OFFICE OF ENGINEERING RESEARCH

OKLAHOMA STATE UNIVERSITY

A PROGRAM FOR SELECTING, EDITING AND DISSEMINATING ENGINEERING AND SCIENTIFIC SUBJECT MATTER FROM NASA TECHNICAL REPORTS

QUARTERLY REPORT

TO

NATIONAL AERONAUTICS

AND

SPACE ADMINISTRATION

REPORT NO. ER 69-I-4

DATE: May 31, 1969

A PILOT PROGRAM FOR SELECTING, EDITING, AND DISSEMINATING ENGINEERING AND SCIENTIFIC EDUCATIONAL SUBJECT MATTER FROM NASA TECHNICAL REPORTS

QUARTERLY REPORT
March 1, 1969 through May 31, 1969

COLLEGE OF ENGINEERING
OKLAHOMA STATE UNIVERSITY
STILLWATER, OKLAHOMA

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QUARTERLY REPORT

I. INTRODUCTION

Objectives of this nine-month phase, December 1968, through August 31, 1969, of the NASA Pilot Program were outlined in the letter proposal (ER 69-T-39), dated November 7, 1968. Efforts during this quarter of the program have been concentrated on the seven points of redirection indicated in the proposal. Highlights of the quarter activities were:

1. A Consultants Conference was held in Washington, D.C.,on March 5, 1969. Seven consultants, representatives of NASA, senior authors and program administrative personnel attended.
2. A proposal for two years funding of a program for continuation of Instructional Monograph preparation was submitted to the American Society for Engineering Education. Upon ASEE approval, the proposal will be submitted to the National Science Foundation.
3. Contact with the Army Research Office has continued to complete arrangements for funding a "Pilot Program in Technology Transfer Through Educational Monographs for Self Study". A completion of this contract should be made during July, 1969.
4. Arrangements for the preparation of additional Instructional Monographs are being developed with several authors. The actual preparation of the documents would occur during the summer months.

II. INSTRUCTIONAL MONOGRAPHS

A. Preparation of Instructional Monographs

Two Instructional Monographs were completed for distribution during the quarter. They were:

CS-8, "Synthesis of Minimal Sensitivity Sampled-Data Control Systems," by L. L. Grigsby and W. A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute.

HT-9, "Thermal Modeling," by Paul L. Miller, Mechanical Engineering, Kansas State University and John A. Wiebelt, Mechanical Engineering, Oklahoma State University.

A total of 23 Instructional Monographs have been completed and are ready for distribution. The preparation of two other Instructional Monographs has been delayed, but will be completed during the next quarter. They are:

CS-9, "An Example of Decoupling in the Design of Multivariable Control Systems," by W. A. Blackwell and L. L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute.

CS-10, "Realization of a Digital Controller," by W. A. Blackwell and L. L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute.

An additional Instructional Monograph has been started by Nicholls Professor Wayne C. Edmister. This document will be completed during the summer -- after Professor Edmister returns from meetings in India and South America.

Arrangements for the preparation of additional Instructional Monographs are being discussed with qualified authors, some outside

of Oklahoma State University. These documents will be prepared during the 1969 summer quarter of the NASA Pilot Program.

The information in Table 1 summarizes the Instructional Monograph preparation portion of the program to date.

TABLE 1. MONOGRAPH PREPARATION

	Number of Monographs
1. Ready for distribution	23
2. Being readied for reproduction	2
3. Being written	1
4. Developed -- not reproduced because of material technical difficulties.	4
	30

B. Dissemination of Instructional Monographs

An active publicity program to encourage general dissemination of Instructional Monographs has not been conducted this quarter. Previous publicity and interest by users continues to generate requests for copies of Instructional Monographs. The decision to decrease publicity was made in an effort to concentrate on evaluation of the program and develop other sources of funding. However, all users of Instructional Monographs will be mailed an updated listing of abstracts during the summer months. This technique will be used to help maintain the present level of interest.

Figure 1 illustrates the number of instructor copies of Instructional Monographs requested by quarter. A total of 261 instructor copies were requested during this reporting period.

Instructional Monographs have been requested by 270 professors in 113 universities which are located in 39 states and 5 foreign countries. A total of 2,461 instructor copies and 6,609 student copies have been mailed to these educators. In addition, a total of 827 instructor copies and 166 student copies have been requested by 151 practicing engineers in 62 industrial organizations.

C. Evaluation of Instructional Monographs

There have been 258 evaluation forms returned by 62 professors at 42 universities located in 30 states and 68 practicing engineers in 10 industrial organizations. Number of completed evaluations by specific Instructional Monograph as listed in Appendices I and II, is shown in Figure 2. An attempt has been made to obtain at least 10 evaluations for each Monograph.

The receipt of evaluations decreased during this quarter. A listing of professors and practicing engineers who have not returned an evaluation form was prepared. These 178 individuals were mailed a letter encouraging them to return evaluations on the Instructional Monographs they have reviewed or used in educational situations. Results of this correspondence should be obtained during the summer and early fall. A copy of the letter mailed is included as Appendix III.

D. Summary - Instructional Monograph Dissemination and Evaluation

The following table summarizes the dissemination and evaluation statistics for the NASA Pilot Program. The statistics illustrate the good response that has been received from individuals evaluating the existing Instructional Monographs during the past

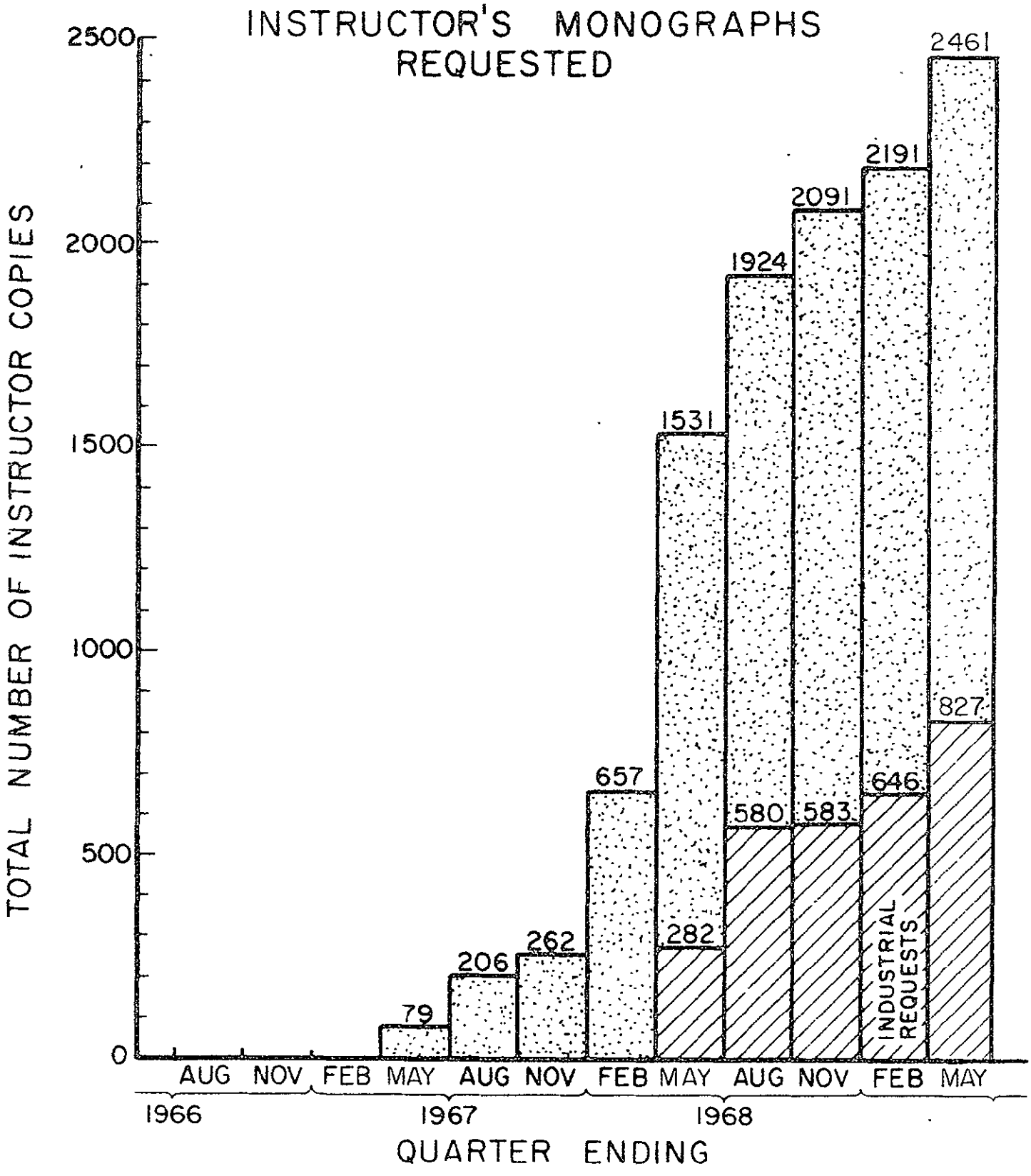

INSTRUCTOR'S MONOGRAPHS REQUESTED
TOTAL NUMBER OF INSTRUCTOR COPIES
2500
2000
1500
1000
500
0
79
206
262
657
1531
282
1924
580
2091
583
2191
646
2461
827
INDUSTRIAL REQUESTS
AUG NOV FEB MAY AUG NOV FEB MAY AUG NOV FEB MAY
1966
1967
1968
QUARTER ENDING

Figure 1

18 months. Twenty-three percent of the professors and 45 percent of the practicing engineers requesting Instructional Monographs for review or classroom use have returned one or more evaluations of specific Monographs.

TABLE 2

Instructional Monograph Dissemination and Evaluation

Dissemination of Monographs	University	Industry	Total
A. Instructor copies mailed	1,634	827	2,461
B. Student copies mailed	6,443	166	6,609
C. Professors requesting Monographs	270		
in Universities	113		
in States	39		
in Foreign Countries	5		
D. Practicing engineers requesting Monographs		151	
in Industrial Organizations		62	

Evaluations Returned	University	Industry	Total
A. Number of Evaluations returned	153	105	258
B. Professors returning evaluations	62		
in Universities	42		
in States	30		
C. Practicing engineers returning evaluations		68	
in Industrial Organizations		10	

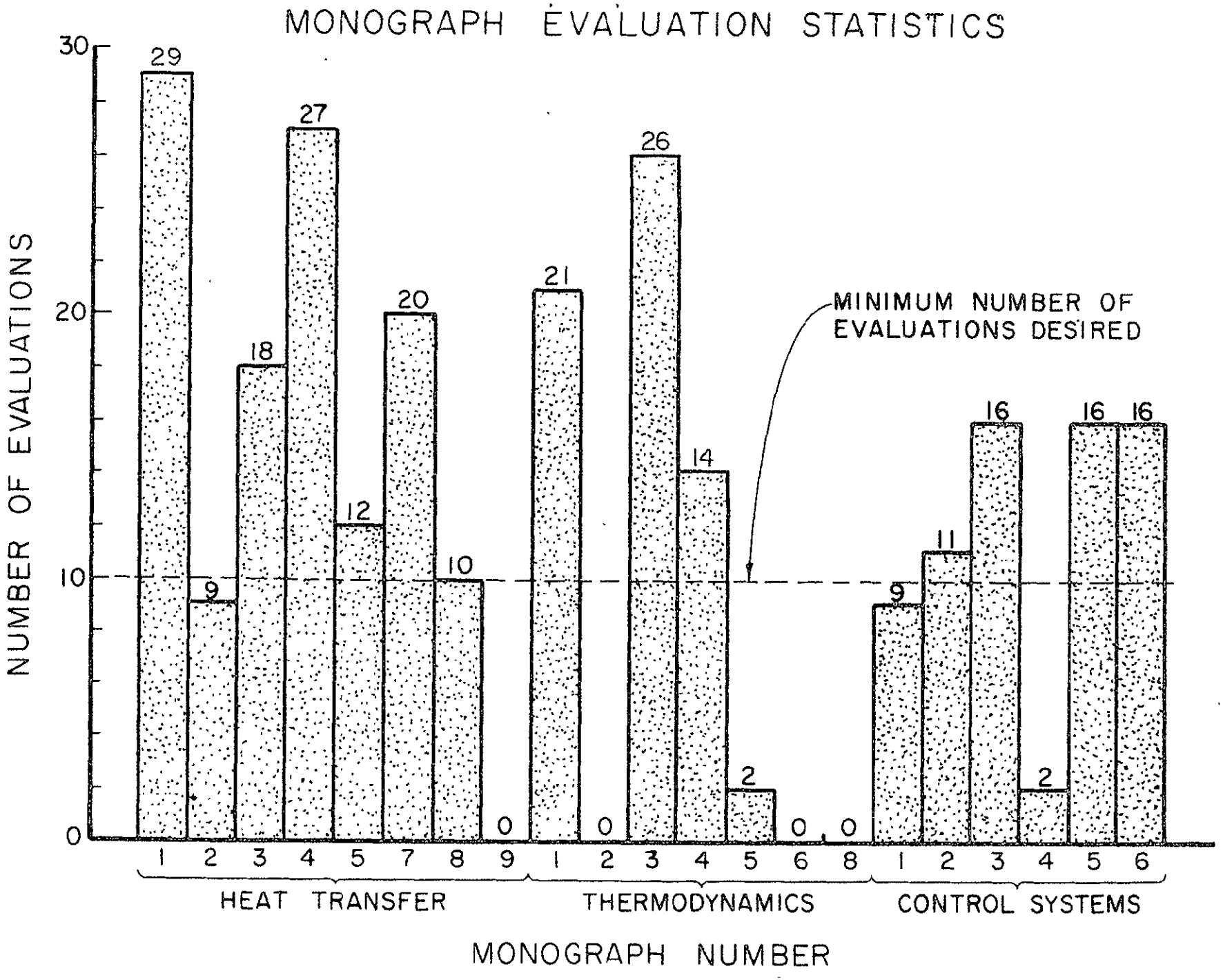

MONOGRAPH EVALUATION STATISTICS
NUMBER OF EVALUATIONS
30
20
10
0
29
9
18
27
12
20
10
0
21
0
26
14
2
0
0
9
11
16
2
16
16
MINIMUM NUMBER OF EVALUATIONS DESIRED
1 2 3 4 5 7 8 9
1 2 3 4 5 6 8
1 2 3 4 5 6
HEAT TRANSFER
THERMODYNAMICS
CONTROL SYSTEMS
MONOGRAPH NUMBER

Figure 2

III. COLLOQUIA

A "Conference on the Transfer of Technological Information to Educational Use" was held on Wednesday, March 5, 1969, in Washington, D.C. Seven consultants, representatives of NASA, senior authors and program administrative personnel attended the conference. Appendix VI lists the conference participants. The agenda for the conference was included in the Quarterly Report, dated February 28, 1969.

The conference participants concluded that an extension of the NASA Pilot Program from the pilot stage to a comprehensive recovery of useful technology in Monograph form should involve a modification of the system of selection of Monograph topics and authors and the method of contracting for editing and writing services as well as an expansion into other specialized technical areas. Material sources outside of those produced from NASA organizations should be used to allow further tests of the techniques already developed.

The opinions of the consultants can best be indicated by several excerpts from their reports on the Washington, D.C. conference, categorized in three general areas.

1. Basic Ideas of Instructional Monographs and the Acceptance of the Concept.

   --The most impressive result of the meeting (March 5, 1969) was the strong affirmation of the potential value of a publishing and educational program of this sort (NASA Pilot Program).

   --The enthusiasm of the entire group for your efforts was most exciting, and I think this indicated clearly the potential value of the approach.

   --There is an urgent need to shorten the time gap between the discovery of the new technological principles and their dissemination to students and to practicing engineers.

2. Identification of Significant Material for Instructional Monographs.

   --They (Monographs) could revolutionize the teaching process itself. One could envision tailor-made courses of the future put together by use of selected monographs alone. Certainly the teaching of design...could use the monographs to great advantage.

   --Panels of experts, selected by the professional societies, should not only choose the material but should indicate what fundamental background the student is expected to have.

3. Identification of Appropriate People to Write Instructional Monographs.

   --People who are recognized authorities and have demonstrated writing skills should author the Monographs. These can also be selected through the professional societies.

As a result of the consultants' comments, a proposal was prepared. It is discussed in Section IV of this report.

The above comments plus others presented by the consultants along with the experience and results obtained in the NASA Pilot Program indicate that the Instructional Monograph method is one of the better ways to insure that scientific and technological developments in current research are retrieved and made available to the maximum extent for the nation's educational and industrial benefit.

Appendix V provides greater detail on the Consultants Conference. Section A of the Appendix presents a categorization of the comments, Section B contains the unedited reports of the consultants and Section C provides resumes on the seven consultants.

IV. PROGRAM SUPPORT - INSTRUCTIONAL MONOGRAPHS

A. American Society for Engineering Education

As a result of the NASA Pilot Program evaluation and the response of the consultants, a proposal (ER 69-T-90) was prepared by Oklahoma State University for submission to the American Society for Engineering Education for consideration at their annual meeting in June, 1969. When approved by ASEE, the proposal for funding will be submitted to the National Science Foundation.

The objective of the program is to create an environment where authorities in specialized technical areas will find it feasible and desirable to convert research information into Instructional Monographs.

The proposal suggests a mutual involvement of the American Society for Engineering Education, the educational committees of technical societies, and university faculty in obtaining the objective of efficient and economical technology transfer. The proposed organization will provide interaction between the universities and the professional engineering disciplines. The American Society for Engineering Education, through its Council of Technical Divisions and the cooperation of the technical societies, will provide recognized expertise in determining the appropriate general subject areas and specialized technical areas in which Instructional Monographs would be prepared. These organizations also will be able to identify prospective authors who are qualified and respected on the basis of their contributions to the specialized technical areas.

Oklahoma State University, on the basis of the experience gained in the OSU-NASA Pilot Program, will function as the operating unit within the proposed organization. Where ASEE's and the technical societies' contribution will be informational and advisory, OSU's contribution will be decisional. This proposed team should provide a blend of recognition and experience that should encourage authors to participate in this technology transfer technique.

The organization presented in the proposal is designed for the proper selection of topics and recognized authorities in the topic areas. The author is the key to the program. Outstanding contributors are a necessity. Program Development and Scope of Activity sections in the proposal deal with the mechanism of obtaining topics and selecting people. These mechanisms should not overshadow the primary objective of the program: to obtain the right people in a right working environment to write effectively about the right topics. For further information on the details of the proposal, refer to Oklahoma State University proposal ER 69-T-90, dated June 2, 1969. (A copy has been submitted to the NASA Pilot Program Technical Monitor, National Aeronautics and Space Administration.)

B. Army Research Office

Proposal ER 69-T-35, entitled "A Pilot Program in Technology Transfer Through Educational Monographs for Self Study" was submitted to the Army Research Office, November 1, 1968. Final contract negotiations will be completed after selection of subject areas where sufficient in-house engineers are available to participate in evaluation. A decision on funding the proposal is expected by August 1, 1969.

V. VISUAL BRIEFS

A. Dissemination

The number of Visual Briefs ready for distribution to educational institutions and industrial organizations remains at 21. There are no plans to prepare additional Visual Briefs. However, the existing films are being supplied to users upon their request.

As reported in the Quarterly Report, dated February 28, 1969, there are no plans contemplated to further advertise the availability of the Visual Briefs. Requests for use of the films will only originate from existing users or individuals who request information on Instructional Monographs. (They will be provided abstracts on the Visual Briefs.)

A total of 300 requests to use the technical films have been received; however, 27 requests have not been filled because of a slow rate of return of films by borrowers. Appendix IV shows the statistics on the technical films mailed to requestors.

B. Evaluations

A total of 134 evaluations have been received. Figure 3 illustrates the number of evaluations received for each Visual Brief. Fifteen Visual Briefs have been evaluated by five or more users; five evaluations for each Visual Brief were specified in the Work Statement.

Although the Visual Briefs are not requested as frequently as Instructional Monographs, they are positively received by the users. A greater percentage of users return the evaluation forms for the Visual Briefs than the requestors of Monographs.

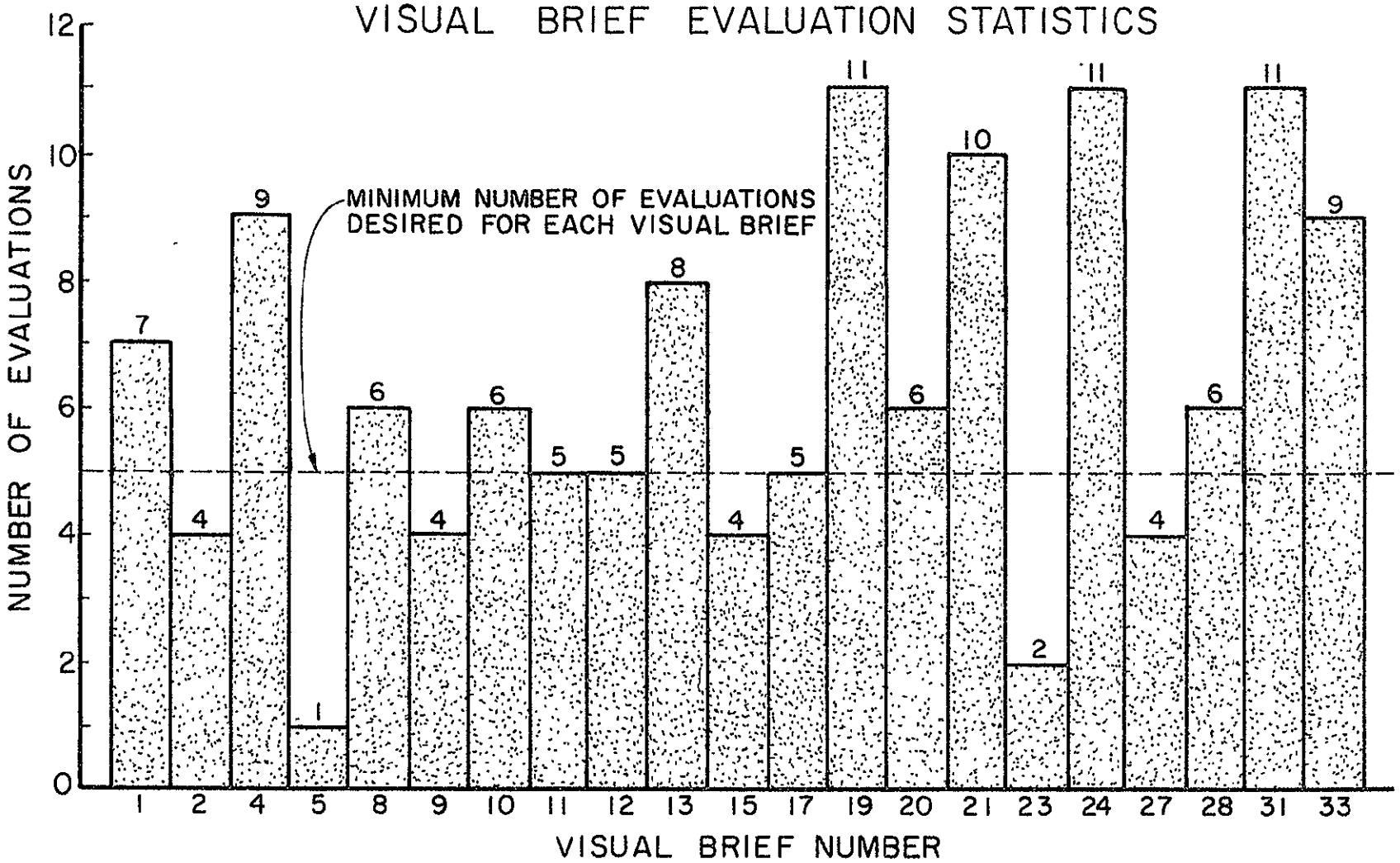

VISUAL BRIEF EVALUATION STATISTICS
NUMBER OF EVALUATIONS
VISUAL BRIEF NUMBER
MINIMUM NUMBER OF EVALUATIONS DESIRED FOR EACH VISUAL BRIEF
0
2
4
6
8
10
12
1 2 4 5 8 9 10 11 12 13 15 17 19 20 21 23 24 27 28 31 33
7 4 9 1 6 4 6 5 5 8 4 5 11 6 10 2 11 4 6 11 9

Figure 3

APPENDICES

APPENDIX I

UNIVERSITY MONOGRAPH DISSEMINATION STATISTICS THROUGH MAY 31, 1969

Monograph Number	Instructor's Copies Sent	Student's Copies Sent	Evaluations Received
CS-1	69	263	4
CS-2	89	626	9
CS-3	84	501	11
CS-4	98	360	0
CS-5	108	428	10
CS-6	116	467	10
CS-7	2	0	0
CS-8	2	0	0
HT-1	146	591	17
HT-2	88	196	6
HT-3	120	585	15
HT-4	111	567	23
HT-5	97	181	7
HT-7	96	247	7
HT-8	80	390	3
TD-1	105	405	10
TD-2	4	0	0
TD-3	111	397	13
TD-4	80	203	7
TD-5	16	36	1
TD-6	8	0	0
TD-8	4	0	0
	1,634	6,443	153

APPENDIX II

INDUSTRIAL MONOGRAPH DISSEMINATION STATISTICS THROUGH MAY 31, 1969

Dissemination Summary by Monograph Number

Monograph Number	Instructor's Copies Sent	Student's Copies Sent	Evaluations Received
CS-1	29	0	5
CS-2	22	0	2
CS-3	42	0	5
CS-4	40	0	2
CS-5	32	0	6
CS-6	42	0	6
CS-7	0	0	0
CS-8	0	0	0
HT-1	52	16	12
HT-2	35	15	3
HT-3	44	15	3
HT-4	37	15	4
HT-5	55	15	5
HT-7	81	15	13
HT-8	64	15	7
TD-1	47	15	11
TD-2	16	0	0
TD-3	90	15	13
TD-4	38	0	7
TD-5	38	15	1
TD-6	9	0	0
TD-8	14	0	0
	827	166	105

Oklahoma State University

College of Engineering, Office of the Dean

STILLWATER, OKLAHOMA 74074
(405) 372-6211, EXT 7551

May 12, 1969

Dr. J. L. Baker
Mechanical Engineering
Pennsylvania State University
University Park, Pennsylvania 16802

Dear Dr. Baker:

You have received copies of Instructional Monographs prepared under the NASA Pilot Program during the last 12 to 18 months. We hope you have found them to be beneficial in providing you with new information or for use in classroom instruction or self study.

One of our objectives in the NASA Pilot Program is to obtain evaluations of the Instructional Monographs from individuals who have reviewed them or used them in some learning situation. If you have had an opportunity to review the documents, we would appreciate your comments. As a guide to the type of information we need, we are enclosing an evaluation sheet for your convenience. Your assistance in this evaluation phase of our program would be appreciated.

Thank you again for your interest in the program. If you want additional material, please write to us.

Sincerely,

Robert L. Overton
Deputy Director
NASA Pilot Program

RLO:mdc

Enclosure

cc: Kenneth A. McCollom
Program Director

APPENDIX IV

VISUAL BRIEF DISSEMINATION STATISTICS
THROUGH MAY 31, 1969

Dissemination Summary by Visual Brief Number

Visual Brief Number	Number Sent	Unfilled Requests	Evaluations Received
VB-1	11	0	7
VB-2	5	1	4
VB-4	20	5	9
VB-5	11	0	1
VB-8	16	8	6
VB-9	10	0	4
VB-10	19	1	6
VB-11	9	1	5
VB-12	15	3	5
VB-13	22	7	8
VB-15	12	0	4
VB-17	9	0	5
VB-19	20	0	11
VB-20	9	1	6
VB-21	11	1	10
VB-23	6	0	2
VB-24	20	0	11
VB-27	9	0	4
VB-28	9	0	6
VB-31	17	0	11
VB-33	13	0	9
	273	27	134

APPENDIX V

This Appendix contains the following information regarding the Consultants' Conference held in Washington, D.C., on March 5, 1969.

V-A A composite of specific comments made by the consultants.

V-B Unedited reports received by the participating consultants.

V-C Resumes of the seven participating consultants.

APPENDIX V-A

FOREWORD

This composite was developed from specific comments made by the consultants in their reports on the "Conference on the Transfer of Technological Information to Educational Use" held in Washington, D.C., on March 5, 1969.

The comments of the authors have been categorized into four general areas.

A. Basic idea of Instructional Monographs and the acceptance of the concept.

B. Identification of significant material for Instructional Monographs.

C. Identification of appropriate people to write Instructional Monographs.

D. Organization of the program and securing the necessary funding.

The last three categories have been subdivided for clarity.

The consultants will be identified on each question or statement by the following code.

Code	Consultant
(1)	Lawrence N. Canjar
(2)	John G. Truxal
(3)	John R. Howell
(4)	Warren M. Rohsenow
(5)	Newman A. Hall
(6)	Stanley B. Adler
(7)	Harold Chestnut

Copies of the Consultants' Reports follow this composite.

COMPOSITE OF EXCERPTS

A. Basic Idea of Instructional Monograph and Its Acceptance.

--The most impressive result of the meeting (March 5, 1969) was the strong affirmation of the potential value of a publishing and educational program of this sort (NASA Pilot Program). [2]

--The enthusiasm of the entire group for your efforts was most exciting, and I think this indicated clearly the potential value of the approach. [2]

--There is an urgent need to shorten the time gap between the discovery of new technological principles and their dissemination to students and to practicing engineers. [1]

--There was general agreement that there exists in NASA literature and other government publications much basic and applied research results which need a more satisfactory dissemination....[4]

--The most important point...was that this transfer is as vital a part of the technological utilization of the research performed as the primary physical application for which it was originally intended. [1]

--There is no doubt...that providing self-contained clearly written monographs describing novel developments in technology is of great potential value...The pilot program itself does a good job of providing such monographs. The program, in my opinion, has some flaws in detail; its overall value is without question, and support for its continuation should be sought. [3]

--Although the preparation of Monographs was not the only product of this early program, it was certainly the outstanding one. The monographs go far beyond the original articles, technical notes and documents...The information being reprocessed by the monographs is seen to be involved not only with the basic data but with the engineering calculation methods...A real need for much more of this sort of publication exists. [6]

--I am of the opinion that the fundamental idea that some of the more novel and more worthwhile technologies developed on R & D type contracts can serve as an effective source for the preparation of special material to supplement books and full technical reports as an aid to education...By special reports, of a character generally like the monographs in this project (NASA Pilot Program)..[7]

--I have been encouraging the development of monographs in this general spirit for many years...In all my own efforts in this direction, I have encountered indifference and frustration, so I commend you on your success. [5]

B. Identification of Significant Material for Instructional Monographs.

1. SELECTION OF SUBJECT AREAS

--They (monographs) could revolutionize the teaching process itself. One could envision tailor-made courses of the future put together by use of selected monographs alone. Certainly the teaching of design...could use the monographs to great advantage. [1]

--I would hope that any expansion of the program in the future would broaden the technical base from which the material can be drawn...[2]

--If the program is expanded past the pilot stage, some guidelines on subject area and a pre-publication evaluation of the material chosen should be incorporated. [3]

--It is important that the particular subject matter for monographs be chosen in technical areas not necessarily limited to the three areas selected. [7]

--It is desirable for an initial validation to be made by a group of technical leaders in the area involved...[7]

2. SELECTION OF SUBJECT MATERIAL FOR INSTRUCTIONAL MONOGRAPHS

--Only that which is novel with good indication of being reapplied in the future on a broader scale should be considered. [1]

--Panels of experts, selected by the professional societies, should not only choose the material but should indicate what fundamental background the student is expected to have. [1]

--I propose that, through the Education Committee in each engineering society, a cooperative program be organized whereby experts in various areas will agree to prepare just monographs in the field of his own specialty. [6]

--...you have been unfortunately restricted in the use of only NASA technical reports as a basis for your monographs...It seems that this whole matter of the choice of an appropriate set of topics is critical in determining the success of the program, and I suspect that a major effort must be made to enlist the assistance of knowledgeable people in the field to make the particular topic selection. [2]

--The monographs should not be limited only to information developed at NASA but should incorporate information on the same subject developed elsewhere. [4]

--...these monographs are probably most useful as out-of-class supplementary material and only occasionally as lecture material. Self-teaching should be the object, and selection of topics for this purpose a requirement...the program should aim for motivating and enlightening the student, not the senior author of the monograph. Selection must be made on the basis of material available and needed, and this takes more than one person, [3]

--Finding good subject material for monographs may well be the hardest part of the process. [3]

--The subject matter of the well-prepared monograph may actually only receive ten or twenty minutes of classroom time but may be studied more intensively outside of class...I suggested that the monographs be broadened and addressed to the practicing engineer rather than to the classroom lecturer. In this form they would be quite useable as augmentive material for the classroom subject. [4]

--I believe the most effective way to proceed would be to ask three or four people, knowledgeable and experienced in each sub-area, to act as a committee to make the selection (of the monograph topic). [4]

--NASA technical personnel themselves may be able to indicate those several topics in each field which they feel are most significant and why. [7]

--...The possibility of having the original researcher make a greater technical contribution to the preparation of the monograph with the assistance of a Senior Editor having writing and teaching experience, the original report writer might be able to prepare most of the monograph with a limited amount of help to cast the abbreviated report in a fashion more acceptable to the students, both university and industrial. [7]

--Candidate material of the type I feel are worthwhile are those which have a base of practical or experimental verification of clearly presented analytically developed ideas. [7]

C. Identification of Appropriate People to Write Instructional Monographs.

1. SENIOR AUTHORS (EDITORS)

--People who are recognized authorities and have demonstrated writing skill should author the monograph. These can also be selected through the professional societies. [1]

--I personally strongly favor the use of consultants for the preparation of particular monographs, naturally under the direction of a senior author who can maintain the objectives and quality of the program. [2]

--Just how the management of the writing effort can be accomplished on any long term basis is not clear. This starts with the problem of finding an editor for any monograph series. Publishers some years ago, enlisted some outstanding individuals for this and the beginning was auspicious, but even the best of men were unable to keep up with the demands of finding the large number of contributors for individual monographs that were needed. [5]

--What we need is a renowned expert who writes inspiringly and works cheap. Perhaps we can settle for two people...a high priced expert and a cheap inspiring writer. Even this will be tough to find. [3]

2. WRITERS

--...the program directors should evolve a good method of topic selection, and then choose outstanding people to work up the monograph on a consulting fee basis. [3]

--The Monographs should be written by a well-qualified person, preferably one who himself has done some research or writing on the particular topic. [4]

--...one can question whether the whole concept has the qualities necessary to inspire the participation of writers of the caliber necessary for success. [5]

--Certainly the persons preparing the material should be well familiar with the field of concern and desirous of doing the material preparation. [7]

--People who are recognized authorities and have demonstrated writing skill should author the monograph. [1]

--I personally strongly favor the use of consultants for the preparation of particular monographs...I believe that, in each specific topic which is selected, we must find the best individual to write on this subject, including his qualifications as a teacher and his ability to bring this material down to the appropriate undergraduate or elementary graduate level. [2]

D. Organization of the Program and Securing of the Necessary Funding.

1. COST OF PRODUCING MONOGRAPHS

--I think it is unreasonable to think in terms of compensating the writer on the basis of consulting fee type payment for time spent...It would seem to me that if the selected authors were people who were deeply emersed in the specialty area of the Monograph, they would be more than willing to do the writing for a fee in the range of $1000 to $5000. [4]

--I frankly don't think that this program can ever be self-supporting... I am sure also that production costs will rise above the $3000-$7000 mark cited for the present series...The conclusion is that outside support on a continued basis will, in my opinion, have to be obtained. [3]

--Motivation for the writers and editors should be from the point of view of increasing understanding of the area involved and from that of enhancing their technical professional reputation. In other words, some of the inducements should be in the form of prestige and professional recognition, not principally financial return. Being requested by a professional society technical committee might provide such non-financial incentive in addition to the monetary honorarium. [7]

--If the monographs were sold at a substantial price, their use would never develop as proposed here. On the other hand, some of the costs associated with their production should be borne by the user. Free copies should be distributed to all teachers at least until their importance and utility are established. [1]

2. REACHING POTENTIAL USERS

--...it seems most important that a logical, careful advertising campaign be launched if the monographs are prepared. We must reach the young research oriented faculty members who are looking for this material. [2]

..The desirability of involving the professional societies seems to go even deeper than the financial aspects. These organizations have valuable mailing lists for reaching the practicing engineers in the field--individuals who should profit as much as the students from the type of monographs being prepared. [2]

--...I would estimate that there are 200 companies (chemical industry) that would have designed data groups of five men or more. Assuming 400 more who would have at least one man and allowing for one library copy, a conservative figure of 2000 copies is obtained. [6]

--Free copies should be distributed to all teachers at least until their importance and utility are established. [1]

3. PUBLICATION AND DISTRIBUTION OF MONOGRAPHS

--Perhaps the government printing office would be willing to undertake distribution...and a reasonable price should be placed on the monographs. [4]

--...in the longer run it is necessary that the user of monographs be charged ($.75 to $1.25 as an example) so that some measure of user preference be obtained. [7]

--It seems that it would be very desirable to involve the professional societies at a very early stage of the program. The professional societies can publish at a relatively low cost and achieve wide distribution of their published material in the programs of continuing education which they are all undertaking. [2]

4. ORGANIZATION

--If a few of the major professional societies could be made partners in this venture from the outset, there would be obvious advantages to OSU and the sponsoring agency. [2]

--I would hope that the Commission on Education of the National Academy of Engineering could be involved as a participating co-sponsor, merely to add the prestige of NAE to the effort. [2]

--There would certainly continue to be a need for a central organization to administer this project when it is continued. Oklahoma State University certainly appears to have done this well in the past. [6]

5. SOURCE OF FINANCIAL ASSISTANCE

--The technical society should be a good one...don't let NASA off the hook. [3]

--...is the desirability of making such a monograph series self-supporting at least once it is established...it seems that it would be very desirable to involve the professional societies at a very early stage of the program. [2]

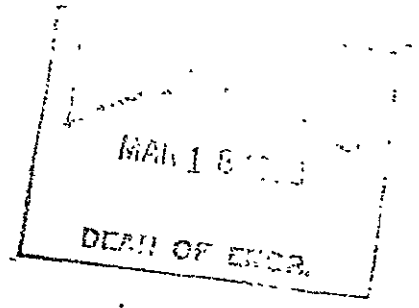
--I have suggested from time to time that the preparation, publication and some distribution subsidy be tied in to the development funding of the projects supported by the federal government out of which can come the type of contribution being discussed...if there is any substance to the argument that these activities are being carried forward in the public interest and consequently should benefit the public in enhancing the store of technical information, then such a means of accomplishing this objective as this should be supported. [5]

APPENDIX V-B

NATIONAL ACADEMY OF ENGINEERING 2101 CONSTITUTION AVENUE, N.W., WASHINGTON, D.C. 20418

Commission on Education

March 17, 1969



Dr. Kenneth A. McCollom
Office of the Dean
College of Engineering
Oklahoma State University
Stillwater, Oklahoma 74074

Dear Ken:

Your recent meeting here in Washington was a most reassuring occasion. To see at first hand the extent of effort being given to a difficult task and yet one which so much needs doing is a pleasure. As you know, I have been encouraging the development of monographs in this general spirit for many years. When the Commission was first organized seven years ago, I set this consideration as one of the first orders of business. In all my own efforts in this direction, I have encountered indifference and frustration, so I commend you on your success.

There are several quite fundamental difficulties. First, it is not at all easy to define in an adequate manner the objective of any monograph series. One can do this superficially, of course, in many ways, but to come up with an objective which is not diffuse which relates specifically to an educational need of consequence and which will provide an adequate basis for implementation is a real trick. You have made progress, probably as much by having the constraint of NASA source material on one hand and the specific topical areas on the other as by any other consideration. Objectives sufficient for the situation with these constraints removed still are not available.

Second, it is very difficult to enlist the participation of the individuals one thinks should be the key contributors. The very good text book writers are not attracted since they do not see the market, and the limitation in scope fails to inspire them. On the other hand, the distinguished engineers and scientists one might seek have, on the whole, more important things to do. You have done rather well in this regard but with a clearly artificial circumstance. Just how the management of the writing effort can be accomplished on any long term basis is not clear. This starts with the problem of finding an editor for any monograph series. Publishers, some years ago, enlisted some outstanding individuals for this and the beginning was auspicious, but even the best of men were unable to keep up with the demands of finding the large number of contributors for individual monographs that were needed. In this regard, it is generally unlikely that one person will

be willing to prepare a whole series of monographs. The other pattern of enlisting contributors in the manner that is accomplished by technical journals would presuppose that the monographs would provide professional recognition or an outlet for research contributions. Neither of these is likely to happen.

All this tends to lead one to the possibility of using professional technical writers for the task. Then one is confronted, however, with the dismal prospect of rather dull and uninspiring monographs which if not very carefully controlled would certainly produce the demise of the endeavor. Summarizing this point, one can question whether the whole concept has the qualities necessary to inspire the participation of writers of the caliber necessary for success.

Third, the problem of marketability remains a discouraging factor. No doubt many individuals in universities and industry will be intrigued by one or another of the monographs. This is a rather random and scattered market, however; and probably not one to carry a sustained effort. Texts survive becasue of large scale adoptions. Journals are either heavily subsidized or have large circulation. Even the most successful single monograph is not likely to have enough sale to carry more than a very few less successful ones. This means that economically one becomes restricted to a very limited list. This is contrary to the spirit and intent of the monograph concept so one ends up with the necessity for subsidy. The problem then is the source of such support. This will not be provided by universities or publishers. If industry steps in at this point, it is very likely that any large concern will come to the conclusion that they should put out their own internal series of monographs - as some now do. Then the general service and concept is lost.

It is because of the implications of this last consideration that I have suggested from time to time that the preparation, publication, and some distribution subsidy be tied in to the development funding of projects supported by the Federal Government out of which can come the type of contributions being discussed. Thus, each major NASA development effort should not be regarded as completed until there appeared the appropriate monograph series. The same concept could be applied to DOD projects, etc., etc. If there is any substance to the argument that these activities are being carried forward in the public interest and consequently should benefit the public in enhancing the store of technical information, then such a means of accomplishing this objective as this should be supported.

These are a few thoughts as to certain aspects of the total problem that I believe are worthy of attention. I hope your effort will continue for some time and from your experience we can all become wiser with regard to the concept.

Sincerely,

Newman

Newman A. Hall

Executive Director

NAH/ms

March 12, 1969

Prof. Kenneth A. McCollom
College of Engineering
Oklahoma State University
Stillwater, Oklahoma, 74074

Dear Ken:

I enjoyed participating in your one-day conference in Washington last week in which a group of us attempted to consider the program which you have had under NASA sponsorship for the preparation of educational monographs based upon NASA research and development reports. It was a privilege to be able to exchange opinions with both the members of the faculty of Oklahoma State University and the various consultants whom you had assembled for the conference.

I think the most impressive result of the meeting was the strong affirmation of the potential value of a publishing and educational program of this sort. I was rather surprised to find that all of us there had considered a program of monograph preparation before. Indeed, most of the professional societies and a number of the commercial publishers have also done serious planning of such a program, although very few have actually come to fruition. The enthusiasm of the entire group for your efforts was most exciting, and I think this indicated clearly the potential value of the approach.

The experience over the past two years seems to indicate certain of the difficulties which such a program will inevitably encounter in the future. First of all, I think that you have been unfortunately restricted in the use of only NASA technical reports as a basis for your monographs. Too many of the outstanding accomplishments of the NASA program, particularly in the development of specific devices and systems for various space missions, have not been reported in the NASA literature in detail. I believe NASA suffers from the same disadvantage of most government and industrial organizations in that the individuals who are concerned with the real forefront of the engineering field are too often busily pressing on to the next challenge after the successful design of a particular component or subsystem. Very seldom do we find reports in the literature of the truly significant engineering design accomplishments. I would hope that any expansion of the program in the future would broaden the technical base from which the material can be drawn--not only in terms of the agencies and organizations sponsoring the work, but perhaps even more in terms of the possibility of senior authors actually visiting installations where the work is currently

being done, and talking with the engineers who are responsible for specific developments. It seems that this whole matter of the choice of an appropriate set of topics is critical in determining the success of the program, and I suspect that a major effort must be made to enlist the assistance of knowledgeable people in the field to make the particular topic selection. This is naturally not meant as a criticism of your program, but merely as an indication of the difficulty which the program in the future will have to face if it is to be successful.

I personally strongly favor the use of consultants for the preparation of particular monographs, naturally under the direction of a senior editor who can maintain the objectives and quality of the program. I believe that, in each specific topic which is selected, we must find the best individual to write on this subject--including his qualifications as a teacher and his ability to bring this material down to the appropriate undergraduate or elementary graduate level. While Dr. Blackwell has obviously done an outstanding job in the group of monographs on control systems, it is asking far too much of him to undertake preparation of material on a variety of different topics within a relatively short time. Here again, the selection of the appropriate authors is difficult, and I think that the OSU group would benefit from advice from people in the specific field.

With regard to the problem of achieving reasonable dissemination, it seems most important that a logical and careful advertising campaign be launched if the monographs are prepared. We must reach the young, research-oriented faculty members who are looking for this material. Most of the older faculty members who are active in ASEE and similar organizations, have already evolved a large number of examples which they like to use, and the reception of monographs by this group is not likely to be great.

Another factor which certainly will be significant is the desirability of making such a monograph series self-supporting, at least once it is established. This problem has plagued most of the commercial firms with whom I am familiar. It seems that it would be very desirable to involve the professional societies at a very early stage of the program. The professional societies can publish at a relatively low cost and achieve wide distribution of their published material in the programs of continuing education which they are all undertaking. If a few of the major professional societies could be made partners in this venture from the outset, there would be obvious advantages to OSU and the sponsoring agency.

The desirability of involving the professional societies seems to go even deeper than the financial aspects. These organizations have valuable mailing lists for reaching the practicing engineer in the field--individuals who should profit as much as students from the type of

Prof. K.A. McCollom

monographs being prepared. Most of the universities in their continuing education programs have encountered great difficulty in attracting to specific courses the quantity of engineers necessary to make the venture economically self-sufficient. Publication programs suffer from the same difficulties, and no commercial publisher that I know is really successful in reaching the practicing engineer.

I hope you realize that these comments are not meant to be critical, but rather to emphasize the difficulty of establishing a truly significant program. On the other hand, the potential rewards and significance of such a program are great. Engineering education badly needs the kind of enrichment, motivational, and supplementary material which monographs can provide. I would hope that the Commission on Education of the National Academy of Engineering could be involved as a participating co-sponsor, merely to add the prestige of NAE to the effort. I did not feel that I should mention this at the meeting, since Newman Hall obviously is in a much better position to comment on this. I know he is enthusiastic about the monograph program, however, since he and I have discussed this on many occasions. We have had difficulty in visualizing how to launch such an effort, and I think it is about time that all of us join forces to try to make a program of this nature succeed. Certainly engineering education, particularly the educational techniques which we can envision during the 1970's sorely needs the kind of input which this program could provide. It has been a pleasure to have participated in these discussions.

Sincerely,

John

John G. Truxal

REPORT ON REVIEW OF TECHNOLOGY UTILIZATION

PILOT PROGRAM SPONSORED BY NASA

by

Stanley B. Adler

March 12, 1969

to

Dr. Kenneth A. McCollum
Oklahoma State University

* * *

On March 5, 1969, I attended a meeting in Washington, D. C. of those responsible for various phases of the Pilot Program on Technology Utilization, sponsored by NASA. The past history and conduct of an initial program to bring forth into general engineering use developments from the space program and related fields were reviewed. The main portion of the day was devoted to considering (1) the problems and their solutions that might result in a continuation and expansion of the pilot program; and (2) other ways to implement the transfer of this new technology for the benefit of engineering students and practicing engineers.

Although the preparation of monographs was not the only product of this early program, it was certainly the outstanding one.

Inasmuch as I was the only person present working in the chemical industry, in the remarks that follow, I have given particular emphasis to the utility of this program therein.

DEFINITION OF A MONOGRAPH

The essential characteristics of a monograph of the kind we are recommending for preparation would be listed as follows:

Involve a significant engineering or scientific accomplishment that is unquestionably new

An orderly development in concise form

A self-contained presentation of one central subject requiring use of outside references only for a peripheral item

A subject of interest to a wide audience is an absolute must

The binding and manner of reproduction of the booklet to be such that price can be minimal.

By concentrating on one central subject it is obvious that this monograph is not the type normally associated with a summary of a state-of-the-art. Furthermore, this sort of monograph is an example of the principle that every text need not be a textbook.

OF WHAT IMPORTANCE IS THIS PROGRAM TO THE CHEMICAL INDUSTRY?

The monographs go far beyond the original articles, technical notes and documents. Written by experts in the field, the subject is put in proper perspective, given proper emphasis, increased in clarity by being developed in logical order, and finally interpreted by a specialist who very likely may have a wider knowledge of the subject than the original authors.

Chemical processes are developed and chemical plants are designed by building upon basic design data. These data are used in many types of calculations involving thermodynamics, heat and mass transfer, kinetics, etc. The information being reprocessed by the monographs are seen to be involved not only with the basic data but with the engineering calculation methods. The question might be asked, "How do you know the basic data are any good, that the experimental technique produced data that are of a quality good enough to use?" There is even a monograph on that; namely, TD-4-67, "Thermodynamic Consistency of Vapor-Liquid Solubility Data". A real need for much more of this sort of publication exists. Solubility data are only one of perhaps thirty types of data which play an important role in chemical engineering design, let alone those of other disciplines.

As in all other areas, the incentive for chemical companies, and in turn the chemical engineers, for keeping themselves abreast of current developments is obviously economics. The concern for avoiding overly large safety factors to hide ignorance is always in evidence. Competition by other plants' designers and other manufacturers always requires that the cost of the plant and the product be kept to a minimum. Engineers are always alert to new developments to reduce costs.

HOW MANY PEOPLE IN THE CHEMICAL INDUSTRY WOULD USE THESE MONOGRAPHS?

Based on a contact of another project, I would estimate that there are 200 companies that would have design data groups of five men (or more). Assuming 400 more who would have at least one man, and allowing for one library copy, a conservative figure of 2,000 copies is obtained. This does not allow for copies for consultants, research laboratories, graduate students, universities, government offices, etc.

WILL THESE MONOGRAPHS BE USED IN ENGINEERING EDUCATION?

One of the key factors in the present country-wide student unrest and agitation is the question of relevance of curriculum material. Moreover, one of the greatest complaints of professors is their inability in this day of committees, of closer association with the student, of the increased emphasis on doing research, etc., is finding the time to keep up with current technological developments. The monographs are an important answer to both of these problems.

The association with the space program, the most glamorous of all current engineering and scientific activities, certainly proves the importance of the subject. The clear, orderly development of the topic of the monograph answers the professor's problem of lack of time to explore a new area and develop the appropriate course material.

FROM THE STANDPOINT OF AUTHORSHIP, HOW CAN A PROGRAM OF MONOGRAPH PREPARATION BE BROUGHT ABOUT?

It was pointed out immediately above that there exists the universal problem of the professor finding time to acquaint himself with a new area to enrich his course. I propose that, through the Education Committee in each engineering society, a cooperative program be organized whereby experts in various areas will agree to prepare just one monograph in the field of his own specialty. The burden on each individual of delving into many areas is thereby circumvented.

CONTROLLING THE QUALITY AND MONITORING THE USEFULNESS OF THESE MONOGRAPHS

There will certainly continue to be a need for a central organization to administer this project when it is continued. Oklahoma State University certainly appears to have done this well in the past. I recommend that the administering group require that drafts of all new monographs be submitted to them for review by specialists, much as papers for publication in the engineering journals are so processed. The reviewers should be encouraged to recommend changes that they feel are necessary, particularly to make the monograph possess the specific characteristics listed previously.

A year after the monographs go into use a report from the schools making use of them should be sought, much as was done in the pilot program. Based on these reports, improvements in manuscripts then in preparation could be effected.

The spiral-bound form of the current series is ideal for the inclusion of a tear sheet which could be inserted for readers to fill out and return their comments to this central agency.

Stanley B. Adler

Stanley B. Adler

3/12/69

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
CAMBRIDGE, MASSACHUSETTS 02139

WARREN M. ROHSENOW
PROFESSOR IN CHARGE
HEAT TRANSFER LABORATORY

TELEPHONE, AREA CODE 617
UN 4-6900

Dr. Kenneth A. McCollom,
School of Engineering,
Oklahoma State University,
Stillwater,
Oklahoma 74074.

12th March, 1969.

Dear Dr. McCollom,

The discussion during our meeting of March 5th in Washington D.C. eventually came to the following overall questions:

1. Should monographs be prepared?
2. To what audience should they be addressed?
3. How can their preparation be accomplished?
4. How should they be distributed?

Our discussions lead to rather definite answers to the first two and less definite answers to the last two questions.

There was general agreement that there exists in NASA literature and other government publications much basic and applied research results which need a more satisfactory dissemination to both practicing engineers and to students enrolled in the Universities. Specifically there are a series of reports on a wide variety of significant problems of engineering and engineering science which should be consolidated in single, short, useful documents. Such documents would obviate the necessity of trying to locate two to ten or even more reports on a particular subject. These monographs should treat timely and novel subjects, should be of limited scope, be short, have a sharp focus, and have broad appeal or interest.

At the beginning of the day the monograph had been defined rather narrowly and really addressed to use in the classroom, the subject matter to be presented in from one to three hours. It was also stated that subject monographs would be used profitably by practicing engineers in seminars or self-study.

In receiving the copies selected in heat transfer for pilot monographs and in anticipating some other subjects which would be candidates for future monographs I concluded that most, though not all, of these would be too specialized to permit devoting even as much as an hour of graduate courses to them. On the other hand, this in no way diminishes their value for instructional purposes. The subject matter of the well-prepared monograph may actually only receive ten or twenty minutes of classroom time but may be studied more intensively outside of class. I suggested that likely topics for useful monographs would have wide appeal to practicing engineers.

...../

For this reason and because I do not believe very much classroom time will be available for these specialized subjects, I suggested that the monographs be broadened and addressed to the practicing engineer rather than to the classroom lecture. In this form they would be quite useable as augmentive material for the classroom subject. In this sense the monographs should be considered as providing technical utilization of information developed in government laboratories as well as providing aids to teaching.

The monographs should not be limited only to information developed at NASA but should incorporate information on the same subject developed elsewhere.

The selection of the topics which should appear in monograph form is not a simple task. Perhaps the initial topics could be selected after a review of the NASA literature, then the literature of other agencies should be reviewed. This selection could be done by a group such as the existing pilot project group at Oklahoma State University or by technical committees of the professional societies. I believe the most effective way to proceed would be to ask three or four people, knowledgeable and experienced in each sub-area, to act as a committee to make the selection. Each group could actually visit some of the NASA laboratories and talk with some of the research people to aid in making selections. Perhaps it would only be necessary to spend time in a central library of NASA.

There was much discussion regarding the financial side of getting the monographs written. The monographs should be written by a well-qualified person, preferably one who himself has done some research or writing on the particular topic.

I think it is unreasonable to think in terms of compensating the writer on the basis of consulting fee type payment for time spent. Authors of text books do not in an overwhelming majority of the cases receive royalties sufficient to compensate for the time spent in writing. Total royalties in the range of $10,000 - $20,000 would be reasonable for a majority of technical books. Contributors of sections in handbooks receive in the range of $100-$2000 for their contributions.

It would seem to me that if the selected authors were people who were deeply immersed in the specialty area of the monograph they would be more than willing to do the writing for a fee in the range of $1000-$5000.

The distribution method was discussed but no general conclusion could be reached. The large number of very short monographs make distribution more expensive. An order for a 10-20 page monograph costs as much to handle as one for a 500 page book. Obviously the cost per page is high for the monograph. Book publishers do not seem to like to take on this type of operation probably because of these higher distribution costs.

Perhaps the Government Printing Office would be willing to undertake the distribution. The monographs are not unlike most of the present literature presently handled by that office. An appropriate price should be charged, which would aid significantly in covering all or most of the costs of preparation and distribution.

An alternative might be to persuade one of the professional societies to distribute them. I think it is unlikely any of the societies would agree to take on this job.

The following is a summary of my conclusions and recommendations:

1. Monographs should be prepared on timely, novel subjects, preferably on narrow subjects on whihh a number of successive reports have been written.

2. The major benefit of such monographs would be the more effective dissemination of information to engineers in industry by bringing together information which now resides in a number of reports. Their major value would be in information transfer to the entire world of technology. There use in classroom instruction would be of secondary importance.

3. Selection of the topics would begin with the published works of NASA but the material in the monographs should not exclude non-NASA generated information on the same subject. Selection of the topics would probably be made best by a group of approximately three people knowledge in a particular area - such as heat tuansfer, thermodynamics, controls, etc.

4. The writing should be done by a specialist - one who has himself contributed to research or writing in the particular areas. Honoraria need not be outside the range of $1000-$5000.

5. Distribution could probably be best handled through the U.S. Government Printing Office and a reasonable price should be placed on the monographs.

Sincerely,

Warren M. Rohsenow.

Report on the Conference on Transfer of Technological Information to Classroom Use

John R. Howell
University of Houston

This report summarizes my evaluation of the OSU-NASA pilot program, plus some comments and recommendations for future programs.

Evaluation of the Pilot Program

There is no doubt in my mind that providing self-contained clearly written monographs describing novel developments in technology is of great potential value. Such monographs are useful in colleges and universities as both classroom and home study materials, and in industry as a means of keeping abreast of new material.

The pilot program itself does a good job of providing such monographs. The program, in my opinion, has some flaws in detail; its overall value is without question, and support for its continuation should be sought.

The flaws in the present program, in my opinion, are these:

1. The monographs are conceived, perhaps subconciously, as chiefly a classroom aid. This is certainly a valid target for use; however, by aiming chiefly at this market (as evidenced by distribution largely to professors rather than students for evaluation, and by the inclusion of homework problems, and by limiting to 1, 2, or 3 hour modules of material) certain difficulties emerge. First, professors hesitate to use one hour of lecture time for a monograph. After all, they have perhaps 40 hours of total lectures per semester to cover all the material ever gathered in a subject area. How many monographs are worth 2 to 7 percent of a course? It is doubtful if many papers are produced throughout the world in a year that have such an impact on a given field. Second, coverage of material is compressed or expanded to fit the modular guidelines. But the material might well need less or more time to be adequately covered. These constraints also limit use in industry and for self-study.

2. The subject material for the monographs is chosen by the senior author and the monograph gets little or no review prior to publication in final form. This leaves a good

deal of the guidance and philosophy of the program in some widely different minds. If the program is expanded past the pilot stage, some guidelines on subject area and a pre-publication evaluation of the material chosen should be incorporated.

3. The methods of evaluating the response to the pilot program may not be valid. The monographs are for learning, and should be evaluated by the student as well as the teacher. Eliciting only teacher response (whether the teacher is in industry or a university) is only a half-way evaluation.

Recommendations for Changes

If the program is expanded and continued, I would suggest certain modifications. Because the production of an individual monograph falls neatly into four segments, I will categorize my recommendations the same way. The segments are: Selection; documentation, transmission, and finance.

Selection: Finding good subject material for monographs may well be the hardest part of the process. For undergraduate courses, most material is basic, and is well covered by a variety of texts. There are new things in some fields, certainly, that merit monographs of the type found in the pilot program. It seems likely that applications and design and project histories and discussions are more valuable at this level---At the graduate level, the technical, more narrow coverage given by the pilot monographs in heat transfer and thermodynamics becomes more valuable. However, the market is smaller.

Further, these monographs are probably most useful, in my opinion, as out-of-class supplementary material and only occasionally as lecture material. Self-teaching should be the object, and selection of topics for this purpose a requirement. I doubt that a reasonable selection of such material can continue to be made on the basis of the interests of an individual author. I realize that without this interest, the author becomes a rewrite man for material he may or may not have a consuming desire to transmit for study. Nevertheless, the program should aim for motivating and enlightening the student, not the senior author of the monograph. Selection must be made on the basis of material available and needed, and this takes more than one person. The market place weeds out useless material---but this is not an economical way to run the program.

Documentation: Once a topic is selected for a monograph, who writes it? What we need is a renowned expert who writes inspiringly and works cheap. Perhaps we can settle for two people---a high priced

expert and a cheap inspiring writer. Even this will be tough to find. My own opinion is that the program directors should evolve a good method of topic selection, and then choose outstanding people to work up the monograph on a consulting fee basis. An understanding should exist that plenty of editorial license for cutting and pasting will be allowed at both ends (You write well, professor; but we have trouble with some of your colleagues....). Some reviewing procedure should precede publication in order to catch any technical errors and to insure clarity of the material.

The monographs should not be limited in size. If the material requires length, let it have length. A man in industry wants to use the material, not get a one hour capsule of a six hour subject (or vice versa, for that matter).

Transmission: Much wider publicity should be given to the program if it is continued. Industry must be kept aware of what is being offered. Universities and the students themselves should have access to lists of available monographs. Feedback from all areas as to usefulness and clarity should be continued. I doubt if many of the people who could really use the monographs in industry have gotten to see them. Manager's shelves are crammed with things that should go to working engineers.

Finance: Let's face it. This category will determine exactly which and how many ideas outlined above can be carried out. I frankly don't think that this program can ever be self-supporting. It isn't in the cards to sell more than a few hundred to a thousand copies per year of the average monograph of the type produced so far at more than a dollar a copy. I'm sure also that production costs will rise above the $3000 - $7000 mark cited for the present series. Further, a good monograph won't have sales for more than a few years---after that, a textbook will incorporate it. A bad monograph may go on forever, but it won't be selling either. (I would note that 67-HT-1 is already included in Love's radiation text and in a monograph in the Advances in Heat Transfer Series).

The conclusion is that outside support on a continuous basis will, in my opinion, have to be obtained. Sources? - The technical societies should be a good one. Or, to quote

> "The aeronautical and space activities of the United States shall be conducted so as to contribute...to the expansion of human knowledge of phenomena in the atmosphere and space. The Administration shall provide for the widest practicable and appropriate dissemination of information concerning its activities

and the results thereof."

National Aeronautics and Space
Act of 1958.

Don't let NASA off the hook.

Unless adequate support can be found, much of what I (and I think others) have suggested will have to be junked. Most of the suggestions would be more expensive than the means used in the pilot program.

Lawrence N. Canjar
University of Detroit

CONFERENCE REPORT

on

TRANSFER OF TECHNOLOGICAL INFORMATION TO EDUCATIONAL USE

The most important point made at the Conference on the Transfer of Technological Information to Educational Use was that this transfer is as vital a part of the technological utilization of the research performed as the primary physical application for which it was originally intended. Apparently a great wealth of engineering facts and principles are now buried in countless reports which will not come to the classroom as general knowledge for a long time, if ever. There is an urgent need to shorten the time gap between the discovery of new technological principles and their dissemination to students and practicing engineers.

All the results of research cannot and should not be transferred. Only that which is novel with good indications of being reapplied in the future on a broader scale should be considered. A methodology or an interesting application of methodology should be discussed in a self-contained teaching module, preferably brief, although some

topics may deserve extended treatment. Panels of experts, selected by the professional societies, should not only choose the material but should indicate what fundamental background the student is expected to have. The senior authors of the monographs should keep this fundamental background in mind while writing and the concept of "self-contained" must be based on the limitations of this background.

Not only would the monographs make excellent supplements to textbooks, they could revoluntionize the teaching process itself. One could envision tailor-made courses of the future put together by use of selected monographs alone. Certainly the teaching of design, in which subject matter cannot be pre-selected, could use the monographs to great advantage.

Broad areas such as heat transfer, fluid mechanics, materials science, solid mechanics, electronics and circuitry, controls, applications of mathematics and thermodynamics are natural candidates for the monographs.

If the monographs were sold at a substantial price their use would never develop as proposed here. On the other hand some of the cost associated with their

production should be borne by the user. Free copies should be distributed to all teachers at least until their importance and utility are established. This is borne out by the development of computer education. Only after a computer is freely available and conspicuous on a campus does its usage grow and does it become accepted as a necessity.

People who are recognized authorities and have demonstrated writing skill should author the monograph. These can also be selected through the professional societies. It is hoped that the authors will be self-motivated because such people are usually extremely busy and monetary compensation will not be a significant factor in getting them to write. If the monographs are accepted they will provide pride of authorship.

GENERAL ELECTRIC
COMPANY

P. O. BOX 43, SCHENECTADY, NEW YORK 12301 . TELEPHONE AREA CODE 518 -374-2211

RESEARCH AND DEVELOPMENT CENTER

March 10, 1969

Professor Kenneth McCollom
Administrator, NASA Pilot Program
Oklahoma State University
Stillwater, Oklahoma

Dear Prof. McCollom:

It was a pleasure to participate as a member of the "Conference on the Transfer of Technological Information to Educational Use" on March 5, 1969 in Washington, D.C. I felt that the meeting was a stimulating one and served to bring out a number of worthwhile ideas with regard to the development of more effective ways of transferring the new technologies developed on NASA and other governmental contracts into effective technical skills for students and practicing engineers.

Transfer of Technology to Educational Use

In particular, I am of the opinion that the fundamental idea that some of the more novel and more worthwhile technologies developed on R&D type contracts can serve as an effective source for the preparation of special material to supplement books and full technical reports as an aid to education. The normal method of full technical reports does not seem to be used as effectively as it might to carry the message from the researcher to the student at the undergraduate or early graduate level. By special reports, of a character generally - like the monographs prepared in this project, the highlights of new developments can be interpreted for many students in a straight-forward fashion which doesn't require each professor or potential industrial user to wade through all of the original reference material unless he so desires.

There are some modifications to the methods used in the selection of the topics for the pilot project which I feel would enhance the value of the resultant product. First, I feel that it is important that the particular subject matter for monograph be chosen in technical areas not necessarily limited to the three areas selected. As examples, reliability and computer applications methods, with emphasis on relating practice to theory, are two other topics which might be included. Further, I feel that it is desirable for an initial validation to be made by a group of technical leaders in the area involved of the topics on which the monographs are to be written. Perhaps advice on the topic subject matter can be obtained from one or more Technical Society Professional Groups as to what particular areas for timely monographs are most appropriate.

Likewise NASA technical personnel themselves may be able to indicate those several topics in each field which they feel are most significant and why. Another factor to be considered in the preparation of such material is the possibility of having the original researcher make a greater technical contribution to the preparation of the monograph. With the assistance of a Senior Editor

having writing and teaching experience experience, the original report writer might be able to prepare most of the monograph with a limited amount of help to cast the abbreviated report in a fashion more acceptable to the students, both university and industrial. In any event, I think it important that the choice of subject matter be given critical attention so that the end monographs are on subjects that are most meaningful to a large group of readers.

Supplementary Material to Textbooks

Characteristics of the supplementary material to the textbooks used by the student and instructor are its novel information content, its timeliness and freshness, its broader coverage of interdisciplinary ideas, and its particular emphasis on problems of significance. Since the time delay between the development and recognition of a new idea and the time when such ideas appear in book form may be more than 5 years, supplementary material like these brief monographs can fill-in this time gap by appearing for the student in a much shorter time interval.

Candidate materials of the type I feel are worthwhile are those which have a base of practical or experimental verification of clearly presented analytically developed ideas. Where possible, experimental results should complement the fundamental presentation. New design methods developed should be compared with existing methods from such points of view as simplicity of analysis, ease of problem formulation, validity of results, speed of obtaining answers, etc.

Although during the development period during which experience is being gained and experiments are being conducted, it was appropriate that no charge be for the monographs, in the longer run it is necessary that the user of the monograph be charged (0.75¢ - $1.25 as an example) so that some measure of user preference be obtained. Even with this income it may still require some agency support for this service to be economically viable.

It would appear that the principal motivational requirement to encourage the use of such material is that the potential users be attractively presented with information about the material and that the material itself be well developed and useful to the person studying it.

Preparation of Supplementary Textbook Material

Two important qualifications exist for the people who prepare supplemental textbook material: one, is that these people should be well familar with the subject being presented; the second is that these people be good at preparing written material for student use. By the first criteria, persons conducting the original work as well as those skilled in the field by virtue of prior work in it should be able to organize and present the fundamental material. The second criteria would indicate that the assistance from skilled professors in the field of the particular material or from first class younger professors who have a good appreciation of the student's point of view can be very helpful. Certainly the

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persons preparing the material should be well familiar with the field of concern and desireous of doing the material preparation.

Motivation for the writers and editors should be from the point of view of increasing understanding of the area involved and from that of enhancing their technical, professional reputation. In other words, some of the inducements should be in the form of prestige and professional recognition and not principally financial return. Being requested by a professional society technical committee might provide such non-financial incentive in addition to the monetary honorarium.

Some quality check by actual use with a sample of students and professors of about 5 or so of each is highly desirable to make sure the intent of the supplemental material is realized by the person preparing it. Written review of each monograph is one way of getting a critical review of the resultant material.

I believe that the above comments reflect a point of view that endorses the basic idea of preparing supplemental, abbreviated material from some of the more novel, worthwhile, and timely topics of research and developmental reports such as those of NASA and other agencies. However, these comments also indicate more of an emphasis on the topical content for these reports that has an approval of a group of experts in the field and which is prepared by persons skilled in the atea of interest including perhaps some of the authors of the original articles. The ideas of editing by a senior professor and a critical review by students and professors alike used in the present experiments were good and should be retained. Finally, an effort should be made to have the monographs be at least partially self-supporting in a financial sense once the initial efforts are underway.

Thank you again for the opportunity to participate in this Conference. I wish you and your associates good luck in carrying along this effort at transferring technological information to educational use that you have pioneered in.

Sincerely yours,

Harold Chestnut

Harold Chestnut, Manager
Systems Engineering & Analysis Branch
Building 37, Room 577
INFORMATION SCIENCES LABORATORY

/maf

APPENDIX V-C

PROFESSIONAL RECORD

Warren M. Rohsenow
Born: February 12, 1921, Chicago, Illinois.

Education:

D. Eng.	Yale University	1944
M. Eng.	Yale University	1943
B.S. in M.E.	Northwestern University	1941

Professional Background

Sept. 1941 - June 1943	Teaching Assistant In Mechanical Engineering, Yale University. Taught laboratory course in Steam Power and Automotive Engineering.
July 1943 - July 1944	Instructor in Mechanical Engineering, Yale University. Taught classes in Thermodynamics and Heat Power.
August 1944 - June 1946	Mechanical Engineer (lt. (jg) USNR), Gas Turbine Division, USN Engrg Expt Sta, Annapolis, Md.
July 1946 - present	Currently Professor of Mechanical Engineering, Director of Heat Transfer Laboratory, Mechanical Engineering Department, Massachusetts Institute of Technology, doing research and teaching in fields of heat transfer, thermodynamics, heat power and gas turbines.

Consulting Activities
July 1946 - present

1943 - 1945	NDRC, Columbia University, Consultant, aircraft torper design group.
1946-50; 1954-56	USN Engrg Expt Sta.,Annapolis, Md., consulting on gas turbine equipment problems.
1948 - 1958	Union Carbide and Carbon Chem. Co., Oak Ridge, Tenn. consulting on heat exchangers, compressors and system in design and development of gaseous diffusion plants for uranium separation.

Page 2 - Professional Record

1951 - 1955	Jackson and Church Co., Saginaw, Mich., Sanders and Thomas Inc., Pottstown, Pa. and Naval Aircraft Factory, Philadelphia, Pa.; consulting on design and operation of naval steam operated catapults.
Summer 1952	Nuclear Engineering Project at M.I.T., Feasibility Study of Nuclear Power reactors for Atomic Energy Commission.
Summer 1953	Project Dynamo at M.I.T., Design study of nuclear power plants for Atomic Energy Commission.
1953 - 1956	Convair, San Diego; consulting on heat transfer problems associated with high speed flight of aircraft and weapons.
1954 - 1958	General Electric Co., Lynn, Mass., consulting on heat exchanger and systems design for various aircraft accessory equipment such as turbo-driven oil pump, turbo-conditioning cooling systems, etc.
1954 - 1956	Arthur D. Little, Inc., Cambridge, Mass., consulting on ordnance and on aircraft turbo-conditioning problems.
1955 - 1957	United Shoe Machinery Corp., Beverley, Mass., consulting nuclear reactor problems.
1956 - 1957	Pratt Whitney Aircraft Corp., Boston Office; consulting on aircraft nuclear power plant.
1956	Borg-Warner, York, Pa.; redesign of gaseous diffusion process Freon-UF6 coolers using extended surfaces.
1957 - 1958	Phelps-Dodge, Yonkers, N.Y.; analog studies of transient temperatures in electrical insulation.
1957	Owens-Corning, Toledo, Ohio; comparison study of roof insulation versus spraying and ponding for total summer-winter economy in different locations.
1957 - present	Chairman of Board of Directors and Director of Engineering, Dynatech Corporation, Cambridge, Mass., doing consulting for numerous organizations in industry and government.

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U.S. Government Committee Participation

1950 - 1956	Consultants Review Board, Project Squid, Princeton University (Sponsored by Office of Naval Research).
1954 - 1955	Sub-Panel on Temperature Pressures and Stresses in Gun Liners, Materials Advisory Board, National Academy of Sciences, National Research Council, Washington D.C.
1963 - present	Chairman, Cooling Panel, NIKE-X Hardened Electric Power Board, National Academy of Sciences.
1965 - present	Member, Engineering Division, National Academy of Sciences.

American Society of Mechanical Engineers.

1943	Member of Executive Committee of New Haven, Connecticut, section.
1951 - 1954	Chairman, Standing Committee on Thermal Properties, Heat Transfer Division.
1951 - 1964	Member, Technical Committee on Aircraft Heat Exchangers, Heat Transfer Division
1953 - 1957	Executive Committee, Boston Section, Chairman in 1955-1956
1954 - 1956	Member, Technical Committee on Gas Turbine Heat Transfer, Heat Transfer Division.
1958 - 1963	Executive Committee, Heat Transfer Division, Chairman 1961-1962.
1962 - 1966	Chairman, Honors and Awards Committee, Heat Transfer Division.
1963 - 1965	Member, Research Planning Committee
1963 - 1964 & 1966-present	Member, Basic Engineering Dept. Policy Board.
1966 - present	Member, Communications Policy Board.

Page 4 - Professional Record

Honorary Organisations

Tau Beta Pi, Member, Northwestern Technological Institute Chapter.

Sigma Xi, Member, Yale University Chapter.

Pi Tau Sigma, Honorary Member, Massachusetts Institute of Technology Chapter.

Awards

1951	Pi Tau Sigma Gold Medal Award of ASME
1952	Yale Engineering Association Award for Advancement of Basic and Applied Science.
1952	Junior Award of ASME for Boiling Heat Transfer Correlation Method.
1955	Merit Award, Northwestern University
1956	Fellow, American Academy of Arts and Sciences.
1967	ASME Heat Transfer Division Memorial Award.
1968	Fellow, American Society of Mechanical Engineers.

Publications

A total of 57. A list will be furnished upon request.

BIOGRAPHICAL SKETCH

John G. Truxal

Born: February 19, 1924

Degrees: A.B. Dartmouth College 1944
Sc.D. (Electrical Engineering) M.I.T. 1950
D.Eng.(Hon.) Purdue 1964

Positions: Purdue University School of Electrical Engineering
Assistant Professor and Associate Professor, 1950-4

Polytechnic Institute of Brooklyn 1954-
Professor and Head of Department of Elec. Engineering 1957-61
Vice President 1961-4
Dean of Engineering 1964-6
Provost 1966-8
Institute Professor 1968-

Current Professional Activities:

Consulting Editor in Electrical Engineering, McGraw-Hill Book Company
Co-Director, Engineering Concepts Curriculum Project
Chairman, National Academy of Engineering Committee on Interplay of Engineering with Biology and Medicine
NIGMS Training Grant Committee on Engineering in Biology and Medicine
Member, National Academy of Engineering
Board of Directors, IEEE and Commission on Engineering Education
New York City Mayor's Science and Tecnology Advisory Committee
NSF Advisory Committee on Engineering
U. S. Chamber of Commerce Science and Technology Committee
Visiting Committees in Electrical Engineering of MIT and Princeton
Board of Overseers of Thayer School of Engineering

BIOGRAPHICAL DATA

John R. Howell — University of Houston
Associate Professor — Mechanical Engineering

Education:

Case Institute of Technology	BS - Ch Eng 1954-58
Case Institute of Technology	MS - Nuc Eng 1958-60
Case Institute of Technology	PhD- Eng 1960-62

Special Honors:

NASA Special Service Award, 1963

Major Research Interests:

Thermal radiation and heat transfer.

Professional Experience:

Associate Professor of Mechanical Engineering, University of Houston 1968 - Present

Research engineer with Advanced Research Institute of NASA Lewis Research Center 1961 - 1968

Registered Engineer in Ohio and Texas.

Publications:

A total of 28, a list will be furnished upon request.

NEWMAN A. HALL

Born: Uniontown, Pennsylvania, 1913

Marietta College: B.A., 1934
California Institute of Technology: Ph.D., 1938
Yale University: M.A. (privatim), 1956
Marietta College: D.Sc. (honorary), 1959

Queens College, New York: Instructor, 1938-41
University of Minnesota: Professor of Mechanical Engineering, 1947-55
Head, Heat Power Div. Mechanical Engineering Department
New York University: College of Engineering, Professor of Mechanical Engineering, 1955-56; Assistant Dean in Charge of Graduate Div., 1955-56
Yale University: Strathcona Professor of Mechanical Engineering, 1956-64
Chairman, Mechanical Engineering Dept., 1956-1962
Chance Vought Division, United Aircraft Corp.: Research Engineer andHead, Analysis Dept., 1944-47
Commission on Engineering Education, Member and Executive Director, 1962-68
Commission on Education of the National Academy of Engineering, Member and Executive Director, 1969-

Consulting Activities and Service on Government Commissions:
United Aircraft Corporation
General Electric Company
Fairchild Aircraft and Engine Corporation
General Mills Corporation
Combustion Sub-committee, NACA, member, 1947-50
Engineering Science Div., Office of Ordnance Research, U. S. Army, member, 1953-58
Scientific Advisory Board, Rock Island Arsenal, U.S. Army, member, 1953-58
Aerophysics Div., Naval Ordnance Laboratory, Consultant, 1950-62.

American Society of Mechanical Engineers
Society of Automative Engineers
American Institute of Aeronautics & Astronautics
International Combustion Institute
Engineers' Council for Professional Development, Education and Accreditation Committee
American Society for Engineering Education

Author: Thermodynamics of Fluid Flow
Engineering Thermodynamics (with W. E. Ibele)

Resume of Lawrence N. Canjar

Dr. Lawrence N. Canjar is the Chrysler Professor and Dean of Engineering at the University of Detroit.

He was educated at the Carnegie Mellon University and received all three of his degrees there in Chemical Engineering; B.S. '47, M.S. '48 and D.Sc. '51. He rose through the ranks from instructor in 1950 to full professor in 1959. In 1961 he was appointed the Associate Dean of Engineering and Science at Carnegie Mellon.

Dr. Canjar's work has been in the field of thermodynamics and kinetics with a special emphasis on physical adsorption. In the area of thermodynamics he is a specialist in physical and thermodynamic properties of hydrocarbons and their mixtures. For over ten years he has been a consultant to the American Petroleum Institute Research Project #44 in this field and has recently published a data book with Professor F. S. Manning.

In more recent years he has become interested in engineering design and the development of curricula which utilize the latest advances in technology in authentic engineering problems. Upon arriving at the University of Detroit in 1965 he immediately began the development of a doctoral program in engineering which is based on advanced technological problems that are found in industry and practice and feature graduate student interns who complete their requirements for the degree working in industrial laboratories and facilities.

He is the author of over 70 papers and has received two awards for excellence in teaching; the Carnegie Award in 1954 and the Western Electric Award in 1968.

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S. B. ADLER

SECTION HEAD - ENGINEERING RESEARCH

EDUCATION:

University of Pennsylvania - Chemical Engineering B.S. - 1939

PROFESSIONAL AFFILIATIONS:

A.I. Ch.E.; Past Chairman of North Jersey Local Section; R.E.S.A., Past Chairman Public Relations Committee, A.I. Ch.E.

PUBLICATIONS:

"Liquid-Vapor Equilibrium Constants from Solubility Data"; "How Transport Data Accuracy Affects Design"; "Transport Information Needed in the Chemical & Process Industries"; "Thermodynamic Consistency of Binary Liquid - Vapor Equilibria Data when one Component is Above its Critical Temperature"; "Application of the Wohl and Redlich-Kwong Equations to the Low-Molecular Weight Hydrocarbon System Phase Equilibria"; "Application of the Wohl Equation to Ternary Liquid Vapor Equilibria"; "These Equations Predict Equilibria"; "Low Temperature BWR Applications".

EXPERIENCE:

1947 - Present	The M. W. Kellogg Co.	
1946 - 1947	Publicker Industries	Chemical Engineer
1944 - 1946	Barrett Division of Allied Chemical & Dye Corp.	Chemical Engineer

In his present position, he supervises the preparation of the thermodynamic, transport, and physical property data used by Kellogg engineers in designing plants for the petroleum and chemical industries. The Research Engineers that he supervises obtain their data either from varied sources of literature or directly from Kellogg laboratories. He then coordinates the collection, collation, testing, correlation and translation of all such data into the most useful engineering form before it can be added to the Kellogg "Technical Data Book".

In establishing correlations of masses of data over a wide range of temperature, pressure, and composition, where many possible variables may be encountered, he is then responsible for the detailed use of Kellogg's IBM 1130 computer, at times the only practical method by which to process the available information. He has prepared over fifty programs for testing and correlating the basic data as well as for calculating the required data from the correlation and putting it into a usable form. These programs are based on fifteen (15) years of experience in the field of liquid-vapor equilibrium.

He has supervised the preparation of the Saline Water Conversion Engineering Data Book, sponsored by the Office of Saline Water, and has also specialized in the development and design of unorthodox heat transfer equipment for atomic energy and low temperature processing applications.

BIOGRAPHICAL MATERIAL

HAROLD CHESTNUT

Manager, Systems Engineering and Analysis Branch
Information Sciences Laboratory
General Electric Research and Development Center

EDUCATION: BSEE and MSEE, Massachusetts Institute of Technology, 1939 and 1940. DEng (honorary degree), Case Institute of Technology, 1966.

EXPERIENCE: Dr. Chestnut is responsible for the development, extension, and practice of the engineering and analysis of large complex systems.

In his present position, previously as Senior Systems Engineer, and Before that as Senior Control Engineer for the Company's former Advanced Technology Laboratories, he has led work in systems engineering and control, adaptive control, gradient optimizing controls, modeling and simulation, and optimization theory. The work of the Systems Engineering and Analysis Branch which he leads is involved in the use of computers, both analog and digital, in the solution of all phases of systems work from problem definition to systems operation and phase out.

In 1954 he was appointed Ordnance Engineer, and in 1955 Project Engineer for the Company's work on the F-104 aircraft. He supervised the Company's Advanced Engineering Program for a year, soon after coming to the General Electric Company in 1940.

Dr. Chestnut is a Fellow of the Institute of Electrical and Electronics Engineers and has been chairman of numerous committees, particularly those dealing with feedback control. He was Chairman of the IEEE Systems Science and Cybernetics Group and is a Director on the IEEE Board of Directors and Executive Committee member. He also serves as Treasurer for the IEEE. He was a founder and 1st President (1957-59) of the International Federation of Automatic Control (IFAC), and is Chairman of the IFAC Systems Engineering Committee. In 1965 he was named Engineer of the Year by the Schenectady Professional Engineering Societies.

Dr. Chestnut is the author of several articles on servomechanisms and control components, and co-author with R.W. Mayer of a two-volume book, Servomechanisms and Regulating Systems Design. He is Chairman of the IFAC/Automatica Journal Editorial Board. He is author of the books "Systems Engineering Tools and and Systems Engineering Methods, both published by John Wiley and Sons, Inc., and editor of the Wiley's Systems Engineering and Analysis Series.

APPENDIX VI

CONFERENCE ON TRANSFER OF TECHNOLOGICAL INFORMATION TO EDUCATIONAL USE

Participants

Stanley B. Adler
Research and Engineering Development
The M. W. Kellogg Company

Kenneth J. Bell
Professor of Chemical Engineering
Oklahoma State University

William A. Blackwell
Professor and Head,
Electrical Engineering
Virginia Polytechnic Institute

Lawrence N. Canjar
Chrysler Professor of Engineering
Dean of Engineering
University of Detroit

M. Bruce Carpenter
O.S.U. Washington Representative
Smith & Carpenter

Raymond E. Chapel
Professor of Mechanical & Aerospace Engineering
Associate Director of Engineering Research
Oklahoma State University

Harold Chestnut
Systems Engineering & Analysis
General Electric Company

Clark A. Dunn
Professor Emeritus of Civil Engineering
Associate Dean Emeritus of Engineering
Oklahoma State University

Wayne C. Edmister
Charles L. Nicholls Professor of Chemical Engineering
Oklahoma State University

Newman A. Hall
Executive Director
Commission on Education
National Academy of Engineering

John R. Howell
Professor of Mechanical Engineering
University of Houston

Melvin R. Lohmann
Professor of Industrial Engineering
Dean of Engineering
Oklahoma State University

Kenneth A. McCollom
Professor of Electrical Engineering
Assistant Dean of Engineering
Administrator, NASA Pilot Program
Oklahoma State University

Dick W. Orrick, Jr.
Assistant Director (Resources)
Technology Utilization
National Aeronautics & Space Administration

Robert L. Overton
Deputy Administrator,
NASA Pilot Program
Oklahoma State University

Ronald J. Philips
Director, Technology Utilization
National Aeronautics & Space Administration

Warren M. Rohsenow
Professor of Mechanical Engineering
Professor in charge of Heat Transfer Laboratory
Massachusetts Institute of Technology

John G. Truxal
Provost,
Polytechnic Institute of Brooklyn

John A. Wiebelt
Professor of Mechanical & Aerospace Engineering
Oklahoma State University

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