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DIRECTORS REPORT...

SUMMER FLUID MECHANICS INSTITUTE

for

COLLEGE TEACHERS

Sponsored by

The National Science Foundation

Colorado State University

Fort Collins, Colorado

June 20 through August 26, 1960

September 1960

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**REPORT OF THE
SUMMER FLUID MECHANICS INSTITUTE**

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at**

**Colorado State University
June 20 through August 26, 1960**

**Submitted to
The National Science Foundation
by
Milton E. Bender -- Director**

I. INSTITUTE OPERATION

There is, in the United States today, a very serious shortage of competent fluid mechanics teachers. Because of this shortage, many Engineering teachers, particularly in smaller colleges and universities, have been assigned the responsibility of developing and teaching courses in fluid mechanics even though their major competence is in some other field of Engineering. The purpose of this Institute was to provide forty teachers of fluid mechanics an opportunity to advance their technical competence in this subject area by attending formal graduate-level courses and seminars during a ten-week summer program. The graduate credit earned can be applied toward an advanced degree, either the M.S. or Ph.D. at this or some other University.

Seven courses, listed subsequently, ranging in difficulty from the lower to higher graduate levels were offered. Each course carried three quarter-credits of graduate credit. In addition to the courses, two two-hour seminars per week were held. Each student was required to attend all seminars and to participate on the program in at least one. One credit was given for the seminar. Each student was required to take at least three courses plus the seminar and could not take more than four courses. About half of them chose to take the maximum load of four courses and the seminar.

List of Courses

Number

CE 140, Heat Transfer	R. V. Smith
CE 151, Intermediate Fluid Mechanics	J. R. Barton
CE 227, Mechanics of Ideal Fluids	J. E. Cermak
CE 252, Hydraulic Structures	D. B. Simons

CE 255, Experimental Techniques in Fluid
Mechanics (two sections)

Philip G. Hubbard
and J. R. Barton

CE 258, Hydraulics of Open Channels

H. K. Liu

CE 267, Wave Mechanics

M. R. Bottaccini

All participants were required to spend one day at the Bureau of Reclamation Laboratories at the Federal Center in Denver. Transportation was furnished by the Institute. Arrangements were made for conducted tours through the Laboratories. This proved to be one of the highlights of the Institute.

There were no major changes in the program as planned. It developed that the average mathematical background of the participants was not as good as we had anticipated. Because of this, the two highest-level courses, "Mechanics of Ideal Fluids" and "Wave Mechanics," got a lighter enrollment than anticipated and also had to be taught at a lower mathematical level than initially planned. The heaviest enrollment was in the lower-level courses and particularly in "Intermediate Fluids" and "Experimental Techniques in Fluid Mechanics." This latter course was split into two sections. Most of the applicants were from smaller schools where a teacher must teach in more than one subject area. All of these teachers were teaching fluid mechanics and many of them were in charge of the fluid mechanics courses and laboratories even though their background did not include an emphasis on this subject area. This accounted, I am sure, for the heavy enrollment in the basic courses that would most directly contribute to the effectiveness of their undergraduate teaching.

Two of the courses, "Intermediate Fluid Mechanics" and "Wave Mechanics," were especially designed for this Institute but will now be continued in our regular offerings during the academic year. The other courses are taught regularly during the school year. It appears to be most desirable, if graduate credit is to be given, to use to as great an extent as

possible courses that are regularly taught in the University. In the first place, such courses have been developed over a period of time and should, therefore, be more effective than a new course that is to be taught only once. Secondly, the grading standards are established and, thirdly, the other schools are much more inclined to accept transfer graduate credit for courses that are formally listed in another University's catalog.

The work requirements and grading standards were the same as those used in our regular graduate program. The participants worked very hard. I have never before seen a group of students with higher morale.

II. STAFF

The staff for the Institute consisted of the following:

Milton E. Bender	Director
J. R. Barton	Associate Director
M. R. Bottaccini	Visiting Professor from University of Arizona
P. G. Hubbard	Visiting Professor from University of Iowa
J. E. Cermak	Colorado State University
R. V. Smith	Colorado State University
D. B. Simons	Colorado State University
H. K. Liu	Colorado State University

The Director and the Associate Director were employed full time during the Institute. All of the other staff members were on a one-half time basis.

Dr. Samuel Park of Korea, a visiting foreign professor, was here for one week. His background is in mathematics and having no background whatever in engineering he did not feel competent to speak in a seminar to the participants in this Institute. He stayed here one week as an observer.

Seminar speakers included Professors E. F. Schulz, M. L. Albertson, A. R. Chamberlain and E. O. Plate of Colorado State University, Professor J. D. Lawson of the University of Melbourne, Australia, and Professor Frank Krieth, University of Colorado.

We experienced no difficulty in getting a highly qualified staff for this Institute.

III. SELECTION PROCEDURE

We received several hundred inquiries and finally 117 completed applications. Each applicant was required to submit NSF forms 9C-24B and 9C-25B and, in addition, complete a supplementary sheet giving information not requested on the NSF forms. Each applicant was also requested to send official transcripts of all of his College and (or) University grades.

The following basic criteria were used in selecting participants:

1. He must have a bachelor's degree from an accredited engineering school.
2. He must have taught (not as a graduate assistant) in an engineering school at least one year prior to June 1960 and he must have been teaching at the time application was made.
3. He must have taught fluid mechanics and have a real interest in developing a high level of competence in this field.
4. He must have the academic ability, as evidenced by his grades in past course work, to benefit from, and to perform satisfactorily in, a graduate program.

In addition to the above basic criteria, careful consideration was given to geographic distribution. An effort was made to accept no more than one from each school. We were not entirely successful

in this because seven of those initially selected declined the offer and, in the process of selecting from alternates, it was necessary to take applicants from some schools from which we had already accepted a participant. The final distribution included participants from 36 schools located in 25 states and Puerto Rico. We feel that this wide distribution of participants will provide the most benefit in upgrading instruction in fluid mechanics throughout the United States.

IV. ADMINISTRATION

Accommodations in a new modern dormitory near the Engineering Center were available for all participants. The dormitory has excellent lounge and dining facilities. All participants, whether they lived in the dormitory or not, were encouraged to use these lounges.

Sixteen participants lived in the dormitory and 24 participants, primarily those with the larger families, lived in off-campus housing. Shortly after all of the participants had accepted, a letter was sent to each participant requesting information as to the housing desired. Using this information, the Institute staff procured housing suitable to each participant before the participants arrived on campus. This required considerable effort on the part of the staff and some expense but the effect this had on the participants' morale at the beginning of the Institute made it well worthwhile.

The Engineering Library was the study center for the Institute. All reference material was placed on specially designated shelves for easy use.

The only formal recreation provided was a get-acquainted picnic for all participants and their families and all members of the Engineering School staff and their families. Most of the participants brought their families with them and preferred to spend what time they could on weekends with their families in the mountains. Through the week, and

sometimes even on weekends, they were very busy with their studies. In this type of program formal group recreation does not seem too desirable.

No administrative problems of any significance arose during the Institute.

V. EVALUATION

It is very difficult to evaluate a graduate study program such as this on any real tangible basis other than grades. The grades made by the participants were very satisfactory.

I think the more important evaluation, although completely intangible, would be the possible effect this Institute will have on the participants future teaching. Most of these participants were from smaller schools where each teacher must teach in more than one subject area. Most of the participants had a rather weak academic background in fluid mechanics although they were all teaching fluid mechanics and many of them were in charge of their fluid mechanics courses and laboratories. It follows that any program that would increase their technical competence must necessarily increase the effectiveness of their teaching. These participants were eager students and each of them increased his competence in the field enormously. I am confident that in this respect this Institute will greatly benefit fluid mechanics teaching in 35 colleges and universities throughout the United States.

Six of the seminars consisted of prepared panel discussions by the participants on topics concerning the teaching of fluid mechanics courses and laboratories. Sometimes the discussions were rather heated but I am sure all of the participants have a much broader understanding of the problems of teaching fluid mechanics than they had before they attended this Institute.

At least 15 of this group plan to use the credit earned in this Institute toward a Ph.D. degree. Some are planning to return here some time in the future to complete their studies, and others intend to transfer this credit to another university.

The staff members of the Institute are very enthusiastic about the attitude and performance of the participants. We feel it has been very successful.

VI. RECOMMENDATIONS FOR THE FUTURE

The overall NSF policy under which these Institutes are conducted is excellent. The support for the participants and for the expenses of the Institute are both adequate. The freedom given the host Institution and particularly the Director is ideal and allows the flexibility so necessary to conduct an Institute for the maximum benefit of the participants.

It would appear from this Institute that many more college-level Institutes are needed throughout the United States to increase the technical competence of teachers in the smaller colleges and universities. These Institutes can have a great impact on undergraduate teaching, where improvement is badly needed.

Most participants in a college-level institute already have a master's degree. A sequential type institute with a degree as the objective would almost have to lead to the Ph.D. A summer sequential program leading to the Ph.D. is unrealistic. It would appear that college-level institutes should concentrate on good, solid, medium-level graduate courses for which graduate credit is given with the primary objective of increasing a participant's technical competence in one or two summers to the point where he will be a capable and effective undergraduate teacher. If he wants to continue for the Ph.D. he can use the credit earned in the Institute but would have to enter a regular graduate program for a year or so to obtain his Ph.D.

No major changes are planned for our Institute next year if our proposal is approved other than to concentrate more heavily on the medium-level graduate courses and to cut the length of the Institute from ten weeks to eight weeks.

VII. ADDITIONAL COMMENTS

None.

VIII. ROSTER OF PARTICIPANTS

<u>Name</u>	<u>Institution</u>	<u>Home Address</u>
Alger, George R.	South Dakota State College	208 17th Avenue Brookings, S. D.
Barnes, Albert H.	University of Kentucky	3320 Newburg Road Louisville, Kentucky
Cassidy, John Joseph	Montana State College	59 Olive Court Iowa City, Iowa
Chenoweth, Harry Holt	University of Washington	4715 47th, N. E. Seattle 5, Washington
Colonell, Joseph Michael	Washington State University	4301 51st, Apt. H. San Diego 15, Calif.
Edwards, Wendell Forrest	Pueblo Junior College	2029 Elizabeth Pueblo, Colorado
Fletcher, Alan Gordon	University of Idaho	324 North Grant Moscow, Idaho
Forss, Vincent Alexander	Lafayette College	R. F. D. No. 2 Easton, Pennsylvania
Frea, Ward John	Michigan College of Mining and Tech.	301 South Street Houghton, Michigan

<u>Name</u>	<u>Institution</u>	<u>Home Address</u>
Garton, James Elmer	Oklahoma State University	1923 W. 10th Stillwater, Oklahoma
Glass, Quentin Lee	South Dakota School Mines and Tech.	8 Oakland Rapid City, S. Dakota
Glenne, Baird	University of Colorado	R. R. No. 2, Royal Oak Vanc. Island, B. C. , Canada
Graves, William Alvin	Colorado State University	540 Skyline Drive Fort Collins, Colo.
Haberstroh, Robert D.	Colorado State University	Route 3, Box 415 Fort Collins, Colo.
Harp, Jimmy Frank	University of Arkansas	311 North Broadway Booneville, Arkansas
Herndon, Charles Lee	Evansville College	Evansville, Indiana
Higgins, George R.	University of Massachusetts	81 Harlow Drive Amherst, Massachusetts
Hinton, Macon George	Tennessee A and I University	1729 14th Ave., South Nashville 12, Tennessee
Kenyon, Richard Albert	Clarkson College of Tech.	18 Crescent Drive Potsdam, New York
Kinslow, Ray	Tennessee Poly. Inst.	832 N. Jefferson Ave. Cookeville, Tennessee
Martinez, Eugene Paul	Lamar State College of Tech.	2311 17th Street Port Arthur, Texas
Middleton, George W.	North Carolina State College	2828 Claremont Road Raleigh, North Carolina
Muir, Clifford Donald	Missouri School of Mines	Pennant Hotel Rolla, Missouri
Mummert, Harold Byron	Colorado State University	508 Peterson Street Fort Collins, Colo.

<u>Name</u>	<u>University</u>	<u>Home Address</u>
Ousterhout, Donald Stewart	University of Alabama	1820 4th Street Tuscaloosa, Alabama
Pashniak, Daniel Walter	Walla Walla College	105 S. W. 13th Street College Place, Washington
Potter, Merle Clarence	Michigan College of Mining and Tech.	2660 Central Ave. S.W. Grand Rapids 9, Mich.
Prichett, Harold Duane	Oregon State College	Corvallis, Oregon
Ragan, Robert Malcolm	University of Vermont	3 Oneida Street Essex Junction, Vermont
Roy, Leland Frederic	University of Mississippi	Box 68, University, Miss.
Schiller, Robert E. Jr.,	A and M College of Texas	510 Crescent Bryan, Texas
Schwar, James Philip	Texas College of A and I.	935 Lantana Drive Kingsville, Texas
Smith, Cecil H.	Southern Methodist University	5753 Greenbrier Dallas 9, Texas
Tan, Felix Chipieng	University of Puerto Rico	52 (bajos), Eduardo Riera Mayaguez, Puerto Rico
Watters, Gary Zanford	Chico State College	1605 Downing Avenue Chico, California
Woods, Calvin Eugene	Lamar State College of Tech.	8760 Skyview Beaumont, Texas
Wright, Harold Eugene	University of Dayton	4303 Steinway Drive Dayton 16, Ohio

<u>Name</u>	<u>University</u>	<u>Home Address</u>
Yarborough, Keith A.	University of Nevada	345 Ardmore Drive Reno, Nevada
Younkin, Larry Myrle	Geneva College	No. 5C, College Hill Apts. Beaver Falls, Pa.
Zoller, James Harold	University of New Hampshire	16 Strafford Durham, New Hampshire