Systems Engineering to Sydney

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Abstract. Systems engineering a worldwide multi-site real-time tele-conference using volunteers is a challenge worthy of any organization. This paper is an introduction to the proposed project. It outlines the goals and approaches to be taken over a four-year period to develop the requirements, prototype communications techniques, and minimize the risks in developing the conference. The paper also describes a number of other benefits of the project to the International Council on Systems Engineering (INCOSE).

INTRODUCTION

The INCOSE is approaching a critical point in its life cycle. In an attempt to grow the organization internationally, the INCOSE has scheduled three of the next four symposia at locations outside the USA., namely:

1998 Vancouver, Canada.
1999 Brighton, England.
2000 Minneapolis, USA.
2001 Sydney, Australia.

While holding the symposia outside the country is laudable for internationalizing the organization, it presents a high risk to the domestic organization. The attendance of most domestic members at the symposia is funded by their employers, and it is likely that the employers will not:

- Be willing to fund the added expense of overseas trips.
- Allow key employees to take time away from work to travel to distant places.

Consequently, the level of attendance by stateside members is expected to drop. Attempts to provide local stateside symposia or conferences could alleviate the risk to the organization but will detract from the main event by drawing away papers and attendance.

This paper proposes one approach to mitigate the risk to the organization and at the same time reap a number of other organizational benefits. The approach is called the INCOSE 2001 Virtual Conference Project (I2VC) Project.

THE INCOSE 2001 VIRTUAL CONFERENCE PROJECT

The I2VC Project is a complex system engineering project. The problems to be solved are relevant to global project management. Conference management and systems engineering have much in common (Kasser, 1996). Thus, the purpose of the I2VC Project is to apply engineering principles to design and manufacture a multi-location tele-conference based on the INCOSE Sydney symposium in 2001. The tele-conference should be a real time event with simultaneous participation (presentation and audiences) in several locations around the world, i.e., Australia, USA (East and West Coasts), Canada, Europe, Africa, etc.

Now several technologies exist for interaction at a distance. These range from two-way audio to two-way video at various resolutions. Each technology has advantages and disadvantages and very different costs for implementation. However, while the companies marketing the technologies tout their advantages, the minimal requirements for their use in a tele-conference seem to be undocumented. Thus, the I2VC project has the following goals:

- Develop techniques for working in and managing virtual teams since the project volunteers are likely to be scattered by geographic location.
- Develop the minimal requirements for knowledge transfer in a tele-conference
- Provide an opportunity for INCOSE to apply systems engineering to a practical project.
- Provide many opportunities for projects for engineers and classroom exercises in the areas of global project

management, distance learning, and tele-participation at INCOSE Chapter meetings and similar events.

- Demolish the myth that working with volunteers is a valid reason for not doing a good job.
- Be documented as a Case Study; hence provide a track of papers for the next four INCOSE International Symposia.
- Provide opportunities for the INCOSE working groups to do something practical. For example, the Requirements Group could develop the requirements, the Risk Management Group could identify the risks and plan on ways to mitigate them, and the Metrics Group could identify and use appropriate metrics.
- Prototype a way for the organization to share speakers using tele-links. This feature will help ease the search load of the chapter program chairs and provide quality speakers irrespective of chapter or speaker location.
- Provide a vehicle to increase participation in the conferences by providing an avenue for those who cannot obtain travel subsidies.

THE I2VC PROJECT PRIME DIRECTIVES

The prime directives for the I2VC Project are:

- Must cause minimal interference to the way the INCOSE symposia are managed between now and the year 2001.
- Must cause minimal interference to attendance at the main symposium sites between now and the year 2001.
- Must employ volunteers to perform the majority of the work.

THE PROJECT PLAN

The plan is to develop the interactive tele-conference in stages as follows:

- Develop a project plan for the I2VC Project including the Work Breakdown Structure (WBS), management methodology, publication rights, ownership of ideas and other important elements.
- Put together a start-up team of volunteers from various INCOSE chapters.
- Gather employer sponsorships for the costs of the use of communications equipment and links.
- Develop an operations concept, the requirements, and then design and organize the worldwide multi-location tele-conference.
- Prototype and test different tele-session technologies before, during, and after the Vancouver symposium, including:
    - two way video.
    - one way video one way audio.
    - two way audio and remote transparencies.
- Use several sessions at the Vancouver symposium to prototype the distant links between the symposium and selected INCOSE chapters. The time zone differences that overlap afternoon sessions in Vancouver with potential evening chapter meetings on the East Coast facilitate this function.
- Identify and prototype ways of facilitating peer-to-peer personal networking at a distance. It is anticipated that these requirements will be more challenging than the technical ones. For example, how do we facilitate person to person networking in a tele-conference? This anticipation is based on experience and the fact that companies are presently doing interactive tele-conferences.
- Develop the requirements for the Sydney 2001 tele-conference in terms of:
    - **knowledge transfer.** The formal presentations which transfer information from the presenter to the audience.
    - **personal networking.** The informal peer-to-peer communications which transfer all sorts of information between the participants.
- Use the Minneapolis and Brighton symposia to further prototype elements of the tele-conference, perhaps use:
    - **Minneapolis** to test links between the symposium and chapters.
    - **Brighton** as a test of a two-site fully interactive symposium (UK to USA). If sufficient resources are available, a three-site fully interactive symposium (UK to East and West Coasts of the USA) could be attempted.

THE WORK PLAN

The work plan will be based on a WBS. The WBS will be developed in an iterative manner. The plan will be reexamined periodically and updated to incorporate results of prototyping. Status reviews and updates will be presented at the annual INCOSE symposia. The work will be split into tasks and organized by products and results rather than by activities (Kasser, 1997). All activities and outcomes will be documented using Microsoft Project software.

The task management approach is based on a multi-contractor task management methodology (Kasser, 1997) which:

- Received an evaluation of “very good” by the Source Evaluation Board at Patrick Air Force Base.

- Was considered "a strength" in the evaluation of a proposal to the National Institute of Standards and Technology Advanced Technology Program.

Each task will be posted on an Internet Listserver or Web page and we will see if volunteers will do it. If INCOSE members do not volunteer, the search for volunteers would expand to academia and outwards. A typical call for volunteers is shown in the box. The information is presented in several categories as follows:

- **Task number.** The task identification numbers in the WBS. All tasks are identified by the expected products rather than by the activities.
- **Background.** The reason for the task and any other pertinent information.
- **Task Description**. The goals of, and a description of, the task.
- **Task Product.** The expected output of the task. This will normally be a product of some kind.
- **Subsequent Task.** A brief description of the following task that will identify how the product produced by this task will be used.
- **Previous Task.** An identification of the previous task(s) so people can see the location of this task in the Project PERT chart.
- **Task Categories.** The category and criticality of this task.
- **Volunteer information.** Each volunteer must provide this information to assure the project that the risk of non-completion is minimal. The goal is to maximize the overlap of the motivation of the volunteer with that of the project (Kasser, 1995).

OPTIONS FOR PROTOTYPING

The following prototyping options have been identified at this time:

- **Two way audio.** There are several methods of prototyping two way audio, including conventional telephone links and Internet real time audio links.
- **Video.** Several technologies appear as candidates using ISDN and the Internet. One technology under consideration MBONE is "Multi-Cast Backbone" (MBONE).
- **World Wide Web.** Use Web pages to hold the presentation graphics for display at the symposium sites and some other technology for the interactive activities. Dr. Kasser already uses this approach for distributing his classroom lecture presentation graphics to his students.

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Background. The number of people attending INCOSE Symposia has increased over the last few years. However, the schedule of locations for the next four years may reduce future attendance simply as a function of location.

Task Description. Two parts.
1. Identify the factors that determine if a company will fund a trip to a Symposium by its employees.
2. Determine the probability of those factors affecting the attendance at the INCOSE Vancouver 19998, Brighton 2000 and Sydney 2001 Symposia.

Task Products. Study report and working group paper. Should provide some requirements for the tele-conference.

Subsequent Task. Data should be useful to organizers to mold the Symposia to the marketplace. The customers are the companies that fund the travel; the products are the improved members.

Previous Task. None.

Task Categories.
1. Not in critical path.
2. May be performed by more than one volunteer. Preferably so, to validate data independently.
3. Suitable for student term papers.

Volunteer information. To volunteer for the tasks please provide the following information
1. Name, e-mail, and mailing address.
2. Qualifications for doing the job.
3. Why you want to do the job (motivation)
4. Resources you have available.
5. Products you plan to deliver (plans, intermediate and final)
6. Schedule for deliveries.

Issues to be addressed include determining the limits on the number of participants for two-way video links.

PROJECT PROGRESS SO FAR

Since the idea was first initiated, progress has occurred in the following areas:

- Membership Interest.
- Prototyping.
- Internet Listserver.

- Identification of similar events.

Membership Interest. Some interest has already been aroused in the I2VC Project. Brief discussions have taken place:

- At the 1997 Symposium in Los Angeles.
- The INCOSE Chesapeake Chapter on November 12, 1997.
- Via the Internet Discussion groups.

Prototyping. Some prototyping has already taken place as described below. Two types of two-way audio tests have already taken place.

In 1992 Joe Kasser gave a presentation in Minneapolis, MN. The unusual aspect of the presentation was that he gave it from his home in Silver Spring, MD. He had previously mailed the transparencies to Minneapolis and then gave the talk via a telephone link. The measurement for the success of the presentation he used is that a year or so later he was invited to present in person on a similar topic (all expenses paid).

Internet real-time audio has also been tried. Excellent results have been achieved using VocalTec Internet Phone (TM) Version 3.11 (Build 20, beta release) - 14 January, 1996. This is a software package that uses a sound card in the Personal Computer and a fast connection to the Internet. There is no cost other than that of the software. Thirty-day evaluation copies of the software are also available at no cost. Brief tests took place (using the evaluation software) between College Park, MD. and various stateside locations. Other tests took place on links out to Canada, Poland, England, and Moscow in Russia. The quality of the links was acceptable to an uncalibrated ear except for the links to Eastern Europe that experienced significant dropouts. However, they can be expected to improve over the next few years.

Further prototyping in this manner could be a distance session using the available technologies. One such technology already identified is marketed by OnLive! Technologies, who offer audio conferencing software that enables live group communication over the Internet or corporate intranets. Their Web page HTTP://www.onlive.com carries more information on their products.

The format for prototyping two-way audio links could be a chapter meeting in which the presenter is at a distance, and the transparencies are accessible at the local site. We would then measure the effectiveness as compared to having the speaker in the meeting.

It may be possible to use a mixture of the technologies, telephone for the sessions, and Internet audio for the peer-to-peer networking. Time will tell.

Internet Listserver. The DXCONF has been set up for discussion of the project and related topics. To sign on the Listserver, send an E-mail message to listproc@nova.umuc.edu with the following request:

Subscribe dxconf <Your E-mail address> <your name>

Identification of similar events. The advantages of modern technological alternatives to conventional conferences have already been noted (O'Haver, 1994). As an example, the ChemConf '98 On-Line Conference on Chemical Education sponsored by the Division of Chemical Education of the American Chemical Society took place between January 16 and May 1, 1998. This was a conference wherein the abstracts of the presentations were posted on the web and discussions took place using conventional text based Internet communications for a limited amount of time.

The ChemConf series of online conferences that started in 1993, decided early on to operate in the asynchronous mode because of time zone differences (e.g., with Australia). Presenters were allowed to decide what multimedia elements to use in their "paper." Some have included pre-recorded video clips (w/sound), but most were just simple text-and-graphics. They have not used any synchronous technologies (e.g., chat, real-time video/audio) (O'Haver, 1998).

NEAR FUTURE PLANS

Planned activities before the Vancouver symposium were to:

- Arrange to prototype tele-sessions at chapter meetings.
- Locate additional volunteers including those to act as chapter contact points to handle the hardware and software interfaces of the communications links.
- Complete the Project Plan for presentation at the symposia.

SUMMARY

This is a preliminary description of an imaginative project that has the potential to make a real contribution to the organization and to change the nature of international

conferences and symposia by applying information age technology in a methodical manner. This project is ongoing and volunteers are needed. Subscribe to the Internet Listserver and watch for *'calls for volunteers'.*

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BIOGRAPHY

Joseph Kasser has more than 25 years of award winning experience in management and engineering. He teaches software design, software validation and verification, and software maintenance in the Graduate School of Management and Technology at the University of Maryland University College. He is a recipient of NASA's Manned Space Flight Awareness (Silver Snoopy) Award for quality and technical excellence. He is a Certified Manager and a recipient of the Institute of Certified Professional Manager's 1993 Distinguished Service Award. He is the author of *Applying Total Quality Management to Systems Engineering* published by Artech House and more than 30 journal articles and conference papers. His current interests lie in the areas of applying systems engineering to organizations and using technology to improve the practice of management.

Marsha Weiskopf has 18 years of experience in various aspects of systems engineering including 'organization' and working with teams. She received a commendation for work on Milstar for frequency management which required leading a very diverse mix of organizations and contractors with various levels of authority, to agreement and implementation of program changes in order to meet frequency management requirements. She is currently a staff engineer with the Space Systems Division of the Aerospace Corporation. She has also worked at Martin Marietta and Hughes Aircraft. She holds a Master of Science degree in Electrical Engineering from the University of Southern California.