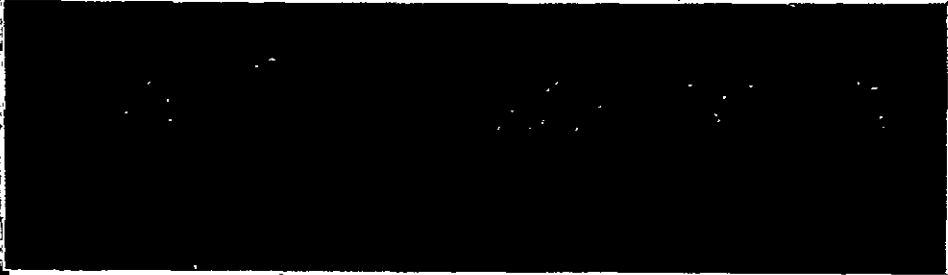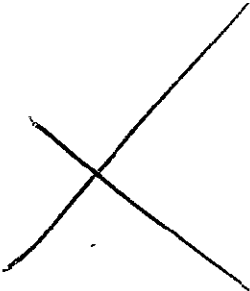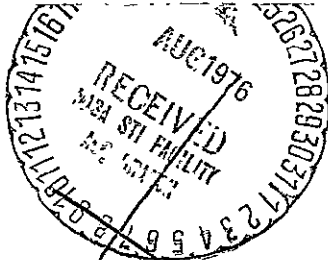(NASA-TM-X-74160) THE NASA TELECONFERENCING     N76-29443
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# THE NASA TELECONFERENCING SYSTEM:  AN EVALUATION

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# CHAPTER I
## INTRODUCTION

The communication requirements of the Apollo project led to the development of a teleconferencing network which linked together, in an audio-fax mode, the several NASA centers and supporting contractors of the Apollo project. The usefulness of this communication linkage for the Apollo project suggested that the system might be extended to include all NASA centers, enabling them to conduct their in-house business more efficiently than by traveling to other centers. The idea gained impetus from the fact that greater emphasis was being placed on the need to restrict travel allocation, while at the same time, travel costs were rising dramatically.

During calendar year 1975, a pilot project was run in which seventeen NASA centers and subcenters, some with multiple facilities, were connected into the NASA teleconferencing network. During that year, costs were to be charted and, at the end of the year, an evaluation was to be made to determine how the system had been used and with what results. This report summarizes the year-end evaluation of the use of NASA teleconferencing system.

An operating teleconferencing system represents a complex mix of hardware and people variables. How well the system works depends on the capacity of the system and on how well conferees are able to utilize this capability.

Lacking formal models of mediated group interaction, the problem faced by researchers is one of formulating questions that seem critical to the understanding and design of teleconferencing systems, devising systematic frameworks in which the questions and their answers can be organized, and developing instruments that will permit fairly clear and unambiguous answers to the -questions.

A common approach to this problem has been to adopt taxonomies of group processes postulated ·by researchers in group dynamics and small-group research. However, these taxonomies tend to be oriented toward dyadic communication (only two persons), and extrapolation from dyadic patterns to group patterns of communication, whether face-to-face or mediated, is subject to question.

One of the more useful frameworks for directing and organizing research in teleconferencing systems is provided by the recently de-classified teleconferencing studies conducted by the Institute of Defense Analyses.[1] These studies examined the possiblities for using various kinds of teleconferencing systems in international crisis communications. Their efforts focused on the careful evaluation and comparison of various teleconferencing systems in relation to particular characteristics of crisis negotiations (e.g., dimensions of crisis and social determinants of interaction), intervening variables (e.g., interaction process variables such as participation frequency, message traffic, etc.), and criterion variables (e.g., group satisfaction and task outcome).

A similar breakdown into antecedent variables, intervening variables and criterion measures is found in Casey-Stahmer and Havron.[2] Drawing on their own survey results and the work of their predecessors, these authors produced a useful organizational framework by subdividing the three main categories of variables into subsystems. Antecedent variables were seen to include the various dimensions by which designers can vary the system. Antecedent variables were subdivided on the basis of the following subsystems and components:

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[1] Bailey, A., P. Nordlie, and F. Sistrunk, Teleconferencing: "literature Review, Field Studies, and Working Papers," Research Paper P-113, Institute for Defense Analysis (October 1963).

[2] Casey-Stahmer, A. E., and M. Dean Havron, Planning Research in Teleconference Systems, Ottawa, Department · of Communication (July 1973)

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Workspace and physical environment,
Audio subsystem and aural environment,
Video subsystem and visual environment,
Telegraphic System, and
Personnel/social subsystem.

Intervening variables in this schema are difficult to explicate, and therefore difficult to measure. The authors considered intervening variables to fall into either intra-system or extra-system categories. Intra-system variables include those factors that influence communication behavior during any given conference. Examples of these factors are feedback, raster, gatekeeping, authority relations between terminals and procedures for conduct of the conference. Extra-system variables were seen as relating to the missions and responsibilities of the users' organizations and to the manner in which the teleconferencing system is used. Examples of extra-system variables include travel time, managerial support, frequency of use and substitutability of teleconferencing for face-to-face meetings.

Criteria variables are broken into two groups: measures of effectiveness (generally quantitative observable indicators) and measures of satisfaction (affective measures gathered from participants).

Bretz[3] draws the distinction between what he calls an "appropriate" communication system and a "practical" communication system.

"To be considered appropriate, a medium need only be capable of expressing the desired message information . . . Practicability of a medium, on the other hand, involves many other considerations such as convenience and accessibility, equipment reliability, interchangeability of software, acceptability to the people who

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[3] Bretz, Rudy, The Selection of Appropriate Communication Media for Instruction: A Guide for Designers of Air Force Technical Training Programs, R and Corporation Report R-601-PR, February 1971.

must use it, special training required for its effective use and finally, its cost relative to those of other equally appropriate alternatives."

Following this distinction, one may determine how relatively "appropriate" a system is either by objective measures (comparing performance on selected tasks with performance on similar tasks using other modes of communication) or by subjective measures (response to and acceptance by users). The practicability of a system, as Bretz notes, involves many considerations not the least of which are the costs associated with the system.

Although other taxonomies have relevance,[4] these suggested outlines hopefully will aid the reader in organizing the findings and the approaches reported in this paper.

The evaluation presented in this report is an attempt to determine both how the system could be used and how it is being used. The heart of this evaluation effort is based on the responses of users of the system (Chapter 4). Chapter 2 provides a comprehensive review of the teleconferencing literature which formed the foundation on which the evaluation is based. Chapter 3 presents a description of the NASA teleconferencing system and insights into its use gathered from interview with center facility managers. Chapter 5 describes the relationships between travel and teleconferencing for one center studied in considerable detail. The final chapter summarizes the findings of the study and outlines our recommendations for improving the usefulness of the system.

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[4] See for instance Johansen, R., R. H. Miller, and J. Vallee Group Communication through Electronic Media: Fundamental Choices and Social Effects, in H. A. Linstone and M. Turnoff, eds., The Delphi Technique: Techniques and Applications, Addison-Wesley; Reading, Mass. 1975.

CHAPTER II

TELECONFERENCING RESEARCH


This chapter presents and discusses the main findings on the effects
and effectiveness of telecommunication systems.  The first part of the
chapter will deal with studies on effects of media on user behavior.
The latter part of the chapter will deal with attitudinal studies and
surveys concerned with acceptability and affective reactions to the
teleconferencing media.

A.    Experiments

1.    Tasks Sensitive to the Medium

Tasks which are particularly sensitive to variations in
the medium of communication are those which necessitate interaction
among conferees and those for which the expression and perception
of emotion is relevant to the outcome.

Need for Interaction.  It is apparent that tasks in which
there is little need for two-way communication (e.g., information
transmission, giving instructions) are relatively unaffected
by constraints on interaction.  In an experiment conducted by
the Communications Study Group,  subjects were required to
communicate to other subjects the contents of a letter.  No
effect of medium was found in retention of the main points of
the letter. In problem-solving experiments requiring somewhat
more interaction between information seeker and information
source, Chapanis et al[2] found that the degree of success in
arriving at a correct solution was not affected by the medium

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[1]    Communications Study Group, Joint Unit for Planning Research (JUPR)
(University College London), P/70240/CH, 1970

[2]    Chapanis, A., R. Ochsman, R. Parrish, and G. Weeks, Studies in
Interactive Communication: The Effects of Four Communication Modes
on the Behavior of Teams during Cooperative Problem-Solving, Human Factors,
Dec. 1972.

of communication.  Other aspects, such as time to solution and
activity patterns, were affected, but the outcome remained constant
over media. Studies concerning the identification of tasks for
which particular media are suitable also support the conclusion
that tasks involving little interaction are unaffected by the
medium.[3]

Perception and Emotions Relevant to Task.  Non-verbal cues
(such as eye-contact, facial expression and posture) convey information
of two types:  information about the emotions of the participants,
and information dealing with the administrative control of the
interaction (e.g., who gets to speak when).  Argyle[4] emphasizes the
importance of non-verbal signals in dealing with mutual attention
and responsiveness, control of the channel, display of interpersonal
attitudes, and provisions of feedback.  Thus, the removal of the
visual channel would be expected to have most effect when this
socio-emotional and administrative information is directly relevant
to the outcome of the task.  For instance, one would hypothesize
that a job interview conducted by non-visual media would be inappropriate
since the socio-emotional content of the interaction would be
expected to be important to the outcome.

In cooperative problem-solving situations, the personal
relationships of participants are not, strictly speaking, relevant
to the outcome.  Here, little effect of medium on the outcome
would be expected.  In tasks ranging from business games to
crossword puzzles, Chapanis[5] found no effects due to the medium
of communication (i.e., face-to-face versus audio-only).  Thus,

[3] Westrum, R., unpub. Ph.D. thesis, Purdue, Univ., 1972

[4] Argyle, M., Social Interaction, Methuen, London, 1969

[5] Chapanis, et. al., op. cit.

6

the evidence supports the hypothesis that the medium of com-
munication will not affect the nature or quality of the solution
reached in cooperative problem-solving situations.

Two task areas which meet the criteria of necessary
interaction and personal relationships are bargaining and
negotiation. Studies of the impact of the medium on bargaining
and negotiation have shown significant effects on almost every
aspect of the outcome.  In these situations, the medium used
has been found to influence the ease of reaching agreement,[6]
the nature of settlement reached,[7] the extent to which individuals
persuade one another,[8] and the perception of the other party's
behavior.[9]  Several investigations indicate that a person who
has a very strong case increases his chances of success in
convincing the other if the discussion is conducted via the
telephone (where arguments can be emphasized) rather than
face-to-face (where socio-emotional factor can intervene).[10]

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[6] Communications Study Group, JUPR, Bargaining and Negotiation - An
Exploratory Study, E/71065/ SH, 1971

[7] Communications Study Group, JUPR, Conflicts of Opinion and Medium
of Communication, E/72001/SH, 1972.

[8] Communications Study Group, JUPR,
        Medium of Communication and Consensus, E/72210/SH, 1972
        Medium of Communication, Opinion Change, and Solution of a
            Priorities, E/72245/ SH
        The Effects of Medium of Communication on Persuasion, Bargaining
            and Perceptions of the Other, E/73100/SH
        Conflicts of Opinion and Medium of Communication, op. cit. Ref. 7.

[9] Communications Study Group, JUPR, Medium of Communication and Consensus,
op. cit. Ref. 8.

[10] Morley, I.E. and G.M. Stephenson, Interpersonal and Interparty Exchange,
a laboratory simulation of an industrial negotiation at the plant level,
Brit. J. Psych., 60, #4, 1969.

Short[11] reports on experiments in which pairs of subjects attempted to reach agreement using face-to-face, audio and audio-video media. His findings indicate that individual opinion change was greater after audio-only discussion than after face-to-face discussion while the audio-video condition did not differ significantly from either the audio-only or the face-to-face conditions.

Morley and Stephenson[12] compared negotiation behavior by telephone and in person in one of two modes: either unconstrained or with no interruptions. These authors consider the progression from telephone/restricted to face-to-face/unrestricted to be a continuum from formality to informality. They found that in the more formal mode there was greater emphasis on interparty aspects (playing roles), less emphasis on interpersonal aspects (maintaining contact with the other) than in the less formal mode. In the formal mode there was less concern with self, more task orientation, more objective appraisal of issues, and greater likelihood of settlement based on the issues, than in the face-to-face mode. Champness[13] reports related findings. His studies showed that face-to-face discussions tend to focus on person-oriented solutions; telephone discussions tend to focus on object-oriented solutions.

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[11] In Communications Study Group, JUPR, Conflicts of Opinion and Medium of Communication, op. cit., Ref. 7.

[12] Morley and Stephenson, op. cit.

[13] Chapness, B.G., Attitudes forwards person/person communication. Communications Study Group, JUPR, London, July 1971.

Kite and Vitz[14] have found that dominance over the other and knowledge of the other's position were more easily established using the telephone than with face-to-face or written communication. These results, indicating more influence on persuasiveness in audio-only situations, confirms the results previously reported by Short (Ref. 11).

2.  Comparison of Media

In their comparison of attitudes, uncertainties, and interpersonal atmospheres in mediated and face-to-face group interaction, Weston and Kristen[15] found that face-to-face conferencing and video conferencing are evaluated more favorably than audio-only conferencing. Uncertainty with regard to values, norms and role expectations was generally greater in audio-only situations but was not significantly different when comparing video and face-to-face. An interesting divergence from predicted results was that uncertainty about those conferees contacted via an electronic medium seemed to "transfer" to those conferees present at the same terminal. In other words, the atmosphere of uncertainty with regard to a mediated group seems to have extended to all conferees. Conferencing atmosphere in the face-to-face and video modes was considered more positive than in the audio mode. Thus, the great source of the differences appears to be the removal of visual information, not the physical presence of conferees.

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[14] Kite, W.R. and P. C. Vitz, Teleconferencing: Effects of Communication Medium, Network, and Distribution of Resources, Arlington, VA: Institute for Defense Analyses (March 1966)

[15] Weston, J.R., and C. Kristen, Teleconferencing: A Comparison of Attitudes, Uncertainty and Interpersonal Atmospheres in Mediated and Face-to-Face Group Interaction, The Social Policy and Programs Branch, Department of Communications, Ottawa, Canada, December 1973.

Kite and Vitz[16] compared face-to-face, telephone and written messages to determine their effects on negotiating disputes. While they found few significant differences in the comparison of face-to-face and telephone negotiations, large differences were found between telephone and written negotiations. The written negotiations tended to take more time, be more rigid, and be more susceptible to developing unchangeable positions. Historical bias in the written negotiations was evident in the form of references to earlier messages. The fact that each player had an objective record of statements gave rise to a feeling of commitment which in turn made it difficult for a player to alter his/her position.

A second emphasis of the Kite and Vitz study was the effect of time on attitudinal and behavioral evaluations. Since teleconferencing was unfamiliar to subjects, it was expected that the greater the divergence from the "normal" (i.e., face-to-face) mode, the more significant the attitudinal and behavioral differences. This expectation was supported. However, it was the belief of the authors that the evaluations of the various media would become increasingly more similar over time and that eventually they would approximate the attitudinal and behavioral evaluations of non-mediated (i.e., face-to-face) conferencing. This hypothesis not only received no support, but a fairly consistent trend in the opposite direction was found. That is, the audio-only situation, rather than invoking attitudes and behaviors which increasingly mimic those of face-to-face, invoked more divergent and, for this particular task, less positive reactions over time with respect to values, norms, role expectations, and situational definition.[17]

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[16]  Kite and Vitz, op. cit.

[17]  Weston, J. R. and C. Kristen, op. cit.

The intuitive notion that the effects of using mediated communications are more significant for strangers than for acquaintances has not been confirmed in two experiments which have addressed this behavioral issue.[18] However, it has been found that the perception of other conferees becomes more positive as they become better acquainted.[19]

In general, differences between face-to-face contact and visual contact via telemedia are much _less_ marked than are the differences between video contact and audio-only. The feedback provided by the visual channel is frequently cited as one important source of this difference between media. The transmission of socio-emotional information is thought to be the other important function of the visual channel. Although far from conclusive, the comments of many users indicate that the socio-emotional information transmission may be the most important function of feedback.[20] The results of one experimental study is consistent with this view of the socio-emotional function of the visual channel.[21] In a bargaining experiment

18  Communications Study Group, JUPR, Factors Influencing the Effect of Medium of Communication Upon Preferences for Media, Conversation and Persons, E/72227/WR.

19  Williams, E. in "Needs, Technology, Effectiveness and Impact, a Discussion of Some Behavioral Aspects of Person/Person Telecommunication," Communications Study Group, JUPR, P/71128/RD.

20  See Cristie, B. Broadband Teleconference Test Between Hartford and Williamantic, New Rural Society Project, Final Report, Appendix N, HUD Contract H-1694, Jan. 1973 and Weston, J.R. and C. Kristen, op. cit.

21  Communications Study Group, JUPR, Conflicts of Interest, and Conflicts of Opinion in an Experimental Bargaining Game Conducted over Three Media, op. cit. Ref. 10.

it was found that the audio condition differed significantly from the face-to-face and the video conditions. Here, attention to the video channel was measured. Individual use of the video channel varied among users from 0% to almost 100% of the time. One might expect that such large differences in use would be reflected in the task outcome--the more the video channels were used, the more the results might be expected to be like the results of face-to-face situations. However, no such effect of usage was observed. This suggests that the visual channel has its effects primarily by its presence (increasing the awareness of the mediated conferee as a person) rather than through its use as a source of additional information.

One should not extrapolate from this to conclude that the nature of the video picture is irrelevant to users. In studies of the Bell Canada Video System,[22] and of the Bell USA Picturephone,[23] users appeared to have firm opinions about video, with a great number of respondents commenting on the inadequacy of the picture for viewing other conferees. Subjects expressed strong preference for particular picture sizes[24] although even quite substantial changes in picture size obtained by zooming the camera in and out did not affect the outcome in two separate experiments.[25]

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[22] Casey-Stahmer, A.E., and M. Dean Havron, Planning Research in Teleconference Systems, Ottawa: Department of Communications (July 1973)

[23] Dickson, Edward M., and Raymond Bowers, The Video Telephone, A New Era in Telecommunications, National Science Foundation Report NSF-RA-S-73-004, 1973.

[24] Communication Study Group, JUPR, E/73267/CH, 1973

[25] Communications Study Group, JUPR,
    Medium of Communication, Opinion Change, and Solution of a
        Problem of Priorities, op. cit. Ref. 8
    The Effects of Medium of Communication on Persuasion, Barganing
        and Perceptions of the Other, op. cit., Ref. 8.

As stated earlier, the degradation or elimination of the visual channel has an effect on the outcome of tasks such as bargaining and negotiating which involve interpersonal relations. Although little experimental evidence has been gathered concerning the substitution of written messages, one such study confirms that written communication leads to more formal, less emotional exhange than audio or audio-visual communication.[26]

Complex effects of medium on liking for others have been demonstrated in a number of contexts.[27] In general, the direction of these effects is that people encountered face-to-face are preferred to those encountered over telecommunications links--a result expected on the basis of people's expressed preference for meeting others face-to-face.[28] However, there are some indications that in more stressful, conflict-ridden tasks, media which provide reduced contact with the other person may be preferred,[29] and the people encountered in conversation over these media may similarly be preferred. However, results do not always support this hypothesis.[30]

[26] Kite, W. R. and P. C. Vitz, op. cit.

[27] Communications Study Group, JUPR,
   The RMT Teleconference System, Ref. P/72024/RD
   The Effects of Medium of Communication on Evaluation of a Conversation and the Conversation Partner, E/72131/WL
   Factors Influencing the Effect of Medium of Communication upon Preferences for Media, Conversation and Persons, E/72227/WL
   Medium of Communication and Consensus, op. cit. Ref. 8
   Weston, C. R. and C. Kristen, op. cit.

[28] Westrum, R., op. cit.;
   Communications Study Group, JUPR, Medium of Communication, Opinion Change, and Solution of a Problem of Priorities, op. cit., Ref. 8.

[29] Communications Study Group, JUPR,
   The Effects of Medium of Communication on Evaluation of a Conversation and the Conversation Partner, op. cit.; Ref. 27.
   Medium of Communication and Consensus, op. cit., Ref. 8.

[30] Communications Study Group, JUPR,
   The Effects of Medium of Communication on Persuasion, Bargaining and Perception of the Other, op. cit. Ref. 8
   Factors Influencing the Effect of Medium of Communication Upon Preferences for Media, Conversation and Persons, op. cit. Ref. 27.

B.  Perceived Effectiveness and User Attitudes

A second area of teleconference research provides an essential complement to the objectivity of the laboratory and field test investigations. This area concerns the subjective reactions of users. It is likely that users' opinions, attitudes and feelings about a system will affect (1) the likelihood of its being installed, (2) the likelihood of its being used if installed, and (3) the way in which it is used. The introduction of a system which is unacceptable to users can have effects over and above simply wasting resources and damaging existing patterns of communication; it may affect job satisfaction of users and prejudice them against any future innovation. One study should be cited as concerned particularly with the structuring of responses to teleconferencing systems. This ambitious attempt at identifying and organizing dimensions which are descriptive of responses to teleconferencing systems was made by Casey-Stahmer and Havron.[31] These authors related the physical dimensions of a system to the psychological attributes that are assumed to be associated with these physical dimensions, and tried to evaluate the importance of the psychological attributes to users. Casey-Stahmer and Havron developed a three-part questionnaire which they used in evaluating four operating teleconferencing systems (two audio-only systems and two audio-visual systems). Part one of the questionnaire posed general, open-ended questions about the system; part two asked open-ended questions about each subsystem identified in their taxonomy; part three raised specific questions about system elements, uses, procedures, etc. Initial responses to the open-ended questions provided information which was integrated into subsequent versions of the questionnaire. The questionnaire was administered as an interview schedule with interviews generally conducted face-to-face. The primary purpose of the questionnaire was to obtain information that could help the writers to confirm and/or modify their initial version of the descriptive dimensions of teleconferencing systems. Particular attention was directed towards:

   a)  Identifying those physical parameters that mattered
       to users and those that did not.

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[31]   Casey-Stahmer, A.E. and M.D. Havron, op. cit.

b) Comparing evaluations of system efficiency and user satisfaction across systems, subsystems and elements.

c) Describing cues especially important to between-terminal communications, and

d) Identifying problems reported by users.

A detailed map of the relationship between physical dimensions of teleconferencing systems and their psychological attributes, and relevent judgments is provided in their report.

Early interview studies conducted by the Communications Study Group and, later, by the Institute for the Future[32] showed that there was a need for well-designed comprehensive studies of users' attitudes in which results could be subjected to proper statistical testing procedures. As a result, the Communications Study Group developed a questionnaire (also concerned primarily with the structure of attitudes) in which people were asked how they felt about the system (the affective component), their predisposition to use the system (the behavioral component), and their opinions or beliefs about the system (the cognitive component). The questionnaire employed the semantic differential instrument (in which users rate the system on a number of adjective pairs). Results from this questionnaire revealed three major dimensions of attitudes to teleconferencing systems: evaluation, aestheticism and privacy.

These authors found video to be more aesthetically pleasing than audio. Video system were also evaluated more favorably than audio systems. On the other hand, video systems were seen as less

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[32] Johansen, Robert, and R. H. Miller, Commentary on the Use of FORUM in a Research Environment, Institute of the Future, September 1973.

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"private" than audio systems. This pattern of results demonstrates that it is not enough to ask users to respond to communication systems on a single dimension. Evaluation of a system has been found to depend heavily on the purpose for which the system is used. For instance, in an investigation by the Communications Study Group,[33] all media were considered to be satisfactory for giving orders, for transmitting factual information, or for general discussion, while only a face-to-face meeting was considered satisfactory for disciplining an employee. For meetings involving interpersonal relations, face-to-face was considered more satisfactory than audio.

A number of attempts have been made to assess directly user reactions to operational teleconferencing systems. The Communications Study Group carried out three case studies by interviewing users of existing systems.[34] These studies considered two separate aspects of acceptability:

a.  What are the reactions of users towards new telecommunications devices; and

b.  What are the factors which affect these attitudes.

The first study[35] consisted of interviews with users of loudspeaking telephones, facsimile transmitters, and remote writing devices. From this study, a listing was compiled of all those factors concerning

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[33]  Communications Study Group, JUPR, Medium of Communication, Opinion Change, and Solution of a Problem of Priorities, op. cit. Ref. 8.

[34]  These assessments often reflect the view of a particular (non-representative) sample of viewers. This is because the recipients of the equipment on trial frequently are senior management personnel of organizations with a direct interest in the success of the system. In addition, the data that such trials provide often is in anecdotal form.

[35]  Communications Study Group, JUPR, The Measurement and Prediction of Acceptability, P/71050/CH.

the user and his environment which reasonably could be considered
to affect user attitudes toward the system. These factors included
the location of the equipment, the way in which it has been introduced
to the user, the support that the user received in the early stages
of use, the need for security of the system, the extent to which
·the users' communications requirements were satisfied, and the
attitude of superiors towards the device.

The second case study concerned the use of a multi-locational
audio conferencing facility at the University of Quebec.[36] The
system was found to be successful, based partially on the large distances
involved in travelling, the natural manner in which the system was
introduced, reliability, users' favorable dispositions to new forms
of equipment, and restriction of use to those purposes for which
the system was appropriate. It appeared that the system was used for
different kinds of meetings and for new types of communications
rather than simply substituting for the customary ones. Despite
regular teleconferences, face-to-face meetings were still frequent.
This was partially because some activities (e.g., negotiation, getting
to know others) were felt to be inappropriate for teleconference
meetings, and partially because of the need to ensure that personal
contact was not lost.

The Bell Canada Teleconference System, the subject of the
Communications Study Group's third interview case study,[37] allows
up to nine conferees at each of the two studios to be connected by
television. Interviews with users covered travel and substitution of

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[36] Communications Study Group, JUPR, A Report on the use of the Audio
Conferencing Facility in the University of Quebec, P/73161/SH.

[37] Communications Study Group, JUPR, The Bell Canada Conference TV
System:  A Case Study, P/73173/WL.

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teleconferencing for travel, level of use of the system, description
of meeting, overall evaluation, comparison with face-to-face and
audio systems, tasks for which appropriate, improvements to system,
and suggestions for future use. The system was seen as a reasonable
substitute for face-to-face meetings involving simple discussion,
problem solving and information transmission, and as a great improvement
over the audio systems available.

In general, studies carried out on operating systems provide
results which are very similar to those obtained for laboratory
systems. In a test of the British Confravision,[38] both the laboratory
video system and the Confravision System were seen as satisfactory
for resolving conflict and for settling differences of opinion. In
a test on the Remote Meeting Table System (the audio teleconferencing
system of the British Post Office Department), neither this system
nor the laboratory audio system was considered adequate for these
purposes.[39] Results on the Confravision System for activities
involving interpersonal relations such as "getting to know someone"
also were similar to those observed for laboratory video systems.

Some differences between laboratory and operating systems have
been noted. Unlike the laboratory audio system, the Remote Meeting
Table audio teleconference system was considered to be satisfactory
for decision making. The addition of speaker identification mechanisms
in the Remote Meeting Table may have influenced this difference in
attitudes.

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[38] Communications Study Group, JUPR, The RMT Teleconference System,
op. cit. Ref. 27.

[39] IBid

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C.   Bases of Media Differences

To understand the effects of a medium sufficiently to specify
when these effects will and will not appear, it is necessary to try
to understand the mechanisms which produce them.  Two major categories
of interpretation seem promising: interpretations in terms of
channel capacity or efficiency, and interpretations in terms of the
relative weighting of task/social factors.

. One could argue that the medium of communication (face-to-
face, audio-video, audio, telegraphic), by determining the channel
capacity available to communicators, specifies the nature of the
communication. Certainly in the extreme (i.e., little channel
capacity), this is true. There also are results from speech patterning
experiments[40] which indicate a correlation between channel capacity
and interactive verbal behavior.  And, as has been indicated previously,
some impairment has been found to be associated with media of
reduced channel capacity (for instance, the reduction in accuracy
in assessing another's opinion[41] and the decline in agreements
reached in negotiating situations[42] with audio compared with
face-to-face communication).  However, results which contradict the
assumption of reduced efficiency with reduced channel capacity
abound.  Opinion change has been found to be greater after an audio-

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[40]   Communications Study Group, JUPR
           Cooperative Problem Solving, E/71159/DV
           Face-to-Face Contacts in Government Departments, P/71270/RD

[41]   Communications Study Group, JUPR, Medium of Communication and
           Consensus, op. cit. Ref. 8.

[42]   IBid

only conversation than after a face-to-face conversation,[43] and in some negotiation simulations, the side with the stronger case has been found to be more successful under audio conditions than under face-to-face conditions.  Also, in problem solving situations, no effect of medium of communication on the quality of the final solution has been observed.[44]

The second proposal which has been made to explain differences between direct and mediated communication is based on the assumption that removal of a particular class of information would increase the reliance on other available classes of information.  The visual signals which are reduced or lost with mediated communication appear, in comparison with verbal messages, to be particularly concerned with the transmission of socio-emotional material and controlling/procedural feedback (as opposed to task-oriented cognitive material).  The removal of these non-verbal signals, then, would be expected to lead to a greater emphasis on the task-oriented cognitive aspects of the interaction and a lesser emphasis on the socio-emotional aspects of the interaction.[45]  Similarly, the removal of aural channels and the replacement with written media would be expected to produce still greater emphasis on task-oriented aspects by reducing further the socio-emotional content conveyed vocally through presentation, voice quality, etc.

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[43] Communication Study Group, JUPR,
      Conflicts of Opinion and Medium of Communication, op. cit.
        Ref. 7.
      Medium of Communication and Consensus, op. cit. Ref. 8
      Medium of Communication, Opinion Change, and Solution of a
        Problem of Priorities, op. cit. Ref. 8
      The Effects of Medium of Communication on Persuasion Bargaining
        and Perception of the Other, op. cit. Ref. 8.

[44] Chapanis, et. al., op. cit.
    Communications Study Group, JUPR, Cooperative Problem Solving, op. cit. Ref 40.

[45] Morley, I.E. and G. M. Stephenson, op. cit.

Such changes in the orientation of the discussion eventually would be expected to affect the outcome. Consider, for example, a negotiation situation in which one side has an objectively weak case. This side would be expected to be more successful the more the negotiation centers on interpersonal considerations and departs from the objective facts of the case. Results support this hypothesis.[46] This same hypothesis has been suggested in predicting who will be victorious in other negotiations situations.[47]

The opinions of those who have used new telecommunication devices bear out this general explanation of the effects of media. If users are asked to comment on the differences between telecommunication and face-to-face contact, the most often cited difference centers on the greater degree of personal contact under face-to-face conditions. Diverse experimental results also are consistent with this explanation. For example, Milgram[48] in studying obedience to authority found subjects to be less willing to punish others with whom they were in face-to-face contact than more remote subjects.

The complementary aspect of the socio-emotional explanation is that the telemedia conversations, since they contain less socio-emotional information, would be expected to be perceived as more task-oriented, formal, structured and efficient than face-to-face conversations. Evidence indicates that this is how users perceive them. Thus, for

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[46] Communications Study Group, JUPR, Bargaining and Negotiation - An Exploratory Study, op. cit. Ref. 6.

[47] Communications Study Group, JUPR, Conflicts of Interest and Conflicts of Opinion in an Experimental Bargaining Game Conducted over Three Media, op. cit. Ref. 10.

[48] Milgram, S., Some Conditions of Obedience and Disobedience to Authority, Human Relations, 18(1), 1965, 57-76.

tasks in which a formal, business-like, task-oriented, impersonal type of interaction is preferred, the audio medium and the written medium might not only be as effective as face-to-face communication, but even more effective. In bargaining situations, for example, a lower level of personal contact may have some advantages in reducing the likelihood that the task-induced conflict degenerates into personal conflict. Therefore, in deciding on the use of a particular piece of equipment for a particular task, one is concerned not simply with which medium most faithfully reproduces face-to-face but with which medium is best for a particular task.

# CHAPTER III
## THE NASA TELECONFERENCING SYSTEM:
### EQUIPMENT, FACILITIES, AND PROCEDURES

When considering the effectiveness of any telecommunication system, one must take into account the physical arrangement and configuration of the hardward involved. To obtain this information "first hand," teleconference coordinators at major NASA Centers were contacted.[1] It was felt that coordinators as experienced users of the teleconferencing system could offer insightful information with respect to successful utilization and operation of the system. To this end, an interview guide was prepared which elicited responses to a number of topics including procedures, equipment, scheduling, estimates of usage, descriptions of rooms, and general observations. This chapter presents the results of these telephone interviews.

In discussing various aspects of the teleconferencing system, a distinction is made between formally designated teleconferencing "rooms" (usually referred to as the "voice teleconferencing system") and portable Bell 50A units (50A system). In general teleconferencing rooms are hardwired into the MSFC 4-wire teleconference circuit. Teleconferences which take place over this circuit must be arranged through the MSFC teleconference operator. In general, these teleconferencing rooms are equipped with overhead microphones and control of the line is accomplished through voice actuation. (A mute switch is available so that persons at each teleconferencing node can converse with each other without broadcasting to all others connected in the teleconference).

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[1]    Coordinators contacted were those at HQ, ARC, FRC, GSFC, JPL, JSC, KSC, LRC, LeRC, MSFC, and WFC.

The Bell 50A units, on the other hand, are portable devices which come equipped with two microphones and two speakers; actuation is accomplished with a push-to-talk switch. These units may be used on any FTS telephone circuit. There is no necessity for using MSFC switching when utilizing Bell 50A units. However, in some cases, 50A units are used to communicate via the MSFC 4-wire system. Generally this is done at Centers which have no room equipped with overhead microphones. At some Centers 50A units remain in place as semi-permanent facilities.

A.   Center Facilities

All Centers contacted were equipped with high-speed facsimile machines located within a reasonable distance of teleconferencing rooms. (Since a large part of the FAX traffic is unrelated to teleconferencing and since most FAX copy used in a teleconference is received prior to the conference, the location of machines within teleconferencing rooms seems neither desirable nor practical.) All Centers were equipped with facilities for producing and projecting viewgraphs.

Major variations were found to be present with respect to types of room(s) available for teleconferencing and the types of equipment on hand. A brief summary of the facilities at each center contacted follows. It should be kept in mind that these data represent facilities at the time this information was taken. As the teleconferencing system grows and improves, these descriptions can be expected to change considerably. Also with respect to Bell 50A units, it is difficult to obtain precise estimates from coordinators due to the fact that these units may be obtained also by projects and/or individuals.

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1. <u>Headquarters</u> - Nine teleconferencing rooms are connected to the 4-wire teleconference bridge (MSFC). These rooms range in seating capacity from about 18 to 40 persons with an average seating capacity of about 20. Facilities are available to accommodate conferences of over 40 persons. At least eleven 50A units are available for FTS teleconferences.

2. <u>Ames Research Center</u> - One dedicated 4-wire circuit is used at ARC. It connects to a conference room which can seat over 20 persons. A number of telephone jacks are present in larger and smaller rooms in which 50A units may be utilized. ARC maintains five 50A units.

3. <u>Flight Research Center</u> - At FRC, six conference rooms are available for teleconferencing, two of which utilize dedicated 4-wire lines. All teleconferencing is done using 50A units whether through dedicated or FTS lines. The average room seats 12-15 persons.

4. <u>Goddard Space Flight Center</u> - A new teleconferencing room with overhead microphones and speakers is nearing completion at GSFC but at present teleconferences are conducted using 50A units. GSFC is currently utilizing eleven 50A units.

5. <u>Jet Propulsion Laboratory</u> - One dedicated 4-wire line is present at JPL. It connects to a conference room seating up to 23 persons and using three table microphones. Six 50A units are available for use at various locations and a great deal of usage of speakerphones is reported.

6. Johnson Space Center - Four rooms complete with overhead microphones and overhead speakers are hardwired into the MSFC bridge. Three of these rooms seat about 40 persons and the fourth about 70 persons. In addition six 50A units are available at JSC.

7. Kennedy Space Center - Two dedicated lines are connected to rooms which seat 50 and 60 persons. In one room overhead microphones are used with voice actuation while in one room table microphones are used with key activation. Many 50A's are in use, perhaps as many as 20.

8. Langley Research Center - Four conference rooms are used at LRC. One is project dedicated. Of the remaning three, one room is wired into the MSFC bridge. Two 50A sets are used for the remaining smaller rooms. Seating capacities for the various rooms range from 10 to 75 persons.

9. Lewis Research Center - At present five 50A units are used in six locations at LeRC. One room is designated for the 4-wire circuit but sound requirements for the room have not yet been met. Most seating accommodates 8-15 persons with one room capable of seating 45 persons.

10. Manned Space Flight Center - Six teleconferencing rooms are in use at MSFC with three rooms wired into the 4-wire circuit. The other three rooms utilized FTS lines and use 50A units. Average seating capacity is 30 persons.

11. Wallops Flight Center - One main teleconferencing room, seating 20 persons, is equipped with a 4-wire circuit. This room is used with the Bell 50A system. Two alternate rooms are equipped with telephone jacks and can be used with 50A sets on FTS.

## B. Estimates of Usage

Coordinators were asked to make subjective estimates pertaining to room usage, numbers of persons normally involved in teleconferences, usage of 50A units, return on evaluation forms, and facsimile usage. It should be kept in mind that these data are, as stated, subjective estimates. Nevertheless, coordinators should be in reasonably good positions to make such estimates although some optimism in terms of over estimation could be expected.

With respect to teleconferencing activity, coordinators at the eleven centers contacted were asked to specify the average number of teleconferences per week at their facility. This estimate included use of both the 4-wire conference bridge and 50A units (FTS). Most coordinators reported a range of use.[2] The lowest range of usage reported was 1-3 teleconferences per week (tc/week) while the highest estimate was 40 tc/week.

Using figures from the high end of the range, the average number of teleconferences per week per center equals 11.4. Using numbers from the low end of the range yields a mean of 3.5 tc/wk/center. If missing data are placed in for centers with no estimates,[3] and the midpoint of each range is used, a mean figure of 5.82 tc/wk per center is obtained.

An estimate of the average number of persons involved in a tele-conference at a given location was also requested. The lowest estimate received was six persons per teleconference and the highest was 20 persons per teleconference. With low-range estimates the mean attendance

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[2] Some coordinators refused to estimate due to the fact that they felt unable to provide a reliable figure.

[3] Data supplied from Fordyce, S.W., "Memorandum to the Record," (NASA, Washington, D.C., September 12, 1975), pg. 2.

per teleconference was 10; with high-range estimates, 11.5. By averaging these mean estimates, a figure of 10.75 persons per teleconference is derived. This figure is consistent with earlier findings of Fordyce.[4]

From the estimates of the number of teleconferences per week and the average number of persons normally involved in a teleconference, one can calculate the number of persons involved in teleconferencing per year.

Assuming the average number of persons involved at each terminal (center) is 10.75, and that, on the average, 3.5 teleconferences per week take place, then 21,522 persons would be involved in teleconferences in a year at these eleven centers.[5] From the high-range estimate of 11.4 tc/wk a projection of 70,099 persons involved in teleconferences would be obtained[6]. Using the estimate of 5.82 tc/week, 35,787 persons would be involved in teleconferences over a year at these eleven locations.[7]

When questioned about facsimile usage, coordinators estimated that only about 20% of all teleconferences made use of FAX either before or during the teleconference. Of the FAX usage associated with a teleconference, most copy was received prior to the teleconferences with coordinators reporting very little usage during teleconferences.

Coordinators were asked about their success in obtaining evaluation reports for teleconferences. In all cases, coordinators had more success in obtaining reports for designated voice teleconference rooms (usually 4-wire) than for 50A units. Combining reports on the two systems, the lowest reported completion rate was 25% and the highest 100%. It seems reasonable to conclude that probably no more than 50% of the teleconferences are being reported through evaluation forms.

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[4]  IBid. (Fordyce reports an average of 32.5 person at 3.4 terminals.)
[5]  These data should be viewed with some caution since they are based on the subjective estimates of a few persons.
[6]  10.75 persons/tc X 11.4 tc/week X 52wk/year X 11 centers.
[7]  10.75 persons/tc X 5.82 tc/week X 52wk/year X11 centers.

## C. Coordinators' Suggestions

When asked direct questions concerning difficulties with the utilization and operation of the teleconferencing system, coordinators reported very few problems. However, when asked for possible ways to improve the system, coordinators were able to generate a number of procedural and hardware suggestions.

1. Arrangements - For two party teleconferences, most coordinators encourage the conference leader to make the necessary reservations of lines and to establish the connections. For multiple locations the procedure varies at different centers. In some instances coordinators make all necessary arrangements and in others the conference leader assumes major responsibility. In all cases a trouble number is available for help if problems arise. Most difficulties encountered involve multiple-terminal connections. The primary problem seems to involve delay in starting the conference while connections are made.

   A possible solution for this problem is to develop a standardized checklist for conference leaders. This list could-be-distributed by the coordinator and could serve to remind the conference leader of the steps necessary to conduct a successful teleconference. For example, one check-off item could be the line reservation through MSFC. Another step would be to list the office phone numbers of the persons involved at other centers in addition to their tele- conference number. Thus, if any trouble arises, they could be contacted quickly. Another item might be to check and determine if prepared materials had arrived at all centers prior to the teleconference.

2.  Equipment - Few specific suggestions were made regarding
    existing equipment (although suggestions were offered for
    additional equipment).  Available equipment seems to perform
    satisfactorily.

3.  Procedures - Two procedural difficulties were mentiond repeatedly.
    (1) the difficulty of interrupting persons speaking from other
    locations, and (2) terminals dropping off the conference with
    no notice.  It seems likely that these two problems are related,
    i.e., if another location is speaking, a location may merely
    drop-off rather than wait for a pause in order to announce its
    intention.  A possible solution might be the addition of a
    "polite interrupt" feature to the available hardware.  This
    feature could be a tone which actuates a light of some type at
    all connected terminals; this signal would inform the speaker
    that someone would like to make a comment or ask a question.
    The speaker could then decide whether to respond or ignore the
    signal.

    The problem of terminals dropping off seems more difficult.
    However, a procedural rule could be added whereby anyone going
    off-net could interrupt and announce their intention.

    Another suggestion offered by several coordinators is to
    hold regularly scheduled teleconferences of co-ordinators for the
    purpose of keeping abreast of changes in the operation of the
    system.  Co-ordinators could discuss recent practices and improve-
    ments utilized at their installations.  For example, some centers
    have begun to use telepresentations in which 35mm slides are
    mailed and the presentor uses a simple amplified telephone
    call to present the material.  Other centers might find this
    technique useful.

Some coordinators felt that more use of high-speed FAX would increase the probability of material arriving in time for the teleconference. Materials sent by mail frequently arrive after the teleconference is completed.

4. <u>General</u> - All coordinators were aware of the need for decreased reliance on travel and for increased teleconferencing usage, (although many seemed unaware of what they could do to encourage more use).

A possible approach to increased usage is to request a written report (probably semi-annually) from co-ordinators outlining what steps they have undertaken or would suggest be undertaken, to increase utilization. The content of these reports could be a subject of discussion·at the coordinators' meetings (mentioned under 3).

D. Conclusion

Whenever a communication system is introduced on a voluntary-use basis, the success of the system will depend on how potential users <u>perceive</u> the system in terms of their own requirements. It should .be kept in mind that it makes no difference to the utilization of the system whether potential users fail to take advantage of it because there are problems within the system itself, or because users are insufficiently trained or motivated to use the system. Either cause produces the same net effect - underutilization, and both conditions must be addressed by those with primary responsibility for the system.

In the present evaluation, teleconferencing coordinators were found to be able to provide useful information concerning the operation of the system from the standpoint both of the facilities and of the users, and to make suggestions for improvements. Future additions and changes to the system are more likely to prove successful if these key individuals are kept actively involved in the process.

# CHAPTER IV
## USER EVALUATION

A.  Study Objectives and Overall Approach

The overall objective of this study was to evaluate the utility
to users of the existing NASA teleconferencing system including the
Voice Teleconferencing System (conference room arrangement) and the
Bell 50A Telephone System (portable arrangement).  In order to do
this, a questionnaire was constructed which sought information on
factors believed to be important in teleconferencing systems generally
(see Chapter 2) and factors of special interest in determining the
utility of this particular system.

Evaluations of telemedia generally refer to another form of
communication for baseline comparison.  In the present study the
NASA teleconferencing system is compared both with other media and
with face-to-face communication.  A major emphasis in this study
has been placed on comparing the Voice Teleconferencing System with
the 50A System.  Since the Bell 50A system is considerably less
costly than the dedicated voice system, it is necessary to determine
if the Voice System provides either better or different service
than can be provided by the 50A System or by other available telemedia.

B.  Subjects

Five installations (Ames, Goddard, JPL, Langley, and Lewis)
formed the center sample from which users were selected.[1]  Questionnaires

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[1]  These installations were selected because they are major NASA Centers
and because information on specific users of the system was obtainable.

were mailed to virtually everyone from these centers who could be identified as having used the NASA teleconferencing system, and who could be located. The primary source of user names was the forms completed by a representative of the users at the time of a teleconference. Facility managers at the several centers supplied either copies of these forms (if available) or lists of individuals who had completed them. Additional forms were supplied by NASA Headquarters. Questionnaires were sent to all those from the five centers who had completed these forms. In those cases where the forms were available, names of other attendees were frequently listed. Questionnaires were sent to as many as 50 additional attendees from each center. Where the number of additional attendees named exceeded 50 for a single center, 50 users were randomly selected from the total group to receive the questionnaires. In all, questionnaires were sent to 398 separate users.

C.   Questionnaire

A copy of the questionnaire and the cover letter sent to users are provided in the Appendix. The first section of the questionnaire was concerned with demographics and the background of the respondent. Section II of the questionnaire was concerned with group communication patterns. This section was designed to discover the relative frequencies of group meetings held face-to-face or using various media, and to examine the preferred manner of communicating. Section III of the questionnaire was concerned with the respondents' knowledge of and experience with the NASA Voice Teleconference System and the Bell 50A System. Respondents were queried about the length of time they had known about and used the systems, the amount of use of each of the two systems and the use of other forms of conference calls. Also examined was the location and dedication (to particular groups) of the system and the ease or difficulty in using the

systems. Section IV of the questionnaire concerned procedures
followed during teleconference. This section was concerned with
whether a chairperson was usually appointed, whether prepared
agendas were used, and the nature of prepared materials used during
teleconferences. Section V asked respondents some detailed questions
concerning their most recent teleconference. Section VI contained
two arrays of questions. The first array dealt with the users'
satisfaction with the media for various communication activities.
The second bank of questions was used to obtain user attitudes
concerning the extent to which they felt various pressures, constraints,
etc. during their teleconferences. Section VII inquired about needed
improvements and how these improvements might affect future use.
Section VIII of the questionnaire contained mostly open-ended questions
concerning user-suggested changes in physical arrangements and in
procedures, as well as the users' preferred choice of media. This
section also provided information on estimated number of trips
and teleconferences between the user's home installation and nine
other installations.

D. Analysis

The statistics presented in this evaluation are largely descriptive.
However, occasionally the data indicate differences based on the
system used or characteristics of the user. Where "significant"
differences are indicated they have been derived primarily from
chi-square statistics. We have attempted to limit reporting of such
differences to those instances where the probability of a difference
being due to chance was .05 (5%) or less.

E. Results

User responses will be presented under eight headings: demographics,
communication needs and patterns, meeting procedures, communication

content, communication alternatives, user attitude and satisfaction, suggested improvements, and forced compliance evaluation.

1.    Demographics

Table I lists the number of questionnaires sent to each of the centers used in the sample, and the breakdown of questionnaires returned.

TABLE I.    Questionnaires Sent and Returned

| Centers | No. Sent | No. Returned | % Returned | % of Total |
|---------|----------|--------------|------------|------------|
| Ames | 102 | 47 | 46.1 | 29.0 |
| Goddard | 77 | 24 | 31.2 | 14.8 |
| JPL | 94 | 31 | 33.0 | 19.1 |
| Langley | 76 | 32 . | 42.1 | 19.8 |
| Lewis | 49 | 26 | 53.1 | 16.0 |
| Other* | | 1 | | .6 |
| Missing** | | 1 | | .6 |
| Total | 398 | 162*** | 40.7 | |

*    One respondent had moved to headquarters.  The questionnaire was sent to his former center.

**   One respondent did not note his center affiliation.

***  Thirteen additional questionnaires were received but they either arrived too late to be included in the analysis or were rejected for another reason (answered insufficient number of questions, completed by someone other than the individual who had used the system, etc.)

Ames Research Center is significantly overrepresented when compared with other installations.  However, there is a reasonably good spread of representation among the other four centers.

Table 2 provides a breakdown of respondents by job class. Job classes were arrive at by coding job titles in the following manner. The highest level (designated Job Class 1) included center directors and their assistants, division chiefs, assistant division chiefs, and branch chiefs. The next level, Job Class 2, included office heads, section heads, assistant branch chiefs, and project or mission managers. Job Class 3 included technical or staff assistants, scientists and engineers. Job Class 4 included all others not in the above classes.

| TABLE 2. Number of Respondents by Job Class | | |
| --- | --- | --- |
| | Number | % of All Respondents |
| Class 1 | 41 | (26.1%) |
| Class 2 | 42 | (26.8%) |
| Class 3 | 44 | (28.0%) |
| Class 4 | 30 | (19.1%) |

Responses to the questionnaire were divided about equally among the three classes of identified respondents.

2. Communication Needs and Patterns

a. Face-to-Face Meeting Behavior

To determine what the communication needs of the user population might be, we inquired as to the number of direct group meetings (and their location) and the number of group meetings using an electronic medium held during the six months prior to the receipt of the questionnaire. The responses are given in Table 3. This table gives us some idea of the number and the location of group meetings in which the potential NASA users of teleconferences participate.

TABLE 3. Frequency of Face-to-Face Meetings and Locations

| Meeting Type | Mean Frequency/month (all respondents) |
|---|---|
| Group meetings (total) | 17.7 |
| Total meetings at own installation | 16.0 |
| - in own office building | 10.3 |
| - in other building at installation | 5.7 |
| Meetings outside installation | 1.7 |
| - in the local area | .6 |
| - in another city | 1.1 |

Meeting behavior was found to vary significantly with the job category of the user. Higher job classes tended to have relatively more group meetings of all kinds and more group meetings at their own centers. Group meetings held outside the center in the local area and meetings held outside the installation in another city also showed differences between the job classes. The following table reports the mean number of meetings per month in the local area and in another city. Class 2 users tended to travel to meetings in other cities more and to meet with others in their local area less than other groups.

TABLE 4. Frequency of Face-to-Face Meetings by Job Class

| Job Class | Mean Freq. in Area | Mean Freq. Another City |
|---|---|---|
| All classes | .59 | 1.10 |
| Class 1 | .73 | 1.29 |
| Class 2 | .43 | 1.36 |
| Class 3 | .71 | 1.25 |
| Class 4 | .47 | .27 |

b.  Media Usage

Of the returned questionnaires, 72% of respondents reported at least one use of the NASA Voice Teleconferencing System, 65% reported at least one use of the 50A sets, and 61% reported at least one use of a group conference call (i.e. either a speakerphone call with more than one person at a terminal node or an operator-assisted call involving at least three terminals). Table 5 presents a summary of the frequency of media use.

| TABLE 5.  Summary of Media Use (Mean Frequency Per Month, Based on Last Six Months) | | |
|---|---|---|
| | Voice Teleconferencing | Bell 50A's | Other Group Tel. Calls |
| By Reported Users of System+ | .42 | .87 | 1.81 |
| Total Respondents++ | .22 | .45 | .90 |

  +  Based on respondents using the system at least once in the last six months.

 ++  Based on all respondents.

c.  Influence of Job Category on Mode of Communication

To determine what inclinations the respondents had in their selection of media, we asked each of the respondents to indicate their "primary" mode of communicating. The ranking of primary mode of communication for all respondents was: 1) face-to-face (59.9%), 2) telephone (27.8%), 3) correspondence (4.9%) and 4) other, including teleconferencing (1.0%). This ranking of "primary mode of communication" was found to vary significantly with the job description reported by the respondents. The following table shows the frequencies with which respondents in various job classes selected a particular mode of communication as their primary mode.

TABLE 6. Primary Mode of Communicating (Percentage of respondents reporting)

| Primary Mode | All | Class 1 | Class 2 | Class 3 |
|---|---|---|---|---|
| Face-to-Face | 63.3% | 82.5% | 61.9% | 46.2% |
| Telephone | 30.6 | 17.5 | 31.0 | 43.5 |
| Correspondence | 6.1 | 0.0 | 7.1 | 10.3 |

Significant differences have shown up also among the various job classes in the usage patterns for the two teleconferencing media. The following table indicates the teleconferencing behavior of those users who reported using the particular medium at least once. While all job classes reported approximately equal use of the NASA Voice Teleconference System rooms, Job Classes 2 and 3 reported significantly higher use per individual of the Bell 50A sets.

TABLE 7. Mean Number of Teleconferences by Job Class
(based on those reporting use)

| Job Class | Mean No. Voice Sys/Mo. | Mean No. 50A uses/mo. | Mean No. Other Conf. Calls |
|---|---|---|---|
| All classes | .42 | .84 | 1.87 |
| Class 1 | .37 | .48 | 1.68 |
| Class 2 | .44 | 1.16 | 2.25 |
| Class 3 | .47 | .97 | 1.06 |
| Class 4 | .41 | .50 | 2.64 |
| % Total respondents Reporting use of medium | 51.9% | 50.6% | 47.5% |

From these figures we surmise that the mid-level job class relies very heavily on the conference telephone (i.e. 50As and other forms) and that their jobs generally require a high level of group contact.

3. Meeting Procedures

In both NASA Voice Teleconference System conferences and 50A conferences, users reported that there was generally an appointed chairperson or leader. (Of Voice System users, 98.5% reponded 'yes', and 50A users responded 91.7% 'yes'.) In general there were prepared agendas. (Voice System users, 94.0% 'yes'; 50A users, 88.0% 'yes'.)

In attempting to gauge the use of facsimile during these conferences, we asked respondents to generalize about the source of the materials used during their teleconferences. The following table reports their responses. (The columns do not sum to 100% since the respondents could check as many entries as applied.)

TABLE 8. Sources of Materials Used in Teleconferences
(percent of respondents answering "yes")

|  | Voice System | 50A |
|---|---|---|
| Were prepared materials used? | 80.3 | 91.5 |
| Were these: | | |
| Passed out by persons at your installation? | 42.0 | 46.4 |
| Received by mail prior to the teleconference? | 57.4 | 79.8* |
| Received by FAX prior to the teleconference? | 20.3 | 44.0* |
| Received by FAX during the teleconference? | 7.2 | 11.9 |

* Difference between Voice and 50A Systems reached a significance level of less than .01.

These data show relatively little use of facsimile during conferences, more prior to a conference. The differences found between voice teleconference and 50A teleconference indicate that 50A teleconferences as they have been used include a higher requirement for prepared materials from remote locations than do voice teleconferences.

4. Communication Content

The topical nature of teleconferences was investigated through questions about the respondents' last teleconference. The following table provides a summary of the frequency with which various topics emerged as describing the nature of the conference.

TABLE 9. Purpose of Conferences (percentage of reponses)

|  | All | Voice TC | 50A |
|---|---|---|---|
| RTOPs, program review | 45.0 | 45.8 | 44.1 |
| Planning, general | 26.9 | 28.9 | 25.0 |
| Management, administration | 13.7 | 16.9 | 10.3 |
| Lecture, presentation | 8.1 | 3.6 | 14.7 |
| Bargaining, negotiation | 2.5 | 1.2 | 4.4 |
| Other | 3.8 | 3.6 | 1.5 |
|  | 100.0 | 100.0 | 100.0 |

.Also of interest was the extent to which teleconferences were used to address matters that had been dealt with previously through other modes. Table 10 lists the percentages of respondents who during their most recent teleconference had reconsidered such topics. (Since more than one mode could have been used, columns do not sum to 100%.) No significant differences between responses to the two media were found.

TABLE 10. Teleconferences and Previous Communication
(Percentage of Users Responding "yes")

| Mode through which topic previously discussed | Voice System | 50A | Combined |
|---|---|---|---|
| Face-to-face meeting | 28.8 | 41.3 | 35.8 |
| Written correspondence | 73.8 | 68.4 | 70.7 |
| Standard telephone conversation | 43.1 | 40.3 | 41.5 |
| Previous teleconferences | 27.6 | 30.4 | 29.1 |

Certain activities occur during communication. These activities often are related to the topic or purpose of the conference. However, they also tend to be related to the medium used by the group. General questions regarding respondents' impressions of interpersonal communication activities were asked in the questionnaire. Table 11 rank orders the activities according to the frequency with which they were reported.

TABLE 11. Communication Activity
(Ranked by percentage of respondents reporting)

| Communication Actitivty | % Reports | |
|---|---|---|
| Giving and receiving information | 96.7 | |
| Asking questions | 92.1 | |
| Exchanging opinions | 79.6 | |
| Maintaining friendly relations | 62.5 | |
| Problem solving | 53.3 | |
| Generating ideas | 50.7 | |
| Resolving conflicts | 46.1 | |
| Persuasion | 38.2* | 50A>Voice |
| Resolving disagreements | 36.8 | |
| Giving or receiving orders | 27.6* | 50A>Voice |
| Bargaining | 25.0 | |
| Getting others on one's side in argument | 21.7 | |
| Getting to know someone | 19.2 | |

* Significant difference between 50A's and Voice Teleconference

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The teleconferencing medium in seen to be widely used for the more narrowly defined exhanges, used less frequently for the more complex and broadly-defined exhanges.

5. Communication Alternatives

Users were queried to determine whether they felt that the teleconference system was the right or appropriate way to conduct their most recent teleconference. The responses were almost identical for Voice System users and 50A users. Of the respondents, 84% replied that the system used was appropriate. Users were asked also whether an equivalent exchange could' have taken place if the teleconferencing system had not been used. Of the respondents describing their last teleconference using the Voice Teleconferencing System, 26.1% stated that an "equivalent exchange would not have occurred." Of the respondents describing their last teleconference using Bell 50A sets, 11.9% stated that an "equivalent exhange would not have occurred." The frequencies with which other modes of communication were named as likely alternatives is given in Table 12. (The percentages do not sum to 100 since respondents could check as many alternatives as applied.)

TABLE 12. Alternative Media to Teleconferencing System

| Alternative | Voice Teleconference Users | 50A Users |
|---|---|---|
| By travel to remote location | 58.0 | 48.8 |
| By operator-assisted conference call | 21.7 | 27.4 |
| By a series of long-distance calls | 33.3 | 42.9 |
| By a speakerphone call | 18.8 | 16.7 |
| By TWX, TELEX, or telegram | 14.5 | 14.3 |
| By mail | 44.9 | 33.3 |

It is interesting that more than half of all respondents
believed that the contact might have been made by a face-to-face
meeting if teleconferencing had not been available. When asked
whether they would have participated in such a meeting if travel
had been required,47% of the Voice System users and 58% of the 50A
users answered "yes"; 24% of the Voice System users and 22% of the
50A users answered "no"; while the remainder of the respondents
didn't know. Of those who listed their reasons for not attending a
face-to-face meeting, the overwhelming majority listed limited
travel funds or low priority of the meeting as the reason they
would not have attended. A smaller but significant group responded
that someone else would have been sent if the meeting was at a
remote location.

In an open-ended question, respondents were asked what they
considered the main reasons for electing either to attend a
meeting in person or to attend by teleconferencing. Reactions of
respondents are shown in Table 13.

TABLE 13.  Reasons for Selecting Live or Teleconferencing Mode

| Reasons | Number of Respondents Listing |
| --- | --- |
| Nature of meeting (purpose, subject matter, importance, complexity) | 63 |
| Time considerations | 41 |
| Costs and availability of travel funds | 31 |
| Previous acquaintance with participants | 10 |
| Desirability of travel | 7 |
| Number and kinds of people able to participate | 4 |
| Length of Meeting | 4 |

Many respondents answered this question by expressing their conviction that teleconferencing could not adequately replace a personal meeting; a smaller number of respondents noted that they would choose a teleconference under almost all conditions. However, the majority of respondents saw teleconferencing as appropriate under some conditions, face-to-face meetings under others. These respondents saw the nature of the meeting as the prime determinant of the mode choice. Respondents agreed that if the meeting was for routine matters, teleconferencing was the preferred mode. If the meeting was important and complex (especially involving negotiations), face-to-face was the preferred mode. Respondents also placed high value on their time and competing commitments and on saving the costs of travel. Of those who saw the relationship to others in the meeting as very important, there was unanimous agreement that teleconferencing was to be used in continuing contacts with those with whom one was already acquainted, not in initiating new relationships.

6.   User Attitude and Satisfaction

Several groups of questions were addressed to the user's satisfaction with the Voice System and the 50A system. The following table shows the percentage of respondents who indicated they had encountered problems.

TABLE 14.   Problems with Telconferencing System
             (percentage of system users who responded "yes")

| System | Technical Problems | Procedural Problems |
|--------|--------------------|---------------------|
| Voice System | 15.8% | 7.9% |
| 50A | 10.2% | 8.5% |

While suprisingly few users mentioned specific problems, the vast majority of those who did report problems had experienced difficulty with voice quality. This was true for both systems. A question which addressed specifically whether problems had been encountered with the quality of the voice connection brought an affirmative answer from 43% of the users of the Voice System and from 52% of the users of the 50A systems. Users of the Voice System ascribed voice quality difficulties to the physical system, while users of the 50A sets reported both technical and procedural problems (such as participants too far from the mics.) 50A users also reported difficulty in trying to move mics around, and in reconnecting to a conference once the connection was broken.

Respondents were questioned concerning the ease of use of the NASA Voice Teleconference System and the 50A sets. Table 15 reports their ratings.

| TABLE 15. | Ease of Use of Teleconferencing Systems Number of responses (and percentage) of reported users | | |
|---|---|---|---|
| | RATING | | |
| | Easy | Usable, but not especially easy | Difficult |
| Voice Teleconference System | 72 (59.5%) | 40 (33.1%) | 9 (7.4%) |
| Bell 50A | 76 (71.7%) | 27 (25.5%) | 3 (2.8%) |

While both systems were rated quite easy to use, there appears to be a difference in the relative assessments of the two systems, with the 50A's somewhat easier to use than the Voice Teleconferencing room.

A main concern of this evaluation was how well the teleconference system handled a variety of communication activities and whether this judgement changed as users had experience with the system. Users were asked how satisfactory they found the system with respect to 14 activities. Each activity was rated by the user on a four-point scale (very satisfactory, satisfactory, unsatisfactory, and very unsatisfactory.) The ratings for the various activities are given in Table 16. The activities have been ordered in roughly descending order for ease in reading. A rating of "equivocal" signifies that the percentage of satisfactory responses approximately equalled the percentage of unsatisfactory responses. Unless otherwise specified, ratings for the Voice Teleconferencing System and the 50A System and for inexperienced and experienced users were similar. Where notation is made of differences between systems or between high frequency (experienced) users and low frequency users, these differences reached statistical significance at the .05 level.

TABLE 16. <u>User Satisfaction on Various Actitivies using the Telconferencing System</u>

| Activity | Rating |
|---|---|
| Giving or receiving information | Very Satisfactory (high frequency Voice System users more satisfied) |
| Exchanging opinions | Very Satisfactory (high frequency Voice System users more satisfied) |
| Giving or receiving ideas | Very Satisfactory |
| Asking Questions | Very Satisfactory |
| Maintaining friendly relations | Satisfactory (high frequency Voice System users more satisfied) |
| Generating ideas | Satisfactory |
| Problem solving | Satisfactory - Voice System<br>Equivocal - 50A system<br>(high frequency users of both systems more satisfied) |
| Decision making | Equivocal |
| Resolving conflicts | Unsatisfactory (high frequency Voice System users more satisfied) |
| Persuasion | Unsatisfactory |
| Resolving disagreements | Very Unsatisfactory - Voice System<br>Unsatisfactory - 50A System |
| Getting to know someone | Very Unsatisfactory |
| Getting another on one's side | Very Unsatisfactory |

    Recipients of the questionnaire were asked to indicate their affective responses to teleconferencing by indicating the extent to which they felt various pressures and other attitudinal responses during their last teleconference. The user rated each item on a five-point scale (always, almost always, sometimes, almost never, never). Table 17 presents a summary of responses to twenty of these items (compressed here to "yes", "sometimes" and "no"). Again, unless specified, ratings for the Voice Teleconferencing System and the 50A system and for high and low frequency users were similar. Where notation is made of differences between systems or between high frequency users and low frequency users, these differences reached statistical significance at the .05 level.

TABLE 17. <u>User Response to Affective-Reaction Items</u>

| <u>Items</u> | <u>Rating</u> |
|---|---|
| Pressed for time | No |
| Threatened or Intimidated | No |
| Frustrated | No (high frequency Voice System users less frustrated) |
| Confused | No (high frequency Voice System users less confused) |
| Under Pressure to Perform | No |
| Distracted by Equipment | Generally No (Voice System users more distracted than 50A users; high frequency Voice System users more distracted than low frequency users. High frequency users of 50A less distracted). |
| Distracted by Nature of the Medium | No |
| Appreciated | Sometimes (high frequency Voice System users felt more appreciated). |
| Relaxed | Yes |
| Ignored | No |
| Cooperative | Yes |
| Defensive | No |
| Competitive | Sometimes |
| Critical | Sometimes (Voice System users felt less critical than 50A users; high frequency Voice System users felt less critical than low frequency users). |
| Overloaded with Information | No |
| Able to Influence Procedure | Sometimes (tending to "no") |
| Physically Comfortable | Yes (high frequency Voice System users more comfortable that low frequency users). |

As can be seen from this table high frequency users of the
Voice System tend to have the most positive responses to teleconferencing.

Users were invited to mention any advantages they believed
that teleconferencing brought to their meeting that would not have
been possible otherwise. Their responses are shown in Table 18.

TABLE 18. <u>Users' Perceptions of Advantages of Teleconferencing</u>

| <u>Advantage</u> | <u>Frequency of Responses</u> |
|---|---|
| Possibility of involving more individuals | 30 |
| Time saving, less disruptive of schedule | 30 |
| Money saving | 20 |
| Discussions more to the topic, more honest, less emotional | 12 |
| Capability of meeting with very short notice | 4 |
| Can meet more frequently, not forced to a premature decision | 3 |
| Permits meetings that could not be held otherwise | 2 |
| Allows a broader view of agency projects and expands contacts | 2 |

It can be seen from this table that along with time and money
savings, users placed a very high value on the number of individuals
who could participate in a meeting and the propensity of teleconferencing to direct the meeting towards substantive issues.

## 7. Suggested Improvements

Users were asked to contribute their ideas on what could be done to make the teleconferencing system better suited to their needs. Responses to this question fell into two categories, those concerned with the physical arrangement and those concerned with procedural arrangements. Suggestions on improvements to the physical arrangement are given in Table 19, procedural suggestions in Table 20.

TABLE 19.  Suggestions for Improving Physical Plant

|  | Frequency of Response |
|---|---|
| More mics and better arrangement of mics | 24 |
| Video or other dynamic visual presentation | 16 |
| Improved reliability of system especially volume | 14 |
| Improved talk/mute buttons with greater accessibility | 10 |
| Full Duplex [2] | 7 |
| More 50A sets and jacks | 7 |
| More fax, better location of fax | 5 |
| More speakers and better location of speakers | 4 |
| Better physical location of facilities | 4 |
| Feedback capability | 3 |
| Use commercial lines or improve FTS | 2 |
| Quality control to keep volume up as centers join | 2 |

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[2] "Full duplex" is used in this report to mean a method of operation where each end can simultaneously transmit and receive. (IEEE Standard Dictionary of Electrical and Electronic Terms, J. Wiley & Sons, Inc., N. Y. 1972.)

TABLE 20.  Suggestions for Improving Procedural Arrangements

|  | Frequency of Response |
|---|---|
| More attention to structuring meeting (pre-arranged agenda, better preparation, conference chairperson, list of participants) | 31 |
| Shorter teleconferencing meetings | 13 |
| Smaller number of participants and participaht centers | 6 |
| Training on use of mics (correct distance, avoiding extraneous noises, audience question repeated by speaker) | 6 |
| Attention to visual materials arriving in advance (50A users) | 5 |
| Earlier warning on meetings and convenient scheduling for both coasts | 3 |
| Procedure for interrupting and gaining attention | 2 |
| Scheduled breaks when centers can join or leave | 2 |

Clearly, the greatest emphasis for ameliorating the physical arrangements involves improving the quality of the audio reception. Problems with microphones were mentioned frequently by 50A users, and almost as frequently by users of the Teleconferencing rooms. (However specific comments about volume and poor sound quality were made more frequently by users of 50A systems.)  Problems with operating buttons were mentioned frequently by both groups.  50A users stressed difficulty in going from one microphone to another while teleconferencing room users were concerned primarily with the accessibility of buttons.  A significant number of users believed that a dynamic visual display would aid their efforts.  For improving procedures, users placed heavy emphases on structuring and shortening meetings.

8.  Forced Compliance Evaluation

Forcing individuals to participate in a particular system by reducing their options often is seen as quick, efficient method

of inducing change. However, using such an approach causes a
system to be introduced in a manner that is fundamentally
different from tnat of voluntary participation, and raises
questions about acceptance and long term use of the system.

The NASA teleconferencing system has been utilized,
generally, by a population of users who see it as a preferred
way to conduct a particular conference. It is the reactions
of these users to teleconferencing that form the basis of the
present report. We know virtually nothing of how the responses
reported here might be affected if individuals were forced
to interact by teleconferencing. An event occurred during the
course of the pilot project evaluation that gave us an opportunity
to look at least at a single case of non-preferred use of the
teleconferencing system. An airline strike caused last minute
cancellation of a trip for six Ames exployees. Arrangements
quickly were made to allow these individuals to participate in
the scheduled meeting through teleconferencing. A modified
version of the questionnaire given in the appendix was sent to
these users in an attempt to gain insight into the reactions
of those who use the system under some duress. (Since the
data are so limited, no attempt will be made to report them in
a quantitative manner.)

Of primary concern were two sections of the questionnaire
which examined the affective reactions of these users and their
satisfaction with the system. The affective responses of
users differed hardly at all from those of the subject population
generally. For instance, these users felt as cooperative
("yes"), as critical ("sometimes") and as overloaded with
information ("no") as the population generally. However they
tended to be, overall, less satisfied with the conference in
almost every category than were the general pool of

subjects.[3]  Since only a small number of individuals were
involved, no inferences can be drawn.  One can conclude only
that the possibility is still open that those who use the
teleconferencing medium under a forced compliance condition
will be less satisfied with it than those who choose to use
it, although their other reactions will probably not change.

F.  DISCUSSION

1.  Voice Teleconferencing and 50A

Few differences were found between responses to the NASA
Voice Teleconferencing System and the 50A System overall.
Although the audio quality of the Voice System was found to be
superior to that of the 50A System, levels of satisfaction and
affective responses were comparable for the two systems along
most dimensions.  However, responses to the two systems over
time did differ.  Repeated use of the 50A's resulted in few
changes in attitude towards the system, while repeated use of
Voice Teleconferencing produced some marked changes in attitude.
Experienced users of the Voice Teleconfencing System generally
were the most satisfied and positive group of users.

One might wonder whether greater use of the Voice Telecon-
ferencing System resulted in favorable responses or whether
those who favored the system initially tended to use it repeatedly

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[3]
It should be noted also that these users had less experience with
teleconferencing than the population generally, and might be expected,
on the basis of familiarity alone, to be less satisfied with the
system than the average, more experienced, user.

(resulting in a population of favorable repeat users who were self-selected from the original population of users.) Although the latter explanation is certainly reasonable and probably plays some part in explaining the more favorable attitudes of experienced users, there is also evidence from within[4] and outside[5] teleconferencing research that repeated use leads to more favorable responses. If this principle can be applied to the NASA system (and the experience with the Voice Teleconferencing System indicates it can) then anything that can be done to encourage use of the system is likely to result in more positive attitudes towards it, and to still greater use of the system.

2. Users Groups

Although the Voice Teleconferencing System has certain quality advantages to users, especially as they gain familiarity with the system, the 50A System appears to have certain advantages of convenience which have made it a desirable working tool. Middle managers, a group which has very high communication needs, make extensive use of the 50A System. This differential use of systems by job class tends to cloud the question of the overall relative value of the two system.[6]

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[4] Williams, E., in Needs Technology Effectiveness and Impact, a Discussions of Some Behavioral Aspects of Person/Person Telecommunication, Communications Study Group, JUPR, P/71128/RD

[5] Zajonc, R.B., The Attitudinal Effects of Mere Exposures, Journal of Personality and Social Psychology, Monograph Supplements, 1968,9,2.

[6] To date, those who can be identified as users of the NASA teleconferencing System fall heavily into the management groups.

3. Improvements

Second only to requests for improved audio quality, the suggested improvement most frequently offered by users of both the Voice Teleconferencing and the 50A systems concerned the interactive aspects of the audio communication. Many comments concerned the inadequacy of, and need for improvement in, talk buttons, in mechanisms for gaining attention, in methods for providing feedback, etc. Only a few respondents mentioned the desirability of full duplex, but many of the suggestions offered either implied full duplex or would have been unnecessary if full duplex had been available.

Other frequently-offered suggestions were those emphasizing the structuring of meetings. In spite of the fact that almost all users reported that a conference chairperson had been appointed and an agenda proposed, numerous comments express the need for more organization. Some participants pointed out that there is a relationship between the number of conferees who can effectively participate in a mediated meeting and the degree of structuring required for the meeting, with more structuring allowing greater numbers to participate, less structuring limiting the number who can effectively participate.

Techniques for structuring meetings should include: scheduling meetings with as much lead time as possible and at times convenient to all time zones involved; assuring that visual materials arrive in advance of the meeting (a particular problem when using 50A's where conferees are generally some distance from facsimile facilities); preparing and distributing agendas; scheduling time for asking questions and devising methods to assure that questions are heard by all conferees; establishing protocols for interrupting, for joining and leaving the meeting, etc.

Although greater attention to planning and organization
will help a teleconference run more smoothly, teleconferencing
appears to require greater overall concentration and more
expenditure of energy than a face-to-face meeting. Therefore,
it is highly desirable to limit the duration of a teleconference.
Ideally it should last no more than two to three hours.

4.    Comparison with Other Research

Responses to the NASA Teleconferencing System resemble in
many dimensions the results of investigations and evaluations
of other teleconferencing media.  For instance, a general
finding of mediated communication studies is that mediated
systems are perceived as more appropriate for rather narrowly-
defined informational tasks than for more complex and social
tasks such as bargaining and "getting acquainted."[7]  A preference
for the use of the NASA Teleconferencing System for relatively
simple informational tasks was affirmed in the present study.
Similarly, resolving disputes has been found in other
studies to be handled inadequately by telemedia having audio-
only capability.[8]  In the present study fewer than half the
respondents reported that this kind of activity took place in
their conference and, projecting to the situation where such
activity would take place, most users believed the system
would not handle this activity adequately.  However, there  is
some evidence from other research that such activity  could
be handled with reasonable adequacy if the telemedia had a
visual component.[9]

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7    See, for instance, Communications Study Group, JUPR, A Report on the
use of the Audio Conferencing Facility in the University of Quebec,
P/73161/SH.

8    Communications Study Group, JUPR, The RMT Teleconference System,
P/72024/RD

9    IBid

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Previous acquaintance with others in the meeting was mentioned frequently by respondents in the present study as important in choosing the mode of communication. (Users are willing to use teleconferencing more the better they know the others). Although evidence showing a relationship between acquaintance with the other and success on an assigned task is lacking,[10] there is other evidence to support the judgment made by users of this study. Research has shown that the conference atmosphere is more positive in a face-to-face meeting than in an audio meeting,[11] and that the other is perceived more positively with previous acquaintance.[12] These two relationships would lead one to choose a face-to-face meeting if the other conferees were not previously known (since personal careers probably depend more on the favorable perception of the individual than on the successful performance of the task.) Here again, the addition of video could help to reduce the reluctance to use telemedia among those who are not acquainted, since it would be expected that the general atmosphere of the conference would be more positive than with audio only.[13]

5. Communication Impact

About one-fourth of the respondents in the present study believed that if the meeting they had attended had not taken

10  Weston, J.R. and C. Kristen, Teleconferencing: A Comparison of Attitudes Uncertainty, and Interpersonal Atmospheres in Mediated and Face-to-Face Group Interaction, the Social Policy and Programs Branch, Dept. of Communications, Ottawa, Canada, Dec. 1973.; Communications Study Group, JUPR, Factors Influencing the Effect of Medium of Communication Upon Preference for Media, Conversations and Persons, E/72227/WL.

11  Weston and Kristen, op. cit.

12  Williams E. in "Needs, Technology, Effectiveness, and Impact, A Discussion of Some Behavioral Aspects of Person/Person Telecommunication," Communications Study Group, JUPR, P/71128/RD.

13  Weston and Kristen, op. cit.

place by teleconferencing, it would not have taken place at all; the remainder of the respondents believed that the meeting would have occurred using either other telemedia or by direct contact. These responses indicate that the NASA teleconferencing system is being used both as an addition to conventional communication and as a substitute for other kinds of communication. However, there is another, and probably more important way, in which teleconferencing is supplementing conventional communication.

Many respondents noted that if a live meeting had been held, they would not have participated. As one respondent noted, when a live meeting is planned, those who are considered "too important or too unimportant" to travel are excluded. It cannot be determined which of these subgroups is contributing to the NASA teleconferenced meeting, but it is clear that one or both of them are. Teleconferencing users placed great value on the opportunity to include those who would not normally be in attendance. In this sense, teleconferencing can be seen as a qualitative as well as a quantitative supplement to conventional meetings.

Previous research has shown that mediated communication places more emphasis on formal, business-like methods and less emphasis on social concerns than does face-to-face communication. In the present study several respondents mentioned the more business-like emphasis of mediated communication as a particular advantage of teleconferencing. These users found that the teleconference allowed them to stick closely to the topic and to have an honest exchange of opinion, without the emotional involvement that frequently accompanies face-to-face exchanges. These observations point out what is perhaps obvious - that differences related to the mode of communication do no imply that one mode is preferred. Each mode has its own characteristics which must be considered in terms of the goals to be achieved in a particular meeting.

# CHAPTER V

# THE RELATIONSHIP OF TELECONFERENCING AND TRAVEL: THE AMES EXPERIENCE

Communication and transportation share a unique and close relationship. In fact, the term "communication" is used often to connote transportation activities.[1] There is good reason for this close association. Both activities are avenues by which an individual or a group can extend the boundaries of its environment in order to share experiences with others. And, historically, these two industries have followed parallel paths. Increases in transportation facilities are mirrored by increases in communication facilities. It seems clear that the ability to communicate over large distances has necessitated new travel, just as travel has led to additional communication, in an ascending spiral of contacts.

We are now entering what promises to be a new historical era, marked by the shortage of and concomitant necessity to conserve, energy resources. This concern and the related concern over dramatically increased costs of transportation have led to the question of whether sophisticated communication systems can replace, as well as stimulate and supplement, planned travel. This question is of interest to those concerned with the design and evaluation of the NASA teleconferencing system.

The question of whether teleconferencing can offer an acceptable substitute to travel is fraught with difficulty in analysis since so many variables intervene in the decision to make or to replace a business trip. It was for the purpose of better understanding the interralations of these variables that the following analysis was made of the travel-teleconferencing experience at Ames Research Center.

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[1] In the reporting statistics of many nations, the heading "communication" is as likely to contain information about newly-constructed bridges or newly-paved roads as to update information on the telephone or the postal systems.

A.  Analyses

In the absence of competing media, one can view travel expenditures as a measure of perceived need to communicate. Although this measure gives no indication of whether the perceived need to communicate is general (i.e., potentially replaceable by other forms of communication) or specific (i.e., not replaceable by other forms of communication); travel expenditures provide at least a starting point from which the impact of teleconferencing can be assessed.

The Ames Research Center teleconferencing system became fully operational as a hands-off, four-wire system in March 1975. The periods that were selected for travel comparison were: July-December 1974 and July-December 1975. Travel expenditures for the July-December 1975 period were up approximately 35% over the similar period for 1974. This increase includes a large rise in the cost of travel[2]; the number of trips taken in the 1975 sample period actually declined 3% from those made in the similar 1974 period.

1.  Analysis of Travel Expenditures at the Directorate Level

Each of the six directorates at Ames received an increase in travel allocation for fiscal year 1976 which was roughly proportionate to the over-all center increase. This allowed a comparison to be made between travel and teleconferencing usage for the two six-month periods of interest by directorate. Since different directorates made widely varying use of the teleconferencing system, it was believed that some useful insights concerning the relationship between teleconferencing and travel might be gained from an analysis at the directorate level.

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[2] Including a 32% increase in general per diem allowance.

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The six directorates were rank ordered according to travel commitment per professional employee[3], and this ordering was compared with similar orderings of teleconferencing use. Three directorates were selected as representing varying degrees of teleconferencing use. The directorate whose relative teleconferencing use exceeded what would have been predicted based on travel budget was classified as a "heavy user." The directorate whose relative use of teleconferencing was about on a par with its relative travel budget was termed a "moderate user," and the directorate whose relative use of teleconferencing was below what would be predicted from the communication need implicit in its travel budget was termed a "light user."[4]

Comparison of travel budgets at the directorate level for the six-month periods before and after the availability of teleconferencing provides no evidence that teleconferencing was being used to cut travel expenses. The travel commitments of "heavy users" increased proportionately more than similar commitments of "moderate users" and "light users." The travel expenditures for "heavy users" increased by 98% over the similar period for the previous year while expenditures for "moderate users" and "light users" increased 41% and 44% respectively.[5]

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[3] There is no clear category of "potential traveller." Employees belonging to professional job classifications were assumed to be both the employees who use most of the travel monies and the employees who potentially would be users of teleconferencing facilities.

[4] "Heavy" implies a high use of teleconferencing; "light" implies a low use of teleconferencing.

[5] The travel expenditures of "heavy users" were actually higher but a large outlay was associated with one particular trip. The costs of this trip were considered nonrepresentative and eliminated from the calculations prior to arriving at the figure of a 98% increase over the previous year.

Although the data presented in this chapter are intended only to suggest hypotheses about relationships, rather than provide answers concerning them, the travel data at the directorate level does lead one to believe that teleconferencing, by itself, will not result automatically in travel reduction.

These data raise the question, "If teleconferencing is not being used to reduce travel in some general fashion, how is it being used?" There are two major possibilities. Teleconferencing is being used simply as a supplement to travel generally (or to particular types of travel) allowing the user to increase his contacts, but in no way changing his travel habits. Or, teleconferencing is being used to replace certain kinds of travel, freeing travel allocations that would have been used for this purpose for other uses. To explore these two possibilities, an analysis was made of the categories of travel engaged in by the "heavy users," "moderate users," and "light users" directorates for the two six-month periods under consideration.

## 2.   Analysis of Travel Categories

NASA travel can be broken down into three broad categories: (1) travel associated with programs (RTOP reviews, design and inspection of facilities, preflight planning, etc); (2) travel assocated with administration (management training seminars, change of station expenses, etc); and (3) travel associated with scientific and technical meetings. If teleconferencing were used to replace certain kinds of travel, one might reasonably expect that the category of travel where replacement would take place would be program travel. Although the travel funds made available by such replacement could be used for

additional travel in any of the three categories[6], it would not be unreasonable to expect that meeting travel would increase (since this travel is completely nonreplaceable under the present system).

Table 1 shows a breakdown of the percent change in travel expenditures for the three types of teleconferencing user directorates when the six-month period following teleconference availability is compared with the similar six-month period preceding teleconference availability.

TABLE 1. Percent change in travel expenditures after teleconferencing compared with before teleconferencing.

| TYPE OF TRAVEL | USERS | | |
| --- | --- | --- | --- |
| | Heavy | Moderate | Light |
| Program | - 50 | + 89 | + 40 |
| Administrative | +169 | - 32 | - 2 |
| Meeting | +363 | - 9 | - 28 |

"Light" teleconferencing users spent proportionately more of their available travel funds on program travel and less on meeting travel in 1975 than in 1974; "heavy" users spent proportionately more on meeting travel, and perhaps more important, less on program travel in 1975 than in 1974. These findings are consistent with the suggestion that teleconferencing can (and is) used to replace certain kinds of travel, freeing funds for other uses. However, there are also alternate explanations for these findings, including the unique demands of certain periods for particular kinds of travel.

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[6] For instance, travel to a high priority project meeting could be replaced by a teleconference and the travel funds saved used for travel to a lower priority project meeting. This kind of substitution would not be revealed by this analysis.

3. Analysis of travel Categories for Selected Users

      Ames employees who used the teleconferencing system
repeatedly were selected for further analysis of their travel
patterns. The subject group consisted of those who had completed
teleconferencing use evaluation forms at least three times
during the life of the pilot project.[7] Fifteen individuals
at Ames met this criterion. The travel experiences of these
15 individuals were examined for the two six-month periods of
interest. These data were compared with similar data for the
entire population of Ames travellers. These data are shown in
Table 2. The Ames travellers generally increased the amount
spent on travel during the period teleconferencing was available
by 33%, compared with a similar period when teleconferencing
users decreased travel expenditures by 12%. However, of the
repeat teleconferencing users, only six individuals reduced
their travel expenditures while eight increased their expenditures
and one remained the same for the two periods.

| TABLE 2 | Percent change in travel expenditures after teleconferencing compared with before teleconferencing, repeat users and Ames travellers generally. | |
|---|---|---|
| TYPE OF TRAVEL | USERS | |
| | Repeat Teleconferencing | Ames Generally |
| Project | - 34 | + 47 |
| Administrative | - 53 | + 12 |
| Meeting | +400 | + 2 |
| Overall Travel Total | - 12 | + 33 |

---

[7] This method of identifying those who choose to use teleconferencing is not
wholly satisfactory for several reasons. First, not every node of a tele-
conference has a member who takes the time to complete the user evaluation
form, so many users remain unidentified. Second, even when the evaluation
form is completed, a list of attendees is frequently omitted. By selecting
those who had completed evaluation forms three times, we assembled a popula-
tion that we knew had this level of experience with the system, although
there may have been others who had as much or more experience whom we could
not identify.

More suggestive than the gross amounts spent for travel
is the pattern of expenditure. Overall, for the population of
repeat teleconferencing users, project travel and administrative
travel was reduced in the latter half of 1975, while meeting
travel increased considerably during this same period. This
is in contrast to the travel patterns at Ames generally, where
most of the travel allocations were directed towards project
work with meeting travel remaining essentially unchanged.
Within the repeat user population, the direction of change for
individual travellers for the latter half of 1975, was as
follows: six individuals increased and six individuals decreased
their project travel expenditures; three individuals increased
and four individuals decreased their administrative travel
expenditures. The big change occurred in the meeting data. Six
repeat users increased expenditures for meeting travel in the
latter part of 1975, while no one is this group decreased
meeting travel.

It does appear that repeat users of teleconferencing were
able to increase their meeting travel expenditures while
reducing their overall travel expenditures - a finding not
inconsistent with the notion that teleconferencing was used as
a substitute for some kinds of travel[8]. This finding for the
population of repeat users gives added credence to the findings
reported in the previous section for directorates - that those
who made the most use of teleconferencing tended to shift
travel allocations away from project endeavors and towards
meeting travel[9], a finding supportive of a partial substitution
hypothesis.

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[8]     This assumes that travel saved by a particular individual will be
allocated for other use by this same individual.

[9]
The analysis reported here for repeat users of teleconferencing is
not entirely independent of the directorate travel pattern analysis.
Some teleconferencing repeat users were also members of the "heavy
users" directorate. However, this fact does not influence the con-
clusions. When members of directorates which were used in the
directorate travel pattern analysis were excluded from the repeat
user analysis, the results changed only slightly, and in a direction
suggesting even less project and more meeting travel.

B. Repeat User Interviews

In an effort to determine if repeat users of teleconferencing were conscious of any changes in their patterns of travel following the availability of teleconferencing, telephone interviews were conducted with these users. Thirteen of the fifteen individuals comprising this group of users were contacted and questioned on how they perceived the relationship between their use of teleconferencing and their travel. Significantly, none of these users gave any indication that he was aware of category changes, although one respondent did mention that he believed that teleconferencing led to less travel to Headquarters, more travel elsewhere. A common response was that teleconferencing was used as a supplement to travel, allowing the user to participate in meetings that he could not attend otherwise. Another related difference between the suggestions based on travel data of these users and their own impressions concerns the relative importance of the meetings conducted by teleconference. Changes in the pattern of travel as suggested by the travel data imply that high priority concerns are being addressed through teleconferencing. However, the impressions of the repeat users were that they were travelling to high priority meetings, using teleconferencing for lower priority meetings[10].

C. Discussions

A potential decrease in travel reasonably might be expected to follow the introduction of a new communication system if potential users believe they are doing too much, or at least a sufficient amount of travelling. Where individuals believe they should be doing more travelling than their budgets allow, the introduction of a new communication system on a voluntary basis would not be expected to

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[10] One user did volunteer that some member of his group had attended a particular meeting each year prior to teleconferencing and that, since teleconferencing had been available, no one from the group had attended in person.

result in lowered travel expenditures[11]. At Ames there is a high level of awareness of and response to tight travel limitations. It is not surprising then that, under these circumstances, travel budgets are coincident with travel expenditures.

However, the availability of an adequate communication system can give users, not only the potential for greater participation, but also more discretionary power in allocating their travel budgets[12]. Data from Ames suggest that teleconferencing users are both participating in more meetings and exerting greater choice than non-users in determining how they will participate in various meetings. In other words, the combined evidence from Ames suggests that the teleconferencing system has been used both for supplementing contacts and as a substitute for certain kinds of contacts.

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[11] The belief that professional and other benefits are associated with business travel appears to be widely accepted and quite resistant to change. Kollen and Garwood (Travel/Communication Tradeoffs: the Potential for Substitution Among Business Travellers, Bell Canada, April 1975) report that 68% of the travellers they interviewed either want to travel at the same rate or to increase their travel. These authors conclude that travellers will continue to travel as much or more than at present unless they are compelled to do otherwise. Westrum in an early study (The Effect of Improved Electronic Communication on Business Travel, IEEE Transactions on English, Writing, and Speech, December 1971) arrived at a similar conclusion. He reports that of a sample of 260 executives, 13 times an many respondents believed they should make more trips as believed they should make fewer trips.

[12] Increasing the discretionary power associated with the allocation of travel funds increases the benefits potentially derived from these funds.

It must be remembered though that the partial substitution relationships suggested by the present analyses are both post hoc and based on a very limited experience.[13]  Repeat users of teleconferencing are few in number and had, in general, quite limited experience with the system.  They were simply the most experienced users available.  Analyses of their travel patterns can help us to better understand the relationship of teleconferencing and travel by providing credible hypotheses; they cannot provide definitive answers.

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[13]  And are not reinforced by the subjective impressions of users.

CHAPTER VI
CONCLUSIONS AND RECOMMENDATIONS


A.    SUMMARY

The NASA Teleconferencing System has received considerable acceptance during its first year of life, with an average of six teleconferences being conducted per center per week. The primary use of the system has been for RTOP and other program reviews. The main users of the system to date are in management positions. Those in upper management tend to favor the Voice Teleconferencing System; those in middle management tend towards greater use of the 50A System.

Affective responses of users are quite positive to the NASA Teleconferencing System generally, and, overall, users report the system to be a satisfactory mode of contact. Users are more satisfied with the system when it is used for narrowly-defined tasks such as information exchange, questions and answers, etc., than when it is used for complex tasks such as persuasion, or tasks with high social content, such as getting to know the other. Voice quality has been found to be better on the Voice Teleconferencing System than on the 50A System. User reactions to and acceptance of the 50A System are comparable to those of the Voice Teleconferencing System, although users who have had multiple experiences with the Voice Teleconferencing System appear to be the most positive and satisfied subgroup of users.

The travel analysis conducted at Ames Research Center indicates that the presence of a teleconferencing system, by itself, will not reduce overall travel expenditures.[1]    This analysis suggests

_____

[1]    This conclusion applies to the situation where the travel budget is considered less than optimum. If users were able to do as much traveling as they thought necessary, it is possible that the mere availability of teleconferencing would reduce travel expenditures.

that the availability of teleconferencing does change the <u>nature</u> of the trips on which travel monies are spent. Data from this analysis, along with data based on responses of users at five major centers, indicate clearly that the NASA Teleconferencing System is both replacing certain kinds of contact previously made through travel and other communication modes, and also allowing contacts to be made that could not take place otherwise. That is, the NASA Teleconferencing System is both a substitute for and a supplement to conventional contacts.

B.   USER SUGGESTIONS

Suggestions from users and from facility managers tended to focus heavily on the need for:

-   Improving the audio quality

-   Adding equipment or procedures which would allow for easier interactive exchange, and

-   Initiating procedures to structure and shorten teleconferences.

Other suggestions mentioned frequently were: adding video, establishing procedures for a center to go off network, and giving more attention to assuring that visual materials arrive on time (for instance, by greater use of the facsimile system).

C.   STUDY RECOMMENDATIONS

Based on the data obtained in this study, the following recommendations are offered.

1.   Equipment
Although full duplex appears to be the ideal many users would wish, a significant benefit could be gained by providing

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even a simple means of interrupting the speaker in order to let him know that someone wishes to ask a question or offer a comment. Such a device would benefit both the speaker and the audience. It would give the speaker greater contact with his audience and it would allow a member of the audience to interrupt without having to vocally wrest control from the speaker.

Many respondents commented that they believe the addition of video would improve the system. There is some evidence that video leads to more positive responses of users and to a greater capacity to deal with tasks with socio-emotional content. To date, relatively few teleconferencing systems have had video and so the data on video is sparse. The value of adding video to the NASA Teleconferencing System should be assessed. The CTS experiment offers a unique opportunity to examine the benefits of video to the system. Data from this and other video uses of the system would be especially valuable since these data could be compared with the audio-only data of the present study.

2. Procedures

There is ample evidence from this and from other studies that teleconferences require greater planning and more procedural attention than do face-to-face meetings. Although those who regularly run teleconferences tend to accept the extra attention required, new users may overlook some simple preparations that could make the difference between a successful and an unsuccessful experience. Since initial experiences with a system determine to a large extent whether the system will be used again, an effort should be made to reduce the problems of new users. A simple help which could be offered new users would consist of a checklist for starting a conference along with a few brief suggestions about its conduct. This checklist could be distributed to conference leaders by facility managers at the time the teleconferencing room is reserved or when 50A phones are checked out.

3. Extending Use

Facility Managers. Facility managers are, to a large extent, the key individuals in determining the extent to which the tele- conferencing system is used. Some managers have expressed the desire to gather suggestions and compare experiences with managers at other facilities. It would seem highly desirable to establish a communication link among these individuals and the logical mechanism is the teleconference. Establishing periodic teleconferences would help to involve facility managers, to disseminate productive ideas, and to reduce the isolation some now experience.

Users. Individuals who have used either the Voice Telecon- ferencing System or the 50A System are still only a fraction of potential users. From the information now available it would appear that one would have a better chance of coaxing upper management personnel (who have a marked preference for face-to-face communication) into a teleconferencing mode through the Voice Teleconferencing System rather than the 50A System. However, for middle managers and scientists, emphasis should be given, at least in the near term, to exploring how the 50A System could be expanded to meet the needs of this potential user group.

It is likely that many potential users do not know enough about the NASA Teleconferencing System to make the determination that it could be useful to them. For the benefit both of these in-house personnel and the outsiders who frequently inquire about the specifics of the NASA system, a descriptive brochure should be prepared. This brochure, preferably of about three pages, should be made available to, and distributed by, facility managers.

Extending the usefulness of the system implies not only more use but better use. It seems clear that use of the facsimile system in conjunction with a teleconference should be encouraged, especially to ensure timely arrival of materials. Also, users should be encouraged to use the teleconferencing system in the most cost-effective manner. Teleconferencing is very efficient for long-distance communication (especially when replacing travel). If teleconference scheduling conflicts develop among users, preference should be given to long-distance communications.

4.  Research

As has been mentioned, events surrounding the upcoming CTS experiment provide an opportunity to gather information on the benefits of video. This information can contribute to the understanding of the NASA Teleconferencing System and to the understanding of the dynamics of teleconferencing generally. In addition, the present study revealed questions which should be explored further.

Data from the present study strongly suggest that teleconferencing changes the nature of concomitant travel. This hypothesis needs further testing.

In the present study the responses of users who were forced by circumstances to use the teleconferencing system were to have been examined. Unfortunately, only a few such users could be identified. Although the reactions of this group (affective responses similar to other users but somewhat less satisfied than other users) are intriguing, these data are sufficient only to refine the hypothesis on forced compliance. Many more users in this category will have to be identified before any conclusions can be drawn concerning involuntary participation. This could be an important question and should be examined as opportunities arise.

In addition to knowing how much a system is being used and how successfully it is being ·used, one also wishes to know how efficiently the system is being used. In order to understand this it is necessary to examine each link in the communication network. Teleconferencing and travel are two modes of this communication network. Further data is needed on node-to-node conferencing and node-to-node travel in order to determine if the system is being used efficiently, and if present switching arrangements are cost effective in terms of potential traffic.

Decisions on the continuance and further development of the NASA Teleconferencing System depend on both its usefulness and its costs. This study has dealt with the former question. It should be remembered in considering the results of this study that the system is still quite new. Since users tend to like better systems with which they are familiar, it is reasonable to expect that the NASA Teleconferencing System will be used more in the future than it has in the past, and that users will be increasingly satisfied with it.

APPENDIX

DIRECTIONS: The purpose of this questionnaire, as described in the accompanying letter, is to evaluate user's response to the NASA teleconferencing system. We are interested in describing how the system is being used and in what ways it may be improved. Please answer all questions; if you need more space use backs of sheets or attach additional pages as needed. Thank you in advance for your cooperation.

I. BACKGROUND INFORMATION

    1. Name: _____

        (Note: If you prefer to remain anonymous, leave name blank)

    2. Date: _____

    3. NASA Center: _____

    4. Work Group or Division: _____

    5. Job Title: _____

II. COMMUNICATION USAGE

    1. Thinking back over the last working week, please estimate how many long distance telephone calls you made: _____

    2. How many group meetings (i.e., more than two persons) have you attended in the past month? (estimate) _____

        a. Number of meetings in your own office building?_____
        b. Number of meetings in another office building at your installation?_____
        c. Number of meetings in the city area, outside of the installation?_____
        d. Number of meetings in other cities?_____

    3. During the last two weeks, have you been involved in telephone calls in which three (or more) persons participated? (For example, two telephone sets on the same extension might be used to allow two persons at your installation to talk simultaneously to the third party at the other end of the line.)        Yes_____ No_____

        How many of these calls in the last two weeks?_____

    4. Can you briefly describe your "primary" mode of communicating? (For example, some persons rely primarily on face-to-face meeting; others rely on written correspondence, etc.)_____

III. TELECONFERENCE USAGE

    1. How long have you known about the availability (or the existence) of:

        the NASA Voice Teleconferencing System? (months)_____
        the 50A Telephone? (months)_____

    2. How long ago did you first use (i.e., attend a teleconference using):

        the NASA Voice Teleconference System? (months)_____
        the 50A telephone? (months)_____

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3. Which of the following teleconference facilities have you used?  (Check as many as apply.)

    NASA Voice Teleconference System (conference room)_____
    Bell 50A Speakerphone sets_____
    Other Conference telephone calls_____

4. About how many times have you used each of these in the last six months?

    Teleconference Room_____   Bell 50A_____   Other Conference Calls_____

5. Have you personally made arrangements for a teleconference?        Yes_____   No_____

    If "yes," have you experienced difficulty making reservations?

    For 50A's:              Yes_____   No_____   Didn't use_____
    For Teleconference Room: Yes_____  ·No_____   Didn't use_____

    What kinds of problems have you encountered?_____

    _____

    _____

6. How easy is the Voice Teleconference Room System to use?

    Haven't used Teleconference Room_____
    Easy_____        Usable, but not especially easy_____        Difficult_____

    If you have experienced difficulty, please briefly describe._____

    _____

7. How easy is the Bell 50A unit to use?

    Haven't used 50A_____
    Easy_____        Usable, but not especially easy_____        Difficult_____

    If you have experienced difficulty, please briefly describe._____

    _____

8. Is the Teleconference Room dedicated to your project or working group?

                                            Yes_____   No_____   Don't know_____

9. Is a Bell 50A unit dedicated to your project or working group?

                                            Yes_____   No_____   Don't know_____

10. Is the Teleconference Room facility in your building?        Yes_____   No_____

11. Do you find the Teleconference Room to be conveniently located?

    Extremely well located_____        Good location_____        Fair location_____
            Poor location_____                Extremely poor location_____

12. Have you experienced difficulty with the quality of the voice connection:

    In using the Conference·Room facility?        Yes_____   No_____   Haven't used_____
    In using the Bell 50A unit?                   Yes_____   No_____   Haven't used_____

## IV. TELECONFERENCE PROCEDURES

The following questions concern various procedures and features of teleconferences you've attended.

1. Was there generally an appointed chairperson or leader? Yes_____ No_____

2. Was there a prepared agenda? Yes_____ No_____

3. Were prepared materials used? Yes_____ No_____

 These were: (Check those that apply.)

  _____Passed out by persons at your installation?
  _____Received by mail prior to teleconference?
  _____Received by FAX prior to teleconference?
  _____Received by FAX during conference?

4. During teleconferences you've attended, did you notice any participants attempting the following activities? (Check as many as apply.)

 _____a. giving or receiving information  _____h. asking questions
 _____b. maintaining friendly relations  _____i. resolving disagreements
 _____c. problem solving  _____j. getting to know someone
 _____d. bargaining  _____k. giving or receiving orders
 _____e. generating ideas  _____l. getting others on one's side in
 _____f. persuasion   argument
 _____g. resolving conflicts  _____m. exchanging opinions
  _____n. Others (specify)_____

## V. YOUR LAST TELECONFERENCE

1. In your most recent teleconference did you use: (Check one)

 50A_____ Teleconference Room_____

2. Had your last teleconference not been possible, how might the equivalent exchange of information have occurred? (Check as many as apply.)

 a. It would not have occurred.  ( )
 b. By travel to the remote location.  ( )
 c. By a conference call (a many-location,
  operator-connected telephone call)  ( )
 d. By a series of long distance calls  ( )
 e. By a speakerphone call  ( )
 f. By TWX, TELEX, or telegram  ( )
 g. By mail  ( )
 h. Other (specify) _____

3. Thinking about your last teleconference, if the teleconference system had not been used, and there had been an alternative meeting, would you have participated in the alternative meeting? Yes_____ No_____ Don't know_____

 If "no," why not? _____

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4. What was the nature of your last teleconference? (e.g., program review, lecture presentation, RTOP review, planning session, etc.)

_____

5. Do you think the teleconference system was the right or appropriate way to conduct the last meeting you attended using the system?  Yes_____ No_____

   If "no," explain _____

_____

6. In the last teleconference you attended, did the participants reconstruct topics previously covered in:

   a. a face-to-face meeting?                          Yes_____ No_____
   b. written correspondence?                          Yes_____ No_____
   c. standard telephone conversation?                 Yes_____ No_____
   d. previous teleconferences?                        Yes_____ No_____

VI. TELECONFERENCE EVALUATION (Applies to 50A and/or Conference Room)

   1. How satisfactory do you think you would find the voice teleconference system for the various activities listed below? (left column for "very satisfactory;" right for "very unsatisfactory," etc.)

<u>Very Satisfactory</u>

<u>Somewhat Satisfactory</u>

<u>Somewhat Unsatisfactory</u>

<u>Very Unsatisfactory</u>

   a. giving or receiving information    ( ) ( ) ( ) ( )
   b. maintaining friendly relations     ( ) ( ) ( ) ( )
   c. problem solving                     ( ) ( ) ( ) ( )
   d. decision-making                     ( ) ( ) ( ) ( )
   e. bargaining                          ( ) ( ) ( ) ( )
   f. generating ideas                    ( ) ( ) ( ) ( )
   g. persuasion                          ( ) ( ) ( ) ( )
   h. resolving conflicts                 ( ) ( ) ( ) ( )
   i. asking questions                    ( ) ( ) ( ) ( )
   j. resolving disagreements             ( ) ( ) ( ) ( )
   k. getting to know someone             ( ) ( ) ( ) ( )
   l. giving or receiving ideas           ( ) ( ) ( ) ( )
   m. getting others on one's side        ( ) ( ) ( ) ( )
   n. exchanging opinions                 ( ) ( ) ( ) ( )
   o. other(s) specify _____

                                          ( ) ( ) ( ) ( )

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2. Thinking back over the last teleconference you attended, please indicate the extent to which you felt . . .

<u>Always</u>

    <u>Almost Always</u>

        <u>Sometimes</u>

            <u>Almost Never</u>

                <u>Never</u>

a. Pressed for time ( ) ( ) ( ) ( ) ( )
b. Threatened or intimidated in some way ( ) ( ) ( ) ( ) ( )
c. Frustrated ( ) ( ) ( ) ( ) ( )
d. Confused ( ) ( ) ( ) ( ) ( )
e. Bored ( ) ( ) ( ) ( ) ( )
f. Amused ( ) ( ) ( ) ( ) ( )
g. Under pressure to perform ( ) ( ) ( ) ( ) ( )
h. Distracted by the equipment of the teleconference system ( ) ( ) ( ) ( ) ( )
i. Distracted by the nature of the medium ( ) ( ) ( ) ( ) ( )
j. Appreciated ( ) ( ) ( ) ( ) ( )
k. Relaxed ( ) ( ) ( ) ( ) ( )
l. Ignored ( ) ( ) ( ) ( ) ( )
m. Cooperative ( ) ( ) ( ) ( ) ( )
n. Defensive ( ) ( ) ( ) ( ) ( )
o. Competitive ( ) ( ) ( ) ( ) ( )
p. Critical ( ) ( ) ( ) ( ) ( )
q. Constrained in the types of contributions you were free to make ( ) ( ) ( ) ( ) ( )
r. Overloaded with information ( ) ( ) ( ) ( ) ( )
s. Able to influence the procedure being followed ( ) ( ) ( ) ( ) ( )
t. Able to express your views completely ( ) ( ) ( ) ( ) ( )
u. Physically comfortable ( ) ( ) ( ) ( ) ( )
v. Able to interject relevant comments ( ) ( ) ( ) ( ) ( )

VII. POSSIBLE IMPROVEMENTS

1. What changes in physical arrangements of the teleconference do you feel would result in significantly improved performance? (For example, location of FAX, number of microphones, location of talk button, availability of lines, etc.)

   Please be specific and list as many as occur to you.

   _____

   _____

   _____

   _____

2. What changes in procedures used do you feel would result in significant improvements? (e.g., more highly structured meeting, less structured meeting, longer duration of the teleconference, etc.)

   Please list.

   _____

   _____

3. If the improvements you suggested were made, would you use the Voice Teleconferencing System more than you do now?                                              Yes_____ No_____

4. Can you list possible advantages that the teleconference medium brought to your meetings that would not have been present if the meeting had been face-to-face? _____

_____

_____

_____

5. If you had the choice of attending a meeting in person or via teleconference, what would cause you to choose one or the other? _____

_____

_____

_____

_____

TRAVEL

1. Do you think that an improved system would allow you to reduce the amount of traveling you do now?                                       Yes_____ No_____ Don't know_____

2. Do you think an improved system would permit you to interact significantly more with persons at other installations?                     Yes_____ No_____ Don't know_____

During 1975, how many trips to and teleconferences with the following installations have you been involved in?   (Estimate)

| | # of trips | # of teleconferences |
|---|---|---|
| Headquarters | _____ | _____ |
| Goddard | _____ | _____ |
| Langley | _____ | _____ |
| Lewis | _____ | _____ |
| Ames | _____ | _____ |
| Kennedy | _____ | _____ |
| Johnson | _____ | _____ |
| JPL | _____ | _____ |
| Marshall | _____ | _____ |
| Edwards | _____ | _____ |

Please mail completed questionnaire in the enclosed envelope to:

Mary Connors, B 242-4
Ames Research Center

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