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✓ THE EFFECTS OF AUTOMATED  
DATA PROCESSING B  
ON NAVAL COMMAND

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Code 462, Arlington, Va 22217

⑥ THE EFFECTS OF AUTOMATED DATA PROCESSING  
ON NAVAL COMMAND.

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## ABSTRACT

Forty (40) military and civilian personnel of the Navy and other agencies were interviewed to determine the effects of Automated Data Processing (ADP) on the Navy command structure. The most important impact was on the attitudes of military personnel concerning the function of ADP in their operational role and the influence of ADP in their Navy careers. It was recommended that the Navy assess present ADP training programs to determine ways that they can be supplemented to meet the needs of command-control environments. The second impact concerns the influence of ADP on information handling procedures existing in the Navy. In anticipation of further inclusion of ADP in the Navy command structure and implementation of Navy-wide integrated command management systems, it was recommended that an activity devoted exclusively to problems of ADP technology and Navy command be given attention and emphasis.

## SECTION I

### INTRODUCTION

Early in January, 1966, Admiral Caldwell expressed concern over the capability of Navy organization to respond to changes that have resulted from technological advances in communication and automated data processing (ADP) based on his experiences in the Cuban and Dominican Republic crisis. The Admiral had experienced the direct interaction of top echelons of the government with subordinate defense elements. The Gulf of Tonkin represents one of many additional instances where such apparently pre-emptive actions were taken. The Admiral expressed his concern that ADP is tending to move command upward and thereby requiring the redefinition of the mission of middle echelons in command organizations.

The second concern expressed by the Admiral was the effect of implanting data processing systems in the "old line" command structure without the consideration of the consequences. The Admiral traced the problem to the many advances in technology and the effects of the number of information conversions in communications used to control increasingly larger numbers of forces. ADP was cited as a reason for further proliferation of these information conversions with related, uncontrolled, consequences to the exercise of command (Appendix I). Caldwell's concern that the Navy may be implanting ADP into an old line command

structure without recognizing the consequences and the tendency for ADP to move command upward can be considered part of the central issue regarding the general impact ADP has on the Navy command structure. Therefore, the tasks germane to the understanding of this issue and pertinent to the present study involve the determination of any effects that have occurred or can be expected to occur in command structure because of the introduction of ADP and what can be done by the Navy to meet these effects in a positive manner.

The impact of ADP on organizational structure, personnel, planning and control have been widely discussed in the literature (Myers, 1). Despite the lack of agreement reflected in these sources as to the impact of ADP on such management elements, general concensus about its importance in these areas is expressed. ADP provides greater facility in the manipulation of data; ADP leads to greater attention to detail in problem analysis and, in general, permits a greater awareness of the value of data in prediction. The increased emphasis on attempts to understand the human decision processes, particularly in military situations, also stresses the importance of ADP (Ward, 2). The recent emphasis on developing an integrated concept for information management is of singular importance. An effort must be made to understand the effects of computer technology on military organizations. (Harris & Erdman, 3). The present study attempts to provide a base upon which

the impact of ADP on Naval operations can be viewed and to recommend further studies and actions as required.

## SECTION II

### APPROACH

Approximately forty (40) ranking military and civilian personnel were questioned about crisis situations, particularly concerning their views on the effect of automated data processing in Naval operations. Reports related to crisis situations were studied. For purposes of comparison, certain industrial organizations were examined to determine what effects ADP has had on their organizational structure. The historical study was undertaken to assess the present findings in the perspective of past technological developments in the Navy.

### SECTION III

#### FINDINGS

The present study does not support Caldwell's concern that "by-pass" of command by higher echelons (centralization of authority) during a crisis situation was solely the result of the use of automated data processing; on the contrary high speed communication appears to have contributed significantly to such a "by-pass" situation. The historical study and current advances in communication and ADP technology indicate that the by-pass problems will increase in number and significance. Because such technology makes more pertinent information accessible to all levels of command, the inducement for top command to approach the tactical element closest to the source of the information will be greater. The framework of advanced command control systems available to top political and military echelons also will increase the probability of direct control of subordinate elements. Crisis situations, therefore, will probably result in increasing incidence of the by-pass of middle echelons. The suspicion that ADP may be moving command upward and that the middle echelons of command may be losing their identity is not necessarily because of incorporation of technological advances, but because the operational role of the middle echelon has not yet been fully defined with respect to the employment of ADP.

Admiral Caldwell's assertion that the Navy is placing automated data processing in the line of command without full recognition of the consequences was supported by the study ADP is leading to feelings of insecurity in Naval personnel concerning their careers, particularly as applied to the development and use of skills. ADP requires well-defined concepts of information handling procedures which provide greater precision in planning and control of military operations.

ADP has contributed attitudes of uncertainty in Naval personnel about the nature and extent of their responsibilities, the direction of their careers, and their ability to cope with developments in information technology. Almost all of the replies to our queries were oriented toward such concerns. For example, senior personnel acknowledged the merits of ADP but believed that such capabilities require younger, highly intelligent and well-trained individuals to assume the roles the respondents presently hold. The need for seniority and experience in the classical sense was questioned, although most maintained that experience certainly enters the picture. Many expressed an inability to see how machine processed data could be used in making decisions; some felt that the "technocrats" were taking over the Navy; that the ADP programmers were determining the nature of operations, that while the middle echelon would be needed, they were not sure what their role would be when most of the decisions were being made at the top echelons of command. The replies focused on the uncertainties of definition and

execution of responsibilities, the need to develop new skills to meet the demands of the new technology and particularly the need to know how ADP is applied in the realization of better decision-making during operations. These conclusions suggest that an immediate attempt be made to improve the present training concept enabling personnel in the line of command to integrate the beneficial effects of ADP in their orientation and job functioning and possibly reduce their uncertainties about ADP.

The second impact of ADP concerns the changes that occur in the techniques and procedures used to handle information. Although management philosophy permits the top echelons in certain circumstances to go directly to the lower echelons for implementation of operational decisions, the lower echelons are not provided access to the top without adhering to procedures which are part of the formal chain of command. Some maintain that greater accessibility and availability of data (brought about by ADP) will enable the lower echelons to exercise greater options in their decision making (without reference to higher echelons) which at present time are not entertained.

The formal chain of command that prescribes information processing procedures to maintain control in the traditional sense will be supplemented by the introduction of advanced ADP technology which will prescribe the incorporation of more effective procedures and techniques. The possibility of direct interaction with subordinate elements will

increase as advanced command information systems become more available at top echelons. Present informal means used to exchange information among Naval personnel usually provides the richness of interpretation to data and events based on personal experience and training. Informal means of communication compensate for the time required for acquiring, transmitting and processing of information. ADP tends to accelerate much of these information handling operations, thus reducing the amount of informal person-to-person contact.

ADP provides greater accessibility of data to commanders. Some commanders state that much of the qualitative data is lost in the volume of quantitative data. ADP will tend to subordinate the qualitative features of operational experience unless ways are found to maintain this experiential factor in an information handling system.

The relationship between system programmers and the users of systems is significant to ADP and information handling. Many of our respondents claimed that their decisions have been influenced largely by how programmers organize the data in the computer. In some cases, system programmers are apparently setting the patterns which are reflected in the constraints which are imposed in the selection of data during operations. Such allegations suggest that data held in the computer may not be fully utilized in command operations.

Changes in information management philosophy, therefore, are strongly indicated. The greater use of ADP will increasingly challenge

present definitions of the responsibility of middle command echelons particularly in crisis situations. If real time information availability is a distinct possibility for all elements of command in the future, then a very careful realignment of the distribution of information handling and command decision tasks seems to be in order. The problems of information management in crisis can be expected to grow proportionally with more extensive use of ADP; thus, an integrated concept which will closely align the personnel and information handling factors to the information management needs of the Navy must be implemented. Such integrated concepts have been proposed and their adoption should provide the basis for the achievement of standards and means of handling information throughout the Navy.

## SECTION IV

### DISCUSSION

#### 1. METHOD USED TO OBTAIN RESPONDENT PROTOCOLS

Ranking personnel familiar with operational problems of the Navy were interviewed as follows: During the first interview the general problem of ADP and Navy structure was briefly described and the respondent was asked to react to the problem in a general way. No attempt was made to direct the individual towards any specific aspect of the problem. This was followed by a second interview, where specific questions were raised regarding ADP and Navy structure. The questions were aimed at obtaining specific reaction to several issues:

1. In respect to crisis situations what is your reaction to the allegation that ADP instigated by-pass of command? In what ways do you believe that Automated Data Processing has influenced or is not influencing the Navy command?
2. Regarding the role of the top echelons of the command structure--it is alleged that there

is some preemption of the command role. How real is this? On what specific facts do you base your reactions? Do you consider this to be a serious problem to the Navy? Why?

3. It is alleged that Automated Data Processing is affecting our present concept of military leadership. Several basic facts are given to support this contention. Command is exercised from positions remote from the area of operations. Computers reshape decision making skills, etc. Do you agree with these contentions? What sort of things are important for leadership training? How important do you consider this factor to future Naval command and why?

Some of the interviews were taped, while for other interviews, the salient points of the discussion were studied and subsequently summarized.

## 2. DISCUSSION OF INTERVIEWS

The data obtained from our respondents were examined in terms of three dimensions considered of significance of the Navy, namely, the impact of ADP on the organizational structure, ADP's influence on the people in the organizational structure and ADP's

impact on the control function of command.

a. Impact on the Organizational Structure

One of the concerns of the present study was to determine whether the observed trend to move command upward, expressed as "by-pass of command echelons" or "centralization of command" was due to the inability of the present organizational structure of the Navy to respond to specific kinds of situations (crisis).

The accounts of crisis situations that we examined were not sufficiently explicative to enable us to arrive at firm conclusions about how the organizational machinery sustained or deteriorated under crisis. But two findings in general militate against the belief that the occurrence of by-pass of command during crisis reflects an inadequacy of the organizational structure to react effectively to such situations. First, there is nothing in military doctrine which obviates against the exercise of unilateral action when the military circumstance dictates. Second, no evidence obtained seemed to suggest that by-pass is now the accepted way of doing things regardless of the situation. By-pass is a phenomena which at present appears to be peculiar to specified critical operational situations, and not to normal

operations. The study indicated that the formal discipline which unites command elements through the information processing function has not suffered any deterioration because of special crisis situations the command has encountered.

In contrast to the military situation, our study of industrial organizations indicated that during normal operations by-pass of intermediate levels of function is not considered to be an anomaly. By-pass of intermediate functionaries is designed as a deliberate part of the procedure of management. At present, it is not clear how ADP will alter the situation. During labor crisis, however, industrial organizations are known to take precautions to avoid by-pass and unauthorized communications. Respondents agreed that ADP could permit greater accessibility as well as manipulation of data. Because of the greater accessibility and faster manipulation of large amounts of data available to top echelons, faster and more complete responses could probably be applied to the operational situation if these were to be required. Data availability can be expected to affect the span of control of the user, and does not necessarily have to be restricted to the top echelons. Nor do the potentialities of ADP have to be restricted to crisis situations. ADP will allow movement of command upward during normal as well as crisis situa-

tions. From the study of the crisis reports and through the interrogation of Navy personnel we are inclined to believe that communication capabilities rather than ADP at present may constitute the force that would tend to move command upward. Historically, communication technology has very definitely tended to move command upward, both during normal as well as crisis situations.

Another reference to ADP and command is the allegation implied in many of the respondents replies that ADP tends to subordinate the usefulness of the middle echelon. Military men strongly hold the conviction that the middle echelon in a large armed forces organization is required to support the top echelons. The background and experience of middle echelon commanders (commanders claim) can be applied to strengthen and extend the decision making functions of senior echelon commanders. The present investigators do not believe that because the middle echelons may have been excluded in the top decision function during crisis that this is sufficient basis to believe or suspect that the middle echelons are being deprived of their command prerogatives. In the first place, middle echelons never had policy decision making functions which are similar to functions that are required during crisis. As was indicated above, crises constitute unusual situations requiring actions unique to a special crisis situation.

We view the problem of the middle echelon as one of mission reorientation adjusted to the capabilities of advanced ADP and communication technology. Such technologies will undoubtedly influence all command elements. But it is our hypothesis that the middle echelon of command may be losing its functional identity, not necessarily because of ADP but because their operational role has not as yet been defined in respect to it. The impact of ADP and communications has not been so much on organizational structure as it has been in the need to develop new approaches to how these technologies can be integrated in the way people do things. Without a clear recognition of the new status the various command elements will assume, individuals will continue to question their personal worth in the organization and particularly their loss of their prerogatives in exercising command. Background and technical experience are definite advantages in the exercise of command, but it is questioned if such advantages are realized in the absence of a clear idea as to how these experiences and know-how can be applied. In this respect, the concepts outlined by NRL Memorandum Report 1807 for a Navy-wide Integrated Command Support System (5); Department of the Navy Management Information and Control System (MICS Concept), August 1967) (6); Report of the Navy Study Group for Navy Integrated Command/Management Information System-I

(NAICOM/MIS-I), April, 1968(7), are positive steps in this direction.

b. Impact on People

ADP has a real and significant impact on people and causes them to question their sense of worth to the organization, their position in it and, ultimately, their entire sense of career direction. The middle echelon can be understood in terms of how people see ADP as affecting them personally. By-pass is usually envisaged as entailing the omission of certain organizational elements in the processing of information and can exist at all levels whether or not ADP is installed. ADP provides greater data availability and, as a consequence, enables more effective manipulation and control of resources. When by-pass is viewed as the result of the availability of ADP then by-pass is seen as a way to achieve objectives. Yet, when "by-pass" is discussed with Naval personnel the reference to "by-pass" is not primarily seen as a technique engendered by the computer but rather as a state of conditions in which by-pass is a threat to the position of the individual in the system. Individuals sense the increasing possibility of their being left out of the picture. By-pass is seen as contributing to their loss of command prerogatives. What this may mean is that a conflict could exist between the discipline that binds the behavior of the individual during operations and his

ability to maintain control under conditions (by-pass) which appear to undermine this control.

One respondent indicated that "the staff interactions are no longer ways of getting information; you can get the information from the computer." Another indicated, "as more functions are automated the influence of personal relationships in getting things done is reduced. Computers enable fast updating of events, whereas previously the staff was responsible for updating which was often slow."

These reactions indicate that ADP has instilled a basic suspicion in Naval personnel that the computer will ultimately take over their position in command. The repeated assertion that computers should never take over the human decision function is an indication that this suspicion is real and strongly held. The suspicions exist in the absence of any operational experience with the computer by the individual and support the contention that lack of understanding by personnel of what computers can and cannot do tends to force the individual to consider them as devices which are a threat to his personal worth in the Navy.

The influence of ADP on the people is further reflected in the uncertainties that individuals express about the action prerogatives of commanders. Officers questioned whether there were ways to know what decision prerogatives will ultimately remain for commanders. They want to know now computers can help them in

decision functions. Not knowing, they tend to reject the role of computers in decision-making. As Hanes and Gebhard (8) have concluded from their experiments with Navy commanders using a simulated computer program in the execution of defense exercise ". . . commanders are not about to let combat automation take over their command and control responsibilities. They will reject the robot's advice when the solution to a tactical problem disagrees with their own." In the absence of an understanding of how the computer manipulates the pertinent data, commanders will sense a loss of their ability to control and will continue to question the worth of ADP as a tool which facilitates the exercise of command.

In general, the expressions we were able to obtain from commanders support Parson's (9) assessment that whatever system is provided, commanders need information that will tell them "what kinds of data are there? Where are the best places to obtain the data? What are the basic concepts which should guide the selection of "where" and "how" to obtain the data?" Computers, as manipulators of data, must be understood as to how they extend man's capabilities. The individual must learn what ADP can and cannot do, with the data that are available to him. As such ADP requires that personnel develop new skills in the use of inductive and deductive logic as well as knowing how ADP can facilitate the use of these skills.

The present study suggests that although Navy personnel adequately sense the capabilities and potentialities of ADP, their understanding is limited to gross impressions. Possessing gross impressions, individuals tend to search for relevance of ADP to what they are doing. Finding relevance in the absence of understanding difficult, the trend is to reject the importance of computers. Having rejected their importance, the motivation to explore and use these technologies is absent. Without motivation to use these technologies, resistance is generated towards their presence in the working environment. The fact that ADP makes possible new capabilities and requires new skills, the fact that present crisis require flexible response, the fact that the generalized competence required by officer personnel needs to be further developed and extended all point to the need for the development of a comprehensive training philosophy in the Navy which meets these needs. The backlog of new ADP capabilities, which some quarters of the Department of Defense claim is being experienced, suggests a lack of acceptance of these capabilities by military personnel. Harshbarger (10) in discussing military command control indicated: "people must be brought to accept technology. The acceptance of technology must come through training." Whisler (4) clearly points out "that training people in special skills may mean that they will be expected to use such skills in decision making functions". Harshbarger (10) further warns of the con-

sequences of training individuals about computers "remote from their application".

The study has not been able to determine whether such mandates are all now accounted for in the training programs of the Navy but the following assertions have been made:

1. Programs for future Naval leaders have been established to provide familiarity with ADP capabilities, but these appear to be technically rather than operationally oriented.
2. Training programs are fragmented.

Numerous "ad hoc" seminar type programs are available to Naval personnel to acquaint such personnel with computers and their related technology. These efforts appear to be based on the philosophy that training for ADP is a matter of familiarizing the individual with the capabilities of the hardware components despite the fact that software is the overpowering consideration.

A comprehensive training program should satisfy the following minimum requirements:

- a. Provide a compact view of the present state of the art in ADP and related technologies and its applications to Naval operations.

- b. Expose the interdisciplinary nature of Information Science and the criticality of its understanding for Naval operations.
  - c. Provide an understanding by the individual as to how ADP can be used as an extension of his cognitive capabilities.
- c. Impact on Control Functions

Carroll (11) defines control as the process of assuring that specific tasks are carried out effectively and efficiently. Harshbarger (10) identifies the matter of the value of ADP on control as being:

"What does information processing capability enable us to do at this time that we either could not do at all before, or could do only with great difficulty?"

Navy personnel who were questioned regard ADP as enabling them to now do things faster which were previously considered manual operations. Scientists in contradistinction regard ADP as a potentially powerful tool of control, enabling individuals to grapple with complex decision-making problems.

To obtain more direct data concerning the control function as now conceived in the Navy and to determine probable influence of ADP on this function two concepts now under review by the Navy were examined. The detail in the specification of the con-

trol function in such concepts should provide the basis for more objective evidence concerning the general impact of ADP on the command control function. The Management Information and Control System (MICS) proposed by the Advisory group established by the Secretary of the Navy and the Advanced Concept for a Navywide Integrated Command Support System (ANICSS) proposed by the Naval Analysis Staff of the Naval Research Laboratory were examined.

The study of these concepts indicate that:

1. ADP can influence control by providing a wider base from which information needed in the exercise of command control can be obtained.
2. ADP allows for greater manipulation of data without formal risk and commitment.
3. ADP affects control by increasing the various ways in which plans, decisions and actions can be subject to evaluation.
4. ADP sharpens the exercise of the control function through its insistence that the responsibilities of men, machines and organizational functions be clearly specified and defined
5. ADP affects control by providing the possibility of ex-

panded "span of control" over information as well as human and material resources.

The MICS and ANICSS provide a significant attempt at alleviating much of the uncertainties that now exist as to the organization and execution of the command control function. As long as the distribution and management of ADP remains undefined, many of the man-machine problems which are generated by the installation of ADP will continue to exist.

The MICS and ANICSS concepts when evaluated against the findings for the present study, however, do provide some misgivings. For example, individuals in the Navy who were questioned expressed a concern that ADP will transfer their present responsibilities for command to the top echelons. In this respect there appears to be insufficient recognition that information is the viable source for the formation and execution of control power within the organization. Information enables the directing and controlling of human and material resources in unprecedented ways. If information is not so conceived and proper account made in the management concept, then the uncertainties about the influence of such power will uphold the uncertainty that people have about ADP.

It is interesting to note from these system concepts that management of the information will be vested at the top:

"It must be emphasized that the ultimate control of the entire concept must rest with the hierarchy of commanders."

(Underline is our own.) ANICSS (5)

and

"It is envisaged as a subsystem of an eventual office of the Secretary of Defense - Management Information System". (6)

These statements indicate that the management of the information resource will largely be a matter for its distribution at the top levels. This practice tends to encourage the centralization of command. On the other hand, there is some recognition in these concepts that command and control systems to be effective, must distribute the information utility throughout the entire command control organizational structure. The difficulty probably lies in the extent to which the responsibilities of commanders are tied to the operational procedures describing relationships by which information exchange occurs. Only nominal attention is paid to how the military executive can relate to his contemporaries and to what extent the relationships safeguard the normal prerogatives commanders view as sacred to their responsibility as military decision makers. By and large,

the concepts give credence to the assertion that ADP shifts decision making from lower echelon elements to higher organizational management entities (hierarchies of command) geographically remote from the lower elements. ADP provides the higher echelons with more data to make decisions the lower echelons have traditionally made.

The fear expressed that the system programmers orient the action of the commanders was the second point of concern. Of course, the implicit danger in such concepts exists in the fact that the system programmer or engineer may be highly influential in the decision-making function of the commander. Because the system programmer and system designer are in a position to influence the way the data requirements are treated in the system, both are in a position to set the decision response patterns of the commander. It is in this context that the requirement is advanced for training to provide commanders with substantial software and systems training.

The third concern about the concepts is the absence of a training plan in sufficient detail to support the management concept that is advanced. If people fear ADP because they do not understand it, and because they believe that ADP robs them of prerogatives; then any concept which does not address itself to how these attitudes

are to be overcome in Navy personnel is doomed to failure.

Training should not be dismissed in a few words or paragraphs which state that training will be provided as the result of the implementation of the system. Because of the importance of the man-machine problems in these systems, it is necessary that training be given detailed attention during the system concept phase and before its implementation.

**SECTION V**  
**RECOMMENDATIONS**

1. Based on the impact of ADP on personnel suggested by the present study, it is recommended that an assessment of present ADP training programs be undertaken to determine whether or not the training meets the following requirements:
  - a. Provide a compact view of the present state of the art in ADP and related technologies and its applications to Naval operations.
  - b. Expose the interdisciplinary nature of Information Science and the criticality of its understanding for Naval operations.
  - c. Provide an understanding by the individual as to how ADP can be used as an extension of his cognitive capabilities.

Each of the above criteria should be applied to the training of three levels of personnel, namely, those individuals who are now entering the Naval service, second those who have just completed their training and are now in initial assignments with the operating forces and third, for those individuals with extensive operational experience.

2. ADP is and will continue to exert an influence on information handling procedures in the Navy. The need for rapid updating and accessibility of data to the command increases the importance of ADP and its application in contemporary warfare. The wide segments of defense community can be integrated through sophisticated acquisition, transmission, processing and display technology which provide improved methods for the development of plans and the execution of control by the commander. The need for greater understanding of the technical problems implied in developing an integrated information environment was explicit both from the interviews conducted and the written reports examined. We recommend therefore that the present efforts in the Navy attending to such problems be given greater emphasis by the establishment of an activity devoted exclusively to the following:
- a. The study of the problems in technology, information handling procedures, concept validation and testing techniques which are implicit in the implementation of the (proposed) Advanced Concept for a Navy-Wide Integrated Command Support System, Navy Logistics Information System Workshop, Management and Control Systems, Navy Integrated Command/Management Information System and other similar proposals.
  - b. The conduct of studies in advanced areas of information science which are pertinent to man-machine communications

and decisions i. e, psycholinguistics, information retrieval, human learning, decision making, etc.

- c. Provide the basis for developing specifications for very advanced software research; interrelate available knowledge from mathematics and computer technology to advanced information system development.
- d. Provide a source for the continuous evaluation of information systems. In this connection the activity should provide knowledgeable individuals to assist in crisis situations and who can complete the necessary analysis.

## SECTION VI

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APPENDIX I

Admiral Caldwell Comments  
on Impact of ADP in the Navy

1. Modern high speed data processing (using this term in a broad sense) and high-capacity rapid communications are being applied to naval affairs on a large scale. I am not sure that we are doing this with a clear understanding of the far-out implications.
2. The command process, to oversimplify a bit, uses people as adaptive analog computers. Information comes in from sensors (radars, sonars) and from data storage (status boards, oral reports, files, indicators, etc.) and by message. The commander makes decisions which change the situation. Within the particular system there usually are many analog-analog conversions; a coded radio message may be received and typed (one conversion) then decoded (second conversion) then typed in plain language (third) and lastly perhaps paraphrased (fourth) and transmitted orally (fifth) or via internal communications (sixth). The extreme complexity of these many conversions, plus the inability to communicate beyond line of sight, led in the past to our present multi-layer command system, going from theatre to fleet to task force to task group to task unit to task element, etc. With the advent of radio it became possible to control larger forces but the analog-to-analog conversion problem remained; indeed it became more acute because radio generated more conversions. Digital data processing was greeted with joy because people clearly began to understand that some of their problems could be solved thereby. We are now very busy adapting it to command problems in the context of the old-line command structure without examining carefully whether this is what we really want. This will lead to unexpected things, many of them a little unpleasant.
3. It is obvious that the tendency implicit in the application of ADP along with high-capacity rapid communications is to move detailed command "upward". The Cuban-crisis was a particularly

dramatic example of what is happening. Intermediate levels of naval command will more and more tend to lose their usefulness as technology advances, allowing more and more decisions to be made at remote locations.

4. What we need, I think, is a study, or series of studies, of the broad implications of all of this, as a guide for future actions. This can show the disadvantages of overdependence on automation as well as its advantages. The studies must be of broad scope, to take into consideration the strategic political and economic factors as well as the tactical. They should lead to a better understanding of the kind of people we need as well as equipment. I believe such an effort would pay dividends and recommend it be undertaken.

APPENDIX II

PERSONNEL AND AGENCIES VISITED

Adm. Turner Caldwell, Staff, CINCLANTFLT  
Adm. James Howard, USN (Ret.)  
Adm. R. C. Needham OPNAV  
Dr. Eugene Ferraro, Ass't. Sec'y. of the Air Force, Manpower  
Mr. H. Bennington, OSD  
Capt. William Laliberte, OPNAV  
Capt. C. E. Swallow, Jr. OPNAV  
Capt. E. D. Napier, OPNAV  
Cmdr. R. E. McCall, OPNAV  
Capt. H. H. Niehaus, OPNAV  
Capt. E. Lothrop, OPNAV  
Capt. L. S. Howeth, USN (Ret.)  
Mr. Robert Taylor, ARPA  
Capt. Arthur K. Bennett, Jr. Office of SASN  
Mr. Richard Barry, Office of SASN  
Mr. Donald Pollock, ONR  
Mr. John Evans, Mitre Corp.  
Dr. William Sen, USAF, Electronic Systems Div. L. G. Hascom Field  
Dr. Carlo Crosetti, Rome Air Development Center, Griffis AFB, N. Y.  
Mr. Raymond Saben, DCA  
Lt. Robert Hammett, ONR  
Mr. H. B. Goertzel, Inform. Proc. & Display, JCCRG  
Dr. Melvin Snyder, USAF, Training Branch, Aerospace Med. Laboratory  
Mr. George Renaud, U. S. Army Behavioral Science Research Laboratory  
Mr. Francis Farrell U.S. Army Behavioral Science Research Laboratory  
Mr. Donald Coates, JCCRG  
Mr. Marvin Denicoff, ONR  
Mr. Steve Putnam, CONSAD Research Corp., Pittsburgh, Pa.  
Dr. Roger Gillette, Stanford Research Institute  
Dr. W. S. Vaughn, Whittenberg-Vaughn Assoc.  
Col. Fred Holdrige, USAF  
Mr. Frank Milillo, NRL  
R. Admiral W. A. Stuart USN (Ret.)  
Capt. L. S. Edmonds, OPNAV

APPENDIX III  
HISTORICAL ASSESSMENT  
OF THE  
EFFECTS OF TECHNOLOGY ON THE NAVY

### III-1

#### 1. INTRODUCTION:

#### TECHNOLOGY AND THE NAVY

The purpose of this introductory section is to provide some perspective for viewing the manner in which the implementation of rapid communications was accepted by naval personnel. Before the effects of the introduction of electronics communications on the command structure are critically examined, it is desirable first to discuss how technological changes have in general been received by the Navy. A brief look at the way naval personnel reacted to some of these past changes adds meaning to an analysis of naval reaction to developments of a later era in the fields of communication and data dissemination.

Innovations, technological or otherwise, have commonly produced both desirable and undesirable effects upon the societies in which they have been extensively implemented. This has been the case since before the advent of powered machinery and has remained so up to the present time. In each instance of change, society has consistently been altered to a greater or lesser degree, depending upon the magnitude of the particular new device coming onto the scene.

Whether one considers the social situation following the invention of the power loom or the introduction of Protestantism, some similarity is perceived. On the occasion of every such innovation there existed for

### III-2

awhile--sometimes for a very long while--a good deal of chaos, dislocation, confusion, often injustice. Fortunately, these undesirable effects have usually proven to be only temporary; as time passed society proved able to adjust and re-arrange itself. In each case a new order was brought about, due partially at times to a conscious effort to smooth things out.

More often, however, the character and organization of society have evolved through unconscious compromise towards relative stability. The innovation, whatever it may have been, became an accepted, perhaps integral part of the social environment. While it was once the subject of intense controversy, the innovation may have hardly been thought of after a few years. Time and adjustment have worked to develop a new context in which society's members are once again able to live "normally" in spite of or in conjunction with the innovation. This has been true of the aftermath of all types of innovations. For example, centuries ago the Protestant Reformation was introduced with some unsettling results, including a large amount of violence. Today, however, few Europeans would participate in a holy war to determine the official state religion. In the technological realm, anyone who would attempt the destruction of power looms would seem strange to us. Yet, at one time many people perceived some disturbing effects accompanying each of these innovations and took extreme measures in attempts to prevent

their implementation.

People who live and work within a certain social context for a long time, using familiar tools in familiar surroundings, are not likely to welcome any innovations which threaten to disturb well-established patterns. This holds true for society in general and is especially true of military organizations. To better understand how modern communications and data collection affect the Navy, the way in which other innovations of various types have been accepted should briefly be examined.

Elting E. Morison, a modern historian of naval technology, said that a navy is more than just an armed force; "it is a society. Men spend their whole lives in it and tend to find the definition of their whole being within it".<sup>1</sup> Because of this characteristic aspect of navy life, long-time members have traditionally resisted change in an effort to maintain a familiar way of life. Any major change has normally been resisted since, "intuitively and quite correctly the military man feels that a change in weapon portends a change in the arrangements of his society."<sup>2</sup>

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<sup>1</sup>Elting E. Morison, Men, Machines and Modern Times(London, 1966), p. 34.

<sup>2</sup>Ibid., p. 36.

Perhaps the least comfortable change encountered by the navy mind during the last century involved neither weaponry nor communications. The shift from sail to steam propulsion caused tremendous changes in the theory and practice of naval operations. When first introduced, steam was used primarily as an auxiliary to sail power on board naval warships. It took over half a century before the transition from sail to full steam propulsion could be completed.

Recalling the early days of steam, Alfred T. Mahan said that its introduction immediately signaled the end of sail as the motive power of warships. Whatever its disadvantages, steam propulsion enabled ships to carry out maneuvers independently of wind direction. This was an invaluable advantage over sail power and made steam equipment an essential part of the modern warship. Even so, there was an "extreme conservatism" among naval men of the time which Mahan characterized as, "probably judicious, and (it) certainly represented the naval opinion of the day."<sup>3</sup> An important question to be considered is whether this conservatism was justified or merely unreasonable resistance to change.

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<sup>3</sup>Captain Alfred T. Mahan, From Sail to Steam (New York, 1907,) p. 25.

There was much early criticism which emphasized the shortcomings of the first efforts to utilize steam propulsion. The new motive power had a few disadvantages not shared by the traditional sail. It was observed that the paddle wheels used on the early steam warships required the placement of boilers, engines and paddles in vulnerable positions almost entirely above the waterline.<sup>4</sup> A well-placed shot could damage any one of several exposed pieces of equipment rendering the ship nearly helpless. True, the ship might still maneuver under masts and sails, but the weight of the engine and the drag of the paddle wheel made sailing under such conditions extremely difficult at best.

Early steam equipment was very heavy and took up a great deal of space. Conservative naval opinion held that a ship was more useful if its weight capacity were taken up by more guns and sails rather than by coal and machinery. In the beginning steamships were slow and cumbersome; because they required a large amount of expensive fuel. The operating range was severely limited by the relatively small amounts of fuel which could be carried.<sup>5</sup>

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<sup>4</sup>James Phinney Baxter, The Introduction of the Ironclad Warship(Cambridge, 1933), p. 11.

<sup>5</sup>Ibid.

As time passed, however, so did the basis for many of the objections to the full implementation of steam. By 1850, the screw propeller had been introduced making it possible to place all of the essential machinery below the waterline where it enjoyed relative protection. It could no longer be objected that a single shot would be sufficient to disable a steam warship.<sup>6</sup> In addition, screw propellers were more efficient than paddle wheels, and with constantly improved engines the speed of steamships was bound to increase considerably.<sup>7</sup>

Of course, these improvements were not fully implemented at the time of their introduction. Critics of steam could point to numerous side-wheelers in service long after the screw propeller made them obsolete. Paddle-wheel men-of-war were still being built as late as 1850 with all the old disadvantages inherent in such craft. It is interesting to note that in spite of their shortcomings, many of these ships were successfully employed by the Union blockade during the Civil War. This fact drew the observation from Mahan that it is possible to discard obsolete machinery too quickly without getting the full possible return from the investment.<sup>8</sup>

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<sup>6</sup>Mahan, p. 26.

<sup>7</sup>Bernard Brodie, Sea Power in the Machine Age (Princeton, N. J. 1941), p. 34.

<sup>8</sup>Mahan, p. 26.

By the late 1850's, warships not provided with steam equipment were generally recognized as being of little tactical value. The inclusion of sails was continued until the final decade of the century in order to conserve fuel.<sup>9</sup> Coal was expensive, and it is one authority's opinion that, "if the overlapping of steam with sails had not eased the former through its growing pains, steam would have been much longer in coming to the navies."<sup>10</sup>

There is, however, some question as to whether the equipping of modern steamships with sails significantly curtailed fuel consumption. Immediately after the Civil War, the Navy Department issued a directive that all vessels should proceed exclusively under sail power while at sea. Admiral Samuel R. Franklin recalled that the order had to be constantly disobeyed. The weight of the newer ships was prohibitive; steamers simply could not get anywhere under sail.<sup>11</sup>

Morison observed this phenomenon from an historical point of view and explained the retention of sails in terms of habitual tradition.

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<sup>9</sup>Brodie, p. 76.

<sup>10</sup>Ibid., p. 111

<sup>11</sup>Samuel Rhoades Franklin, Memories of a Rear-Admiral (New York, 1898), p. 203-4

By way of analogy, he related an incident from the early days of World War II.<sup>12</sup> It seems that the British were desperately in need of artillery pieces of all types. Older guns, some dating as far back as the Boer War, were hitched to trucks and employed as mobile coastal defense units.

It was felt that these "venerable" field pieces could serve a useful purpose if only the rapidity of fire could be significantly improved. An expert in such matters was called upon to observe the method of firing, and certain aspects of the procedure puzzled him greatly. He showed some slow-motion pictures of the operating procedure to an old artillery officer. What he wanted to know was why the gun crew stopped all activity to come to attention for a period of time before and during the gun's discharge. The officer, also puzzled, asked to see the pictures again. After some moments of thought he knowingly exclaimed, "I have it. They are holding the horses."<sup>13</sup>

The point is clear. There exists the tendency to protect oneself from change by clinging to familiar past patterns of behavior. It made little difference that trucks did not react to the noise of guns like horses did. Similarly, naval men of the last century found comfort in the sight of sails and masts, which in many cases, served no other practical

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<sup>12</sup>Morison, pp. 17-18.

<sup>13</sup>Ibid., p. 18.

purpose. This was apparently the case in Britain as well as in the United States; Morison pointed out that, "sails were continued on... first-line snips long after they ceased to serve a useful purpose mechanically, but like the holding of the horses that no longer hauled the... field pieces, they assisted officers over the imposing hurdles of change. To a man raised in sail, a sail on an armored cruiser propelled through the water at 14 knots by a steam turbine was a cheering sight to see."<sup>14</sup>

By the end of the nineteenth century the advantages of steam over sail were so overwhelming that overt opposition was virtually eliminated. Certain aspects of steam were still criticized, but no one any longer advocated the elimination of steam powered warships. Fuel difficulties remained as the most objectionable aspect of steam navigation. It was difficult to carry out a long range mission, such as the blockade of a port, which required spending protracted periods of time away from a base of supplies. Indeed, estimated fuel requirements could be utilized by an alert enemy to determine the approximate location of a squadron. This was demonstrated when Cervera's force

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<sup>14</sup> Morison, pp. 34-35.

attempted to evade the American fleet; knowledge of the Spaniard's fuel requirements facilitated the task of locating the squadron in Cuban waters and blockading it at Santiago.<sup>15</sup>

Nevertheless, it was universally recognized by the last decade of the nineteenth century, that steam power was an indispensable part of the naval environment. Objections to problems stemming from fuel difficulties were made and answered in terms of better machinery and fuel utilization. Naval men no longer suggested the curtailment of steamship production.

The resistance of naval personnel to steam propulsion changed in character throughout a half century of development. It can be said that at the beginning a judicious opposition prevailed, which, however, became steadily less reasonable. Perhaps more than the nature of the opposition, the bases upon which it claimed to rest changed most radically during this period.

A navy man of the 1890's could not justify his opposition to steam nearly as effectively as he could have fifty years before. Few would even openly attempt it. In 1850 it might make sense to deride the paddle-wheelers for their vulnerability and general inadequacies. Then one could proclaim the superiority of sailing vessels. Navy men brought up in the tradition of Nelson, and that included American navy men,

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<sup>15</sup>  
Brodie, p. 97.

understandably seized every opportunity to point out the disadvantages of steam as compared to sail. By the end of the century, however, such overt expressions of resistance no longer made sense and entirely disappeared. The only comfortable connection with the past which remained were the sails and masts still decorating some of the modern warships, but even those would soon be eliminated.

The extent to which an innovation will be implemented in the Navy has always been uncertain in its early stages of development. Writing in the 1880's James R. Soley said that few naval men of a decade or so prior to that time realized that sailing vessels would soon be entirely abandoned in favor of steam. It required an open mind to judge such trends accurately. Soley, himself, correctly predicted the full implementation of such weapons as rifled guns and selfpropelled torpedos, but he was not immune to the uncertainties in naval development. He included in a list of new weapons, one which he felt would revolutionize naval warfare, the ram.<sup>16</sup>

This was not a new concept; since antiquity ships had intermittently been provided with reinforced bows or additional projections designed to crush an enemy's hull by ramming it. During the Civil War, the Confederate government commissioned an English company to provide two ships designed to be used exclusively as rams. Since they never

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<sup>16</sup>James Russell Soley, The Blockade and the Cruisers

(New York, 1883), p. 1.

were delivered, no one could be certain of their possible effectiveness against the Union blockade.

Little more might have been heard of the ram if it had not been for action taken by an Austrian admiral against an Italian naval force in 1866. During the Battle of Lissa, Admiral Tegetthof issued an order to the effect that the armored Austrian ships were to run down and sink the enemy. In the melee which followed, his own flagship managed to ram and sink the Italian flagship assuring an Austrian victory. For many decades thereafter the major navies of the world equipped their ships with ramming bows in expectation of another Lissa, but there never was another major battle similarly decided.<sup>17</sup>

The potential value of the ramming ship as demonstrated at the Battle of Lissa greatly impressed Admiral Daniel Ammen. He spoke with Admiral Tegetthof shortly after the battle and was amazed by his description of the action. The ease with which the Austrian destroyed the Italian flagship was particularly impressive; "in ramming the Re'd'Italia he actually ran through her."<sup>18</sup> Ammen, partially as a result of his talk to Tegetthof, proposed the introduction of ships, especially designed as rams, into the American Navy.

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<sup>17</sup> Edward Crankshaw, *The Fall of the House of Habsburg* (New York, 1963), p. 229.

<sup>18</sup> Daniel Ammen, *The Old Navy and the New* (Philadelphia, 1898) pp. 471-472.

One segment of the establishment objected on the grounds that battleships were already equipped for ramming. Ammen felt that to compare a battleship with a reinforced bow to one of his proposed rams was like saying that, "all men who carry swords are to be considered equally effective in their use, when the sword is the weapon to decide the combat."<sup>19</sup>

The ram which he conceived was a slender, armored ship capable of attaining high speeds. No large guns were to be provided since they might distract the captain from utilizing his ship in the way which it was intended. Indeed, the blazing guns of a battleship might discourage even a less timid captain from ramming if a safer, more distant means of fighting was available.

He saw certain advantages which a ram would have over a battleship. Since good lighting was required to fire guns accurately while very little light was needed to run into a vessel, battleships would be at a distinct disadvantage at night or in foul weather. Large ships could be plainly seen at long distances while rams would be barely visible until it was too late to escape destruction.<sup>20</sup>

According to Ammen, rams could be built more speedily and cheaply

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<sup>19</sup> Ammen, p. 472.

<sup>20</sup> Ibid., p. 471

than battleships. The cost of maintaining them would be less too and only a few would be needed to protect American shipping. He contended that a total of only five rams of his design would be sufficient, "to patrol our coast in the face of any naval force that might be sent against us."<sup>21</sup>

In spite of Ammen's urgings, however, the Navy Department refused to implement the proposed innovation, a fact which he ascribed to political maneuvering.<sup>22</sup> Actually there were sound bases for resisting the large scale implementation of rams. Ordnance had improved quite a bit since the Battle of Lissa; powerful rifled guns could inflict great damage, even to heavily armored vessels. Speed requirements would force the armor or rams to remain relatively light. It was likely that a battleship under attack would have sufficient opportunity to fire its guns at point-blank range, easily preventing an approaching ram from making contact.

Improved ordnance was largely responsible for the judicious decision to refrain from constructing a large number of rams. It was also the dominating factor in the extensive implementation of armor and iron

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<sup>21</sup> Ammen, p. 472.

<sup>22</sup> Ibid. p. 472.

construction.<sup>23</sup> Wooden snips were very vulnerable to shell-fire; consequently a strong opinion became prevalent in favor of iron construction.

Although a majority of naval personnel appear to have favored the rapid change to iron, it was not so easy a transition as some have supposed. Bernard Brodie, a modern historian, wrote that the implementation of iron construction, "all the ancient lore of naval architecture, the selection and treatment of woods, the hewing and scarfing of the timbers, the mode of construction for maximum strength, and a whole catalog of subsidiary arts were swept onto the scrap heap."<sup>24</sup> Some who were disturbed by iron construction complained that to build a ship out of a material heavier than water was "contrary to nature."<sup>25</sup> Another criticism was that iron ships would constantly lose their bearings and be run aground on account of the effect iron has on the needle of a compass.

More substantial grounds for early resistance to iron were found in the various naval experiments. In 1840 it was demonstrated that five-eighths inch thick iron plates could be easily penetrated by a naval gun

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<sup>23</sup>Brodie, p. 175.

<sup>24</sup>Ibid. p. 127.

<sup>25</sup>Baxter, p. 35.

with a very small propelling charge. Worse yet, upon being struck the iron disintegrated into "small jagged fragments" which would have an exceedingly devastating effect in battle.<sup>26</sup>

Further tests in 1846 with an iron ship showed discouraging results. "As the shot passed through the vessel it caused especially heavy damage on the far side. When the target was placed end-on-end to the guns, the shot so tore the ribs and plates that this was evident that a single such blow in action might instantly sink the ship."<sup>27</sup> There were other tests in 1849 and 1851 which produced similarly discouraging results.

For awhile it appeared that iron would not be widely used in ship construction. The United States Navy, like all of the navies of the last century, often looked to England for guidance in such matters. In the 1850's the British Admiralty became convinced that iron vessels were unsuitable for purposes of war.<sup>28</sup> It was soon evident, however, that only through iron construction and armor could a ship be at all protected from modern explosive shells. Besides, by using iron, ships could be made with water-tight compartments. Their hulls did not weigh nearly as much as wooden ones, and the screw propellor, which caused

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<sup>26</sup>Brodie, p. 136.

<sup>27</sup>Ibid.

<sup>28</sup>Baxter, pp. 36-38.

leaks in wooden ships, could be more securely installed in iron vessels. Thus, in spite of some sound opposition, ships were more and more to be constructed of iron.<sup>29</sup>

Even so, improvements in the penetration power of ordnance precipitated some opposition to the continued development of armor. As naval guns became more powerful the thickness and weight of armor necessary for real protection became prohibitive in the eyes of some naval men. A few doubted the future value of armor and believed that unencumbered ships would be more effective in maneuvering against ships armed with modern guns.<sup>30</sup> However, this was a minority opinion. Naval men predominantly agreed that it was obvious that unarmored ships would be liable to quick destruction in a modern battle.

Armored ships were employed during the Civil War, but their tactical value was more highly rated by the public and the government than by those who commanded them. There was a tendency to criticize the personnel rather than the machinery for failures to attain easy victories with ironclad ships. When his wife made some remarks about ironclad commanders typical of the public criticism of the day,

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<sup>29</sup>Baxter, p. 35

<sup>30</sup>Brodie, p. 180

Admiral Charles Steedman refuted her contentions that they had been cowardly in their reluctance to approach Confederate fortifications. He answered her by claiming that the ironclads were not so good as people thought; "in your last letter you compare the commanders of the ironclads to McClellan in not running the obstructions in Charleston harbor. You do these gentlemen more than injustice. The machines sent down for the purpose are the greatest humbugs of the war. Under the most favorable circumstances they would not answer for what they were intended."<sup>31</sup> Steedman felt that too many ironclads had been hastily built before the concept itself had been properly tested. He blamed the Secretary of Navy for this state of affairs and accused him of being most responsible for implementing this untried innovation.<sup>32</sup>

Objections to early ironclads like those to early steamships, had a sound basis in reality. The early "monitors" were clumsy, unseaworthy craft with insufficient firepower. Improvements in the construction of ironclads, however, came regularly during and after the Civil War. The advantages of iron construction and armor in the face of modern ordnance made it necessary that wooden warships be discarded. Naval men might enjoy the comfortable sight of sails and

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<sup>31</sup> Charles Steedman, *Memoir and Correspondence* (Cambridge, 1912), p. 373.

<sup>32</sup> Ibid., p. 372.

masts on ships which could only move under steam, but there could be no similar compromise with the implementation of iron construction.

Whether it is steam propulsion, iron construction, or any other major innovation which is considered, it is apparent that such changes have been traditionally resisted by some elements within the Navy. In general, such resistance has been judicious when applied to hastily conceived innovations. Moderate criticisms and objections to certain aspects of these changes have usually resulted in improvements. Occasionally certain extreme conservatives have objected to the over-all implementation of an innovation. Its defects were rigorously pointed out with no intention of improving the innovation, but rather of eliminating it. At times, as in the case of the ram, such opposition has been justified. More often, however, as with steam propulsion and iron construction, such opposition became less reasonable as the innovation was developed and improved.

In any case, the Navy has generally accepted the changes and implemented what were considered essential innovations, even when the sensibilities of large numbers of its personnel have been offended. This was true of iron construction and perhaps more evident with steam propulsion.

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It is an important point to remember when considering the implementation of electronics communications, which, of all the manifestations of technological progress, most affected the perogatives and powers of command personnel.

## 2. ROLE OF THE NAVAL COMMANDER

Man is in constant pursuit of ways in which to perfect all of the technological advances which have worked to make life generally more pleasant. He has recognized the value of such progress and sees it as the means to an ever better world in which to live. Except for this somewhat general assumption, however, little thought has actually been given to the question of why particular improvements ought to be made. Emphasis is placed on how to make more things work better; insufficient reflection has been devoted to why individual technical advances promise more good effects than bad.

As this is true of the rest of society, naval personnel have on the whole been concerned with finding ways to improve the machinery integral to the effective performance of the modern Navy. The development of electronics communications over the years has provided an excellent picture of such technical advance, but in this case not everyone believed in the inherent good supposed to accompany constant progress in the field. Conflict early centered around the way in which the traditional manner of naval command was affected and many believed that the role of the independent naval commander was being usurped. Indeed, the role of the captain at sea, while not

really usurped, did change a great deal as rapid communication grew ever more extensive and effective.

In the process of modernizing naval communications, the Navy has inevitably moved forward as it has in all of the other technological fields in which it has had a vital interest. This has resulted in a departure from the old ideal of the independent naval commander. Now there is much more cohesion within the Navy; and the captain of a ship or a commander of a fleet cannot act with the same degree of independence as was possible in the "old days". This is by no means meant to suggest that the naval commander at sea has declined in importance; on the contrary in some respects his responsibilities and the complexities of his duties have greatly increased. It is true, however, that the nature of his job is much different in terms of what it might have been in the distant past. But just as the ships he commands are better suited to modern naval operations than would be the ships of a few generations ago; it is also true that the naval commander's role has changed for the better in the context of modern times.

Those who have actively participated in the development of naval communications have generally applauded the alterations being wrought

in the command structure. Stanford C. Hooper, the most notable of early naval radio officers, delivered a lecture in 1926 in which he clearly enunciated the goal hoped for as a result of improvements in communications. Praising the Navy for its recent developments in radio, he stated that it was due to radio's extensive implementation that "two or more ships are bound together into divisions, divisions into squadrons, squadrons into fleets, and the entire Navy is bound into one grand unit, rendering possible, in each case, the exercise of command by one officer over these units, or by the Commander-in-Chief, United States Fleet, over the Navy afloat as a whole."<sup>1</sup> If this was not quite the case when Hooper delivered his lecture, the tendency toward centralization had long since begun to make it so. It has continued with each improvement in communications and, with the rapidly increasing capacity for centralized intelligence, continues today.

One important result has been in the realm of strategic planning. At one time isolated captains had to be able to make decisions of a strategic nature, but this seldom occurs anymore. It has been stated that field commanders must still be acquainted with matters of strategy. But this is only so that they will be able to recognize changes in the tactical situation which might affect the over-all plan of operation.<sup>2</sup> Knowing how a particular maneuver or tactical action may affect some

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<sup>1</sup>Stanford C. Hooper, "Lecture on Fleet Communications", April 21, 1926.

<sup>2</sup>Bern Anderson, "The Impact of Rapid Communications on the Employment of Naval Forces," United States Naval Institute Proceedings, Nov. 1951, p. 1165.

distant operation which would certainly aid the captain in his decision of how to handle the present situation. Even actions on the local level, however, are now often guided from offices located far from the theatre of action. The increased ability to collect, interpret and disseminate information with a tremendous amount of efficiency has made Hooper's visionary centralized command system almost a reality today.

In order to see how the nature of command at sea has changed, a brief look at the way it used to be is very helpful. Before it was possible to carry on rapid communications out of sight of land or of another ship, the only way to communicate was by means of dispatch boats. Consequently, in the days of sail, a ship at sea was a law unto itself. The commander was called upon to make decisions affecting not only his ship or fleet, but even the diplomacy and foreign policy of the country he sailed for.

In the eighteenth century, for example, it was not uncommon for a British naval officer on a foreign station to be officially designated as a diplomatic agent as well as a military commander. In those times several months might go by before a commander could report critical developments involving national interests. Because of the problem of communications he had to be ready to act on his own initiative without consulting his distant superiors.<sup>3</sup> Since the

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<sup>3</sup>Ibid., p. 1157.

government authorities realized that it was necessary for naval officers to make such strategic decisions, they encouraged independent action. Officers who could operate well, even when out of contact with their superiors for prolonged periods, were considered by all to be the best naval commanders. Such independence became traditional among naval officers. An intense spirit of individualism remained for a considerable time even after the isolation, which was its original cause, had largely disappeared.

The freedom of action and the attendant responsibility may seem to have been entirely desirable, but there were numerous disadvantages felt by all concerned.

Of course, there was little complaint registered as regards the slowness of communications. Dispatch boats, after all, could go no faster than the wind allowed, and who could conceive of any other means of long range communications? In the days of sail, to voice annoyance at the long delays in sending and receiving messages was regarded as a futile gesture.

In 1805 Napoleon seemed invincible on the Continent, and, if England were to prevent an invasion of the home islands, she had to prevent divided elements of the French fleet from uniting in an effort to destroy Britain's supremacy on the sea. The French fleet, not quite the equal of the English, could nevertheless inflict deadly damage to the British

first line of defense if it was not prevented from joining together in all of its elements somewhere in the Atlantic.

When the French fleet under the clever Admiral Villeneuve slipped out of the Mediterranean, it was Lord Nelson's mission to locate, engage and destroy this grave menace to England's survival. He had no reliable way of ascertaining its exact position. But Nelson surmised that the French fleet was headed as rapidly as possible for the Carribean with the intention of keeping a rendezvous with another major part of the navy before the inevitable arrival of the English fleet.

Nelson chased Villeneuve across the wide expanse of the Atlantic until he reached the West Indies where the inhabitants told him that the French fleet had never arrived in that part of the world. Villeneuve had eluded him and was now freely operating in European waters. There was nothing for the Englishman to do except turn about and go back to Europe as quickly as possible. Nelson must have felt a great deal of consternation at being temporarily powerless against the French ships which he could not reach. Moreover, the British Admiralty was unable to prepare in advance to deal with the French fleet which was now speeding to safety on the other side of the ocean. A dispatch frigate was hurriedly sent in advance of the rest of his fleet, but Nelson could hardly have hoped for a

timely arrival. The 3,500 miles to be covered naturally delayed the information concerning Villeneuve's whereabouts so that no British plans for a new disposition of forces could be originated and effectively implemented from in London.<sup>4</sup>

It should not be thought that the lack of modern communications worked only to the detriment of the English admiral in this instance. After all, Villeneuve had no way of knowing how effectively Nelson had been deceived. The English flag might have appeared on the horizon at any time. Uncertainty as regards Nelson's location was bound to hamper the freedom of action of the French fleet. Incomplete intelligence and the lack of rapid long range communications was common to all navies of that day; no one long held any advantage in this respect.<sup>5</sup>

The first half of the nineteenth century, before electronics was applied to communications, provided the setting for highly independent decision making on the part of naval commanders. The roles they played in diplomacy have sometimes been neglected by modern historians who tend to focus more upon the activities and intentions of the governments involved. One such agreement, The Treaty of Wanghia, was a result of China's war with Britain. The United States took

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<sup>4</sup>Harry A. Rochester, "Some Strategical Aspects of Radio," United States Naval Institute Proceedings, August, 1927, p. 853.

<sup>5</sup>Ridley McLean, "Naval Communications," United States Naval Institute Proceedings, October, 1926, pp. 2033-2044.

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Perhaps even more so than Cushing, however, Commodore Lawrence Kearny was instrumental in gaining favorable terms for the United States. When the war broke out between Britain and China in 1839, Kearny was on hand with an American squadron. He as an important representative of neutral America, took his extra-military duties seriously. Through tact and a firm posture of neutrality, he gained the good will and respect of influential government leaders at Canton. When peace came in 1842, Kearny became aware of the trading privileges about to be conceded to Great Britain. Acting on his own initiative, he entered into unofficial negotiations with the Chinese in the hope

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<sup>6</sup> Robert H. Ferrel, *American Diplomacy: A History* (New York, 1959), p. 216.

that American citizens could "... be placed upon the same footing as the merchants of the nation most favored."<sup>7</sup> The governor of Canton was amenable to his request, and thus was laid the basis for the future treaty.

There are other cases in which naval officers have negotiated famous treaties with foreign powers. The classic example, Matthew C. Perry's role in the opening of Japan, is perhaps too well known to describe here. It should not be thought, however, that Kearny and Perry represented unique instances of independent initiative. Insofar as they were involved with extremely important diplomatic agreements, they certainly were exceptional. But many lesser known aspects of foreign policy were handled by numerous naval officers. It is these smaller incidents which emphatically demonstrate how much independence of judgment the lack of rapid communications left to the commander afloat.

For example, in Tahiti, which was far from the European capitals, there were difficulties which eventually led to a heated diplomatic exchange between Paris and London. This South Sea island had early been the recipient of some British missionaries and a British consul was present there by the early part of the nineteenth century. During

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<sup>7</sup>Anderson, p. 1158

the 1830's some French Catholic missionaries came onto the scene, but not without arousing some degree of friction. For a time the French and English existed together in a precarious tolerance for one another as they competed for converts among the natives.

In 1839, however, rumors to the effect that the French were being mistreated reached the sympathetic ear of a French naval commander who was in that part of the world. Captain Dupetit Thouars sailed to Tahiti where he made a show of force; this was followed by negotiations with the local ruler who agreed to see to the protection of the French residents. Further troubles occurred in 1842, and Thouars, by then an admiral, returned to Tahiti. He authored a series of demands which he presented to the native rulers who consented to place the island under the protection of France. Admiral Thouars negotiated this agreement without consulting Paris, and in the face of strenuous objections on the part of the British consul. When the matter was brought to the attention of government authorities in England and France, however, the decisions and actions of Thouars were endorsed by his government.<sup>8</sup>

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<sup>8</sup>Ibid., p. 1159.

While it was not unusual for naval commanders to make decisions involving strategic questions of foreign policy, not every such instance of independent action was happily received by the governments back home. One interesting lonesome decision involved the premature seizure of California by the United States Navy several years before the war with Mexico began. The decision to invade Mexican territory was not made by the government at Washington, but by Commodore Thomas Ap Catesby Jones at Callao, Peru.<sup>9</sup>

If such a move on the part of Jones seems ludicrous to us, that is partially because of the tendency to view his actions in the context of more modern times. Changes in the methods of collecting, interpreting and disseminating information have largely erased the possibility of facing problems similar to the one which confounded Jones. Today there is little likelihood that a naval commander would long remain uninformed if a state of war should exist between the United States and any other country. In such a case, plans strategic in nature would be formulated in Washington, accurate and timely

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<sup>9</sup> Robert G. Albion, "Communications and Remote Control," United States Naval Institute Proceedings, August, 1956, p. 833.

instructions would be quickly available to commanders in every part of the world. Commodore Jones could not have even conceived of such a thing; it was nothing like that in the old days.

In the place of accurate information promptly communicated, he had to rely on a curious mixture of judgment, intuition and plain rumor. There was bound to be a war with Mexico sooner or later, everyone knew that. For a long time people had talked about annexing Texas, and there was a great deal of speculation concerning the positions of Britain and France. Many thought that as soon as war should break out, both of these powers would attempt to acquire California from Mexico.<sup>10</sup>

It was with these things in mind that a troubled Commodore Jones learned of the recent departure of the French squadron which had left Valparaiso without revealing its destination. Desperate for information, he gratefully received an eight months old Mexican journal which erroneously proclaimed that a state of war now existed with the United States. Seeking more intelligence, he got hold of a Boston newspaper which quoted an old item from a New Orleans

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<sup>10</sup>  
Anderson, p. 1159.

paper to the effect that Britain had secretly purchased California.

Not sure of the reliability of his sources in this information, Jones hesitated until the British squadron suddenly weighed anchor and sailed from Callao under secret orders. He was certain that its mission was to put California under the English flag, and that called for action.<sup>11</sup>

Far from the seat of government in Washington, Jones sat in conference with his captains off the coast of Peru. The decision was agreed upon that California must not be allowed to fall into European hands. No more time was given to speculation; Jones immediately sailed his squadron towards Monterey which he reached on October 19, 1842. Relieved to see that he had beaten the British to California, he demanded the surrender of the Mexican forces. Realizing that he was in no position to resist, the Mexican commander courteously surrendered and then invited the Commodore to dinner. After a short time, however, it became apparent that war with Mexico had not yet commenced and that the British squadron was not on a mission to secure California. Jones was somewhat embarrassed by his action

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<sup>11</sup>  
Albion, p. 833

which was certainly of questionable legality; he extended his country's profuse apologies to the Mexicans and quickly sailed away.<sup>12</sup>

The government rebuked Jones for taking such a unilateral action, but there was also much sympathy for his position. When the Mexican War did break out in 1845, he was fully exonerated and returned to the command of the Pacific Squadron. In defense of his decision to seize Monterey, he later wrote: "if I took possession of the country and held it by right of conquest in war, and there was war with Mexico, all would be right; then if the English should come and claim (California) under a treaty of cession. . . I should have established a legal claim for my country to the conquered territory and at least have placed her on strong grounds for forcible retention or amicable negotiations, as after circumstances might dictate."<sup>13</sup> That was his opinion, but whether he was justified in his actions is not questioned here, the important point is that he had to make decisions without the help of sufficient guidance from above. Such unilateral dealings would be neither possible nor desirable in later years. The criticisms which he received at the time were tempered by the knowledge that Jones acted in the national

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<sup>12</sup> Ibid.

<sup>13</sup> Quoted by Anderson, p. 1159.

interests as well as these could be determined with the information at hand.

Not long after this attempt to take California, a struggle began to develop between England and the United States. The Hawaiian Islands was the area under contention. Early in the nineteenth century a group of missionaries came from the United States to convert the population. Although nominally under native rule, the descendants of these missionaries gained economic dominance over the islands. Close ties were maintained with the United States because of the control which it exercised over the sugar market. Eventually this was to lead to annexation, but that was not until the later part of the century.<sup>14</sup>

Earlier, however, the British were also interested in Hawaii, and some Englishmen had settled in the Islands. Their presence in increasing numbers precipitated a series of minor crises which came to a head in 1842. The British consul urgently requested Admiral Thomas to send a frigate to Honolulu in support of English interests in Hawaii. The American agent at Honolulu also sent for help, and, to ease the

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<sup>14</sup> Ferrel, p. 184.

tense situation, Commodore Jones dispatched a small warship to the Islands.

The British frigate, however, was under the command of an aggressive man who did not hesitate to threaten violence unless his demands were met. Using this forceful approach, tempered with some British nicety, Captain Paulet demanded and received the cession of Hawaii from the Hawaiian King on February 25, 1843.<sup>15</sup>

However, Commodore Lawrence Kearny, who was the equal of Paulet in his aggressive disposition, anchored at Honolulu on a return trip from the China station. He reached Hawaii in July, 1843, and he was enraged by the news of the British takeover. Kearny rigorously protested the cession and announced that the British would be held fully responsible for any injury or loss suffered by Americans as a result of Captain Paulet's action. As soon as Admiral Thomas, who was Paulet's superior, became aware of what had happened, he promptly disavowed his subordinate's decision to take Hawaii for England and he extended his apologies to the Americans.<sup>16</sup>

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<sup>15</sup>Anderson, p. 1159

<sup>16</sup>Ibid.

Captain Paulet's action in Hawaii, like that of Commodore Jones in California, represented the type of initiative forced upon naval commanders of the day. A good officer was expected to act boldly and to exercise his own judgment on a wide range of problems extending from the least of tactical maneuvers to the greatest of diplomatic negotiations. All of this often had to be accomplished in the absence of information, advice or instructions from the home government. It was only natural that mistakes would be constantly made under these circumstances. Heads of government, consequently, tended to be somewhat tolerant towards the actions of naval officers, whether of their own or of a foreign country's navy. But this did not long remain the case after the middle of the nineteenth century.

The reason for the change can be found in the introduction of electronics communications. Of course, the gradual implementation of modern communications beginning with the submarine cable did not immediately effect a revolution in naval command. The change of attitude towards the independence, initiative and responsibility of

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the individual commander underwent a progressive change as the extension of modern long range communications worked to break down the former isolation.<sup>17</sup>

In 1837, Samuel F. B. Morse applied for a United States patent on a telegraph system, and by 1844 a circuit between Baltimore and Washington demonstrated its practicality. In the years that followed all of the major world powers worked to develop and exploit the possibilities of the telegraph. The first successful Atlantic cable was completed in 1866, and by 1899 there were 170,000 miles of cable stretched all over the world handling millions of messages per year.

Such a vast system of communications greatly affected the traditional role of the independent commander. Governments were quick to see the possibilities for handling a far away situation by remote control. Although naval officers were slow to surrender their perogatives, the effects of electronics communications became evident almost as

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<sup>17</sup> Anderson, p. 1160

soon as the cables were laid.

As early as 1890, the famous complaint was enunciated by an Admiral Goodrich against the influence exercised by the government over the affairs of the naval commander on the China station. "The cable spoiled the old Asiatic. Before it was laid, one really was somebody out there, but afterwards one simply became a damned errand boy at the end of a telegraph wire."<sup>18</sup> Goodrich may have over-stated the situation, but he was correct in observing the declining independence of the lone commander. With his superiors now able to contact him very quickly, at least while he was in port, the naval commander was required to seek advice and accept orders in a manner not possible before the implementation of the cable.

Of course, communications at sea still had not been greatly improved since the days of Lord Nelson. During the Spanish American War, dispatch boats were yet being employed as the only reliable means of communicating beyond the horizon. The speed of such communication had been slightly increased since the old days,

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Quoted by Albion, p. 832.

but only because steam had replaced sail, releasing dispatch boats from the caprice of the winds.<sup>19</sup>

The same steam equipment which increased the speed and reliability of the dispatch boats had been applied to all other ships as well. Consequently, warships had to make frequent calls at coaling stations which were usually served by the new means of communication. The "twin facility" of fuel and the telegraph kept naval squadrons close to the larger ports. Thus, as one author has stated, "no longer enjoying the independence and freedom of action that was his lot in the earlier heyday of sail, the naval commander had become enmeshed in the web of progress."<sup>20</sup>

In spite of this, a great deal of freedom of decision and action prevailed even during the Spanish American War. This transitional period for the role of the individual commander has provided an excellent example in the person of Admiral George Dewey. Extremely independent by nature, he was a natural enemy of centralized control and he welcomed the circumstances which enabled him to make decisions free from the influence of Washington.

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<sup>19</sup> Rochester, p. 853.

<sup>20</sup> Anderson, p. 1162

Before the war he had been stationed in Japan, but in February, 1898, he was ordered to move his squadron from Yokahama to Hong Kong. Perhaps aware of his temperment or merely on the account of custom, few messages were cabled to Dewey before war came. He was, however, advised to keep his ships well provided with coal and ready to move against the Spanish fleet at Manila as soon as the war should begin.<sup>21</sup> Outside of that he received little information and was apparently expected to keep himself informed of developments through the press or any other source at his disposal.<sup>22</sup>

Finally, on April 24, 1898, he received the historic message from the Secretary of the Navy informing him that hostilities had begun. The order stated that he was to "proceed at once to the Phillipine Islands. Commence operations immediately, particularly against the Spanish fleet. You must capture or destroy vessels. Use utmost endeavors."<sup>23</sup> In reply Dewey cabled that he would await the arrival of the United States consul from Manila and that he was ready to begin operations immediately. No further orders were sent to him, so that this one message represented the entire war plan as far as he was concerned.

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<sup>21</sup> Adelbert M. Dewey, The Life and Letters of Admiral Dewey, (Akron, Ohio, 1899), pp. 203-204.

<sup>22</sup> Anderson, p. 1162.

<sup>23</sup> Dewey, p. 206.

After he left the vicinity of Hong Kong for Manila, Dewey had to depend upon dispatch boats to maintain his long distance communications. The naval battle was fought and won under these circumstances, but Dewey was still concerned with the question of conquering the mainland. Since it would be some time before sufficient American troops could be applied to the task, he had to do the best he could with the forces at hand. In the meantime, he saw to it that instructions would not be rapidly forthcoming from Washington by severing the Manila cable.

This cable had been the connecting link with Hong Kong, and subsequently with Europe and the United States. Dewey offered to share the cable with the Spaniards who refused to allow any messages to be sent which were not approved by the Spanish government. Consequently, he cut the cable and conveniently neglected to haul the end of it aboard ship in an attempt to maintain contact with Washington. It has been contended by some that he did this deliberately and in so doing, he "set back the clock a quarter of a century so far as remote control went."<sup>24</sup>

As a result, Dewey had a free hand in his dealings with the Spanish authorities and with the insurgents who were attempting to overthrow

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<sup>24</sup> Albion, p. 835

Spanish rule. Despite Dewey's successful effort to remain largely free from the influence of the cable, authorities in Washington felt that his campaign showed the possibilities of departmental control over distant operations. With that in mind, a War Board was set up within the Navy. The idea was that he would now be able to make decisions involving naval men in foreign stations. Action on the advice of his counselors led the Secretary of Navy to be able to issue orders which could be rapidly transmitted to any commander in a foreign port.

Apparently, however, the idea was repugnant to many Americans, even those outside of the military. It was an era of "rugged individualism", and many felt that this attempt at centralization was debilitating. To some it appeared to be a rebuke for Dewey's action in severing the cable; they applauded him and denounced attempts at "departmental interference" in the affairs of naval officers. These criticisms did not reflect a reaction against technological progress, but rather were symptomatic of the feeling "that the traditional independence of naval commanders was being curtailed by rapid communications."<sup>25</sup>

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<sup>25</sup> Anderson, p. 1162

That the spirit of independence of the naval office afloat was never entirely destroyed by the cable was further demonstrated at Tampico in 1914. Admiral Mayo, aboard the U. S. S. Dolphin, was stationed off the coast in order to keep a close eye on the tense Mexican situation. When he sent a gunboat ashore for supplies, a lower ranking Mexican officer tried to carry out orders not to allow any foreign ships to land. The Americans persisted in coming ashore, however, so he arrested them and took them back to his headquarters. Upon seeing what had been done, a superior officer quickly arranged for the release of the Americans. They were returned to the Dolphin accompanied by the profound regrets and apologies of the Mexican commander.<sup>26</sup>

Unhappy at the audacity displayed by the Mexicans in this attempt to detain American sailors. Admiral Mayo demanded satisfaction. Besides punishment of the one responsible, he required that a twenty-one gun salute be given to the American flag which the Mexicans would have to hoist on shore. A twenty-four hour ultimatum was issued, but the time passed without any action being taken. The resulting political and diplomatic chaos was too extensive and involved to be examined here.<sup>27</sup> What is significant is that all of this was at least partially due

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<sup>26</sup> Barbara W. Tuchman, *The Zimmermann Telegram* (New York, 1965) p. 47.

<sup>27</sup> For an elucidating description of what followed Admiral Mayo's demands see Tuchman, pp. 47-53.

to the old impulse of a naval officer to act independently of departmental control.

Admiral Mayo never bothered to exercise his ability to communicate with the Navy Department for advice or direct orders. He saw the situation as calling for immediate action and he did not adequately reflect upon the strategic ramifications of such action. He has been aptly described as one of those officers who was never reconciled to the changes wrought by modern communications and, "who believed that after a ship was out of sight of land she belonged in the hands of her master, and that orders from the blue were an outrage and an affront to dignity."<sup>28</sup>

The Secretary of the Navy at the time, Josephus Daniels, was much disturbed by Mayo's unilateral decision, and he was determined to prevent similar things from happening in the future. Before acting, Daniels waited until enough time had passed so that the regulations governing such behaviour could be amended without seeming to be a

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Robert Bigelow, "Wireless in Warfare, 1885-1914. "United States Naval Institute Proceedings, February, 1951, 1. 123.

rebuke to Admiral Mayo.<sup>29</sup>

This incident marked the end of an era in naval command policy; such unilateral action would not be lightly tolerated after that.

Admiral Mayo acted rashly on his own judgment when he could easily have contacted his better informed superiors in Washington.

Radio had just come into its own, and in conjunction with the cable a means was provided by which the government could communicate with naval commanders even while they were not in port. In the years to follow, modern means of communication would work to alter not only the role of commanders, but of lower echelon personnel as well. The extensive implementation of radio, as the single most important means of naval communication, was to be accompanied by further dislocations within the organizational structure of the Navy.

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<sup>29</sup> Albion, p. 835. Daniels had the regulations amended to read as follows: "Due to the ease with which the Navy Department can be communicated with from all parts of the world, no commander-in-chief, division commander, or commanding officer shall issue an ultimatum to the representative of any foreign Government or demand the performance of any service from such representative that must be executed within a limited time, without first communicating with the Navy Department, except in extreme cases where such action is necessary to save life."

### 3. THE IMPLEMENTATION OF RADIO BY THE NAVY

Early radio, or "wireless" as it was usually called in the first decades of its existence, came to the United States Navy at the beginning of the twentieth century. Major European powers had proceeded to equip their navies with wireless apparatus several years before American naval men cautiously began to sample the benefits and frustrations inherent in the primitive stage of technical development of radio. England's navy, traditionally in the forefront of all modern navies, seems to have been the first to implement radio on a wide scale. This was due in part to the fact that the main pioneer in the development of wireless apparatus saw in the British fleet an excellent market for his inventions.

Guglielmo Marconi had performed some experiments on his father's estate in Italy, and in 1894 he made a major break-through. Without the aid of wires he managed to transmit a signal through the air using the earth as one of his poles and a crude antenna for the other. From these humble beginnings, radio was destined to climb within a few short decades to tremendous heights of influence touching society everywhere, but in its beginnings, the influence of wireless telegraphy

was largely felt within the modern navies.

Marconi was not the only man to develop the principle of radio transmission, but he became the most successful because he combined inventiveness with an alert business sense. He saw the possibilities of the application of his invention to naval communications, and he knew that the entire world had recognized the hegemony of the British Navy for almost a hundred years. If he could perfect wireless apparatus to a practical degree and then manufacture it for use in England's navy, financial success would be assured. Consequently, immediately after his 1894 experiment demonstrating the feasibility of wireless transmission, Marconi applied for a British patent and resumed his experiments in England. The following year he was able to transmit over a distance of one mile, by 1899 across the English Channel and, by 1901, across the Atlantic Ocean.<sup>1</sup>

In that same year, Marconi came to the United States to report via wireless the activities of a yacnting race; several American naval officers were on hand to observe the procedure and equipment employed. This provided an excellent, inexpensive opportunity for the Navy to see

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<sup>1</sup>Bigelow, p. 117.

first hand the possibilities of radio communication afloat. There had been some interest in wireless for several years before that; more naval men became enthusiastic over the potentialities of radio after Marconi's demonstration. The American Navy, cautiously conservative, went ahead with some experiments of its own the following year, but these trials did not clearly demonstrate the practicality of radio. In 1900, the Annual Report of the Secretary of the Navy announced the decision that "the Department did not consider it advisable to conduct further experiments at that time . . . ." <sup>2</sup>

Perhaps the reasons for such a decision made more sense to naval men of the times than to those familiar with today's modern United States Navy. In those days, American naval power, though elevated in the esteem of the world by the recent events of the Spanish-American War, was still a secondary factor in the scheme of things. Britain was the world's greatest sea power and America was insignificant beside her. It was natural for Americans to look toward Britain as the ideal from which a model could be copied. Under such circumstances it seemed wise to leave expensive experiments for the development of an efficient wireless system to the British Navy. English and American

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<sup>2</sup> Annual Report of the Secretary of the Navy, 1900, p. 25.

interests coincided more than they conflicted; perhaps a friendly Britain would eventually enable the United States to reap the benefits of radio without sharing in the costs of redundant development.

Combined with this was the fact that wireless equipment, as it then existed, was not very reliable or useful. Some felt that it was not significantly superior to the homing pigeons with which the Navy had been experimenting for some time for use in "over the sea" communications. The various hazards and diversions which prevented a percentage of the birds from carrying out their missions could be favorably compared to the breakdowns and interference which often prevented early radio from working at all. Indeed, it was some time before it was finally conceded that wireless telegraphy must entirely replace the pigeons. As late as the first World War the Navy recognized the value of homing pigeons, maintaining lofts so that some of the birds would be available for use in limited communications.<sup>3</sup>

Fortunately for the future of radio in the American Navy, the urge to implement some sort of wireless equipment led to the investigation of systems then in use by the major European navies. The Navy Department was determined to see which equipment worked the best before

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<sup>3</sup> Lawrence J. Haslett, Some Notes on the Early History of the Radio Division (Washington, 1944), p. 21.

having it installed on American ships.<sup>4</sup> In 1902 testing stations were established to experiment with wireless apparatus from the various foreign manufacturers. As a result of these tests it was reported to the Bureau of Ships in September, 1903, that the Slaby-Arco apparatus of German manufacture was superior to the others. Subsequently, twenty of these sets were purchased for further testing in fleet maneuvers.<sup>5</sup> After that radio became more a part of the American naval environment. A New York Navy Yard radio school had thirteen men in training to be operators, and seven ships were radio-equipped by the end of 1903.<sup>6</sup> Each year thereafter saw an increase in the interest in the utilization of wireless. In 1906, the range of naval radio to the longest distances possible. There was no doubt, at least in the mind of the Secretary of the Navy, that "the value of wireless telegraphy for the purpose of national defense is inestimable."<sup>7</sup> By 1907, all of the Navy's surface vessels had been equipped with radio, and many shore stations had been in

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<sup>4</sup>Annual Report of the Secretary of the Navy, 1901, p. 16

<sup>5</sup>Haslett, p. 2.

<sup>6</sup>Bigelow, p. 126.

<sup>7</sup>Annual Report of the Secretary of the Navy, 1906, p. 384.

operation for several years.<sup>8</sup>

As radio came to be more and more utilized by the Navy, some difficulties were encountered which prevented a smooth transition to full confidence in wireless as a desirable means of communication. Early problems stemmed not only from mechanical imperfections in the apparatus, though these were certainly significant, but also from naval personnel. Commanding officers not directly concerned with communications, as well as the operators and radio officers themselves, often unintentionally--and sometimes deliberately--acted to the detriment of naval radio communications. Honest uncertainty regarding the value of radio as well as the new alterations in command power and influence which accompanied its implementation, combined to confound the best efforts of many naval men to make the transition to radio a smooth one.

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<sup>8</sup> Linwood S. Howeth, History of Communications-Electronics in the United States Navy (Washington, 1963), p. 167. Although the surface ships of the Navy were equipped with radio by 1907, the practicality of similiary equipping submarines was doubted. The Navy Department reported in 1906 that, "experiments relative to the usefulness of wireless telegraphy on submarines are in progress but have not been concluded. It is doubtful, however, if the use of wireless on submarines will be of value." Annual Report, 1906, p. 385.

That the Navy was dilatory in the full implementation of radio is a fact that could not easily be explained by any one simple cause. True, there were immense technical difficulties in the development of wireless. And by today's standards, the rapidity of all technological developments was ponderously slow at the turn of the century.<sup>9</sup> Even so, evidence points to the conclusion that difficulties arose largely as the result of new personnel problems which were created by this technological innovation.

One basic problem was early recognized as a major reason why the United States Navy was behind the major navies in the use of wireless; that was the tremendous shortage of trained men in the field of radio. The Navy Department complained in 1902 that the United States was behind Europe in this field because there were few competent operators and even fewer qualified officers to be placed in charge of them.<sup>10</sup>

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<sup>9</sup>Howeth, p. 167

<sup>10</sup>Annual Report of the Secretary of the Navy, 1902, pp. 375-376.

Attempting to discern why this situation continued to exist with only the slowest improvement over several decades is a difficult task at best. One authority on naval affairs, Linwood S. Howeth, offers some plausible suggestions as to why this was the case.<sup>11</sup> It seems that senior officers little understood the nature of radio, and, for the most part, were not at all interested in it. Junior officers were not easily attracted to communications assignments because there was usually little appreciation shown when they were successfully handled. On the other hand, when messages could not be put through, which often happened in the early days of radio, the communication officer was likely to be subjected to the displeasure of an unsympathetic superior.<sup>12</sup>

Some commanding officers were more than just unsympathetic when it came to radio communication; some captains and admirals were said to have "opposed with might and main the new agency of communication."<sup>13</sup> Usually, however, they were less deliberate or,

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<sup>11</sup>Howeth, p. 419.

<sup>12</sup>Ibid.

<sup>13</sup>Gleason L. Archer, *History of Radio to 1926* (New York, 1938), p. 73.

at least, more subtle than this suggests in their opposition. George H. Clark, one of the Navy's earliest radio experts, recorded the facetious remarks of some commanding officers who were not favorably disposed to the implementation of wireless. He recalled a statement made by one officer, "who saw a flat-top antenna not yet drawn up taut and who remarked testily, "how can they expect to tune a thing like that when its strings are loose!"<sup>14</sup> This flippant attitude, apparently shared by many a commanding officer, hopefully did not often result in the carefree attention paid to naval communications as it was when one ensign was assigned to radio duty, "because he could play the piano, hence, 'knew how to tune a set'."<sup>15</sup> Remarks such as these might be construed as representing nothing more than a quick sense of humor on the part of various officers. Actually they were uttered by men who knew little about radio, however they were too well informed of its technical aspects to let their statements indicate anything but a slightly sarcastic humor. These men did not see much

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<sup>14</sup> Quoted by Howeth, p. 107.

<sup>15</sup> Ibid.

value in radio and they were not sufficiently interested in it to attempt to exploit its full potentialities. In its beginnings, radio afloat was not very effective over long distances, besides there were more traditional means of communications between ships. Commanders had been accustomed to having their ships directed in close formation maneuvers by visual signals. In times of good visibility, the disposition of each ship could easily be observed; it was a simple matter to discern whether a ship had received and understood its instructions. This was not always the case when it came to using wireless which spirited unseen messages through the air. Naval men were not prone to favor this new method which replaced the traditional visual signals with invisible waves which officers "could not see, nor understand, and . . . which they certainly distrusted."<sup>16</sup>

There were, of course, some very good reasons not to trust too much in radio communications. It was not unreasonable to suspect that wireless communications could not be maintained in battle. If the

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<sup>16</sup> Howeta, p. 168

concussion of the ship's own guns was not sufficiently powerful to destroy it, there was the likelihood that an enemy's fire would quickly carry away the fragile topside antenna. Besides, the equipment was primitive and subject to frequent failures. In many cases, however, the reliability and range of radio apparatus was further curtailed "by some commanders who secured their equipments as soon as they were at sea in order to eliminate what they considered an undesirable shore contact."<sup>17</sup>

The unfavorable attitudes of higher ranking officers were often agitated by the actions and attitudes of lower echelon personnel who were more directly involved with the actual operations of radio communications. One of the major problems here was the complete lack of radio discipline in evidence in the early wireless years. Radio men, left to their own designs by superior officers, often utilized a ship's equipment to pass on "cheap gossip, intrigue, assignations, amatory trivia"

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<sup>17</sup>  
Ibid.

and other personal messages of a similarly non-naval nature.<sup>18</sup>

One early operator recalled the radio chaos which existed in the years before Stanford C. Hooper became a fleet radio officer.<sup>19</sup>

It was some time before rigorous efforts on his part were able to bring some order out of the haphazard condition of wireless communications. Even the code to be used was not entirely standard with the various operators; "Morse" and "Continenta" were sometimes promiscuously interchanged according to the whim of the sender with confusion and delay in receiving as the inevitable result. There was little attention devoted to providing a set form for sending messages, and, of course, a general disregard of the idea that naval radio should not be used for other than official business. In the years before the first World War if a naval operator was unexpectedly unable to get into port he might contact a shore operator and ask him to relay a message for him. "Say, old man, how is it to call Gertrude and say I can't get in today..."<sup>20</sup> Thus, the free and easy atmosphere which surrounded

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<sup>18</sup> Bigelow, p. 127

<sup>19</sup> C. N. Ingraham, "Radio Communications from an Operator's Viewpoint," United States Naval Institute Proceedings, August 1921, p. 1203.

<sup>20</sup> Ibid.

the early operator may have been very good for his romantic connections, but it certainly was not conducive to the maintenance of efficient naval communications. And, in fact, such laxity could have had disastrous ramifications if it had not been greatly amended by the time war broke out.

When early radio operators were ordered to send out messages, they often disregarded the rules of elementary courtesy in order to be able to begin transmitting immediately. If someone else was attempting to send or receive, the equipment then in use made it impractical for another operator too nearby to attempt to communicate at the same time. Radiomen were not always entirely at fault when such breaches of courtesy did occur. Sometimes superior officers, impatient with delays caused by waiting for others to complete their transmissions, and ignorant of the possible consequences for the entire fleet's communication system, heedlessly ordered operators to get their messages through immediately.<sup>21</sup>

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<sup>21</sup> Ingraham, p. 1205

More often, however, the fault rested with the operators themselves who were not given sufficient supervision and acted accordingly. To the operator, the particular message which he was assigned to transmit became, at the moment, the most important message to be sent in the entire fleet. Consequently, the transmitter would be turned up to the highest power possible in order to insure a clear signal at the receiving end. This caused considerable interference, and often unnecessarily since much lower power would usually have sufficed to get the message through. Since the amount of power to be utilized was not officially regulated, it was common among the early operators to attempt to transmit at the highest possible power to the detriment of the other senders.<sup>22</sup> Sometimes in an effort to "clear the air" for their own use, operators were known to "drop a book on the key" so that interference would be deliberately continuous until the others would give up trying to send or receive.<sup>23</sup>

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<sup>22</sup> Ibid.

<sup>23</sup> Alvin F. Harlow, Old Wires and New Waves (New York, 1936), p. 448.

One alert officer complained that operators had a wrong conception as to what constituted efficient communications. Rather than accuracy and sureness in reception which were desirable ends, they thought and acted in terms of "transmission at the highest possible speed, regardless of the receiving operator's ability, the receiving conditions, or the amount of transmission."<sup>24</sup> It seemed to him that operators were wielding an undesirable amount of influence over naval radio. He protested that "radiomen should not be permitted to run radio communication any more than gun's (sic) crews should dominate gunnery."<sup>25</sup> The fact remained, however, that early radiomen were to exercise influence and power within the command structure of the Navy considerably out of proportion to their designated roles.<sup>26</sup>

A contemporary observer of the situation of early naval radio said that the highest officials of the Navy, such as the heads of bureaus, admirals of fleets and squadrons, and others in high positions were

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<sup>24</sup> Letter from Milton H. Anderson to C. E. Courney of Jan. 25, 1939.

<sup>25</sup> Ibid.

<sup>26</sup> Harry F. Breckel, "The Vital Importance of Radio Communication in Modern Naval Warfare," United States Naval Institute Proceedings, March, 1922, p. 384.

constantly at the mercy of an operator and the manner in which he discharged his duties.<sup>27</sup> In those days the senior operator on each ship had charge over the communication personnel on board. He was in a position to exercise a tremendous amount of influence, and once at sea he "quickly became a law unto himself."<sup>28</sup>

During the first World War, operators were entrusted with countless vital messages, a situation never before experienced. Both the quality and priority of transmissions were paramount to successful communications, and it was the radiomen who most often had cognizance over both of these considerations.<sup>29</sup> Even after the war, operators were making important decisions which some felt should have been made by higher ranking personnel. That enlisted men should have so much influence irritated men like Lieutenant Commander C. N. Ingraham who, in 1921, complained that, "excepting in cases where competent officer operators... are in charge, radio communication is almost entirely controlled by enlisted personnel. There is no other department which is so controlled, yet there

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<sup>27</sup> Ibid.

<sup>28</sup> Howeth, p. 61

<sup>29</sup> Breckel, p. 384.

is no other branch which is more important strategically or tactical-  
ly ..."<sup>30</sup>

The situation remained that way for some time, however, because of a lack of radio officers. Men who were sufficiently knowledgeable about radio were few and far between. It was recognized that, ideally, communications officers should have been well acquainted with the mechanics and operational factors involved in radio communications. However, it was difficult to find many officers who desired to learn about the new art which was, after all, still in the process of rapid development.<sup>31</sup>

Especially scarce were communications officers who had gone through radio school; most had been assigned to their positions after having accumulated a haphazard knowledge of radio on the job. Lieutenant H. D. Kent, who was a radio officer in the early 1920's, was troubled by the fact that "the present-day communication officers are too often accidental rather than designed. There are more communication officers in name than in fact."<sup>32</sup>

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<sup>30</sup> Ingraham, p. 1206.

<sup>31</sup> Ibid. p. 1201-1202.

<sup>32</sup> H. D. Kent, "Fleet Radio Communication in War," United States Naval Institute Proceedings, August, 1921, p. 1064.

This shortage was felt by higher ranking personnel as well. In a conference on naval radio held in 1922, Stanford C. Hooper outlined the main difficulties then being faced in radio communications. Of the officer situation, he said that "we had ten p. gs. (radio officers with post graduate training in the field) this year; we could not get ten operators (out of these officers) and had to require them to learn."<sup>33</sup> Under such circumstances it is not surprising that operators were not well inspired by communication officers who were unable to handle the practical operation of a station. One former operator wrote that this was the case with almost all of the early radio officers.<sup>34</sup> That the situation was not promptly remedied was demonstrated by complaints in the 1930's to the effect that even many capital ships were without a qualified radio officer on board.<sup>35</sup>

The general lack of discipline among the earlier radiomen was detrimental to radio communications even after this condition of things was changed. There was for awhile a tendency to look upon operators as being incapable of adapting to anything but the simplest of new

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<sup>33</sup>"Conference on Fleet Radio," June 26, 1922.

<sup>34</sup>Breckel, p. 384.

<sup>35</sup>Letter from Stanford C. Hooper to J. L. Allen of Sept. 8, 1933.

equipment. It was felt by some that anything else would require more concentrated effort to master than operators would be willing or able to put out.<sup>36</sup> Communication officers were similarly regarded by other naval men, and they sometimes lived up to these expectations. The position was often sought by the less ambitious to the detriment of efficient communications. An angry observer of this phenomenon deplored the idea "that the toughest assignment in the Fleet should be considered as a sinecure with time for 'bunk' exercises at sea and liberty in port..."<sup>37</sup>

The communication officer had traditionally been relegated to an uncertain position as regards his status and influence. In the earlier days of radio, it was not deemed necessary to provide special training for radio officers. Ordinary signal training was felt to be sufficient. At first, naval exercises were conducted without any attention devoted to radio personnel. Equipment was frequently tested and steadily improved, but as the winter fleet maneuvers of 1923 seemed to demonstrate, communications functioned poorly on account of personnel defects, not mechanical failures.<sup>38</sup>

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<sup>36</sup>"Conference on Fleet Radio", June 26, 1922.

<sup>37</sup>Anderson to Courtney, January 25, 1939.

<sup>38</sup>Memorandum on Communication Competitions", 1924

Attempts to improve the situation centered around providing a greater number of better trained radiomen. As both the quality and quantity of communication officers increased, so did the amount of influence and power which they exercised. Manuals and texts emphasized the auxiliary nature of their positions,<sup>39</sup> but communications men were thought by some to have gone beyond their proper spheres in the amount of control which they exercised over the transmission and distribution of messages. As if in the hope of making it so, one textbook of the 1920's told future radio officers that they would have "very little independent responsibility." Their duties and the amount of responsibility they could exercise would be contingent upon their "tact, courtesy and cheerful assumption of work."<sup>40</sup> The best way for future radiomen to serve the Navy and to further their own careers seemed to reside in a passive, dependent attitude in their work.

Even so, while being strictly subordinated to his superiors, the prospective radio officer was told that he must take charge when it came to the routing of messages. Priorities usually had to be decided

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<sup>39</sup> Navy Department, Communications instructions, U.S. Navy, (Washington, 1926), p. 69.

<sup>40</sup> Alexander C. Kidd, Notes on Naval Communications (Annapolis, 1924, p. 212.

by the communication officer and he was urged to make his decisions "with reference to congestion of traffic, existing regulations, orders and instructions on the subject, and the wishes or orders of the commanding officer...the desires of the commanding officer are placed last."<sup>41</sup> This was commonly the case, and certain antagonisms were bound to be felt by both communication officers and commanders.

This conflict was illustrated by the reaction of a commanding officer to a brief statement which appeared in a bulletin issued by the Communication Division in August, 1928. The editor of the bulletin commented on the role of the communication officer and his importance concerning the decisions he must make in the routing of messages. He declared in an offhand way that "communication officers cannot know too much about the Naval Organization if they are to be competent judges as regards the dissemination of information."<sup>42</sup>

Shortly afterwards, a displeased commanding officer sent a letter to the Communication Division in which he took to task the author of this statement for making such an assumption. "Dissemination of information," he proclaimed, "is in no way the business of the Com-

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<sup>41</sup> Navy Department, Communications Instructions, p. 79 .

<sup>42</sup> Stanford C. Hooper, "Dissemination of Information," Communication Division Bulletin, August 18, 1928, p. 1

munication Division, except in carrying out the instructions of the Commanders."<sup>43</sup>

The editor numbly submitted to this rebuke, and agreed that the commanding officer was the sole authority when it came to the question of releasing information. He did, however, have the temerity to assert that "the Communication Officer can be of great value in preparing and suggesting information for release in accordance with the Commanding Officer's wishes."<sup>44</sup>

Throughout the period between the two World Wars, radio apparatus was steadily improved, but at the same time personnel problems were only sporadically eradicated. Attitudes and actions, or lack of them, consistently played a significant role as regards the efficiency of naval communications. Fortunately, it was recognized by some men such as Stanford C. Hooper and other conscientious naval officers, that the successful implementation of radio required not only technical advancement; attention also had to be given to the personal outlooks of naval men directly and indirectly affected by the new means of communication.

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<sup>43</sup>Dissemination of Information is a Command Function,"  
Communication Division Bulletin, November 17, 1928, p. 2.

<sup>44</sup>Ibid. p. 3.

Gradually, through the necessity of continuous usage, radio became thoroughly accepted as an integral part of the modern Navy. After the first World War commanders were more willing to rely on radio communication. During the 1920's the volume of naval radio traffic expanded greatly from what it had been at the end of the War. It was noted that with this increased volume "a definite trend is indicated, wherein the naval service is gradually accepting and depending more on radio communication, just as the broadcasting of speech and music gradually has popularized radio ashore within recent years."<sup>45</sup> Fortunately, this general acceptance of radio was able to develop in spite of the many stumbling blocks which were encountered along the way.

The transition to radio might have occurred more smoothly and quickly, but it could not have been more complete. Now there are other adaptations to be made by Navy men, and the struggle for the efficient implementation of radio is in the main, forgotten. Earl E. Stone, over twenty years ago said that "in the future, instantaneous communications rather than merely rapid communications will probably

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<sup>45</sup> Rochester, p. 853.

become a prime military necessity."<sup>46</sup> Whatever electronic developments have since been made or about to be implemented in relation to the handling of information, experience gained by the Navy men when radio was an innovation should provide some valuable guidelines for adapting to this modern age.

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Earl E. Stone, "Lecture on Naval Communications,"  
May 13, 1947, p. 2.

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13. ABSTRACT Forty (40) military and civilian personnel of the Navy and other agencies were interviewed to determine the effects of Automated Data Processing (ADP) on the Navy command structure. The most important impact was on the attitudes of military personnel concerning the function of ADP in their operational role and the influence of ADP in their Navy careers. It was recommended that the Navy assess present ADP training programs to determine ways that they can be supplemented to meet the needs of command-control environments. The second impact concerns the influence of ADP on information handling procedures existing in the Navy. In anticipation of further inclusion of ADP in the Navy command structure and implementation of Navy-wide integrated command management systems, it was recommended that an activity devoted exclusively to problems of ADP technology and Navy command be given attention and emphasis.			

14. KEY WORDS	LINK A		LINK B		LINK C	
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