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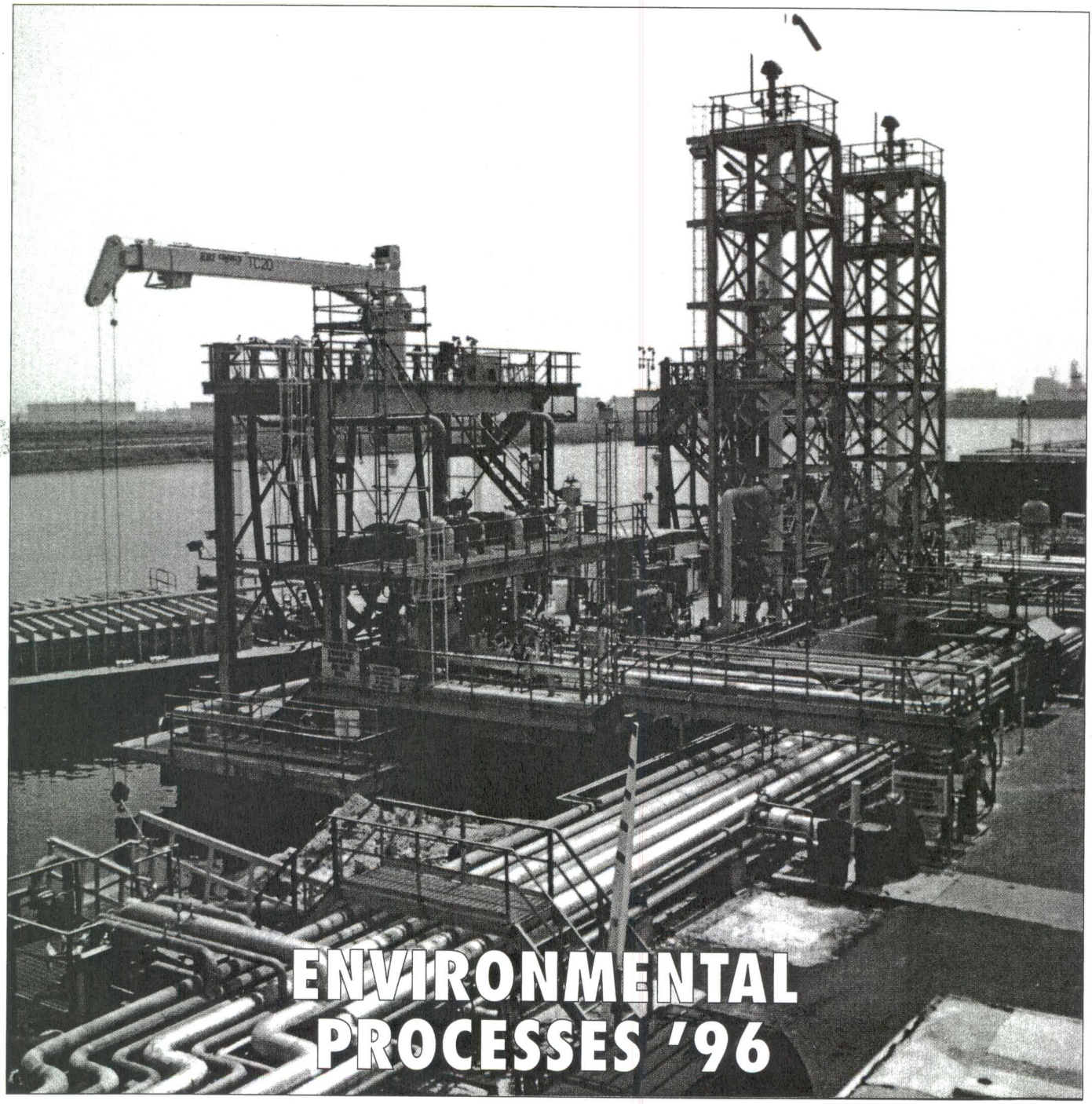

ENVIRONMENTAL PROCESSES '96

REDUCE COSTS WITH LASER ALIGNMENT

GROUP DYNAMICS OF VIDEO CONFERENCING

USE DESALTING FOR FCC FEEDSTOCKS

INTERNATIONAL EDITION

Hydrocarbon Processing®

AUGUST 1996 • VOL. 75 NO. 8

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HYDROCARBON PROCESSING (ISSN 0018-8190) is published monthly by Gulf Publishing Co., 3301 Allen Parkway, Houston, Texas 77019-1805. Periodicals postage paid at Houston, Texas, and at additional mailing office. United States and Canada, one year $24, two years $39, three years $49. All other countries, one year $36, two years $60, three years $75. Airmail rate in North America $85 a year; Outside North America $175 a year. Single copies $12, prepaid. POSTMASTER: Send address changes to Hydrocarbon Processing, P.O Box 2608, Houston, Texas 77252.

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Hydrocarbon Processing is indexed by Applied Science & Technology Index, by Chemical Abstracts and by Engineering Index Inc. Microfilm copies available through University Microfilms, International, Ann Arbor, Mich. The full text of Hydrocarbon Processing is also available in electronic versions of the Business Periodicals Index.

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Group dynamics of video conferencing

Effective use of this decision-making technology tool can save an organization time and money

F. D. Boutte, E. C. Jones, B. Hendricks and **G. J. Rodger**

Today, engineering organizations have a powerful communication tool to achieve higher productivity levels. Video conferencing is a meeting held by linking two or more locations via video and audio transmission lines. Managers and organizations must learn and implement certain "best practices" to fully use this medium. In addition, the limits of this communication form must also be understood to appropriately integrate it into an execution strategy.

The most common form of video conferencing in industry is studio-to-studio video conferencing. In this setting, employees are able to discuss issues via a video and audio link. The capabilities of the studios vary, depending on money spent at each location.

When video conferencing was first introduced, proponents of the new technology sold it on the basis of reducing costs associated with travel such as airline tickets, rental cars and hotel rooms. Although video conferencing, in some cases, reduces travel costs, most experts do not recommend selling it to management solely on that basis, but rather on the many other benefits of the technology.

Many engineering firms are participating in distributed project execution and are finding that a video conference is an excellent tool to supplement standard communication approaches to increase effectiveness. With video conferencing, the quality of communication between groups improves, decision making takes less time and problem responses requiring executive attention are faster.[1]

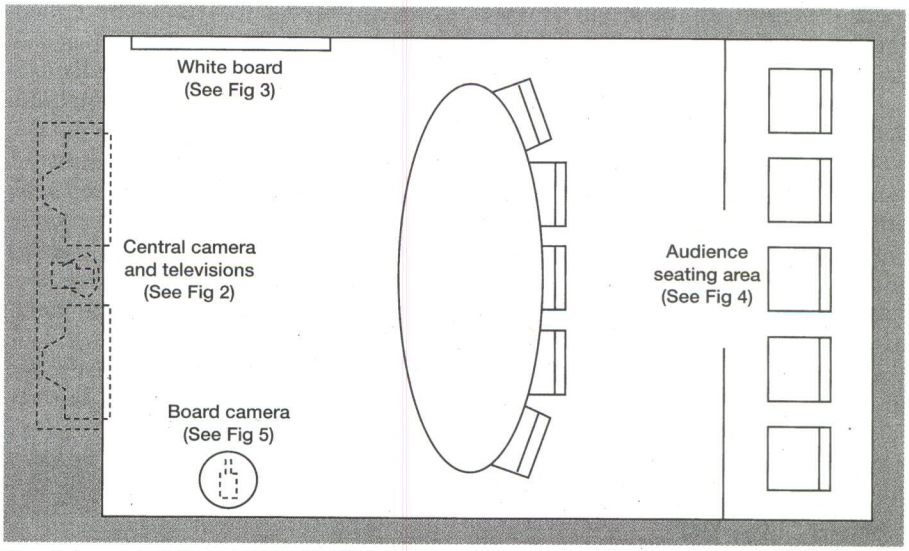

Fig. 1. Layout of Brown & Root's Clinton Drive, Houston, facility.

One of the strongest arguments used against video conferencing in the past was the high cost of building the video conference studio. Although costs are still relatively large, they are decreasing. Also, business service companies such as Kinko's Copies are offering video conference rooms that are affordable—even for small companies.[2]

VIDEO CONFERENCE STUDIO

A video conference studio is designed to facilitate meetings and maximize the quality of the image projected. A typical video conferencing center can receive multiple video signals. It can display images from multiple locations and view their transmission. However, only one location can transmit the audio signal. Therefore, a central switching center is used to send the audio signal of whomever is speaking. With a three-way video conference, the primary video picture is selected by voice activation. When an audience member at one of the sites speaks, the switching system selects that video signal as the one to be broadcast.

Video conferences can also be combined with teleconferences to include other parties not on the video link. Most video conference studios do not transmit in true real-time video, some delay is visible.

The cost of building a state-of-the-art video conference studio varies from $50,000 to $75,000 in the United States. Video conference equipment such as a PictureTel system, may cost up to $45,000.[3] This will vary with the purchase of additional equipment, such as dedicated document cameras that are designed for viewing material

close-up. The communication line cost can vary from $1,000 to $4,000 per month, depending on what level of services are leased.[4]

Customizing a dedicated room can also add to the expense. The rooms are designed with special attention to the ergonomic issues involved with video cameras. Lighting, furnishings and room layout are all considered. Figs. 1 to 5 show the video conference room layout at Brown & Root's Clinton Drive, Houston, facility.

GROUP DYNAMICS IN VIDEO CONFERENCING

Although a video conference meeting is similar to a normal face-to-face meeting, the dynamics of the meeting are very different. Understanding group dynamics involved is very important to running an effective video conference meeting.

TYPES OF TASKS

The video conference provides remote groups and individuals a very effective tool for interaction and decision making. In a situation where it might be difficult or impossible for a large group of regional managers to attend a meeting in an out-of-town location, attending via a video conference is easy. The dynamics and mechanics associated with video conferencing use provide some insight into the capabilities and shortcomings of this communication technology. A manager using it must understand which tasks are more effectively performed and how it is best administered.

In addition to managerial functions associated with planning, organizing, leading and controlling, other opportunities for successful video conferencing include specific developmental processes associated with definitive work tasks. With the technology currently available, which includes document cameras, graphics capabilities and the ability to merge video tape presentations into a video conference, the tasks that can be performed using video conferencing significantly broaden beyond just a "meeting" facilitation concept.

Tasks that can be successfully executed using video conference medium are:

- Progress and status meetings

This is the most widely used task associated with video conferencing. These meeting types normally have a very structured format and are performed at regular intervals.

- Training

Another fairly common use of video conferencing is for training. Many corporations have developed training programs that can be conducted using video conferences. Advantages include the ability to be interactive and the cost savings associated with reductions in travel costs.

- Nonprogrammed decision-making

Problem solving tasks can be successfully executed using video conferences. For decisions requiring group input, a video conference provides a more effective medium for problem communication and obtaining input and ideas. Certain techniques for problem solving are more appropriate using video conferencing. The use of brainstorming is not normally conducive to video conference problem solving. The more structured nominal group technique (NGT) is a better format for stimulating ideas for problem solving using video conferencing.

- Reviews and presentations

Design reviews, model reviews, vendor submittal reviews and various execution and design concept presentations can be effectively managed from remote locations, thereby saving time and money.

ROLES

In general, video conferencing works best for groups of people who already know each other and are comfortable working together. Video may exaggerate problems between groups that have a high degree of conflict to begin with. If two groups that do not know each other must meet via a video conference, it may be helpful for them to meet face-to-face initially to get acquainted.

There are three main roles in a video conference meeting: the facilitator, the participants and the observers.

Facilitator. The facilitator plays the most crucial role in a video conference: orchestrating the meeting. He or she keeps the meeting focused on the agenda, and encourages discussion and feedback. The person must know how to skillfully use the equipment to run the meeting efficiently. In addition, he or she must be able to communicate the message, as well as ensure that the information flows through the video medium.

The facilitator must understand nonverbal communication techniques to project the right message, and to interpret the message to other members. The facilitator should expedite the meeting but not dictate it for a

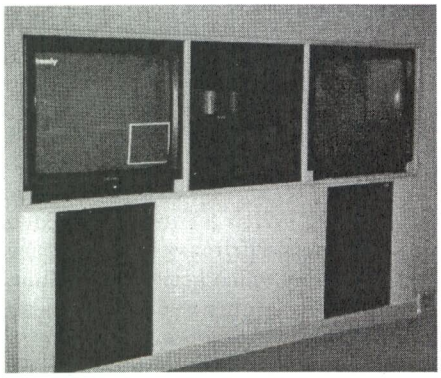

Fig. 2. Photograph of central camera and video monitors.

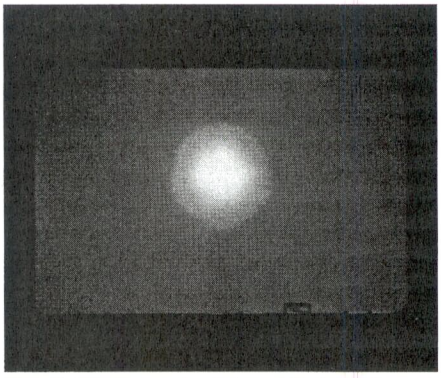

Fig. 3. Photograph of the white board.

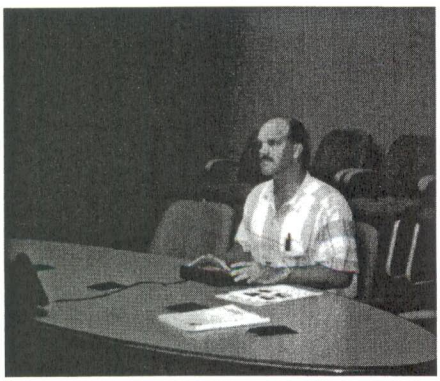

Fig. 4. Photograph of Doug Boutte using the controller keypad.

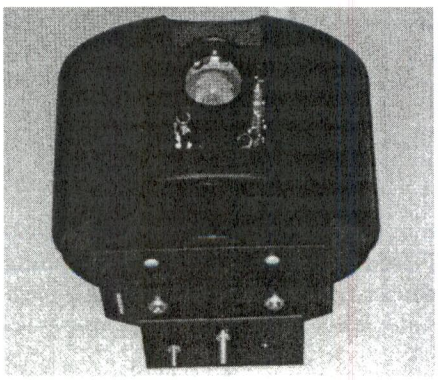

Fig. 5. Photograph of wall-mounted board camera.

private agenda. In general, he or she must be able to run an effective meeting within the constraints of video conferencing.

Participant. The participants are the group members who have direct expertise or are involved with the meeting's subject. Usually, they are required to give some type of feedback. They should know and adhere to video conference protocol as defined within their group structure.

Observer. An observer is a person who attends the video conference but does not normally contribute to the discussion. In some cases, observers may have some expertise and can provide additional background information. In other cases, they are persons who can benefit from the information discussed. Participants should be informed of all observers in the video conference for political reasons. Observers should also be informed of the groups' norms and protocol.

NORMS

Certain norms and protocol must be followed to get the most out of a video conference. Because of the medium, discipline that is not present in normal meetings is enforced. Less time is spent on greetings and incidental chatter. The result is invariably a better, quicker conclusion to the meeting.[5] The most important norms are:

- Following the facilitator's direction
- Not speaking out of turn
- Not changing the subject while speaking.

INDIVIDUAL BEHAVIOR

Individuals participating in group meetings using video conferencing may exhibit different behavior than they would otherwise exhibit in a conventional meeting. Including video screens that project pictures of the group and individuals can be distracting for certain participants. An individual's attention can be diverted by seeing his or her own mannerisms and posture while trying to participate. Audio delays associated with video conferencing can also be a barrier to effective communication for those who are untrained or inexperienced in the use of this communication tool.

- Shyness—Individuals who have a natural shyness or inhibition in group discussions are normally even more shy or inhibited in a video conference atmosphere. The facilitator must make a conscious effort to elicit those individuals' input. If properly coached, those individuals will eventually become more proactive in the discussions as their experience level increases.
- Overbearing personalities—Because of the mechanics of the audio transmissions associated with video conferencing technology, the facilitator must establish ground rules early in the process to avoid disruptions that can be caused by vocally opinionated individuals.
- Mannerisms—Because of the presence of the video camera and the projection of the participants image on the video screen, individuals have a tendency to alter their mannerisms. This alteration in nonverbal communication may effect the impact of a message, especially if up to 55% of the message's impact is in the form of facial expressions, as believed by some researchers.[6]

GROUP COMMUNICATION

Contrary to popular belief, studies have shown that communication mediated by audio or video can be just as effective as face-to-face meetings. Two studies by Harmon, et al., used 90 small, well-established decision teams.[7] These teams examined the effects of a one-time use of teleconferencing on group decision performance and status structure across two different problem solving tasks. The first was intellective, the other value-laden. Teleconferencing did not affect performance or structural stability in either study.

Teleconferencing groups were no more or less likely to produce high-quality solutions or to support their groups' decisions than were face-to-face groups. Status differentiation and leader influence remained relatively stable regardless of medium of communication. The results of these studies contradict popular wisdom and provide a needed baseline for further research on electronically mediated interaction among established groups.

LEADERSHIP

In terms of leadership, some studies have shown significant differences between video mediated and face-to-face meetings. A study by Strickland, et al., was done to assess the role of the communication medium on leadership differentiation in discussion groups using face-to-face discussion and video conferencing networks.[8] Face-to-face conditions produced an almost classic form of leadership development. In the video conference situation, role differentiation tendencies were curtailed.

This study reflects the need for an identified facilitator to be designated the "de jure" leader for effectively implementing video conferencing. Proper facilitation of video conference group meetings is essential. The best facilitator/leader in a video conference typically uses a participative leadership style.[6] He or she solicits opinions and input in an orderly fashion that minimizes disruptions that can erode the effectiveness of a video conference.

RESOLVING CONFLICTS

Resolving conflicts through video conferencing is not as effective as face-to-face mediation. A study by Barefoot and Strickland examined the effect of video mediation in situations involving conflict.[9] It was found that television-mediated group discussion was not as likely to produce integrative solutions indicative of high conflict and that greater variability in leader dominance and discussion time occurred among face-to-face groups. Experiment data underscores that social processes including conflict resolution are altered by adding electronic communications media.

MANAGING GROUPS WHO USE TELECOMMUNICATION

There are many different situations in which video conferencing might be beneficial to engineering organizations. For instance, in the case of two or more project teams in different countries working on a new product or process design, video conferencing may be used for design reviews. Another example is an engineering design team in the home office and a construction team at some remote jobsite. In this case, video conference can be used to resolve construction problems more quickly and reduce the need for engineers to be sent to the jobsite.

ORGANIZATION SITUATIONS

Video conferencing allows an organization to coordinate the work of disperse groups in an effective manner. The video medium allows managers to show emotional commitments and confidence. Compared to teleconferencing, the increase in information communicated is dramatic. Emotions, feelings, body language and facts are communicated in a clear manner.

Video conferencing does not replace physical face-to-face meetings. It offers an alternative between a physical meeting requiring travel and telephone con-

versations. A telephone call lacks visual information including facial expressions, explanatory gestures, and the exchange of photos and diagrams. Video conferencing restores the visual information, and allows participants to view plans, drawings, equipment and any other material needed to support the discussion.

CASE STUDIES

Case Study 1: Ciba-Geigy

Ciba-Geigy, a pharmaceutical company, has found that it can use video conferencing to reduce development time for new products. On one drug development project, research team members were based in three locations. Using video conferencing for project team meetings allowed better use of staff resources. Less time was spent traveling, so there was more time to focus on the project. More people could attend video meetings than those who would have traveled to another site. Also, other team members could be brought into the meeting on short notice. Graphic information, including photographs and experimental results, was transmitted using a document camera.[10]

Case Study 2: The Virtual Classroom—a reality

At Electronic Data Systems (EDS), the virtual classroom is a reality. EDS required a more timely and efficient approach to internal training. So, abandoning the four walls and chalkboard of a fixed location, EDS built the interactive distance learning network (IDLN). Within this virtual classroom, the instructor controls what the participants see. With nine video windows, touch screen control of cameras, VCRs, external computers, audio and live action, the instructor can transmit interactive multimedia presentations to all participants in real time. While there was a brief period of adjustment for EDS managers, the network has become popular for training and meetings with a variety of EDS groups. Sessions may take many forms. Some are geared to distributing information to people in the field, while others are used to distribute management strategies.[11]

Case Study 3: ARCO Clean Fuels Project vs ADNOC ONG Project

The third case study contrasts the differences between two distributed projects performed by the same company: with and without video conferencing.

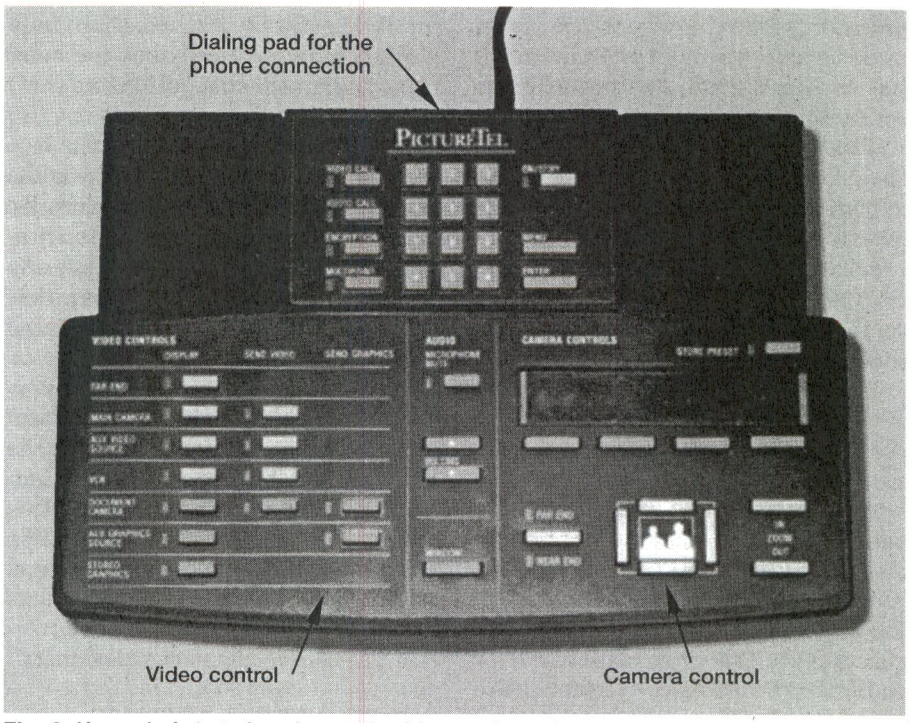

Fig. 6. Keypad of control equipment in video conferencing room.

ARCO CLEAN FUELS PROJECT

Brown & Root, an engineering and construction company, was performing a plant upgrade for Arco Production. On this project, Brown & Root executed a distributed engineering strategy, working between its Singapore and Alhambra, California, offices.

No video conferencing capability was available during the execution of this project. All drawings and information were transferred electronically by computer. The final drawings were downloaded on tapes in Singapore and dispatched by courier to Alhambra. Executing this project revealed some technology issues, such as software and hardware compatibility problems, that required additional coordination. Using electronic mail was essential for project execution. However, communication problems between the two groups still existed. Video conference capabilities could have enhanced the overall coordination and group interaction.

ADNOC ONG PROJECT

Brown & Root was chosen by the Abu Dhabi National Oil Company as the project management consultant for the ADNOC ONG Project. Bechtel, Technip and the Pritchard Corporation formed a joint venture to perform engineering and construction. Bechtel was responsible for utilities and compression design from their Hammersmith office in London. Technip performed the gas stripping and treating design in its Paris office. Pritchard performed the sulfur removal engineering from its Kansas City, Missouri, office.

Each of the engineering offices and the ADNOC headquarters in Abu Dhabi City were linked via electronic mail. Video conference capabilities were established at each engineering office and at the ADNOC headquarters in Abu Dhabi City. Each firm worked with the inhouse review team to ensure compliance with the owner's requirements. Although each firm had an inhouse review team, conflicts with design issues were a constant object of discussion.

Using video conferences successfully solved these problems by having weekly status meetings. Because of the high-pressure environment of this project, conflict between various video conference participants was inevitable. Early meetings where conflicts occurred were very ineffective. Facilitator skills had not been developed and the control and flow of the meetings were lost. In some cases, certain participants were overbearing and did not allow opinions to be expressed, or inhibited input from the other participants. Diversity of the cultures participating in the project also proved to be a challenging element in the group interaction.

No formal training in the effective use of video conferences was provided

to the managers who functioned as facilitators. They were required to learn how to improve meeting dynamics through trial and error. Some managers successfully navigated their way through the early "mine fields" associated with video conferences while others were never truly effective. The managers who were successful developed very effective meeting facilitating skills while those who were unsuccessful avoided using video conferences as a communication tool altogether.

Although electronic mail proved to be a valuable instrument on the ARCO Clean Fuels Project, some communications problems did occur that might have been solved by using video conferencing. Video conferencing was a very helpful tool on the ADNOC ONG project, although better training would have made it even more effective.

RECOMMENDATIONS

Before implementing video conferencing, a cost-benefit analysis should be performed to calculate return on investment to the organization. The level of commitment to video conferencing is dictated by organizational needs. Multinational organizations or other distributed operations should be able to benefit from some form of video conferencing.

The following strategies are recommended for groups that implement video conferencing:

STRATEGIES FOR USING VIDEO CONFERENCING

- Ask, "Is video conferencing appropriate for the meeting?"
- Facilitator training. The facilitators should be trained on managing specific video conferencing group dynamics.
- Schedule meetings early. Participants should be given as much advance notice as possible so they have time to prepare for the meeting.
- Have a detailed agenda. The person who called the meeting should send a detailed agenda to all participants prior to the meeting. It should include time allotments for each subject.
- Follow proper protocol. A list of video conferencing protocols should be given to each participant before the meeting, and everyone should be held accountable for adhering to them.
- Include all participants in the discussion. Use a "round robin" or other formal technique to guide the discussion.
- Practice, practice, practice. Facilitators should practice being in front of the camera to overcome inhibitions.

ACKNOWLEDGMENT

The authors would like to thank Dr. Chung of the industrial engineering department at the University of Houston for his guidance and support.

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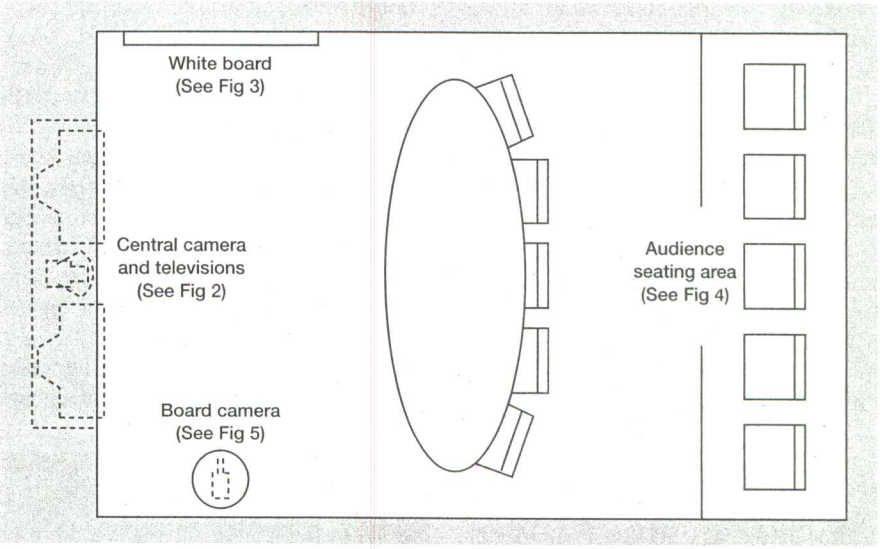

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Video conferences can also be combined with teleconferences to include other parties not on the video link. Most video conference studios do not transmit in true real-time video, some delay is visible.

The cost of building a state-of-the-art video conference studio varies from $50,000 to $75,000 in the United States. Video conference equipment such as a PictureTel system, may cost up to $45,000.[3] This will vary with the purchase of additional equipment, such as dedicated document cameras that are designed for viewing material

close-up. The communication line cost can vary from $1,000 to $4,000 per month, depending on what level of services are leased.[4]

Customizing a dedicated room can also add to the expense. The rooms are designed with special attention to the ergonomic issues involved with video cameras. Lighting, furnishings and room layout are all considered. Figs. 1 to 5 show the video conference room layout at Brown & Root's Clinton Drive, Houston, facility.

GROUP DYNAMICS IN VIDEO CONFERENCING

Although a video conference meeting is similar to a normal face-to-face meeting, the dynamics of the meeting are very different. Understanding group dynamics involved is very important to running an effective video conference meeting.

TYPES OF TASKS

The video conference provides remote groups and individuals a very effective tool for interaction and decision making. In a situation where it might be difficult or impossible for a large group of regional managers to attend a meeting in an out-of-town location, attending via a video conference is easy. The dynamics and mechanics associated with video conferencing use provide some insight into the capabilities and shortcomings of this communication technology. A manager using it must understand which tasks are more effectively performed and how it is best administered.

In addition to managerial functions associated with planning, organizing, leading and controlling, other opportunities for successful video conferencing include specific developmental processes associated with definitive work tasks. With the technology currently available, which includes document cameras, graphics capabilities and the ability to merge video tape presentations into a video conference, the tasks that can be performed using video conferencing significantly broaden beyond just a "meeting" facilitation concept.

Tasks that can be successfully executed using video conference medium are:

- Progress and status meetings

This is the most widely used task associated with video conferencing. These meeting types normally have a very structured format and are performed at regular intervals.

- Training

Another fairly common use of video conferencing is for training. Many corporations have developed training programs that can be conducted using video conferences. Advantages include the ability to be interactive and the cost savings associated with reductions in travel costs.

- Nonprogrammed decision-making

Problem solving tasks can be successfully executed using video conferences. For decisions requiring group input, a video conference provides a more effective medium for problem communication and obtaining input and ideas. Certain techniques for problem solving are more appropriate using video conferencing. The use of brainstorming is not normally conducive to video conference problem solving. The more structured nominal group technique (NGT) is a better format for stimulating ideas for problem solving using video conferencing.

- Reviews and presentations

Design reviews, model reviews, vendor submittal reviews and various execution and design concept presentations can be effectively managed from remote locations, thereby saving time and money.

ROLES

In general, video conferencing works best for groups of people who already know each other and are comfortable working together. Video may exaggerate problems between groups that have a high degree of conflict to begin with. If two groups that do not know each other must meet via a video conference, it may be helpful for them to meet face-to-face initially to get acquainted.

There are three main roles in a video conference meeting: the facilitator, the participants and the observers.

Facilitator. The facilitator plays the most crucial role in a video conference: orchestrating the meeting. He or she keeps the meeting focused on the agenda, and encourages discussion and feedback. The person must know how to skillfully use the equipment to run the meeting efficiently. In addition, he or she must be able to communicate the message, as well as ensure that the information flows through the video medium.

The facilitator must understand nonverbal communication techniques to project the right message, and to interpret the message to other members. The facilitator should expedite the meeting but not dictate it for a

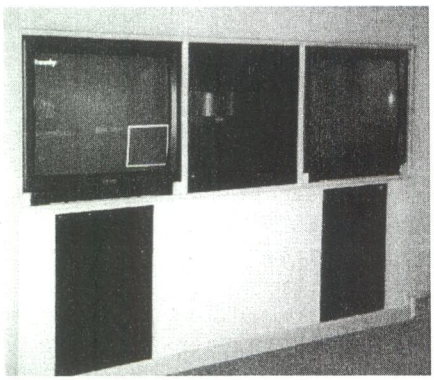

Fig. 2. Photograph of central camera and video monitors.

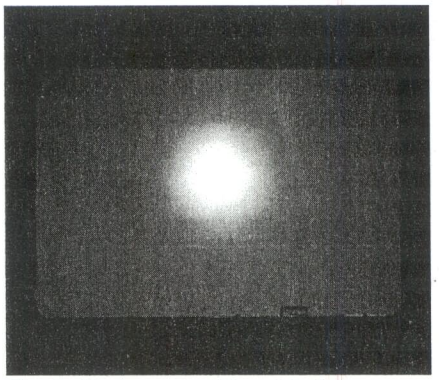

Fig. 3. Photograph of the white board.

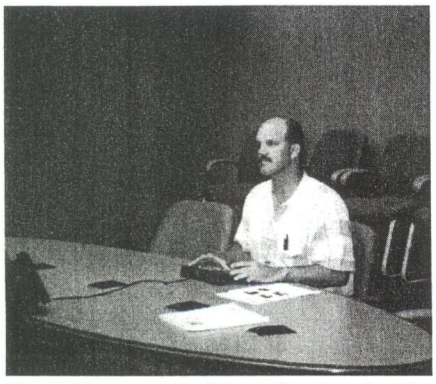

Fig. 4. Photograph of Doug Boutte using the controller keypad.

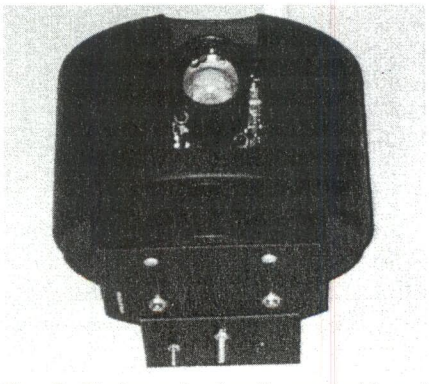

Fig. 5. Photograph of wall-mounted board camera.

private agenda. In general, he or she must be able to run an effective meeting within the constraints of video conferencing.

Participant. The participants are the group members who have direct expertise or are involved with the meeting's subject. Usually, they are required to give some type of feedback. They should know and adhere to video conference protocol as defined within their group structure.

Observer. An observer is a person who attends the video conference but does not normally contribute to the discussion. In some cases, observers may have some expertise and can provide additional background information. In other cases, they are persons who can benefit from the information discussed. Participants should be informed of all observers in the video conference for political reasons. Observers should also be informed of the groups' norms and protocol.

NORMS

Certain norms and protocol must be followed to get the most out of a video conference. Because of the medium, discipline that is not present in normal meetings is enforced. Less time is spent on greetings and incidental chatter. The result is invariably a better, quicker conclusion to the meeting.[5] The most important norms are:

- Following the facilitator's direction
- Not speaking out of turn
- Not changing the subject while speaking.

INDIVIDUAL BEHAVIOR

Individuals participating in group meetings using video conferencing may exhibit different behavior than they would otherwise exhibit in a conventional meeting. Including video screens that project pictures of the group and individuals can be distracting for certain participants. An individual's attention can be diverted by seeing his or her own mannerisms and posture while trying to participate. Audio delays associated with video conferencing can also be a barrier to effective communication for those who are untrained or inexperienced in the use of this communication tool.

- Shyness—Individuals who have a natural shyness or inhibition in group discussions are normally even more shy or inhibited in a video conference atmosphere. The facilitator must make a conscious effort to elicit those individuals' input. If properly coached, those individuals will eventually become more proactive in the discussions as their experience level increases.
- Overbearing personalities—Because of the mechanics of the audio transmissions associated with video conferencing technology, the facilitator must establish ground rules early in the process to avoid disruptions that can be caused by vocally opinionated individuals.
- Mannerisms—Because of the presence of the video camera and the projection of the participants image on the video screen, individuals have a tendency to alter their mannerisms. This alteration in nonverbal communication may effect the impact of a message, especially if up to 55% of the message's impact is in the form of facial expressions, as believed by some researchers.[6]

GROUP COMMUNICATION

Contrary to popular belief, studies have shown that communication mediated by audio or video can be just as effective as face-to-face meetings. Two studies by Harmon, et al., used 90 small, well-established decision teams.[7] These teams examined the effects of a one-time use of teleconferencing on group decision performance and status structure across two different problem solving tasks. The first was intellective, the other value-laden. Teleconferencing did not affect performance or structural stability in either study.

Teleconferencing groups were no more or less likely to produce high-quality solutions or to support their groups' decisions than were face-to-face groups. Status differentiation and leader influence remained relatively stable regardless of medium of communication. The results of these studies contradict popular wisdom and provide a needed baseline for further research on electronically mediated interaction among established groups.

LEADERSHIP

In terms of leadership, some studies have shown significant differences between video mediated and face-to-face meetings. A study by Strickland, et al., was done to assess the role of the communication medium on leadership differentiation in discussion groups using face-to-face discussion and video conferencing networks.[8] Face-to-face conditions produced an almost classic form of leadership development. In the video conference situation, role differentiation tendencies were curtailed.

This study reflects the need for an identified facilitator to be designated the "de jure" leader for effectively implementing video conferencing. Proper facilitation of video conference group meetings is essential. The best facilitator/leader in a video conference typically uses a participative leadership style.[6] He or she solicits opinions and input in an orderly fashion that minimizes disruptions that can erode the effectiveness of a video conference.

RESOLVING CONFLICTS

Resolving conflicts through video conferencing is not as effective as face-to-face mediation. A study by Barefoot and Strickland examined the effect of video mediation in situations involving conflict.[9] It was found that television-mediated group discussion was not as likely to produce integrative solutions indicative of high conflict and that greater variability in leader dominance and discussion time occurred among face-to-face groups. Experiment data underscores that social processes including conflict resolution are altered by adding electronic communications media.

MANAGING GROUPS WHO USE TELECOMMUNICATION

There are many different situations in which video conferencing might be beneficial to engineering organizations. For instance, in the case of two or more project teams in different countries working on a new product or process design, video conferencing may be used for design reviews. Another example is an engineering design team in the home office and a construction team at some remote jobsite. In this case, video conference can be used to resolve construction problems more quickly and reduce the need for engineers to be sent to the jobsite.

ORGANIZATION SITUATIONS

Video conferencing allows an organization to coordinate the work of disperse groups in an effective manner. The video medium allows managers to show emotional commitments and confidence. Compared to teleconferencing, the increase in information communicated is dramatic. Emotions, feelings, body language and facts are communicated in a clear manner.

Video conferencing does not replace physical face-to-face meetings. It offers an alternative between a physical meeting requiring travel and telephone con-

versations. A telephone call lacks visual information including facial expressions, explanatory gestures, and the exchange of photos and diagrams. Video conferencing restores the visual information, and allows participants to view plans, drawings, equipment and any other material needed to support the discussion.

CASE STUDIES

Case Study 1: Ciba-Geigy

Ciba-Geigy, a pharmaceutical company, has found that it can use video conferencing to reduce development time for new products. On one drug development project, research team members were based in three locations. Using video conferencing for project team meetings allowed better use of staff resources. Less time was spent traveling, so there was more time to focus on the project. More people could attend video meetings than those who would have traveled to another site. Also, other team members could be brought into the meeting on short notice. Graphic information, including photographs and experimental results, was transmitted using a document camera.[10]

Case Study 2: The Virtual Classroom—a reality

At Electronic Data Systems (EDS), the virtual classroom is a reality. EDS required a more timely and efficient approach to internal training. So, abandoning the four walls and chalkboard of a fixed location, EDS built the interactive distance learning network (IDLN). Within this virtual classroom, the instructor controls what the participants see. With nine video windows, touch screen control of cameras, VCRs, external computers, audio and live action, the instructor can transmit interactive multimedia presentations to all participants in real time. While there was a brief period of adjustment for EDS managers, the network has become popular for training and meetings with a variety of EDS groups. Sessions may take many forms. Some are geared to distributing information to people in the field, while others are used to distribute management strategies.[11]

Case Study 3: ARCO Clean Fuels Project vs ADNOC ONG Project

The third case study contrasts the differences between two distributed projects performed by the same company: with and without video conferencing.

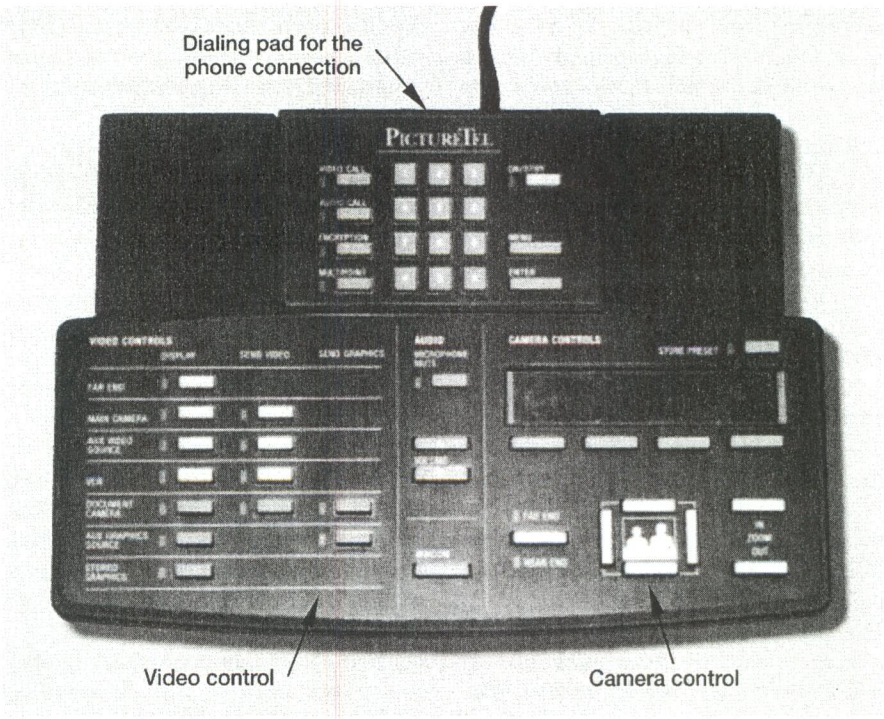

Fig. 6. Keypad of control equipment in video conferencing room.

ARCO CLEAN FUELS PROJECT

Brown & Root, an engineering and construction company, was performing a plant upgrade for Arco Production. On this project, Brown & Root executed a distributed engineering strategy, working between its Singapore and Alhambra, California, offices.

No video conferencing capability was available during the execution of this project. All drawings and information were transferred electronically by computer. The final drawings were downloaded on tapes in Singapore and dispatched by courier to Alhambra. Executing this project revealed some technology issues, such as software and hardware compatibility problems, that required additional coordination. Using electronic mail was essential for project execution. However, communication problems between the two groups still existed. Video conference capabilities could have enhanced the overall coordination and group interaction.

ADNOC ONG PROJECT

Brown & Root was chosen by the Abu Dhabi National Oil Company as the project management consultant for the ADNOC ONG Project. Bechtel, Technip and the Pritchard Corporation formed a joint venture to perform engineering and construction. Bechtel was responsible for utilities and compression design from their Hammersmith office in London. Technip performed the gas stripping and treating design in its Paris office. Pritchard performed the sulfur removal engineering from its Kansas City, Missouri, office.

Each of the engineering offices and the ADNOC headquarters in Abu Dhabi City were linked via electronic mail. Video conference capabilities were established at each engineering office and at the ADNOC headquarters in Abu Dhabi City. Each firm worked with the inhouse review team to ensure compliance with the owner's requirements. Although each firm had an inhouse review team, conflicts with design issues were a constant object of discussion.

Using video conferences successfully solved these problems by having weekly status meetings. Because of the high-pressure environment of this project, conflict between various video conference participants was inevitable. Early meetings where conflicts occurred were very ineffective. Facilitator skills had not been developed and the control and flow of the meetings were lost. In some cases, certain participants were overbearing and did not allow opinions to be expressed, or inhibited input from the other participants. Diversity of the cultures participating in the project also proved to be a challenging element in the group interaction.

No formal training in the effective use of video conferences was provided

to the managers who functioned as facilitators. They were required to learn how to improve meeting dynamics through trial and error. Some managers successfully navigated their way through the early "mine fields" associated with video conferences while others were never truly effective. The managers who were successful developed very effective meeting facilitating skills while those who were unsuccessful avoided using video conferences as a communication tool altogether.

Although electronic mail proved to be a valuable instrument on the ARCO Clean Fuels Project, some communications problems did occur that might have been solved by using video conferencing. Video conferencing was a very helpful tool on the ADNOC ONG project, although better training would have made it even more effective.

RECOMMENDATIONS

Before implementing video conferencing, a cost-benefit analysis should be performed to calculate return on investment to the organization. The level of commitment to video conferencing is dictated by organizational needs. Multinational organizations or other distributed operations should be able to benefit from some form of video conferencing.

The following strategies are recommended for groups that implement video conferencing:

STRATEGIES FOR USING VIDEO CONFERENCING

- Ask, "Is video conferencing appropriate for the meeting?"
- Facilitator training. The facilitators should be trained on managing specific video conferencing group dynamics.
- Schedule meetings early. Participants should be given as much advance notice as possible so they have time to prepare for the meeting.
- Have a detailed agenda. The person who called the meeting should send a detailed agenda to all participants prior to the meeting. It should include time allotments for each subject.
- Follow proper protocol. A list of video conferencing protocols should be given to each participant before the meeting, and everyone should be held accountable for adhering to them.
- Include all participants in the discussion. Use a "round robin" or other formal technique to guide the discussion.
- Practice, practice, practice. Facilitators should practice being in front of the camera to overcome inhibitions.

ACKNOWLEDGMENT

The authors would like to thank Dr. Chung of the industrial engineering department at the University of Houston for his guidance and support.

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