2017: Issue #1

How Many Piano Tuners *Are* in Chicago?

NASA Launches a New Model

ICEAA World

The magazine for the International Cost Estimating & Analysis Association

Set Sail for the City of Roses!

2017 Professional Development & Training Workshop Preview

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Cover Photo by Brian Taylor
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ICEAA World
The Magazine for the International Cost Estimating & Analysis Association

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The International Cost Estimating and Analysis Association is a 501(c)(6) international non-profit organization dedicated to advancing, encouraging, promoting and enhancing the profession of cost estimating and analysis, through the use of parametrics and other data-driven techniques.

ICEAA World is a publication of the International Cost Estimating and Analysis Association. Members of the association receive copies as a benefit of membership. Subscriptions for non-members are available on a yearly basis for $30.00 per year.

Letter from the Editor

Joe Wagner, ICEAA World Editor

In the spring each year, we focus on the ICEAA Professional Development & Training Workshop, which for 2017 will convene in the "City of Roses", Portland, Oregon. We will gather at the Portland Marriott Downtown Waterfront hotel from June 6th to 9th. To assist with your planning, we have included in this issue a look at activities taking place in Portland on the two weekends surrounding the workshop dates. These range from onboard tours of Navy fighting ships to Chinese dragon boat races to Oregon roses and classic automobile shows. Many of the events will be located right in front of our hotel, along the Willamette River. Of course, inside the Marriott you will find all the essential training, career broadening presentations, enlightening general programs and professional information and interactions you have come to expect from ICEAA workshops.

For almost 30 years, the cost estimating of spacecraft, lift vehicles and other out of this world technology centered on one tool – the NASA/Air Force cost model, known to all by its acronym NAFCOM. This parametric tool no longer rules the NASA estimating roost. There is a new model in town – the NASA Project Cost Estimating Capability (PCEC), which has replaced NAFCOM. Learn something about this new model in our feature article *NASA Launches a New Model* from **Andy Prince**, engineering cost manager, and **Brian Alford** of NASA's Marshall Space Flight Center, Huntsville, AL.

Some months back, at the 2016 Integrated Program Management Workshop, which ICEAA co-sponsors, a hot topic was the application of earned value management (EVM) concepts to software development programs based on the Agile method. Varying opinions were guaranteed, since EVM traditionally calls for extensive planning, pricing, and scheduling of program content, while the nature of Agile development advocates a more freewheeling flexibility of content and schedule as the program matures. To continue that discussion, see **Joe Hamaker's** *Ask an Analyst* column.

We've started a new feature in *ICEAA World*, publishing comments and ideas sent in by our readers. **Sandy Burney**, from Northrop Grumman, wins a mention for being the first to submit her thoughts on the newly minted parametrics certification specialty (see **Peter Andrejev**'s articles in this issue and the Fall 2016 *ICEAA World*). Thank you, Sandy. We would like to hear from the rest of you when you have the urge to share, so please send any comments or criticisms to me at jwagner@iceaaonline.org, and we'll pass them along in the next issue.

We again thank the contributing authors who make each issue of this magazine such a great value for ICEAA cost professionals, and welcome Air Force **Captain Greg Brown** to that honored company. His description of the "Fermi problem" can be useful to any estimator/analyst. It complements nicely the book review from **Colonel David Peeler** on a similar subject. If you would like to join in the fun, all professional articles are welcome for consideration. See you in Portland.

READERS WRITE

Dear *ICEAA World* Editor,

I applaud the creation of the new CCEA-P certification *(ICEAA World #3, 2016, page 7),* and that it requires the submittal of a work product demonstrating a level of competency. I am concerned about a 75-question multiple choice test that is paper based. As someone who has been building and using spreadsheet -based parametric cost estimating tools for decades, I am not sure I could pass a test using 20th Century tools: paper, pencil, and a calculator.

Thank you,
Sandy Burney, CCEA®
Northrop Grumman Corporation
Aerospace Systems
Systems/Cost Engineer

*Thanks for your email, Sandy! It's amazing how much going paperless has changed every aspect of our lives - the CCEA-P exam may end up being a test of both parametric expertise **and** memory!*
Joe Wagner, *ICEAA World* Editor

All communications submitted for publication must include the authors complete name and email address.
Please use the subject "Readers Write" in your email to jwagner@iceaaonline.org.
ICEAA World reserves the right to edit and condense submissions.

President's Address

Paul Marston, ICEAA International President

Are you ready for Portland? The 2017 Professional Development & Training Workshop is shaping up to be ICEAA's best yet. The Workshop Committee, co-chaired by **Rich Harwin** and **Christina Snyder** have been busily pulling the strings to get the whole thing ready. Thanks to everyone who has chipped in: the entire Workshop Planning committee, best paper judge and track chair volunteers, training instructors and paper presenters, and of course, the team in the International Business Office: **Sharon Burger**, **Joe Wagner**, and **Megan Jones** for making all of our volunteer efforts possible.

The program for 2017 is going to be fantastic, with new and familiar speakers giving presentations on their latest research, findings, and innovative best practices. In the training tracks, sessions based on CEBoK® modules will provide those attendees who have been studying for the PCEA® and CCEA® exams with the reinforcement and resources they need to finalize their months-long preparations in time for the exams on Saturday, June 10.

With over 75 papers and 40 training sessions scheduled, not to mention the keynote speakers and networking events, it would take something big to divert your attention from the Workshop - and Portland is going to deliver. Little did we know when we chose this location over 2 years ago that we'd be in town at the same time as the Portland Rose Festival and Fleet Week! Right around a dozen ships from the United States and Royal Canadian Navies, as well as historic ships will be sailing down the Willamette and docking right outside our windows!

If you weren't already convinced that the 2017 Workshop is a must-go event, you will be by the end of this issue. Book your hotel room early - we're about as close to the action as you can get, and once our room block is full, the rest of the hotel is sure to be too.

I'm the last person to suggest missing any of the Workshop content for a ship tour or a moment to literally smell the roses, but being so close to it all, you should be able to sneak a whiff during one of the breaks!

Business Office Update

Megan Jones, ICEAA Executive Director

Notice anything different about ICEAA lately? That's right: we've got a shiny new office! Sharon, Joe and I packed up the office in Tyson's Corner and headed about 10 minutes south to Annandale. It's a great suite, though technically smaller than our old office, the space is better utilized making it feel bigger. The building is right in the heart of Annandale's Korean neighborhood, so if anyone has a hankering for bulgogi or wants to belt out some karaoke, it's the place to be!

ICEAA's Swanky New Digs at

4115 Annandale Road, Suite 306
Annandale, VA 22003

Before we could move, we had to do what hadn't been done since...well, based on the artifacts that were unearthed, since the Reagan administration. We purged over 25 boxes of paper: decade-old receipts, triplicate copies of old hotel menus, phone directories from 1986, all tossed, shredded or scanned in the name of lightening the movers' load and streamlining our storage needs.

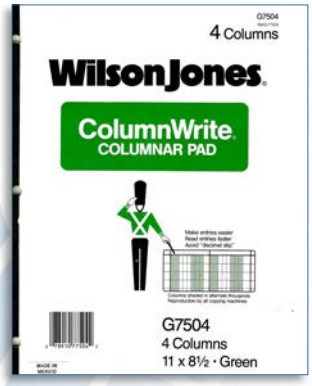


Exhibit A

But there were some things we had to keep. Exhibit A: **Wilson Jones Column Rite Columnar Pads**. Nothing I could say about them could be better than what was printed on the back, so I'll just leave that here:

Plan on Columnar Pads Before You Compute

- *Spreadsheets are designed quickly*
- *Column widths & text formats are easily determined*
- *Formulas are easier to visualize & "debug" on paper*
- *It's your fastest, most convenient way to…*
  …experiment with different column & row titles
  …devise alternate layouts for data presentation

Exhibit B

Another thing we couldn't bear to part with is at least still practical, and we knew when a *Mad Men*-esque show about the 1980's comes on TV we can heed the call for props. I took the photo in Exhibit B on one of my first days at ICEAA and have since been playing a guessing game with my friends as to what it is, with varying results.

I'll spill the beans for those of you who are stumped. This is a stand for a dot matrix printer (otherwise known as an *eeechk eeechk eeechk* printer). The shelf on the bottom held a box of paper with perforated sides that fed through the slot in the center to the waiting drum above.

Partial credit goes to those generous souls who guessed it is a fax machine stand from that thankfully short period in the early 90's when faxes were spat out on rolls of smeary paper that never quite got the page breaks right.

So even though there's really no such thing as an easy move, we managed to have a little fun with it, and all the hard work has paid off: we're in an awesome new environment, and feeling refreshed and renewed by the change. Stop in and see us sometime!

Certification Corner

Peter Andrejev, CCEA®, PMP®
ICEAA Director of Certification

Next Up: Software Cost Estimation Training and Certification Programs

CEAA and three other professional groups; NESMA (an independent international organization focused on software metrics and software measurement), the Common Software Measurement International Consortium (COSMIC), and the International Function Point Users Group (IFPUG), are undertaking the development of a training and certification program for Software Cost Estimation. A working group chaired by Professor Ricardo **Valerdi** of the University of Arizona and comprised of experts from industry, government, and academia has been assembled to identify the "boundaries" or testable topics that would be included in a world-class training and certification program designed to benefit commercial and governmental organizations worldwide. The steering committee for this effort is made up of **Brian Glauser** (ICEAA), **Eric van der Vliet** (Nesma), and **Mauricio Aguiar** (IFPUG). This committee provides the strategic agenda and oversees progress, with support from **Peter Braxton** (ICEAA Vice President of Professional Development) and **Peter Andrejev** (ICEAA Certification Chair) to assure integration with existing ICEAA training and certification programs.

Reminder: CCEA–Parametric Methods

In the last issue of *ICEAA World*, I was proud to announce that ICEAA will be accepting applications for a specialty designation, CCEA-P, offered to CCEAs who demonstrate exceptional competency in Parametric Methods. The CCEA-P certification requires that applicants possess a current CCEA, submit an original work product for peer review, and achieve a grade of 70% or greater on the three-hour CCEA-P examination. The CCEA-P examination consists of 75 multiple choice questions including several work problems that require candidates to derive the correct answers from real-world data sets.

Ask an Analyst

Edited by Joseph W. Hamaker PhD, CPP®,CCEA®

Joe Wagner, the stalwart editor of ICEAA World and a longtime reader and cheerleader for "Ask A Cost Analyst" submitted the following question:

Q: How do the operating concepts of Agile software development programs conflict/interact with earned value management (EVM) requirements when those are imposed for a software development contract? As an old EVM guru, the concept of detailed, well-planned, and thoroughly estimated schedule and budget planning is important if you expect accurate EVM reporting and final cost projections. My admittedly skimpy exposure to Agile seems to imply none of that process is applied in a comprehensive way. Plans and schedules seem to be adjusted continuously as program content and approaches change, which they always will. Budget/effort adjustments are an expected part of the Agile process, and it seems basic program plans and goals are adjusted and overridden as you go along. In short, it looks like upfront attempts at well laid budgets and schedules are modified based on performance, which makes projections of cost/schedule end points nearly impossible to achieve.

I very much like Joe Wagner's question but as editor, I have to admit that my knowledge of EVM is practically nil[1] and my knowledge of Agile even "nil-er". But that has frequently been the case when fielding questions for this column so I have done what I always do—I have gone out to someone much more expert than myself. This time I asked **Bob Hunt** of Galorath Federal--a recognized expert on Agile and **David Graham**, retired, formerly NASA--a recognized expert on EVM, to provide their enlightened responses.

I have edited their combined responses to the following….

Yes, software has always caused an EVM problem! You can track hours and dollars against a plan. But, you can be on budget for hours and dollars and still deliver an unacceptable software product.

In a traditional software program you might also track lines of code delivered or defect discovery and removal as additional measure of program progress. But often, traditional earned value approaches do not deal sufficiently with the idiosyncrasies of software intensive programs. This can be especially true when Agile Software Development processes are employed.

There is a general impression that an Agile software development program is chaotic and unstructured. Some small commercial programs may operate that way. However, major Agile software development programs are based on a plan. Contrary to a popular misconception, agile is a disciplined methodology. A reasonable life cycle estimate can be developed and an execution schedule can be presented. Agile is not;

- unlimited or uncontrolled scope,
- unplanned, undocumented,
- unverified,
- A mini waterfall
- trial and error
- a synonym for flexible, or
- a synonym for fast.

In the Agile world the basic program building blocks are expressed as "User Stories" or "Features". (User Stories and Features are the same thing.) When done correctly, the program requirements are mapped to Features. The Features are then spread over time and the result is a resource loaded program execution schedule.

Successful management of agile software development programs can be achieved by focusing on establishing

continued

[1] Someone once noted that Hamaker's knowledge of EVM could all be written down on one side of a 3X5 index card with plenty of room left for his grocery list.

the requirements, developing a reliable baseline estimate for cost and schedule, selecting effective software metrics (that include both quantity and quality measures), and using analytic processes to project cost and schedule based on actual performance.

So, for an Agile program we would **track three things**:

1) Hours,
2) Dollars, and
3) Feature Completions against a plan.

Feature Completions does become the BCWP, aka earned value. Feature Completions is the metric for work accomplishment relative to what was expected relative to the plan (BCWS) and actual cost (ACWP).

Now comes the more complex part. The technical complexity of Features vary greatly. In Agile language, some Features may take one sprint and others may take multiple sprints. If you only track the raw number of Features completed, a contractor could do all the easy ones first and look really good, when the real problem is around the corner.

To normalize Feature complexity, a numeric rating schema (points) are assigned to each Feature using small-medium-large, 1-10-100, a Fibonacci sequence (0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144…), Planning Poker[2], or some other rating schema. Features represent a basic "measurable" work package and Feature Points represent the technical difficulty of each work package.

One could argue that we should track "Feature Points" rather than "Feature Completion", but the abstractness of the pointing system makes this difficult. So, we recommend tracking both metrics, while keeping Feature completions as the basic EVM metric.

So now I am **tracking four things** against a plan;

1) Hours,
2) Dollars,
3) Feature Completion, **and**
4) **Feature Points**.

The EVM analyst wants the best measure of actual work accomplishment so if BCWS is based on a weighted value of Features, weighted by the complexity points, then BCWP will reflect weighted work actually accomplished. One way to weight Features is by using hours to budget less difficult Features with fewer hours and more difficult Features with more hours. EVM stresses basing BCWP on discrete milestones and Feature deliveries are examples of such discrete milestones. But, if BCWS and BCWP is based solely on the completion of Features, the BCWP won't be based on the completion of hours. And, if BCWP is based on Feature deliveries only, there could be a distortion of work accomplishment if easier to accomplish Features were completed initially, possibly falsely exaggerating work accomplishment.

However, if Features were categorized by difficulty-to-achieve delivery (represented by a greater number of hours for more difficult to achieve Feature deliveries) and required to be reported by category when completed, there would be visibility to the customer as to what type of Features were actually being delivered. For example, if Features were categorized as Category D for the least hours to complete, progressively going to Category A for the most difficult to deliver, this reporting would identify clearly that only the easiest Features were being delivered exposing that the most difficult Features had yet to be delivered. This information would be available to Government customers in their monthly reports potentially generating questions eliciting insight providing a truer picture to actual work accomplishment. This required reporting would eliminate the obfuscation of what work has not been completed. This would be especially helpful if award fees were based on early Feature delivery completions. Customers could discount the quantity of Feature deliveries relative to the quality of the deliveries.

As an aside, a cost analyst mind probably wants a value they can use in a parametric equation to estimate future costs. "Feature Velocity" (the rate at which Features are completed) is a parametric value one can use to predict future costs. But we will avoid the temptation to make this more complicated here and not include Feature Velocity in this discussion and stick with **tracking the 4 things** listed above.

For a hardware system, e.g. a missile, applying EVM can be straightforward in that both quantity (how

continued

[2] Planning poker, also called Scrum poker, is a consensus-based, game technique for estimating, mostly used to estimate software effort or relative size. In planning poker, members of the group make estimates by playing numbered cards face-down to the table, instead of speaking them aloud. The cards are revealed, and the estimates are then discussed. By hiding the figures in this way, the group can avoid the cognitive bias of anchoring, where the first number spoken aloud sets a precedent for subsequent estimates.

many units come off the line) and quality (how many units pass test) can be measured. For a system with a quantity of one, e.g. a satellite or software intensive system the measure of "quality" can become problematic. In a satellite system one might measure progress towards meeting weight and mass requirements as a measure of quality. In a SLOC or Function Point based system, measuring defect discovery and removal, might be a good measure of quality. The question becomes 'what to measure in an agile software development program?'

User Stories or Features are the key elements (work package) for many Agile programs. Earned Value is usually reported at the Feature/ User Story level rather than the Sprint level due to the large number of sprints. When done correctly there is a direct correlation between the work packages described in the Contractors Work Breakdown Structure (CWBS) and the Features/User Stories.

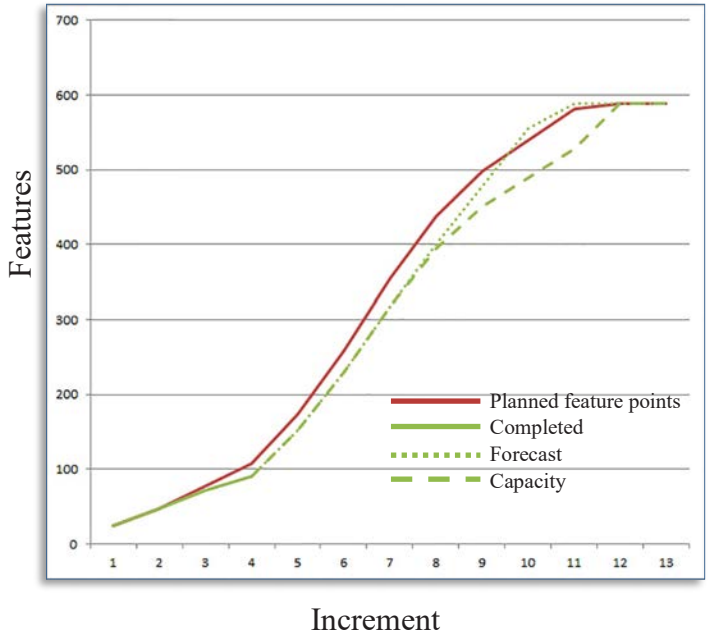
The figures below present how Feature Completion and Feature Points might be tracked in an agile environment. First, Feature Delivery, demonstrates how Feature Completion can be planned and tracked. This may be a good measure of quantity in an Agile environment.

In the second graph, Feature Point Delivery, shows how Feature Points could be planned and measured. Feature points, provide a measure of both quantity and technical progress.

So in summary, using earned value to plan and manage software intensive projects can prevent expensive failures. Earned value should be based on the foundation of establishing the requirements, developing a reliable baseline estimate for cost and schedule, selecting effective software metrics, applying Earned Value Management, and using analytic processes to project cost and schedule based on actual performance. For Agile software development programs, a combination of 1) Hours, 2) Dollars, 3) Feature Completion, and 4) Feature Points can be used as a measure of quantity and quality for program performance. When the system requirements from the contractor work breakdown structure (CWBS) are cross walked to the Features, a meaningful EVM system can be developed.

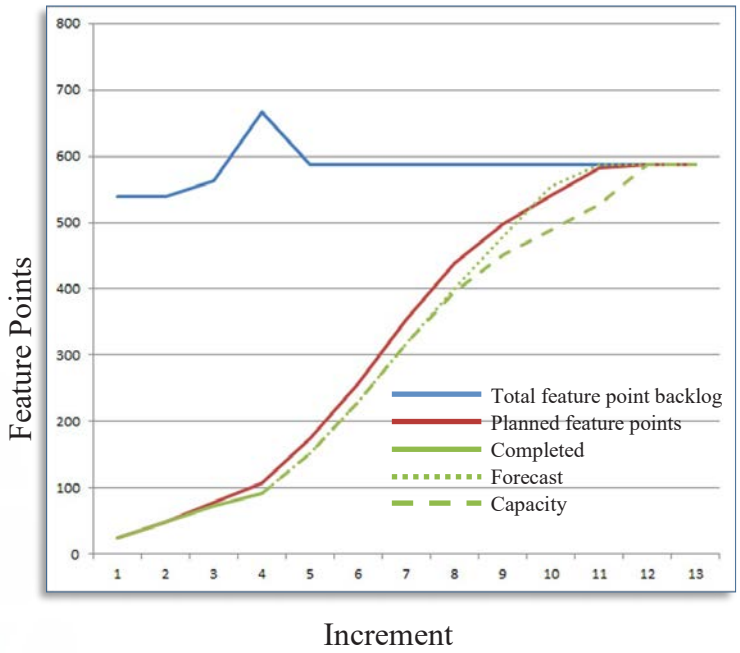
Plan for Delivery of Features Versus Actual Delivery

(This chart will provide a good "top level" assessment)



Feature Point and Plan Performance

(This chart provides an assessment of "technical" performance)



Certification Congratulations

ICEAA Certification had another successful year in 2016! With the help of those acknowledged below and others listed in previous issues of *ICEAA World*, we administered a total of 113 certification exams to those interested in pursuing this important professional distinction. This would not have been possible without our valued CCEA's who volunteered their time to proctor the Certification Examination. If you are CCEA® certified and would like to proctor an exam in your area in exchange for points toward recertification, please contact the ICEAA International Business office.

CCEA® Achievers:

Sohaib Ahmed, Booz Allen Hamilton

Paul Cook, US Air Force

Richard (John) Cousins, QinetiQ, Ltd.

Robbie Cox, Australian Department of Defence

Sam Easterly, Booz Allen Hamilton

Reuben Hine, Calibre Systems

Benjamin Hooten, Missile Defence Agency

Pamela Keller, Booz Allen Hamilton

Jennifer Lampe, Engility

Bridget O'Brien, MITRE

Dustin Paik, Booz Allen Hamilton

The following individuals are those who proctored exams between October 2016 and February 2017:

Sandeep Bassi, John Beerman, Tom Dauber, Jeremy Goucher, Daniel Hoy, Robyn Kane, Eric Mosier, Patrick Myers, Richard Osseck, Cari Pullen, Michael Shortell, David Torgerson, Beth White and **Kris Yoon.**

PCEA® Achievers/CCEA® Eligible:

Alissa Grant-Walker, QinetiQ, Ltd.

Robert Hampson, Tecolote Research, Inc.

Thomas Lamb, USAF

Terry Slenn, LAMATEK, Inc.

Brittany Staley, Herren Associates

PCEA® Achievers:

Mark Cunnington, Rolls-Royce PLC

James Fakult

Carol Hover, Sandia National Laboratories

David Jones, QinetiQ, Ltd.

Francis Muya, Booz Allen Hamilton

Edgar Neira, Booz Allen Hamilton

Douglas Poggi, Deloitte Consulting, LLP

Cassandra Robbins, Reliant Consulting Solutions

Amy Smith, BAE Systems - Australia

The following are those who have recertified between October 2016 and February 2017

Peter Andrejev

Andrew Banks

David Bracamonte

Aidan Depetro

Amy Fox

Franco George

Kristina Golden

Kirk Hoy

Christian Kaldes

Robyn Kane

Stephanie Lewis

Chad Lucas

Tina McMillian

Elmira Mukailova

Douglas Reimel

Bruce Reynolds

Erin Shea

Jose Enríque Tejeda

Geoffrey Zahn

FREE BOOKS!

As part of our recent move, we had to climb into the attic and search through decades worth of old stuff, to decide what we should take and what we could get rid of. One of the discoveries was a bookcase full of high quality professional publications related to the costing profession. As most of you know, specific cost estimating/analysis texts are not that plentiful. Our find can be your gain, as we now have available **free** to our members about 50 professional books and other texts dealing with all aspects of the cost estimating/analysis profession.

Most of these books are in virtually brand new condition. A large proportion are from the John Wiley and Sons InterScience publication series. For several decades, Wiley & Sons publishers have provided more than 1,300 titles in scientific fields of all descriptions, including acquisition costing. For most, we have only a single copy, but for a few we have up to a half dozen copies.

To add one or more of these books to your library:

1. Email me at jwagner@iceaaonline.org with the titles of up to **five books** from the list that you would like. It will be first come, first served in terms of the date/time of your email.
2. Pick up the available volumes at our new office or provide us with a Fedex shipping account number and your mailing address, to allow shipment to you.

Activity Based Costing
Karen R. Burke, Douglas W. Webster

Activity-Based Cost Management
Gary Cokins

Break-even Analysis: Basic Model, Variants, Extensions
Marcell Schweitzer, Ernst Trossmann, Gerald H. Lawson

Catalysts for Change
William B. Rouse

Computer-Interactive Data Analysis
A.D. Lunn & D.R. McNeil

Cost Estimator's Reference Manual
Rodney D. Stewart & Richard M. Wyskida

Costing Government Services: A Guide for Decision Making
Joseph T. Kelley

Decision Support Systems Engineering
Andrew P. Sage

Design for Success - A Human-Centered Approach to Designing Successful Products and Systems
William B. Rouse

Designing Expert Systems
Paul J. Kline, Steven B. Dolins

Earnst & Young Guide to Total Cost Management
Michael R. Ostrenga, Terrance R. Ozan, Robert D. McIlhattan, Mnarcus D. Harwood

Engineering Economy for Engineering Managers
Turan Gonen

Evaluating Decision Support and Expert Systems
Leonard Adelman

Expert Systems Programming: Practical Techniques for Rule-based Systems
Ken Pedersen

Financial Reporting & Analysis
Lawrence Revsine, Daniel W. Collins, W. Bruce Johnson

Forecasting and Management of Technology
Alan L. Porter, A. Thomas Roper, Thomas W. Mason. Frederick A. Rossini, Jerry Banks

Fundamentals of Project Performance Measurement
Robert R. Kemps

Handbook of Governmental Accounting & Finance
Nicholas G. Apostolou & D. Larry Crumbley

Handbook of Industrial Engineering
Gavriel Salvendy, editor

Integrated Cost-Schedule Risk Analysis
David Hulett

Management Control Systems
Joseph A. Maciariello & Calvin J. Kirby

Management of Advanced Manufacturing Technology
Donald Gerwin & Harvey Kolodny

Managing Expert Systems
Nigel Bryant

continued

FREE BOOKS!

Microestimating for Mechanical Engineers
Rodney D. Stewart, Ann L. Stewart

Modern Project Management
Norman R. Howes

Multiobjective Decision Analysis with Engineering and Business Applications
Ambrose Goicoechea, Don R. Hansen, Lucien Duckstein

New Product Development Design & Analysis
Ronald Eugene Kmetovicz

Practical Schedule Risk Analysis
David Hulett

Project Performance Management
Robert R. Kemps

Proposal Preparation
Rodney D. Stewart & Ann L. Stewart

Public Dollars, Common Sense New Roles for Financial Managers
William R. Phillips, Bonnie L. Brown, C. Morgan Kinghorn, Andrew C. West

Rule of Thumb Cost Estimating for Building Mechanical Systems
James H. Konkel

Software Engineering Economics
Barry W. Boehm

Statistical Methods in Engineering and Quality Assurance
Peter W. M. John

Subcontract Planning and Organization
Quentin W. Fleming, Quentin J. Fleming

System Engineering Management
Benjamin S. Blanchard

The Coming Energy Revolution
Jeane Manning

The Learning Curve
Ahmed Belkaoui

The Polar Bear Strategy: Reflections on Risk
John F. Ross

The Selection Process for Capital Projects
Hans J. Lang & Donald N. Merino

Also available are several handbooks and workshop proceedings handouts from our parent and related groups:

Proceedings of the 2nd ISPA-SCEA Joint Conference, 1999

Training Track of the 2nd ISPA-SCEA Joint Conference, 1999

Society of Cost Estimating and Analysis Glossary of Terms, 1994

SCEA 1991 National Conference papers

SCEA 1992 National Conference papers

Lecture Notes in Economics and Mathematical Systems: Proceedings of the Institute of Cost Analysis Conference, 1989

Space Systems Cost Analysis Group (SSCAG) Standard Data Handbook, 1981

Space Systems Cost Analysis Group (SSCAG) Standard Data Handbook (abbreviated content), 1981

Money Changes Hands…
…A Good Book Changes Minds

Book review by Col David Peeler

Book Review

Although this month's reading selection doesn't mention the art vs the science of cost estimating, the topics discussed clearly lend themselves to the distinction between the "pure" science, mathematically oriented aspects of the cost estimating profession verses the social science "artistic" nature of our business. While this book doesn't have blanket applicability to the daily jobs of all cost estimators/analysts, it does provide interesting insights for those that are asked to estimate on the edge of technology or without an applicable historical data set.

Subjective Probability Distribution Elicitation in Cost Risk Analysis: A Review

Lionel A. Galway

RAND: Santa Monica, CA; 2007

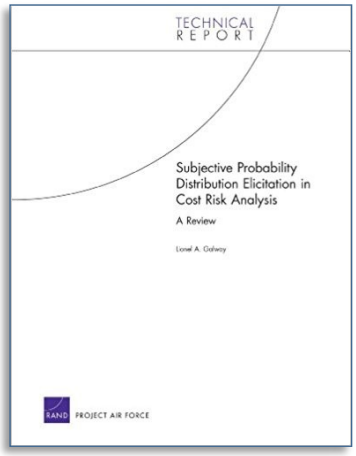
In six short chapters, Galway provides a technical report on the state of elicitation procedures for cost estimating and the broader fields using decision and risk analyses. Two preceding RAND projects sparked this inquiry into elicitation procedures: *Quantitative Risk Analysis for Project Management: A Critical Review – an* internal RAND report by Galway; and **Impossible Certainty: Cost Risk Analysis for Air Force Systems**, by Arena, *et.al.* This elicitation piece, based upon a selective review of the literature of elicitation, explores the methodologies and procedures for gleaning information from experts to enlighten projects/programs.

Chapter one provides an introduction into why judgement and ranges matter to cost estimating and associated risk analysis. Galway begins with the well known precept that the one thing we know about a point estimate is that it's wrong. He turns to how we can explicate probability distributions to inform decision-makers. The author further points out that often we assume too much. We often admire the math in the distribution calculations without serious thought to the method used to obtain subjective distributions and the biases fixed into the inputs.

In chapter two, Galway discusses the origins of elicitation for decision analysis and the parallel development of general risk analysis. Based on the need to quantify probabilities of hazards that might be rare or stem from untried technology, early researchers sought to refine elicitation methods. The study of human decision-making under uncertainty is an interesting topic that must address bias. Galway summarizes the common biases and expounds on the criticisms associated with previous studies attempting to find sophisticated elicitation methods. Of note… to date, the relevance of psychological research for expert elicitation is inexact, but we cannot ignore its applicability to many of our most challenging estimates. Therefore, it is important to recognize the substantial body of existing work that cost estimators can leverage to improve our analyses.

Risk analysis is the topic of chapter three, with a point to understanding both uncertainty and utility measures. Stipulating to the rigor of the math associated with CER development, simulations, and analytic methods, Galway turns to the precision associated with how elicitation is accomplished. The petitioning of values from experts is insufficient without an understanding of the bias of both the elicitation methods and of the experts themselves.

continued



Chapter four provides some current best practices associated with distribution elicitation. Most notably and perhaps highly applicable to DoD activity is the recommendation to use independent experts in the field of endeavor. Often our information/distributions are extracted from experts close to the project and likely those that already anchored their biases. Another key point is documentation of elicitation approaches and methods, not just the values garnered from the experts.

Specific emphasis of elicitation in cost analysis is the subject of chapter five. While routinely recommending elicitation of expert judgement, cost risk analysis literature contains little regarding the practicalities of elicitation. Additionally, there is little overlap between the literatures of elicitation in cost risk analysis and other fields – general risk analysis, statistics, and psychology. Galway goes on to point out that elicitation practices in cost estimating and risk analysis are very diverse and lack standardization. He provides a list of worrisome issues common to current elicitation practices in cost work.

The piece concludes in chapter six. Most notably, Galway points out that when little relevant data are available elicitation is a reasonable alternative; however, a standard set of procedures – although emerging in the literature – are not generally followed in the cost community. Most importantly, he stresses the need for documentation. Documentation provides information to evaluate the use of obtained data and an avenue for reflective studies of elicitation vis-à-vis eventual outcomes at program completion.

The report is short – easily read in one sitting – and clear regarding the subject matter. Well worth a few minutes of your time, if you are merely interested; and essential, if you are involved in the estimating or analysis of new technology costs and associated risks. The text is available for download at the RAND website – free of charge.

Colonel Peeler serves as Deputy Director, Financial Management and Comptroller for the Air Force Life Cycle Management Center. He is a certified cost estimator/analyst and an Air Force certified acquisition professional in both financial and program management. He is a member of both the American Society of Military Comptrollers and the International Cost Estimating and Analysis Association.

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1. Topic Category
Parametric Estimating:

2. Topic
CER

3. Question 1.If a CER for Site Development was developed giving the relationship, y (in $K) = 31.765x + 145.32 (where x is the number of workstations) for a data set cost driver that had a range minimum of 2 workstations to 52 workstations, and the independent variable has tested positively for significance, the predicted cost for a site that had 33 workstations would be:

4. Five multiple choice answers

a. $ 1,193.57
b. $1,193,565.00
c. $ 1,797.10
d. $1,797,100.00
e. $ 208,850.00

5. Answer B

6. Solution:
y = 31.765 * 33 + 145.32 = 1,193.57 but must convert from $K; value is 1,193.57 * $1000 = $1,193,565

7. Reference
CEBoK Module 3

REWARD: RECERTIFICATION POINTS

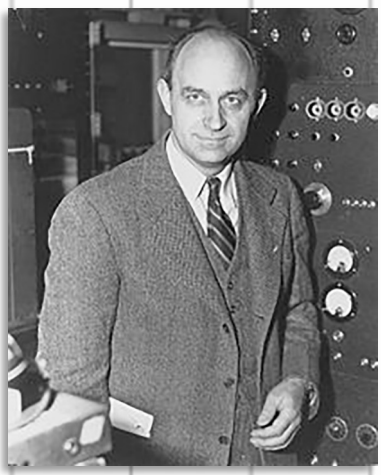
Contact the ICEAA Office or Director of Certification for details

Simplify an Estimating Problem: Channeling Enrico Fermi

By Capt. Gregory E. Brown, USAF

Consider this actual interview question Google gives to prospective employees: "*How much does the Empire State building weigh?*" Many individuals simply give up and say "that's impossible!"

Why would Google—a company based around data and analytics—ask an interview question that one must solve without using data? Ultimately, Google wants to know whether the prospective employee can rationally think their way through a strange—and hence new—problem in the absence of data. The question is a variant of the 'Fermi problem', named after the creator of the world's first nuclear reactor, physicist Enrico Fermi. As a professor at the University of Chicago, Fermi became known for assigning homework sets with seemingly impossible problems, the most famous being:



Enrico Fermi (1901-1954)

"*How many piano tuners are there in Chicago?*"

So how would you approach Professor Fermi's piano tuner problem? Assuming you are an experienced estimator with access to modern technology, you would likely begin by searching the Internet for relevant data. If you are able to identify the number of piano tuners across many American cities—Chicago excluded—you might attempt to build a parametric regression model using the relationship between a city's population and the number of piano tuners. Alternatively, if you only have data for one similar point—such as the number of piano tuners in New York City—you might consider using an analogy approach.

But what if you have no data? Under these circumstances, your estimate may be nothing more than a wild guess. But Professor Fermi believed almost any problem could be estimated within a single order of magnitude or better, even in the absence of data. His methodology was simple: break the question into more manageable questions, identify the necessary assumptions, and then use generally available knowledge to answer those assumptions.[i]

As an example, here is a Fermi solution which requires only a few assumptions about Chicago, pianos, and piano tuning.[ii] The solution is refined by utilizing a subject matter expert, which is common in cost estimates. So again consider: "*How many piano tuners are there in Chicago?*"

continued

1) ***Assumption: How many pianos are in Chicago?***
I don't know. Let's break down the assumption further.

a. ***Assumption: How many people live in Chicago?***
I'm confident it's between 1.5 and 3.5 million. I settle on 2 million as most likely.

b. ***Assumption: What percent of people in Chicago own a piano?*** I have around 100 close friends, and only two own a piano. Although my friends in Dayton, Ohio are probably not demographically representative of Chicago, I consider it reasonable that about 2% of people in Chicago would own a piano.

2) ***Assumption: How often are pianos tuned?***
At this point, I decide to call one of my friends who owns a piano. She is now my subject matter expert. My friend responds that she has her piano tuned by the local tuner once a year.

3) ***Assumption: How long does it take to tune a piano?***
Once again, I call my friend. She responds that it typically takes her local tuner 2 hours.

4) ***Assumption: How many hours does the average piano tuner work a year?*** I guess that most piano tuners work 50 weeks a year. Working 40 hours a week, they would most likely have 2,000 hours available for tuning.

Using our most likely response to each of the questions, we generate the following estimate:

$$\frac{2{,}000{,}000\ people * 0.02\ \frac{pianos}{person} * 1\ \frac{piano\ tuning}{person} * 2.5\ \frac{hours}{piano\ tuning}}{2{,}000\ \frac{hours}{tuner}} = 50\ \text{piano tuners}$$

How'd we do? In comparison to the estimate of 50, it was found that the 2014 Chicago Yellow Pages contained 83 listings for piano tuners.[i] Our answer is within 40% of the actual value, which is impressive given the lack of data and how little we knew about piano tuning!

So what's the application to cost estimating? At first glance, completing a cost estimate for a cutting-edge program with limited reference data may appear impossible. But by simplifying what is not known into sub-problems, you are more likely to yield questions which you—or the subject matter expert—do know. At the top level of a work breakdown structure, a program may appear to be completely new. But nothing is 100% new or unique.[iii] As you break down the program into lower levels, you will likely discover that the program contains cost categories or cost drivers with which you are familiar. So the next time you are stuck in an estimate, ask "what would I need to know or assume to provide an estimate?" With the help of the subject matter expert, continue to simplify the problem into reasoned assumptions until you have sufficient basis to provide an estimate. Remember, the Fermi method produces an initial "order of magnitude" estimate only. For some purposes, this is sufficient. Fermi once said he could produce a physics formula accurate to a factor of 2 quickly with only a few sheets of paper, while finding the precise number would take 2 years.[iv] More data, more analysis, and more time will produce successively better estimates.

---

[i] Levitin, Daniel J. The Organized Mind: Thinking Straight in the Age of Information Overload. New York: Dutton, 2014.

[ii] Von Baeyer, Hans C. Fermi Solution: Essays on Science. New York: Random House, 1994.

[iii] Tetlock, Phillip E. and Dan Gardner. Superforecasting: the Art and Science of Prediction. New York: Broadway Books, 2016.

[iv] Bretscher, E.; Cockcroft, J. D. (1955). "Enrico Fermi. 1901-1954". Biographical Memoirs of Fellows of the Royal Society.

Captain Brown serves as the Chief of Cost Analysis for the Special Operations Forces & Personnel Recovery Division, Air Force Life Cycle Management Center. He is a professional cost estimator/analyst and an alumnus of the Air Force Institute of Technology Graduate Cost Analysis (GCA) program.

International Cost Estimating & Analysis Association

2017 Professional Development & Training Workshop

June 6 - 9, 2017 • Portland, Oregon

Sponsor the year's premiere cost estimating and cost analysis workshop

Sponsoring ICEAA's 2017 Professional Development & Training Workshop provides a unique opportunity to position your company as an active player in advancing the profession of cost estimating and analysis. The ICEAA 2017 Workshop exhibit hall will be open for over 30 hours, with 8 hours on the Workshop schedule dedicated for attendees to visit our exhibitors. The limited number of available booths allows for a focused, consultative environment in which you can meet with current and future clients. Tuesday and Wednesday's receptions as well as food buffets and beverage breaks will be served in the exhibit hall among the booths, providing ample time to develop leads. The exhibit hall is centrally located to the breakout session rooms and mere feet from the general session ballroom.

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Details and information at www.iceaaonline.com/portland2017

2017 Workshop Preview

By Rich Harwin & Megan Jones

This year is moving faster than a steampunk dandy on a unicycle, and the ICEAA Professional Development & Training Workshop will be here as fast as Journey comes on the jukebox on dollar PBR night. Grab a kombucha or a flat white and get ready: We're going to Portland.

Fine Tuning the Schedule

The adjustments to the program and schedule we've been making over the past few years continue to enhance the experience at the Professional Development & Training Workshop: papers will be scheduled all day Tuesday and Wednesday, with the final papers of the Workshop concluding on Thursday afternoon. Meanwhile, training will begin on Tuesday afternoon, run all day Wednesday and Thursday, and then Friday will consist of CEBoK-based training sessions all morning, with opportunities for attendees to review specific topics, break out into study groups, and leave the workshop with a thorough understanding of what it takes to earn their CCEA.

The exhibit hall will again be open first thing Tuesday morning where you can meet this year's sponsors over your bacon and eggs that morning or throughout the week. Tuesday and Wednesday evenings' receptions will be among the booths and our sponsors will be available to talk about the latest innovations and opportunities in the cost estimating world through Thursday afternoon.

The high water mark for abstract submissions was breached yet again! Our program co-chairs **Jeremy Goucher** and **Karen Mouriakas** did an outstanding job of identifying the best 78 abstracts for this year's schedule. We anticipate having the problem we love to have: hearing that there are so many intriguing abstracts that you'll be torn as to which presentations to see, so be sure to check out the abstract summaries online ahead of time to best navigate the schedule.

As with previous years, we allowed the abstracts submitted to determine the tracks in which the presentations will be organized. Some new hot topics emerged for 2017, and we've got the papers organized into a few tracks that haven't been seen before.

It's not an ICEAA Workshop without something new and different, and this time it's a pretty minor one (at least for some).

continued

78 Papers in Ten Tracks:

- Agile
- Data Analysis
- Economic Analysis
- EVM & Scheduling
- Methods
- Operating & Support
- Parametrics
- Policy & Standards
- Risk
- Software

40 Training Sessions in Four Tracks:

- Cost Estimating Basic
- Cost Estimating Advanced
- Parametrics
- Integration

Traditionally, we allowed you to set your alarm an hour later on Friday morning since there isn't a general session planned... or at least we scheduled it that way. Apparently either not everyone got the memo or inertia is in full force on day 4 of the Workshop and the breakfast area has been full by 7:30 with bleary-eyed attendees checking the schedule only to realize they've got an extra hour to sit. Rather than fight the current, we'll be starting at the same time each day this year , which will result in less alarm adjustment and let everyone out into Portland on Friday in time to score an amazing lunch at one of the neighborhood's many hip foodie restaurants.

The Best of the Best

Once again, we plan to feature the year's best paper as a general session for all attendees to enjoy. The Best Paper Awards will be presented as part of the opening general session on Tuesday morning, and then the Best Paper Overall will be presented as a general session on Thursday before lunch.

Competition is sure to be stiff with abstracts from several previous Best Paper Overall winners having been accepted: 2014 winner Dr. **Christian Smart** and previous best-in-track winners **Brent Johnstone**, **Eric Lofgren**, **Nicholas DeTore**, and **Wilson Rosa** are all in the running. But the big question is: will 2015 and 2016 Best Paper Overall winner **Andy Prince** pull off the hat trick?

Gary Bliss

Mark Meckler

Recognizing Outstanding Contributions

Do you know of an outstanding ICEAA member who has made a difference in the profession? An individual or team whose work is leaping beyond the forefront? An emerging superstar with a blindingly bright future, or a pillar of the cost community whose years of dedication have strengthened everyone around him or her? These people are ideal candidates for the ICEAA Association Awards, which will be presented on Wednesday morning..

Review the full award descriptions and nominate your candidate online by **Monday, April 10.**:

The awards committee, chaired by **Joe Hamaker**, will review all nominations against the award criteria and the winners will be announced at the Workshop during Thursday morning's general session.

Down the sights...

Following Tuesday morning's Best Paper Awards, attendees will hear from our first keynote speaker of the week, **Gary Bliss**, Director, Performance Assessments and Root Cause Analyses (PARCA), in the Office of the Assistant Secretary of Defense for Acquisition. A leading authority on the economics of defense procurement, Mr. Bliss will call upon his established track record in institutional reform and enterprise reengineering to give insight on defense procurement, major weapon systems, and the importance of cost estimating in the acquisition process .

continued

...and through beer goggles

Wednesday morning's keynote speaker, Dr. **Mark R. Meckler**, from CraftingAStrategy.com, is going to give us a look at cost from a different point of view: from the perspective of a craft beer brewer! The craft beer industry is thriving in Portland and around the country, and CraftingAStrategy.com, is an online knowledge sharing community designed to help brewers craft a business as strong as their beer. Dr. Meckler's presentation, while scheduled well before beer o'clock, will discuss how brewers use a combination of customer value and corporate values to keep costs down in order to gain healthy margins: familiar themes to the kind of work our attendees take on every day.

As for Thursday's keynote speaker? Stay tuned. We're finalizing another presentation that will get the morning started off right.

Ready for your closeup?

On the subject of beer goggles, it's time we all faced a fact: too many of us have a photo of ourselves on LinkedIn or elsewhere that just so happens to be the best picture we could convincingly crop a beer out of; or worse: a picture that was taken long before chefs with too many tattoos started filling Portland restaurants with truffle-infused bacon lollipops. Our professional photographer, usually hired to take the photos you have seen here, in previous issues, and on the website, will be sticking around for a few hours on Tuesday and Wednesday afternoon to take real-deal headshots at no charge to the attendees. Sign up for a headshot, say *umami*, and you'll have a great new photo for all of your social media needs, no cropping required.

Are We Having Fun Yet?

What lifts the Workshop experience head and shoulders above tuning into a webinar or downloading a PowerPoint is the human interaction. Perennial presenter, track chair, and 2015 Best Paper In Track winner, **Kammy Mann** said it best,

"The Workshop is a great place to network with fellow cost analysts and really meet some of the important people in the field, especially for younger analysts. Since we work in a small, niche, profession it is important to attain the training, and keep track of emerging issues and topics, and meet peers who you will be working with for your entire career!"

The schedule provides generous time cushions between sessions not just to help you stay on top of the emails and calls that keep coming in, but for instructors and attendees to address specific questions offline, or otherwise take advantage of the benefits of being with your colleagues in person.

The real chances to get to know one another will be at Tuesday and Wednesday night's receptions. After the intense, content-filled days, the receptions will provide a fun and casual environment for you to continue the day's conversations. The level of familiarity amongst many of the participants which speaks to the sense of community and openness to share knowledge and collaborate with others. The Workshop is the year's best opportunity to interact with other people who are passionate about costing and related practices.

Or as they say in Portland, it's where you can be with your people.

Thanks to **Genevieve Burkett** from the Chugach Alaska Corporation and **Bob Hunt** from Galorath Federal for their efforts in finding and securing our keynote speakers!

Association Awards

By Joe Hamaker

ICEAA provides many benefits to its members including education, handbooks, standards, certification, chapter workshops, an online library, the annual international workshop and many, many others. One of the more important endeavors of the Association is that of recognizing outstanding individual contributions to improve cost estimating and analysis in government and industry and to acknowledge those who enhance the professional competence and achievements of our members. ICEAA does this with its Annual Awards. Each year we follow a process which begins with you, as a member of the Association, nominating individuals that you believe have made outstanding contributions to our community of practice. The Award Committee, which I chair, will review all nominations against the award criteria and make selections. But none of that can happen until you make nominations. The nomination process is now open through **Monday, April 10**.

So I ask you, as a valued ICEAA member to consider those with whom you have worked and take the time to nominate one or more of your fellows for any of the awards for which you believe they should be considered. Remember the **April 10** deadline and please get those nominations in.

The **Association Service Award** recognizes individuals (or a team) who have shown unparalleled dedication to ICEAA and ICEAA Chapters, having made significant and sustained volunteer contributions that have made a positive impact on the association and our members for a number of years.

The **Educator of the Year Award** is intended for individuals (or a team) who have made outstanding education and training contributions over the past year by advancing the skills and knowledge of cost estimating and analysis through teaching, writing, editing and/or publishing educational materials used to further the professional development of current and future cost professionals.

The **Technical Achievement of the Year Award** recognizes the individual who has made outstanding contributions to the profession in the past year through significant achievement in technical work and/or by playing an instrumental part in the development of technical products.

The **Management Achievement of the Year Award** is to acknowledge the outstanding management contributions an individual has accomplished over the year. These contributions can range from creating a productive and encouraging work environment for staff or colleagues, to developing and maintaining standards of proficiency and performance, to overall effective project management competence.

The **Team Achievement of the Year Award** recognizes a team effort in the past year that had a significant impact on the relevant mission or influenced a crucial decision through the use of cost analysis.

The **Junior Analyst of the Year Award** is for highlighting the accomplishments of an individual with 5 or less years of experience. This person will have utilized principles from CEBoK in their work throughout the year while their professionalism and dedication to ICEAA's principles forecasted a bright future in the community.

And finally, the **Frank Freiman Lifetime Achievement Award** honors an individual making lifetime outstanding accomplishments in cost estimating and/or parametric analysis. It is presented to a person who has demonstrated exceptional dedication and made an outstanding contribution (theoretical or applied aspects) to the cost estimating and analysis community during his or her lifetime. This individual's skills have been honed over years of effort, and their passion will leave an indelible legacy for years to come. The award is named after the creator of the first successful commercial parametric cost estimating model and an early advocate of one of ICEAA's parent organizations, the International Society of Parametric Analysts (ISPA).

Read the detailed criteria and submit your nomination at

www.iceaaonline.com/awards

Beyond the Workshop

By Joe Wagner

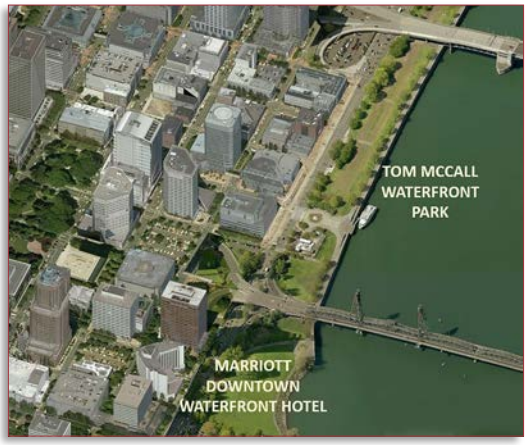
Often at the ICEAA annual workshop, activities outside the hotel are almost as important for our attendees and their families as the professional activities inside. Below is information on a few of the many events and activities you will find in the Portland area in the days surrounding our workshop week of June 6 to 9th. Most of these events have their own websites where you can find more details. Probably of greatest interest to the ICEAA membership is the "Fleet Week" event, with naval warships tied up at Tom McCall park on the Willamette River, right in front of our Marriott hotel, where they are available for public tours.

2016 Fleet Week Visitor USS Russell

Fleet Week – June 7-11

A Portland tradition, for over a hundred years visiting navy ships and related naval elements have been making their way to Portland's waterfront and hosting ship tours for both residents and visitors. One purpose of Fleet Week has always been to celebrate and thank the active and reserve military personnel and all veterans for their service. This Portland event is one of the few regular U.S. Ports of Call courtesy visits by the U.S. Navy, U.S. Coast Guard, and Royal Canadian Navy to be found anywhere in the nation. As many as a dozen vessels, including guided missile cruisers, destroyers, coastal patrol, lifesaving, law enforcement, and other active duty and historic vessels from the US and Canada will be docked at the waterfront within a block or two of our hotel and will be open for tours daily.

2016 Fleet Week Visitors HMCS Edmonton & Brandon



Portland Rose Festival: June 1 - 11

The events going on in the first two weeks of June are collectively known as the Portland Rose Festival. Most of the action will be held at Tom McCall Waterfront Park – a block from our Marriott hotel headquarters.

Spring Rose Show: June 8-9

Each year at this time, Portland's Lloyd Center, located just a few blocks across the Willamette River from our hotel, hosts the Annual Spring Rose Show. This is the largest and longest-running rose show in the nation. The exquisite beauty and fragrances of this yearly show emanate from more than 4,000 blooms, with Rose growers from across the Pacific Northwest participating.

continued

Starlight Parade

The Starlight Parade: June 3

One of the Portland Rose Festival's popular events offers eclectic fun for everyone. From traditional marching bands and flood-lit floats, to glow-in-the-dark umbrellas and unique hand-built entries, you'll see the best of Portland's community groups (and surrounding Northwest region) together in one whimsical pageant.

Floral Parade

The Grand Floral Parade: June 10

Another parade that is a highlight of the Portland Rose Festival, this procession of spectacular floral floats is a beloved annual tradition. For more than 100 years, Portland families, visitors and community groups have supported the Floral Parade. The parade passes along a 4.2 mile route that winds through city streets and across the river, passing only three blocks from our venue at the Marriott Downtown Waterfront hotel.

Dragon Boat Races: June 10-11

Also located on the Willamette River in front of our Marriott workshop hotel, Dragon Boat races have carried on an exciting Chinese tradition in Portland for more than 26 years. Held near the Hawthorne Bridge, the races feature exciting four-team heats held every nine minutes. More than 80 different teams – local, national and international – compete in boats graciously provided through the Portland-Kaohsiung Sister City Association.

Dragon Boat Races

Classic Car Show: June 10

Located about 15 miles southwest of downtown Portland is the site of the annual Sherwood classic car show in historic downtown Sherwood, Oregon. Typically drawing over 500 antique and classic vehicles, the show includes musical entertainment, food, beverages, and vehicle demonstrations.

Sherwood Classic Car Show

All that and a golf tournament, carnival, musical performances, food and drink offerings, a traveling zoo, and numerous other attractions and events. Additional details and times are at:

www.rosefestival.org

View speaker bios, paper abstracts, training session descriptions, and hotel information on our website. You can also download the latest detailed schedule, featuring session dates and times at:

www.iceaaonline.com/portland2017

Outline Schedule

Tuesday, June 6

Breakfast buffet available	7:00 - 8:00
Welcome & Overview	7:45 - 8:00
Best Paper Awards	8:00 - 8:30
General Session	8:30 - 9:30
Exam Overview/ Training Intro/Papers	9:45 - 11:45
Lunch	11:45 - 12:45
Training/Papers	12:45 - 4:45
Welcome Reception	4:45 - 7:00

Wednesday, June 7

Breakfast buffet available	7:00 - 8:00
Welcome, day intro	7:45 - 8:00
Association Awards	8:00 - 8:45
General Session	8:45 - 9:45
Training/Papers	10:15 - 12:00
Lunch	12:00 - 1:15
Training/Papers	1:15 - 5:15
Networking Reception	5:15- 7:00

2017 Workshop Committee

Workshop Co-Chairs:	Rich Harwin Christina Snyder
Best Paper Co-Chairs:	Andrew Drennon Rod Olin
Program Co-Chairs:	Jeremy Goucher Karen Mourikas
Training Co-Chairs:	Remmie Arnold Derreck Ross
Awards Chair:	Joe Hamaker

Thursday, June 8

Breakfast buffet available	7:00 - 8:00
Welcome, day intro	7:45 - 8:00
General Session	8:00 - 9:00
Training/Papers	9:15 - 11:00
Best Paper General Session	11:15 - 12:00
Lunch	12:00 - 1:15
Training/Papers	1:15 - 5:15

Free Evening -Enjoy Portland!

Friday, June 9

Continental Breakfast Available	7:00 - 8:00
Training day review, Q&A etc.	7:45 - 8:00
Training	8:00 - 11:30
Conference Ends	**11:30**

NASA Launches a New Model

By Brian Alford and Andy Prince

The NASA Project Cost Estimating Capability (PCEC) is a new parametric tool used for estimating the cost of unmanned spacecraft, landers, launch vehicles, crewed systems, and in-space transportation systems. PCEC is based in Excel and comprises two components: the PCEC Library and the PCEC Interface. The PCEC Library is a collection of artifacts such as cost estimating relationships (CERs), their associated statistics, variable dictionaries, work breakdown structures (WBS), estimating templates, and inflation indices--the building blocks of the cost estimate. The PCEC Interface is an Excel Add-in (shown in Figure 1) that facilitates the investigation, selection, and use of PCEC Library items in order to build a parametric estimate for a space flight hardware system in an Excel workbook.

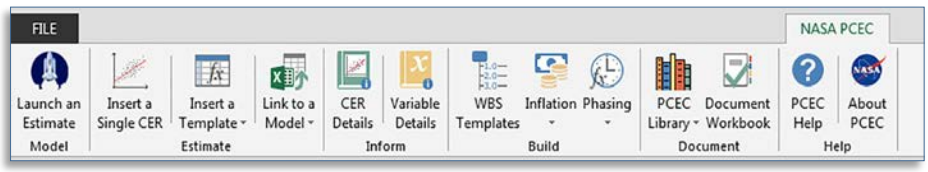


Figure 1: The PCEC Ribbon appears as another tab in the Excel Ribbon

PCEC development began in late 2013 to replace the NASA / Air Force Cost Model (NAFCOM), a legacy parametric estimating software program dating back to the early 1990s. The primary philosophy behind the creation of a new tool was to provide a transparent, customizable estimating environment for space flight hardware estimates. The Interface is completely open, allowing the calculations, code, and items in the Library to be accessible by the user. By making the CERs and supporting calculations completely visible, PCEC empowers users in the development of their parametric estimates. Rather than just inputting data into a model and accepting its output, PCEC challenges analysts/estimators to take ownership of their estimates and not just let the model take the credit (or more often, the blame) for its result. This increased flexibility comes at a cost, as it often requires more work to create estimates. But with this control comes the flexibility to infinitely customize the model, and it pushes users to become better estimators rather than just savvy exercisers of a tool.

Most people just envision the Ribbon displayed in Figure 1 when they think of PCEC, but PCEC is more than just the add-in. The primary model development efforts, one for Robotic Spacecraft (Robotic SC) and one for Crewed and Space Transportation Systems (CASTS), provide the foundational CERs that are accessed through the PCEC Interface. Through rigorous and repeatable data collection, normalization, and analysis processes, raw cost data is standardized across all missions, and CERs are developed using commonly-employed statistical techniques (e.g., log-transformed OLS, Principal Component Analysis). The PCEC Library is then populated with the outputs from these processes, and these outputs are then incorporated into the Interface for the user to consider when creating an estimate.

By means of the Interface, the user can either build a cost estimate by inserting elements into a workbook one-at-a-time using the buttons on the Ribbon or using a dialog box that allows the user to customize a WBS and have the routine build out the entire estimate (illustrated in Figure 2). Embedded in the tool are pre-built worksheet templates for estimating a variety of types of WBS elements for a space system: launch vehicle subsystems, robotic spacecraft subsystems, scientific instruments, project support functions (commonly referred to as "wraps"), throughputs, etc. These templates are populated at runtime with the CERs needed to estimate the specific type of element (e.g., attitude control, systems engineering, environmental control & life support system, tooling) and contain calculations for estimating the Design, Development, Test, & Evaluation (DDT&E) and

continued

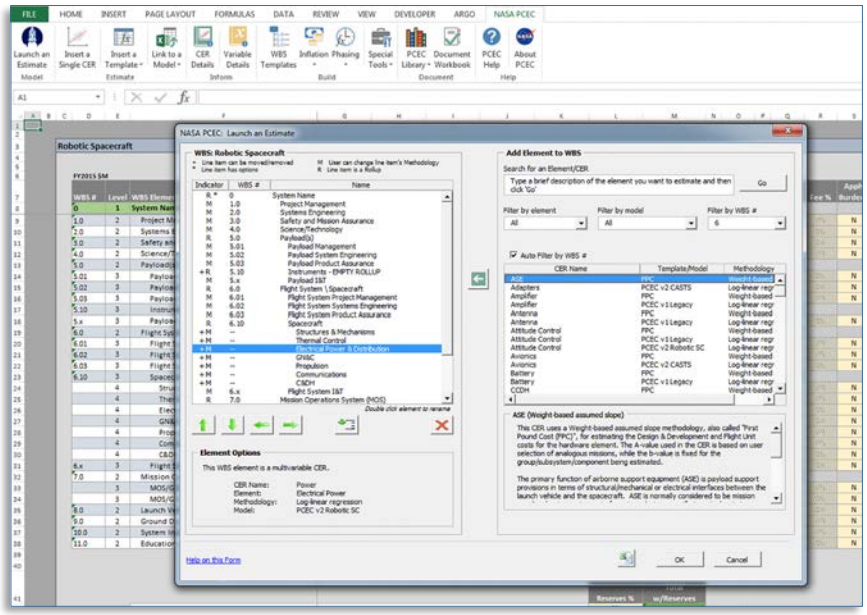


Figure 2: The Launch feature helps the user search the set of available methodologies, insert them into the WBS, and build the complete estimate.

Production costs for the element. A dedicated input section provides space for not only entering point estimate values for the independent variables but also for entering alternative values to support input sensitivity and uncertainty analyses. The templates include calculations needed to create a prediction interval to model CER uncertainty (when combined with a Monte Carlo Add-in such as Argo, @Risk, or Crystal Ball), and they contain a number of production variables to incorporate both the learning and production rate effects into the production cost. The Interface also provides links to / integration with other NASA-developed tools (e.g., the NASA Instrument Cost Model) so that those estimates can be incorporated with PCEC-estimated elements into a more comprehensive cost estimate.

In keeping with the tenets of PCEC, the estimating templates contain no cell protection or hidden calculations. Users are able to see the complete CERs and trace all the calculations to understand how the different variables contribute to the results (see Figure 3). This flexibility allows each estimate to be tailored to support unique estimating requirements by adjusting the calculations directly in the templates. Going beyond these simple changes, users can even customize their own copy of the Interface by replacing the built-in WBS, adding their own CERs to the Library, and/or writing code to add new capabilities. Thus, while PCEC is primarily focused on supporting the estimating needs of the NASA space cost community, it can be adapted for use by other organizations and for developing parametric estimates in other domains (IT, aircraft, ships, etc.)

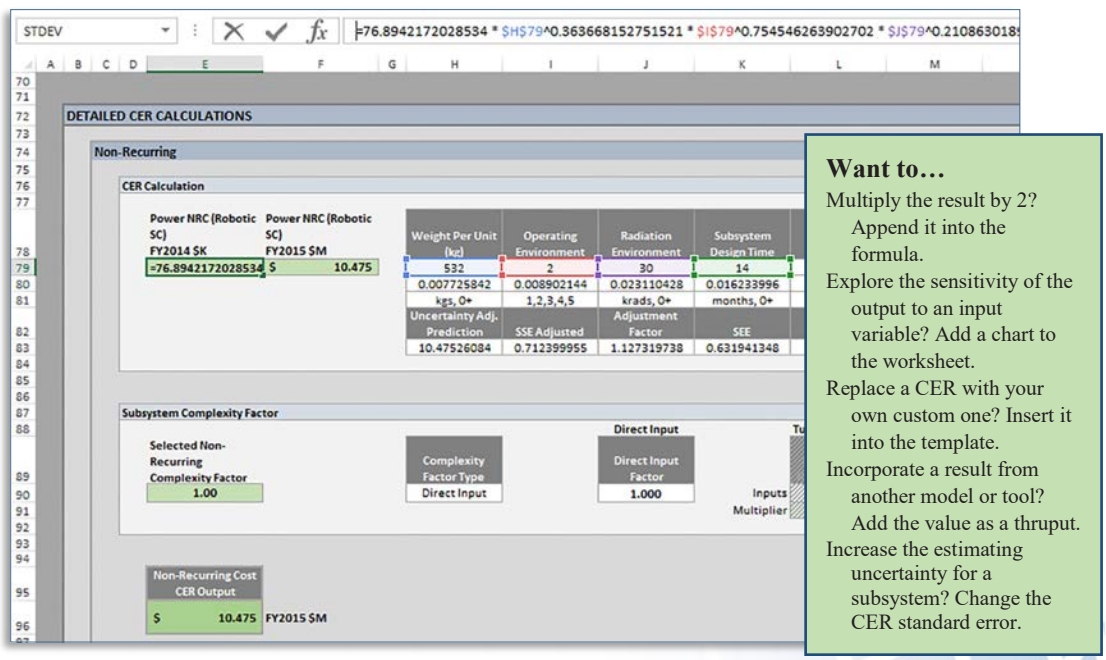


Figure 3 Worksheet templates provide full visibility into the CER calculations and allow for customization to meet the needs of the user.

PCEC is free and available to the general public (with some exclusions). Prospective users can obtain PCEC by visiting the NASA Software Catalog (https://software.nasa.gov/), searching for PCEC, and completing an application found on the site; the current version available is v2.1 (as of February 2017). For more information about the tool, to share any ideas, or to provide feedback, please contact the development team by emailing msfc-pcec@mail.nasa.gov.

Society for Cost Analysis & Forecasting (SCAF): Costing News from the UK

by Dale Shermon, SCAF Chairman

Cost engineering, as a part of developing and producing new products, continues to have increased visibility. With the austerity and improved efficiency in government spending now in vogue, the expected costs of projects, systems and services have become more important as a public and political consideration. There are three stages to producing a useful cost product:

1. The application of valid costing techniques to technical and programmatic data to produce a sound estimating product.
2. The correct estimating process approach in terms of level of detail, structure of the program, and end conclusions to be reached.
3. The desired information useful to the customer, in terms of the decision process to be employed for the outcome.

It's important in this context to remember that cost engineers typically come with a technical background; they are not accountants. While their ultimate design and production focus is not watts, lines of code, function points, amps or kilograms, but rather the dollars, euros and pounds needed to produce those things, the processes they use are still less focused on resulting budgets, expenditures, and accounting concerns, and more on the requirements and effectiveness of the results those costs can achieve in a broad sense

It is not commonly appreciated that while the cost process is largely technical as related to the thing being estimated, the presentation of the results must take into account the original purpose of the costing activity. There are any number of reasons for offering a set of cost information, and a great number of different types of cost formats and structures which can be deployed in the final product, depending on the application, including:

- Rough Order of Magnitude (ROM) cost
- Independent Cost Estimate (ICE)
- Whole life cost (WLC) or Life Cycle Cost Estimate (LCCE)
- Budgetary cost estimate
- Commercially committing proposal estimate
- Discounted cash flow and net present value (NPV)
- Parametric top down forecast
- Should cost / Would cost / Could cost
- Operating & support cost or through life cost (TLC)
- Activity-based costing (ABC)

These various structures and directions for the estimate to take, as noted above, hopefully lead to cost estimating results that have meaning and are actionable for the customer. These may include, but are not limited to:

- Financial analysis (for example affordability, budgeting)
- Economic analysis (for example options analysis)
- Cost benefit analysis (for example different process or technology)
- Business case analysis (for example due diligence of capital expenditure)
- Project management and project control (for example setting EVM baseline)
- Design and performance trade-off Decisions (for example analysis of alternative)
- Acquisition analysis (for example technology insertion)

It takes a broad set of attributes, including experience, knowledge and understanding for the estimator to produce a technically useful estimate, prepared in a format and by a process that makes it valuable for the customer, and is presented with regard to the ultimate purpose and need of the customer, in a way that is credible. There must be a combination of science, math, structure, and art to communicate an estimate that will withstand scrutiny and provide insight throughout the process.

If you are in the UK or the continent at any time in the future, and would like to attend our next SCAF workshop either in London or Abbey Wood, please contact us. Come and join in, as you may both learn something new and contribute to the learning of others.

Air Force Institute of Technology (AFIT)

By Lt Col Brandon Lucas

The Value of Cost in a Deployed Environment

The Cost Analysis Program at AFIT is designed to provide students with the knowledge and skills needed to effectively estimate program resources within the Department of Defense acquisition management community. As a result, the cost student population (and faculty!) is overwhelming comprised of military members. While at AFIT, the students are exposed to a wide range of classes that enhance their analytic skills (statistics, decision analysis, risk analysis, etc.) along with the requisite economic and cost analysis classes. Additionally, research skills are honed as each student completes a thesis. After graduation military students are typically assigned to a product center (e.g. Life Cycle Management Center) or the Air Force Cost Analysis Agency (AFCAA) to apply their newly learned skills. Inevitably duty calls and many AFIT grads are selected for deployment. However, deployment tasking for FMers are typically thought of as "O&M" jobs. The question(s) ultimately become "Why are they deploying a *cost* person?" "Will he/she have the skills necessary to complete the mission?"

To answer these questions, I'm going to share with you my recent deployment experience. In the fall of 2015 I had the opportunity to leave the cost program faculty at AFIT for a year to serve as an Air Advisor in Kabul, Afghanistan. Our primary job was to Train, Assist, and Advise (TAA) the Afghan Air Force. My counterparts to TAA were the Afghan Comptroller and Programmer. While it is true that much of my job was O&M focused, there were several skills that I have obtained as a cost analyst that proved invaluable.

The first area where my cost background was value-added involved the expansion and modernization of Afghan Air Force (AAF) aircraft platforms. Over the past seven years or so, the AAF has added C-208s, C-130s, MD-530s, and A-29 aircraft. These procurements/modernizations occurred through pseudo -FMS sales with stateside Army and Air Force Program Management Offices (PMO). My understanding of acquisition and cost proved invaluable as we worked with the PMOs to provide better capability for the AAF.

Lt Col Ritschel with his Afghan Counterpart

Research is the second area where my cost skills were utilized. I found that the research skills I gained at AFIT were extremely helpful in understanding the current financial processes the Afghans were using, analyzing gaps, and suggesting alternatives to remedy those gaps. It really was similar to the thesis efforts that AFIT students conduct today! While the application of the research was to something completely foreign to a cost analyst (e.g. the Afghan budget process), the foundational skills were universal.

Audience at Greater Dayton chapter meeting

Lastly, I found analytic skills to be incredibly important. In the fast-paced world of a deployment, decisions are made quickly. This pace can, at times, lead to "gut-feelings" driving decisions. I found that my background as a coster led me to ask questions and request data. I won't exaggerate and claim the result was necessarily "better" decisions, but at least they were more informed. In summary, I think the answer to the questions initially posed is as follows: the skills that cost people acquire are applicable in a wide-range of areas. The ability to think analytically and research a problem is valuable in almost any situation… including a deployed environment.

AFIT ICEAA Presentations

Finally, I'd like to transition from discussing cost in a deployed environment and talk about a recent event hosted by the Greater Dayton ICEAA Chapter. On March 2nd, three AFIT students (Capt **Michael Brown**, 1Lt **Virginia Galbraith**, and Capt **Ryan Trudelle**) were afforded the opportunity to share their thesis research results. The event was attended by over 40 cost professionals and their feedback was immensely valuable. We would like to thank **Donna Gravely** (President), **Phil Popovich** (Vice-President), **Deb Walter** (Secretary) and the Greater Dayton Chapter for their continued partnership in this event with special thanks to Joe Bauer for hosting.

Captain Michael Brown Briefing his Research

Washington Capital Area Chapter Report

By Meghan Kennedy, ICEAA Washington Capital Area Chapter President

The Washington Capital Area chapter has had a great winter. We've continued our monthly presentation series highlighting some of the best cost analysis work in the region, branched out with social and service events, and successfully conducted our annual membership meeting. There's a summary of our biggest events below. In addition, our chapter website is now live. Check it out for all the latest on events, training, and presentations, as well as how to contact the board:

www.washingtoniceaa.com

Monthly Presentations

The chapter continues to offer a popular monthly lunchtime speaker series. Some of our recent presentations include:

January 2017: *Applying Earned Value Management to Agile Software Development Programs*. Presented by **Bob Hunt** of Galorath Federal. Held at Technomics, Inc., Arlington, VA.

February 2017: *Better Cost Estimation Through Radically Improved Risk Identification.* Presented by **Laurie Wiggins** of Sysenex Inc. Held at Tecolote Research, Inc., Arlington, VA.

March 2017: *Failure to Reason: Intuition and Decision Making Under Uncertainty*. Presented by **Capt Chris Thomas** of AFCAA. Held at Herren Associates, Inc., in Washington, DC.

Planned events include:

2017 ICEAA National Workshop previews

Summer 2017: **Chris Graham** of DC Brau – forecasting, scheduling, and project management for the beer industry (happy hour presentation).

DC Chapter Service Project

Nine Washington Capital Area members met on the morning of December 4, 2016 to sort food for the Arlington Food Assistance Center. It was a great event lauded by the Center director: "You did twice as much as we expected. Thank you so much for coming to volunteer!"

Watch for another chapter networking event, tentatively planned for April.

ICEAA Washington Capital Area Members Volunteer at the Arlington Food Assistance Center

Annual Membership Meeting

Our annual chapter meeting was held on February 23, 2016 at the Washington Golf and Country Club in Arlington, VA. Over 60 members and guests attended, one of our highest annual meeting turnouts. A huge thanks to our event sponsors – **Tecolote Research**, **Technomics**, **Cobec Consulting**, and **Herren** – who were instrumental in its success. While it was a great opportunity to network and partake in good food and drink, the business of the meeting included: a chapter board of directors summary, a short update from **Megan Jones** of the International office, a keynote presentation by Ms. **Shateela Winter**s of Edelman Financial Services, and a presentation of our annual chapter award winners.

We presented five chapter awards for great work and contributions to the cost estimating field during 2016. Our chapter winners will be put forward as nominees in their respective categories for the 2017 ICEAA Association awards presented at the Professional Development and Training Workshop. Congratulations to all of our winners:

continued

Best Luncheon Presentation:

Kammy Mann, Herren Associates, Inc.
for her presentation: *Training Cost Analysts – a Cohesive Pedagogical Framework for Success*

Kammy Mann (L) and Meghan Kennedy (R)

Leadership/Management Award

Michelle Petre,
Technomics, Inc.

Michelle Petre (L) and Meghan Kennedy (R)

Technical Achievement Award:

Nicholas Aaron Lanham,
NCCA

Nicholas Lanham (L) and Meghan Kennedy (R)

Junior Analyst of the Year Award:

Brandon Bryant,
Technomics, Inc.

Al Leung (L) accepts for Brandon Bryant with Meghan Kennedy (R)

Team Achievement Award:

Columbia Class Component Cost Position Team,
Naval Center for Cost Analysis (NCCA)

Representing the team, left to right: Rashmi Kashyap, Nicholas Lanham, Meghan Kennedy, Nick Wilkoff, Alan Behning

Team Members:

Adonis Ajayi
Elise Anderson
Todd Andrews
Robert Aspden
Juan Avila
Brittany Basilone
Alan Behning
Alison Bell
Jay Bottelson
Angela Buck
Thais Canedo
Denitra Carter
Matt England
Kevin Gallagher
Samantha Green
Annette Harris
Anne Hasson
Christopher Jensen
Philip Koenig
Rashmi Kumari
Nicholas Lanham
Richard Lee
Matthew Lewis
Lauren Mauceri
Michael Mender
Madeline Miller
Catherine O'Keefe
Stephen Pack
Avishek Panth
Michael Perkins
Bryan Powers
Nicholas Rodriguez
Michael Russano
Stephen Salisbury
John Semanchick
Uma Sivaramakrishnan
Aaron Spinak
Duncan Thomas
Matthew Thomson
Sheridan Ward
Nicolas Wilkoff
Richard Wu

Region Seven News

Southern California and San Diego Chapters

Rich Harwin, Southern California (SoCal) Chapter President

Tom Bosmans, SoCal Chapter Vice-President

Kurt Brunner, SoCal Director Emeritus and Region 7 Director

Rich Harwin

Tom Bosmans

Kurt Brunnerclaus

The Southern California (SoCal) Chapter of ICEAA Region 7 conducted an extremely successful winter workshop at scenic Fort MacArthur in San Pedro, California on December 14 courtesy of the United States Air Force. The day's terrific speakers included **John Karns** and **Bruce Thompson** of the Space and Missiles Center (SMC), **Wayne Wright** of Lockheed Martin, **Christian Smart**, Ph.D., Director of Cost at Missile Defense Agency, **Doug Howarth**, CEO of MEE Inc, **Dan Galorath**, CEO of Galorath Incorporated, **Steve Sterk** from NASA and **Kent Joris** from Northrop Grumman.

Our March 27, 2017 workshop at the expansive Northrop Grumman Aerospace Systems facility in Redondo Beach, California, features a keynote by **Scott Willoughby**, Vice President/Program Manager, Northrop Grumman, **Aditya Satsangi** & **Giovanni Martinez** of Nitai Partners, **Randall Jensen**, **Shu-Ping Hu** of Tecolote, Research, Inc., **David Bloom** of Raytheon, and **Kurt Brunner** of Leidos.

As always, our workshops are no cost, last most of a day, and as an incentive to stay until the last presentation is complete, a membership drawing is held at the end of the day.

If you have questions about your membership status or would like information about membership in general, contact **Steve Sterk** at steve.a.sterk@nasa.gov or (661) 276-2377, or the ICEAA office at iceaa@iceaaonline.org or (703) 642-3090.

If you are interested in hosting a workshop or making a presentation at a workshop, please contact **Rich Harwin** at richard.a.harwin@boeing.com or **Tom Bosmans** at tom.l.bosmans@leidos.com

The December SoCal Workshop also featured the induction of our new Board of Directors!

We would like to thank both the old and new boards for their tireless teamwork in making the SoCal chapter a great success, as well as all the members and participants for their support over the years.

continued

ICEAA Southern California Chapter Board of Directors:
January 1, 2015 - December 31, 2016

President	**Kurt Brunner**
Vice-President	**Quentin Redman**
Secretary	**Melissa Winter**
Treasurer	**Chris Hutchings**

Board Members:
Dara Billah **Tom Bosmans**
Rich Harwin **Doug Howarth**
Suzanne Lucas

ICEAA Southern California Chapter Board of Directors:
January 1, 2017 - December 31, 2018

President	**Rich Harwin**
Vice-President	**Tom Bosmans**
Secretary	**Melissa Winter**
Treasurer	**Chris Hutchings**

Board Members:
Dara Billah **David Bloom**
Kurt Brunner (Emeritus) **Danny Polidi**
Steve Sterk (Honorary)

continued

Chapter and Region Updates

ICEAA

View upcoming SoCal Chapter workshop agendas or download previous workshop briefings at:
www.iceaaonline.com/chapters/socal

December 2016 SoCal Workshop Attendees

2015-2017 Board of Directors (left to right):
Tom Bosmans, Darah Billah, Suzanne Lucas, Melissa Winter,
Kurt Brunner, and Quentin Redman

2017-2019 Board of Directors (left to right):
David Bloom, Darah Billah, Tom Bosmans, Rich Harwin (on banner),
Melissa Winter, Danny Polidi, and Kurt Brunner

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visit www.iceaaonline.com/certification-matters for more information

In Memoriam

Gregory Charles Bell

The cost community lost one of its own when **Greg Bell** passed away unexpectedly over the Christmas holidays. As a long-time resident in the DC area, many of us had the great pleasure of working with Greg. He spent the last 10 years of his career working for MCR at NELO, MDA, DARPA, AFCAA, and NAVAIR. In a world filled with data-hounds, Greg was renowned for the 30 years of aircraft, space systems, and radar data that he had accumulated. At any opportunity he would happily open his excel files and expound on the analysis, insights, and CERs that he was able to develop.

After hearing of the passing of Greg Bell, **Tim Anderson**, **Paul Marston**, and **Mike Thompson** shared some of their thoughts of Greg:

His generosity in sharing his life's work was legendary, and it's probably an understatement that the fruit of his labor was used by hundreds of his colleagues and made significant impacts to more defense programs than we'll ever know. Reminiscing about his life and legacy, the following quotations poured in: "Greg was a true gentleman; Greg was thorough and detailed and provided wonderful products to our users; Greg was brilliant and had an incredible knack for getting to the heart of a problem." As remarkable an analyst as Greg was, those of us who really got to know him will remember his devilish sense of humor and warm friendship. Whenever a friend hadn't seen him in a while and happened to pass him on the streets or at a conference, Greg would always take a few minutes to walk over and catch up. It was hard not to walk away from his warm handshake and genuine smile knowing that you'd feel a little bit better about the day.

Greg Bell (L) accepts the 2008 SCEA Technical Achievement Award from Bill Haseltine (R)

Tim Anderson's memory of Greg is very much in line with what all who knew him and how they felt, upon learning of his passing. "I first met Greg Bell in 2008 when I began working for MCR. He was always one of the most congenial gentlemen I have ever met. He was consistently generous and kind. I soon came to realize that Greg had been collecting cost and technical data for a wide variety of systems for years. As a result, he could always provide some much-needed data in support of a cost estimate. In fact, I came to know him as the man who could estimate the cost of practically anything! During my time at MCR, iParametrics, and The Aerospace Corporation, I could always consult with Greg to help me out of a tough cost estimating pickle. He was a mentor, and a friend, and I will miss him very much."

We'll all miss our great friend and colleague, but still feel our lives are better for having known Mr. Greg Bell.

Upcoming Events

3rd Annual ICEAA Canada Workshop
Ottawa Westin, Ottawa, Canada
May 1-2, 2017
www.iceaa.ca/2017

Society for Cost Analysis & Forecasting (SCAF) Workshop
Ribby Hall Village, Preston, UK
June 13, 2017
Contact: ndmorrill@dstl.gov.uk

2018 ICEAA Professional Development & Training Workshop
Renaissance Phoenix Downtown Hotel, Phoenix, Arizona
June 12-15, 2018

2017 ICEAA Professional Development & Training Workshop
Portland Marriott Downtown Waterfront, Portland, Oregon
June 6-9, 2017

2017 Integrated Program Management Workshop
Bethesda North Marriott Hotel & Conference Center, Bethesda, MD
October 30 - November 1, 2017

2019 ICEAA Professional Development & Training Workshop
Tampa Marriott Waterside Hotel & Marina, Tampa, Florida
May 14-17, 2019

International Cost Estimating & Analysis Association

2017 Professional Development & Training Workshop

June 6 - 9, 2017 • Portland, Oregon

Full Name

Informal Name for Badge *(e.g. Bob for Robert, Sue for Susan)*

Job Title

Employer Name

Email

Phone

Address ☐ Business ☐ Home

City, State, Zip, Country

Participation Status

☐ ICEAA Member ☐ First time attendee

☐ Speaker/Presenter ☐ Spouse/Guest

☐ Other: ☐ Sponsor/Exhibitor

_____

Job Position Category

☐ Owner, President, Executive-Level Manager

☐ Senior-level Manager ☐ Mid-level Manger

☐ Non-management Personnel

Employer Information:

☐ US Military Branch: _____

☐ US Government ☐ Int'l Government/Military

Rates:

ICEAA Member	☐ $960
Non-Member	☐ $1,060
Member & Government Employee	☐ $840
Non-member Government Employee	☐ $920

Group Rates

For companies sending 5 or more paid employees

Member Group Employee	☐ $905
Non-Member Group Employee	☐ $1,005

Email us for information on passes for guests to attend meals but not workshop sessions.

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On or after May 29, 2017: No refund. Substitutions available at any time.

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2017 ICEAA Association Awards

Nominate your fellow ICEAA Members by **April 10**

- Association Service Award
- Educator of the Year Award
- Technical Achievement of the Year Award
- Management Achievement of the Year Award
- Team Achievement of the Year Award
- Junior Analyst of the Year Award
- Frank Freiman Lifetime Achievement Award

www.iceaaonline.com/awards