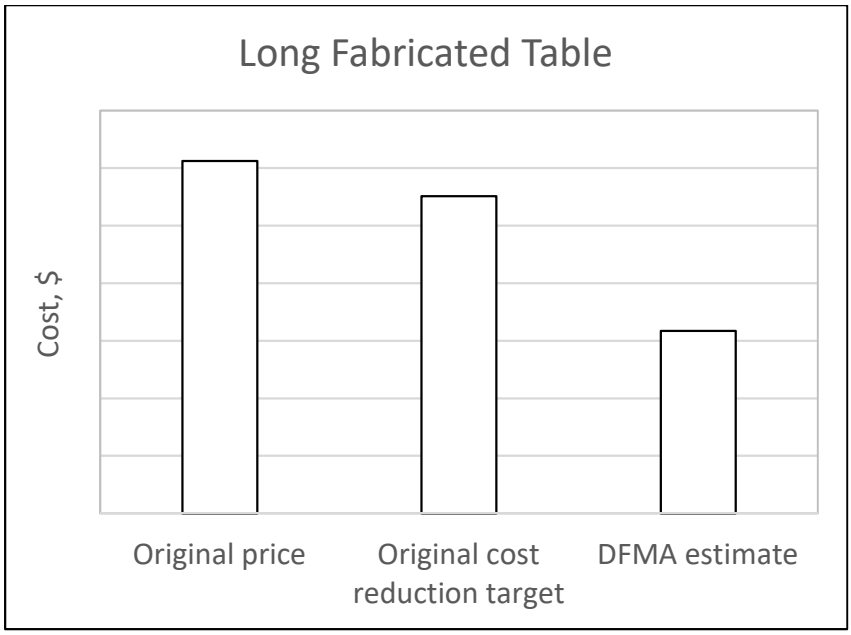

Figure 2 - Comparison of original price, original cost reduction target from management, and DFMA estimate for long fabricated table

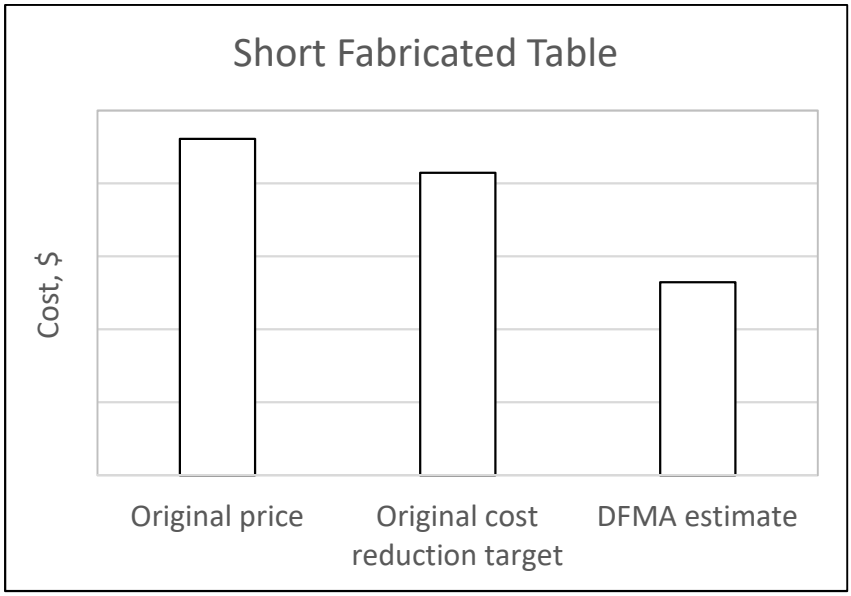

Figure 3 - Comparison of original price, original cost reduction target from management, and DFMA estimate for short fabricated table

Considering that my cost estimates for the tables were 52 to 57 percent of their current price, people within my organization at Ortho Clinical Diagnostics had trouble believing my estimates were correct. On top of that, the current supplier dug their heels in and refused to negotiate. I had a credibility problem to overcome with many people within my organization questioning the validity of the DFMA software. Based on my previous experience and the results I've achieved at other companies, I had confidence in my estimates, so I contacted a new supplier for a quote on each of the tables.

The new supplier's quotes are shown in Figs. 4 and 5. Note that with absolutely no negotiation, the new supplier's quotes were within 7.5 percent of my DFMA estimate on the long table and within 12.2 percent on the short table. This shed some light on the accuracy of my estimates with the DFMA software and restored some of my credibility with many people in my organization.

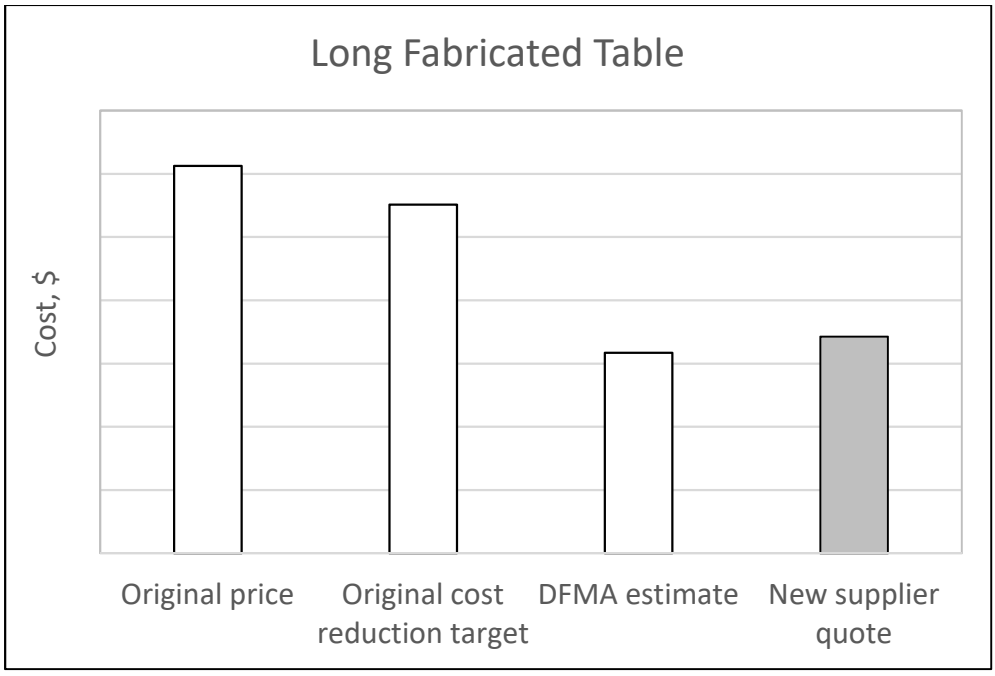

Figure 4 - Comparison of original price, original cost reduction target from management, DFMA estimate, and a quote from a new supplier for long fabricated table

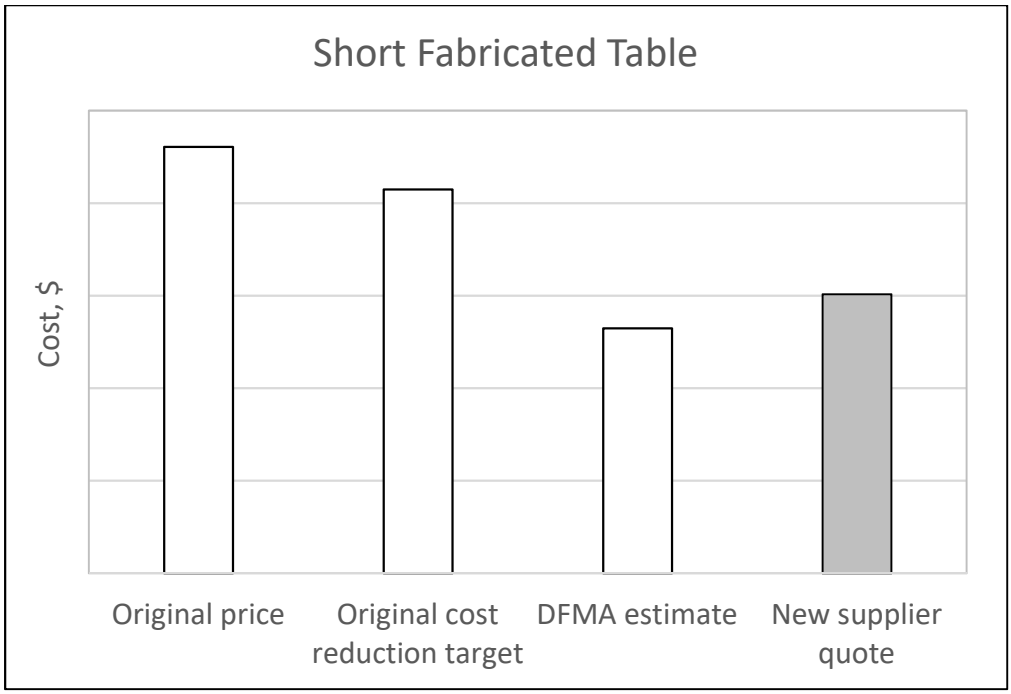

Figure 5 - Comparison of original price, original cost reduction target from management, DFMA estimate, and a quote from a new supplier for short fabricated table

Next, I negotiated with the new supplier to reduce their price further and during the negotiation we compared process steps, cycle times, and cost information. Together, we determined that in some areas they could do a bit better than they had assumed in their original quotes and their prices were reduced accordingly. We also found that some adjustments to my original estimates were necessary. Specifically, the 316-stainless steel material that many of the table's parts are made from had to be purchased by the supplier in very small quantities at additional expense. I also assumed that many of the table's parts would be painted only on a single side, but the supplier planned to paint both sides of those parts at increased cost. In these areas, I updated my original cost estimate and we converged at the purchase agreement values shown in Figs. 6 and 7. When compared with the prices originally paid for the pair of tables, this means we captured a total lifetime savings of just under three million dollars. This is particularly impressive considering that the fabricated tables are produced in such low quantities.

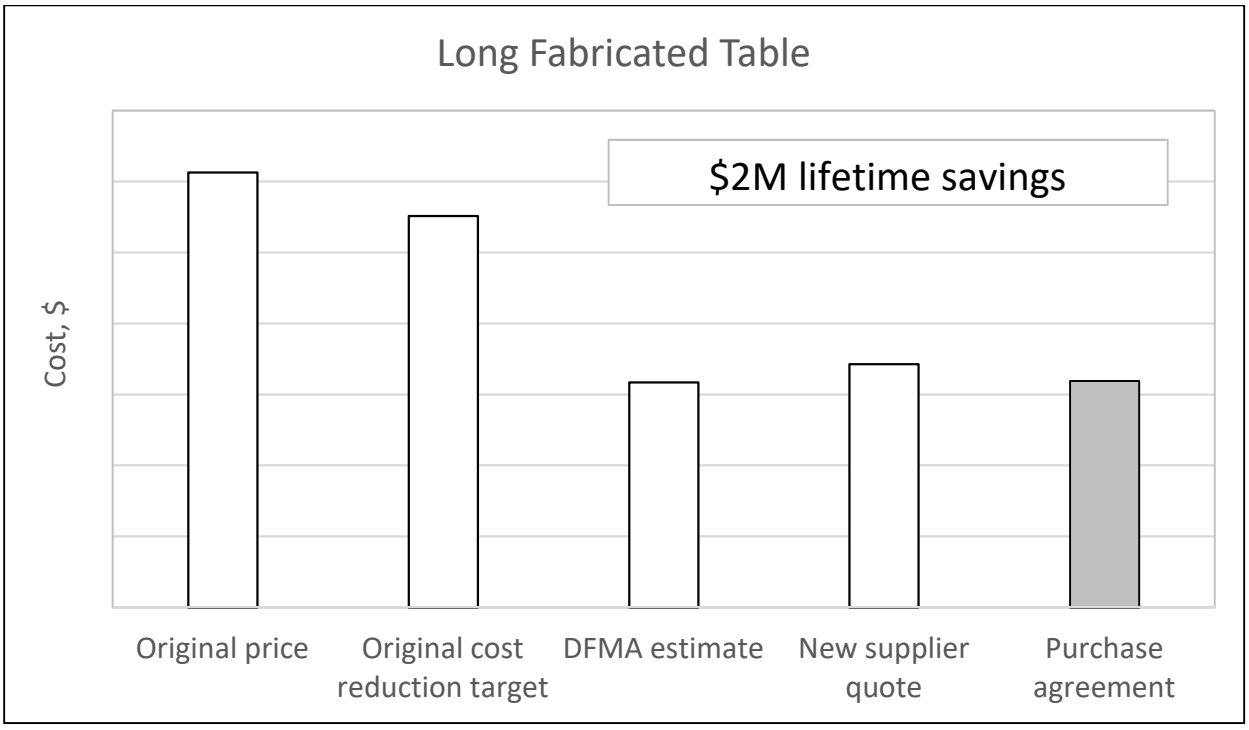

Figure 6 - Comparison of original price, original cost reduction target from management, DFMA estimate, quote from a new supplier, and the final purchase agreement for long fabricated table

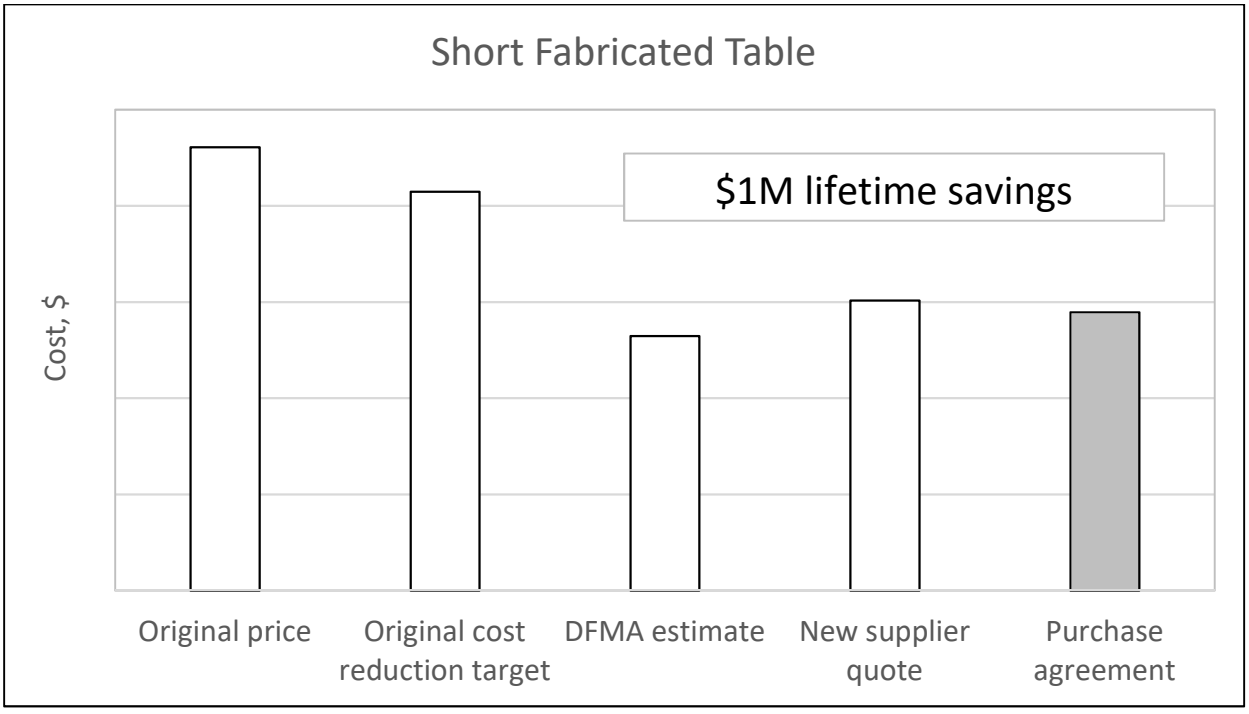

Figure 7 - Comparison of original price, original cost reduction target from management, DFMA estimate, quote from a new supplier, and the final purchase agreement for short fabricated table

Second costing project - Anchor Brackets

My next project was to cost-down some sets of anchor brackets which are used to anchor and secure machinery to the floor or wall within a building. My project was to estimate and negotiate the price for the three largest kits of anchor brackets that we produce. For reference, a single set of anchor brackets with associated hardware is shown in Fig. 8. The brackets that make up the kit are primarily stamped, formed, and then finish machined and they are produced in low annual volumes with less than 1000 of each kit produced.

Figure 8 - Anchor bracket kit and associated hardware

As shown in Fig. 9, a comparison of my DFMA estimates with the current supplier's prices indicates that there exists a small but still substantial gap in two of the kits and a much larger gap in the third. The current supplier for the anchor bracket kits also refused to negotiate a price. I contacted a new supplier for new quotes on each of the anchor bracket kits and, as shown in Fig. 9, there is reasonable correlation between the new supplier's quotes and my DFMA estimates. After a small amount of negotiation with the new supplier, purchase agreements were signed to re-source the anchor bracket kits which resulted in a lifetime savings of almost $700,000.

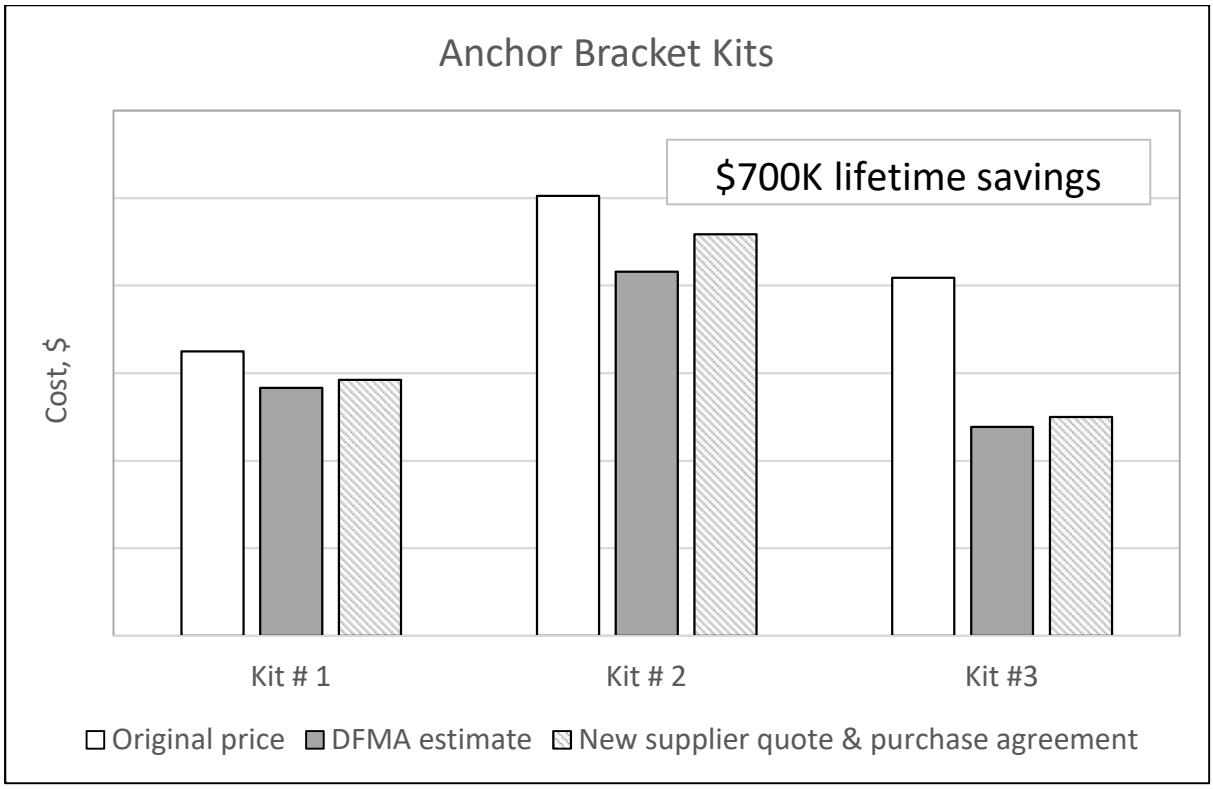

Figure 9 - Comparison of original price, DFMA estimate, and the final purchase agreement for three anchor bracket kits

Third costing project - Cart

The cart shown in Fig. 10, is used to carry and store various consumable support supplies for the blood analysis machines we produce. Each cart is primarily composed of sheet metal and standard structural steel shapes that are fabricated, welded, and pop-riveted together.

Figure 10 - Cart

We produce less than 1000 of these carts annually and my initial DFMA estimate for the cart was roughly 30 percent lower than the current price. The supplier producing the cart was unwilling to negotiate and, for that reason, I investigated re-sourcing the cart to a new supplier. The initial quote from this new supplier was somewhat high, as shown in Fig. 21, but they were willing to negotiate based on my estimate. During these negotiations, I sat with the design and manufacturing teams at this new supplier and we redesigned the cart so that they could produce it more efficiently. The changes made during our redesign included:

1) See Figs. 11 and 12 - Original design's base used standard structural steel shapes which were welded together. Redesign used a custom formed sheet metal base that had the required rigidity.

2) See Figs. 13 and 14 - Caster mounting brackets in the original design were very complex and required significant labor for assembly. Redesign used a set of simplified caster mounting brackets which were welded in place underneath the base. Welding of redesigned caster mounting brackets occurs at same time as other welding on base so that additional handling of large parts is eliminated. All base welding on the redesign occurs in areas never seen by the final customer which makes expensive dressing of welds unnecessary.

3) See Figs. 15 and 16 - Rear spine on the original design was made from structural steel tubing that was welded in place. Original spine's structural steel tubing was metric stock so it was an expensive special purchase for the supplier. Redesigned spine uses two custom-formed sheet metal parts that are tab and slot welded together.

4) See Figs. 17 and 18 - Top divided compartment on the original design was secured to spine with two separate brackets. Original brackets were pop-riveted to the spine using 12 pop-rivets. Redesign used integral features formed into the spine to serve the function of the brackets and eliminate 14 parts.

5) See Figs. 17 and 18 - Vertical dividers on original design's top compartment were all pop-riveted in place with many pop-rivets. Redesign used vertical dividers that were tab and slot welded to back panel.

6) See Figs. 19 and 20 - Original design used four center bin brackets which were pop-riveted together and pop-riveted to the cart's spine. Redesign used two central bin brackets which were tab and slot welded to the cart's spine to reduce the part count. The cross section of the redesigned brackets was shaped to meet strength and stiffness requirements while still eliminating the two vertical brackets.

7) Original design's countertop was made from marine board that was cut from sheet and then contoured to shape on a router and painted. The redesign's countertop utilized a less expensive molded part that was molded in color.

8) The color scheme of the redesigned cart was changed so the entire cart was a single color to eliminate additional setup of the paint line.

Figure 11 - Original design of base showing standard structural shapes welded together

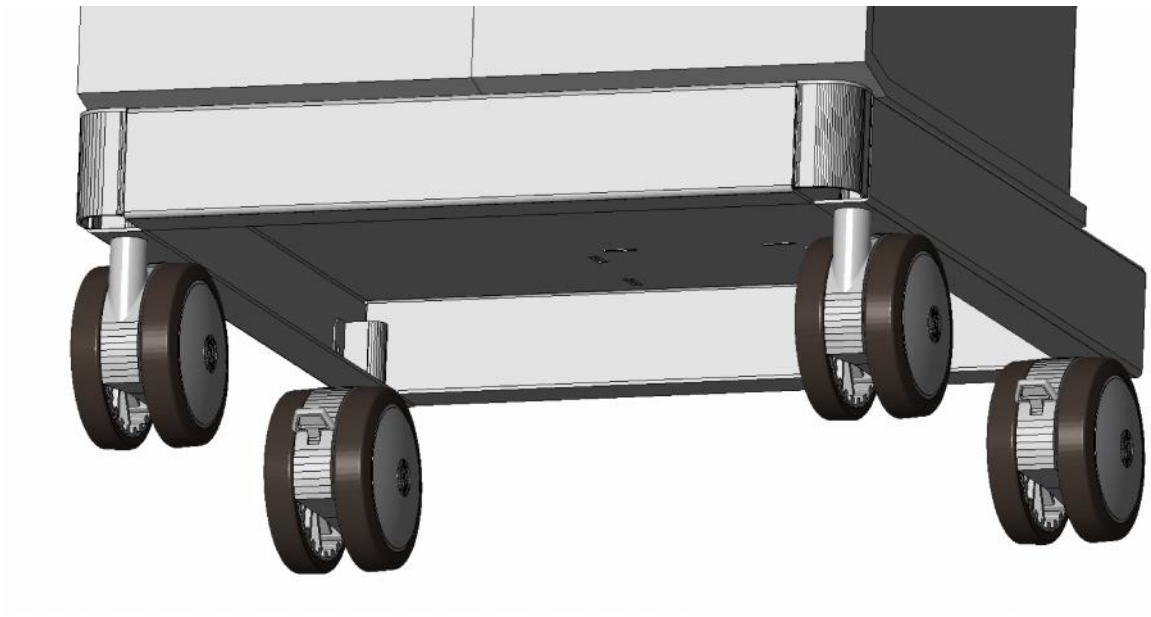

Figure 12 - Redesign of base showing custom formed sheet metal base with required rigidity

Figure 13 - Original design showing attachment of casters and exposed welds

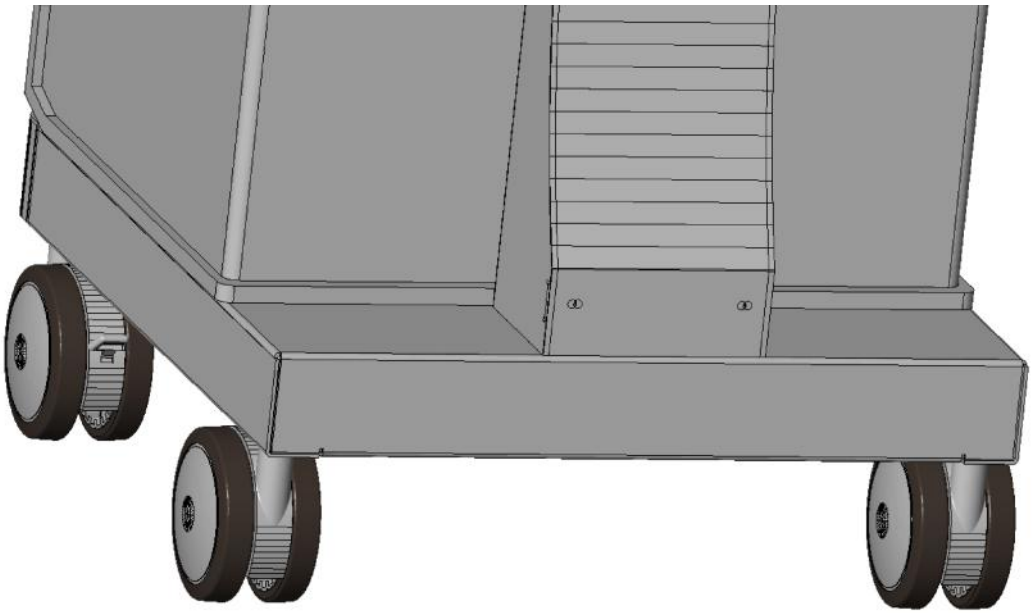

Figure 14 - Redesign showing simplified attachment of casters

Figure 15 - Original design showing structural steel tubing spine

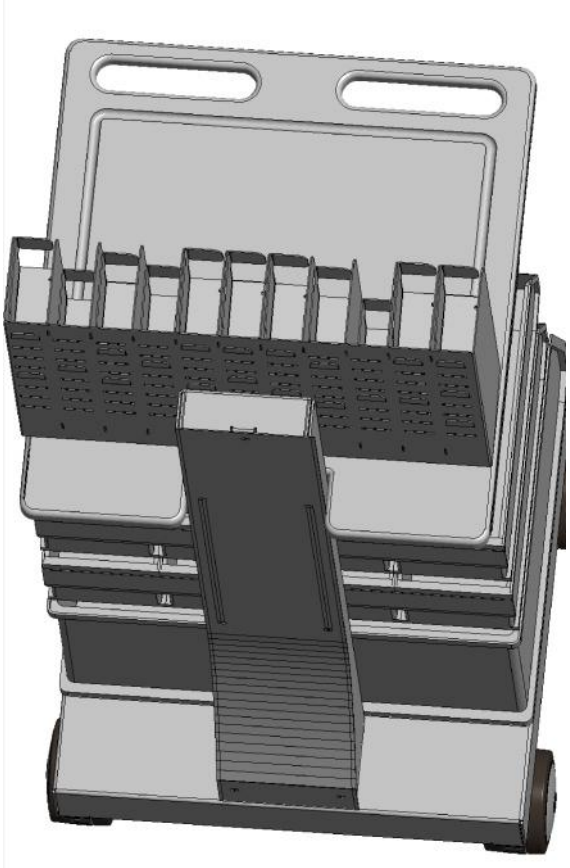

Figure 16 - Redesign showing custom formed sheet metal spine

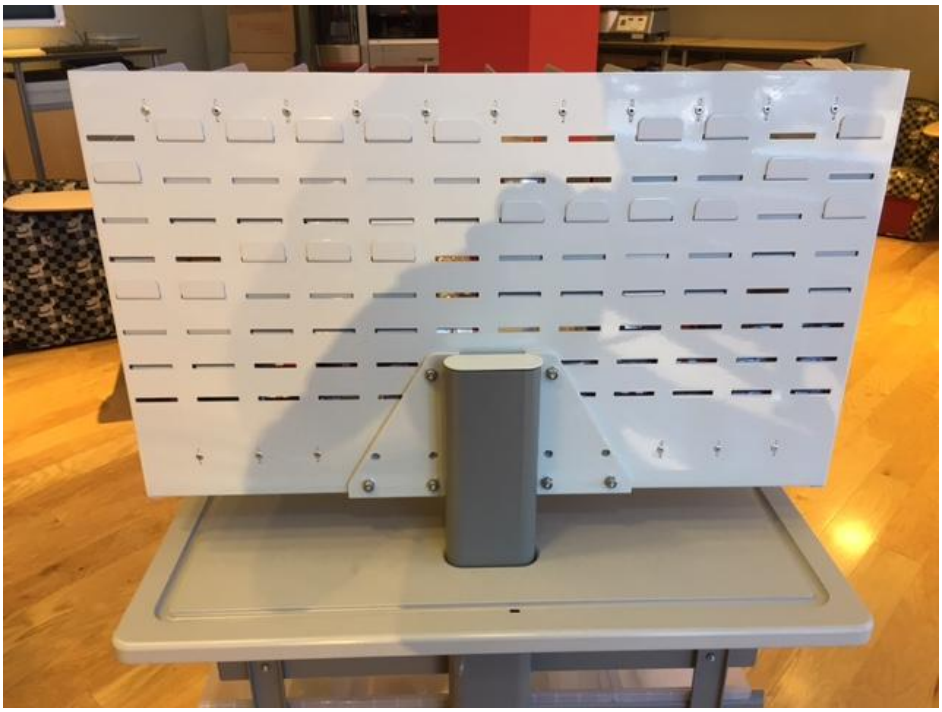

Figure 17 - Original design showing separate brackets to secure top divided compartment to spine - Also shows pop-riveted construction used on vertical dividers.

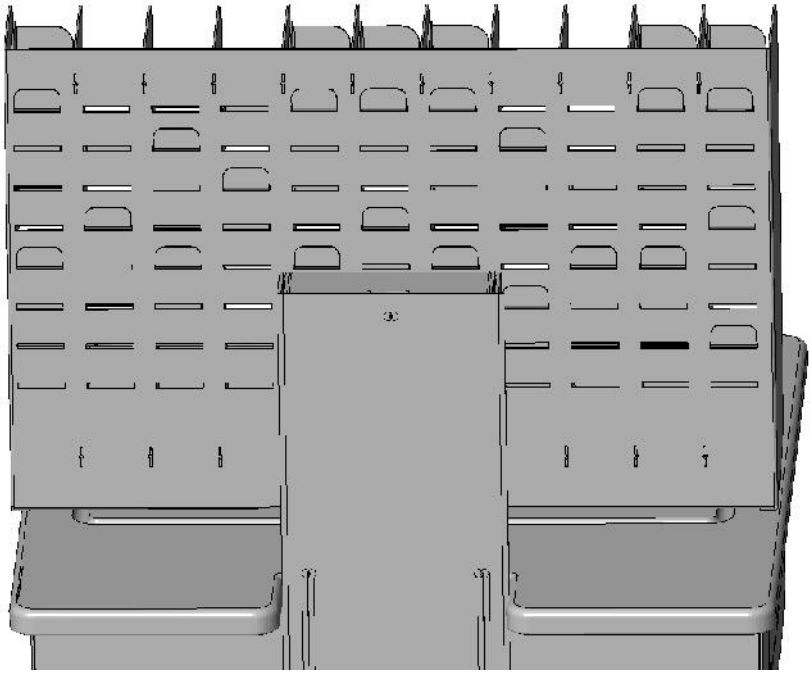

Figure 18 - Redesign showing integral features to secure top divided compartment to spine - Also shows tab and slot welded construction used on vertical dividers.

Figure 19 - Original design showing four center bin brackets pop-riveted together and to cart's spine

Figure 20 - Redesign showing two center bin brackets welded to cart's spine

After these design changes were made, I continued with some additional price negotiation and, as shown in Fig. 21, the new supplier agreed to produce the cart for much less than their original quote. A purchase agreement was signed which resulted in a lifetime savings of just under $600,000, as shown in Fig. 21.

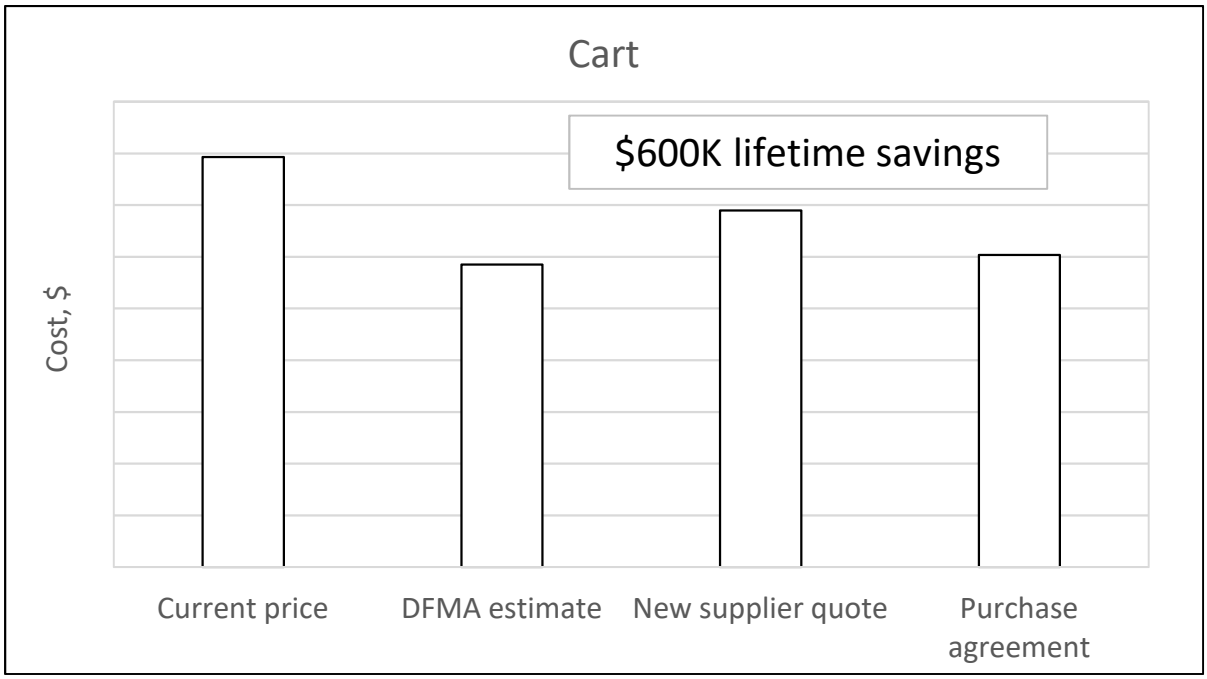

Figure 21 - Comparison of current price, DFMA estimate, quote from a new supplier, and the final purchase agreement for the Cart

During price negotiations, the new supplier also agreed to handle the logistics of selling the cart direct to our customers, which represents an additional and presently undocumented cost savings to my organization.

Redesign for cost reduction projects

As my credibility and visibility have increased within our organization, various design teams have consulted with me on assorted redesign for cost reduction projects and one simple example of these projects is shown in Fig. 22. Production volumes for this assembly are low with less than 5000 assemblies produced per year, and designers had difficulty meeting its cost target. The original design of the aluminum bracket is composed of four standard stock pieces which are welded together. My cost reduced redesign, shown in Fig. 23, changes the bracket to a single laser-cut sheet metal aluminum part that uses a contour shaped hole to accept the aluminum rail precisely. After the rail is inserted through the hole, the two parts are joined together with a stitch weld on the reverse side. Using the DFMA software, I estimated that the production cost of my redesign is less than half of the original design's cost which more than meets the established cost target for this assembly.

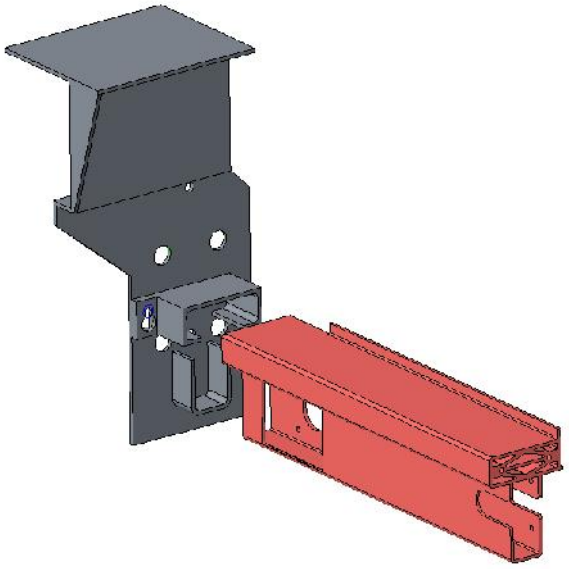

Figure 22 - Original design - bracket composed of four-piece weldment

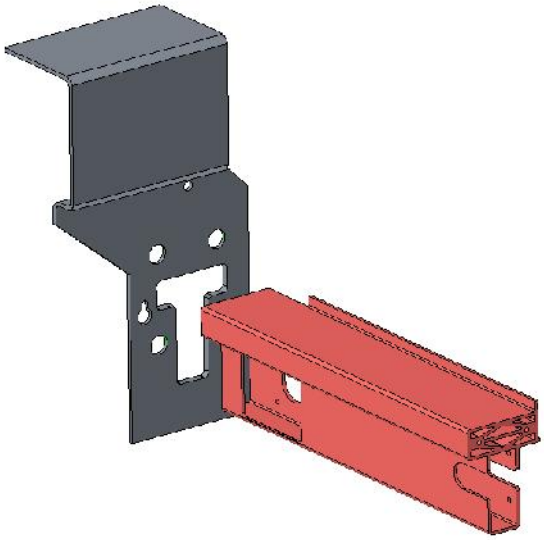

Figure 23 - Redesign that utilizes a cost reduced, single-piece bracket

I also plan to investigate replacement of the two-piece welded assembly shown in Fig. 23 with a single piece machined casting.

Conclusions and overall supplier costing results

I started work at Ortho Clinical Diagnostics just about a year and a half ago. In that short period of time, I've worked on 33 different supplier costing projects which are each somewhat similar in scope to the earlier examples described in the present paper. In total, for these projects, I've captured a total lifetime savings 32.7 million dollars. It's important to realize that these figures represent my actual captured savings and they do not include the possible savings that I've only identified with my DFMA estimates but have yet to negotiate. The possible identified savings is much larger than what I've actually captured. These results are particularly impressive when you consider that my work has primarily focused on the lower volume side of our business. Some of the projects I've worked on have resulted in annual savings which might be considered small due to the smaller production volumes of these products. However, when these smaller annual savings are taken together in total, they add up very quickly. Based on the results I've been able to achieve in a short period of time and in this low volume production environment, the total savings is certainly worth the effort to capture.

It's also important to note that to be successful in this type of work, you must have confidence in your costing tools and your cost estimates. Frequently, I bet my reputation and my credibility on these tools and my cost estimates. My credibility with suppliers and within my organization itself would have been lost very quickly if my cost estimates were poor or if I was unable to back them up with knowledge and experience. If that would have happened at the very beginning of my work at Ortho Clinical Diagnostics, very little cost savings would have been achieved.