Superwatch Average Graphs for Week of 12/10/73

TIME PLOT OF AVERAGE NUMBER OF GO JOBS FOR WEEK OF 12/10/73
x axis labeled in units of hr:min, xunit = 30 minutes 1

```
 7.0
 6.5
 6.0                   *         *
 5.5                   *  * *    *
 5.0                   ** ****   *
 4.5                   *******   *  *
 4.0                  ********* *** **
 3.5                  **************** **
 3.0                  **************** ***
 2.5              *  **********************
 2.0              * ************************
 1.5             *****************************
 1.0           ************************************
 0.5   ***  *************************************** *
 0.0 *************************************************
     +'''''''''+'''''''''+'''''''''+'''''''''+''''''''
    0:00      5:00     10:00     15:00     20:00
```

1a

TIME PLOT OF AVERAGE PER CENT OF SYSTEM USED IN DNLS FOR WEEK OF 12/10/73
x axis labeled in units of hr:min, xunit = 30 minutes 2

```
22.0
20.0                                 *
18.0                      *          *
16.0                     **  *   *  *** **
14.0                   ********  *  ******
12.0                   *********** ********
10.0                  *********************      *
 8.0                  **********************    **
 6.0                  **********************    ***
 4.0                 ***********************   *****
 2.0              **********************************
 0.0 *************************************************
     +'''''''''+'''''''''+'''''''''+'''''''''+''''''''
    0:00      5:00     10:00     15:00     20:00
```

2a

SRL 18-DEC-73 13:01 20950

Superwatch Average Graphs for Week of 12/10/73

TIME PLOT OF AVERAGE NUMBER OF NETWORK USERS FOR WEEK OF 12/10/73
x axis labeled in units of hr:min, xunit = 30 minutes 3

```
8
7              * *
6             *****
5             ******
4             ********  *******
3            *******************                *
2   *        *********************       **** * *
1 ***********************************************
0 ************************************************
  +'''''''''+'''''''''+'''''''''+'''''''''+'''''''
 0:00      5:00     10:00     15:00     20:00
```
3a

Superwatch Average Graphs for Week of 12/10/73

TIME PLOT OF AVERAGE NUMBER OF USERS FOR WEEK OF 12/10/73
x axis labeled in units of hr:min, xunit = 30 minutes 4

```
16                   **   **
15                  ********  **
14                  ********  *** **
13                  ********* ******
12              * ********************
11             ************************
10             *************************
 9             **************************
 8             **************************
 7            **************************** * *
 6            ********************************* * *
 5            *************************************
 4   **      **************************************
 3   **********************************************
 2 ************************************************
 1 ************************************************
 0 *************************************************
   +'''''''''+'''''''''+'''''''''+'''''''''+''''''''
  0:00      5:00     10:00     15:00     20:00
```

4a

Superwatch Average Graphs for Week of 12/10/73

TIME PLOT OF AVERAGE PER CENT OF CPU TIME CHARGED TO USER ACCOUNTS FOR WEEK OF 12/10/73
x axis labeled in units of hr:min, xunit = 30 minutes 5

```
61.6                      ***    *
53.9                   *************** ****
46.2           *  *  ***********************
38.5           * ** *************************  *
30.8           *********************************
23.1   ***    *************************************  *
15.4   **********************************************
 7.7 ************************************************
 0.0 *************************************************
     +'''''''''+'''''''''+'''''''''+'''''''''+''''''''
    0:00      5:00     10:00     15:00     20:00
```

5a

TIME PLOT OF AVERAGE IDLE TIME FOR WEEK OF 12/10/73
x axis labeled in units of hr:min, xunit = 30 minutes 6

```
67.5
60.0      **                                       *
52.5    *******                                   ***
45.0   ********                               * *****
37.5   ******** *                            ** *****
30.0 ********** ** *                        *********
22.5 ********** ** ***                     **********
15.0 *****************                *    **********
 7.5 ******************       *** ** ****************
 0.0 *************************************************
     +'''''''''+'''''''''+'''''''''+'''''''''+''''''''
    0:00      5:00     10:00     15:00     20:00
```

6a

20950 Distribution

James C. Norton, Richard W. Watson, Douglas C. Engelbart, Paul Rech, Jeffrey C. Peters, Dirk H. Van Nouhuys, Elizabeth J. (Jake) Feinler, Kirk E. Kelley, Duane L. Stone, Beauregard A. Hardeman,

Superwatch Average Graphs for Week of 12/10/73

(J20950) 18-DEC-73 13:01; Title: Author(s): Susan R. Lee/SRL;
Distribution: /JCN RWW DCE PR JCP DVN JAKE KIRK DLS BAH;
Sub-Collections: SRI-ARC; Clerk: SRL;
Origin: <LEE>WEEK12/10GRAPHS.NLS;1, 18-DEC-73 11:12 SRL ;

Blap

Bob,
Here is a sample message for you. Did you get it?? 1

20951 Distribution
Robert L. Martinez,

Blap

(J20951) 18-DEC-73 13:04; Title: Author(s): Marcia Lynn Keeney/MLK; Distribution: /RLM2; Sub-Collections: SRI-ARC; Clerk: MLK;

Jean,
Your network mailbox address is listed in the idantfile as JI@NIC.
Are you aware that this address doesn't work ?? I tried to send you
a message at that address today and got a blurb back from the mailer
"no such mailbox at this site".
Marcia 1

20952 Distribution
Jean Iseli,

(J20952) 18-DEC-73 13:54; Title: Author(s): Marcia Lynn Keeney/MLK;
Distribution: /JI; Sub-Collections: SRI-ARC; Clerk: MLK;

VISIT
- - - -

DEAN -- I AM STILL PLANNING TO BE IN MENLO PARK
JAN 2-4 (MEETING PLANNED 3-4). WILL YOU BE FREE PART OF JAN 2?

IF SO, WHEN WILL BE CONVENEIENT?? 1

DAVE.
------- 2

20953 Distribution
N. Dean Meyer,

DHC 18-DEC-73 15:31 20953

VISIT

- - - -

DEAN -- I AM STILL PLANNING TO BE IN MENLO PARK
JAN 2-4 (MEETING PLANNED 3-4). WILL YOU BE FREE PART OF JAN 2?

(J20953) 18-DEC-73 15:31; Title: Author(s): David H. Crocker/DHC ;
Distribution: /NDM ; Sub-Collections: NIC; Clerk: DHC;

merry christmas

this is a typing exercise 1

20954 Distribution
Susan R. Lee, David N. Berg,

merry christmas

(J20954) 18-DEC-73 15:52; Title: Author(s): David N. Berg/DNB;
Distribution: /SRL DNB; Sub-Collections: NIC; Clerk: DNB;

If I am not on vacation, I will be available for sure. Ask me again in a week. Hope to see you. --Dean 1

20955 Distribution
David H. Crocker,

(J20955) 18-DEC-73 17:02; Title: Author(s): N. Dean Meyer/NDM;
Distribution: /DHC; Sub-Collections: SRI-ARC; Clerk: NDM;

MDK 18-DEC-73 17:23 20956

This is the text of two messages I've received 18-Dec. Kirstein of UK is concerned that with NIC users on Utility 5 AM to 9 PM Pacific Time, his people won't be able to benefit in THEIR morning hours from this arrangement. Kahn of ARPA (who received a copy of Kirstein's msg) wants to know the status of the Tymshare machine, and the plans for its availabiloity on the Network. How shall I reply ? ...
Mike

18-DEC-73 0701-PST UK at USC-ISI: AVAILABILITY OF THE NIC AT TYMSHARE
cc: KAHN, KIRSTEIN
Received 18-DEC-73 11:39:39 1

I AM VERY CONCERNED TO HEAR THAT THE NIC AT TYMSHARE WILL ONLY BE AVAILABLE 5AM TO 9PMPST. THIS PRECLUDES OUR USING IT IN OUR MORNINGS, WHICH IS THE BEST TIME ALLROUND, IN GENERAL, I AM RATHER CONCERNED WITH THE AMOUNT OF TIME HOSTS SEEM TO BE DOWN MIDNIGHT TO 5AM, AND MUST CHECK IF MY SUSPICIANS ARE TRUE THAT THIS IS A PARTICULARLY BAD TIME. IS THIS ONLY ATEMPORARY PHASE WITH THE TYMSHARE NIC, OR WILL IT LAST A LONG TIME THAT WAY? IF IT WILL BE THIS WAY A LONG TIME, CAN WE STAY AT SRI? KIRSTEIN 1a

18-DEC-73 1513-PST KAHN at USC-ISI: TYMSHARE DSTATUS AND PLANS
cc: KIRSTEIN, PERRY
Received 18-DEC-73 15:12:51 2

FOR MIKE: IN VIEW OF KIRSTEINS MSG, CAN YOU ADVISE ME ON THE STATUS OF THE TYMSHARE MACHINE (PDP-10) AND THE PLAN FOR ITS AVAILABILITY ON THE NETWORK. THANKS... BOB 2a

20956 Distribution
Douglas C. Engelbart, James C. Norton, Richard W. Watson, Michael D. Kudlick,

(J20956) 18-DEC-73 17:23; Title: Author(s): Michael D. Kudlick/MDK;
Distribution: /DCE JCN RWW MDK; Sub-Collections: SRI-ARC; Clerk: MDK;

Re my note about Kirstein's and Kahn's messages, this is what I suggest as a feasible reply (not yet sent, of course).

Re my note about Kirstein's and Kahn's messages, what I suggest as a feasible reply is this: 1

It is expected that the TYMSHARE facility will be operational within the next two weeks (sometime around the end of 1973). The full NLS facilities (including the NIC Journal and relevant features of TENEX) will be available on that system. 1a

The contract with TYMSHARE requires that the system will be running six days a week, from 5 AM to 9 PM Pacific Time. It may be run for longer hours, but we contractually cannot expect that. 1b

Computer services offered to the NIC users will be different from what they have been at SRI-ARC. 1c

We intend to limit the period of log-in for any one NIC user to about twenty or thirty minutes, and offer a subset of the full NLS fac lities. 1c1

The intended purpose is to make these services available to as large a number of NIC users as practicable, given that there are only four slots reserved on the TYMSHARE system for NIC users. 1c2

The facilities offered to NIC users will probably be restricted to 1c3

a) the NIC/QUERY system for browsing through selected NIC data bases such as the Resource Notebook, and 1c3a

b) the NIC Journal and SNDMSG systems, for sending and receiving Network Mail. 1c3b

Details of these arrangements have not been finalized. When final (in the near future), they will be announced. Allowance will be made of course for user transitions and adjustments to the new schedules. 1c4

The above plans apply only to NIC users of the TYMSHARE system, not necessarily to other users who have separately negotiated with SRI-ARC for the use of system resources. 1c5

To accommodate the UK users, we will continue to offer services on the SRI-ARC system as at present, but not for the indefinite future. 1d

Under the Proposal submitted by SRI-ARC to ARPA for the continuation of NIC services into the next two-year contract period beginning Febreuary 1974, the services that might be provided to UK (other than the NIC services described briefly above) must be negotiated with the NIC. 1d1

These services would not be free. 1d2

They would be appropriate, mutually agreed upon support functions that a Network user community such as UK might desire from a network-oriented information service. 1d3

This is the sense of the "ACIS" (ARPA Community Information Services) described in that Proposal. 1d4

We therefore suggest that UK begin thinking about negotiating with us and other Network Hosts for more extended computer use than the basic NIC servicees outlined above. 1d5

We of course will not take unilateral action with respect to UK, but do want to proceed as quickly as possible to reach a satisfactory resolution of their needs vis-a-vis our capacities. 1d6

20957 Distribution

Douglas C. Engelbart, James C. Norton, Richard W. Watson, Michael D. Kudlick,

(J20957) 18-DEC-73 18:37; Title: Author(s): Michael D. Kudlick/MDK;
Distribution: /DCE JCN RWW MDK; Sub-Collections: SRI-ARC; Clerk: MDK;

Suggestions for Tickler

in response to DLD's message

Suggestions for Tickler

I find the tickler full of items that have no interest to me. Its inconvenient to scan the whole thing and seperate out those that pertain to me. It will get worse as the file grows with the addition of ISIS. There is the further problem for Bobbie, of getting new items in just after she has journaled the file for the week...this will always be a problem. 1

We can create an open file for everyone to write on, but that leads to problems when people don't update it properly, or when people want simultaneous access to it. 2

It would seem to be the cleanest approach, for now, to have Bobbie as the focal point for updating the tickler. Items for input could be sent to her on the system using sndmsg, and she could insert them in the proper place in the file and in a consistent format. Essential information includes " what, where, when, who should be notified..and maybe why". 3

An additional service which would be of use to me, at least, would be for Bobbie to sndmsg a day or two before I had to meet a dead line or attend a meeting. This could be accomplished fairly easily by creating a null file, copying the part of the tickler into it that was pertainent, and doing an Output Sequential. Sndmsg could then be used to send the sequential file to only those who it affected. SRI has been promising us that soon there will be a number of options available within the Journal subsystem...one of which is immediate delivery of a journal message via sndmsg, with options for having it catalogued or not. When this comes it will be much easier for Bobbie to provide this kind of personal service. 4

20966 Distribution

Roberta J. Carrier, Edmund J. Kennedy, Joe P. Cavano, David L. Daughtry, John L. McNamara, Rocco F. Iuorno, Frank J. Tomaini,

Suggestions for Tickler

(J20966) 19-DEC-73 05:13; Title: Author(s): Duane L. Stone/DLS;
Distribution: /RJC EJK JPC DLD2 JLM RFI FJT; Sub-Collections: RADC;
Clerk: DLS;
Origin: <STONE>TICKLER.NLS;1, 19-DEC-73 05:11 DLS ;

EXECUTIVE SUMMARY

Who knows, maybe we can dig this up in a couple of years and shove it back into the system.

EXECUTIVE SUMMARY

RADC is no small operation. It is entrusted annually with expenditure of $145 million. A substanitial portion of this is paid out in salaries to 1420 employees. The employee expense is at least doubled with overhead. It has a number of special facilities it has acquired over a period of years, representing another $XXX million of capital investment.

RADC places great emphasis on managing and supporting these resources (dollars, people and facilities). There are 613 people in Staff offices alone. In addition, there are roughly 160 slots in the line divisions with managerial, administrative or secretarial job descriptions. Thus we see that over 50% of the Center personnel have jobs which support the remainder of the S&E types, which are primarily charged with accomplishing the Center's mission. Some unknown, but significant amount of S&E time is also expended on administrative/managerial type duties.

This ratio of overhead to project personnel is greater than 1 and way out of line with comparable industry. The Stanford Reasearch Institute, for example, quotes an overhead rate of 105% and G&A of 26%; but the overhead includes the land, buildings and facilities, as well as the managerial and support people.

One can only speculate on how this came to be. One can observe, however that there is a great amount of overlap of managerial, administrative and clerical functions and responsibilities, from the Project Engineer through Staff. This overlap seems necessary given the state of the current Management Information System within the Center. For any given manager to get an adequate picture of his resource situation at any instant in time, he must essentially reconstruct it from his own internally maintained files. In most cases these files are manual in nature, maintained in filing cabinets, or the heads of his administrator. They invariably give a picture of the world that differs significantly from that obtained from related horizontal or vertical managers.

There are isolated instances of attempts to automate small parts of the total MIS, i.e., PMS, CMS, and JOCAS. These systems do not support everyday management decisions, however, since they are accounting or reporting systems, which only reveal what happened after the fact (from a week to a month). There is no way to query these files, and if there were, one cannot ask a question which cuts across these files (i.e., give me a listing of all the GS-13's and over with advanced degrees who are monitoring contracts of over $100,000 per year...because I suspect that we are misusing the Center's high powered people).

If the operations side of the house is in bad shape, the planning side is in even worse condition. The annual TPO and Program Call exercises are just that, exercises. There is little relationship between planned and executed efforts. There is little or no technical planning quidance that filters down to the project engineer who makes up the plans, only due dates and format constraints. The Center really does not have any visible, relatively stable, technical policies or objectives. What there are, are conveniently ignored when outside prassures are brought to bear. This weak planning position affects operations, turning management at the line level into "management by flap." The current wind that is blowing causes Center management to bend to the leeward. The "smart" project engineer has learned to use this to his advantage; by circumventing Center management, selling his ideas to AFSC, Hq USAF or a user and having them send a letter of direction down from above.

Finally, there is a significant communications problem in the Center. Policy, objectives and guidance may exist at higher level management, but there is no convenient means of transmitting this knowledge to the working level. Knowledge which might help management to solve a current sticky problem may be available at the working level, but again there is no convenient means of tapping it. Changes in direction and scope of ongoing efforts occur at the project engineers' direction, but he cannot easily convey the significance of the changes to higher level management.

Over and above these vertical communication problems, there is a significant horizontal communication poblem. What horizontal communications occur, are based primarily on friendships that have developed in the past, and not on complementary information needs and expertize.

Overshadowing these internal problems is the very real possibility of further reductions in manpower. With so little SSE manpower now engaged in mission work, how can we suffer further reductions and survive as a viable force in the AFSC laboratory world?

There is an answer to these problems. It is essentially a technological solution, with networks of time-shared computers as its central ingredient. The technology proposed encompasses structured data, unstructured narrative text, and the communication of both within an integrated, but geographically distributed system. The technology has been proven by actual use, yet there is some risk involved, since very few applications of this technology have been made on as wide or deep a basis as that proposed. It requires a commitment on the part of the Center Commander and Staff. It requires investment of substantial amounts of dollar and manpower resources. It requires a change in the way we do business.

Commitment..To start with, we ask only that the proposal be given honest and thoughtful consideraton by Center Staff. It should be reviewed with the future of the Center in mind, i.e., with regard to survival and position of RADC relative to other labs in AFSC. If it is found acceptable in principle, we ask that the requested resources be provided, and that trust in the capabilities of the implementaton team be maintained for the duration of the project.

Resources..We are asking for $2.4 million over a 2 1/2 year period to develop the system and are estimating an operational cost of $1.4 million per year. It would require an in-house development team of 10 people. These figures may seem excessive, but are far less than the present "system". They represent less than 1% of annual RADC dollar and manpower expenditures. The development and operating expenses could be defrayed by levying a "tax" on all moneys entering the Center, in much the same way that travel and documentation costs are now handled.

Business changes..The daily business of RADC would be conducted in an environment permeated with terminals and on-line access to a multitude of services available on the ARPANET. Pencil, paper, filing cabinets and procedures associated with that technology will fade into a relatively minor role. The implementation of the proposed system would involve organizational changes..elimination of some offices, combination of others, reduction of others. It would require Center management and S&E personnel alike to be more open and precise in their communications.

The benefits to be derived from implementing this proposal are:

a substantial reduction in the ratio of overhead to S&E personnel.

the ability to plan for and manage internal resources with a much greater degree of precision, accuracy and completeness than is now possible.

a role of LEADERSHIP in the application of Information Technology to management of an Air Force R&D laboratory.

20967 Distribution

Robert H. Thomas, Frank J. Tomaini, John L. McNamara, Edmund J. Kennedy, Rocco F. Iuorno, David L. Daughtry, Roger B. Panara, Joe P. Cavano,

EXECUTIVE SUMMARY

(J20967) 19-DEC-73 05:45; Title: Author(s): Duane L. Stone/DLS;
Distribution: /RHT FJT JLM EJK RFI DLD2 RBP JPC; Sub-Collections: RADC;
Clerk: DLS;
Origin: <STONE>BIGPIC.NLS;2, 19-DEC-73 05:37 DLS ;

Notes from Meeting with John Nicholas--PRC

for the record

Notes from Meeting with John Nicholas--PRC

RADC MIS Team Meeting with PRC--13DEC73 1

PURPOSE: 1a

To tap PRC's experience in implementing an IDS system (PACER) 1a1

ATTENDEES: 1b

PRC--Val Marahall, John Nichols 1b1

RADC--Iourono, Panara, Daughtry, Stone, Liuzzi, Cavano 1b2

DISCUSSION: 1c

John Nichols is head of an applications programming group at SAC. John was not in on the initaial system design, data collection etc, but he refered us to documents (possibly attainable from IR) where he claims the proceedures for information flow analysis are covered in great detail. PRC is primarily in charge of developing new applications programs and modifying PACER exec to meet SAC needs. Military types take care of the routine maintenance and minor program modifications 1c1

John estimated that a programing staff of 50-75 people altogether was required to keep the PACER system running and responsive to new user needs. Some breakouts: 1c2

PRC--5 systems programmers 1c2a

PRC--13 applications programmers 1c2b

SAC--15 maintenance programmers 1c2c

SAC--10 minor system mods programmers 1c2d

SAC--5 data base quality assurance people 1c2e

PACER itself is a modified GECOS, primarily to give on-line interactions with BR-90 and RCA consoles. IDS was modified to operate in an on-line mode, where most of the updates are also made on-line. This is accomplished by the use of directories to give rapid access to segments of the disc, which are then searched alla IDS to gain access to the records in question. 1c3

H-6080 (2), one for development and backup work 1c3a

max response time--10 sec 1c3b

max consoles--48 1c3c

typical--30-35 consoles with 3-5 sec response 1c3d

Implementation comments: 1c4

Information flow/analysis..starts with a visit to all the pertinent offices, in an attempt to discover what inputs come into the office, what manipulations are preformed on these inputs, and what the output/product looks like. Next based on this, design data collection sheets to determine amount of information flowing through the office, type, length of time spent on manipulating it, etc..Collect the data..All this is done to try to develop a picture in the designer's mind of what goes on in the organization...It will have to be redone in some cases, until the designer is satisfied that he understands what's going on. Only then does one go to the initial IDS design. He says that their current design is far from their initial design. 1c4a

Leave lots of dummy fields, records, and chains for later expansion. 1c4b

Security type records are kept in IDS, which define the access to records, files etc; when the user logs onto the system. 1c4c

They have several roll-back and recovery procedures..systems dumps three times a day..IDS journal tapes provide them with restart and recovery capability 1c4d

They write a functional spec document (which is written in user type language) before they start coding. The user has to sign off on the document, or give his comments/critique. 1c4e

They have an elaborate quality assurance program, which involves a seperate system, hardware and software and smaller data base, which they use to check out new applications programs before installing them in the operating system. 1c4f

They maintain a cross reference list of programs vs data elements used by each program, so that they can tell which programs or data elements are effected when one or the other is changed. This list is developed and maintained by a program embedded in the translator. 1c4g

5 people are kept busy in off hours doing "chain chasing" assuring that the data base is in good shape. 1c4h

UNRESOLVED ITEMS: 1d

Notes from Meeting with John Nicholas--PRC

ACTION ITEMS: 1e

Get PACER early documentation, to use the table of contents as an outline for the revised proposal. 1e1

COMMENTS: 1f

DLS--John Nichols is not the man to help us with the information flow analysis, because he has not gone through it himself. 1f1

DLS--SAC environment is different than ours, in that the job is more structured and better defined..therefore more amenable to conventional systems analysis techniques. 1f2

DLS--PACER has to operate in an on-line update mode (as well as query), therefore some of the design techniques are not appropriate here. PACER is also a dedicated system and gets 63/64ths of the time avaiable. Not too much like our TSS environment. 1f3

20968 Distribution

Joe P. Cavano, Roger B. Panara, David L. Daughtry, Ray A. Liuzzi, Rocco F. Iuorno, Edmund J. Kennedy,

Notes from Meeting with John Nicholas--PRC

(J20968) 19-DEC-73 06:22; Title: Author(s): Duane L. Stone/DLS;
Distribution: /JPC RBP DLD2 RAL RFI EJK; Sub-Collections: RADC; Clerk:
DLS;
Origin: <STONE>PRC/IDS.NLS;1, 19-DEC-73 06:20 DLS ;

The Initial RADC MIS Proposal

This is the way the proposal finally looked (for those of you who have not seen it). Its 50 pages, so see me for hard copy if interested. This is the one that Gabe rejected, wlthough he did not see it. I am journaling it in the hopes that we can use it later in the game...like maybe 20 years

RADC MIS--A PROPOSAL

Prepared for

COMMANDER, RADC

by

Joe Cavano

David Daughtry

Roger Panara

Duane Stone

RADC/ISIM

RADC MIS--A PROPOSAL

15 DEC 73

Table of Contents

INTRODUCTION

The purpose of this proposal is to request support for the development and operation of a Management Information System to support the Commander and managers at all levels within RADC. The essence of this proposal is the fusion of a human communications system and a data base management system into an integrated whole. The proposed systems are computer based, have been in existence for some time, and extensive in-house experience with them has been acquired under exploratory development efforts.

The support is required for three activities:

tailoring existing data management systems to RADC data and procedures,

purchasing terminals and computer time on the ARPANET,

and interfacing the data management system with the human communications system.

STATEMENT OF WORK

We were not given a formal statement of work. Informal meetings were held with Frank Tomaini, who verbally gave us guidance. We also had the letter from Col Larsen to IS as background information. The text of the letter and notes from the meeting are contained in Appendix C.

From these sources we deduced a statement of work, summarized below.

Design, construct, test and implement a MIS to serve all levels of Center management. Accomplish this with state-of-the-art technology available at RADC.

For purposes of the proposal, a manager's job consists of planning and accounting for Center resources in three basic categories; contractual dollars, manpower, and facilities. Each major resource category will have several levels of subcategories, which managers will wish to track.

Provide for the communication of both structured and unstructured information in horizontal and vertical directions throughout the Center.

REVIEW OF PROBLEMS IN CREATING A MIS

Information scientists in the past have over estimated both their capabilities and their understanding of the manager's job. As a result there have been a number of attempts at building MIS's for higher level management which have been less than successful, particularly in supporting the manager in his policy making and planning roles. In retrospect, some of the more outstanding reasons for "under achievement" were:

the disjointed development of isolated subsystems, which are often incompatible with each other and merely fortify the organizational barriers extant between personnel, training, R&D and purchasing.

the assumption that with enough diligence, anything is programmable. The complexity of some of the resulting systems is so great that they seldom work for more than short periods of time. The programming teams that built them are subject to the same communication problems that any working group has; with one vital exception. When they fail to communicate adequately, the system does not just slow down; it stops altogather.

the use of the systems approach, on a "system" which could not be bounded. The manager's needs changed while the system was being constructed. It was not so much that the systems approach was inappropriate, but that the designers failed to include adaptability as one of their system design criteria. The result was often an inflexible system, delivered several years after the original analysis was made, which no longer met the manager's needs.

The corollary of the above was management's failure or unwillingness to involve themselves in all phases of system analysis, design and construction. Too often the manager was more than willing to step aside and let the "whiz kids" construct the system for him.

the failure to recognize a dichotomy that exists in most organizations. The people in the lowest levels of an organization generate most of the data that enters the MIS yet they have the least need for information generated by it. Each successive level in the hierarchy produces less and less data but they have correspondingly greater information needs. Finally, at the very top of the organization almost no new data is generated. A situation arises where the individuals who must input the data to the MIS are the least motivated to keep it accurate and up-to-date. As a result, we find the reliability of the data decreasing with time and a corresponding decline in the validity of decisions made on the basis of this data.

the failure to recognize the central fact of uncertainty in a manager's job. A manager's job has been described as making decisions under conditions of uncertainty (the higher the level of the manager, the greater the degree of uncertainty). If there was no uncertainty in a specific decision-making activity, a routine could be established that would lay out what actions to perform depending on the given conditions and anyone could accomplish this. In some cases, it would not be necessary to invest money in a manager at all. By this definition a manager should apply his energy toward those efforts or tasks that are new. Since there is by definition no prior experience to rely on in a novel situation, no one could predict exactly what kind of information would be relevant to this new problem. Therefore, the information system cannot provide all the information needed because the manager, himself, cannot identify in advance what kind of information he might want. If an easy way to communicate his information needs to his subordinates is provided the manager, however, some of the limitations of the conventional MIS can be overcome.

PROBABLY MOST IMPORTANT is the lack of an overall philosophy of management and technology to guide system design and development. It is necessary to first recognize that a manager is just a special subclass of the more general class of people in this country called "KNOWLEDGE WORKERS." ref. (4,5) It is also necessary to realize that an evolutionary, incremental approach to system development must be taken in a situation like the managers', where information needs and technology are both changing rapidly.

It now appears that both the philosophy and technology are coming into focus, which will allow successful integration of previously isolated information systems into a cohesive whole. See Appendix A and ref. (3) for more detail.

To attack the problems discussed above, we are proposing a MIS which has three distinct parts [fig.1]. The communications subsystem will provide the tools to assist managers and workers alike in the documentation and communication of their work. The data base management system will provide services to organize, store, update and retrieve structured data. Underlying the two principle modules, will be a model which represents the organizational activity of RADC.

```
                         %%%%%%%%%
                         %       %
                         % QUERY %-----------------
                         %       %
                         %%%%%%%%%

##################                    #####################
#                #                    #                   #
#                #                    #                   #
#  GENERALIZED   #                    #   COMMUNICATION   #
#                #                    #                   #
#  ************  #                    #  ***************  #
#  *          *  #                    #  *             *  #
#  * database *  #<------------------>#  * information *  #
#  *          *  #                    #  *             *  #
#  ************  #                    #  ***************  #
#                #                    #                   #
#      DBMS      #                    #      SYSTEM       #
#                #                    #                   #
#                #                    #                   #
##################                    #####################

                  ---------- MODEL ----------
```

[FIG. 1]

Data neccesary for input to the data base management system will be collected as a by-product of work done by workers and administrators in the communication system and will be shipped daily to the data base management system to update it. Querying of the data base management system will be acomplished from the communication system, with commands consistent with the communication system command language. The model will draw upon advanced management sciences techniques to aid Center management in policy formulation and decision making.

DESIGN CONSIDERATIONS

Throughout our deliberations in the course of preparing this proposal, we were guided and constrained in our thinking by a set of design criteria. The purpose of this section of the proposal is to make these criteria explicit, in the hopes that it will convey to the reader the underlying logic of the proposed approach. The criteria are listed roughly in their order of importance.

Criterion 1: Extensive working knowledge of proposed systems

This criterion was deemed most important, because it substantially reduces the risk of bringing a project like this to a successful conclusion. Implicit in this criterion, is the assumption that the individuals knowledgeable in the proposed technology will also be those charged with the construction of the RADC MIS.

Criterion 2: Reliability/Stability/Supportability/Maintainability

This criterion reflects the "service attitude" of the proposal team. There needs to be an underlying community of people using, refining and developing a system if there is any hope of transforming it into a useful service. If a system was in the development stages, one of a kind, or otherwise not being used by a number of organizations; it was rejected as a candidate.

Criterion 3: Flexibility/Adaptability/Evolvability

It is almost impossible to foresee all the changes that will occur in users' information needs and in technology. The only thing that is certain is that there will be changes during both the development and life cycles of the system. Therefore, any system chosen as the basis of the RADC MIS must have the inherent property of flexibility.

Criterion 4: Extensibility, horizontally and vertically

Candidate systems must be relatively unaffected by increases in scope and depth of coverage. For example; if it appeared that the response time of a system would be adversely affected by increasing the data base or user population by an order of magnitude, it was rejected.

Criterion 5: Minimize Development

This criterion is really an extension of No. 2 and No's. 6-7. In order to deliver useful products as soon as possible with minimum expenditure of resources; one cannot consider systems which require a significant amount of development.

Criterion 6: Resource Constraints

The proposal team was given an arbitrary flat rate of $200K and 3-4 men per year as guidelines for developing and operating the RADC MIS. During the course of the proposal preparaton, we began to think of the cost in terms of a percentage of annual expenditures of total RADC dollars and manpower. We set a goal for ourselves of keeping both the development and operation of the RADC MIS under 1% of the annual dollar and manpower expenditure rates of the Center.

Criterion 7: Time Constraints

Useful products should begin coming out of this project almost from its very beginning. There should be a steady flow of products representing increased services throughout the development cycle. This criterion reflects the sense of urgency to deliver, felt by most of the proposal team. Technology and knowledge has been around for some time, why has it taken so long to apply it to the running of our own business?

APPROACH:

GENERAL:

The introduction of any information system into an organization consists of activity in three areas; System Planning, System Developing and System Life Cycle. (2) None of these can be ignored, they are not mutually exclusive and can proceed simultaneously. The first two are iterative in nature and make up the bulk of the activity in the third area.

SYSTEM PLANNING ACTIVITY - to determine the information needs of the anticipated user population and a system concept of how best to satisfy them.

We must further study the information needs of the Center and its problems. We must also survey the environment, the organizational structure, the operating procedures and objectives. After we accomplish this, we should be able to summarize this analysis into a blueprint of what we are trying to achieve.

This sounds a bit unnecessary to some people because everyone seems to think that they intuitively know the information requirements and problems of the Center. At this time, however, they have not been stated with sufficient clarity or in the detail necessary to allow their transformation into system software and internal operating procedures. What this phase is really doing is defining the problem and then documenting it.

Step 1--This proposal represents the first step in zeroing in on needs and a system concept. Hopefully, it has served the following purposes:

(1) described solutions in terms of needs that will be met, working environments, resource requirements, timing, costs, contracts, consultation, and alternative options.

(2) documented the proposal teams' perceptions of the above, and as such, sould serve the additional purpose of;

(3) acting as the formal vehicle for a dialogue with potential system users, operators, interfacers, etc. The end product of this interchange should be an agreement on the basic system development parameters outlined in (1) above and would be reflected in an updated proposal. This represents a commitment by the responsible Center

management to the next step in the initial system planning activity.

Step 2--Information analysis

This step will define the information needs and the patterns of information flow which will satisfy those needs in sufficient detail such that they can be translated into system requirements. Specific values for parameters such as response time, areas of data base coverage, user population mix, etc., will be delineated and documented. Again, this document will be used as the focal point for discussion and revision. The end product of this step will be a "frozen" requirements document from which the development team will proceed to the system development activity.

SYSTEM DEVELOPING ACTIVITY - to develop the system that will satisfy the user's requirements (as determined in step 2 above).

Step 1--This is a design step, in which specifications for the components are developed, within the limitations of the system concept, and the available manpower, funds and time. The end product of this step would be a detailed system design document, which would be circulated among other technical people at RADC and finally submitted to management for approval. Until this time, management has only agreed to commit themselves to spending internal manpower. When the critical design review is completed, management faces a decision point; namely, whether or not to commit manpower and dollars to the next step.

Step 2--This is the procurement and/or construction step. It includes the testing of components, construction of component interfaces and comprehensive testing of the total system.

Step 3--Concurrent with the testing of the system, a training program must be developed. It is also important at this time to develop operating procedures to insure the smooth flow of information into, through and out of the MIS.

Step 4--This is the phase-in of the new system. It includes education of the system users, training of the system operators, gathering and loading the necessary operational data bases, and final checkout of the system in the operational environment. It will be necessary to run both the old and new systems during this time period. This requires a special kind of tolerance on the part of management to allow time for the training of their employees. The manager must also have a sensitivity to the psychological problems inherent in the introduction of a new "way of doing business."

SYSTEM LIFE CYCLE ACTIVITY - to continuously satisfy user's needs with new or improved information systems.

This activity must provide users with reliable and stable system operation. It also includes maintenance, performance testing, additional training and correction of system discrepencies as they occur.

A feedback system must also be implemented, which measures system use and performance. The purpose of this is to provide information to the system designers and operators, so that they might more intelligently introduce refinements.

Finally, this activity includes a monitoring of the changing system component technology and user information needs, to facilitate responsive recycling through the system planning and development activities.

SPECIFIC:

Given the assumptions stated thus far, we propose to create a MIS for RADC, in 4 phases over the next 2 and 1/2 years. The basis for the initial MIS will be the oNLine System (NLS) and the Integrated Data Store (IDS). NLS will handle the "unstructured, narrative text" portion of the information. It will form the center of the communications portion of the MIS and will continue throughout the life of the project. IDS will handle the "structured or formatted" portion of the information initially, but may be replaced by another data base management system, if necessary, later in the project.

Both of these systems meet all of the criteria established by the statement of work and the design considerations. They are available now, have been used internally within ISI for some time (1), can be molded to Center use, and are relatively inexpensive for the capability they offer.

PHASE 0 JAN74--JUN74

This phase is an in-house preparatory phase, which will accomplish those items listed in the System Design Cycle above. It includes:

study of information flow and needs.

verification of basic system concepts and design parameters.

design of the initial file structure for IDS.

specification of procedures for use of NLS.

specification of terminals for phase I.

At the end of Phase 0, we should be in a position to start implementing the initial MIS capability. A document detailing the system design will be prepared and coordinated with appropriate Center management. A go-nogo decision is required to start implementation of phase I at this point.

PHASE I JUL74--DEC74

The principle activities during phase I will be:

The implementation of a limited data base for the Center, similar to that detailed in Appendix B. To include:

data base description,

coding of load programs,

data collection, conversion and loading,

exercise of initial system and

training of users in the two IDS query languages.

Purchase of terminals.

Training in the use of NLS.

At the end of phase I, we should have a capability to query a limited data base under IDS and the ability to send and receive messages and documents via NLS. The two systems will be independent at this time. That is, the data input to IDS will be separate from the use of NLS, although there will be experimental communication between the two.

There will be a user population of approximately 40 people (in addition to the 40 people in the ISI branch). There will be a user within each branch and division office in the line divisions and others within selected staff offices.

PHASE II JAN75--JUN75

Activity during phase II includes:

expansion of the user population to the entire IS division and additional Staff offices.

Interfacing NLS and IDS in a real time interactive manner, to include:

procedures for filling out all pertinent forms for collection of management information within NLS,

coding of "data stripping" algorithms within NLS, to allow the filtering of form data for transmission to IDS.

establishing a query language in NLS to allow querying of the IDS data base from NLS and the return of IDS results to NLS for further processing.

design of an expanded data base for IDS, to cover all of the major Center management needs.

design of interface for a line drawing capability.

specification of initial components of the model.

By the end of phase II, we should have a user population of about 200 people. Procurement, travel, manpower, etc forms will be filled out using the forms generator package available in NLS. Data will be stripped from these forms, reformatted, shipped over the ARPANET to RADC and be used to update the IDS data base. Querying of the IDS will be accomplished from NLS, with the results returned to NLS for incorporation into reports. We will have at this time a skeletal system, operating across the principle line and staff management offices of the Center and in depth within one line division.

Major decisions to be made at this point are, whether or not to extend the system to the rest of Staff and a second line division, and whether or not IDS has sufficient services to handle the Center's management information needs.

PHASE III JUL75--DEC75

The principle activities in Phase III include:

expansion of user populaton to a second division (probably Communications) and the rest of Staff.

phase out of activities concerned with MASIS, JOCAS, FEMIS, CMS, AND PMS.

implementation of the common query language against the RADC data base and the MASIS data base.

implementation of the line drawing capability.

interface of initial modeling techniques to the RADC data base.

By the end of Phase III, approximately half of the Center personnel should by using the system; all principle offices in Staff and two complete line divisions. The transformation of overhead slots into S&E slots should have begun. The system will have expanded to include a common query language with the potential of querying more than one data base on the ARPANET, line drawing capability, statistical analysis and plotting capability, and an initial modeling capability.

The decisions to be made at this point are whether or not to extend the system to the entire Center (which involves substantial capital investment) and whether or not to interface with advanced systems on the ARPANET, such as on-line conferencing, graphics, or inexpensive bulk storage.

PHASE IV JAN76--JUN76

Activities in Phase IV include:

extension of the system to the entire Center.

extension of the system's capability to include other advanced management techniques available on the ARPANET.

initial design of an AFSC MIS modeled after the one at RADC.

The end product of this phase will be the most advanced OPERATIONAL MIS in the Air Force, probably in the country. It can serve as a model for other AFSC organizations and a test bed for further development, evaluation and application work.

DISCUSSION of NLS and IDS

Since NLS and IDS form the core of the proposed RADC MIS, this section of the proposal will expose the reader in some additional detail to these systems. For further information on NLS see ref. (3,10). These reports are available from ISIM at any time, as are internal working documents on IDS.

NLS

NLS has been developed by the Augmentation Research Center at Stanford Research Institute; primarily under ARPA sponsorship, over the past 10 years. It contains a host of computer based tools for manupulating text, available to the user via a unique and integrated command language. It is available over the ARPANET and has been increasingly used within ISI for the past year and a half to conduct their daily business.

Interest in the system has arisen around the ARPANET, and as a result the computer at SRI has become saturated. A second facility has been created; which will offer a reliable and stable service to paying customers. ARPA and RADC are purchasing the major part of this utility for the first year, which will begin service in Dec 73.

Some of the more important communication features of NLS include:

LINKING..the ability to connect one's terminal to another (or several) and hence to carry on a "conversation" between the linked parties.

MESSAGE DISTRIBUTION..allows the immediate distribution of messages to one or more individuals.

SHARED FILES..allows two or more people to read and write on the same file, thus facilitating recorded dialog.

SHARED SCREENS..allows two people, provided with CRT's, to work on and view the same file at the same time. This mode of communication is often further augmented by a telephone voice link between the two parties.

JOURNAL..allows one to send any document (from one word to several hundred pages) to any individual or group using the system. A reference to the document is delivered on-line. The document can be viewed on-line or is delivered off-line via a remote printer or the US mails. The document is automatically indexed by author, number and keyword in the title. The indices are also available on-line and off-line for subsequent searching.

Documentation capabilities in NLS include:

TEXT EDITING..a full range of text editing features are availible to the user.

VIEWING..the text is arranged in an hierarchical fashion and a number of special views of the document one is preparing or studying can be easily obtained based on the structure of the document.

FORMATTING..several hundred directives are available for the users to format his document for publication.

PRINTING..can be done on any conventional teleprinter terminal, on a highspeed line printer, or on a phototypeset machine, where controls over font, character size, columns, etc. are possible.

Some special features of NLS include:

CALCULATION..a desk calculator package allows one to transfer numerical data from the NLS text files and to transfer the results back to the text files. There are 10 acumulators and it provides control over the format of the numbers.

FORMS GENERATION..a forms generator package allows one to describe a form to the system, prompts the user when filling out the form, and automatically prints the content of the form in the right place on the official AF form.

INTERFACING..the programming language of NLS (L-10), in combinination with the File Transfer Protocol and TELNET programs common to every host on the ARPANET, make it relatively easy to construct interface modules between NLS and other processes running on the ARPANET.

IDS

Integrated Data Store (IDS) is the Honeywell Information System's extension to the COBOL programming language. It is an information-oriented method of integrating the operating functions of a business. IDS uses mass random access storage as an extension of memory and provides a data organization technique with a procedural language to operate the system. Using IDS, a Data Base designer can describe and subsequently create a very sophisticated data-structured file.

ISI is currently using IDS to facilitate management of its internal affairs. Extensive in-house work has been done on the design and implementation of a data base for this purpose. This design will form the basis for the design of the RADC MIS. For a more detailed description of this design, see Appendix B.

Through the major governmental contract with Honeywell Information Systems (HIS), IDS is expected to be an important tool for management information systems throughout the Air Force and the World-wide Military Command and Control System community. HIS will certainly promote IDS as the mainstay of their proposed World-wide Data Management System (WWDMS); therefore, since IDS is a major item for WWDMS we should expect that continuing developements of the data management system will enhance the usefulness of IDS itself.

The user can think of IDS as a warehousing manager, storing and retrieving a variety of materials on demand, based on a predetermined plan. The space can consist of several different "buildings" which are in turn subdivided into numbered "areas". Different kinds of materials can be stored in the areas systematically. In the same way IDS uses the mass storage devices allocated to a specific Data Base very much like warehouse space; that is, different "subfiles" which are divided into "pages" are used for storage and retrieval of different kinds but related data.

The data structuring capability of IDS is one of its primary features. [fig 2.] Data structuring is accomplished using this system because it permits any record type (data item) in the data base to participate in multiple hierarchies; that is, any record can be declared:

1. A master of one chain (detail grouping) while a detail of another master; for hierarchical structures.

2. A master of any number of detail groupings; for tree structurings.

3. A detail to any number of masters; for network structurings.

4. A record in an unlimited combination of the above; for multiple hierarchies.

The benefits derived from structuring data; that is, intermixing record types and logically organizing them into chains or record sets are as follows:

1. Effective space management; minimizes overflow problems

2. Affords good response to important records

3. Economy of variable chain lengths (record groupings)

4. Provides for elimination of redundant data

5. Permits shared use of data

6. Allows exception processing

7. Multiple entry points to data base

Storing common data once in a data base and having it shared by many users provides for:

1. Standardization of data

2. Consistency in reporting

3. Minimum file maintenance

4. Reduction in storage requirements

QUERYING IDS

There are currently two means of querying IDS, the Data Query System, which operates in the time-sharing environment and the Interactive Command Language (ICL), which operates in the batch environment.

IDS DATA QUERY SYSTEM

Data Query allows the terminal user to satisfy spontaneous or unplanned needs for retrieval of data from the IDS data base. It is used in conjunction with applications programs to provide exception reporting. The system operates in the time-sharing environment and is able to support multiple on-line users. It is designed for the user who does not have specific knowledge of the IDS file characteristics and programing.

The features of Data Query are summarized below:

1. Allows on-line retrieval of data from an IDS file.

2. Satisfies spontaneous, impulsive and unplanned needs for information.

3. Designed for use by non-programming users.

4. Provides options for output formats and disposition.

5. Provides security at the data field level.

6. Operates as a time-sharing subsystem.

7. Allows multiple on-line users.

8. Provides off-line support features (output to printers and permanent files).

The Data Query System will eventually be expanded to handle queries that retrieve across network files; that is, files (rings) that are related via connector record-types. This capability currently exists only in ICL, as discussed in the next paragraph.

INTERACTIVE COMMAND LANGUAGE

ICL operates in the batch processing mode and permits retrieval of information from IDS data files from remote terminals. The ICL system compliments Data Query by allowing the user to retrieve data across network structures; that is, although Data Query can only process rings (chains) and hierarchial structures, ICL allows the programmer ways of making exception reports based on criteria that can be applied aross related files (chains, hierarchies, etc.).

Although ICL is a direct access batch program, a software package such as the Transaction Processing Executive (TPE) can potentially be used to improve its interactive capability by vastly speeding up response times.

The features of ICL are summarized below:

1. Allows access to IDS files using data names created by the user, not by the programmer.

2. Selects data (records) based on boolean criteria.

3. Allows selection criteria using values of fields which may or may not be in the selected record.

4. Permits criteria to be saved and reused within a problem series.

5. Prints field values which describe the selected records even though the fields are not in the selected records.

6. Allows manipulation of data (records) saved on temporary files.

7. Provides data security at the user level.

INTERFACING NLS AND IDS

The creation of the proposed RADC MIS is certainly within the scope of reasonable technical achievement. There are three main approaches that may be used in constructing the MIS:

(1) one complete system designed as a single entity and implemented on one central computer system.

(2) integrating existing components and interfacing them together under the same computer system.

(3) integrating existing components that are distributed across a number of computer systems and interfacing them together through some kind of network.

Inherent within each of these approaches are advantages and disadvantages. What one approach does well might be a problem in another approach. The first may be considered the classical approach; that is, redesign the wheel by building one super system from scratch and running the whole world on it. By designing and building it from the bottom up, there will be no duplication or overlapping of capabilities between the components making up the system. The interfacing among these components would be relatively simple because they would all operate on the same computer and the interface, itself, would be part of the original design. Drawbacks in this approach would be the high cost and the long time in development. And in the end, the system would be committed to the computer it was initially built on and there would be a problem in transferring the MIS to other computers or having other people access it.

The second approach will make use of previous work and will save much development time and money by utilizing existing packages that are already in operation and may have been checked out. There is a limitation in the selection of the components in that they must all run on the same computer or must be capable of being transferred to the central computer before they can be implemented into the MIS. Interfacing will be more of a problem since the various components would have been designed independently of each other. However, the task will be eased somewhat since they all will be operating on the same operating system on the same computer. One of the drawbacks in mixing and matching the modules that makeup the MIS is that there is bound to be some duplication and overlapping of capabilities but although this will contribute to overhead, it shouldn't make much of a difference otherwise. Naturally, you will again be committed to the selected computer and would, thus, lock out many potential users.

The final approach is similar to the second except that you are no longer restricted to modules that all run on the same computer. This method gives you the freedom to choose the best available components that can supply the necessary capabilities. This type of implementation will be available to more users since it will be distributed across a network instead of being centrally located on one operating system. As in the second approach there will no doubt be overlapping of capabilities contributing to overhead and the problem of interfacing the components becomes correspondingly more difficult. Besides trying to match independently created modules, there is the further problem that they run on different computers. However, by using existing network facilities like the ARPANET, this approach becomes more feasible.

In the initial model of a MIS [fig. 1], there was no requirement that the whole system had to be designed together or that the various components had to exist and operate on the same computer. Rather, each component is logically independent of the others in the sense that each has its own function to perform that contributes to the total MIS. This parallels the definition of modularity used by Glenford Myers in programming - modularity is not an arbitrary division of a large program into smaller parts or modules. The primary goal should be to have the modules as independent as possible. In fact, as long as the various modules of the MIS can be "married" by means of appropriate interface packages, this separation becomes an advantage instead of a hindrance to the total system. For example, a new database could be integrated into the MIS simply by supplying an interface package. The database would remain unchanged to the original users and existing programs and operating procedures would not have to be modified. But the database would now be available to many additional users. The use of the protocals of the ARPANET is envisioned to simplify this integration of distributed databases and components.

The last approach is the one recommended. A prototype of this kind of MIS could be put together by utilizing components that presently exist and are in operation at RADC and SRI. A database exists under the Integrated Data Store system (IDS) on the H635 computer at Rome. Rome can thus supply the GDMS, Filing Structure, Query and Database portions of the system.

> Before we commit ourselves completely to IDS, however, it would be worthwhile to investigate other DMS as possible candidates. They might not have to be limited to the ones we have at Rome either, although DM-1 should be considered. One option that should be available should allow us to evaluate DMSs that have already proved themselves in operational environments. Another possibility would be to explore other DMSs that are already on the ARPANET. The type of DMS that is selected will make a great impact on how usable a system we would end up with.

NLS would be used as a vehicle to collect the data necessary for input to the DMS. This collection would be automatic, in the sense that it would be accomplished by programs written in L-10, which run against files of forms filled out by engineers and administrators during the course of their everyday work. NLS would also serve as the query formulation vehicle. Both the update data and the query would then be shipped over the ARPANET to the appropriate DMS for execution. The results would be returned to NLS to a specified file, for further manipulation, inclusion in reports and communication to interested parties. The results could just as well be returned to any other subsystem on the ARPANET as input to plotting , statistical analysis, or other DMS systems such as MASIS.

The first step is to arrange the interface to allow the systems on GCOS and TENEX to communicate between themselves. This job would be easier if GCOS was on the ARPANET, but there are a number of interim strategies that could provide unsophisticated interfacing. Among the possiblities that will be considered are using the DN-355 to treat the ARPANET as a terminal, digital cassette recorders, the tape unit on the 8090, the TIP magnetic tape option, the Imlacs or maybe even a minicomputer.

A project that is already being considered involves the Forms system currently being designed under NLS. The purpose of the Forms generator package is to implement the procedures for filling out forms in an on-line mode. Since much of the data in our database is initially entered by way of forms, we can avoid the tedious process of handling the same data a second time when we keypunch it to enter our database by simply transferring it from NLS files into GCOS files on the H635. Once the data has gone through some modifications in format, it can be assimilated into our database with the same maintenence programs we use now.

Furthermore, since much of the data that goes onto a form may already exist in the database (with the exception of completely new entries), we can partially fill out a form by sending over data from the database to NLS. Then the user could make what changes or corrections that are needed without having to input a lot of information that is not affected.

A two-way process along these lines can be very important because one of the major problems we have encountered in maintaining our database is keeping it up-to-date and correct. If we could simplify the updating procedure, the database would be more valid and more useful. For a more detailed scenario on how the two systems could work together with the Forms system, see (Ref. 2).

BENEFITS

The installation of the RADC MIS as proposed, throughout the Center would measureably improve the responsiveness, accuracy, and completeness of the Center's mission. There are a number of political reasons for implementing the proposed MIS, as well as areas where tangible savings can be realized.

Political

There are a number of "political" reasons why the proposed RADC MIS should be implemented. The Center purports to be the principle Information Sciences development activity within AFSC, yet we do not use or apply our own technology to the conduct of internal affairs. How can higher headquarters or a potential customer have faith in the "words of wisdom" emanating from the Center, when it does not "practice what it preaches?" There have been a number of exercises in the past, where RADC was in a weak postion that could have been considerably improved, if we had an internal capability to point to.

The continuing battle over development territory with ESD, the Computer Technology Center, the assignment of the ARPANET managerial role to RML (rather than RADC), the upcoming plans for an AFSC Computer Network, the implementation of the findings of the Base Communications Analysis Study and the current Support Data Automation Processing Requirements - 85 study, the AFSC MIS...all of these are areas where RADC should be the leader, but plays minor or supportive roles partially because the Center does not have a visible implemented version of the technology it develops.

Manpower Savings

The Center had 1421 employees as of 30 Sep 73. Of these, 613 occupy "staff" positions. In addition, there are many positions in the line divisions which are supportive or managerial in nature. Thus, we see that over 50% of the Center personnel have job titles which fall into the indirect or overhead labor category. In addition, there is considerable S&E time spent in this category, which never appears on the JOCAS printout. THE LARGEST SINGLE SAVINGS, THEN, WILL COME FROM THE REDUCTION OF SLOTS IN THE SUPPORT AND MANAGERIAL CATEGORIES. With manpower reductions continually being applied throughout the Air Force, the implementation of the RADC MIS offers an opportunity to reduce the ratio of overhead to S&E manpower. Since the strength of any laboratory is in the quality and quantity of its S&E personnel, this must happen if RADC is to remain a significant force in the AFSC R&D community.

The slots associated with the input to and maintenance of existing reporting systems, such as; MASIS, JOCAS, PMS and CMS, can be eliminated. These slots will be unneccessary, because of source data automation...the elimination of continual rekeypunching, verifying, etc., of data which can be collected as a by-product of filling out a form using NLS.

Additional slots can be pared from all levels of management and support within Staff and to some degree at the mission division level. Staff functions which replicate the line management function to a large degree can be eliminated or drastically reduced with the aids to communication and documentation available within NLS.

The RADC MIS will also substantially reduce the administrative burden on the S&E personnel, freeing them to spend more time on mission activities.

Dollar savings

Tangible dollar savings could come from the elimination of one of the B-3500 computers (which now supports existing management reporting systems).

Other minor sources of savings could come from turning in typewriters, desks, filing cabinets, etc. There should be considerably less paper used, and less reproduction, xeroxing,etc.

Although the most difficult to demonstrate, perhaps the greatest source of dollar savings will result from the reduction of duplicative efforts (in-house and contractually), which now occurs due to lack of horizontal communication within the Center. Not only will the Center S&E personnel be able to better communicate with their peers, but through the ARPANET, they will be exposed to advanced thinking throughout the country.

COST FACTORS

There are two principle categories of cost; the developmental costs, and the costs of operating the RADC MIS once it has been brought into being. The two primary factors which influence these costs are the size of the user population and the costs of computing time to service the user population at any instant of time.

It should be possible to increase the user population at an expotential rate, from the current 20 users to 1280 users within 2 1/2 years. The availability of NLS service should be more wide spread as time passes. One of the biggest problems is training the increased user population. ISI is currently sponsoring the adaptation of the BBN developed computer aided instruction program, SCHOLAR, to the teaching of NLS. Within a year, it should be available to be used by trainees via the ARPANET. Within a year and a half it should be incorporated into NLS as an integral part of the other tools. The projected user population growth rate is depicted in Fig 3.

USER POPULATION

```
1280 -                                                        X

 640 -                                              X

 320 -
                                         X
 160 -

  80 -                          X

  40 -                X

  20 -X

      --------- --------- --------- --------- --------- -
                JUL        JAN       JAN       JUL       JAN
                74         75        75        76        76
PHASE ----0---->----I---->----II--->---III--->----IV--->
```

[FIG 3.]

COST OF NLS COMPUTER SERVICE

```
$/HR

  10 -----------



   5 -                -----------


                                          ----------

       --------- --------- --------- --------- --------- -
  JAN        JUL        JAN        JUL        JAN        JUL
   74         74         75         75         75         76
PHASE ----0---->----I---->----II--->---III--->----IV--->
```

[FIG 4]

The current total cost of NLS on the initial Workshop Utility is $800K; which will simultaneously serve a minimum of 20 users, 16 hours a day, 6 days a week for one year. This cost includes SRI services to transfer and maintain the software, train prospective users and provide documentation and consulting services to the using community.

The cost of the computing service from TYMSHARE (OFFICE-1) is about $500K, for 100,000 hours of available connect time. This means that the computing service costs $5.00 per available user connect hour. User statistics (collected within ISIM for the past year) reveal that the average use is 6 hours per week.

In practice, however, we must consider that the load will be spread over a 10 hour day..from 8:00 in the morning until 6:00 at night..and over a 5 day week. This means that there will only be 52,000 user hours per year available in the "real world". This raises the cost per connect hour to $9.62. The remaining "off" hours will be used to run heavier process like the journal, DEX, data stripping programs, printing, etc.

There are, however, several factors which will lower the cost per user connect hour, over the next two years.

The use of DEX should push bulk input jobs into the off hours, freeing the prime time for more interactive terminal jobs.

SRI is becoming more attentive to the efficiency of NLS programs, since they have been pushed by the using community around the ARPANET. They have instituted an analysis function, which has revealed the most commonly used commands. The NLS programmers have, and will continue to improve the efficiency of the code associated with these commands.

NLS contains some 300+ commands, which can be cut considerably for an office environment like RADC, either by modular programming techniques or by configuring a special version of NLS. This would reduce the overall size of NLS, and increase the number of simultaneous jobs that could be handled by a machine of a given size.

In addition, it is possible to install dual processors, or go to a higher speed version of the PDP-10X, either of which would nearly double the capacity of the facility for a nominal increase in cost.

For purposes of this proposal, then, we estimate that the cost of NLS will drop to $2.00 per user connect hour during the next 2 1/2 years in the manner indicated in Fig 4.

Developmental Costs:

Terminals

No development of terminals per se is anticipated. A less expensive version of the DNLS terminal is being developed by SRI under ARPA sponsorship. ISIM is now in the process of developing a line printer interface for the TIP under project 5581. Terminals necessary for the development team are available in-house.

It will be necessary to lease terminals during the development stages, however, to allow training of the new seqments of the user population. The lease cost of 300 baud teleprinters is about $100 per month. During Phase I, a ratio of 1:1 between terminals and users will be maintained, because of their scattered geographical locations. The final ratio for the Center will be 1:2, which we have found to be a reasonable compromise between convenience and cost.

The cost of terminals during the 4 development phases was calculated using the data in Table 1.

PHASE	I	II	III	IV
pop	80	250	600	1280

# terms	40	110	280	556
$ X 1000	24	66	168	282*

* This represents the 6 month terminal cost based on purchased terminals, see discussion following Table 1.

Training

There are two types of training costs; the cost of the trainer and the cost of the time of the trainee. It requires a manmonth of trainee's time to become proficient in the use of NLS and a manweek to learn IDS. Both systems require "hands-on" training sessions with an instructor present for at least 1/4th of the initial training period. The rate of learning varies widely from person to person. The classes must be small (about 5 people per instructor) because of the varying backgrounds of trainees. Each person needs individual attention in the beginning. For the purposes of this proposal, then, we will assume 6 manweeks of training per trainee and a ratio of 1:20 of trainer to trainee time, with a cost of $40K per manyear for a contractual trainer. (During phases III & IV it should be possible to use BBN's SCHOLAR computer aided training system to provide the necessary individual training)

PHASE	I	II	III	IV
pop	80	250	600	1280
trn'ee (my)	5	20	40	78
$ X 1000	10	40	80	156

Communications

Internal (to the base) telephone lines are required to link terminals to the TIP and the H-635. Assuming that all voice lines are now used for that purpose, this means ultimately a doubling of the internal line capacity. For phase I, however, it is assumed that existing voice lines can be used without hampering voice communications.

Access to NLS is currently through the ARPANET, which is accessed via a TIP. A TIP can accommodate up to 64 terminals. Modems on the TIP and associated electronics average about $1,000 per port. A TIP costs between $50K and $100K; depending upon the variety purchased. The yearly communication charge for the ARPANET is $16K, with another $8K for maintenance of the TIP. During phase III it will be necessary to purchase another TIP and associated electronics to accommodate the increased user population.

PHASE	I	II	III	IV
pop	80	250	600	1280
TIP			100	
comm	8	8	16	16
maint	4	4	8	8
modems		30	60	
$ X 1000	12	42	184	24

NLS

Sufficient NLS capacity is available for development team support and initial limited training of Phase I RADC MIS users. Project 5581 has purchased 1/4th of the initial Knowledge Workshop Computer Service Computer (KWCS-1) for $125K. This entitles RADC to a minimum of 5 simultaneous users for 16 hours a day six days a week, through the end of calendar year 74. This coincides with the end of phase I, which means that additional shares must be purchased at that time to allow the RADC MIS users to actively use the system and to continue development team activity within ISI. As indicated by Fig. 1, the cost per user connect hour will be coming down, so that the KWCS-1 rate for phase II will be $5 per user connect hour, or $195K for six months. During phase III, roughly half the Center will be brought up to user status. This will require an additional 468K during the first 6 months of FY-76. Finally, during phase IV when the entire center is brought into using status, it will require $400K during the last 6 months, since the cost of NLS service will have dropped to $2 per user connect hour.

PHASE	I	II	III	IV
$ X 1000	0	195	468	400

IDS

The principle costs for IDS will be contractual support required to augment in-house applications and maintenance programmers. At $40K per manyear, these are estimated to be:

PHASE	I	II	III	IV
$ X 1000	80	80	40	40

Interfacing NLS and IDS

There are two types of cost involved; interfacing the H-635 to the ARPANET and writing programs in L-10 (the NLS programming language) and COBOL to allow NLS and IDS to communicate. Due to other pressures of the AFSC Computer Network and exploratory development efforts, it is expected that the H-635 (or its successor) will be a host on the ARPANET. Therefore, it will not be considered a part of the costs of developing the RADC MIS.

The cost of interfacing NLS to IDS is the cost of programmers' time to write the data stripping and transfer programs in L-10. This would be a continuing effort as the size and scope of the IDS data base increased, but should not be more than a manyear of effort for each year of the RADC MIS development cycle.

PHASE	I	II	III	IV
$ X 1000	20	20	20	20

Total development costs ($ X 1000)

PHASE	I	II	III	IV	total
Terminals	24	66	168	282	540
Training	10	40	80	156	286
Commun.	12	42	184	24	262
NLS	0	195	468	400	1063
IDS	80	80	40	40	240
Interface	20	20	20	20	80
Totals	146	443	960	946	2471

TABLE 1

The total developmental cost figure includes costs associated with operational service supplied to the users as they become trained.

Operating Costs:

Predicting the operational costs of the RADC MIS depends upon forecasting cost trends in technology and assuming the degree of use of a system which has not yet been built. The costs of the ARPANET are well known. We can cost out terminals fairly accurately. A years worth of use statistics have been collected on the use of NLS. No operational use statistics have been collected on IDS. In all cases, the estimates are conservative so that the final cost estimate represents an upper boundary.

Terminals

There are four basic types of terminals now in use with NLS. Current costs of terminals and associated I/O equipment are:

110 baud typewriter	$ 3000
300 baud teleprinter	3000
9600 baud graphics crt	16000
2400 baud text crt	5000
line printer	12000
cassette recorder	2000

In determining the quantity and mix of terminals, we have assumed:

a Center population of 1280.

a ratio of terminals to people of 1:2.

a ratio of cassette recorders to teleprinters of 1:10.

a ratio of text crt's to teleprinters of 1:10.

a ratio of graphics crt's to teleprinters of 1:20

1 line printer in each building, except 106 where there will be two.

In determining the cost of the terminals, we have assumed:

purchased price to be amortized over a 5 year period.

a 10% additional cost for maintenance and supplies.

The total monthly cost for all terminals and I/O equipment would be:

Terminal	number	$/month	total
Teleprinter	556	55	$30580
Cassette rec	56	36	2016
Text crt	56	91	5096
Graphics crt	28	294	8232
Line printer	6	220	1320
TOTALS	702		$47244

Or an annual total cost of $566,928 for terminals. This cost will be reduced substantially in practice, because there are terminals in existance within the Center and because the actual life of terminals is more than 5 years.

Training

The operational training costs are not separable from a person's everyday work. It is essentially on-the-job training, and will be assisted by various help features built into NLS and the BBN SCHOLAR programs.

Communications

The yearly communication charge for the ARPANET is $16K plus $8K for maintenance of the TIP for each site. Assuming two sites are necessary, the total yearly cost for communications (disregarding internal lines) is $68K.

NLS

Assuming a population of 1280, an average weekly use of 6 hours per individual, and a cost of $2.00 per connect hour; the total annual cost of NLS will be $798,720.

IDS

The cost of IDS is difficult to determine. It includes the cost of the computer time, but this is already paid for out of project 5581. The only direct additional cost would be for an additional disc pac, or $20K per year.

Interfacing NLS and IDS

One manyear per year of contractual support is needed to maintain the programs associated with the Data Base Management system, or $40K.

Total

The total estimated annual operational cost for the RADC MIS is $1,365,776.

PERSONNEL

A team of 10 in-house people is required to implement this proposal and guide contractual labor. The emphasis is on in-house implementation, therefore, they must be individuals intimately familiar with the proposed technology and with RADC organization and procedures. They would be organized as shown in fig. 5.

M I S
Team
Leader

Admin
Office

Database
Design
Group

Applications
Programming
Group

Database
Maintenance
Group

MIS DEVELOPMENT TEAM ORGANIZATION

[FIG 5]

Responsibilities & Functions:

MIS Team Leader (TL)

This office will be the primary interface with the Center and the facility. It will be responsible for deciding courses of action to be taken in MIS implementation. It will prepare the plans and budget for the MIS program. It will maintain an awareness of the Exploratory Development program appplicable to the evolving MIS and insure orderly transition of developments. It will approve the database design and changes thereto. It will translate application program requirements to the programming group. It will maintain liason with the ISI NLS group through the ISI branch chief in matters of training and changes to this subsystem. It will insure that groups are adequately manned and personnel are properly trained.

Personnel Required:

Team Leader

Secretary

Administration Office (AO)

This office will do all keypunching, maintain all logs, load all programs to be run on the computer, run back-up tape daily, update primary file as required and report status on NLS log, and run and distribute the batch runs produced from the MIS (this includes NLS runs which might be identified). Logs of all runs made on the computer will be maintained in the NLS system (i.e. the type of run made <load data, programming, database design, etc.>, action required, action taken, etc.) and the actual runs will be maintained as a log. An archive system will be maintained. This system of maintaining records will serve as important experience information for us in what it takes to establish a MIS. This office will also input textual information into the NLS subsystem as requested by other team members.

Personnel Required:

Clerk/NLS Input

Clerk/DMS Input

Database Design Group (DDG)

This group will design all records and fields in the DMS subsystem. It will design and test all maintenance programs and mapping for the subsystem. It will document necessary and pertinent information related to this task in the NLS subsystem. For Phase III, it will be responsible for transferring the database to the new DMS. For Phase IV, it will be responsible for the stripping functions to be performed at each source (i.e. it will design the files and work with the APG in writing the "stripping" programs). Inputs to the IDS subsystem will be submitted to the AO on coding sheets. It will be responsible for contractual efforts related to its function.

Personnel Required:

System Analyst

Programmer

Applications Programming Group (APG)

This group will do all COBOL applications programming and L-10 programming for the system. It will document necessary and pertinent information related to this task in the NLS subsystem. Inputs to the DMS subsystem will be submitted to the AO on coding sheets. The NLS subsystem will be used to notify the AO on the status of programs for logging purposes. It will be responsible for contractual efforts related to its function.

Personnel Required:

Programmer COBOL

Programmer L-10

Database Maintenance Group (DMG)

This group will act as the data administrator. It will collect and update all data which goes into the DMS subsystem. It will prepare all data to be inserted into the DMS database on coding sheets and verify entries into the database. It will write and maintain all SOP's for the total MIS. It will be responsible for contractual efforts related to its function.

Personnel Required:

Data Administrator

Clerk- Data collection

MILESTONES

```
        JAN        JUL        JAN        JUL        JAN        JUL
        74         74         75         75         76         76
PHASE ----0---->----I---->----II--->---III--->----IV--->
study ---------1-----------------2-------------------->
pop   ---------[1]-------[2]-------[3]-------[4]---------
term  ---------------------------[5]-------------------
train ---------------------------[6]-------------------
NLS   ---------------------------------------------------
DMS   ---------------------------[7]-------------------
I'face---------------------------------------------------
capabilty------3---------4---------5---------6---------7
```

Milestone 1: Initial user needs study & database design.

Milestone 2: Final user needs study & database design.

Milestone 3: ISI Branch using NLS & IDS.

Milestone 4: Staff, Div and Brn offices using limited NLS & IDS.

Milestone 5: IS div plus above using NLS and IDS, connected via ARPANET.

Milestone 6: Additional div plus all Staff using NLS, IDS plus other management sciences techniques on the ARPANET.

Milestone 7: Entire Center using full MIS.

Decision points [1]--[4] Decisions, based on information to date and resources available, as to whether or not to increase the user population to the planned level.

Decision point [5] Continue to lease or buy terminals.

Decision point [6] Continue manual training or conduct training on-line via BBN Scholar system.

Decision point [7] Whether or not to stay with IDS as the data base management system to handle structured information.

APPENDIX A RATIONAL UNDERLYING PROPOSAL

This appendix contains extracts from references [X&Y); which should give the reader further insight into the rationale underlying this proposal.

Purpose of an Information System

The ultimate goal of such an information system would be to present a unified view of the organization and its problems. The information system should cut across all the individual functional areas that may now exist. It would seek to emulate an individual entrepreneur by being a central depository for all the data of the organization. It can accomplish this by providing integrated non-redundant information, by incorporating techniques of management science and by responding in a timely manner to ad hoc requests for information.

J. D. Aron describes a manager's job as making decisions under conditions of uncertainty. If there was no uncertainty in a specific decision-making activity, a routine could be established that would lay out what actions to perform depending on the given conditions and anyone could accomplish this. You wouldn't need to invest money in a manager either. By this definition a manager should apply his energy toward those efforts or tasks that are new. Since there is no prior experience to rely on in this type of situation, no one could predict exactly what kind of information would be relevant to this new problem. Therefore, the information system cannot provide all the information needed because the manager, himself, cannot identify in advance what kind of information he might want. The system will, however, provide the starting point. As the gaps in the manager's knowledge become filled, useful information is retained and more appropriate information can be requested . Each time the cycle is repeated, the current needs of management can be more closely satisfied. Finally, this reiterated process would allow management to make decisions in an efficient and timely manner.

At the same time the system should not be used to generate information indiscriminately. In our "information-rich" society the necessary data needed to solve some problem is usually buried with so much other data that it cannot be used effectively. Therefore, another prime goal of an information system would be to deliver only the data that is needed; that is, the minimum information necessary for the problem at hand.

An information system would provide management with the data they need to coordinate their activities, allocate resources (people and money) and control operational plans and schedules. To do this, the information system should provide management with unbiased information on the status of personnel and the current financial condition of the organization in a real-time mode. Managers can then establish sound policies and be made aware of shortcomings within the organization as they occur and not after the fact.

As the system becomes an integral part of day to day operations, it can begin to provide a real Command and Control service. Besides providing the information so that decisions can be reached, it can also provide feedback or reactions to those decisions that are being carried out. It can report whether they are being carried out according to plan. This feedback would further help a manager know what is happening in his organization.

There is a dichotomy in most organizations that an information system should be aware of and work around. The people in the lowest levels of an organization generate most of the data yet they have the least need for information. Each successive level in the hierarchy produces less and less data but they have correspondingly greater information needs. Finally, at the very top of the organization almost no new data is generated. This level is completely devoted to making decisions and ,therefore, needs access to all the data about the organization.

Although an information system cannot be all things to all people, it should be able to resolve this dichotomy. Each level will work on the same system even though they will not be using it for the same purposes. For the people at the lower levels the system would be used as a tool to augment the way they work. As the system communicates and documents their work, the data would be captured automatically for use by the higher levels which would selectively extract the information they need from this larger base pool. This would avoid constant rehandling of the data so that different levels can use it the way they want. It would also lead to the system becoming partly selfsufficient by maintaining and collecting the data it needs itself.

There is one other aspect to an information system. Since it is built upon interfacing the many functions within the organization (and to accomplish this it must recognize the interfaces between man and the computer) and since one of its objectives is the optimum operation of the total organization, the information system contributes to the generation of changes. But it must do even more - it must aid in the implementation of these changes even when they are changes in the system itself. Two characteristics become important for this. First, the system must be flexible enough to handle a wide variety of circumstances and secondly, it must be adaptable enough to meet major changes with minimum impact.

Finally, since information in the hands of only one person is not enough, the information system should contain the means to facilitate the communication and dissemination of the information to the people who can make use of it.

RADC MIS--A PROPOSAL

Philosophy

The importance and implications of the idea of knowledge work have been described by Drucker [4,5]. Considering knowledge to be the systematic organization of information and concepts, he defines the knowledge worker as the person who creates and applies knowledge to productive ends, in contrast to an "intellectual" for whom information and concepts may only have importance because they interest him, or to the manual worker who applies manual skills or brawn. In those two books Drucker brings out many significant facts and considerations highly relevant to the theme here, one among them (paraphrased below) being the accelerating rate at which knowledge and knowledge work are coming to dominate the working activity of our society:

> In 1900 the majority and largest single group of Americans obtained their livelihood from the farm. By 1940 the largest single group was industrial workers, especially semiskilled machine operators. By 1960, the largest single group was professional, managerial, and technical -- that is, knowledge workers. By 1980 this group will embrace the majority of Americans. (The Air Force, and RADC in particular, has passed this point already). The productivity of knowledge has already become the key to national productivity, competitive strength, and economic achievement, according to Drucker. IT IS KNOWLEDGE, NOT LAND, RAW MATERIALS, OR CAPITAL, THAT HAS BECOME THE CENTRAL FACTOR IN PRODUCTION.

In his provocative discussions, Drucker makes extensive use of such terms as "knowledge organizations," "knowledge technologies," and "knowledge societies." It seems a highly appropriate extension to coin the phrase "knowledge workshop", just another name for the place in which knowledge workers do their work. Knowledge workshops have existed for centuries, but only recently has special emphasis been placed on their systematic improvement, toward increased effectiveness of this new breed of craftsmen.

Technology

The visible components of the technology are the time-shared computer (allowing a number of persons to simultaneously share a computer's resources in a real time manner) and the effective networking of dissimilar computers [7,11].

The less visible side stems from a recognition of the common "core" of activity carried on daily by knowledge workers, regardless of their speciality.

To illustrate this later point, if you asked a particular knowledge worker (e.g., scientist, engineer, manager, or marketing specialist) what were the foundations of his livelihood, he would probably point to particular skills such as those involved in designing an electric circuit, forecasting a market based on various data, or managing work flow in a project. If you asked him what tools he needed to improve his effectiveness he would point to requirements for aids in designing circuits, analyzing his data, or scheduling the flow of work.

But, a record of how this person used his time, even if his work was highly specialized, would show that specialized work such as mentioned above, while vital to his effectiveness, probably occupied a small fraction of his time and effort.

The bulk of his time, for example, would probably be occupied by more general knowledge work: writing a planning or design document; carrying on dialogue with others in writing, in person, or on the telephone; studying documents; filing ideas or other material; formulating problem-solving approaches; coordinating work with others; and reporting results.

The Augmentation Research Center (ARC) at SRI has been working for some years to develop a general purpose information system that would augment the common core activities of knowledge workers ref. (3). It has been more successful than other similar attempts because of its underlying philosophy and because of its development strategy called "bootstrapping".

Bootstrapping implies a pragmatic, evolutionary development process; where the developers of the system also used the system to further develop it. If newly developed capability was insufficient, just window dressing or otherwise fell into disuse, its deficiencies were soon noted by the developing group at the ARC and the new feature was eliminated, modified or upgraded.

The development of the system has progressed to the point where it is now being used by small groups around the country as their primary medium for conducting their daily business. The Information Management Sciences Section (ISIM) at RADC is just one example of such a group. It contains a host of tools, procedures and methodology embedded in a consistent command language; which allow one to accomplish most of his daily communication and documentation activities.

Concurrently, a second technology has been developed which allows the interconnection of dissimilar computers. It has been supported by the Advanced Research Projects Agency (ARPA) and is called the ARPANET. There are currently over 60 sites in the US and 5 overseas, representing all the major computer manufacturers, linked together.

This makes it possible to connect programs together which are running on different computers located at different geographic sites. This means that one no longer has to replicate software, hardware and expertize on site before he can use some newly developed information system. One need only provide a software interface from the general purpose information system to the more specialized (and more powerful in its domain) information system.

Examples of such special purpose systems available on the ARPANET include:

a DELPHI system at the Universtiy of Southern California, which allows the rapid collection of expert judgements in a formal manner. [12,13]

a powerful 3 dimensional graphics capability at the University of Utah, which can assist in the design and analysis of complex 3D objects.

a computer based instruction program at the Bolt Beranek & Newman company in Boston, which allows an instructor to insert course material and students to be taught in an on-line interactive tutoring mode.

generalized data management systems at SDC.

APPENDIX B CURRENT ISI IDS DATABASE DESIGN

This appendix contains a description of the IDS data base now in use within ISI, with some thoughts on activity required to extend it to the Center.

EXISTING DATA FLOW STUDY

The IDS software system allows the designer to "integrate" the operating functions of a business or organization. This means that the functions must be modeled so that the flow of data is schematically represented at all unit levels and across units. The representation will allow a functional as well as a systems approach to organizational planning, coordination, directing, and controlling.

A complete study of the Rome Air Developement Center and its functions must be made before a modeling effort is undertaken. A study of such magnitude would require individuals who are presently assigned to RADC and have a working knowledge of its structure and activities.

PRESENT-FUTURE DATA REQUIREMENTS

The data flow study should identify most of RADC's present information requirements; however, the "KEY" to building a MIS that will account for unforeseen information needs is the ability to extrapolate present data and functional trends so that future requirements can be easily realized and satisfied by appending extensions to the present model. The MIS study group and data base designers must build an initial model that will serve as the basis for an expandable data base system.

DATA BASE SUBDIVISION

As discussed above, the initial model would serve as the skeletal system and would "integrate" the functions of divisions, branches, etc within RADC. The skeletal model, therefore, would be a composite of the data base models that define the operations of each division, and within each divisional model, the branch models, etc. Thus, the data base design and description will be based on subdivisional relationships where data can be stored in separate but logically related files and available at different levels of the organizational structure on a broader or more systems oriented basis.

ISI DATABASE

Basically, the database is comprised of two main parts. One is centered around the personnel in our branch and the other monitors the projects and efforts the branch is involved with. Provisions have been made to allow for expansion to the entire division if results on the smaller scale appear promising.

Besides the usual data kept about an employee, the ISI database incorprates a fairly comprehensive record of the employees education. This ranges from the actual degrees a person has earned down to courses he has taken whether on a formal basis as part of fulfilling a specific degree or short term courses taken at various universities or job related courses given by industry. In addition, data has been compiled about the skills an employee has gained on particular systems pertaining to the branch. Finally, a history of the employees promotion record is being maintained.

Personnel (subfiles 1 & 2)

There are five main areas involved in these two subfiles and they incorporate the contents of 18 records. These areas of interest are about employees, education, organization, skills and grades.

The employee record contains the usual information associated with a personnel file (social security number, age, date of employment, DOLP, sex, etc.). In addition, there are also links to other main areas which show how those areas apply to each individual employee.

The education portion of the database contains a record for each degree an employee has earned as well as the date and the school and the major field. There is also an entry point by way of degrees so that everyone with a certain degree may be selected and retrieved easily. Another record describes the codes which were used in the degree record as a way of saving space. Finally, three different types of courses are accounted for: college (formal courses as part of a degree program), short-term, and training (job-related).

Three records deal with organization structure and employee assignment. These records also provides a link between which organization is in control of which project.

The skills of an employee are referenced by four records which describe the skills and the level of competency that is achieved for each appropiate skill along with a description of the codes used and the overall classification of the skills.

Finally, the salary history and grade status of each employee is maintained, including both the military and civilian pay-tables.

Project-Management (subfiles 3 & 4)

The Project Management half of the database is even more complex. Here the appropriate efforts will be related to the respective Center tasks, projects, and programs. We are also attempting to keep track of the entire procurement cycle of Purchase Requests through contracts and this will be linked to a record of the organization's planning activities. Furthermore, both applied and planned manhours will connect each individual to the efforts he is charging time against.

These next two subfiles cover six topics including purchase requests, contracts, funding, planning, keywords, man-power expenditures and a breakdown of the organization's activities from programs to work units.

All the programs that fall under control of the ISI branch are included in the database. Under the programs we find a breakdown into their respective projects. Likewise, the projects are broken down into tasks, and tasks into work units. The projects are linked back to the other half of the database through the organization that is responsible for it. Similarly, the work units refer back to the people working on them by way of applied and planned manhours.

The purchase request record contains the same information that is found in the PMS file. In addition, we tried to preserve the complex relationships between PRs and work units and contracts.

The contract record was also obtained from another external file, in this case the CMS file. Relationships associated with contracts were kept intact as much as possible.

The funding record is a direct link between purchase requests and contracts. It includes current year expenditures as well as second and third year estimates and total money to date.

The planning record should be able to supply all the information needed on a form-30 as well as inputs to other records as the plans become reality.

The keyword area associates two levels of keywords to projects, work units and contracts. The more general level will probably be a listing of TPO areas that the branch works on. The lower and more detailed level will be user supplied keywords that would describe specific areas such as DM-1 or AKW.

Through manpower expenditures we form a link between employees and the work units that he spends his time against. This connection not only tells who is working against what, but also gives us his time expenditures by month (Form 2).

APPENDIX C COMMANDER'S MEMO TO IS

24 Aug 1973

Center Computer Support/IS (Colonel Thayer)

1. Computer technology is pervading all aspects of our Center's operations in an ever increasing fashion. I am concerned that we are not taking advantage of the knowledge and experience which is available in the Information Sciences Division. I know that your view, as supported by the Division's mission statement, is that your fundamental responsibility lies in investigating the more basic research and development aspects of computer technology--particularly as relating to software. Because of this, and because of your manpower limitations, the Division as a whole has been reluctant or reticent in providing more routine support to other divisions within the Center.

2. It is somewhat a dichotomy to profess to be the Air Force Center of excellence in a vital area and not provide the same service to our own people. Thus, because it is both essential and necessary, I want you to prepare a program which will provide the following Center computational support from within the IS resources. I should like to discuss this program with you on 6 September at 0930.

a. Provide the computational support in a guaranteed time period on a daily basis. As a goal this time period would be the normal work shift.

b. Establish a group to provide consulting service to application programmers of other divisions.

c. Perform a periodic analysis of the total RADC requirements for R&D computational support. As a result of this analysis, plan and implement changes to the facility hardware and software consistent with the total requirements.

d. Establish an education and training program for personnel of the other mission divisions.

e. Establish and maintain a Management Information System.

3. The above should insure that the RADC mission divisions will be provided the computational support required in performing their functions.

RADC MIS--A PROPOSAL

PHILLIP N. LARSEN
Colonel, USAF
Commander

RADC MIS--A PROPOSAL

EJK notes on Meeting #1 with FJT

What is needed is a proposal to the Division on a Center Management Information System. The proposal saould include provision for contractor support.

ground rules - Basic conditions of the proposal. The ARPANET and anything that is reasonabley available on the net shall be used in the Management Information System. Existing Computer system ie. the HONEYWELL shall be used, as well as the UTILITY. The basis of the sytem will be IDS - COBOL

IDS - COBOL is here, the NLS utility is almost here. Both of these have sufficient merit for non-military purposes that much of the work will be done by the contractor independently of our need and our support.

We must prepare a draft work statement for a contractor. The starting point is what we have NOW. We do not start a new system.

Formatted files - available down to Branch level..Inputting capability - one per Division.

What does it take? $200,000/year for several years to develop. The type and number of people should be determined by study.

Cost estimates must be made for implementing the Management Information System for the entire center. But, in order to get anything started, Phase one must be a cheapie.

Frank, in describing how he visualizes the development is thinking in terms of a takeoff on the way I once described the growth of NLS. He envisions a currently small group of users (us) with a tentacle or finger going up one or two levels of command. The first stage of a center Management Information System, would be some broadening of the base, ie. our Branch possibly the whole division. Other lines going up in the other division and in all divisions up to the commander and selected elements of staff. The next phase would include a broadening at the lowest level to give the peons in the other divisions some capability to use the system and in that way broaden the data base. Additionally there will be a broadening at the top to include the rest of the staff. As the final phase, there will be a proliferation through the Center (Frank says from the top down).

Primary concern of the immediate effort has to be the first phase, but we should remember that this is to be a continuing effort and consideration must be paid to contiauing costs.

The plan must account for Cost, Time, Impact, and facilities. For impact, tradeoff dollars for people (contract - reduces impact on ISI)

We should take a look at the study that was done under contract for Roy Allen.

Frank is frankly scared at the idea of wasting our people working on a bunch of vertical files instead of an integrated Management Information System.

REFERENCES

(1) J H BAIR
Evaluation and Analysis of an Augmented Knowledge Workshop
To be published as a RADC Technical Report 1973

(2) J P CAVANO
Generation of an Information System
To be published as a RADC Technical Memorandum 1973

(3) D C ENGELBART, R W WATSON, J C NORTON
The Augmmented Knowledge Workshop
Proceedings: National Computer Conference, June 1973

(4) P F DRUCKER
The Effective Executive
Harper and Row New York 1967

(5) P F DRUCKER
The Age of Discontinuity: Guidelines to Our Changing Society
Harper and Row New York 1968

(6) T W HALL
Implementation of an Interactive Conference System
AFIPS Proceedings-Spring Joint Computer Conference Vol 38 pp 217-229
1971

(7) R E KAHN
Resource-Sharing Computer Communication Networks
Proceedings of the IEEE Vol 147 pp 147- September 1972

(8) J C R LICKLIDER R W TAYLOR E HERBERT
The Computer as a Communication Device
International Science and Technology Number 76 pp 21-31 April 1968

(9) J C R LICKLIDER
Man-Computer Symbiosis
IEEE Transactions on Human Factors in Electronics Vol HFE-1 pp 4-11
March 1960

(10) N LINDGREN
Toward the Decentralized Intellectual Workshop
Innovation Number 24 pp 50-60 September 1971

(11) L G ROBERTS B D WESSLER
Computer Network Development to Achieve Resource Sharing
AFIPS Proceedings-Spring Joint Computer Conference Vol 36 pp 543-549
1970

(12) M TUROFF
"Party-Line" and "Discussion" Computerized Conference Systems
Computer Communication, Impact and Implications Proceedings of First International Conference on Computer Communication Stanley Winkler (Editor) 24-26 October 1972 Washington D C pp 161-171 1972

(13) M TUROFF
Delphi and Its Potential Impact on Information Systems
AFIPS Proceedings-Fall Joint Computer Conference Vol 39 pp 317-326 1971

The Initial RADC MIS Proposal

(J20969) 19-DEC-73 06:28; Title: Author(s): Duane L. Stone/DLS;
Distribution: /JPC RBP DLD2 RFI EJK JLM FJT RHT2; Sub-Collections: RADC;
Clerk: DLS;
Origin: <STONE>MISPROP.NLS;2, 18-DEC-73 13:28 DLS ;

20969 Distribution

Joe P. Cavano, Roger B. Panara, David L. Daughtry, Rocco F. Iuorno, Edmund J. Kennedy, John L. McNamara, Frank J. Tomaini, Richard H. Thayer,

PRC/PACER MEETING

These are a few of my comments abot what we learned from PRC.

PRC/PACER MEETING

I was not particularly impressed in what Mr. Nichols of PRC had to tell us under such short notice. Out of 4 main poits that he brought up, we had stumbled on three of them ourselves with our local ranch effort:

1) Detailed analysis or study before any IDS design - we tried to do this as much as possible and have recommended it for all proposals although nobody else seems interested.

2) Back-up procedures for recovery of database - the procedure for recovery in our system were een more detailed, i.e. a back-up database, a data entry log to record updates, and a number of file saves as well as testing programs out on the back-up data base.

3) data base experts for "chain-chasing" to maintain validity of database- I knew we needed this type of support but we were never able to get it.

The final point was the most noteworthy and I had only begun to suspect it.

4) that IDS itself was incapable of supporting an operation like PACER withou modifications to IDS and GCOS. One important type of mod was the directory for faster retrieval. We might be able to use that idea in our current effort to provide more responsiveness to our system. Howver, I have serious doubts now whether stand-alone IDS in an unmodified GCOS can handle the job.

One final thought: the Pacer effort currently uses upwards of 50 people ...maybe our guessitimate is too small. 1

20970 Distribution

Roger B. Panara, Ray A. Liuzzi, Frank J. Tomaini, Edmund J. Kennedy, John L. McNamara, David L. Daughtry, Rocco F. Iuorno,

PRC/PACER MEETING

(J20970) 19-DEC-73 07:31; Title: Author(s): Joe P. Cavano/JPC;
Distribution: /RBP RAL FJT EJK JLM DLD2 RFI; Sub-Collections: RADC;
Clerk: JPC;

Some Old Thoughts on IDS

This ws written approx a year and a half ago but it might be of interest today in light of our current effort.

Some Old Thoughts on IDS

Initial Findings 1

Our early work in generating this system has already suggested some conclusions that can be made and has also raised some intersting questions. A system design can be subdivided into logical and physical parts. The logical design is concerned with stability, modifiability, and most important, capability. Stability in our system implies continued operation through changes in hardware, software, and personnel. So far our system hasn't been up long enough for us to really determine how it would react to drastic changes in its environment. We did undergo one saddle-change in GCOS but this didn't have any serious consequence for us. However, problems have been encountered due to our lost of our system programmer. In fact, we were lucky that we were able to come up at all. Many of the necessary computer programs were never tested out and it was impossible to document either the system design or the maintenance programs sufficently. This has become a serious problem today as we try to work with the system and access the database. 1a

Modifiability is concerned with how changes in the systems functioning can be accomplished in an orderly fashion at the request of the organization managers 1b

The most important role of the database is for it to perform its intended functions in a manner suited to human interaction and decision-making, and this is what we refer to as its logical capability. Although IDS works upon a model of the organization, what happens when there are a multiplicity of models, none of which has absolute priority? This question is further complicated by the fact that many of our branch's involvements with other government agencies seem almost illogical and conflicting. What may be the real test of IDS as an information system in a command and control environment is how it can be made to handle unpredefinable needs and nebulous relationships. 1c

20971 Distribution

Duane L. Stone, John L. McNamara, Frank J. Tomaini, Rocco F. Iuorno, David L. Daughtry, Roger B. Panara, Ray A. Liuzzi, Edmund J. Kennedy,

Some Old Thoughts on IDS

(J20971) 19-DEC-73 07:38; Title: Author(s): Joe P. Cavano/JPC;
Distribution: /DLS JLM FJT RFI DLD2 RBP RAL EJK; Sub-Collections: RADC;
Clerk: JPC;

WWMCCS STATUS REPORT AS OF 19 December 1973

WWMCCS STATUS REPORT (December 19, 1973)

WWMCCS OPERATING SYSTEM STUDY GROUP

The next WWMCCS operating system release that will be studied at the RADC ficility will be release 4.0. This version of the WWMCCS O/S includes several enhancements such as the extended memory, new security features, the ANSI 68 COBOL compiler, and WWDMS B.2 corrections. The WWDMS of this release is to satisfy 315 of the 698 operational capabilities requirements. The JTSA system release has already been delivered to RADC/ISF; however, the assigned study team prefers to wait for delivery of the Honeywell source code release (4.0) which is due for arival during the week of 24 December 1973. The source version is necessary so that required changes can be made by RADC personnel.

The RADC/IS team that will attempt to load the operating system and other software on our H635 computer includes:

Trad, David	team leader
Walker, Robert	team co-leader
Wingfield, Michael	
Lamonica, Frank	
Robinson, Richard	

AABNCP REMOTE TERMINAL SYSTEM STUDY

A general work plan has been given to IS (Al Barnum) for review. ISI personnnel will prepare a more detailed work plan to use during the Remote Terminal Study. Also, the AABNCP SPO will be formally notified of our plan which calls for work to start in February 1974 and to complete in March 1975. It appears that the two jobs would involve the same offices and possibly some of the same people (ESD, MITRE, and RADC). Additionally the Remote Terminal Emulator may be the device proposed by ESD/YSE to access the RADC computer for the AABNCP RTS study (see YSE letter undated, subject "RADC FY-74 Support for the 481B Program").

The detailed work plan prepared by Major Patterson and Mr. Kesselman appear to indicate some overlap or a logical extension to study the GCOS or WWMCCS capability to handle remote transaction generated by the AABNCP terminals.

WWMCCS TRAINING

The training program to date is not fixed to include a scheduled program. The objective now is to have several engineers complete a series of Honeywell sponsored courses related to the GCOS software. The course include: 1) 601 Introduction to series 6000 (2 days), 2) 602 6000 Utilities and Job Control Language (3 days) 3) 605 General Macro Assembly Programming (10 days), 4) 607 Disk Management (4 days) 5) 620 System Software (5 days), 6) 630 GCOS analysis (10 days). The rest of the training involve the establishment of study teams to load and run the WWMCCS software and programs on the H635 computer. As shown above the teams will consist of four to five people from throughtout IS and will include at least two who have completed Honeywell course 630 (item 6).

The following individuals have completed the course series to course #630:

Walker, Robert

Kalynycz, John

Wingfield, Michael

Other individuals who have not completed the courses but are considered knowledgeable of the GCOS software include: Mclean, Liuzzi, Van Alstine, Trad, Robinson, Mark, and Falzarano.

Donald Mark and David Trad have expressed interest in attending the honeywell 630 course (now designated courses 650, 660, and 670) either at Mclean Va. or Phoenix Ar. Bear in mind that the course at Phoenix costs $200 per man per week; however, there is some indication that Honeywell will revise its policy of charging tuition for advanced courses as the 650 series (formally 630).

The following schedule shows the available course offerings at both Phoenix and Mclean.

Jan 7	650 only	Phoenix
Feb 4, 11	650,660	Phoenix
Mar 4,11	650,660	McLean
Mar 11,18,25	650,660,670	Phoenix
Jun 10,17,24	650,660,670	Phoenix

Sep 25,30	650,660	Phoenix

WWMCCS TASKS IN RADC/IS

ISIM (Information Management Sciences Section)

AABNCP ----- A proposal has been written in a general format that describes what assistance RADC will provide ESD/YSE during the study of the effect of Remote Terminal (AABNCP) transactions on the operations of WWMCCS or GCOS operating systems. ESD/YSE expressed a desire to have RADC assign man power to serve as liaison between the 481B SPO, MITRE, and RADC, and, to assist in the RTS studies. RADC must decide if the required manpower is available in RADC/IS and how will be allotted for this effort. Since this study was to provide input for the 481B Block I phase, a decision must be made soon or the need for the work will vanish with the beginning of the Block II phase scheduled for implementation in 1977.

427M ------- This effort supports ESD in the Cheyenne Mountain Improvement Program, called system 427M which replaces the current 425L system at NORAD in Colarado Springs Colorado. The job orders applicable are 427M0101 and 427M0201. The lead engineer is Mr. E. F. La Forge. ISIM is currently programmed for 0.4 man years for the fiscal year (74). The work consists mainly of monitoring the hardware and system integration contractors efforts. The system consists of two major segments: 1) The NORAD computer system (H6070 machine) 2) The Space Computation Center (H6070 machine). The chief areas requiring support and the individuals assigned are as follows: Displays/Data processing -- La Forge, Lombardo 2) Reliability and Compatibility -- Fuchs 3) EMI/RFI -- Long 4) Communicatons -- Manzo.

ISIS (Software Sciences Section)

JOVIAL ----- RADC is providing a J3 compiler which will will run on the H6000 series computer for implementation with WWMCCS. The compiler validation tool is JOCIT. The individuals at RADC assigned to the task of validating the compiler are Mr Richard Motto and Samuel Dinitto.

ISFO (Facility Operations Office)

------- The facility is currently supporting efforts to evaluate the Network Processign Supervisor, Testing of the WWMCCS operating system, and Testing of the standard GCOS system.

ISFE (Facility Engineering Office)

ISFA (Special Projects Office)

FOCAL POINT - Mr. Anthony DeMinco is designated WWMCCS focal point as established by job order WWCS0001. Most of the work involved has been in compiling and desseminating information received relating to the WWMCCS community and the WWMCCS operating system.

ISCA (Computer Architecture Section)

SOFTWARE --- The assigned job order is 55500802 subject Software First. The asssigned engineers are Major William Patterson and Sgt Robert Walden. A proposal has been submitted to the Advanced Airborne Command Post (481B SPO) to emulate a WWMCCS machine using micro-programmable processor. The purpose of the processor is to test the concept for possible implementation as an on-board computer.

NPS -------- The assigned job order is 55810902, subject Network Processing Supervisor evaluation. The assigned engineers are Maj William Patterson, Mr. Murray Kesselman. Mr. Robert Walker, Mr. Thomas Lawrence, Mr. Mark Theopolis. The NPS is a new operating system for the HIS Datanet 355, and front-end Processor for the WWMCCS computer. The NPS is being run on the Datanet 355 at RADC as a TEST system. A detailed test plan has been published and work is scheduled to begin in January 1974.

ISCP (Interactive Processing Section)

20972 Distribution
Richard H. Thayer, Frank J. Tomaini, Rocco F. Iuorno,

(J20972) 19-DEC-73 08:24; Title: Author(s): David L. Daughtry/DLD2;
Distribution: /RHT2 FJT RFI; Sub-Collections: NIC; Clerk: DLD2;
Origin: <DAUGHTRY>WWMCCS-STATUS.NLS;1, 19-DEC-73 08:22 DLD2 ;

USING THE IMLAC TO ACCESS DNLS

This file contains beginning instructions for setting up the IMLAC and logging into DNLS (the display version of NLS). 1

FIRING UP THE IMLAC 1a

The IMLAC display is controlled by a small computer (located under the table). Because it is a computer, it must have the proper program loaded in it before it can talk to the TIP or NLS. If the IMLAC is already turned on, and there are some numbers at the top of the screen, then GOTO INSTRUCTION (1b4b). If not, then check to see if the program is OK, 1a1

Turn on the power switch, located in the upper left rear corner of the machine. 1a1a

Go to the back of the table and set the start switch (white) to the 100 position. 1a1b

Press the reset button (yellow) on the back of the table. 1a1c

If the numbers 003000080 123.......appear at the top of the screen, the program is OK 1a1c1

GOTO INSTRUCTION (1b4b) 1a1c1a

If no numbers appear, then you must reload the program. To do this: 1a1d

Rewind the tape in the recorder by pushing the lever on the recorder to the left and holding it until the tape is rewound. 1a1d1

Go to the back of the table and set the start switch (white) to the 40 position. 1a1d2

start the recorder going by pressing the center lever forward 1a1d3

After about 5 seconds press the reset button (yellow) on the back of the table. 1a1d4

The program has successfully loaded when a string of numbers appears on the screen. It takes about 2 minutes to load, so don't be impatient. When the numbers appear, stop the recorder. 1a1d5

GETTING THE IMLAC TO TALK TO THE TIP 1b

DLS 19-DEC-73 08:50 20973

USING THE IMLAC TO ACCESS DNLS

Each IMLAC is directly connected to the TIP by a wire. Each IMLAC is on a different port; right now ports 1, 2 & 8. The port number is on a card taped to the left front of the IMLAC. 1b1

If the TIP has crashed, been brought down for maintenence or if you have been diconnected from SRI by network problems, you may have to reset the TIP port to which your IMLAC is connected. To do this: 1b2

Go to another terminal..TI, Execuport, etc. and call up the TIP. Then type: 1b3

e (to get the TIP's attention) 1b3a

Depending on the IMLAC you are using, type: 1b3b

@1 e a <lf> @2 e a <lf> @8 e a <lf> 1b3c

@1 i e <lf> @2 i e <lf> @8 i e <lf> 1b3d

@1 d r 761 <lf> @2 d r 633 <lf> @8 d r 633 <lf> 1b3e

@1 g b <lf> @2 g b <lf> @8 g b <lf> 1b3f

where <lf> means the line feed key 1b3f1

SPACES ARE IMPORTANT Note that the data rate for 1 is different than for 2 and 8. 1b3f2

the @ key on the IMLAC is the 0 key in the righthand cluster on the keyboard 1b3f2a

You are now ready to connect to SRI. Do this by returning to the IMLAC and typing: 1b4

@l 2 <lf> the same as you would using the TI or Execuport; or: 1b4a

If the connection throught the ARPANET has not been broken or SRI has not gone down since the last session at the IMLAC, then check to see if the string of numbers at the top of the screen reads 003000080 123.......... If the 7 is still on you will not be able to communicate with the TIP. Any of the numbers at the top of the screen can be turned on or off manually from the keyboard by typing the number while depressing the control key. If the 7 is still on, type control 7 to turn it off. 1b4b

Then type a control C, and you will be directly connected to SRI. 1b4b1

USING THE IMLAC TO ACCESS DNLS

LOGGING INTO TENEX 1c

You do this the same way as you would on the TI or Execuport by giving your name, password, etc. After being assigned a job number etc. you should type: 1c1

width 62 <cr> 1c1a

This is not absolutly necessary, but it sets the screen width to 62 characters, which prevents wrap around when printing messages or linking to someone. 1c2

You may now exercise any of the commands in TENEX...EXCEPT NLS 1c3

ENTERING NLS 1d

Before entering NLS, you may have to set the TIP port to which you're connected and you will have to tell TENEX about the special terminal you have. 1d1

To set the TIP type: 1d1a

@e n <lf> (echo none) 1d1a1

@i n <lf> (intercept none) 1d1a2

If you get a ? when typing the @, then it means that you are already in the echo none and intercept none mode. 1d1b

To tell TENEX that you have an IMLAC, type: 1d1c

term<esc>im<esc>w<esc><cr> where <esc> means the escape key. 1d1c1

After doing this the 7 in the string of numbers at the top of the screen will be turned on. This indicates that TENEX understands that you have a terminal called IMLAC with the long-vector option. 1d1c1a

Now type NLS<cr> to enter NLS. 1d1d

The 6 in the string of numbers at the top of the screen will be turned on. This means that you are in NLS. The screen will go blank...don't panic...depending upon the load on the system, it may take up to 30 seconds to display your initials file. 1d1d1

CONGRATULATIONS YOU HAVE MADE IT 1d1d2

For instructions on how to work the beast now you're there, consult the mannual next to the terminal or print out your own copy on an Execuport or TI by saying Print Plex (userguides,arclocator,xb).....The DNLS instructions are contained in several files as indicated in the arclocator file. Pick one you think you might like and jump on the link and print it out...or see any IMLAC user..Stone, Lawrence, Cavano, Rzepka, Panara, etc.. 1d1d2a

RENTERING NLS 1e

Any number of "wierd" situations may arise while using the IMLAC. It may not respond because NLS, TENEX, ARPANET or the IMLAC program has been screwed up. Its not always easy to determine which, but here are some common problems, their diagnosis and treatment. 1e1

PROBLEM..The screen goes completely blank. 1e1a

DIAGNOSIS..You may have loaded a file with tabs in it. The IMLAC has problems right now handling more than a few tabs. It will be fixed, but we have to live with it for now. A related problem is having the statement numbers turned on while loading the file (although they may be turned on after the file is loaded). This also blows he IMLAC program. If the text of the file you are displaying contains a control G, this will also blow the IMLAC's mind. These are the currently known no-no's. 1e1a1

TREATMENT..start from the ground up..GOTO INSTRUCTION (1b). 1e1a1a

DIAGNOSIS..There may have been a momentary fluctuation in the power. This causes the IMLAC to go into a "save you ass" loop in its program, which hopefully prevents the IMLAC program from being completely destroyed, but will also cause the screen to go blank. 1e1a2

TREATEMENT..Hit the reset button on the back of the IMLAC, with switch in 100 position. You should get the string of numbers on the top of the screen. Type control C, reset<cr>, term<esc>im<esc>w<esc><cr>, nls<cr> and you should be back in business. 1e1a2a

PROBLEM..No response to commands, the damn thing just sits there. 1e1b

DIAGNOSIS..The ARPANET may be heavily loaded. Delays of this type also occur due to momentary problems at SRI. 1e1b1

TREATEMENT..Have a little patience..like a minute or so. If you are too hasty in restarting the program in the IMLAC, you may waste more time than you gain. Light up a weed, go get a cup of coffee..things may have fixed themselves when you return. 1e1b1a

DIAGNOSIS..SRI or the ARPANET may have crumped. You could get a NET TROUBLE message, or you might get a HOST DEAD message. 1e1b2

TREATEMENT..If the host went dead, you will have to reestablish a connection to SRI. Hit the restart button on the back of the IMLAC (switch in position 100). The TIP port should have been reset for you, but this does not always happen. If there is no response to an @l 2<lf>, the GOTO INSTRUCTION (1b3). 1e1b2a

TREATEMENT..If there has been ARPANET problems, you may still be logged in at SRI, but in a detached state. Reestablish the connection to SRI, and type where<esc>username<cr>. If it lists you in the detached mode, then say att<esc>username<esc>password<esc>job number <cr>. You should then do a control C, reset, @ e n, @i n, term im w, nls. 1e1b2b

20973 Distribution

Larry M. Lombardo, Anna A. Cafarelli, Roberta J. Carrier, Donna R. Robilotta, David L. Daughtry, Richard H. Thayer, Frank J. Tomaini, Mike A. Wingfield, Edmund J. Kennedy, Ray A. Liuzzi, John W. Johnson, Donald Van Alstine, Dean F. Bergstrom, William P. Bethke, Frank S. LaMonica, William E. Rzepka, Rocco F. Iuorno, Frank P. Sliwa, Thomas J. Bucciero, Robert E. Doane, David A. Luther, Roger B. Panara, John L. McNamara, Joe P. Cavano, Duane L. Stone, Marcelle D. Petell, Josephine R. Stellato, Robert K. Walker, Thomas F. Lawrence, James H. Bair,

USING THE IMLAC TO ACCESS DNLS

(J20973) 19-DEC-73 08:50; Title: Author(s): Duane L. Stone/DLS;
Distribution: /RADC; Sub-Collections: RADC; Clerk: DLS;
Origin: <STONE>DNLS.NLS;2, 19-DEC-73 08:48 DLS ;