



The SSCAG Legacy: Evolution of a Concept

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This is the first time publication of this paper; the PowerPoint version incorporates additional photos and exhibits

Abstract

Active partnership in the 2016 ICEAA International Training Symposium marks the final milestone of a spectacular forty-year journey of the **Space Systems Cost Analysis Group**. SSCAG provided a unique international forum for space-system cost analysts from the US, Europe, and Asia. Over those years, collectively more than 300 skilled cost estimators, business analysts, program managers, space engineers, and logisticians filled the international venues, at more than 100 scheduled meetings, to deliberate major issues associated with government and commercial development, deployment, and operation of manned and unmanned space systems.

Organized similar to earlier government/industry cost groups, such as the Aircraft Systems Cost Analysis Group (ASCAG), each employee represented his organization - government, industry, or academia - as SSCAG was an organization of organizations (US Air Force, NASA, ESA, Lockheed, Boeing, British Aerospace, MIT, Georgia Tech, et al). Organization membership was approved by application. Then, each organization was represented by one delegate and an alternate and took its turn as meeting host.

Credit for SSCAG success is given to (a) the timing (real need for non-advocate discussions of space system estimating process in light of then-limited cost experience), (b) the dedicated support by organizations and delegates (some participating over the full forty-year life span), plus (c) the evolutionary organization style based on responsive working groups (hardware, software, risk, et al.)

This paper, and its complimentary Power Point briefing, describes the birth of SSCAG, in words and photos submitted by early members, all of whom were pioneers in the economics of international space. Specific meeting agendas, meeting hosts, meeting venues, and distinctive products are described in this paper.

SSCAG products went on to influence major government and industry working procedures, such as MIL STD 881 (the space WBS appendix), recurring and non-recurring space cost definitions, a space systems software cost database, compendium of space hardware and software parametric cost estimating models, systems engineering desk reference, space operations cost database, space estimating rules of thumb, risk analysis methods survey, and space program acquisition policy.

The paper draws a parallel between SSCAG and contemporary cost estimating societies in order to trace their purpose, origin, ascent, and eventual decline - with supporters and intellectual capital transitioning to a more relevant alternate society. Examples include NES, ISPA, ICA, SCEA, ICEAA, AIAA Economics Technical Committee, and Government Cost IPTs.

Although this paper is offered for presentation at the final SSCAG meeting, the members and their intellectual capital will be preserved as the ICEAA Space Special Interest Group (SIG).

And so, the SSCAG legacy lives on.

Biography of Presenter

Henry (Hank) Apgar has been a SSCAG member since the second meeting in 1978. He served several leadership roles including Software Subgroup Chair, Risk Subgroup Co-Chair, and Steering Subgroup Chair as well as acting SSCAG Secretary after the untimely death of the first SSCAG Secretary.

Hank's SSCAG membership spanned three employers. He is currently Technical Director of MCR Technologies. He enjoyed a lifetime pursuing space program affordability and has acted as Affordability Manager for several international programs.

Hank has a BS degree in electrical engineering and an MBA. He is a founder and former President of the International Society of Parametric Analysts (ISPA). Hank is an AIAA Associate Fellow and an ICEAA Certified Cost Estimator/Analyst (CCEA). He prepared the Cost Estimating Chapter for the 2011 Space Mission Engineering Handbook (SMAD).



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Birth of a Concept

The Space Systems Cost Analysis Group (SSCAG) was created in 1978 by space systems cost analysis professionals representing government, industry and academia. Our charter, approved by the Air Force Systems Command's Space Division (now Space and Missiles Systems Center) proclaimed that we would:

- Foster the advancement of space systems cost analysis,
- Promote cost analysis techniques through the free interchange of ideas among its international membership, and
- Deliver products to its organization members and the international cost community.

SSCAG was born at a time of strong growth in applied parametric cost estimating techniques and the subsequent professionalism of those who promoted cost analysis as a distinct profession, with strong ties to engineering, economics, and management. Membership focused on information and techniques of interest to space system organizations, whose employees would take advantage of an open forum to discuss issues related to the science of estimating with the challenge to promote enlightened decision making based on the challenge of free and open discussion (excluding proprietary or classified information) about credible estimating and effective decision making. The intent was to exchange cost models and estimating techniques without disclosing proprietary or classified information. At the time, this organization style was little more than a concept.

A partial list of SSCAG **products** delivered over our forty-year life is shown in Figure 1.

Five years after its inception, more than 60 organization members were paying annual dues and hosting meetings such that its employee delegates could support the SSCAG mission as delegates assigned to subgroups. Host organizations took turns in hosting a meeting and the waiting list to host was sometimes 3 or 4 years long. Meetings generally followed a two-day agenda (three days on special occasion, such as international meetings which added host tours of their home facilities) to include featured general session presentations followed by working group sessions. Each meeting was generally followed by distribution of minutes of the meeting, including copies of presentation by all working subgroups. And so the organizational and professional concepts matured.

Much work was accomplished beyond its three two-day scheduled meetings per year by ambitious members of each of its **subgroups**, operating under elected leadership, and initially designated as:

- Administration (later renamed Steering Subgroup)

- Glossary, Space Cost-Related Terms
- Subgroup Handbooks:
 - Software Methodology Handbook
 - Hardware Cost Estimating Handbook
 - Risk Handbook
 - Systems Engineering Desk Reference
- SSCAG Software Database (SWDB)
- SSCAG Operations and Support Database (OSDB)
- Evaluation Reports
 - Compendium of Cost Analysis Models
 - Rules of Thumb
 - Evaluation of Government Acquisition Initiatives
- SSCAG Document Library (SAIC Huntsville – *still there*)
- FPGA Study (software)
- Annotated Bibliographies (software)
- Standard WBS for Space Systems
- Nonrecurring/Recurring Definitions
- “New Ways of Doing Business” (NWODB) Survey
- Risk Analysis Survey(s)
- Data Collection Guidelines

Figure 1 – Sampling of SSCAG products

- Data Acquisition and Dissemination (building and delivering cost and technical databases)
- Education (particularly the specialized training not available in universities or short courses)
- Hardware Methodology (including the review and evaluation of cost estimating models)
- Software Methodology (eventually the largest subgroup of all)
- Standardization (focused initially on a standard Space Systems WBS with definitions)

SSCAG's first **international** meeting (#9) was hosted by the European Space Agency (ESA) in Noordwijk, the Netherlands, in 1980, beginning a SSCAG tradition of bi-annual meetings outside the United States. Figure 2 illustrates our 80th meeting, hosted by Northrop Grumman in Redondo Beach.

A characteristic of the SSCAG organization was its **fluid structure**, wherein subgroups were retired when its goals were accomplished and the members reassigned to new subgroups to meet more stringent needs. New ad hoc subgroups were formed from time to time to address such issues as risk analysis, program acquisition, and systems engineering. In its early days, SSCAG members were invited to use an "instant mail" system, provided by RCA PRICE, so that work might continue outside scheduled meetings.

From its inception, SSCAG **focused on the products** which were freely disseminated among the member organizations and beyond. Several products were instrumental in shaping official US Government policy in areas of cost estimating, work breakdown structure with work package definitions, and procurement procedures. We are pleased to note that SSCAG publications are being maintained by the NASA Redstone Library in Huntsville, Alabama. Even without a formal journal or newsletter, SSCAG has published hundreds of documents, including papers, handbooks, evaluation reports (Consumer Report style), specialized bibliographies, acquisition recommendations, industry surveys, model compendiums, evaluation of government acquisition initiatives, estimating rules of thumb, and comprehensive databases (software lines of code, cost trends, estimating factors).

Figure 2 – 80th SSCAG Meeting in Redondo Beach (2004)



The First Meeting

Keith Burbridge, representing Lockheed Missile and Space Company (LMSC), responded to a lack of focus on **space** systems within the burgeoning interest in parametric cost estimating and cost model development. At a one-day workshop in 1977 in Sunnyvale, LMSC hosted an organizing meeting, attended by 45 invited estimators, program managers, engineers, and economists.

Colonel Conlin, then USAF Space Division Comptroller, persuaded General Richard Henry, Space Division Commander, to charter a joint government-industry working group to be called SSCAG. The second meeting was then hosted by Space Division in El Segundo. Chairmanship was to be rotated each year between USAF and NASA, and this role was later expanded to include European Space Agency (ESA) leadership. In 1982, General Alton Slay, Commander of Air Force Systems Command, officially confirmed government sponsorship of SSCAG. Early SSCAG Chairs included Colonel Lowell Maxwell (USAF), Colonel Dan Fitzgerald (USAF), Humboldt Mandell (NASA), David Pine (NASA), Joe Hamaker (NASA), Andy Prince (NASA) and David Greves (ESA).



Figure 3 – Keith Burbridge

During our first twenty years, Keith, shown in Figure 3, served officially as **SSCAG Secretary** but more importantly as SSCAG’s facilitator and promoter. Keith passed away in 1996.



Figure 4 – SSCAG Brochure

By 1984, our membership boasted 90 organization members (from the US, France, Germany, United Kingdom, Netherlands, and Israel), from which 115 of their delegates attend the 22nd meeting in Munich. Forty-five percent of our delegates considered themselves engineers. Our membership peaked during our first decade. A **brochure** was freely distributed among the international cost community to promote SSCAG’s mission and to encourage more organizations to join.

A list of all **107 SSCAG meetings**, with their hosts and locations, can be found in Appendix A.

The Ascent of SSCAG

The **SSCAG concept** was unique among working groups, professional societies, and Cost IPTs because of:

- Recognized growing interest in **space programs** (in US and Europe) for surveillance, communications, intelligence gathering, and broadcasting.
- Provided an **open platform** for exchange of ideas not currently available in government or industry; good for networking; enjoyed credibility; got best speakers.
- Assured a unique **international format** to reflect the global aspects of our space program, with minimal administrative overhead and maximum professional involvement.
- Benefited from unusually strong **professional leadership**, some leaders shown in Figure 5, which motivated continuous support from sponsoring organizations and enthusiastic participation by delegates.
- Early **partnerships** with professional societies, especially ISPA.

SSCAG also published periodic yearbooks and annual reports; two are shown in Figure 6.

SSCAG enjoyed a forty-year life (longer than most professional societies) and SSCAG was among the first US professional cost organizations to promote an international platform.

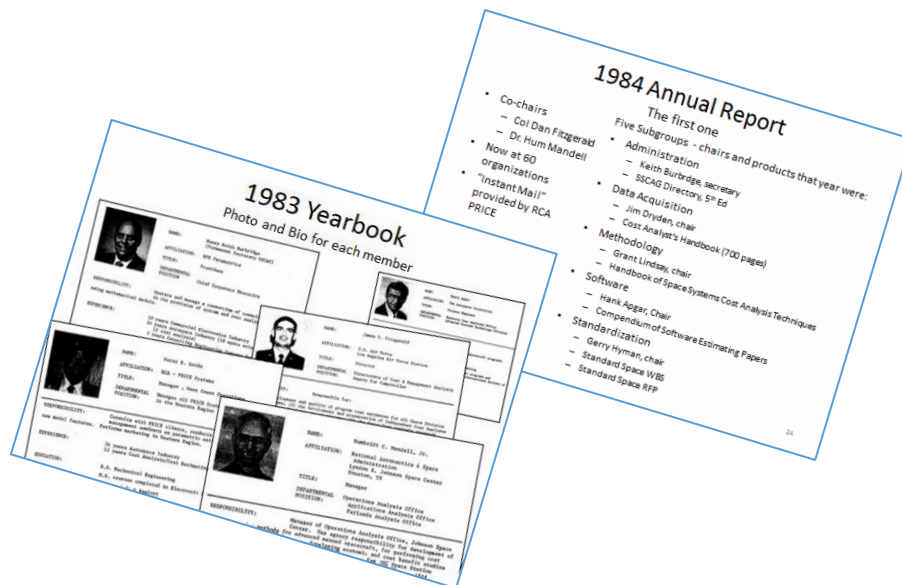


Figure 6 – First SSCAG Yearbook and Annual Report

Other Cost Estimating Organizations

SSCAG preceded chartering of ICEAA, ISPA, SCEA, and similar professional societies devoted to aerospace and military cost estimating. Most SSCAG members also supported one or more of these professional societies but found SSCAG to be especially rewarding due to the atmosphere of open discussions, its emphasis on space systems, and an unusually strong international comradery. A popular SSAAG publication was its annual Directory of Members, an uncommon benefit of current professional societies. The 2009 members' directory (with organizations and delegates) is shown in Appendix B.

It is interesting to note the evolution (ascent and decline) of US and international aerospace and military professional cost societies, as shown in Figure 7.

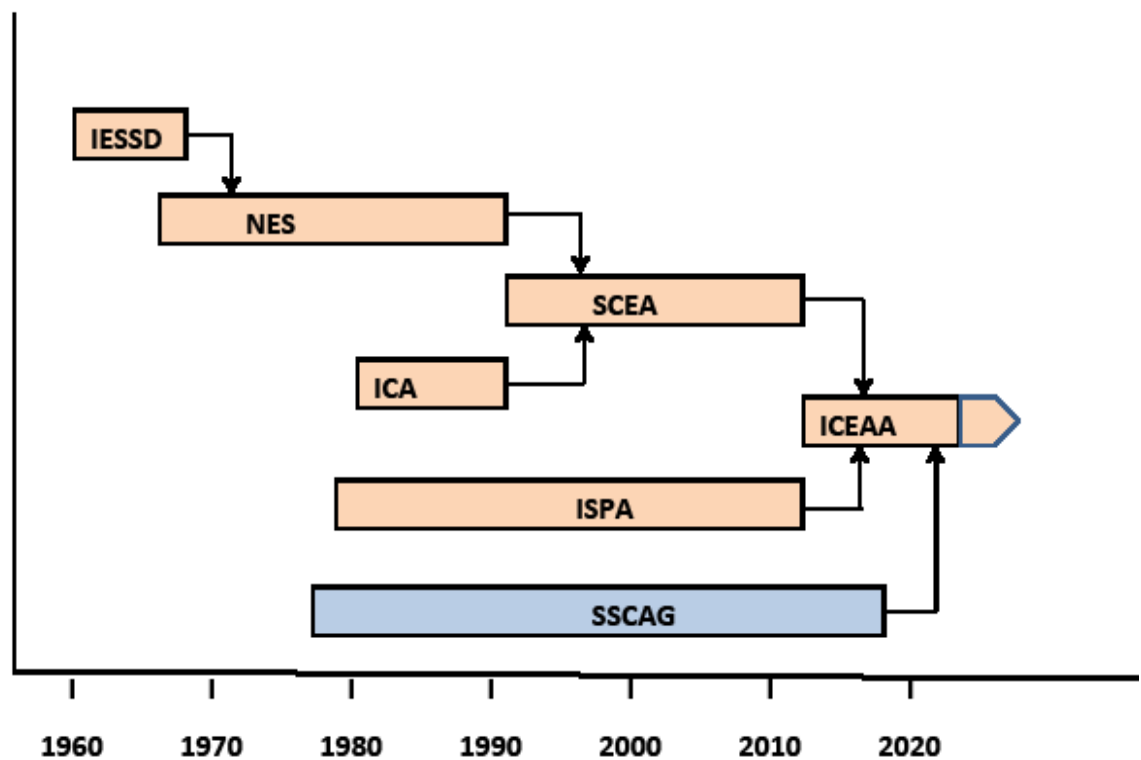


Figure 7 – Comparing lifetimes of US and international cost estimating organizations

My records show the earliest US professional cost society devoted to aerospace and military systems was chartered in 1960, when Roy Ashe of Convair recognized that any local cost estimating societies were devoted to civil engineering or construction projects and so he organized the **Industrial Estimating Society of San Diego (IESSD)**. There were 160 local estimators at their inaugural meeting. Six years later (in 1966), they merged with the new **National Estimating Society (NES)** to focus on cost engineering issues beyond aircraft and also to participate in a national organization.

SSCAG was chartered in 1977.



Figure 8 - SSCAG partnered with other professional organizations at international venues; see more graphics like these in the PowerPoint version of this paper.

Then, in 1978, 300 international cost engineers, with primary interest in parametric estimating methods, met in Washington DC to charter the **International Society of Parametric Analysts (ISPA)**. Their primary goal was to convince the US Government to allow parametric cost estimating methods to be used for cost proposals. SSCAG frequently sponsored international meetings, coincident with ISPA, as shown in Figure 8.

Since NES attracted mostly industry members, the US Department of Defense (DoD) in 1981, with support from government support contractors and FFRDCs, established the **Institute of Cost Analysis (ICA)**. Their first goal was to provide training at annual conferences.

Then, in 1990, NES and ICA merged to form the **Society of Cost Estimating and Analysis (SCEA)**. Reasons for the merger included the quest for economy of scale by holding one annual conference with similar training programs and a single management office. ISPA declined to join the merger at that time, citing their ongoing quest to promote wider use of parametric estimating techniques.

Finally, in 2012, SCEA and ISPA merged to form the **International Cost Estimating and Analysis Association (ICEAA)**, for some of the same reasons that NES and ICA had merged twelve years earlier.

Later, ICEAA invited SSCAG to assimilate as a Space Special Interest Group (SIG), perpetuating their legacy as a space systems estimating entity, to be effective in 2016.

The Decline of SSCAG

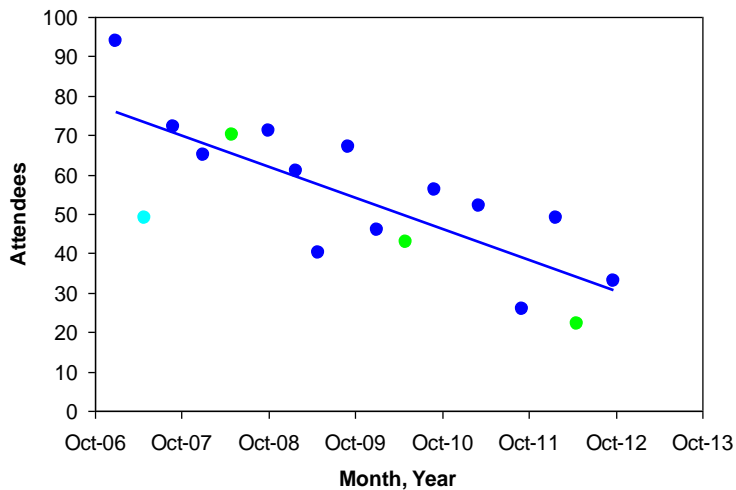


Figure 9 – Declining meeting attendance hampered SSCAG operations during the past ten years. Green dots are international meetings, blue dots are US meetings. (Data provided by Don MacKenzie)

limited to employees of the group and to their contractors. Some meetings were classified, further limiting participation, and the agendas were designed to be of primary interest to the government sponsor. Other competitors included the AIAA Economics Technical Committee and ICEAA.

Another reason was the general **downsizing** of the international space industry due to mergers, acquisitions, and travel budget reductions. When the SSCAG organizational charter limited membership to space organizations (or even organization-locations), we did not realize that there would be a declining base to attract from.

Still another reason was the impact of the **internet** and its promotion of virtual meetings. Why would a delegate need to travel across the country to attend presentations when he could dial in to those of which he would be most interested. This venue, of course, limited the opportunities for open discussions.

Our 73rd meeting was the first to be cancelled as it was scheduled for just one month after the infamous 9/11/2001 attack, causing a brief reduction in business travel. Subsequently, more planned SSCAG meetings were cancelled during 2012-2014 due to inadequate interest.

When it became obvious that SSCAG's future as a stand-alone organization was in jeopardy, the leadership explored opportunities to merge with other professional organizations so as to perpetuate our concept. Our first choice, determined in 2014, was to join **ICEAA** as a **Space Special Interest Group (SIG)**. This union will be consummated after our final (the 107th) meeting, with ICEAA in Bristol.

it's time to turn in your badge (Figure 10). But, our legacy endures.

By 2010, the number of SSCAG international organization members had declined to less than forty. Meeting attendance dropped from over 100 delegates to thirty, as shown in Figure 9. Several reasons have been offered to explain this decline.

The first reason is the rise of **competing** organizations for space cost engineers to support, many with government sponsorship and specialized agendas. For example, several government space system acquisition groups including SMC (one of the SSCAG founders), NRO, and NASA formed their own Cost Integrated Project Teams (IPTs) to which meeting attendance was



Figure 10 – So, it's time to turn in your badge

Appendix A – List of SSCAG Meetings

Meeting	Date	Host	Location
1	June 1, 1977	LMSC	Sunnyvale, CA
2	February 1, 1978	SAMSO (USAF)	Los Angeles, CA
3	May 1, 1978	SAMSO (USAF)	Los Angeles, CA
4	September 1, 1978	McDonnell Douglas	St. Louis, MO
5	January 1, 1979	Harris Corp	Melbourne, FL
6	May 1, 1979	General Dynamics	San Diego, Ca
7	September 1, 1979	Boeing Aerospace	Seattle, WA
8	January 1, 1980	NASA JSC	Houston, TX
9	May 1, 1980	European Space Agency	Noordwijk, Netherlands
10	September 1, 1980	Thiokol	Ogden, UT
11	January 1, 1981	RCA PRICE	Hollywood, CA
12	May 1, 1981	Grumman	Bethpage, NY
13	September 1, 1981	LMSC	Sunnyvale, CA
14	January 1, 1982	Martin Marietta	Denver, CO
15	May 1, 1982	British Aerospace	Stevenage, England
16	September 1, 1982	Planning Research Corp	McLean, VA
17	January 1, 1983	Aerospace Corp	Los Angeles, CA
18	May 1, 1983	NASA JSC	Houston, TX
19	September 1, 1983	Analytic Sciences	McLean, VA
20	February 1, 1984	JPL	Pasadena, CA
21	May 1, 1984	Sperry Defense	St. Paul, MN
22	September 1, 1984	MBB Erno	Munich, Germany
23	February 1, 1985	Rockwell International	Downey, CA
24	June 1, 1985	Morton Thiokol	Ogden, UT
25	September 1, 1985	RCA PRICE	Princeton, NJ
26	January 1, 1986	TRW	Redondo Beach, CA
27	June 1, 1986	French Space Agency (CNES)	Toulouse, France
28	September 1, 1986	NASA JSC	Houston, TX
29	January 1, 1987	LMSC	Sunnyvale, CA
30	June 1, 1987	Grumman	Bethpage, NY
31	September 1, 1987	McDonnell Douglas	St. Louis, MO
32	January 1, 1988	Harris Corp	Melbourne, FL
33	July 1, 1988	British Aerospace	Brighton Sussex, England
34	October 1, 1988	Space Division (USAF)	Los Angeles, CA
35	January 1, 1989	TRW	Rancho Bernado, CA
36	June 1, 1989	Air Force Institute of Technology	Dayton, OH
37	September 1, 1989	Mitre	Bedford, MA
38	January 1, 1990	Rand	Santa Monica, CA

39	June 1, 1990	European Space Agency	Noordwijk, Netherlands
40	September 1, 1990	General Dynamics	St. Louis, MO
41	January 1, 1991	JPL	Pasadena, CA
42	June 1, 1991	Air Force Academy	Colorado Springs, CO
43	September 1, 1991	EER	Huntsville, AL
44	January 1, 1992	Aerospace Corp	Los Angeles, CA
45	May 1, 1992	MBB DASA	Munich, Germany
46	September 1, 1992	Boeing Airplane Company	Seattle, WA
47	January 1, 1993	Harris Corp	Melbourne, FL
48	June 1, 1993	Loral Space	Palo Alto, CA
49	October 1, 1993	Grumman	Bethpage, NY
50	February 1, 1994	JPL	Pasadena, CA
51	June 1, 1994	French Space Agency (CNES)	Toulouse, France
52	October 1, 1994	Martin Marietta	Denver, CO
53	January 1, 1995	Thiokol	Ogden, UT
54	June 1, 1995	MCR	Washington, DC
55	October 1, 1995	Tecolote	Santa Barbara, CA
56	January 1, 1996	Phillips Lab	Albuquerque, NM
57	June 1, 1996	Aerospatiale	Cannes, France
58	October 1, 1996	SAIC	McLean, VA
59	February 1, 1997	EER	Santa Barbara, CA
60	June 1, 1997	Space & Missile Systems Center	Los Angeles, CA
61	October 1, 1997	LMMS	Sunnyvale, CA
62	January 1, 1998	Boeing	Cocoa Beach, FL
63	June 1, 1998	Rand	Toronto, Canada
64	October 1, 1998	Motorola	Phoenix, AZ
65	January 1, 1999	RCA PRICE	Santa Barbara, CA
66	June 24-25, 1999	Air Force Academy	Colorado Springs, CO
67	October 13-14, 1999	The MITRE Corporation	Bedford, Massachusetts
68	February 17-18, 2000	Tecolote	Ogden, UT
69	May 9-10, 2000	European Space Agency	Noordwijk, Netherlands
70	October 12-13, 2000	Boeing (Airplane Division)	Seattle, WA
71	February 7-8, 2001	Boeing (Rocketdyne)	Canoga Park, CA
72	July 11-12, 2001	Air Force Cost Analysis Agency	Arlington, VA
73	October 16-17, 2001 (Cancelled)	NASA Marshall Space Flight Center	Huntsville, AL
74	February 12-13, 2002	Space and Missiles Systems Center	San Pedro, CA
75	June 25-27, 2002	Italian Space Agency	Frascati, Italy
76	October 22-23, 2002	NASA Langley	Newport News, VA
77	March 4-5, 2003	Lockheed Martin	Sunnyvale, CA
78	July 29-30, 2003	Boeing	Huntington Beach, CA

79	October 29-30, 2003	NASA Marshall Space Flight Center	Huntsville, AL
80	January 28-29, 2004	Northrop Grumman	Redondo Beach, CA
81	May 13-14, 2004	Italian Space Agency	Frascati, Italy
82	November 17-18, 2004	NRO/Wyle Laboratories	Chantilly, VA
83	Feb. 23-24, 2005	Harris Corp.	Melbourne, FL
84	July 20-21, 2005	Tecolote Research	Santa Barbara, CA
85	November 16-17, 2005	Lockheed Martin	Denver, CO
86	March 1-2, 2006	Space & Missile Systems Center	San Pedro, CA
87	May 22-23, 2006	Boeing	Seattle, WA
88	September 19-21, 2006	SCAF/EACE	London, UK
89	January 17-18, 2007	RAND	Santa Monica, CA
90	May 16-17, 2007	Canadian Space Agency	Quebec, Canada
91	September 25-26, 2007	PRICE Systems	Arlington, VA
92	February 6-7, 2008	General Dynamics	Phoenix, AZ
93	May 15-16, 2008	European Space Agency	Noordwijk, Netherlands
94	October 15-16, 2008	Booz Allen	Reston, VA
95	February 4-5, 2009	Galorath	El Segundo, CA
96	May 6-7, 2009	NASA Langley	Hampton, VA
97	September 16-17, 2009	Pratt & Whitney Rocketdyne	Canoga Park, CA
98	January 20-21, 2010	Raytheon Missile Systems	Tucson, AZ
99	May 11-12, 2010	German Space Agency (DLR)	Berlin, Germany
100	September 28-29, 2010	MCR	Herndon, VA
101	March 30-31, 2011	JPL	Pasadena, CA
102	September 21-22, 2011	Wyle	Chantilly, VA
103	February 7-8, 2012	Galorath, Inc	El Segundo, CA
104	May 17-18, 2012	Joint with ISPA	Brussels, Belgium
105	October 18-18, 2012	NASA Hq	Wash DC
106	May 14-15, 2013	Boeing	El Segundo, CA
107	October 18-20, 2016	Joint with ICEAA, SCAF, EACE, APM, DACE ACostE, NESMA, IFPUG	Bristol, UK

Appendix B – Membership Directory – 2009

<u>Organization Members</u>	<u>Location</u>	<u>Delegate</u>
ACSG	Yorktown, VA	David Pine
Adv. Concepts & Technologies	Dayton OH	Michael Niggel
Aerospace Corporation	Chantilly VA	Rosemary Hsu-Brooks
Aerospace Corporation	Los Angeles CA	Mel Broder
Air Force Cost Analysis Agency	Arlington VA	Bill Seeman
Air Force Space Command	Peterson AFB CO	Jim Ball
Applied Physics Laboratory	Laurel, MD	Larry Wolfarth
Astrium Ltd.	Stevenage, UK	David Lewis
AT&T Gov't Solutions	Santa Barbara, CA	Ned Dodson
Ball Aerospace Technology Group	Boulder, Co	Gary Zarlengo
Boeing IDS Home Off.	Seal Beach CA	Pat Corcoran
Boeing Space & Intelligence	Seattle WA	Ken Vergowe
Boeing Missiles & Space	Huntsville AL	Hollis Black
Boeing SD&A Affordability	Huntington Bch, CA	Elizabeth O'Donnell
Boeing West Hills	Canoga Park CA	Miles Nesman
Boeing Space & Intelligence	Seal Beach CA	Steve Cohen
Booz Allen Hamilton	Los Angeles CA	Tim Hohmann
Booz Allen Hamilton	McLean, VA	Ian Brown
Booz Allen Hamilton	Fredericksburg,VA	Terry Vogt
Canadian Space Agency	Montreal, Canada	Ziad Ali
CMS Information Services	Vienna VA	Bob Lindley
Defense Contract Management Agency	Alexandria VA	Donald Reiter
DFV Group	Virginia Beach VA	Ed Dean
Electronic Systems Command (Space)	Peterson AFB CO	NEED INFO
European Space Agency	Noordwijk NL	Herve' Joumier
Futron Corp.	Bethesda, MD	Michael Kanaby
Galorath Inc.	El Segundo CA	Dan Galorath
General Dynamics Adv. Info Sys.	Mountain View CA	Jeffrey Leap
General Dynamics AIS/ISS	Gilbert AZ	Crystal Whitlatch
German Space Agency	Bonn, Germany	Gerd Goelz
Grant Thornton LLP	Alexandria, VA	Andy Lieber
Harris Corporation	Malabar FL	Bill Vitaliano
Hopkins Consulting	Cupertino CA	Charlie Hopkins
Hulett & Associates	Los Angeles CA	David Hulett
IC CAIG	Washington DC	John Georges
Institute for Defense Analyses	Alexandria VA	David Nicholls
Italian Space Agency	Rome Italy	Giancarlo Filippazzo
Jet Propulsion Laboratory	Pasadena CA	Leigh Rosenberg
Lockheed Martin Space Systems	Sunnyvale CA	George Barbic
Loral Space Systems	Palo Alto CA	Garry Jackson
MacKenzie Consulting	Santa Rosa, CA	Don MacKenzie
Mainstay Software	Englewood CO	Dan Walkovitz
Mass. Inst. Of Technology	Cambridge, MA	Ricardo Valerdi
MCR Technologies, LLC	El Segundo CA	Hank Apgar
MCR	Huntsville, AL	Rod Duke
MCR Federal, LLC	McLean VA	Tim Anderson
Missile Defense Agency	Alexandria VA	Paul Grim
Mitre Corporation	Bedford MA	Mark Fortune
Mitre Corporation	McLean VA	Jim Bui
NASA-Headquarters	Washington DC	Tom Coonce
NASA-IPAO	Hampton VA	Richard Greathouse
NASA- Johnson Space Center	Houston TX	Oscar Gutierrez
NASA-Langley Research Center	Hampton VA	Hernani Tosoc
NASA-Marshall Space Flight Ctr.	Huntsville AL	Andy Prince
Naval center for Cost Analysis	Washington, DC	Duncan Thomas
Northrop Grumman ESS	New Freedom PA	Richard Basner
Northrop Grumman PRC	Huntsville AL	Maureen Kelley
Northrop Grumman TASC	Los Angeles, CA	Michael Butterworth
Northrop Grumman TASC	Huntsville AL	Heidi Rose
Northrop Grumman Mission Systems	Redondo Beach CA	Steven Wong
Northrop Grumman Sensor Systems	Azusa CA	Bruce Shoemaker
Northrop Grumman Space Technology	Redondo Beach CA	Steve Huniu
Northrop Grumman	El Segundo CA	Tom Harwick
Northrop Grumman	Sacramento CA	Dennis Vronay

National Reconnaissance Office	Chantilly VA	Keith Robertson
Office-Dir. Of Nat'l Intelligence	Washington, DC	Jim Fuime
Oracle	Denver, CO	Dennis Furbush
Pratt & Whitney Rocketdyne	Canoga Park, CA	Stuart Swalgen
PRICE Systems	Cherry Hill, NJ	Siobhan Kernan
PRICE Systems	Dayton OH	Jim Otte
Quaternion Consulting	Arlington, VA	Paul Cymerman
R2Estimating	Phoenix, AZ	Michael Ross
Rand Corporation	Santa Monica CA	Mel Eisman
Rand Corporation	Washington, DC	Bernard Fox
Raytheon Missile Systems	Tucson, AZ	Tim Christopherson
RCI	Torrence CA	Don Reifer
Resource Calculations	Wales, UK	Tony Collins
Science Applications International Corp.	Huntsville AL	Sharon Winn
Science Applications International Corp.	Cocoa Beach, FL	Joe Hamaker
Skybridge	Cedex France	Pierre Fraise
Software Tech Support Center	Hill AFB UT	Randy Jensen
Space & Missiles System Center	El Segundo CA	Paul Killingsworth
Target Software	Los Altos CA	George Bozoki
Tecolote Research	Manhattan Beach CA	Nick Lozzi
Tecolote Research	Santa Barbara CA	Darren Elliott
Tecolote Research	Chantilly, VA	Larry Zebell
Tecolote Research	Albuquerque, NM	Brian Berry
University of Southern California	Los Angeles CA	Barry Boehm
Wyle Inc.	Chantilly VA	Mary Sue Collins

Appendix C – Acronyms

FFRDC	Federally Funded Research & Development Center
ICA	Institute of Cost Analysis
ICEAA	International Cost Estimating and Analysis Association
IESSD	Industrial Estimating Society of San Diego
IPT	Integrated Project Team
ISPA	International Society of Parametric Analysts
NES	National Estimating Society
SCEA	Society of Cost Estimating and Analysis
SIG	Special Interest Group
SSCAG	Space Systems Cost Analysis Group