

Preface

"Since things in motion sooner catch the eye than what not stirs." *Troilus and Cressida*

This volume contains text and photographic material related to the sound films* prepared under the direction of the National Committee for Fluid Mechanics Films (NCFMF). The films, and the related text material herein, cover nearly all of the fundamental phenomena of fluid motions.

Each chapter of this volume is based on the script of a particular film. Each is heavily illustrated with experimental scenes from the film. The many photographs of interesting and significant phenomena in fluid mechanics are in themselves highly educative to both beginning and advanced students. In addition, descriptions of experimental phenomena help to develop in students that valuable faculty: a physical intuition, a "feel" for the diverse ways in which fluids behave. With the "film in print," in the form of a chapter of this book, the reader who has seen a film can relive the film, as it were: he can recapture the phenomena, the motion, and the vividness of the film, but he can do so at his own speed, without being pressured by the pace of the film. A student can reflect on what he has seen, and relate it to his classroom and textbook learning. Furthermore, a reading of the appropriate chapter before viewing a film is most helpful in getting the maximum satisfaction and benefit from the film.

Formed in 1961, the NCFMF functions in collaboration with Education Development Center, Inc. (EDC) in Newton, Massachusetts, formerly Educational Services Incorporated. The NCFMF, a self-constituted group of eleven university faculty members interested in education and active in various branches of fluid mechanics, was responsible for the general structure of the film program, for the substantive content, and for the creation of this volume. Education Development Center was responsible for film production, for a part of the editing and composition of this book, and also provided administrative and laboratory services. Funding was provided mainly by the National Science Foundation, with some contribution by the Office of Naval Research. The program was completed in 1969.

The concept that brought the NCFMF into existence was the conviction that films would provide

*The films are currently distributed by Encyclopaedia Britannica Educational Corp., 425 N. Michigan Ave., Chicago, Ill. 60611, from whom a brochure is available on request.

a convenient, economic, and powerful way of filling a serious educational gap. On the one hand are the concrete, experimental, perceptual phenomena of the real world of fluid motion. On the other hand is the abstract, mathematical, conceptual treatment of the subject in textbooks and classroom lectures.

With the objective of bridging this gap, we shaped the film program along certain policy guidelines that are of course reflected in the chapters of this book.

1. First priority was given to the presentation and elucidation of *experimental* phenomena. The usual kinds of lecture and text material, and of mathematics, are notably absent. The films and the chapters of this book were not designed as substitutes for lectures (although they have been so used!), but rather as teaching aids. Our aim was to use the power of graphical illustration to support the weakest point of the lecture/textbook system.

2. Out of the extremely large number of experiments and topics available, only those of fundamental and broad nature, and of permanent character, were selected. In each case, an "introductory" treatment was used: one aimed at the student's first study of a particular topic, whether the topic was elementary or advanced.

3. Each film, and the related chapter in this book, was designed to show the broad ramifications of fluid mechanics by drawing on examples from many fields. Parochial viewpoints and unnecessary jargon were avoided. As a consequence, we expect them to have a broadening influence, and, further, that they will be useful to other professions than those principally occupied with fluid mechanics, for instance, medicine, oceanography, acoustics, and architecture.

4. No attempt was made to organize the films, or these related chapters, in an ordered sequence or curriculum. There is too much variation in courses on fluid mechanics for such to be satisfactory. Moreover, the capability of films to range over wide areas in a short time is a stimulating contrast to the slower unfolding of topics in a long series of lectures.

Out of these governing views grew a virtually new component of scientific and engineering education, certainly one previously untried on a large scale: demonstration-experiment films, and related written material, for a difficult subject

having a strong mathematical flavor. In 1961 it was admittedly a speculation whether such films could be effective, and, even if they were, whether they would be widely used. In the intervening years both these speculations have become resounding positive statements. The films have won their share of awards at film festivals, to be sure. But more important, they have been widely adopted and used inside and outside the classroom. The remarks of a generation of students, who now take these films for granted as part of their educational experience, confirm that they produce a deep imprint connected with the other parts of their learning experience in fluid mechanics. Groups attempting similar programs in other scientific and engineering fields have emulated the NCFMF. Journals that regularly review books have been stimulated by the NCFMF product to review films as well. In its issue of July 1967, the distinguished *Journal of Fluid Mechanics* inaugurated its reviews of films with the statement:

The work of the U.S. National Committee for Fluid Mechanics Films is now well known. . . . Films on fluid mechanics have been made before now by other people, but the scale of this programme, the quality of the Committee's work, and the wide distribution of the products make these films a notable development in the academic world. Already the impact on the teaching of fluid mechanics in colleges and universities has been considerable, and it is likely that films are here to stay as a regular teaching aid. Fluid mechanics is a photogenic subject; and the Committee have opened our eyes to what can be done by an effective combination of thought and money.

We hope that the related written material presented in this volume will be received with equal pleasure by those already familiar with the films, and, further, that the book will augment the film audience.

Many different ways of using the films have evolved on university campuses. The sound films are sometimes shown in class hours. More often each film is shown several times each term, in the afternoon or evening, at well-advertised times, open to the entire community. Where a well-equipped audiovisual facility exists, students can schedule a film at their convenience. Sometimes the library will serve a similar function. Complete courses have been built around the films and the film notes as central exhibits. There are obvious ways in which this present volume may be worked into the related program of film showings.

For the convenience of interested readers, the

volume also contains brief descriptions of the 133 four-minute silent films produced by the NCFMF. These are *single topic* films that show a particular experiment or illustrate a particular phenomenon. They are ideal for illustrating a point that arises during the course of a lecture. They can be operated in corridor showcases, or left in the laboratory to be viewed at any time. Many schools have viewing rooms for cartridge projection in the library or audiovisual center. Students can study the cartridge loops at will on recommendation of the instructor, or they may be assigned as homework.

While the cost of the program, some \$3 million, was substantial, no less important were the intellectual and professional contributions so generously made by so many individuals. Mindful that we were acting for a national and international scholarly community, and that a similar effort could not be undertaken for at least a generation, we felt especially conscious of a responsibility for high quality and broad acceptance. An important mechanism for this—and a highly successful one—was the Advisory Committee for each film, which was always encouraged to be aggressive and outspoken in establishing and maintaining the highest of standards. As one principal put it, the development of his film was a "chastening experience." The chapters of this volume reflect these standards of quality.

To the members of the Advisory Committees, and most particularly to the principals, the NCFMF offers its thanks. Acknowledgment is made also of the dedicated efforts of the professional staff at EDC, especially to Charles R. Conn II, Bruce Egan, and Benjamin T. Richards for their contributions to the editing of the material of this book.

Its work completed, the NCFMF remains as an entity only to keep a paternal eye on its product, and to ensure that it survives its youth. While not all we produced was of even quality, the best should survive without growing old.

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for the National Committee for
Fluid Mechanics Films
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