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Cost and Price Collaboration

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Panel 21. Methods for Improving Cost Estimates for Defense Acquisition Projects

Thursday, May 5, 2016	
3:30 p.m. – 5:00 p.m.	**Chair: Major General Casey Blake, USAF,** Deputy Assistant Secretary for Contracting, Office of the Assistant Secretary of the Air Force (Acquisition) ***The Role of Inflation and Price Escalation Adjustments in Properly Estimating Program Costs: F-35 Case Study*** Stanley Horowitz, Assistant Division Director, Institute for Defense Analyses Bruce Harmon, Research Staff Member, Institute for Defense Analyses ***The Impact of Learning Curve Model Selection and Criteria for Cost Estimation Accuracy in the DoD*** Candice Honious, Student, Air Force Institute of Technology Brandon Johnson, Student, Air Force Institute of Technology John Elshaw, Assistant Professor of Systems Engineering, Air Force Institute of Technology Adedeji Badiru, Dean, Graduate School of Engineering and Management, Air Force Institute of Technology ***Cost and Price Collaboration*** Venkat Rao, Professor, Defense Acquisition University David Holm, Director, Cost and Systems Analysis, TACOM LCMC Patrick Watkins, Chief, Stryker/Armaments Pricing Group, Army Contracting Command

Cost and Price Collaboration

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Abstract

This paper examines how collaboration between the cost analysis and price analysis functions can achieve program efficiencies. Collaboration is defined along two dimensions: (1) as interactions between analysts from the two functions and (2) as exchange of relevant data and information between the functions. This study facilitated an exchange of financial data common to all programs, namely, the Cost and Software Data Reports and Price Negotiation Memorandums, between the two functions. Interviews with subject-matter experts provided the basis of estimates of the effects of the information exchange on the respective functions. The effects estimated were improvements in price negotiations by price analysts and improvements in program cost estimates by cost analysts. In addition to the common reports outlined above, the paper also identified other sources of information used by price and cost analysts to perform their functions and realize improvements. Based on the results, the paper proposes an information environment to systemically improve and institutionalize collaboration.

Introduction

This paper examines the benefits of collaboration, defined as information sharing, between price analysts and cost analysts. Both groups support a program's acquisition activities with financial analysis. Price analysts typically reside in acquisition contracting commands, and cost analysts reside in either System Command cost analysis organizations, on Program Executive Organization staff, or in business management offices. Both groups access financial information for different purposes: Price analysts support contracting actions, evaluate contractor proposals, and develop government positions to support negotiations to arrive at a final contract price. Cost analysts, on the other hand, develop life cycle cost estimates that are used to support program budgets, develop user requirement documents, and support program offices in their tradeoff and affordability analysis. Both groups need accurate cost information to meet their goals and have adopted various techniques and access multiple sources to obtain that information. Price and cost analysts sometimes collaborate and share information, but this collaboration is sporadic and based on existing practices, known data sources, and individual relationships.

This paper examines the state of current collaboration between price and cost analysts in four Army ground vehicle programs, captures the resultant benefits to both

functional disciplines, and recommends business process improvements to promote further collaboration.

Background

From 1992–2003, the Cost and Software Data Reports (CSDRs) were rarely collected on Army ground vehicle programs. In 2004, however, after more than a decade, a renewed emphasis was placed on contractors' contractually providing the CSDRs to the cost analysis community. The CSDRs report the actual recurring and non-recurring costs incurred by the contractor on the contract. By contrast, the Price Negotiation Memorandums (PNMs) are internal documents developed by price analysts that analyze contractor proposals' costs and price, document the government position, and record the final negotiated price. Both the CSDRs and the PNMs include detailed costs for labor, material, and overhead, but the CSDRs also provide costs by a standardized detailed work breakdown structure. Currently, this information is not exchanged between the pricing and cost analysis communities on a routine basis.

This paper examines the impacts of exchanging this information between cost and price analysts for four Army programs. In addition to the CSDRs and PNMs, the analysts were asked to report additional sources of price and cost information that supported their activities and improved their results. The additional sources include information from external organizations like the Defense Contract Management Agency (DCMA) and the Defense Contract Audit Agency (DCAA) and can vary by program to include the contract data requirements lists (CDRLs). As subject matter experts, price and cost analysts in the programs estimated the impacts of this information exchange by measuring the percentage improvements in cost-estimating and price-analysis outputs.

Project Description

Methodology

Ideally, we would have research data available on those programs that displayed high collaboration between cost analysts and price analysts and those that did not display such collaboration. We might then be able to compare results from those programs to quantify the benefits of collaboration. However, such program data is not generally available. Further, most programs in the ground vehicle community are well into the second or third cycle of system enhancements on very mature platforms, so early program data, such as for the Technology Maturation and Risk Reduction (TMRR) phase and the Engineering and Manufacturing Development (EMD) phase, are not available. Given the paucity of historical data, we developed the methodology described below which relies on questionnaires administered to subject matter experts in both cost analysis and price analysis to determine the value of collaboration to each discipline. While this methodology is less precise than one using accurate, matched historical data, it does provide enough information on the value of collaboration to inform potential changes in work practices.

To help inform the participants and to obtain some insight from them into the benefits of the collaborative process, we selected four Army ground vehicle programs and documents to exchange. For each program, we matched a cost analyst volunteer and a price analyst volunteer, each a subject matter expert with at least one year of experience on that particular program and with several years of experience in their respective disciplines. The selected participants were well versed in the details of their particular programs and had participated in at least one full budget cycle or one full contract negotiation cycle, respectively. The two principle sets of documents common to all of the programs were CSDR data and the PNMs. We had the cost analysts provide the Cost Performance Reports

(DD 1921) and the Functional Cost Hour Reports (DD 1921-1) to their price analyst counterparts. We had the price analysts provide the PNMs to their cost analyst counterparts. Participants were able to ask questions and discuss data with their counterparts prior to completing the questionnaires. We then administered the questionnaire to gauge the value of collaborating using these documents. The questionnaires also included open-ended questions about other practices that might foster collaboration, which proved informative.

The CSDRs are submitted by the contractor to the Government after completion of key events in a program (e.g., Critical Design Review, Prototype delivery, etc.) and at or near major decision points in the program lifecycle. It is at these points that contractor proposals are reviewed in preparation for the next contract award. Hence, the CSDRs are expected to inform the price analysis and proposal review with actual costs from the most recent contractor effort, thereby improving the negotiation position of the price analysts for the next contract award.

CSDR

The CSDR may consist of up to seven different reports. The details of the cost-reporting requirement (including, for example, the types of reports required, reporting structure, frequency, due dates, etc.) are communicated to the contractor in the request for proposal through the DD 2794 CSDR Plan. The CSDR Plan identifies which of the seven report types the contractor will be required to submit under that contract. The following are the seven different report types and short descriptions of the information they contain:

1. Contractor Work Breakdown Structure (CWBS) Dictionary: Provides a detailed description and definition of both technical and cost content for each Work Breakdown Structure (WBS) reporting element from the CSDR plan.
2. Cost Data Summary Report (DD 1921): A contract-level report that lists all WBS elements from the DD 2794 CSDR Plan. Provides a breakout of non-recurring and recurring costs incurred to date and estimated costs at contract completion. Provides a breakout of overhead costs (General & Administrative, Management Reserve, Profit/Fee, etc.) and quantities completed to date and estimated at contract completion.
3. Functional Cost and Hour Report (DD 1921-1): Provides a detailed breakout of all resource data (labor hours, labor dollars, material dollars, overhead dollars) across four functions (Engineering, Tooling, Quality Control, and Manufacturing) for each identified WBS element on the DD 2794 CSDR Plan. Costs are identified as non-recurring or recurring. They are further identified as incurred to date or estimates at contract completion. Reported costs do not include overhead costs from DD 1921 (General & Administrative, Management Reserve, Profit/Fee, etc.). The report also includes direct-reporting subcontractors' costs.
4. Progress Curve Report (DD 1921-2): Provides a detailed breakout of all resource data (labor hours, labor dollars, material dollars, overhead dollars) across four functions (Engineering, Tooling, Quality Control, and Manufacturing) for specified WBS elements on the DD 2794 CSDR Plan. Costs are direct recurring costs incurred to date and hours incurred to date. Costs are also segregated by unit or lot to develop learning curves and to project future units. Reported costs do not include summary element costs from DD 1921 (General & Administrative, Management Reserve, Profit/Fee, etc.). The report also includes direct-reporting of subcontractors' costs.

5. Contractor Business Data Report (DD1921-3): Annual report designed to facilitate overhead cost analysis at a specific contractor's site. Includes specific overhead information on all Major Defense Acquisition Programs, government contracts, and other government and commercial business. Also includes actual direct and indirect cost data on Government contracts and proposed direct and indirect cost data for future fiscal years.
6. Contractor Sustainment Functional Cost Report (DD 1921-5): This report is similar to DD 1921-1 except that its focus is on sustainment activities. Provides a detailed breakout of all resource data (labor hours, labor dollars, material dollars, overhead dollars) across four functions (Engineering, Program Management, Maintenance Operations, Materials) for each identified WBS element on the DD 2794 CSDR Plan. Costs are identified as non-recurring and recurring. They are further identified as either incurred to date or as estimates at contract completion. Reported costs do not include overhead costs from DD 1921 (General & Administrative, Management Reserve, Profit/Fee, etc.). Includes direct-reporting subcontractors' costs.
7. Software Resource Data Report (SRDR): Provides information for selected WBS elements on the DD 2794 CSDR Plan on software size, effort, and schedule.

PNM

The PNM contains several sections of interest to the cost analyst, including a reference to a DCAA Audit if one was performed, a reference to the Program Management Technical Evaluation of the proposed labor and material costs, a reference to an technical evaluation by the DCMA if one was performed, and a cost element summary for each of the contract deliverables and the total contract. The cost element summary includes many details of interest to cost analysts, such as the following:

- Material costs with part number detail on the contractor's proposal and an explanation of the U.S. Government analysis
- Additional detail on other part numbers, non-Bill of Material, and other material costs is also included in the discussion on material costs
- Total Labor Hours by Work Breakdown Structure description and cost center for the contract deliverables followed by the U.S. Government analysis
- Details on other direct costs
- Direct Labor Rates by rate and skill band
- Indirect Rates for Manufacturing, Engineering, G&A, Material Acquisition, and Material Handling and other overhead costs with an analysis of the overhead pool
- Facilities Cost of Capital (FCCM)
- An analysis of the profit based on the risk and other factors impacting the contract
- Government Furnished Material used by the contractor to prepare the proposal

The PNMs are documents reflecting the negotiated cost for labor and material by component in an awarded contract. Hence, the PNM is expected to inform the cost analyst in generating more accurate program budget estimates for the next funding cycle.

As stated earlier, the CSDRs are expected to inform the price analysis and proposal review with actual costs from the most recent contractor effort, thus improving the negotiation position of the price analysis for the next contract award.

These two premises were captured in a questionnaire with a section for the cost analyst and a section for the price analyst.

The price analyst section of the questionnaire asked a series of questions on the improvement in the negotiated price of a contract due to the availability of the CSDRs from the previous phase. For example, the questionnaire asked for improvement in the negotiated price for the Engineering and Manufacturing Development (EMD) Phase contract when the CSDRs from the Technology Maturation and Risk Reduction (TMRR) phase were made available. Similarly, improvements in the negotiated price of the Low Rate Initial Production (LRIP) Contract were sought given the CSDRs from the EMD phase. Finally, improvements in the Full Rate Production (FRP) contract were recorded given the CSDRs from the LRIP phase. Additional questions on the benefits of the detail in the CSDRs were also sought, along with additional reports or data that the price analyst used in determining their final negotiated position.

The cost analyst section of the questionnaire similarly focused on the improvement in the cost estimating given the PNM for the TMRR phase. Analysts also estimated the improvement in program estimates given the PNM for the EMD phase followed by improvements given the PNMs for the LRIP and the FRP contracts. Cost analysts were also asked to discuss other sources of information besides the PNMs that improved their cost-estimating efforts.

The questionnaire was reviewed by the Director, Cost and Systems Analysis and Pricing Chief for the Stryker program, and the Acquisition Contracting Command leadership.

Cost and price analysts responsible for four Army ground vehicle programs were asked to complete the questionnaire. A discussion was conducted with each team of price and cost analysts by program to document and clarify the responses. The discussions also captured the benefits of other sources of information that analysts used, such as Earned Value Management (EVM) Reports, Defense Contract Management Agency (DCMA) analysis of Forward Pricing Rate Proposals and Agreements (FPRP & FPRA), and the Defense Contract Audit Agency (DCAA) analysis of actual costs reported by contractors.

The results of the survey along with the analyst discussions are summarized in the paper under the Results section of the paper.

Selected Programs

Four Army ground vehicle programs were selected for this study.

- **Stryker**: A family of eight-wheeled armored fighting vehicles.
- **M88**: M88 and its variants are one of the largest armored recovery vehicles in use and include the M88, M88A1, and the M88A2 Hercules.
- **Paladin Integrated Management (PIM) Program**: An artillery vehicle delivering the M109A7 self-propelled howitzer.
- **Heavy Tactical Vehicles (HTV):** Program for Combat Support and Combat Service Support.

Four teams of price and cost analysts with responsibility for the above programs supported this study and paper.

Summary Results: Percentage Improvement Due to Collaboration

Tables 1 and 2 summarize the results recorded by the analysts and are followed by a discussion of each program's questionnaire responses.

Table 1 records the improvement that the CSDR and other reports provided the price analyst in supporting their price negotiation position. Each column records the percentage improvement estimated by the analyst in the government's price analysis of the contractor's proposal for the next phase due to the availability of the actual costs reported via the CSDR.

For example, the Stryker price analyst, in reviewing the CSDR submitted during the TMRR phase, was able to realize an estimated 5% improvement in the negotiated price for the EMD contract. Similarly, data from the CSDR received during the EMD phase supported an improvement in the government position of between 5% and 10%, while the CSDR from the LRIP phase supported a 25% improvement in the final position for the FRP contract.

A more detailed discussion by program follows the summary results tables.

Table 1. Price Analyst Input Percentage Improvement

Program	TMRR CSDR to EMD Contract	EMD CSDR to LRIP Contract	LRIP CSDR to FRP Contract
Stryker	5%	>5 ≤10%	>25%
M88	< 5%	>5 ≤10%	>5 ≤10%
PIM	< 5%	>5 ≤10%	>5 ≤10%
HTV	NA	NA	>0 ≤5%

Table 2 records the improvement in the cost estimates going forward that the cost analysts estimated due to the availability of the PNM from the last contract. For example, given the PNM for the TMRR contract, the cost analyst was able to improve the program cost estimates going forward by 10% to 15%. Similarly, given the price negotiation memo of the EMD contract, the cost analyst was able to improve the program cost estimates by 10% to 15%, the PNM of the LRIP contract enabled a 5% to 10% improvement, and the PNM for the FRP contract again showed a 5% to 10% improvement in program cost estimates going forward.

Table 2. Cost Analyst Input Percentage Improvement

Program	TMRR PNM to Inform Program Cost Estimates	EMD PNM to Inform Program Cost Estimates	LRIP PNM to Inform Program Cost Estimates	FRP PNM to Inform Program Cost Estimates
Stryker	>10 ≤15%	>10 ≤15%	>5 ≤10%	>5 ≤10%
M88	<5%	>15 ≤ 20%	>20 ≤ 25%	>20 ≤ 25%
PIM	>5 ≤10%	>15 ≤20%	>15 ≤20%	>5 ≤10%
HTV	>25%	>20 ≤25%	>15 ≤20%	>15 ≤20%

Price and Cost Discussion by Program

Stryker Program Discussion

The Stryker program is unique in that collaboration has been a longstanding practice. Price and cost analysts were collocated, which led to collaboration by physical proximity and resulted in improved cost and price outcomes. Observation of this effect led to program leadership exploring the effects of collaboration and has been an additional impetus for this paper.

Cost analysts reported the use of the following information in addition to the PNMs that supported their cost and budgeting efforts. Current Contractor Rates enabled the estimation of current costs. The Contractor Cost Proposals (CCPs) provided a window into expected costs that supported forecasting. The Bills of Material (BOM) enabled analysis of system configurations and have been reported as a significant benefit. Contract Scope helped in understanding the relationship of proposal costs to work effort and the time frame of the contract. Cost analysts also used CDRL reports provided as part of the contract deliverables, while access to Army supply systems provided visibility to parts costs.

The data from these sources was used to respond to requests for the Initial Government Cost Estimates (IGCEs) and also supported the Basis of Estimates for program costs. The sections of the PNM on Other Direct Costs (ODCs) and Indirect Rates were beneficial in developing a more complete cost estimate.

Cost analysts also stated that while access to reports was important, discussions with subject matter experts and price analysts for additional insights on current negotiations and contract structure helped develop future estimates. The structure of future contracts also helped the cost analysts appropriately bucket future expenses into the appropriate categories. Price analysts also provided a future Period of Performance (POP) which helped identify the fiscal year in which funding would be required to determine the plan for funds obligation.

Price analysts for the Stryker program reported that in addition to the CSDRs, the standard CDRL A007 that provided actual hours and cost expended was available to them. The Stryker program also had unique CDRLs; one example is the CDRL 0005 Parts Receipt Report which included part number detail, unit costs and quantities, and average unit costs over a rolling 12-month period that was especially useful in evaluating contract costs. These actual costs were beneficial in preparing for the next contract negotiations.

The PNMs from prior contracts and back up detail were also beneficial in developing the government position. DCAA Audit reports and DCMA Forward Pricing Rates were useful in analyzing current data and preparing for future contracts. Price analysts also received and used internal technical reviews from engineers regarding labor hours and types and quantities of material to prepare government positions and validate contractor proposals.

The CSDR 1921 was beneficial for a top level price analysis, but detailed analysis for configuration specific labor hours, dollars, and material dollars required the 1921-1. The detail also supported an analysis at the individual element level rather than at a total price level to determine the major changes from the awarded contract to the new proposal.

The IGCE from the cost analysis group also supported the evaluation of new proposals.

The Stryker cost analysts estimated greater percentage improvement in the early phases, around 10–15%, when programs' costs are less precise and when the negotiated contracts and contractor proposals can assist the analyst in developing more effective and accurate cost estimates.

Price analysts did not experience significant benefit—only 5% to 10%—in the early phases of programs. One possible explanation is that engineering effort can vary significantly from the early technology development in the TMRR phase to engineering development and integration effort in the EMD phase. As such, analyzing proposals based on past technical efforts is highly dependent on the scope of the engineering effort, which can vary significantly. In the early program phases, configurations for engineering models and prototypes are not firm, thus limiting the use of information from early prototypes.

However, price analysts reported greater benefit in the production phase—about 25%—going from the LRIP to FRP since actual costs from production are available for negotiating future production costs along with projected learning curve reductions. The production and post-production phases also benefited in the negotiations for program support costs as parts usage and cost information became available.

In summary, both price and cost analysts leverage information from multiple sources in addition to the PNMs and CSDRs to support cost estimates and price analysis effectively and have realized measurable and meaningful benefits from this collaboration. The mechanism for collaboration is primarily a human interface with access to reports along with limited automation of data.

M88 Program Discussion

For the M88 program, in addition to the PNMs, the cost analyst used the Forward Rate Pricing Proposal (FPRP) and FPRA to support cost analysis along with detailed data showing the Base and Overhead costs that the contractor assumed when the FPRPs/FPRAs were formulated. In addition to the PNMs and FPRAs, Actual Incurred Cost Reports (from the DCAA), Purchase Orders for selected parts (also from the DCAA), Hours per Vehicle (HPV) Reports (supplied by the DCMA and the contractor), and cost data collected from contractors via tailored CDRLs (i.e., Systems Technical Services (STS) Monthly Cost Reports) also proved beneficial. EVMS and CSDR data from other programs were also used.

Specific sections of the PNM, such as the Cost Element Summary, helped to break out the Base, Overhead, ODC, G&A, FCCM, and Profit at the negotiated price. This helped to compare estimates and assumptions with actual prices. It provided a method to compare PNM to PNM to understand and determine the cause for price increases, which helped explain the differences between actual and estimated costs. On the M88 program, the negotiated prices in the BOM of the PNM were important to identify the largest cost-driving components, and to track changes from PNM to PNM, which in some instances helped identify the change in part sourcing from Contractor Furnished Material to GFM. The Labor Hours by WBS provided a useful means to verify estimates and to track negotiated labor rates over time (from PNM to PNM), but Hours per Vehicle (HPV) Reports from the DCMA and the contractor provided better estimates. The Other Direct Costs (ODC) breakdown between interdivision, subcontractor, travel and other miscellaneous categories helped identify costs/scope that sometimes slip through the cracks of estimates. The Direct Labor Rates in a PNM were useful in some circumstances for generating IGCEs or tracking costs from PNM to PNM, but generally the additional detail was not accessed as frequently. The Indirect Rates were useful in some circumstances for identifying changes from PNM to PNM and understanding the variations to rates in the FPRPs/FPRAs, and helped in formulating IGCEs, but the level of detail is not typically applicable. The Pool Analysis in the PNM was marginally beneficial, but helped to point to other sources that the Acquisition Contracting Center used, such as documentation from formal audits to negotiate the various Pool Rates. It was also useful to account for Material Handling Overhead that the contractor adds to the GFM, and the PNM was helpful in identifying the specific additions that were applicable. The analyst also concluded that additional analysis into the various costs contained within different overhead pools would provide insights into how the contractor splits Direct and Indirect costs.

The price analysts did not rely on information from cost analysis and primarily used information from contractor and subcontractor proposals (current and past), prior PNMs, Request for Quotes (RFQ), the Government Supply System, and DCAA Audit Reports. The availability of CSDRs is a recent development, and it is expected to be an important source

of information for price analysts. In addition, technical evaluations from the PMO, the DCMA, and the ACC, along with historical labor costs and material purchase orders from the contractor, were useful sources of data for the price analyst. Industry forecasts such as Global Insights on price escalations and learning curve calculators also supported the price analysis.

A review of the CSDRs by the price analyst led to the conclusion that the level of detail in the CSDR between recurring and non-recurring hours would improve the analysis of the contractor's proposal. An analysis of the reported costs and negotiated price on contracts currently under execution would improve the government's negotiation position for the next contract. Inflation estimates used by the cost analysts would provide better estimates than the OMB estimates currently used by price analysts which do not capture DoD pricing as effectively. The CSDRs used to develop Program Objectives Memorandums may also provide better insight into Indirect Costs for negotiations.

In summary, both price and cost analysts relied on quality information from independent sources such as the DCMA, DCAA, past negotiations, and contractor proposals and actual costs from different sources to deliver effective results. However, in this case, the review suggests that a systemic access to actual costs and the corresponding detail from the CSDRs can lead to greater insights and better government positions. The estimates on improvements by the cost analysts suggest that program cost fidelity increases from the EMD phase to the LRIP and FRP phases combined with access to negotiated costs from concluded contracts is supporting improved program cost estimates. The price analysis function suggests that access to current and traditional sources of information such as the DCMA and DCAA is providing improvement, while access to cost analyst sources such as the CSDRs might result in additional improvements.

PIM Program Discussion

In addition to the BOM and labor hours from the PNMs, the cost analyst accessed the FPRA from the DCMA. Additional sources included Earned Value information from the contractor's system and actual costs from the System Technical Services (STS) contracts.

The PNM includes the total Material Price and total Material Overhead by Contract Line Item which supports a top level analysis of material costs. The PNM also assisted detailed analysis by providing information on the top 50 material cost drivers, as well as an explanation of negotiations for those parts. A benefit of having this information was sharing material cost information for common components across programs for more accurate estimating. In one instance, the Driver's Vision Enhancer (DVE) component's latest negotiated cost was provided to another program for an improved estimate.

The PNM contains negotiated labor hours by Contract WBS and cost center, and this supported a cross reference to the actual hours from the EVM system for leverage in future negotiations on labor hours. In another example of collaboration, based on the FPRP, the price analyst provided the contractor's additional costs for material acquisition, material handling, and general and administrative, which were then used to analyze and validate historical markups and understand the trends. These trends were then applied to direct labor rates from the PNM to estimate future costs. Cost analysts relied extensively on price analysts' data to support their program cost estimates.

Similar to the M88 program, price analysts did not rely extensively on cost analysis data but instead used the standard available information from the DCAA and DCMA. Additionally, for material costs, contractors were asked to provide information on high dollar items which was compared to past proposals with adjustments for quantities and inflation. Price analysts also looked at other contracts being executed and identified common parts

across systems to achieve volume discounts based on total purchases by the contractor. Price analysts also estimated additional usage of parts based on Foreign Military Sales (FMS) to negotiate discounts on current contracts. Labor hours and costs are one area where active input was sought from cost analysts to review proposed manufacturing labor for inconsistencies based on current and historical data. The program management office was also engaged to provide a technical analysis of the non-manufacturing hours to ensure that the contractor is providing the support the Government requires.

In summary, as in other programs, cost and price analysts relied on traditional sources of information but also demonstrated best practices such as seeking volume discounts by combining common parts from several systems and by including additional unit volume from FMS. Similar to the M88 program, the estimates on percentage improvements for the PIM program by the cost analysts suggest that as the program cost fidelity increases from the EMD phase to LRIP and FRP phases, estimates of program costs show significant improvement. Thus, better access to negotiated costs from concluded contracts is supporting improved program cost estimates. Cost analysts are suggesting that availability of and access to price information is resulting in improved estimates and thus making the case for improved collaboration. For price analysis, the percent improvement suggests that, similar to the M88, current available information was sufficient and therefore price analysts predicted a moderate improvement in performance. However, price analysts are only now being made aware of the CSDRs and other analytical approaches used by cost analysts. Thus, a systemic access to actual costs and the corresponding detail from the CSDRs can perhaps lead to greater insights and better government positions.

HTV Program Discussion

The HTV program has been in production for many years, and therefore data from prior contracts has been a significant source of information for the price analysts. Cost analysts have relied on PNM data, along with the supporting detail, extensively for their analysis. In addition to the CSDRs, cost analysts have used EVM data to support analysis and program estimates. Program Management Office technical input on configurations and labor was also important for cost analysts. EVM data was a valuable source of actual data, and learning curve data was significant in estimating manufacturing costs.

Price analysts are only now getting access to CSDR information, and their analysis has relied on other traditional sources for price analysis. Their review of the CSDR suggests that available data can be segregated by truck variant and is detailed enough for direct comparisons on several large cost items such as engines and transmission and will prove to be a useful source of information. Material negotiations rely on current standard costs and quotes, but the recent history and actuals from the CSDR will support an analysis of the reasonableness of contractor proposals. The price analyst review of the CSDRs also suggested that actuals to date and the estimate at completion date would be useful in assessing prior negotiations and provide leverage for future negotiations. Cost analysis by bill of material would be beneficial, but the contractor report provides history of labor costs by category and assembly station, which is more representative of the manufacturing operation. This report, when combined with actual data of production units and their progress through assembly stations, can be a more accurate representation of manufacturing costs. The price analyst also stated that when the CDRLs are not available due to timing, the CSDRs can be an important source of indirect cost information. The traditional sources of information for the price analyst include prior contract prices, PNMs, spreadsheets showing agreed-to cost buildups from prior contracts or contract modifications, overhead rates with pools and bases, both for current rates proposals and prior year actuals, along with the IGCEs and market research.

The price analyst assessed that the HTV production benefits due to current cost information may be limited since the purchased material by cost is commercial or competitively procured and actual data may not show a significant improvement. The information could have helped for labor since the contractor runs all production vehicles down the same assembly line, thus supporting a comparison of actual labor costs to negotiated labor costs. However, labor is only about 20% of vehicle cost, and the realized improvement may not be significant.

In summary, the HTV has been in production for many years, and the contractor generally includes historical data in follow-on production proposals for labor hours by department and truck variant, and also provides recent purchase costs for individual material items. The DCAA provides indirect projected pools and bases to the ACC along with actual versus proposed historical information. Thus, the availability of historical data closely matches the benefits of current data and shows only a slight improvement in the production phase.

Similar to other programs, the estimates on percentage improvements for the HTV program by the cost analysts suggest that as the program cost fidelity increases from the EMD phase to the LRIP and FRP, forecasted estimates of program costs show significant improvement. Thus, better access to the PNM, EVM data, and actual costs are supporting improved program cost estimates. This implies that availability of information is resulting in improved estimates, which suggests the potential to realize significant value through improved collaboration. For price analysis, the limited percent improvement suggests that current information sources are sufficient to deliver effective results. However, price analysts are only now being made aware of the CSDRs and other analytical approaches used by cost analysts. Thus, a systemic access to actual costs and the corresponding detail from the CSDRs can perhaps lead to greater insights and better government positions.

Information Sources Used Price and Cost Analysts Other Than PNMs and CSDRs

In this section, the sources of information other than the PNMs and the CSDRs are documented.

- DCMA:
  - Forward Pricing Rate Proposals (FPRP) and Agreements (FPRA)
  - Hours per Vehicle Reports
- DCAA:
  - DCAA audit reports on labor and overhead rates
  - Actual Incurred Cost Reports
  - Purchase Orders for selected parts
- EVM:
  - Earned Value Management System Reports on actual costs by work breakdown structure
- IGCE (Initial Government Cost Estimates)
- BOE (Basis of Estimates)
- POP (Contract Period of Performance)
- CDR:
  - A007 for Stryker program
  - 0005 Parts Receipt Report
  - Systems Technical Services Monthly Cost Reports

Observations

The analyst estimates of percentage improvements in their process suggests that cost analysts anticipate or have experienced significant benefits with access to information from price analysts and other sources used by the pricing group.

The cost analysis function fundamentally requires projections of costs in the future. Hence, the emphasis on using all sources of information to improve the fidelity of future forecasts is paramount. Any information that can be used to improve the accuracy of projections is validated and included in the analysis.

Price analysts in general have developed fairly complete sources of information to support a near-term contracting action, hence the reliance on DCMA and DCAA reports, prior contracts, prior proposals, and market research. The availability of the CSDRs has been a recent development, and the CSDR data is not available for all programs. Awareness of the availability of the CSDRs, where available, also was not widespread. Thus, there is an opportunity to share lessons learned from programs that have leveraged the use of this data and encourage its use across other programs.

It was also clear that the PNMs and CSDRs are necessary for collaboration but may not be sufficient. Several additional and important sources of information from the DCMA, DCAA, EVM, and Contract CDRLs are used extensively by cost and price analysts to deliver effective results.

All programs have used collaboration, but were primarily driven by individual initiative and relationships. This suggests that developing means to capture the institutional experience in the current collaborative efforts and an environment that supports systemic collaboration are critical for continued improvement in price and cost analysis.

Several best practices were observed across many programs, and sharing these benefits broadly would be beneficial. In one program, the historical overhead rates were analyzed by identifying the costs used to determine those rates. Applying a regression analysis to this data created a predictive model of future overhead rates. Other programs identified common parts across many programs and used the total volume across all programs to negotiate an improved Government position. This approach was further enhanced by including anticipated FMS volumes in determining total volumes and realized a better government position.

Conclusions

Benefits of Collaboration

Collaboration has benefited both cost and price analysts. The benefits are along two dimensions: (1) information exchange of reports and data between the analysts and (2) analyst-to-analyst interactions. The questionnaire data and the follow up discussions suggest that the magnitude of the benefit varies between price analysts and cost analysts. It appears that there is a significant flow of information from the pricing group to the cost analysis group, but the information flow from the cost analysis group to the pricing group is limited. However, price analysts have taken advantage of other similar sources of information and interactions with program offices to make up for the limited access to the cost groups. The grid in Figure 1 graphically displays the positioning of the cost and price analysts relative to the two dimensions.

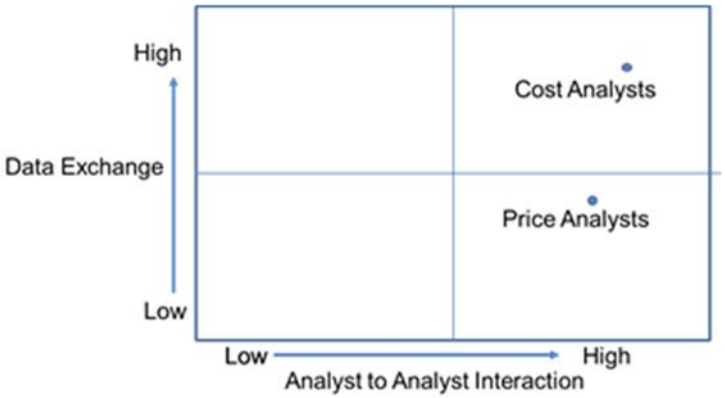

Figure 1. Positioning of Cost and Price Analysts Relative to the Two Dimensions

PNMs and CSDRs Are Necessary but Not Sufficient

The discussions with the analysts also revealed that there are several additional data sources that are significant in supporting analysts. Because the CSDRs and PNMs are the standard reports and should be available for all negotiated contracts, they were considered in our analysis as the primary sources of information. That said, the increased availability of the CSDRs is only a recent development, even though those reports are an increasingly common source of information for price analysts. Contract CDRLs, Earned Value Management System reports, and DCMA and DCAA reports on both forward and realized rates play an important role in supporting analysts.

Silos of Information

It is also clear that information exists in silos across the DoD enterprise, as evidenced by the information from the DCMA, DCAA, Program Offices, Acquisition Contracting Command, and Cost and Systems Analysis groups accessed by the analysts. Generally, only *experienced* analysts are able to obtain the required information based on relationships and knowledge of data. However, when new data sources are available, active use of these data sources demands proactive engagement. Given resource and time constraints, this may not always be possible. There is also not a readily available organizational mechanism to share best practices across the teams of analysts that support different programs.

Recommendations

- **Business processes and supporting information systems for rapid collection of and access to key program cost and pricing data would have several benefits.**
  - All analysts would have access to information on demand. (For contractor proprietary information, appropriate security and non-disclosure rules would need to be a part of the business processes.)
- **A notional information model is shown in Figure 2 where information is organized by Program ID.**
  - The information associated with every contracting action on the PNM is linked to the Program ID, which would include the PNM, EVM, DCMA, DCAA, and Contract CDRLs. As additional contracts are executed for the Program ID, information from each contract would be linked to the Program ID. As the program progresses through the acquisition framework, the CSDR, Bills of Material, LCCs, and POM

inputs would also be linked by Program ID. This information would be made available to analysts from across the enterprise for active use.

- Such an information organization would also lend itself to comparing the PNMs and Bills of Material, thus potentially automating the identification of changes and cost drivers.
- Bills of Materials comparisons could also be made across programs for tracking costs of common parts with similar form, fit, and function.
- Over time, the accumulated data could support large-scale data mining to understand configuration and cost trends.

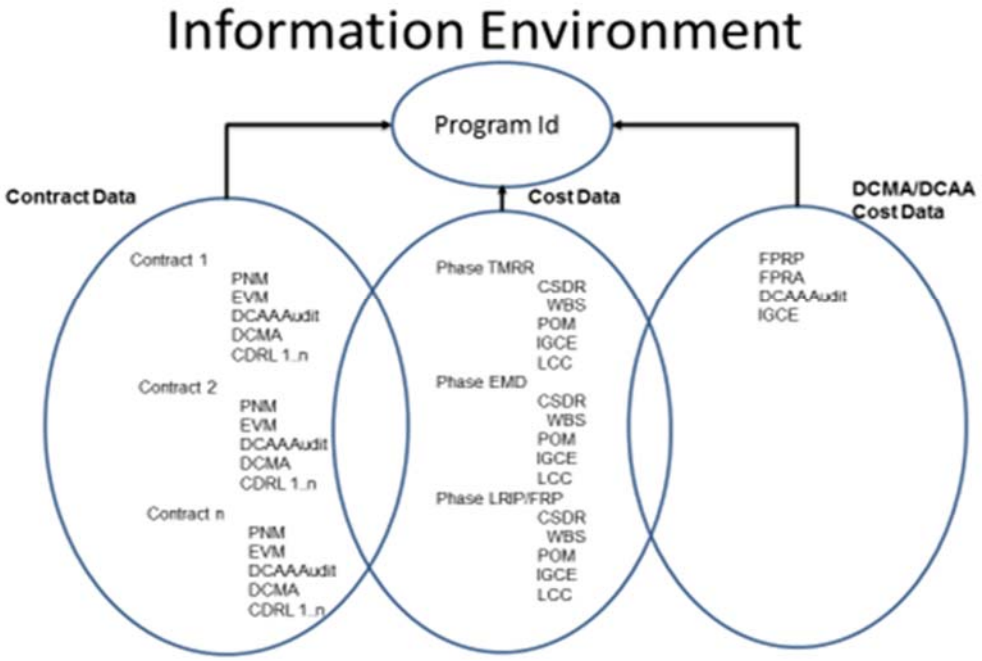

Figure 2. Notional Information Model Organized by Program ID

- **Collaborative Environment**
  - The benefits of co-location and collaboration were realized by the Stryker program, and while co-location may be constrained by availability of space, a simulated collaborative environment for price and cost analysts for all programs could be established. This environment could also include analysts from the Program Office, DCMA, and DCAA.
  - A technology environment that includes modern collaborative tools such as messaging, desktop video conferencing, and screen sharing applications to facilitate rapid communications should be considered.
- **Community of Practice (COP)**
  - The establishment of a Community of Practice (COP) to share best practices across the DoD enterprise where analysts could share insights, experiences, analysis, and successes should be considered.

Next Steps

This paper provided a window into the state of collaboration between price and cost analysts. It documented how collaboration is being practiced today and also identified several benefits of collaboration. It also recommended business process improvements and an information model to enhance the current state of collaboration. The next steps would involve describing in greater detail potential business process modifications and validating the expected improvements with the process changes. Other recommendations, such as the establishment of a community of practice and a clearinghouse for best practices, could be implemented in the short term.

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