Where We Started and How We Evolved — Page 6

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A Look Back

First Board of Directors, 1979

Madeline Ellis, Karen McRitchie, Arlene Minkiewicz and Marilee Wheaton at 2002 Awards Ceremony.

Touring at ESA, 2000

Hank Apgar and Dave Mizer present Parametrician of the Year Award to Keith Burbridge, 1982

INSIDE THIS ISSUE

PARAMETRIC WORLD

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LETTER FROM YOUR EDITOR

IN THIS ISSUE

This is the last issue of *Parametric World* under the ISPA banner. Appropriately we have fixed our focus on a retrospective of what ISPA has achieved in its thirty-three years of existence. The retrospective starts with Hank Apgar's summary of our history. Then we present snapshots of how parametric analysis has evolved in various disciplines over ISPA's lifetime. These records are in the form of selected recollections:

- My thirty-three year overview of our art,
- Darryl Webb on technology forecasting,
- Dr. Christian Smart on cost uncertainty quantification (the Black Swan paradox).
- Dr. Joe Hamaker's highlights of his feature 'Ask a Parametrician'.

We also include in this issue some regular features: 1) Listings of current and upcoming events in the US and Europe, and 2) Final reports from ISPA departments.

Finally, let me say that I have enjoyed coming back to ISPA publications, though not the tragic circumstances of the return. My friend Nina Tahir had found the formula for *PW* excellence, and as far as I was concerned she could have continued as editor indefinitely. But she couldn't continue and I inherited the job. The job has been made easier with the support of an outstanding team. Most of these folks have demanding day jobs and helped me in their 'spare time'.

Joe Hamaker: Joe has provided technical "beef" to *Parametric World* content.

Hank Apgar: Hank is our historian and is my fellow ISPA charter member. His data bank of records, photos and memories has been our primary resource.

Madeline Ellis: Madeline is our liaison to the ISPA Board. *See note on page 31 for her new honors*. She also has been a diligent proof reader and fact checker.

Quentin Redman: Quentin was drafted to act for Madeline when she was ill, and performed admirably on short notice.

Continued on page 31.

GOODBYE AND HELLO

By Andy Prince, ISPA Chairman of the Board

As you are very much aware, ISPA and SCEA have merged to form the International Cost Estimating and Analysis Association (ICEAA). Folks from both legacy societies are working together to make the new Association a reality. We have before us a rare opportunity to have a major impact on the future of our profession by defining how we will advance all the disciplines, around the world, that encompass cost estimating and analysis. This is a daunting challenge that those of us on the ICEAA Pro-Tem Board take very seriously. Like riding a roller-coaster, it is both exhilarating and scary. However, this is also a bittersweet time. For those of us who have worked hard to make ISPA a success, who have enjoyed the camaraderie of fellow parametric professionals, and who have devoted our careers to parametric analysis, it is sad to see the end of ISPA.

One of the truisms of life is that there is no progress without change. For most of its existence, ISPA was an engine for change. ISPA moved parametric analysis from a niche field into the mainstream by making it an international profession, complete with its own conferences, handbook, certification, and academic journal. ISPA got the US Department of Defense to recognize parametrics as an acceptable estimating method for proposals. ISPA was a focal point for disseminating the knowledge and expertise needed by organizations to build high quality estimating systems around parametric analysis. With all of these changes came better, less expensive, cost estimates that benefited government and industry. ISPA made a difference.

To take our profession to the next level required more change than ISPA could accomplish alone. Over the past several years, our joint activities with SCEA demonstrated that the two organizations could do more for our members by working together. Better conferences and business operations are just two examples. We have also seen a change in how parametrics fits into the larger cost estimating and analysis community.

At the Brussels Conference this past May, Dominique Arnal of Airbus did an outstanding job of describing the modern estimating organization. In his position as Vice-President of Finance and Head of Costing, his actions (and the actions of his organization) directly affect the company's bottom line. His organization encompasses a broad range of skills including parametricians, labor/material estimators, aerospace engineers, and affordability experts. Airbus uses cost estimates and analyses to support new product development, manufacturing cost targets, supplier should-cost analyses, assessments of financial risk, and many other cost management decisions.

The wide range of products and services provided by the Airbus cost organization, supported by a number of different skills, is indicative of the current state of the cost estimating and analysis profession. Parametrics is an important capability, but it is not the only capability. For ISPA to remain a valuable service to our members, we had to broaden our focus and reach (the same was true for SCEA). That was a prime motivator behind our decision to merge with SCEA and form ICEAA.

So as you read this final issue of *Parametric World*, remember and be proud of what ISPA accomplished. And if you feel a little sad (or angry) that ISPA is no more, that's OK. You feel that way because you care. ICEAA needs people who care to help us advance all the cost estimating and analysis disciplines to meet the challenges of cost management in the 21st Century. Let's be a part of the future. Let's make a difference.

Andy Prince

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ISPA's SHORTHAND: AN EDITOR'S NOTE

People new to our profession may not understand the language we have created to describe our craft. I find the following definitions useful: 'Parametric' in our parlance signifies that cost analysis is performed using non-cost factors. It works by creating models that solve for cost by assigning parameters for technical variables, programmatic factors or other cost drivers. In our shorthand this process is called 'parametric analysis' or 'parametrics'. People who follow this discipline we call 'parametric analysts' or 'parametricians'.

WHERE WE STARTED AND HOW WE EVOLVED

By Hank Apgar, ISPA Historian

Figure 1: Frank Freiman receives Honorary Director Certificate from Bryant Barnes, ISPA President, at close of 1979 Charter Meeting.

BACKGROUND

ISPA was founded to promote the development, application, and acceptance of parametric cost estimating methods throughout government and industry. In the 1970s, parametric estimating methods and cost modeling techniques were limited to engineering trade studies, cross-checks on program and proposal estimates, and as academic exercises. A small group of cost engineers in the U.S. and in Europe joined forces early in 1979 to share experiences and to jointly proclaim the virtues and advantages of the parametric approach for business decisions and cost proposals.

This legacy article traces the formation and maturation of a tightly-focused professional society working with U.S., European, and Asian organizations to educate the players and to ultimately change the procurement process.

Thirty-five years later, with the ISPA mission essentially completed, we consider the question. 'Did we succeed, and, if we did, what was gained by government and industry in terms of effectiveness and efficiency?'

This article was based on previous ISPA international conference papers:

- *2012 (Brussels): 'The Evolution of Parametrics in Parallel with the Maturing of ISPA'*
- *2008 (Noordwijk): 'Chasing Affordability with Parametrics: A Lifetime Perspective'*
- *2004 (Frascati): 'The ISPA Legacy'*

PROLOGUE: 1930s through 1960s

The first edition of the Parametric Cost Estimating Handbook describes early parametric usage this way: "The origins of parametric cost estimating date back to World War II. The war precipitated a demand for military aircraft in numbers and models that far exceeded anything the aircraft industry had manufactured before. While there had been some rudimentary work from time to time to develop parametric techniques for predicting cost, there was no widespread use of any cost estimating technique beyond a laborious buildup of labor-hours and materials. A type of statistical estimating had been suggested in 1936 by T. P. Wright in the *Journal of Aeronautical Science*. Wright provided equations that could be used to predict the cost of airplanes over long production runs, a theory which came to be called the learning curve. By the time the demand for airplanes had exploded in the early years of World War II, industrial engineers were using Wright's learning curve to predict the unit cost of airplanes."

In the late 1940s, the DOD and, especially, the United States Air Force began a study of multiple scenarios concerning how the country should proceed into the age of jet aircraft, missiles and rockets. The military saw a need for a stable, highly skilled, cadre of analysts to help with the evaluation of operational alternatives. In 1950, the RAND Corporation established its Cost Analysis Department under David Novick for the purpose of analyzing weapons system costs using operations research methods developed during the war. One of their first challenges was to identify the elements (or dimensions) of cost, later to lead to the work breakdown structure (WBS). Once cost elements became common, and cost drivers could be identified, the RAND analysts focused on developing cost estimating relationships (CERs); the term parametric cost estimating became common by 1952. Subsequently, RAND found it necessary to differentiate between one-time outlays (non-recurring) for investment and recurring expenses for procurement and operations. David Novick retired from RAND in 1971.

ISPA's BEGINNING: the 1970s

It was 33 years ago, in April of 1979, that 300 dedicated parametric analysts met in Washington D.C. to test the feasibility of formally establishing a new professional union: the International Society of Parametric Analysts (ISPA), dedicated to the principles of developing and applying parametric methods to the process of predicting future events. Although cost prediction was our greatest interest, some members were also interested in predicting performance, size, reliability, and other metrics important to our high-tech community.

Those early parametricians were mostly cost engineers and program estimators, but there was a strong representation from the ranks of statisticians, scientists, and program managers. The representation was about equal between government and industry, and about 15% represented academia. Their shared frustrations were:

- Lack of acceptance by the U.S. Department of Defense (DoD) for parametric-generated cost proposals in spite of the fact that government and contractor engineers routinely were using parametric estimating tools for preliminary estimates, for engineering trade studies, and for estimate cross-checks.
- Absence of a professional society that met their needs.

The most popular conference workshop track at the Charter Meeting was a well-attended session of international papers (typically space and military) in support of the conference slogan, 'The World is Uniform.' The attendees (from eight countries) applauded the opening general session during which the ISPA charter was presented to ISPA President Bryant Barnes. Our resolve was simply stated as '...to educate managers and analysts on the creation and application of parametric models to solve real-world problems.' Conference Registration fee was $50. Annual dues were set at $10 ($5 for students).

ISPA superseded the PRICE Users Group (PUG), an independent association of PRICE Model users who wanted to expand their interests beyond a single commercial model. Frank Freiman, then-Director of RCA PRICE, actively supported the formation of ISPA and later was honored by ISPA as its Honorary Director, shown in Figure 1.

Prior to the ISPA Charter Meeting, RCA PRICE had released its first family of commercial cost estimating models, identified as PRICE-H (1973), PRICE-L (1976), and PRICE-S (1977). Other generally-available cost prediction tools soon followed, including Larry Putnam's QSM SLIM (1979), Barry Boehm's COCOMO (1981), PRICE-M (1982), Don Reifer's SoftCost-R (1986), Caper Jones' SPQR/20 (1986) (later rereleased as CheckPoint in 1988), Dan Galorath's SEER-SEM (1987) and SEER-H (1990), and Randy Jensen's SAGE (1996). This was, indeed, an exciting time to build a professional society dedicated to the development and application of parametric cost estimating models. The emphasis was to develop cost models by inductive reasoning, where the modeler (as quoted by Frank Freiman) believes, 'It should work this way.'

The most-noted initiative those first years was the application of parametric models for primary estimates, not just for cross-checks or for engineering trades. Typical presentations at follow-on conferences were case studies on how parametric methods had produced estimates more useful than from other methods, in less time and with less detailed information. The application of statistically-derived algorithms relating cost parameters (dependent variables) to non-cost parameters (independent variables) was already in widespread use as for engineering cost estimates at NASA and at most aerospace corporations.

The first ISPA Secretary, Keith Burbidge, published a well-received tome in 1984 entitled, 'A Touch of History,' with 27 vignettes of famous kings, clergymen, naval officers, financiers, American founding fathers, and others who employed parametric methods to predict future outcomes, including cost. One vignette was about Leonardo da Vinci, who developed a sales price CER for Italian cargo ships based on their size and capacity.

OUR GOLDEN AGE: the 1980s

In 1981, our first *Journal* Editor (and current *PW* editor), Charlie Hopkins, began development of a new standard and vision for our fledging society: the very professional ISPA Journal. In his Editor's Welcome to the Journal, Charlie greeted the reader to our flagship publication by pronouncing *"The Journal of Parametrics will be focused on membership-generated*

Continued on page 6.

Continued from page 5.

papers; these papers are our lifeblood and the Journal can be no better than ISPA members make it." That first issue, which set the standard for 52 more issues to follow, delivered three articles: the first by Bob Gaffney, our first Parametrician-of-the-Year representing the Air Force, described his TI-59 Handheld Calculator Cost Estimating Model; the second, by Tom Tracey of Perkin Elmer, described how parametric estimates apply to small quantity production (optical devices); and the third by Robert Lavoie and James Lawlor of TASC, described a model for developing life cycle cost estimates. These were pragmatic papers with clear recommendations for making good estimates and they attracted large international audiences when presented at subsequent ISPA and SCEA conferences (see Figure 2).

In March 1984, Cindy Castellana replaced Charlie Hopkins as *Journal* Editor, and reprinted a paper from the SCEA newsletter, *the Estimator*, by Steve Otrosa on 'Parametric Estimating: Its Present and Future.' Steve identified a major trend, just in the previous 5 years, by wealthy organizations (in terms of available labor and available cost information) to build extensive databases, This was made possible in part due to data-rich cost reporting requirements (CDRLs.) He, also, gave credit to the emerging personal computer industry for

Figure 2: ISPA and SCEA members learn from the masters at the international conferences.

providing engineers the luxury of developing their own CERs, and to the advent of government/industry working group, such as the Space Systems Cost Analysis Group (SSCAG), populated primarily by ISPA members from the space community. Steve predicted that, within

Figure 3: We found time to mix networking and business at international meetings.

the decade, 80% to 90% of bids would be developed with parametric methods.

The other articles in this issue focused primarily on comparing and adjusting the many models available at that time: comparing software estimating models (Dunsmore), adjusting software models (Rudwick), and assessing hardware logistics support models (Ferens). At that same time, the Air Force Institute of Technology was awarding Masters Degrees to students who delved into the intricacies of why different parametric models produced different estimates.

Subsequent journals in the 1980s focused more on software models than hardware models (possibly trying to catch up for the previous decade when industry favored hardware models). For example, three of the six articles in the December 1984 issue proposed methods and applications for software estimating. In the September 1984 issue, three of the four articles were about software estimating, and the September 1986 issue featured four of the five articles on software estimating techniques. Some authors, such as Bob Tausworthe, focused on peripheral tools, such as the application of the work breakdown structure (WBS) to software project management (and cost estimating) at the Jet Propulsion Laboratory. In June 1984, Bernd Madauss described the 'management advantages of the standard WBS for European Satellite Projects' and justified alternate WBS schemes.

David Parker, while assigned to the UK embassy in Washington DC, described in the December 1985 Journal the emergence of parametric estimating in the UK defense industry. He proclaimed that parametric

estimating was introduced to UK companies who were bidding on some U.S. defense contracts, including AMRAAM, and were encouraged to buy commercial model licenses. This led to incorporation of the concept of Design for Through Life Costs (DTLC). Parker pointed out that parametrics applications in the UK were pioneered by industry, rather than by the government, which differed from the case in the U.S. The European Space Agency (ESA) followed later with an article (September 1985) by Achim Franzke, Chief of the ESA Cost Analysis Division, and Joe Lex, who described their ESA Cost Model (ECOM).

During the 1980s, ISPA pursued a deliberate path of international relations, establishing the plan for an international (outside North America) conference every four years. I believe this was significant in the international promotion of parametrics. International acceptance was due, also, to wider offerings of parametric-type training and invitation to other business cultures to present conference papers and, perhaps more significant, establishing life-long professional international relationships. Twenty percent of our membership was European and chapters had been formed in the UK, Germany, and France. Several European nations adopted parametric initiatives of their own, modeled on the U.S. PCEI.

Our 10th anniversary conference was held in Brighton and was hosted by our UK chapter, now the independent Society of Cost Analysis and Forecasting (SCAF). We enjoyed seven international meetings, with unique networking opportunities (see Figure 3) at the following venues:

1988	Brighton, England, hosted by our UK chapter
1992	Munich, Germany, hosted by MBB
1996	Cannes, France, hosted by Aerospatiale
2000	Noordwijk, Netherlands, hosted by the European Space Agency
2004	Frascati, Italy, hosted by the Italian Space Agency
2008	Noordwijk, Netherlands, hosted by the European Space Agency
2012	Brussels, Belgium, hosted by ISPA/SCEA plus five other societies

Within our first decade, ISPA members began thinking (in Journal articles) about our own identity. In the June 1986 Journal, Bernie Grabois pondered the issue of how parametric analysts should be organized, and to which organizational department the parametricians should be assigned. His 1985 survey of 286 ISPA members attending the 1985 conference concluded that Engineering was the preferred location with Finance a distant second. Bernie cited a 1979 conference presentation by Noel Hargrove on integrating parametrics into the management decision process with the goals of: (1) permanent staff, (2) with modeling their sole assignment, (3) with a technical orientation, (4) with access to top decision makers, and (5) with the opportunity to interact with designers, price analysts, and managers.

In March of 1986, Paul Garvey introduced the concept of measuring uncertainty in a software development effort estimate, where he recommended the triangular density function and provided a table of suggested confidence levels. This was an update to his June 1985 article. This led to a plethora of risk articles by Bob Black, Jim Wilder, Paul Garvey, Steve Book, and others.

Near the end of this decade, the January 1989 *Journal* began with an editorial 'The Next Decade,' by Keith Burbidge, Journal Editor, in which he summarized the closing decade this way: 'ISPA celebrated its 10th anniversary during 1988, and those members attending the Summer session in Brighton (UK) could not fail to be impressed with the rapid pace of technological change within our chosen profession. In the space of ten short years, our working tools have changed markedly, from 'dumb' terminals operating at 300 baud, to the ubiquitous PC and 2400 baud. When ISPA began, one hardware estimating parametric model was the only game in town. Today, a wide variety of models is the norm. Estimators have changed, too. The green eyeshade, the #2 pencils, the adding machine — all essential to the stereotyped estimator - have vanished. The new 'genus estimatoris' is as much at home with risk analysis, computers, and databases as with learning curves and the cost of money. Societies are people united by common aspirations, motivations, and excellence. Thus, as people changed, so did ISPA, from a small group of like-minded economists, engineers, estimators, and operations research personnel, to a major society in which could be found representatives from almost every technical discipline.'

Keith, then, predicted the future this way: "It does not stretch imagination too far, to aver that society is poised on the brink of a second industrial revolution, perhaps titled as the 'automaton revolution.' It is you, the ISPA member, who must undergird this revolution with your expertise, to estimate the resources necessary for the 'factories of the future.'"

Continued on page 8.

Continued from page 7.

In this decade, perhaps our Golden Age, we delivered 30 issues of the ISPA *Journal* with innovative articles and we stepped closer to our primary goal, i.e. the acceptance of parametric analysis as a bidding tool. Now we were poised for an all-out assault on final acceptance.

THE DECADE OF APPLICATIONS: 1990s

In our first journal (February 1990) of the 1990's decade, Claus Meisl proposed that parametric-derived life cycle cost estimates would soon become the key evaluation criterion for acquisition design concept ranking. His paper was based on a quantitative approach for evaluating and ranking liquid propellant rocket engine design concepts for future reusable space transportation launch vehicles.

Our October 1990 *Journal* reprinted the award-winning papers from our 12th annual conference promoting the theme, Total Quality Management (TQM). Appropriately, the best software paper by Jairus Hihn, explored requirements volatility and implementation as software development cost drivers. Thus begins a decade which seems to really focus on parametric cost drivers and the opportunity to control system design through understanding those cost drivers — a role uniquely played by parametrics.

Darryl Webb built on this theme in the December 1990 *Journal* with the first of several reports on his trend forecasting methodology, in which he explains cost trends based on evolving cost driver values over time. His cost drivers are based on concepts of weight, manufacturing complexity, and technology. See Darryl's article on page 17.

Hank and Darryl, in the early 1990s, began a series of parametric estimating training seminars delivered across the US and Europe.

Our August 1991 *Journal* reprinted the 1991 Conference keynote speech by Larry Uhlfelder, Assistant Director for Policy and Plans, Defense Contract Audit Agency (DCAA), who explained DCAA's policy regarding audits of parametric cost estimates. Larry referred to a previous article in the Spring 1982 Journal by Chuck Starrett, then the DCAA Director, who identified the five major auditing criteria to be verified before submitting a parametric estimate to the government (these are still valid today):

- Logical relationships,
- Verifiable data,
- Significant statistical relationships,
- Reasonably accurate predictions, and
- Proper systems monitoring.

The May 1995 *Journal* published the 1993 ISPA Conference Keynote Address by Bill Reed, DCAA Director. After referring (again) to the watershed presentation in our 1982 Journal, entitled, 'Parametric Cost Estimating — An Audit Perspective,' by the then-Director of DCAA, Bill reiterated DCAA's support to parametric estimating for contractor proposals but went on to identify where many such proposals were failing the original auditing criteria. The contractor parametric estimating failures were judged to be:

- Estimates not based on actuals or updated data.
- Estimates over time varied significantly.
- Estimators and accountants not communicating with each other.
- Lack of written policies and procedures.
- Estimates made by persons not responsible for performing the work.

Back in 1971, the DoD established their acquisition initiative, Design to Cost (DTC). The initiative would focus on unit production cost during the development phase of major acquisitions. Unfortunately, DTC did not entirely succeed because:

- Estimators focused on production cost, rather than life cycle cost.
- The 'User' (source of the performance requirements specification) was not involved later in the design trade process.
- There were no mission affordability goals; performance goals were still the driver.
- Cost targets and cost estimates were still absolute measures, rather than being defined by probabilistic bands, thereby making success an unattractive all-or-nothing prospect.

So, faced with a 60% reduction in the DoD acquisition budget from 1985 to 1994, a new cost-reduction initiative, Cost As an Independent Variable (CAIV), was introduced in 1995. The consideration of cost as an independent variable became a crusade for parametric modelers and estimators and they embraced the fundamental tenets of CAIV, through early affordability studies of CAIV flagship programs: the Joint Strike Fighter (JSF), the Air Force Evolved Expendable Launch Vehicle (EELV), the Army Crusader vehicle (see Figure 4), and the Navy Aim-9X Sidewinder Missile).

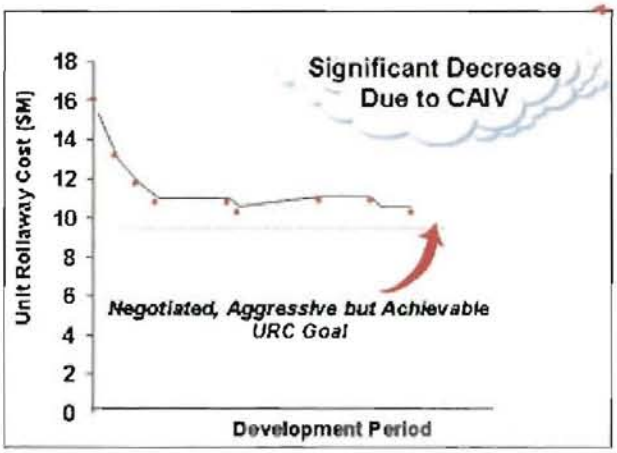


Figure 4: Unit Rollaway Cost was reduced 30% on the Crusader Program through application of CAIV.

The new CAIV tenets were seen to be:

- Focus on life cycle cost,
- User as stakeholder,
- Realistic but aggressive goals, and
- Risk dimension of targets and estimates.

So we see a maturing of our discipline over the previous decade, with less emphasis on model selection and estimating methods, but with more emphasis on applications of parametric estimates and focus on estimate credibility.

For the special millennium issue of *Parametric World* (Dec 1999), several Parametricians (Ed Dean, Tony DeMarco, Bruce Fad, Dan Ferens, Peter Korda, Paul Lubell, Chuck Mauro, Gerry McNichols, Clyde Perry, Sherry Stukes, Darryl Webb, and Hank Apgar) were invited to answer the question: 'What do you regard as the most significant parametric accomplishments of this century?'The most common responses were:

- Commercial parametric models, e.g. PRICE, SEER,
- Parametric Cost Estimating Initiative (PCEI), and
- Evolution of ISPA as a catalyst for knowledge sharing and methods review.

Perhaps the commemorative contribution during the 1990s was the Parametric Cost Estimating Initiative (PCEI). It began in January 1994 with an exploratory meeting initiated by Hq DCAA and with participation by DCMA plus 13 industrial organizations serving as Reinvention Laboratory Teams (as shown in Figure 5). These team agreed to participate in a laboratory experiment to determine the feasibility of the use of parametrics for improving the DoD procurement process. A series of meetings explored the barriers to utilizing parametric estimating methods for proposals due to regulatory and cultural barriers.

The objectives for the Reinvention Laboratory were:

- Identify opportunities for using parametric techniques.
- Test parametric techniques on actual proposals submitted to the Government.
- Develop case studies based on the best practices and lessons learned.

The documented results of the PCEI were:

- Addition of parametric-friendly wording to the Federal Acquisition Regulations (FAR).
- Numerous letters of support for parametric-based estimating from key DoD procurement executives.
- PCEI Newsletter issued during the reinvention phase that shared best practices and lessons learned.
- Parametric Estimating Handbook with the

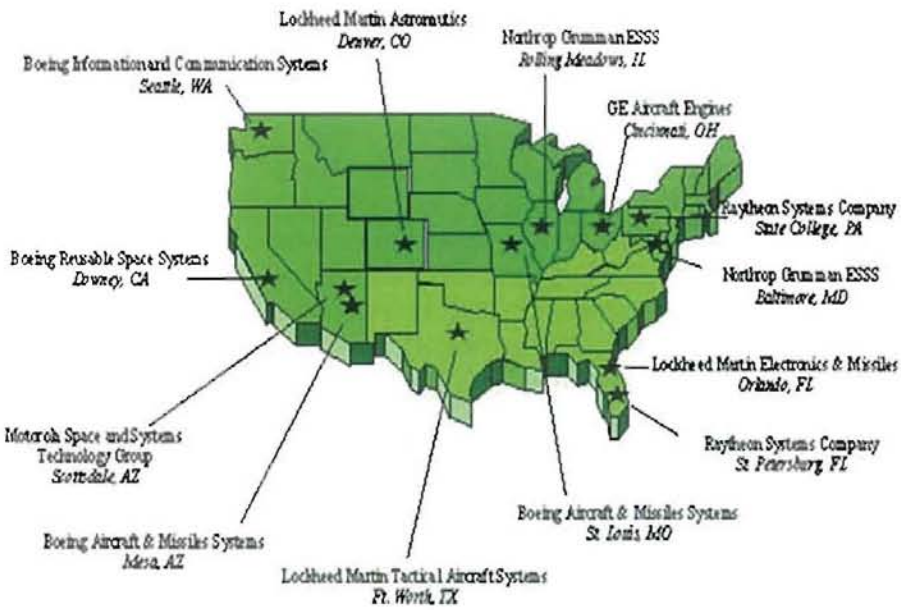


Figure 5: Reinvention Laboratory Teams in 1994 were located across the United States

Continued on page 10.

following attributes:
  - Identifies parametric principles, calibration and validation requirements, and guidelines for evaluation of parametrics-based Basis of Estimate documentation.
  - Incorporates lessons learned and best practices from Reinvention Laboratory sites
  - Sponsored by HQ DCAA and maintained by ISPA.
  - Now in its fourth edition.
- Incorporation of parametric-friendly 'Instructions To Offerers' in RFPs.

- Delivery of presentations at professional estimating conferences.

Success by the PCEI led directly to preparation of the ISPA Parametric Estimating Handbook (PEH) by a dedicated group of volunteers, first published in 1999 and now in its 4th edition. The PEH has been the standard reference for the ISPA Certified Parametrics Practitioner (CPP) exam and will be incorporated into the new ICEAA certification curricula.

The Laboratory results demonstrated that, when properly implemented, parametric estimating complies with the Government procurement laws and regulations including the Truth in Negotiations Act (TINA), the Federal Acquisition Regulation (FAR), and Cost Accounting Standards (CAS). Case studies and examples were developed based on the teams' best practices and lessons learned, and they are incorporated in the Handbook.

Eleanor Spector, Director of U.S. Defense Procurement, in her Office of the Under Secretary of Defense Policy Memorandum, in August 1999, released the famous 'Parametric Estimating' policy which endorsed (and encouraged) the use of parametric estimating methods for cost proposals. This step, two decades after the formation of ISPA, satisfied one of the primary reasons for our establishment.

EMPHASIS ON QUALITY: the 2000s

The Summer 2006 issue featured an invited article by Rich Hartley from his position as Deputy Assistant Secretary of the Air Force and the Chair of the Air Force Cost Analysis Improvement Group (AFCAIG), entitled 'What are Quality Cost Estimates?' in which he identifies the following areas to 'watch out for' when preparing government and contractor cost estimates:

- Lack of transparency associated with data sources or estimating methods used; failure to establish a clear track from actuals to estimates that can be reproduced by a knowledgeable reviewer.
- Use of piecemeal (partial) data or data that otherwise cannot be traced to auditable total program cost data.
- Use of selective data and estimating models from multiple sources; raises suspicion of 'cherry-picking' to get pre-desired results.
- Unrealistic risk-analysis results, not defining risk inputs precisely, or not tracing them to historical experience; not linking risks to potential cost impacts.
- Excessively detailed briefings to decision makers or inclusion in such briefings of information extraneous to the decision to be made.
- Failure to integrate schedule and time-phasing with the cost estimate.
- Lack of, or improper, calibration.
- Omitting cost elements (i.e., systems-of-systems level, systems engineering, and program management).

Then, in the Spring 2007 issue, Joe Hamaker, Director of the HQ NASA Cost Analysis Division, provided his response to the first 'What are Quality Cost Estimates?' article but adding his own most important attributes of quality in cost estimating to be:

- Sufficient reserve to cover the 'up morphs' that most projects undergo.
- Independent cost estimates performed by non-advocates.
- Top-level sanity checks.
- A management culture that desires good estimating.

These two quality-focused articles by government executives were quickly followed, in the Fall 2008 issue of the Journal of Cost Analysis and Parametrics (successor to the ISPA Journal), by a contractor perspective written by Richard Janda, Vice President of Program Assessment and Evaluation, Lockheed Martin. Richard believes consideration of the following challenges assure a quality cost estimate:

- Is the estimate based on objective data?
- Is the analysis honest?
- Are the data and analysis relevant?
- Is the basis of the cost estimate logical?

- Is the estimate accurate?
- Is the estimate holistic? Integrated? Complete?
- How well is the estimate communicated?

Then, in June 2009, Stephen Bagby, Deputy Assistant Secretary of the Army for Cost and Economics and the Director of the Army Cost and Economic Analysis Center (CEAC), entered the debate on estimating quality to describe the Army process to ensure the probable costs of its programs are adequately reflected in the budget.

Finally, in the Winter/Spring 2010 issue, Herve Joumier, Head of Cost Engineering at the European Cost Agency (ESA) describes estimating quality from the perspective of the cost engineering situation in Europe and its impact on the current state of the world economy.

Ricardo Valerdi, frequent ISPA Journal contributor and current co-editor of its successor, the *Journal of Cost Analysis and Parametrics (JCAP)*, attributes the growth of parametrics to the synergy between industry, government, and academia. He cites the continuing need by industry to better understand the total cost of ownership and to anticipate the opportunity to acquire cost databases from the many large programs being funded during the 1980s and 1990s. Industry began sharing their best practices through professional societies, such as ISPA and SCEA, which provided a neutral forum for knowledge sharing. The societies became an enabler for sharing knowledge and for integrating best practices in their training and certification programs.

In his Keynote Address to a joint ISPA/SCEA Southern California Workshop in March 2011, Dan Galorath expressed the opinion that future parametric cost estimating models would be data-centric, rather than CER-centric. Dan feels that the key to good estimating is access to objective, complete, relevant, and verified data. A recent illustration of this prediction may be found in the NASA Cost Analysis Data Requirement (CADRe) initiative for building space system cost databases. The CADRe documents the programmatic, technical, and life cycle cost information for Category I and Category II Flight Systems and Ground Support Projects. It is the NASA version of the Department of Defense Cost Analysis Requirements Description (CARD).

CONCLUSION

To answer the question posed at the beginning of this article: I believe we should declare success, based on the following observations:

- Parametric estimating methods have been not only accepted for support to the highest-level decision making, but are enthusiastically preferred.
- Professional parametricians provide the corporate business memory, in government and industrial organizations, and provide the most relevant and credible information for business decision making.
- More important to me are the personal relationships and international networking opportunities offered and developed over the past 35 years. We value the camaraderie and the challenges to have made a difference working together. Sadly, many of our society pioneers were last mentioned in previous *PW* stories because they have passed on.

Our legacy belongs to them.

POSTLOGUE

In preparing this article, I am reminded of the final battlefield scene in the Camelot musical play where, the evening before King Arthur concluded his political career, Arthur reminisced with Tom, a young boy:

'Each evening, from December to December,
Before you drift to sleep upon your cot,
Think back on all the tales that you remember
Of Camelot.
Ask ev'ry person if he's heard the story,
And tell it strong and clear if he has not,
That once there was a fleeting wisp of glory
Called Camelot'

Camelot Lyrics by Alan Jay Lerner, 1960

ISPA's Contribution: A Personal View

By Charles Hopkins

I came to cost estimating from the engineering side, and immediately got immersed in parametric costing. From my viewpoint, ISPA's founding helped solve a paramount problem that I had seen first-hand. The problem was solved by a new breed of cost analysts; these 'parametric analysts' represented a set of truly original thinkers. ISPA became the gathering place for people who solved the original problem and then went on to tackle the other major challenges of its time.

The Original Problem: Acquisition Costs

Hank Apgar's lead article identifies the pressing problem that helped motivate the founding of ISPA. Industry and Government needed a credible way to establish the magnitude of acquisition costs for future programs, particularly those that were outside the common experience. We also needed answers broader than a single cost value. In Hum Mandell's definition, we needed a true cost model. Such a model could establish not only a 'number' for acquisition cost, but also show the *combination of technical and managerial circumstances under which that estimate could be true.*

Our principal tool to find acquisition cost of a project had been grass-roots estimating, level by level; this is a highly manpower-intensive process that results in a single point estimate. The credibility of this process is highly dependent on the skill of professional estimators and the availability of valid analogs, and it still provides no insight on the programmatic/technical characteristics of the product.

I first saw this bottom-up costing process in operation in the early 1960s at General Dynamics in San Diego. We were working on a bid for the NASA RIFT nuclear rocket hardware development program (I was in the Program Office). Although I had no direct cost responsibility at that time, I saw Clyde Perry lead a team of estimators who swung through the company's functional departments building manpower estimates one department at a time. Not surprisingly, the estimate was excruciatingly detailed but inaccurate by orders of magnitude, as were those of all the other bidders. The problem was that RIFT was three times the size of any vehicle any of us had ever produced, and it operated in environments that were much more difficult to engineer. We had no basis for extrapolation. No wonder Clyde became a devoted advocate of parametric costing!

The next time I observed grass-roots costing (1975), the process was no different. By this time I was Lockheed's manager of Design to Cost for the Air Force IUS proposal. Finance teams roamed the halls building a grass-roots projection for this proposal. This estimate also turned out to be precise but inaccurate. Moreover, as the design-to-cost person, the grass-roots estimate was my only point of departure; this was a single-point production cost estimate. There was no tool to do trade studies, sensitivity analysis or any other DTC function.

Then in the mid 1970s Frank Freiman's PRICE model solved the dilemma of acquisition-cost credibility and traceability. In the process, Frank ended up recruiting an army of analysts who, like him, thought outside the box. (Luckily, Frank and many of his disciples ended up helping shape ISPA). But no sooner had Frank Freiman and company solved the acquisition-cost issue than three other problem areas emerged.

Software Costs

Software was an entirely new challenge for cost analysts. This was because software came to be applied to space, airborne and mobile platforms. These classes of software made possible autonomous operation of spacecraft, aircraft, ships and ground vehicles. We needed tools to evaluate them. But there was no repeatable way to use grass-roots for estimating these products.

Software, previously a topic peculiar to mainframe computer systems, became a cost estimating challenge when applied to the new compact computers for mobile hardware. PRICE Systems and others (Randy Jensen and Don Reifer come to mind) developed software cost-prediction models. ISPA joined the effort by collaborating on a historical data base of software characteristics that could serve as a platform for parametric cost analysis. This data base included product descriptors (application etc.) and software parameters (code size, productivity, language, and fraction of new design/code/test).

Technology Forecasting

As editor of the predecessor to *Parametric World* I got to see the emergence of yet another new area of analysis for the newly formed ISPA. This was the topic of complexity growth over time. Earlier cost analysts had identified 'Year of Technology' or 'Year of Introduction' as single variables to reflect cost growth over time.

Darryl Webb, who pioneered this branch of parametric analysis, called it 'technology forecasting' because once you have established a historical trend line of complexity growth over time then you can extrapolate future costs. Darryl published his earliest reports of this work in what was then the ISPA *Journal of Parametrics*. His work greatly expanded and refined previous analyses; for example, he showed that different classes of end items grow at different rates.

Lest you think that Darryl's work begins and ends with him, it turns out that in the UK Mr. Phillip G. Pugh had been pursuing a parallel line of inquiry. This research has been picked up by Mr. Dale Shermon, formerly of PRICE Systems UK, now of QinetiQ and was incorporated into an award winning presentation on Historical Trend Analysis at the 2003 ISPA SCEA conference.

Cost Uncertainty

Prior to ISPA, single-point cost estimates were normally presented either without any assessment of uncertainty, or at best a range that had been 'eyeballed' based on 'judgment' factors. I once asked why no Monte Carlo or comparable analysis was performed and I was told that there was no need to do so; the answer *had* to be normally distributed because the Central Limit Theorem applied. No thought was given to the likelihood that cost distributions might well be skewed! In recent years I have seen this question resurface and be resolved.

Many ISPA members have played key roles in overseeing the application of uncertainty to assessing the inherent risk underlying a cost estimate. In the early years of ISPA Jim Wilder and Bob Black published a paper in the *ISPA Journal* on Method of Moments as an alternative to Monte Carlo to calculate probability density functions.

But in recent years three of our members in particular have kept cost uncertainty in focus with frequent papers that instructed analysts on correct analytical approaches. The three were: Don Mackenzie, the late Dr. Stephen Book, and Dr. Christian Smart. As I recall, Don was the first of the three to publish; at the 1991 ISPA conference he presented a paper on use of a PRICE simulator to model the bounds of estimate uncertainty. He followed that with papers on specific problems of cost and cost risk, focusing on the knotty topic of correlation.

During the time that Dr. Steve Book was with us, he used the ISPA podium to (amongst other things) play 'sheriff' on identifying wrong analytical cost modeling practices. And most recently Dr. Christian Smart has translated the findings in Nassim Taleb's book *The Black Swan* into concrete procedures for cost uncertainty analysis in our domain.

Where We Are Now

ISPA has grown beyond my wildest expectations. 'Parametric Cost Analysis', or its equivalent in Europe 'Cost Engineering,' is now an established tool to forecast future cost. It has also become a profession all its own. Like any good idea it has attracted keen minds, and one innovator tends to stimulate still more. In my professional life, I was influenced by one of the most notable of these savants: Peter Korda. Peter had an engineer's approach to operating the PRICE hardware model. He augmented the tables in the PRICE user's manual with algorithms that made model results more plausible. Ultimately, he collaborated in creating a hardware parametric model (SEER for Manufacturing) that estimates cost down to individual manufacturing processes on the factory floor.

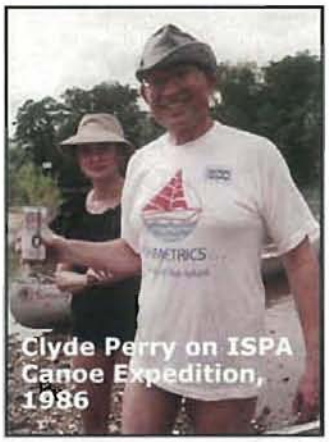
Another indication of ISPA's success is its global scope. The fact that ISPA is chartered as an international organization has borne fruit. Not many people know the role that ISPA's own Keith Burbridge had in making this happen. In an early assignment at Lockheed, Keith had led a team to European aerospace firms to foster standard US practices supporting hardware production on the Continent. So later when Keith was involved the formation of ISPA (organizational activities were always his strength) he naturally joined with others in advocating that our new society be international. In my professional lifetime, his vision has proved correct. Excellent parametric cost analysis is now being done around the world!

Freiman Award Winners in San Diego, 2002

Gary Constantine presents Best Paper Awards to Karen Lum and Jarius Hihn, 2002

Banquet Entertainment at Noordwijk, 2000

Discussion at Cannes, 1996



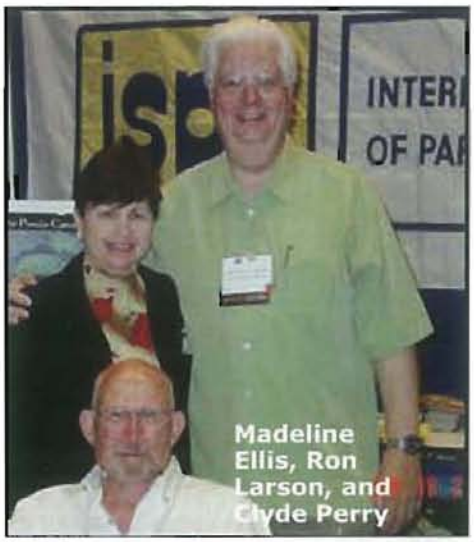
Clyde Perry on ISPA Canoe Expedition, 1986

Fourth Board of Directors, 1982

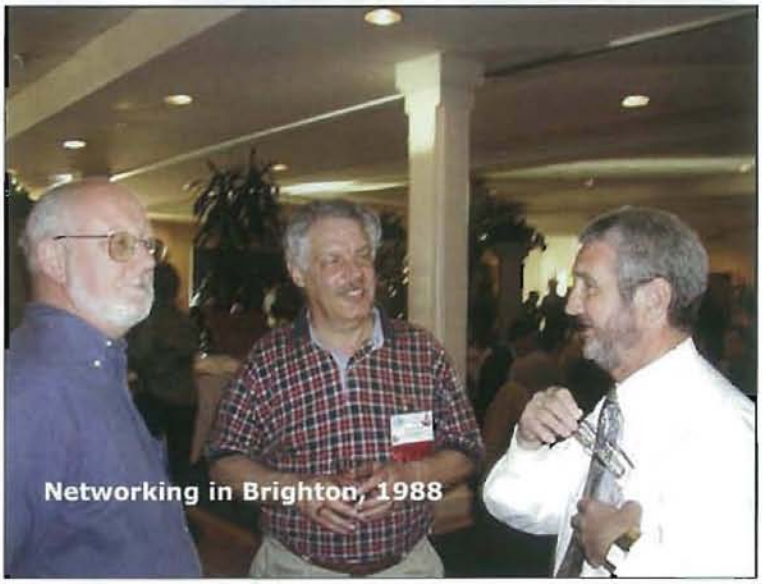
Conference Committee, Frascati, 2004, Herve Joumier, Sherry Stukes, Joe Hamaker

Clyde Perry and Fred Tucker working together on many of our conferences.

Stukes and Botta find Source Code.



Madeline Ellis, Ron Larson, and Clyde Perry



Networking in Brighton, 1988

Second Board of Directors, 1980

A Look Back...

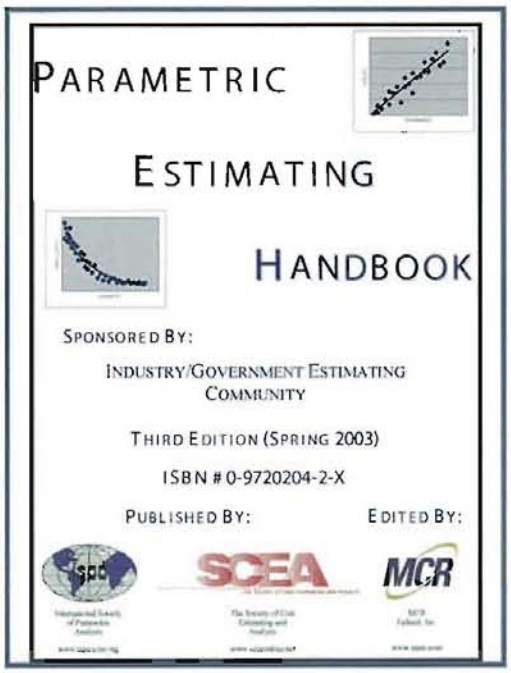
more photos on page 16.

Support by our exhibitors in Frascati, 2004

Support by our exhibitors in Frascati, 2004

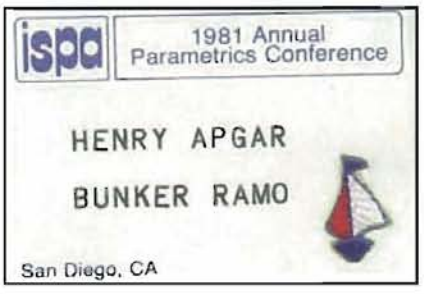
Nina Tahir

Charles Hopkins receiving Freiman Award, 2002



Early edition of Parametric Estimating Handbook (2003)

Freiman getting award from Jim Daschback, 1982



Name badge at third conference, 1981

A CAREER IN TECHNOLOGY FORECASTING: ISPA'S ROLE

By Darryl W. Webb

The energy of early parametric cost analysts (1975-1985) was driven by a curiosity that had no bounds and was truly passionate. Every dimension of cost engineering was material for new ideas, especially the search for underlying principals of performance, design, technology, reliability, and manufacturing processes as they related to cost. I cannot help but imagine that the same magnitude of emotional energy existed in the parametric cost community then as had occurred in the early years of flight. Of course I had no idea that participation in a new organization called ISPA would provide me with a sound foundation for a diverse and fulfilling career in technology forecasting.

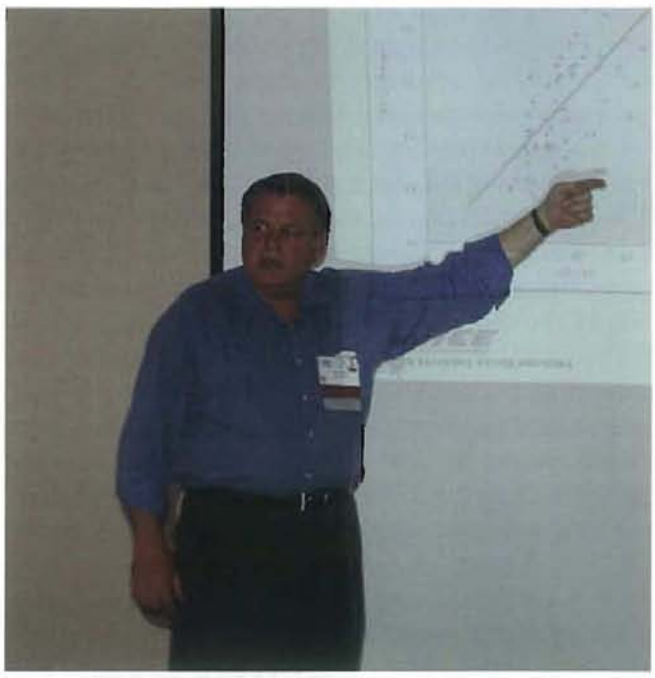
The first exposure I had to technology forecasting at ISPA was a commercial model's table of cost complexity factors for electronic equipment. The table listed vacuum tubes, discrete components, and several levels of integrated circuit density. Being a historian by nature, I attached the cost complexity values to time. A few years later I came across a graphic by the UK Ministry of Defense that plotted ship cost complexity values versus the year of initial operational capability. **Bingo!** The connection between time, technology, performance and cost was solidified in my thick head. In 1990 my next step was to publish in the ISPA *Journal* a hundred years of cost complexity trends for weapons, vehicles, ships, aircraft, and spacecraft.[1] That small feat cost 1,200 hours of research but changed the direction of my career. ISPA and parametric methods had given me license to study all engineering disciplines and every system manufactured since the industrial revolution.

The feedback received from that ISPA technology trends article journal sent me on a quest that expanded my research from cost complexity versus time to technology, performance, design trends, and design paradigm shifting. As a result my career expanded from independent cost evaluation to building models that predict performance, requirements, demand, supply, and cost. These predictions are used for Technology Readiness Level (TRL) assessment, critical technology analysis, demand and supply modeling, system optimization, advanced concepts, and war scenario development. These applications are then used to create technology-forecast driven decision frameworks that aid the government in acquisition planning and policy. Oh, what a road traveled from that first ISPA *Journal*!

Sadly, my shelf does not possess a collection of ISPA *Journals*. Upon receipt of every issue, each one was torn apart and the contents distributed through hundreds of file folders by subject. Although the *Journal* issues are not intact, I have used the valuable contents of the ISPA *Journal* (and its successors) faithfully every week of my career since the first issue.

Individuals that deserve acknowledgement for their contributions to my and others work in technology forecasting are Frank Freiman (PRICE Systems), Bob Solverson (Hughes), Gail Stalker and Frank Hoffman (both of Northrop). My respects and gratitude are extended to them, my ISPA associates, and the ISPA publications.

[1] Cost Complexity Forecasting: Historical Trends of Major Systems, Journal of Parametrics, Volume X Number 4, December 1990



CHRISTIAN SMART'S RESEARCH ON COST RISK, 2007-2012

By Dr. Christian Smart, Director Cost Est. & Analysis, Missile Defense Agency

The idea of a cost estimate as a random stochastic variable gained widespread use in the 1990s, thanks in part to the influence of Dr. Steve Book and Paul Garvey. In the last decade much attention has been paid to accurately measuring cost risk. In a series of papers, Dr. Christian Smart discussed issues with cost risk realism implied by empirical cost growth data, and presented ways to ensure that cost risk analysis is realistic.

In recent years there has been a significant amount of reliance on the 'portfolio effect' by government agencies, to such an extent that it has driven policy. The essence of this effect is that individual government projects can be funded at relatively low confidence levels, such as the 70th or even the 60th percentiles, which are popularly referred to as 'confidence levels,' but that the overall portfolio of multiple projects will have a much higher percentile, such as the 95th or the 98th percentile. This idea draws upon portfolio analysis for investments, as pioneered by economist and Nobel Laureate Harry Markowitz (Ref. 1). For example, if an investor buys stock in both Coca-Cola and General Dynamics, the overall portfolio risk is likely to be less than if the investor only buys stock in one of the two companies. This is because, while there are underlying factors that impact the stock of both companies, the stock prices are not perfectly correlated. For example, while General Dynamics is subject to the cyclical nature of defense spending, Coca-Cola is not and is therefore less subject to the impact of federal spending than General Dynamics. However, government projects have attributes that are unlike traditional investments. One of these differences is that cost for government projects may grow by more than 100%; that is, they can more than double. There are several instances where projects and programs have more than doubled or even tripled in cost. Notable examples include the Hubble Space Telescope and the Comanche Helicopter. This history of extreme cost growth for government projects led Dr. Smart to be skeptical of the portfolio effect and led to research that resulted in several papers presented at Joint conferences of ISPA and SCEA over the past few years. Two of these papers have been published in the Journal of Cost Analysis and Parametrics.

In *The Portfolio Effect Reconsidered*, (Ref. 2) Dr. Smart connected cost growth history with risk analysis. For the first time, empirical evidence was the basis for determining how much risk should be included in a cost risk analysis. The empirical evidence demonstrates that the amount of risk is much greater than used in examples to illustrate the portfolio effect. This paper suggested the cost growth history implied that cost risk distributions exhibit right skewness and have heavy right tails.

In 2007, Nassim Taleb published *The Black Swan: The Impact of the Highly Improbable* (Ref. 3), which indicated that market risks follow power laws. A power law is any polynomial relationship that exhibits scale invariance. Scale invariance means that the relationship does not vary as the scale changes. The implication is that market risks have much heavier right tails than would be predicted by a normal or even a lognormal distribution. Scale invariance and power laws are an important part of fractals, as introduced to the public in Benoit Mandlebrot's famous book *The Fractal Geometry of Nature*. (Ref. 4)

The Black Swan inspired Dr. Smart to apply power laws and fractals to cost risk, which resulted in a paper presented at the 2008 ISPA-SCEA Conference in Noordwijk titled *'The Fractal Geometry of Cost Risk.'* (Ref. 5) Applied to a sample of cost growth data for 40 NASA missions, cost growth was found to follow a power law. This was the first published evidence that cost risk may have a heavy right tail. This paper also introduced the notion of the 'Lognormal Paradox.' A lognormal distribution has a heavier right tail than a normal distribution. However, when budgeting to the percentile of a cost risk distribution, Smart showed that unless the percentile was above the 84th percentile, the normal distribution would require greater funding than a lognormal distribution, everything else being equal. Also for percentile funding, increasing the risk of a lognormal distribution results in less funding required. Imagine going to a manager, and reporting cost risk, and being asked to add a risk, and then going back and saying that the required funding had decreased! But that

is what can happen when budgeting to a percentile of a lognormal distribution. On the surface, this calls into question the applicability of the lognormal distribution to cost risk (but as demonstrated in later research by Dr. Smart, it actually points to deep structural problems with the practice of budgeting to percentiles). An expanded version of this paper was published in the *Journal of Cost Analysis and Parametrics* in 2012 (Ref. 6).

In 2009, Dr. Smart collected more cost growth data, as well as schedule growth data, for his paper titled *'The Portfolio Effect and the Free Lunch'* (Ref. 7). Using a data set of around 100 missions, Dr. Smart found that cost growth fit a lognormal distribution and did not follow a power law. He also showed that schedule growth is right skewed, just like cost growth, although it does not seem to be as extreme in magnitude as cost growth. In this paper, Dr. Smart introduced the notion of using measures other than percentile for cost risk. A prime example of this is expected shortfall, which is the amount that will be needed, on average, once a specified percentile of the cost risk distribution is exceeded. This idea was expounded upon in 2010 in *Here, There be Dragons: Considering the Right Tail in Risk Management* (Refs. 8,9).

In *Here, There Be Dragons*, Dr. Smart showed that budgeting to percentiles is problematic, since percentiles do not fully account for the right tail of the cost risk distribution. It is this property that causes the Lognormal Paradox. Thus it is no fault of the lognormal distribution, but rather the fault of using percentiles to measure cost risk, that leads to the Lognormal Paradox. Another problem is that budgeting to percentiles is not a risk management policy. Rather, it only indicates that there is a problem; it does not indicate what to do once a problem occurs. Also, percentile budgeting is not consistent. Rather than guaranteeing a Pollyannaish portfolio effect, it can actually lead to a reverse portfolio effect! That is, budgeting to a percentile of a portfolio can require more funds than needed for the sum of budgeting to the same percentile for individual projects. Expected shortfall, a widely used risk measure in the insurance industry, was shown to overcome all these defects. Expected shortfall accounts for the risk in the right tail, it guarantees a portfolio effect, and it provides not only an indication that an adverse condition has been encountered (the percentile), but how much additional money will be required once this condition is triggered (the expected shortfall beyond the percentile). *Here There Be Dragons* has been influential in cost risk analysis, and inspired the Naval Center for Cost Analysis' *S-Curve Tool* (Ref. 10) and Paul Garvey's *Expanded Scenario Based Method* (Ref. 11).

Two of the main lessons presented in Smart's papers from 2007-2010 were that realism in risk analysis should not be taken for granted, and that the portfolio effect is more apparent than real. In 2011, in *Covered with Oil: Incorporating Realism in Cost Risk Analysis* (Ref. 12), Dr. Smart demonstrated that typical cost risk analyses are not realistic and under-account for risk. Using an expanded data set of 289 Department of Defense and NASA missions, he showed that the lognormal provides an excellent fit for cost growth, and hence cost risk. Dr. Smart also showed how to use this information to calibrate cost risk analyses to realistic levels.

If the portfolio effect is a myth, that leads to the conclusion that in order to determine portfolio level risk, a true portfolio analysis must be conducted. In his 2012 paper *Trying To Do Too Much With Too Little: How Poor Portfolio Management Can Lead To Schedule Delays And Cost Overruns* (Ref. 13), Smart shows the importance of portfolio analysis, and provides a detailed example that the lack of portfolio analysis can be a significant source of cost growth. The lack of a sophisticated portfolio analysis leads to myopic selection of new projects, which leads to starting projects prematurely. This results in trying to manage more projects that can be afforded. This in turn results in funding constraints that cause schedule growth, which leads to cost growth. The bottom line is that there is no excuse for developing portfolio level risk analysis. The use of portfolio analysis by government agencies could go a long way towards solving the cost-growth epidemic.

References:

Markowitz, H., *Portfolio Selection: Efficient Diversification of Investments*, Wiley, Yale University Press, 1959.

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Smart, C.B., *The Fractal Nature of Cost Risk: The Portfolio*

Continued on page 31.

CALL FOR PAPERS

2013 ICEAA Professional Development & Training Workshop

New Orleans, LA • 18 - 21 June 2013

Submit your abstract by 11 January 2013

The Workshop Planning Committee will be accepting abstracts until 11 January 2013 for the 2013 ICEAA Workshop in New Orleans, LA. This event will be a great opportunity to demonstrate your expertise and contribute to the advancement of the profession, and we expect a high number of quality submissions, so be sure to submit your abstract early!

The 2013 Workshop Program Committee would like to present a wide variety of cost estimating and cost analysis topics, which will fall into the following Tracks:

- Hardware/Software Estimating
- Parametrics
- Risk Analysis
- Management
- Methods & Models
- Earned Value Management
- Life Cycle Cost Analysis

Deadlines:

- Abstract and Biography submission deadline - 11 January 2013
- Author Notification - 11 February 2013
- Paper/presentation and release form submission - 29 March 2013

Submission Process:

To upload materials, select the "Call for Papers" link under the Calendar menu on the SCEA website (www.sceaonline.org). For your abstract submission, you are encouraged to choose a desired Track designation for your paper.

For more information. . .

Contact Mel Etheridge, Programs Chair (metheridge@mcri.com), or Andrew Drennon, Deputy Programs Chair (adrennon@cobec.com).

ISPA Southern California Chapter News

By Kurt Brunner, President and Quentin Redman, Vice-President

It is with no small sadness, but also with an upbeat, positive, and optimistic outlook that we report on the final ISPA Southern California Chapter actions and workshop. The workshop forums have continued to draw a huge cross section of the parametric and cost analysis community while presenting the latest concepts and techniques. This forum has unfailingly produced energetic dialogues and great interest in the topics discussed. The excellent news is that the Southern California chapter of ICEAA will continue to operate in this same manner, with workshops that will include a notable and diverse group of extraordinary speakers, training, topics, and attendees. Our number one purpose has been and will be to 'To advance, encourage, promote and enhance the profession of cost estimating and analysis through the use of parametric analysis and other data-driven techniques for use by the membership as well as the general public'.

Our Summer Joint ISPA/SCEA Workshop was hosted by **Science Applications International Corporation (SAIC)** on 12 September 2012 in El Segundo CA. The speakers and topics at this workshop included:

- **Dr. Roberto Vasquez, Senior Vice President, National Security Space, SAIC:** 'Welcome to SAIC'
- **Michael Hickey, SAIC:** 'Contractor Estimating Systems: The Foundation for Producing Sound Estimates'
- **Greg Kiviat, Sikorsky Aircraft:** 'Enterprise Affordability through the Product Life Cycle'
- **Patrick Malone, MCR LLC, and Steve Sterk, NASA Dryden:** 'The Unique Estimating Requirements for Unmanned Aerial Vehicles'
- **Kurt Brunner, Tecolote Research, Inc.:** 'Basic Data Analysis Principles' *(Training Topic)*
- **Andy Prince, NASA Marshall Space Flight Center (MSFC):** 'Human Spaceflight Value Study'
- **Henry Apgar, MCR Technologies:** 'The Evolution of Parametrics in Parallel with the Maturing of ISPA'

The results of the ISPA/SCEA merger election were announced at this workshop with many of the International ISPA Board of Directors in attendance. In addition to briefing his award-winning paper, ISPA Chair Andy Prince spoke about the merger and the way forward.

Workshop Attendees — 12 September 2012 — SAIC, El Segundo

Pictured are the winners from the ISPA and SCEA membership drawings!

If you would like a copy of these or previous workshop briefings please go to the ISPA web site located at: ***www.ispa-cost.org*** under the Southern California Chapter Past Presentations. This will soon be merged with the SCEA website forming the new ICEAA website.

All available presentations are loaded on the web site immediately following the meeting. If you have any questions about the presentations please feel free to contact the workshop program coordinator, **Henry Apgar**, at hapgar@mcri.com.

Our Fall Joint ISPA/SCEA workshop planning is well underway. It will be hosted by **The Aerospace Corporation** in El Segundo, California and is to be held on 12 December 2012. There will be 'Best Paper' winners presenting their briefings from the Joint 2012 Conferences, and a training subject. An executive speaker from The Aerospace Corporation will also address the group. The provisional lineup of briefers and topics include:

- **Marilee Wheaton, General Manager, The Aerospace Corporation:** 'Welcome to Aerospace'
- **Lorrie Davis, The Aerospace Corporation:** 'Schedule Risk Analysis with the Aerospace QASAR Tool'
- **Kathy Watern, Air Force Deputy Assistant Secretary for Cost and Economics (acting):** "Should-Cost Estimating and Initiatives"
- **Mike Ross, Tecolote Research,** Award-Winning Paper from 2012 Brussels Conference: 'Joining Effort and Duration in a Probabilistic Method for Predicting Software Cost and Schedule'
- **Dr. Roy Smoker, MCR Technologies,** Award-Winning Paper from 2012 Brussels Conference: 'Use of EVM Trends to Find WBS Level 3 Completion Dates'
- **Don MacKenzie, Consultant,** Award-Winning Paper from 2012 Brussels Conference: 'Influential Data Points in Regression Analysis'
- **Ralph Smith, Lockheed Martin Aeronautics:** 'Optimum Cost Assessment Tool Roadmap for Lean Design'

The agenda was e-mailed to all ISPA and SCEA members and previous workshop attendees in October by the ICEAA (joint) office, and it contains a location map and driving instructions. The agenda is also posted on the ISPA web site. You may contact the Aerospace Corporation registration point of contact, Ms. Nora Spring at: *Nora.D.Spring@aero.org*, or (310) 336-1786 to register. As always, our workshops are free.

At the conclusion of the workshop, and as an incentive to stay until the last presentation is complete, a membership drawing will be held. Our Membership Chair, **Steve Sterk**, will be on hand with a selection of great gifts for the drawing 'winner must be present'. If you have questions about your membership status or would like information about membership in general, contact Steve at *steve.a.sterk@nasa.gov* or (661) 276-2377.

Please consider hosting a workshop or presenting at a

workshop! It will be a rewarding experience. If you are interested in hosting a workshop, please contact **Kurt Brunner** at *kbrunner@tecolote.com*, or **Quentin Redman** at *quentin.redman@pricesystems.com*. Also, if you are interested in making a presentation at a workshop, please contact our Program Coordinator, **Henry Apgar**, at *hapgar@mcri.com*.

The New SoCal ICEAA Chapter Bylaws and constitution are under construction and should be finalized by the time you read this. They are intended to be consistent (as previously stated) with the very successful model we have implemented. SoCal ICEAA Elections will be held soon, so keep your eyes open for announcements!

We would like to thank the SoCal board for their tireless teamwork in making the workshops a great success, as well as all the members and participants for their support over the years. Finally, and with a very heavy heart, we must let you know of Sherry Stukes' departure from the SoCal board. Sherry has been an energetic, upbeat, and encouraging volunteer under whose tutelage our organization has shown brightly, prospered, and grown. Our thanks go out to Dave Graham who has assumed her role as Secretary/Treasurer. As we look back on our association with ISPA, it has been the many involved, dedicated, and caring persons such as Sherry who have made ours a unique and wonderful society. Godspeed all, and we hope to soon see you all in the near future! It's been a great ride so far and it's only just begun!

Our Southern California Chapter Board consists of:

President, Kurt Brunner

Vice-President, Quentin Redman

Secretary/Treasurer, David Graham

Board Members

Hank Apgar (Program Coordinator)

Doug Howarth

Chris Hutchings

Mike Ross

Stuart Swalgen

We look forward to seeing you at the next workshop!

Kurt Brunner
President,
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Vice-President,
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ISPA Logos Over the Years

ICEAA International Cost Estimating and Analysis Association

Ask A Parametrician Q&A

EDITED BY: JOSEPH W. HAMAKER PHD, CPP®, CCEA®

This column has run in *Parametric World* since 2009 with the aim of featuring knotty cost analysis questions from members with answers provided by experts in the field. In this swan song edition of 'Ask A Parametrician' I want to feature brief snippets from some our better Q&A's from the past. I hope you enjoy it.

Question from the Winter 2010 Issue: *My Program Manager says he can do better than all [the] programs in the database and pushes back on my most likely [estimate]. He says the Agency can give back the extra year and return money to the taxpayers. What should I do?*

Answer: [As an estimator, if you] are convinced the Program Manager and his team are really high achievers, and that he has accounted for almost all risks that have a significant probability of happening, then [you] might go with a lower estimate. But those are pretty big 'ifs'. Alternately, if [you are] uncomfortable with these assumptions, [you] should go for the median (50% estimate). And if [your] intuition is that this Program may have more than the average problems, then educate the PM on unknown unknowns. Cap off [the] argument by advocating that enlightened PM's budget to the median or higher and then try to bring the Program in at the most likely; but few things are as bad as discovering halfway through implementation that there is insufficient budget to continue.

Question from the Spring 2010 Issue: *Does history support significant savings when technology projects precede the DDT&E phase?*

Answer: There is a general almost automatic belief that technology investment will reduce development, production, and/or operations cost. But this is not always the case. Sometimes the technology is needed just to make the project work and does not contribute to lowering cost. Even if the technology is one that is supposed to make things work better, if the project's thirst for performance outstrips the technology's ability to provide that performance, or the technology proves not to be as effective as believed, cost suffers. R&D to advance technologies must be specific to the program, or program planners will either re-do it or ignore it. It must also be planned into the overall program plan, with close monitoring by program team members to insure acceptance, and it must have adequate lead time.

Inserting technology into a program can certainly have negative consequences on cost. If the technologies are not mature at the start of development, schedule delays and standing-army costs will result that otherwise would not have occurred in the development program; meanwhile the project slows everything down to wait for the technology to catch up. One problem is that we always assume the technology is more mature than it really is.

When we estimate cost we view the object to be estimated through the eyes of a shopper in a store. To understand cost reduction, a different perspective is required. Cost arises from the doing of something. Cost and duration are quality measures of an *action taken upon an object. Cost is the measure of the effort* required to do something. *Duration is the measure of the time required* to do something. *Difficulty is a measure of the 'action taken upon' and complexity is a measure of the 'object'.* Together, *difficulty and complexity drive both cost and duration*: the greater the difficulty, the greater the cost and the greater the complexity, the greater the cost.

Note that and action upon an object can be described by the combination [verb phrase, noun phrase], known as a function. The doing of the function can be described by the combination (verb phrase, noun phrase), known as an activity or process. A high level example we are all familiar with is the process (develop, system). Thus, to reduce the cost of developing a system we need to reduce either the difficulty of the development or the complexity of the system. If a technology development project will decrease the difficulty of the development process, it will reduce the cost of (develop, system). *If a technology development project will decrease the complexity of the system without increasing the difficulty of developing the system, then it will reduce the cost of (develop, system).*

Question from the Summer 2010 Issue: *How can launch vehicles attain 0.9999 reliability one day?*

Answer: The answer to this question must address two different types of launch vehicle reliabilities in order to be complete: 1) the *inherent reliability* of a design and 2) the *demonstrated reliability* of a system. So the

simple answer to the question is: a launch vehicle will attain a 0.9999 *demonstrated reliability* when it has successfully flown 10,000 times without failure. Of course this is a trivial response; the questioner is actually more interested in how one attains the *inherent reliability* that would make such a feat possible some day. For this we need to examine why launch vehicles have not been able to achieve this feat to date.

The launch vehicle with the highest demonstrated reliability, if one does not consider the re-entry and landing portion of its flight, is actually the Space Shuttle, which has experienced only one ascent failure over 132 attempts so far giving it a demonstrated launch reliability of 0.9924, meaning that the Shuttle would have to fly successfully 9,868 more times in order to be the first launch vehicle to demonstrate a reliability of 0.9999. Thus we see one major impediment to achieving a 0.9999 demonstrated reliability i.e. *flight rate*.

The flight rate, I contend however, is correlated to the inherent reliability of the system design as demonstrated in Figure 1. As seen in the Figure, both the Soyuz and the Shuttle have roughly a 1 in 100 chance of failure ('two nines') on any given flight. Both the Soyuz and the Shuttle have very low flight rates, less than 10 times per year. On the other extreme, the major airlines collectively mount about 10 million flights per year worldwide and achieve reliabilities that are better than '6 nines'; less than 1 crash in a million flights (actually only 1 crash in several million flights). Between these two extremes there is another good data point; the Concorde, which flew roughly 4,000 flights per year and achieved nearly '5 nines' reliability; only 1 loss in about 80,000 flights over its lifetime. The plot of this data in Figure 1 suggests that reliability is highly correlated to flight rate. So not only do the mathematics of demonstrated reliability depend on large numbers of flights but the basic engineering impetus to build inherently reliable launch systems seems correlated to their flight rate; fly them more and one has the business incentive to make them more reliable as well as the luxury of amortizing the cost of reliability (both non-recurring and recurring) over a large number of flights.

So if flight rate and inherent reliability are correlated factors the question becomes how do we increase inherent reliability so that we can achieve 400 flights per year (this is the point on the curve in Figure 1 where the per mission failure probability is 1 in 10,000, or conversely, the reliability is 0.9999).

The main avenue for doing this is to use a completely reusable vehicle and increase design margins so that between flight maintenance and overhauls are minimized or completely eliminated. Design margins today are limited by the fact that approximately only 10% of the initial weight of a launch vehicle is structure, about 1% is the payload and/or crew with the rest being propellant. In order to significantly increase design margins the structure mass ratio must be increased to somewhere between, 20% to 30%. That is, the empty mass of the launch vehicle needs to be a lot 'beefier' so that engineers can be confident that it can take the punishment of repeated flights with minimal between-flight inspection and maintenance just the way airlines operate. Today, launch vehicles have to be very light weight and thus too fragile for repeated uses without the major overhaul between flights that the Shuttle is subjected to. Rockets need some technologies that allow more beef to be put into the structural parts of the vehicle. How can this be achieved? Most likely by engendering launch vehicles that use scramjets rather than rockets and take-off and land horizontally rather than lift-off vertically. This would allow the launch vehicles to take advantage of the oxygen in the air rather than having to load it on-board before launching.

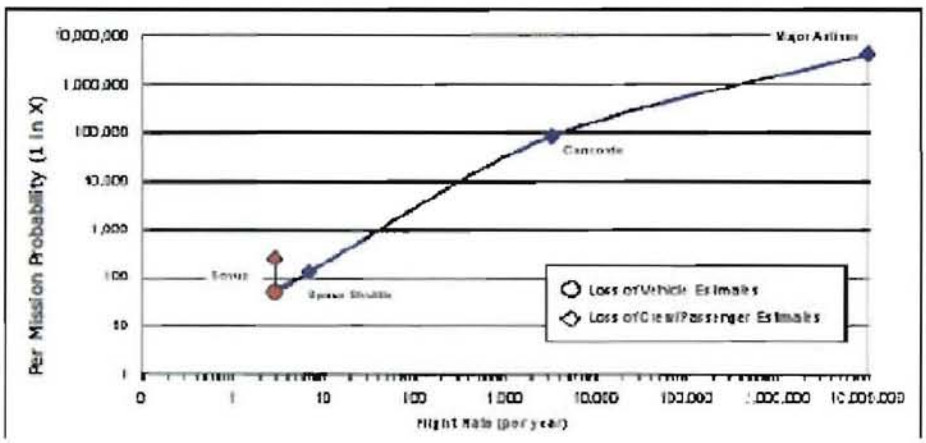

Figure1: Relationship between Mission Failure Probability and Flight Rate

Continued on page 26

Continued from page 25.

Question From the Winter 2011 Issue: *How do various senior estimators use performance measurement techniques, such as EVM or the performance baseline, against their parametric estimates to develop better budget estimates or spend plans on to-go costs? I've seen EVM basis used. I've seen a couple of other methods with more manual analysis of cost and schedule. I'm just wondering what the general consensus is (if there is one).*

Answer: First, do not look at Budgeted Cost of Work Performed, BCWP (Planned Value of Work Accomplished, as NASA used to call it). Also, do not consider Budgeted Cost of Work Scheduled, BCWS (Planned Value of Work Scheduled) at all. Just use Actual Cost of Work Performed, ACWP (same term in old NASA parlance).

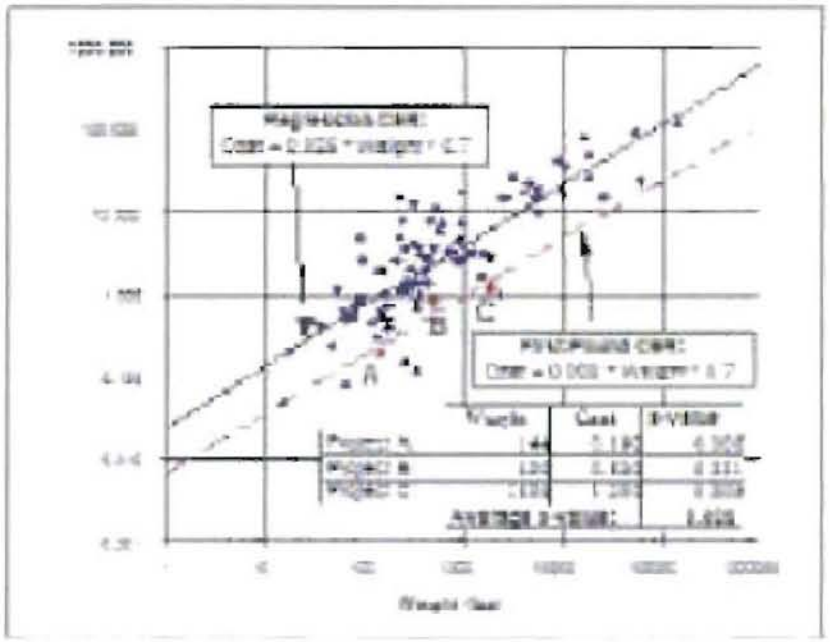

Figure 2. Example of CER calibration.

ACWP gives values that any cost estimator would use as actual data. Such date would be collected for a Cost Analysis Data Requirements (CADRe) document or any other data collection exercise. Keep in mind that the costs are in 'Then Year' dollars so data has to be brought back to some constant year dollar by using an inflation factor. There's always the problem of quality of the data when dealing with EVM data; so-called 'discipline' is often an issue on the EVM reviews.

An Estimate At Complete (EAC) developed using EVM data can serve as a comparison or cross-check against a parametric estimate; it can also as help provide a cost range. Put the EVM metrics to work and come up with an EAC if the performance of the work is still going on. The estimator has to be careful not to use an EAC that is based on a project that is less than 50% complete. Various researchers have concluded that the projections don't 'stabilize' until 60% or greater percent complete has been achieved. Some analysts have argued that space projects are an especially contrary breed and may not stabilize until about 80% complete (but remember that many space projects are "one-off" or very low production runs). Parametric estimates tend to work better very early on and can be used to supplement an EAC when the project or WBS being estimated is less than 20% complete.

Since EVM data is reported monthly, it is pretty straightforward to develop 'burn rates' to use as the velocity at which money is being spent. If you have an idea of the period of performance of the project being estimated, one can extrapolate the burn rates for the elements in question. Since the EVM data starts early in the project and continues over time, the estimator can pick different points in time as the contractor ramps up, goes peak and then ramps down his resource expenditures. Using this data stream makes the analyst's estimates more credible.

Question from the Summer 2011 Issue: *I decide to 'calibrate' my parametric CER to [a] known 'analogous' data point. Do I apply my normal growth to the analogous design and how do I adjust my estimating uncertainty bounds to account for the fact that I calibrated to an analogous data point?*

Answer: There are two sources of uncertainty that should be distinguished in this discussion. One is uncertainty about the model parameters (i.e. inputs or 'independent' variables) and the other is estimating uncertainty. Estimating uncertainty can be thought of as the uncertainty that is not explained by the model parameters (weight, heritage, etc.). It is variation about the trend line of the cost estimating relationship.

Calibration adjusts the cost estimating relationship so that it intersects the analogy. For an equation of the form Y=aX^b this means an adjustment to the 'a' value of the equation. In his question, Greg is using one data point for an analogy but any number of data points can be used. Figure 1 shows an example of using three

Continued on page 31.

CALENDAR OF EVENTS

December 12, 2012
Fall Joint ISPA/SCEA Workshop
El Segundo CA
Contact: Ms. Nora Spring at:
Nora.D.Spring@aero.org,
or (310) 336-1786 to register.

February 5, 2013
SCAF: Economics and Estimating
Royal Institution of Naval Engineers, London
Contact: ndmorrill@dstl.gov.uk
Or call 023 9253 7271

March 2013 (Date TBD)
Space Systems Cost Analysis Group
Spring 2013 Meeting
Southern California (Location TBD)
Contact: David Pine:
dpine2@cox.net

March 2-9, 2013
IEEE Aerospace Conference
Big Sky, Montana
Contact: www.aeroconf.org

March 27, 2013
AIAA Economics Technical Committee Workshop
The Jet Propulsion Laboratory
Pasadena, CA
Contact: Sherry Stukes,
818-393-7517 or
sherry.a.stukes@jpl.nasa.gov

April 23, 2013
The 2013 SCAF Estimating Challenge
BAWA Centre, Bristol
Contact: ndmorrill@dstl.gov.uk
Or call 023 9253 7271

June 4, 2013
SCAF: Quantitative Cost and Risk Analysis
Ashton & Lea Golf Course,
Preston, Lancashire
Contact: ndmorrill@dstl.gov.uk
Or call 023 9253 7271

June 18 – 21, 2013
2013 SCEA/ISPA Joint Annual Conference & Training Workshop
Sheraton New Orleans,
New Orleans, LA

September 2013 (Date TBD)
Space Systems Cost Analysis Group
Fall 2013 Meeting
Booz Allen Hamilton, Reston VA
Contact: David Pine:
dpine2@cox.net

In Witness whereof, I affix my Hand and Seal

Bryant Barnes

President

CODE OF ETHICS

I acknowledge that

I shall promote the understanding of parametric analysis methods and procedures.

I have an obligation to my fellow members to uphold the high ideals of the I.S.P.A. as outlined in its International Bylaws. I shall cooperate with my fellow members in the dissemination of knowledge pertaining to the general development of parametric analyses. I shall not use knowledge of a confidential nature pertaining to the business of a fellow members' employer to further my personal interest.

I have an obligation to my employer whose trust I hold; therefore, I shall endeavor to discharge this obligation to the best of my ability, to guard his interests and to advise him wisely and honestly.

I shall not engage in direct selling efforts during a regularly scheduled I.S.P.A. meeting unless specifically and officially invited to do so; I shall not be indiscreet in any of my dealings wherein the society or a fellow member is involved.

I have an obligation to my country, which in my personal, business and social contacts I shall uphold.

I accept these obligations as a personal responsibility and, as a member of this society, I shall actively discharge these obligations and I dedicate myself to that end.

This is the Code of Ethics, first published in 1980, and signed by first President, Bryant Barnes.

Membership Report

By Steve Sterk, CPP

The Merger

More than a handful of Parametric Practitioners came up at our last workshop in Southern California and spoke to me regarding the merger. As a member of the International Board of Directors, I want to reassure you that the merger is good for ISPA. Parametric analysis will always play an important role to the cost estimation process. We currently have 306 members worldwide; one-third of them are lifetime members, meaning two-thirds are actually paying annual dues and contributing financially to the success of the organization for over 34 years. The income generated from annual dues never was enough to sustain ISPA; we have always made the bulk of our revenue from annual conferences. From an accounting perspective, the larger the organization the larger the conference revenues. So it made sense for the merger to be ratified.

One of the core values within ISPA is being able to network with other professionals within the society. With the ratification of the merger our new association's network just became larger and presents itself with additional opportunity. Now is the time for change. As you all know, many of us either work in the Department of Defense or within the Space Industry. With the latest deficit reduction sequestration news, we all know there is a possibility that by the end of 2012, there could be a deep military cut and an automatic cut within the federal government to the tune of $500 billion dollars. A merged organization will have a better chance of survival should that happen.

The new association known as the International Cost Estimation and Analysis Association (ICEAA) will represent government agencies, universities, and over 180 organizations in 12 countries. ICEAA's membership ranges in experience from beginners to seasoned professionals. They are united by their interest in the practical application of grass roots or systems engineering build-up, cost estimation by analogy or by a parametric approach. ICEAA has chartered regional Chapters for technical workshops, training, and networking opportunities to meet and associate with others in our profession. ICEAA has also collected a library of over a thousand publications that could prove especially helpful to many new members. Parametric analysis employs equations that describe relationships between cost, schedule, and measurable attributes of systems, hardware and software. The equations describe how a product's physical, performance, and programmatic characteristics affect its cost and schedule. Parametric techniques have proven their ability to extrapolate from past and current experience to forecast the economic impact of fast-developing technologies. These techniques are applied using custom cost estimating relationships or commercially available tools.

ICEAA International Cost Estimating and Analysis Association

Other Membership News

Please welcome back Fred Missel who recently rejoined our professional society. He was a long-time ISPA member dating back to the 1990's. Fred is the final member to join the ISPA Society. He comes from Scottsdale, Arizona, and will retire from a successful career with Boeing. We look forward is working with Fred in the future.

The new ICEAA Logo (shown above) will be placed on the ICEAA Membership Application form. For renewals, heritage ISPA members will be given an ICEAA user account. From there, you will be able to renew you membership either online or by calling the National Office. The ICEAA National Office phone is 703-938-5090.

See you in Los Angeles at the ICEAA Workshop, on Wednesday, December 12th, 2012.

Steve Sterk (CPP)
ISPA Membership Chair
steve.a.sterk@nasa.gov
(661) 276-2377

ICEAA Secretary's Report

By Greg Kiviat
Secretary, ICEAA Pro Tem Board of Directors

The first meeting of the new ICEAA Pro Tem Board of Directors was held on October 20 with appointed representatives of the legacy ISPA and SCEA societies. The Pro Tem board will be replaced at the next ICEAA election in 2013 and, by agreement, no current Pro Tem executive board member will run for election in the first ICEAA election cycle.

ICEAA Pro Tem co-Presidents Paul Marston (former SCEA President) and Andy Prince (former ISPA President) opened the meeting challenging the board to create our new association with an open mind and going outside our individual 'comfort zones'.

As stated by Paul and Andy the objectives of the Pro Tem Board include:

- Serve association and its members
- Incorporate new objectives of the Association with a strategic plan and an upgrade to the Cost Estimating Body of Knowledge (CEBoK)
- Keep spirit of cooperation between legacy societies
- Set path for new association

To illustrate the scope of the ICEAA Board efforts here is a summary of the first ICEAA Board of Directors' meeting:

Financial health of the new society was reported by the legacy and pro tem Treasurers indicating positive results for the past and projections for future. The pro tem board will be developing a five-year financial plan to ensure ongoing health of the new association.

The 'I' of ICEAA was highlighted reflecting the international focus of the new association. The new board will be looking to strengthen our commitment and relationships with international members and other related cost societies. A reinvigorated outreach program will be implemented to the European cost community noting that CEBoK may be of real value to these groups. There are currently over 800 members of various European cost groups including legacy ISPA members.

Committee Chair selections were mostly completed for the various ongoing ICEAA committees including Certification, Chapters, Body of Knowledge, CEBoK updates, Strategic Planning, Outreach, Honors and Awards, Governance, Training, Special Interest Groups and Overseas Conferences.

The ICEAA Business Office report noted that the total combined membership between ISPA and SCEA is nearly 2400 and the new ICEAA web domain name is www.iceaaonline.org that is now running but will be continually updated as the association moves forward.

Elections for 2013 are being organized with electronic ballots to be distributed to the membership in February.

Reports on the 2012 conferences in Brussels and Orlando indicated an increase in both the quantity and quality of the papers presented. The 2013 New Orleans conference committees reported that the Call for Papers has been sent out and that the conference committee chair positions have been filled.

The draft of the ICEAA Strategic Plan objectives was presented and there were comments and discussion

A Request For Information (RFI) from potential suppliers to upgrade the CEBoK is in development. The CEBoK will be updated to also include the Parametric Estimating Handbook (PEH)

Legacy local regional chapters are merging their activities, as exemplified by the Southern California workshops, and sharing standard work templates across the new ICEAA organization

A Special Interest Group (SIG) will be formed to organize those in the new association with high interest in parametric estimating. This will be the first SIG organization within ICEAA.

It's clear that the new ICEAA board is motivated and actively moving to provide new and expanded benefits to the ICEAA. I am confident that combined membership of the new Association will work well together keeping an open mind to new ideas and moving beyond our past comfort zones to provide the benefits to the entire cost estimating community.

ISPA Milestones

Year	CONFERENCE			HONORS		
	Location	Joint with SCEA	Alternate SCEA Location	Clyde Perry Parametrician of the Year Award	Keith Burbridge Service Award	Frank Freiman Award
1979	Washington, D.C.					
1980	Cherry Hill, NJ					
1981	San Diego, CA			Robert Gaffney		
1982	Virginia Beach, VA			Keith Burbridge		
1983	St Louis, MO			Jim Wilder		Larry Putnam
1984	San Francisco, CA			Darryl Webb		Randy Jensen
1985	Orlando, FL			Sylvan Pinsky		Bill Cheadle
1986	Kansas City, MO			Henry Apgar		
1987	San Diego, CA			Clyde Perry		
1988	Brighton, England			Alan Mayer	Jack Griffin, Seb Botta	Barry Boehm
1989	Washington, D.C.				Henry Apgar	
1990	San Diego, CA			Dan Ferens	Cindy Castellana	Gerald McNichols
1991	New Orleans, LA			Marilee Wheaton	Clyde Perry	Don Reifer
1992	Munich, Germany			Peter Korda	Charles Mauro	Keith Burbridge
1993	San Francisco, CA				Nina Tahir	Peter Korda
1994	Boston, MA			Gary Constantine	Madeline Ellis	
1995	San Diego, CA			Bruce Fad	Seb Botta	
1996	Cannes, France			Meinolf Wenzel	Marilee Wheaton	
1997	New Orleans, LA			Sherry Stukes	Ron Larson	Tony DeMarco
1998	Toronto, Canada	Yes		Pierre Foussier		Henry Apgar
1999	San Antonio, TX	Yes		William Rutledge	Paul Lubell	Dan Ferens
2000	Noordwijk, Netherlands		El Segundo, CA	Georg Reinbolt	Sherry Stukes, Karen Davies	Don MacKenzie
2001	Washington, D.C.	Yes			Tom Brents	Dan Galorath
2002	San Diego, CA			Arlene Minkiewicz, Karen McRitchie	Gary Constantine	Charles Hopkins
2003	Orlando, FL	Yes		David Eck	Clyde Perry	Darryl Webb
2004	Frascati, Italy	Yes	City of Industry, CA	Jairus Hihn	Giancarlo Filippazzo	Joe Hamaker
2005	Denver, CO	Yes			Georges Teologlou	Steve Book
2006	Seattle, WA			Richard Stutzke	Quentin Redman	
2007	New Orleans, LA	Yes		William Brundick	Diana Patane	Humbolt Mandel
2008	Noordwijk, Netherlands	Yes		Hervé Joumier	George Stratton	
2009	St Louis, MO	Yes		Christian Smart	Hank Apgar, Madeline Ellis	Dale Shermon
2010	San Diego, CA	Yes		Tom Coonce	Kurt Brunner, Sherry Stukes	Neil Albert
2011	Albuquerque, NM	Yes		Roy Smoker	Doug Druley	Sherry Stukes
2012	Brussels, Belgium	Yes	Orlando, FL	Peter Frederic	Jason Dechoretz	Arlene Minkiewicz

Letter From Your Editor: Continued from page 2.

Sherry Stukes: Sherry was the one who coped with our many 'By the way could you...' requests.

Particular thanks go to all those of you who have faithfully supplied articles issue after issue: Andy Prince, Jason Dechoretz, Kurt Brunner, Steve Sterk, Arthur Griffiths, Rene Berghuis, Roy Smoker, Lisa Yedo and the rest. We have also had excellent support from the UK and the Continent, especially in our overseas conferences.

Operating out of readers' sight (but not mine) has been Allison Brown, the person who transformed *Parametric World* to the professional standard that Nina Tahir envisioned. When Allison joined us in 2004 the look of the magazine changed instantly. I never dreamed it could look so classy, both to the eye and to the intellect!

Charles Hopkins

Editor, *Parametric World*
charlesvhopkins9@aol.com

MADELINE ELLIS RECEIVES HONORARY LIFETIME MEMBERSHIP

As one of its last official actions, the ISPA Board of Directors, at its September 10-11 meeting, voted to award Madeline Ellis an honorary lifetime membership. Under the rules of merger, this honor will carry over to ICEAA. This recognition was based on a quarter-century of active support to the society. This honor has been bestowed upon only one other ISPA member: Frank Freiman in 1979.

Christian Smart's Research on Cost Risk, Continued from page 19.

Tail in Risk Management, The Journal of Cost Analysis and Parametrics, 5:2, 2012 (to appear).

Garvey, P., Flynn, B., Braxton, P., and R. Lee, *Development and Application of CV Benchmarks*, Presented at the Department of Defense Cost Analysis Symposium, February, 2011.

Flynn, B., Braxton, P., Garvey, P., and R. Lee, *Enhanced Scenario-Based Method for Cost Risk Analysis: Theory, Application, and Implementation*, Presented at the 2012 Joint ISPA-SCEA Annual Conference, Orlando, Fl, June 2012.

Smart, C.B., *Covered with Oil: Incorporating Realism in Cost Risk Analysis*, Presented at the 2011 Joint ISPA-SCEA Annual Conference, Albuquerque, NM, June, 2011.

Smart, C.B., *Trying To Do Too Much With Too Little: How Poor Portfolio Management Can Lead To Schedule Delays And Cost Overruns*, Presented at the 2012 Joint ISPA-SCEA Annual Conference, Orlando, FL, June, 2012.

Ask a Parametrician Q&A: Continued from page 24.

point should reduce most, if not all, of the uncertainty due to the a-value, or equation intercept, leaving only the standard error of the slope. When transformed linear least squares is used to estimate the equation's coefficients, there is a simple relationship, in log space, between the standard error of the estimate and the standard error of the slope. That relationship can be expressed mathematically as

SE(b) = SE(Y)/Sqrt(SS(XX))

That is, the standard error of the slope is equal to the standard error of the estimate divided by the square root of the sum of squares of the X-values and the average X-value. In the case of a weight-based CER, X = weight. Note that the standard error is in $ (or log($)), so the standard error of the slope is in log$/log(lbs.), so in order to get the units back to log$, SE(b) should be multiplied by the average of the log-transformed weights. This smaller uncertainty value can then be used to calculate the standard deviation of a lognormal distribution that reflects the adjusted slope-only estimating uncertainty of the CER.

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