

Minutes
Rigging Working Group
Friday, 20 January 2006
Dallas/Ft. Worth Airport Marriott South
Ft. Worth, Texas

Presiding chairman: Bill Sapsis; Sapsis Rigging, Inc.; P; U

Recording secretary: Karl G. Ruling; ESTA

Members attending:

William Conner; Bill Conner Associates LLC, representing the Amer. Society of Theatre Consultants; P; U
William Bradburn; Clowes Memorial Hall (Butler University); P; U
Charlie Weiner; P; U (new representation at this meeting)
Don Dimitroff; Columbus McKinnon Corp.; P; MP
M. Brad Dittmer; Downhome Productions; P; U
Joseph Champelli; Fisher Technical Services, Inc. (FTSI); P; CP
Reid Neslage; H & H Specialties Inc.; P; MP
Edwin S. Kramer; I.A.T.S.E. Local 1; P; U
Kent H. Jorgensen; IATSE Local 80; P; G
Rodney F. Kaiser; J.R. Clancy Inc.; P; CP
Mike Garl; James Thomas Engineering, Inc.; P; MP
Harvey Sweet; LA ProPoint, Inc.; P; DR
William Beautyman; Limelight Productions, Inc.; P; DR
James B. Evans; Mountain Productions Inc.; P; DR (joined at this meeting)
Tim Hansen; Oasis Stage Werks; P; DR
Richard J. Nix; Performance Systems Integration; P; G
Ron Bonner; PLASA; P; G
Dan Culhane; SECOA; P; CP
Steve Walker; Steve A. Walker & Associates; P; G (joined at this meeting)
Shawn Nolan; Entertainment Structures Group (Steven Schafer Associates); P; G
Christine L. Kaiser; Syracuse Scenery & Stage Lighting Co., Inc.; P; DR
James Niesel; Theatre Projects Consultants, Inc.; P; G
Jeff Wilkowski; Thern, Inc.; P; MP
Keith Bohn; Tomcat USA, Inc.; P; MP
Pete Happe; Walt Disney Imagineering (Walt Disney Company); P; U (voting status change at this meeting)

Visitors: None

1 Opening remarks

Bill Sapsis called the meeting to order at 19:02.

2 Attendance and membership

2.1 Introduction of those present

Those present introduced themselves.

2.2 Circulation of attendance sign-in sheet

A sign-in sheet packet, with some pages a dull green and some a bright blue, was circulated. Those present were instructed to find their names and place a check mark in the "Present?" column.

2.3 Call for quorum

Sapsis asked for a show of hands of voting members. He quickly counted them and then announced that a quorum was present and the group could conduct business.

2.4 Requirements for membership

The following statement was read aloud to the assembly by Bill Sapsis:

"Membership is open to all who are affected by the work of the group. People who would be in the dealer/rental company or user interest groups are particularly encouraged to join. However, voting members are required to attend meetings. Any principal member and voting alternate who both miss three consecutive meetings will have their membership status changed to observer. This action will be taken as the last item of business at each meeting and recorded in the minutes of that meeting."

3 Processing of new membership requests

The following people had applied for working group membership:

James Evans; Mountain Productions; principal; dealer/rental company

Steve Gonella, City of Phoenix; observer; user

Steve Walker, Steve Walker and Associates, Principal, general interest

Bob Medve, Limelight Productions, alternate; dealer/rental company

Charlie Weiner; Charlie Weiner; principal; user (change of company represented)

Pete Happe, Walt Disney Imagineering; principal; user (change of voting status)

Harvey Sweet moved that the applications be accepted. The motion was seconded. The motion was approved by a unanimous show of hands.

The consensus body during the period of this meeting was thus:

Name	Company	Representing	Voting status	Int. cat.
William Conner	Bill Conner Associates LLC	Amer. Society of Theatre Consultants	P	U
William Bradburn	Clowes Memorial Hall	Butler University	P	U
Charlie Weiner	Charlie Weiner	Charlie Weiner	P	U
Ted Jones	Chicago Spotlight, Inc.	Chicago Spotlight, Inc.	P	U
Don Dimitroff	Columbus McKinnon Corp.	Columbus McKinnon Corp.	P	MP
Wally Blount	Columbus McKinnon Corp.	Columbus McKinnon Corp.	A	MP
Howard R. Ott	D.E.O. Associates, Inc.	D.E.O. Associates, Inc.	P	G
M. Brad Dittmer	Downhome Productions	Downhome Productions	P	U
Joseph Champelli	Fisher Technical Services, Inc.	FTSI	P	CP
Reid Neslage	H & H Specialties Inc.	H & H Specialties Inc.	P	MP
Jeffrey Hoffend	Hoffend & Sons, Inc.	Hoffend & Sons, Inc.	P	CP
Peter Hoffend	Hoffend & Sons, Inc.	Hoffend & Sons, Inc.	A	CP
Damon Atwood	Hoffend & Sons	Hoffend & Sons, Inc.	A	CP
Edwin S. Kramer	I.A.T.S.E. Local 1	I.A.T.S.E. Local 1	P	U
Kent H. Jorgensen	IATSE Local 80	IATSE Local 80	P	G
Rodney F. Kaiser	J.R. Clancy Inc.	J.R. Clancy, Inc.	P	CP
Jack Suesse	J.R. Clancy, Inc. (NC)	J.R. Clancy, Inc.	A	CP
Thomas S. Young	J.R. Clancy Inc.	J.R. Clancy, Inc.	A	CP
Mike Garl	James Thomas Engineering, Inc.	James Thomas Engineering, Inc.	P	MP
Tray Allen	James Thomas Engineering, Inc.	James Thomas Engineering, Inc.	A	MP
Harvey Sweet	LA ProPoint, Inc.	LA ProPoint, Inc.	P	DR
William Beautyman	Limelight Productions, Inc.	Limelight Productions, Inc.	P	DR
Bob Medve	Limelight Productions, Inc.	Limelight Productions, Inc.	A	DR

Name	Company	Representing	Voting status	Int. cat.
Michael J. Carnaby	Mikan Theatricals	Mikan Theatricals	P	DR
James B. Evans	Mountain Productions Inc.	Mountain Productions Inc.	P	DR
Tim Hansen	Oasis Stage Werks	Oasis Stage Werks	P	DR
Richard J. Nix	Performance Systems Integration	Performance Systems Integration	P	G
Ron Bonner	PLASA	PLASA	P	G
Bill Sapsis	Sapsis Rigging, Inc.	Sapsis Rigging, Inc.	P	U
Peter A. Scheu	Scheu Consulting Services	Scheu Consulting Services	P	G
Dan Culhane	SECOA	SECOA	P	CP
Jerald Kraft	SECOA	SECOA	A	CP
Olan Cottrill	Staging Productions, Inc.	Staging Productions, Inc.	P	DR
Steve Walker	Steve A. Walker & Associates	Steve A. Walker & Associates	P	G
Shawn Nolan	Entertainment Structures Group	Steven Schafer Associates	P	G
Christine L. Kaiser	Syracuse Scenery & Stage Lighting Co., Inc.	Syracuse Scenery & Stage Lighting Co., Inc.	P	DR
Mark Newlin	Texas Scenic Company	Texas Scenic Company	P	CP
Larry Lutz	Texas Scenic Company	Texas Scenic Company	A	CP
James Niesel	Theatre Projects Consultants, Inc.	Theatre Projects Consultants, Inc.	P	G
Jerry Gorrell	Theatre Safety Programs	Theatre Safety Programs	P	G
John C. Snook	Thermotex Industries Inc.	Thermotex Industries Inc.	P	CP
Jeff Wilkowski	Thern, Inc.	Thern, Inc.	P	MP
Keith Bohn	Tomcat USA, Inc.	Tomcat USA, Inc.	P	MP
Mitch Clark	Tomcat USA, Inc.	Tomcat USA, Inc.	A	MP
John James	Tomcat USA, Inc.	Tomcat USA, Inc.	A	MP
Hans van der Moolen	Stagemaker Division Europe	Verlinde Spa. France	P	MP
Carlos Garcia	R&M Materials Handling	Verlinde Spa. France	A	MP
Pete Happe	Walt Disney Imagineering	Walt Disney Company	P	U
		Total votes possible	36	
		Votes by interest category	6	CP
			6	MP
			7	DR
			8	U
			9	G

4 Approval of minutes from the previous meeting (Rig/2005-2042)

Richard Nix said he had arrived late at the last meeting and had not signed the attendance sheet, but that he was there and the minutes should show this. He also had voted Yes on the roll call vote for E1.22, and this should be shown.

Dan Culhane moved that the minutes so amended to show Nix's presence and vote be accepted. The motion was seconded. The motion was approved with a unanimous show of hands.

The amended and approved minutes are document number Rig/2005-2042r1

5 ESTA declarations

5.1 Anti-trust statement

The following statement was read aloud to the assembly by Bill Sapsis:

"The ESTA Board of Directors, the Technical Standards Committee, and the leadership of this working group will reject or nullify any actions that unlawfully restrain trade. Anyone who feels that such an action is being or has been taken is requested to bring that matter to the attention of

the chair immediately. Anyone who feels that actions in restraint of trade have been taken and not properly annulled is requested to notify the TSC chair or ESTA president immediately.

"ESTA legal counsel has informed us that violations of the anti-trust laws can have serious consequences. Individuals engaged in certain unlawful conduct can be found criminally liable. An individual convicted of a criminal violation of the Sherman Act may be fined as much as \$1,000,000 and imprisoned for up to ten years. An easy to read pamphlet describing restraint of trade issues is available from the Technical Standards Manager."

No anti-trust or restraint of trade issues were brought to the attention of the assembly.

5.2 Call for patents

The following statement was read aloud to the assembly by Bill Sapsis:

"ESTA intends not to publish any standard that contains protected intellectual property, unless that information can be licensed by anyone for a reasonable fee. ESTA uses a process of open patent and copyright disclosures to implement its intent. ESTA does not conduct patent or copyright searches and does not warrant that its standards contain no protected intellectual property.

"In keeping with the open disclosures policy, I ask if anyone present wishes to notify this working group of the existence of a patent or copyright or other intellectual property that might protect material in a standard being developed by this working group. You need not be the holder of the patent or copyright to notify this working group of its existence."

No protected intellectual property issues were brought to the attention of the assembly.

6 Approval of agenda

Harvey Sweet asked that a report and discussion of the fire study be added under new business.

Bill Conner asked that a report on meanings of "fail safe" also be added.

Eddie Kramer moved that the agenda so amended be accepted. The motion was seconded and then approved with a unanimous show of hands.

7 Old business

7.1 E1.1 — Wire rope ladders

Karl Ruling reported that no comments were received during the public review of Draft American National Standard BSR E1.1, Entertainment Technology — Construction and Use of Wire Rope Ladders (Rig/2004-2029r1). The review ran from 14 October through 13 December 2005.

Mike Garl moved that we accept the revised E1.1 (Rig/2004-2029r1) as an American National Standard. The motion was seconded. The motion shall be decided by letter ballot to allow all voters a chance to vote on the motion.

7.2 E1.2 — Aluminum trusses and towers revised

Karl Ruling reported that the public review had closed on 17 January. Some comments had been received from Dan Culhane, but he had not had time to collate them and to make a formal report. Culhane's comments were all editorial. Ruling suggested that accepting the comments and possibly accepting the revised standard (if no substantive changes are made) could be handled at the next working group meeting.

7.3 E1.4 — Manual rigging systems

Karl Ruling reported that the public review had closed on 17 January. Some comments had been received, and some of them suggest substantive changes. Ruling had not had time to collate the comments and to make a formal report. He suggested that they be considered at the next meeting.

7.4 E1.6-1, powered winch hoist systems

Harvey Sweet reported that progress was being made and a document that can be considered for public review should be ready soon.

7.5 E1.6-2, electric chain hoist systems

The working group had voted by letter ballot to approve the first public review of BSR E1.6-2. Out of a voting body of 33, 27 voted "Yes," one voted "Yes with comments, and two voted "No with reasons." Three ballots were not returned. Because of the comments and reasons, voting members were given until this working group meeting to change their votes if they wish. There was discussion, but no one changed his vote. The motion carried.

The public review motion next moves to the TSC for approval.

Brad Dittmer moved that the objections offered during the letter ballot be handled as public review comments. The motion was seconded. The motion was approved by a unanimous show of hands.

7.6 E1.8 — Speaker enclosures

Ruling reported that it still needs to be laid out for publication. It will be done soon.

7.7 E1.15 – Boom & base standard

Karl Ruling reported that the ESTA Board had approved it, but that he had not submitted it to ANSI yet. Richard Nix asked that Ruling do it soon. Ruling agreed that this is a standard people in the field want.

7.7 E1.21 – Stage roofs

The resolutions to the last public review of BSR E1.21 had been approved at the last meeting. Two versions of BSR E1.21 embodying those resolutions were offered to the working group. The r6 version was the version offered at the last meeting, with some quite obvious typographical errors corrected, but with no substantive changes and with no years specified for the referenced standards. The r7 version cited particular editions of the cited standards, removed a few obsolete references, and added a new reference. Ruling advised that he thought the changes from r6 to r7, while not great in number, were substantive.

Ruling had outlined four possible motions in regard to the two documents that could be made, and had solicited absentee ballots from those who would be unable to attend the meeting as to which motions they would support. The four options were:

(1) to vote to accept the r6 version as an American National Standard.

(2) to vote to offer the r7 version for another public review.

(3) to vote to accept the r7 version as an American National Standard. (Ruling advised that he would have a hard time arguing to the ANSI Board of Standards Review that it is not substantively different from the document last offered for public review.)

(4) to vote to accept the r6 version as an American National Standard, and then to start work revising it by voting to offering the r7 version for public review. There are advantages and disadvantages to these options.

Keith Bohn pointed out a typographical error in a formula that restated in mathematical terms a written requirement given immediately preceding it. He said that the mistake was obviously typographical. Ruling agreed and made the correction. The requirements of the text were not changed.

Keith Bohn moved that version 6 be accepted as an American National Standard. The motion was seconded. The motion was decided by roll call ballot with the absentee ballots counted in:

Name	Company	Representing	Voting status	Int. cat.	Yes	No	Abstain
William Conner	Bill Conner Associates LLC	Amer. Society of Theatre Consultants	P	U	X		
William Bradburn	Clowes Memorial Hall	Butler University	P	U	X		
Charlie Weiner	Charlie Weiner	Charlie Weiner	P	U	X		
Ted Jones	Chicago Spotlight, Inc.	Chicago Spotlight, Inc.	P	U			
Don Dimitroff	Columbus McKinnon Corp.	Columbus McKinnon Corp.	P	MP	X		
Wally Blount	Columbus McKinnon Corp.	Columbus McKinnon Corp.	A	MP			
Howard R. Ott*	D.E.O. Associates, Inc.	D.E.O. Associates, Inc.	P	G	X		
M. Brad Dittmer	Downhome Productions	Downhome Productions	P	U	X		
Joseph Champelli	Fisher Technical Services, Inc.	FTSI	P	CP	X		
Reid Neslage	H & H Specialties Inc.	H & H Specialties Inc.	P	MP	X		
Jeffrey Hoffend	Hoffend & Sons, Inc.	Hoffend & Sons, Inc.	P	CP			
Peter Hoffend	Hoffend & Sons, Inc.	Hoffend & Sons, Inc.	A	CP			
Damon Atwood	Hoffend & Sons	Hoffend & Sons, Inc.	A	CP			
Edwin S. Kramer	I.A.T.S.E. Local 1	I.A.T.S.E. Local 1	P	U		X	
Kent H. Jorgensen	IATSE Local 80	IATSE Local 80	P	G	X		
Rodney F. Kaiser	J.R. Clancy Inc.	J.R. Clancy, Inc.	P	CP	X		
Jack Suesse	J.R. Clancy, Inc. (NC)	J.R. Clancy, Inc.	A	CP			
Thomas S. Young	J.R. Clancy Inc.	J.R. Clancy, Inc.	A	CP			
Mike Garl	James Thomas Engineering, Inc.	James Thomas Engineering, Inc.	P	MP	X		
Tray Allen	James Thomas Engineering, Inc.	James Thomas Engineering, Inc.	A	MP			
Harvey Sweet	LA ProPoint, Inc.	LA ProPoint, Inc.	P	DR	X		
William Beautyman	Limelight Productions, Inc.	Limelight Productions, Inc.	P	DR	X		
Bob Medve	Limelight Productions, Inc.	Limelight Productions, Inc.	A	DR			
Michael J. Carnaby	Mikan Theatricals	Mikan Theatricals	P	DR			
James B. Evans	Mountain Productions Inc.	Mountain Productions Inc.	P	DR	X		
Tim Hansen	Oasis Stage Werks	Oasis Stage Werks	P	DR	X		
Richard J. Nix	Performance Systems Integration	Performance Systems Integration	P	G	X		
Ron Bonner	PLASA	PLASA	P	G	X		
Bill Sapsis	Sapsis Rigging, Inc.	Sapsis Rigging, Inc.	P	U	X		
Peter A. Scheu*	Scheu Consulting Services	Scheu Consulting Services	P	G	X		
Dan Culhane	SECOA	SECOA	P	CP	X		
Jerald Kraft	SECOA	SECOA	A	CP			
Olan Cottrill	Staging Productions, Inc.	Staging Productions, Inc.	P	DR			

Name	Company	Representing	Voting status	Int. cat.	Yes	No	Abstain
Steve Walker	Steve A. Walker & Associates	Steve A. Walker & Associates	P	G	X		
Shawn Nolan	Entertainment Structures Group	Steven Schafer Associates	P	G	X		
Christine L. Kaiser	Syracuse Scenery & Stage Lighting Co., Inc.	Syracuse Scenery & Stage Lighting Co., Inc.	P	DR	X		
Mark Newlin	Texas Scenic Company	Texas Scenic Company	P	CP			
Larry Lutz	Texas Scenic Company	Texas Scenic Company	A	CP			
James Niesel	Theatre Projects Consultants, Inc.	Theatre Projects Consultants, Inc.	P	G	X		
Jerry Gorrell	Theatre Safety Programs	Theatre Safety Programs	P	G			
John C. Snook	Thermotex Industries Inc.	Thermotex Industries Inc.	P	CP			
Jeff Wilkowski	Thern, Inc.	Thern, Inc.	P	MP	X		
Keith Bohn	Tomcat USA, Inc.	Tomcat USA, Inc.	P	MP	X		
Mitch Clark	Tomcat USA, Inc.	Tomcat USA, Inc.	A	MP			
John James	Tomcat USA, Inc.	Tomcat USA, Inc.	A	MP			
Hans van der Moolen	Stagemaker Division Europe	Verlinde Spa. France	P	MP			
Carlos Garcia	R&M Materials Handling	Verlinde Spa. France	A	MP			
Pete Happe	Walt Disney Imagineering	Walt Disney Company	P	U	X		
		Total votes possible	36		27	1	0
		Votes by interest category	6	CP	3	0	0
			6	MP	5	0	0
			7	DR	5	0	0
			8	U	6	1	0
			9	G	8	0	0

* Absentee ballots

The motion carried with a supermajority voting Yes. (27 out of 36 voting Yes and with one voting No. This is the majority of the consensus body and more than 2/3rds of those who voted voting Yes.)

7.8 E1.22 – Fire safety curtain systems

Ruling reported that the TSC had approved the public review, and that the document will be in public review through 28 March 2006.

8 New business

8.1 Fire modeling project

A letter from Harvey Sweet to Karl G. Ruling requesting funding for a fire modeling project to develop performance criteria for fire safety curtains had been distributed before the meeting. Also a letter from Rodney Kaiser to Dr. Johnathan Barnett describing the desired study had been distributed. (The text of the letters is appended to these minutes.)

Richard Nix moved that the Rigging Working Group accept the scope as defined in the letter from Rodney Kaiser and go on record as feeling that it is appropriate for the task. The motion was seconded.

There was discussion. Bill Conner suggested that ASTC cannot support the research with the given scope. The scope seems to be predicated on proving the efficacy of fire safety curtains.

The motion was approved by a show of hands, with one voting No, two voting Abstain, and the rest voting Yes.

Harvey Sweet moved that we request funding of this project in principle from the TSC, pending acquisition of available funds. The motion was seconded. The motion was approved with a show of hands, with one voting No and the rest Yes, with no abstentions.

8.2 Fail-safe

Bill Conner handed out a sheet of paper documenting his research on "fail-safe" and various concepts of "fail-safe" or "single-point failure proof." (The text of the document is appended to these minutes.) He advised that the term "fail-safe" should be avoided in contracts. He also said that the definition from answers.com seems fairly useful: "Capable of compensating automatically and safely for a failure, as of a mechanism or power source."

8.3 Email reflectors

Bill Sapsis reported that the ESTA email reflector site will be discontinued. We will set up simple email reflectors (alias lists) for task groups or working groups if requested.

8.4 Discussion of other possible projects, in particular, guidance on the use of aluminum trusses as scaffolding or work platforms.

Kent Jorgensen explained the issue of people using trussing as elevated work platforms. There was a brief discussion. No motions were made.

9 Other business

Bill Sapsis was asked about the ETCP exam results. He reported that a good number of people have passed the rigging exams and that the exams went very well. There are now 97 ETCP certified arena riggers and 111 ETCP certified theatre riggers.

10 Schedule for future meetings

The next meeting is scheduled for 19:00 to 23:00 on Wednesday, 29 March 2006, at the Louisville Marriott Downtown, 280 West Jefferson Street, Louisville, Kentucky.

11 Changes of membership status resulting from lack of attendance.

Principals (and alternates) who have missed the previous two meetings:

William Beautyman, Limelight Productions

Beautyman was present, so no change of voting status was warranted.

12 Adjournment

Dan Culhane moved that the meeting adjourn. The motion was seconded. The motion was approved with a unanimous show of hands. Bill Sapsis declared the meeting adjourned at 20:54.

Rigging Working Group Membership and Contact Information as of Thursday, 16 February 2006

Name	Company	Representing (This is the primary sort field.)	Voting stat.	Int. cat.
Baer Long	Ninja Rigging	Act 1 Rigging Inc.	O	G
Andre Broucke	ADB - TTV Technologies	ADB-TTV Group	O	MP
Michael G. Wiener	Aerial Rigging & Leasing, Inc.	Aerial Rigging & Leasing, Inc.	O	U
Andy Sutton	AFX UK Ltd.	AFX UK Ltd.	O	U
William Conner	Bill Conner Associates LLC	Amer. Society of Theatre Consultants	P	U
Jim Fletcher	American Sling Company, Inc.	American Sling Company, Inc.	O	MP
Andrew T. Martin	ATM Group, Inc.	ATM Group, Inc.	O	MP
Dennis J. Lopez	Automatic Devices Co.	Automatic Devices Co.	O	MP
Jiantong Wu	Beijing Special Engineering Design & Research Institute	Beijing Special Engineering Design & Research Institute	O	G
Buddy Braille	Bestek Lighting & Staging	Bestek Lighting & Staging	O	U
Lee J. Bloch	Bloch Design Group, Inc.	Bloch Design Group, Inc.	O	G
Eric Todd	BML Inc.	BML Inc.	O	MP
Paul Tardue	BML Inc.	BML Inc.	O	MP
William Bradburn	Clowes Memorial Hall	Butler University	P	U
Joachim Stoecker	CAMCO GmbH	CAMCO GmbH	O	MP
Charles E. Gorgen	Charles E. Gorgen	Charles E. Gorgen	O	G
Charlie Weiner	Charlie Weiner	Charlie Weiner	P	U
Mark M. Witteveen	Chicago Flyhouse Inc.	Chicago Flyhouse Inc.	O	U
Ted Jones	Chicago Spotlight, Inc.	Chicago Spotlight, Inc.	P	U
Julie Rogers	City of Phoenix Civic Plaza	City of Phoenix	O	G
Steve Gonnella	City of Phoenix, Theater Division	City of Phoenix	O	U
Don Dimitroff	Columbus McKinnon Corp.	Columbus McKinnon Corp.	P	MP
Wally Blount	Columbus McKinnon Corp.	Columbus McKinnon Corp.	A	MP
Mylan Lester	Creation Logics Ltd.	Creation Logics Ltd.	O	U
Howard R. Ott	D.E.O. Associates, Inc.	D.E.O. Associates, Inc.	P	G
Harry Donovan	Donovan Rigging, Inc.	Donovan Rigging, Inc.	O	G
Wes Jenkins	Down Stage Right Industries	Down Stage Right Industries	O	CP
M. Brad Dittmer	Downhome Productions	Downhome Productions	P	U
F. Robert Bauer	F.R. Bauer & Associates, LLC	F.R. Bauer & Associates, LLC	O	G
Thomas Reaoch	RC Consultoria e Representação Ltda.	Feeling Structures	O	MP
Ben Hayes	Freedom Flying	Freedom Flying	O	G
Dean Hart	Stage Rigging, Inc.	Freeman Companies	O	U
Rocky Paulson	Stage Rigging, Inc.	Freeman Companies	O	DR
Joseph Champelli	Fisher Technical Services, Inc.	FTSI	P	CP
David M. Campbell	Geiger Engineers	Geiger Engineers	O	G
Timothy Mills	Geiger Engineers	Geiger Engineers	O	G
Paul Brady	Grand Stage Company, Inc.	Grand Stage Company, Inc.	O	U
Kevin Denis	Gravitec Systems, Inc.	Gravitec Systems, Inc.	O	CP
Reid Neslage	H & H Specialties Inc.	H & H Specialties Inc.	P	MP
Delbert Hall	Hall Associates Inc.	Hall Associates Inc.	O	U
Jeffrey Hoffend	Hoffend & Sons, Inc.	Hoffend & Sons, Inc.	P	CP
Peter Hoffend	Hoffend & Sons, Inc.	Hoffend & Sons, Inc.	A	CP
Damon Atwood	Hoffend & Sons	Hoffend & Sons, Inc.	A	CP
Edwin S. Kramer	I.A.T.S.E. Local 1	I.A.T.S.E. Local 1	P	U
G. Anthony Phillips	I.A.T.S.E. Local 16	I.A.T.S.E. Local 16	O	U
Gregory C. Collis	I.A.T.S.E. Local 16	I.A.T.S.E. Local 16	O	G
Michael Di Ieso	IATSE Local 481	IATSE Local 481	O	U
Kent H. Jorgensen	IATSE Local 80	IATSE Local 80	P	G
Gian Carlo C. Bartolotti	Ibeam SP / Banco de Eventos	Ibeam SP / Banco de Eventos	O	U
Michael Keppler	Bogen	IFF	O	MP
Rodney F. Kaiser	J.R. Clancy Inc.	J.R. Clancy, Inc.	P	CP
Jack Suesse	J.R. Clancy, Inc. (NC)	J.R. Clancy, Inc.	A	CP
Thomas S. Young	J.R. Clancy Inc.	J.R. Clancy, Inc.	A	CP
Mike Garl	James Thomas Engineering, Inc.	James Thomas Engineering, Inc.	P	MP
Tray Allen	James Thomas Engineering, Inc.	James Thomas Engineering, Inc.	A	MP
Jay O. Glerum	Jay O. Glerum & Associates, Inc.	Jay O. Glerum & Associates, Inc.	O	U
Chuck McClelland	Jeamar Winches Inc.	Jeamar Winches Inc.	O	MP
John Kaes	John Kaes	John Kaes	O	U
John R. Burgess	John R. Burgess	John R. Burgess	O	U

Name	Company	Representing (This is the primary sort field.)	Voting stat.	Int. cat.
Edward Paget	Jones & Phillips Associates, Inc.	Jones & Phillips Associates, Inc.	O	G
Christopher Purpura	Jones & Phillips Associates, Inc.	Jones & Phillips Associates, Inc.	O	G
Nevin Kleege	Kleege Industries	Kleege Industries	O	U
Harvey Sweet	LA ProPoint, Inc.	LA ProPoint, Inc.	P	DR
William Beautyman	Limelight Productions, Inc.	Limelight Productions, Inc.	P	DR
Bob Medve	Limelight Productions, Inc.	Limelight Productions, Inc.	A	DR
Louis Bradfield	Louis Bradfield	Louis Bradfield	O	U
Michael L. Savage, Sr.	Middle Dept. Inspection Agency, Inc.	Middle Dept. Inspection Agency, Inc.	O	G
Michael J. Carnaby	Mikan Theatricals	Mikan Theatricals	P	DR
Todd Petersen	Mixed Productions	Mixed Productions	O	U
James B. Evans	Mountain Productions Inc.	Mountain Productions Inc.	P	DR
Bradford A. Kegel	National Production Services Inc.	National Production Services Inc.	O	U
François Defarges	Nexo	Nexo	O	MP
Tracy Nunnally	Northern Illinois University	Northern Illinois University	O	U
Ted Hickey	OAP Audio Products	OAP Audio Products	O	MP
Tim Hansen	Oasis Stage Werks	Oasis Stage Werks	P	DR
Gary Justesen	Oasis Stage Werks	Oasis Stage Werks	O	DR
Robert A. Grenier Jr.	Ocean State Rigging Systems Inc.	Ocean State Rigging Systems Inc.	O	DR
Olaf Soot	Olaf Soot Associates	Olaf Soot Associates	O	CP
Joseph Rapier	Parkhill, Smith & Cooper, Inc.	Parkhill, Smith & Cooper, Inc.	O	CP
Richard J. Nix	Performance Systems Integration	Performance Systems Integration	P	G
Ron Bonner	PLASA	PLASA	P	G
Michael Akrep	Polar Focus, Inc.	Polar Focus, Inc.	O	MP
Michael Patterson	Pook Diemont & Ohl, Inc.	Pook Diemont & Ohl, Inc.	O	CP
Marc Hendriks	Prolyte	Prolyte	O	MP
Douglas Franz	QVC Network	QVC Network	O	U
Scott Mohr	R&R Cases and Cabinets	R&R Cases and Cabinets	O	G
Michael Reed	Reed Rigging, Inc.	Reed Rigging, Inc.	O	U
Rinus Bakker	Rhino Rigs B.V.	Rhino Rigs B.V.	O	G
Rikki Newman	Rikki Newman	Rikki Newman	O	U
Randall W. A. Davidson	Risk International & Associates, Inc.	Risk International & Associates, Inc.	O	U
Heinz Siller	RST Präsentations-systeme	RST Präsentationssysteme	O	G
Thomas M. Granucci	Associated Students, Cox Arena	San Diego State University	O	U
Bill Sapsis	Sapsis Rigging, Inc.	Sapsis Rigging, Inc.	P	U
Peter A. Scheu	Scheu Consulting Services	Scheu Consulting Services	P	G
Dan Culhane	SECOA	SECOA	P	CP
Jerald Kraft	SECOA	SECOA	A	CP
Luigi Sbalzarini	Selvolina SNC	Selvolina SNC	O	MP
Robert Barbagallo	Solotech Inc.	Solotech Inc.	O	DR
Jon Lagerquist	South Coast Repertory	South Coast Repertory	O	U
Jerrold S. Tiers	St. Louis Music Inc.	St. Louis Music Inc.	O	MP
Olan Cottrill	Staging Productions, Inc.	Staging Productions, Inc.	P	DR
Roger Barrett	Star Events Group Ltd.	Star Events Group Ltd.	O	DR
Steve Walker	Steve A. Walker & Associates	Steve A. Walker & Associates	P	G
Shawn Nolan	Entertainment Structures Group	Steven Schafer Associates	P	G
Christine L. Kaiser	Syracuse Scenery & Stage Lighting Co., Inc.	Syracuse Scenery & Stage Lighting Co., Inc.	P	DR
Reuben Goldberg	Technic Services	Technic Services	O	U
Mark Newlin	Texas Scenic Company	Texas Scenic Company	P	CP
Richard C. Mecke	Texas Scenic Company	Texas Scenic Company	O	CP
Alan Broadhurst	The Broadhurst Partnership	The Broadhurst Partnership	O	P
James Niesel	Theatre Projects Consultants, Inc.	Theatre Projects Consultants, Inc.	P	G
Jerry Gorrell	Theatre Safety Programs	Theatre Safety Programs	P	G
Ed Nicholas	Theatrical Lighting Systems, Inc.	Theatrical Lighting Systems, Inc.	O	DR
John Van Lennep	Theatrix Inc.	Theatrix Inc.	O	DR
John C. Snook	Thermotex Industries Inc.	Thermotex Industries Inc.	P	CP
Jeff Wilkowski	Thern, Inc.	Thern, Inc.	P	MP
Tim Franklin	Theta-Consulting	Theta-Consulting	O	G
Thomas Paterson	Thomas Paterson	Thomas Paterson	O	G
Richard D. Thompson	Thompson Associates	Thompson Associates	O	G
Keith Bohn	Tomcat USA, Inc.	Tomcat USA, Inc.	P	MP
Mitch Clark	Tomcat USA, Inc.	Tomcat USA, Inc.	A	MP
John James	Tomcat USA, Inc.	Tomcat USA, Inc.	A	MP
Peter Hind	Anthony Ward Partnership Ltd.	Total Structures, Inc.	O	MP

Name	Company	Representing (This is the primary sort field.)	Voting stat.	Int. cat.
Ian Coles	Total Structures, Inc.	Total Structures, Inc.	O	MP
Peter Johns	Total Structures, Inc.	Total Structures, Inc.	O	MP
Doug Recher	Total Structures, Inc.	Total Structures, Inc.	O	MP
Hans van der Moolen	Stagemaker Division Europe	Verlinde Spa. France	P	MP
Carlos Garcia	R&M Materials Handling	Verlinde Spa. France	A	MP
JoAnna Kamorin-Lloyd	Vincent Lighting Systems	Vincent Lighting Systems	O	U
Eckart Steffens	SOUNDLIGHT	VPLT	O	G
Hank Miller	W.E. Palmer Co.	W.E. Palmer Co.	O	CP
Rand Goddard	W.E. Palmer Co.	W.E. Palmer Co.	O	CP
Pete Happe	Walt Disney Imagineering	Walt Disney Company	P	U
Warren A. Bacon	Warren A. Bacon	Warren A. Bacon	O	U
Robin Crews	Wrightson, Johnson, Haddon & Williams, Inc.	Wrightson, Johnson, Haddon & Williams, Inc.	O	G
Ray Robins	XS Lighting, Inc.	XS Lighting, Inc.	O	CP
Robert Dean	ZFX Inc.	ZFX Inc.	O	CP

Key to codes:

P principal voting member
A alternate voting member
I individual voting member
O observer, non-voting

MP mass-market producer interest category
CP custom-market producer interest category
DR dealer or rental company interest category
U user interest category
G general-interest interest category



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ISO 9001 Certified

December 23, 2005

Professor Janathan Barnett
Fire Protection Engineering
Worcester Polytechnic Institute
100 Institute Road
Worcester, Massachusetts 01609

Re: FIRE CURTAIN MODELING PROPOSAL

Dear Dr. Johnathan Barnett,

ESTA - The Entertainment Services & Technology Association, a 501[C]6 not-for-profit trade association, is seeking proposals to model the performance of proscenium mounted fire safety curtains in the event of a fire on stage. ESTA is a qualified ANSI standard writing body. The Rigging Working Group of the ESTA Technical Standards Committee is currently working on Draft Standard BSR E1.22, "Fire Safety Curtain Systems.

Fire curtains have been in use for more than 100 years but very little solid test data exists regarding how curtains really function. We have been unable to locate on site real observations or technical data regarding the movement of air, smoke, gas, or heat as influenced by the closure of fire curtains. Codes and standards seem to be based mostly on assumptions with their origins lost in history.

Current building codes mandate when fire safety curtains need to be installed. Our task is to explain how they should perform. To accomplish this we need to understand the performance and develop criteria by which curtains can be tested.

In order to accomplish our goal, the Fire Safety Curtain Task group has approached ESTA for funds to study the performance of fire curtains using computer modeling techniques. We all understand the desirability of burning down a fully equipped theater, but no one seems ready to offer a theater for testing in this manner.

The initial response for funding from ESTA has been very positive for next year's budget. Therefore we are requesting proposals including goals, methods, and costs for modeling fire curtains. It should be possible to begin the project in the spring with results in a timely manner to be determined.

ESTA would require ownership and full publishing rights of the modeling results. Participants in the program would have a one time right to write and publish their papers for educational credit. We would also insist that student participation be fully supervised by university professors. ESTA and the task group would also want access to interim reports and possibly onsite meetings. While our standards efforts can be very complicated in an effort to maintain total openness and fairness, we would limit your contacts to the organization to a very few people to avoid confusion and extra effort on your part.

We are very interested in becoming informed about your approach and conclusions to be sought during this modeling program. As a beginning point we are suggesting the following:

Modeling will (should) answer questions about:

- a. When do convection currents change so there is pressure against the curtain?
- b. At what elevation does the current change: all, specific heights, fire source dependent?
- c. If the smoke vents open before the fire curtain is fully deployed what will happen (what pressures will be imposed) on the surface of the curtain as it attempts to descend?
What happens if the curtain does not fully close?
- d. What temperatures will be achieved at various elevations before the fire curtain deploys?
And afterwards, will either fusible links function (which ones, what elevation(s)) or will the safety condition be better served by rate-of-rise detectors or ETL's?
- e. What effect, if any, will occur when the audience exits the facility and the air flow is changed by exit doors being opened?
- f. How rapidly will fuels on stage be consumed and what temperatures for what durations will be experienced at the stage floor and other elevations?

Suggested modeling conditions:

Study three typical stage types:

- a. MODEST: A platform stage with a 14'H x 32'W proscenium. Model with or without a fire safety curtain. The stage is slab on grade with a raised hardwood floor. The stage is equipped with a full set of fixed legs, borders, main and rear curtains and three electrics pipes with up to 20 lights on each pipe.
- b. AVERAGE: A proscenium theatre with a proscenium opening 20'H x 40'W (could be 24'H x 48'W). The fly loft has 25 line sets located 12" on center with 4 dedicated stage electrics. Use a walk on grid at 55' AFF. All sets are counterweighted. Use a USC, straight lift fire curtain
- c. PERFORMING ARTS CENTER: Proscenium theatre with an opening of 34'H x 65'W. Use a grid with 70, line sets on 8" centers with 8 dedicated stage electrics with 50 spotlights on each pipe, including a first electric bridge with 100 theatrical lighting fixtures. Locate the grid at 90 or 100 feet AFF. Provide manual counterweight and motorized line sets. Figure a full complement of drapes and a USC specification framed fire curtain.

Study four typical fire sources for each stage type:

- a. STAGE LEVEL: Use a performer or technician (or crummy extension cord) perhaps igniting a drape with a candle.
- b. BORDER LEVEL: This is the most likely location for a fire to start in a modern theatre. Examples would include a light fixture against the scenery, or something fired (exploding) and igniting curtains or scenery.
- c. LOFT: This would be somewhere in the upper third of the loft (or on the grid if one is present) and could be an errant light fixture igniting drapes.
- d. AUDITORIUM: A fire started in the auditorium, maybe from a cigarette.

Study three conditions of stage usage:

- a. LOAD IN: The space is occupied by workers on stage. There is no audience. The exterior doors and loading doors are open on stage.
- b. PERFORMANCE: The audience is in their seats. Access doors to the stage from backstage spaces (whether fire doors or not) are blocked open. The exterior loading doors would be closed. Drapes, scenery, and lighting are in place, and the wings are congested.
- c. UNOCCUPIED: Everyone has gone home after rehearsal or performance. The space is unoccupied and the fire safety curtain was NOT lowered although all doors are closed.

In an effort to contain the cost of this project while maintaining a reasonable time frame, we have thought about the possibility of making the study a summer project for two or perhaps three students. We are certainly interested in your thoughts

FORM OF THE PROPOSAL

Your proposal will be shared and reviewed by ESTA's standards officer, office personnel, Technical Standards Committee, Rigging Working Group and Fire Safety Curtain Task Group. To assist us with our review, we are requesting electronic PDF formatted proposals.

Please include at least the following in your proposal:

- a. Proposed time line(s)
- b. Proposed project staff
- c. Pricing
- d. Payment terms
- e. Project description and procedures
- f. Data on past projects to assist in evaluation of our needs
- g. Faculty biographies

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If you have any questions you can contact me.

If possible, we would like to have at least a preliminary expression of interest and possible funding requirements in early January.

Please submit your proposal to:

Rodney F. Kaiser
c/o J.R. Clancy, Inc.
7041 Interstate Island Road Syracuse, NY 13209

Phone: 315-451-3440
Fax: 315-451-1766
e-mail: rodkaiser@jrclancy.com

Best Regards,

Rodney F. Kaiser

Rodney F. Kaiser

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January 3, 2006

Karl Ruling
Technical Standards Manager
Entertainment Services & Technology Association
875 Sixth Avenue
Suite 1005
New York, NY 10001

Dear Karl,

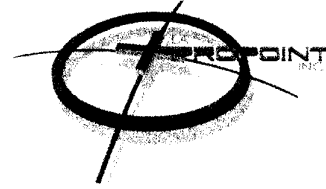
Attached please find a Request for Proposal prepared by Rodney Kaiser on behalf of the E 1.22 Fire Safety Curtain Task Group.

Through the course of our efforts to develop a viable fire safety curtain standard, the working group has discovered that little "hard" data or anecdotal information has been collected or published about the behavior of fires or fire safety curtains in theatres. The information that is available is dated: mostly, it consists of United States Department of Commerce studies from the early part of the 20th Century. These studies analyzed fabrication and installation of fire curtains with materials and under conditions acceptable at the time. Neither formal nor informal studies have been found that address the effectiveness of fire safety curtains and their related detection systems or release mechanisms. We have also found no anecdotal data verifying that a deployed fire curtain was instrumental in saving a facility, or descriptions of the behavior of a fire initiating in backstage spaces with or without a working fire safety curtain or a sprinkler system. Meaningful data that validates fire safety curtain designs described in UBC, IBC or any other building code or standard is also lacking.

Current development of BSR E1.22, the proposed fire safety curtain standard, is based upon historical designs and assumptions about air flow, fire behavior, assumed pressure differentials, as well as the effectiveness of sensors, sprinklers and deployment mechanisms. The project has been influenced by European commentators and United States industry professionals who have participated in our meetings. We have considered comments of those who have worked with fire safety curtains and fire safety curtain standards for many years. The document prepared by the task group is based on the limited information available and generally accepted practices.

The members of the task group believe that the industry would be well served to base ESTA's standards on as much "hard data" as possible. Perhaps the best means to collect hard data is to bum down several theatres while video taping the event from multiple vantage points and equip them with various sensors

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reporting conditions at locations throughout the facility. This is, at best, impractical. In lieu of actually burning down several theatres, we have concluded that fire modeling by fire safety professionals will provide the most meaningful data upon which to develop future standards.

Rodney Kaiser has identified at least one academic organization offering advanced degrees that include fire modeling. In discussion with the professor-in-charge, Mr. Kaiser has determined that we could request various levels of university participation ranging from a professorial consultancy at a minimum fee of \$45,000 plus expenses to funding a graduate student stipend at \$7,000 plus expenses. Since we see this project as complex and multi-faceted, we are proposing a project involving three graduate students, each funded at \$7,000 to perform the analyses described in the attached proposal. In preparation for the studies, we would take the supervising professor and the three students to facilities to familiarize them with the types of spaces to be studied. Rodney Kaiser would make two or more trips to the campus to review the work in progress. Finally, ESTA would acquire ownership of the modeling reports. These documents would be presented in writing and orally to ESTA. To "sweeten the deal" we would permit one-time publishing rights of the data by each of the students and the professor (such publication would require attribution to ESTA).

To support this very important research effort, the E1.22 task group is requesting funding as follows:

3 graduate student stipends at \$7,000 each, for a total of Pre-study facility study (Mr. Kaiser, Professor, 3 students)	\$21,000.00
Interim-study travel for Mr. Kaiser	\$6,000.00
Post-Study presentation to Task Group and Guests	\$2,500.00
TOTAL FUNDING REQUEST	\$32,500.00

I or Rodney Kaiser would be pleased to discuss this request with the TSC or any other appropriate body.

Respectfully submitted,

Harvey Sweet, Chairperson
BSR E.122 Fire Safety Curtain Task Group

Three definitions from the NFPA glossary:

Fail-Safe: A state or an attribute of a system such that every single point failure in the system results in all controlling parts of the system with the ability to do harm to humans, animals, or equipment being disconnected from all sources of power and stored energy at the primary disconnect point. (Preferred definition - NFPA 160 Standard for the Use of Flame Effects Before an Audience)

Fail-Safe: A term used to describe design features that provide for the maintenance of safe operating conditions in the event of a malfunction of control devices or an interruption of an energy source. (secondary definition - NFPA 160 Standard for the Use of Flame Effects Before an Audience)

Failsafe: A design feature that provides for the maintenance of safe operating conditions in the event of a malfunction of control devices or an interruption of an energy source. (preferred definition - NFPA 59A Standard for the Production, Storage, and Handling of Liquefied Natural Gas.

A concise and unambiguous example from answers.com:

Fail-safe: Capable of compensating automatically and safely for a failure, as of a mechanism or power source.

Some less concise and more ambiguous:

From m-w.com: Incorporating some feature for automatically counteracting the effect of an *anticipated* possible source of failure

From Wikipedia.org: A device which, if (or when) it fails, fails in a way that will cause no harm or *at least a minimum of harm* to other devices or danger to personnel.

Related definition from NFPA Glossary: Worst-Case: The maximum concentration, pressure, temperature, or flow-rate that can occur with a *reasonable* single-point failure or upset. (Preferred definition - NFPA 53 Recommended Practice on Materials, Equipment and Systems Used in Oxygen-Enriched Atmospheres)

Two references items from entertainment related documents on Single Point Failure:

From F. X. Control Systems Inc.: "The single-point failure proof design prevents the catastrophic failure of any single winch, lifting cable, connection or sensor from precipitating further failure or placing the cast or audience at risk of injury."

From American Youth Circus Organization Safety and Risk Management Standards for Aerial Activities: "Requirement for Single Point Failure Proof Design: Aerial equipment systems used in American Youth Circus Organization shall be designed in such a manner that the failure of any single component of the system shall not cause catastrophic failure of the system. "

From www.reference.com

Safety engineers distinguish different extents of defective operation: A "fault" is said to occur when some piece of equipment does not operate as designed. A "failure" only occurs if a human being (other than a repair person) has to cope with the situation. A "critical" failure endangers one or a few people. A "catastrophic" failure endangers, harms or kills a significant number of people.

Safety engineers also identify different modes of safe operation: A "probabilistically safe" system has no single point of failure, and enough redundant sensors, computers and effectors so that it is very unlikely to cause harm (usually "very unlikely" means less than one human life lost in a billion hours of operation). An "inherently safe" system is a clever mechanical arrangement that cannot be made to cause harm- obviously the best arrangement, but this is not always possible. For example, "inherently safe" airplanes are not possible. A "fail-safe" system is one that cannot cause harm when it fails. A "fault-tolerant" system can continue to operate

with faults, though its operation may be degraded in some fashion.

from www.iasa.com.au

Certification requirements for civil aircraft have always specified that "no single failure shall have a catastrophic effect." Consequently, all safety-critical failures (and human errors) must be survived by design. This is the prime definitive requirement for safety in air transport, which should be burned into the minds of all involved. But is it? At the Farnborough air show, I continued a survey I have pursued for several years. I ask experienced aviation people: "What do you believe is the most important factor that has made air transport so safe?" The answers invariably are in the areas of technology, training, maintenance, professionalism, piloting and combinations. No one has given the irrefutable answer: "The universal application in all safety-critical areas, engineering and human, of the concept of fail-safety." All aircraft and ground systems have failures, and all the humans make mistakes. When there is no preplanned fail-safety "umbrella"--monitoring, backups, redundancy, etc.--in a safety-critical area, or implementation breaks down, an accident is inevitable. There is worldwide concern about the leveling of the accident rate, and compelling evidence that the main reason is that total fail-safety efficacy has been exhausted at the extremely low failure probability levels now demanded. Any attempt to improve the accident rate that does not concentrate on enhancing fail-safety is doomed. This underappreciated vital concept has been neglected in safety improvement programs. It needs serious attention if a decreasing accident rate is to be reestablished as the world fleet expands.

Ron Howard, Adelaide, Australia

From the The International Society for Optical Engineering.

A new concept of electromechanical shutter has been designed and qualified for the OSIRIS imaging system to fly onboard the Rosetta Mission, whose main scientific goal are the rendez-vous and the study of the Comet Wirtanen. The shutter, is composed by two blades, driven by dedicated four-bar linkages, that are moved independently by two torque motors each mounted on the same shaft of an high resolution optical encoder. A dedicate *fail safe* mechanism is also integrated in order to make the shutter *single point failure proof*. The mechanism has been designed in order to fulfil high reliability with high performance. Reliability has been verified by life testing over 100000 cycles (factor 2 on expected operative cycles). Performance verified by calibration show that the minimum exposure time with a uniformity of 1/500 is 10 ms over a large sensitive area (about 30x30 mm). The exposure time can vary from 10ms to 5s. Scope of this paper is to present the mechanism and to demonstrate that it accomplishes the sciences and interfaces requirements.

From ARMED SERVICES BOARD OF CONTRACT APPEALS

On or about 30 March 1994, appellant Grumman Aerospace Corporation submitted a claim to the contracting officer, seeking roughly \$65,000,000 for a host of Government actions and inactions which purportedly caused performance disruption, delay and increased cost. One of appellant's claims was that the Government constructively changed the contract by directing Grumman to change the wiring configuration of the two mission computers on the aircraft to eliminate a "single point failure" - the flow of power to both computers through a single circuit breaker which if "popped" would disable both computers. In brief, Grumman contends that its design was consistent with contract requirements and hence the Government's directive was "out-of-scope" or change order work under the Changes clause. The Government contends that Grumman's design was not consistent with contract requirements since it frustrated the contract requirement that one computer serve as a backup to the other, and hence the Government's directive sought to correct a defective design and was not a change order.

- (a) use two circuit breakers
- (b) don't use the term single point failure
- (c) if sued, find this judge
- (d) all of the above

(ps: the Government paid the \$65 million)