

UNCLASSIFIED

AD NUMBER
AD874789
NEW LIMITATION CHANGE
TO Approved for public release, distribution unlimited
FROM Distribution authorized to DoD only; Administrative/Operational Use; JUN 1970. Other requests shall be referred to Chief of Naval research, Arlington, VA 22217.
AUTHORITY
ONR ltr 9 May 1973

THIS PAGE IS UNCLASSIFIED

7

AD 874789

TECHNICAL REPORT 784-1

THIS RESEARCH IS FUNDED BY
THE OFFICE OF NAVAL RESEARCH
GROUP PSYCHOLOGY PROGRAMS
UNDER CONTRACT No. N0014-68-C-0304
NR 170-713

JUNE 1970

ATTITUDINAL FACTORS IN THE ACCEPTANCE OF INNOVATIONS IN THE NAVY

MICHAEL MECHERIKOFF
ROBERT R. MACKIE

EACH TRANSMITTAL OF THIS DOCUMENT OUTSIDE
THE DEPARTMENT OF DEFENSE MUST HAVE PRIOR APPROVAL OF
THE CHIEF OF NAVAL RESEARCH, CODE 452, ARLINGTON, VA, 22217

REPRODUCTION IN WHOLE OR PART IS PERMITTED FOR ANY PURPOSE OF
THE UNITED STATES GOVERNMENT

HUMAN FACTORS RESEARCH, INCORPORATED
SANTA BARBARA RESEARCH PARK, GOLETA, CALIFORNIA

ATTITUDINAL FACTORS IN THE ACCEPTANCE
OF INNOVATIONS IN THE NAVY

Michael Mecherikoff
Robert R. Mackie

Prepared for
Psychological Sciences Division
Office of Naval Research
Department of the Navy
Arlington, Virginia 22217

Prepared by
Human Factors Research, Incorporated
Santa Barbara Research Park
6780 Cortona Drive
Goleta, California 93017

Contract N00014-68-C-0304

NR 170-713

June 1970

Reproduction of this publication in
whole or in part is permitted for
any purpose of the United States
Government.

The greatest problem of communication

is the illusion that it has been achieved.

--Thomas H. Carroll

ACKNOWLEDGMENT

The assistance and support of Drs. John A. Nagay and Bert T. King of Group Psychology Programs, Psychological Sciences Division, ONR, are sincerely appreciated. In addition, we wish to recognize the willing participation of many Navy personnel, in Washington offices, at training schools, and aboard ship, whose cooperation reflects a true concern for solving the acceptance problems associated with new developments in the Navy.

PROJECT SUMMARY

This project was conducted in response to the evident lack of acceptance by military personnel of innovations in operating equipment, training devices, and operational procedures, sometimes culminating in outright rejection of a new equipment or procedure. An attempt was made in the project to translate principles derived from laboratory research on attitude formation and change into practical guidelines that would maximize acceptance of innovations by Navy personnel.

This attempt was only partially successful because much laboratory research on attitude change was found to be characterized by restriction of variables, artificial settings, issues that were largely irrelevant to the subjects, unknown relationships between expressed changes in attitude and actual changes in behavior, and limited time intervals for assessing the effects of persuasive communications. Despite these shortcomings, the literature was productive of a number of useful generalizations concerning the qualifications of effective change advocates, the variables and processes that influence attitude change, and some important characteristics of the relationship between the change advocate and the audience (potential users).

As a complementary approach to the development of practical guidelines for innovation introduction, case studies were conducted of the events that occurred during the actual introduction of a number of new developments to Navy personnel. The innovations included a new unit of operational hardware, a new training device, and two new operational procedures. It soon became evident that the case study approach led to a differential stress on the variables apparently

important in the acceptance of innovations from those typically emphasized in laboratory research. Differences that were particularly evident centered on the comparative importance in the operational environment of *cognitive* factors (agreement on the nature of the operational problem); *design* factors (recognition of restraints imposed by the operating environment); and *training* factors (degree to which the users felt competent to handle the innovation in their day-to-day routine). It seems likely that many of the more subtle psychological variables that have been the principal concern of many laboratory studies, such as self-esteem, level of anxiety, need for approval, commitment to previous position, etc., play a significant role in acceptance only as a *consequence* of inadequacies during the introduction process, in meeting the cognitive and training needs of the potential users.

The case studies revealed, nevertheless, a number of violations of good practice in the introduction of innovations that certainly related to the kinds of variables that have been the subject of much laboratory research on attitude change. In addition, many insights resulted from the case histories that supplemented the principles reflected by the research literature. Consideration of both the laboratory research and the case studies led to the formulation of a number of practical guidelines to the introduction of innovations in the Navy. These guidelines were concerned with the following major requirements:

1. The need to systematize the entire process of innovation in the Navy and avoid dependence on official dictum as the basis for acceptance.
2. The role of "innovation engineering" during both the design and introduction phases of a new development.

3. The critical importance of designating a qualified *change advocate* in all phases of the introduction of any innovation.
4. The types of qualifications necessary in an effective change advocate.
5. The importance of user participation in the design phase to avoid "not-invented-here" or "this-is-nothing-new" reactions.
6. The problem of reconciling apparent disparate viewpoints between innovator and user concerning the nature of the operational problem.
7. The importance of the innovator's understanding of operational constraints seen as important by the user.
8. The importance of conveying the "large picture," the total system objectives, to users who normally may deal with only a limited portion of the system.
9. The importance of differential treatment of the several heterogeneous groups that may be affected by an innovation.
10. The techniques for dealing with "smoke screens of expertise" as a symptom of user rejection.

TABLE OF CONTENTS

	Page
ACKNOWLEDGMENT.	v
PROJECT SUMMARY	vii
LIST OF TABLES AND FIGURES.	xv
CHAPTER 1. INTRODUCTION.	1
THE PROBLEM.	1
HISTORY OF THE PROJECT	4
ORGANIZATION OF THE REMAINDER OF THIS REPORT	10
DEFINITIONS.	11
<i>User.</i>	12
<i>Change Agent.</i>	12
<i>Change Advocate</i>	12
CHAPTER 2. SEARCH OF THE ATTITUDE RESEARCH LITERATURE.	13
THE SEARCH FOR PRINCIPLES.	13
PROBLEMS IN COLLATION.	18
PROBLEMS OF BRIDGING THE GAP BETWEEN THE LABORATORY AND THE NAVY.	20
POSITIVE OUTCOMES OF THE LITERATURE SEARCH	23
CHAPTER 3. CASE 1. A STUDY OF THE INTRODUCTION OF OPERATIONAL HARDWARE (AERO 46A WEAPON LOADER).	25
BACKGROUND	25
OBSERVATIONS AND INTERVIEW DATA.	29
<i>Factory Training (May, 1967).</i>	29
<i>Engineering Evaluation at Pt. Mugu (8 August - 10 October 1968)</i>	31
<i>School at Cecil Field, Jacksonville (October, 1968)</i>	33
<i>JFK Shakedown Cruise (6 November - 16 December 1968)</i>	34
<i>Lecture and Film at Oceana (20 January 1969).</i>	34
<i>HFR Observer at Oceana NAS to Observe "Training" Sessions (31 January - 7 February 1969).</i>	36
<i>VA-95 Ordnancemen Interviewed at Alameda (13 February 1969)</i>	42
<i>Interview at Naval Missile Center, Pt. Mugu (23 February 1969)</i>	43
	xi

TABLE OF CONTENTS (Cont.)

	Page
<i>Training at Oceana (24 February 1969)</i>	45
<i>Interviews with VA-35 and VF-14 Ordnancemen (28-31 March 1969)</i>	45
<i>JSED Staff Member Aboard the KENNEDY (Early June, 1969)</i>	47
<i>Loading Exercises Aboard Ship (July and August, 1969)</i>	48
<i>OPEVAL (11 August 1969)</i>	49
CHRONOLOGICAL SUMMARY	51
ANALYSIS IN TERMS OF INNOVATION ACCEPTANCE.	53
CHAPTER 4. CASE 2. A STUDY OF THE INTRODUCTION OF A TRAINING DEVICE (GENERALIZED SONAR MAINTENANCE TRAINER, DEVICE 14E22).	63
BACKGROUND.	63
INTERVIEW DATA.	67
CHRONOLOGICAL SUMMARY	74
ANALYSIS IN TERMS OF INNOVATION INTRODUCTION.	75
CHAPTER 5. CASE 3. A STUDY OF THE INTRODUCTION OF A NEW OPERATIONAL PROCEDURE (SONAR TARGET CLASSIFICATION)	83
BACKGROUND.	83
OBSERVATIONS, INTERVIEWS, AND OTHER DATA.	85
<i>Observation of Briefing at Fleet ASW School, San Diego</i>	85
<i>Further Development of the SM Method</i>	87
<i>Observations on the Introduction of the SM Method at Fleet Sonar School, Key West</i>	88
<i>Developments Relating to Acceptance on the Washington Scene.</i>	92
CHRONOLOGICAL SUMMARY	94
ANALYSIS IN TERMS OF INNOVATION ACCEPTANCE.	94
CHAPTER 6. CASE 4. OBSERVATIONS ON THE DIFFERENTIAL ACCEPTANCE OF EQUIPMENT MAINTENANCE PROCEDURES (THE 3-M SYSTEM)	101

TABLE OF CONTENTS (Cont.)

	Page
BACKGROUND.	101
<i>Acceptance of PMS and MDCS</i>	104
INTERVIEW DATA.	106
ANALYSIS IN TERMS OF INNOVATION ACCEPTANCE.	109
CHAPTER 7. SOME GENERALIZATIONS AND RECOMMENDATIONS . .	113
SIGNIFICANT VARIABLES IN INNOVATION INTRODUCTION. . .	113
FACTORS POTENTIALLY INFLUENCING ACCEPTANCE IN THE NAVY	117
SOME TENTATIVE GUIDELINES FOR INNOVATION INTRO- DUCTION.	119
IMPLICATIONS OF A "PSYCHOLOGICAL VIEWPOINT"	125
RECOMMENDATION FOR "INNOVATION ENGINEER".	128
APPENDIX A. QUESTIONNAIRES.	A-1
APPENDIX B. REFERENCES.	B-1
APPENDIX C. SYNOPSIS OUTLINE (adapted from Mackie and Christensen, 1967).	C-1

LIST OF TABLES AND FIGURES

TABLE		Page
1	RESPONSES TO INTERVIEW QUESTIONS, OCEANA NAS, VF-14 SQUADRON	36
2	RESPONSES OF NAVY PERSONNEL TO QUESTIONS ABOUT PMS AND MDCS	106
3	VARIABLES IN A MODEL OF ACCEPTANCE OF INNOVA- TION	115
4	OUTLINE OF FACTORS POTENTIALLY INFLUENCING ACCEPTANCE, WHICH SHOULD BE CONSIDERED IN DE- VELOPING AN INNOVATION INTRODUCTION PROGRAM. . .	117
FIGURE		
1	Concept of Study Design Showing Collation of Findings from Both Research Literature and Opera- tional Situations. (Solid Lines: Information Leading to Principles; Dashed Lines: Information on Limits of Applicability of Principles.) . . .	9
2	Interrelationships Among Variables Affecting Atti- tude Change.	14
3	Model of Acceptance of Innovation.	114

CHAPTER 1

INTRODUCTION

THE PROBLEM

Resistance to change is a phenomenon so pervasive and widely recognized that it scarcely requires documentation. It has been documented repeatedly, however, in a wide variety of settings. For example, new and superior agricultural techniques meet resistance in primitive countries (Arensberg and Niehoff, 1963), production method changes meet resistance in manufacturing settings (Coch and French, 1948), and advances in educational technology encounter what has been called the "innate conservatism of the educational establishment" (Persselin, 1968).

Similarly, one of the most serious problems confronting those responsible for the acquisition of new equipment in the Navy is nonacceptance of that equipment by Navy personnel. The result is that in the hands of the users much new equipment fails to achieve more than a small fraction of its potential performance capability. In a few cases, new equipment may be almost totally rejected.

Although nonacceptance of equipment may be based on valid reactions to design shortcomings, there has been evidence that unfavorable predispositions, or biases, on the part of the potential users may play a highly significant role. Evidence of negative attitudinal factors can be cited not only in connection with operational equipment, but with training devices and procedural innovations as well.

Although numerous cases might be cited, one example of each type should illustrate the point. Simpson and Parker (1965) performed a field study of the maintenance status and

fleet acceptance of a new sonar equipment designed to aid in the classification of underwater targets. They found that the equipment aboard over half the ships was so poorly maintained that the quality of the displayed signals precluded interpretation. On some ships, the equipment was so severely miscalibrated that proper operation was impossible. Interview data indicated that the new device was not generally accepted by sonar personnel as contributing to their performance; further, it was almost never used in the way intended by the designers.

In discussing these findings, Simpson and Parker questioned the adequacy of the introductory training given to the sonar personnel. Of particular interest in terms of the present investigation, however, was the following:

It is possible that sonarmen *do* have sufficient training to maintain this equipment, but because of lack of time, *proper attitude*, or motivation, it is simply not being done. It is considered more probable, however, that a "vicious cycle" exists, in which lack of understanding of the purpose and operation of the device engenders biases against it. These biases, in turn, preclude proper maintenance, thus reducing operating effectiveness, further strengthening biases, and so on (Simpson and Parker, 1965).

Similar conclusions concerning the interactions of design problems, insufficient training, and inadequate maintenance were reached by Mathews *et al.* (1965) in their study of fleet usage of the ASROC system.

User acceptance problems apparently are serious in relation to Navy training devices as well. In a recent study by Naval Training Device Center (NTDC, 1966), a committee of engineers, training specialists, and maintenance personnel investigated the use of the F9F-5 and P2V-5 operational flight trainers (OFT's). The trainers were studied from the standpoint of how effectively they were utilized both

by the training commands and by the fleet. These investigators stated:

The single finding that colors all of the results is that no operational flight trainer could be found in condition to have all its capabilities used, either in a single problem or in a series of problems.

Both in training command and in fleet training, the operational flight trainer is used almost exclusively for cockpit familiarization training in normal and emergency procedures. This area of training is that which would normally be assigned to the procedures trainer.

That attitudinal factors played an important role in these limitations on utilization was strongly implied by the following question:

How can the training use of the operational flight trainer be based on the planned attainment of specific training objectives, rather than on the accidents of availability, individual desires, or administrative whims?

The report went on to state that training unit personnel were found almost invariably to lack cooperation from the squadrons.

Squadron training officers for the most part had little confidence in the trainers, and did not, as a rule, make OFT instruction part of the training syllabus.

The attitude of pilots using the trainers was traced, in part, to the attitude, especially when negative, of the squadron training officer. Several training units reported noticeable changes in the amount of utilization when squadron training officers were transferred. In addition, a *generalized dislike* for simulators, as a result of earlier experience, was reported by instructors as an important reason why pilots avoided OFT's.

It was recognized that the problem of OFT utilization might have been largely one of educating the user.

In many respects, the problem of increasing the utilization of an OFT is similar to that of increasing the demand for a consumer product. The ultimate user of an OFT must be convinced of its worth, and educated concerning its capabilities and limitations. Otherwise, apathetic acceptance will result in poor utilization, or, even worse, it may be rejected completely as a training aid. The latter case might result from overselling, or misinformation concerning the trainers' capabilities.

Finally, although there is little documentation of the problem, there is evidence of user resistance among military personnel to innovations in the world of "software" as well as that of hardware. In the experience of project personnel during many years of research on Navy training problems, reluctance on the part of some personnel to accept innovations in operating technique, training methodology, or maintenance practices has been almost axiomatic.

It seems fairly obvious, then, that nonobjective attitudes, biases, or predispositions of military personnel have adversely affected the adoption and successful use of innovations in equipment, training devices, and operating procedures. The questions to be investigated were (1) why does this occur, and (2) what can be done to minimize the problem?

HISTORY OF THE PROJECT

It seemed reasonable to assume that the substantial amount of research performed by social psychologists on attitude formation and change might yield principles that could be translated and applied to facilitate acceptance of new developments. A cursory examination of the basic

research on attitude formation and change suggested that a number of important principles applicable to Navy problems should emerge from a careful review of this research literature.

However, like other generalizations resulting from research on human behavior, such principles would require *translation* from the context of the laboratory to the context of real-world operations. This requirement, and its consequences for the applicability of research findings in practical settings, has been thoroughly discussed by Mackie and Christensen (1967). These investigators emphasized that the specificity of human responses to an experimental task almost invariably necessitates a translation from the context and variables employed in the laboratory to some corresponding set of variables and conditions in the operational setting where application is to be attempted. Very few psychologists engage in this kind of translation, a fact that seriously restricts the number of applications derived from basic research.

The present study was to be an attempt to provide some of the missing effort on the translation of findings and principles from research on attitude formation and change into techniques for application that could be given trial in the field. However, there are no recognized methods for translating and applying the principles derived from basic psychological research. In fact, Mackie and Christensen (*op. cit.*) concluded, in the case of learning research, that a great deal of it simply was not translatable. In many cases, only the hypothesis of a laboratory investigation proved translatable to the operational world, and entirely new experiments were necessary to verify those hypotheses. Therefore, the feasibility of developing a method of translation for attitude research was to be investigated.

It was expected that the results of this investigation would culminate in a demonstration that the principles derived from research on attitude change are, in fact, applicable to Navy situations, and that rules for their use can be formulated. It was also anticipated that insights would be developed on how attitudes toward new equipment or new procedures develop in the Navy, and with what variables in the experience of Navy personnel these attitudes are associated.

In summary, at the outset, the following specific objectives were to be achieved:

1. In conjunction with ONR Code 452, select a sample of studies on attitude formation and change for intensive review.
2. Collate principles of attitude change made explicit by these researchers and attempt to develop others that may be implicit in their findings.
3. Translate these principles into a set of operational rules that can be applied.
4. Verify with selected investigators that these translations are logical extensions of the principles.
5. In conjunction with ONR, investigate opportunities in the Navy for applying the translated principles.
6. Design a suitable demonstration study or experiment to test the principles.

Although the general objectives of the research have been amply fulfilled, it did not prove feasible to meet all of the listed specific objectives completely. The original intention had been to start with a small number of attitude change studies, to find some commonalities that would be the "principles," and to exercise some creativity in identifying Navy situations with analogous variables--

a seemingly modest endeavor. Soon over 200 articles and books had been examined, still only a small fraction of the massive literature, without finding much commonality on which to base dependable principles. With reference to small group research, McGrath and Altman (1966) had observed that the research is "segmented--in the form of idiosyncratic variables, tasks, and measures peculiar to the individual investigators--that no one has a common base from which to argue." Discussing contradictory results, Sherif (1970) concluded that, along with naturalistic studies, "Within the laboratory itself, there is remarkably little convergence in findings on attitude change." These essentially were the characteristics of the research literature encountered by the present investigators; the basic problem of collation eventually proved virtually insuperable.

In the fall of 1968, two incidents altered the course of the investigation. First, the project staff became aware of a training program adopted by a large utility company in Southern California that was designed deliberately to forestall and counteract negative reactions to innovation. HFR observers visited this company briefly and came away with the strong impression that attitude development in this practical situation seemed to be a function of different variables than those studied regularly in the laboratory, or at least the emphasis, the "flavor," was different. Second, project observers visited the Fleet ASW School, San Diego, to observe the introduction to Navy personnel of a new procedure for classifying sonar targets.¹ Again, there was the conviction that the practical situation had a very different "feel" from the reports of laboratory research.

¹The history of acceptance of this innovation is described in detail in Chapter 5.

These two experiences seemed especially to emphasize differences in how attitudes are formed and *maintained* in the operational environment in contrast to the typical short-term manipulation of attitudes carried out in the laboratory. This is not to say that the laboratory studies had no apparent relevance for the field, but only that there seemed to be important differences in which variables were considered important and how they were manipulated. For this reason, the decision was made to try to develop analogies between the laboratory and the field through extensive study of actual innovation introduction in the Navy. Figure 1 illustrates this dual approach to the hoped for development of useful principles. In the event that translation of principles could not be effected, it would be valuable in any case to have investigated field situations to discover whether practical principles of attitude change could be extracted from a study of several case histories.

Three such cases were subsequently studied as intensively as possible, and a fourth was studied more superficially. A new operational equipment, a new training device, and a new operational procedure were selected for detailed study. As a result of both the literature survey and the case histories, some practical guides to innovation introduction were derived. It is felt that this combination of approaches led to a more comprehensive description of the important variables than otherwise would have been possible, and a more practical orientation toward the solution of acceptance problems in the Navy.

STUDY DESIGN

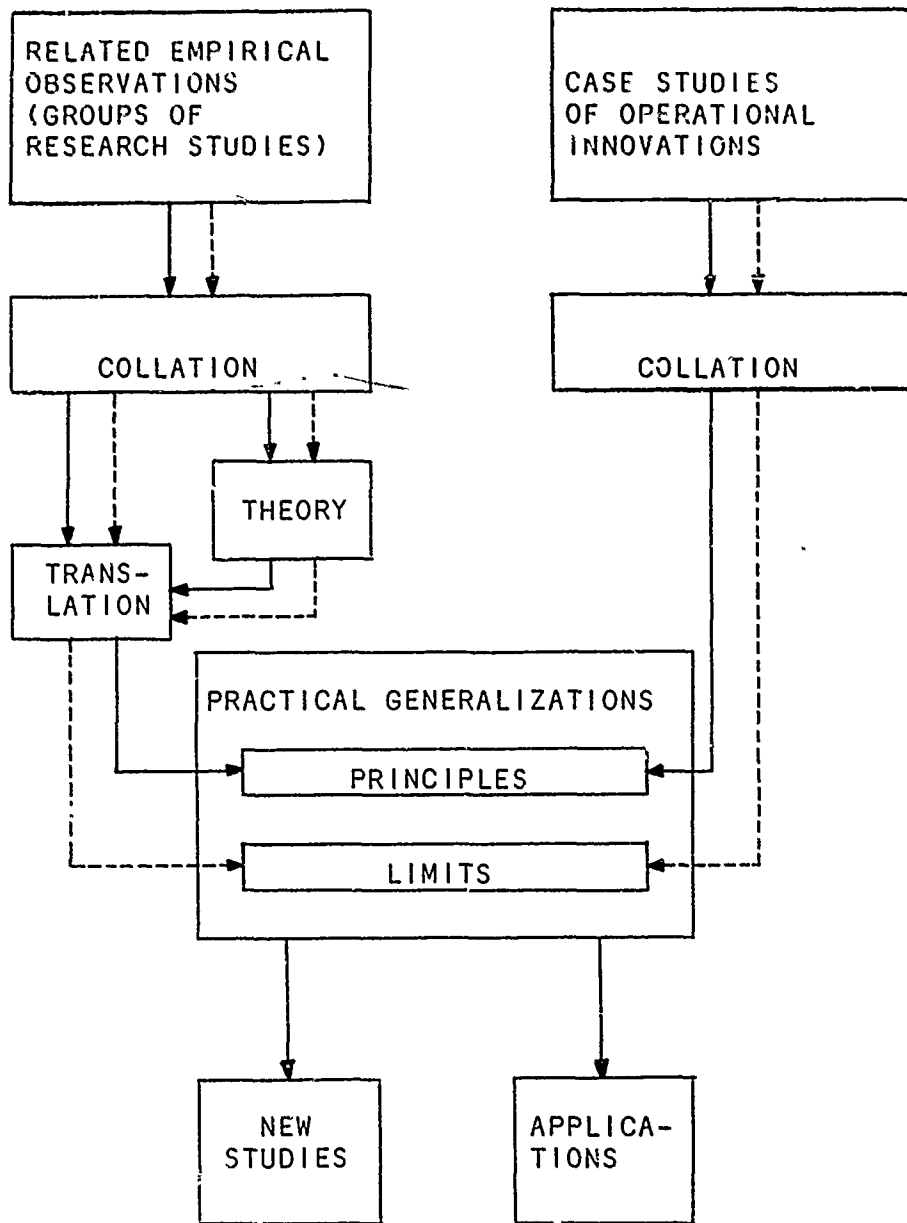


Fig.1. Concept of Study Design Showing Collation of Findings from Both Research Literature and Operational Situations. (Solid Lines: Information Leading to Principles; Dashed Lines: Information on Limits of Applicability of Principles.)

ORGANIZATION OF THE REMAINDER OF THIS REPORT

Immediately following this introduction is a chapter describing in more detail our experience in attempting to derive practical principles from the research literature on attitude change. No attempt is made to provide a review of the literature itself. However, a primitive model organizing potentially useful variables noted in the literature is presented, and then reorganized and expanded to include variables observed in or suggested by the field studies.

The next four chapters present the four case histories. They represent three areas of innovation in the Navy: operational equipment, training devices, and procedure. Each is presented in similar format: (1) background; (2) observations, interviews, data; (3) chronological summary; and (4) analysis in terms of innovation acceptance. The last of these may sound as though there was a procedure or scheme for performing the analysis; there was not. The approach was inductive rather than deductive--an attempt simply was made to organize the material of each case history and extract some generalizations.

It was originally hoped that several more cases could be followed, but time and cost limited the investigation to these. The selection was made largely on the basis of convenience: the case was ripe for study at the time, and in two cases, we were particularly well acquainted with the operational problems involved. The case of the 3-M System (Chapter 6) was somewhat different in that we did not study the introduction process itself. It aroused our interest because, long after the system was installed, two parts of the same system were being differentially accepted.

We consider these cases typical problems in acceptance, although they are few in number. They were not selected

because they were particularly good or bad examples; in fact, at the time they were selected, there were only slight clues as to the eventual degree of acceptance that would occur.

The final chapter includes a detailed listing of the variables considered important in a model of acceptance of innovation, an outline of factors potentially influencing acceptance that should be considered in a program of innovation, and a tentative list of principles or generalizations taken both from the research literature and from the case histories. The recommendations section includes a preliminary specification for an "innovation engineer" and describes his probable activities and responsibilities in the Navy.

DEFINITIONS

Throughout this report, there are many terms which are likely to be unfamiliar to some readers. This is particularly true of some of the abbreviations, acronyms, and jargon associated with the innovations in the cases studied. These terms are defined in context in the exposition, and no attempt has been made to provide an overall glossary. Psychological jargon has been largely avoided so that the report will be easily intelligible to non-psychologists. In general, this has not been a difficult goal to achieve, since most of the names of variables in the attitude research literature are taken from common English without much overall increase in precision. While in a particular experiment or survey a term may have had a highly restricted meaning, there seems to be nearly as much variation in the usage of a term within the field of attitude research as within common English. Even the word "attitude" has numerous definitions, depending upon theoretical orientation; the purposes of this report seemed to us best served by giving close attention to the

usage of terms during our own study of the research literature, but favoring more global, less precise definitions for this report.

There are three terms, however, that require specific mention at this point. They are used throughout this report, and consistency of usage has been maintained. Note especially the definition of the term "user" which is considerably broader than the common definition.

User

Anyone who is influenced by the innovation in such a way that the innovation needs to be introduced to him, because of the fact that he is in a position to resist the innovation. It need not refer only to those directly operating the device or using the procedure, but may refer to those who must approve or for other reasons must have knowledge of the innovation.

Change Agent

The agency sponsoring the change; it may be a single individual or an organizational unit.

Change Advocate

The person(s) who directly interacts with the users as a representative of the change agent.

CHAPTER 2

SEARCH OF THE ATTITUDE RESEARCH LITERATURE

Approximately 250 sources were examined in an attempt to discover principles in the attitude research literature that might be translated for application to the specific problem of innovation introduction in the Navy. These sources ranged from research reports to reviews to theoretical formulations. Appendix B is a complete list of references.

One of the early attempts to organize this literature produced an elementary model of attitude change (Figure 2). This summary lists in convenient categories the variables from the literature that the project staff felt might relate to innovation acceptance; and (2) indicates some degree of order and relationship among the variables, in that the arrows indicate the existence of at least one study linking a variable in one box with a variable in another box.

THE SEARCH FOR PRINCIPLES

In addition to producing a list of the variables commonly studied in attitude research, the project staff was also able to formulate a tentative set of principles. Unfortunately, due to characteristics of the literature which will be explicated shortly, each principle was based on very little research, usually only one or two studies. The set of principles underwent several revisions in attempts to improve their wording, so that they would remain faithful to the studies on which they were based and yet sound applicable to practical situations. As an example of these

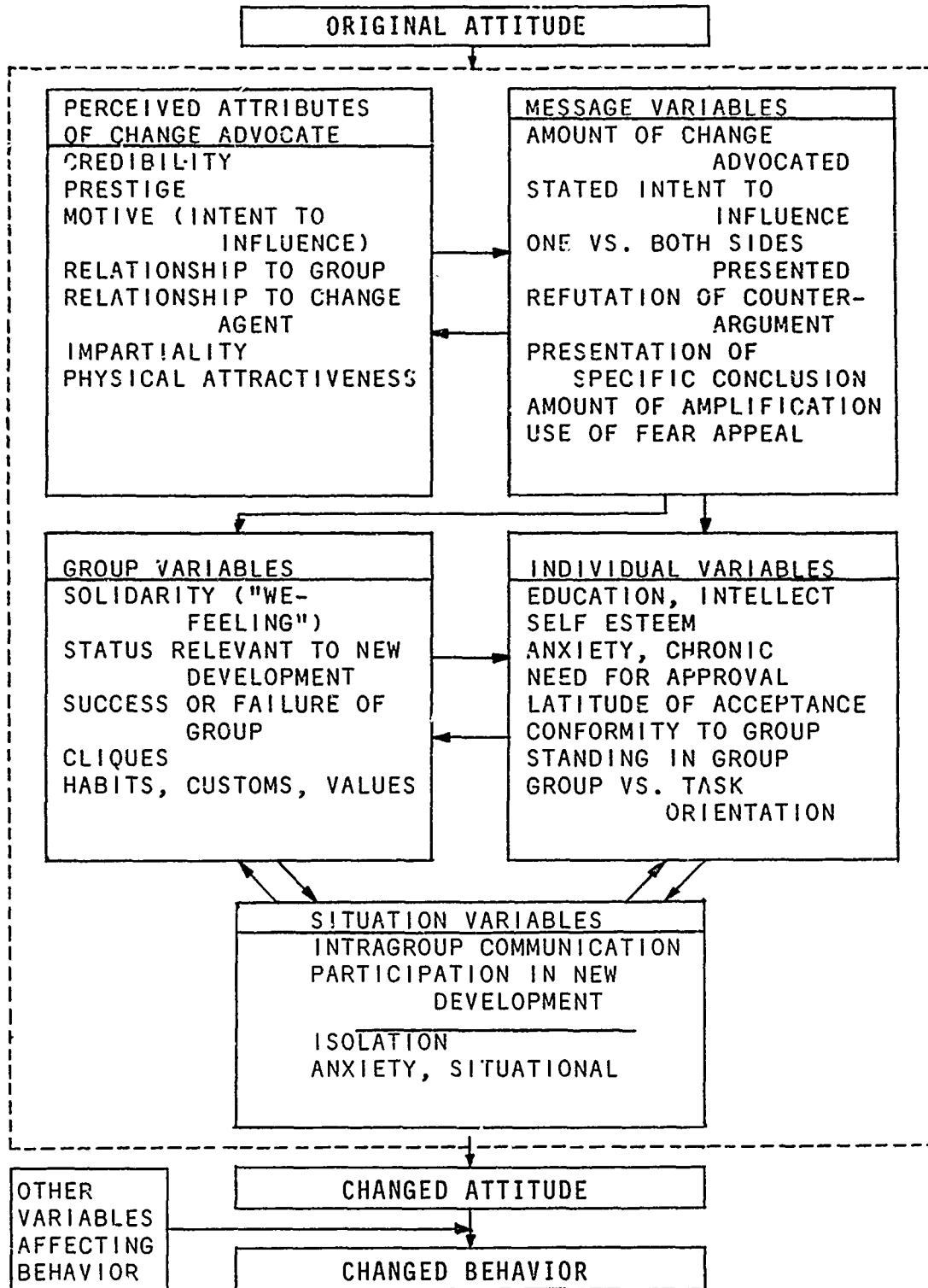


FIG. 2. INTERRELATIONSHIPS AMONG VARIABLES AFFECTING ATTITUDE CHANGE.

efforts, one version of the set of principles, grouped into four categories, is given below:

A. *Selection of the Change Advocate*

1. When selecting a change advocate, factors associated with credibility should be among the first considerations.
2. The change advocate should be selected from the user population whenever possible.
3. The change agent, in selecting change advocates, should identify social leaders by their influence upon the social behavior of the group and not by their official title, position, or rank.
4. The change advocate must be perceived to possess expertise or prestige associated with the issue in question.
5. A change advocate is more effective if he is physically attractive, although physical size as such is not a factor.
6. If the change advocate is unknown to the audience, he must be perceived by the audience as one who (a) has nothing to gain personally by their acceptance of his viewpoint, and (b) likes the audience and desires to influence them.

B. *Susceptibility of the Individual to Change*

1. One measure of an individual's susceptibility to change on an issue may be his relative infrequency of commitment on related issues.
2. Majority opinion has a greater effect on individuals with strong motives for social approval than on other individuals.
3. Individuals whose own stand diverges widely from that advocated in the communication tend to retain their initial attitudes; those with moderate positions, closer to the stand expressed in the communication,

tend to change in the direction advocated.

4. If a person is highly committed to the issue, expectation of debate (as opposed to uncoordinated pro-con speeches) tends to polarize his initial opinions; if he is less highly committed to the issue, expectation of debate tends to moderate his opinions.
5. If the audience is already anxious concerning the issue, inducing further anxiety may render the members less responsive to the persuasive appeal. If, however, they are non-anxious at the outset, raising the anxiety level may increase their receptivity to the persuasive appeal.

C. *The Process of Attitude Change*

1. Intragroup communication (gossip, rumors, etc.) can be used by the change advocate to generate attitude change if there is effective two-way communication between him and those affected by the change, and if the change is perceived by group members as desirable.
2. Attitudes formed in face-to-face group contexts are more stable than those formed in more isolated contexts.
3. Even forced membership in a group whose attitudes differ from the individual's reference group (the group which embodies his own ideals) will, in time, serve to alter the individual's attitudes.
4. Up to a point, if a stimulus object is not overly noxious initially, repeated exposure of an individual to the stimulus object enhances his attitude toward it; however, too long or too frequent exposure may induce monotony and boredom.
5. Successful experience (performance) with equipment leads to positive attitudes more readily than other forms of introduction.

D. *Relational Principles*

1. When a change advocate enjoys a positive (friendly, etc.) relation with the group to be affected, an indirect mode of influence (one not perceived by the listener as an effort to influence him) is more effective than a direct mode of influence. There apparently is no difference in effectiveness of direct and indirect influence attempts when a negative relationship exists.
2. The more knowledgeable the audience is with respect to the issue, the more important it is to acknowledge, but not refute, those points in favor of the counter-argument which are familiar to the audience.
3. The more committed the audience is to a particular stand on the issue in question, the more important it is that they perceive the change advocate's stand as not too discrepant from their own; this must be balanced against the fact that, up to a point, the greater the discrepancy is, the greater the change will be.

Clearly, application of some of these principles would require a knowledge of individual differences which the change advocate may not have in a military setting, and also assumes a homogeneity in the audience which may not exist. At least one principle (A, 3) obviously would be difficult to apply in a military situation. Considerations such as this sharply restrict the translatability of attitude change principles to Navy settings. In addition, the whole set calls up an image of a change advocate delivering a brief persuasive message as the whole change effort, a situation which ordinarily does not obtain during innovation introduction. As McClelland (1968), Rogers (1962), and others have pointed out, innovation acceptance (or rejection) must be viewed as a process covering appreciable time, sometimes years, and which progresses through various stages. Rogers has used *diffusion* of innovation as the term that carries this connotation. Thus, limitations on the variable of

time was one pervading factor in the attempt to develop useful principles from the literature.

PROBLEMS IN COLLATION

Another difficulty was encountered in trying to collate various research findings. This was the problem of imprecise names given to experimental variables. For instance, studies on "threat" and some studies on "self-esteem" (i.e., lowering self-esteem through experimental manipulation) seemed to use similar operations in manipulating the two variables. On the other hand, two studies on "threat" might use very different stimulus manipulations from each other. This suggested that collation could not really be accomplished effectively on the basis of broad "psychological" variable names; a method had to be found which pointed up the actual similarities and differences between experimental manipulations and measurements.

A laborious but potentially promising procedure was tried in an attempt to solve this problem. In an earlier investigation, Mackie and Christensen (1967) had proposed a standard format for reporting a summary or synopsis of an experiment, a format which emphasized rather detailed descriptions of the variables, conditions, and results. There seemed to be a reasonable possibility that if a number of related experiments were abstracted using this format, they could much more easily be compared and sorted for the purposes of collation. However, the degree to which the research literature on attitudes was amenable to this kind of analysis was not known, and it was, therefore, impossible to predict with confidence how far this effort could be carried.

The results of a limited attempt in this direction were not encouraging. In spite of the fact that the abstract format simply called for a standard arrangement of material

which should be contained in any experimental report (see Appendix C), it turned out to be time consuming and difficult, and sometimes impossible, to extract the desired information from the standard journal articles. Because of the high labor cost of this activity, it proved impractical to generate the rather large number of standardized abstracts which would have been necessary to test the value of this method for cutting across traditional psychological variable names.

Our conclusions from these efforts were as follows:

1. Collation of research findings on the basis of broad, vaguely defined variables, without consideration of actual manipulations and measurements, leads to faulty generalizations, particularly in an area such as attitude change where vaguely defined variables abound.
2. The process of digging the relevant information out of the research literature and putting it into a standardized format is enormously expensive, and is, therefore, probably not feasible on a broad scale.
3. A standardized format, more than an abstract, but less than an article or technical report, does have the great advantage of displaying in relatively short form exactly what the similarities and differences between experimental studies are.
4. It is highly desirable that reports of experimental research, whatever their final form, be accompanied by a standard, detailed abstract such as we have attempted to use; it would not be too difficult or expensive for an experimenter to prepare one at the time the experiment is conducted, and the benefits would be very great.

PROBLEMS OF BRIDGING THE GAP BETWEEN THE LABORATORY AND THE NAVY

In addition to the problems already mentioned, certain characteristics of the research literature on attitude change have made collation of findings and translation to practical situations nearly impossible. It seems appropriate to summarize these characteristics here.

Weick (1967) has listed seven properties of laboratory experiments that have "blinded experimenters to crucial issues in attitude change." First, laboratory settings produce acquiescence or compliance through the credibility of the experimenter, his expertise, the subject's desire to help science and, perhaps, by making participation a requirement for class credit.

Second, in the laboratory, the subject has no opportunity to select the communications to which he will be exposed. Weick's concern here is for the gaps in our knowledge of attitude change that center on the real-life opportunity of the individual to expose or not to expose himself to various sources of influence.

Third, Weick points out that the tendency for experiments to seem logical may generate pressures upon college students to behave in a manner that generates support for consistency theories of attitude change.

Fourth, Weick argues that experimenters have focused too much upon attitude change within an individual without taking into account the reference groups in terms of which the subject responds even when he is alone.

Fifth, experiments in which attitude changes are effected and assessed within a short period of time may generate principles that have little to do with the long-term effects of persuasive efforts.

Sixth, the subjects of experiments are usually permitted only to express their attitudes and seldom are permitted to translate these into behavior. Festinger (1964) argued that "When opinions or attitudes are changed through the momentary impact of a persuasive communication, this change, all by itself, is inherently unstable and will disappear or remain isolated unless an environmental or behavioral change can be brought about to support and maintain it."

Finally, Weick emphasized the unfortunate fact that experiments frequently confront subjects with appeals designed to change attitudes on trivial issues.

On the basis of our own experiences and observations of Navy settings, we have also compiled a list, which overlaps very little with Weick's, and, therefore, complements it.

1. *Restriction of Variables.* Some variables influential in practical situations receive little or no attention in the laboratory.
2. *Complex Interaction of Variables.* The methodology of attitude research does not yet appear ready to deal with complex, multi-variate situations. This implies that more attention should be directed toward field investigations as a source of principles.
3. *Artificiality of Setting.* To some degree, this is inevitable, of course, but it does make translation difficult. One feels great qualms about attempting to translate a study, for instance, in which subjects were influenced by the "friendliness" of patterns of thumbtacks (Thibaut and Strickland, 1956).
4. *Irrelevance of Issues.* Weick has mentioned this. In the Navy, the issues involved in attitude development and change are generally highly relevant, affecting one's status and daily activities, and not infrequently one's safety. Laboratory manipulations are rarely so crucial.
5. *Cognitive Factors.* Beliefs and opinions are generally regarded as being closely related in

some way to attitudes. Rokeach (1968), for example, defines attitude as "a relatively enduring organization of beliefs about an object or situation predisposing one to respond in some preferential manner." What one knows or thinks he knows about an innovation seems to be an important determiner of reactions towards the innovation in Navy situations. But a very large number of studies have underplayed the cognitive component in favor of such things as liking the communicator, desire to influence, social structure variables, personality variables, and message format variables. These are sometimes controllable in practice, and are, therefore, important, but in the essentially problem-oriented settings in which the attitudes of Navy men toward innovation are formed or changed, cognitive factors become most important and other factors may even be totally unknown (personality factors, for instance). Thus, even if principles can be derived from the laboratory studies, the principles may be minimally relevant and applicable.

6. *Relationship of Attitudes to Behavior.* Several authors discuss this problem. It is usually not known to what degree shifts in "attitude" (as measured on some opinion scale) correspond to changes in other, more important behavior. Thus, it is not known how valid principles derived from studies using attitude scales are, when what is wanted is modification of behavior far beyond marking a scale.
7. *One-Shot vs. Time/Stages/Levels.* Most of the attitude research has been done in short experimental sessions dictated by academic scheduling. In the Navy, attitudes toward an innovation may shift over months, over several stages of experience. These changes have been aptly called "diffusion of innovation" (Rogers, 1962). They have rarely been studied.
8. *Small Shifts of Attitude.* Much of the attitude change literature reports results in terms of group means, which may differ significantly in the statistical sense, but not differ much in any practical sense. This must be contrasted with the practical requirement to obtain virtually 100% positive attitudes toward an

innovation. Variables that generate barely perceptible attitude shifts in the laboratory will probably be totally ineffective when confounded with many other variables in the field. Principles based on small shifts in group means may not be worth translating to practical situations.

9. *"Principles" Based on Single Studies Because of Differences in Experimental Conditions.* The "idiosyncratic variables, tasks, and measures" noted by McGrath and Altman (1966) have already been mentioned. The lack of commonality means that to a large degree, one must generalize from single studies. It is typical that groups of studies which appear on the surface to be similar, upon close examination, are not.
10. *Need to Go Beyond "Attitude" Research to Deal with the Acceptance Problem.* This difficulty may be due more to naiveté than to an inherent weakness in psychological research. It is deceptive (but an easy trap) to believe that since innovation acceptance means "changed attitudes," the attitude research literature is where the answers are to be found. Whatever is meant by "attitude" in this practical sense is probably as much related to the research in learning, perception, and motivation as it is to the research on "attitude change." The term "attitude" itself needs careful translation, particularly since it seems to have so many definitions within and outside of psychology.

POSITIVE OUTCOMES OF THE LITERATURE SEARCH

Mackie and Christensen (1967) found little translation of learning research into educational practice, partly because of the limited, abstract tasks characteristic of much learning research. Although the findings in the present investigation were similar, an attempt has been made to formulate generalities and to perform primitive translation using the results of the literature survey in conjunction with the case study method.

Thus, as a result of extensive observations of innovation introduction in Navy settings, the principles derived from the literature were modified and amalgamated with principles derived from the observations. These efforts resulted in the list of principles that appears in Chapter 7, following the four case studies of innovation. It will be obvious that further development of these principles is necessary. The evidential basis of the principles, considering both the laboratory research literature and the field observations, is much weaker than it ought to be. Furthermore, the principles are not numerous or comprehensive enough to provide a complete guide to one who wishes to plan for innovation introduction systematically, and the *limits* of applicability of the principles are not known.

It is interesting, however, that in spite of the deficiencies mentioned, it was possible to merge knowledge obtained in the laboratory with knowledge obtained in the field, and obtain guidelines which appear to be helpful and sensible.

CHAPTER 3

CASE 1. A STUDY OF THE INTRODUCTION OF OPERATIONAL HARDWARE (AERO 46A WEAPON LOADER)

BACKGROUND

Aviation ordnancemen think of themselves as the hardest working men in the Navy, in terms of physical labor. Their reputation in this regard stems from the fact that during aircraft carrier operations all conventional ordnance is loaded onto aircraft manually. That is, bombs ranging in weight from 250 to 2,000 pounds are lifted by sheer manpower and latched to the wing of the aircraft. In the case of high-wing aircraft, the load may have to be lifted over the heads of the ordnancemen. A bar, known as a "hernia bar," is screwed into the fuse cavity at one end of the bomb; straps may be used to help support the other end. The lightest ordnance is frequently handled by two-man teams; heavier ordnance is loaded by increasing manpower up to a dozen or more men. In combat operations, a typical working day is 12 to 16 hours. In addition to loading ordnance, aviation ordnancemen have the responsibility of swaybracing, fusing, and arming the bombs, and cleaning, maintaining, and electrically checking the equipment which releases the bombs.

Faced with day after day of such arduous labor, described uniformly by ordnancemen as "backbreaking," it would seem that any mechanical device promising to offer relief, as did the Aero 46A Weapon Loader, would be accepted with enthusiasm. Instead, the staff of the Handling Equipment Branch of the Ground Support Equipment Division (GSED) of Naval Air Systems Command, under whose responsibility the 46A loader had been designed and procured, suspected that the 46A loader might never be put into operational service. Concern was expressed that the

reasons for nonacceptance had to do with attitudes and prejudices, and that the equipment would not receive a fair trial during evaluation exercises.

The HFR project staff thus became interested in this device early in 1969 for the following reasons: (1) it appeared to be a relatively clear-cut case of a highly desirable innovation which was in trouble for subtle psychological reasons (there had been an unfavorable engineering evaluation which was discounted by the GSED people); (2) the device was to be introduced to squadron personnel almost immediately, and arrangements could be made for an HFR observer to observe the introduction and initial training; (3) the "experimental" design seemed very straightforward. Ordnancemen from a single squadron were to be interviewed before any introduction to the loader, and again after a week of training, to determine what attitudes had been formed and what factors seemed to be influential. Meanwhile, during the week, the training sessions would be observed for further clues. As it turned out, the first and third of the above reasons were grossly in error. Nevertheless, interesting and significant information was gained about equipment introduction in the Navy.

Actually, the 46A loader was part of a much larger innovation, a system for speeding the rearming of aircraft. Implementation of the entire system, under a program called IRRP--Improved Rearming Rate Program, included the construction of a new aircraft carrier (USS JOHN F. KENNEDY, CVA-67), procedural changes involving the ship's ordnance division, the aircraft handlers, and the aviation ordnancemen, and some shifting of responsibility for certain critical tasks between ship's company and squadron personnel.

The primary motivation for introducing the 46A loader was that the IRR system required the lifting of some exceptionally heavy loads--over 3,000 pounds--which were simply

impossible to lift manually. These loads were in the form of pre-loaded bomb racks, of which there are two types. The Triple Ejection Rack (TER) is a strongback from which three 250- or 500-pound bombs may be hung in a V-shaped configuration. It has within it electrically controlled devices for releasing the bombs. The Multiple Ejection Rack (MER) is a similar but longer device from which six bombs may be hung, three fore and three aft.

Normally, MER's and TER's are hung on the aircraft, swaybraced, and electrically checked by squadron ordnancemen. The bombs are then lifted and locked into the rack individually, swaybraced, fused, and armed. The tasks of electrical checking and swaybracing are taken very seriously by the squadron ordnancemen, since failure to perform these tasks correctly may result in "hung bombs"--bombs which do not eject over the target and must be carried back to the ship.

The IRR concept involves having the MER's and TER's loaded with bombs and electrically checked below decks by the ship's ordnancemen. Swaybracing of the bombs is also performed by the ship's company. The pre-loaded racks can theoretically be assembled ahead of time and stored in the ready magazine. At the proper time, they are brought to the flight deck by means of a special elevator/conveyor system, at which point they are taken to the aircraft by *squadron* ordnancemen for loading onto aircraft.

It is clear that a MER fully loaded with 500-pound bombs cannot be lifted manually to the wing of an aircraft. The 46A loader was designed for this purpose, and was also designed with enough flexibility to load single 1,000- and 2,000-pound bombs, a variety of missiles, and gun pods. The 46A loader must be seen, then, as the last link in a chain of innovations comprising a total system. The reason that this fact is important is that perceived deficiencies in the system

as a whole, either in concept or in hardware implementation, or negative attitudes developed toward other parts of the system, might conceivably have been reflected upon the particular device we were studying. (The reverse is also certainly true: negative attitudes developed toward specific parts of the system could generalize to the entire system and its underlying concepts.) Furthermore, any sense of disquiet or frustration due to the shifting of important responsibilities to people regarded as under-trained, incompetent, or unconcerned, might create doubts about the system and magnify real or imagined deficiencies in parts of the system.

A brief description of the loader appears in an engineering evaluation report by Kyser and Briggs (1968):

The Aero 46A1 weapon loader is a self-propelled vehicle with a cantilever boom for loading aerial stores on Navy aircraft aboard aircraft carriers. It is a 6,800-pound vehicle with a lift capacity of 4,500 pounds. Primary power is supplied by a two-cylinder, air-cooled diesel engine. Secondary power for boom and manipulator head operation is hydraulic. The official designation is weapon loader, aircraft, self-propelled Aero 46A1.

The manipulator head motion is provided in all directions: limited ram, lateral, and longitudinal as well as tilting, rolling, and yawing. The loader is equipped with a lift fork adapter which can be mounted to the manipulating head in six different positions.

The overall dimensions of the loader are approximately 16 feet long, 4 feet wide, and 2 feet high.

The 46A loader was designed to provide a single machine which would, with the proper adapters, load virtually any store upon any of the aircraft currently in use on carriers. The design was a modification of existing shore-based weapon loaders, which have been used very successfully by the Air Force and the Marine Corps. Specific design features, such as size, shape, type of wheels, method of control, and so

forth, presumably suit this device to the unique, dangerous and restrictive environment of the carrier flight deck.

The discussion to follow is more or less chronologically arranged. A project as large as the IRRP obviously takes years to implement. At the time the HFR project staff became aware of the 46A loader, it had already been designed and procured, and factory training had been conducted two years previously. A minority of the individuals to whom the device was then being "introduced" were already acquainted with it, had formed rather strong opinions and attitudes, and perhaps had communicated some of these to the men in their squadrons who had not yet had direct experience with the loader.

OBSERVATIONS AND INTERVIEW DATA

Factory Training (May, 1967)

When a device is procured by the Navy, factory training is typically part of the procurement package. A small group of men representing the potential users of the device is selected and brought to the factory where the device is explained and demonstrated to them in considerable detail. This training is typically conducted by engineers at the factory, and the emphasis is on hardware characteristics and maintenance rather than on operation of the device. When the device is finally distributed for operational use, the men who have been factory trained are expected to be able to operate and maintain it, and to provide on-the-job training for other users.

When the HFR project staff was making its initial search for innovations to study, the matter of factory training came up repeatedly in connection with a variety of devices and systems. Since for many devices factory training comprises the first introduction of a new development to

operating personnel, and since those selected for factory training are expected to act as experts, and to some degree evangelists, it would seem that attitudes formed at this time might be critical in later acceptance or nonacceptance. Repeatedly, however, factory training was characterized as inadequate and poorly administered. The engineers conducting the training are susceptible to at least three factors which can cause problems as they attempt to take the role of instructors: (1) they are usually much more highly educated than the Navy trainees and are intimately familiar with the particular equipment, so that they can "lose" their students rapidly; (2) they are not as familiar with the details and problems of the operating environment as are the trainees, and there may be profound differences between the engineers' perception of the operating environment and the trainees' perception of the physical and procedural constraints involved; (3) the engineers may be involved in the success of the machine to the extent that their perception of its deficiencies might be unconsciously distorted--they may be unwittingly biased by their own involvement.

Although there are indications that, since it is an early introduction of a device, factory training can be very important in forming positive or negative attitudes, a detailed study of factory training was not considered appropriate to the present investigation. Therefore, we have no objective information about the actual practices involved, the levels of competence actually achieved, or the percentage of instances in which positive or negative attitudes are generated towards equipment. All that can be said at present is that there seem to be many instances in which factory training is deemed less than satisfactory.

The potential impact of factory training upon attitudes, however, is well illustrated in the case of the 46A loader. The following is a portion of the transcript of an interview

with a squadron ordnanceman who attended the factory school (interviewer's statements are in brackets). The ordnanceman has just reported that when he first heard of the loader he was in favor of it because of the labor it would save, and since he was interested, he volunteered for the factory school.

[Your first impression was...] *Bad*. Right after I got to the factory and saw it operate. [No, but your *first* impression.] *First* impression was good. [But when you saw it...] Saw it operate for the first time, and one of the engineers at the company started a loader up and it ran wild in the workshop, and just about tore the shop to pieces. It was knocking over work benches--ended up spearing a rollaway tool chest. There were about eight or ten of us Navy personnel standing around, and we didn't want to laugh--but here's this poor guy that's got these forks sticking through a rollaway tool bin! Oh, no! Is this thing really going to operate?

So then we got it outside and we tried to operate it, and we blew three hydraulic systems, and everybody started panicking about that, 'cause if you get hydraulic fluid all over a flight deck, that causes problems. So everybody was a little bit leery of the thing at the time. So the first impression was bad.

[Did that change during the rest of the factory training?] Not really to a good point. Could see where with improvements it would work--not specifically for shipboard use--which seems to be what I keep bringing up, but it is a problem, I feel. Being in a seagoing outfit, that's what we're most interested in. At the time I saw it, I came back and I told them how I felt about it--that for land base it would be really fine, but I just couldn't comprehend the use of it on the flight deck.

Engineering Evaluation at Pt. Mugu (8 August - 10 October 1968)

At the time that the HFR project staff was first introduced to the problems of the 46A loader, reference was made to an unfavorable report on the loader by the Naval Missile Center, Pt. Mugu, California. We wished to obtain further

information about this, because the possibility had arisen that part of the loader's acceptance problem was due to design and maintenance characteristics as well as "psychological" factors. We were able to examine a copy of the engineering evaluation report (Kyser and Briggs, 1968) and to speak at some length with a representative of the Serviceability Division of the Naval Missile Center, Pt. Mugu. The following is the summary quoted from the report:

The Naval Missile Center, Pt. Mugu, performed an engineering evaluation of the Aero 46A1 Weapon Loader based on tests during loading demonstrations from 8 August 1968 through 10 October 1968. The purpose of this evaluation was to determine the suitability of the Aero 46A1 Weapon Loader to perform in actual usage under normal operating conditions with stores and airplanes presently aboard the aircraft carriers.

It was concluded that the Aero 46A1 loader requires more loading time than the existing unsatisfactory weapons loading systems. Correction or improvement of the design deficiencies would not improve the loading time. Attempts to decrease loading time using this loader would increase the hazards in an already hazardous loading situation. Thus the Aero 46A1 is not suitable for use aboard an aircraft carrier.

The detailed report itself was uniformly unfavorable. In connection with the expressed reservations of several ordnancemen we had interviewed, the following points in the engineering evaluation report are of special interest:

1. *Reliability.* During the last 40 days of the evaluation, the number of loaders available for use averaged close to 50%, and varied from nine loaders down to one loader down (average within a single day). This record of reliability seems to agree with informal estimates made during subsequent training and during the operational evaluation. A high degree of reliability on this device is imperative, since frequent malfunction can seriously impair effective weapon loading, and a machine which happens to go down at a

1

particularly critical time and place can halt the entire flow of weapons and aircraft on the flight deck. No ordnanceman wants to run the risk of having his equipment halt or interfere with flight deck operations.

2. *Control Problems.* The evaluation report states:

The combination of Aero 46A torsional stress, darkened ship, free-wheeling effect, reverse gear not properly engaging, oscillating motion of the boom due to hydraulic control, and hand-grip fatigue will increase the probability of airplane damage during loading operations to a virtual certainty.

A typical ordnanceman's feelings about such an event are expressed in the following excerpt:

The first time that somebody makes a mistake--and in our instance you're working within a half-inch of the aircraft main mount--the first time somebody slips on the controls, and they put a full load of bombs *through* the main mount, it knocks the plane down to the ground, probably breaks the wing spars and everything else--first time something happens, I *don't* want to be the operator! Because that fellow is going to have a lot of explaining to do, and it's going to be rough!

3. *Wheel Slippage.* Reference was made in the engineering evaluation report to the fact that the wheels of the loader tend to slip on a wet surface. The experience of many operators is that the loader will also slip on dry concrete and on the flight deck, particularly when it is wet or oily, which it frequently is. Again, the potential loss of control and the threat of damage to aircraft is a source of negative feelings toward the loader.

School at Cecil Field, Jacksonville (October, 1968)

Of the ordnancemen interviewed, four had been selected for an introductory training course at Cecil Field. One of these had already had factory training approximately 1-1/2 years before. The extent of the training is indicated by the

following excerpt:

Four of us from our shop--three days training. First two days we just learned about it--*how* to operate it--*how* to service it. Third day they let us operate it a little bit. Each of us took it out for about 20 minutes--very limited. [What kind of skill do you feel you have after 20 minutes practice?] I thought I was pretty good at the controls once we got into position, but the actual driving--getting into position; making those minute adjustments to the MER perfect so it will go right in--that will take more practice.

JFK Shakedown Cruise (6 November - 16 December 1968)

The 46A loaders were not taken aboard KENNEDY during this six-week cruise. During this time, and up until the time KENNEDY was deployed to the Mediterranean, there were extensive problems with the ordnance elevator/conveyor system. When asked later about their impression of the IRR system, a frequent response was, "Can't tell--nothing works." Although most of the men had not had direct experience with the 46A loaders at this point, it is not known to what extent their impression of the rest of the system colored their expectations for the loaders.

Lecture and Film at Oceana (20 January 1969)

Five aircraft squadrons were assigned to the KENNEDY. There were three attack squadrons flying A-4 aircraft (VA-81, VA-83, and VA-95) and two fighter squadrons flying F-4 aircraft (VF-14 and VF-32). VA-81 and VA-83 were stationed at Cecil Field, Jacksonville, Florida; VA-95 was at Alameda Naval Air Station, Alameda, California, and the two fighter squadrons were at Oceana Naval Air Station, near Norfolk, Virginia. Several 46A loaders were available at Cecil Field for training and practice, and, as has been mentioned before, a brief school was conducted there for selected members of VF-14. VA-95, on the West Coast, was somewhat isolated at this time; they had not been aboard the KENNEDY on the

shakedown cruise, and except for one or two individuals had seen none of the IRRP equipment as yet.

On 20 January, a representative of the Handling Equipment Branch of GSED, Naval Air Systems Command, came to Oceana to show a film and discuss the loader with the personnel of the fighter squadrons. This session was apparently part of a larger plan to give the fighter squadron personnel information about the loader and some experience with it. What the GSED people had in mind was to deliver to Oceana two 46A loaders, several skids and adapters, practice bombs, and an assembly line for bomb assembly. During the week of 3 February through 7 February, personnel from the ship's ordnance division were to be brought to Oceana to practice the bomb assembly routines and the loading of the multiple bomb racks; it was expected that squadron ordnancemen, using the 46A loader, would practice hanging these loads on their own aircraft. The four men from VF-14 who had been given the three-day introduction to the loader at Cecil Field *were expected to train the rest of the ordnancemen* in VF-14 and in VF-32. The week was to be culminated in a demonstration of the entire routine including assembling the bombs, preloading the MER's and TER's, and hanging the loads by means of the 46A loader; the demonstration was to be attended by engineering, administrative, and military personnel from Washington and Norfolk. It is clear in retrospect that the day's activities were to serve as a triumphant demonstration of the successful and speedy flow of weapons from palletized storage to aircraft wing.

Unfortunately, all these assumptions and expectations were not communicated effectively to the squadron personnel. The actual events of the week are listed below, and the interpretation of the situation as it appeared to the Weapons Officers of the two squadrons is also detailed.

*HFR Observer at Oceana NAS to Observe "Training" Sessions
(31 January - 7 February 1963)*

The HFR observer arrived at Oceana on Friday morning to interview as many ordnancemen as possible before they had any exposure to the 46A loader. He was not aware at this time that some of the men had already received training, and several more had seen the film and heard the presentation two weeks earlier. The weapons officer of VF-14, a Lt. (j.g.), had been identified by a GSED staff member as the coordinator for the week of training, and he arranged for interviews with nine of the men in his ordnance shop. Although a standard set of questions was used for all the interviews (see Appendix A), the men were encouraged to comment at length, and the interviewer probed frequently for fuller explanations of their feelings and perceptions. As a result of these interviews, a great deal of information was obtained about the characteristics of the operating environment as perceived by the ordnancemen, and about their hopes and fears concerning mechanical devices for bomb loading. Responses to the questions were categorized and tallied, and the results appear in Table 1.

TABLE 1
RESPONSES TO INTERVIEW QUESTIONS,²
OCEANA NAS, VF-14 SQUADRON

1. Operated loader?

School at Cecil Field	4
Instructor for Year	1
Factory Training	1
No	<u>4</u>
	10*

*One man had factory training and school at Cecil.

²Question numbers parallel questionnaire and Appendix A.

2. What is it designed to do?	
Save Physical Output	3
Load MER's and TER's	4
Cut Loading Time/Increase Speed	3
Cut Turnaround Time	3
4. What are its capabilities?	
Depends on Experience of Men	2
Can't Say till Proven Aboard Ship	3
Good on Shore	3
Everything They Say	1
Heavy Stuff Faster	1
Can't Compete with Hand Loading	1
Don't Know/Not Sure	3
Will Take Planning for Flight Deck Use	1
5. How easy to operate?	
Easy	4
Hard to Start and Stop Smoothly	4
Need Training	3
Can't Sav/Lack Experience	3
Bulky	1
Gears Unnecessary	1
Hard to Position	2
6. Maintenance?	
We Do Daily Checks	2
Maintained by Ship's People	4
Not Aware of Problems	5
Hydraulics Problems	2
Serious Maintenance Problems	1
7. Will it make your job easier?	
Yes	7
Not Faster/Not Shorter Day	4
No	1
Don't Know	1
8. Will it speed up rearming?	
Yes	1
Maybe/Don't Know	5
No	3

9.	Will IRR work without 46A?	
	Yes	1
	No	6
	Don't Know	1
10.	Good device for Navy?	
	Yes	5
	For Shore Base	2
	Don't Know	2
13.	Where first heard of 46A?	
	1 to 2 Years Ago	5
	3 Months Ago	3
	Recent	1
14.	What did you hear?	
	Load Pre-Loaded TER's/MER's	4
	Mechanical Trouble	1
	Negative Report on Making of Film	1
	Eliminate Work and/or Men	2
	Training Film	1
15.	What was your first impression of the loader?	
	Favorable	2
	Unfavorable/Skeptical	7
17.	Later impression?	
	Same	7
	Favorable to Wait/See	1
	Favorable to Unfavorable	1
19.	How long in Navy? Career?	
	1 to 2 Years	2
	3 to 4 Years	4
	8 to 11 Years	3
	Career	2
	No Career	7

By Monday morning, the practice bombs, various adapters, and the bomb assembly equipment had arrived and were being set up and organized under the direction of engineers who had come to supervise activities and demonstrate procedures. The men

from the ship also arrived and began practicing. The 46A loaders had not arrived, so there was no practice on Monday.

The loaders arrived by truck late Monday afternoon. While ordnancemen from both squadrons and other personnel stood around and watched, the 46A's were off-loaded using a manually operated chain hoist. This was a slow, laborious, awkward procedure, which tended to convey the impression that the 46A loader is a bulky, cumbersome piece of gear. This is exactly the opposite of the impression one would like to create for an equipment which must make delicate maneuvers in a very crowded environment. Those observing this operation appeared quiet and uncomfortable, as if the late arrival and awkward unloading were portents of bad things to come. The first loader off the truck would not start, so it was pushed out of the way. The second loader started, but emitted large clouds of black smoke all the time it was running. The engine noise (reportedly approximately 85 db) echoing inside the hanger was deafening. As if to climax an already thoroughly bad first impression, the machine could not be steered properly due to a lack of traction between the front wheels and the concrete slab. One of the watchers later commented that it had the appearance of a clumsy, crippled monster, roaring and gushing black smoke. The first day of "training," then, was an unqualified disaster for the 46A loader.

One loader was assigned to each squadron, and over the next three days, several ordnancemen got some degree of experience in manipulating the controls and hanging MER's and TER's. Of the four VF-14 ordnancemen who had received training at Cecil Field, three were totally unavailable during this period, and the fourth was assigned to other duties and only sporadically gave assistance during the practice sessions. Records were not kept of the precise activities of VF-32 at this time, but in VF-14, due to previous assignments and other

responsibilities, the composition of the three-man loading teams was different on each of the three days. Thus, no single group of men really learned to function efficiently as a team, and expert instruction in the operation of the loader was entirely absent.

During these three days of desultory practice, one other incident bears mentioning because of the unfavorable impression that it made. A MER, fully loaded with six 500-pound practice bombs, had been loaded onto an F-4 inboard station. During the off-loading, just as the MER was unlocked from the wing but before the lugs had cleared the slots, the 46A loader sputtered to a stop. Presumably, when a loader fails, it can be shifted into neutral gear and pushed out of the way or towed away for servicing. In this situation, however, with a 3,000-pound load riding on the boom and not quite free of the aircraft, any thought of towing or pushing would have been absurd. It was finally decided that the loader had probably run out of fuel, since the fuel tank is rather small, and there is no fuel guage! The opening to the fuel tank on the 46A loader is inside the engine compartment several inches directly below a supporting cross-member. It was quickly discovered that the position of the boom prevented complete opening of the engine compartment cover, and the cross-member further interfered with access to the fuel tank. It was further discovered that it is difficult to determine the amount of fuel in the tank from the fuel dip-stick, since the dip-stick is bright metal and the fuel is thin and clear. By the time the problem was diagnosed, more fuel obtained, and a makeshift funnel constructed to get the fuel into the tank, the loader (and the plane with it) had been stalled for well over half an hour. By this time, there was considerable cursing and remarks to the effect that such a situation on a flight deck would be completely intolerable.

Friday, 7 February, was marked by gloomy weather and gloomy ordnancemen. The men from VF-14 operating the loader had had no more than three to five hours of practice with virtually no instruction. The observers arrived and the demonstration began. Bombs were assembled smoothly and efficiently on the assembly line and several MER's and TER's were pre-loaded. The group moved outside to watch the loading of these stores on the aircraft. It was immediately evident that the loader operators were under-trained and nervous. The weather was cold and windy; everyone was uncomfortable. After a relatively short time, when it was obvious that the loading was going to take several times as long as the established criterion, the dignitaries left. Only two or three loads had actually been hung.

Although the events of the week, and particularly the demonstration on Friday, were largely discouraging, there were still some indications of optimism. One man, who operated a loader during the demonstration, afterwards made the following comments:

I think it will work with a TER--*on land*--I don't know about the MER. I haven't seen the MER yet. I'll have to wait and see. [How much of today's problems were due to the fact that you've only had a couple of days' practice?] If we'd learned the thing more--had more practice on it--we could do a lot better with it. Should just slide right in there and throw it right up. [If you had several months of practice on it and got really good, do you think it could be used on a flight deck?] Yeah, I think so. Yes.

On Monday, 10 February, a meeting was held by GSED staff members and consultants to evaluate the events of the preceding week and to recommend action for improving the situation. The result of this meeting was a memo to COMFAIR comparing the good performance of VA-81 and VA-83 (Cecil Field) with the "failure" of VF-14 and VF-32. The memo further asked that

training be ordered for these two squadrons.

In contrast with the assumptions and expectations of the GSED staff, the Lt. (j.g.), who suddenly found himself named as coordinator, had this viewpoint:

M_____ came down one Friday afternoon and said, "If I send this gear here, would you make sure that it is put in the proper place?" Well, that's fine. I thought he was just bringing down a loader. He left. About three days later messages came. I was lead coordinator for the IRR system. The skipper was a little ticked off--operations officer was ticked off--nobody was ticked off more than I was! We got all this--200 tons worth!--gear to Lt. (j.g.) H_____. Meanwhile, all these messages were getting sent to COMNAVAIRLANT, CNO, and everybody else-- and I had no idea what all this crap was. M_____ just designated me to take care of it. He's getting paid for the thing--why didn't he send somebody down to set it up? Wants this whole system set up so he says, "Hey, you--do it!"

So he's got all this gear coming--adapters, practice bombs--all this garbage just comes flying in--and then he sends the conveyor [assembly line] system for the people on the ship. We had to get it all set up--get fork lifts and so on--he sent two people down to help--and as soon as it's over--all the big shots --Mr. M_____ and Mr. N_____--think it's a terrific system, and it's going to work, but they're not going to do a thing to make it work--just say, "Well, you haven't done anything," and leave, and you're stuck there with the rest of the gear. I didn't fancy that too much at all.

So then messages went out saying that at Cecil they did fine but at Oceana nobody did anything. Well, at Cecil they had everything set up, and instructors. Mr. M_____ came down again right after that. Immediately, the skippers, operations officers, maintenance officers, and ordnance officers of VF-14 and VF-32 got on him--he found out right there that we didn't like a thing that he did. Then we got an instructor for a week.

While this weapons officer felt strongly negative about both the loader and the way it was introduced, he was still willing to admit the possibility of favorable attitudes:

[How much feeling about the loader is because of the loader itself, and how much is because of the way it was handled?] I don't have any love for Mr. M_____ and his group--I don't have any love for the loader either! Can't say how much is due to what. Guys that work with the loader think it is OK as long as it's running, but they keep going down. The other squadrons didn't have as much trouble, from what I understand.

The weapons officer of VF-32 essentially affirmed the foregoing account:

We were having trouble with people from NAVAIRSYSCOM trying to push it. M_____ got everybody mad to start with. He sent messages to the squadrons saying we *will* do this and we *will* do that, when we weren't really directed to.

He didn't go by the chain of command. CAG didn't know about it. We work for CAG, not for NAVAIR. We weren't scheduled to work with the loader, so M_____ didn't get the cooperation that he should have. M_____ was the biggest cause against the success of the 46A.

VA-95 Ordnancemen Interviewed at Alameda (13 February 1969)

The men of VA-95 were largely out of contact with the events at Cecil Field, at Oceana, and aboard the KENNEDY. Interviews with 13 men, including the weapons officer, indicated that nine of them had had no direct experience with the loader, two others had seen one, and two others had attended a school on the loader. The attitudes of the two who had used the loader were largely favorable, while most of the others tended to be somewhat skeptical. The best expression of their feelings is probably, "Wait and see." Four of the men had heard rumors that it was clumsy and/or jerky, and three others cited mechanical troubles or maintenance as a major problem. Four of the men, including the two who had already been to loader school, were leaving shortly for Cecil Field for a training course on the 46A.

Interview at Naval Missile Center, Pt. Mugu (23 February 1969)

An interview with the head of the Logistics Branch of the Serviceability Division of the Naval Missile Center, Pt. Mugu, supplemented the information obtained from the engineering evaluation report discussed earlier. Mr. G_____ stated that they do not have, and never have had, a satisfactory weapons loading system, although the program for developing one is 20 years old. He felt that the fundamental problem was that the Navy moves from a statement of need to quantity production in one step. In connection with the 46A loader, he stated that the fleet found this device on their dock with no provision for schooling, maintenance, storage, operational manuals, etc. The engineering evaluation was performed by his group on the basis of subsequent discussions with COMNAVAIRPAC representatives.

During the course of the discussion, Mr. G_____ questioned at least three of the basic assumptions underlying the IRRP and the 46A loader. First, he felt there was a question of whether it is feasible to preassemble and store MER's and TER's in all the possible configurations that might be needed; second, he questioned the necessity of designing a loader which can lift *any* store to *any* aircraft and is, therefore, greatly over-designed for light loads; third, he questioned whether the 20 to 30 minutes typically allowed for loading could actually be cut appreciably by using a loader. Some of these comments were reminiscent of specific doubts expressed by ordnancemen themselves; for example, several of the experienced ordnancemen were absolutely convinced that no mechanical device could load 250- or 500-pound bombs onto an aircraft faster than a "checked-out crew."

On a brief tour of the facility, Mr. G_____ pointed out several possible alternatives to the 46A loader, none with its versatility, but rather having such advantages as

smaller size, simplicity of operation, and minimal maintenance. In particular, there was a self-powered chain hoist designated HLU-196. It could be used for loading MER's, TER's, and other stores onto the A-4, but was not, at that time, suitable for the F-4. However, it was light enough to be operated by one man, considered highly reliable, and its operation reportedly was simple and smooth. The reason for dwelling on the HLU-196 at this point is that the men of VA-95 who went to Cecil Field for loader training were also introduced to the hoist there, and it was also available for use aboard the KENNEDY. Thus the acceptance of the 46A loader was complicated by the existence of a very attractive competitor, at least with respect to the A-4 aircraft.

Training at Oceana (24 February 1969)

As a result of the memo to COMFAIR from GSED, a warrant officer from COMFAIR, Norfolk, arrived at Oceana to supervise a week of training for VF-14 and VF-32. This training was apparently organized and successful, and was carried out with the full cooperation of the squadrons.

Corresponding to the difference in interpretation of the previous week of "training" described above, there seemed also to be a difference between squadron personnel and GSED personnel in the interpretation of the effect of the presence of the warrant officer. The squadron personnel felt that they cooperated with him because things were being done correctly this time, and they were able to agree to training procedures and policy. A comment from a GSED staff member indicated his continuing belief that, left on their own, the squadrons would accomplish nothing; in order to get anything accomplished, they had to have pressure applied from above.

Interviews with VA-95 and VF-14 Ordnancemen (28-31 March 1969)

The KENNEDY was scheduled for deployment to the Mediterranean on 3 April 1969. Therefore, by the end of March,

the squadron personnel had received all the shore-based training they were going to receive. The men of VA-95 and VF-14 were interviewed again to find out their feelings about what had happened thus far and their current attitudes toward the loader.

The results of these interviews indicated little change in attitude in VF-14. The general atmosphere was still one of skeptical open-mindedness. Their skepticism at this point was rooted largely in the maintenance problems that they had experienced that had prevented them in a number of cases from practicing with the loader. Only one individual of those interviewed had a very strongly negative attitude. VA-95 opinions shifted somewhat, partly due to the fact that they had now gained further direct contact with the device. There was a greater polarization of attitudes seen in this group. Two individuals expressed favorable attitudes, three expressed unfavorable attitudes; one stated, "On land for sure, but not aboard ship," and another expressed a desire to see it work, but wondered if it would.

The VA-95 weapons officer reported that the men who had gone to Cecil Field for training and were exposed to the HLU-196 chain hoist were so strongly in favor of it that he was afraid their motivation to work with the 46A loader was being impaired. He, therefore, ordered them to ignore the HLU-196 completely, to behave as if it didn't even exist. He felt that this improved their motivation with respect to the 46A loader. Four of the men reported favorable attitudes toward the chain hoist, and there were no unfavorable attitudes expressed. One of the men who had been at Cecil Field said, "As much as I like the loader, the hoist is far better. If they saw how the hoist operates, I really don't think there'd be much of an evaluation of the 46A loader."

It is rather interesting that of all the ordnancemen interviewed, two individuals who were very highly in favor of the HLU-196 hoist were also the most favorably disposed toward the 46A loader. We might have expected a contrast effect, whereby the perceived superiority of the chain hoist made the deficiencies of the loader more obvious and more frustrating. This effect seems not to have occurred, however, and it is certainly not illogical to regard both devices as distinctly superior to hand loading.

It is tempting to try to relate the differences in attitudes between the two squadrons to the unfortunate introduction experienced by VF-14 at Oceana, and this may well have been a causal factor. However, there were many other important differences between the two squadrons, such as type of aircraft, contact with other IRR equipment, morale, and so on. The data at this point were suggestive rather than conclusive.

GSED Staff Member Aboard the KENNEDY (Early June, 1969)

The operational evaluation (OPEVAL) of the entire IRR system was scheduled for mid-August. To be properly evaluated, all the hardware needed to be in good operating condition and an adequate amount of training and practice needed to be performed. On the day of the OPEVAL, over 200 tons of ordnance were to be flown off the ship, and all of this ordnance was to be handled by means of the new IRR hardware. In early June, Mr. M___ of the Handling Equipment Branch of GSED spent eight days aboard the KENNEDY evaluating the situation and making efforts to improve the condition of those parts of the system that were his responsibility. Subsequent to his return, he conveyed the following information:

They have the loader over in the Med, and the Skipper and the Admiral are the ones that determine that these guys are going to practice with this thing, so that they will have at least a chance of

looking halfway decent on the OPEVAL.

I went over there about three weeks ago and found out that they are in very bad shape on the whole, but some of the teams were making loads in two minutes. They knew exactly what they were doing, what happened when they grabbed this control or that control, but the other guys had not done their homework. They would grab a handle and move it just to see which way the bomb would go, which showed that they really hadn't studied it much.

This is where we are now. The Navy people have a psychological problem where they've got more jobs to do than the Air Force mechanics doing similar jobs. They don't have the time to practice on things like this, for one thing, and in the Air Force, a guy is a member of a loading team, and that's his whole job. In the Navy, the next week he might be down helping the guy in the laundry, or down in the mess as assistant cook or something.

The captain of the ship chewed me out--knew me from the Bureau. He pointed out that we are on the right track, but we've got to do better in the design of the hardware. At the same time, we do have personnel problems where we have to get this training straightened out. Again, the Air Force would not send people out with equipment of this type without having sent them through a very good schooling procedure and an examination procedure, showing their proficiency before being accredited as a qualified and certified ordnance-man. CNO has put out a directive on qualification and certification. They're having trouble implementing it.

Loading Exercises Aboard Ship (July and August, 1969)

In late July and early August, loading exercises were ordered aboard the ship, two to four hours, every other day at sea and every day in port. In an interview after the OPEVAL, one of the squadron weapons officers described the training this way:

We used different teams. We took times, trying to improve our times. In three weeks we reached our top proficiency. Right now, we're as good as we'll ever be. Every squadron feels the same. We've used it, and used it!

He also noted that "The machinery is not reliable at all-- so complicated mechanically." Another weapons officer estimated the required training time to be 70 to 80 hours. Apparently by the time of the OPEVAL, the squadron personnel felt that they had been trained as well as they could possibly be. There was still considerable dissatisfaction with the loader, however, mostly due to its low mechanical and hydraulic reliability, but also influenced by other design features such as the tendency to slip on the deck, poorly designed control handles, and so forth. A complete listing of specific complaints is quite lengthy.

OPEVAL (11 August 1969)

Because of the persistent mechanical problems associated with the 46A loader and the elevator/conveyor system, everyone interviewed aboard KENNEDY admitted the distinct possibility that the OPEVAL could become a major fiasco. As a matter of fact, however, during the day's strike operations, approximately 95% of the scheduled ordnance was flown off the carrier. In spite of this, squadron personnel reported the usual low reliability of the 46A loaders. Apparently the success of the day's operations was due in large measure to the HLU-196 powered hoist. One attack squadron reported using the hoist for 70% of their loads, and the other attack squadrons probably behaved similarly. This not only largely freed the attack squadrons from having to contend with the mechanical problems of the loaders, but also allowed these loaders to be used as back-up equipment for the fighter squadrons.

The official report on the OPEVAL subsequently issued by the Operational Test and Evaluation Force (OPTEVFOR) essentially confirmed the impressions of the squadron personnel:

Twenty-one failures of the Aero 46A occurred during the 17 hours of operation.

Ten Aero 46A weapon loaders were placed aboard KENNEDY for the evaluation. Two were inoperative

and eight were utilized for aircraft loading during strike operations. Of the 21 failures that occurred, 15 were corrected and the loaders returned to service. Of the eight Aero 46A loaders utilized, only two were in operating condition at the end of the day's strike operations. Maintenance data were collected for the Aero 46A loader during the month of July, which was the period of high usage during the conventional loading exercises. This data showed an availability of 40.6%...

Other observations made by the evaluation team also confirmed beliefs held by the ordnancemen and formed the basis of some of their attitudes. Some of these are listed briefly:

In the unloaded condition, the front wheels of the Aero 46A skidded laterally in the opposite direction of the intended turn when the flight deck was damp or the loader was in the arresting wire area.

The Aero 46A clutch did not operate smoothly and the loader tended to leap instead of making gradual movements.

The loading times for the Aero 46A did not meet the maximum time specified in reference (f) [criterion time of three minutes per load].

In training loading crews with the Aero 46A weapon loader, the end of significant learning occurred after approximately 15 practice loads.

Since the HLU-196 powered hoist had received such praise from the ordnancemen exposed to it, it is of interest to see if the operational data supported their enthusiasm. Again, we quote excerpts from the OPTEVFOR report:

The day and night loading times for the HLU-196E Powered Hoist were less than the desired maximum of three minutes per load as specified in reference (f).

Eight of the nine HLU-196E loaders were available at the end of one day's strike operations. Ten HLU-196E Powered Hoists were placed aboard KENNEDY for evaluation. Nine were available and six were utilized for loading A-4C aircraft during strike operations. Two hoist malfunctions occurred during the 17 hours of operations. One loader was

repaired in 45 minutes and the repair of the second was not attempted because of the availability of spare loaders.

In training loading crews with the HLU-196E Powered Hoist, no significant improvement in loading occurred after the first practice load.

Of the two mobile equipments, the Aero 46A was significantly (at the 0.05 level) more fatiguing to operate than the HLU-196E.

Thus it would seem that the differential attitudes expressed by ordnancemen with respect to the 46A loader and the HLU-196 hoist to a large degree had their roots in empirically valid beliefs about the two equipments. Members of the fighter squadrons, having watched the operation of the hoist with A-4 aircraft, expressed the wish that the hoist could be adapted for use with the F-4 also.

The final evaluation of the 46A loader by OPTEVFOR is as follows:

Conclusions

1. The Aero 46A does not meet the required aircraft arming rate.
2. In its present state, the Aero 46A is not suitable for use aboard CVA's because of reliability, flight deck handling characteristics, and excessive loading time.

Recommendation

The Aero 46A not be accepted for service use aboard CVA's.

CHRONOLOGICAL SUMMARY

May, 1967--Factory training.

8 August through 10 October 1968--Engineering evaluation at Naval Missile Center, Pt. Mugu.

- October, 1968*--School at Cecil Field, attended by four ordnancemen from VF-14.
- 6 November through 16 December 1968*--KENNEDY shakedown cruise. 46A loaders not yet aboard.
- 20 January 1969*--Lecture and film at Oceana NAS by GSED staff member to introduce IRRP and loader to VF-14 and VF-32.
- 31 January through 7 February 1969*--HFR staff member at Oceana NAS to observe "training" sessions with 46A.
- 3 February 1969*--46A's arrive at Oceana late in day. No training.
- 4 February through 6 February 1969*--Desultory practice with little guidance or instruction.
- 7 February 1969*--Demonstration of bomb assembly and loading. Loading generally unsuccessful because of inadequate training.
- 10 February 1969*--GSED staff meeting; postmortem on week of "training" at Oceana. Memo to COMFAIR citing "failure" of VF-14 and VF-32, and asking for training to be ordered.
- 13 February 1969*--Interviews of VA-95 ordnancemen at Alameda NAS by HFR observer.
- 23 February 1969*--Interview at Naval Missile Center, Pt. Mugu, where unfavorable engineering evaluation report was generated.
- 24 February 1969*--Warrant officer from COMFAIR, Norfolk, arrives at Oceana to supervise week of training for VF-14 and VF-32. (Men from VA-95 going to Cecil Field for training.)
- 28 March and 31 March 1969*--Interviews with VA-95 and VF-14 ordnancemen just before deployment of KENNEDY.
- 3 April 1969*--KENNEDY deployed to Mediterranean.
- Mid-May, 1969*--Operational Readiness Inspection.
- Early June, 1969*--GSED staff member aboard KENNEDY for eight days to see about equipment and training.
- 25 July 1969*--Conversation with GSED staff member who was aboard KENNEDY. Training reportedly still inadequate.

Late July through Early August, 1969--Loading exercises ordered, every other day at sea and every day in port

11 August 1969--OPEVAL of entire IRR system, including 46A loader.

12 August through 15 August 1969--Interviews aboard KENNEDY following OPEVAL, by HFR observers.

January, 1970--OPEVAL report issued by OPTEVFOR; 46A loader not recommended for use aboard carriers.

ANALYSIS IN TERMS OF INNOVATION ACCEPTANCE

The ultimate nonacceptance of the 46A loader for operational service depended very little, if at all, on the action of subtle psychological factors. Objective evidence indicated that the equipment was not capable of carrying out the functions for which it was designed in the shipboard environment, and the only hope of controverting the data would be to show that the operators were inept. This, it seems, would be difficult to argue unless one could demonstrate that the skills required to operate the loader properly were vastly more refined than anyone up to this point had imagined. The obvious, objective deficiencies of the device thus tended to obscure more subtle factors in its history which might have lead to rejections and resistances of a less obvious kind even if it had been accepted on a technical basis. The factors do seem to be there, although their effects tend to be seen in the verbal responses of those interviewed rather than in their behavior with respect to the loader.

For the sake of discussion, the factors that either actually or potentially contributed to negative evaluation of the loader can be grouped into two large categories: (1) factors directly connected with the hardware, and (2) factors associated with advocacy, that is, the attempt to "sell" the device. The factors directly connected with the hardware can

be further subdivided into four categories: (1) physical, (2) psychological, (3) conceptual, and (4) support. The factors associated with advocacy can best be discussed under a series of questions.

Beginning with the factors directly connected with the hardware, the *physical factors* are the ones which led to the negative evaluation by OPTEVFOR and became the primary justification given by those ordnancemen who disliked the loader. These physical factors may be thought of in four groups: (1) internal weaknesses, which would be exemplified by most of the mechanical and hydraulic maintenance problems which plagued the loader; (2) mismatch with the operating environment, illustrated by the tendency of the wheels to lose traction on the flight deck or the tendency of the loader to jerk or jump in an environment where one is working very close to expensive aircraft; (3) mismatch with the capacities of the human operators, which includes such examples as the unreadable fuel dip-stick, the fatigue-producing driving controls, and the very short, hard-to-control hydraulic control levers; (4) mismatch with other elements in the system, for which there is no glaring example in connection with the loader.

Under *psychological factors*, we consider how the device is perceived. In the case of the loader, it gives the impression of being bulky and cumbersome to ordnancemen, who try to visualize it in a crowded, chaotic environment. In the face of this sort of perception, it is probably useless to argue the point or cite measurements. If the device is in fact not bulky and cumbersome, and can operate effectively in its intended environment, perhaps actual demonstrations and direct experience are the most effective ways of making the point.

Conceptual factors have to do with the definition of the need or the nature of the requirement that the device is intended to fill. The problem is illustrated by the differing opinions as to whether it is most desirable to have a completely general purpose loader as opposed to less complex special purpose loaders and even a continuation of hand-loading with the lighter ordnance. These are considerations that need to be hammered out and, hopefully, thoroughly resolved before hardware is designed and procured, if resistance is to be minimized. In particular, if the designers and the potential users have different philosophies about what ought to be done, there will be resistance or rejection unless efforts are made either to incorporate the users' approach into the design, or to change the users' philosophy before the device is delivered. If there are conceptual disagreements at the design level which are not resolved, it may be expected that similar questions may be raised by the users when the device is placed in the operating environment.

By *support factors*, we mean essentially the documentation. This may include such things as operating manuals, maintenance manuals, and training materials. Such documentation in connection with the 46A loader was either missing or inadequate in important respects. Inadequate supporting materials may make it unnecessarily difficult to operate or maintain a piece of equipment, leading to adverse emotional reactions which may generalize to the equipment itself.

Before discussing the factors associated with advocacy, it should first be clearly understood that acceptance of equipment is not always a unitary event. In fact, in practical situations, a single, once-and-for-all acceptance or rejection of an innovation may be a rare case. The acceptance process is non-unitary in at least three ways. First, the introduction process may be extended over a considerable

period of time, and initially negative reactions may be eliminated gradually through education, experience with the innovation, and so forth; or, perhaps, initially positive reactions may be counteracted by unfortunate experiences. Second, especially if the innovation is a large, complex system, there may be numerous individuals and groups whose behavior will be modified by the innovation; these people may have widely differing competence, education, intelligence, and involvement with the innovation. Thus, different amounts and types of information, different types of presentation, and perhaps even different change advocates might be required to introduce the innovation smoothly. Third, in an organization such as the Navy, where there is a well defined hierarchy of authority, it may be necessary to introduce an innovation to individuals who are not directly affected by it, but who must recognize, evaluate, and approve it; again, the type of advocacy may have to be modified to allow for different areas and levels of responsibility.

The following set of questions directed toward the problem of advocacy embodies the factors which are suggested by an examination of the history of the 46A loader. In most cases, at least one illustrative reference is made to that history.

1. *To what different persons and groups does the innovation have to be introduced?* The importance of this question is discussed above. In the case of the 46A loader, attempts were made to introduce the loader over a period of time to the squadron ordnancemen. Other individuals whose roles may be affected by the use of the loader, such as the aircraft handlers, the light deck officer, the hanger deck officer, and those in charge of planning for maintenance may not have been made fully cognizant of the ways in which the 46A loader might affect their lives. In retrospect, the source of resistance as perceived by GSED is not clear, although from

the available evidence, one surmises that they felt that unknown psychological factors were generating resistances in the users (the ordnancemen) which would be communicated to OPIEVFOR, possibly resulting in official rejection of the device. In any case, the loader had an important impact upon people other than the ones who operated the controls, and it seems that this fact was not sufficiently taken into account. GSED did not clearly identify the sources of resistance, and did not direct effective countermeasures against them.

2. *What do they need to know about the innovation?* Essentially, what they need to know is whatever will allow them to adjust to the presence of the innovation and, hopefully, take advantage of its benefits. There seems to be a feeling, sometimes shared by the men themselves, that military personnel, particularly those in the lower grades, need to know as little as possible about anything save their own immediate responsibilities. Acting on this sort of policy provides a social situation conducive to misinformation and rumor. Most Navy men develop not only the skills necessary to carry out their own tasks, but also ideas about the roles of others, and how the various roles interact. If an innovation threatens to modify not only their own behavior, but the interface between their own responsibilities and the responsibilities of others, these aspects need to be clarified, explained, and justified. Otherwise, the change agent and the change advocate may simply stir anxieties and lose credibility. The change advocate should be prepared at some point to deal with the following issues:
 - a. The overall purposes of the innovation.
 - b. Direct and indirect benefits to these users.
 - c. Benefits to the system.
 - d. Real or apparent drawbacks compared with the old way.

- e. What adjustments must be made in the users' behavior patterns.
 - f. How these adjustments will be achieved (formal re-training, personal responsibility of the user, etc.).
 - g. What new responsibilities are entailed.
 - h. What present responsibilities are to be reassigned to other personnel.
 - i. To whom these responsibilities are being reassigned, and what their preparation for carrying them out will be.
 - j. How those in the chain of command will be made aware that these responsibilities have been reassigned.
3. *Who Is to be the Change Advocate?* Factors for selecting the change advocate are discussed elsewhere in this report. In the case of the loader, it is probable that the change advocate was not selected optimally in some instances, and in other instances, there was no clearly identified change advocate at all.
 4. *What Is Required to Establish the Credibility of the Change Advocate?* There is evidence that Mr. M___ enjoyed rather low credibility in his interaction with the two fighter squadrons. The source of this problem seems to have been his inability to convey the impression that he understood their working environment intimately enough. The impression given was that he was proposing sweeping changes without understanding the problems that were involved.
 5. *What Is Required to Establish the Authority of the Change Advocate?* Even a more serious problem to Mr. M___ than his low credibility was his lack of authority (as perceived by the squadron personnel) to demand the activities which they perceived him to be demanding. This factor more than any other seems to have been the cause of the fiasco at Oceana.
 6. *What Threats Does the Innovation Present?* These can be quite diverse. In the case of ordnance, there is always a threat of physical danger,

and many of the current, habitual procedures and routines are designed to minimize this danger. Proposed changes in these routines may suggest increased danger. On a more subtle level, introduction of an innovation almost always constitutes an attack on current competence (unless virtually no training is required), since at least in the short run, new, unfamiliar behaviors will be required and habitual responses will be inappropriate. Naturally, adequate re-training is one answer to this problem. On an even more subtle level, there is threat to the self-image. There was an occasional indication among the ordnancemen of pride in their arduous muscular activities, their strength, and stamina. A mechanical loader, in the very process of saving labor, threatens that self-image.

7. *At Each Stage of the Introduction Process, What Does the Change Advocate Expect of the Men, What Do the Users Expect of the Change Advocate, and Are the Two Sets of Expectations Explicitly Known and Agreed to by Both Parties?* The particular set of understandings referred to here was again suggested by the interaction between Mr. M_____ and the fighter squadrons in February. Mutual understanding of expectations would probably have resulted in a clarification and resolution of the authority question mentioned earlier. Certainly the element of surprise which resulted in such negative reactions to Mr. M_____ and the new equipment would not have been present.
8. *How Soon Is It Feasible to Allow Direct Experience with the Innovation?* In spite of all the perceived deficiencies of the 46A loader, the most favorable attitudes toward the loader were found in those who had used it extensively (this is not to say that all those who used it extensively were favorable toward it). Those who had had little experience with it, and relied on rumor and casual observation, tended almost uniformly to be somewhat skeptical. This is in line with findings of other studies that direct experience is frequently a powerful factor in acceptance. In the case of the 46A loader, which is clearly a mixed bag of good and bad features, direct experience resulted in greater acceptance in some cases and greater rejection

in others. For both outcomes, the development of these attitudes depended more and more on the experiences of the operators, and less and less on more subtle "psychological" factors. Among those who continued to have negative feelings about the loader, there was a drift toward objective justification for their rejection. For example, in February, frequently mentioned reasons for skepticism had to do with bulkiness, clumsiness, and slowness; by August, primary consideration was low reliability. While it may be that low reliability is an overriding determiner of attitudes toward equipment once it is discovered, there is also the suggestion here that direct experience tends to result in more objective evaluations. By August, those who disliked the loader disliked it because it was unreliable; those who liked it liked it because they found they could make it do the job to their satisfaction.

In view of the fact that the analysis given above puts a heavy burden upon equipment unreliability as a determiner of unfavorable attitudes, it should be pointed out that there were numerous times when Navy men indicated that they do not necessarily expect a new piece of gear or a new system to work perfectly the first time it is tried. They realize that even in a potentially good piece of gear, it may take some time to work the bugs out. In the case of the 46A, however, the amount of unreliability was regarded as intolerably excessive even for a new piece of equipment, and it was generally known that the device had been under development for some time--long enough to get many of the bugs worked out.

The above discussion implies that the role of change advocate be taken seriously. Analysis of the observations made of this case of innovation introduction and others repeatedly indicates that the activity of a qualified change advocate goes a long way in generating user acceptance. There are three cases to watch out for: (1) the unqualified change advocate; (2) the change advocacy role relegated to documentation; (3) no explicit change advocacy at all.

The case of the poorly qualified change advocate need not be discussed at length here, since the characteristics of a qualified change advocate are discussed elsewhere. It is sufficient here merely to point out that if the change advocate's expertise, credibility, or motivations are suspect, the potential users may feel they are being "snowed" or "sold a bill of goods," and begin to suspect the innovation as well as the change advocate.

Particularly in the case where an innovation must be introduced to a variety of individuals and groups, it may be the case that explicit change advocates are used for some of the introductions, but in other instances, the role of change advocacy devolves upon official letters, reports, manuals, and other documentation. While it may appear that there are advantages to this technique in terms of economy and efficiency, it is our recommendation that this type of change advocacy be resisted as much as possible. There is evidence from another case history in the present study that information conveyed even in well prepared documentation can be misperceived and misunderstood, resulting in (or at least reinforcing) apathy or other forms of resistance. Without face-to-face encounter, there is no opportunity to discover or deal with these resistances, so the risks of the method rapidly outweigh its apparent efficiency.

Perhaps the most glaring violation of good practice in innovation introduction is that case where the device is expected to explain itself and sell itself. There are no doubt some devices which are sufficiently simple to understand, operate, and maintain, and whose benefits are so large and obvious, that they do in fact sell themselves. The HLU-196 hoist may be a case in point. However, our impression is that these cases are relatively rare, and the practice of delivering an innovation to the potential users

with no attempt at explanation or advocacy at all should be firmly discouraged. Implementation of a solution to a problem almost inevitably requires compromises and other decisions which may run counter to the users' perception of the situation. In the most extreme case, the users may not even fully recognize the existence of the problem which is suddenly to be solved for them! Since the designers of the innovation may not even be aware of these user perceptions and potential objections, they need to be explicitly sought out and taken into account, both in the design of the innovation and in the introduction procedures.

The final point, related to the point just made, is that some of the questions listed above are applicable before the innovation is designed as well as when it is to be introduced. In other words, the perceptions of the potential users concerning the operating environment--its problems and restrictions, both physical and procedural--should be considered important inputs in the design of an innovation. It seems more than likely that, if such inputs had been received from ordnancemen, squadron weapons officers, aircraft handlers, and flight deck officers during the design and prototype phases of the development of the 46A loader, its introduction might have turned out quite differently.

CHAPTER 4

CASE 2. A STUDY OF THE INTRODUCTION OF A TRAINING DEVICE (GENERALIZED SONAR MAINTENANCE TRAINER, DEVICE 14E22)

BACKGROUND

Like operational equipment, training devices sometimes have also been known to suffer from a lack of acceptance. Thus, it was considered desirable to document a case of equipment introduction involving a training device. Furthermore, since other devices being considered for study in this investigation had already shown some indications of lack of acceptance, a case displaying a preponderance of positive attitudes seemed desirable for contrast. A case fulfilling these two criteria was close at hand. HFR had designed, built, and evaluated two prototype models of a Generalized Sonar Maintenance Trainer (GSMT), and the device was about to be introduced for the first time to a group of instructors at the Fleet A3W School, San Diego. An additional fact about the GSMT is that it involved not only a new piece of hardware, but a different philosophy of training as well. In the discussion to follow, it is useful to keep in mind that there was a conceptual innovation as well as new hardware; acceptance of one does not necessarily imply acceptance of the other.

The purpose and the essential characteristics of the GSMT were described in a technical report by DePauli and Parker (1968):

The basic premise underlying the development of the device is that functional and design similarities exist among contemporary sonar equipments and that these similarities give rise to a common set of maintenance requirements. By incorporating circuitry common to a variety of sonars into a single

training device, skills and knowledges acquired through its use will transfer to any of a variety of actual sonar equipments. Thus, many maintenance requirements can be met, without tying up costly prime equipment.

The device is not intended to be a complete substitute for experience during the training cycle with real sonar equipment. Rather, it is designed to help the student *transfer* the theoretical knowledge of electronics acquired in the classroom to a set of practical skills related to sonar equipment maintenance. The device allows the student to acquire an understanding of the organization and function of sonar systems and allows him to learn sonar calibration, alignment, preventive maintenance, and simple troubleshooting.

The trainer has an inherent advantage over prime sonar equipment used for training because it does not have to meet the power or packaging requirements of actual sonars. Rather, all circuitry can be arranged for maximum training effectiveness, with all components conveniently recognizable and accessible.

An understanding of the context for this innovation requires a brief description of the training that a sonar technician receives. The following sequence of courses is taken before the sonar technician is assigned to operate and maintain a particular type of sonar equipment aboard ship: (1) Basic Electricity and Electronics; (2) A1-School (training in operation of sonar); (3) A2-School (intermediate general electronics); (4) C-School (maintenance of a particular model of sonar equipment). It should be noted that actual maintenance training occurs only in C-School, and that it is with respect to a particular type of prime equipment. Problem areas in this training sequence are:

1. Great difficulty in transferring electronic knowledge gained in A2-School to the calibration, troubleshooting, and repair skills required in C-School

2. Difficulty in seeing the similarity between the highly simplified circuits introduced in A2-School and the circuits found in actual sonar sets.
3. Feelings of fear and hopelessness engendered by the sudden transition from simple circuits involving a dozen or less components to a sonar set with several large cabinets densely packed with thousands of components.
4. Difficulties in understanding the functions and interactions of subsystems in a sonar set, since in A2-School, the various types of circuits are not presented as functioning in a larger system.
5. After C-School, difficulty in transferring knowledge from one type of sonar gear to another, since "difference in manufacturing techniques, packaging practices, document preparation, console design, and control selection all obscure the fact that sonars are very much alike" (DePauli and Parker, 1968).

The GSMT was conceived as a trainer that would bridge the gap between the simplicity and generality of A2-School and the complexity and specificity of C-School. It was designed to give the students practical experience on equipment which has many of the characteristics of prime sonar equipment, but with less complexity, and with the components and subsystems arranged according to educational criteria rather than on the basis of constraints of packaging and installation.

The two innovative aspects mentioned before can now be clearly seen. On the one hand, there is the concept of generalized systems training, based upon a careful analysis of commonalities between various models of prime equipment. On the other hand, there is a specific device, the GSMT, which not only exemplifies generalized systems training, but also provides a needed bridge for the transfer of knowledge between existing courses. It is possible for the device to be accepted enthusiastically because it fills the need to mediate between the two courses, while its full potential as

a generalized systems trainer is not appreciated.

Early in 1965, an investigation was carried out to determine the feasibility and desirability of developing a generalized trainer. In 1966, an experimental GSMT was constructed, and a preliminary study to evaluate its effectiveness was carried out at the Fleet ASW School, San Diego. Experimentation with the prototype trainer in the classroom, although generally very favorable, suggested ways in which it might be improved. In addition, helpful suggestions were contributed by personnel of the ASW School, San Diego. An improved model of the GSMT was constructed in 1967, incorporating the suggested improvements; this model became known as the production prototype.

A more extensive evaluation of the GSMT was desirable, and this was carried out from March through August of 1968 at the Fleet Sonar School, Key West. It was desired that this take the form of a field test of the GSMT. That is, the normal sequence of events at the sonar school would be disturbed as little as possible during the conduct of the investigation, and, in particular, actual use of the GSMT would be left to Navy instructors who would normally be teaching maintenance classes at that time. The HFR staff prepared a maintenance/training manual, installed the GSMT, selected three matched groups of subjects for the experiment, conducted detailed briefings on the GSMT for the school personnel, conducted special training sessions for the instructors who would be using the GSMT in their classes, and provided a criterion test oriented toward the practical aspects of sonar maintenance. The HFR personnel left Key West before instruction of the experimental subjects began.

The data indicated that the GSMT was an effective aid to learning, and, in particular, that its use benefited students who were in the lower groups in academic aptitude.

That is, ability to perform well depended less on intellectual skills when the GSMT was used than it did when there was greater dependence on lectures and written tests. Furthermore, DePauli and Parker (1968) noted that "the Generalized Sonar Maintenance Trainer is accepted as an effective aid to learning by the instructors using the device. The instructors who used the trainer indicated that they feel the device is both utilitarian and desirable for use in training sonar technicians."

INTERVIEW DATA

On 2 April 1969, interviews were conducted with three of the staff at the Sonar School, Key West, who had had contact with the GSMT during its introduction there. One was in an administrative position and was not directly concerned with the GSMT, but had taken a strong interest in it; the other two were instructors who had used the GSMT during the evaluation study. All three had decidedly favorable attitudes toward the device, although somewhat different opinions as to how it should be used. One instructor thought it should be worked into the A2 curriculum, while the other instructor thought it should be used in a new two-week transition course between A2- and C-Schools. Apparently there were no operating problems and no serious maintenance problems. They characterized it as "great" and "outstanding," and cited some of its advantages:

1. Good for transition from theory to practical situations.
2. Instructor needs less time to motivate sailors because it looks less complicated.
3. Outstanding the way the cabinet folds out to show circuits being talked about.

4. Helps to teach test equipment.
5. Student can learn troubleshooting without building actual circuits.
6. Teaches students to read schematics
7. Easy to use.

Their recommendations concerning the device included dropping some of the then current lab activities and incorporating the GSMT into A2-School, and making three or four units available in a classroom so that more students can get hands-on experience.

Just prior to our interviews at Key West, the ASW School, San Diego, had been given the responsibility for revising the A2 curriculum. Partly as a result of the effectiveness and acceptance of the device demonstrated to this point, the San Diego personnel were also to determine how the use of the GSMT could be incorporated into the new A2 curriculum (although they were *not* the personnel having first-hand experience with it). The GSMT was, therefore, shipped from Key West to San Diego and arrived mid-April, 1969. It arrived in San Diego in somewhat damaged condition (some tubes broken, wires pulled loose, etc.); thus, the introduction to the San Diego personnel was not ideal--their first task was to repair the damage and get it in operating condition.

By this time, HFR had no official responsibilities with respect to the GSMT. Its movements and use were governed completely by Navy procedures. However, HFR was asked by Naval Training Device Center to conduct a briefing to introduce the GSMT to the San Diego personnel, and this briefing was set for 23 April 1969. Arrangements were also made for project personnel to interview the instructors at San Diego on the day before the briefing. This was to determine the extent of their exposure to or experience with the GSMT up

to this point, and to see what attitudes and opinions had been formed. The intention was to follow up these interviews with later observations as the instructors gained experience with the GSMT and as the new curriculum was put into effect.

Fifteen men were interviewed. Only two men had examined the device closely, the two who had had the responsibility of repairing the damage. Only three said that they had never heard of it or had no idea of what it was. The remaining twelve had either seen literature on it, had heard it discussed among their colleagues, or had made a cursory examination of it as it was being repaired. Eleven of these reported favorable attitudes toward the device, and the twelfth favored the idea but disliked the device. Specific negative items mentioned by various men at this time were:

1. Desire for better designed manual. (2)
2. Design is crude, flimsy. (5)
3. Need several GSMT's--8 or so (this reflected a conviction that they wouldn't get enough units per classroom to do the job right). (2)

Some of the positive features or benefits of the GSMT which were mentioned were:

1. It has circuits common to several sonars. (2)
2. Helps to show relationships (either between parts and whole or between schematics and hardware). (5)
3. Provides bridge between A2- and C-Schools and reduces fears. (4)
4. Helps teach calibration and use of test equipment. (1)
5. Allows trainee to see circuits in action in relation to each other. (10)

Twelve of the men interviewed suggested that material presently in the A2 curriculum should be dispensed with in favor of using the GSMT.

An interesting phenomenon occurred during these interviews which suggests a technique for introducing an innovation, a technique which seems to counteract the familiar "not-invented-here" reaction to a large extent. The success of this technique assumes that the innovation is well designed and is in fact responsive to the real needs of the intended users.

What occurred was that some of the questions asked during the interviews dealt with the nature of the present curriculum and deficiencies in it, and the nature of the present training devices and their strengths and weaknesses. The instructors were also asked to suggest improvements in the curriculum and training devices. Although knowing little about the GSMT, many of the participants suggested changes and characteristics that had been considered in designing the GSMT, and some men came close to describing its actual characteristics. In short, they did "invent-it-here"--one day before it was formerly introduced to them. During the briefing the following day, there was a great deal of nodding and smiling, and during the question period and after the meeting, no serious objections were raised.

As an example of this phenomenon, the following statements were made by an instructor who claimed that he never had heard previously of the GSMT:

Most of the men are afraid when they see sonar equipment for the first time. We have to acquaint them with something more complex looking than the simple circuits they get in A2-School. It takes a while to get them in so that they aren't afraid of messing up. The training devices [small chassis with simple circuits] teach what is needed, but don't generate confidence. I would like something

fairly large, but that would have all the basic circuits, so they can go from one circuit to another. With the current equipment, they learn one tube or one circuit at a time, and can't see where it works with anything else. If they could see the total, they would be more ready for C-School.

It is obvious that acceptance will be facilitated if a device can be produced which is responsive to expressed desires and needs. If such comments can be elicited before the introduction of the innovation, the introduction can stress the ways in which the innovation meets these expressed needs. Better still, if the development of the device were influenced in some degree by similar comments from men like those to whom it is being introduced, pointing this out can be a further reinforcement of the idea that the device was designed to fit their needs as they see them.

The briefing by the HFR engineer appeared to be highly successful in terms of acceptance. The factors operating to enhance acceptance appeared to be:

1. The fact that the device had been designed and improved with the advice of sonarmen.
2. The fact that the engineer conducting the briefing was one of the designers of the GSMT and was able to field technical questions competently, since he thoroughly understood both the GSMT and the prime sonar equipment.
3. The fact that we had discovered their perceptions both of their problems and the inadequacies of their current training devices, and were able to relate the capabilities of the GSMT to their expressed needs.
4. The fact that many of the improvements that they had suggested with respect to their training devices were already embodied in the GSMT.

Two months later, on 24 June 1969, further interviews were conducted with four representatives at the ASW School,

San Diego. These men--the Surface Maintenance Training Officer, two Chief Petty Officers, and a Petty Officer First Class--were the only personnel who were at this time involved in any way with the GSMT and the A2 curriculum revision. The Chief Petty Officer originally assigned the responsibility of curriculum revision had been reassigned, and these men had recently begun the job all over again. At this point, they were rewriting the course objectives, eliminating some theoretical material, and making troubleshooting the basic approach. The revision was progressing slower than expected, and they were still having some difficulties getting the GSMT to work properly, but their goal was to run through a trial curriculum by Christmas, make necessary modifications, and test the final curriculum by March. They still seemed excited about the new curriculum and the GSMT. They felt that the present A2 course, even with the C-School which follows it, does not prepare a man to service sonars aboard ship. Therefore, the instructors had tended to feel that they were wasting their time teaching a useless course. Those working on the new curriculum expected a good reception for the curriculum revisions at the instructor level, although they hinted vaguely about possible resistance to their innovations when the curriculum was submitted to BUPERS. Interest still seemed to be high among the other instructors; one of the Chiefs mentioned that they still keep asking when the GSMT will be available for use.

During this time, Naval Training Device Center was drawing up specifications and, otherwise, preparing to procure several copies of the prototype GSMT which was now at San Diego. There were some indications of pessimism at San Diego with respect to both the number of units that would finally become available and the delivery date. It was hoped that there would be four units for each class, so that all the trainees could use the equipment (mere observation of others

using the equipment was considered worthless), and it was further hoped that the units would be delivered by Christmas so that an evaluation of the new curriculum might be made. However, those writing the curriculum were not sure they could count on delivery by Christmas, and were quite sure they could not get as many units as they would like. Their enthusiasm was dampened somewhat by these considerations.

Early in September, 1969, the same instructors were interviewed again for the purpose of seeing what progress had been made and whether there had been a decline in favorable attitudes over time. The major discovery from these interviews was that the work on the new curriculum had been ordered stopped due to the fact that no date could be set for delivery of production copies of the GSMT. The result of this order was a sense of frustration among the men who had been working on the new curriculum, since they had invested a good deal of time and thought up to this point, and were anxious to try out their ideas. They felt additionally frustrated because, as they saw it, if the project were stopped now, whoever picked it up later would have to start from scratch again, and all the work and thinking they had done would be lost. There was some thought of continuing with the development of a pilot course using the GSMT which was already there. This would at least provide some test of the validity of their ideas, and furnish a firmer basis for whoever took up the project later. But the main feeling was one of disappointment and frustration, and the target of these feelings was not the device, but the Naval Training Device Center.

A final check in the spring of 1970 revealed that, while the curriculum was essentially completed, no official word had yet been received to revive the project. Furthermore, the prototype GSMT had been shipped to Naval Training

Device Center, and there was no possibility of working with the hardware or trying out the curriculum revision until the delivery of the production models.³ There was still interest in having and using the device, but less enthusiasm for starting the curriculum project for the fourth time.

CHRONOLOGICAL SUMMARY

Early 1965--Study of feasibility and desirability of GSMT.

1966--Construction of experimental trainer; evaluation of GSMT at Fleet ASW School, San Diego.

1967--Construction of improved prototype GSMT.

March - August 1968--Evaluation of GSMT at Fleet Sonar School, Key West.

Early 1969--ASW School, San Diego, given responsibility for revising ST A2 curriculum, incorporating GSMT.

2 April 1969--Interviews with Key West personnel involved with GSMT.

Mid-April, 1969--Arrival of GSMT at San Diego.

22 April 1969--Interviews with San Diego personnel who would have contact with the GSMT.

23 April 1969--Observed briefing on use and capabilities of GSMT for A2 instructors, conducted by HFR engineer.

24 June 1969--Interviews with San Diego instructors revising curriculum.

9 September 1969--Interviews with San Diego instructors; curriculum revision stopped due to uncertainty in delivery of production GSMT's.

March, 1970--Curriculum revision project still dormant; GSMT prototype shipped back to Naval Training Device

³The GSMT was returned to NTDC to facilitate work on the production models. As of this writing, production models are under construction but no deliveries have been made.

Center, Orlando, Florida.

ANALYSIS IN TERMS OF INNOVATION INTRODUCTION

There are several items in the history of the GSMT which have influenced its acceptance. One factor which seemed to be highly significant is that the designers of the concept and the device remained in close contact with the potential users, and deliberately solicited and used suggestions and criticisms made by them. This was especially true in the design of the second prototype model in which trial classroom use at the ASW School and suggestions made by the instructors there both contributed to the final design. This policy resulted in a device which was responsive to the needs of the users as they perceived them. While it is true that the potential users of an innovation may not perceive their own needs accurately, or may not perceive other constraints operating in the design and production of a device, nevertheless, it is reasonable to expect that their perceptions of *their own operating environment* are to a large degree valid, and, in any case, are important in device acceptance. From the standpoint of enhancing acceptance, designers should know what the users perceive as their problems and what they consider as acceptable solutions. As much as possible, this information should be incorporated into the design of the innovation, and to the degree that the user's expectations must be violated, those introducing the device should expect resistance. Since this resistance can be anticipated, it should be possible to plan the introduction process so that objections are recognized and reasonable justifications can be given for the existing design. However, it should be recognized that this process of re-education may not be easy, and it may not be entirely successful.

One of the specific reasons that the GSMT promises to gain a large measure of acceptance is rooted in a common feeling among A2 instructors that their efforts do not in fact prepare their students adequately for what is to come. This conviction makes their task somewhat unrewarding, and a device which will bridge that gap is perceived as making their work easier and more satisfying. Any aspects of a device which can potentially enhance the users' feelings of status, success, and satisfaction should certainly be made explicit in the introduction of the device.

The "not-invented-here" reaction is apparently very common, or at least it is commonly expected to occur. It is obviously related to the immediately preceding discussion, since what it really means is, "This was not invented here; therefore, it cannot be responsive to my needs as I see them." There are at least two ways of counteracting this reaction. The first is to point out explicitly how the suggestions and contributions of users like themselves were in fact used in the design of the device. This implies that the expertise of the change advocate must extend not only to the characteristics of the device itself, but to the characteristics of the operating environment and the problems felt by the users.

A second, somewhat more elaborate technique for combating the "not-invented-here" reaction was inadvertently discovered during the interviews conducted the day before the presentation of the GSMT at San Diego. The nature of the questions was such that the instructors were called upon to enumerate the deficiencies of the present system and make suggestions for improvements. Since the design of the GSMT was partially based on reactions to similar questions by sonar instructors two to four years previously, many of the criticisms and suggestions given in 1969 had already been

taken into account. It was now only necessary to point out the design characteristics of the GSMT which related to the requirements the instructors had identified. This would seem to be an effective way of ensuring that the change advocate remains well within the latitude of acceptance of the users. Using such a technique may be especially important in cases where *some* characteristics of the device may lie outside the users' latitude of acceptance.

One item in the history of the GSMT distinguishes between the reactions at Key West and the reactions at San Diego: the issue of maintenance and reliability. At Key West, where the HFR staff installed and calibrated the equipment, maintenance problems were minimal and trivial. At San Diego, where the device arrived in damaged condition, and Navy personnel who initially knew nothing about maintaining the device were responsible for repairing it, concern about reliability was rather persistent. Questions were raised here about the percentage of down-time they could expect and the availability of replacement parts. There was strong evidence in the case of the Aero 46A Weapon Loader that reliability is a powerful determiner of attitudes toward equipment, and there is some corroboration of that observation in the present case.

There are two factors in the case of the GSMT leading to potential resistance or nonacceptance. One was the growing discouragement at San Diego due to delays in the procurement of a sufficient number of GSMT's for testing the new curriculum and for effective classroom use. Such delays may be unavoidable, in spite of the fact that the best time to deliver the device is when interest and enthusiasm are running high. From the standpoint of equipment introduction, however, it should be recognized that if there is significant delay, the entire introduction process may have to be repeated. This

is partly due to the flagging enthusiasm of those to whom it has already been introduced, but more importantly, passage of time almost guarantees personnel changes among the potential users. It appears that some of the key personnel who were very much in favor of the device may no longer be at San Diego or Key West when the production models of the GSMT are finally delivered. Just prior to the delivery of these units, there should be another investigation of the expectations and attitudes of the sonar maintenance instructors, and appropriate introduction procedures should be planned.

The second factor does not concern acceptance of the device itself. It has been pointed out earlier that the GSMT involves not only a hardware innovation, but a conceptual one as well. Certain characteristics of the hardware and of the accompanying documentation were designed in a particular way for pedagogical reasons which may not have been obvious to instructors using the device or to those planning the curriculum. In other words, the designers of the GSMT had ideas about how a generalized trainer should be used for maximum effectiveness, and these ideas are not necessarily transmitted to potential users through examination of the hardware or existing documentation. The first evaluation study of the GSMT was conducted by HFR personnel, and the second was conducted by sonar maintenance instructors at Key West after extensive briefing by HFR personnel. There were clearly identified, highly qualified change advocates operating in these situations. After the second evaluation study, however, responsibility for curriculum development was transferred to the instructors at the San Diego ASW School, and there was no provision for official liaison between the GSMT designers and those instructors who would be writing curriculum involving its use.

There was some fear among the HFR staff that the GSMT would come to be regarded merely as a set of discrete circuits

which happen to be packaged together in the same cabinets. This would mean that its capabilities for teaching the relationship between subsystems, calibration procedures, use of test instruments, and troubleshooting might be lost. The problem arose from the fact that an explicit change advocacy was not maintained. By its nature, this particular advocacy would have entailed repeated contacts over an extended period of time with the instructors who were revising the curriculum. No provision was made for such consultation, and the possible need for such advocacy was not recognized until curriculum revision was underway.

It is certainly possible, of course, that those revising the curriculum will in fact become sufficiently aware of the full capabilities of the GSMT, and that the new curriculum will take optimal advantage of them. The stated goals of maximizing transfer from A2-to C-School and organizing the new course around troubleshooting indicate that some of the major advantages of the GSMT will be used. But the work of these men would have been simplified, and the chances of optimal usage of the conceptual features of the GSMT would have been significantly improved, had consultations by expert change advocates been planned for. This tendency to fail to recognize all of the circumstances in which change advocacy is required, and the consequent failure to provide for an adequate change advocate, has been noted in the other case histories as well as in this one. The general lesson seems to be that open channels of communication are highly desirable between the users and the designers both during the design and evaluation phase (mainly to convey the users' requirements, constraints, and perceptions to the designers) and during the introduction phase (mainly to convey the designers' goals, constraints, and compromises to the users).

One final observation concerning the acceptance of the GSMT may be of interest. During the discussions of the failure of other training devices to achieve acceptance, a point which was frequently brought up was the adequacy of simulation. Since many training devices do in fact simulate the prime equipment and often the operating environment as well, there seems to be a feeling among users and designers that anything less than perfect simulation--"the world in a box"--is unacceptable for training purposes. In some cases, enormous amounts of money are expended trying to improve the accuracy of simulation. The GSMT seems to be a striking counter-example. It is clearly an intermediate piece of equipment, which simulates certain characteristics of the prime equipment, but in many respects is quite different. It was designed as a stepping-stone toward the use of the prime equipment as a training vehicle, rather than as a replacement for the prime equipment. The acceptance of the GSMT was very high, and although there were some suggestions for incorporating additional features, there seemed to be no resistance based on failure to simulate prime equipment perfectly.

The point seems to be that the *limitations* of the GSMT as a training vehicle were clearly understood by everyone, and the fact that it could fulfill significant training functions within its own range of applicability also became quickly obvious. The difficulties in other cases may arise from the fact that the range of applicability of the device is not explicitly understood or agreed upon when the requirements are generated and development is taking place. When the device is finally delivered (frequently to a different set of people from those who generated the requirement), the limitations of the training device and its advantages *within its own range of applicability* again need to be made clear. The relative improvement in training

efficiency to be gained by very expensive, realistic simulations needs to be balanced against the expense of using prime equipment for training and the problems (and sometimes danger) of conducting training in the operating environment. The history of the GSMT does, however, illustrate the fact that a training "simulator" which was deliberately designed to be *different* in important respects from every existing piece of prime equipment can still achieve a high level of acceptance.

CHAPTER 5

CASE 3. A STUDY OF THE INTRODUCTION OF A NEW OPERATIONAL PROCEDURE (SONAR TARGET CLASSIFICATION)

BACKGROUND

In contrast to the acceptance of hardware innovations described in Chapters 3 and 4, it was of interest to learn whether principles of attitude change and acceptance of innovation might be identified where changes in *operating procedure* were involved. A unique opportunity presented itself to the project staff for studying an innovation in the methods by which sonar contacts are classified as submarine or nonsubmarine. This is the most complex and demanding task undertaken by sonar operators. It seemed to be an excellent candidate for study because senior Petty Officers in the Navy have long enjoyed a reputation as experts in the analysis of sonar target signals; they are rarely challenged either by their superiors or their subordinates with respect to their expertise in this matter. In fact, the officer structure of the Navy normally defers to the opinions of these personnel insofar as the interpretation of target signals is concerned. (The classification *decision* is theoretically made by command on the basis of several information sources in addition to sonar. In practice, the interpretation by sonar personnel is heavily weighted in arriving at the classification conclusion.)

Sonar target classification is taught primarily at two locations: (1) the Fleet ASW School, San Diego, and (2) the Fleet Sonar School, Key West. For some years, the classification procedure taught in these schools has been the "21-cue" method. In this method, a large number of

cues from both audio and video displays must be perceived and combined according to certain logical steps in arriving at a statement of the probable nature of the target. Training is accomplished through lectures, demonstrations, and practice in recognizing cues from tape recordings and motion pictures of signals recorded from actual sonar contacts at sea.

Problems in training the 21-cue method became evident in 1967 when representatives of the Fleet ASW School, San Diego, requested assistance from the Naval Personnel and Training Research Laboratory in "simplifying" the 21-cue method. Their complaint was that the method was too complicated for inexperienced operators to master. Assistance was desired in reducing the number of cues and simplifying the instructional process.

The Bureau of Naval Personnel subsequently entered into a contract with HFR to develop such a "simplified" system (July, 1968). It soon became clear that no simple reduction in the number of traditionally employed cues, as requested by the ASW School, would achieve the objectives of the program. Such an approach would only lead to a degradation in performance. While it would be possible to reduce the number of traditional cues used, no manageable subset showed promise of sufficient validity. A fundamental overhauling of the approach to classification was required. This implied that changes and innovations were needed that would be quite different from those envisioned by the personnel who had requested "simplification" of the system.

It was, therefore, presumed that there might well be an acceptance problem, even among those personnel who had requested the change. In addition, the Key West school had not been involved in the request for a change and conceivably could be a source of more substantial resistance. The decision was

made to take advantage of the absence of communication between the two schools on this issue by consulting San Diego personnel early in the development, but not involving Key West Personnel until the procedure was ready for evaluation.

OBSERVATIONS, INTERVIEWS, AND OTHER DATA

Observation of Briefing at Fleet ASW School, San Diego

The first meeting between project personnel, representatives of the Naval Personnel and Training Research Laboratory, and the staff of the ASW School, San Diego, occurred in October, 1968, at which time a preliminary briefing was given on the new method as so far developed. The school was represented by the officers in charge of enlisted instruction, Chief Petty Officers with primary responsibility for training in target classification, and several other Petty Officers from the instructional staff who periodically drew the assignment to teach target classification. The appeal to these personnel by the project staff was that of soliciting suggestions and criticisms of the proposed new method (hereafter referred to as the SM method) in a kind of mutual problem solving atmosphere. It was expected that significant contributions toward the refinement of the newly developed system might well be forthcoming. The basic approach was to foster acceptance through objectivity. This might be regarded as the logical opposite of the attempt to foster uncritical acceptance through more nonrational, non-cognitive appeals, in short, the "Madison Avenue" approach.

Members of the staff responsible for development acted as change advocates in this meeting. An independent group of HFR personnel carefully observed user reaction to the proposed SM method. It was clear that although there was no overt rejection of the proposed method, there was significant evidence of resistance in various forms. It seemed likely

that the SM procedure was quite different in concept from the expected "simplified" 21-cue system. Concern was expressed over what was perceived to be a more significant role of less experienced sonar operators in the classification process with a suggestion of less complete dependence upon the more expert senior Petty Officer for classification. The proposed SM system was seen as more discrepant from traditional practice in this respect than was anticipated by those acting as change advocates.

Concern was expressed over how much time the SM procedure would require, although comparative analysis would have clearly indicated that it should take less time than the 21-cue method. Doubt was expressed that the system would exhaustively treat all types of targets that might be encountered. This might have been a form of rejection or simply a failure to understand all of the ramifications of the system in a relatively short initial introduction (two hours). Finally, there was the somewhat surprising reaction (to the change advocates) that some regarded the SM system as "the same as we're doing now."

The suggestion that there is nothing really new in what is being proposed appears to be a subtle form of rejection that can effectively block innovation and change in many contexts. It is interesting that this same theme later appeared in comments submitted by the Key West school. (The possibility that the proposed method really *was not* fundamentally different from traditional practice must, of course, be considered; however, any reasonable analysis of the SM and 21-cue methods would reject this hypothesis, although both do, of course, draw upon some of the same kinds of target information.)

In reviewing this initial attempt to manipulate acceptance by the mutual problem solving approach, it appeared

that the change advocates, while generally successful in their objectives, had made some assumptions about the Navy's representatives that were not entirely warranted. The proposed SM method went far beyond the original request of the school for a simplified 21 system. In essence, it reflected a much broader definition of the target classification problem. To perceive the relevance of many of the proposed "improvements," the audience first had to recognize the defects in the system it was to replace. It is clear that the innovators had perceived many defects in the old system that were not shared by Navy personnel. Consequently, the requirement for a radical change, rather than a mere simplification, was in need of communication.

The proposed SM method related more completely to the "big picture"; that is, not only to simplifying the classification procedure but to several related objectives as well, which included the identification of meaningful detection rates, minimizing of false alarms, standardization of reporting procedures aboard ship, and improving equipment and displays necessary for target classification. Clearly, not all of these objectives were reflected in the initial request by school personnel for a simplified classification method.

The second problem is related to the first. An attempt was made to describe a complex innovation in a short period of time. Since the audience did not share a comprehensive understanding of the defects of the 21-cue system, they were less quick to accept the potential worth of the SM method. There was evidence that this led to a preoccupation with their own doubts and a consequent failure to grasp some of the points being presented.

Further Development of the SM Method

Further development work took place during November and December, 1968, during which time positive steps were taken

to respond to a number of concerns that had been expressed by ASW School personnel. In January, 1969, complete descriptions of the refined procedure, in the form of a Naval Personnel Technical Bulletin (69-5), were submitted to the ASW School and, for the first time, to the Fleet Sonar School, Key West. This report described the reasons for the development of the SM system, and the procedures to be followed in its use aboard ship. Representatives of the Naval Personnel and Training Research Laboratory subsequently met with San Diego school representatives to again solicit comments, criticisms, and general reactions. This meeting was generally characterized by acceptance. There was no substantive criticism or obvious evidence of resistance.

Observations on the Introduction of the SM Method at Fleet Sonar School, Key West

The manner in which the SM method was introduced at Key West can be considered an example of a frequently employed method of communication in large organizations. Training personnel were requested to respond to a proposed change without those most affected being consulted beforehand, either concerning the need for the change, or what kind of a change might be in the best interest of the users. There is little doubt that many innovations, both in hardware and procedures, appear, to the military personnel concerned, to be introduced in this fashion. This is related to the problem of not having the "big picture," and it probably is inevitably a source of resistance to change by military personnel.

Upon receipt of the request by the Key West school to review the proposed SM method, a committee of two officers and two enlisted instructors was formed to study the new procedure and provide recommendations concerning its merit to the Commanding Officer. The officers selected had primary

responsibility for enlisted operator training; the two Chief Petty Officers were selected because they had recent experience at sea with the type of sonar system for which the method was designed. They otherwise were considered neither more nor less qualified than other instructors in target classification procedures.

The full burden of introducing the Key West group to the SM method thus fell on a printed report. By design, there was no change advocate. Following individual readings of the report, these personnel met as a group to discuss the merits of the proposed procedure. Their conclusions generally reflected these viewpoints:

1. A need does exist for a simplified target classification procedure. The procedures proposed in the report were felt to have merit; however, it was considered essential that extensive at-sea evaluations be conducted prior to initiating changes to existing procedures.
2. It was pointed out that the proposed classification method would have the virtue of better documenting and standardizing what was being done in the fleet; however, the proposed method *is not new*.
3. If the proposed procedures were validated by fleet experimentation, and the SM method adopted, it should be taught in *addition* to the 21-cue method rather than as a replacement for it.

In addition to these principal points, a number of positive suggestions were made directed at clarifying ambiguities in the report, or aiding in the implementation of the method aboard ship.

It was clear that this response represented some degree of acceptance but with reservations that were not expressed at the San Diego school. First, the proposed SM method was regarded with sufficient skepticism to emphasize the need

for fleet validation; second, it was, in any event, considered supplementary to the 21-cue method, not as a replacement for it. The reappearance of the "this is nothing new" response is interesting. It seems to be the logical counterpart of the "not-invented-here" reaction, that is, it may be a disguised claim that it *was* invented here.

Three months later, in April, 1969, project representatives visited the Key West school and personally interviewed each member of the staff who had participated in the evaluative review of the SM classification procedure. This was a semi-structured, open-ended interview, in which an attempt was made to establish the respondents' familiarity with the SM system, determine how well its exact purpose was understood, and how the newly proposed method compared in various ways with past practice. The exact questions asked are provided in Appendix A. It was clear from the interviews that each respondent had first heard of the SM method through the required review of Technical Bulletin 69-5. All expressed some positive attitudes toward the SM method, but most expressed substantial reservations as well. It is noteworthy that only two of the four respondents could describe the specific objectives of the procedure, and only one in four was able to identify, unaided, the fundamental premise on which the method was based. The following arguments, which can be regarded as evidence of resistance, were made by one or more respondents:

1. The SM method should not be taught to officers; they should continue to get the 21-cue method (this argument made by an officer).
2. Concentration on the SM method could be detrimental to the 21-cue method since it concentrates on just two target clues (this argument is technically incorrect).

3. Operators on watch should report *every* contact as a possible submarine. They should get the experts on the scene as quickly as possible; they are simply not qualified to do the job (without my expertise)
4. The system will not reduce the time required to classify or the false alarm rate.
5. The time required by the SM method is greater than we can afford; we just concentrate on (target) aspect and heading so we can fire. (This assumes away the problem, i.e., the target is *presumed* to be a submarine.)
6. The TRR (a unit of sonar equipment) is inoperative on most ships; therefore, the SM method cannot be employed. (This argument is not strictly relevant. Both the SM and the 21-cue methods required the use of the TRR, so this is not a valid rationale for favoring either method over the other.)

In conducting these interviews, the project staff encountered a behavioral dynamic that is commonplace with military personnel. It occurs when the respondent perceives himself as more expert and knowledgeable about the subject matter than the inquirer. Under these circumstances, a "smoke screen" of expertise is often raised that effectively serves as a barrier to change. It is exemplified by points two, four, five, and six above. If the innovator does not know enough, if he is prematurely discouraged by the counter-argument, or is incapable of refuting it, the attempted innovation may be defeated. On the other hand, if he demonstrates by a series of questions that his knowledge is technically on par with that of the respondent, a remarkable change in expressed attitudes can take place. In the present instance, this occurred with one of the respondents who initially raised many of the objections listed above, and who took the viewpoint that the older, traditional target classification procedure was much to be preferred. He cited, for example, the use of cues that were known by the project

staff to be both unreliably perceived and to have little validity for classification. The interviewer responded to these assertions with technical questions that clearly reflected a substantial background in target classification. The discussion soon centered around the advantages of the proposed method of analysis; gradually the respondent completely reversed his position, strongly endorsing the value of changing to the SM procedure. He continued to reflect the viewpoint that it would be primarily of value to inexperienced operators who were not sophisticated in classification methodology. But, in his final statement, he completed his self-contradiction by concluding that maybe the SM method would benefit even the older "expert" sonar supervisors: "Maybe we will even do better than we have been doing--it gives us more of a basis of what to look for than before "

This "smoke screen of pseudo-expertise" technique of discouraging innovators or even neutral investigators is apparently not rare, although it is not universal either. Other investigators have had the experience from time to time of having to establish their own expertise in some subtle way, usually by asking sophisticated questions, in order to get "straight" answers from the respondents.

Developments Relating to Acceptance on the Washington Scene

Contract work on the development of the new system was completed in July, 1969, with delivery of a final report to the Bureau of Naval Personnel detailing the procedure, along with all necessary materials for training the SM method and a guide for employing it aboard ship. Receipt of these materials was followed by a meeting in early September between representatives of Pers-A and Pers-C. The conclusion from this meeting was that the SM method was considered sound and the training materials satisfactory for introduction to the ST/A1 course. It was further decided that an evaluation

phase should be initiated that would include the conduct of a pilot course at the Fleet ASW School by Navy instructors and evaluation of training effectiveness by personnel of the Naval Personnel and Training Research Laboratory

Since the newly developed method involved changes in operating procedure and doctrine, it was also evident that review and approval by the Chief of Naval Operations was essential. In the fall of 1969, NPTRL Technical Bulletin 69-5, together with copies of all related training materials and the operator's guide for the SM method were forwarded to Op-322 for evaluation. It was indicated that Op-322 would seek additional evaluations from COMCRUDESPAC, COMASWFORPAC, COMCRUDES-LANT, and COMASWFORLANT. It was estimated that the required comments could be expected in about two months, after which, assuming they were favorable, the pilot course would be initiated as planned. As of this writing, no formal evaluation has been received from Op-322, although a positive response to the fundamental logic of the SM method and a statement that the approach should lead to a major improvement in destroyer sonar target classification was received in a letter from Op-321 on 26 November 1969.

In the meantime, in an independent development, the A1 (operator) portion of the Sonar Technician's Training course had been undergoing modification. Both the Fleet ASW School, San Diego, and the Fleet Sonar School, Key West, did, in the course of their revisions, request the Bureau of Naval Personnel to permit inclusion of the SM classification in the new curriculum. It was indicated that the San Diego school would relay strong endorsements to COMCRUDESPAC and COMASWFORPAC in an attempt to encourage adoption. Thus, a strong degree of acceptance at both schools appeared to have become fact

CHRONOLOGICAL SUMMARY

- 1967--Fleet ASW School, San Diego, requested assistance of Naval Personnel and Training Research Laboratory to simplify the 21-cue method of target classification
- July, 1968--In response to this request, Pers-A established a project to develop a simplified system and contracted with HFR for the work
- October, 1968--Initial presentation of partially developed SM system to instructional staff at Fleet ASW School, San Diego.
- January, 1969--NPRA Technical Bulletin 69-5 describing complete SM system and the rationale for its development submitted for review to Fleet ASW School, San Diego, and Fleet Sonar School, Key West. Subsequent full acceptance by San Diego.
- March, 1969--General endorsement of the need for a simplified classification system received from the Fleet Sonar School, Key West, but stressing need for field validation. Proposed SM method regarded as an *addition* to the 21-cue method.
- April, 1969--Interviews with key personnel at Fleet Sonar School, Key West.
- July, 1969--Refined system and all related training materials delivered to Pers-A.
- September, 1969--Meeting of Pers-A and Pers-C personnel; plans for pilot course initiated; official evaluation from OpNav requested.
- Circa October, 1969--SM description and related training materials sent to Op-32 for evaluation.
- February, 1970--Materials being readied by Op-32 for evaluative comment by COMASWFORPAC, COMASWFORLANT, COMCRUDES PAC, and COMCRUDES LANT.

ANALYSIS IN TERMS OF INNOVATION ACCEPTANCE

The history of the SM target classification method exhibits several factors possibly influencing acceptance

either positively or negatively, and three rather interesting forms of resistance. The discussion to follow will first consider the influencing factors:

1. *The Change Advocate.* As is probably typical of innovation introduction in the Navy, the introduction of the SM method actually involved several stages over a period of time. At least two partial introductions occurred during the development of the method, in that early versions were presented to school personnel for reaction and constructive criticism. On these occasions, HFR personnel assumed the role of change advocate, attempting to present the deficiencies of the current method and the improvements represented by the new method in as objective a context as possible. In the process, they demonstrated their own expertise in target classification and knowledge of the operating environment, and solicited the expertise of the users. Because of factors to be discussed shortly, these efforts to effect acceptance did not meet with unqualified success.

But with delivery of the materials to the Bureau of Naval Personnel, Pers-A, in effect, became the change agent, though, with respect to this particular development, its representatives could meet few of the criteria for the selection of an effective change advocate. They were confronted first of all with the task of convincing Pers-C, where there was some evidence of the "not-invented-here" syndrome. Subsequently, they were in a position of having to influence OpNav in a problem area where the expertise is clearly presumed to rest with the fleet. Under these circumstances, the burden of influence obviously rested with the printed materials; there were no effective change advocates directly influencing the evaluation process at this point.

However, because of the groundwork previously laid, the training schools had, by this time, assumed the role of change agent and were in position to play a significant part in the fleet evaluation. In the absence of some such influence (which ordinarily means the active

involvement of at least one interested, qualified change advocate), it can confidently be predicted that the unexpected delivery to the fleets of a newly proposed classification procedure will meet with a variety of delays, resistances, and proposed alternatives. This is not to depreciate the importance of the fleet's evaluation; rather, it is simply the predictable result of a violation of a cardinal rule for effectively introducing change: *A qualified change advocate must be explicitly provided at all the crucial stages in the introduction of an innovation.*

2. *Participation of Users in Design.* One factor which almost certainly contributed to the eventual enthusiasm of the schools for the SM method was the effort made by its developers to consider seriously and, if feasible, incorporate suggestions and criticisms made by the school personnel who reacted to early versions of the method. This practice in the design of an innovation potentially benefits acceptance in two ways. First, it increases congruence between the approach of the designers and that of the users (tends to reduce the latitude of rejection). Sometimes increasing congruence does not even necessitate changing matters of substantive importance, but only some reorganization or rewording. There occurred instances of this in the present case. Second, when the innovation is later presented to other users, the change advocate is able to justify design features by citing inputs made by operating personnel like themselves. This not only conveys an impression of expertise (the designer has taken the trouble to know how it really is in the operating environment), but mitigates the "not-invented-here" reaction as well.
3. *Designer-User Differences in Perception of Problem.* It was previously emphasized that the requirement for improving target classification procedure soon became a considerably broader problem in the minds of developers than the original expectations of the instructional personnel requesting the "simplification." It may be true that complications of this sort develop to some degree in the history of every innovation--those working on solutions to problems soon develop perceptions,

or understandings different from those who are not directly involved in the creative effort. It is probably also true that the extent of this difference is regularly underestimated by the designers. It was the impression of the development team that they were staying rather close to the operating environment (in this case, the San Diego school), and yet there was surprise that the school personnel showed many signs of not comprehending the problem, *as the designers saw it*, after the initial two-hour presentation.

A special case of this problem involves recognition of the deficiencies in the present system (or hardware, as the case may be). As a result of their analysis, the designers may come to perceive these deficiencies as much more deep rooted and serious than they appear to the present users. Thus, the solutions they suggest may appear more radical than necessary to solve the problems the users currently see.

It cannot be taken for granted that the potential adopters of an innovation see the problem in the same light as the designers, or at the point of introduction, that they can be easily re-educated. Yet, the innovation is presumably a response to a problem, and the users cannot be expected to accept the solution if they misunderstand the problem.

These observations again point up the need for the designers to have very frequent communication with the users in the operating environment, both so that the designers can monitor the extent to which their thinking is diverging from that of the potential adopters of the innovation, and so that there will be opportunities to educate the user population to thinking which will eventuate in a completed design that they will both accept and appreciate.

4. *Diversity Within Audience.* The briefing at which the preliminary version of the SM method was presented in San Diego was attended by a variety of Navy personnel who might be concerned in one way or another with changes of target classification procedure. Not only

were there those present who represented classification training, but also individuals whose primary backgrounds were in tactics, maintenance, and administration. The project observers noted great differences in the concerns of various people for various aspects of the proposed method, and great differences in sophistication as to problems and practices in target classification. As a result, it was not possible to design a single presentation of the SM method suitable to everyone in the audience.

In the discussion afterwards, it was evident that misunderstandings had arisen (which were probably not completely resolved) due to the varying qualifications of the personnel at the meeting, and time was wasted with questions and explanations that would not have been necessary had the group been more homogeneous. Change agents should recognize that an innovation usually must be introduced to several audiences, differing in qualifications and interest. The presentations should be designed to match the audience, and the wisdom and "efficiency" of a general conference should be carefully considered, in view of the greatly increased danger of misunderstanding that may result in erroneous evaluation of the innovation.

In addition to the four points discussed above, three interesting and subtle forms of resistance appeared in this case history. First, there was the claim that the innovation was "nothing new," which, in effect, allows the user to go on doing what he has been doing. It is suggested that this may be a variant of the "not-invented-here" reaction, in that it may be a claim that the innovation really *was* invented here. Second, the change advocate may be exposed to a smoke screen of pseudo-expertise; this is likely to occur only if the change advocate is perceived as ill informed in matters of the problem, the operating environment, and relevant procedures. The smoke screen, then, is an attempt to "snow" him and thereby get rid of him. The change advocate must, therefore, establish his own expertise in the eyes of the users, and an effective way of doing this seems to be to

ask questions and make comments in the normal context of the discussion which reveal his own sophistication with respect to the equipment, system, or whatever. In other words, it is necessary to demonstrate that the change advocate can "speak the language" of the audience accurately and see their problems as they see them (even though his ultimate objective may be to change their perception of their problems).

Third, during the briefing when the change advocates were trying to present the early version of the SM method in the context of a broadened concept of the target classification problem, there were several questions from the audience on rather trivial points of the method, and a seeming inability or unwillingness to grasp the "big picture." It is not known to what extent this represented resistance as opposed to misunderstanding, but the possibility exists that an unconscious tendency to question and criticize minor points provides a defense against the unpleasant prospect of change. If one can convince himself that the system is erroneous in easily grasped details, he can reject the innovation without having to understand the complexities.

CHAPTER 6

CASE 4. OBSERVATIONS ON THE DIFFERENTIAL ACCEPTANCE OF EQUIPMENT MAINTENANCE PROCEDURES (THE 3-M SYSTEM)

BACKGROUND

Beginning in 1963, the Maintenance and Material Management System (3-M System) was gradually installed aboard operating ships throughout the Navy, with complete implementation of the system scheduled for early 1967. The general purpose was to standardize maintenance procedures and scheduling throughout the Navy, in order to counteract a growing proliferation of practices and paperwork engendered by the massive growth of technology after World War II. In the words of a brochure outlining the 3-M System and its initial tool, the Planned Maintenance System (PMS):

The Planned Maintenance System (PMS) returns simplicity --plus control--to the ship's Commanding Officer. It eliminates paperwork--confusion--time delays--because it eliminates indecision as to who is to do what--when.

The brochure goes on to explain that the 3-M System and PMS resulted from a study directed by the Chief of Naval Operations, and that:

Work-study techniques practiced by leading industries have been used in developing the system. Personnel, qualified in electronics, weaponry, propulsion, and other fields, familiar with your ship and its operation, have tailored and installed the system to work for you.

Simplicity is the keynote--control the watchword.

The following items are considered the tools of the system:

1. Equipment List
2. Maintenance Requirement Cards
3. System Manual
4. Cycle Schedule
5. Quarterly Schedule
6. Weekly Work Schedule
7. Manhour/Rate Analysis
8. Feedback Report

These items are considered to provide (1) detailed information on all equipment aboard the ship and all necessary information for preventive maintenance; (2) materials for scheduling preventive maintenance down to daily assignments for each man, allowing flexibility for unexpected variations in availability of personnel; (3) a means of quickly reporting irregularities or discrepancies in the system, changes in equipment or procedure, or suggestions. It is again emphasized that:

Simplicity is the key feature of the system. Staff work load is reduced as paperwork is eliminated. Indecision is eliminated as clear instructions are furnished as to what is to be done...when...where... by whom...taking how much time...how to do the job... with what tools...and safety precautions. Everyone from top to bottom knows what to do--when to do it.

The second element of the 3-M System is the Maintenance Data Collection System (MDCS). A brochure on MDCS characterizes this portion of the system as:

...the medium by which information is gathered from operating units on a timely basis, in a standard form, to assist Navy management in answering the questions--are we using our resources in the best possible manner--is our maintenance effective? This system will furnish intelligence which will assist Unit Commanders, Type Commanders, Fleet Commanders, the Naval Material Support Establishment, and the Office of the Chief of Naval Operations in making decisions. This is based on factual maintenance and material information and will help us attain our common goal--IMPROVED FLEET MATERIAL READINESS.

Briefly, MDCS is intended to function as follows. Each time a corrective maintenance action (aside from routine

preventive maintenance) is performed, a "Shipboard Maintenance Action" form is to be filled out by the man performing the repair, and each time an item is drawn from ship's supply, a form is likewise filled out specifying the item. From these reports are generated ADP punched cards, and the information is eventually processed for the entire Navy at the Maintenance Support Office, Mechanicsburg, Pennsylvania. Reports intended to assist in management decisions are provided to the following: ship level, Fleet Command level, Navy Department level, material managers, and design agencies.

The following is a summary from the explanatory brochure:

THE MAINTENANCE DATA COLLECTION SYSTEM (MDCS) IS A TOTAL SYSTEM DESIGN developed to obtain data where it is generated--at the working level. This system has the following characteristics:

Capture data as soon as maintenance actions are performed.

Record data in an accurate and uniform medium suitable for mechanized processing.

Eliminate repetitive reports, manage by exception, and reduce paperwork.

Correlate manpower utilization with parts consumption and supply transactions.

Identify the activity which detects the deficiency, how it was detected, and the one who effects the repair.

Process the data rapidly.

Produce the reports on a current and timely basis.

Distribute the reports to the "user" activities.

Feedback data of accomplishment and/or action taken.

TO BE USED FOR MANAGEMENT OPERATIONS, SUCH AS:

- Forecast maintenance budgets.
- Determine material requirements.
- Develop an optimum maintenance policy.
- Relate material support requirements to the optimum maintenance policy.
- Determine personnel and training requirements.
- Identify equipment design deficiencies and sources of unreliability.
- Develop and schedule design changes and modifications.
- Schedule ship and aircraft overhaul.
- Determine the effectiveness of return and repair cycles and reduce turnaround time.
- Revise the levels of inventories aboard ships, tenders, and shore facilities, and in the repair pipeline.

The goals and characteristics of PMS and MCDS have been described in moderate detail to provide a setting for understanding what seems to be a substantial difference in acceptance between the two parts of the 3-M System, the evidence for which is presented next.

Acceptance of PMS and MDCS

In the fall of 1969, a project staff member attended a presentation of the 3-M System by a representative of the 3-M System branch (Code 04D21), which reports to the Director of the Fleet Support Division, Naval Material Command. In addition to a general description of the system, the observer recorded the following comments:

Little Trouble Getting PMS Accepted Aboard Ship. 35% of all shipboard time is spent in preventive maintenance; biggest single problem has been having the right tool on hand.

Weekly and quarterly schedules are filled out by department heads and maintenance group supervisor. Check cards for each equipment are posted near that equipment.

PMS Feedback Report--checklist of items where discrepancies exist between Maintenance Requirement Cards and status of tools, etc. All procedures generally accepted and working.

MDCS Not Working. Data required to check validity of the Maintenance Requirement Cards not systematically submitted. Supposed to feed back to ship and squadron CO's, TYCOMS, FLEETCOMS, OPNAV, NAVMAT, SYSCOMS, and Bureaus.

Resistance to the Shipboard Maintenance Action report which is *supposed* to be filled out by man who does the work. Requires the coding (numerically) of malfunction and a variety of identification numbers for ship's identification and accounting purposes. All required numbers have to be looked up anyway in conjunction with supply man. Should relieve them of other paperwork that used to be required.

Concern about 3-M training classes. Special training now underway for changes that will occur at first of year (1970) in the MDCS standardized Maintenance Data form. Found out in one follow-up that training had deteriorated and personnel no longer recalled how to fill out forms.

Revisions aimed at better failure analysis and more accurate reliability estimates. Revisions reflect need of Systems Command for more data. Still expect problem of lip service. Will the revision be more of a burden?

PMS Had Fleet Involvement During Its Development, MCDS Did Not; largely copied from Air Force; now committed to the system because of computer programming. The system was "layered on" the old log-book system.

These comments, together with a careful reading of the brochures and training materials associated with the 3-M System, suggested that any differences in acceptance between PMS and MDCS might be attributed to several factors:

1. User involvement in the development of the system.
2. Adequacy of training (and permanency of the results of training).
3. Benefits to the user, particularly the perceived immediate usefulness to the men who had to use the basic tools (and do the paperwork).

INTERVIEW DATA

To investigate these factors further, although in only a preliminary way, arrangements were made through COMCRUDESPEC to interview personnel involved with the 3-M System aboard six destroyers docked at San Diego. In addition, 10 Chief Petty Officers, who were teaching 3-M as a small part of various engineering courses, were interviewed as a group. In all, 33 men were interviewed, ranging in rank from Commander to Petty Officer 2nd Class. The interviews were open-ended, although guided by specific questions, so the results are somewhat difficult to categorize. However, the comparisons between PMS and MDCS in Table 2 bear out the fact that these two elements of the program were in fact differentially accepted and liked.

TABLE 2
RESPONSES OF NAVY PERSONNEL TO
QUESTIONS ABOUT PMS AND MDCS

QUESTION: What do you like most about

<i>PMS?</i>	<i>MDCS?</i>
Scheduling/Organization Aid.....19	Nothing.....5
Training Aid.....13	No Comment.....4
Procedural Guides..... 6	Management Tool, info to Bureaus.....3
Full Equipment Coverage... 2	Identifies Training Deficiencies and Bad Manufacturers.....2
Miscellaneous..... 3	

PMS?

MDCS?

 Gives Machinery History... 2
 Miscellaneous..... 4

QUESTION: What do you like least about

PMS?

MDCS?

Training Inadequate..... 8	Excessive Paperwork.....10
Paperwork..... 6	Fear of Errors (Forms Are Returned to Ship for Correction).....10
Maintenance Required Too Often, Can't Keep Up..... 4	(Almost) No Useful Feedback..... 5
Miscellaneous..... 4	
No Disadvantages..... 6	

QUESTION: What are the advantages to you personally of

PMS?

MDCS?

Training Aid/Learning Tool.....16	None.....18
Planning/Management Tool..14	Potential Feedback..... 3
Monitor Material Status... 4	Reduced Down Time..... 1
Catch Small Problems..... 1	Plan Work Load..... 1
Miscellaneous..... 1	Long-Range Planning..... 1
	CYA if Deferred Action Is Not Taken..... 1

QUESTION: Do you consider PMS to be a good system?

 Yes.....32
 No..... 1

QUESTION: Do you consider MDCS to be a good system?

 Yes.....7
 Yes, with Reservations..4
 No.....6 (Plus all 10 CPO's interviewed together)
 Don't Know.....2

Interpretation of these data is complicated by the fact that it is impossible to distinguish the individual responses of the 10 CPO's interviewed together. If there were consensus.

this concensus was included in the tally. A number of men made more than one response to a question. These were tallied separately, but no one contributed more than three responses to a single question. There were also cases where no answer was given. The tallies, then, provide a rather rough rank ordering of the comments made to each of these questions.

Interpreted in this way, some of the differences between PMS and MDCS are striking. A majority felt that MDCS had no advantages for them personally, although no one felt that way about PMS. Nine men could specify *nothing* that they "liked most" about MDCS, and at least five other responses reflected advantages of the system that bore only a remote relationship to the respondent's own immediate work. Yet, a great number of the complaints about MDCS were directed either to an excessive amount of paperwork or fears about mistakes in filling out the forms. (There was hope that a revised reporting form would alleviate some of this problem.) Thus, it appears that MDCS is perceived largely in terms of excessive and threatening paperwork, for which there is very little if any benefit to the men who must do the reporting.

Of the three factors suggested earlier as potentially influencing the acceptance of PMS as opposed to MDCS, it appears that perceived direct benefit or usefulness to the user may be a powerful influence, particularly since the minimal direct benefits of MDCS are accompanied by what is perceived as an unnecessarily excessive amount of paperwork. (There may be selective factors operative here as well; that is, there may be a positive correlation between being in a rate involving maintenance and dislike for paperwork, as opposed to "working with your hands." If this were true, then even small amounts of paperwork might strongly influence the acceptance of a system, especially if a high degree of accuracy were also required.)

Within the scope of this limited inquiry, it was not feasible to investigate the effects of user involvement in the development of the system. Some data were collected, however, on training with respect to MDCS. To the question, "When you assumed your current responsibilities for MDCS, were you properly prepared?" eight men said "Yes" and 21 said "No." Asked if they *now* felt prepared, only 15 said "Yes" and 14 said "No." In the case of the Aero 46A Weapon Loader, the suggestion was made that the skillful operation of the device appeared simpler to the designers than it actually was, and the proper amount of training may have been underestimated. A similar situation may exist with respect to MDCS. Filling in blanks with numbers and descriptions of casualties may not seem very complex on the surface. But a feeling of being fully qualified for the errorless use of reference materials and forms which must be filled out perfectly for computer processing may require more training than was anticipated. Thus, limited initial training, plus the impression that every small mistake is consequential (an impression fostered by returning the form to the ship for corrections of every error), could well create an unfavorable disposition toward the system.

ANALYSIS IN TERMS OF INNOVATION ACCEPTANCE

From the data available to us, nothing can be said about the actual introduction of the 3-M System as an innovation, since our observations were made long after the system was installed in the fleet. Our goal in this case was to investigate an apparent difference in the degree of acceptance in two parts of the system and to suggest reasons for it. Two factors seem to stand out from the interviews conducted, although, of course, there may have been other factors operating as well.

First, out of 27 men interviewed who had been in the Navy at the time PMS was installed, 26 regarded it as an improvement over earlier procedures. All of the reasons given for liking PMS had to do with some aspect of getting one's work done better, either in terms of organization, or in terms of procedures. By contrast, few of the comments in favor of MDCS (in themselves a small minority) had to do with improving one's own work; furthermore, any benefits which might accrue to remotely located management at some future time were at the expense of a perceived *increase* in work (paperwork). This onerous burden had to be performed infallibly, with what was perceived as a heavy penalty for even small errors.

The material quoted from the brochures summarizing the two aspects of the 3-M System bears out these differences between PMS and MDCS. In PMS, the advantages to the immediate work of the sailor are obvious and are stressed. In MDCS, most of the advantages are intended to benefit "management." The goal of eliminating or reducing paperwork has not been effective in the eyes of the men for this part of the 3-M System, and the feedback, the reports to the "users," are not of obvious usefulness to the men who must do the work of generating the data. There are, in other words, several levels of users; and as has been previously pointed out in this report, these various levels need to be recognized and planned for in innovation introduction procedures.

Actually, the 3-M System has taken cognizance of several levels of users, corresponding to levels of command in the Navy. Presumably, the computer-analyzed feedback is tailored to the needs of each level. But the one level which is insufficiently recognized is the lowest level--where the basic data are produced. It may have been assumed that these men would simply do what they are told by their superiors, and

that any emotional or attitudinal reactions they might have would not interfere with the carrying out of their responsibilities. This assumption is faulty for human beings, no matter how low in a hierarchy. If actual cooperation with a system is desired, incentives must be provided at every level in the system.

Perhaps this judgment of MDCS is a bit too harsh, in that an incentive is suggested in the previous quotation from the MDCS brochure, which states that the system "... will help us attain our common goal--IMPROVED FLEET MATERIAL READINESS." The same theme appears in the training materials for the 3-M System. The point is that something as impersonal as "improved fleet material readiness" is not likely to be an effective day-to-day incentive for most of the sailors who will have to fill out the forms, although it may be for career officers.

The second factor of importance is the apparent inadequacy of training. The task requires perfection, training is brief, and the cost of errors is perceived as high, since the forms are returned to be corrected and resubmitted. About three-fourths of the men interviewed felt inadequately trained for the responsibilities of MDCS when they assumed these duties. Apparently what is needed is a more careful analysis of the actual level of training required to produce skill and confidence. Even though a higher level of training implies greater training time and cost, the price of not doing it can be ineffective performance, feelings of threat and fear, and dislike for and rejection of the system.

CHAPTER 7

SOME GENERALIZATIONS AND RECOMMENDATIONS

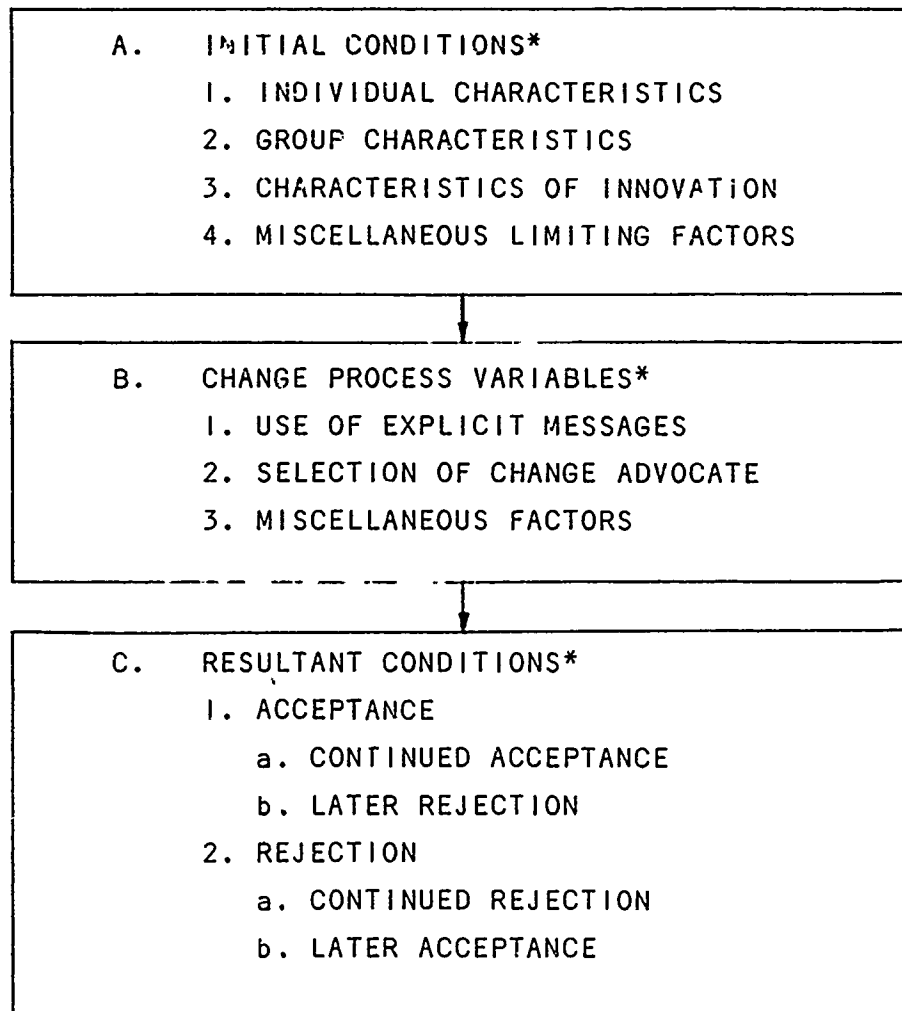
Because of the diverse and somewhat exploratory nature of this investigation, it is difficult to pull together the results into a single, comprehensive pattern or model. Therefore, three separate but related summaries are presented. The first lists what appear to be significant variables for research (and later for planning) in the innovation introduction process. The second lists factors and conditions in the practical setting which should be given consideration by anyone planning the introduction of an innovation. The third presents a set of principles to serve as guides in planning an introduction. Some final recommendations conclude the report.

SIGNIFICANT VARIABLES IN INNOVATION INTRODUCTION

Beginning with the categories of variables discovered in the research literature and presented in Chapter 2, other variables were added as a result of field observations. The organization of the categories was changed to emphasize the "action" or "engineering" goal inherent in the objectives of this investigation, and the format resembles that suggested by Rogers (1962) and modified by McClelland (1968) (see Figure 3).

Since most of the research literature was not amenable to translation to the practical settings of interest in this investigation, it was concluded that an identification of variables worthy of further investigation should be the primary contribution of the literature search. Secondarily, in spite of the fact that few even moderately precise

relationships between the variables (and interactions among them) have been identified, the lists can still function as a guide to common sense and a reminder of variables that otherwise might be overlooked by change advocates.



*Detailed List of Variables Appears on Following Pages

FIG. 3. MODEL OF ACCEPTANCE OF INNOVATION

TABLE 3
 VARIABLES IN A
 MODEL OF ACCEPTANCE OF INNOVATION

A. INITIAL CONDITIONS

- | | |
|--|--|
| <p>1. Individual Characteristics</p> <p style="margin-left: 20px;">a. <i>General</i></p> <p style="margin-left: 40px;">Education/Training
 Intellectual Level
 Self-Esteem
 Reaction to Ambiguity
 Chronic Anxiety
 Inertia/Motivation
 Attitudes Toward Change
 Exposure to Outside
 Attitudes
 Cognitive Rigidity/
 Flexibility ("Latitude of Acceptance")</p> <p style="margin-left: 20px;">b. <i>Authority Related</i></p> <p style="margin-left: 40px;">Need for Authority
 Approval
 Attitudes Toward Change Agent
 Habitual Resistance to Authority</p> <p style="margin-left: 20px;">c. <i>Peer-Group Related</i></p> <p style="margin-left: 40px;">Conformity to Group
 Status in Group
 Group vs. Task Orientation</p> <p style="margin-left: 20px;">d. <i>Equipment or System Related</i></p> <p style="margin-left: 40px;">Attitudes Toward Present Equipment/System
 Feelings of Competence
 Competence with Present Equipment/System
 Objectivity About Present Equipment/System
 General Attitudes Toward Hardware
 Beliefs About Desirable Characteristics of Hardware</p> | <p>2. Group Characteristics</p> <p style="margin-left: 20px;">Goals, Values, Customs
 Cohesiveness
 Communication Patterns
 Communication with Change Agent
 Performance Norms
 Attitude Toward Authority
 Past Participation in Changes
 History of Success/Failure
 Reaction to Ambiguity
 Size of Group
 Formality
 Means of Pressuring Individual</p> <p>3. Characteristics of Innovation</p> <p style="margin-left: 20px;">Superiority to Present Device/System
 Similarity to Present Device/System
 Relevance to Group/Individual Goals
 Difficulty of Making Change
 Complexity
 Possibility of Negative Transfer
 Saving of Effort
 Increase of Proficiency</p> <p>4. Miscellaneous Limiting Factors</p> <p style="margin-left: 20px;">Routine, Channels
 Time Limits
 Space, Facilities, Other Environmental Factors</p> |
|--|--|

TABLE 3 (Cont.)

VARIABLES IN A
MODEL OF ACCEPTANCE OF INNOVATION

B. CHANGE PROCESS VARIABLES

- | | |
|---|---|
| <p>1. Use of Explicit Messages</p> <p>Form of Communication (Oral, Written, Film, etc.)</p> <p>Expressed Intent to Influence One-Sided vs. Both Sides</p> <p>Refutation of Counter-arguments</p> <p>Amount of Amplification</p> <p>Use of Fear Appeals</p> | <p>3. Miscellaneous</p> <p>Participation in Planning/ Decision</p> <p>Experience with New Equipment</p> <p>Relating Change to Group Individual Goals</p> <p>Manipulation of Group Pressures</p> <p>Training Materials</p> |
| <p>2. Selection of Change Advocate</p> <p>Credibility</p> <p>Expertise</p> <p>Prestige</p> <p>Motive</p> <p>Relationship to Group</p> <p>Impartiality</p> <p>Physical attractiveness</p> <p>Attractiveness of Personality</p> <p>Relationship to Change Agent</p> | <p>Sequence</p> <p>Clarity</p> <p>Attractiveness</p> <p>Negative Reactions to Change Procedure Itself</p> <p>Expectation of Debate</p> <p>Incentives/Reinforcements</p> |

C. RESULTANT CONDITIONS

- | | |
|---|--|
| <p>1. Individual</p> <p>Competence (Technical)</p> <p>Attitudes Toward Future Change</p> <p>Interest in Applying Competence</p> <p>Objectivity as to Changed Conditions</p> | <p>3. Time-Dependent Factors</p> <p>Continued Experience with Innovation</p> <p>New Communications</p> <p>Peer Authority</p> |
| <p>2. Social</p> <p>Relations to Peers</p> <p>Relations to Authority</p> <p>Group Cohesiveness</p> | |

FACTORS POTENTIALLY INFLUENCING ACCEPTANCE IN THE NAVY

As a consequence of the observations in the case of the Aero 46A Weapon Loader, an outline with a decidedly practical flavor was developed for discussing the results. With some modification to take account of other observations, together with the other two summaries in this chapter, this outline can be used as a preliminary checklist of items to consider in planning an introduction program; it appears as Table 4.

Not all the factors in the outline are equally important or even applicable in every case. The outline merely lists items that may not be sufficiently considered in the design of an introduction program. It obviously suggests that planning for introduction should be concurrent with hardware or system design, which, in turn, implies contact with and analysis of groups and individuals to whom introductions must be made.

TABLE 4

OUTLINE OF FACTORS POTENTIALLY INFLUENCING ACCEPTANCE, WHICH SHOULD BE CONSIDERED IN DEVELOPING AN INNOVATION INTRODUCTION PROGRAM

A. HARDWARE OR SYSTEM FACTORS

1. Conceptual
 - a. Definition of the need or requirement
 - b. Various approaches to solving the problem
2. Physical - Foreseeable Problems of:
 - a. Equipment reliability
 - b. Mismatch with operating environment
 - c. Mismatch with capabilities of human operators
 - d. Mismatch with other elements of the system

TABLE 4 (Cont.)

3. Psychological

- a. Reactions to appearance
- b. Perceptions of its "fit" into operating environment
- c. Reactions to delays in delivery
- d. Opinions formed on the basis of hearsay and rumor
- e. Opinions formed on the basis of limited experience with innovation

4. Support

- a. Documentation of purposes and functions
- b. Documentation of operation
- c. Documentation of technical specifications and maintenance data

B. ADVOCACY FACTORS

- 1. To what different persons and groups does the innovation have to be introduced, and what are their characteristics?
- 2. What communication channels can be provided for user inputs during the design phases?
- 3. What means exist to detect and resolve differences in approach or philosophy concerning the nature of the problem or the nature of the solution?
- 4. What will users likely want to know about the innovation?
 - a. Overall purposes of the innovation
 - b. Direct and indirect benefits to themselves
 - c. Benefits to the system beyond themselves
 - d. Data on reliability
 - e. Real or apparent drawbacks compared with the old way
 - f. Adjustments that must be made in the users' behavior patterns
 - g. How these adjustments will be achieved (formal retraining, personal responsibility of the user, etc.)

TABLE 4 (Cont.)

- h. New responsibilities that are entailed
 - i. Present responsibilities that are to be reassigned to other personnel
 - j. To whom these responsibilities are being reassigned and what preparation will be given for carrying them out
 - k. How those in the chain of command will be made aware that these responsibilities have been reassigned
5. Who is to be the change advocate at each stage?
 6. What is required to establish the credibility of the change advocate?
 7. What is required to establish the authority of the change advocate?
 8. What threats might the innovation present?
 - a. Physical danger
 - b. Threat to current competence with present equipment or system
 - c. Threat to other aspects of user's self-image, prestige, etc.
 9. At each stage of the introduction process, what does the change advocate expect of the users, what do the users expect of the change advocate, and are the two sets of expectations explicitly known and agreed upon by both parties?
 10. How soon is it feasible to allow direct experience with the innovation?
 11. Have the introduction communications (both oral and written) been designed for maximum appropriateness considering the characteristics of the audience?

SOME TENTATIVE GUIDELINES FOR INNOVATION INTRODUCTION

For reasons discussed in Chapter 2, the original goal of extracting general principles from the research literature on attitude change for application to the problem of innovation

acceptance proved unattainable to a large degree. Some themes did seem to emerge and make sense in the Navy context, however, and some observations from the case studies can be generalized also. Thus, there developed a list of statements that may be regarded as tentative generalizations or recommendations for planning innovation introduction. The list is presented below under four categories.

- I. The Change Advocate
- II. User Participation in Design
- III. Communication Content
- IV. Relationships Between Users and Innovation

The list might be criticized for over-generalization, with the consequence of sounding like dogmatic recipes. We emphasize that we regard these "principles" as tentative and the list as very incomplete. Another criticism may be that the "principles" are obvious. The answer to that is that while they may appear obvious to the reader or to the psychological observer, violations of them can be found regularly in the field, even when the change agent might be expected to be sophisticated in these matters. The problem is to develop a frame of mind to consider these principles far enough in advance to anticipate problems of acceptance, rather than recognizing the obviousness of the violations of good practice in hindsight.

I. THE CHANGE ADVOCATE

- A. A qualified change advocate must be explicitly provided at all the crucial stages in the introduction of an innovation. The following should be resisted:
 1. The assumption of advocacy by an unqualified person.
 2. Dependence on documentation to carry the advocacy function.

3. The expectation that a device will explain itself and sell itself without any explicit documentation or advocacy.
- B. Face-to-face communications are preferable to any other form; individual confrontations *following* a group presentation are often desirable.
- C. The change advocate should identify with the users through evident knowledge of the operating environment.
- D. The change advocate's expertise (if not obvious by reputation) should be established subtly through objective discussion of technical details known to the users. It should never be imposed or asserted.
- E. The change advocate should minimize threats to the user's "expertise" and self-esteem.
- F. When the innovation is to be introduced to a large number of men, special training and trial usage should be provided for representatives of the user group; these, in turn, will become additional change advocates.
- G. Certain instances of training, notably factory training, should be explicitly recognized as a setting in which new equipment is introduced, which implies that in addition to the instructional functions, it is important that at least one person fill the role of qualified change advocate. Since the trainees in factory training will become change advocates (or antagonists) in their own units, it is especially important that development of their attitudes is given careful attention and that they have the information they need to be effective change advocates.

II. USER PARTICIPATION IN DESIGN

- A. Opportunity should be provided for the users (or representatives of the users) to "invent it here"-- provide inputs about operating procedures, constraints, and environment to the designers.
- B. In the case where the users themselves had no input into the design of the innovation, care

should be taken to explain to them how inputs from individuals like themselves were considered in the design of the innovation. (This assumes, of course, that such inputs were, in fact, made and considered seriously.)

- C. If an innovation has a number of the characteristics which the users might have requested had they been asked to participate in the design, the "not-invented-here" reaction can be avoided by asking the users (preferably individually) what characteristics they would like to see. After they have expressed themselves, it is then possible to later present the innovation, pointing out the characteristics that fulfill their expressed wishes. Application of this technique assumes that the innovation does, in fact, correspond to felt and expressed needs. The temptation to "lead" their responses in the direction of what has already been invented should be resisted.
- D. It is important to resolve as much as possible serious differences concerning either the nature of the problem to be solved by an innovation or the approaches to be used in solving the problem *before* hardware is procured or new procedures instituted. The continued existence of widely discrepant opinions at the point where implementation of the innovation occurs may be a strong clue that similar differences will appear at the user level, leading to resistance or rejection. In particular, if the designers and the potential users have different philosophies about what ought to be done, there will be resistance or rejection unless efforts are made either to incorporate the users' approach into the design, or to change the users' philosophy before the innovation is delivered.

III. COMMUNICATION CONTENT

- A. Advocated changes should be presented in the context of the "larger picture," i.e., the system objectives. Formulate the issues explicitly; do not assume the users will do so.
- B. The users must generally agree on deficiencies of the existing system, if not the advantages

of the proposed one. Present objective data (demonstration if possible) with respect to both.

- C. Never introduce the problem by means of the proposed solution.
- D. Advance announcements should focus on existing acknowledged problems rather than proposed changes.
- E. Manipulating social pressures to obtain conformity or acceptance is likely to be ineffective, since the attitude changes desired generally take place in a task-oriented or problem-oriented context in the Navy.
- F. Find out what the user wants to know to make him feel comfortable and competent with the innovation, and give him the appropriate information and experiences. Be sure training is adequate to instill feelings of confidence.
- G. Evidence that the change agent desires to influence the user's position should be minimized; the objective is to solve the problem, not to persuade.
- H. Recognize points in favor of counterarguments to the proposed change in an impartial manner; do not refute them. Avoid, if possible, introducing counterarguments of which the user is not already aware, since these may arouse doubt. However, failure to mention counterarguments of which the user *is* aware may suggest bias and reduce credibility.
- I. Minimize message complexity and jargon, but employ technical vocabulary necessary to convey expertise.
- J. In cases where the user attempts to raise a "smoke screen" of pseudo-expertise in an attempt to either test or discourage the change advocate, it should be dispersed through positive, objective arguments (not counterarguments). This, together with

questions that demonstrate the change agent's sophistication with respect to the equipment, procedures, or operating environment, will reveal his own expertise in an unobtrusive way, and will tend to elicit cooperation instead of resistance.

- K. Appeals to fear (threats) are ill-advised except when the users are totally lacking in concern over the problem. Lowering self-esteem has mixed effects upon persuasibility, depending on other variables, and should also be avoided.

IV. RELATIONSHIPS BETWEEN USERS AND INNOVATION

- A. It is important to recognize all the different users to whom the innovation must be introduced; presentations should be designed and change advocates selected to meet their individual characteristics. Consider carefully whether the technique of assembling a general conference where a single presentation must be made to individuals *widely* differing in background, status, responsibilities, and interests is really efficient. (In some instances, widely differing people must be brought together for exchange of information that is not obtainable in a more homogeneous group; this is a different case.)
- B. The skills required to operate a device or system at the criterion proficiency level should be assessed as expertly as possible, so that adequate training or upgrading can be instituted before delivery. Underestimating the amount of training required to achieve criterion performance can result in negative attitudes due to the threat of being considered incompetent.
- C. Provide *all* required supportive material (operating and maintenance data) upon delivery.
- D. Present material during an introduction that seems to minimize the discrepancy between the old and new systems on features of the old system known to be favored by the users.

(Stay within the "latitude of acceptance.")

- E. Acceptance is aided when the innovation is perceived as directly benefiting the adopters. A particular problem arises when the innovation is essential to the system, but of no direct benefit to the immediate user. Whenever possible, direct advantages to the immediate user should be designed into the device or procedure, and these benefits should be pointed out in the introductions. If there are no benefits to the immediate users, compliance with the system may be obtained in some cases through stressing benefits to the system, *esprit de corps*, patriotism, etc., or it may be necessary to enforce compliance in spite of continuing unfavorable attitudes.⁴

- F. Successful performance with a new system leads to positive attitudes more readily than other forms of introduction. Even apart from direct experience, however, if an innovation is not actually noxious, repeated exposure to it will, up to a point, enhance attitudes toward it; too long or too frequent exposure may induce monotony and boredom.

IMPLICATIONS OF A "PSYCHOLOGICAL VIEWPOINT"

The comments to follow are decidedly speculative, and are not based on explicit data. They are based instead on an attempt to understand why individuals in the Navy, who are in a change agent's role, do things that hinder acceptance of the new devices and procedures, and fail to do things to facilitate acceptance. It clearly is not a lack of concern for the problem; it seems to be rather an inability to see

⁴Some methods of enforcing compliance are less aversive than others; strongly aversive methods may reinforce already existing unfavorable attitudes. A discussion of these topics is beyond the scope of this paper.

the factors leading to resistance, even in retrospect. There is an apparent tendency to attribute "resistance to change" to some innate characteristic of human nature, which is essentially the view that there is no solution to the problem.

In contrast, psychologists and other behavioral scientists are inclined to look immediately to the environment for causes of behavior (including social relationships) or in man's cognitive or physiological makeup. If the behavioral scientist can find such factors, then there is some chance of modifying behavior (including emotional reactions) by exercising control over these factors.

The point is that one must first be *disposed* to look for such causal factors seriously and diligently, and while it appears that behavioral scientists acquire this disposition by virtue of their training, most other people do not. It would appear, therefore, that if *systematic programs* of innovation acceptance are to be instituted in connection with hardware and software development, the distinctive orientation of behavioral scientists would significantly contribute to the discovery of the relevant factors and the planning of effective innovation acceptance procedures.

Aside from the disposition to seek variables in the environment that influence behavior, there is at least one other useful orientation of behavioral scientists, and that is their emphasis on the extent and importance of *differences* between individuals. In reporting the literature search, we de-emphasized studies that related attitude formation and change to variables such as chronic anxiety and self-esteem which require the measurement of individual differences, because such data are not typically now available in practical Navy situations, and our objective was to generate principles that could find some applicability now. Individual differences are important, however, and in many cases can be

taken into account without formal measurement procedures by considering group differences rather than actual differences between individuals. For example, an analysis of the things that can act as incentives for certain kinds of behavior would probably reveal differences between career officers and enlisted men. If this had been sufficiently recognized with respect to the MDCS, probably little emphasis would have been placed on "fleet material readiness" as an incentive for enlisted personnel to do unwelcome paperwork. In general, the process of innovation introduction in the Navy is a complex one, involving many individuals at many levels. The more accurately the characteristics of the groups at each level are assessed, the more effective will be the planning for innovation introduction.

The "engineering" of attitudes and behavior in the direction of desired objectives, aside from ethical and moral questions, may seem to some to be an untenable, impractical, unattainable goal. Even if attitudes and behavior are viewed as being strongly influenced by external (environmental and social) conditions, not enough is known about the relationships between attitudes and these external conditions to speak of "engineering."

It is true that our knowledge is deficient, and for that reason, we urge further study of practical situations. It is also true that all engineering is to some degree an art; designing can be done using the most current scientific knowledge, but eventually a prototype must be built and tried, because complex designs are rarely free from "bugs" that have to be worked out. It is unreasonable to require perfect predictability in human systems, when it is unattainable even in physical systems. In both cases, however, it is reasonable to work for improved predictability through better understanding of the factors controlling and influencing the situation.

RECOMMENDATION FOR "INNOVATION ENGINEER"

It has been suggested that to facilitate acceptance and forestall predictable resistances, planning for introduction should be concurrent with hardware or system design. There seems to be little recognition in the Navy at present for explicit, *comprehensive* planning for innovation introduction, with the result that there are minimal formal provisions for this important function. The growth of technology, in both number and complexity of devices, and the constant revision of procedural systems are clearly recognized, and there is also a general awareness of the acceptance or "resistance to change" problem. Although there are numerous cases in which some device is delivered without warning and with insufficient documentation, there are also cases where careful planning *has* been done. For instance, attention was given to introduction planning in the case of the 3-M System, although there were defects, such as underestimating the amount of training necessary.

Repeatedly, however, the study team encountered cases in which acceptance seemed to hinge largely on the efforts of a single individual who was for some reason interested in the innovation and, fortuitously, by virtue of his interest, position, and understanding of the Navy was able to arrange and expedite conditions for acceptance. In other cases, where such an unofficial change advocate failed to appear, acceptance has been delayed or blocked. The case of the SM target classification method is illustrative: as long as HFR personnel functioned as change advocates, resistance could be identified and dealt with; when explicit change advocacy was relegated to documentation, progress towards acceptance became slow.

The point is that the communication functions involved in effective innovation design and introduction need not and

should not be left to fortuitous circumstances. We would like to suggest strongly that *acceptance of innovations can to a significant degree be "engineered"*; at least a careful analysis of potential users' characteristics and perceptions can result in a significant reduction of the blunders that should be obvious if sufficient attention were paid to these matters. The data from attitude studies and other psychological research, coupled with analysis of field observations such as appear in this report, can provide important cues for facilitating innovation diffusion, although they provide only suggestions and insights rather than recipes. What is needed, however, is that consideration be given to the development of the role of "innovation engineer" or planning specialist whose general functions are listed below.

A. IN THE DESIGN PHASE

1. To provide liaison between those in the operating environment and those involved in the design.
2. To identify not only the obvious users of the innovation but all those who would be affected by its development and implementation.
3. To arrange or expedite contacts between concerned individuals at all levels, to minimize surprises resulting from divergent perceptions of the problem, etc.
4. To ensure that inputs from the operating environment are being made and seriously considered.
5. To identify the tasks that the innovation will impose upon the users and try to ensure that incentives are built in if possible.

B. IN THE INTRODUCTION PHASE

1. To plan a systematic program of introduction, identifying the various audiences and their

characteristics and arranging for selection of qualified change advocates.

2. To serve as change advocate on appropriate occasions.
3. To supervise the introduction to those who will be change advocates for other audiences, and give them brief training in handling counterarguments, avoiding threat, etc.
4. To arrange for communication to the potential users such explicit matters as how user inputs were made into the design, what the advantages to the user are, what the limitations of the device or system are, and so forth.
5. To reevaluate the perceptions of the potential users to determine what features of the innovation might not agree with their desires or expectations, and arrange for attempts to reorient their desires and expectations before delivery.

Although some functions of the "innovation engineer" are anticipated in the above list, a specification of the precise duties, authority, and training of such a specialist will require much more study and planning. For example, it is not immediately clear whether an officer billet should be created for such a specialist, whether these functions should constitute a new role for in-service psychologists, or whether these services should be obtained from Navy contractors having the necessary capabilities.

The primary function of the "innovation engineer" will be to facilitate communication and acceptance, not to manage development or design. It will be part of his function, however, to become as familiar as possible with both the operating environment and the design practices and constraints. In the cases of simpler devices and systems, he, himself, may be able to master enough of the technology, operating problems, and so forth to mediate communication

and to avoid being "snowed" by the pseudo-expertise of those who might use this technique of resistance against him. With more complex innovations, he will have to have the assistance of technical experts and representatives of the users.

It is obvious that this recommendation for the development of an innovation specialist will require more study in terms of implementation. The need, however, clearly exists. The fragmentation of interest and responsibility in a large organization such as the Navy and its contractors leads directly to many of the acceptance problems observed in the present study. What is needed is a person analogous to the systems engineer, overseeing the whole development, but from the standpoint of human reactions to new ideas and proposals.

~~STUCKING PAGE BLANK - NOT FILLED~~

APPENDIX A
QUESTIONNAIRES

QUESTIONNAIRE FOR AERO 46A
BOMB LOADER INTERVIEW

VF-14, Oceana NAS, 31 January 1967
VA-95, Alameda NAS, 13 February 1969

1. Have you ever operated the 46A bomb loader? (How much? Under what circumstances?)
2. Can you describe *exactly* what the 46A was designed to do? I'm interested in how well the purposes of the machine were communicated to you.
3. How does this compare with the way the job was done without the 46A?
4. In actual operation what are its capabilities? (What can it do, and what can't it do?)
5. How easy is it to operate? Are there any particularly good or bad features you could mention about operating the device?
6. Do you know anything about the maintenance of the 46A? Would you rate it as easy or difficult to maintain? Are there specific problems that you happen to know about? (Probe for relationships to ship's personnel.)
7. Do you expect the 46A to make your job easier, more difficult, or about the same? Could you give me specific details?
8. Do you think its use will speed up or slow down the rearming of planes?
9. Do you think the IRR system would work as well without the 46A? (If yes, get detail.)
10. Do you think this is a good device for the Navy? (Even though it makes your job more difficult in some respects?)
11. What do you think of the whole IRR system? Do you think it will do what it's supposed to do?
12. Can you think of any other things about the bomb loader, either good or bad, which we haven't talked about so far?

13. Can you recall when you first heard about the 46A bomb loader? What was the situation? From whom did you hear about it?
14. Do you remember exactly what you heard about it at that time?
15. Was your first impression generally favorable or unfavorable?
16. What happened after that? What did you hear about it (and at what point did you actually operate it)?
17. Was your first impression of the machine changed in any way? How and why?
18. I'd like to know if you have any impressions about how *others* feel about this bomb loader, what kind of reputation it has. For instance, do you have any ideas about how any of your superior officers feel about it? How about men of your own rank?
19. Is there anything else that comes to mind that you'd like to say about the 46A that we haven't covered?
20. Now in order to help us put what you've said into perspective, I'd like to ask a couple of general questions about yourself. What is your actual job; what duties do you perform regularly? How long have you been doing this?
21. Have you been deployed to WESPAC with a combat air group? Length of work day?
22. How long have you been in the Navy? Are you thinking of a career in the Navy?

QUESTIONNAIRE FOR AERO 46A
BOMB LOADER INTERVIEW

VF-14, Oceana NAS, 28 March 1969
VA-95, Norfolk (KENNEDY) and Alameda, 28-31 March 1969

1. To what extent have you operated the 46A loader (since I talked to you two months ago)?

Shore.....

Ship.....

2. Do you think it will do the job it's supposed to do?
3. Has your opinion of the machine changed in the last two months?
4. Are there any particular difficulties you found operating the 46A?

Characteristics of the 46A itself?

Characteristics of the flight deck environment?

5. How reliable was the 46A? What kinds of maintenance problems were there?
6. Do you think the use of the 46A will speed up or slow down the rearming of planes?

Now?

In future?

7. Do you think the whole IRR rearming system would work as well without the 46A?
8. What do you think of the whole IRR system? Do you think it will speed up the rearming of planes?
9. Can you recall when you first heard about the 46A bomb loader? What was the situation? From whom did you hear about it?
10. Was your first impression generally favorable or unfavorable?
11. What happened after that? What did you hear about it (and at what point did you actually operate it)?

12. Was your first impression of the machine changed in any way? How and why?
13. I'd like to know if you have any impressions about how *others* feel about this bomb loader, what kind of reputation it has. For instance, do you have any ideas about how any of your superior officers feel about it? How about men of your own rank?

QUESTIONNAIRE FOR GENERALIZED SONAR
MAINTENANCE TRAINER INTERVIEW

Fleet Sonar School, Key West, 2 April 1969

1. What has been your experience with the GSMT? How have you used it and for how long?
2. Can you describe exactly what the GSMT was designed to do?
3. In actual use, what are its capabilities? What can it do, and what can't it do?
4. How easy is it to use in instruction? Are there any particularly good or bad features you could mention about using the device?
5. How easy is it to use from the standpoint of the student?
6. What about maintenance of the GSMT itself? Were there any specific problems that came up?
7. Do you expect the GSMT to make your job easier, more difficult, or about the same?
8. Do you think this was a good device for the Navy to develop (even though it may make your job harder in some respects)?
9. Can you recall when you first heard about the GSMT? What was the situation? From whom did you hear about it, and what did you hear?
10. Was your first impression generally favorable or unfavorable?
11. What happened after that? What did you hear about it, and at what point did you actually use it?
12. Was your first impression of the machine changed in any way? How and why?
13. I'd like to know if you have any impressions about how *others* feel about this device, what kind of reputation it has.

14. Is there anything else that comes to mind that you'd like to say about the GSMT that we haven't covered?

QUESTIONNAIRE FOR GENERALIZED SONAR
MAINTENANCE TRAINER INTERVIEW

Fleet ASW School, San Diego, 22 April 1969

We are studying the process of how new devices are introduced into the Navy. As you may know, tomorrow there will be a briefing on a sonar maintenance training device which is being evaluated. The device is called the GSMT, or Generalized Sonar Maintenance Trainer. We're interested in what, if anything, you know about this trainer, or what you've heard about it. In other words, when something new is introduced, part of the introduction is through formal channels such as briefings and technical manuals, but there's also information which might filter in informally. We're interested in both aspects, so we'd like to find out now what information you might have picked up about the GSMT.

1. When was the first time you heard of this device? What did you hear? From whom?
2. Was your first impression generally favorable or unfavorable?
3. Has anything happened since you first heard of the GSMT to change your impression?
4. Could you tell me as much as you know about the GSMT-- why it was developed, what it was designed to do, how it might fit into the maintenance training curriculum-- anything you know about it.
5. What training devices are used *now* in sonar maintenance training? What would you say are the good and bad points about using these devices for training?
6. What changes would you like to see, either in the training devices or in the curriculum?
7. How long have you been instructing in sonar maintenance? Have you been an instructor in other courses?

8. Name? Rate?

QUESTIONNAIRE FOR INTERVIEW ON NEW
TARGET CLASSIFICATION PROCEDURE

Fleet Sonar School, Key West, April, 1969

1. Are you aware of a recently proposed new procedure for initial sonar target classification? (Have you read Technical Bulletin STB 69-5 published by the Naval Personnel Research Activity or was the procedure described to you by someone else?)
2. Can you describe *exactly* what the purpose of this proposed procedure is?
3. How does this compare with how initial classification was performed in the past?
4. In actual operation, what classification capability does this procedure supposedly have? What capabilities does it have, and what are its limitations, compared to other classification procedures?
5. How easy is the procedure to follow? What particularly good or bad features can you mention about it?
6. Do you know anything about changes in equipment or operating practices that would be required by the new procedure? Are these practical?
7. As a sonar supervisor aboard ship, would you expect the new procedure to make your job easier, about the same, or more difficult?
8. Do you think the new procedure will help or hinder ASW operations? Will more targets (or fewer) be classified correctly? Will less (or more) time be required to classify? Will the false alarm rate be affected? If so, how?
9. Do you think this is a good procedure for the Navy to adopt, regardless of whether it might make your job more difficult in some respects? (If not, are there some modifications that could be made to make it effective?)
10. Can you recall when you first heard about the new initial classification procedure? Do you remember

exactly what you heard about it at that time?

11. Was your first impression generally favorable or unfavorable?
12. Has your first impression changed in any way? How and why?
13. I'd like to know how *others* feel about this proposed procedure. Do they feel any different from yourself? How and why?
14. What is your assignment at the school? Your exact duties? How long have you had this assignment?

QUESTIONNAIRE FOR 3-M SYSTEM INTERVIEW

Destroyer Base, San Diego, January, 1970

1. When and under what circumstances were you first introduced to the 3-M System?
2. Are you familiar with the previous shipboard maintenance management system (Machinery History Cards, Ordnance History Cards, Current Ship's Maintenance Projects [CSMP], etc.)?
3. Which system was in effect when you entered the Navy?
4. Which do you prefer?
5. Do you consider PMS to be a good system?
6. What do you like most--like least about PMS?
7. What are the objectives of PMS?
8. Are these objectives being achieved?
9. Are these objectives worthwhile for the Navy--for your ship?
10. What are the advantages of PMS to you personally?
11. Do you consider MDCS to be a good system?
12. What do you like most--like least about MDCS?
13. Do you continue to maintain the CSMP?
14. What are the objectives of MDCS?
15. Are these objectives being achieved?
16. Are these objectives worthwhile for the Navy--for your ship?
17. What are the advantages of MDCS to you personally?
18. What is the single most/least desirable feature of MDCS?

19. When you assumed your current responsibilities for MDCS, were you properly prepared?
20. What changes would you like to see in the system?
 - a. Forms
 - b. Reports (input and feedback)
 - c. Shipboard management
21. Has MDCS changed, have the changes been improvements?
22. Does the 3-M System provide procedures for users to make suggestions and recommend changes in 3-M?
 - a. Describe them.
 - b. Have you ever submitted a proposed change?
 - c. Was it or a similar change implemented?

APPENDIX B

REFERENCES

- Abelson, H. I. *Persuasion: How opinions and attitudes are changed*. New York: Springer Publishing, 1959.
- Abelson, R. P., & Kanouse, D. E. Subjective acceptance of verbal generalizations. In S. Feldman (Ed.), *Cognitive consistency*. New York: Academic Press, 1966.
- Adams, J. S. Reduction of cognitive dissonance by seeking consonant information. *Journal of Abnormal and Social Psychology*, 1961, 62, 74-78.
- Adorno, T. W., Frenkel-Brunswik, E., Levenson, D. J., & Sanford, R. N. *The authoritarian personality*. New York: Harper, 1950.
- Allyn, J., & Festinger, L. The effectiveness of unanticipated persuasive communications. *Journal of Abnormal and Social Psychology*, 1961, 62, 35-40.
- Applewhite, P. B. *Organizational behavior*. Englewood Cliffs, N. J.: Prentice-Hall, 1965.
- Apsler, R., & Sears, D. O. Warning, personal involvement, and attitude change. *Journal of Personality and Social Psychology*, 1968, 9, 162-166.
- Arensberg, C. M., & Niehoff, A. H. Technical cooperation and cultural reality. Department of State, Agency for International Development, 1963.
- Argyris, C. *Interpersonal competence and organizational effectiveness*. Homewood, Ill.: Dorsey Press, 1962.
- Aristotle (Selected Works). In R. McKeon (Ed.), *The basic works of Aristotle*. New York: Random House, 1941.
- Arnold, W. E. An experimental study of the effects of communicator credibility and attitude change on subsequent overt behavior. *Dissertation Abstracts*, 1967, 27, 3969.
- Aronson, E., & Carlsmith, J. M. Performance expectancy as a determinant of actual performance. *Journal of Abnormal and Social Psychology*, 1962, 65, 178-182.
- Baker, E. E., & Redding, W. C. The effects of perceived tallness in persuasive speaking: An experiment. *Journal of Communication*, 1961, 12, 51-53.

- Bare, C. E. The measurement of attitudes toward man-machine systems. *Human Factors*, 1966, 8, 71-79.
- Bass, B. *Organization psychology*. Boston: Allyn and Bacon, 1965.
- Behan, R. A., & Siciliani, F. A. The landing task and pilot acceptance of displays for landing in reduced weather minimums: Display implications and cockpit instrument arrangement. Serendipity Associates, 1965.
- Berelson, B., & Steiner, G. A. *Human behavior: An inventory of scientific findings*. New York: Harcourt, Brace & World, 1964.
- Berger, P. K., Matheny, W. G., & Newmiller, C. E. The role of trial in the acceptance and adoption of new equipment: A review and summary. *Life Sciences Rep. No. LS/TR 66-1*, 1966.
- Berkowitz, L. (Ed.) *Advances in experimental social psychology*. Vol. 1. New York: Academic Press, 1964.
- Berkowitz, L. (Ed.) *Advances in experimental social psychology*. Vol. 2. New York: Academic Press, 1965.
- Berkowitz, L. (Ed.) *Advances in experimental social psychology*. Vol. 3. New York: Academic Press, 1967.
- Berkowitz, L., & Cottingham, D. R. The interest value and relevance of fear arousing communications. *Journal of Abnormal and Social Psychology*, 1960, 60, 37-43.
- Berlyne, D. E. Emotional aspects of learning. *Annual Review of Psychology*, 1964, 15, 115-142.
- Blau, P. M. *Exchange and power in social life*. New York: Wiley, 1964.
- Bonchek, V. Commitment, communicator credibility and attitude change. *Dissertation Abstracts*, 1967, 27, 3929-3930.
- Boomer, D. S. Subjective certainty and resistance to change. *Journal of Abnormal and Social Psychology*, 1959, 58, 323-328.
- Bowers, D. G. Three studies in change: An account of data-based organizational development activities in three continuous process firms. Institute for Social Research, University of Michigan, Contract N00014-67-A-0181-0013, NR 170-719/7-29/68, Technical Report, September 30, 1969.

- Brayfield, A. H., & Crockett, W. H. Employee attitudes and employee performance. *Psychological Bulletin*, 1955, 52, 396-429.
- Brehm, J. W. A dissonance analysis of attitude discrepant behavior. In M. J. Rosenberg, C. I. Hovland, W. J. McGuire, R. P. Abelson and J. W. Brehm, *Attitude organization and change*. New Haven: Yale University Press, 1960.
- Brehm, J. W., & Cohen, A. R. *Explorations in cognitive dissonance*. New York: John Wiley & Sons, 1962.
- Brewer, B. A., & Gross, M. C. Conditioning of attitudes using a backward conditioning paradigm. University of Hawaii, Honolulu, Hawaii, Contract N00014-67-A-0387-0007, Technical Report No. 3, August, 1969.
- Brock, T. C., Edelman, S. K., Edwards, D. S., & Schuck, J. R. Seven studies of performance expectancy as a determinant of actual performance. *Journal of Experimental Social Psychology*, 1965, 1, 295-310.
- Campbell, D. T. Social attitudes and other acquired behavioral dispositions. In S. Koch (Ed.), *Psychology: A study of a science*. New York: McGraw-Hill, 1963.
- Carlson, E. R. Attitude change through modification of attitude structure. *Journal of Abnormal and Social Psychology*, 1956, 52, 256-261.
- Cartwright, D. Achieving change in people: Some implications of group dynamics theory. *Human Relations*, 1951, 4, 381-392.
- Cartwright, D., & Harary, F. Structural balance: A generalization of Heider's theory. *Psychological Review*, 1956, 63, 277-293.
- Coch, L., & French, J. R. P. Overcoming resistance to change. *Human Relations*, 1948, 1, 512-532.
- Cohen, A. R. Some implications of self-esteem for social influence. In C. I. Hovland and I. L. Janis (Eds.), *Personality and persuasibility*. New Haven, Yale University Press, 1959.
- Cooper, J. B., & Michiels, L. J. A study of attitudes as functions of objective knowledge. *Journal of Social Psychology*, 1952, 36, 59-71.

- Corrozi, J. F., & Rosnow, R. L. Consonant and dissonant communications as positive and negative reinforcements in opinion change. *Journal of Personality and Social Psychology*, 1968, 8, 217-230.
- Cromwell, H., & Kunkel, R. An experimental study of the effect on the attitude of listeners of repeating the same oral propaganda. *Journal of Social Psychology*, 1952, 35, 175-184.
- Das, J. P., & Nanda, P. C. Mediated transfer of attitudes. *Journal of Abnormal and Social Psychology*, 1963, 66, 12-16.
- Deese, J., Lazarus, R. S., & Keenan, J. Anxiety, anxiety reduction, and stress in learning. *Journal of Experimental Psychology*, 1953, 46, 55-60.
- De Fleur, M. L., & Westie, F. R. Attitude as a scientific concept. *Social Forces*, 1963, 42, 17-31.
- Deutsch, M. Field theory in social psychology. In G. Lindzey (Ed.), *Handbook of social psychology*. VI. *Theory and method*. Reading, Mass.: Addison-Wesley Publishing, 1954.
- Deutsch, M., & Gerard, H. B. A study of the normative and informational influences upon individual judgment. *Journal of Abnormal and Social Psychology*, 1955, 51, 629-636.
- Deutsch, M., & Karuss, R. M. *Theories in social psychology*. New York: Basic Books, 1965.
- Dubin, R. *Human relations in administration*. Englewood Cliffs, N. J.: Prentice-Hall, 1961.
- Elbing, A. O. An experimental investigation of the influence of reference group identification on role playing as applied to business. Doctoral dissertation, University of Washington, 1962.
- Ewig, T. N. A study of certain factors involved in changes of opinion. *Journal of Social Psychology*, 1942, 16, 63-88.
- Eysenck, H. J., & Crown, S. An experimental study in opinion-attitude methodology. *International Journal of Opinion and Attitude Research*, 1949, 3, 47-86.

- Feldman, S. *Cognitive consistency: Motivational antecedents and behavioral consequents*. New York: Academic Press, 1966.
- Festinger, L. Cognitive dissonance. *Scientific American*, 1952, 207, 93.
- Festinger, L. Behavioral support for opinion change. *Public Opinion Quarterly*, 1964, 28, 403-417.
- Fiedler, F. E. *A theory of leadership effectiveness*. New York: McGraw-Hill, 1967.
- Fishbein, M. Beliefs, attitudes, and behavior. In S. Feldman (Ed.), *Cognitive consistency*. New York: Academic Press, 1966.
- Fishbein, M. (Ed.) *Readings in attitude theory and measurement*. New York: John Wiley & Sons, 1967.
- Fishbein, M., & Hunter, R. Summation versus balance in attitude organization and change. *Journal of Abnormal and Social Psychology*, 1964, 69, 505-510.
- Fisher, S., Rubenstein, I., & Freeman, R. W. Intertrial effects of immediate self-committal in a continuous social influence situation. *Journal of Abnormal and Social Psychology*, 1956, 52, 200-207.
- Folley, J. D., & Elliott, T. K. A field survey of electronic maintenance data. Aerospace Medical Research Laboratories, Aerospace Medical Division, Wright-Patterson AFB, 1967.
- Foster, G. M. *Traditional cultures: And the impact of technological change*. New York: Harper and Row Publishers, 1962.
- Fraser, T. M., Jr. *Sociocultural parameters in directed change*. Ithaca, N. Y.: Human Organization, 1963.
- French, J. R. P., Jr. A formal theory of social power. *Psychological Review*, 1956, 63, 181-194.
- Gelfand, D. M. The influence of self-esteem on rate of verbal conditioning and social matching behavior. *Journal of Abnormal and Social Psychology*, 1962, 65, 259-265.

- Gollob, H. F., & Dittes, J. E. Effects of manipulated self-esteem on persuasibility depending on threat and complexity of communication. *Journal of Personality and Social Psychology*, 1965, 2, 195-201.
- Greenwald, A. G., Brock, T. C., & Ostrom, T. M. (Eds.) *Psychological foundations of attitudes*. New York: Academic Press, 1968.
- Gross, M. C., & Staats, A. W. Interest inventory items as attitude eliciting stimuli in classical conditioning: A test of the A-R-D theory. University of Hawaii, Honolulu, Hawaii, Contract N00014-67-A-0387-0007, Technical Report No. 4, September, 1969.
- Hamblin, R. L., & Wiggins, J. A. Ambiguity and the rate of social adaption. Washington University, Contract ONR 811(16), Technical Report 1, 1954.
- Hartman, G. A. A field experiment on the comparative effectiveness of "emotional" and "rational" political leaflets in determining election results. *Journal of Abnormal and Social Psychology*, 1936, 31, 99-114.
- Harvey, O. J., & Consalvi, C. Status and conformity to pressure in informal groups. *Journal of Abnormal and Social Psychology*, 1960, 60, 182-187.
- Havron, M. D., Fay, R. J., & McGrath, J. E. The effectiveness of small military units. Institute for Research in Human Relations (Adjutant General's Office, *Personnel Research Section Rep. 980*), 1952.
- Iembree, H. W. Criteria of soldier acceptance. USA Quartermaster Research and Development Center, *Environmental Protection Division Rep. 229*, 1954.
- Hennes, J. D. Attitudes toward instructional television as a function of social interaction and resistance to innovation. *Dissertation Abstracts*, 1967, 27, 3925-3936.
- Hobart, E. M., & Hovland, C. I. The effect of commitment on opinion change following a communication. *American Psychologist*, 1954, 9, 394.
- Hoffman, M. L. Some psychodynamic factors in compulsive conformity. *Journal of Abnormal and Social Psychology*, 1953, 48, 383-393.
- Hollander, E. P. Conformity, status, and idiosyncrasy credit. *Psychological Review*, 1958, 65, 117-127.

- Hollander, E. P., & Julian, J. W. Sources of leader authority, leader behavior, and interpersonal influence. State University of New York at Buffalo, Contract ONR 4679(00) NR 177-269, Final Report, December, 1969.
- Horowitz, I. A. Effects of volunteering, fear arousal, and number of communications on attitude change. *Journal of Personality and Social Psychology*, 1969, 11, 34-37.
- Hovland, C. I. Effect of mass media on communication. In G. Lindzey (Ed.), *Handbook of social psychology*. Vol. 2 *Special fields and applications*. Reading, Mass.: Addison-Wesley, 1954.
- Hovland, C. I. Reconciling conflicting results derived from experiments and survey studies of attitude change. *American Psychologist*, 1959, 14, 8-17.
- Hovland, C. I., Harvey, O. J., & Sherif, M. Assimilation and contrast effects in reactions to communication and attitude change. *Journal of Abnormal and Social Psychology*, 1957, 55, 244-252.
- Hovland, C. I., & Janis, I. L. (Eds.) *Personality and Persuasibility*. New Haven: Yale University Press, 1959.
- Hovland, C. I., Janis, I. L., & Kelley, H. H. *Communication and persuasion: Psychological studies of opinion change*. New Haven: Yale University Press, 1953.
- Hovland, C. I., Lumsdaine, A. A., & Sheffield, F. D. The effects of presenting "one side" versus "both sides" in changing opinions on a controversial subject. In R. L. Rosnow and E. J. Robinson (Eds.), *Experiments in persuasion*. New York: Academic Press, 1967.
- Hovland, C. I., & Mandell, W. An experimental comparison of conclusion drawing by the communicator and by the audience. *Journal of Abnormal and Social Psychology*, 1952, 47, 581-588.
- Hovland, C. I., & Pritzker, H. Extent of opinion change as a function of amount of change advocated. *Journal of Abnormal and Social Psychology*, 1957, 54, 257-261.
- Hovland, C. I., & Weiss, W. The influence of source credibility on communication effectiveness. *Public Opinion Quarterly*, 1951, 15, 635-650.
- Insko, C. A. *Theories of attitude change*. New York: Appleton-Century-Crofts, 1967.

- Insko, C. A., & Robinson, J. E. Belief similarity versus race as determinants of reactions to Negroes by southern white adolescents: A further test of Rokeach's theory. *Journal of Personality and Social Psychology*, 1967, 7, 216-221.
- Jahoda, M., & Warren, N. (Eds.) *Attitudes: Selected readings*. Baltimore: Penguin Books, 1966.
- Jakobovits, L. A. Effects of mere exposure: A comment. *Journal of Personality and Social Psychology*, 1968, 9, (Monograph Supplement), 30-32.
- Janis, I. L., & Feshbach, S. Effects of fear-arousing communications. *Journal of Abnormal and Social Psychology*, 1953, 48, 78-92.
- Janis, I. L., & Feshbach, S. Personality differences associated with responsiveness to fear-arousing communications. *Journal of Personality*, 1954, 23, 154-166.
- Janis, I. L., & Field, P. Sex differences and personality factors related to persuasibility. In C. I. Hovland and I. L. Janis (Eds.), *Personality and persuasibility*. New Haven: Yale University Press, 1959.
- Janis, I. L., Kaye, D., & Kirschner, P. Facilitating effects of "eating-while-reading" on responsiveness to persuasive communications. *Journal of Personality and Social Psychology*, 1965, 1, 181-186.
- Janis, I. L., & Mann, L. Emotional arousal and attitude change. In R. L. Rosnow and E. J. Robinson (Eds.), *Experiments in persuasion*. New York: Academic Press, 1966.
- Janis, I. L., & Terwilliger, R. F. An experimental study of psychological resistances to fear arousing communications. *Journal of Abnormal and Social Psychology*, 1962, 65, 403-410.
- Jarrett, R. F., & Sherriffs, A. C. Propaganda, debate, and impartial presentation as determiners of attitude change. *Journal of Abnormal and Social Psychology*, 1955, 48, 33-41.
- Johnson, H., Torcivia, J. M., & Poprick, M. A. Effects of source credibility on the relationship between authoritarianism and attitude change. *Journal of Personality and Social Psychology*, 1968, 9, 179-183.

- Johnson, R. E. Smoking and the reduction of cognitive dissonance. *Journal of Personality and Social Psychology*, 1968, 9, 260-265.
- Jones, E. E., & Gerard, H. B. *Foundations of social psychology*. New York: John Wiley & Sons, 1967.
- Jones, L. V., & Bock, R. D. Methodology of preference measurement. University of Chicago (USA Quartermaster Research and Development Center), 1950.
- Jones, R. A., & Brehm, J. W. Attitudinal effects of communicator attractiveness when one chooses to listen. *Journal of Personality and Social Psychology*, 1967, 6, 64-70.
- Jordan, N. Motivational problems in human computer operations. *Human Factors*, 1962, 4, 171-175.
- Joshi, V. Attitude towards reception of technology. *Journal of Social Psychology*, 1962, 58, 3-7.
- Julian, J. W., & Kimball, R. K. Effects of task orientation, and level of prior agreement on willingness to agree. State University of New York at Buffalo, Contract ONR 4679-(00)-NR4177-269, Technical Report 13, November, 1969.
- Kamen, J. M. Prospects for shaping soldiers' attitudes toward material. Seventh Annual Army Human Factors Engineering Conference, 1961.
- Katz, D. (Ed.) Attitude change. *Public Opinion Quarterly*, 1960, 14, 1-365 (special issue).
- Katz, D. The functional approach to the study of attitudes. *Public Opinion Quarterly*, 1960, 24, 163-204.
- Katz, D., McClintock, C., & Sarnoff, I. The measurement of ego defense as related to attitude change. *Journal of Personality*, 1957, 25, 465-474.
- Katz, D., Sarnoff, I., & McClintock, C. Ego defense and attitude change. *Human Relations*, 1956, 9, 27-45.
- Kelley, H. H., & Woodruff, C. L. Member's reactions to apparent group approval of a counternorm communication. *Journal of Abnormal and Social Psychology*, 1956, 52, 67-74.
- Kelman, H. C. Three processes of social influence. *Public Opinion Quarterly*, 1961, 25, 57-78.

- Kelman, H. C., & Hovland, C. I. "Reinstatement" of the communicator in delayed measurement of opinion change. *Journal of Abnormal and Social Psychology*, 1953, 48, 327-333.
- Kennedy, A. Individual reactions to change as seen in senior management in industry. *The Lancet*, 1957, 1, 261-263 (University of Edinburgh).
- Kidd, J. S., & Campbell, D. T. Conformity to groups as a function of group success. *Journal of Abnormal and Social Psychology*, 1955, 51, 390-393.
- Kiesler, C. A., Collins, B. E., & Miller, N. *Attitude change: A critical analysis of theoretical approaches*. New York: John Wiley & Sons, Inc., 1969.
- Kimbrell, D. L., & Blake, R. R. Motivational factors in the violation of a prohibition. *Journal of Abnormal and Social Psychology*, 1958, 56, 132-133.
- Lipnis, D. The effects of leadership style and leadership power upon the inducement of an attitude change. *Journal of Abnormal and Social Psychology*, 1958, 57, 173-180.
- Knower, F. H. Experimental studies of changes in attitude: I. A study of the effect of oral argument on change of attitude. *Journal of Social Psychology*, 1935, 6, 315-347.
- Lana, R. E. Interest, Media, and order effects in persuasive communications. *Journal of Psychology*, 1963, 56, 9-13.
- Parmer, G. Social judgment approach to the investigation of French and English Canadian attitudes. Paper presented to the Annual Meeting of the Eastern Psychological Association, New York City, April, 1966.
- Leshner, R. L., & Howick, G. J. Assessing technology transfer. National Aeronautics and Space Administration, Scientific and Technical Division, NASA SP-5067, 1966.
- Leventhal, H., & Perloe, S. I. A relationship between self-esteem and persuasibility. *Journal of Abnormal and Social Psychology*, 1962, 64, 385-388.
- Levonian, E. Self esteem and opinion change. *Journal of Personality and Social Psychology*, 1968, 9, 257-259.
- Likert, R. Motivational dimensions of administration. In R. A. Walker (Ed.), *America's manpower crisis: The report of the Institute on Manpower Utilization and Government Personnel*. Public Administration Service, 1952.

- Likert, R. *New patterns of management*. New York: McGraw-Hill, 1961.
- Linn, L. S. Verbal attitudes and overt behavior: A study of racial discrimination. *Social Forces*, 1965, 43, 353-364.
- Linton, H. B. Dependence on external influence: Correlates in perception, attitudes and judgment. *Journal of Abnormal and Social Psychology*, 1955, 51, 502-507.
- Lowlin, A., & Epstein, G. F. Does expectancy determine performance? *Journal of Experimental Social Psychology*, 1965, 1, 248-255.
- Mackie, R. R., & Christensen, P. R. Translation and application of psychological research. *HFR Tech. Rep. 716-1*, 1967.
- MacLean, M. Some multivariate designs for communication research. *Journalism Quarterly*, 1965, 42, 614-622.
- Madadi, S. R. Meaning, novelty, and affect: Comments on Zajonc's paper. *Journal of Personality and Social Psychology*, 1968, 9 (Monograph Supplement), 28-29.
- Mann, L. The effect of relations between evaluated entities on attitude change. *Australian Journal of Psychology*, 1966, 18, 41-48.
- Matheny, W. G., & Berger, P. K. Study of attitude change toward equipment design: Effects of brief experience vs. printed communication on altimeter preference. *Life Sciences Tech. Rep. 1*, Contract Nonr 4097(00), 1964.
- Mathews, J. B., Whittenburg, J. A., Barnes, R. P., Cheek, F. V., & Wise, J. E. A pilot study to investigate non-utilization of Navy equipment (U). *Human Sciences Rep. HSR-RR-65/9-Rn*, 1965. CONFIDENTIAL.
- Mausner, B. The effect of prior reinforcement on the interaction of observed pairs. *Journal of Abnormal and Social Psychology*, 1954, 49, 65-68.
- McClelland, W. A. The process of effecting change. Presidential Address to the Division of Military Psychology, American Psychological Association, 1 September 1968.
- McGinnies, E., & Leibowitz, J. M. An outline of selected persuasion research between 1952 and 1967. University of Maryland, College Park, Maryland, Contract Nonr 595-21, NR 171-250, Tech. Rep. No. 14, July, 1969.

- McGrath, J. E., & Altman, I. *Small group research*. New York: Holt, Rinehart and Winston, 1966.
- McGuire, W. J. Persistence of the resistance to persuasion induced by various types of prior belief defenses. *Journal of Abnormal and Social Psychology*, 1962, 64, 241-248.
- McGuire, W. J. *Effectiveness of fear appeals in advertising*. New York: Advertising Research Foundation, 1963.
- McGuire, W. J. Inducing resistance to persuasion. In L. Berkowitz (Ed.), *Advances in experimental social psychology*. Vol. 1. New York: Academic Press, 1964.
- McGuire, W. J. Attitudes and opinions. *Annual Review of Psychology*, 1966, 17, 475-514.
- McGuire, W. J. Personality and susceptibility to social influence. In E. F. Borgatta and W. W. Lambert (Eds.), *Handbook of personality theory and research*. Chicago: Rand McNally, 1968. (a)
- McGuire, W. J. Personality and attitude change: A theoretical housing. In A. G. Greenwald, et al. (Eds.), *Attitude change theory and research*. New York: Academic Press, 1968, in press. (b)
- McNiven, M. The effects on learning of the perceived usefulness of the material to be learned. USN Special Devices Center, SPECDEV CEN 269 7 54, 1955.
- Millman, S. Anxiety, comprehension, and susceptibility to social influence. *Journal of Personality and Social Psychology*, 1968, 9, 251-256.
- Mills, J. Opinion change as a function of the communicator's desire to influence and liking for the audience. *Journal of Experimental Social Psychology*, 1966, 2, 152-159.
- Mills, J., & Aronson, E. Opinion change as a function of the communicator's attractiveness and desire to influence. *Journal of Personality and Social Psychology*, 1965, 1, 173-177.
- Moeller, G., & Applezweig, M. H. A motivational factor in conformity. *Journal of Abnormal and Social Psychology*, 1957, 55, 114-120.
- Moscovici, S. Attitudes and opinions. *Annual Review of Psychology*, 1963, 14, 231-260.

- Naval Training Device Center. Use of the operational flight trainer. Naval Training Device Center Rep. NAVTRADEVCCEN 1734-00-1, 1966.
- Niehoff, A. H. Food habits and the introduction of new foods. *Journal of the Washington Academy of Sciences*, March, 1967, 30-37.
- Niehoff, A. H. Intragroup communication and induced change. *HumRRO Professional Paper* 25-67, 1967.
- Niehoff, A. J., & Anderson, J. C. The process of cross-cultural innovation. *HumRRO Professional Paper* 36-67, 1967.
- Parker, J. F., Jr., & Hackman, R. C. The relationship between attitudes toward the Army and the acceptance accorded to OM items of issue. *Journal of Applied Psychology*, 1956, 40, 329-332.
- Peak, H. Attitude and motivation. In M. R. Jones (Ed.), *Nebraska symposium on motivation*. Lincoln, Nebraska: University of Nebraska Press, 1955.
- Peak, H. Annual report of attitude change project. University of Michigan, Contract Nonr 1224(10), 1956.
- Peak, H. The effect of aroused motivation on attitudes. *Journal of Abnormal and Social Psychology*, 1960, 61, 463-468.
- Peak, H., & Morrison, H. W. The acceptance of information into attitude structure. *Journal of Abnormal and Social Psychology*, 1958, 57, 127-135.
- Pepitone, A. Some conceptual and empirical problems of consistency models. In S. Feldman (Ed.), *Cognitive consistency*. New York: Academic Press, 1966.
- Pepitone, A. Theories of, in and near social psychology. *Contemporary Psychology*, 1967, 12, 289-291.
- Perloe, S. I. Status and the judgment of occupational prestige. *Journal of Abnormal and Social Psychology*, 1961, 63, 671-674.
- Persselin, L. E. Conditions for innovation in educational technology. *Educational Technology*, 1968, 8, 5-8.
- Peterson, P. D., & Koulack, D. Attitude change as a function of latitudes of acceptance and rejection. *Journal of Personality and Social Psychology*, 1969, 11, 309-311.

- Pitz, G. F. An inertia effect (resistance to change) in the revision of opinion. *Canadian Journal of Psychology*, 1969, 23, 24-33.
- Pollis, N. Relative stability of reference scales formed under individual, togetherness, and group situations. Doctoral dissertation, University of Oklahoma, 1964.
- Prentice, W. C. H. Some cognitive aspects of motivation. *American Psychologist*, 1961, 16, 503-511.
- Price, H. E., Smith, E. E., & Gartner, W. B. A study of pilot acceptance in the development of all-weather landing systems. Serendipity Associates, April, 1964.
- Rath, R., & Misra, S. K. Change of attitudes as a function of size of discussion groups. *Journal of Social Psychology*, 1963, 59, 247-257.
- Rhine, R. J., & Silun, B. A. Acquisition and change of a concept attitude as a function of consistency of reinforcement. *Journal of Experimental Psychology*, 1958, 55, 524-529.
- Rodgers, R. W., & Thistlethwaite, D. L. An analysis of active and passive defenses in inducing resistance to persuasion. *Journal of Personality and Social Psychology*, 1969, 11, 301-308.
- Rokeach, M. *Beliefs, attitudes and values*. San Francisco: Jossey-Bass, 1968.
- Rorer, L. G. The great response style myth. *Psychological Bulletin*, 1965, 63, 129-156.
- Rosenberg, J. J., Hovland, C. I., McGuire, W. J., Abelson, R. P., & Brehm, J. W. *Attitude organization and change*. New Haven: Yale University Press, 1960.
- Rosnow, R. L., & Robinson, E. J. *Experiments in persuasion*. New York: Academic Press, 1967.
- Rossomando, N. P., & Weiss, W. Attitude change effects of timing and amount of payment for counterattitudinal behavior. *Journal of Personality and Social Psychology*, 1970, 14, 32-38.
- Sarnoff, I., & Katz, D. The motivational bases of attitude change. *Journal of Abnormal and Social Psychology*, 1954, 49, 115-124.

- Schramm, W. Mass communication. *Annual Review of Psychology*, 1962, 13, 251-284.
- Schroder, H. M., Driver, M. J., & Streufert, S. *Human information processing*. New York: Holt, Rinehart and Winston, Inc., 1967.
- Scott, W. A. Attitude change through reward of verbal behavior. *Journal of Abnormal and Social Psychology*, 1957, 55, 72-75.
- Sears, D. O. Social anxiety, opinion structure, and opinion change. *Journal of Personality and Social Psychology*, 1967, 7, 142-151.
- Sears, D. O., Freedman, J. L., & O'Connor, E. F. The effects of anticipated debate and commitment on the polarization of audience opinion. *Public Opinion Quarterly*, 1964, 28, 615-627.
- Sears, D. O., & Abeles, R. P. Attitudes and opinions. *Annual Review of Psychology*, 1969, 20, 253-288.
- Seaton, R. W. Bases of soldiers' opinions of material. Proceedings of the Seventh Annual Army Human Factors Engineering Conference, Ann Arbor, 1961.
- Sells, S. B., & Trites, D. K. Attitudes. In E. W. Harris (Ed.), *Encyclopedia of educational research*. (3rd ed.) New York: Macmillan, 1960.
- Sensenig, J., & Brehm, J. W. Attitude change from an implied threat to attitudinal freedom. *Journal of Personality and Social Psychology*, 1968, 8, 324-330.
- Sherif, C. W., Sherif, M., & Nebergall, R. E. *Attitude and attitude change: The social judgment-involvement approach*. Philadelphia: W. B. Saunders, 1965.
- Sherif, M., & Hovland, C. I. *Social judgment: Assimilation and contrast effects in reaction to communication and attitude change*. New Haven: Yale University Press, 1961.
- Sherif, M., & Sherif, C. W. Attitude as the individual's own categories: The social judgment-involvement approach to attitude and attitude change. In C. W. Sherif and M. Sherif, *Attitude, ego involvement and change*. New York: John Wiley & Sons, 1967.
- Sherif, M. On the relevance of social psychology. *American Psychologist*, 1970, 25, 144-156.

- Siegel, A. E., & Siegel, S. Reference groups, membership groups, and attitude change. *Journal of Abnormal and Social Psychology*, 1957, 55, 360-364.
- Silverman, I. Differential effects of ego threat upon persuasibility for high and low self-esteem subjects. *Journal of Abnormal and Social Psychology*, 1964, 69, 567-572.
- Silverman, I. Role-related behavior of subjects in laboratory studies of attitude change. *Journal of Personality and Social Psychology*, 1968, 8, 343-348.
- Simpson, H. K., Jr., & Parker, E. L. Human factors problems in antisubmarine warfare: Maintenance status and fleet acceptance of ASPECT target classification equipment (U). *HFR tech. Rep. 206-33*, 1965. SECRET.
- Smith, E. E. The effects of clear and unclear role expectations on group productivity and defensiveness. *Journal of Abnormal and Social Psychology*, 1957, 55, 213-217.
- Smith, E. E. The power of dissonance techniques to change attitudes. *Public Opinion Quarterly*, 1961, 25, 626-639.
- Smith, M. H., Jr. Instructional sets and habit interference. *Journal of Experimental Psychology*, 1952, 44, 267-272.
- Smith, R. H. Vital goal--A workable Navy. *U. S. Naval Institute Proceedings*, 1965, 91, 60-67.
- Solarz, A. K., Matheny, W. G., Dougherty, D. J., & Hasler, S. G. The effect of attitude toward link training upon performance in the aircraft. University of Illinois, Contract AF 33(038) 25726, *Memo. Rep. D 12*, 1953.
- Spicer, E. H. (Ed.) *Human problems in technological change*. New York: Russell Sage Foundation, 1952.
- Staats, A. W., & Staats, C. K. Attitudes established by classical conditioning. *Journal of Abnormal and Social Psychology*, 1958, 57, 37-40.
- Stalling, R. B. Conditioned attraction, similarity, and evaluative meaning. University of Hawaii, Honolulu, Hawaii, Contract N00014-67-A-0387-0007, Technical Report No. 1, August, 1969.
- Stewart, M. Resistance to technological change in industry. *Human Organization*, 1957, 16, 36-39.

- Sundby, E. A. A study of personality and social variables related to conformity behavior. Thesis. Vanderbilt University, Nashville, Tennessee, August, 1962. University Microfilms, 63-1848.
- Tandy, R. E. Effects of programmed instruction on the attitudes, behavior, and knowledge regarding smoking among selected seventh-grade students. *Dissertation Abstracts*, 1967, 27, 3999.
- Tannenbaum, A.S., & Bachman, J. Attitude uniformity and role in a voluntary organization. *Human Relations*, 1966, 19, 309-322.
- Tannenbaum, P. H., & Gengel, R. W. Generalization of attitude change through congruity principle relationships. *Journal of Personality and Social Psychology*, 1966, 3, 299-304.
- Taylor, J. B., & Parker, H. A. Graphic ratings and attitude measurement: A comparison of research tactics. *Journal of Applied Psychology*, 1964, 48, 37-42.
- Taylor, J. C. The conditioning effects of technology on organizational behavior in planned social change. University of Michigan, Ann Arbor, Michigan, Contract N00014-67-A-0181-0013, NR 170-719/7-29-68, Technical Report, September, 1969.
- Thaibaut, J. W., & Strickland, L. H. Psychological set and social conformity. *Journal of Personality*, 1956, 25, 115-129.
- Thistlethwaite, D. L., de Haan, H., & Kamenetzky, J. The effects of 'directive' and 'non-directive' communication procedures on attitudes. *Journal of Abnormal and Social Psychology*, 1955, 51, 107-1113.
- Thistlethwaite, D. L., & Kamenetzky, J. Attitude change through refutation and elaboration of audience counter-arguments. *Journal of Abnormal and Social Psychology*, 1955, 51, 3-12.
- Torrance, E. P. An experimental evaluation of "no-pressure" influence. *Journal of Applied Psychology*, 1959, 43, 109-113.
- Trumbull, R. Psychological aspects of weapons and weaponry. Sixth Navy Science Symposium, Office of Naval Research, San Francisco, 1962.

- Wagman, M. Attitude change and authoritarian personality. *Journal of Psychology*, 1955, 40, 3-24.
- Walster, E., & Festinger, L. The effectiveness of 'overheard' persuasive communications. *Journal of Abnormal and Social Psychology*, 1962, 65, 395-402.
- Ward, C. D., & Park, G. D. Issue saliency and the correspondence between measures of attitude. University of Maryland, College Park, Maryland, Contract Nonr 595-21, NR171-250, Technical Report No. 15, August, 1969.
- Weick, K. E. Task acceptance dilemmas. In S. Feldman (Ed.), *Cognitive consistency*. New York: Academic Press, 1966.
- Weick, K. E. Promise and limitations of laboratory experiments in the development of attitude change theory. In C. W. Sherif and M. Sherif (Eds.), *Attitude, ego-involvement, and change*. New York: John Wiley & Sons, 1967.
- Weiss, W. A. " Sleeper " effect in opinion change. *Journal of Abnormal and Social Psychology*, 1953, 48, 173-180.
- Weiss, W. A. The relationship between judgments of a communicator's position and extent of opinion change. *Journal of Abnormal and Social Psychology*, 1958, 56, 380-384.
- Whittaker, J. O. Resolution of the communication discrepancy issue and attitude change. In C. W. Sherif and M. Sherif (Eds.), *Attitude, ego-involvement and change*. New York: John Wiley & Sons, 1967.
- Wright, P. H. Attitude change under direct and indirect interpersonal influence. *Human Relations*, 1966, 19, 199-211.
- Zajonc, R. B. Balance, congruity and dissonance. *Public Opinion Quarterly*, 1960, 24, 280-297.
- Zajonc, R. B. Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, 1968, 9 (Monograph Supplement), 1-27.
- Zimbardo, P. G. Involvement and communication discrepancy as determinants of opinion conformity. *Journal of Abnormal and Social Psychology*, 1960, 60, 86-94.
- Zimbardo, P. G., Weisenberg, M., Firestone, I., & Levy, B. Communicator effectiveness in producing public conformity and private attitude change. *Journal of Personality*, 1962, 30, 135-146.

APPENDIX C

SYNOPSIS OUTLINE

(adapted from Mackie and Christensen, 1967)

- I. IDENTIFICATION
 - A. Reference (author, title, etc.)
 - B. Study objectives
- II. INDEPENDENT VARIABLES
 - A. Psychological name
 - B. Method of manipulation
 - C. Stimulus (physical) specifications
- III. DEPENDENT VARIABLES
 - A. Psychological name
 - B. Response (physical) specifications--raw measurements
 - C. Performance measures--combination of raw measurements into performance index
- IV. TEST SITUATION
 - A. Subjects
 - B. General physical setting
 - C. Specific stimulus specifications
 1. Nonverbal
 2. Verbal
- V. PROCEDURE
 - A. Task
 - B. S-R relational/temporal specifications
- VI. RESULTS
 - A. Data
 - B. Conclusions and generalizations
- VII. ABSTRACTER'S COMMENTS

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified.

1. ORIGINATING ACTIVITY (Corporate author) Human Factors Research, Incorporated 6780 Cortona Drive Goleta, California 93017		2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	
		2b. GROUP --	
3. REPORT TITLE ATTITUDINAL FACTORS IN THE ACCEPTANCE OF INNOVATIONS IN THE NAVY			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Technical Report (Final)			
5. AUTHOR(S) (First name, middle initial, last name) Michael Mecherikoff, Robert R. Mackie			
6. REPORT DATE June 1970		7a. TOTAL NO OF PAGES 180	7b. NO OF REFS 229
8a. CONTRACT OR GRANT NO N00014-68-C-0304		9a. ORIGINATOR'S REPORT NUMBER(S) 784-1	
b. PROJECT NO. NR170-713		9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) --	
10. DISTRIBUTION STATEMENT Each transmittal of this document outside the agencies of the U.S. Government must have prior approval of the Chief of Naval Research, Code 452, Arlington, Virginia 22217.			
11. SUPPLEMENTARY NOTES --		12. SPONSORING MILITARY ACTIVITY Office of Naval Research Department of the Navy (Code 452) Arlington, Virginia 22217	
13. ABSTRACT <p>In response to evident resistance by military personnel to innovations in operating equipment, training devices, and operational procedures, sometimes culminating in outright rejection, an attempt was made in this project to translate principles derived from laboratory research on attitude formation and change into practical guidelines that would maximize acceptance of innovations by Navy personnel. This attempt was only partially successful because of certain characteristics of much of the laboratory research, such as restriction of variables, artificial settings, issues irrelevant to the subjects, and observation over very short time periods.</p> <p>As a complementary approach, case studies were conducted of the actual introduction to Navy personnel of several innovations, including an operational equipment, a training device, and two operational procedures. The case studies, in addition to revealing a number of violations of good practice relating to the variables typically studied in laboratory investigations of attitude change, suggested that variables not typically studied in the laboratory are often crucial in practical situations, and provided insights which supplemented the principles reflected by the research literature.</p> <p>Consideration of the laboratory research and the case studies together led to the formulation of a number of practical guidelines for the introduction of innovations in the Navy.</p>			

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
INNOVATION ACCEPTANCE						
EQUIPMENT ACCEPTANCE						
ATTITUDES						
ATTITUDE DEVELOPMENT						
ATTITUDE CHANGE						
APPLICATION OF BASIC RESEARCH						