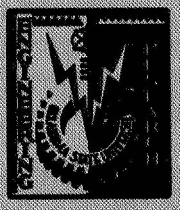


OFFICE OF ENGINEERING RESEARCH

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

ER 68-I-4

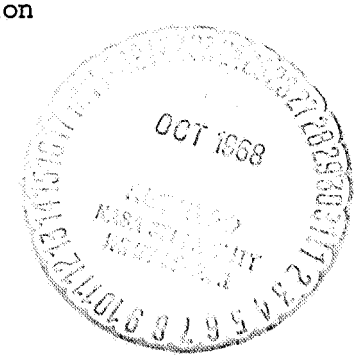
AUGUST 31, 1968

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

QUARTERLY REPORT
June 1, 1968 through August 31, 1968

COLLEGE OF ENGINEERING
OKLAHOMA STATE UNIVERSITY
STILLWATER, OKLAHOMA

Administered under Contract Number NSR 37-002-045
of the
National Aeronautics and Space Administration



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NASA PILOT PROGRAM

QUARTERLY REPORT

A. Summary

From the efforts of the Monograph authors, eighteen Educational Monographs are now available for immediate distribution, six other Educational Monographs have been written and are either being readied for reproduction or are out to original authors and four Monographs are being worked on.

The number of evaluations of the Educational Monographs was greatly increased during the quarter with 95 evaluations being received. A total of 159 evaluations have now been returned from educators and individuals in industry. As a greater number of evaluations are returned it will be easier to determine the acceptance of the concept as well as the points that need improvement.

The number of Visual Briefs ready for immediate distribution remains at 21. During the program, 269 requests have been received; 234 requests have been filled. A total of 111 Visual Brief evaluations have been received from the individuals that have used the films.

The following statistical information summarizes the program activity to August 31, 1968.

MONOGRAPH PREPARATION

1. Monographs Ready for Distribution ----------18
2. Monographs in Progress ----------10

28

a. Ready for reproduction ---------- 3
b. Back from original author and being readied for reproduction--- 2
c. Ready to send to original author- 1
d. Being written---------- 4*

*Two will probably be completed prior to October 31, 1968.

MONOGRAPH DISSEMINATION	University	Industry
1. Instructor Copies Mailed	1344	580
2. Student Copies Mailed	5464	165
3. Number of Professors	248	---
at Universities	106	---
in States	39	---
and Foreign Countries	5	---
4. Number of Industries	---	47

MONOGRAPH EVALUATION	University	Industry	Total
1. Monograph Evaluations Received	126	33	159
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	9 %	6 %	8 %
3. Number of Favorable Evaluations	112	33	145
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	89 %	100 %	91 %
5. Number of Unfavorable Evaluations	14	0	14
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	11 %	0	9 %

VISUAL BRIEFS

1. Number of Visual Briefs Ready for Distribution---------- 21
2. Number of Visual Briefs in Progress---------- 0
3. Number of Requests Filled----------234
4. Number of Evaluations Returned----------111
5. % Evaluations Returned

   $\frac{\text{Evaluations Returned}}{\text{Number of Requests Filled}} \times 100$ ---------- 47 %

B. Educational Monographs

Two Educational Monographs were completed for mailing during the quarter. They were: TD-8, "Thermodynamics of Space Flight" by Paul L. Miller, Mechanical Engineering, Kansas State University, and John A. Wiebelt, Mechanical Engineering, Oklahoma State University, and CS-4, "An Example of Bang-Bang Control System Design" by William A. Blackwell and A. Wayne Bennett, Electrical Engineering, Virginia Polytechnic Institute.

Three other Educational Monographs are ready for reproduction. They are: TD-2, "Thermodynamic Equations, Data and Techniques for Preparing Properties Compilations" by Wayne C. Edmister, Chemical Engineering, Oklahoma State University, TD-6, "Enthalpies of Co-existing Equilibrium Vapor and Liquid Mixtures from Solubility Data and Equations of State Calculations" by Wayne C. Edmister, Chemical Engineering, Oklahoma State University, and HT-9, "Thermal Modeling" by Paul L. Miller, Mechanical Engineering, Kansas State University and John A. Wiebelt, Mechanical Engineering, Oklahoma State University.

Two additional Educational Monographs have been reviewed by the original authors and are being readied for reproduction. They are: CS-7, "An Example of Gain Insensitive Design by State Variable Feedback" and CS-8, "Synthesis of Minimal Sensitivity Sampled-Data Control Systems". Both Educational Monographs were written by Leonard L. Grigsby and William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute.

Four other Educational Monographs are being written but require additional development work by the Monograph authors. Abstracts for 20 Educational Monographs are included in Appendix XI.

A total of 1,924 instructor copies and 5,629 student copies of Educational Monographs have been mailed to individuals who have requested them for review or use in a classroom situation. Appendix I shows the statistics on the copies mailed to educators while Appendix II tabulates statistics of those requested by individuals in industrial organizations.

In addition to those tabulated in Appendices I and II, as previously reported, an additional 1,182 instructor copies of Educational Monographs were distributed with letters to educators and industry designed to stimulate interest in the program; 615 copies of Educational Monographs with the initial letters to industry (OSU survey) and 597 copies of Educational Monographs with the letters to the Deans of Engineering. These additional copies of Monographs are not included in the tabulations in Appendices I and II.

C. Visual Briefs

The number of Visual Briefs ready for distribution to universities and industry remains at 21. A total of 269 requests to use the technical films have been received; 234 requests have been filled. The 35 requests have not been filled because the borrowing institutions have not been prompt in returning the Visual Briefs. A letter reminding the institutions of the need to return the films will be mailed to those insitutions that have had the material an undue length of time. A copy of a typical letter is shown in Appendix VII. Visual Brief dissemination by Visual Brief number is tabulated in Appendix VI.

D. Dissemination of Monographs

There have been 248 professors at 106 universities located in 39 states of the United States and 5 foreign countries who have received Educational Monographs for their review or use in classroom situations. Monograph dissemination by university is tabulated in Appendix V.

Dr. Kenneth A. McCollom was invited to speak at the Annual Convention of the American Society for Engineering Education which was held at Los Angeles on June 17-20, 1968. This was the second consecutive year that Dr. McCollom presented a paper on the NASA Pilot Program to the ASEE organization. Requests for Educational Monograph material have been received as a result of the presentation. As an example, Mr. Gilbert E. Seeley, Director of Education, American Concrete Institute, attended the ASEE meeting where he obtained a copy of Dr. McCollom's paper on the NASA Pilot Program. After reviewing the material he reports:

"I was very pleased to have the opportunity to hear you present the NASA Pilot Program at the ASEE Meeting at the University of California in Los Angeles. For quite some time ACI has been studying ways in which it might produce instructional materials for the concrete construction industry. We have the usual amount of pressure to produce textbooks but we feel that this is rather a slow process and that we cannot keep up with the technological developments if we were to concentrate in that one area."

"Your paper has been distributed quite widely among our members and we are all quite impressed with what you are doing. So that we might have the opportunity to become better acquainted with your program, would it be possible for you to send me a copy of the Instructor and student Monographs, CS-6?....."

Mr. Seeley's letter is included as Appendix X.

On June 5 and 6, 1968, Dr. Kenneth A. McCollom and Mr. Robert L. Overton attended the NASA Technology Utilization Conference at Langley Research Center. On June 5, 1968, Dr. McCollom reported on the progress of the NASA Pilot Program. Questions from other NASA contractors attending the meeting exhibited an interest in this technology transfer technique. This meeting was beneficial to the attendees from Oklahoma State University in pointing out the overall approach NASA is conducting to effectively transfer new technology from contract research to universities and industry.

The letters to Deans of Engineering, advertisement in the Journal of Engineering Education, and letters to industry continued to generate requests for Monograph material. A total of 393 requests for instructor copies of Educational Monographs were filled during the quarter. Individuals from industrial organizations requested 298 copies while educators requested 95 copies. The decrease in requests from educators during this quarter was expected as professors are usually on vacation or have taken employment with industry during the summer months.

Figure 1 shows accumulative total number of instructor copies that have been requested and mailed at the end of each quarter of the NASA Pilot Program. It is significant to note that 66% (or 1267) of the total instructor copies have been mailed in the last 6 months of the program. Of the 1,267 copies, approximately 54% were mailed to educators while 46% were mailed to industrial organizations. The educators receiving the material in the last 6 months probably did not have time to incorporate the Monograph material in their classroom study plans during the spring, 1968 semester. This indicates that additional evaluations are likely to be received during the latter part of the fall, 1968 semester.

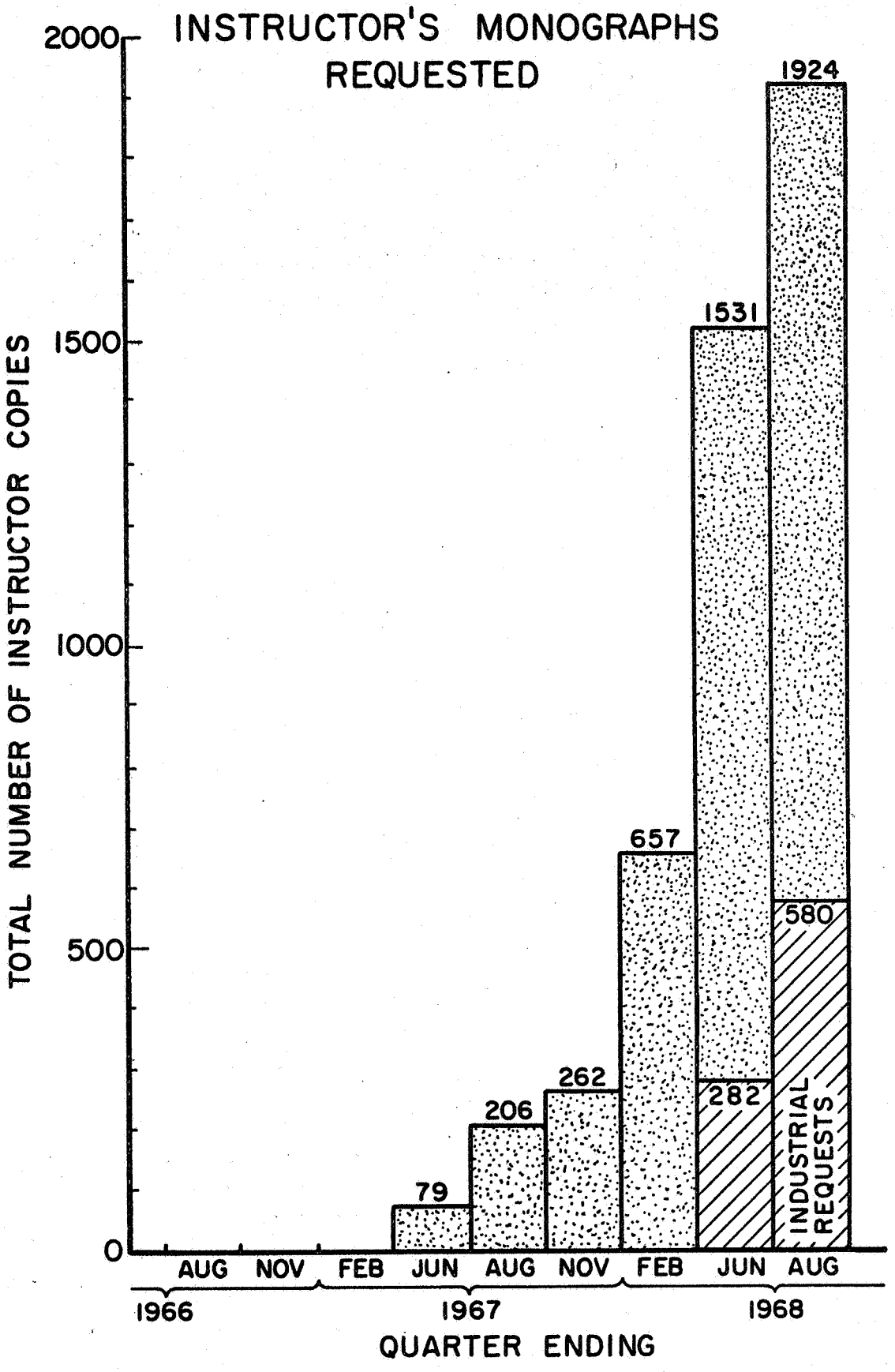
INSTRUCTOR'S MONOGRAPHS REQUESTED
TOTAL NUMBER OF INSTRUCTOR COPIES
2000
1500
1000
500
0
79
206
262
657
1531
1924
580
282
INDUSTRIAL REQUESTS
AUG
NOV
FEB
JUN
AUG
NOV
FEB
JUN
AUG
1966
1967
1968
QUARTER ENDING

Figure 1

E. Evaluation

Evaluations of Educational Monographs increased from 64 on May 31, 1968, to 159 on August 31, 1968. Figure 2 illustrates the total number of evaluations returned at the end of each quarter of the NASA Pilot Program. During the last 6 months of the program, 136 evaluations have been returned by reviewers in education and industry; it is noteworthy that 95 evaluations have been received in the last 3 months of the program.

The concept of preparing Educational Monographs continues to be favorably received by individuals requesting the material. For every 11 positive responses to the concept only one negative response is received. However, as a larger number of evaluations are obtained it is apparent that some modification of the material might be desirable to produce the highest quality of the documents.

Some of the evaluators have commented that the Educational Monographs are too specialized for undergraduate students and should be used for graduate students either as seminars, research references, or specialized studies. Other evaluators have suggested that the material should be expanded to reflect the format of a section of a textbook. Another evaluator comments that the Educational Monographs he reviewed should have included additional home problems, while another evaluator suggested a more practical approach to Monographs than the theoretical approach presently followed.

Another evaluator responds that the Educational Monographs "are of definite value" in presenting new technical material. "They would be more complete if all the basic material, the fundamentals, were included."

The above comments reflect approval of the concept but present a wide variety of suggested modifications that given evaluators think might improve the contents of the documents. In depth, analysis of the evaluations will be made and reported in the annual report. All comments from the evaluations are shown in Appendices III and IV.

Figure 3 illustrates the number of evaluations received for each Educational Monograph. A minimum of ten evaluations have been received on ten of the documents. It would appear that the minimum of ten evaluations as specified in the Work Statement be obtained on all of the documents when they have been in the hands of the reviewers a sufficient length of time.

A total of 111 evaluations of Visual Briefs have been received from users of the technical films. At least one evaluation of each film has been received. Figure 4 illustrates the number of evaluations received for each Visual Brief. Originally, a minimum of five evaluations were specified in the Work Statement as desired for each Visual Brief. A total of 13 Visual Briefs have been evaluated by five or more users. See Appendices VIII and IX for all comments taken from evaluation sheets. Analysis of the evaluations indicate a favorable response by individuals using the films. The inability to modify the films for educational use appears to be the main obstacle to wider use of this technique to transfer technology.

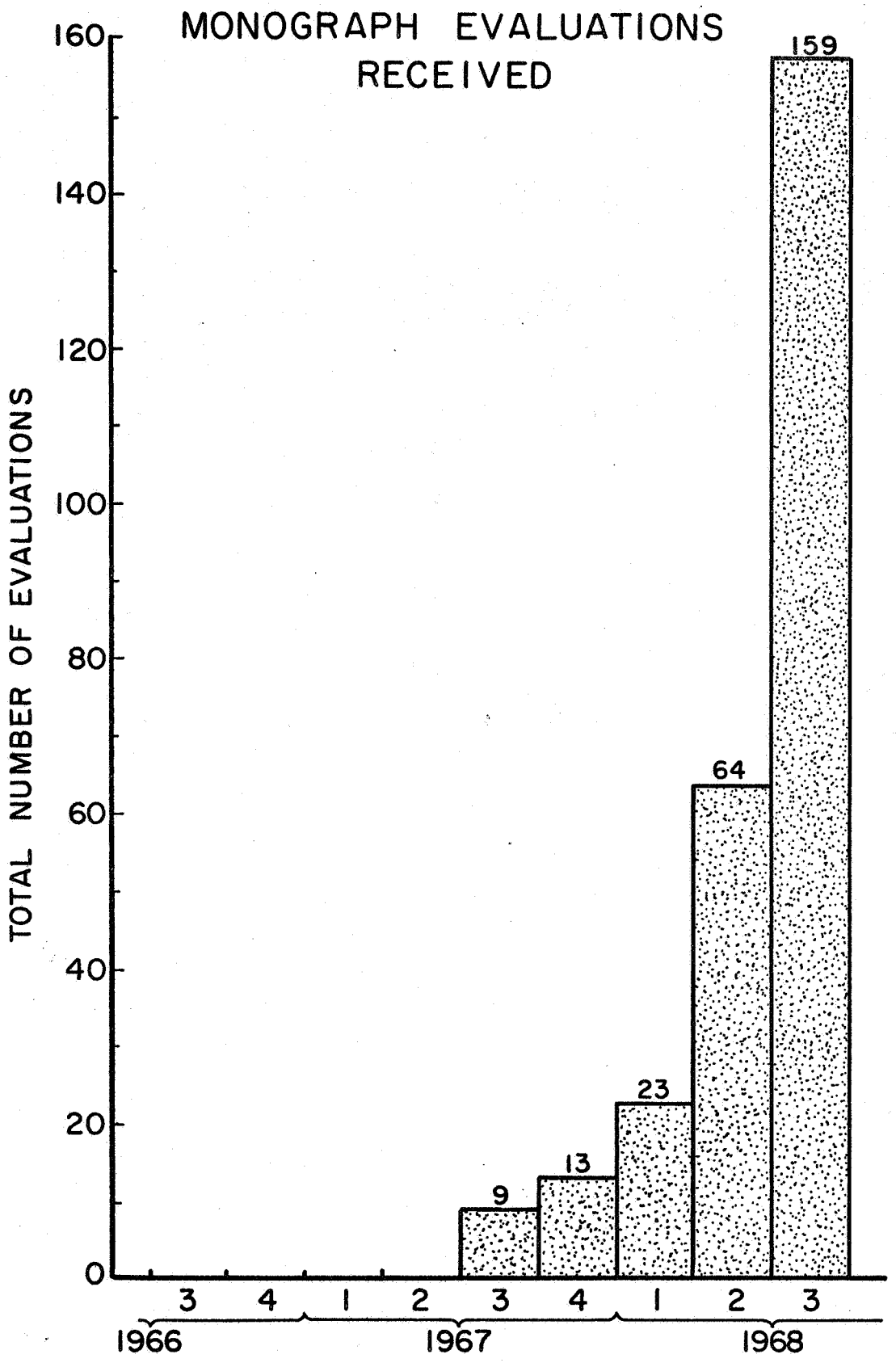
MONOGRAPH EVALUATIONS
RECEIVED
TOTAL NUMBER OF EVALUATIONS
160
140
120
100
80
60
40
20
0
9
13
23
64
159
3
4
1
2
3
4
1
2
3
1966
1967
1968

Figure 2

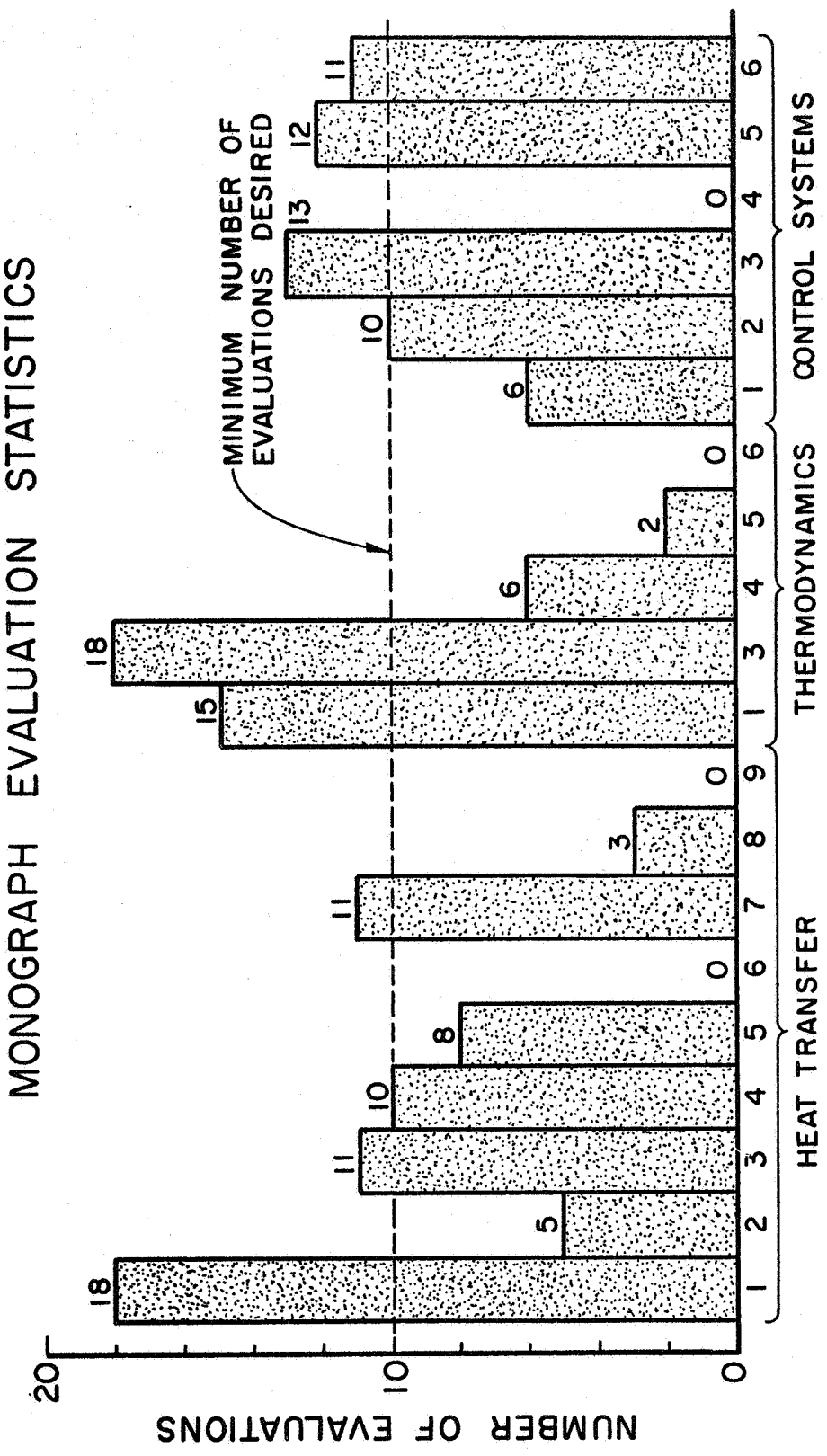
MONOGRAPH EVALUATION STATISTICS
NUMBER OF EVALUATIONS
20
10
0
MINIMUM NUMBER OF EVALUATIONS DESIRED
18
5
11
10
8
0
11
3
0
18
15
6
2
0
6
13
10
12
0
11
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
HEAT TRANSFER
THERMODYNAMICS
CONTROL SYSTEMS
MONOGRAPH NUMBER

Figure 3

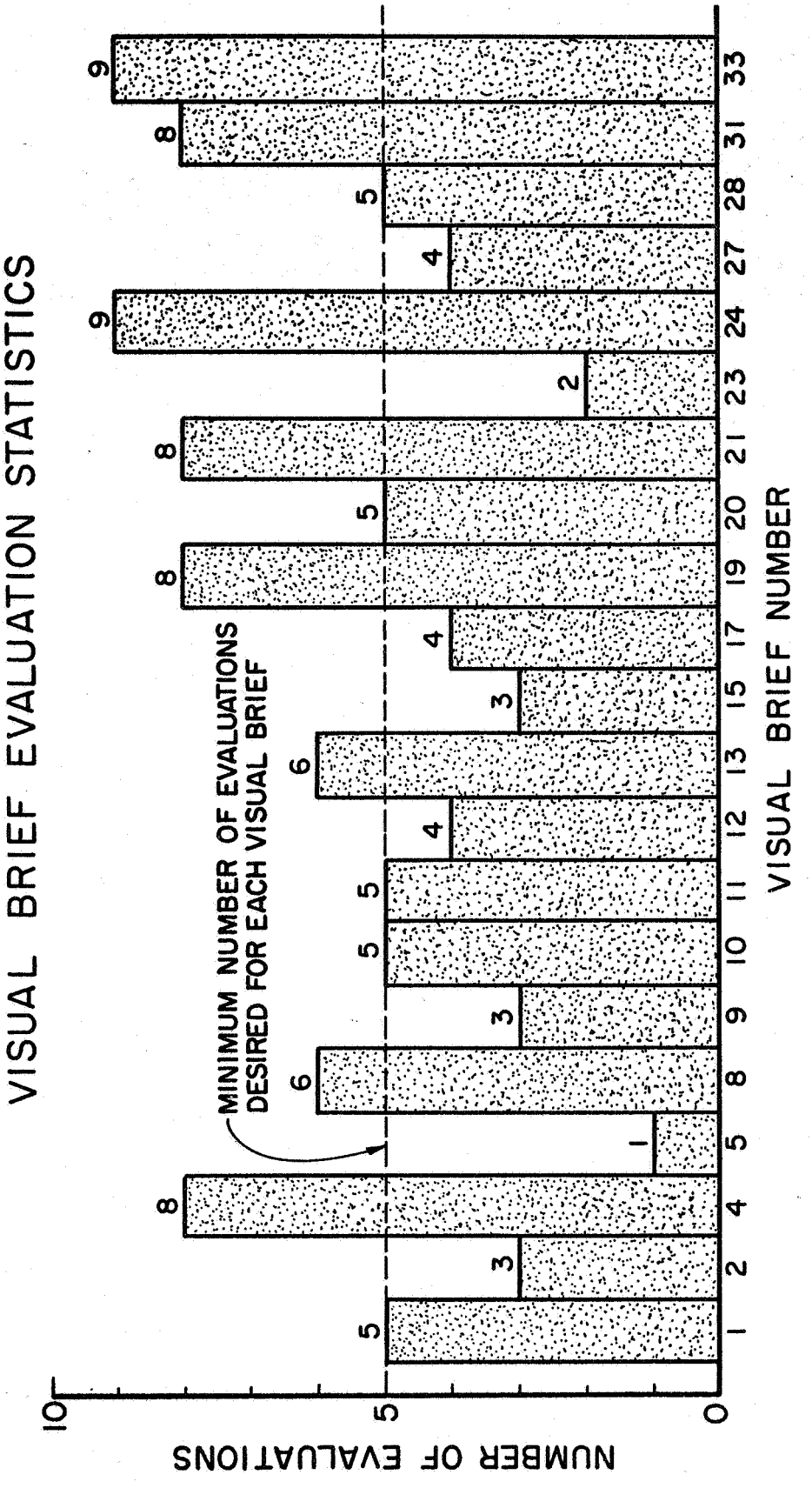
VISUAL BRIEF EVALUATION STATISTICS
MINIMUM NUMBER OF EVALUATIONS DESIRED FOR EACH VISUAL BRIEF
NUMBER OF EVALUATIONS
VISUAL BRIEF NUMBER
0
5
10
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

Figure 4

F. Program Support

Proposal ER 68-T-144, entitled "A Center for Creating Educational Monographs in Engineering" submitted to the National Science Foundation is still being evaluated. Dr. Borg, National Science Foundation, has reported that the outside reviewers had submitted their reviews. Dr. Borg indicated that a decision on the proposal would be made in September, 1968. A meeting with Dr. Borg has been arranged for September 5, 1968.

A preliminary letter proposal dated, August 14, 1968 has been submitted to the Army Research Office. This proposal presents a pilot program to determine how the techniques developed in the NASA Pilot Program can be applied to "in house" technology transfer in the Army Research Office. A critique of the preliminary proposal has been scheduled for September 6, 1968.

A Proposal ER 68-T-152, dated June 13, 1968, to continue the NASA Pilot Program from September 1, 1968 through May 31, 1968 was submitted to the National Aeronautics and Space Administration on June 14, 1968. It was proposed that the NASA Pilot Program be continued during the academic year to allow time to seek other funding to support the program through a developmental period now that the concept has been proven successful. An analysis of the evaluations received and expected during the next 6 months would be of considerable value in developing a highly acceptable technology transfer technique.

APPENDICES

APPENDIX I

UNIVERSITY MONOGRAPH DISSEMINATION STATISTICS THROUGH AUGUST 31, 1968

Dissemination Summary by Monograph Number

Monograph Number	Instructor's Copies Sent	Student's Copies Sent	Unfilled Requests Instructor's	Unfilled Requests Student's	Evaluations Received
CS-1	62	248	0	0	4
CS-2	77	561	0	0	9
CS-3	73	471	0	0	11
CS-4	57	169	34	267	0
CS-5	97	398	0	0	10
CS-6	103	437	0	0	10
HT-1	123	513	0	0	14
HT-2	79	179	0	0	5
HT-3	106	526	0	0	11
HT-4	96	484	0	0	10
HT-5	83	176	0	0	6
HT-6	0	0	91	201	0
HT-7	81	174	0	0	6
HT-8	63	325	0	0	2
TD-1	82	338	0	0	10
TD-3	94	327	0	0	11
TD-4	58	138	0	0	6
TD-5	10	0	0	0	1
	1344	5464	125	468	126

APPENDIX II

INDUSTRIAL MONOGRAPH DISSEMINATION STATISTICS THROUGH AUGUST 31, 1968

Dissemination Summary by Monograph Number

Monograph Number	Instructor's Copies Sent	Student's Copies Sent	Unfilled Requests Instructor's	Unfilled Requests Student's	Evaluations Received
CS-1	22	0	0	0	2
CS-2	15	0	0	0	1
CS-3	35	0	0	0	2
CS-4	33	0	0	0	0
CS-5	25	0	0	0	2
CS-6	30	15	0	0	1
HT-1	37	15	0	0	4
HT-2	20	15	0	0	0
HT-3	30	15	0	0	0
HT-4	25	15	0	0	0
HT-5	41	15	0	0	2
HT-6	0	0	15	15	0
HT-7	66	15	0	0	5
HT-8	49	15	0	0	1
TD-1	31	15	0	0	5
TD-3	67	15	0	0	7
TD-4	24	0	0	0	0
TD-5	30	15	0	0	1
	580	165	15	15	33

APPENDIX III

Totaled Responses on a Monograph Evaluation Sheet

Comments on Monograph from Classroom Use

1. The Monograph (was 13 , was not 2) used in a classroom situation.

2. The Monograph (was 13 , was not 1) used in context with closely related material in the course presentation.

3. The Monograph (was 7 , was not 4) used for the course described in the "Instructor's Guide for Monographs."

4. The Monograph (was 11 , was not 2) found suitable for the course in which it was used.

5. The technical information presented in the Monograph was (new to me 4 , well known to me 9) and (new to my students 11, well known to my students 0).

6. The technical information in the Monograph (did 12 , did not 3) contribute to further understanding of the course material by the students in this course.

7. The home problems in the Monograph (were 5 , were not 8) assigned to the students in the course.

8. The home problems in the Monograph were (useful 9 , too complex 1 , too simple 0 , unnecessary 0).

9. The amount of material for the Monograph was found to be suitable for presentation in (--) hours of classroom lecture.

10. The amount of material for this Monograph should be made (longer 2 , same 11, shorter 1) to have maximum effectiveness in class.

11. The reference bibliography (was 7 , was not 6) used and (was 4 , was not 5) a necessary requirement to gain additional information on Monograph subject.

Recommendations on Monographs in General

1. Monographs of technical literature such as this could be of (great 4 , some 10 , little 0) use to me in my course presentation.

2. Monographs should include (more 3 , less 0 , no change in 11) material over that given here.

3. The general reference bibliography (should 6 , should not 6) include information as to what is available in each reference.

4. The format of the Monograph is considered (good 12 , could be better 3 , poor 0 , completely incorrect 0) for use as an insertion in a course in engineering.

Totaled Responses on a Revised Monograph Evaluation Sheet

General Information on Monographs:

Was the technical information convered in the Monograph of value in course presentation?	Good	72
	Some	18
	Little	7
Should the Monographs include more information than was presented?	More	36
	Same	49
	Less	1
Is the format of the Monographs appropriate for use in engineering courses?	Good	88
	Fair	15
	Poor	2
	Incorrect	

Comments on Monograph from Classroom Use:

Was the Monograph used in a classroom situation?	Yes	41
	No	51
Was the Monograph used in context with closely related material in the course presentation?	Yes	49
	No	39
Did the technical information in the Monograph contribute to the further understanding of the course material by the students in the course?	Great	11
	Some	45
	Little	4
	None	1
Were the home problems in the Monograph too complex?	Not Used	25
	Too Complex	1
	Useful	30
	Too Simple	5
	Unnecessary	

How many hours of classroom lecture time should be allocated for presentation of this Monograph? Average of 2

Would you use the Monograph if you taught the course again?	Yes	48
	No	39

APPENDIX IV

Comments on Monographs from Professor Evaluators

HT-1: Calculation of Radiant Heat Exchange by the Monte Carlo Method

1. I did not require the students to program and operate the technique (as a result this knowledge of it is somewhat superficial). I asked them for a flow chart of the program to be written. This might be sufficient for some, but not the majority. (University of Florida)

2. I received the Monograph too late in the school year for proper usage. I will use it next year. (University of Nebraska)

HT-3: Method of Estimating Ratio of Absorptance to Emittance

1. Material is elementary and I fail to see its technical value for radiant heat transfer. (University of Arizona)

2. One advantage of using monographs should be found in the manner in which basic heat transfer theory is related to current practical applications. Problems should be written which deal with current and future aerospace and outerspace hardware. The theory presented in the monograph should be better illustrated and applied, via the problems. Even though the problem, and its solution, would remain basically the same, student motivation would be greatly increased if the problems were rewritten. In addition to relating the problems to specific hardware, a statement of difficulties and history which led to the problem (such as a practicing engineer might encounter) would stimulate the teaching and learning process. (United States Naval Academy)

HT-4: Formulas for Radiant Heat Transfer Between Non-gray Parallel Plates of Polished Refractory Materials

1. A paragraph of introduction is needed before the analysis section. It would aid the incentive and understanding of the students to introduce them to the problem with information such as why the research was necessary, how it was conducted, and how the results have been used in specific space applications. On the whole I feel that these monographs will serve a useful purpose. (United States Naval Academy)

2. Much too specific to be useful. The formulas given apply only to very special situations and are not generally applicable. (Kansas State University)

CS-5: Controller Design for Nonlinear and Time-Varying Plants

1. Since the monograph arrived in the summer there has not been an opportunity to evaluate it in a classroom situation, but I do have some comments to make on it. I think the idea and general format of the Monograph is good. This particular Monograph presents an interesting and useful approach....I am interested in the Monograph series and would appreciate being put on the mailing list for all Monographs dealing with control systems. (University of Texas)

TD-3: Critical Flow of Real Gases Through Nozzles

1. We used the Monograph ...at the end of our year's course in Thermodynamics for undergraduates. Only one hour was devoted to this and this is admittedly too little to give the Monograph full treatment. Also, clearly this material is more suitable for first year graduate students. My own opinion of this Monograph is that it is an excellent discussion of various ways to determine critical flow conditions. I think it is something graduate students should have available to them. It should probably be used for graduate study as a textbook supplement. For undergraduates, the Monograph proceeds too rapidly ....Reiterating, I think this is a nice report but a little too sophisticated for seniors....Thanks for the opportunity to use this program. I hope to have the privilege of using another one this coming fall. (University of Southern California)

Comments to Questions Asked on Revised Monograph Evaluation Sheet

IN YOUR OPINION, ARE MONOGRAPHS A USEFUL METHOD OF PRESENTING NEW TECHNICAL INFORMATION IN THE CLASSROOM UNTIL THE MATERIAL CAN BE INCLUDED IN A TEXTBOOK?

CS-1

Yes (University of Wisconsin)

CS-2

Yes (Southern Illinois University)

Not good for presenting new material before text coverage. (University of Massachusetts)

Yes (Rose Polytechnic Institute)

The technique is standard. The difficult part is the modeling problem which is not explained in detail. In the present form, the Monograph does not offer any new information other than that from the standard textbooks. (State University of New York)

Yes (University of Kentucky)

This is a useful method of presenting new technical information. However, this particular Monograph contained very little new information. (North Caroline State University)

This one serves chiefly as an example and application of Root Locus. Will not use it to teach any new techniques. This is done adequately in text. (University of Utah)

CS-3

The Monograph serves a useful purpose. (University of Florida)

As a taxpayer, I'd say that they aren't worth the price and NASA could well cut it from its budget without jeopardizing Engineering Education. As long as they do exist, I'd like to keep getting them so I can use one once in a while. A more direct answer to your question is that they do not do what your question wishes to imply. Much of the material is in textbooks now to a very large extent. The part that isn't never will be because it is too specialized. What your question really describes is the function of the technical journals. If you had significant, new technical information it would be appearing in journals, not in Monographs. Most of your references are textbooks, and a few company or university reports that didn't merit publication, and most of the references are not new. (University of Nebraska)

They don't seem to fit in with a course without changing the content slightly. It would be helpful if some suggestions were made as to where the material would most logically fit into several of the books likely to be used. (University of Denver)

The contents seem to have nothing to do with the Rocket Control design. Some of the presentations are not clear. (State University of New York)

Very positive reaction, most effective way to introduce new material. (General Precision Equipment Corporation)

Yes (University of Wisconsin)

CS-5

Yes, in my opinion these Monographs will help students in coming in contact with research material; yet on a level he can understand. I feel that these Monographs are written less concisely. The difficult concepts should be expanded. These should be written like a section of a book rather than a paper. (Oklahoma State University)

I generally found the material well presented and with the example given a means of learning the application of the theory presented. I would judge it to be valuable in a classroom for this reason. (Allis Chalmers)

It would appear that the Monographs definitely serve a useful purpose. Although I would not feel sustained to teach only what was in the Monograph, nor as much. (University of Florida)

Definitely useful (Iowa State University)

Personally, I have some doubt about the feasibility of the approach. This material is just a standard application of the Lyapmion theory. (State University of New York)

Yes (University of Wisconsin)

CS-6

Yes, they give the student the sense that he is actively engaged in topics of current interest. I think they add a certain amount of confidence that he needs when he has to attack the rather formidable bulk of literature he sees when he first gets out of the classroom to try his wings as a "real engineer". (Tulane University)

Perhaps I misunderstood the purpose of the Monographs. I thought they would be addressed to bridging the gap between textbook approaches and actual practice, using NASA contractors' experience as a base. The 4 Monographs I looked at definitely do not do this and appear not to be trying to do this. They seem to be essentially the same kind of material as found in textbooks and they also are not far ahead of what is available in the latest textbooks. There is a wealth of application type information in many NASA reports, (I have hundreds of them) which can be successfully tied to the more conventional classroom textbook approaches if one is interested in showing students how the theory actually gets applied. I had hoped the Monographs would try to do this, even though it involves considerable effort. (Ohio State University)

This is purely mathematical manipulation. Some motivation is needed. If possible, an application from real systems should be included. (State University of New York)

Yes (University of Wisconsin)

HT-1

Yes (Auburn University)

Very much so. This particular Monograph was too advanced for my senior level heat transfer course. For the level of course I was teaching, a more descriptive and less ingenious Monograph would have been more useful. I had introduced the concepts before but the math in the Monograph was too much for the undergraduate. (University of Wyoming)

Yes, makes students aware that classroom material has application. Informs students of type of work being done currently. (University of New Mexico)

Monographs could be very useful in presenting technical information for continuing education courses. This Monograph, as well as the others which were listed, appear to be too specialized to have applicability in our courses. (Humble Oil & Refining Company)

Yes, if passed out to and read by students before lecture.(Humble Oil Co.)

Too little experience to make a judgment. (University of Minnesota)

Yes (University of Wisconsin)

HT-2

Yes (Auburn University)

Yes (University of Wisconsin)

HT-3

They are of definite value. They would be more complete if all the basic material, the fundamentals, were included. (University of Kentucky)

Yes (Auburn University)

Yes (University of Wisconsin)

This material is too specialized for regular inclusion in an undergraduate course. It would be appropriate for use in subsequent, advanced courses. I feel it had some value to the students as an introduction to current topics in heat transfer. (Kansas State University)

Yes (University of Virginia)

HT-4

Yes (University of Virginia)

This Monograph is useful reference material but too confined to one area. Most of the information, except the graphs, is already in textbooks. The homework problems were assigned and students were asked to write the program to evaluate total emittance. This proved very useful in illustrating the usefulness of computers in facilitating the solution of engineering problems. (University of Detroit)

The Monograph technique is useful in adding to the lecture material to indicate the state of the art. It is especially useful in graduate course work where texts can form the basis for instruction but must be augmented with current outside material. (Auburn University)

Yes, they are. I used them in two ways this semester. (1.) As a basis for a lecture. (2.) As a basis for a student lecture on a particular topic in radiation. As I used them I found them as excellent aides to my own as well as student understanding. (Lehigh University)

HT-5

Yes. However it is necessary to be quite detailed if the professor is going to take the time to use them. Otherwise, the tendency is to stick with what you have because of "time problems" in developing new material and filling in the gaps in the Monographs. (Stanford University)

Yes. I use the Monographs as outside reading material. (University of Cincinnati)

I like the idea but it does not appeal to others in our department. (Michigan State University)

Yes. (University of Wisconsin)

Only if they offer substantial clarification or amplification on the original paper. HT-1 on Monte Carlo techniques in Radiation was good and was used in class. This paper, HT-5, is too specialized for inclusion in any of our 3 heat transfer classes. (University of Nebraska)

HT-7

Yes (University of Virginia)

Yes (Lehigh University)

These Monographs are useful. They seem to strike a balance between too much and too little information although in the case of HT-7, I felt a little more detail would be useful. (Caterpillar Tractor Company)

Yes, a method of presenting recent developments to those interested in the field. (Caterpillar Tractor Company)

Monographs could be extremely useful in industry as well as the classroom for keeping engineers abreast of current developments in their field. (Caterpillar Tractor Company)

I think the Monographs would be quite useful in industry as a means of continuing education for technical specialists. (Caterpillar Tractor Co.)

Monographs are an important source of "updated" material for graduate courses. Frequently government publications are of little value because they are poorly presented, too concise and do not bother to specify the application of limitations of the material. (Caterpillar Tractor Company)

Yes. This particular one was of no value in the undergraduate course. It would be of value in an advanced course. Simply a matter of my obtaining it for a course for which it was not intended. (Kansas State University)

I used the Monograph to illustrate the usefulness of computers in solving chemical engineering problems. Students used the Monograph and wrote programs to solve the homework problems. (University of Detroit)

HT-8

They are of definite value. They would be more complete if all the basic material, the fundamentals, were included. (University of Kentucky)

Yes (University of Wisconsin)

TD-1

This should be useful in my graduate seminar. It does not fit in with the more elementary treatment we use in our undergraduate courses. (University of Michigan)

I think the idea of the Monographs is excellent as they bring the latest in technical developments to the attention of the students. As a practicing engineer, I think they are excellent. Also, I would appreciate receiving any other ones OSU publishes in the field of Chemical Engineering. (Lummus Company)

As all teachers know, paedagogy is a highly subjective art. We have little solid evidence of what is or isn't good teaching. Thus my comments below represent my own subjective appraisal. I make this preface, because I favor the kind of experiment you are trying, but do not intend to use the result. My impression is that each of the Monographs was too detailed on one specific item to justify inclusion in the courses we teach. To use the material properly we would have to devote two class days to the subject of a Monograph and probably two nights of homework time. I simply do not believe that the gain from such a process would justify the effort. My second comment is that the relation of the subjects treated to practical problems (i.e. problems someone will pay to get the answer to) was too sketchy. If it were closer we might have fitted these into a design course, but these would not fit in their present form. Neither the university I teach in, nor the one I attended teaches a course in which the students are expected to do directed reading and problem solving. Instead we use lecture-recitation. I think we ought to

try more of the former, but we don't. If I can ever sell my colleagues on such a course we might use the Monographs as subject matter for part of the course. They are better suited for that than for lecture-recitation. (University of Utah)

Useful (University of Oklahoma)

The material presented in this Monograph is of great interest to a thermodynamicist and would be valuable to a (mechanical) engineering student as reference material. However, because of the complexity of the material and its restricted potential application for a mechanical engineering student, I do not believe we could afford the time to present it in a thermodynamics course, particularly at the undergraduate level. It is unfortunate that this is so, since it is difficult to demonstrate chemical equilibrium in realistic systems without introducing much time-consuming complexity. (Massachusetts Institute of Technology)

Yes (University of Wisconsin)

In my opinion, Monographs are a useful method of presenting technical material. This assumes that the Monograph is carefully edited to present the material in a logical sequence, is as self-contained as possible, and does not presume too much prior knowledge on the part of the student. An instructional Monograph, as opposed to an article in a technical journal, should not presume a familiarity by the student with the field of research covered by the Monograph, nor should it require the student to look up further references in that field of research in order to understand the instructional Monograph, i.e., it should be self-contained. (Humble Oil Co.)

Monographs could be very useful in presenting technical information for continuing education courses. This Monograph, as well as the others which were listed, appear to be too specialized to have applicability in our courses. (Humble Oil Company)

A very useful technique for above stated purpose; also particularly well suited for "refresher" or augmentive material for already knowledgeable engineers. The Monograph affords capsule coverage of specific technical aspects of a problem by the most noted men in that field. The format is good. The text however is somewhat too mathematically oriented for the usual refinery engineer, who is likely to appreciate a more practical application approach. (Humble Oil Company)

TD-3

I believe the Monograph is a very useful method of presenting technical information especially in an industrial situation. (Caterpillar Tractor Co.)

Yes (Auburn University)

Yes, they are useful and could be quite helpful in conjunction with advanced fluid dynamics courses. (Caterpillar Tractor Company)

Very useful method for engineers in industry to improve or update their skills by self-study or study groups. This particular Monograph would be difficult to improve upon. (Caterpillar Tractor Company)

Too specialized for undergraduate (University of Cincinnati)

The Monograph was not used for educational instruction purposes, but as a technical reference in the work done by the writer. It is excellent for this purpose as I am sure it must be as a classroom reference.(Changes in format of a Monograph intended as a technical reference rather than as a classroom text are obvious) (ARO, Inc.)

Yes--excellent idea. (University of Notre Dame)

Yes (University of Michigan)

Yes (University of Wisconsin)

In general, Monographs are a useful method. However, the content of a Monograph will, by purpose, usually delve deeper into a particular area than a person (student) can absorb or appreciate in a one-hour lecture. This Monograph, in particular, would be of much more value to an engineer experienced in the field of mass flow measurements than to a student being introduced to the subject. (ARO, Inc.)

This is a fairly useful method of supplementing fundamental material, although the time needed for students to assimilate everything in this Monograph may be greater than the importance of the specific detailed subject warrants. Each teacher uses his own scheme, however, and one who chooses this subject for elaboration on principles will have a convenient source of material. (University of Michigan)

The material is presented good but it is too simple for graduate students. I would like to see more complicated problems presented in similar form. (University of Cincinnati)

TD-4

I have found this Monograph interesting reading. I can only assume the student will find it both interesting and useful when I am in a position to introduce it into a course. (University of Michigan)

WHAT ARE THE GOOD POINTS?

CS-2

It points out to the students that the theory they are learning has applications. (Southern Illinois University)

Very good as a practical example. Main advantage is that the problem discussed seems very typical of a real engineering problem not just an academic example. (University of Massachusetts)

Very Excellent. (Caterpillar Tractor Company)

CS-3

Excellent (Caterpillar Tractor Company)

CS-5

Excellent (Caterpillar Tractor Company)

I generally found the material well presented and with the example given a means of learning the application of the theory presented. I would judge it to be valuable in a classroom for this reason. (Allis Chalmers)

CS-6

They provide a means to give the student some depth. (University of Iowa)

HT-1

Good Points: Provided sufficient numbers of Monographs are available, the instructor can be selective to the extent that he presents topics which complement his course outline. New materials of this form should confront students with a segment of the current literature which should be helpful in simulating research ideas. (University of Virginia)

It includes current information ready for distribution to students. (Auburn University)

HT-2

It presents current material. (Auburn University)

HT-3

Students get acquainted with the real analysis of problems which are confronting engineers who are active now. (University of Virginia)

HT-4

Monographs can discuss specific problems and specific methods which a textbook cannot cover completely. Monographs enable presentation of a specific information in fairly detailed manner which a textbook cannot due to the limitation placed on the number of pages. Monographs may be developed to supplement textbooks and expound information newly developed. Monographs may be written for laboratory courses to explain and inform the techniques, procedures, etc., with examples. (Rose Polytechnic Institute)

Students observe analysis of real problems like ones that one might experience. (University of Virginia)

I used them in 2 ways this semester; (1) as a basis for a lecture, (2) as a basis for a student lecture on a particular topic in radiation. As I used them I found them as excellent aides to my own as well as student understanding. (Lehigh University)

HT-7

The good points were: (1) the mathematical derivations and manipulations were complete enough to follow--no gaping holes. (2) The background information for iteration procedures and numerical integration was complete enough that the reader need not refer to other texts. (3) The presentation was complete in itself. One could follow the development of the procedure to its conclusion and then use it. (Caterpillar Tractor Co.)

Brevity. (Lehigh University)

The material is well presented in a concise manner. (Caterpillar Tractor)

TD-1

I think the idea of the Monographs is excellent as they bring the latest in technical developments to the attention of the students. As a practicing engineer, I think they are excellent. Also, I would appreciate receiving any other ones OSU publishes in the field of Chemical Engineering. (Lummus Company)

Good point is that one subject is treated in some depth. (University of Oklahoma)

TD-3

This particular Monograph, TD-3, contained enough information to obtain a thorough understanding of the material presented without several reference volumes. The material was initially outlined in sufficient detail, and there presented in an orderly fashion that was easy to follow. The example and home problems helped demonstrate the calculation procedures involved. (Caterpillar Tractor Company)

Very good. (Caterpillar Tractor Company)

Monographs can discuss specific problems and specific methods which a textbook cannot cover completely.

Monographs enable presentation of a specific information in fairly detailed manner which a textbook cannot due to limitation placed on the number of pages. Monographs may be developed to supplement textbook and expound information newly developed.
Monographs may be written for laboratory courses to explain and inform the techniques, procedures, etc., with examples. (Rose Polytechnic Institute)

Newness. (University of Michigan)

TD-4

Quite a useful method for updating textbook material. Students were able to follow presentation due to concise notation presented in Monograph. (University of Detroit)

ANY IMPROVEMENTS NEEDED?

CS-2

For my particular use, I feel that a photograph of the actual steering mechanism and the individual components would be useful. I also feel that pictures of the response of the systems before and after compensation would emphasize the importance of compensation techniques. (Southern Illinois University)

No (Rose Polytechnic Institute)

More information needed as to how the system was modeled. (University of Kentucky)

CS-3

CS-3 should be expanded. (Caterpillar Tractor Company)

Additional problems associated with the brief, illustrating different points is desirable. (University of Florida)

Title is misleading--paper presents a method of synthesizing a sub-optimal controller. Not suitable for first-year graduate students. First half is a fair summary of the maximum principle & Liapunous direct method. Second half is difficult to comprehend on first reading (not exactly a desirable attribute for an educational Monograph). (Iowa State University)

It would be useful to review the underlying mathematical theories more extensively. (General Precision Equipment Corporation)

CS-5

Could be geared more fully to classroom use--those I've seen are not far removed from technical journal formats--need more motivation, introduction and student problems. (Iowa State University)

CS-5 could be expanded. (Caterpillar Tractor Company)

I think a couple of problems illustrating different points in the presentation would be useful, instead of just the one. (University of Florida)

CS-6

Additional problems associated with the brief, illustrating different points would be desirable. (University of Florida)

HT-1

More background material in beginning and example problems. (Humble Oil Co.)

Even for use in an undergraduate course, the Monograph does not cover sufficient material to allow full utilization of the technique. For example, no mention is made of how the method can be adapted to determine surface temperatures, net interchange, radiation in absorbing or scattering media, etc., or to what extent it is limited. This could be done in additional sections or appendices. (Massachusetts Institute of Technology)

HT-2

No (Auburn University)

I would like to see more area covered in a similar Monograph. (University of Cincinnati)

HT-3

Have more Monographs so that the instructor can be more selective. (University of Virginia)

HT-4

Have more Monographs so that the instructor can be more selective. (University of Virginia)

HT-5

The applied mechanic's model used to derive the basic equations such as 4 should be treated in detail. This is the interesting part of the problem. (General Precision Equipment Corporation)

HT-7

This particular Monograph would have been a little clearer with a simple graph (Temp. vs Distance) in conjunction with the discussion of the method (pgs. 2-3). (Caterpillar Tractor Company)

No (Lehigh University)

I felt a little more detail would be useful. (Caterpillar Tractor Co.)

HT-8

They would be more complete if all the basic material, the fundamentals, were included. (University of Kentucky)

TD-1

We would have appreciated greater detail at the level (senior undergraduate) of the present course -- but for grad student use this is O.K. Most of my students also consulted the original TN. (Pennsylvania State University)

TD-3

Too specialized for undergraduate. (University of Cincinnati)

A teaching Monograph on mass flow measurements should treat the problems of: (1) perfect fluid mass flow, (2) areas of pressure and temperature where real gas relations are important, (3) approximate real gas corrections, as outlined in the subject Monograph. (Arnold Research Organization, Inc.)

The material is presented good but it is too simple for graduate students. I would like to see more complicated problems presented in similar form. (University of Cincinnati)

Yes (Auburn University)

An example problem would be a helpful improvement. (Caterpillar Tractor Co.)

SHOULD A PROGRAM OF PREPARING MONOGRAPHS BE EXPANDED TO COVER A WIDE VARIETY OF SUBJECT AREAS?

CS-2

Yes (Southern Illinois University)

I should like to see others of this same general type. (University of Massachusetts)

The program should be expanded. I would use them to the extent that they would fit into the context of the course. Due to the difficulty of fitting them in, this would probably result in occasional use, rather than frequent. (North Carolina State)

Yes (University of Kentucky)

CS-3

No (University of Nebraska)

Yes, they are valuable and should find application in many fields. (Allis Chalmers)

It would depend on the Monograph covering topics of interest. If so, yes. (University of Florida)

Yes, yet it should be expanded to include quiz questions to test the understanding of the material. (General Precision Equipment Corporation)

Not wide variety. (University of Wisconsin)

CS-5

Yes, they are valuable and should find application in many fields. (Allis Chalmers)

Yes. (Iowa State University)

No (University of Wisconsin)

CS-6

Yes. (University of Massachusetts)

Yes. (Oklahoma State University)

No (University of Wisconsin)

HT-1

No (University of Minnesota

Yes (University of Virginia)

HT-2

Yes (Auburn University)

Yes (University of Cincinnati)

No (University of Wisconsin)

HT-3

Yes. I think the fact of the Monographs coming from actual engineering research makes the material more interesting to the student. They see the work they are doing in class is directly related to current technology. (University of Kentucky)

Yes (University of Virginia)

Yes (Auburn University)

No (University of Wisconsin)

HT-4

Yes (Rose Polytechnic Institute)

Yes (University of Virginia)

I think so. The Monograph technique if used by the instructor is an excellent way of promulgating recent technical information. (Auburn University)

No (University of Wisconsin)

Yes (Lehigh University)

I would like to see a series of Monographs in Kinetics and Mass Transfer. They should be geared for an undergraduate level and would be useful for instructional purposes. (University of Detroit)

HT-5

Yes (Stanford University)

Generally no. Only if Monograph is a big improvement over the original. (University of Nebraska)

If the Monographs were not so much on specialized subjects they would be used more. (University of Cincinnati)

HT-7

Yes. These Monographs may be quite useful in industry where very short courses on specific topics would be better attended and probably retain higher interest. (Caterpillar Tractor Company)

Only in a few subject areas. (Lehigh University)

Yes, they should be developed but some should be developed for undergraduate study. (University of Detroit)

Yes (University of Virginia)

No (University of Wisconsin)

Monographs for other subject areas would probably be well accepted. The material should be presented such that it would also be of value to engineers. This would probably entail greater detail and certainly more bibliography references. (Caterpillar Tractor Company)

A wide variety of subjects would be necessary to be of general interest in industry. For use in classroom groups, however, they would have to be available to the students for a reasonable period of time, (two months). (Caterpillar Tractor Company)

HT-8

Yes. I think that the fact of the Monographs coming from actual engineering research makes the material more interesting to the student. They see the work they are doing in class is directly related to current technology. (University of Kentucky)

TD-1

Yes (University of Virginia)

Yes (Auburn University)

Yes. Particularly some of the NASA cascade data and information on turbomachinery, nozzles, etc. (Pennsylvania State University)

Yes (Humble Oil & Refining Company)

The Monographs which we would need would have to be specific for our courses and might not have very wide applicability. (Humble Oil & Refining Company)

To be used effectively in other areas of industry, it would be mandatory to cover a wide variety of subject. (Humble Oil & Refining Company)

Yes (Lummus Company)

TD-3

Yes (University of Michigan

No (University of Wisconsin)

Yes (Rose Polytechnic Institute)

Yes (University of Cincinnati)

Yes (Arnold Research Organization, Inc.)

These can be quite useful. (University of Notre Dame)

Expansion of subject matter would undoubtedly create more interest. I had planned to organize a study group of interested persons, but the length of time allowed was insufficient for preparation of lectures. (Caterpillar Tractor Company)

This type of presentation would level itself very easily to an industrial self-study or group-study situation. New technical information or older information in which a new interest has arisen would be presented by this method if Monographs covering a variety of subjects were available. (Caterpillar Tractor Company)

Yes they should be expanded. This appears to be a fairly comprehensive short course for working engineers to "keep up" in their technical knowledge. (Caterpillar Tractor Company)

Yes. These Monographs will be helpful in industry in small study groups where very short courses with attendance tailored to the topic would be preferable to long and ultimately unworkable groups. (Caterpillar Tractor Co.)

TD-4

No (University of Wisconsin)

Yes (University of Massachusetts)

One should avoid embarking on an expanded program unless the intent of the course was to survey recent literature. (University of Detroit)

WOULD YOU USE THEM FREQUENTLY IF YOU TAUGHT CLASSES IN THE SUBJECT AREAS?

CS-1

Yes (University of Iowa)

Not frequently (University of Wisconsin)

CS-2

I think so. (Tulane University)

I would use them to the extent that they would fit into the context of the course I am teaching. Due to the difficulty of fitting them in, this would probably result in occasional use, rather than frequent. (North Carolina State)

Yes, as examples and problems. (University of Utah)

Yes (University of Massachusetts)

Yes (Southern Illinois University)

In the undergraduate level it is doubtful. (Rose Polytechnic Institute)

Yes (University of Kentucky)

CS-3

In the introductory course I have been teaching time does not permit the use of this particular Monograph. (Rose Polytechnic Institute)

Not frequently (University of Wisconsin)

I think so. (Tulane University)

If they fit in with a topic they would be used. (University of Denver)

It would depend on the Monograph covering topics of interest, if so, yes. (University of Florida)

CS-5

I think so. (Tulane University)

It would depend upon how much the Monographs touched in the direction of my interest. If so, yes. (University of Florida)

Yes (Iowa State University)

Not frequently (University of Wisconsin)

Yes, I use them whenever possible. (Oklahoma State University)

Not yet used. (University of Michigan)

CS-6

It would depend on the Monographs covering topics of interest. If so, yes. (University of Florida)

Yes, I would use them whenever it is possible. (Oklahoma State University)

Yes (University of Massachusetts)

Not Frequently (University of Wisconsin)

Not yet used. (Univeristy of Michigan)

HT-1

Probably not frequently, but some times (University of Wisconsin)

If I were teaching, I would attempt to include them to advantage. (Humble Oil and Refining Company)

Yes (Auburn University)

Yes, I feel the Monographs could help the course become more "current research program" oriented, and this is good. I feel that about four Monographs (with homework problems) would be the most I could use in my radiation heat transfer course.....unless there is a major modification of the outline. (University of Virginia)

No (University of Minnesota)

HT-2

Yes (Auburn University)

Yes (University of Cincinnati)

Occasionally (University of Michigan)

No (University of Wisconsin)

HT-3

I would use them only in courses dealing with current topics and in seminar-type courses. (Kansas State University)

Yes (Auburn University)

No (University of Wisconsin)

Yes (University of Virginia)

HT-4

Yes (Lehigh University)

No (University of Wisconsin)

Yes (University of Virginia)

Yes (Rose Polytechnic Institute)

I think so. The Monograph technique if used by the instructor is an excellent way of promulgating recent technical information. (Auburn University)

HT-5

I doubt that the material will be widely used. (University of Wisconsin)

Generally no. Only if the Monograph is a big improvement over the original. (University of Nebraska)

Yes (Stanford University)

HT-7

Only if not well presented in text or texts. (Lehigh University)

Yes (Caterpillar Tractor Company)

Yes (University of Virginia)

This Monograph should be used on a graduate level or advanced (senior) undergraduate level course. (University of Detroit)

Not frequently (University of Wisconsin)

HT-8

Yes (University of Kentucky)

Occasionally (University of Wisconsin)

TD-1

Depends on the level. Doubtful for undergrads. (University of Michigan)

Occasionally (University of Wisconsin)

Yes, provided they were supplemented by classroom instruction. (Humble Oil and Refining Company)

I'm not sure. I plan to continue use of Monographs on an experimental basis, along with other innovations which seem potentially valuable. (University of Oklahoma)

Yes--particularly some of the NASA cascade data and info on turbomachinery, nozzles, etc. (Pennsylvania State)

TD-3

Frequent use would depend on permanent copies of Monographs - perhaps they should be purchased. (Caterpillar Tractor Company)

Yes (Rose Polytechnic Institute)

Probably not frequently, but occasionally for the special subjects I may wish to expand upon. (University of Michigan)

Yes (University of Cincinnati)

Yes (Auburn University)

These Monographs will be helpful in industry in small study groups where very short courses with attendance tailored to the topic would be preferable to long and ultimately unworkable groups. (Caterpillar Tractor Company)

New technical information or older information in which a new interest has arisen would be presented by this method if Monographs covering a variety of subjects were available. (Caterpillar Tractor Company)

If I taught a class only in mass flow measurements, then the subject Monograph would be of use, otherwise not. (Arnold Research Organization)

Use them infrequently--when a particular subject needs more background. (University of Cincinnati)

Yes (University of Michigan)

TD-4

Yes(University of Massachusetts)

Not frequently (University of Wisconsin)

Monographs were not used because after examination they did not appear to be pertinent or appropriate for use in our courses. There are better ways to spend the taxpayers' money. (University of Wisconsin)

TD-5

I intend to use the Monograph computer program in a design course. (University of Michigan)

ADDITIONAL COMMENTS ON MONOGRAPHS BY EVALUATORS

CS-1

This Monograph represents a small band in the very broad spectrum of electronics. More specifically it deals with the specialized field of design for compensation networks to compensate for signal distortion within networks. Such networks are frequently found in communication, data transmission, and associated facilities.

This Monograph would be of particular value in the academic classroom since it allows the student to put theory into practice by solving actual problems. This would also be true in certain industrial classrooms where communication and data transmission is of principal importance.

For engineers outside this specialized field of technology, this Monograph would be of doubtful value. This opinion is based on the premise that although an engineer's progress is related to his continuing education and study, there should be priorities in his program of continuing education. So it seems reasonable to assume that an engineer's first priority would be to study and upgrade himself in his principal area of responsibility. (R. J. Reynolds Tobacco Company)

In my opinion, the Monograph was well organized from a technical viewpoint, presenting a sufficient amount of information in a logical sequence. The written presentation is brief and does not distract the reader from the technical information. The problem included in the Monograph illustrates the design value of the outlined procedure.

This and similar Monographs would be a valuable reference. Although the information may not be immediately useable, its value as a future design format cannot be over-emphasized. Since the material is generally oriented toward classroom applications, it presents a logical sequence helpful in explaining a design to other technical people. (Union Carbide Corporation)

The subject matter of this particular Monograph is not normally encountered in our area of control theory (process control). It deals with techniques which are useful at higher frequency levels than we usually have to work with. The technique discussed might be applicable if extended by use of active network compensation methods, but that is not covered in this Monograph.

The subject matter might be of interest to someone in S.I.D., particularly by someone interested in recording data at higher frequency levels such as noise and vibration work.

We would certainly like to see more of these Monographs if they are available, particular (though not necessarily restricted to) those dealing with process control. (Union Carbide Corporation)

HT-1

This particular Monograph deals with the Monte Carlo method for solving problems in which energy is emitted and reflected such as that occurring in radiant heat transfer problems. In these problems, the happenings at a given location are mathematically described, but the equations of the interaction between locations are extremely difficult to solve. The Monte Carlo method effects a solution to this type problem through use, between defined limits, of random numbers as variables in a sequence of inter-dependent calculations. Since this necessitates many repetitive calculations, use of a computer is required.

The author assumes the reader has a good working knowledge of the theories and mathematics involved and takes simplifying shortcuts which could be difficult to follow. Unless the reader is familiar with this particular field, I feel this Monograph, as written, would be of little benefit to the average engineer in industry. If this material could be presented in a simpler, more detailed and better organized form, it could possibly be an effective tool for disseminating technical material to the practicing engineer. (R. J. Reynolds Tobacco Company)

Although the need for rapid dissemination of new technology in the university has been recognized by the instructional Monograph program, a similar need in industry should be fulfilled. In many instances, the engineer is either insufficiently trained in a particular discipline or too remote from current activity in a particular area to take advantage of new advances. If some of the formalism were relaxed and additional background material were introduced into the Monographs, an instructional program for industry could supplement the seminar-type courses which are at present the main source of new technology for the engineer in industry. In fact, from reading the list of Monographs, it would appear that many are of such a specialized nature that they may not be as useful in the university as they would be for an engineer with a need for a method of solution to a particular problem. (Massachusetts Institute of Technology)

This Monograph technique obviously has the merits attributed to it:
- --Capsule coverage of specific aspects of a subject - good for refresher or new material.
- --Dissemination of very recent developments within a subject area, well in advance of incorporation in published textbooks.
- --Preparation by recognized experts in their respective fields.
- --Advanced preparation of lesson plans plus homework assignments, if this technique were adopted for sequential segments of a course.

For our use it would be more advantageous to have whole subject coverage (sequential Monographs) emphasizing engineering practice rather than mathematical development. The mathematics should be included, however, as instructor's background information. (Humble Oil and Refining Company)

HT-4

I think the Monograph idea is a very good one and commend your office for the work you are doing in instigating it. I think the extra effort required by the faculty in preparing for the lectures on the Monograph subjects is a good investment also. (University of Virginia)

TD-1

The instructional Monograph is an excellent method of disseminating the results of recent research and scientific technical information; however, if it is to be used by engineers in industry, I feel that it must be presented in a classroom by a qualified instructor or its use will probably be limited. The Monograph requires that the student have a general familiarity of chemical equilibria and advanced mathematics - differential equations and numerical analysis. Engineers in industry who have not been concerned with chemical equilibrium thermodynamics on a daily basis or who have not used advanced mathematics appreciably since their formal education, will be unable to follow the discussion in the Monograph without first reviewing the prerequisites.

On this basis I feel that this instructional Monograph will not find widespread use in industry. The engineer in industry can better continue his education by reviewing technical papers published by the ASME and other founder societies, studying programmed instructional courses through extension divisions of colleges and universities and taking other educational courses presented in formal classrooms or through television networks. (R. J. Reynolds Tobacco Company)

The specific example used has no application for us at Bayway. However, the numerical methods and procedures used could be applied to chemical equilibrium reactions such as those in the Chem Plant. We don't know of any immediate plans to attack these problems here. The methods used are more likely to find application at Florham Park in EMSI where convergence techniques and solution methods are a more general problem. We are not qualified to comment on a comparison of these techniques with alternative procedures. (Bayway Refinery--Humble Oil & Refining Company)

APPENDIX V

MONOGRAPH DISSEMINATION BY UNIVERSITY

Professors who have requested and received one or more Monographs for review and for use in an engineering classroom are listed below.

University	Professor
Arizona State University	H. H. Young
Auburn University	R. I. Vachon
Brigham Young University	John M. Simonsen Bill J. Pope
California Institute of Technology	R. H. Sabersky
California State College at Long Beach	Ali Eshett
California State College at Los Angeles	Philip Gold George Mann Dan R. Rankin
Carnegie-Mellon University	S. William Gouse, Jr.
Case Western Reserve University	H. K. Wiskind
City College of the City University of New York	Robert M. Graff Latif M. Jiji Reuel Shinnar
Clemson University	Duane F. Bruley Eugene Harrison J. C. Mullins
Cleveland State University	George V. Parmelee R. M. Hochner
Colorado School of Mines	Frank Stermole
Columbia University of the City of New York	Harold G. Elrod
Cornell University	Victor H. Edwards

Dartmouth College	A. O. Converse
Harvey Mudd College	Taghi Mirsepassi
Hudson Valley Community College	R. M. Frinks
Indian Institute of Technology, New Delhi, India	Raja Rao
Iowa State University	Donald C. Scouten Bion L. Pierson
Kansas State University	P. L. Miller C. L. Hwans P. E. McNall, Jr.
Lake Superior State College	D. L. Carsteus
Lehigh University	Luis Pujol Benjamin E. Nevis
Louisiana Polytechnic Institute	Buck F. Brown Charles A. Killgore
Louisiana State University	Dupree Maples Ralph W. Pike
Massachusetts Institute of Technology	Y. T. Li
Michigan State University	George Coalman Gerald Park
Michigan Technological Institute	S. Winnikow R. D. Audi
Mississippi Research and Development Center	Kenneth Wagner
New York University	John R. Ragazzini John Happel
North Carolina State University	W. C. Peterson
North Dakota State University	Kam Wu Li Karl G. Maurer Lampert P. Vogel Phillip C. Pfister
Northwestern University	Professor Walker Professor Larson William E. Schmitendorf
Ohio University	R. S. Mayer
Ohio State University	E. O. Doebelin

Oklahoma State University	Charles M. Bacon Paul A. McCollum John B. West Rao Yarlagadda K. C. Chao W. C. Edmister
Oregon State University	Carl G. Downing J. R. Welty
Pennsylvania Military Colleges	Anthony J. Calise
Pennsylvania State University	J. L. L. Baker C. Birnie, Jr. D. A. Bowlus J. A. Brighton G. M. Faeth D. R. Olson F. W. Schmidt J. L. Shearer
Princeton University	James B. Anderson Ronald P. Andres Ernest F. Johnson Richard K. Toner John C. Whitwell
Purdue University	Paul E. Stanley
Queen's University, Kingston, Ontario, Canada	Philip G. Hill
Rensselaer Polytechnic Institute	H. J. Sneck Euan F. C. Somerscales
Rose Polytechnic Institute	Thomas Hutchinson Stan S. Thomas
Rutgers, the State University	Robert H. Page Marvin L. Granstrom
Saint Louis University	Benjamin H. Ulrich, Jr. John A. George
San Jose State College	Robert F. Clothier
Southern Methodist University	James L. Melsa Andrew S. Page J. C. Denton Donald C. Price
Stanford University	H. C. Perkins
State University of New York	Chi-Tsong Chen

Stevens Institute of Technology	Kenneth Tompetrine Leo Rosenthal H. W. Phair
Tatung Institute of Technology	T. S. Lin
Tennessee Technological University	Cecil O. Alford John P. Wallace James Seay Brown
Tulane University	Robert C. Weaver John R. O'Loughlin Chester A. Peyronnin Harold H. Sogin Robert G. Watts Robert P. Chambers
United States Air Force Academy	Myron D. Harnly
United States Naval Academy	James A. Adams
University of Alabama	C. H. T. Wilkins
University of Arizona	H. C. Perkins Harvey Christensen Donald M. McEligot N. D. Cox Lynn Weaver
University of Arkansas	William J. Buche Stanley E. Stephenson
University of California, Berkeley	H. A. Johnson L. S. Caretto R. Greif Y. Taitel C. Tien L. Farbar R. F. Sawyer E. D. Howe P. B. Stewart R. J. Bollard
University of Cincinnati	James F. Thorpe Widen Tabakoff Marvin English R. D. Zerkle
University of Denver	M. L. Moe
University of Detroit	Leon Kowalcyzk C. O. Smith

University of Florida	J. S. Gilbert R. K. Irey Calvin C. Oliver A. D. Randolph Joseph Mahig R. D. Walker J. P. O'Connell
University of Hawaii	R. M. Fan J. S. Fox H. C. Chai
University of Houston	Dan Luss W. I. Honeywell F. M. Tiller
University of Illinois	R. G. Hering
University of Iowa	Earl Eyman
University of Kentucky	Clifford J. Cremers Ronald D. Bonnell
University of Maine	Walter W. Turner David B. Young Richard C. Gibson Richard C. Hill
University of Massachusetts	Richard V. Monopoli W. L. Short Donald E. Scott Professor Herchenreder Lawrence L. Ambs
University of Michigan	S. W. Churchill Robert B. Keller J. J. Martin Richard A. Matula George S. Springer
University of Minnesota	E. R. Eckert K. Ogata E. M. Sparrow Richard J. Goldstein
University of Mississippi	F. A. Anderson R. E. Aven H. Bostian H. T. Huddleston
University of Missouri at Rolla	J. C. McBrayer A. E. Morris

University of Nebraska	D. R. Haworth
University of New Hampshire	David H. Chittenden S. S. S. T. Fan
University of New Mexico	A. V. Houghton K. T. Feldman Charles Gilbert Richards
University of North Dakota	Milton B. Larson C. P. Naismith
University of Notre Dame	Edward W. Jerger J. C. Hogan J. L. Novotny
University of Oklahoma	C. Phillip Colver Tom J. Love Michael L. McGuire Kenneth E. Sterling
University of Pittsburgh	G. E. Geiger
University of Portland	George F. Babits
University of Santa Clara	Richard C. Dorf
University of Southern California	John M. Lenoir
University of Tennessee Space Institute	R. L. Young
University of Tennessee	James C. Hung
University of Texas	R. A. Halfinstine J. J. McKetta B. E. Short H. A. Walls C. W. Jiles W. R. Upthegrove
University of Utah	E. B. Christiansen Otto C. Davidson Dietrich K. Gehmlich Wayne S. Brown Fabio R. Goldschmied Arlo F. Johnson Gary M. Sandquist J. D. Seader Noel de Nevers Forrest L. Staffanson
University of Virginia	J. Taylor Beard Herbert Goller James W. Moore Robert Smoak

University of Washington	Creighton A. Depew
University of Wisconsin	Edward Obert Charles G. Hill C. A. Coberly Howard L. Harrison David R. Poirer John W. Mitchell W. A. Beachman
University of Wyoming	William D. Batton
Utah State University	R. M. Holdredge Jack Keller
Valparaiso University	Leslie M. Zoss
Vanderbilt University	John W. Williamson
Villanova University	Joseph Goldberg
Washington University	Albert W. Black J. C. Georgian William J. Murphy
Washington State University	I. M. Yeyinmen
West Virginia University	Barnett F. Dodge J. F. Parmer
Ecole Centrale des Arts and Manufactures, Paris, France	R. Kling
Ecole Ploytechnique, Montreal, Quebec, Canada	Michel Rigaud
Instituto Politecnio Nacional, Mexico	Morris S. Ojalvo Paul Alper
University of Calgary, Calgary, Alberto, Canada	J. E. Venart
University of Waterloo, Waterloo, Ontario, Canada	George D. Fulford D. C. T. Pei G. F. Pearce F. A. Dullien
University of Windsor, Windsor, Ontario, Canada	J. Gordon Parr

APPENDIX VI

VISUAL BRIEF DISSEMINATION STATISTICS THROUGH AUGUST 31, 1968

Dissemination Summary by Visual Brief Number

Visual Brief Number	Number Sent	Unfilled Requests	Evaluations Received
VB-1	9	0	5
VB-2	4	1	3
VB-4	17	6	8
VB-5	10	0	1
VB-8	13	9	6
VB-9	9	1	3
VB-10	17	2	5
VB-11	8	1	5
VB-12	14	4	4
VB-13	19	7	6
VB-15	9	1	3
VB-17	9	0	4
VB-19	16	0	8
VB-20	9	1	5
VB-21	9	2	8
VB-23	5	0	2
VB-24	14	0	9
VB-27	9	0	4
VB-28	8	0	5
VB-31	13	0	8
VB-33	13	0	9
	234	35	111

APPENDIX VII

May 16, 1968

Professor Hiram H. Puig, Head
Department of Electrical Engineering
College of Agriculture and Mechanic Arts
University of Puerto Rico
Mayaguez, Puerto Rico

Dear Professor Puig:

On January 22, 1968, we mailed you a copy of Visual Brief VB-20 for your use in the classroom. On January 26, we were informed by you through a Western Union telegram that the VB-20 film cartridge was missing from the package you received. A second copy of Visual Brief VB-20 was mailed to you on January 26. We are wondering if you now have two copies of Visual Brief VB-20. If so, we would appreciate the return of one of the copies to us.

These technical films are provided on a loan basis. It would be appreciated if they were returned to us after you have had an opportunity to use them in your classroom. We would then have them available to loan to another university for use in their engineering education programs. Listed below are the Visual Briefs that have been provided to you:

VB-5
VB-8
VB-11
VB-20
VB-21

Please return them after you have had the opportunity to use them. If at some future time you would desire to use them again, we would be happy to return them on a loan basis.

Sincerely,

Robert L. Overton
Deputy Administrator
NASA Pilot Program

RLO:jir

APPENDIX VIII

Totaled Responses on a Revised Visual Brief Evaluation Sheet

General Information on Visual Briefs:

Was the technical information covered in the Visual Brief of value in course presentation?	Yes	31
	No	7
Should the Visual Brief include more information than was presented?	More	22
	Same	20
	Less	3
Would the Visual Brief be more useful if the accompanying report material had been prepared specifically for a classroom lecture?	More	21
	Same	17
	Less	2
Would the material shown on the film be more effective if edited and condensed?	Yes	13
	No	26
Does the inconvenience of obtaining a projector for a classroom lecture affect the frequent use of technical movies?	Yes	7
	No	36

Comments on Use of Visual Briefs:

In what situation was the Visual Brief used? _____

Did the instructor read the documents accompanying the Visual Briefs before the film was used?	Yes	28
	No	15
Was the Visual Brief used in context with closely related material?	Yes	21
	No	17
Did the Visual Brief present the effect well and contribute to the further understanding of the participants?	Well	20
	Fair	11
	Poor	7
Would the Visual Brief be more useful for educational purposes outside the classroom?	Yes	13
	No	23
Could the subject matter have been as easily presented without the visual matter?	Yes	6
	No	34
Would you use this Visual Brief again in an educational situation?	Yes	30
	No	11

APPENDIX IX

Comments on Questions Asked on Revised Visual Brief Evaluation Sheet

IN YOUR OPINION, ARE VISUAL BRIEFS A USEFUL AND DESIRABLE METHOD OF PRESENTING NEW TECHNICAL INFORMATION IN THE CLASSROOM?

VB-1: Smoke Trail Wind Shear Measurements

From the point of view of teaching courses in a fundamental way, my opinion is that the Visual Briefs are useful and desirable insofar as they are helpful in demonstrating basic phenomena in a well defined manner. Of course, technical information presentation by movie can be useful if it is directly relevant to the course objectives. (Case Western Reserve University)

This brief was interesting, but not directly applicable to classroom subjects. (University of Wisconsin)

VB-2: Hydrodynamic Rotating Shaft Seals

Helpful to those familiar with the basic subject matter. Well prepared. (Ingersoll Rand Company)

The film was not shown to a class but was reviewed for possible future classroom use. However, since we have demonstration units of the type shown in the film, we do not need this particular film for classroom use. As a matter of interest--we had demonstration units of the type shonw in the film long before the filmed units were conceived. (University of California at Berkeley)

This VB was very well done and since the application is a dynamic one, non-moving presentations could not compare. (Cleveland State University)

VB-4: Bubble Dynamics for Nucleate Boiling in Reduced Gravity

I am afraid that not enough people are aware of the existence of these excellent teaching aids. (North Carolina State University)

This subject of boiling is much easier to describe by visual methods, as in motion pictures, than by written material or still photographs. This movie was very good. (University of Pittsburgh)

This brief is quite good. (Utah State University)

VB-8: Flight Measured Control Power and Damping Required for VTOL Aircraft

The Visual Briefs should include more information of technical nature. This Brief was interesting, but it included very little information on the control system. (University of Arkansas)

This brief had no sound, and the barest minimum of information was given in subtitles. More information as to the physical meaning of the vehicle maneuvers presented would have made this brief much more useful. (North Carolina State University)

VB-9: Pool Heating of Liquid Hydrogen Over a Range of Accelerations

Visual Briefs are helpful for special lectures. This film was off the topic but was useable. (North Dakota State University)

VB-10: Visualization Studies of Combustion Instability in a Hydrogen-Oxygen Model Combustor

It is very useful to use movies on technical material such as this Visual Brief. Often universities cannot afford to obtain all the necessary equipment for research or class experiments in a particular subject, and the movies can aid the student in visualizing material presented in class. (University of Texas)

VB-11: Transonic Buffeting of Hammerhead Launch Vehicles

Visual Briefs are a useful and desirable method of presenting new technical information in the classroom because more information is presented in the brief time that the film takes to run. By reading the accompanying documents that were sent with the brief it was possible to prepare the students for what they say in the film. (Tennessee Technological Institute)

Yes. The visual brief is good enough for the information of the movies in consideration, however, the documentary material should be more complete and more comprehensive. (West Virginia University)

VB-12: Experimental Observations of Transient Boiling in Subcooled Water and Alcohol

The brief was used as a part of the above course, however, the film was shown at a separate session in order that other interested students and faculty could see it. (North Carolina State University)

After previewing it was decided the film was not what was needed, and was not shown to the class. (Utah State University)

VB-13: A Visual Study of Two Phase Flow in a Vertical Tube with Head Addition

Very good. (University of Pittsburgh)

We got these to see what kind of material you had to offer. I do not think this one or the other one will fit nicely into any of our course offerings, but they do make good supplementary material. (University of Utah)

VB-17: Expansion Tube Hypersonic Test Facility

Yes, classroom is good place as any. (Rose Polytechnic Institute)

VB-19: Experimental Research in Aerospace Structural Dynamics

Very useful when supplemented by addition comments by instructor. (North Dakota State University)

Yes. Generally superior to other techniques. (University of Oklahoma)

Yes. The Visual Brief is good enough for the information of the movies in consideration, however, the documentary material should be more complete and more comprehensive. (West Virginia University)

A very definite aid. Gives a good picture of real system problems arising from flexible design structures. Shows that the system designer must consider more than one phase of a complete system and look at the total picture. (Tennessee Technological Institute)

This Visual Brief was desirable in that it presented pertinent material succinctly, and its effect is to emphasize and make realistic classroom presentation. (University of Florida)

VB-20: Magnetically Supported Superconducting Spherical Gyro

Yes (Hudson Valley Community College)

Visual Briefs are a useful and desirable method of presenting new and technical information in the classroom; however this brief was too advanced for the intended audience and projected upside down and backwards. (Tennessee Technological Institute)

VB-21: The Supersonic Transport in the Air Traffic Control System

Yes. The current nature and extensiveness of the problem presented expands student outlook. He gains a realization of the complexity of modern day problems which are hard to get across during a lecture. (Oregon State)

The Visual Briefs would be more valuable if they included more information about design, analysis, etc. (University of Arkansas)

Loan was also requested by a Civil Air Patrol Unit to show at an air show. (University of Virginia)

VB-23: Hypergolic Propellant Research

This was a difficult phenomena to show on a movie. (University of West Virginia)

The idea is a good one but material needs better organization and abstraction. Movies need more "on film" explanation (either titles or sound). Use of this material should be rather difficult for someone not well-acquainted with the problem. (University of California)

VB-27: Flammability of Surface in Zero Gravity

Sound would be desirable for this presentation. (North Dakota State University)

VB-28: Journal Bearings in Laminar and Turbulent Regimes

Yes, they are a good idea. This was too brief, in the sense that explanation of phenomena and parameters was inadequate. Sound films in which the material is competently discussed and commented upon are, in my opinion, much more effective. (University of Pennsylvania)

VB-33: Saturn Radiation and Convection Base Heating

Very good, but too advanced. (University of Calgary)

These Films would be better with sound on the track and more explanation on the film. (West Virginia University)

This particular brief was not useful. A sound track and audio description is a must. (U.S. Naval Academy)

This Brief suffered from two faults (1) No sound--hard to tell what is going on at all times (2) The objective of the Brief -- heat transfer-- is very difficult to visualize. Its effect is not shown clearly by film. (University of Wisconsin)

Brief was used as an introduction to the space-age need for radiation heat transfer analysis. (University of Virginia)

TELEPHONE 313-531-8102

american concrete institute

BOX 4754 REDFORD STATION
22400 WEST SEVEN MILE ROAD
DETROIT, MICHIGAN 48219

August 23, 1968

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

Dear Professor McCollom:

I was very pleased to have the opportunity to hear you present the Nasa Pilot Program at the ASEE Meeting at the University of California in Los Angeles. For quite some time ACI has been studying ways in which it might produce instructional materials for the concrete construction industry. We have the usual amount of pressure to produce textbooks but we feel that this is rather slow process and that we cannot keep up with the technological developments if we were to concentrate in that one area.

Your paper has been distributed quite widely among our members and we are all quite impressed with what you are doing. So that we might have the opportunity to become better acquainted with your program, would it be possible for you to send me a copy of the Instructor and Student Monograph, CS-6? I doubt if we will be able to give you much of an evaluation since the topic is not very closely related to concrete but surely we can expect some reactions which might be of benefit to you, and anything that our members care to comment on I would be very pleased to pass on to you. If there is any charge for these, don't hesitate to let me know.

Sincerely yours,

Gilbert E. Seeley
Director of Education

GES:eg

APPENDIX XI

MONOGRAPH ABSTRACT

HT-1 Calculation of Radiant Heat Exchange by the Monte Carlo Method

HT-2 A Generalized Correlation of Vaporization Times of Drops in Film Boiling on a Flat Plate

HT-3 Method for Estimating Ratio of Absorptance to Emittance

HT-4 Formulas for Radiant Heat Transfer Between Nongray Parallel Plates of Polished Refractory Metals

HT-5 Pool Boiling Heat Transfer at Reduced Gravity

HT-6 Condensation of Liquid Metals

HT-7 The Method of Zones for the Calculation of Temperature Distribution

HT-8 Heat Pipes and Vapor Chambers for Thermal Control of Spacecraft

TD-1 Calculation of Complex Chemical Equilibria

TD-2 Thermodynamic Equations, Data and Techniques for Preparing Properties Compilations

TD-3 Critical Flow of Real Gases Through Nozzles

TD-4 Thermodynamic Consistency of Vapor-Liquid Solubility Data

TD-5 Computer Program for Thermodynamic Performance of Brayton Cycle Space Power Systems

TD-6 Enthalpies of Co-existing Equilibrium Vapor and Liquid Mixtures from Solubility Data and Equation of State Calculations

TD-8 Thermodynamics of Space Flight

CS-1 An Example of Compensation Network Design

CS-2 An Application of Root Locus Techniques to Lunar Vehicle Control

CS-3 An Example of Nuclear Rocket Control Design

CS-4 An Example of Bang-Bang Control System Design

CS-5 Controller Design for Nonlinear and Time-Varying Plants

CS-6 An Example of Optimal Control Design

CS-7 An Example of Gain Insensitive Design by State Variable Feedback

CS-8 Synthesis of Minimal Sensitivity Sampled-Data Control Systems

MONOGRAPH HT-1

ABSTRACT

Title: Calculation of Radiant Heat Exchange by the Monte Carlo Method

By: John A. Wiebelt, Mechanical Engineering, Oklahoma State University

The Monte Carlo Method of solving radiant heat transfer problems basically consists of following groups of photons around through a system until they are either absorbed or lost. By using a large number of photon groups the statistical behavior of the large group will approach the behavior of an actual system. This Monograph discusses the technique required to select photon groups, such that a given statistical distribution will be achieved. An example problem is included, which shows how the Monte Carlo technique can be used to solve problems where energy is emitted and reflected in a non-diffuse or non-specular method. In particular it is assumed that the Fresnel type surface is present. The Fresnel surface distribution is used as an example problem.

MONOGRAPH HT-2

ABSTRACT

Title: A Generalized Correlation of Vaporization Times of Drops in Film Boiling on a Flat Plate

By: Kenneth J. Bell, Chemical Engineering, Oklahoma State University

A dimensionless correlation for the vaporization times of discrete liquid masses in the Leidenfrost state is obtained and verified with experimental data in the literature. The correlation is presented as a single curve relating a dimensionless vaporization time to a dimensionless initial liquid volume. The correlation works well for the entire range of initial liquid volumes from spherical drops to large pancaked blobs.

MONOGRAPH HT-3

ABSTRACT

Title: Method for Estimating Ratio of Absorptance to Emittance

By: John A. Wiebelt, Mechanical Engineering, Oklahoma State University

A graphical method is presented for estimating the values of the ratio of absorptance to emittance α/ϵ that can be achieved with surfaces having a high degree of spectral selectivity. The ratio of emitting source to absorbing surface temperature is the parameter in the graphs. In principle, the results of the calculations presented are general and apply for any source or surface temperature. In practice, the ratios of absorptance to emittance so estimated

can be used in radiant heat transfer calculations involving space vehicles. In this case α becomes α_s the total normal absorptance of a surface to solar radiation, and ε the total hemispherical emittance.

MONOGRAPH HT-4

ABSTRACT

Title: Formulas for Radiant Heat Transfer Between Nongray Parallel Plates of Polished Refractory Metals

By: John A. Wiebelt, Mechanical Engineering, Oklahoma State University

Hemispherical emittance, both total and normal, were calculated from normal spectral-emittance data. The metals evaluated were clean polished tungsten, molybdenum, and tantalum, each of which exhibits spectral emittances that vary considerably with temperature and wavelength.

Net radiant heat flow between two parallel infinite plates was computed by summing the monchromatic energy exchange. The evaluation was made for all nine possible combinations obtained by interchanging metals on the two surfaces. The results are graphically presented as a function of temperatures of the two surfaces. Equations of the form

$$q = a(T_1^b - T_2^b) \left(\frac{T_2}{T_1}\right)^c$$

were fitted to each of the nine sets of heat flux calculations, where q is the heat transfer rate, and T_1 and T_2 are the temperatures of the hotter and cooler surfaces, respectively. Values of the constants, a, b, and c are presented along with contour plots showing the temperature regions in which the equations are accurate. A comparison with conventional calculation techniques is presented.

MONOGRAPH HT-5

ABSTRACT

Title: Pool Boiling Heat Transfer at Reduced Gravity

By: Kenneth J. Bell, Chemical Engineering, Oklahoma State University

The role of gravity in the theory of nucleate and film pool boiling mechanisms is examined and compared to experimental results. Particular attention is given to the critical heat flux and interface stability. Bubble growth and dynamics in reduced gravity fields are also considered.

MONOGRAPH HT-6

ABSTRACT

Title: Condensation of Liquid Metals

By: Kenneth J. Bell, Chemical Engineering, Oklahoma State University

The theory of condensation of liquid metal vapor on a cool vertical surface both with and without forced convection of the vapor is discussed. Experimental results are presented to show the probable existence of a resistance to heat transfer at the vapor-liquid interface. An approximate analytical treatment of interfacial resistance effects is included.

MONOGRAPH HT-7

ABSTRACT

Title: The Method of Zones for the Calculation of Temperature Distribution

By: Paul L. Miller, Mechanical Engineering, Kansas State University
John A. Wiebelt, Mechanical Engineering, Oklahoma State University

The method of zones is an improved method for obtaining approximate solutions to certain partial differential equations. The application of this method of heat transfer problems is discussed in detail. The method of zones assumes the temperature in the zone of interest varies parabolically with the space coordinates. Volume integrated mean temperatures are used as the "zone temperature" and area integrated mean temperatures are used as the "surface temperatures" at the boundaries of the zone. The higher order of approximation of the method permits a complicated system to be divided into fewer parts than is necessary when conventional linear approximation methods are used.

The heat flow equation is integrated over the volume of the zone to give an instantaneous heat balance equation which involves the fluxes over the boundaries of the zone and the rate of change of the volumetric mean temperature of the zone. Approximate formulas, which are based on the parabolic assumption, are derived which express the boundary heat flow rates in terms of the volumetric mean temperature of the zone and the mean temperatures over the zone boundaries. These simultaneous equations in temperature, one for the zone and one for each boundary, are integrated numerically to obtain the temperature as functions of time.

The integration is a two-point integration involving an integration parameter. Rules for choosing this parameter to insure stability and accuracy are given. A rule is also given for selecting the time increment, and methods for selecting the zone size are discussed.

MONOGRAPH HT-8

ABSTRACT

Title: Heat Pipes and Vapor Chambers for Thermal Control of Spacecraft

By: Paul L. Miller, Mechanical Engineering, Kansas State University
John A. Wiebelt, Mechanical Engineering, Oklahoma State University

This Monograph reviews the basic theory and application of devices that transfers heat by evaporation of liquid from heated areas and condensation on cold areas, with continuous return of the condensate to the heating area by capillary action. Computed examples are presented to indicate possible applications to the solution of thermal control problems and to illustrate the principles and methods of analysis. Items discussed include wicks and associated capillary structures for optimum transfer of heat and minimum resistance to fluid flow.

MONOGRAPH TD-1

ABSTRACT

Title: Calculation of Complex Chemical Equilibria

By: K. C. Chao, Chemical Engineering, Oklahoma State University

Calculation of chemical equilibria in a complex reaction system is carried out in an iterative manner on computers. For this purpose the basic equations are linearized. The linearized equations are applied first to the case of a homogeneous ideal gas mixture and then extended to more complex situations.

MONOGRAPH TD-2

ABSTRACT

Title: Thermodynamic Equations, Data and Techniques for Preparing Properties Compilations

By: W. C. Edmister, Chemical Engineering, Oklahoma State University

Alternate equation of state methods for calculating the enthalpies and entropies of pure real substances in the preparation of thermodynamic properties compilations, are presented in this Monograph. Four pressure-explicit equations of state are used as bases for the derivations, namely; Redlich-Kwong, Benedict-Webb-Rubin, Modified Benedict-Webb-Rubin, and the Virial Equation of State. These equations provide the relationships for

calculating the isothermal effects of pressure on the enthalpy and the entropy and also the molal volumes or densities. Calculations were made for the enthalpy and entropy values of nitrogen, using the Redlich-Kwong relationships and these results were compared with similar results obtained by another via the Modified B-W-R Equations. Ideal gas state heat capacities and the properties of co-existing vapor and liquid were included in this work.

MONOGRAPH TD-3

ABSTRACT

Title: Critical Flow of Real Gases Through Nozzles

By: Wayne C. Edmister, Chemical Engineering, Oklahoma State University

Methods for calculating the mass flow of real gases through critical-flow nozzles are presented by: (1) equation derivations, (2) tabulations of thermodynamic properties for critical flow conditions of steam, (3) problem on application of tabulated data in thrust calculation, and (4) problem on evaluation of critical flow thermodynamic properties of a fluid represented by the Redlich-Kwong equation of state.

MONOGRAPH TD-4

ABSTRACT

Title: Thermodynamic Consistency of Vapor-Liquid Solubility Data

By: Wayne C. Edmister, Chemical Engineering, Oklahoma State University

Methods for testing the thermodynamic consistency of vapor-liquid solubility data with other properties are presented for binary systems. Derivations of the equations for testing isothermal solubility data with densities of the coexisting phases are given, as are the equations for testing isobaric data with enthalpies of the coexisting phases. The isothermal case is illustrated for the Hydrogen-Helium system.

MONOGRAPH TD-5

ABSTRACT

Title: Computer Program for Thermodynamic Performance of Brayton Cycle Space Power Systems

By: J. A. Wiebelt, Mechanical Engineering, Oklahoma State University

This Monograph presents a computer program to be used in the calculation of the thermodynamic performance of one and two shaft Brayton cycle space power systems. The systems which can be analyzed include those with or without reheating, with or without intercooling and with or without turbine coolant flow.

Inputs required for the program include the component performance parameters and cycle temperature variables. Output from the program includes cycle efficiency and prime radiator area, and other cycle parameters.

MONOGRAPH TD-6

ABSTRACT

Title: Enthalpies of Co-existing Equilibrium Vapor and Liquid Mixtures from Solubility Data and Equation of State Calculations

By: Wayne C. Edmister, Chemical Engineering, Oklahoma State University

Methods for calculating the enthalpies of the saturated vapor and liquid phases of mixtures are presented theoretically and illustrated on the helium-hydrogen system, using previously published pressure-temperature-composition experimental data for the coexisting equilibrium vapor and liquid phases. An enthalpy-composition diagram is prepared for the helium-hydrogen binary at 400 psia using the results obtained in this example. Differential and integral forms of the isobaric Gibbs-Duhem equation were two of the methods used with the experimental temperature composition data for the binary mixture.

MONOGRAPH TD-8

ABSTRACT

Title: Thermodynamics of Space Flight (Heat Transfer Phenomena in Space)

By: P. L. Miller, Mechanical Engineering, Kansas State University
J. A. Wiebelt, Mechanical Engineering, Oklahoma State University

The analysis used in determining energy gains or losses to spacecraft in orbit is discussed. This is the basic environment parameter type approach without detailed discussion of the heat transfer problem. The Monograph discusses some practical as well as theoretical aspects.

MONOGRAPH CS-1

ABSTRACT

Title: An Example of Compensation Network Design

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
Leonard L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute

This Monograph gives the design criteria for wide-band phase realization. The design of lattice phase equalizers, all-pass networks that correct the phase response of a system without affecting its amplitude response, are introduced. These equalizers are used to obtain particular phase vs. frequency characteristics which are desirable for phase correction in a wide variety of systems.

MONOGRAPH CS-2

ABSTRACT

Title: An Application of Root Locus Techniques to Lunar Vehicle Control

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
Leonard L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute

This Monograph illustrates the use of the root locus technique as an aid to the design of a portion of the control complex of the steering mechanism of a 4-wheel lunar-surface vehicle. Examples of root loci for different steering control systems are presented and compared as to suitability for use in the lunar-surface vehicle with a human operator.

MONOGRAPH CS-3

ABSTRACT

Title: An Example of Nuclear Rocket Control Design

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
H. F. vanLandingham, Electrical Engineering,Virginia Polytechnic Institute

A technique which provides a practical compromise between system complexity and speed of response for a large class of systems is discussed in this Monograph. The method is illustrated by an example of its application to a nuclear rocket control problem.

MONOGRAPH CS-4

ABSTRACT

Title: An Example of Bang-Bang Control System Design

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
A. Wayne Bennett,Electrical Engineering, Virginia Polytechnic Institute

This Monograph discusses a technique for the systhesis of a Bang-Bang Control System. The technique employs linear switching logic and uses time-dependent gains to eliminate endpoints. For illustrative purposes, the technique is applied to the attitude control of a spinning space vehicle.

MONOGRAPH CS-5

ABSTRACT

Title: Controller Design for Nonlinear and Time-Varying Plants

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
H. F. vanLandingham, Electrical Engineering, Virginia Polytechnic Institute

This Monograph discusses a technique to generate a control signal which forces the state of a nonlinear plant to be close to the state of a reference model. The method is suitable for a broad class of nonlinear plants. Special emphasis is placed on the time response to perturbations for equilibrium.

MONOGRAPH CS-6

ABSTRACT

Title: An Example of Optimal Control Design

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
A. Wayne Bennett, Electrical Engineering, Virginia Polytechnic Institute

This Monograph discusses a technique for the design of minimum energy descrete-data control system. The "derived" matrix is used to determine a control sequence that will take the state of the plant from some initial state to a desired final state in N sampling periods. The cost function is a time weighted function of the control energy.

MONOGRAPH CS-7

ABSTRACT

Title: An Example of Gain Insensitive Design by State Variable Feedback

By: L. L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute
W. A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute

This Monograph illustrates the use of state variable feedback to design a feedback controller for a linear time-invariant plant in a manner such that the system response is insensitive to gain variations in a linear gain block preceding the plant. The design procedure is developed and applied to the design of the controller for a third-order plant.

MONOGRAPH CS-8

ABSTRACT

Title: Synthesis of Minimal Sensitivity Sampled-Data Control Systems

By: L. L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute
W. A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute

This Monograph gives the development of a procedure for the design of a minimal sensitivity deadbeat sampled-data control system. This procedure is an extension of the usual z transform deadbeat design procedure. The design procedure is illustrated by two examples.