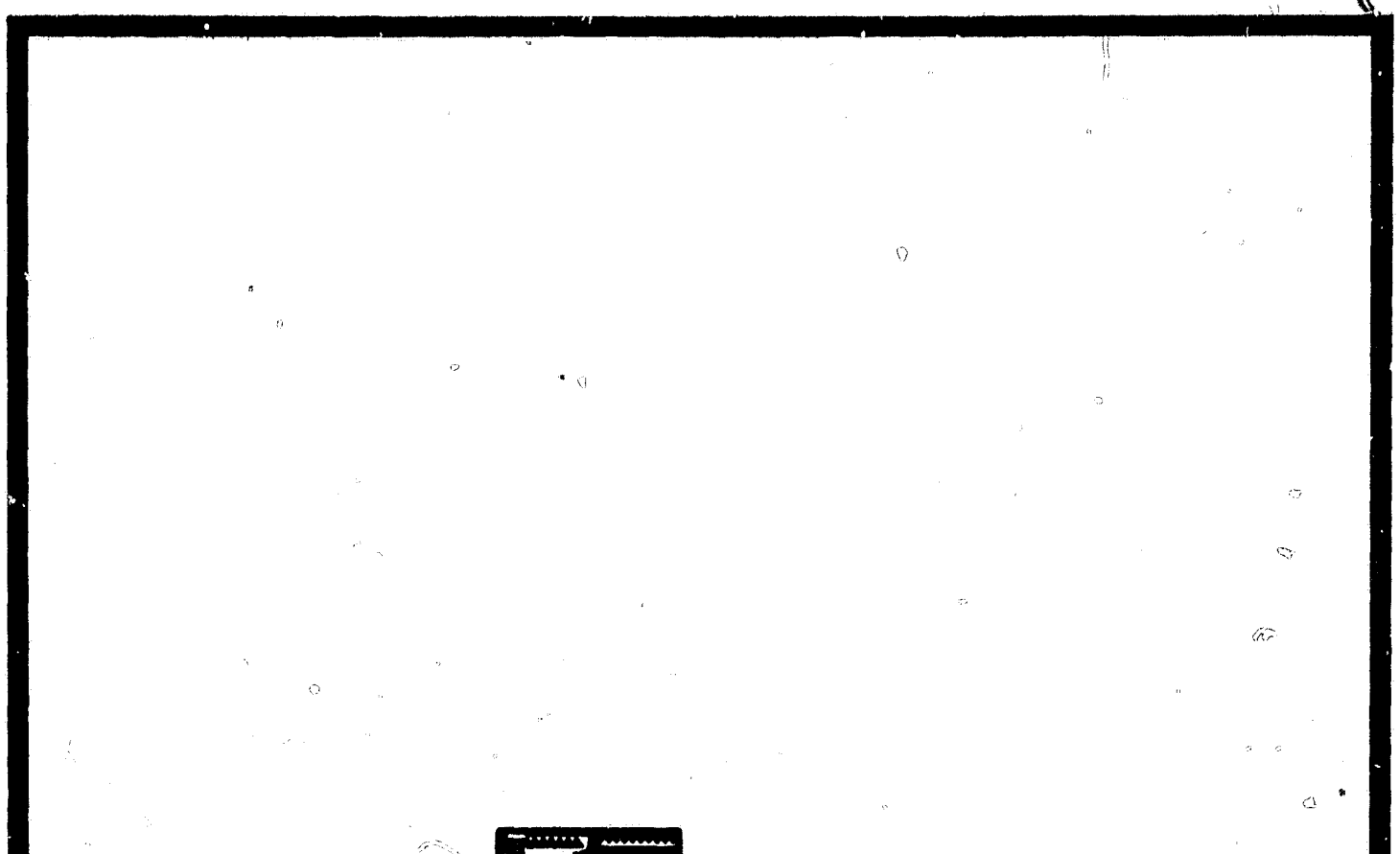

OFFICE OF ENGINEERING RESEARCH

OKLAHOMA STATE UNIVERSITY

ANNUAL REPORT
(ADDENDUM)

TO

NATIONAL AERONAUTICS
AND
SPACE ADMINISTRATION

APPENDIX XII

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

REPORT NO. ER 69-I-2

DATE: NOVEMBER 30, 1968

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

APPENDIX XII

ANNUAL REPORT

September 1, 1967 through November 30, 1968

COLLEGE OF ENGINEERING
OKLAHOMA STATE UNIVERSITY
STILLWATER, OKLAHOMA

Administered under Contract Number NSR 37-002-045

of the

National Aeronautics and Space Administration

APPENDIX FOREWORD

This Appendix is divided into subsections, one subsection for each Educational Monograph. Each subsection presents the dissemination statistics and evaluation statistics and analysis for each Educational Monograph ready for distribution.

EDUCATIONAL MONOGRAPH: HT-1

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

PREPARED BY: J. A. Wiebelt, Mechanical Engineering, Oklahoma State University

RELEASE DATE: September, 1966

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

The quality of the documents received favorable acceptance. Six of the evaluators responding to the question "Would you use the Monograph if you taught the course again?" replied favorably while only two reported they would not use the document again. The answers to the question on format were extremely favorable with 14 favorable responses to 2 unfavorable.

HT-1

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	139	37	176
2. Student Copies Mailed	513	15	528
3. Number of Professors	47	--	---
at Universities	32	--	---
in States	22	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	16	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	16	4	20
2. % Evaluations Returned	12%	11%	11%
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$			
3. Number of Favorable Evaluations	16	3	19
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	100%	75%	95%
5. Number of Unfavorable Evaluations	--	1	1
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	--	25%	5%

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation? ----- Good 4, Some 4, Little ____

Should the Monographs include more information than was presented? ---- More 4, Same 4, Less ____

HT-1

Is the format of the Monographs appropriate for--- Good 14
use in engineering courses? Fair 2
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?-- Yes 4
No 5

Was the Monograph used in context with closely---- Yes 5
related material in the course presentation? No 2

Did the technical information in the Monograph---- Great 1
contribute to the further understanding of the Some 6
course material by the students in the course? Little 1
None

Were the home problems in the Monograph too------- Not Used 4
complex? Too complex 1
Useful 2
Too simple
Unnecessary

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

Would you use the Monograph if you taught the course-----Yes 6
again? No 2

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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)

HT-1

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 & Refining Company)

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

Yes (University of Wisconsin)

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)

More background material in beginning and example problems. (Humble Oil & Refining Company)

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-1

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

No (University of Minnesota)

Yes (University of Virginia)

Probably not frequently, but sometimes. (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)

HT-1

Additional Comments from Evaluators:

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 interdependent 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. (Humble Oil Company)

HT-1

DISSEMINATION TO UNIVERSITIES:

Brigham Young University
John M. Simonsen

California Institute of Technology
R. H. Sabersky

Centro de Profesores
Morris S. Ojalvo

City College of the City University of New York
Latif M. Jiji

Cleveland State University
Dr. Ed Keshock

Columbia University of the City of New York
Harold G. Elrod

Hudson Valley Community College
R. M. Frinks

Kansas State University
Paul L. Miller
P. E. McNall

Lake Superior State College
D. L. Carstens

Lehigh University
Benjamin E. Nevis
Luis Pujol

Louisiana State University
Dupree Maples

New York University
John Happel

North Dakota State University
Philip Pfister

Notre Dame University
Mrs. Levee (Dept. Secretary)
J. L. Novotny

Ohio University
Richard S. Mayer

Oregon State University
J. R. Welty

Pennsylvania State University
J. L. L. Baker
C. Birnie, Jr.

Princeton University
J. R. Welty

Queen's University
Philip G. Hill

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rutgers--The State University
Robert H. Page

San Jose State College
Robert F. Clothier

Southern Methodist University
J. C. Denton
Donald Price

Tatung Institute of Technology
T. S. Lin

Tennessee Technological Institute
John Wallace

United States Air Force Academy
Major Myron Harnly

University of Alabama
William K. Rey

University of Arkansas
Philip E. Bocquet

University of Calgary
J. E. Venart

University of California (Berkeley)
H. A. Johnson

HT-1

University of Cincinnati
Marvin L. English
Widen Tabakoff
James Thorpe

University of Detroit
Lawrence Canjar

University of Florida
Calvin Oliver
R. D. Walker

University of Hawaii
Dr. R. M. Fand
Dr. J. S. Fox

University of Illinois
R. G. Hering
S. Konzo

University of Maine
Richard C. Hill

University of Michigan
S. W. Churchill
J. J. Martin

University of Minnesota
E. R. G. Eckert
Richard Goldstein
E. M. Sparrow

University of Mississippi
Frank Anderson

University of Missouri at Rolla
J. D. McBrayer

University of New Hampshire
Dr. S. S. T. Fan

University of New Mexico
R. C. Dove
Charles Gilbert Richards

University of North Dakota
Milton B. Larson

University of Oklahoma
Tom J. Love

University of Texas
Hugh A. Walls

University of Utah
Wayne S. Brown
Fabio R. Goldschmied
J. D. Seader
Forrest Staffanson

University of Virginia
J. T. Beard

University of Washington
Creighton Depew

University of Waterloo
George D. Fulford
G. F. Pearce
D. C. T. Pei

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison
John W. Mitchell
Warren E. Stewart

University of Wyoming
William D. Batton

Utah State University
R. M. Holdredge
Jack Keller

Vanderbilt University
John W. Williamson

Washington University
Albert Black

HT-1

DISSEMINATION TO INDUSTRY:

Arnold Research Organization, Inc.
H. D. Gardinier
M. R. Jones
E. K. Latvala
D. Taylor
L. F. Webster

Cummins Engine Company
L. Eltinge

Denver Research Institute
Miss Terry Sovel

E. I. DuPont de Nemours
F. E. Rush

Foster Wheeler Corporation
R. J. Zoschak

Hittman, Associates
Warren C. Lyon

Humble Oil & Refining Company
Frank W. Wheeler

Inland Steel Research Labs
Eugene Urban

Lockheed Missile & Space Company
Wayland C. Griffith

LTV-Aerospace Corporation
Dr. Charles Hester

Martin Marietta Company
John W. Smith

Mississippi Research & Development Center
Dr. Kenneth Wagner

Olin
Monte H. Jacoby

Pan American Petroleum
George Roberts, Jr.

Rocketdyne
Dr. W. T. Rinehart

Texas Instruments, Inc.
Dr. David A. Peterman

EDUCATIONAL MONOGRAPH: HT-2

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

PREPARED BY: Kenneth J. Bell, Chemical Engineering, Oklahoma State University

RELEASE DATE: November, 1966

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

Only six evaluations have been returned on this Monograph. Four responders considered the format good while two rated it fair. The written comments on the evaluation sheets were limited. One evaluator wanted to see more area covered in a similar Monograph. In answer to the question, "Should a program of preparing Monographs be expanded to cover a wide variety of subject areas?", we received two "yes" replies and one "no" response.

HT-2

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	85	20	105
2. Student Copies Mailed	179	15	194
3. Number of Professors	59	--	---
at Universities	45	--	---
in States	25	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	12	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	5	1	6
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	6%	5%	6%
3. Number of Favorable Evaluations	5	1	6
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	100%	100%	100%
5. Number of Unfavorable Evaluations	--	--	--
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	--	--	--

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation?	Good	5
	Some	
	Little	
Should the Monographs include more information than was presented?	More	2
	Same	1
	Less	1

HT-2

Is the format of the Monographs appropriate for--- use in engineering courses?
Good 4
Fair 2
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?--
Yes 2
No 3

Was the Monograph used in context with closely---- related material in the course presentation?
Yes 2
No 3

Did the technical information in the Monograph---- contribute to the further understanding of the course material by the students in the course?
Great 2
Some
Little 1
None

Were the home problems in the Monograph too------- complex?
Not Used 1
Too complex
Useful 2
Too simple
Unnecessary

How many hours of classroom lecture time should be allocated for presentation of this Monograph? an average of 1 1/2 hours

Would you use the Monograph if you taught the course----Yes 2 again?
No 1

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

Yes (Auburn University)

Yes (University of Wisconsin)

It presents current material. (Auburn University)

No (Auburn University)

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

HT-2

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

Yes (Auburn University)

Yes (University of Cincinnati)

No (University of Wisconsin)

Occasionally (University of Michigan)

HT-2

DISSEMINATION TO UNIVERSITIES:

Auburn University
R. I Vachon

California Institute of Technology
R. H. Sabersky

Carnegie-Mellon University
S. William Gouse, Jr.

Centro de Profesores
Morris S. Ojalvo

Cleveland State University
Dr. Edward G. Keshock

Columbia University of the City of New York
Harold G. Elrod

Kansas State University
Paul L. Miller

Lake Superior State College
D. L. Carstens

Lehigh University
Luis Pujol

New York University
John Happel

North Dakota State University
Philip C. Pfister

Notre Dame University
Mrs. Ella Levee (Dept. Secretary)
J. L. Novotny
Joseph C. Hogan

Oregon State University
J. R. Welty
Dr. Carl G. Downing

Pennsylvania State University
J. L. L. Baker
Dr. D. A. Bowlus

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rutgers--The State University
Robert H. Page

San Jose State College
Dr. Robert F. Clothier

Southern Methodist University
J. C. Denton
Donald Price

Tatung Institute of Technology
T. S. Lin

University of Alabama
William K. Rey

University of Calgary
J. E. Venart

University of California (Berkeley)
H. A. Johnson

University of Cincinnati
Widen Tabakoff

University of Detroit
Lawrence N. Canjar

University of Florida
Calvin C. Oliver
R. D. Walker

University of Hawaii
Dr. H. C. Chai
Dr. R. M. Rand

University of Illinois
R. G. Hering
S. Konzo

University of Michigan
J. J Martin

University of Minnesota
Richard Goldstein

HT-2

University of Missouri at Rolla
J. D. McBrayer

University of Nebraska
D. R. Haworth

University of New Hampshire
Dr S. S. Fan

University of North Dakota
Milton B. Larson

University of Oklahoma
Philip C. Colver

University of Texas
J. J. McKetta
W. R. Upthegrove

University of Utah
Fabio R. Goldschmied
Wayne S Brown

University of Waterloo
George D. Fulford
G. F. Pearce
D. C. T. Pei

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison
Warren E. Stewart

University of Wyoming
William D. Batton

United States Air Force Academy
Major Myron D. Harnly

Utah State University
R. M. Holdredge

Washington University
Albert W. Black

West Virginia University
J. F. Parmer

HT-2

DISSEMINATION TO INDUSTRY:

Arnold Research Organization, Inc.
H. E. Gardinier
L. Taylor
L. F. Webster

Cummins Engine Company
L. Eltinge

Denver Research Institute
Miss Terry Sovel

E. I. DuPont de Nemours
F. E. Rush

Inland Steel Research Labs
Eugene Urban

Lockheed Missiles & Space Company
Wayland C. Griffith

LIV-Aerospace Corporation
Dr. Charles Hester

Martin Marietta Corporation
John W. Smith

Mississippi Research & Development Center
Dr. Kenneth Wagner

Pan American Petroleum Company
George Roberts, Jr.

Rocketdyne
Dr. W. T. Rinehart

Whirlpool Corporation
T. H. Goodgame

EDUCATIONAL MONOGRAPH: HT-3

TITLE: Method for Estimating Ratio of Absorptance to Emittance

PREPARED BY: John A. Wiebelt, Mechanical Engineering, Oklahoma State University

RELEASE DATE: January, 1967

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

All twelve of the responses were from educators. All the evaluations were favorable to the general concept. Some of the comments were:

---They are of definite value. They would be more complete if all the basic material, the fundamentals, were included.

---Students get acquainted with the real analysis of problems which are confronting engineers who are now active.

---I would use them only in courses dealing with current topics and in seminar type courses.

HT-3

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	112	30	142
2. Student Copies Mailed	526	15	541
3. Number of Professors	71	--	---
at Universities	56	--	---
in States	32	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	16	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	12	--	12
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	11%	--	8%
3. Number of Favorable Evaluations	12	--	12
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	100%	--	100%
5. Number of Unfavorable Evaluations	--	--	--
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	--	--	--

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation? ----- Good 3, Some 2, Little

Should the Monographs include more information than was presented? ---- More 1, Same 4, Less

H'o. 3

Is the format of the Monographs appropriate for--- use in engineering courses?
Good 6
Fair
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?--
Yes 4
No 2

Was the Monograph used in context with closely---- related material in the course presentation?
Yes 3
No 2

Did the technical information in the Monograph---- contribute to the further understanding of the course material by the students in the course?
Great 1
Some 3
Little
None

Were the home problems in the Monograph too------- complex?
Not Used 1
Too complex 2
Useful
Too simple 1
Unnecessary

How many hours of classroom lecture time should be allocated for presentation of this Monograph? an average of 1 1/2 hours

Would you use the Monograph if you taught the course-----Yes 4 again? No 1

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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)

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

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

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)

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

HT-3

DISSEMINATION TO UNIVERSITIES:

Auburn University
R. I. Vachon

California Institute of Technology
R. H. Sabersky

Centro de Profesores
Morris S. Ojalvo

Cleveland State University
Dr. Edward G. Keshock

Columbia University of the City of New York
Harold G. Elrod

Kansas State University
Paul L. Miller

Lake Superior State College
D. L. Carstens

Lehigh University
Benjamin E. Nevis

Louisiana State University
Dupree Maples

New York University
John Happel

North Dakota State University
Philip C. Pfister

Notre Dame University
Mrs. Ella Levee (Dept. Secretary)
Joseph C. Hogan
J. L. Novotny

Oregon State University
J. R. Welty

Pennsylvania State University
J. L. L. Baker
C. Birnie, Jr.

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rutgers--The State University
Robert H. Page

Saint Louis University
Benjamin H. Ulrich, Jr.

San Jose State College
Dr. Robert F. Clothier

Southern Methodist University
J. C. Denton
Donald C. Price

Tatung Institute of Technology
T. S. Lin

Tulane University
Kathy Burgess

University of Alabama
William K. Rey

University of Arizona
Dr. N. D. Cox

University of Calgary
J. E. Venart

University of California (Berkeley)
H. A. Johnson

University of Cincinnati
Widen Tabakoff

University of Detroit
Lawrence N. Canjar

University of Florida
Calvin C. Oliver

University of Hawaii
Dr. R. M. Fand
Dr. J. W. Fox

University of Houston
Dr. W. I. Honeywell

HI-3

University of Illinois
R. G. Hering
S. Konzo

University of Kentucky
Clifford J. Cremers

University of Michigan
S W. Churchill
J. J. Martin

University of Minnesota
Richard Goldstein
E. R. G. Eckert
E. M. Sparrow

University of Mississippi
Frank A. Anderson

University of Missouri at Rolla
J. D. McBrayer

University of Nebraska
D. R. Haworth

University of New Hampshire
Dr. S. S. Fan

University of New Mexico
R. C. Dove

University of North Dakota
Milton B. Larson

University of Oklahoma
Tom J. Love

University of Texas
Hugh A. Walls

University of Utah
Fabio R. Goldschmied
Wayne S. Brown
Forrest L. Staffanson

University of Virginia
J. T. Beard

University of Washington
Creighton A. Depew

University of Waterloo
George D. Fulford
G. F. Pearce
D. C. T. Pei

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison
Warren E. Stewart

University of Wyoming
William D. Batton

United States Air Force Academy
Major Myron D. Harnly

United States Naval Academy
James A. Adams

Utah State University
R. M. Holdredge

Vanderbilt University
John W. Williamson

Washington University
Albert W. Black

West Virginia University
J. F. Parmer

HT-3

DISSEMINATION TO INDUSTRY:

Allis Chalmers
R. C. Dancy

Arnold Research Organization, Inc.
D. S. Bynum
H. E. Gardinier
R. W. Harvey
E. K. Latvala
D. Taylor
L. F. Webster

Astro-Met Associates, Inc.
John W. Graham

Cummins Engine
L. Eltinge

Denver Research Institute
Miss Terry Sovel

Inland Steel Research Labs
Eugene Urban

Lockheed Missiles & Space Company
Wayland C. Griffith

LTV-Aerospace Corporation
Dr. Charles Hester

Martin Marietta Corporation
John W. Smith

Mississippi Research & Development Center
Dr. Kenneth Wagner

Olin
Monte H. Jacoby

Pan American Petroleum Company
George Roberts, Jr.

Reynolds Metals Company
O. R. Singleton

Rocketdyne
Dr. W. T. Rinehart

Texaco, Incorporated
B. D. Lee

Texas Instruments, Incorporated
Dr. David A. Peterman

EDUCATIONAL MONOGRAPH: HT-4

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

PREPARED BY: John A. Wiebelt, Mechanical Engineering, Oklahoma State University

RELEASE DATE: January, 1967

ABSTRACT:

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 nonchromatic 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

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

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.

EVALUATION -- OVERALL ANALYSIS:

The eleven evaluations returned by educators were all favorable to the concept and format. Six professors reported they would use the Monograph if they taught the course again; there were no negative comments on using the document in class. The following statement is indicative:

".....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."

HT-4

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	103	25	128
2. Student Copies Mailed	484	15	499
3. Number of Professors	73	--	---
at Universities	58	--	---
in States	32	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	15	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	11	--	11
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	11%	--	9%
3. Number of Favorable Evaluations	11	--	11
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	100%	--	100%
5. Number of Unfavorable Evaluations	--	--	--
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	--	--	--

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation?	Good	6
	Some	1
	Little	
Should the Monographs include more information than was presented?	More	2
	Same	4
	Less	

HT-4

Is the format of the Monographs appropriate for--- Good 6
use in engineering courses? Fair 1
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?-- Yes 5
No 1

Was the Monograph used in context with closely---- Yes 5
related material in the course presentation? No 1

Did the technical information in the Monograph---- Great
contribute to the further understanding of the Some 4
course material by the students in the course? Little 1
None

Were the home problems in the Monograph too------- Not Used 1
complex? Too complex
Useful 4
Too simple
Unnecessary

How many hours of classroom lecture time should be allocated for presentation of this Monograph? an average of 1 1/2 hours

Would you use the Monograph if you taught the course----Yes 6
again? No

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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)

HT-4

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)

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)

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

HT-4

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

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)

H:-4

DISSEMINATION TO UNIVERSITIES:

Auburn University
R. I. Vachon

Brigham Young University
John M. Simonsen

California Institute of Technology
R. H. Sabersky

Centro de Profesores
Morris S. Ojalvo

Cleveland State University
Dr. Edward G. Keshock

City College of the City University of New York
Robert A. Graff

Columbia University of the City of New York
Harold G. Elrod

Kansas State University
P. L. Miller

Lake Superior State College
D. L. Carstens

Lehigh University
Benjamin E. Nevis

Louisiana State University
Dupree Maples

Michigan State University
Dr. George Coalman

New York University
John Happel

North Dakota State University
Philip C. Pfister

Notre Dame University
Joseph C. Hogan
Mrs. Ella Levee (Dept. Secretary)
J. L. Novotny

Oregon State University
J. R. Welty

Pennsylvania State University
J. L. L. Baker
C. Birnie, Jr.

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rose Polytechnic Institute
Thomas Hutchinson

Saint Louis University
Benjamin H. Ulrich, Jr.

San Jose State College
Dr. Robert F. Clothier

Southern Methodist University
J. C. Denton
Donald C. Price

Tatung Institute of Technology
T. S. Lin

Tulane University
Kathy Burgess

University of Alabama
William K. Rey

University of Arizona
Dr. N. D. Cox
Donald M. McEligot

University of Arkansas
Philip E. Bocquet

University of Calgary
J. E. Venart

University of California (Berkeley)
H. A. Johnson

HT-4

DISSEMINATION TO UNIVERSITIES:

Auburn University
R. I. Vachon

Brigham Young University
John M. Simonsen

California Institute of Technology
R. H. Sabersky

Centro de Profesores
Morris S. Ojalvo

Cleveland State University
Dr. Edward G. Keshock

City College of the City University of New York
Robert A. Graff

Columbia University of the City of New York
Harold G. Elrod

Kansas State University
P. L. Miller

Lake Superior State College
D. L. Carstens

Lehigh University
Benjamin E. Nevis

Louisiana State University
Dupree Maples

Michigan State University
Dr. George Coalman

New York University
John Happel

North Dakota State University
Philip C. Pfister

Notre Dame University
Joseph C. Hogan
Mrs. Ella Levee (Dept. Secretary)
J. L. Novotny

Oregon State University
J. R. Welty

Pennsylvania State University
J. L. L. Baker
C. Birnie, Jr.

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rose Polytechnic Institute
Thomas Hutchinson

Saint Louis University
Benjamin H. Ulrich, Jr.

San Jose State College
Dr. Robert F. Clothier

Southern Methodist University
J. C. Denton
Donald C. Price

Tatung Institute of Technology
T. S. Lin

Tulane University
Kathy Burgess

University of Alabama
William K. Rey

University of Arizona
Dr. N. D. Cox
Donald M. McEligot

University of Arkansas
Philip E. Bocquet

University of Calgary
J. E. Venart

University of California (Berkeley)
H. A. Johnson

HT-4

DISSEMINATION TO INDUSTRY:

Arnold Research Organization, Inc.
H. E. Gardinier
D. Taylor
L. F. Webster
P. M. Wood

Astro-Met Asscoiates, Inc.
John W. Graham

Cummins Engine Company
L. Eltinge

Denver Research Institute
Miss Terry Sovel

E. I. DuPont de Nemours & Company
F. E. Rush

Inland Steel Research Labs
Eugene Urban

LTV-Aerospace Corporation
Dr. Charles Hester

Lockheed Missiles & Space Company
Wayland C. Griffith

Martin Marietta Corporation
John W. Smith

Mississippi Research & Development Center
Dr. Kenneth Wagner

Pan American Petroleum
George Roberts, Jr.

Reynolds Metals Company
O. R. Singleton

Rocketdyne
Dr. W. T. Rinehart

Texas Instruments, Inc.
Dr. David A. Peterman

Whirlpool Corporation
T. H. Goodgame

EDUCATIONAL MONOGRAPH: HT-5

TITLE: Pool Boiling Heat Transfer at Reduced Gravity

PREPARED BY: Kenneth J. Bell, Chemical Engineering, Oklahoma State University

RELEASE DATE: December, 1967

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

The evaluations received, six from educators and two from industry, approve of the concept. The following comments are significant:

---"I like the idea but it does not appeal to others in our department."

---"Only if they offer substantial clarification or amplification on the original paper.....This paper, HT-5, is too specialized for inclusion in any of our 3 heat transfer classes."

---"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."

HT-5

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	91	41	132
2. Student Copies Mailed	176	15	191
3. Number of Professors	66	--	---
at Universities	52	--	---
in States	29	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	12	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	6	2	8
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	7%	5%	6%
3. Number of Favorable Evaluations	6	2	8
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	100%	100%	100%
5. Number of Unfavorable Evaluations	--	--	--
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	--	--	--

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation?	Good	3
	Some	2
	Little	1
Should the Monographs include more information than was presented?	More	3
	Same	1
	Less	

HT-5

Is the format of the Monographs appropriate for use in engineering courses?
Good 6
Fair 1
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?
Yes 2
No 4

Was the Monograph used in context with closely related material in the course presentation?
Yes 3
No 2

Did the technical information in the Monograph contribute to the further understanding of the course material by the students in the course?
Great
Some 3
Little
None

Were the home problems in the Monograph too complex?
Not Used
Too complex
Useful 2
Too simple 1
Unnecessary

How many hours of classroom lecture time should be allocated for presentation of this Monograph? average of 1 1/2 hours

Would you use the Monograph if you taught the course again?
Yes 3
No

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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)

HT-5

Yes. (University of Wisconsin)

Only if they offer substantial clarification or amplification on the original paper. HT-1 on the 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)

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-5

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

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)

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

HT-5

DISSEMINATION TO UNIVERSITIES:

Auburn University
R. I. Vachon

California Institute of Technology
R. H. Sabersky

Carnegie-Mellon University
S. William Gouse, Jr.

Centro de Profesores
Morris S. Ojalvo

City College of the City University of New York
Robert A. Graff

Cleveland State University
Dr. Edward G. Keshock

Columbia University of the City of New York
Harold Elrod

Lake Superior State College
D. L. Carstens

Lehigh University
Luis Pujol

Michigan Technological University
S. Winnikow

Michigan State University
Dr. George Coalman

New York University
John Happel

North Carolina State University
W. C. Peterson

North Dakota State University
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Ohio Northern University
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Oregon State University
J. R. Welty

Pennsylvania State University
J. L. L. Baker
Dr. F. W. Schmidt

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rutgers--The State University
Robert H. Page

Saint Louis University
Benjamin H. Ulrich, Jr.

San Jose State College
Dr. Robert F. Clothier

Southern Methodist University
J. C. Denton
Donald C. Price

Stanford University
H. C. Perkins

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Tulane University
Kathy Burgess

University of Alabama
William K. Rey

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University of California (Berkeley)
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University of Cincinnati
Marvin L. English

HT-5

University of Florida
Calvin C. Oliver
R D. Walker

University of Hawaii
Dr H C. Chai
Dr. R. M. Fand

University of Illinois
R. G. Hering
S Konzo

University of Michigan
Richard A. Matula

University of Minnesota
Richard Goldstein

University of Mississippi
Frank A. Anderson

University of Missouri at Rolla
J. D McBrayer

University of Nebraska
D R Haworth

University of New Hampshire
Dr S. S. Fan

University of North Dakota
Milton B. Larson

University of Oklahoma
Philip C. Colver

University of Texas
J. J. McKetta
W. R. Upthegrove
Hugh A. Walls

University of Utah
Wayne S. Brown
Fabio Goldschmied

University of Waterloo
G. F. Pearce
George D. Fulford

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison
John W. Mitchell
Warren E. Stewart

University of Wyoming
William D. Batton

Utah State University
R. M. Holdredge

Vanderbilt University
John W. Williamson

Washington University
Albert W. Black

West Virginia University
J. F. Parmer

HT-5

DISSEMINATION TO INDUSTRY:

Arnold Research Organization, Inc.
D. Taylor
L. F. Webster

Caterpillar Tractor Company
Miss Carol Mulvaney (Librarian)

Cummins Engine Company
L. Eltinge

Denver Research Institute
Miss Terry Sovel

E. I. DuPont de Nemours & Company
F. E. Rush

General Electric Company
Yi-Yuan-Yu

Hughes Aircraft Company
Masse Bloomfield

Lockheed Missiles & Space Company
Wayland C. Griffith

LTV-Aerospace Corporation
Dr. Charles Hester

Martin Marietta Corporation
John W. Smith

Pan American Petroleum
George Roberts, Jr.

Rocketdyne
Dr. W. T. Rinehart

EDUCATIONAL MONOGRAPH: HT-7

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

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

RELEASE DATE: October, 1967

ABSTRACT: 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. Methods for selecting zone size are discussed.

EVALUATION -- OVERALL ANALYSIS:

A total of 12 evaluations have been returned on this Monograph -- 6 from educators and 6 from industry. Nine evaluators considered the technical information covered in the Monograph of value. The industrial evaluators were most enthusiastic in their acceptance of the Monograph program. One evaluator (industry) reports that this Monograph would have been a little clearer with a simple graph.

HT-7

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	90	66	156
2. Student Copies Mailed	174	15	189
3. Number of Professors	61	--	---
at Universities	48	--	---
in States	27	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	20	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	6	6	12
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	7%	9%	8%
3. Number of Favorable Evaluations	6	6	12
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	100%	100%	100%
5. Number of Unfavorable Evaluations	--	--	--
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	--	--	--

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation?	Good	9
	Some	1
	Little	
Should the Monographs include more information than was presented?	More	2
	Same	9
	Less	

HT-7

Is the format of the Monographs appropriate for use in engineering courses?
Good 10
Fair 2
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?
Yes 3
No 8

Was the Monograph used in context with closely related material in the course presentation?
Yes 5
No 6

Did the technical information in the Monograph contribute to the further understanding of the course material by the students in the course?
Great 1
Some 7
Little
None

Were the home problems in the Monograph too complex?
Not Used 4
Too complex
Useful 5
Too simple
Unnecessary

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

Would you use the Monograph if you taught the course again?
Yes 6
No 1

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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)

HT-7

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 Company)

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)

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 Company)

Brevity. (Lehigh University)

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

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)

HT-7

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

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)

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

Yes (Caterpillar Tractor Company)

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

Not frequently (University of Wisconsin)

HT-7

As all teachers know, pedagogy 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 results. 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 aritcle 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 and Refining Company)

HT-7

DISSEMINATION TO UNIVERSITIES:

Brigham Young University
Dr. Bill J. Pope

California Institute of Technology
R. H. Sabersky

California State at Long Beach
Ali Eshett

Centro de Profesores
Morris S. Ojalvo

Cleveland State University
Dr. Edward G. Keshock

Columbia University of the City of New York
Harold G. Elrod

Hudson Valley Community College
R. M. Frinks

Kansas State University
P. L. Miller
P. E. McNall, Jr.

Lake Superior State College
D. L. Carstens

Lehigh University
Benjamin E. Nevis
Luis Pujol

Louisiana State University
Dupree Maples

New York University
John Happel

North Dakota State University
Philip C. Pfister

Ohio University
Richard S. Mayer

Oregon State University
J. R. Welty

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

San Jose State College
Dr. Robert F. Clothier

Southern Methodist University
Donald C. Price

Tatung Institute of Technology
T. S. Lin

University of Alabama
William K Rey

University of Arkansas
Philip E. Bocquet

University of Calgary
J. E. Venart

University of California
H. A. Johnson

University of Cincinnati
Marvin L. English

University of Detroit
Lawrence N. Canjar

University of Florida
Calvin C. Oliver

University of Hawaii
Dr. R. M. Fand

University of Houston
F. M. Tiller

University of Illinois
R. G. Hering
S. Konzo

University of Maine
Richard C. Hill

University of Minnesota
Richard Goldstein
E. M. Sparrow

HT-7

University of Missouri at Rolla
J D McBrayer

University of New Hampshire
Dr S. S. Fan

University of New Mexico
Charles Richards

University of North Dakota
Milton B. Larson
D. P Naismith

University of Oklahoma
Tom J. Love

University of Texas
J. J. McKetta
W. R. Upthegrove

University of Utah
Wayne S. Brown
Fabio R. Goldschmied
J. D. Seader

University of Virginia
J. T. Beard

University of Washington
Creighton A. Depew

University of Waterloo
George D. Fulford
G. F. Pearce
D. C. T Pei

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison
John W. Mitchell
David R. Poirier
Warren E. Stewart

University of Wyoming
William D. Batton

Utah State University
R. M. Holdredge

Washington State University
T. M. Yeyinmen

Washington University
Albert W. Black

HT-7

DISSEMINATION TO INDUSTRY:

Allis Chalmers
R. C. Dancy

Arnold Research Organization, Inc.
H. E. Gardinier
R. M. James
A. D. Jaratt
E. K. Latvala
D. Taylor
L. F. Webster

AVCO Corporation
D. F. Salmon

Caterpillar Tractor Company
Miss Carol Mulvaney (Librarian)

Cummins Engine Company
L. Eltinge

Denver Research Institute
Terry Sovel

E. I. DuPont de Nemours
F. E. Rush

Ethyl Corporation
John L. Guillory

Foster Wheeler Corporation
R. J. Zoschak

Hughes Aircraft Company
Masse Bloomfield

Inland Steel Research Labs
Eugene Urban

Lockheed Missiles & Space Company
Wayland C. Griffith

LTV-Aerospace Corporation
Dr. Charles Hester

Martin Marietta Corporation
John W. Smith

Pan American Petroleum
George Roberts, Jr.

Reynolds Metals Company
O. R. Singleton

Rocketdyne
Dr. W. T. Rinehart

Texaco, Incorporated
B. D. Lee

Texas Instruments, Inc.
Dr. David Peterman

Whirlpool Corporation
T. H. Goodgame

EDUCATIONAL MONOGRAPH: HT-8

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

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

RELEASE DATE: January, 1968

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

Only three evaluations have been returned. All three have been favorable to both concept and format.

HT-8

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	73	49	122
2. Student Copies Mailed	350	15	345
3. Number of Professors	50	--	---
at Universities	46	--	---
in States	28	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	17	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	2	1	3
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	3%	2%	2%
3. Number of Favorable Evaluations	2	1	3
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	100%	100%	100%
5. Number of Unfavorable Evaluations	--	--	--
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	--	--	--

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation? ----- Good 1, Some ____, Little ____

Should the Monographs include more information than was presented? ---- More 1, Same ____, Less ____

HT-8

Is the format of the Monographs appropriate for use in engineering courses?
Good 2
Fair
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?
Yes 1
No 1

Was the Monograph used in context with closely related material in the course presentation?
Yes 1
No 1

Did the technical information in the Monograph contribute to the further understanding of the course material by the students in the course?
Great
Some 1
Little
None

Were the home problems in the Monograph too complex?
Not Used
Too complex
Useful 1
Too simple
Unnecessary

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

Would you use the Monograph if you taught the course again?
Yes 1
No

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

   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? What are the good points? Any improvements needed?

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

HT-8

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

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)

Yes (University of Kentucky)

Occasionally (University of Wisconsin)

HT-8

DISSEMINATION TO UNIVERSITIES:

Brigham Young University
John M. Simonsen

California Institute of Technology
R. H. Sabersky

California State at Los Angeles
Dan R. Rankin

Centro de Profesores
Morris S. Ojalvo

Cleveland State University
Dr. Lowell C. Domholdt

Colorado School of Mines
Frank Stermole

Columbia University of the City of New York
Harold G. Elrod

Kansas State University
P. L. Miller
P. E. McNall, Jr.

Lake Superior State College
D. L. Carstens

Lehigh University
Luis Pujol

Louisiana State University
Dupree Maples

Michigan Technological University
R. D. Audi
S. Winnikow

Ohio Northern University
Robert J. Glass

Oregon State University
J. R. Welty

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

San Jose State College
Dr. Robert F Clothier

Southern Methodist University
Donald C. Price

Tatung Institute of Technology
T. S.Lin

University of Alabama
William K. Rey

University of California (Berkeley)
H. A. Johnson

University of Cincinnati
Marvin L. English

University of Florida
Calvin C. Oliver
R. D. Walker

University of Hawaii
Dr. J. S. Fox
Dr. R. M. Fand

University of Illinois
R. G. Hering
S. Konzo

University of Kentucky
Clifford J. Cremers

University of Massachusetts
Lawrence L. Ambs

University of Michigan
Richard A. Matula

University of Minnesota
Richard Goldstein
E. M. Sparrow

HT-8

University of Missouri at Rolla
J. D. McBrayer

University of New Hampshire
Dr. S. S. Fan

University of New Mexico
K. T. Feldman

University of North Dakota
Milton B. Larson
D. P. Naismith

University of Oklahoma
Tom J. Love

University of Texas
J. J. McKetta
W. R. Upthegrove

University of Utah
Wayne S. Brown
Fabio R. Goldschmied

University of Washington
Creighton A. Depew

University of Waterloo
George D. Fulford
G. F. Pearce
D. C. T. Pei

University of Windsor
J. Gordon Parr

University of Wisconsin
Warren E. Stewart
C. A. Coberly
Howard L. Harrison
John W.Mitchell

University of Wyoming
William D. Batton

Utah State University
R. M. Holdredge

Vanderbilt University
John W. Williamson

Washington State University
I. M. Yeyinmen

Washington University
Albert W. Black

Worcester Polytechnic Institute
John M. Boyd

HT-8

DISSEMINATION TO INDUSTRY:

Allis Chalmers
R. C. Dancy

Allison
Dr. F. G. Myers

Arnold Research Organization, Inc.
F. H. Minger
L. F. Webster

Astro-Met Associates
John W. Graham

AVCO Corporation
D. F. Salmon

Cummins Engine Company
L. Eltinge

Denver Research Institute
Miss Terry Sovel

E. I. DuPont de Nemours
F. E. Rush

Foster Wheeler Corporation
R. J. Zoschak

Hughes Aircraft Company
Masse Bloomfield

Inland Steel Research Lab
Eugene Urban

Lockheed Missiles & Space Company
Wayland C. Griffith

LTV-Aerospace Corporation
Dr. Charles Hester

Martin Marietta Corporation
John W. Smith

Pan American Petroleum
George Roberts, Jr.

Rocketdyne
Dr. W. T. Rinehart

Texas Instruments, Inc.
Dr. David A. Peterman

EDUCATIONAL MONOGRAPH: CS-1

TITLE: An Example of Compensation Network Design

PREPARED BY: William A. Blackwell, and Leonard L. Grigsby,
Electrical Engineering, Virginia Polytechnic Institute

RELEASE DATE: March, 1967

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

General comments by the evaluators indicate a favorable acceptance by both educators and industrial personnel. Several of the evaluators commented that this Monograph was not in their specialized field. Therefore, it was of doubtful value. However, one dissenter says, "We would certainly like to see more of these Monographs if they are available, particularly (though not necessarily restricted to) those dealing with process control.

CS-1

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	66	22	88
2. Student Copies Mailed	248	0	248
3. Number of Professors	58	--	---
at Universities	51	--	---
in States	29	--	---
and Foreign Countries	4	--	---
4. Number of Industries	--	10	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	4	2	6
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	6%	10%	7%
3. Number of Favorable Evaluations	2	2	4
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	50%	100%	67%
5. Number of Unfavorable Evaluations	2	--	2
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	50%	--	33%

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation? ----- Good 1 / Some / Little 1

Should the Monographs include more information than was presented? ---- More / Same 1 / Less

CS-1

Is the format of the Monographs appropriate for--- use in engineering courses?
Good 1
Fair
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?--
Yes
No 3

Was the Monograph used in context with closely---- related material in the course presentation?
Yes
No 3

Did the technical information in the Monograph---- contribute to the further understanding of the course material by the students in the course?
Great
Some 1
Little
None

Were the home problems in the Monograph too------- complex?
Not Used 1
Too complex
Useful 1
Too simple
Unnecessary

How many hours of classroom lecture time should be allocated for presentation of this Monograph? None, use as extra reading

Would you use the Monograph if you taught the course----again?
Yes 1
No 1

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

Yes (University of Wisconsin)

CS-1

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

No. Not Frequently (University of Wisconsin)

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

Yes (University of Iowa)

CS-1

Additional Comments from Evaluators:

This Monograph represents a small band in the very broad spectrum of electronics. More specificall, 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.

CS-1

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, particularly (though not necessarily restricted to) those dealing with process control. (Union Carbide Corporation)

CS-1

DISSEMINATION TO UNIVERSITIES:

Auburn University
R. I. Vachon

Centro de Profesores
Dr. Paul Alper

City College of the City University of New York
Reuel Shinnar

Colorado School of Mines
Frank Stermole

Harvey Mudd College
Dr. Taghi Mirespassi

Indian Institute of Technology
Raja Rao

Kansas State University
P. L. Miller

Lake Superior State College
D. L. Carstens

Louisiana Polytechnic Institute
Buck F. Brown

Michigan Technological University
S. Winnikow

New York University
John R. Ragazzini

North Carolina State University
W. C. Peterson

Northwestern University
William E. Schmitendorf

Notre Dame University
Mrs. Ella Levee (Dept. Secretary)
J. C. Hogan

Ohio State University
Dr. E. O. Doebelin

Pennsylvania Military Colleges
Anthony J. Calise

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rose Polytechnic Institute
Thomas Hutchinson

Southern Methodist University
J. C. Denton
James L. Melsa
Andrew S. Page

State University of New York at Stony Brook
Chi-Tsong Chen

Stevens Institute of Technology
H. W. Phair

Tatung Institute of Technology
T. S. Lin

University of Alabama
William K. Rey

University of Arkansas
W. J. Buche
Stanley E. Stephenson

University of California (Berkeley)
H. A. Johnson

University of Cincinnati
Widen Tabakoff

University of Denver
M. L. Moe

University of Detroit
Lawrence N. Canjar

University of Florida
A. D. Randolph

CS-1

DISSEMINATION TO UNIVERSITIES:

University of Illinois
S. Konzo

University of Iowa
Earl Eyman

University of Kentucky
R. D. Bonnell

University of Maine
David B. Young

University of Minnesota
K. Ogata

University of Missouri at Rolla
J. D. McBrayer

University of North Dakota
Milton B. Larson

University of Oklahoma
Michael L.McGuire

University of Puerto Rico
Hiram H. Puig

University of Tennessee
James C. Hung

University of Texas
J. J McKetta

University of Texas at Arlington
C. W. Jiles

University of Utah
Dietrich K. Gehmlich
Fabio R. Goldschmied

University of Virginia
J. T. Beard

University of Waterloo
George D. Fulford
G. F. Pearce

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L.Harrison

University of Wyoming
William D. Batton

United States Air Force Academy
Major Myron D. Harnly

Villanova University
Joseph Goldberg

Tennessee Technological University
Cecil Alford

CS-1

DISSEMINATION TO INDUSTRY:

Arnold Research Organization
D. S. Bynum
A. H. Cortner
K. E. Latvala
L. F. Webster

Cummins Engine Company
L. Eltinge

Denver Research Institute
Miss Terry Sovel

Electronics, Inc.
Paul Dickson

Inland Steel Research Labs
Eugene Urban

Lockheed Missiles & Space Company
Wayland C. Griffith

Martin Marietta Corporation
Herman Pusin
John W. Smith

Mississippi Research & Development Center
Dr. Kenneth Wagner

Pan American Petroleum
George Roberts, Jr.

Rocketdyne
Dr. W. T. Rinehart

EDUCATIONAL MONOGRAPH: CS-2

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

PREPARED BY: William A. Blackwell, and Leonard L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute

RELEASE DATE: February, 1968

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

Eight of ten evaluators were favorable in their comments. The terms "useful method," "very excellent," "very good as practical example" were used in describing their reviews. However, two of the evaluators commented as follows: (1) "Not good for presenting new material before text coverage," and (2) "In the present form, the Monograph does not offer any new information other than that from standard textbooks."

This particular Monograph could have been improved - "more information needed as to how the system was modeled."

CS-2

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	84	15	99
2. Student Copies Mailed	576	0	576
3. Number of Professors	75	--	---
at Universities	61	--	---
in States	32	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	12	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	9	1	10
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	11%	7%	10%
3. Number of Favorable Evaluations	7	1	8
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	78%	100%	80%
5. Number of Unfavorable Evaluations	2	--	2
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	22%	--	20%

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation? ----- Good 6, Some 2, Little ___

Should the Monographs include more information than was presented? ---- More 2, Same 7, Less ___

CS-2

Is the format of the Monographs appropriate for--- Good 8
use in engineering courses? Fair 1
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?-- Yes 5
No 2

Was the Monograph used in context with closely--- Yes 7
related material in the course presentation? No 1

Did the technical information in the Monograph---- Great 1
contribute to the further understanding of the Some 6
course material by the students in the course? Little 1
None 1

Were the home problems in the Monograph too------- Not Used 2
complex? Too complex
Useful 4
Too simple 2
Unnecessary

How many hours of classroom lecture time should be allocated for presentation of this Monograph? One hour

Would you use the Monograph if you taught the course----Yes 6
again? No

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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)

CS-2

Question 4, cont.

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

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)

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-2

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

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)

I think so. (Tulane University)

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

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

CS-2

DISSEMINATION TO UNIVERSITIES:

Arizona State University
H. H. Young

Auburn University
R. I. Vachon

Brigham Young University
John M. Simonsen
Dr. Bill J. Pope, Jr.

Carnegie-Mellon University
Frank W. Paul

Centro de Profesores
Dr. Paul Alper

City College of the City University of New York
Reuel Shinnar

Clemson University
Eugene Harrison

Colorado School of Mines
Frank Stermole

Harvey Mudd College
Dr. Taghi Mirespassi

Indian Institute of Technology
Raja Rao

Iowa State University of Science & Technology
Bion L. Pierson

Lake Superior State College
D. L. Carstens

Michigan State University
Gerald Park

Michigan Technological University
S. Winnikow

New York University
John R. Ragazzini

North Carolina State University
W. C. Peterson

Northwestern University
William E. Schmitendorf

Notre Dame University
Mrs. Ella Levee (Dept. Sec)
Joseph C. Hogan

Ohio Northern University
Robert J. Glass

Ohio State University
Dr. E. O. Doebelin

Pennsylvania Military Colleges
Anthony J. Calise

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rose Polytechnic Institute
Thomas Hutchinson
Stan S. Thomas

Rutgers--The State University
Marvin L. Granstrom

Saint Louis University
Benjamin, H. Ulrich, Jr.

Southern Illinois University
Curtis W. Dodd

Southern Methodist University
J. C. Denton
James L. Melsa
Andrew S. Page

CS-2

State University of New York at Stony Brook
Chi-Tsong Chen

Tatung Institute of Technology
T. S. Lin

Tennessee Technological University
Cecil Alford

Tulane University
Kathy Burgess

University of Alabama
William K. Rey

University of Arkansas
W. J. Buche
Stanley E. Stephenson

University of Denver
M. L. Moe

University of Florida
Joseph Mahig
J.P. O'Donnell

University of Hawaii
Dr. J. S. Fox

University of Illinois
S. Konzo

University of Iowa
Earl Eyman

University of Kentucky
R. D. Bonnell

University of Massachusetts
Richard V. Monopoli
Donald E. Scott

University of Michigan
Richard A. Matula

University of Minnesota
K. Ogata

University of Missouri at Rolla
J. D. McBrayer

University of Nebraska
D. R. Haworth

University of North Dakota
Milton B. Larson

University of Oklahoma
Michael L. McGuire

University of Santa Clara
Richard C. Dorf

University of Tennessee
James C. Hung

University of Texas
W. R. Upthegrove

University of Texas at Arlington
C. W. Jiles

University of Utah
Dietrich K. Gehmlich
Fabio R. Goldschmied
Gary M. Sandquist

University of Virginia
J. T. Beard
James W. Moore

University of Washington
R. J. H. Bollard

University of Waterloo
George D. Fulford
G. F. Pearce

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison

CS-2

University of Wyoming
William D. Batton

Villanova University
Joseph Goldberg

Virginia Polytechnic Institute
William A. Blackwell
Leonard L. Grigsby

Washington University
Albert W. Black

CS-2

DISSEMINATION TO INDUSTRY:

Arnold Research Organization
F. C. Hightower
L. F. Webster

Caterpillar Tractor Company
Carol E. Mulvaney

Cummins Engine Company
L. Eltinge

Denver Research Institute
Terry Sovel

Detroit Edison Company
Miss Dorene Harling

Hughes Aircraft
Masse Bloomfield

Kelsey-Hayes Company
Harriet Noble (Librarian)

Lockheed Missiles & Space Company
Wayland C. Griffith

McDonnell Douglas
Roger L. Berger

Martin Marietta Corporation
John W. Smith

Pan American Petroleum
George Roberts, Jr.

Rocketdyne
Dr. W. T. Rinehart

EDUCATIONAL MONOGRAPH: CS-3

TITLE: An Example of Nuclear Rocket Control Design

PREPARED BY: William A. Blackwell and H. F. vanLandingham,
Electrical Engineering, Virginia Polytechnic Institute

RELEASE DATE: December, 1967

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

Only eight of the thirteen evaluators were favorably impressed with the concept on the basis of their reviews. An evaluator comments, "As a taxpayer, I'd say they aren't worth the price and NASA could well cut it from its budget without jeopardizing Engineering Education." The same evaluator does continue "As long as they do exist, I'd like to keep getting them so I can use one once in a while." Several other evaluators comment on the need to expand this Monograph - for clarity reasons.

CS-3

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	80	35	115
2. Student Copies Mailed	486	0	486
3. Number of Professors	71	--	---
at Universities	59	--	---
in States	32	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	10	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	11	2	13
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	1%	6%	11%
3. Number of Favorable Evaluations	6	2	8
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	55%	100%	62%
5. Number of Unfavorable Evaluations	5	--	5
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	45%	--	38%

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation? ----- Good 3, Some 3, Little 2

Should the Monographs include more information than was presented? ---- More 2, Same 4, Less ___

CS-3

Is the format of the Monographs appropriate for--- Good 6
use in engineering courses? Fair 1
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?-- Yes 3
No 6

Was the Monograph used in context with closely---- Yes 5
related material in the course presentation? No 3

Did the technical information in the Monograph---- Great 1
contribute to the further understanding of the Some 2
course material by the students in the course? Little
None 1

Were the home problems in the Monograph too------- Not Used 3
complex? Too complex
Useful 2
Too simple
Unnecessary

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

Would you use the Monograph if you taught the course----Yes 3
again? No 3

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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

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-3

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)

Excellent (Caterpillar Tractor Company)

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-3

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

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)

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

I think so. (Tulane University)

Not frequently (University of Wisconsin)

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

CS-3

DISSEMINATION TO UNIVERSITIES:

Auburn University
R. I. Vachon

Brigham Young University
John M. Simonsen

Carnegie-Mellon University
Frank W. Paul

Centro de Profesores
Dr. Paul Alper

City College of the City University of New York
Reuel Shinnar

Clemson University
Eugene Harrison

Cleveland State University
George Parmelee

Colorado School of Mines
Frank Stermole

Harvey Mudd College
Dr. Taghi Mirespassi

Indian Institute of Technology
Raja Rao

Lake Superior State College
D. L. Carstens

Michigan Technological University
S. Winnikow

New York University
John R. Ragazzini

North Carolina State University
W. C. Peterson

Northwestern University
William E. Schmitendorf

Notre Dame University
Joseph C. Hogan

Ohio Northern University
Robert J. Glass

Ohio State University
Dr. E. O. Doebelin

Pennsylvania Military Colleges
Anthony J. Calise

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rose Polytechnic Institute
Thomas Hutchinson

Saint Louis University
Benjamin H. Ulrich, Jr.

San Jose State College
Dr. Robert F. Clothier

Southern Illinois University
Curtis W. Dodd

Southern Methodist University
J. C. Denton
Andrew S. Page

Tatung Institute of Technology
T. S. Lin

Tennessee Technological University
Cecil Alford

Tulane University
Kathy Burgess

University of Alabama
William K. Rey

University of Arkansas
W. J. Buche
Stanley E. Stephenson

CS-3

University of California (Berkeley)
H. A. Johnson

University of Denver
M. L. Moe

University of Florida
Joseph Mahig
A. D. Randolph

University of Illinois
S. Konzo

University of Iowa
Earl Eyman

University of Kentucky
R. D. Bonnell

University of Maine
Richard C. Gibson

University of Massachusetts
Richard Monopoli

University of Michigan
Richard A. Matula

University of Minnesota
K. Ogata

University of Missouri at Rolla
J. D. McBrayer

University of Nebraska
D. R. Haworth

University of New Hampshire
Dr. S. S. Fan

University of North Dakota
Milton B. Larson
D. P. Naismith

University of Oklahoma
Michael L. McGuire

University of Santa Clara
Richard C. Dorf

University of Tennessee
James C. Hung

University of Texas
J. J. McKetta
W. R. Upthegrove

University of Texas at Arlington
C. W. Jiles

University of Utah
Wayne S. Brown
Dietrick K. Gehmlich
Fabio R. Goldschmied
Gary M. Sandquist

University of Virginia
J. T. Beard
James W. Moore

University of Waterloo
George D. Fulford
G. F. Pearce

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison

University of Wyoming
William D. Batton

Villanova University
Joseph Goldberg

Virginia Polytechnic Institute
William Blackwell
H. F. vanLandingham

Washington University
Albert W. Black

CS-3

DISSEMINATION TO INDUSTRY:

Arnold Research Organization
L. F. Webster

Caterpillar Tractor Company
Carol Mulvaney (Librarian)

Cummins Engine Company
L. Eltinge

Denver Research Institute
Miss Terry Sovel

Hughes Aircraft Company
Masse Bloomfield

Lockheed Missiles & Space Company
Wayland C. Griffith

McDonnell Douglas Corporation
Roger L. Berger

Martin Marietta Corporation
John W. Smith

Pan American Petroleum
George Roberts, Jr.

Rocketdyne
Dr. W. T. Rinehart

EDUCATIONAL MONOGRAPH: CS-4

TITLE: An Example of Bang-Bang Control Sytem Design

PREPARED BY: William A. Blackwell and A. Wayne Bennett,
Electrical Engineering, Virginia Polytechnic Institute

RELEASE DATE: March, 1968

ABSTRACT:

This Monograph discusses a technique for the synthesis 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.

EVALUATION -- OVERALL ANALYSIS:

Evaluations have not been returned from the recipients of this Educational Monograph.

CS-4

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	94	33	127
2. Student Copies Mailed	345	0	345
3. Number of Professors	70	--	---
at Universities	57	--	---
in States	32	--	---
and Foreign Countries	2	--	---
4. Number of Industries	--	16	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	--	--	--
2. % Evaluations Returned: $\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	--	--	--
3. Number of Favorable Evaluations			
4. % Favorable Evaluations: $\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	--	--	--
5. Number of Unfavorable Evaluations			
6. % Unfavorable Evaluations: $\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	--	--	--

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation? ----- Good _____ Some _____ Little _____

Should the Monographs include more information than was presented? ---- More _____ Same _____ Less _____

CS-4

DISSEMINATION TO UNIVERSITIES:

Arizona State University
H. H. Young

Auburn University
R I Vachon

Brigham Young University
Dr. Bill J. Pope
John M. Simonsen

Carnegie-Mellon University
Frank W. Paul

City College of the City University of New York
Reuel Shinnar

Clemson University
Eugene Harrison

Cleveland State University
R. M. Hochner

Colorado School of Mines
Frank Stermole

Harvey Mudd College
Dr. Taghi Mirespassi

Iowa State University of Science & Technology
Bion L. Pierson

Kansas State University
C. L. Hwans

Michigan State University
Gerald Park

Michigan Technological University
S. Winnikow

University of Mississippi
Frank A. Anderson

New York University
John R. Ragazzini

North Carolina State University
W. C. Peterson

Northwestern University
William E. Schmitendorf

Notre Dame University
Joseph C. Hogan

Ohio State University
Dr. E. O. Doebelin

Ohio University
Richard S. Mayer

Pennsylvania Military Colleges
Anthony J. Calise

Princeton University
R. H. Wilhelm

Rose Polytechnic Institute
Thomas Hutchinson

Saint Louis University
Benjamin H. Ulrich, Jr.

Southern Methodist University
J. C. Denton
James L. Melsa
Andrew S. Page

State University of New York at Stony Brook
Chi-Tsong Chen

Stevens Institute of Technology
Lee Rosenthal

Tatung Institute of Technology
T. S. Lin

Tennessee Technological University
Cecil Alford

Tulane University
Kathy Burgess

CS-4

University of Alabama
William K. Rey

University of Arkansas
W. J. Buche
Stanley E. Stephenson

University of California (Berkeley)
H. A. Johnson

University of Denver
M. L. Moe

University of Florida
Joseph Mahig
A. D. Randolph

University of Hawaii
J. C. Burgess

University of Houston
Dr. W. I. Honeywell

University of Illinois
S. Konzo

University of Iowa
Earl Eyman

University of Kentucky
R. D. Bonnell

University of Maine
Walter W. Turner
David B. Young

University of Massachusetts
Richard V. Monopoli

University of Michigan
R. B. Keller
J. J. Martin

University of Minnesota
K. Ogata

University of Missouri at Rolla
J. D. McBrayer

University of Oklahoma
Michael L. McGuire

University of Santa Clara
Richard C. Dorf

University of Tennessee
James C. Hung

University of Texas
J.J. McKetta

University of Texas at Arlington
C. W. Jiles

University of Utah
Wayne S. Brown
Dietrich K. Gehmlich
Fabio R. Goldschmied
Gary M. Sandquist
Forrest L. Staffanson

University of Virginia
James W. Moore

University of Waterloo
George D. Fulford
G. F. Pearce

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison

Villanova University
Joseph Goldberg

Washington University
Albert W. Black

CS-4

DISSEMINATION TO INDUSTRY:

Arnold Research Organization
A H Cortner
E. K Latvala
L F. Webster

Caterpillar Tractor Company
Miss Carol Mulvaney (Librarian)

Detroit Edison Company
Miss Dorene Harling

Fischer & Porter Company
Mrs. Irene Little

General Electric Company
Yi-Yuan Yu

Humble Oil & Refining Company
F A. Westphal

Industrial Publishing Company
Paul Rolnick

Inland Steel Research Labs
Eugene Urban

Kelsey-Hayes Company
Miss Harriet Noble (Librarian)

Lockheed Missiles & Space Company
Wayland C. Griffith

McDonnell Douglas Corporation
Roger L. Berger

Martin Marietta Corporation
John W. Smith

Pan American Petroleum
George Roberts, Jr.

Reynolds Metals Company
O. R. Singleton

Rocketdyne
Dr. W. T. Rinehart

Whirlpool Corporation
T. H. Goodgame

EDUCATIONAL MONOGRAPH: CS-5

TITLE: Controller Design for Nonlinear and Time-Varying Plants

PREPARED BY: William A. Blackwell and H. F. vanLandingham,
Electrical Engineering, Virginia Polytechnic Institute

RELEASE DATE: March, 1967

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

Ten of the twelve evaluations were for the concept of the Instructional Monographs. Several comments for the concept were: (1) "I generally found the material well presented and with the example given a means of learning the application of the theory presented." (2) "Yes, in my opinion these Monographs will help students in coming in contact with research material, yet on a level they can understand." Several dissenting comments: (1) "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." (2) I think a couple of problems illustrating different points in the presentation would be useful, instead of just the one." and (3)" CS-5 could be expanded."

CS-5

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	104	25	129
2. Student Copies Mailed	413	0	413
3. Number of Professors	82	--	---
at Universities	67	--	---
in States	33	--	---
and Foreign Countries	4	--	---
4. Number of Industries	--	20	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	10	2	12
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	10%	8%	9%
3. Number of Favorable Evaluations	8	2	10
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	80%	100%	83%
5. Number of Unfavorable Evaluations	2	--	2
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	20%	--	17%

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation? ----- Good 5, Some 2, Little ___

Should the Monographs include more information than was presented? ---- More 3, Same 3, Less ___

CS-5

Is the format of the Monographs appropriate for--- Good 7
use in engineering courses? Fair 1
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?-- Yes 3
No 3

Was the Monograph used in context with closely---- Yes 5
related material in the course presentation? No 1

Did the technical information in the Monograph---- Great 1
contribute to the further understanding of the Some 3
course material by the students in the course? Little 1
None

Were the home problems in the Monograph too------- Not Used 2
complex? Too complex
Useful 2
Too simple
Unnecessary

How many hours of classroom lecture time should be allocated for presentation of this Monograph? one hour

Would you use the Monograph if you taught the course----Yes 5
again? No 1

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

Yes, in my opinion these Monographs will help students in coming in contact with research material; yet on a level they 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)

CS-5

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)

Excellent (Caterpillar Tractor Company)

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-5

2. Question 5, Evaluation Form;

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

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

Yes (Iowa State University)

No (University of Wisconsin)

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 (Oklahoma State University)

Not frequently (University of Wisconsin)

Not yet used. (University of Michigan)

CS-5

DISSEMINATION TO UNIVERSITIES:

Auburn University
R. I. Vachon

Brigham Young University
Dr. Bill J. Pope
John M. Simonsen

Carnegie-Mellon University
Frank W. Paul

Centro de Profesores
Dr. Paul Alper

City College of the City University of New York
Robert A. Graff
Reuel Shinnar

Clemson University
Eugene Harrison

Cleveland State University
George Parmelee

Colorado School of Mines
Frank Stermole

Cornell University
Victor H. Edwards

Dartmouth
A. O. Converse

Harvey Mudd College
Dr. Taghi Mirespassi

Indian Institute of Technology
Raja Rao

Iowa State University of Science & Technology
Bion L. Pierson

Kansas State University
C. L. Hwans

Lake Superior State College
D. L. Carstens

Louisiana Polytechnic Institute
Buck F. Brown

Michigan State University
Gerald Paek

Michigan Technological University
S. Winnikow

New York University
John Happel
John R. Ragazzini

North Carolina State University
W. C. Peterson

Northwestern University
William E. Schmitendorf

Notre Dame University
Joseph Hogan

Ohio State University
Dr. E. O. Doebelin

Ohio University
Richard S. Mayer

Pennsylvania Military Colleges
Anthony J. Calise

Pennsylvania State University
Dr. D. R. Olson

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rose Polytechnic Institute
Thomas Hutchinson

Saint Louis University
Benjamin H. Ulrich, Jr.

CS-5

Southern Methodist University
J. C. Denton
James L. Melsa
Andrew S. Page

Stevens Institute of Technology
H. W. Phair
Lee Rosenthal

State University of New York at Stony Brook
Chi-Tsong Chen

Tatung Institute of Technology
T. S. Linn

Tennessee Technological University
Cecil Alford

Tulane University
Kathy Burgess

University of Alabama
William K. Rey

University of Arkansas
Philip E. Bocquet
W. J. Buche
Stanley E. Stephenson

University of Cincinnati
Widen Tabakoff

University of Denver
M. L. Moe

University of Florida
Joseph Mahig
A. D. Randolph

University of Houston
Dr. W. I. Honeywell

University of Illinois
S. Konzo

University of Iowa
Earl Eyman

University of Kentucky
R. D. Bonnell

University of Maine
Walter W. Turner
David B. Young

University of Massachusetts
Richard V. Monopoli

University of Michigan
J. J. Martin

University of Minnesota
K. Ogata

University of Missouri at Rolla
J. D. McBrayer

University of North Dakota
Milton B. Larson

University of Oklahoma
Michael L. McGuire

University of Puerto Rico
Hiram H. Puig

University of Santa Clara
Richard C. Dorf

University of Tennessee
James Hung

University of Texas
J. J. McKetta

University of Texas at Arlington
C. W. Jiles

University of Utah
Dietrich K. Gehmlich
Fabio R. Goldschmied
Gary M. Sandquist

University of Virginia
J. T. Beard
James W. Moore

University of Waterloo
George D. Fulford
G. F. Pearce

CS-5

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison

University of Wyoming
William D. Batton

United States Air Force Academy
Major Myron D. Harnly

Valparaiso University
L. M. Zoss

Villanova University
Joseph Goldberg

Washington University
Albert W. Black

CS-5

DISSEMINATION TO INDUSTRY:

Allis Chalmers
R. C. Dancy

Arnold Research Organization
L. F. Webster

Caterpillar Tractor Company
Miss Carol Mulvaney

Cummins Engine Company
L. Eltinge

Denver Research Institute
Miss Terry Sovel

Detroit Edison Company
Miss Dorene Harling

Electronics
Paul Dickson

Fischer & Porter Company
Mrs. Irene Little

Humble Oil & Refining Company
F. A. Westphal

Inland Steel Research Labs
Eugene Urban

Kelsey-Hayes Company
Miss Harriet Noble

Lockheed Missiles & Space Company
Wayland C. Griffith

McDonnell Douglas Corporation
Roger L. Berger

Martin Marietta Corporation
John W. Smith

Mississippi Research & Development Center
Dr. Kenneth Wagner

Pan American Petroleum
George Roberts, Jr.

Reynolds Metals Company
O. R. Singleton

Rocketdyne
Dr. W. T. Rinehart

Texas Instruments
Dr. David A. Peterman

Whirlpool Corporation
T. H. Goodgame

EDUCATIONAL MONOGRAPH: CS-6

TITLE: An Example of Optimal Control Design

PREPARED BY: William A. Blackwell and A. Wayne Bennett,
Electrical Engineering, Virginia Polytechnic Institute

RELEASE DATE: March, 1967

ABSTRACT:

This Monograph discusses a technique for the design of minimum energy discrete-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.

EVALUATION -- OVERALL ANALYSIS:

A total of 11 evaluations have been returned on this Monograph. The nine favorable responses are basically similar to previous Monographs. The two negative responses were: (1)"This is purely mathematical manipulation. Some motivation is needed. If possible, an application from real systems should be included." (2)"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.

CS-6

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	109	31	140
2. Student Copies Mailed	467	16	483
3. Number of Professors	85	--	---
at Universities	68	--	---
in States	33	--	---
and Foreign Countries	4	--	---
4. Number of Industries	--	20	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	10	1	11
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	9%	3%	8%
3. Number of Favorable Evaluations	8	1	9
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	80%	100%	82%
5. Number of Unfavorable Evaluations	2	--	2
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	20%	--	18%

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation? ----- Good 5, Some 1, Little 1

Should the Monographs include more information than was presented? ---- More 4, Same 2, Less

CS-6

Is the format of the Monographs appropriate for use in engineering courses? — Good 6; Fair 1; Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation? — Yes 3; No 4

Was the Monograph used in context with closely related material in the course presentation? — Yes 5; No 2

Did the technical information in the Monograph contribute to the further understanding of the course material by the students in the course? — Great 4; Some 1; Little; None

Were the home problems in the Monograph too complex? — Not Used 3; Too complex; Useful 3; Too simple; Unnecessary

How many hours of classroom lecture time should be allocated for presentation of this Monograph? one hour

Would you use the Monograph if you taught the course again? — Yes 5; No 1

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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 attach the rather formidable bulk of literature he sees when he first goes out of the classroom to try his wings as a "real engineer." (Tulane 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)

CS-6

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)

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

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

CS-6

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the same subject areas?

Yes (University of Massachusetts)

Yes (Oklahoma State University)

No (University of Wisconsin)

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)

Not Frequently (University of Wisconsin)

Not yet used. (University of Michigan)

CS-6

DISSEMINATION TO UNIVERSITIES:

Arizona State University
H. H. Young

Auburn University
R. I. Vachon

Brigham Young University
Dr. Bill J. Pope
John M. Simonsen

Carnegie-Mellon University
Frank W. Paul

Centro de Profesores
Dr. Paul Alper

City College of the City University of New York
Robert A. Graff

Clemson University
Eugene Harrison

Cleveland State University
George Parmelee

Colorado School of Mines
Frank Stermole

Cornell University
Victor H. Edwards

Dartmouth
A. O. Converse

Harvey Mudd College
Dr. Taghi Mirespassi

Indian Institute of Technology
Raja Rao

Kansas State University
C. L. Hwans
P. L. Miller

Lake Superior State College
D. L. Carstens

Louisiana Polytechnic Institute
Buck F. Brown

Michigan State University
Gerald Park

Michigan Technological University
S. Winnikow

New York University
John Happel
John Ragazzini

North Carolina State University
W. C. Peterson

North Dakota State University
Philip C. Pfister

Northwestern University
William E. Schmitendorf

Notre Dame University
Joseph C. Hogan

Ohio State University
Dr. E. O. Doebelin

Ohio University
Richard S. Mayer

Pennsylvania Military Colleges
Anthony J. Calise

Princeton University
R. H. Wilhelm

Rose Polytechnic Institute
Thomas Hutchinson

Saint Louis University
Benjamin H.Ulrich, Jr.

Southern Methodist University
J. C. Denton
James L. Melsa
Andrew S. Page

CS-6

State University of New York at Stony Brook
Chi-Tsong Chen

Stevens Institute of Technology
Lee Rosenthal
Kenneth Tompetrine

Tatung Institute of Technology
T. S. Lin

Tennessee Technological University
Cecil Alford

Tulane University
Kathy Burgess

University of Alabama
William K. Rey

University of Arkansas
Philip E. Bocquet
W. J. Buche
Stanely E. Stephenson

University of Cincinnati
Widen Tabakoff

University of Denver
M. L. Moe

University of Detroit
Lawrence N. Canjar

University of Florida
Joseph Mahig
A. D. Randolph

University of Houston
Dr. W. I. Honeywell

University of Illinois
S. Konzo

University of Iowa
Earl Eyman

University of Kentucky
R. D. Bonnell

University of Maine
Walter W. Turner
David B. Young

University of Michigan
R. B. Keller
J. J. Martin

University of Minnesota
K. Ogata

University of Mississippi
Frank A. Anderson

University of Missouri at Rolla
J. D. McBrayer

University of New Hampshire
Dr. S. S. Fan

University of North Dakota
Milton B. Larson

University of Oklahoma
Michael L. McGuire

University of Puerto Rico
Hiram H. Puig

University of Santa Clara
Richard C. Dorf

University of Tennessee
James C. Hung

University of Texas
J. J. McKetta

University of Texas at Arlington
C. W. Jiles

University of Utah
Dietrich K. Gehmlich
Fabio R. Goldschmied
Forrest L. Staffanson
Gary M. Sandquist

CS-6

University of Virginia
J. T. Beard
James W. Moore

University of Waterloo
George D. Fulford
G. F. Pearce

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison

University of Wyoming
William D. Batton

United States Air Force Academy
Major Myron D. Harnly

Valparaiso University
L. M. Zoss

Villanova University
Joseph Goldberg

Washington University
Albert W. Black

CS-6

DISSEMINATION TO INDUSTRY:

American Concrete Institute
Gilbert E. Seeley

Arnold Research Organization
E. K. Latvala
L. F. Webster
S. C. Williams

Caterpillar Tractor Company
Miss Carol Mulvaney

Cummins Engine Company
L. Eltinge

Denver Research Institute
Miss Terry Sovel

Detroit Edison Company
Miss Dorene Harling

Electronics
Paul Dickson

Fischer & Porter
Mrs. Irene Little

Humble Oil & Refining Company
F. A. Westphal

Industrial Publishing Company
Paul Kolbick

Inland Steel Research Labs
Eugene Urban

Lockheed Missiles & Space
Wayland C. Griffith

LTV-Aerospace Corporation
Dr. Charles Hester

Martin Marietta Corporation
John W. Smith

Mississippi Research & Development Center
Dr. Kenneth Wagner

Pan American Petroleum
George Roberts, Jr.

Reynolds Metals Company
O. R. Singleton

Rocketdyne
Dr. W. T. Rinehart

Texas Instruments, Inc.
Dr. David A. Peterman

Whirlpool Corporation
T. H. Goodgame

EDUCATIONAL MONOGRAPH: TD-1

TITLE: Calculation of Complex Chemical Equilibria

PREPARED BY: K. C. Chao, Chemical Engineering, Oklahoma State University

RELEASE DATE: February, 1967

ABSTRACT:

Calculation of chemical equilibria in a complex reaction system is carried out in an iterative manner on computers. For this purpose the basic equations expressing the equilibrium conditions are arranged systematically. The 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.

EVALUATION -- OVERALL ANALYSIS:

Thirteen of the fifteen evaluations were favorable. Industrial evaluators were more prone to make written comments. These comments are generally enthusiastic about the Monograph concept. One dissenter (educator) does not believe the Monograph would be used too often in undergraduate courses. One dissenter (industry) does not believe the Instructional Monograph will find wide-spread use in industry.

TD-1

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	95	31	126
2. Student Copies Mailed	363	15	378
3. Number of Professors	75	--	---
at Universities	55	--	---
in States	27	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	17	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	10	5	15
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	1%	16%	12%
3. Number of Favorable Evaluations	8	5	13
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	80%	100%	87%
5. Number of Unfavorable Evaluations	2	--	2
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	20%	--	13%

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation?	Good	4
	Some	2
	Little	
Should the Monographs include more information than was presented?	More	3
	Same	3
	Less	

TD-1

Is the format of the Monographs appropriate for--- Good 5
use in engineering courses? Fair 2
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?-- Yes 2
No 6

Was the Monograph used in context with closely---- Yes 4
related material in the course presentation? No 2

Did the technical information in the Monograph---- Great 2
contribute to the further understanding of the Some 2
course material by the students in the course? Little
None

Were the home problems in the Monograph too------- Not Used 1
complex? Too complex
Useful 2
Too simple
Unnecessary

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

Would you use the Monograph if you taught the course----Yes 4
again? No

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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)

TD-1

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 appreciat a more practical application approach. (Humble Oil Company)

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 Co.)

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

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)

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2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

Yes (University of Virginia)

Yes (Auburn University)

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

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 subjects. (Humble Oil & Refining Company)

Yes (Lummus Company)

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

Occasionally (University of Wisconsin)

Yes, provided they were supplemented by classroom instruction. (Humble Oil & 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)

TD-1

Additional Comments from Evaluators:

> 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 wide-spread 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)

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DISSEMINATION TO UNIVERSITIES:

Brigham Young University
Dr. Bill J. Pope
John M. Simonsen

California Institute of Technology
R. H. Sabersky

California State at Los Angeles
Dan R. Rankin

Centro de Profesores
Morris S. Pjalvo

City College of the City University of New York
Robert A. Graff

Clemson University
J. C. Mullins

Cleveland State University
Dr. Lowell C. Domholdt

Columbia University of the City of New York
Harold G. Elrod

Cornell University
Victor H. Edwards

Dartmouth
A. O. Converse

Ecole Polytechnique
Michel Rigaud

Lake Superior State College
D. L. Carstens

Lehigh University
Luis Pujol

Louisiana Polytechnic Institute
Charles A. Killgore

Louisiana State University
Ralph W. Pike

Michigan State University
Dr. George Coalman

New York University
John Happel

Notre Dame University
Joseph C. Hogan
Edward M. Jerger

Ohio University
Richard S. Mayer

Pennsylvania State University
Dr. G. M. Faeth

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Saint Louis University
John A. George
Benjamin H. Ulrich, Jr.

Southern Methodist University
J. C. Denton

Tatung Institute of Technology
T. S. Lin

Tulane University
Kathy Burgess
Robert P. Chambers
Robert E. C. Weaver

University of Alabama
William K. Rey
C. H. T. Walkins

University of Arkansas
Philip E. Bocquet

University of Calgary
J. E. Venart

TD-1

University of California (Berkeley)
H. A. Johnson

University of Cincinnati
Widen Tabakoff

University of Detroit
Lawrence N Canjar

University of Florida
Calvin C. Oliver
R. D. Walker

University of Houston
Dr. W. I. Honeywell

University of Illinois
R. G. Hering
S. Konzo

University of Maine
Richard C. Hill

University of Massachusetts
Lawrence L. Ambs
W. L. Short

University of Michigan
J. J. Martin
Richard Matula

University of Mississippi
Frank A. Anderson

University of Missouri at Rolla
J. D. McBrayer
Dr. A. E. Morris

University of Nebraska
D. R. Haworth

University of New Hampshire
David H. Chittenden
Dr. S. S. Fan

University of North Dakota
Milton B. Larson

University of Oklahoma
Kenneth E. Starling

University of Portland
George F. Babits

University of Texas
J. J. McKetta
Hugh A. Walls

University of Utah
Wayne S. Brown
E. B. Christiansen
Fabio R. Goldschmied
Noel de Nevers
J. D. Seader

University of Waterloo
F. A. L. Dullien
George D. Fulford
G. F. Pearce
D. C. T. Pei

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison

University of Wyoming
William D. Batton

United States Air Force Academy
Major Myron D. Harnly

Vanderbilt University
John W. Williamson

Worcester Polytechnic Institute
John M. Boyd

Yale University
Barnett F. Dodge

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DISSEMINATION TO INDUSTRY:

Arnold Research Organization
H. E. Gardinier
R. W. Harvey
L. F. Webster

Cummins Engine Company
L. Eltinge

Denver Research Institute
Terry Sovel

Dow Chemical Company
R. W. Belfit, Jr.

Ethyl Corporation
D. R Liimatti

Foster Wheeler Corporation
A. G. Parker

Humble Oil & Refining Company
Frank W. Wheeler

Inland Steel Research Labs
Eugene Urban

Lockheed Missiles & Space Company
Wayland C. Griffith

LTV Aerospace
Dr. Charles Hester

Lummus Company
Stanley S. Grossel

Martin Marietta Corporation
John W. Smith

Mississippi Research & Development Center
Dr. Kenneth Wagner

Pan American Petroleum
George Roberts, Jr.

Rocketdyne
Dr. W. T. Rinehart

Texas Instruments, Inc.
Dr. David A. Peterman

EDUCATIONAL MONOGRAPH: TD-2

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

PREPARED BY: W. C. Edmister, Chemical Engineering, Oklahoma State University

RELEASE DATE: September, 1968

ABSTRACT:

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 coexisting vapor and liquid were included in this work.

EVALUATION -- OVERALL ANALYSIS:

Evaluations have not been returned on this Educational Monograph.

EDUCATIONAL MONOGRAPH: TD-3

TITLE: Critical Flow of Real Gases Through Nozzles

PREPARED BY: Wayne C. Edmister, Chemical Engineering, Oklahoma State University

RELEASE DATE: February, 1967

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

This Instructional Monograph received favorable reviews by both educators and practicing engineers. Sometimes there is a conflict of interest between the educators and practicing engineer as illustrated by the following two examples: (1)"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." (2)"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."

TD-3

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	104	69	173
2. Student Copies Mailed	352	15.	367
3. Number of Professors	80	--	---
at Universities	56	--	---
in States	27	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	17	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	11	7	18
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	11%	10%	10%
3. Number of Favorable Evaluations	10	7	17
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	91%	100%	94%
5. Number of Unfavorable Evaluations	1	--	1
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	9%	--	6%

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation?	Good	11
	Some	2
	Little	1
Should the Monographs include more information than was presented?	More	2
	Same	11
	Less	1

TD-3

Is the format of the Monographs appropriate for--- Good 12
use in engineering courses? Fair 1
Poor 2

8 Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?-- Yes 4
No 7

Was the Monograph used in context with closely---- Yes 4
related material in the course presentation? No 6

Did the technical information in the Monograph---- Great 1
contribute to the further understanding of the Some 8
course material by the students in the course? Little
None

Were the home problems in the Monograph too------- Not Used 4
complex? Too complex
Useful 4
Too simple 1
Unnecessary

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

Would you use the Monograph if you taught the course----Yes 8
again? No 3

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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

Yes (Auburn University)

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

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) (Arnold Research Organization, Inc.)

Yes--excellent idea. (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. (Arnold Research Organization, 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)

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

TD-3

courses to explain and inform the techniques, procedures, etc., with examples. (Rose Polytechnic Institute)

Newness (University of Michigan)

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.)

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

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

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 Company)

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

TD-3

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

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

TD-3

DISSEMINATION TO UNIVERSITIES:

Auburn University
R. I. Vachon

Brigham Young University
Dr. Bill J. Pope
John M. Simonsen

California Institute of Technology
R. H. Sabersky

Centro de Profesores
Morris S. Ojalvo

City College of the City University of New York
Reuel Shinnar

Cleveland State University
Dr. Lowell C. Domholdt

Columbia University of the City of New York
Harold G. Elrod

Ecole Centrale des Arts & Manufactures
R. Kling

Ecole Polytechnique
Michel Rigaud

Kansas State University
P. L. Miller

Lake Superior State College
D. L. Carstens
Dr. S. S. Fan

Lehigh University
Luis Pujol

Louisiana Polytechnic Institute
Charles A. Killgore

Louisiana State University
Ralph W. Pike

Michigan Technological University
S. Winnikow

New York University
John Happel

North Dakota STate University
Philip C. Pfister

Notre Dame University
Joseph C. Hogan
Mrs. Ella Levee
Edward M. Jerger

Pennsylvania State University
Dr. D. A. Bowlus
Dr. J. A. Brighton
J. L. Shearer

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Rose Polytechnic Institute
Thomas Hutchinson

Saint Louis University
John A. George
Benjamin H. Ulrich, Jr.

San Jose State College
Dr. Robert F. Clothier

Southern Methodist University
J. C. Denton
Donald Price

Tatung Institute of Technology
T. S. Lin

Tulane University
Kathy Burgess

University of Alabama
William K. Rey

University of Arizona
H. C. Perkins

TD-3

University of Calgary
J. E. Venart

University of California (Berkeley)
H. A. Johnson

University of Cincinnati
Marvin L. English
Widen Tabakoff

University of Florida
Calvin C. Oliver
R. D. Walker

University of Hawaii
Dr. J. S. Fox

University of Houston
Dr. W. I. Honeywell
F. M. Tiller

University of Illinois
S. Konzo

University of Maine
Richard C. Hill

University of Massachusetts
Lawrence L. Ambs
W. L. Short

University of Michigan
R. B. Keller
J. J. Martin

University of Missouri at Rolla
J. D. McBrayer

University of Nebraska
D. R. Haworth

University of New Hampshire
David H. Chittenden

University of North Dakota
Milton B. Larson

University of Portland
George F. Babits.

University of Southern California
John M. Lenoir

University of Texas
J. J. McKetta
Hugh A. Walls

University of Utah
Wayne S. Brown
E. B. Christiansen
Fabio R. Goldschmied
Arlo F. Johnson
J. D. Seader

University of Virginia
J. T. Beard

University of Waterloo
F. A. L. Dullien
George D. Fulford
G. F. Pearce
D. C. T. Pei

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison
Charles G. Hill
Edward F. Obert

University of Wyoming
William D. Batton

United States Air Force Academy
Major Myron L. Harnly

Vanderbilt University
John W. Williamson

Washington State University
I.M. Yeyinmen

Washington University
Albert W. Black

TD-3

DISSEMINATION TO INDUSTRY:

Allis Chalmers
R. C. Dancy

Arnold Research Organization
T. E. Beavers
V. A. Cline
P. M. Hood
R. M James
G. F. Dickinson
R. W. Harvey
E. K. Latvala
H. E. Gardinier
A. D. Jaratt
F. H. Minger
J. W. McCurdy
R. E. Smith, Jr.
C. J. Schueler
L. F. Webster
D. Taylor

Caterpillar Tractor Company
Carol E. Mulvaney

Cummins Engine Company
L. Eltinge

Denver Research Institute
Terry Sovel

Detroit Edison Company
Miss Dorene Harling

Ethyl Corporation
D. R. Liimatti

General Electric Company
Yi-Yuan Yu

Humble Oil & Refining Company
F. A. Westphal

Inland Steel Research Labs
Eugene Urban

Lockheed Missiles & Space Co.
Wayland C. Griffith

LTV Aerospace Corporation
Dr. Charles Hester

McDonnell Douglas
Frank D. McVey

Mississippi Research and
Development Center
Dr. Kenneth Wagner

Pan American Petroleum
George Roberts, Jr.

Rocketdyne
Dr. W. T. Rinehart

Whirlpool Corporation
T. H. Goodgame

EDUCATIONAL MONOGRAPH: TD-4

TITLE: Thermodynamic Consistency of Vapor-Liquid Solubility Data

PREPARED BY: Wayne C. Edmister, Chemical Engineering, Oklahoma State University

RELEASE DATE: November, 1967

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

In summary, the evaluators favor the concept of Educational Monographs for use in Engineering Education. There is some contradiction in the amount of detail that should be included in the document. Out of six evaluations only one voiced a dissenting note. It was very specific! Quality of the material was not questioned.

TD-4

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	67	24	91
2. Student Copies Mailed	188	0	188
3. Number of Professors	56	--	---
at Universities	42	--	---
in States	23	--	---
and Foreign Countries	3	--	---
4. Number of Industries	--	12	---

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	6	0	6
2. % Evaluations Returned			
$\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	9%	--	7%
3. Number of Favorable Evaluations	4	--	4
4. % Favorable Evaluations			
$\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	67%	--	67%
5. Number of Unfavorable Evaluations	2	--	2
6. % Unfavorable Evaluations			
$\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	33%	--	33%

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation? ----- Good 2, Some ___, Little ___

Should the Monographs include more information than was presented? ---- More 1, Same 1, Less ___

TD- 4

Is the format of the Monographs appropriate for--- Good 3
use in engineering courses? Fair
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?-- Yes 2
No 2

Was the Monograph used in context with closely---- Yes 2
related material in the course presentation? No 1

Did the technical information in the Monograph---- Great 1
contribute to the further understanding of the Some 1
course material by the students in the course? Little
None

Were the home problems in the Monograph too------- Not Used
complex? Too complex 1
Useful 1
Too simple
Unnecessary

How many hours of classroom lecture time should be allocated for presentation of this Monograph? average 1 hour

Would you use the Monograph if you taught the course----Yes 2
again? No 1

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

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)

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

TD-4

2. Question 5, Evaluation Form:

Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

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)

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-4

DISSEMINATION TO UNIVERSITIES:

Brigham Young University
Dr. Bill J. Pope

California Institute of Technology
R. H Sabersky

California State at Los Angeles
Dan R. Rankin

Centro de Profesores
Morris S. Ojalvo

City College of the City University of New York
Robert A. Graff

Clemson University
J. C. Mullins

Columbia University of the City of New York
Harold G. Elrod

Cornell University
Victor H. Edwards

Dartmouth
Myron Tribus

Ecole Polytechnique
Michel Rigaud

Lake Superior State College
D. L. Carstens

Lehigh University
Luis Pujol

Louisiana Polytechnic Institute
Charles A. Killgore

New York University
John Happel

Ohio University
Richard S. Mayer

Princeton University
R. H. Wilhelm

Rensselaer Polytechnic Institute
Euan F. C. Somerscales

Southern Methodist University
J. C. Denton

Tatung Institute of Technology
T. S. Lin

Tulane University
Kathy Burgess

University of Alabama
William K. Rey
C. H. T. Walkins

University of Arkansas
Philip E. Bocquet

University of Calgary
J. E. Venart

University of Florida
Calvin C. Oliver

University of Houston
Dr. W. I. Honeywell
F. M. Tiller

University of Illinois
S. Konzo

University of Maine
Richard C. Hill

University of Massachusetts
W. L. Short

University of Mississippi
Frank A. Anderson

University of Missouri at Rolla
J. D. McBrayer

University of Nebraska
D. R. Haworth

TD-4

University of New Hampshire
David H. Chittenden
Dr. S. S. Fan

University of North Dakota
Milton B. Larson

University of Oklahoma
Kenneth E. Starling

University of Texas
J. J. McKetta
Hugh A. Walls

University of Utah
Wayne S. Brown
E. B. Christiansen
Fabio R. Goldschmied
Noel de Nevers
J. D. Seader

University of Waterloo
F. A. L. Dullien
George L. Fulford
G. F. Pearce
D. C. T. Pei

University of Windsor
J. Gordon Parr

University of Wisconsin
C. A. Coberly
Howard L. Harrison
Charles G. Hill
Edward F. Obert

University of Wyoming
William D. Batton

Washington University
Albert W. Black

Yale University
Barnett F. Dodge

TD-4

DISSEMINATION TO INDUSTRY:

Arnold Research Organization
H E. Gardinier
R. W. Harvey
L. F. Webster

Cummins Engine Company
L. Eltinge

Denver Research Institute
Terry Sovel

Hughes Aircraft Company
Masse Bloomfield

Inland Steel Research Labs
Eugene Urban

Lockheed Missiles and Space Company
Wayland C. Griffith

McDonnell Douglas
Frank D. McVey

Martin Marietta Corporation
John W. Smith

Pan American Petroleum
George Roberts, Jr.

Rocketdyne
Dr. W. T. Rinehart

Texas Instruments, Inc.
Dr. David A. Peterman

Whirlpool Corporation
T. H. Goodgame

EDUCATIONAL MONOGRAPH: TD-5

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

PREPARED BY: John A. Wiebelt, Mechanical Engineering, Oklahoma State University

RELEASE DATE: December, 1967

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

Insufficient information returned to comment on this Instructional Monograph.

TD-5

DISSEMINATION:

	University	Industry	Total
1. Instructor Copies Mailed	12	30	42
2. Student Copies Mailed	2	15	17
3. Number of Professors	12	--	--
at Universities	11	--	--
in States	10	--	--
and Foreign Countries	1	--	--
4. Number of Industries	--	6	--

EVALUATION -- STATISTICAL:

	University	Industry	Total
1. Monograph Evaluations Received	1	1	2
2. % Evaluations Returned: $\frac{\text{Evaluations Returned}}{\text{Instructor Copies Mailed}} \times 100$	8%	3%	5%
3. Number of Favorable Evaluations	1	1	2
4. % Favorable Evaluations: $\frac{\text{Favorable Evaluations}}{\text{Total Evaluations}} \times 100$	100%	100%	100%
5. Number of Unfavorable Evaluations	--	--	--
6. % Unfavorable Evaluations: $\frac{\text{Unfavorable Evaluations}}{\text{Total Evaluations}} \times 100$	--	--	--

7. General Information on Monographs

Was the technical information covered in the Monograph of value in course presentation?	Good	1
	Some	
	Little	1
Should the Monographs include more information than was presented?	More	1
	Same	1
	Less	

TD-5

Is the format of the Monographs appropriate for--- Good 1
use in engineering courses? Fair 1
Poor

8. Comments on Monograph from Classroom Use

Was the Monograph used in a classroom situation?-- Yes
No 1

Was the Monograph used in context with closely---- Yes 1
related material in the course presentation? No

Did the technical information in the Monograph---- Great
contribute to the further understanding of the Some 1
course material by the students in the course? Little
None

Were the home problems in the Monograph too------- Not Used 1
complex? Too complex
Useful
Too simple
Unnecessary

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

Would you use the Monograph if you taught the course----Yes 1
again? No

EVALUATOR COMMENTS:

1. Question 4, Evaluation Form:

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? What are the good points? Any improvements needed?

The general presentation in Monographs is effective. In this instance the material is not adequately covered. (General Precision Equipment Corporation)

TD-5

2. Question 5, Evaluation Form:

> Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?
>
> I intend to use the Monographs computer program in a design course. (University of Michigan)

TD-5

DISSEMINATION TO UNIVERSITIES:

Carnegie-Mellon University
S. William Gouse, Jr.

Lake Superior State College
D. L. Carstens

Rutgers- The State University
Marvin L. Granstrom

San Jose State College
Dr. Robert F. Clothier

Southern Methodist University
James L. Melsa

University of Alabama
William K. Rey

University of Massachusetts
Lawrence L. Ambs

University of Michigan
R. B. Keller
Richard Matula

University of Waterloo
F. A. L. Dullien

University of Wisconsin
Edward F. Obert

Washington State University
I. M. Yeyinmen

TD-5

DISSEMINATION TO INDUSTRY:

Cummins Engine Company
L. Eltinge

Denver Research Institute
Terry Sovel

Hughes Aircraft Company
Masse Bloomfield

LTV Aerospace Corporation
Dr. Charles Hester

Pan American Petroleum
George Roberts, Jr.

Martin Marietta Corporation
John W. Smith

EDUCATIONAL MONOGRAPH: TD-6

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

PREPARED BY: W. C. Edmister, Chemical Engineering, Oklahoma State University

RELEASE DATE: October, 1968

ABSTRACT:

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 co-existing equilibrium vapor and liquid phases. The differential form of the isobaric Gibbs-Duhem Equation was the basis for the method used with the experimental temperature-composition data for the binary mixture. A computer program was developed for calculating the enthalpies of saturated vapor and liquid mixture. The mathematical derivations and the computer program are given in detail. An example is included to illustrate the new method.

EVALUATION -- OVERALL ANALYSIS:

Evaluations have not been received on this Educational Monograph.

EDUCATIONAL MONOGRAPH: TD-8

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

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

RELEASE DATE: September, 1968

ABSTRACT:

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.

EVALUATION -- OVERALL ANALYSIS:

Evaluations have not been received on this Educational Monograph.