

Geologic Applications of Network Conferencing: Current Experiments with the FORUM System

JACQUES VALLEE

Institute for the Future, 2740 Sand Hill Rd., Menlo Park, Calif. 94025

GERALD ASKEVOLD

U.S. Geological Survey, 345 Middlefield Rd., Menlo Park, Calif. 94025

Computer-based teleconferencing is a mode of communication which enables geographically separated users to jointly manage long-term projects, to organize "instant meetings" without the need for costly transportation, and to exchange documents and review position papers between face-to-face sessions. It thus fulfills a function quite different from that of the telephone, TELEX, electronic mail, or facsimile transmission.

Since 1973, the Institute for the Future and a group within the U.S. Geological Survey have been jointly experimenting with this medium of communication. The experiments have used a family of systems--known as FORUM and PLANET--which the Institute implemented first on the ARPA network, later on a commercial network, and most recently on the Survey's own PDP-10 computer in Denver, Colorado. The experience of the Survey in using computer teleconferencing is typical of what can be anticipated when other scientific communities, such as chemists or physicists, begin to use such media, and thus provides some specific examples illustrating the design and use of these systems.

The Conferencing System

The basic idea of FORUM is to allow unhampered interaction of participants under the guidance of an organizer who defines a topic of discussion, assembles a panel of participants on that topic, and presents the material relevant to the subject. Each participant establishes communication with the computer network via a portable terminal with a standard typewriter keyboard. FORUM is able to convey questions and answers, assemble group opinions, protect anonymous statements, and supply other information to, and within, the group while the organizer monitors the proceedings and intervenes as necessary.

In order to illustrate the nature of the interaction made possible by FORUM, it is appropriate to imagine a hypothetical discussion among a group of experts on the subject of the projected availability of mineral and energy resources in the period

1980-1990. The participants are about 20 in number. Among them are planners, economists, geologists, and petroleum experts. Two are specialists in computerized data bases. In addition, there might be representatives from power and utility companies and the president of a mining corporation. The organizer of the conference has experience in dealing with groups and is familiar with the various techniques which can be brought to bear on the elicitation of forecasts and intuitive judgments in areas of high technology.

This hypothetical conference differs from the usual workshop in that the participants are not meeting face-to-face. Instead, they are geographically separated and use a variety of communication media. Some are sitting around a terminal in a Washington, D.C., office building. A geologist is in the computer room of the Branch of Computations of the U.S. Geological Survey in Denver. One of the economists is in his office at Stanford University. Another one may be sitting in his study at home in New Jersey or in London, for that matter. (These experts are in telephone communication with a central operator who can instantly advise them of the status of the conference, of the progress of work done in subcommittees, or of the reasons for any particular difficulty or delay.) The substantive part of the interaction takes place through entries typed on standard terminals. All of the terminals are connected to the network and are controlled by a computer.

The central problem of implementing such a computer conferencing system clearly reduces to that of identifying, defining, and implementing a range of structures under which the participants are able to share information and enter comments into a common computer-storage file.

The implementation of a system like FORUM raises unusual problems of design: a group of experts or decision-makers typically does not have much knowledge of, or interest in, computer technology per se. There is no opportunity to train them in the use of a text-oriented language before the conference. And it is not feasible to ask them to interface with their peers through information specialists because each participant has a unique awareness of the problem at hand and needs to experience direct contact with his data and with other participants in order to perform at the "cutting edge" of his thinking.

When a group of conferees communicates via FORUM, each participant uses a terminal of the type that can be rented for \$150 a month or less. Once the terminal has been logged into the network, the user is presented with a list of discussions which he can attend (just as he would if he were to walk into the lobby of a convention center to review the day's program). Having selected an activity, the conferee is given a short background statement describing the activity. He is then free to observe the ongoing discussion, to review past comments entered into the conference, or to start typing his own remarks. At any point during

the discussion, a conferee can send a private message to another participant or make an anonymous entry. All of these communication modes can be entered without the participant's having to learn a single command, thus avoiding a major problem of most interactive systems in existence; namely, that system commands get in the way of the person who types and clutter the transcript with extraneous lines that only have meaning for the machine.

An important facet of FORUM conferences lies in the ease with which the participants have access to services outside of the discussion itself: they can, for instance, submit a prepared statement to the rest of the group or insert parts of the discussion into a personal file. They can also draw responses from a data-base system and enter them into the general discussion. Clearly, the level of interaction thus reached is one not found in face-to-face meetings where experts are cut off from their files and personal notes.

The initial tasks in the FORUM project included an analysis of the available resources and a review of the existing terminal technology in terms of character set, plotting symbols, size of frame, speed of presentation, and interface standards. A decision involving the programming language to be used had to be made early; after exploration of the languages available on the PDP-10 under the TENEX operating system, we reluctantly concluded that assembly language was the only suitable medium to gain access to shared files and to control terminal behavior, both functions being critical to our goal. Additional requirements were speed and low central-processor utilization.

Actual development of the conferencing program proceeded through a series of stages identified as "releases." Release 5 (FORUM-5) was the first version that could conveniently support heavy usage by real-world participants. The code had been modified to make the entire program sharable. Performance measurements showed its central-processor utilization ratio to be excellent (one minute of CPU time for two hours of synchronous discussion per participant). Most command-language features became available to the user within the discussion itself, and use of control characters was practically eliminated. The ability to retrieve and display past entries by date, name, content, and range was made available. Network-wide discussions were conducted routinely and included such topics as the design of advanced teleconferencing systems, the transportation/communication tradeoffs, and initial exchanges of research information with the Communications Study Group in London.

FORUM-6, which was introduced on an experimental basis in August 1974 and was tested until December 1974, features a single, integrated command language, a generalization of the concept of a conference to make joint authorship and other management tasks possible, and a scheme for handling private messages in a personal user file rather than as part of the main discussion.

In October 1974, the Institute converted the FORUM program

to a commercial network. This release is tailored especially to the business environment and is known as PLANET-1.

Approach to Evaluation

The Institute's approach to evaluation has been founded on the concept of computer conferencing as a means of communication. The criteria for evaluation of a medium of communication typically involve comparison with other media. And since the medium most familiar to the majority of us is face-to-face communication, there is a tendency for it to become the standard of judgment. One needs to exhibit great care in such comparisons because telecommunications media are not necessarily surrogates for face-to-face patterns. It seems more likely that each medium has its own inherent characteristics which should not be expected to mimic face-to-face patterns. At the same time, computer-based systems are too often evaluated and analyzed solely in their own terms. In the case of FORUM, we have sought to relate observations of the medium to an external standard--one which can apply to many media--as much as feasible.

In turning to the literature of group communication, however, we do not readily discover general principles or procedures which are easily adopted as "standard." Certainly the literature of group process is broad and provocative, and the potential for relating group process research to communication research is real, though complicated by many factors.

In designing our research, we have sought to answer two sets of questions:

1. What are the operational characteristics of FORUM as a communications medium? What are the characteristic social patterns of FORUM communication, and how might these be altered?
2. What are the likely social effects of communicating via FORUM on the individual and on the group? How can these social effects be measured? How can FORUM be compared to other media?

To answer the first set of questions, we have devised a method for plotting characteristic social patterns and for analyzing the resulting graphs. A sample of this graph appears in Figure 1.

In the second set of questions, the problem of comparison with other media has led to a search for a general taxonomy--that is, a comprehensive classification system for elements of group communication--which could be employed across media in various group communications situations.

The existing taxonomies of group process are primarily oriented toward communication between two persons (dyadic

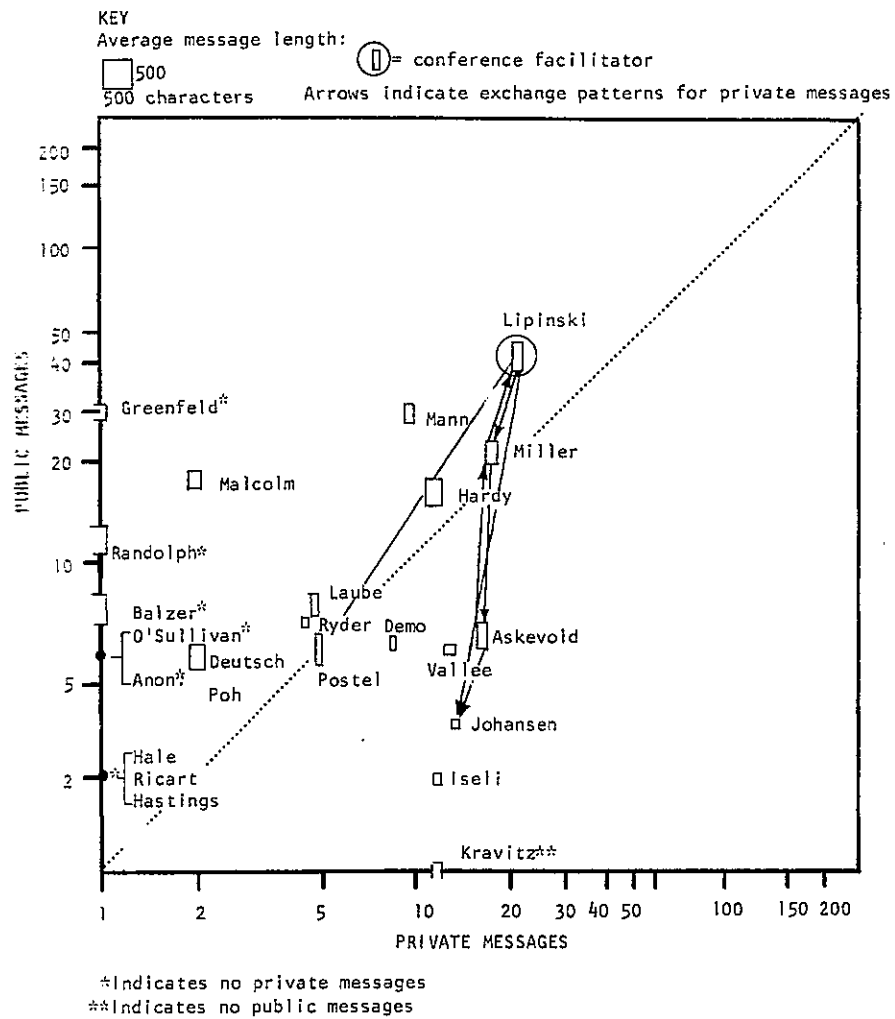


Figure 1. Participation map showing characteristic social patterns

communication). Even though a number of experiments have been categorized as "group" communication, most of these have dealt with the interconnection of two face-to-face groups (i.e., an individual in face-to-face contact with his own group and in contact via electronic media with a single distant group). Extrapolation from dyadic patterns to group patterns, however, is questionable. The principles simply cannot be assumed to be transferable.

In our initial attempt to construct a taxonomy, we have not treated the dynamic aspects of the communication, but have concentrated instead on the elements in a communication situation before the interpersonal process begins. Our first, partial taxonomy has thus been arranged to suggest a varied weighting among five key factors--medium, task, rules, person, and group--none of which will be completely discrete. For instance, if members of a given group have a very high need to communicate, they are more likely to make appropriate efforts to gain access to any medium, even if it is difficult to use or unfamiliar to them. Conversely, familiarity with a particular medium is likely to be a very important factor in the choice of that medium for practical communication.

The preliminary results of this social evaluation of computer conferencing are presented in *Group Communication through Computers, Volume 2: A Study of Social Effects*. More definitive results are forthcoming.

Review of Some Early Experiments with the U.S.G.S.

The Survey's interest in creating and using data bases prompted us to begin our experiments by linking mineral resource experts in Washington, Denver, and Menlo Park in teleconferences discussing the present and future availability of fossil fuel and other commodities. Two data-base systems were available online to the participants; one of them was a data base of petroleum reserves which was on the INFONET network, and the other was a catalogue of Alaskan mineral resources stored in the Stanford computer. (Transfer of information in and out of the conference was achieved simply by having two sites operate two terminals, one for the conference and one for the retrieval system.)

The teleconferencing system for these experiments was an early version of the FORUM system on the ARPA network. Although the details of the project have been reported elsewhere (1), it is useful to review briefly its conclusions, which encouraged us to enlarge the scope of our joint experimentation:

1. The major advantage of computer conferencing for these applications is the ability to introduce human judgment at a new level in an information system, linking together not only users and sources of data but information experts as well.

2. In computer conferencing situations, group leaders can obtain more deliberate answers to specific technical questions, backed up by facts and with less delay. Both questions and answers are captured on record and can later be reviewed.
3. Computer conferencing appears to be especially useful in coordinating technical projects, when participants are widely disseminated (or traveling extensively) and have a continuing need for reporting and sharing notes.
4. Users of the medium have reported an ability to deal with a larger amount of information more efficiently than through the use of conventional media, such as mail and the telephone.

On the negative side, a major drawback of the early system was the unreliability of the experimental computer network we were using. Access was limited, and frequent hardware failures made "real" work all but impossible. In response to this problem, we initiated two new approaches; namely, reimplementing of an advanced version of FORUM on the Survey's own hardware and research on the feasibility of international conferences using a commercial network.

The FORUM System at the U.S.G.S.: Some Initial Applications

During February and March 1975, a dedicated version of FORUM was mounted on the Survey's own PDP-10 computer in Denver. This installation marked the first instance in which an advanced teleconferencing system had been completely turned over to an operational group.

Figure 2 shows a typical entry process for a FORUM activity. Currently available conferences are presented as a multiple-choice list for the participants. Once a conference has been selected, the agenda is reviewed. In this example, the user (Askevold) was up-to-date in both parts of the discussion. He went to part 1 and requested a listing of the entries made so far. Three entries were found (Figure 3). At this point, another user (Betsy Yount) joined the discussion from her own terminal, and private messages were exchanged (Figure 4). Such messages are not retrievable.

Moving to the second part of the conference, the user again reviewed the transcript from Menlo Park and added an entry requesting that a file of mineral information be loaded into disk storage in Denver (Figure 5). The data base systems under discussion in this conference deal with the chemical analyses of rock samples. An interactive storage and retrieval system named GRASP (developed by Botbol and Bowen of the U.S.G.S.) is used for general geologic applications (Figure 6).

RUN FORUM [721,722]

Welcome.

Please type your last name (and then strike the CR key).

- Askevold

Please type your password.

-

Good. Are you using a terminal that prints on paper?

- Yes

Thank you.

You may attend any one of the following activities:

1. Comments on FORUM
2. Background on RASS and Test on the Denver System
3. FORUM Users Session
4. Canada Test of FORUM

Please type the number of the activity you wish to join.

- 2

Figure 2. The FORUM System at USGS: Joining a Conference

The title of the activity is:
Background on RASS and Test on the Denver System

The parts in the activity are:

1. General Information on RASS
2. Instructions on How to Access RASS Remotely (Using GRASP)

(To FORUM)
- GO (to part) 1

Part 1
General Information on RASS
You are up to date.

(To FORUM)
- REVIEW (entries) all

[1] Askevold (Org) 15-Apr-75 9:23 AM
The purpose of this activity is to get some information on RASS which I don't have, but need prior to my departure to Europe tomorrow. I will be sitting in on a meeting of an ad hoc Working Group on Rock Chemical Data at the UNESCO headquarters in Paris on April 29 and 30 and would like to contribute something on what RASS is all about, how it is used, and the role GRASP might have (as Roger and Joe envision it).

[2] Askevold (Org) 15-Apr-75 9:30 AM
In part 2 I have listed my understanding of how I should arrange to pull off an Alaska subset of the file as well as how to access what is currently available for testing; I would appreciate confirmation from someone on this along with anything else that might be helpful.

[3] Askevold (Org) 15-Apr-75 9:32 AM
Joe, Roger mentioned an article on RASS (that you authored); could you shoot me the reference?

3 entries were found.

Figure 3. Reviewing the conference transcript

(To FORUM)
 - STATUS (of participants)

Name	Last Time Entered	Last Entry Seen
Askevold	15-Apr-75 3:49 PM	6
Bowen	15-Apr-75 6:25 AM	4
Botbol	Never entered	
Yount	15-Apr-75 3:36 PM	6

(To FORUM)
 -

You are now back in the discussion.

(To Yount)

- Betsy, maybe you can give me some of the heaviest users of RASS here in Menlo Park for future reference, and some of the problems they run into
 - by having to operate in a batch mode, and how going online might solve
 - some of these problems.

[7] Yount

Some of the heaviest users of RASS here in Menlo Park are: the people associated with the wilderness programs and the PAMRAP people. The people associated with PAMRAP have no problems, or rather, few problems in using RASS because each quadrangle has a Denver research chemist working with the team leader and they are the RASS interface. Anyone else wanting to use RASS data which they have contributed to--by that I mean the analytical results of their own samples--has difficulty getting the data in.

(To Yount)

-That's great, Betsy, thanks a lot.

Figure 4. Fragments of a synchronous discussion with private and public messages

(To FORUM)

- GO (to part) 2

Part 2

Instructions on How to Access RASS Remotely (Using GRASP)

You are up to date.

(To FORUM)

- Review (entries) all

[1] Askevold (Org) 15-Apr-75 9:33 AM

My instruction to test GRASP on RASS is to: Run IRIS from the Denver machine; how long will this be available? I got into it once, and have to go back to the search examples Roger sent me to complete a valid test.

[2] Askevold (Org) 15-Apr-75 9:36 AM

The data sets for ALASKA are: FIORD.DAT, NEBESN.DAT, and YUKON.DAT. They are protected.

[3] Askevold (Org) 15-Apr-75 9:40 AM

I am to go into SYS F and request MOUNT T658, correct? This should be for a few minutes. Should have two discs mounted. I'm not really sure I have all this right, so please confirm.

3 entries were found.

(To FORUM)

-
 You are now back in the discussion.

[4] Askevold (Org)

- Roger, could you please do the above so that this file could be read
 - onto the disc space that Mony has set aside for me, and get it off his
 - hands? You may have to get in touch with him to get everything
 - straight.

Figure 5. Sample transcript with request for a file of mineral information

?

While in the activity you can type an entry at any time. To edit, you may type:

- Control A to delete the last character you typed
- Control W to delete the last word
- Control Q to delete the last line
- Control X to delete the whole entry

In addition,

- Control R will retype the last line as corrected
- Control S will retype the entire message as corrected

To end the entry, strike the carriage return (CR) key twice.

You can send a private message to a participant by typing a left parenthesis "(", followed by his name, a carriage return, and then your message. You can also gain access to special services by sending a private message to FORUM itself or typing a [CTRL] F.

(To FORUM)

- ?

The FORUM services listed below are available to you:

GO (to part)	FEEDBACK (entries)
QUIT	JOIN (activity)
REVIEW (entries)	STATUS (of participants)
REVIEW (entries)	ADD (participant)
STATUS (of participants)	REVISE (contents)
SAVE (entries)	DELETE (entries)
SUBMIT (file)	ERASE (activity)
ASK (the following question)	

If you do not wish to use any of these services, strike the CR key to return to the discussion.

Figure 6. General user instructions available outline

The ability present in FORUM to elicit online votes and to feedback probability distributions reflecting group judgment in situations involving reserve estimates or exploration decisions represents a new dimension in the use of information systems. These and other user options are readily available to any participant in a FORUM conference.

The system is self-documenting, so that a participant can type a question mark, either during the discussion or in the FORUM services mode, to receive a list of options available at that point. Further documentation is provided when specific services are requested. Figure 6 shows two general overviews of the communication or retrieval options available to the FORUM user.

International Networking

During 1974, we began moving the computer conferencing concept "out of the laboratory" by implementing a conferencing program on a commercial timesharing network. The name of this new program is PLANET, reflecting the major emphasis on joint planning among disseminated user groups. At this writing, the PLANET system has been operational for seven months. It is used by educational institutions in France and in the United States in the coordination of joint computing projects. We have also had experience with several actual "conferences" in which participants made entries through remote terminals over a two- or three-week period instead of traveling to a central location; for such conferences, we have observed a cost reduction of 50 to 60 percent over similar face-to-face conferences.

Since April 1975, we have been holding a continuous computer conference, intended as a computing experiment among members of the COGEODATA community in North America and Western Europe. Figure 7 illustrates the nature of the dialogue in this conference. The reader will note from the time stamps that some entries were made while a user was "alone" in the conference, but others were "synchronous" (entries 20 to 28) with users in Paris and in Menlo Park participating at the same time.

Conclusion

In this paper, we have described two communication systems in current use by a scientific community sharing geochemical and geological information. The first system, named FORUM, is running on the computer of the U.S.G.S. in Denver. The second system, named PLANET, is available to commercial and educational organizations on an international network. Such systems represent a significant tool for the management of joint projects among disseminated groups. They make possible a reduction in travel costs while promoting timely and accurate exchange of data. They also represent an alternative means of publication and a powerful medium for the dissemination of scientific ideas.

- [13] Vallee 22-Apr-75 1:39 PM
- Your trip seems to be off to a very good start. You will probably find that telephones are the worst problem in Europe, but we hope to hear from you
 - from time to time. Also, Bob Johansen would like to know if you expect to be at the World Future Society in June?
- [14] Yount 22-Apr-75 3:21 PM
- Gerry, I had the PLANET manual but not the account and keyword information; however, Thad phoned and all is now arranged. I will not be able to phone
 - Roger until tomorrow, as it is already 3:30 PM here. I hope that that will be soon enough for your purposes.
 - Things are going smoothly here. One question has arisen regarding connection with Stanford. Bruce's feeling is that someone here should write a memo to confirm our interest in getting that service. I will check further with Bruce and let you know more about it. If anything needs to be done before you get back, I will write a memo for you.
- [15] Askevold (Org) 23-Apr-75 9:44 AM
- Thanks a lot, Jacques. Will keep this short. Am using a coupler now rather than a MODEM. Appears to be going okay.
- [16] Askevold (Org) 23-Apr-75 9:45 AM
- Please apologize to Bob for not responding to him more formally (which I will do with a letter), but if there is a way he can see for me to attend with FORUM, but not physically, I would definitely prefer it.
- [17] Askevold (Org) 23-Apr-75 9:47 AM
- Thanks, Betsy. We should formally request a line for higher speed work with the CRT's. If you can shoot one in, please do so.
- [18] Askevold (Org) 23-Apr-75 9:48 AM
- Pleased to report everything went very well--beyond expectations--in London, and looks like a good study effort. Will try to come in from Paris...leave tomorrow. Many thanks, everyone, and the people here and at ATLAS are very anxious to get in touch with Roger Bowen. Will fill him in as soon as I get back.
- [19] Bowen 24-Apr-75 9:43 AM
- Gerald--I have the impression from reading your past entries in FORUM (Denver) that you didn't get the info in time so I am going to repeat it here just in case.
 - For RASS data, the system has been renamed IRIS. Once you are logged onto the system, you access IRIS by: RUN IRIS, etc. (followed by CR)
 - There are 5 data sets up. They are as follows:
 - (1) RASS1 - An initial data set from Jessie Whitlow.
 - (2) ALSKA - All Alaska RASS data (7000 recs)
 - (3) YUKON - Data from the Yukon region (>3000 recs)
 - (4) NABSN - Data from the Nabesna region (<300 recs)
 - (5) FIORD - Data from the Fiord region (<3000 recs)

Figure 7. Sample transcript

- Data sets 1 and 4 are on-line in the public area; data sets 2, 3, and 5 will require a private disk to be mounted. I suggest that (in IRIS) after giving
- the file command to identify a particular data base, the names command be issued to examine the structure of RASS data sets. Or if you let me know,
- I'll send a copy of the output you will get using this command.

- [20] Vallee 24-Apr-75 4:18 PM
Gerry, I am preparing the draft of the paper for the American Chemical Society meeting on computer networking and chemistry. I am going over the material we assembled. What about a title like: "Network teleconferencing and Mineral Resource Information: Current Experiments with the FORUM System?"

- [21] Askevold (Org) 28-Apr-75 9:47 AM
I am at this moment in Fontainebleau at the Centre de Recherche Informatique of the Ecole des Mines de Paris. Looking on with me are: M. Kremer, M. Bloch, and M. Lenci. Typical problem now solved: terminals, but usually hard wired. An IBM, but with a French keyboard. Solution: a teletype--voila!
- [22] Askevold (Org) 28-Apr-75 9:49 AM
Actually, the phone noise is not apparent at all. Greetings, Jacques and Thad. See your ESP radar is still on track...a pleasant surprise. What's happening?

- [23] Wilson 28-Apr-75 9:50 AM
Hi Gerry! Summer finally has arrived in Menlo. Is Paris full of the fragrance of spring?

- [24] Vallee 28-Apr-75 9:50 AM
Gerald, I am working on the first draft of the Chemical Society paper. Perhaps I could tell you something about the outline, and you could give me some first-order reactions before I proceed with it. Would you have time for that? As an alternative I can put this into the conference and you can react in the next few days. Which do you prefer?

- [25] Askevold (Org) 28-Apr-75 9:52 AM
I should add that the main purpose of this discussion doesn't have to center around RASS and GRASP....this was only for a special request peripheral to this COGEDDATA conference.

- [26] Wilson 28-Apr-75 9:53 AM
Time for me to get back to computing statistics, Gerry. Good talking with you. Will drop in later.

- [27] Askevold (Org) 28-Apr-75 9:55 AM
Jacques, the title sounds fine. Actually I have to catch a bus back to Paris in 15 minutes. I will have access to this same terminal tomorrow, if you can enter what you have and I will review it tomorrow and give you some immediate feedback. Okay? Good talking with you, and will check back tomorrow.

- [28] Vallee 28-Apr-75 9:56 AM
Re 27: Will do. Bonsoir, et salut a l'ecole des mines.

Figure 7. (Continued)

This work has been supported by the U.S. Geological Survey and the National Science Foundation, Division of Computer Research.

Literature Cited

1. Vallee, Jacques, *Datamation* (1974) 20(5) 85-6, 91-2.