

# PARAMETRIC COST ESTIMATING INITIATIVE NEWSLETTER



## Working Group Message:



Welcome to 1997 and the 1st issue of the Parametric Cost Estimating Initiative Newsletter this year! **1997 will be the key year for the parametric cost estimating initiative (PCEI), as DoD, NASA and Industry await our results!** Key activities for 1997 include PCEI Executive Steering Committee (PCEI ESC) visits to selected reinvention lab sites, documentation of the reinvention lab site test results, updating of the parametric cost estimating handbook, and development and delivery of the formal parametric cost estimating training course. **We have a lot to accomplish during 1997 and with everyone's contributions and support, the PCEI will be successful!**

**Members of the PCEI ESC and / or PCEI Working Group (PCEI WG), are in the process of visiting all of the reinvention lab sites to obtain specific details on the models being tested, the accuracy of the models in predicting costs, and the customer's involvement and satisfaction with these techniques.** To date, four site visits have taken place: Lockheed Martin Tactical Aircraft Systems - Ft. Worth, Texas; McDonnell Douglas Helicopter Systems - Mesa, Arizona; McDonnell Douglas Aerospace - St. Louis, MO; and Northrop Grumman ESSD - Baltimore, Maryland. The first set of site visits was scheduled to obtain specific details on a variety of the parametric techniques currently being tested with an overall customer base representing Army, Navy and Air Force. These lab teams have made tremendous progress.

This newsletter includes summary write-ups on the Lockheed Martin Tactical Aircraft

Systems and McDonnell Douglas Helicopter Systems visits. The complete papers describing the test results to date for each site visited will be included on the International Society of Parametric Analysts (ISPA) web page (pg. 7), and the DCAA Bulletin Board System (DCAA access only) by May 15, 1997. These papers can also be obtained from the Newsletter Editor (pg. 20).

In conjunction with the site visit to McDonnell Douglas Helicopter Systems, the PCEI ESC and WG members were invited to visit Motorola in Scottsdale, AZ to obtain a briefing on an in-house developed model that will be used to estimate indirect forward pricing rates (FPRs). The briefing showed that the model will greatly improve the FPR estimating process. The two biggest benefits are that the estimates will be better supported and the proposal can be prepared, reviewed and negotiated to establish a forward pricing rate agreement (FPRA) at the beginning of the year rather than mid-year. This is the first model that has been demonstrated to the PCEI ESC and WG that helps estimate FPRs. The Motorola integrated product team (IPT) expects to validate the model fairly quickly so it can be used to estimate FPRs on a test proposal within the year. Motorola was invited to participate in the reinvention laboratory so that the PCEI can document a model for indirect expense rates. Motorola accepted the challenge. We welcome the Motorola team to the PCEI and look forward to their results!

**The reinvention laboratory results will provide the information needed to achieve recognition of parametrics as an acceptable estimating technique throughout government and industry. We hope to have all of the results documented by the end of 1997.** These



documented case studies will help institutionalize the proper use of parametrics by providing examples for the handbook. The handbook will then serve as the basis for the parametric training course that will be available to both government and industry.

In regard to the parametric cost estimating handbook, the PCEI WG recently developed a statement of work (**SOW**) to update the handbook. The successful execution of the SOW will result in several improvements and enhancements to the handbook. Some of the key additions or updates being targeted include case studies based on the reinvention lab sites test results, calibration and validation best practices, and guidance for performing price analysis and negotiating estimates based on parametric techniques. **We still welcome feedback on the parametric cost estimating handbook SOW.** The draft SOW is available on the ISPA web page (pg. 7) and the DCAA Bulletin Board System. You can also contact the Newsletter Editor (pg. 20) to obtain a copy. We anticipate that the request for proposal to update the handbook will be issued during April 1997. The following is the schedule for the handbook update:

- 📖 Issue contract - May '97
- 📖 Updating process - May '97 - Oct '97
- 📖 Issue 2nd edition - Jan '98

**If you have any suggestions for the update, please provide them by June 30, 1997. Earlier submission will be greatly appreciated.**

In regard to the formal parametric cost estimating training course, the PCEI WG received feedback from approximately 200 people. All of this feedback was used in establishing the recommendations that will be presented to the Defense Acquisition University (**DAU**) shortly. **The bottom-line recommendation is that training in an IPT format once a company has identified and targeted an initial parametric opportunity, is the preferred delivery method. However, this will not always be feasible so classroom instruction will also be needed.** The IPT should include the contractor, major customer, DCMC and DCAA. The results of the DAU briefing will be discussed in the next newsletter.

On January 15, 1997, a briefing on the


PCEI was provided to acquisition executives as part of DCMC's periodic Joint Services Contract Administration Services meeting. Some of the attendees at this meeting were Mr. William Reed, Director of DCAA; Major General Robert Drewes, Commander of DCMC; and acquisition executives from the military services. The attendees look forward to the successful completion of the laboratory in 1997, and the documentation and publicity of the results. They were most interested in what actions are needed to institutionalize the use of parametrics (e.g., handbook and training). They also support keeping the PCEI WG intact for the next several years to oversee the handbook, training, and to be available to fact-find issues as they arise.

**One of the key indicators for measuring the success of the lab will be the metrics collected by the teams.** The lab teams are using several metrics to measure their accomplishments. The following are the key metrics frequently asked about in executive briefings.



1. Customer satisfaction (can have many different metrics)
2. Accuracy of estimates
3. Contract award cycle time
4. Proposal preparation cycle time and costs

The PCEI WG has information available on the metrics process. This is available on the ISPA web page (pg. 7) and the DCAA Bulletin Board System under the "Metrics, Q&A's" file. It can also be obtained by contacting the Newsletter Editor (pg. 20). The PCEI WG is available to assist the reinvention lab teams with metric and data collection activities.

**We continue to receive top level support of the PCEI.** Of note, is a recent endorsement letter issued by Ms. Darlene A. Drayun, Principal Deputy Assistant Secretary for Acquisition & Management, Department of the Air Force. The letter endorses the use of properly calibrated / validated parametric cost estimating techniques on proposals submitted to the government. We are pleased to 

include the Air Force letter in this newsletter (pg. 4) and we appreciate the continued support the Department of the Air Force provides to the PCEI.

**We would also like to draw your attention to several upcoming and key events.** We expect that the next PCEI ESC meeting will take place in June 1997. We will provide more information on this in future newsletters. Also, the ISPA International Conference is scheduled for May 28-30, 1997 in New Orleans, LA. Three of the lab teams are scheduled to present their test results. Please refer to page 5 for additional information on the ISPA conference. We anticipate the next PCEI workshop will take place in February 1998, with all of the lab teams showcasing their results.

**Finally, we wish to thank everyone for contributions being made to the PCEI newsletter.** We have received many outstanding articles and pictures from various organizations. We hope to include all of these in upcoming issues of the newsletter. We expect to issue another PCEI newsletter very quickly due to the volume of recent

contributions received. We are also interested in obtaining articles on best practices for data collection and validation and any other parametric related subjects.

**We look forward to successful results of the Reinvention Lab Teams and the PCEI in 1997!** As always, please feel free to contact us or any other member of the PCEI WG to discuss any ideas or issues.

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***You don't want to ask for formal guidance this early in the (Parametrics Laboratory) process . . . if you do, you will tie your hands and force limits . . . We need to continue to test the use of the various parametric cost estimating techniques and sell their use so it is brought to the forefront . . .***

Mr. Gary Thurber, Deputy  
Defense Contract Management Command  
Parametric Cost Estimating Workshop - October 16, 1996

***The GE jet engine parametric cost model has a huge potential to produce better estimates in substantially less time as compared to GE's existing estimating techniques . . .***

Colonel Joseph Timmons, Commander  
Defense Contract Management Command - General Electric  
DCAA Quality Conference, November 15, 1996

DEPARTMENT OF THE AIR FORCE  
WASHINGTON, DC



**Office of the Assistant Secretary**

30 JAN

1997

MEMORANDUM FOR SEE DISTRIBUTION

FROM SAF/AQ

1060 Air Force Pentagon  
Washington, DC 20330-1060

SUBJECT: Expanding Use of Parametrics to Reduce Acquisition Cycle Time and Costs

I strongly encourage Air Force PEOs and DACs to actively team with industry, DCMC, and DCAA to expand the use of parametrics to price contracts.

Acquisition cycle time and the cost of proposal preparation and evaluation can be significantly reduced using properly calibrated and validated parametric models. When appropriately used, these models can produce contract price estimates of equal or better reliability than traditional "bottoms-up" estimates.

The Director of Defense Procurement (DDP) issued a memo in Aug 95 (Atch 2) advocating parametrics and affirming that there are no regulatory barriers to their use. The joint Industry/Government Parametric Cost Estimating Initiative (PCEI) Working Group has published a handbook on preparing and reviewing parametric estimates. The handbook is accessible via the Internet at <http://seaO2www.navsea.navy.mil/webdata/pceh/pceh.html>. The AF PCEI Working Group representative is Mr. Virgil Hertling, HQ AFMC/PKPC, DSN 787-6861.

Attachment 3 is an excerpt from the Dec 96 Parametric Estimating Initiative Newsletter identifying 12 Reinvention Lab sites evaluating applications and parametric models. Early involvement by your contracting officers with industry, DCMC, and DCAA is critical to ensure expanded use.

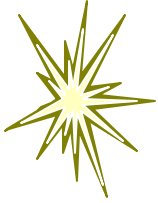
The SAF/AQC POC is Maj Garry Shafovaloff, DSN 225-0042.

/s/

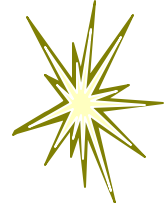
**DARLEEN A. DRUYUN**  
Principal Deputy Assistant Secretary  
(Acquisition & Management)

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**Editor s Note: The acronym PEO stands for Program Executive Officer and the acronym DAC stands for Designated Acquisition Commanders.**



**Notification of 1997 ISPA Annual Conference**  
***Parametric Perspectives in the Information Age***  
**May 28-30, 1997 / New Orleans, LA**



**The annual International Society of Parametric Analysts (ISPA) conference will be held May 28-30, 1997 in New Orleans, LA.** "Parametric Perspectives in the Information Age" is the theme of the conference this year.

**The PCEI will be one of the key topics on the conference agenda this year.** A general session panel is scheduled where members of the PCEI WG will discuss many of the topics significant to the PCEI. These discussions will focus on the current status of the PCEI as well as future plans, status of the reinvention lab test sites and calibration / validation issues. There will also be workshop tracks where three of the reinvention lab teams will present the results of their tests to date. These three teams will present test results in the following areas: (i) cost estimating relationships (**CERs**), (ii) in-house developed models, and (iii) commercial models.

The ISPA conference will also focus on other important topics. These include general sessions on topics such as cost as an independent variable and risk management. There will also be many workshops relating to parametrics theory, models and training.

Further information can be obtained by contacting Mr. Clyde Perry. He can be reached at the following locations:



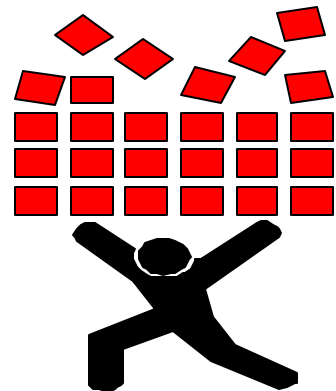
**Phone**      314/527-2955  
**Fax**              314/256-8358  
**E-mail**        clydeperry@aol.com

Conference information is available on the ISPA web site (pg. 7) or by contacting the Newsletter Editor (pg. 20). **We encourage everyone's attendance at this workshop.**

**PCEI ESC AND WG  
 ADDITIONS**

**PCEI ESC Additions:** **Joe Fowler**, Director of Estimating at Lockheed Martin Tactical Aircraft Systems (LMTAS) - Ft. Worth, TX and **Chris York**, Vice-President of Business Management at McDonnell Douglas Helicopter Systems (MDHS) - Mesa, AZ are new members of the PCEI ESC.

**PCEI WG Additions:** **Lester Richmond**, Manager of Parametric Estimating, also of LMTAS and **LCDR Jack Stem**, F-18 Deputy Program Contracting Officer at the Naval Air Systems Command - Arlington, VA are new members of the PCEI WG. We welcome the insight and contributions these individuals will provide the PCEI.

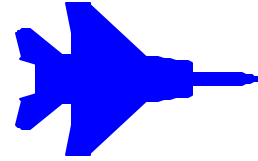


Lockheed Martin Tactical Aircraft Systems

Ft. Worth, TX

*Executive Summary on the*

*Results of the PCEI ESC / WG Site Visit*



Lockheed Martin Tactical Aircraft Systems (**LMTAS**) is one of the 10 original reinvention lab test sites. The team includes representatives from the contractor, DCAA, DCMC and the F-16 SPO at Wright-Patterson Air Force Base in Dayton, Ohio. As reported in the December, 1996 issue of the newsletter, the teams primary test to date has been to develop, implement and validate an in-house model that can be used to estimate engineering design costs for F-16 engineering change proposals (**ECPs**) at less cost and with greater reliability. Also, the change order process cycle time will be reduced significantly for the F-16 aircraft at LMTAS. The contractor is also testing the use of a commercial model to analyze subcontractor costs and establish negotiation targets for subcontractor costs. Details of this test application are contained in Joe Fowler's article, ***The Future of Cost Estimating is Parametrics*** (pg. 11).

Members of the PCEI ESC and WG visited the LMTAS lab team on January 29, 1997. The LMTAS team demonstrated how significant savings can be achieved by implementing parametric cost estimating techniques while achieving a high level of accuracy. The results of this visit are described below.

Engineering design labor is a major cost driver on engineering change proposals for the F-16 aircraft at LMTAS. The contractor currently uses various methods to estimate engineering design labor costs, such as estimates based on analogies ("similar-to" estimates) or estimates prepared using bottoms-up techniques. The contractor estimates that these proposals take on the average, 185 hours each to prepare. ***The contractor estimates that by implementing a standardized process for developing, calibrating, validating and maintaining in-house developed models, proposal preparation hours can be reduced to 10 hours each.*** The following is a summary of the teams' test results to date for the engineering design model.

1. **Logical Relationships**: LMTAS determined that engineering change notices (**ECNs**) and drawing size should be logical predictors of engineering design hours.
2. **Currency and Adequacy of Data Bases**: LMTAS collected data consisting of ECNs, drawing size and engineering design hours from 300 completed ECPs. ECPs were classified as simple or complex. (Simple ECPs include drawings that require only minor revisions or enhancements whereas, complex ECPs include drawings that are new or require major modifications.) The team established standard criteria for the data that should be included / excluded from these data bases.
3. **Statistical Analysis (Validation)**: After the data bases were established, the team utilized the  $R^2$  statistical test to evaluate the correlation between the independent variables (i.e., cost drivers - ECNs and drawings) and the dependent variable. The  $R^2$  test was applied at various levels of the work breakdown structure (**WBS**), (e.g., total aircraft WBS, aircraft segment WBS and aircraft segment component WBS) to identify the highest correlation. The team determined that the highest correlation occurred at the aircraft segment component WBS level. Consequently, a model was developed that included various equations based on the type of ECP (i.e., simple or complex) and the specific component of the aircraft. The team performed a test to validate the model by comparing the accuracy of the model to estimate engineering design hours to actual hours for 300 other ECPs. This comparison resulted in a 97% accuracy level. Currently, the model is in process of being validated.



4. **In-House Model Updating and Monitoring:** The team is currently defining the updating and monitoring process. LMTAS is expected to update the data bases annually unless certain conditions arise that require a more frequent update. The team expects to implement adequate controls to ensure the model is properly used and that the integrity of the data is maintained.
5. **Estimating Policies and Procedures:** LMTAS is in process of formalizing its policies and procedures. When complete, these will include guidelines for (i) appropriate use of the model, (ii) data collection and normalization, (iii) validation processes, (iv) updating processes, (v) ensuring adequate training is provided to estimating personnel and (vi) criteria for internal reviews.

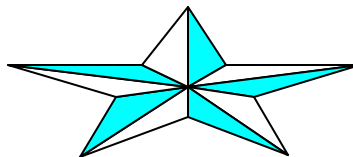


### Newsletter Acronyms

<b>CAS:</b>	Cost Accounting Standards
<b>CERs:</b>	Cost Estimating Relationships
<b>DAU:</b>	Defense Acquisition University
<b>ECPs:</b>	Engineering Change Proposals
<b>IPT:</b>	Integrated Product Team
<b>ISPA:</b>	International Society of Parametric Analysts
<b>MOA:</b>	Memorandum of Agreement
<b>PCEI:</b>	Parametric Cost Estimating Initiative
<b>PCEI ESC:</b>	PCEI Executive Steering Committee
<b>PCEI WG:</b>	PCEI Working Group
<b>SOW:</b>	Statement of Work
<b>TINA:</b>	Truth in Negotiation Act
<b>WBS:</b>	Work Breakdown Structure

### Web Site Addresses

- ◆ ***International Society of Parametric Analysts (ISPA)***
  - ★ <http://mijuno.LARC.NASA.gov/dfc/societies/ispa.html>
- ◆ ***Parametric Cost Estimating Handbook***
  - ★ <http://sea02www.navsea.navy.mil/webdata/pceh/pceh.html>
- ◆ ***Other Reinvention Lab Sites***
  - ★ <http://www.npr.gov>



**McDonnell Douglas Helicopter Systems**

Mesa, AZ

**Executive Summary on the  
Results of PCEI ESC / WG Site Visit**



McDonnell Douglas Helicopter Systems (**MDHS**) became a reinvention lab test site in October, 1995. The team includes representatives from the contractor, DCAA, DCMC and the contractor's primary customer, the Army Aviation and Troop Command (**ATCOM**). **The teams overall objective on the PCEI was to develop parametric cost estimating relationships that would be acceptable to the contractor, DCAA, DCMC and its primary customers for negotiating contractual items.** At the start of their test, the team held a brainstorming meeting to identify good parametric cost estimating candidates. This resulted in identification of 13 areas of cost that could be developed into parametric cost estimating techniques. The team prioritized these techniques based on data availability and chose 3 to test on the PCEI. The team chose to develop improved CERs to estimate non-recurring in-house tooling raw material costs and technical manual costs. The team also chose to test software estimating models. **The teams initial objectives were to develop an estimating process for identifying, developing, validating, and updating CERs and then to apply this process to other CERs.** MDHS had been using over 200 CERs to estimate program specific costs for many years. However, there was a lot of reluctance by the government to use these CERs because no standard process for developing, implementing or evaluating these techniques existed. Also, the government believed that the estimates produced by the CERs were not accurate.

Members of the PCEI ESC and WG visited the MDHS lab team on February 12, 1997. The PCEI ESC and WG site visit focused on the processes used by the team to implement the non-recurring in-house tooling raw material costs CER (hereafter referred to as tooling material CER). This visit disclosed that the **MDHS team efforts have resulted in the development of an acceptable estimating process for identifying, developing, validating, and updating CERs.** This process is explained below.

1. **Integrated Product Team:** During the initial stages of the test, the **team committed to meeting weekly, discussing relevant issues and planning action items.** The team established roles and responsibilities for the various members:
  - ◆ MDHS would collect the data, perform statistical analysis, make on-going presentations, incorporate team feedback, and establish / update the estimating policies and procedures
  - ◆ The government team members would provide real-time review and feedback and perform statistical analysis

All of the team members participated in the pilot training course together and this provided them with a common understanding of effective statistical analysis (validation techniques).

2. **Logical Relationships:** The first thing the team did in developing the tooling material CER was to determine if the cost estimating relationships were logical. They determined that the data relationships appeared logical.
3. **Currency and Adequacy of Data Bases:** The next process was to determine if the supporting data bases were current and adequate (e.g., sufficiency of data). It was found that the data bases were not current. The team updated the data bases to reflect the last 4 years of program history.



4. **Statistical Analysis (Validation):** After the data bases were updated, the team applied statistical tests to determine if significant data relationships existed and whether the cost driver selected would be a good predictor of costs. MDHS acquired a commercial statistics software program that was used by the entire team during this process. As a result of the PCEI pilot training, the team learned that tests other than  $R^2$  (also known as the Coefficient of Determination) should be performed to determine if the CER is a good predictor of costs. The team used several statistical tests to interpret the data in addition to  $R^2$ , including the  **$R^2$  adjusted test** and the **F-stat test**.
- ◆ The  **$R^2$  adjusted test** is a refined version of  $R^2$ .  $R^2$  is often used as the primary statistic for measuring the amount of variation in a dependent variable (cost being estimated) that is explained by the independent variable (cost driver).  $R^2$  is a value between zero and one. A number closer to zero indicates the data relationship is poor. Typically, the  $R^2$  value gets artificially inflated by certain factors (e.g., small number of data points or addition(s) of independent variables) because they are not considered in the  $R^2$  formula. For example, adding an independent variable (cost driver) will always increase the  $R^2$  value even though the predictability may decrease. Because these factors aren't considered in the  $R^2$  formula,  **$R^2$  should not be used to compare predictability of different models.** The  **$R^2$  adjusted statistic normalizes the  $R^2$  statistic by adjusting the formula to compensate for the number of data points and / or the number of independent variables (cost drivers) in the model.** The  $R^2$  adjusted value is generally less than the  $R^2$  value. Consequently, **the  $R^2$  adjusted statistic can be used to compare models.** The MDHS team initially used the  $R^2$  adjusted statistic because the number of data points was small. However, the team plans to increase the number of data points and will also test additional cost drivers in the future. As a result,  $R^2$  adjusted was used to compensate for the factors that artificially inflate the  $R^2$  value and so the team can compare different models in the future.
  - ◆ The **F-stat test** is used to determine if a good cost driver has been selected for the model. The higher the F-stat value, the higher the predictability capability of the cost driver. At MDHS, the f-stat test indicated that the initial cost driver selected for the tooling material CER was a good predictor of costs.

If the results of the statistical tests indicated that (i) **logical relationships exist**, (ii) **significant statistical relationships exist**, and (iii) **the CER will be a reasonably accurate predictor of cost**, then the CER would be validated. The statistical tests also provided the team with a standard error that describes, on the average, how accurate a CER will be in predicting costs. If the accuracy isn't as high as one would like, the team could consider testing other data relationships. For some of the test CERs, the statistical analysis found opportunities for improving CER accuracy (e.g., considering other cost drivers). The team developed a survey process that can be used to improve the CERs by identifying other cost driver candidates. This survey considers such factors

Picture eliminated from electronic subscriptions - please contact the Newsletter Editor (pg. 20) if you would like the complete electronic file.

**Pictured: Art Fraga, DCAA  
Member of MDHS Lab Team  
Parametrics Fall '96 Workshop**



as (i) ability of the cost driver to predict costs, (ii) anticipated correlation between the cost driver and the costs being estimated, (iii) availability of cost driver data, (iv) cost that would be incurred to obtain historical information for the cost driver data and, (v) difficulty and cost of obtaining this particular data in the future. This survey would be completed by the particular functional area representatives. The summary results of this survey would indicate other potential cost drivers that could be considered for future data collection activities.

5. **CER Updating and Monitoring:** MDHS also established a maintenance (updating) process where they agree to analyze monthly, new data that has been gathered, perform data analyses (e.g., unusual data falling outside the normal range is analyzed and the results and recommendations on inclusion / exclusion are presented to the team), and discuss possibilities of improving the CERs. This process will be applied to the tooling material CER, as well as to the 200 CERs previously referenced. The team has also established a Memorandum of Agreement (**MOA**) that defines specific criteria on how the CERs will be used, maintained and documented.
6. **Estimating Policies and Procedures:** MDHS documented the processes it used in identifying, developing, validating and monitoring CERs in its estimating system policies and procedures. The government team members evaluated these policies and procedures and have provided real-time feedback to the contractor. MDHS policies and procedures describe cost estimating relationships and include most of the following key estimating policy and procedure elements:
  - ◆ Identification of key cost drivers and database construction
  - ◆ Data analysis, calibration and validation criteria
  - ◆ Frequency of data updates
  - ◆ CER monitoring
  - ◆ Procedures for using the CER

As indicated, the teams' efforts to implement the tooling material CER resulted in the development of the processes described above. The contractor executed a MOA in January, 1997 defining the CER utilization requirements for the tooling material CER and it has been validated for use on proposals. The process was applied in parallel to the other 200 CERs and these have been validated for use on specific programs. The team is currently applying this process to other CER candidates identified during the teams' initial brainstorming session.

The team anticipates the following benefits will be achieved by implementing effective parametric cost estimating techniques:

- ◆ Simplified negotiations and field pricing
- ◆ Streamlined acquisition processes
- ◆ Reduced procurement cycle time
- ◆ Reduced proposal preparation costs
- ◆ More consistency in estimating practices

The MDHS team is a good example of how government and industry can work together and be successful with parametric cost estimating. The team training and regular meetings provided them with the opportunity to effectively implement parametric cost estimating techniques.



**The Future of Cost Estimating is PARAMETRICS!!!!!!!!!!!!!!**  
*by Joe Fowler, Director of Estimating at Lockheed Martin Tactical Aircraft Systems*

### **Introduction**

Parametrics has been utilized at Lockheed Martin Tactical Aircraft Systems in Fort Worth, TX for many years on development type contracts or for rough order of magnitude (**ROMs**) and budgetary estimates. LMTAS is now actively pursuing using parametrics on recurring aircraft proposals. The U.S. Government has often required a bottoms-up estimate on aircraft proposals even though it costs in excess of \$1.0 M for internal proposal preparation costs, and takes on average a span of 100 to 120 days to prepare a major aircraft proposal. When you are selling 150 to 600 airplanes at a time, these proposal preparation costs are not significant when compared to the total contract value. However, when you are selling 6 to 8 airplanes at a time, **FASTER, BETTER, CHEAPER, MORE ACCURATE** proposals are mandatory. As a result, LMTAS has committed to using parametrics as the primary "Basis-of-Estimate" (**BOE**) for production proposals.

We at LMTAS view parametrics as a critical process improvement to achieving **BEST PRACTICES** in estimating our products. We also believe that parametrics can be the single largest contributor to reduced proposal preparation and negotiation span times. As a result, we have selected the use of the commercial model "PRICE H" to **CONTINUE** our parametric journey.

There are several important things to remember as you move to parametrics:

- ◆ Parametrics is an estimating process that is based on and calibrated to your actual costs.
- ◆ Parametrics can significantly reduce proposal span times and cost.
- ◆ Cost reduction benefit is not just limited to the contractor.
  - ◆ Can be a significant reduction in fact finding, audit and negotiation
  - ◆ Triple savings for government (SPO, DCMC, DCAA), once the process is validated.

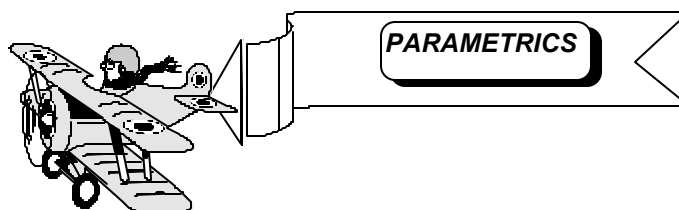
### **Background**

LMTAS has a long standing use of in-house developed parametrics or cost estimating relationships (**CERs**).

- ◆ 61 Formal (Factors) Negotiated Forward Pricing Rate Agreements (**FPRAs**)
- ◆ 82 Informal CERs

In July 1995, at the first Parametric Cost Estimating Initiative (**PCEI**) Workshop, LMTAS volunteered to be one of the initial PCEI Reinvention Laboratory Sites. We began our program developing additional in-house CERs and models. Our initial Reinvention Laboratory efforts have concentrated on:

- ◆ Tooling recurring costs
- ◆ Other tooling costs
- ◆ Engineering design for engineering change proposals



### **Commercial Models**

LMTAS soon concluded that our estimating approach could be at “too low a level of detail” and that if we continued down this path we could easily have several thousand CERs. As a result, LMTAS began to explore the use of commercially available models as a parametric tool. LMTAS started with high dollar procurements primarily because we had a lot of internal personnel that questioned “Why would you want to use parametrics when it was **Easy** to get a vendor quote and nothing could be more **Accurate?**” **The reason is simple:**

- ◆ There are more than 33,000 parts that go into an airplane.
- ◆ Many of these parts are buy parts.
- ◆ Takes too long to get vendor quotes, vendor cost and pricing data; perform the price cost evaluation (**PCE**); and include all of this data in our first proposal submission.
- ◆ Many proposals are held up in audit waiting for PCEs.
- ◆ Takes too long to prepare airplane proposals - span time can be anywhere from 100 to 120 days.
- ◆ Kills too many trees - airplane proposals currently generate over 1,500 pages of data.
- ◆ Costs way too much to develop a major proposal (often exceeding \$ 1.0 M in proposal preparation costs).
- ◆ And finally, **PARAMETRICS can be FASTER and CHEAPER with EQUAL or BETTER ACCURACY.**

### **Phase I**

Our primary purpose was to prove that you could use parametrics as an accurate estimating tool for follow-on or repetitive procurements of high dollar parts. We also wanted to quickly demonstrate the potential savings of using commercial parametric models such as the “PRICE H” estimating tool. We selected three high cost subcontracted assemblies. For part number A, we had 128 individual purchase orders or 128 lots. Even though many were purchased in the same lot and the same negotiation, we decided to put the data in our commercial model by purchase order so that DCAA auditors could trace the input data back to our source purchase order documents.

We normalized the first 127 lots to 1993 base year dollars, escalating any purchase orders prior to 1993 and de-escalating any purchase orders after 1993. Since procurement practices may vary from site to site and over time, it is critical that you examine the negotiation memorandum to determine if escalation is already included in the base price. We found instances where a purchase order was negotiated in base year dollars and other instances when it was negotiated in then year dollars. It is essential that you normalize all of your history to base year dollars utilizing acceptable and auditable escalation / de-escalation rates and techniques.

### **Commercial Model Calibration**

After normalizing the purchase order data, we calibrated our commercial model to the cost of Lot # 1 to obtain the manufacturing complexity for that item. Next, we put the first 127 lots or purchase orders in the model and then estimated the cost of Lot 128 and compared the result to the negotiated price for Lot 128.

#### **Method # 1**

Our first estimate utilized the following “PRICE H” model assumptions:

Normal Technology Improvements  
Normal PRICE Cost Slope (90 %)



The model generated an estimate of \$ 20,100 while our actuals were \$ 28,144. There was an \$8,000 difference in the "PRICE H" estimate compared to actuals. It was obvious that we could not use this as our BOE.

### **Method # 2**

Our second estimating technique utilized the following assumptions:

No Technology Improvement  
Normal "PRICE H" Cost Slope (90%)

The "PRICE H" Model generated an estimate of \$ 23,800 compared to actuals of \$ 28,144. Although the difference was now only \$ 4,344, it still indicated that we could not use this technique as our primary BOE since the accuracy was only 84.6 %.

### **Method # 3**

Our third estimating technique utilized the following assumptions:

Normal Technology Improvement  
Cost Slope calibrated to Vendor Actuals (97.2 %)

The resulting estimate was \$ 28,000 compared to actuals of \$ 28,144. A **99.5% ACCURACY !!!!!** (Or a difference of **less than 1 %**.) If these results could be repeated on other parts, than we felt we could easily justify and validate the use of "PRICE H" as the Primary BOE on high dollar purchased parts. We used **Method # 3** on two other high dollar purchased parts and the results were very similar to our experience on part number A.

And since **Method # 3** could accurately predict the vendor's price for the next lot, we started looking at our parametric analyses as a tool to replace the onerous requirements of a PCE.

Additionally, other insights were gained as we calibrated more high dollar purchased parts. For example, assume the following data.

<b><u>Vendor</u></b>	<b><u>Part</u></b>	<b><u>Vendor Cost Slope</u></b>
111	A	97.2%
222	B	93.1%
333	C	93.4%
444	C	89.7%
555	D	92.1%
666	E	93.7%

This data might be very useful to LMTAS buyers. One might ask why Vendor 111 has a cost slope that is significantly higher than other high dollar vendors, or why two vendors for part C have significantly different cost slopes.



Also, as you calibrate other programs, you might observe the same vendor with different cost slopes for the same part number:

<u>Vendor</u>	<u>Part # for</u>	<u>Vendor Cost Slope</u>
111	F16A	97.2%
111	F22A	93.1%

This data would be very useful in negotiations with Vendor 111.

The first phase of LMTAS implementation of commercial models is focused on high dollar subcontracted parts. We eventually plan to extend this process to the total aircraft, first replacing our existing tools for ROMs and Budgetaries and then utilizing "PRICE H" as our primary "Basis-of-Estimate." Finally, we will extend this tool to engineering change proposals and contract change proposals.

### ***Lessons Learned***

Most Contractors believe the major barriers will be their local oversight. However, we have found thus far, that ***data collection and normalization has constituted a sizable barrier.*** Dealing with the changes in management systems and processes over the years has been a formidable barrier.

### ***Other Lessons Learned***

- ◆ Many internal barriers exist in functional areas
- ◆ Need more education, training and understanding
- ◆ Commercial models are excellent estimating tools
- ◆ Commercial models can be utilized to perform "Price Analysis" on repetitive buys substituting for PCEs
- ◆ Commercial models can be utilized to perform "What Ifs" on vendor data to establish negotiation positions or targets

### ***Next Steps***

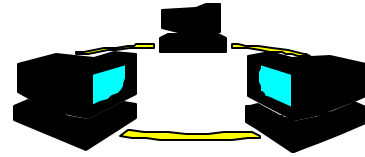
- ◆ Get Customer Involved (SPO, DCMC, DCAA)
- ◆ Get Company Procurement Department Involved

### ***Summary***

Once we have a properly calibrated and validated parametric model, we believe that we can prepare a Major Aircraft proposal in less than one week where it previously took 100 to 120 days. We believe we can also reduce our internal proposal preparation costs from \$ 1 M to less than \$ 10 K. And finally, working closely with our Customers, we believe that the negotiation span can be significantly reduced as the Customer validates our parametric process.



## Questions and Answers:



The following is a selection of questions submitted during the Fall '96 Workshop and working solutions developed by the PCEI WG. The PCEI WG received feedback on the working solutions provided in response to the subcontracting / interdivisional transfers questions included in the December '96 issue of the PCEI Newsletter. We have updated the working solutions (see pg. 17) to these questions to incorporate the feedback received. The document containing all of the questions submitted during the Fall '96 Workshop and their working solutions are available on the ISPA web page (pg. 7), the DCAA Bulletin Board System, or can be obtained by contacting the Newsletter Editor (pg. 20).

## Regulatory Issues:

1. *Please discuss any potential post award issues for contracts that will be negotiated on estimates that were prepared using parametric techniques.*

Parametric estimates must meet the requirements for certification when subject to the Truth in Negotiation Act (**TINA**). The contractor will certify to the parametric model as of the last update period. Assuming that there is no significant data which would require an out of period update to the contractor's parametric model, this certification should be sufficient to meet the TINA requirements.

The contractor should have adequate policies and procedures for updating and validating parametric models. These procedures must include what constitutes significant data for out of period adjustments to the parametric model. As indicated in the last newsletter, some lab sites have negotiated a Memorandum of Agreement (**MOA**) to restate updating procedures and define significant data.



2. *What are the Cost Accounting Standard (CAS) ramifications of using parametric cost estimating techniques?*

For the most part, CAS has no impact on parametrics. However, the PCEI WG is familiar with several instances where there were claims that parametrics are inconsistent with CAS 401, "Consistency in Estimating, Accumulating and Reporting Costs." The basic requirement of CAS 401 is that costs estimated for proposal purposes must be presented in such a manner that any significant proposed cost can be compared with the actual cost accumulated.

The PCEI WG's working solution is that there would not be a CAS 401 violation if a contractor can satisfy the following criteria:

- ◆ explain the need and benefits of estimating costs at the lower level
- ◆ explain why it is not feasible to accumulate & collect costs at the lower level
- ◆ provide reasonable support for the estimated cost
- ◆ provide a reconciliation of the lower level detail to the level at which costs are accumulated and reported

There have been a few CAS 401 issues raised at the reinvention lab sites. However, all were resolved at the local level.

## Working Relationships:



### 1. *What is the suggested make-up of the integrated product team (IPT) for implementing new parametric techniques?*

The IPT's should include members from the contractor's organization, the contractor's major buying activities, DCAA and DCMC. The contractor should identify and demonstrate new parametric cost estimating initiative opportunities and how they improve the estimating process. The contractor should also update its estimating policies and procedures in regard to parametric tools and techniques, as discussed in the Regulatory Issues questions and answers category in the December '96 PCEI newsletter. The DCAA, DCMC and buying activity team members should provide input to the contractor on items such as expectations for disclosure relating to estimating policies and procedures, calibration and validation criteria, and government evaluation criteria. All members of the team should provide input on metrics to evaluate the new techniques.

One of the best practices from the lab is to have the IPT attend a one week training course on parametrics after a new parametric technique has been identified for implementation, for the first time.

### 2. *Do you envision the formal training course being more of a general statistical nature or more specific, and do you anticipate taking it as a team or pursuing it individually?*

There are indicators that two different training courses will be needed since the potential audience will be so varied. Some people will only have a need for "general training" while others will have a need for more "specific training." The general training would provide more of a top-level executive summary of parametric cost estimating processes and techniques. The specific training would provide more of the "how-to's" for the users of the parametric cost estimates. Also, the PCEI WG will most likely recommend that certain pre-requisites be established for the "specific training,"

such as basic knowledge of statistics and regression analysis, familiarity with estimating systems and basic computer skills.

Team building was one of the most significant benefits obtained during the initial pilot training courses and would be beneficial to future IPT's as well. The bottom-line recommendation is that the IPT should attend a one week training session on parametrics after the company has identified a new parametric technique that it plans to implement, for the first time. However, this may not always be feasible due to turn-over of team members and integration of additional buying office personnel. As a result, the courses would probably be available to both teams and individuals.

### 3. *What is the status on delivering a formal parametric training course?*

The PCEI WG has summarized all of the training evaluation forms and surveys and used this feedback in identifying the formal training requirements. This summary is available on the ISPA web site (pg. 7), the DCAA Bulletin Board, or can be obtained by contacting the Newsletter Editor (pg. 20). The PCEI WG will be briefing the Defense Acquisition University in April 1997 on the formal training course recommendations. After the briefing, we will publicize the results on the web site and DCAA Bulletin Board. These results will also be included in the next issue of the PCEI newsletter.

In the meantime, short-term training needs may be satisfied by providing the teams with the initial training developed by the Air Force Institute of Technology, Army Logistics Management College, or the Defense Systems Management College. Short-term training needs can be referred to Marty Deutsch, the PCEI WG training facilitator at 303/971-6060. He may also be reached by e-mail at: [marty.deutsch@den.mmc.com](mailto:marty.deutsch@den.mmc.com).

Some contractors offer training internally on applicable contractor models, applicable commercial models, regression analysis or other topics that may be relevant. Some classes may be available for government personnel.



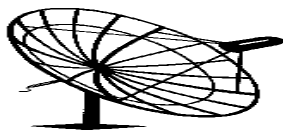
### Allocation of Resources and Internal Guidance:

1. *What actions are being taken to communicate to all levels that properly calibrated and validated parametric estimates are acceptable?*

Since the start of the PCEI, the members of the PCEI ESC and WG have stressed that properly calibrated and validated parametric cost estimating techniques are acceptable cost estimating techniques. This was endorsed by Mrs. Eleanor Spector, Director of Defense Procurement, in her letter dated 28 August 1996. In that letter she wrote ***I fully support the use of properly calibrated and validated parametric cost estimating techniques on proposals submitted to the DoD and I encourage your enthusiastic support.*** Other senior executives have also endorsed the use of properly calibrated and validated parametric techniques including, Major General Robert Drewes, Commander of DCMC; Mr. William Reed, Director of DCAA; and Ms. Darleen Druyun, Principal Deputy Assistant Secretary (for Acquisition and Management) of the Dept. of the Air Force. Each of the services and NASA have senior executives on the PCEI ESC. They are getting the word out to their organizations to support a documented test to expand the use of parametrics.

The PCEI WG continues to communicate this message through a variety of mechanisms, including the annual workshops, the periodic newsletter and various presentations. If any additional assistance is needed in this area, please contact any of the PCEI WG members. A directory of PCEI WG members is available on the ISPA web page (pg. 7) as well as the DCAA Bulletin Board System.

We also need your support in spreading the word that appropriately calibrated and validated parametric cost estimating techniques are acceptable estimating methods.



### Calibration / Validation:

1. *Is there any document available that provides guidelines for determining significant statistical relationships?*

The Parametric Cost Estimating Handbook provides guidance related to statistical relationships in Chapter 3, "Elementary Statistical Techniques and CER Development" and Appendix D, "More About Statistics." This is available on the Internet (pg. 7). The DCAA Contract Audit Manual (CAM) contains guidance in Appendix E, "Graphic and Computational Analysis Techniques."

Another good source for guidance on statistical relationships are business statistic textbooks. The following is a list of suggested references:

- Iman & Conover's "Modern Business Statistics"
- Draper & Smith's "Applied Regression Analysis"

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### Subcontracting / Interdivisional Transfers:

1. ***What is the contractor's FAR Part 15 requirements when the subcontractor's proposal does not qualify for an exemption to submitting cost or pricing data?***

A contractor is required to obtain certified cost or pricing data in accordance with TINA, if a subcontractor's cost estimate will exceed \$500,000 (or at lower levels if price reasonableness cannot be determined by price analysis techniques). If a prime contractor intends to analyze and estimate subcontractor costs utilizing parametric cost estimating techniques, without obtaining certified cost or pricing data, it would need to obtain a waiver for TINA requirements. It is the position of many that the subcontractor should put together the initial estimate since they are "experts" in pricing the specific good or service they will be

providing. The subcontractor would be in the best position to include the impact of new events, such as changes in production processes or changes in prices of key commodities. As discussed in the question below, a parametric model may be used to evaluate the subcontractor's submission. Of course, the subcontractor could use parametric cost estimating techniques in developing its quote provided the models are adequately calibrated and validated.

**2. How would you incorporate subcontractor cost estimates into your parametric estimates in circumstances where cost or pricing data is required?**

Both the subcontractor's cost or pricing data and the results of the parametric analysis (including calibration and validation data) should be disclosed in the proposal. If the prime contractor has a reliable model to analyze the subcontractor data this tool can be used to satisfy the contractor's cost or price analysis responsibilities.

**3. Please provide examples on the use of parametric techniques for estimating subcontract costs.**

The following is an example of a technique being tested at a lab site.

Parametric models can also be used to perform price analysis and set negotiation targets prior to obtaining vendor quotes.

Parametric models can also be used to determine if the price on a recurring procurement is within a reasonable range. This is accomplished via a trend analysis in constant year dollars. For example, consider Vendor A for Part Number XYZ has the following trend, with lot 5 being the current proposal:

<i>Purchase</i>	<i>Base \$</i>	<i>Constant \$</i>	<i>Quantity</i>	<i>Extended Constant \$</i>
1	\$100	\$110	100	\$11,000
2	\$102	\$112	100	\$11,200
3	\$102	\$111	100	\$11,100
4	\$103	\$110	80	\$8,800
5	\$90	\$98	6000	\$588,000

In this example, you would be required to perform a cost analysis of the 5th procurement even though the base price and constant year dollars indicate a downward trend for this part. This is because the procurement exceeds the \$500,000 threshold (see question 1 above) and also, there is a significant difference in the quantity being estimated. Certified cost and pricing data from the subcontractor would normally be required.





The following section includes selected questions asked of the specific Reinvention Lab Teams who participated on the In-House Development / Models panel at the Fall Workshop. We have included a selection of these questions and the respective organizations responses in this newsletter. The document containing all of the questions asked of the specific Reinvention Lab Teams during this panel presentation is available on the ISPA Web Site (pg.7), the DCAA Bulletin Board or by contacting the Newsletter Editor (pg. 20). We appreciate the efforts of Mr. Ron Brandstetter (formerly of General Electric Aircraft Company and former member of the PCEI WG), in coordinating these responses.

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1. Please discuss resistance to the use of parametrics and how it can be overcome.

**Boeing Defense & Space Group:** "There is always a resistance to change, and we believe a key to minimize the resistance is to first offer a process that has done the research and analysis, documented the results, and is useable with some obvious benefit. To implement the process successfully you need a team (including customers) that is committed to a common goal. There needs to be open communication within the team, with no secrets or hidden agendas that would impede the establishment of trust. Finally, you need persistence to work challenges as they come, continue to sell / train new team members and institutionalize and continuously improve the process."

**Lockheed Martin Tactical Aircraft Systems:** "Resistance can be found at many levels and for many reasons. Mainly, lack of training, lack of knowledge, skepticism of new methods, and unfamiliarity with statistical theory. You overcome resistance by addressing the issues as they develop, in a team environment."

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2. Does any team anticipate transitioning to a commercial model? If so, what do you see as a transition plan?

**Boeing Defense & Space Group:** "Boeing currently uses commercial models for early rough order of magnitude estimates or independent estimates; we do not use them as a basis of estimate on firm proposals. There is currently no plan to transition our in-house CER technique to a commercial model. However, we are always looking to expand our estimating tool box. We are currently doing a case study that calibrates the "PRICE" model to a specific electronic end item product line. If the results prove to be equal to or better than our other estimating techniques, then a plan to implement commercial models for specific end item firm estimates may be considered."

**Lockheed Martin Tactical Aircraft Systems:** "Lockheed Martin Tactical Aircraft Systems is planning to use the "PRICE H" model for estimating the costs of fighter aircrafts. The transition plan includes: calibration, analyzing the accuracy, documenting the methodology, training estimators and procurement personnel, building the parametric database, obtaining DCAA, DCMC, and customer involvement and concurrence, briefing internally to gain wider support, implementing on an actual proposal, refining the process as necessary, maintaining and updating the databases, and influence changes in accounting and other management information systems where necessary."

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**NEWSLETTER EDITOR:**

Please provide any questions regarding the PCEI Newsletter to Karen Davies at phone number 201/284-2257, fax number 201/284-2797 or e-mail "kdavies@rma.dcaa.mil".

**NEWSLETTER CONTRIBUTIONS:**

A goal of the PCEI Newsletter is to make this a joint effort between all parties participating with the lab or interested in the lab activities. **Anyone interested in making contributions to the newsletter is encouraged to do so.** Suggestions for topics to submit include best practices, lessons learned, concerns and opinions, parametric estimating techniques, team accomplishments, and training. Newsletter contributions should be provided to the Newsletter Editor.

**MAILING LIST:**

If you would like to receive a copy of the newsletter, please fax or e-mail the following information to the Newsletter Editor: Name, Organization, Address, Phone Number, Fax Number and E-Mail Address. The newsletter is also available on the ISPA Web Site (pg.7) and the DCAA Bulletin Board.

**DISTRIBUTION:**

Those receiving the newsletter should copy and distribute this to other respective team members and others interested in the initiative. We encourage everyone's participation in distributing this newsletter to others, particularly buying activities. Electronic subscriptions will be provided upon request. We encourage you to take advantage of this method of distribution so you can forward the newsletter to others.

**FURTHER INFORMATION:**

Questions related to the PCEI may be directed to either one of the Working Group Co-Chairmen identified on page 1.

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