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A STUDY OF  
PERSONALITY AND LEADERSHIP IN A  
TECHNICAL ENVIRONMENT

THESIS  
SUBMITTED FOR THE DEGREE  
DOCTOR OF PHILOSOPHY

by

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## ABSTRACT

1. This report presents the findings of a study of individual personalities of Naval Officers, Chief Petty Officers and Petty Officers serving in different environments within the Ministry of Defence and the Fleet. This sample was used to establish norms for the Cattell 16 PF Questionnaire, and these are compared with other occupational norms discussed in the literature.
  
2. The results obtained on psychometric measures were related to other data collected about the work and the formal organisation. This was in its turn related to problems facing the Navy because of changes in technology which have occurred or which are now taking place and are expected to make an impact in the future.
  
3. A need is recognised for a way of simulating the effects of proposed changes within the manpower field of the Royal Navy and a simulation model is put forward and discussed.
  
4. The use of psychometric measures in selection for entry and for special tasks is examined. Particular reference is made to problems of group formation in the context of leadership in a technical environment.
  
5. The control of the introduction of change is discussed in the recognition that people represent an increasingly important resource which is critical to the continuing life of the total organisation.
  
6. Conclusions are drawn from the various strands of the research and recommendations are made both for line management and for subsequent research programmes.

## PREFACE

1. This work has been sponsored by the Ministry of Defence and the only constraint placed upon the Author was to observe the security regulations. This report therefore reflects a personal view. It aims to outline the research undertaken, to identify any contribution made to the Service as a result of the activity, to discuss the significance of observations made and finally to make appropriate recommendations.
2. Meeting the vital need for improved allocation of recruits in the Royal Navy during the Second World War gave Occupational Psychology a flying start into the postwar world. If the time has come to repay the compliment, it is hoped that this report will show to the Naval reader what is on offer. In particular it is hoped that by indicating what can be done by individual activity and by sign-posting interesting areas for further study others will be encouraged to follow.
3. In reporting on work which has involved volunteers (who between them have answered over a quarter of a million questions) there clearly is a place for a word of thanks. It is true to say that the involvement has been stimulating and entirely pleasurable. The co-operation received at all levels was most heartening. Particular thanks are due to the supervisors of the project, Dr W G Brown who gave the psychological guidance, Dr Alastair Cochran who provided the inter-disciplinary scepticism needed to steer the work and Captain McClune who acted as buffer against some of the hazards met when researching into a sensitive area in a large organisation. Many people contributed in other ways but particular mention should be made of Mr Terence Harris and Dr Buckley-Sharp of the Department of Research and Services in Education at the Middlesex Hospital Medical School. Finally, two people in particular within Director General Weapons in Bath, Miss Carol Mundy who did considerable work in collating data and Lt J F J Simpson who collaborated in the development of the Hocus model which we both hope will prove a valuable tool.
4. As a direct result of this work being conducted in parallel with a staff appointment in a material department it has been possible to relate the research to current problems. To make the report more valuable in discussing these, it has been agreed to mark it "Staff in Confidence" until May 1975.

REPORT OF A STUDY OF  
PERSONALITY AND LEADERSHIP  
IN A  
TECHNICAL ENVIRONMENT

BY  
COMMANDER M R H PAGE ROYAL NAVY

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## SECTION 1 - INTRODUCTION

### The IHD Scheme

1.1 This is the report on a programme of work conducted under the auspices of the Inter disciplinary Higher Degree Scheme. This new award by the University of Aston represents a large step in the direction of closer collaboration between the technological universities and industry. It follows recommendations by the Swann, Willis Jackson and Bosworth Committees, and has been worked out in close collaboration with the Science Research Council, the University Grants Committee, and a number of major industrial organisations.

1.2 The aim is to provide a new type of post graduate training, at the level of more traditional PhD research, but more directly applicable to the immediate problems facing the parent organisation. The concept required applied research work in the sponsoring organisation on a problem of considerable importance to that organisation. The boundaries of the problem were drawn with more emphasis on the decision making needs of the organisation than on any one academic discipline, and implementation of the findings was expected to be treated as part of the overall project.

### Selection of Area of Research

1.3 On completion of a course in Applied Psychology it was recognised that there was a clearly identifiable need for further research in the area which provided material for the dissertation. The area of study was the interaction of personality and leadership in the technical environment of the Royal Navy, and the Ministry of Defence (Navy) agreed to sponsor further work within the IHD Scheme. The research was to be combined with an appointment as a Staff Officer within the Co-ordination Directorate of Director General Weapons (Naval). For this reason, as well as personal preference, the research was biased towards the weapon engineering aspects of the employment of men in the Naval service. It was considered that it was in this area of employment, that major difficulties in manpower would have to be faced and resolved.

1.4 A pilot study into leadership training at HMS ROYAL ARTHUR provided a basis for considering further areas of activity in the context of the personality and leadership styles of the Naval personnel involved. The aims of this study were:

- a. to seek an objective measure of the effect of the course on individuals taking part.
- b. to investigate the pattern of personality as measured among technical and non-technical ratings.

c. to seek a correlation between these measures and performance, both on course, and afterwards working in the Fleet.

1.5 The results obtained indicated that psychometric measures do disclose shifts of attitude following a short but intensive course. However, the job specification did not include a definition of leadership, this study used two subjective criterion variables:

- a. Success on course, as assessed by training staff.
- b. Success in the job, as assessed by superiors.

1.6 It was considered that the study had added to the understanding of leadership training in the Royal Navy for the following reasons:

- a. Leadership training was shown to produce measurable shifts in attitudes among the trainees which were amenable to investigation by psychometric methods.
- b. The effects of the course of training as measured in that study appeared to be in accordance with the aims of the course.
- c. It was shown that different groups within the sample responded in quite dissimilar ways to the course but it would be necessary to investigate this aspect in greater depth before any significance could be attached to these findings.
- d. There was a remarkable agreement between the aim declared by the training establishment of increasing self-confidence and the results of the course as measured by
  - (i) the psychometric measures
  - (ii) the view of the reporting officers
  - (iii) the Petty Officers individual reports of their own reaction after three months back at work.

1.7 It was not possible, in the timescale of the pilot study, to include any examination of the longer term shifts in attitude which resulted from the training given at HMS ROYAL ARTHUR. Neither was it possible to apply the findings from the study of the training situation to the real world of work in a ship.

1.8 The proposal to follow up with further work was in two parts. The first part was a continuation of the study of the individual in various technical environments. This was to increase the breadth and depth of the pilot study to embrace a typical sample of management in the fleet. The second part was to be aimed at putting the work into the framework of the whole ship.

1.9 The study was expected to relate ship system effectiveness with the psychosocial composition of the ship's complement at management level. The aim was to seek an understanding of which personality variables appeared to be critical to ship effectiveness. This was expected to result in suggestions for attaining better utilisation of the leadership potential within the technical fields of the Royal Navy.

#### Naval Activity in Personnel Field

1.10 At about that time, three areas of activity were generating questions for personnel management in the Ministry of Defence:

- a. The reorganisation of DGW(N) as a result of the establishment of the Procurement Executive was expected to result in profound changes in the career pattern of Naval Officers employed in the weapon field. These changes were expected to become apparent as the new organisation developed.
- b. The User Maintainer and the Principal Warfare Officer Concepts were expected to be accepted as official policy. It was predicted that these schemes might create difficulty in the selection and allocation of naval personnel.
- c. C in C Naval Home Command had initiated a study into leadership training of officers and ratings. This was as a result of the alleged shortcomings of the training given to officers compared with that provided for Petty Officers at HMS ROYAL ARTHUR.

In total, these represented major aspects of an increasing awareness of the changing needs of the service for trained men.

1.11 It became clear that although there was little individual overlap between these areas, there was a common theme. This is most easily identified if the whole process of the employment of naval personnel is considered in system terms. It was possible to identify some of the separate entities, such as:

- a. Initial selection of individuals for Naval Service.
- b. Training and education of groups.
- c. Allocation of individuals.
- d. Work afloat.
- e. Work ashore.
- f. Selection of individuals for promotion.

These are all inter-connected within iterative processes and possess a number of feed-back chains, which must be considered together when attempting to understand how the system functions and what are the possible outcome from proposed change.

1.12 The conceptual framework for the larger study relied upon the premise that there were wide individual differences between naval personnel of equivalent rank or rate. The importance of these differences had not been studied in the past because the comparatively stable nature of the service minimised their effect. As explained above, this situation was changing. The most marked effect of this variation in personality was expected to manifest itself in the leadership or "officer-like-qualities" of the individual man.

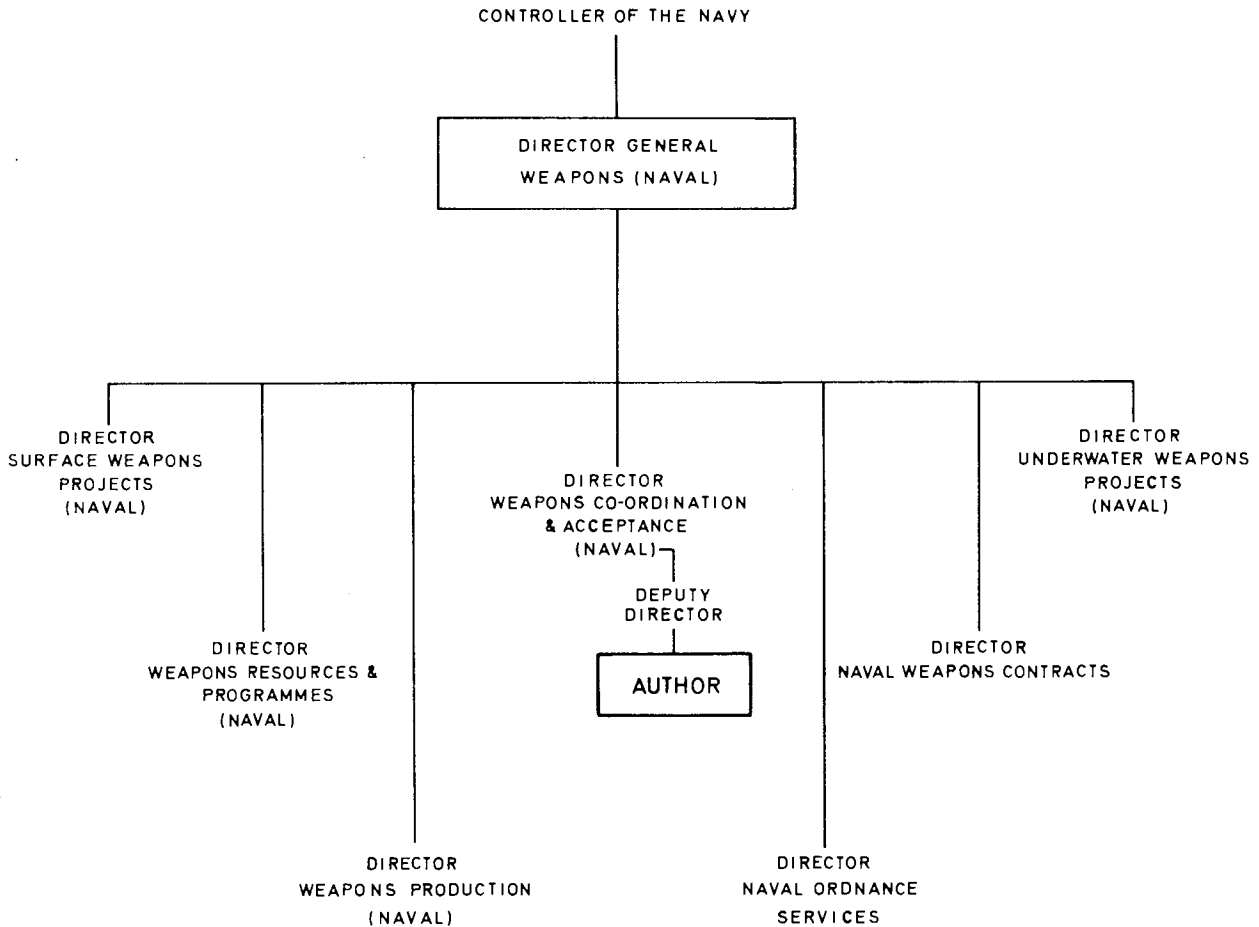


Fig 1.1

1.13 To be able to draw conclusions, it was necessary to investigate the place of leadership in the total work environment. This was possible in a number of ways, but for the purpose of this Study was restricted to certain key areas.

- a. The sea going environment restricted to surface ships.
- b. The shore employment of officers in a Headquarters function.
- c. Training.

The plan was flexible and designed to adapt to the needs of the organisation as the research developed. Figure 1.1 shows the family tree of the part of the organisation in which the author worked.

1.14 It was clear from the literature that leadership makes a complex contribution to the effectiveness of the individual and that any study of it could not be restricted to a narrow interpretation of this contribution. In particular, leadership as an organisational function was recognised as being as important as the officer-like qualities of the individual leaders and must therefore be included in any plan.

1.15 In the simplest terms, there is a Process = Person = Product balance which may be depicted in the way shown in Figure 1.2. The environment acts upon the individual characteristics of the person, initiating leadership behaviour. The organisational results obtained provide a feed back to change the environment and also modify both the leadership behaviour and the individual characteristics of the person himself.

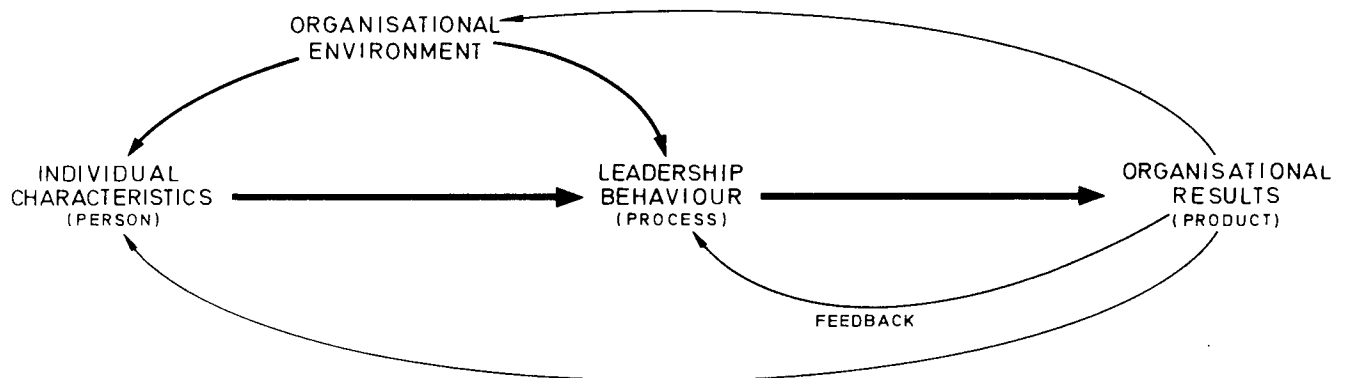


Fig.1.2 Simple model of leadership process

1.16 The research set out to look at the person who was in a leadership position, enquire into leadership behaviour and examine organisational results in the context of their interactions.

The disciplines which are most directly involved in personnel research are social psychology, sociology, occupational psychology, and economics. Although the work-content of these disciplines changes and overlaps, their separate and combined efforts constitute the broad theoretical network for personnel research.

1.17 The use of research techniques and, theoretical constructs to solve, describe, or predict problems has a number of inherent difficulties. These problems must be understood in order to comprehend the difficulties of conducting personnel research, which is an applied research field. A number of these problems derive from the nature of a social science. To quote Berry (1968):

"Social science faces problems basically different from those of natural science. It is faced with problems of value and fact, in which fact must frequently be determined by the researcher. The plight can be described in this way: The social scientist frequently derives a concept by intuition (rather than deducing formal concepts by postulation), collects a "factual" description of what he observes (which involves a selection and interpretation of facts that may not be exactly duplicated by a subsequent observer), matches the two, and personally determines the correspondence in regard to either the theoretical intent of prediction or description. In addition, the researcher can form his concepts either on a normative (what ought to be) or descriptive (what is) basis. Also, the data accumulated in such a process can be both bulky and complex".

1.18 He claimed that changes in the problems of both Society and business were forcing researchable issues into the research arena creating a melding of hitherto scattered scientific approaches. This came from a more holistic concern for the total organisation. The Royal Navy can provide examples.

1.19 A recent investigation into drug abuse on the messdecks of ships of the fleet brought out the fact that boredom was a primary cause of experimenting with drugs. This was general over a wide range of personalities. Of perhaps greater significance were the bases where a shy, lonely sailor became a drug taker because he found that he then became one of the boys. Drug taking gave him a circle of friends so that he was no longer the lonely one.

1.20 The Service looks after the married sailor, it gives the Senior Rates a more friendly atmosphere in the CPO and PO Mess. It provides a wide range of sporting facilities for the extrovert. The questions "is the loneliness of the sailor's mess deck appreciated? Is this an aspect of which the leading hand should be made more aware, and from him the Divisional Officer?" were asked by Naval Home Command in recent discussion.

1.21 They went on: "One rating had deserted because of his overwhelming desire to paint, and indeed held an exhibition in London during his absence. Another deserted because he could no longer stand the language of his mess deck. Another reason for desertion was through sheer boredom brought on by staying in the same tedious job too long, For example, an RP served over 2 years in Ships (Communal Party, a Writer 18 months in Typing and Despatch Section, an REM, keen on electronics, kept on teleprinters".

The Conclusion stated was:

"It is considered that the need to be aware of the sensitivities of our young new material and to overcome these sort of problems should be widely promulgated".

1.22 If it is behoven on the Naval high command to exhort the young leaders to be sensitive to the needs of the individual recruit, it must be appropriate to embark upon a research programme to examine the inter actions in small groups and to consider the personality variables found in the individual characteristics of leaders. It was just this kind of change in the attitude to the young rating that highlighted the appropriateness of this research in the eyes of Naval Home Command.

#### Research Aim

1.23 Taking as a starting point this interactive view of the collection of people making up the organisation, the aim of the research was to identify the formal and informal factors at work and to attempt to draw conclusions from these observations. There was apparently a lack of information about the individual characteristics of the various groups of people within different sectors of the Naval Service. The need for information about these differences has been identified but as far as can be ascertained very little work has been done in studying individual difference along dimensions of personality. Economics cannot be left out in this cost effective age. The employment of men in the Naval Service is very costly and the price of selection and training to produce an effective and experienced leader is sufficiently high to justify an investigation of ways of either making it more efficient or making it more economical by an understanding of the processes involved.

1.24 The processes determining Leader-follower relationships based on research into group dynamics, together with the under-lying principles of personality structure, are key areas and the next few chapters examine these as an introduction to the research design.



## SECTION 2

### PERSPECTIVES IN LEADERSHIP RESEARCH

2.1 The literature on leadership is very rich and practically every book on Sociology, Psychology and Management includes the word in the index. It is at the core of military teaching and is part of the Christian ethic. Because of this extensive range of application for the word, the interpretations placed upon it are limitless. For the purposes of this particular study, the military connotation has been taken as the appropriate one and only passing note has been taken of such studies as leaderless group behaviour in primary school children at summer camp.

2.2 Some definitions give the Naval view of leadership:

Leadership is the art of exacting cheerful and willing obedience from subordinates.

(Admiral Sir Richard Onslow)

Leadership is the ability to induce others willingly to take a course of action.

(Vice Admiral A T F G Griffin)

Discipline has been defined as:

"The Acceptance of Leadership"

It produces "A man's sacrifice of safety, comfort, even life for others, for something greater than himself. It is the refusal to be the weak link in the chain that snaps under strain." (Field Marshal Slim)

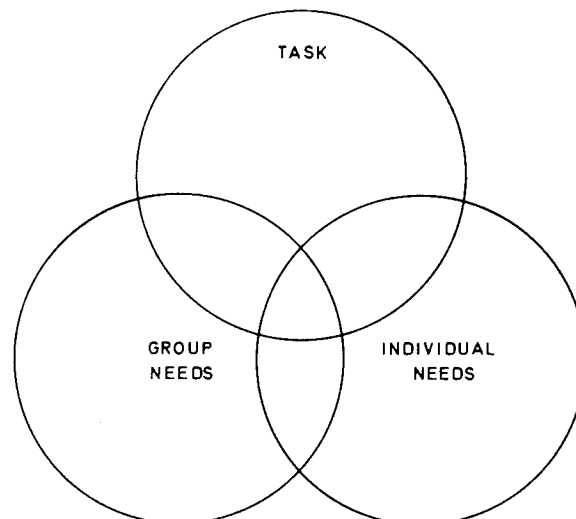
"The Key to Leadership and Discipline is acceptance and understanding. The common word in the two leadership definitions is "willing"; the antithesis of compulsion which has no part in leadership; because you cannot compel initiative and loyalty. When leadership fails, ill discipline will occur and it must be treated if it is not to rot the whole structure. Compulsion, however, can only produce a man's presence and minimum response." (Burne 1970)

2.3 These definitions indicate a recognition that the concept of leadership is an operational one and embraces the group and that this group is working towards an aim. Unlike Management which is defined throughout the Royal Navy as "getting things done through people in an organisation", Leadership and Discipline enjoy no such universal definitions and there is a continual debate about what is meant.

2.4 The Royal Navy has in the past taken an ambivalent view of leadership, avoiding any fine distinction between that term and management. Heath (1969) represented the view that leadership was a form of authority and a function of management and claimed that functional leadership as defined by Adair (1968) was nothing more than personalised management. Groves (1970) agreed saying management is the exercise of sanctioned authority over resources of men and material towards defined objectives. This concept of functional leadership had a considerable following within all three Services. It may be represented as a dynamic balancing of the needs of the group being led. These needs are clustered into

- a. Task achievement,
- b. Individual needs, and
- c. Team maintenance needs,

similar to Cattell's group syntality (1957) which he defines as that which determines a group's performance when the situation is given.



**Fig 2.1 The Adair model**

2.5 Adair demonstrated this by using three overlapping circles as shown in figure 2.1. This was intended to represent the interactions between the three needs. For example, group morale and individual satisfaction might be expected to be high when the task is seen by all involved as having been achieved. He sees the model in terms of shifting centroids which, when closer to coincidence, represent greater need satisfaction and by inference a greater success. One of the chief lessons Adair would have the student learn from this model is that each circle is equally significant in the optimisation of the leadership act. The leader must balance correctly the amount of attention he gives to each area

in different circumstances. Likert (1961) reported on research which confirmed this view and stressed that the task oriented leaders failed to achieve optimum effectiveness.

2.6 Leadership researchers have been active for many years and the extent of the literature is vast. Hollander and Julian (1969) presented an excellent survey of the work, highlighting the different lines of development. They first discussed the study of personality traits of leaders which was in vogue until the 1930s and compared it with the situational approach which followed it, reported by Stogdill in his 1948 survey. They claimed that "the trait and situational approaches afforded a far too glib view of reality; not representing their philosophical underpinning very well and each resulted in a caricature".

2.7 They made the following points:

- a. Leadership must be considered separately from the Leader, that is to say, the leader/follower situation must be examined, although neither can be ignored.
- b. A leader provides leadership which may be considered as a resource. In return he receives greater influence, which builds up with time.
- c. The leader's role has personality characteristics determined by the perceptions held by the followers.
- d. Leadership effectiveness embraces more than the action of the leader. He defines a situation for the followers in terms of reality, to justify the existence of the group.

2.8 In their conclusions and implications they say "it is evident that a new set of conceptions of leadership is beginning to emerge after a period of quiescence". They point to the system approach and the need to pay attention to the organisational framework in which leadership is expected to operate. This is the concept of leadership used in this research where an attempt is made to relate the whole to a system approach. This differs considerably from the classical view of leadership.

2.9 Before 1900, interest in leadership was philosophical, attempting to predict how leaders should behave. The literature consists of biographies of outstanding people in different fields. The leader's personality appeared to give him a divine right to lead his fellow men, but such studies were not helpful in selecting and training leaders.

2.10 Early psychological researches on leadership were more sophisticated, but were influenced by this classic approach. Leaders were seen to possess certain traits in common, and the literature abounds in attempts to identify such traits (eg in Allport, 1924; Bernard, 1926; Tead, 1935; Coffin, 1944). The results were contradictory. The search for general leadership traits failed. Stogdill (1948) surveyed the literature and in his conclusion states:

"The evidence suggests that leadership is a relation that exists between persons in a social situation. The findings suggest that leadership is a working relationship among members of a group, in which the leader acquires status through active participation and demonstration of his capacity for carrying co-operative tasks through to completion. Significant aspects of this capacity for organising and expediting co-operative effort appear to be intelligence, alertness to the needs and motives of others, and insight into situations, further reinforced by such habits as responsibility, initiative, persistence, and self confidence. The studies surveyed offer little information as to the basic nature of these personal qualifications."

This statement by Stogdill foreshadowed many subsequent approaches which looked at more than one aspect of leadership at a time and thus marked a water-shed for research by social psychologists into small group behaviour.

#### Personality Characteristics and Group Performance

2.11 McGrath and Altman (1966) in a review of work which sought to relate leadership performance with personality characteristics of members identified 24 separate research projects, 12 of which showed a relationship significant at the 0.05 level. There was a high relationship between scores on such personality measures as extroversion, assertiveness and social maturity, when they were associated with the behaviour in leaderless group discussion. There were only slight relationships between other traits such as seriousness, and general activity. They quote Spector and Suttell (1956) who researched into the specific leader behaviour patterns most effective in influencing group performance. US Navy teams were presented with a problem to solve while working under three types of leader behaviour:

- a. Reinforcement in which the leader guided, but maximised positive reinforcement.
- b. Authoritarian in which the leader maximised the quality of planning and decision making.
- c. Democratic in which the leader maximised the individual satisfaction of group members.

2.12 Trials were conducted under normal and emergency conditions, including some where the leader was absent. Performance was measured in terms of number of group errors. Neither leadership style nor leadership intelligence was found to be related to group performance.

The study variables used were:

- a. General abilities of members
- b. Leader intelligence
- c. Task, or physical position in the group
- d. Leader behaviour - of the three types described above
- e. Group task performance

2.13 This research has been concentrated in the United States with the Office of Naval Research taking a leading role, and most of the major names have at one point or another reported work for the US Navy. Fielder (1966) reports on studies he conducted with Belgian Naval ratings funded by a contract with Advanced Research Projects Agency. He was endeavouring to confirm his contingency model where he stated that a psychologically distant manager who is a task specialist, when compared with the psychologically close manager, a human relations specialist, produces a dichotomy which is more meaningful. His work sought to rate the most preferred and the least preferred co-workers and use these as a measure of the favourableness of the group-task situation.

2.14 Special emphasis was given to the additional problems of isolation in a major study by the US Navy. Project ARGUS led by Haythorn of the Naval Medical Research Unit included an experimental social psychological study of the contagion of aggressive behaviour and the comparison process by which men evaluate the adequacy of their task performance including the reaction of mature and immature character structures to different leadership styles (Haythorn 1967). The ultimate objective of this research was to improve the cost-effectiveness ratio of future Naval underwater systems.

2.15 Theory drawn from small group research was also used in work by the Danish Armed Forces Psychological division led by Rieneck (1970) into the response of Young Recruits on joining a military environment. Principles of leadership were seen to generate a "military teaching atmosphere" which supported the socially less competent recruit and hence enhanced the rate of learning by the majority.

2.16 Most researchers have tended to look at the leaders as the focal point, and they are generally agreed about some of the factors which are relevant to successful leadership. For example: Carter (1950) lists the following characteristics of a leader:

- a. Able to focus the behaviour of the other members of the group
- b. Able to lead the group towards its goals
- c. Is selected by the members as the leader of the group
- d. Has demonstrable influence upon group syntality
- e. Engages in leadership behaviours

and various elaborations and combinations of these recur. For example, Adair (1969) would see a and e as meeting the needs of the individual, b is related to the task, while c and d meet the needs of the group.

2.17 Taylor (1962) used the following classification to examine leadership:

- a. Leadership is a force - it is a causative power. It exists outside the individual applying it.
- b. Leadership functions in the environment and varies in important detail with the environment. This suggests that the situational factors are important.
- c. Leadership is dynamic. Without an objective it ceases to be meaningful. It is task dependent.
- d. Leadership employs principles, tools and methods. It utilises consistent guides, procedures and techniques which can be learned and controlled.

2.18 This view highlights the need and importance of training programmes for the development of successful leaders. It assumed that performance, as in any field where skill can be learnt, will respond to feed back and is improved with experience. This implication that leadership can be taught was accepted by Taylor who went on to list the qualities essential before training is worthwhile:

- a. Mental Ability: 5-10% better than the followers in the group. He stresses the need for a high degree of tolerance and empathy in the young potential top leader. He must play down his superior intelligence at the lower levels of his career. This is an important but often neglected consideration in assessing behaviour.

- b. Broad Interests and Abilities: One study he quotes linked leadership potential with many aptitudes at an above average level. This highlights the need to exercise care in the preparation of a screening procedure to select leaders, because relationships identified by research may not be valid when used as predictors.
- c. Skill in Communication: He quotes Disraeli - "with words we govern men". Language is the primary means of influencing all followers. This is an area which has been neglected in the technical branches at some stages of their recent expansion.
- d. Maturity for, as he says: "Only a real man can lead people". A leader is objective and thoughtful. He is self-controlled, self-reliant, self-sufficient, even-tempered and well-adjusted to life. While the service is interested in effective selection, an understanding of maturation is clearly necessary.
- e. Motivational Strength: The successful leader enjoys the work of planning, organising and directing the work of others. This is an increasingly important consideration in an all volunteer service.
- f. Social Skill: The leader must be sensitive to human feelings and attitudes, and study the art of getting things done through people. This probably implies a certain degree of extroversion in his make up.
- g. Administrative Ability in which is included the ability to do the 'whole' job from conception to final completion.

2.19 This can be compared with the characteristics reported upon in Naval Officer's confidential report and listed in table 2.1. It will be seen that both recognise the person as central to the act of leadership while not ignoring the place played by the situation.

Table 2.1

Zeal and energy	Keeness, drive, and zeal in the execution of duty.
Reliability	Trustworthiness, dependability, conscientiousness and thoroughness necessary to see a job through to its conclusion.
Commonsense	Sense of proportion. The possession of sound and well-balanced judgement.
Intelligence and reasoning power	Power of intellectual penetration. Capacity to master a complex and difficult subject in all necessary detail.
Initiative and alertness	Quickness of mind and immediate grasp of essentials which enable an officer to sum up a situation at once and take the initiative.
Leadership	The power of inspiring and directing others both under normal conditions and in an emergency.
Power of expression	The ability to use language clearly and effectively in speech and writing.
Organising ability	The capacity and foresight to plan so as to meet successfully the needs of any situation.
Tact and co-operation	Discretion and courtesy in dealing with others both senior and junior.
Social attributes	Ability to mix with all grades of society ashore and afloat.

2.20 The attributes defined above are assessed in relation to the average degree which could be expected from the normal officer taking into account rank, seniority and List. The marking is from 1 to 9, as defined in table 2.2.

Table 2.2

9.	Absolutely outstanding
8.	Exceptional
7.	Very good indeed
6.	Above average
5.	Average or normal
4.)	Satisfactory but with some shortcomings
3.)	
2.	Unsatisfactory
1.	Quite inadequate
IK	Insufficient knowledge



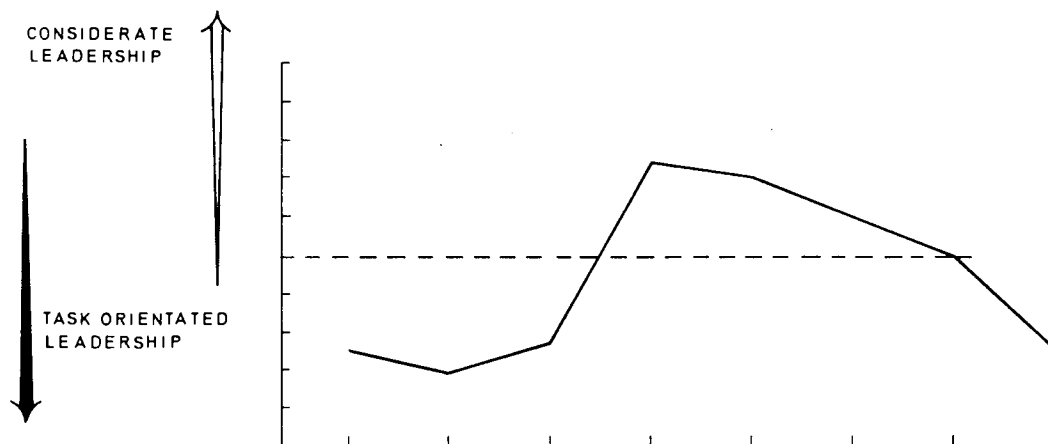
2.21 Kelly (1969) in the context of the trait approach discussed the position of dominance in the personality of a leader which, in earlier studies of leadership, appeared to be the major characteristic quality which was used to identify the person with potential. This was seen in the veneration paid to very senior officers between the World Wars. Young (1946) said that this was acceptable, being a special form of dominance, since the followers more or less willingly accepted the leader's control. However, Kelly disagreed and claimed that this is "essentially a naive and primitive concept - quite unsupported by empirical evidence". In any case, the trait approach failed because firstly, the personality measures were inadequate, and secondly, people reach leadership positions for reasons other than leadership potential. This leads to consideration of a group approach which says that a leader is thrown up by sociological pressures within the group. Many members of a group may contribute to leadership functions. Kelly defined leadership in a very general way as the ability to influence others in a group, and quotes Elliot Jaques of the Glacier Metal Company, who did much work on the human relations oriented leader, over a long period of time in one factory. He used a term "going into role" to describe the effect of a leader playing a part and intentionally increasing the anxiety felt by a subordinate in an effort to gain control over him. This is a very common technique used in the services, for example at Admiral's Inspections to create a cohesive force within a ships company.

2.22 Katz and Kahn (1966) described both good and bad features of leadership. A good leader cannot be 'one of the boys', a good leader must delegate, a good leader must consider the whole man. In the early 1940s they studied the Chesapeake and Ohio railway, the Provincial Assurance Company and the Caterpillar Tractor Company and they found that the man-oriented leaders produced better results than the work-oriented leaders. However, Argyle (1957) suggests that this increase in productivity resulting from human relations oriented leaders was of the order of 15 per cent only. Kelly recommended that the Argyris approach of a complex, reality centred, style of leadership is the most appropriate and rewarding. It was in this context that mention was made of the concept of a leader having a spectrum of leadership styles from which to choose, and that this flexible technique was appropriate to all situations. It should be noted that the leadership would not necessarily appear flexible to the followers.

2.23 This is borne out by the work of Misumi and Shirakashi (1966) in their study of Japanese Post Office workers and their relative effectiveness when working under different types of leaders. They found that the task centred leader created a group which was low in morale but moderately successful judged on output. A group centred leader produced a less effective team but morale was

high. A leader who could embrace both task and group needs achieved both high morale and greater output. This research, conducted in Japan, showed that the most successful leader is the one who applies task-oriented leadership techniques with a large human relationship bias, but one must bear in mind that cultural factors play a part. This is particularly true of Japan where the large paternalistic, company is common.

2.24 Fiedler (1968) saw leadership as an influence process. The leader is the man who has power. This influence is a function of leader/member relationships, the task structure and position power. He developed a contingency model to explain different leadership performance under different conditions of these three variables. The most important he saw as leader-member relations. If these are good, the leadership task is made easier. Next in importance, he placed task structure. That is because it is easier to enforce compliance in a well structured task where sanction from superior authority is clear cut. Finally, position power is the third dimension and is inherent in the leadership position irrespective of the occupant's personal relations with his members.



LEADER-MEMBER RELATIONS	GOOD	GOOD	GOOD	GOOD	POOR	POOR	POOR	POOR
TEST STRUCTURE	STRUCTURED		UNSTRUCTURED		STRUCTURED		UNSTRUCTURED	
LEADER POSITION POWER	STRONG	WEAK	STRONG	WEAK	STRONG	WEAK	STRONG	WEAK

Fig 2.2 Fielder model indicating appropriate styles of leadership

By studying 59 group-task situations, he graded the correlation between group effectiveness and the esteem for the least preferred co-worker (LPC) score of the leader. Figure 2.2. demonstrates the form which this model takes.

2.25 Both research and discussion has suggested that the study of leadership using the general systems approach would be profitable. This approach does not invalidate studies of a leader in isolation or the study of groups where the leadership is varied. It introduces a discipline to ensure that all the factors are considered when conclusions are drawn. The number of interactions which can be identified in a very simple model is high and this possibly explains some of the contradictory results when only part of the system is examined. Fiedler's contingency model is well suited to examine the problem in system terms. It suggests that task-oriented leaders are more effective in less favourable leadership situations. This supposed that the leader, although able to monitor the situation, is unable to adjust his leadership style sufficiently to suit. The more able leader however may have a wide repertoire of responses, well adjusted to the function he is performing, thus enabling him to succeed in a wide range of circumstances.

2.26 Kelly attributes this concept of wide response repertoire to Fiedler. Fiedler said that his research was based on the definition that "Leadership is the problem of wielding influence and power". Further, he declared that the only groups considered were those interacting, rather than co-acting or counteracting. By this he meant that all members of the group are working together towards a common goal, like a football team or a boat's crew. The individual's contribution cannot be separated from total group performance. In the co-acting group, such as a rifle team or a squadron of aircraft, the group performance is the sum of the individual performances. The counteracting group contains sub-groups which have to reconcile competing or partially incompatible goals. An example of this can be seen in the various divisions of the naval staff seeking to get their own requirements installed in ships in competition with other specialist groups.

2.27 Hill (1970) saw the Fiedler contingency model further developed into "people oriented" leaders being complex and "task oriented" leaders being simple. With the same amount of contact the complex person recognises difference in people, sees fewer unwarranted similarities between people and himself, judges more accurately, relies less on recency effects, his inner states concern him more, he is less confident in the judgements he makes, gives more information, and seeks more information. These attributes are more useful in the unstructured situation and these difference are caused by the way people think, by their cognitive style. In a structured situation, a task oriented person is more effective because he has few stimuli and they are adequate for the job. One measure of cognitive complexity is the number of stimuli people perceive; the number of dimensions they use for their decision rules. This is also relevant

in the context of Introversion/Extroversion, where the extrovert may suffer from perceptual starvation and the introvert be exposed to sensory saturation in identical situations.

2.28 Bagchus et al (1967) reported on a study conducted in Holland to investigate the effects of special leadership training on attitudes and behaviour of non-commissioned officers of the Royal Netherlands Navy. Using a modification of the leadership scales evolved during the Ohio State University leadership studies, it was found that those who attended the course acquired "softer" opinions on leadership. Proficiency ratings by direct superiors after three months placed them higher than the control group at the 1% level of significance. It was also found that sub-ordinates were more satisfied with them. These measures looked at manifest inter-actions and no measure was attempted to assess leadership effectiveness in terms of some quantifiable output which would satisfy the researcher in the Fiedler tradition, who would wish to know how productivity within the groups fluctuated. A major stumbling block was met when trying to assess the change which was carried over into the working environment. It proved impossible to link an investigation of behavioural change with group efficiency in the same way as has been done for aircraft crews when studying the impact of different sorts of leadership. The reason was overwhelming administrative complexity in attempting to keep the subjects within the researcher's overall scheme, during the length of time necessary for the study to be meaningful.

2.29 Borg et al (1959) investigated the relationships between physical proficiency measures of leadership and personality of US Air Force Officer candidates at the Air Force Officer Candidate School. Their findings showed that physical proficiency did not appear to be related to leadership ability but they stressed the fact that all the subjects had been screened for physical fitness. Had physically weak or handicapped individuals also been included, the result might have been different. Another interesting point they made was that US Army studies go counter to studies by the Air Force and Navy in that the latter two find no correlation between physical proficiency and later officer effectiveness. The explanation they offer is that the Navy and Air Force expect their junior officers to be technicians and executives, while in the infantry the junior officer, such as a platoon leader, is expected to be more of a "leader of men", and in this context, physical prowess is still respected.

2.30 Schein (1967) reported a study of attitude changes during Management Education and relates these changes to the attitudes held by senior faculty members. The groups he studied were of particular interest because one consisted of regular graduate students, the other was composed of mature managers returning

for an intensive 12 month course. The results showed that the attitudes of the faculty are at variance with those held by executives in line command. However both student groups shifted towards the faculty attitudes.

2.31 One of the more ambitious studies in this field has been undertaken by the Human Resources Research Office at the George Washington University for the US Army. In a progress report, Hood (1967) described the aims of the programme as the design of a Leader preparation programme applicable to non commissioned officers of the US Army. The US Navy has also undertaken a major programme and in the Statement of Objectives for the Bureau of Personnel (1972) identified this as being to improve the quality of officer and enlisted Leadership. To achieve this, three targets were set:

- a. Establish and expand the Command Development Programme
- b. Upgrade and expand leadership training
- c. Develop the means to evaluate more accurately leadership ability.

No results are available at present.

#### Identifying the Leader

2.32 Despite the fashionable ebb and flow of attention to the person or the situation in research into leadership variables, and while recognising that the total system has to be examined before any conclusion can be drawn, there is a certain natural rightness about the assumption that the leader is the central player. It can be accepted that certain people are so inadequate that they could never lead in any situation. The majority of people find themselves taking a lead in certain circumstances. A few people can be recalled who seem to be turned to by those around them under a wide range of conditions. It is unlikely that the underlying factors are controlled by any discontinuous variable. It is probable however that the continuum is a complex multivariate function and that there is a causal relationship dependent upon certain personality variables, inter-related in a special way.

2.33 Major acts of leadership are comparatively rare and therefore leader behaviour is difficult to study. However, one key to such study is the assumption that the group follows the leader from free choice. Using this assumption it is seen that many situations which are studied to discover more about leadership behaviour are in fact studies of subordinates responding to authority. The response may facilitate subsequent behaviour in a "free-choice" situation and in that respect be of interest, but there is a real risk of confusion when interpreting the findings, because the central factors involved may be masked by bureaucratic responses.

2.34 Cattell (1957) said that the relationships between individual differences in both personality and motivation to group phenomena depend upon complex and difficult, but at the same time fascinating, principles. Until recently, most experimental work on leadership defined a leader by his official role or by leadership acts and essentially measured his effectiveness as a leader by nothing better than votes as to his popularity. The alternative proposal was to recognise as a leader the person who produced the most desirable group change. As stated earlier, Cattell (1957) called the abstraction behind the behaviour of a group, the group's syntality. He said it was comparable with personality, predicting the behaviour of an individual.

2.35 Eysenck and Cattell have both studied the personality profiles of leaders using psychometric techniques. Cattell (1957) gives examples of effective leaders, elected leaders, popular leaders and technical leaders and these profiles have been used to judge student groups of naval Petty Officers. Eysenck (1969) discusses leaders and in his model places the dominant characteristics firmly in the Stable-Extrovert quadrant of behaviour. The narrow approach of identifying the individual who fills the specification of a leader can be accepted if it is recognised that this may lead to false conclusions. McGregor (1966) points out in the context of leadership studies, "the personality characteristics of a leader are not unimportant, but those that are essential differ considerably, depending upon the circumstances. Further, society characteristically rejects any suggestion that human behaviour is governed by natural law and attempts at measuring behaviour and recommending innovation must expect to meet opposition."

#### Leadership Profiles and Prediction

2.36 Cattell and Stice (1954) studied groups in a leadership situation and from this study developed a specification equation for effective leadership where the individual's scores on the 16PF questionnaire were given appropriate weighting. Cattell's interpretation of this equation was designed to permit an observer to predict the likelihood of successful face to face leadership being exercised by a given individual as a result of the measures taken on the 16PF Inventory. The higher the total score, weighted in this way, the more likely is the prediction of success.

2.37 A further development of this concept was the preparation of a qualification grid for the task under observation. This approach presents a linear regression for each factor and could be used as a means of determining cut-off in a selection process. Because leadership is never clearly defined, so-called acts of leadership may be lower level activities by agents of authority

directing subordinates by what Fiedler calls position power. In discussing simple tasks in a leadership experiment and the performance achieved by recruits in competition with their Petty Officers, Fiedler says "Could it be that recruits were overawed by the high ranking and prestigious Petty Officers? - Post meeting data do not support these contentions". The results obtained showed no difference between the performance of groups led by career Petty Officers and groups led by young (20 year old) recruits. The conclusions drawn by Fiedler put in question all schemes of leadership selection and training. In particular, he enlarged on the lack of validity of the concept of a minimum level of experience being necessary before a leader could be effective. He developed this theme in a later article (Fiedler (1970)) where he defines a leader as "the individual in charge of a group, given the task of directing the task-relevant activities".

2.38 It is possible that the difficulty is similar to that revealed by Mann (1959). Where those characteristics of the leader which were considered were not perceived as relevant by other group members, the results were highly inconsistent. The criticism can be made that the acts of leadership called for in the experiment were trivial and therefore measures of success or failure were likely to be insignificant. This is an important issue when deciding how to judge people subjectively for leadership potential.

#### Organisational Leadership

2.39 In parallel with much research into small groups there was an increase in the number of studies which focused on leadership problems in larger, formally organised institutions. The majority of research projects were based on data from filled-in questionnaires or were carried out using subjectively interpreted case studies so that psychological factors of the individual had been neglected. Some of the variables were called personality factors, but were really biographical details such as age, length of service, and educational attainment.

2.40 Most recent definitions consider leadership as a process of influence exercised between members of a group. Leadership then becomes a relative process in the sense that every group member influences the rest in one way or the other (Tannenbaum, Weschler and Massarik 1961). If we try to describe one person alone as the group leader, the net result is merely that we shall be identifying the individual who occupies the highest point along a scale of influences exercised to greater or lesser degree by every group member. This is clearly inappropriate to a military environment and ignores position power in the Fiedler (1968) tradition.

2.41 Where the object of study is to be a formal leader in a ship or establishment, it is far from certain that what is being studied is a leader in the fullest sense. However, 'Managers' have been considered suitable as subjects in many leadership studies. Ohio, Michigan and California universities have all studied managers identified by means of formal criteria. The manager holds a position where he is expected to act as a leader. In terms of role theory, the formal rules governing his position are expected to function as a model for role expectations leading to the kind of role behaviour which gives rise to leader-follower relations between the manager and his subordinates.

2.42 Psychologists regard the individual's behaviour as determined by interacting individual and situational factors. This is usually expressed in the most general of psychological formulas, where B refers to behaviour, O to organism and S to situation:  $B = f((O)(S))$ . This relation is also assumed to hold for leadership behaviour. By reason of individual differences, we expect different kinds of leadership behaviour from different individuals put in the same leadership situation. On the grounds of situational differences, we assume that the same individual will exercise different kinds of leadership in different leadership situations. If we regard leadership as interpersonal influence, its direct effects will be the immediate influence which is exercised on others. This influence will produce more or less persistent changes. It is this individual difference in behaviour which can be examined in terms of personality, and this is discussed in later sections.



SECTION 3

SERVICE STUDIES IN RELATED FIELDS

3.1 A Survey of work in this and related fields by the departments at headquarters and by individuals shows that a previously steady interest in the problems of maintaining a balanced structure and attracting suitable candidates was dramatically increased in the second half of the 1960's. Figure 3.1 gives the major reason for this. A simple analysis of demographic trends indicated that the "post war bulge" would pass through the catchment area for naval recruitment from 1970 onwards. As a result, a sharp decline in the available population would lead to serious problems in attracting sufficient numbers of recruits because historically, the Navy has secured about 0.25% of this available population. The actual number of recruits (shown dotted) did nothing to provide reassurance.

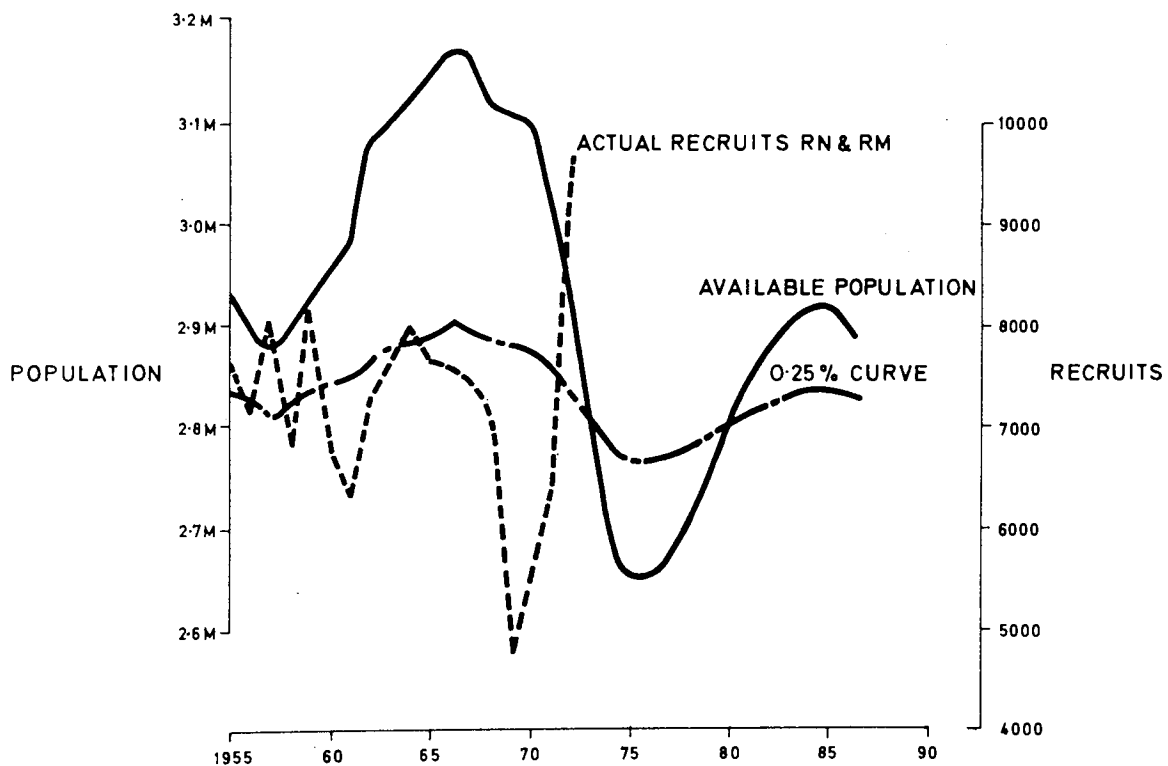


Fig 3.1 Population and recruit numbers showing demographic trends

3.2 This situation, combined with other long term uncertainties, resulted in the formation of a Naval Manpower Future Policy Division in September 1967 which existed for 5 years and formulated a series of philosophies as a basis for the discussion of manpower problems. These studies were issued in a series of papers identified with a Prefix MFP and a full list with short abstracts was

given in MFP 3/72 dated 12 September 1972. The work of the division began with a study of the probable supply and demand for manpower in 1975-1980 which was an early attempt to predict long term trends. Later that year a study of the changes to be expected to equipment design in relation to manpower resulted in a paper touching many subjects that have since been dealt with in much more detail.

3.3 Early work concentrated on the fundamental structures for both officers and ratings. A paper "Officers in 1975 Plus - Principles for Skeleton Structure" examined the features on which a new officer structure might be based. It discussed the Officer Career overall, and divided it into 3 specific phases which were examined in detail. It then moved on to the different categories (Lists) of officers, followed by a number of other considerations, such as management objectives, technical trends and promotion. Finally, there was a summary of the main principles deduced.

3.4 At about the same time principles for RN rating branch structures were examined to deduce the guide lines which should govern future branch structures. The work started with a survey of the literature and went on to discuss all the various factors affecting structuring. It concluded that the RN can no longer rely on career structures dictated by complementing considerations and that a balance between complementing and career factors in a branch could be cost-effective. Finally, the principles of a generalised branch structure were set out.

3.5 Following from these basic studies the forecast was projected into the 1980s. Based on reasonable assumptions, among which were a continuation of "relative" peace, the forecast looked ahead at environment, composition of the Fleet, technological and sociological trends, training methods and management. A particular aspect was studied to assess the manpower implications of a changing sociological environment in "1985 Plus" brought about by a lengthening period of relative peace. It made predictions about lengths of engagement, competition, civilian attitudes and Vote A requirements and concluded the Navy would need to increase its "sales and marketing" efforts. Shorter engagements would throw much more emphasis on re-engagement incentives.

3.6 Finally, in this period of the division's work, detailed recommendations for possible solutions were put forward. For example a paper, "Future Trends for Engineer Officers" (1971) formed one part of this comprehensive study of the Navy's Officer structure, and identified 9 major studies affecting Engineer Officers' Employment. In its conclusions it questioned the need for the present numbers, with the resulting danger of over-manning small ships. It identified a

trend towards deeper specialisation and also a conflicting trend towards a furtherance of the general list concept with non-seaman officers having the opportunity of Sea Command. Subsequent studies examined the problems in greater detail and played a significant part in the executive actions which followed.

3.7 This work represented a significant step forward in the understanding of manpower problems by the naval staff. It was the more valuable because a great deal of assistance was given by Naval psychologists and the statisticians in the statistical divisions. However, despite the input from the psychologists, the thinking behind these studies was of an actuarial nature, relating the numbers available to the numbers needed. As Jones (1969) says "Naval Manpower planning is a continual process of forecasting, feedback and reassessment - not unlike the regular process of actuarial valuation of assets and liabilities of a pension fund".

3.8 At about the same time as this work was going on, the Ministry of Defence instituted a new scheme of study by individuals into important areas of concern. These Defence Fellowships created new opportunities for serving officers to study some aspect which they felt was central to the affairs of national defence. Some of these studies made a contribution to the understanding of personnel problems. In particular, Wright (1970) reported on a study of the contemporary British Officer in the three services. The work threw light on to the self-image of the officer corps and highlighted some of the stresses inherent in a period of rapid change. The study used the disciplines of sociology and developed some very valuable insights into the problems facing the Armed Forces of the Crown.

3.9 Baynes (1969), Bensham-Booth (1969) and Baylis (1970) studied subjects which were closely related to man in his working environment but all looked at the global problem and did not consider that individual difference was a significant element in the discussion. Eberle (1971) studied the politico-military aspects of operational command and because this is an area where very few people are fortunate enough to be involved, of necessity had to consider individual style and ability.

3.10 In addition to the work of Defence Fellows other officers were given sabbatical opportunities for post graduate studies in a number of areas of interest. Groves (1970) using a number of advance techniques examined the organisation of a technical department in a Warship. One aspect of the report highlighted the stresses generated in a warship by weakened authority in the middle strata of the service. This weakening has been caused by the granting

of rank to those possessing certain expertise as a means of providing better pay and living conditions. Problems identified were attributed to conflict between:

- a. Need to maintain viable line of military succession.
- b. Need to reward technical skill.
- c. Need to provide adequate sea experience for Senior rates and Officers.

It was stated that the study threw light on organisational weaknesses which would be remedied once they were clearly defined. He identified one of the causes of stress in an operational warship as being the overriding need to provide a "training environment". This results in about one third of the technical officers at sea being in a complement billet for the first time. The proliferation of intermediate ranks, now including the Fleet Chief Petty Officer, has created an image of weakened authority and inevitably a reduction in the span of control has followed (Janowitz et al) 1968. The organisation in a ship has been forced to develop to minimise the effect of this and other stresses and two of the major mechanisms are duplication of lines of authority and role-splitting.

3.11 Role-splitting is identified as typically the "one-over-one" situation where the head of department has a deputy and the head of section has one senior technical rating as his immediate subordinate. It was suggested that the head of department felt he had to be constantly on his guard against losing control while the subordinate resented the lack of authority which he felt was rightly his lot. In the case of younger officers working with experienced senior rates, the officer was frequently forced to leave technical aspects to the senior rating causing a number of reactions:

- a. Those younger officers felt their technical expertise was under utilised.
- b. There was a reaction by seeking outlets into the fields of innovation and administration.
- c. The Chief Artificers maintained a role of link man on most material matters, filtering much detailed information (Likert 1961).

3.12 A very important observation was made in the discussion of assessment of subordinates who are working below their capacity, concerning the difficulty of identifying a marginally incompetent role-holder. This was seen as being particularly difficult when the subordinate was from a different professional background to the reporting officer, or where the role had been amended or

changed, probably unconsciously to match the individuals concerned. Much damage can be caused by such distortions.

3.13 The results of this study showed that in an operational warship the Stratum II of management in Jaques' terminology embraced the rank and rate structure from the top of the Petty Officer structure through Chief Petty Officers and Junior Officers to Lieutenant Commanders. This conclusion will be subject to reinforcement by the introduction of the Fleet Chief Petty Officer which has meant a further subdivision of responsibility.

3.14 Gardner (1970) conducted a Long Term Follow-up of Naval Officers' Careers. For this work, he used multi-variate techniques of analysis to identify key relationships between individual characteristics and success in both the short-term and longer term. He concluded that the research showed the need for important changes in selection, training and career development of RN Officers. His work was based on an analysis of historic data held at Headquarters as a direct result of the organisation's Personnel Management system. No additional data was collected because of time constraints although consideration was given to a sampling of personality profiles using a suitable psychometric technique.

3.15 His results indicated shortcomings in the selection process of the period under examination which extended from 1947 to include about three hundred entrants. He also criticised the numerical reporting system used for periodical assessment of officers in the performance of their duties. This scholarly work lacked one perspective. It appeared to fail to take account of the great social changes which were occurring during the period in which the reports were written. Two critical forces were at work. The first was the transition to a peace time force with a traumatic reduction in numbers to be accepted. This made reporting very much more uncertain because of the turbulence at all levels. Secondly, the Royal Navy changed its attitude to Engineer Officers. Prior to 1956, Executive Officers, headed by the gunnery branch were at the top of a clearly remarked pecking order, with distinctive cloth between the gold on the arms of the lesser breeds. After that date, all officers were of one company, and most were on the General List. The respective esteem of the various branches was not homogeneous for many years. This had a great bearing on the fortunes of otherwise equally well fitted officers.

3.16 Among other studies undertaken during the recent past, resulting from an upsurge of interest in management, Evans (1970) recommended that Systematic Management be introduced into the Fleet. In the discussion of the manner of its introduction he stated that authority and accountability are ill-defined and

performance is seldom measured against set standards. It was claimed that this situation could be changed by stating objectives, stating limits of authority and specifying mandatory procedures to limit the discretion of individual officers. It was recommended that nominated ships operate under these constraints for a trial period. The results of these trials were beginning to emerge in 1972.

3.17 It can be seen that there has been a considerable amount of activity aimed at an understanding of manpower problems. None of them questioned the place of an individuals' personality in the equation. The next section examines this concept of personality and problems of its measurement.

## SECTION 4

### PERSONALITY STRUCTURE AND MEASUREMENT

4.1 The Persona - a mask - the outward aspect of an individual - his personality: any generally acceptable definition of personality might be expected to satisfy the following criteria described by Kreech et al (1969)

Comprehensiveness - all aspects of the individual must be considered.

Adaptability - it must recognize that personality is modified by experience.

Pattern - the personality is not a summation of isolated characteristics.

Uniqueness - No man can be exactly like another.

Such definitions include:

- Personality is the dynamic organisation within an individual of those psycho-physical systems that determine his unique adjustments to his environment.
- Personality is the organisation of all the integrative processes in the brain.
- Personality is a theoretical interpretation derived from a person's behaviour.

4.2 Kurt Lewin (1951) said that a study of Personality becomes a quest for the significant interpersonal relationships in which one is currently involved and which one has experienced throughout life. The total situation confronting a person may be represented in the standard form  $B = f(PE)$  such that the "Life space of the moment" (B) is a function of the Person (P) and his psychological environment (E).

It follows from this that any organisation with a workforce is, by implication, concerned with the personality of the individuals in it. What usually happens though, is that the need to reduce the amount of information held about people and the need to simplify decision making in the personnel field results in the construction of stereotypes. These inhibit thought about personality in the working environment. To take one example, in the USN Lewis (1967) estimated that in the promotion of Lieutenant to Lieutenant Commander, the selection board would have to review 60,000 fitness reports, unless some short cuts were taken.

4.3 It is the aim of this Section to introduce the theoretical bases of personality structure and to discuss the measuring of individual difference, with particular reference to personality questionnaires in the Cattell tradition.

#### Levels of Abstraction

4.4 A study of personality theory is necessary to provide a framework for a look at the structure of personality. Such theories present different conceptual boxes according to which individuals might be described. These theories differ not only in the content of these boxes but also in their level

of abstraction and in the complexity of the structural organization. Freud's (1924) structural boxes are at a very high level of abstraction. One cannot observe an id, ego or superego. Less abstract are the structural units employed by Kelly (1955) who offers a technique for assessing the 'construct system' of an individual. The structural boxes of Cattell (1957) belong to several levels of abstraction, with source traits being more abstract than surface traits, and temperament traits being more abstract than ability traits. At the lowest level of abstraction is the major structural 'brick' employed by learning theorists to describe behaviour - the response. Whether it refers to a simple reflex or a complex behaviour, the response is always external and observable. The response is defined by the behaviour. In this case, one does not go from the specific act to an abstract structural unit.

### Complexity

4.5 Complexity of structural organization may be considered in terms of the number of units involved and whether they are formed in some kind of hierarchical arrangement in relation to one another. Cattell's theory involves a complex structural organization of personality. Not only are there many units but also there is a hierarchical arrangement of these units into surface traits, source traits, and second-order factors (types). Kelly's system also allows for a complex system of constructs - some being superordinate and others being subordinate. However, the complexity of organization is viewed as varying considerably with the individual personality. The psychoanalytic framework includes many structural units and almost unlimited possibilities for inter-relationships among the units. Although no clear hierarchical structure is set forth, the concept of character types clearly indicates layers of organization beyond that of specific behaviours. In contrast to such complexity of personality structure a fairly simple structure is described by most learning theorists. There are few categories of responses, no suggestion that behaviour involves the simultaneous expression of many units, and a definite bias against the concept of character types.

### Importance of Consistency in Behaviour

4.6 Differences in levels of abstraction and complexity of structural organization can be related to differences in the general importance attributed to structure in behaviour. The concept of structure is generally used to account for the more stable aspects of personality and for the consistency of individual behaviour. To consider two extremes: psychoanalytic theory places great emphasis on the stability of behaviour over time, whereas learning theory does not. Psychoanalytic theory places great emphasis on the consistency of behaviour across situations, whereas learning theory does not. Psychoanalytic



theory places great emphasis on individual differences, whereas learning theory does not. There appears to be a relationship between the importance attributed to structure in a theory and the theory's emphasis on stability in human behaviour. There also appears to be a relationship between an emphasis on structure and an emphasis on individual differences. McGregor (1966) says in the context of leadership studies, "the personality characteristics of a leader are not unimportant, but those that are essential differ considerably, depending upon the circumstances". The Naval approach has been predominantly biased towards the learning theorists, assuming that adequate training will ensure the correct behaviour at the appropriate time.

#### Stability of Behaviour Patterns

4.7 There is evidence to support the view that individuals develop characteristic ways of behaving that tend to be stable over time and consistent across situations. This would justify the concept of personality. However, neither an extreme emphasis on stability nor an extreme emphasis on change will do justice to the facts. In examining the concept at least three variables must be taken into consideration.

a. Individual differences in stability. Variability in behaviour may itself be a personality characteristic. For example, Wessman and Ricks (1966) found that some individuals were consistently variable in their moods, both during a day and from day to day, whereas others were not. Some individuals may rely more on internal standards for performance, whereas other individuals may rely more on situational norms.

b. The second source of variation might occur in a particular characteristic of a given individual. There is no justification to assume that all characteristics of an individual maintain the same stability and consistency. Furthermore, what may be a stable characteristic in one person may be an unstable characteristic in another. A study by Pervin (1960) suggested that individuals are not constant in all areas of personality. However, it did not suggest that an individual can not be consistent in one area of functioning across many situations and over time.

c. Some situations can be expected to exert a powerful influence on subjects, whereas others will not. In the unstructured test situation the individual is given considerable freedom to respond where in the structured test situation he is not. The latter shapes behaviour by limiting the options available to the individual. The effects of a new environment will depend on how radically different it is from the

individual's old environment and how much pressure is put on the individual to change.

These three variables do not operate in isolation from one another. Where a characteristic is an important part of the individual's personality, it will take greater differences in the new situation to produce change.

#### Growth and Development of Personality

4.8 There are many issues in developmental psychology which are relevant (Endler et al (1968)). Cattell studied the influences of heredity, environment and age on personality development. Psychoanalytic theory gives attention to the role of constitutional and environmental factors in personality development but in most cases this remains speculative. Learning theorists have done a great deal to interpret the processes through which cultural, social and family influences are transmitted. There is a difference of opinion among theorists as to the utility of the concept of stages of development. Psychoanalytic theory attaches great importance to this concept placing greatest emphasis on the early years of growth and development. Cattell's work on age trends suggests that certain periods are critical for the formation of different traits.

4.9 Research suggests that the effects of the environment are greatest at the time of rapid change in a personality characteristic. Since change and development are most rapid for many personality characteristics during the early years, it is during these years that environmental forces exert their greatest impact. This is not to say that the early years are critical for every characteristic, since different characteristics have different development. For some, the period of most rapid development may be during the teens or even later in life. Nor is this to suggest that the effects of early experience are permanent. However, generally, the early environment is of critical importance. This is true because it is a period of rapid growth, and what is learned during these years sets the stage for later learning. Also these early experiences affect the total organization of behaviour. It is this which provides the justification for expecting a selection procedure of limited duration to be successful.

4.10 While understanding of the critical ages for different developments in personality is essential for theoretical progress, it is also needed for progress in attempts to correct various shortcomings. This plays an important part in the process of changing the behaviour of potential leaders. The nineteenth century military leader was expected to draw considerably upon his early experience on

his father's estate and gained significant position power from the social distance separating the officer class and those in the ranks. The present-day officer may well join a ship to find ratings serving him with whom he went to school. Personality characteristics are required for this sort of situation which must be developed by training, rather than selection. However, selection, as a minimal task must ensure that those incapable of benefitting from training are excluded. Monitoring this may be difficult.

#### Interactive Models of Behaviour

4.11 In contrast to the concept of structure, the concept of motivation emphasizes the more momentary aspects of the individual's functioning. Theories of motivation emphasize the efforts on the part of the individual to reduce tension. The push toward tension-reduction is clearly indicated in psychoanalytic theory, in Cattell's theory, and in learning theory.

Most personality theories employ motivational models, and view anxiety as an important part of the individuals' experience, leading to some form of action.

4.12 Early work in psychology on the relationship between anxiety and performance tended to ignore the interaction between personality variables, situational variables, and task variables. Thus the relatively simple question of whether high or low anxiety would result in better performance was asked either by a drive-oriented learning theorist who was interested in the relationship between drive (that is, anxiety) and performance, or by a clinically-oriented theorist who was interested in individual differences in anxiety and how they relate to performance. The former emphasized the general relationship between drive and performance, the latter the relationship between individual differences and performance, but neither took into consideration the full range of factors influencing performance.

4.13 When individuals are performing in a situation, there are three kinds of variables that need to be taken into consideration

- a. individual differences
- b. the setting in which the individuals are behaving.
- c. the nature of the task that they are performing.

It is not possible to say whether individuals high on anxiety will perform better on tasks than will individuals low on anxiety, since this depends on how the task is presented to them and the nature of the task itself. In a situation where instructions are not presented so as to reduce anxiety, low-anxiety subjects perform better than high-anxiety subjects. However, when instructions are presented so as to reduce anxiety, the opposite is true (Sarason 1961). With respect to task variables, high anxiety subjects may perform better than low-

anxiety subjects on simple tasks, but the low-anxiety subjects increasingly perform better than the high-anxiety subjects as task complexity increases (Sarason 1960).

4.14 The situation is further complicated, since the conditions that lead to high anxiety in one person are not the same conditions that lead to high anxiety in another person. This is equally true for dimensions of behaviour, such as leadership. Some individuals have greater leadership potential than do others. However, in any given situation, leadership will be determined by

- a. the general leadership potential in each of the individuals
- b. by the specific style of leadership associated with each of the individuals.
- c. by the demands of the situation.

Thus Lifton (1963) concluded from his study of leaders that leadership is related to the peculiar demands that prevail in a particular environment at a given time. Ultimately leadership is a function of a match between individual leadership styles and the situational demands of the task and the people (Fielder 1965). These three ingredients keep recurring in different forms.

#### Personality and Job Satisfaction

4.15 An important dimension in a study of work is Job satisfaction. In the same way that performance can be viewed in terms of the relationships among individual differences, situational variables, and task characteristics, the same kinds of dimensions are relevant to satisfaction. There are happy people and unhappy people, pleasant situations and unpleasant situations, but the task of psychologists is to understand the interactions between these individual and environmental differences. Some of the relevant research in this area follows from self-concept theory. Thus a number of studies indicate that an individual's satisfaction with a job or with other individuals is dependent on the congruence between his self-concept and his perception of the job or other individuals. For individuals who like themselves, jobs and people that are similar to the self-concept are considered desirable. For people who do not like themselves, jobs and people that are similar to the ideal-self are considered desirable. In either case, however, satisfaction is dependent on the relationship between the characteristics of individuals and the characteristics of jobs or other individuals.

4.16 These differences are important in a number of ways. Take, for example, the relationship between individual characteristics and training methods. The training method most suitable for learning and growth in one person is not the same as the one for another person. Some individuals need more direction in

their work, and others need less direction. Whereas people who are not very sociable perform best in a lecture setting, the more sociable tend to perform best in leaderless discussion groups. Furthermore, the motives of students interact with those of the training staff to affect performance. Thus, a person with a high need for achievement may perform best with an instructor who emphasizes achievement, whereas one with a high need for affiliation may perform best with an instructor who emphasizes warmth and friendship.

4.17 The same kind of issues are found in relation to job content. Some people perform best in jobs having a great deal of structure, and some perform best in unstructured jobs. For example, differences in cognitive style - along the concrete-abstract dimension were studied by Pohl and Pervin (1968) who found that in engineering "concrete" students performed better than "abstract" students, whereas in the humanities abstract students performed better than concrete students. Thus, independent of intelligence, the relationship between cognitive style and course requirements affected performance. The assumption here is that the engineering curriculum involves more learning of specific skills, whereas the humanities curriculum calls for the analysis of many different kinds of content and the establishment of broad principles. Concrete cognitive style is more relevant to the former; abstract cognitive style to the latter. This difference might be equally significant when comparing the requirements for seamen and engineer officers.

#### The Place of Personality Assessment

4.18 Personality, understood as that which makes one man different from another, has basic elements that are common to all men. It is the varying amounts of these and their integration that determine the uniqueness of any given individual. Personality assessment is an attempt to measure this individual pattern and to provide cues to the prediction of how a man will react in any specific situation. Cronbach and Gleser (1965) when reporting on their work in the field of personnel selection suggested that some very simple personality screening, when added to an already elaborate selection and allocation process would provide a very valuable additional dimension. This could be used to make certain that the right person was allocated to a particular sort of job or, alternatively, that a person with some flaw in his make-up would not be given that kind of work.

4.19 Personality assessment can take one of three forms:

- a. The whole man approach which is used by Clinical Psychologists, where the subject is given the opportunity to project the uniqueness of his personality in a variety of unstructured situations. A typical example of how this might be achieved is the Rorschach ink-blot test,

which provides the practitioner with a standard starting point for the interpretation of results.

b. "Situational" techniques which expose the subject to an extended period of observation in a semi-planned environment where his reactions, and behaviour patterns are noted and interpreted. This technique was developed by the German Army in the 1930s, was adapted for WOSB and is now used in the selection of Naval Officers by the Admiralty Interview Board.

c. The dimensional approach uses the concept of the interrelations of the various traits possessed by individuals to form major dimensions in the patterning of behaviour. These are measured by paper and pencil tests. A British questionnaire of this type is the Eysenck Personality Inventory. This measure uses the two dimensions Extraversion-Introversion and Neuroticism (stability-instability) on which to rate the individual's personality type. This approach has the advantage of being easily administered on a group basis.

4.20 It is the dimensional approach which lends itself most readily to the screening of large numbers and is used widely in the selection of personnel for tasks such as airliner cabin staff where there is a great deal of inter-personal activity. Luft Hansa, the German airline use the Cattell 16 PF test battery for this purpose. The Post Office and Standard Telephones and Cables are also examples of large organizations using the Cattell 16PF for selection of Management and Engineering staff.

#### Cattell 16PF Questionnaire

4.21 The 16PF Q is a multi-dimensional set of sixteen questionnaire scales arranged in omnibus form. It is designed to make available in a practicable testing time information about an individual's standing on the majority of primary personality factors. The form used has 187 items which take approximately 50 minutes to answer. The 16PFQ is based on a series of research activities over 25 years directed to locating independent, and pragmatically important 'source traits'. Cattell uses this term to mean factors affecting large areas of the overt personality behaviour such as intelligence, emotional stability, dominance, and super ego strength. His research has created a big pool of knowledge about the nature of these dimensions through studies with laboratory measures, questionnaire ratings and real life situations.

4.22 The author of the test claims that there has been substantial and wide-spread research on the criterion predictions, numerical forecasts and interpretive decisions in the personnel and guidance fields as well as in

clinical, educational and social psychology. It is claimed that the 16PFQ is designed as an all-purpose instrument bringing to applied psychology the concepts central to general personality theory. It includes a measure of intelligence but motivation and interest measures are not included.

Administration of the 16PFQ leads to the individual being allotted a source trait score on each of the 16 factors. The resulting profile of source trait scores is potentially usable in specific behaviour predictions. For estimation of future performance it would be necessary to have the weighting for the given performance for each factor. This has to be discovered by research. The profile provides only part of any set of predictors because it lacks any motivational weighting.

#### Validity of the 16PF

4.23 There has been much discussion about the reliability (that is, the agreement of the results at two different applications of the test) homogeneity (that is the agreement of different parts of the test) and transferability (that is the agreement of what is measured in different groups of people). Tests which do not have these properties ie are not consistent cannot have validity. For this reason a number of coefficients have been calculated for test - retest reliability, stability coefficients and equivalence coefficients on various examples of a test form. The validities quoted for the various source traits using Form A give figures varying from .63 to .94 on the 16 factors. A distinction has been made in the literature between factor validity and factor trueness of a scale. Both are desirable properties, factor trueness asks whether variance other than the required factor variance is systematic contamination or merely an accumulation of random error. It is claimed that the correlations among the factor scales are (except for attenuation) close to those among the true factors.

4.24 There is a close relationship with the results obtained using the Eysenck Personality Inventory and second order factors developed from the 16PFQ. Two of these, the anxiety and excia scales, match closely to the neuroticism and extroversion scales on the EPI.

#### Justification of the Use of Tests

4.25 Cronbach and Gleser (1965) state that in sequential testing for selection or allocation, the increase in use of differential predictors can be justified even if they are of low validity. This justification is based on the non-availability of any other measure or previous experience to replace this inefficient tool. They link their assessment to the payoff resulting from the decision when taken. The relevance of this point of view is quite clear when

allocating men for flying duties or the submarine service. An error can be very expensive in both material and life, in these high risk areas. It may be just as important but not as obvious when considering the Naval general service. The formal recognition of personality as an important variable in job performance cannot be far away.

#### The Problem of Deception

4.26 Both questionnaire results and behaviour rated by observers are subject to role distortion. Sources of distortion in such situations are:

- a. Deliberate sabotage: as when a subject refuses to cooperate, and answers in a random manner or with intent to deceive.
- b. Unconscious motivational distortion when, for example, the subject assumes a particular test-taking role as a job hunter.
- c. Sheer ignorance of the individual about himself: that is, having a vague self concept.

Sabotage can usually be reliably predicted if the situation is bad enough to justify the investigator making a specific search for it. The regular patterns which are usually characteristic of such behaviour can be detected in the answer sheet or in the subsequent program. Motivational distortion and self illusion are less easy to rule out in analysis. It is claimed however that these distortion responses like any other behaviour, are a function of the personality and the situation. There are in real life many kinds of 'socially acceptable' ways in which the intelligent subject modifies to new kinds of role situation. It is considered that when the instrument being used measures 16 factors, all of which will contribute to the selection process the chances of significant faking are unlikely to be a real problem.



## SECTION 5

### RESEARCH INTO GROUP FORMATION

#### Introduction

5.1 Project Management and the resulting formation of project teams within DGW(N) have recently been reshaped to accord with the principles of the new Procurement Executive.

5.2 In recent research, group effectiveness has been shown to correlate with the particular combination of individuals and their unique personalities and skills. Many other constraints bear upon the selection of individuals to form a project team but an understanding of the optimisation of the "personality mix" is considered to be of value.

5.3 The aim of this chapter is to demonstrate that scientific method is applicable to the study of group behaviour and to show how a unique opportunity is offered for research into project management effectiveness within the Naval Service.

#### Background

5.4 Under the new rules, project teams of a multi disciplinary nature are being formed. This means that they contain members with very different backgrounds and values. The correct mix of professional skills is intrinsic in organisation. The interaction of personality variables is normally ignored as being too difficult to understand and therefore cater for.

#### Discussion

5.5 Haythorn (1968) in a most valuable survey of the literature on the composition of groups reached the following conclusions:-

- a. To a significant degree, group behaviour is a straightforward function of the modal characteristics of individual group members. There is little information, however, regarding specific group characteristics concomitant with specific member characteristics.
- b. Irrespective of modal considerations, group characteristics are directly affected by the personality characteristics of individual members. The personality and behavioural characteristics of leaders exert profound influences on group characteristics. Furthermore, certain individual characteristics are found to have facilitative, while others have inhibitive effects on overall group functioning.

- c. On the basis of short and limited acquaintance, individuals can make stable and accurate (better than chance) estimates of their own compatibility with other individuals. Furthermore, under some circumstances at least, work groups composed by a self-selection technique perform better than work groups randomly composed.
- d. There is a tendency for individuals homogeneous with regard to fundamental value systems relevant to the nature of their interaction to be more compatible than groups heterogeneous with regard to such values. In some situations, at least, homogeneity of values has also been shown to be related to group effectiveness.
- e. There is some evidence that group effectiveness is related to the particular combination of individual skills comprising the group members. The nature of these relationships depends on the nature of the task. For example, tasks involving the performance of functions in series may be performed as well as the weakest member of the link performs, but no better. Tasks involving parallel functions allow for compensatory mechanisms - load balancing - within the group to offset, weaknesses of individual members.
- f. There are relatively weak but reliable relationships between the complementarity of need structures of individuals and their resulting compatibility. Thus, the dominance needs of one individual and the submissiveness needs of another suggest reliably that the two will be compatible, at least with regard to this particular aspect of their interaction. This research area has suffered especially from the difficulty in scoring multivariable relationships between personality profiles.

#### Research into Groups using the Cattell 16PF

5.6 A method has been developed by the Industrial Training Research Unit at Cambridge for the study of selection and training of management teams. This work has been done at the Administrative Staff College at Henley, and extended over the past 3 years. In examining the training given they reached some most interesting conclusions. In particular, despite a considerable programme of testing and follow-up it has not proved possible to provide proof that management training is effective and it seemed to these researchers that any benefit was dissipated after 6 months. It was claimed however, that these courses of 11 weeks provided by the Administrative Staff College came when a manager was changing his role in mid-career and thus gave him an opportunity to consider new styles of management to suit his own particular talents, in his new environment.

5.7 This finding is equally applicable to certain career courses in the Royal Navy. The SD officers' qualifying course at HMS ST GEORGE represents a prime example of a period set aside for adjustment to a very different role. If the conclusion is accepted that the real value of such courses is in providing a period for self-assessment and adjustment, it must bring into question the reasoning behind some of the other Royal Navy courses on which considerable effort and money is expended. This effort is clearly wasted if the Student has not reached the stage where readjustment is required.

#### Measurement of Group Effectiveness

5.8 The first stage of this work was used to collect data to describe different groups by measuring personalities using the Cattell 16PF. Subsequently, the mix of personality in a given syndicate was related to the effectiveness of that syndicate in a business game. The business game was complex, competitive and was played 'on-line' with a computer. The measurement of effectiveness was the profit made by the syndicate at the end of the game, compared with other syndicates involved. It was from these observations that a number of rules for team formation were put forward. Some of these rules were apparently robust and were used in a predictive manner.

5.9 For example, it was claimed that a successful team demands certain essential contributions from the members, but that these must match a pattern. One such ideal team should include three dissimilar personality types. The three were called a 'utiliser', a 'plant' and an 'applicator'. If the team was larger than three, the duplication should be of 'applicators' and not of 'utilisers' or 'plants'. These three types were described as follows:-

#### The Leader or UTILISER

5.10 A 'utiliser' is likely to show a tendency towards extraversion, and to be high on the extravert component characteristic of group dependency ( $Q_2$  - on the 16PF). His role is chairman. The 'utiliser' must see his main function as using the strengths and resources of the group. The effective 'utiliser' will be sensitive to the potential latent in the 'plant'. He will cast him in an expansive role, and give him his head. At the same time he will maintain a balance between the 'plant' and the 'applicators'. To enable the group to 'gel', he will encourage the perception of roles amongst group members by posing different types of question to each and by structuring the contribution of members without becoming over-formal.

## The Creator or PLANT

5.11 The 'plant' is similar to the creative personality described by CATTELL having the independent attributes of the introvert (A-, F-, Q<sub>2</sub>+), the thrusting characteristics of the extravert (E+, H+), and the qualities of the radical artist (I+, M+, N-, Q<sub>1</sub>+). The 'plant' is also distinguished by his intellect. Almost by definition, there are few 'plants' about. The 'plant' is an ideas man, having both a creative intellect and a creative disposition. The term 'plant' is used because it conjures up the need for nurture. To flourish, the 'plant' needs to grow in the right bed and in the right climate. The 'plant' is easily choked by having too many quasi-plants in the vicinity, or by general overcrowding. The 'plant' may be relatively ineffective and perhaps even disastrous outside his allotted role.

## The Worker or APPLICATOR

5.12 The 'applicator' is the term used for what has also been termed "company worker characteristic". Ideal 'applicators' are conscientious, practical, down-to-earth, conservative, controlled and lacking in any proneness to jealousy (G+, I-, L-, M-, Q<sub>1</sub>-, Q<sub>3</sub>+ on the 16 PF). The 'applicator' concerns himself with the objectives of the project and with everything that has a direct bearing on its attainment without regard to the position of self or to whether the task that he undertakes is to his personal liking.

## Formation of Groups

5.13 In the next stage of the experiment, fresh students were measured using the 16PF and the results were used to form teams in accordance with the hypothesis developed from stage one. These syndicates then played the business game and the results examined for comparison with results obtained from teams assembled by chance.

5.14 To test the hypothesis, teams were chosen on a latin square design employing intelligence and creative disposition as the 2 dimensions shown in fig 5.1. The results showed that the successful groups fell into one of a small range of patterns. If an active plant was included in the group while the rest of the group was low in Company Worker Characteristic, the group demonstrated anxiety. If the plant was inactive and there was much Company Worker Characteristic, the group was high in critical thinking. Of the 6 top groups, 5 were "unclever" but each included one "super plant". One company had no plant but the team was high in Company Worker Characteristic, very extroverted and low in critical thinking. This combination appeared to stimulate group thinking and thereby achieved the success that would not have otherwise been expected. This suggests that different combinations can achieve

success for different reasons.

		INTELLIGENCE	
		LOWER	HIGHER
CREATIVE DISPOSITION	LOWER	TYPE A	TYPE B
	HIGHER	TYPE C	TYPE D

Fig 5.1 Latin square design for team formation

5.15 'Plant' effectiveness was found to be linearly related to the critical thinking gap which was defined as the difference between the plant's ability, compared with the rest of the group. It was noted that this was contrary to most leadership studies where the gap between the leader and the led in intelligence is recognised as critical. Some supremacy is necessary but too marked a difference prevents the followers from identifying with the led and is counter productive. The results of a further analysis of the experiment are not yet available but the preliminary reports are encouraging.

5.16 This conceptual framework for examining team formation was judged to have relevance to the data collected in the present research. It was thought to show promise, both as a means of describing what was observed and also as a possible predictive tool for allowing more successful utilisation of the available skills found in service personnel.

#### Command Teams in Ships

5.17 It is recognised, for example, that Commanding Officers of ships have considerable autonomy in the choice of officers to lead their ships company. Thus, a more experienced, senior captain is in a position to form his command team in any image he sees fit. This process may take a number of paths. He may perhaps ask for certain officers who he has known in the past. He may refuse to accept an officer proposed by the appointing authorities. Finally, he may "sack" an officer at some stage of the building up of the team into a trained group. This last method is not uncommon during "work-up" at Portland under the Flag Officer Sea Training.

5.18 Although individual examples of this method of team formation may cause an eyebrow to be raised, it is recognised that the concept is strong in equity and works well in practice. If the Captain is to take full responsibility for every aspect of his ship, he must have the power which enables him to accept it. There should be no suggestion that this power be diminished.

5.19 What is of interest, however, is that on occasion a Captain goes to endless trouble to bring together a most carefully selected team of officers who are all recognised as "flyers" in their own field. Most officers can bring an example to mind and the result is frequently judged as a disaster. Few such ships are "happy" ships and neither the individuals nor the group seem to benefit in the long term. This phenomenon has been called "The Ministry of the talents" in the Henley research and even at the superficial level of the "business game" the same lack of success is apparent.

#### Formation of Project Teams

5.20 It is possible that the example quoted above of how team formation may fail can be interpreted as a warning against tinkering with the system. That was not the intention. There are many examples of great success following the bringing together of a carefully selected group. A recent example can be found in the setting up of the Polaris Project Team within the Ministry of Defence. The establishment of this project was judged to be of great national importance and particular care was taken in the forming of the team. The director had first call on anyone in the parent organisation and the result was a classic example of an "in" group, which might have been expected to be counter productive.

5.21 However, the magnitude of the task faced by the resulting work force generated great cohesiveness so that members were totally committed and a "steam roller" image was presented to the outside world. The success of the group in achieving the declared aim within both the budget and the timescale has stood out as a shining example of what can be achieved. The uniqueness of this achievement has been reflected in the subsequent success of a large proportion of the individuals who were involved.

5.22 The eventual replacement of the "first eleven" has been by the normal processes of personnel Management. The organisational aim of the project has also been blurred by time. As a result of these two factors, the corporate image is very different. Because of a reduction of individual commitment from the level held previously, it is suspected that the group effectiveness is also different.

5.23 If these observed differences in performance by groups can be predicted in other groups, by examining the personality dimensions of the individuals, a very powerful Management tool would be available. At the very least, an appreciation of these concepts should help individuals to recognise the roles to be played and the behaviour style which is appropriate to the various members of a project team.

PART II    OVERALL PLAN OF THE INVESTIGATION

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## SECTION 6

### RATIONALE AND HYPOTHESES

6.1 Part 1 examined some of the basic thinking behind the research and suggested some of the links which are to be established. This section develops the theme at greater length before stating the hypotheses chosen for examination.

#### Scale of Operation of Parent Organisation

6.2 The Royal Navy is a large and complex organisation which has a budget of some £600 million a year and with this deploys ships and aircraft world-wide. She has a Vote A strength of uniformed personnel of 85,000 people. In addition to this she is supported by civilians totalling a similar number working in the Headquarters Departments of the Ministry of Defence and in various Dockyards and Stores organisations throughout the country.

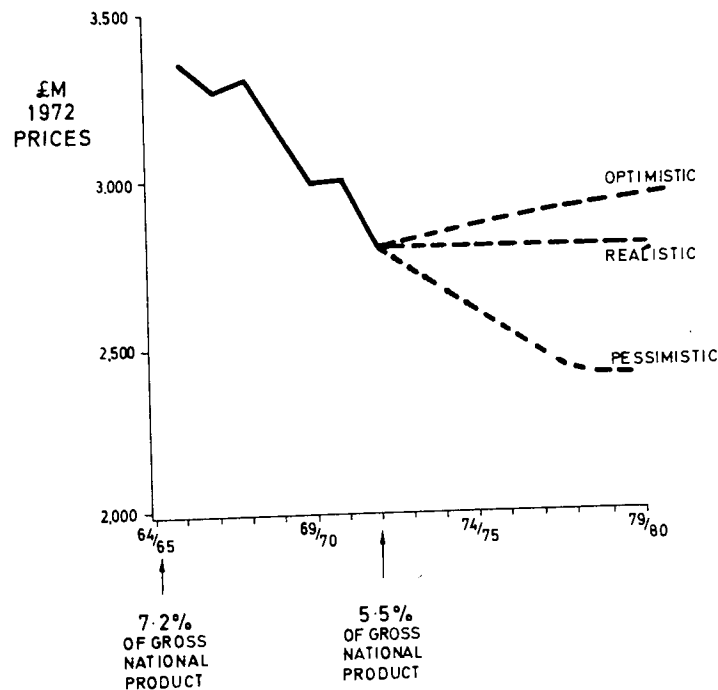


Fig. 6.1. Defence Budget

Following 25 years of peace the defence budget is continuously under pressure. Despite attempts made to reduce the money provided, the declared policy is to keep the allocation at a fixed percentage of the GNP. The trend is shown in figure 6.1. This means that the serving Naval Officers who are members of the Admiralty Board are faced with a complex balancing activity. Between them they propose the policy to the politicians and this must be designed to ensure that the Fleet reaches a minimum level of effectiveness within the budget in the short term and at the same time make provision for maintaining this capability in the future.

6.3 In recent years the requirement to reduce the money to be spent in the longer term has caused continual reshaping of re-equipment programmes and the results of such activities are well known. The most wide spread reappraisal was caused by the refusal to allow the design and construction of a new generation of aircraft carrier to proceed. One school of thought would claim that although this decision had been forced upon the Navy it was in the long term interest of the service, because from it stemmed a whole series of examinations to find ways of conducting the Navy's affairs within the financial budgets imposed.

6.4 The first approach was to look at the money spent on material. This was mainly a look at new provision, including new construction ships and new aircraft for the Fleet Air Arm. It also included a look at the money spent on the provision of fuel and replacement parts for the material heart of the fleet.

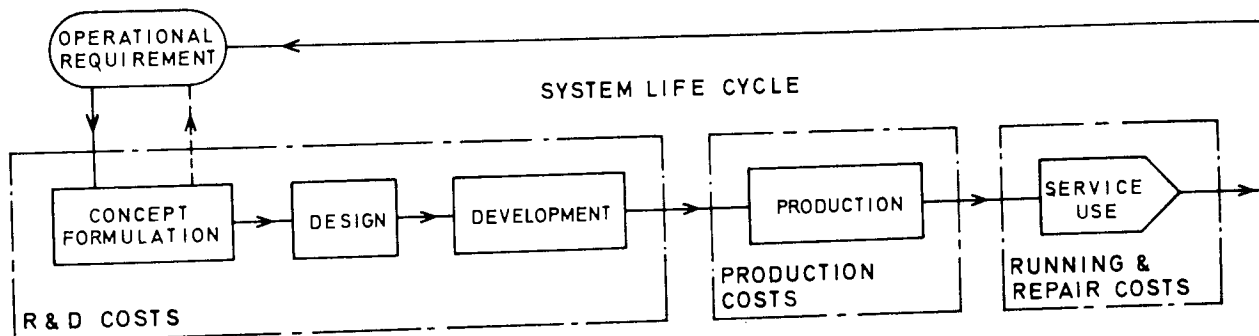


Fig 6.2 Cost of ownership as a life cycle

An examination of these year by year failed to show benefits which could be expected from buying equipment which was more expensive but required less support. It was recognised that an equipment which required less expensive maintenance such as the hull of a ship given special treatment to avoid frequent docking did not appear in the most favourable light if only the capital cost was considered. To identify how these changes would reflect in the long term, an approach known as life cycle costing was developed. To forward this aim a complex examination of all the variables involved in controlling the Royal Navy were brought together. Figure 6.2 shows a simple example of this approach.

6.5 Statistical evidence highlighted a very central fact from these studies. The numbers showed that in a 20 year life span the money spent upon a ship could be divided into two parts which were roughly equal. One part would represent the purchasing and maintenance of all the ship and its equipments; the other part represented the cost of paying and supporting the men who fought her. In

addition to the direct costs attributable to each man on board, an element was included for the cost of training another man to replace him; for the provision of medical services in shore service hospitals; for pensions and travel; and all the other hidden costs which go to build up the total bill for supporting the men rather than the material.

6.6 The realisation that so much money was being paid for the men and recognising at the same time that men were increasingly difficult to recruit gave people cause to examine ways of cutting down on manpower. This examination of men was conducted almost exclusively on the basis of statistics and numbers. A close association with the policy makers confirmed that although there was an awareness acquired from long experience about the individual abilities and strengths of the uniformed personnel, these understandings were never brought into discussion about ways of changing the balance of costs.

6.7 The money allocated to research and development of new equipments historically represents 10% of the total budget provided for defence hardware. In contrast, the money provided for research into Naval personnel matters is very much less and represents under 1% of the total annual spend in support of personnel. It was this contradiction which indicated a lack of a full understanding of what could be achieved by aimed research into ways of employing this human resource in a more effective and meaningful manner. There was an occasional exchange at Admiralty Board level suggesting that more could be done to find ways of improving this situation. For example, a Naval Manpower Utilisation Unit was established by unorthodox means to look at the complements of ships. The author was sent during its early life, to learn about its work and to report to his principal. It was clear that the methods of analysis being used, while most valuable in the work study field were not going to provide the break-through that was required.

6.8 The driving force behind the thinking at that time came from the realisation that in the submarine fleet, allocation of function among the crew was a critical activity. This was forced upon the command because of the high cost of providing space inside a submarine for an extra man, and because each man must carry a nearly equal responsibility for the safety of the boat. In passing it should be noted that this demand for a high level of competence is achieved by employing a large transfer rate to and from the general service to ensure the maintenance of a Corps d'elite.

6.9 At this time also, various consultants and specialist groups were offering solutions. WOFAC, a consultancy specialising in the reduction of the costs of white collar workers showed what could be achieved in the industrial field. Working on the principle that 20% of the people in any administration do 80% of the work, they concentrated on ways of marginally increasing the output of the remaining 80% of the staff by motivational techniques. At that time, they were concentrating on the grossly inefficient and honestly admitted that the techniques used were coarse grained. At the same time, American experience was tapped and for example, a team from the Stanwick Corporation came across to examine the total task of producing the Ikara Leander in a cost effective manner. (Groves 1969).

6.10 This widespread activity was observed from a very privileged position in a board office from which vantage point it was possible to comprehend the complexity of the task facing the Royal Navy. It also provided a unique opportunity for testing ideas about the way the service might set about the generation of suitable leaders for a changing fleet. Thus the thinking prior to the start of this research programme took place in an environment where the problem was a very real one and where there was access to the arguments behind possible solutions. Individual discussions highlighted problem areas. A very disturbing one was the marked deterioration of the morale of the Weapon and Electrical Engineer Officers employed in Headquarters. The feeling, which was widespread, of being a second class citizen did not match up to the expectations implicit in the concept of the general list which was looked upon as a model for the integration of engineering talent into line management by the then Minister of Technology (Law 1968a).

Table 6.1 Prediction of Manpower Requirements showing Effects of Technical Trend

		1950	1967	1978
Percentage of RN OFFICERS IN BRANCHES	Seamen and Supply	54.1	45.0	43.1
	Aircrew	7.5	11.3	8.4
	Engineer	27.3	30.5	34.0
	Others	11.1	13.2	14.5
		100%	100%	100%
Percentage of RN RATINGS IN BRANCHES	Artificers & Mechanics	11.8	17.5	16
	Technical Branches	32.6	36.6	35.8
	Other Branches	55.6	45.9	47.2
		100%	100%	100%

6.11 At about that time, it became apparent that the concept of sea command for Engineer officers was a myth. Previously, a significant number of more senior seaman officers saw the WE officer being in line for sea command as a natural progression from being the most knowledgeable officer on board about weapon performance. This view was encouraged by the WE officers themselves. Now, it was felt that there might be a mismatch in outlook and experience between the two groups. There was a similar disquiet about the increasing size of the technical departments in ships and thus the ratios throughout the navy. Various predictions were made of how this trend would develop. The results of one estimate made as a statistical prediction without technical insight is shown in Table 6.1. It will be seen that the increase in size would make the technical Branch the largest employers of men. A typical response to this from the user was that of McKaig (1969) who when discussing the ideas behind this project said that the underlying aim should be to reduce the technical content of the weapons complement in smaller ships to that of a pre-war destroyer; ie about half-a-dozen artificers supported by a shore staff.

6.12 As a result of discussion and background reading, a number of questions were identified as being central to an examination of naval manpower in the longer term. Some of these were originally raised in the context of an application for a Defence Fellowship but at that time the thinking was premature. The application was supported by the Naval Manpower Future Policy Division but failed to gain support in the selection committee. One question identified by the researcher and of great personal interest asked "what would be the optimum relationship in the future between the Executive Command and the Weapon Engineer Officer in small ships such as frigates." It was bound to change as a result of the tendency to become a small ship navy. Unlike the situation in 1947, where a sea-going Admiral took with him a staff including technical officers of Captains rank, there is now talk of promoting officers who have not been to sea as Commanders. This is bound to interact on the amount of support available to those at work in ships. There followed a question which sought to define the ideal mix between "user" and "maintainer" experience in both Seamen and Engineer Officers to fit them for higher command. This led naturally to examine the discontinuity in expertise at the Senior Rate/Officer interface. Must it be inevitable in the technical branches or was it an indication of a fundamental error in the allocation of function to the various ranks in the naval personnel structure?

6.13 In questioning Standards of efficiency the researcher queried what were likely to be the minimum acceptable levels of training and experience required to fight a modern warship, considered as a single weapon system. It was thought that they had not been reached because many people claimed to be overtrained. However, there may be an unavoidable need for redundancy in ships companies to allow for periodic variations in individual competence. It was thought that it may be possible to use "individual difference" as a dimension along which some optimisation in the complementing of ships could be achieved. This led on to questions on the Age - Experience - Resilience - Training Balance. Does the Navy need Senior Rates on the present scale? The percentage of ratings on the Chief Petty Officer and Petty Officer pay scale was 31.2% in 1970. The service is becoming less labour intensive so the Navy should, perhaps, re-examine the policy on the fundamental training of skilled ratings. It could be worthwhile to see if there are advantages to be gained from isolating the truly rare and essential skills. Baylis (1970) showed that changes of this sort could produce substantial economies.

#### Enabling Knowledge

6.14 Although the formal training received as an engineer and a Naval Officer and experience in a wide range of appointments were sufficient, together, to identify problems, more knowledge was required before there was any likelihood of being able to investigate what the underlying structure might be. The opportunity to gain this knowledge was offered in the post graduate course in Applied Psychology at the University of Aston, where there was a choice of course modules which matched the need very closely, as may be seen in table 6.2. An application to attend the course was supported in the following terms:-

"His subject is well chosen and I believe that there is a great need in the Service at this time for a searching look into the technical manpower structure, its standards of qualifications and its role in the future Fleet." (Law (1968b))

In one part of this course, a research project was undertaken as a training exercise. It was naturally based on a naval problem.

TABLE 6.2 - RELEVANT MODULES AVAILABLE AT ASTON UNIVERSITY

SUBJECT AREA	$\frac{1}{2}$ Subject	$\frac{1}{2}$ Subject	Comment
RESEARCH TECHNIQUES	Compulsory full	Subject *	Basis for field study and general broadening of experience
EXPERIMENTAL PSYCHOLOGY	Introduction, <sup>*</sup> Perception Psychophysics	Human Skill <sup>*</sup> and senses	Had relevance to the Man/ Machine interface in the Royal Navy
ERGONOMICS	Environmental Stress	Work Organisation	Directly applicable to the Seagoing task
PERSONNEL PSYCHOLOGY	Guidance & <sup>*</sup> Selection	Training <sup>*</sup>	Has relevance to Training in Establishments or Headquarters duties involving people
SYSTEMS DESIGN	Human factors <sup>*</sup> in Systems Design	Operational <sup>*</sup> Research	Useful in Project work in Material Departments. Also broader view
MATHEMATICAL PSYCHOLOGY	Mathematical <sup>*</sup> Psychology	-	This included game and decision theory and concepts of communication.

\* Modules taken

6.15 A concentration upon an investigation of the relationships between seamen and technical branches resolved itself into an examination of the individual differences of 150 Senior rates who were readily available on course at a naval establishment. During the negotiations for access to this sample, the establishment explained that training efficiency inspections were stressful because of the lack of an objective measure of training effects. Out of this, the study of the effect of a six week course of leadership training upon senior Naval ratings was undertaken as the training project for this postgraduate course. Thus, although individual difference had been the point of departure, leadership and the teaching of it became an equally important part of the study. The results obtained were interesting and indicated a number of points worthy of attention. Many of these came out in discussion with the training establishment, after distribution of the report. What stood "head and shoulders" above all other conclusions was the clear lack of a unified understanding of the leadership problem facing the Royal Navy which embraced both branch differences and temporal perspectives.

6.16 Throughout the subsequent work, the ability to change the point of focus when necessary to facilitate the making of decisions on policy in the longer term, has been seen as a key skill required in both material and manpower fields. The concept of "span of discretion" developed by Jaques (1965) and used by Groves

highlights the need for this. It is discussed in some research as an ability to handle cognitive complexity (Hill 1970). The development of this skill has been left to chance. Changes in technology and constant re-organisation have not helped.

6.17 The rationale of this study was to consider selected aspects of naval manpower and by data collection from individuals to judge what impact this concept of "individual difference" might have, in discussing possible changes. This is shown in figure 6.3.

The Importance of Individual Difference

6.18 The formal organisation sees itself as selecting men carefully and by training and experience, moulding them to match a task. The logic of all subsequent activity is based on the assumption that there is an "average" man. These "average" men are considered to be completely interchangeable when they hold similar rates and belong to the same specialisation. This actuarial approach is a legitimate simplification required for global manpower planning but tends to result in an over-simplification of subsequent utilisation. Men are not equal. Men of similar rank may differ widely in age, motivation, latent ability and experience. Further, the organisation is not homogeneous (Emery 1969). Summing these "tolerances" results in a wide range of potential response to an input. Because failure is frequently not acceptable as an alternative when considering outcomes, elaborate precautions are taken to avoid it. It would appear that as a result, men are employed at a level which will minimise the likelihood of such failure. Evidence to support this is provided by the statistical analysis of casual wastage, shown in table 6.2.

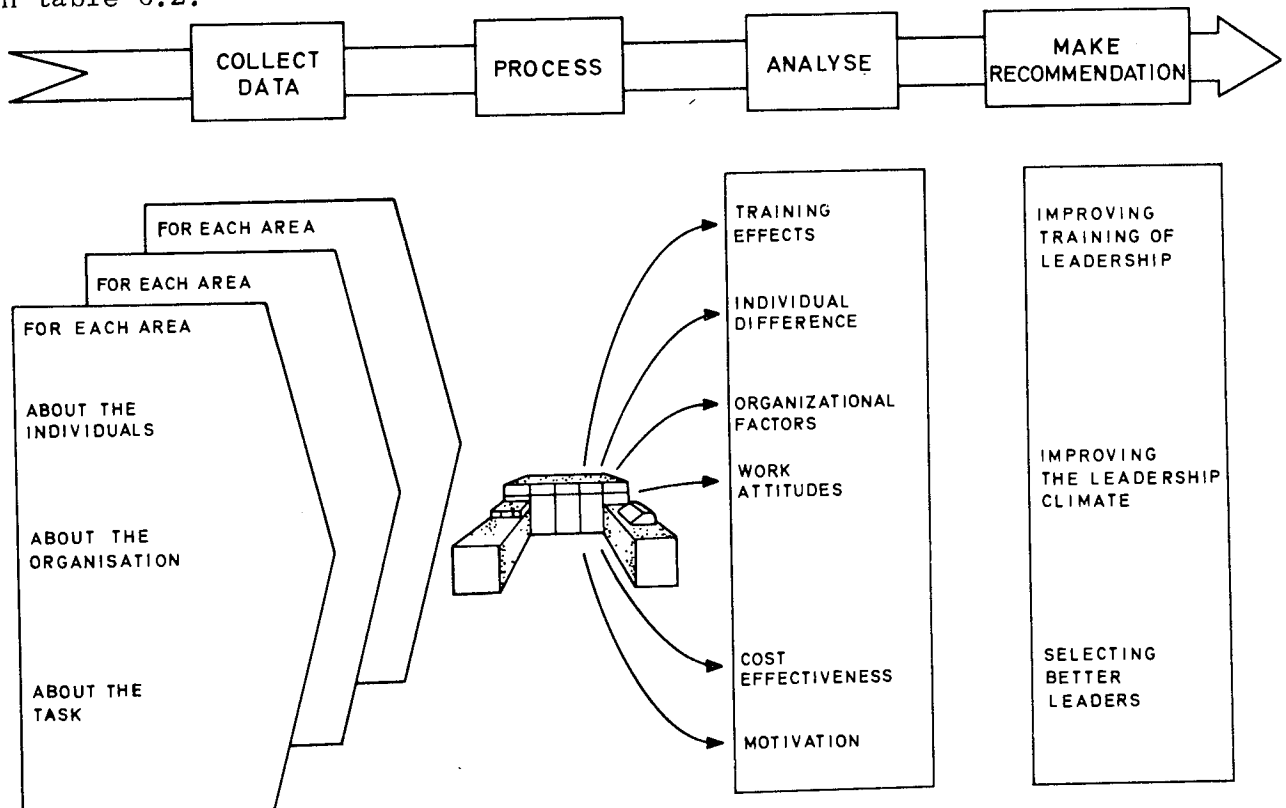


Fig 6.3



Invalidating and Deaths	Discharge by Purchase	Unsuitable	Dismissed	Other Causes	Total
1.2%	1.4%	1.29%	0.37%	0.34%	4.6%

6.19 This policy has the consequential effect of generating posts where the task may not match the talents of the incumbent. Efforts have been made to reduce this to a minimum by a very complicated rating structure. This, however, earns the penalty of a reduction in flexibility in the deployment of individuals. This stereotyping, while serving a purpose, can become maladaptive when the organisation is experiencing a high rate of change. Further, it does not take note of any personality variables other than the gestalt interpretation at the selection stage. Gardner (1970) demonstrated that "personality" might be a useful predictor of success in the context of General List Officers. The construct which he developed separates the contribution to the different specialisations in a very distinctive way. However, psychometric measurements were not included in that particular study and it was this aspect which was taken as an essential element for the present work. The research literature, naval selection procedures and individual experience all point to a recognition that it is the personality of the individual and the way he reacts within the environment which determines his success as a leader. Semantics and a natural reluctance to discuss individual differences have made it difficult to evaluate this contribution. This natural reluctance has become an overriding factor in similar research in the USN. There is so much potential resistance from Congress and elsewhere that any research proposals requiring the use of psychometric techniques are unlikely to see the light of day.

#### Early Models

6.20 Experience gained during the pilot study indicated that while official reaction to a proposal to enquire into personality variables might be expected to be cool, the response from individuals was usually enthusiastic. There was a widespread and serious interest in the work, based upon the individual's own encounters. It was from many discussions about such encounters and experience that a pre-theoretical model of the environment of leaders working in the Fleet or ashore was developed. (Kock 1959). The way in which this approach was utilised can be illustrated by considering the situational demands made by the environment upon the Commanding Officer of an operational warship. An elegant model to use in this context was that developed by Reddin (1969). It lent itself very well to identifying the different elements in a complex situation.

Further, it provided a means of comparing the more obvious differences in situational demands placed upon a role-holder caused by organisational and other changes that the role might undergo. In Figure 6.4 the captain of a ship is shown in the central position and has no coworkers on board. He meets with his peers, infrequently, in harbour. The organisation is formal, giving him very considerable position power and also ensuring that he only has dealings with a small number of subordinates. This is often restricted to four or five heads of Departments. His superior is either based ashore or afloat in another ship and this physical remoteness is enhanced by traditions of the service which reinforce the Commanding Officer's independence. Counter-balancing this lack of inherent interpersonal stress is the considerable measure of advanced technology which forms part of the working environment.

6.21 From this simple model it was possible to propose that the qualities required in a captain of a warship are more likely to be ones associated with independence of thought and action while not calling for a high level of interpersonal skill as an essential ingredient. This is in sharp contrast to the second-in-command who, while operating in the same organisational and technical environment has very different interpersonal demands placed upon him. Firstly, of course, he is very close to his superior, upon whom he relies for support but who in turn expects a close alignment of attitudes and techniques of working. The second-in-command also has to consider the other heads of

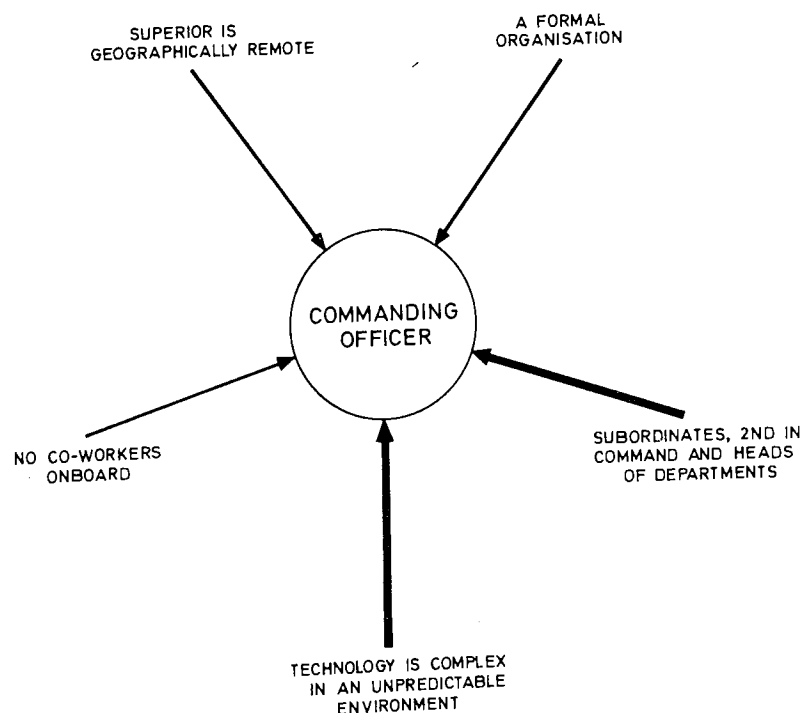


Fig 6.4 Situational demands on CO of a ship

departments both as technical peers and as fellow members of the mess of which he is president. Finally, he has responsibility for the discipline and morale of all the ships company. This adds up to a task which makes very high demands upon interpersonal competence as can be seen by comparing Figure 6.5 with 6.4.

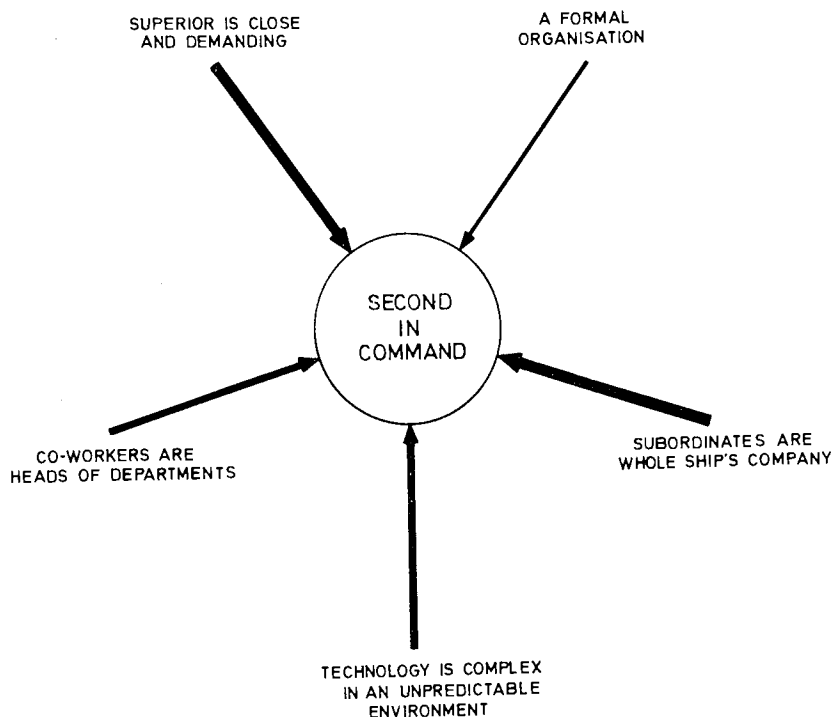


Fig 6.5 Situational demands on 2nd in command of a ship

6.22 The officer in command has almost certainly been a second in command although not necessarily afloat. For such reasons, flexibility in response is recognised as desirable. "Style flex" is the term used by Reddin to describe the ability to vary one's own basic style of behaviour. Some officers use one basic style consistently, whatever the situation: these have low flex. Other officers use a variety of basic styles regularly: these have high flex. The "low-flex" officer has a narrow range of behaviour with which to respond to a situation. For this reason he tends to prefer to have things very clear, to have the power in his hands or know where it rests, and to be interested in controls. The high-flex officer has a wide range of behaviour with which to respond to a situation. For this reason, he tends to be more willing to accept change, not unhappy if things are loosely structured, and not too concerned with power or controls. Such model making showed that the identification of individual differences which were central to success but which were not being examined in an objective way should be a basic aim of the research.

6.23 The key points were considered in the framework of the variables identified by Tiffin and McCormiche (1967) shown in figure 6.6. The individual variables chosen for study were personality characteristics, interests and motivation considered in a wide context. The physical and job variables were not examined but the organisational and social variables were chosen in an examination of situational variables.

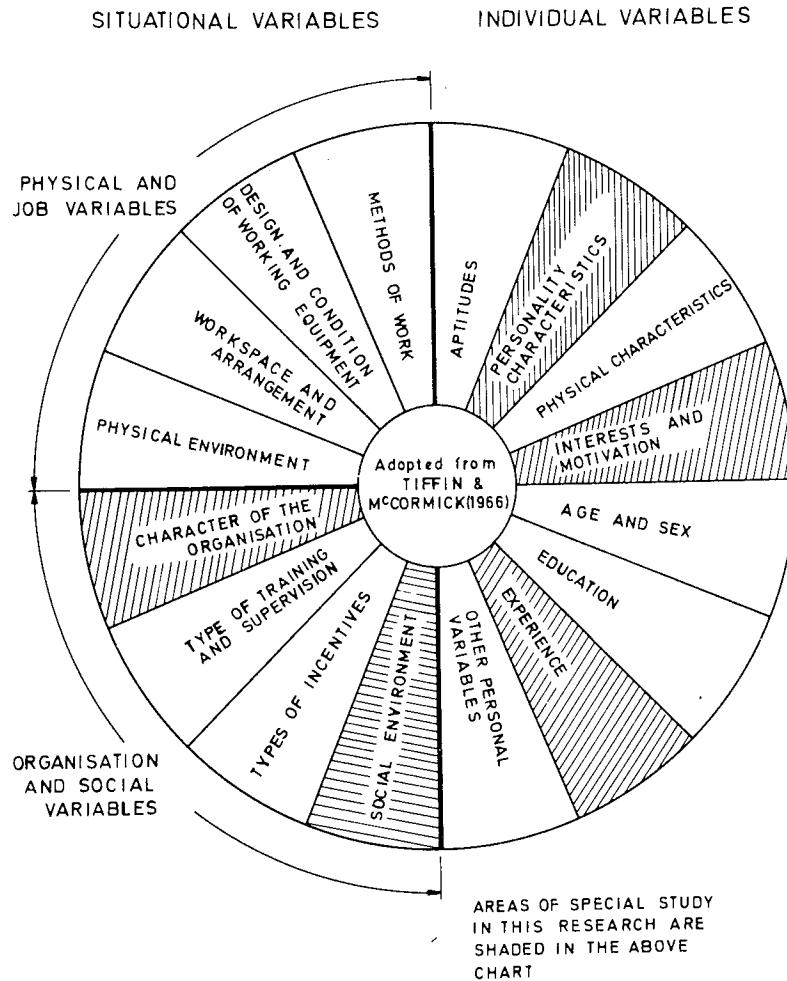


Fig 6.6 Pie chart of system variables

This was the beginning of a developing theme that a tight rope had to be walked, balancing between the traditional thinking of the service, which considers everything in organisational terms and the more liberal concepts of the individual in social psychology, giving full play to utilisation of the strengths of individual difference.

### Organisational Model

6.24 This led to the construction of a model which could be used to discuss the various facets of the employment of people, and one based on Litterer (1964) is shown in figure 6.7. It shows the service as an open system, and the enveloping

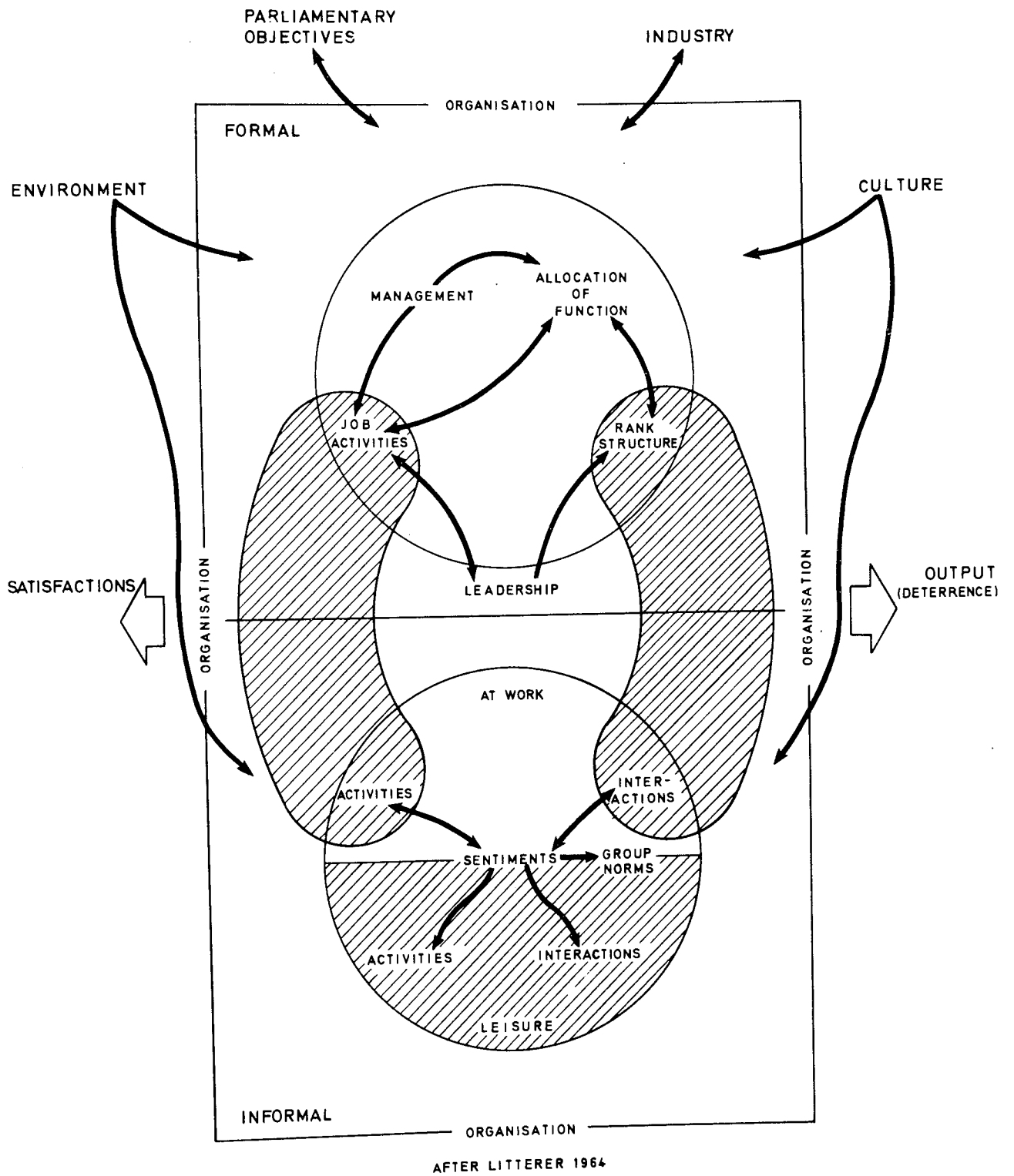


Fig 6.7 Interactions within the total Naval system

square represents the total organisation of the Royal Navy including Headquarters. Outside that system are certain influences:

- a. Technology and resources of the manufacturing sector of the country;
- b. The objectives set for the Navy by Parliament and established by international alliances such as NATO;
- c. The environment in which the Navy works, particularly large distances.
- d. The external influences arising from the culture and social pressures of the country.

Classifying the output from such an organisation always presents difficulty during a period of peace. At least one segment of the Navy can be judged successful if it achieves the deterrence for which it was established. Another very important output from this 'black box' is the satisfaction which individuals experience and then communicate back into the parent community. There are two sub divisions within the Model. There is the formal organisation which is described in Queens Regulations (RN) and there is the informal organisation which is a summation of a number of small groups brought together by the formal organisation but generating within themselves an internal system of values and interactions. The effectiveness of an individual in attempting to contribute to the formal aim of such a complex system will depend in very large measure upon the stability of the various feed-back loops within the formal and informal systems.

#### Formal Organisation

6.25 Considering the formal organisation first, it can be said that the allocation of function is achieved on lines which are established traditionally and are adjusted by a process of evolution. In this way the various skills are brought together in packages which permit some continuity from one year to the next. These various skills are determined by the job activities which are necessary to operate the fleet. These will change as a result of changing technology. There is also within this balance a relationship between the various jobs which must be co-ordinated and controlled. This is achieved in the formal organisation by the rank structure. To make sure that objectives are met, an element of leadership is required. This model of the formal organisation can be equated to a department within a small ship, to the ship itself or to the fleet commander and his various seagoing units. It applies equally well to describe the organisation of the various Headquarters Departments and Dockyards.

## Informal Structure

6.26 Material and psychological satisfactions generated by the members cannot be considered in relation to the formal organisation but must recognise the existence of some less formal grouping of people. This is represented in the lower part of the diagram, and recognises the links between the informal groups and the formal organisation. The interactions with each job, mould and interact with the attitudes and personalities of the individuals who form the working group. These people, having already been moulded by the external culture, in their turn determine the norms established within that working group. The impact of the informal organisation on the formal can be traced through a number of chains indicated in the model. An example of this interactive effect can be found in the life of a messdeck. It is often organised on functional lines, being composed, perhaps, of all the weapon electrical junior rates. The leading rate in charge of the mess has the difficult task of belonging to the group while representing 'Authority'. Thus, he is very vulnerable to conflicting pressures when there is any change in expectations from above. This is recognised in the old Naval maxim of starting a commission with strict discipline and then gently slacking back as the situation permits.

## Summary

6.27 This package was thus put together to examine parts of the organisation, sampling various parameters and then by falling back on personal experience to arrive at some conclusions which would hopefully assist in predictive argument. To this end some general and some specific hypotheses were established about the organisation and the people who work in it.

## HYPOTHESES

6.28 In general terms, the hypothesis for this research was stated thus:- Individual differences between persons serving in the Royal Navy are taken into account by a complicated Rank and Branch structure. This categorisation tacitly assumes that those in a given category are in all respects equivalent for organisational purposes. This structure has evolved within a close knit, stable community where the majority of people concerned joined the organisation in their late teens with an expectation of employment of more than ten years. A period of rapid change has resulted in proposals for a new manpower structure, and this creates a need for a more generalised frame of reference for discussing individual difference. The dimension most clearly needed is one for considering personality. Psychometric techniques might provide a method for examining this dimension in the work environment of the Royal Navy. This general hypothesis was broken down by further sub-divisions for more detailed examination and these

contributory hypotheses have been grouped into four. The null hypotheses are stated in the presentation of results.

#### GROUP 1 - TRAINING EFFECTS

6.29 These have a bearing on changes observed as a result of the training given during leadership courses.

Individual Change. On the assumption that a man's personality changes with experience, it seems reasonable to expect that any such change can be measured by a suitable personality test (Cattell 1957). Further, some facets of personality are more deeply involved with problems of inter-personal behaviour than others. An intensive course in leadership which has at its core the study of group behaviour may result in a change of attitudes by the student. A personality measure might detect these changes and indicate those aspects of personality which are central to this particular skill. This information would be valuable to the training organisation, particularly when changing methods.

6.30 Predictive Use. On the assumption that there is a significant difference between the scores in tests before and after completing the course, this hypothesis states that this change in attitudes can be used as a predictor of the success on course as measured by the subjective assessment of the course officer and his staff. Such knowledge could help in career planning.

6.31 Group Characteristics. Because of age and selection differences, cohorts of Artificers and non technical petty officers might show significant differences in performance on course. This may be explained by personality differences between the groups. These differences will be displayed in terms of total scores on personality inventories. Any difference in response to the training would be measured by the training staff. This could be of use in the choice of selection criteria.

6.32 Permanence of Change. A measure of change after a six week course may indicate a temporary effect. To examine this a repetition of personality tests after a two year period, might show higher correlations with the 'post-test' scores than with the 'pre-test' scores indicating that the change was not transitory. Such information would contribute to the evaluation of training effectiveness.

#### GROUP 2 - PERSONALITY FACTORS

6.33 Population Difference. The results of personality measures obtained using psychometric techniques might be expected to reflect the effects of a careful selection and training procedure for producing the leaders of the Naval



Service. This would be demonstrated by a significantly different profile for the group when compared with the total population. Such information could be valuable when considering the target population for recruitment or in discussion of minimum training requirements.

6.34 Rank Difference. Selection procedures for officers are more rigorous than those for senior ratings and it must be expected that some of the criteria used refer to aspects of personality. It follows that any accurate measure of personality would indicate this difference. Thus, group statistics for officers could be expected to differ significantly from results for Senior Ratings. This data would help in the formulation of selection policy.

6.35 Task Difference. It has been noted in similar research that there are differences between people doing different types of work. The work of the technical branches might therefore be expected to attract a different sort of person from the seaman branches. It is hypothesised that leaders with a high technical content to their work will display significantly different profiles when compared with those who belong to the seaman branches. This is an important consideration in the allocation of men to different tasks.

6.36 Effectiveness. Measures of leadership effectiveness are elusive but promotion to commissioned rank and promotion to Commander are both significant organisational recognitions of superior performance by leaders. A personality difference could be expected between these groups and the rest of their naval peers. A similar dichotomy might be expected between those selected for sea command and their peers. Knowledge of any such difference would assist in the planning of extraction rates.

#### GROUP 3-WORK ATTITUDES

6.37 Work attitudes would be expected to reflect both the individual's commitment to his task and the satisfaction he obtains from it. Where this also reflects the effectiveness of the leadership, it could be extended to examine the relationship between work attitudes, personality factors and effectiveness. Work attitudes could be expected to vary between the many environments in which Naval leaders operate. Differences might assist in the identification of apparent anomalies. For example, the flow of information might be a key indicator of a need satisfaction among leaders. However, the extrovert needs more than the introvert and it might be expected that attitudes to information flow would differ along a personality dimension. If this was in such a way that performance was also involved, the information would be useful in studying group formation.

#### GROUP 4 - ORGANISATIONAL ASPECTS

6.38 The areas of work selected for data collection were very different in organisational terms and some measure was required for this. It was expected that this could be identified using the Criteria developed at Aston (Pugh 1967) and that there would be value in examining the correlations with work attitudes and individual personality measures. This information would provide insights into the present organisation and would have predictive value in any reorganisation. A particularly important aspect is in study of group formation because any improvement in matching individual characteristics to role requirements would represent a potential saving in the use of resources.

6.39 The remainder of Part II describes the methods used to collect the data for testing these hypotheses.

## SECTION 7

### DATA COLLECTION AND ANALYSIS TECHNIQUES

7.1 The techniques for data collection used were selected for the purpose of gathering information about the individual, and his place in the organisation. For this, both questionnaires and interviews were used and most of the data was obtained in a face to face situation. In two cases postal methods had to be resorted to because of the distances involved, but particular care was taken to ensure as much control as possible over the environment in which the questions were answered.

7.2 Cattell, (1967) discussing Test Batteries for Aptitude and Personality Measurement, states that a complete measure should cover 3 trait modalities:-

- a. abilities including both achievements and skills representing potential;
- b. personality temperament traits;
- c. dynamic interest attitude traits.

This approach was adopted in the experimental design.

#### Selection of Questionnaires

7.3 A measure of individual difference in personality was needed and the natural choice was to use the EPI and Cattell 16PF which had already been used for the earlier study at HMS ROYAL ARTHUR. This decision was reinforced by two factors which emerged subsequently.

Firstly, the work of the Industrial Training Research Unit, Cambridge in studies of group effectiveness at Henley and described in Section 5 was based upon the 16PF questionnaire.

Secondly, the clerical effort needed to process the questionnaires was reduced dramatically by the opportunity to use the facilities provided by the Middlesex Hospital Medical School for processing Mark Sense cards.

7.4 A questionnaire was designed to attempt to measure the sociometric as well as organisational patterns of social behaviour in the three principal areas of work which were chosen for study. The other questionnaire used was designed to obtain information about attitudes to work and to measure the job satisfaction felt by naval personnel in the various environments. Examples of these questionnaires are included at Annex A.

## Structured Interviews

7.5 In parallel with the completion of questionnaires, naval personnel were interviewed using a structure which was intended to elicit a free discussion of attitudes to work and the Service. The structure was prepared for interviewing selected subjects only and the interview was recorded to make subsequent analysis more meaningful. The questions used to form the structure are given in Annex P and the interview lasted between 35 and 45 minutes. The subject was not told that the interview would be recorded until he actually sat down. A Sony Cassette TC 120 was used which provided sufficient playing time on one side of the Cassette for one interview and because of its balanced interior microphone was inconspicuous and readily accepted by the subject. The initial interviews were not entirely satisfactory and the researcher had a certain amount of difficulty in establishing rapport with the subject. This improved with experience and also as a result of changing the form and order of the questions. The questions given in Annex B were the final ones used; they were slightly modified in certain circumstances if they were not appropriate to the particular person's position.

## Biographical Details

7.6 By the very nature of the administration of a military community there is a considerable amount of biographical data available on Officers and Ratings. The discussion in the analysis of results in the Gardner Study shows that the relevance of this information once the selection hurdle has been passed is limited. Thus although biographical data was collected, rank, age and specialisation were the elements most frequently used in subsequent analysis and interpretation of the data collected in this study.

## Collection of Data about the Organisation

7.7 As described in previous sections not only does the individual personality contribute to leadership but also the organisational structure can be expected to have a considerable bearing on the development of that personality, which in turn has considerable influence on the organisation. For this reason particular care was taken to collect information about the organisation, its aims and the way these aims were interpreted both formally and informally. This was achieved in three principal ways. The organisations orders were studied, secondly the Directing Staff and Heads of Departments were interviewed and thirdly questionnaires were circulated among the staff to seek a measure of their involvement both with the organisation as a formal machine and with the organisation as a social group satisfying their affiliation needs. An attempt was also made to judge how the individual matched up with the expectations of the organisation. Where the data was collected by structured

interview an attempt was made to discover the stress level within the organisation so that an estimate could be made of the various strains created within the different sub-cultures.

The researcher's previous knowledge of the Royal Navy and traditions of the service were reinforced with as much literature as could be made available. This took the form of Orders, organisational charts and a wide assortment of memoranda explaining the aims and methods employed which in total provided many insights.

#### Feedback to Individuals

7.8 Throughout this programme of data collection a very high degree of cooperation was encountered, which made the task much easier. However, Training Establishments, for example, work to a tight programme which is much more highly organised than an equivalent academic establishment outside the services. For this reason time allocated for such data collection had to be carefully planned and particular care had to be taken in establishing the right atmosphere at the testing sessions. It was considered particularly fortunate therefore when it was found possible to offer subjects some sort of bonus in the shape of an individual print out of their own personality profile in the Cattell 16 PF inventory. Interest had been shown during the pilot study in some sort of follow up from the work. The administrative problems of scoring and plotting an individual Sten profile for all subjects was considered to be too big an undertaking. However, when it was found possible to use the Middlesex Hospital version of the Cattell questionnaire, part of the service included an individual print-out for each subject. This facility was used with advantage to sustain the interest of those who were otherwise rather reluctant to commit themselves to yet another introspective enquiry by the Ministry of Defence. An example of a print out showing the format it took together with a copy of the explanatory notes sent with it to each subject is shown at Annex C.

#### Feedback to Ships and Establishments

7.9 Except in the case of the study of training effects at HMS ROYAL ARTHUR, no immediate feed back to the parent establishment has been attempted. The reason for this was that any such formal contribution would have been required fairly soon after the data collection and in isolation from findings from the rest of the research. Further, it would have damaged the image of being independent from the Naval heirarchy. This policy did not inhibit lively discussion with individual officers about general impressions if this was thought to be helpful or was requested.

## Techniques of Analysis used in the Research

7.10 A large quantity of data was accumulated as a result of the research design and methods chosen for analysis reflected this. The answer to questionnaires were scored and then stored on cards prior to statistical analysis. Interviews were subject to content analysis. These findings were collated into a narrative analysis for subsequent discussion.

### STATISTICAL ANALYSIS

7.11 The techniques available have been described very fully in Gardner (1970) and the same statistical package, XDS3, was used on the ICL 1905E computer at the University of Aston. Means, standard deviations and Histograms were examined initially to "get a feel" for differences. Correlations were also examined. An examination of a principal component analysis of the data was used to estimate the potential for factor analysis.

### Statistical Comparison of Groups

7.12 Methods of comparing two groups when only a single variable is involved present no problems. Distinguishing between two groups measured on sixteen variables involves problems of pattern recognition which are not so amenable to computation. The use of a coefficient of similarity has been offered as a method (Cattell et al, 1970; Horn 1961) and has been used (Stern et al 1971) for analysis of groups of Medical students. The technique was used to compare the groups studied in this research.

7.13 First, a difference function 'f', based on the sten differences of the two groups, is calculated.

$$f = (\text{sten difference})^2 \times \frac{N_A + N_B}{2}$$

where  $N_A$  is the number of people in Group A  
 $N_B$  is the number of people in Group B

Using the difference function 'f', and nomographs (Cattell et al 1970) for the numbers of factors included, the coefficient of similarity can be read off. The coefficient ' $r_p$ ' can be checked in significance tables to show, if the coefficient is positive, whether the groups are statistically similar, or if the coefficient is negative, whether the groups are statistically different.

### Limits

Assuming 16 factors, and  $p = 0.1$

- a. if  $f \ll 72$ , the two groups are statistically similar.

b. if  $72 < f < 183$  the groups are a random match: that is, they are neither statistically similar, or statistically different.

c. if  $f \geq 183$  the groups are statistically different.

Using this method, each group may be compared with every other.

### Content Analysis

7.14 A simple form of content analysis was used as a way of marshalling data collected by structured interview and from reports of individuals.

Holsti (1968) in his survey of content analysis, emphasises that among the characteristics that adequate content analysis must have, in addition to objectivity, system and quantification, is that of generality. "By generality we mean that the findings must have theoretical relevance; purely descriptive information about content, unrelated to other attributes is of little scientific value".

The need for such theoretical relevance has been borne in mind and is examined in the discussion of results.

### Pattern Recognition

7.15 The assessment of an individual against a large number of attributes can be done sequentially or as a "gestalt". Computer assistance for the second method has been receiving attention (Jardine 1971) and it was considered that it had relevance to this project. Although not explored adequately to be used in analysis, it is an area which warrants more work.

### Simulation

7.16 Interpretation of results by simulation promised to provide valuable insights and was developed to a stage where an assessment could be made. This is discussed in Section 18.

## SECTION 8

### DATA COLLECTION WITHIN THE TRAINING ENVIRONMENT

#### Sample

8.1 The sample taken for this section of the research was drawn from a number of areas where leadership training is practised. This includes HMS ROYAL ARTHUR, the Senior Rates Leadership School, the Leadership School for Leading Rates within HMS COLLINGWOOD, Officers under instruction at HMS EXCELLENT and the Royal Naval College at Manadon and at HMS COLLINGWOOD and the Staff at those establishments. In addition the Commander in Chief Naval Home Command set up an investigation into the co-ordination of leadership training, and data was collected as a result of that exercise.

#### Authority

8.2 An informal network of acceptance throughout the training world was established as a result of the earlier research at HMS ROYAL ARTHUR. This was found to be more than sufficient for all the data collection requiring face to face contact. In the special case of the preliminary survey at HMS COLLINGWOOD, it was deemed prudent to clear the way, and a memorandum was issued by the Captain of the Establishment. This mentioned that this was not the first such investigation. There was a real danger of meeting a hostile response, but in the event this did not occur.

### METHOD

#### Measurement of Training Effects at HMS ROYAL ARTHUR

8.3 As part of this larger study, and as a follow-up to the earlier study at the Senior Rates Leadership Training Establishment, (Page 1970) EPI and Cattell 16PF questionnaires were given to a further series of Petty Officers undergoing the 6-week course. In the previous study, the 1962 Edition of the 16PF Inventory was used in its standard form. The test was applied at the beginning of the course, the day after ratings had joined the establishment and the test battery was re-taken on the last day of the course, on return from an endurance test in the Black Mountains. Differences between the before and after scores were examined to seek some objective measure of the effectiveness of the leadership training given. A repeat of this data collection activity was conducted using the Middlesex Hospital adaptation of the 16 PF questionnaire, which uses mark-sense cards for computer scoring (Harris and Buckley-Sharp 1968). Details of this adaptation are given at Annex C. Four separate courses were tested at weekly intervals.



8.4 The average size of each course was 25 Petty Officers and they were tested in groups. The course officer explained that the answers would be kept private and not used for any service reason. The methods used were similar to those used in the previous study of training effects on ratings and no difficulty was experienced in achieving a similar standard of rapport with the senior rates undergoing the course.

8.5 The Cattell 16PF test and the Eynsenck EPI 'A' and 'B' were given to each course as soon after arrival at HMS ROYAL ARTHUR as possible. This was the Friday after joining on the Thursday afternoon. It was administered as a group test and a standard introduction and ice-breaking comments were used on each occasion in an effort to maintain constant test conditions. The same tests were given 6 weeks later after the ratings had returned from their mountain exercise. This was the last Wednesday afternoon before the course broke up and the ratings departed for their ships on the Thursday.

8.6 The groups were required to report for the tests and listen to the introduction. Petty Officers were given the option of not participating at this stage. It was tacitly assumed that all those who had completed the first test would also complete the second test. The timing of the second test was critical. On the one hand, it was clearly desirable to have reasonably fresh, well-disposed subjects but it was considered more important to try to measure the effect of the whole course, and a very important part of it is the Black Mountain Trek. Therefore, the test had to be fitted into the 24 hours after the return to Corsham and before the ratings left to join their ships. Also, at this time, the Petty Officers were shown their course assessment and discussed its implications with their Course Officer. In these circumstances, recency effects would be expected to be at a maximum. On the other hand, the feeling of "well-being" after strenuous physical exercise was thought to be a counter effect.

8.7 Copies of the end of course assessment prepared by the Course Officer were supplied to the researcher. Numerical assessments given were Leadership (on a scale of 1 to 9) and Leadership Potential (also on a scale of 1 to 9) but not on the six attributes included previously. It had been shown in the analysis of the previous results that numerical scores showed a marked halo effect and this change does not represent any serious loss of information. The new format appears to have allowed more attention to be given to the written description of the individual and his performance on course. A grading of the individual against another scale using these written reports was attempted, using an independent assessor.

## Investigation of other Training Environments

8.8 The relevance of the interaction of personality within the training environment has a number of facets when considering the development of leadership skills.

- a. What sort of people are under training: are they similar to those who are on the staff.
- b. Do men show any consistent personality shift as a result of training.
- c. Are their expectations supported by their experience after the completion of training.

Some of these questions were examined in the previous study and this experimental design called for a follow up among that sample two years after they completed the course.

## Studies in HMS COLLINGWOOD

8.9 HMS COLLINGWOOD is the Shore Establishment responsible for the technical training of Weapon and Electrical Engineer Officers and Ratings for the Surface Fleet and therefore has an impact on a considerable proportion of men serving in the Naval service. Because of this it was chosen for examination of personality dimensions and attitudes among the staff. The Establishment is large, employing a staff of about 300 Officers and at any one time having a total complement of about 3,500 people. It was decided to conduct a preliminary survey by questionnaire and follow this up in selected areas with structured interviews. This programme was completed over a period of 9 months, and the particular areas chosen for the follow-up study were those areas of training design and training execution which were principally concerned with the training of leadership with management to Officers and Ratings. A further dimension was added by taking a sample of Officers under Instruction at HMS COLLINGWOOD who belonged to the WE application course. The organisation is shown in Figure 8.1.

8.10 The preliminary study was based on a "postal" survey technique although the questionnaires were delivered through the internal system of the establishment. As explained in the case of the follow-up of Petty Officers within the fleet, care was taken to generate a favourable frame of mind in the recipient. As in the Fleet survey, the use of a succession of sealed envelopes were used to structure the situation at the time of the test. An example is given in Annex D. HMS COLLINGWOOD, as part of her feed back organisation, had been conducting an exercise to enquire of officers who have completed the recently reorganised course in management to discover whether they were satisfied with the training given and to find guide-lines on its relevance and effectiveness. The Officer

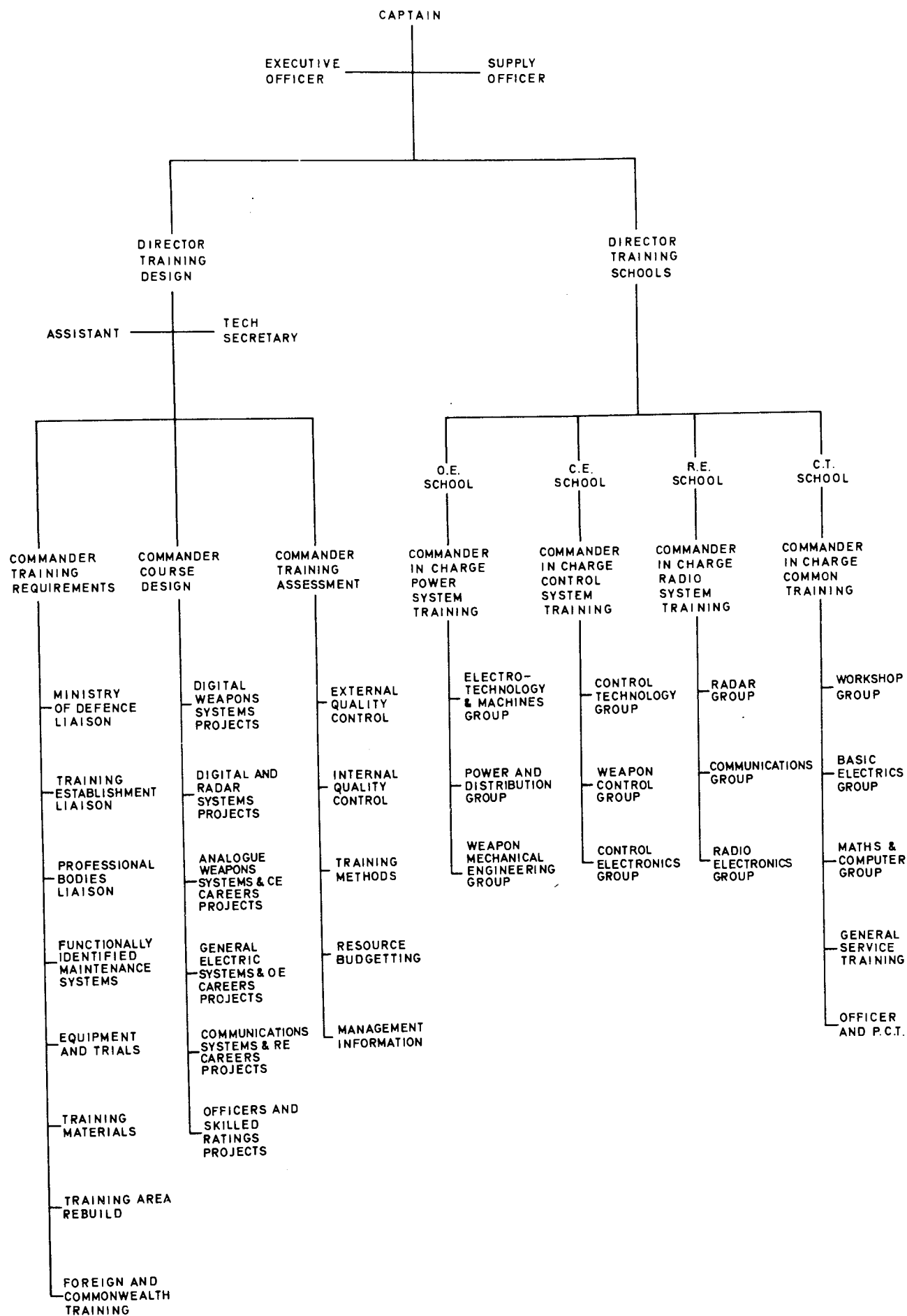


Fig 8.1 Line management diagram of a training establishment

conducting that survey was interviewed and his experiences in data collection and the results he obtained have relevance to the present study and were included in the analysis.

#### Leadership Training for Leading Rates at HMS COLLINGWOOD

8.11 As a result of a heightened awareness at HMS ROYAL ARTHUR following the interest aroused by the pilot study, provocative statements were made at the regular meetings held with the officers responsible for training leadership to the Leading Rates at the Home Ports and HMS COLLINGWOOD. In particular, the statement was made that Senior Rates were given a better grounding in the basic skills required of leaders than was given to Junior Officers. This resulted in an invitation being given to the Applied Psychology Unit at Teddington to examine the problems involved in updating the methods used for the training of leadership.

At that time, the psychologist at the Applied Psychology Unit who undertook that investigation was a tutor for this research. Thus he was aware of the relevance to this study and invited the author to join in at various stages as it progressed.

A summary of the findings and comment on how it contributes to the present study are given in Annex E.

#### Principal Warfare Officers

8.12 It was considered desirable to include a sample from Seaman Officers who were on course but who had had some experience in the Fleet in an effective leadership position. An ideal group for this purpose was provided by the first qualifying course for Principal Warfare Officer which at the time was undergoing training at HMS EXCELLENT. The data collection within this group was restricted to questionnaires. Some staff officers were included in the sample.

#### Royal Naval Engineering College, Manadon

8.13 A sample was taken from general list officers undergoing training at the Engineering College at Manadon and it was again decided to use questionnaires only to provide data for comparison with those employed in different working groups. Staff Officers were again included in the data collection.

## SECTION 9

### DATA COLLECTION IN THE SURFACE FLEET

#### Choice of Sample

9.1 Some difficulty was experienced in choosing an appropriate sample for this part of the study. The difficulty arose because of the need to find suitable ships at a stage in their programme where a time-consuming extraneous activity was acceptable. In addition to this, it was considered essential to make the approach on a voluntary basis and it was found that some ships were not prepared to undergo the additional stress of having an outsider on-board asking a wide range of intimate questions.

9.2 After some false starts, two ships were chosen for a full-scale study. The first was a frigate of the Leander class, which is one of the most numerous classes of surface ship in service at present. The second was a Guided Missile Destroyer of the Country Class which provided an example of the larger ship with a more formal organisation. In addition, a follow-up within the fleet was made of the Petty Officers tested in 1970 at HMS ROYAL ARTHUR.

#### Authority

9.3 The authority for the study was established early in the negotiations and its credibility as a worthwhile project was enhanced by the support of the Commander in Chief, Naval Home Command. No difficulties were encountered once the original permission had been given.

#### Method

9.4 The questionnaires described in Section 7 and the structured interviews were used for collecting information about a representative sample of each ship's company. The choice of individuals was dictated in some measure by the programme of the ships concerned and for this reason there were some gaps which have been discussed in the section on the total sample.

9.5 Unlike the experience in the training environment where the Cattell 16 PF Questionnaire created most stress amongst the people being tested, in the ship environment there was a suspicion about the questionnaire seeking data on attitudes to work. This, combined with the close community feelings involved in life on-board, made the testing session more emotional and called for extra care in explaining the nature of the research. The research supervisor joined in parallel interview during the early stage of this part of the study to monitor the techniques used.

### County Class Destroyer

9.6 The ship selected had been in commission for some time and was deployed away from the UK. During the data collection she was undergoing an assisted maintenance period. For this reason, the sample did not include a representative number of Marine Engineering Ratings. The Ship was working tropical routine and all the testing was done in working hours. Facilities were provided to administer questionnaires to groups and to interview subjects in complete privacy. Some early suspicion was encountered concerning the hidden motives of the research but this was overcome and a very good rapport was finally established.

### Leander Class Frigate

9.7 The ship was in a home port to give Christmas Leave after a period of intensive seetime operating within the Nato Standing Force. She had been in commission for some time and the ships company was clearly a closely integrated community. The sample was reasonably representative but was slightly distorted because of the absence of the Retard Leave Party.

### Follow-up investigation of Petty Officers

9.8 In the experimental design for data collection in the 1970 sample a follow-up questionnaire was sent to each rating after he had returned to work and in most cases this was 3 months after completion of the course. During discussion of these results and their comparison with the results from the personality inventories it was recognised that a further follow-up after about 2 years would provide valuable additional information. This was administratively difficult because the ratings involved were widely spread throughout the Fleet and shore Establishments. It was not considered an effective use of time to attempt to interview each one individually or to administer a questionnaire in person. For this reason it was decided to use a postal approach and it was considered more important to have a good response to a more simple questionnaire than a less complete response to a fuller but lengthier battery. It was decided, therefore, to use the EPI Test A and B as the means of measuring the more long lasting effects on Senior rates who had completed the course at HMS ROYAL ARTHUR. The rationale behind the design of supporting documents which went with these questionnaires is given in some detail.

9.9 It was felt that considerable care was needed in approaching the subjects for two reasons. The first was that the Fleet is being bombarded by surveys, questionnaires and experiments investigating the whole field of management and therefore there is a reluctance to take action on yet another

one. Secondly, for any information of real value to be forthcoming from questionnaires with a comparatively small number of simple questions it was essential that the environment in which the questions were answered should be as controlled as possible. For this reason the divisional officers of the Ratings concerned were invited to become involved.

9.10 The paramount consideration in the whole programme of research has been to create the true impression that the results will be kept entirely separate from Naval records; at the same time it was necessary to apply some discipline to the administration of the test. For this reason a compromise was attempted invoking the services of the Rating's Divisional Officer and the package had therefore to be carefully designed.

9.11 EPI Forms A and B were enclosed in an envelope with a covering letter addressed to the Rating by name. The covering letter explained why a follow-up was necessary and this was sent with a note to the Rating's Divisional Officer explaining what was being attempted and setting the scene for the actual administration of the test. With this went a progress report of the work which had been promised to the Rating at the earlier testing session. The Divisional Officers were asked to give this to the Rating after he had answered the questions. An envelope for returning the questionnaires was addressed to my private house to reinforce the research aspect of the activity. All this was sent officially to the Rating's Commanding Officer with a brief note of explanation. A sample "package" is included at Annex D.

FRAMEWORK FOR DISCUSSION OF RESULTS

9.12 Some thought was given to the best framework to use when discussing the

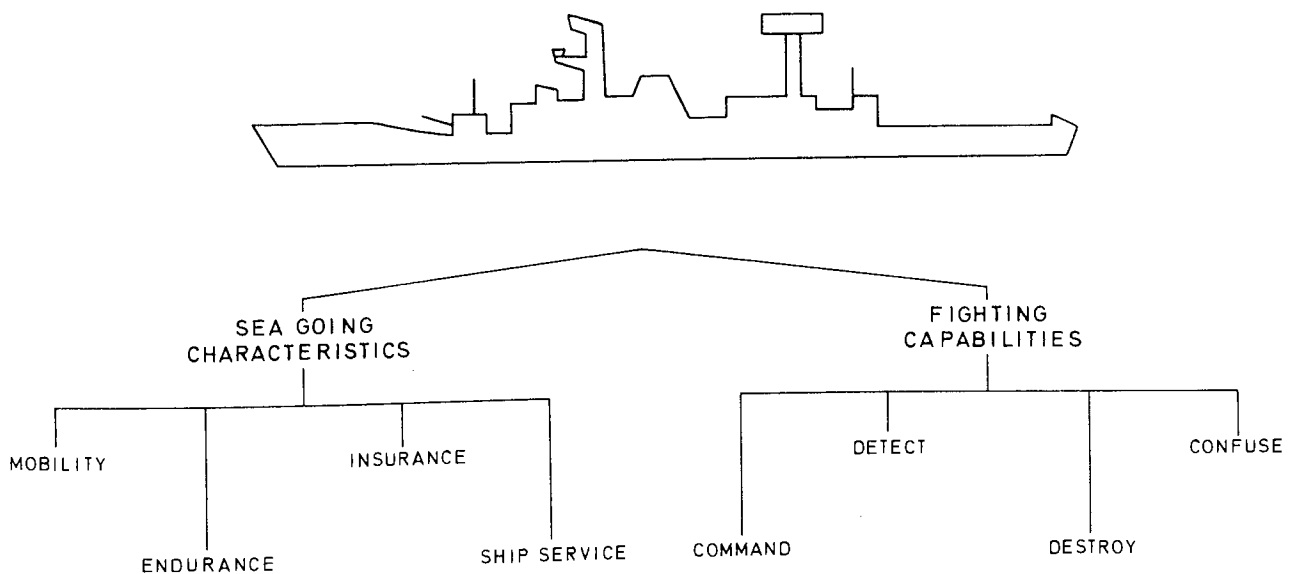


Fig 9.1 A simplified conceptual model of a warship, showing basis of hierarchical structure

results obtained from data collection in the two ships and elsewhere. The organisational tree was found to be unsuitable because in its simplest form it was overshadowed by rank structure. The functional approach used in simulation modelling for a study sponsored by the Ship availability and Usage Working Part was found to match the need more closely. Figure 9.1 shows a much simplified conceptual model of a warship in these functional terms. This will be used in discussing the contribution of an individual to the overall effectiveness of his ship.



## SECTION 10

### DATA COLLECTION IN HEADQUARTERS

#### The Sample

10.1 The sample for this part of the research activity was drawn from Naval Officers employed in the Weapons Department who were working in multi-disciplinary teams with civil servants belonging to the administrative and professional classes. The majority of the officers included in the sample were employed in a research and development establishment close to a Naval Base where there was no difficulty in identifying with the Fleet at sea. Some of the officers however were employed in London and in the Ministry of Defence in Bath.

#### Authority

10.2 The authority for this part of the data collection was drawn from the sponsorship of the research by the Deputy Director General (Weapons). It was subsequently enhanced by joining a team of staff inspectors who were collecting data for a staff audit. The opportunity was taken to gather information about the formal organisation during this work.

#### Method

10.3 Individuals were invited to complete a questionnaire on their work and responsibilities and were subsequently interviewed. Some of these interviews were recorded. As this part of the research took place early in the overall programme it was at this time that there were changes in the nature of the interview and for this reason some of the results were not as complete as they might have been. An auxiliary programme of interviewing was undertaken subsequently in an attempt to fill the gaps where these were apparent.

#### State of the Organisation

10.4 During this data collection the Rayner Report (Command 4641) was published. This caused a change from being a separate and identifiable part of the Ministry of Defence (Navy) to being fragmented within the new Procurement Executive. In an organisation undergoing fundamental changes of this size there was considerable ebb and flow of opinion and rumour. It was inevitable that some of this should be encountered in collecting data. After a further two years it has not been possible to identify real stability in this area of the Ministry of Defence so the results are considered to be representative of a transient. However, taken in the perspective of a continuously changing relationship between the uniformed active service officers and the civil servants who make up the large majority of the Headquarters element, it was felt that conclusions can be drawn and recommendations could be made about these very important areas.

## Background to the Management of Weapon R & D

10.5 The organisation for Weapon Research, Development and Procurement resulted from a Committee set up in 1956 with broad terms of reference and chaired by Sir Berkeley Nihill. This Committee followed from the establishment of an amalgamated General List of Naval Officers also introduced in 1956. The Committee was appointed to make recommendations aimed at solving problems related to the employment of Naval Officers in the technical field, particularly in posts in which continuity of experience was desirable. Substantial modifications were introduced. The recommendations outlined the top level structure, giving some indication of the way in which the proposed large new department should be subdivided. No attempt was made, however, to deal with the subdivisions or to investigate in detail the number of people required to man the organisation. The Committee was satisfied that the proposed organisation would increase efficiency, but it recognised that it would give rise to a number of teething troubles.

10.6 Troubles were encountered and solutions were sought on a piecemeal basis during the subsequent decade until, in 1964, Sir John Carroll led a Working Party which proposed a major change by reshaping the Weapon Department organisation on functional lines. This gave headquarters status to the R & D Establishments and created a Management Team in the form it took until 1972. The place of the Naval Officer in this functional organisation was recognised as a major area of difficulty. For example the relationship between the Captain Superintendent and the Chief Scientist of the R & D Establishments had been a difficult one and the proposals were expected to resolve this problem. However, it was recognised that by placing the R & D Organisation under civilian direction there was a danger that the influence of Naval Officers might be lost, or seriously weakened.

10.7 These proposals were approved in modified form in July 1965, and after a short time some of the arrangements were found to be unsatisfactory; in particular the position of the Captains at the Establishments. A further Working Party was set up which reported in 1966. The resulting reorganisation was still not satisfactory and in 1969 further changes were made. Adjustments in the organisation to fall in line with this most recent ruling were still going on when the Rayner Report was implemented. It was noticeable that the organisation which had evolved as a result of these several reports did not achieve the expected results because the detailed examination of the consequences of re-organisation stopped at a quite high level in the hierarchy. The re-allocation of tasks and the organisation for working level relationships was left to develop in a random manner. This development was not always fortunate and sometimes merely grafted new complications on old bad practices.

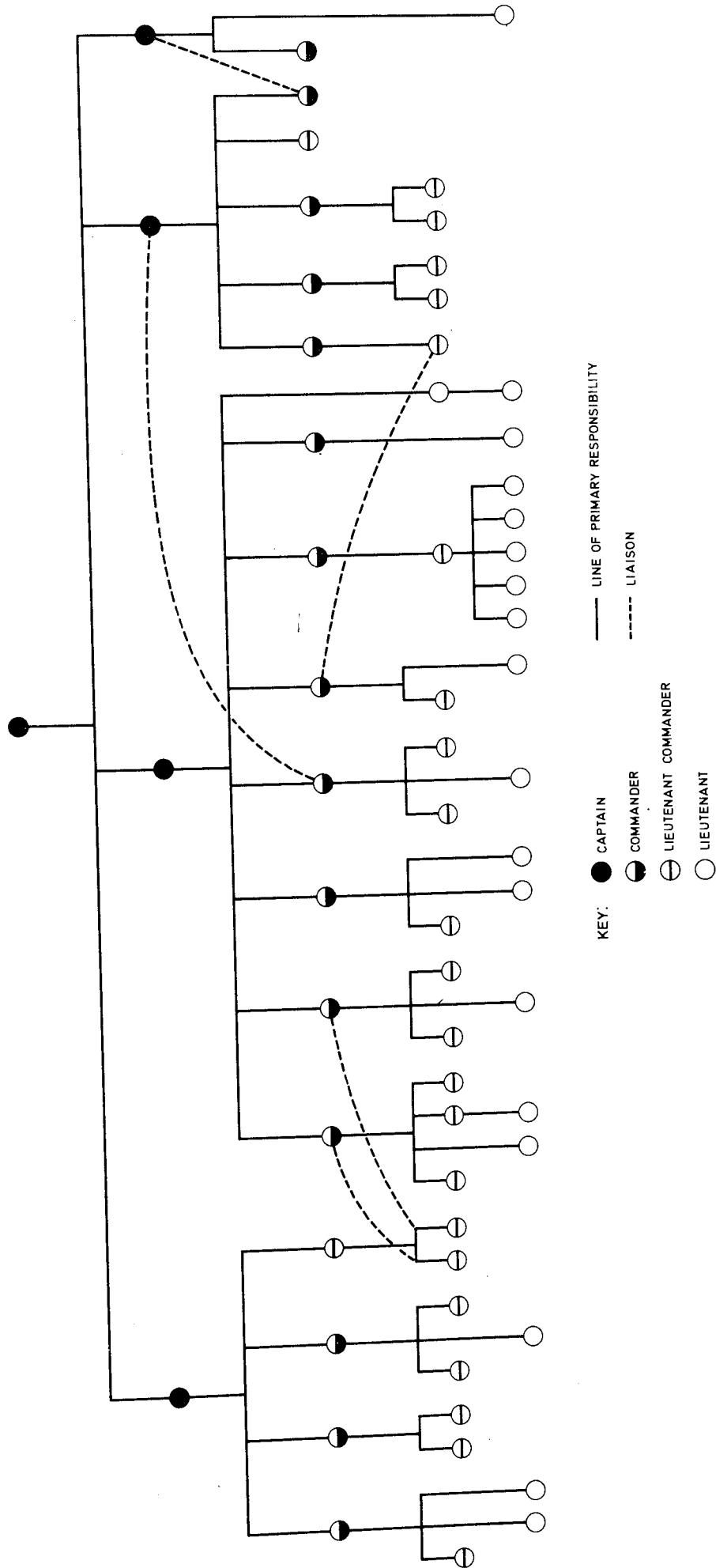


Fig.10.1 Part of a Line Management Diagram at Headquarters – Pre Rayner

## The Place of the Naval Officer

10.8 In general terms, the contribution made by the Naval Officer to new weapon projects usually takes the form of:-

- a. Provision of Naval advice and assistance to the R & D Authority.
- b. Acceptance of Weapons Equipment into service in the Fleet.
- c. Introduction of Weapons Equipment into Service in the Fleet.
- d. Management of Weapon Equipments and Systems already in service in the Fleet.

To achieve this, DGW(N) employs Naval Officers of both the Seaman and Engineering specialisations. At desk officer level, (usually Commander) both Seaman and Engineer Officers might be associated either with one large or with several small projects. In some fields, such as Underwater Weapons, Officers were responsible for groups of equipment during both development and in Fleet Service. In other cases, such as radio, the tasks associated with new projects and those associated with in-service equipment management, were assigned to different officers. The hierarchical structure is shown in Figure 10.1.

### Weapon Project Leaders

10.9 Special mention must be made of the functions and responsibilities of a Project Leader. For this purpose a Project Leader is defined as an officer who has been appointed to carry out a task in the Research and Development programme in the Long Term Defence Costing. The officer may be a Civil Service member of the RNSS, the RNES or a Naval Officer. The task may be part of a Research Objective, an assessment, a Project in response to a Naval Staff Requirement, a Post Design task, etc.

One of the main responsibilities is to keep to a budget. In this context Watson (1971) said

"It is of interest to look back with hindsight on the decisions which have been taken in the past decade. From this I believe that more upset to the naval R & D programme has been caused by bad cost estimation than by any changes in the military scene."

A successful project leader is usually task-oriented and is unlikely to welcome extraneous activities.

10.10 The data collection of views about the task, the organisation and the satisfaction felt by Naval Officers employed in this complicated environment was used to provide insight into measures of personality obtained at the same time.

## SECTION 11

### DATA COLLECTION AT THE ADMIRALTY INTERVIEW BOARD

11.1 A systems view of the interaction between leadership and personality in a service such as the Royal Navy requires consideration of those who offer themselves at the "front door". Various studies have been made but none known to the author produced psychometric measures of the candidates.

#### Authority

11.2 An approach was made through the resident psychologist and supported by the supervisors to test a sample of the candidates coming before the Board. After some discussion the President of the Board agreed to this for a limited period, provided the candidates were informed that it formed no part of the selection procedure.

#### Sample

11.3 A sample of 110 candidates offering themselves for the various types of commission were included. All candidates within a short period were tested with the exception of the deferred cadetship entry.

#### Choice of Cattell 16PF Questionnaire

11.4 As described in preceding sections the research required the administration of the 16PF questionnaire to a number of different working groups within the Royal Navy. One aim of this research was to identify the personality factors which are representative of these working groups, in line with other programmes of research using this same questionnaire. The sample already tested included a broad cross-section of specialisations and seniorities in both officers and senior ratings. It was considered that an added insight would be gained by including a sample of candidates offering themselves to the Admiralty Interview Board. The Cattell 16PF questionnaire was chosen because of its wide use as a research instrument and in addition because of the accessibility of a facility for scoring the questionnaire and analysing the results, without imposing a burden on the staff of the Admiralty Interview Board.

11.5 It was stressed that the identity of individual candidates would not be disclosed because all subsequent processing would be on the basis of a reference number. The AIB alone would hold the list which matched numbers to the individual's name. It would however be necessary to put the various numbers into sets, for example:

Those who failed v Those who were successful  
Short service v General list  
Engineers v Seamen

for subsequent analysis.

11.6 The following use for results obtained from the adoption of such a test as a part of the selective procedure were identified in discussion with the AIB.

- a. An analysis to see if there was any significant difference on personality dimensions between the groups who were selected and the groups who were rejected. This could be repeated for different categories of candidate and for different Boards.
- b. A comparison of the measured personality of those offering themselves for Naval Service with those who are undergoing other professional training.
- c. A comparison of the characteristics of the entrants with the personality measures of serving officers.

11.7 In considering the results, it was necessary to consider the underlying aims of the Admiralty Interview Board. These have been recorded as seeking evidence for or against the proposition that the individual will, if he gains the necessary academic qualifications and after appropriate training, make a satisfactory officer.

The evidence given (a priori) and the evidence generated by boarding procedures has to be judged in relation to the whole man, and the whole man has to be judged in relation to his environment, and in relation to his development potential. A guide has been prepared to assist Board members in reaching a decision. Some extracts are quoted below.

#### Style

The style of a man in this context embraces his appearance, bearing, speech and manner. It is not critical but it is not insignificant. The "presence" of an officer is relevant to his ability to lead and the style of an individual is a significant factor in his ability to influence comparative strangers and is therefore of some importance in a Naval Officer. A sense of humour is part of "style".

### Intelligence

This is perhaps the most crucial area. Without adequate intelligence a candidate's other qualities may be largely useless to the Navy.

### Personality

The Navy has room for introverts and extroverts, for conformists and radicals. We need be satisfied only that an individual has an adequate measure of integrity, stability and self-control to serve the Navy.

### Moral Character

We are not looking for boy scouts or lay preachers we are looking for moral energy and courage.

### Drive

This is difficult to define, but relatively easy to recognise; it is the outgoing quality that enables an individual to transmit some of his energy to others.

### Ability to Communicate

If a relatively inarticulate candidate dislikes reading, the weakness is unlikely to correct itself in the time scale with which we are concerned.

11.8 It was stressed that the Royal Navy is an institution with a fairly high specific gravity. Its weight applied to an individual can remarkably channel his energies in the direction that it is in the Navy's interests that they go. We should not therefore unduly worry if a young boy who has the intelligence and the drive and a pleasant style and potential presence seems a bit uncertain how much he really wants to be a Naval Officer; has not worked too hard at school, and is caught out in an exaggeration. The might of the evidence is that the Navy will turn him into what it requires.

### Origins of the Admiralty Interview Board

11.9 It is interesting in passing to note that in 1903 Admiral Fisher was the first President of a formal selection board for Officers wishing to join the Royal Navy. He prepared a structured interview before meeting the candidates, and a copy of some of the notes (made in his own handwriting) hangs on the wall of the wardroom mess at HMS SULTAN where the Admiralty Interview Board is now housed. He started off with some warming up questions, going on to some such as:-

Are you as clever as your brothers and sisters?

Any relations in the Navy?

Do you have high tea or dinner?

Why?

How many tips do you expect at Christmas?

What shall you do with them?

In a P & O as a passenger what would you first do in case of shipwreck?

He ended up

Who are your Godfathers and Godmothers? (NB Very good question for finding out if a gentleman by birth, also detected a boy of Jewish faction last time! (He got in.)).

#### ADMINISTRATION

11.10 The administration of the questionnaires was undertaken by the Personnel Selection Officers at the Admiralty Interview Board and the author would like to acknowledge this assistance.



SECTION 12

COMPOSITION OF THE SAMPLE

12.1 The total sample of officers and ratings who were interviewed or answered questionnaires numbered 602 and in addition 35 civilian and 110 candidates at the AIB completed the Cattell 16PF. The breakdown by rank and employment of this sample is given in Table 12.1 and it may be compared with the total population of adult males serving in the Royal Navy on 1 April 1972 given in Table 12.2.

Table 12.1: - COMPOSITION OF THE NAVAL SAMPLE (N=602)

RANK GROUP	Captains	Commanders	Lieutenant Commanders	Lieutenants and below	Chief Petty Officers	PO Petty Officers
Senior Rates Leadership School 1970	-	1	3	2	3	142*
Senior Rates Leadership School 1972	-	1	2	1	-	100*
Headquarters	8	17	22	21	-	-
Guided Missile Destroyer	1	3	3	6	42	18
Leander Class Frigate	-	1	2	5	15	14
Technical Training Establishment	1	5	59	32	-	-
Seaman Training Establishment	-	-	2	15	-	-
Royal Naval Engineering College	1	1	4	44	-	-
TOTAL NUMBERS	11	29	97	124	60	274

\* Tested Twice

12.2 Distribution of officers by rank is shown in figure 21.1 in Section 21. It will be seen from these that the sample was not representative either by branch or by employment. This limitation was recognised in the outset and no attempt was made to relate to the whole range of the Naval Service. The decision was taken to restrict subjects to areas where access was attainable. For this reason the Submarine Service and the Fleet Air Arm were not considered, as being outside the experience of the researcher. Similarly no hard and fast rule was imposed upon the sample from ships when collecting data on board.

Table 12.2: - Adult Male Population of Royal Navy

<u>RN OFFICERS</u> Numbers by Specialisation (including SL and SD)			<u>RN OFFICERS</u> Numbers by Type of Officer			Total
Seaman	Engineers	S & S	Gen List	Supp List	SD	
4,600	2,960	895	5,083	1,394	1,978	8,455

Artificers	Fleet Chief	Chief	1st Class	2nd & A/2 Class	3rd Class and Apprentices	Total
	196	924	3,267	1,278	1,329	6,994

Mechanicians	Fleet Chief	Chief	1st Class	2nd Class	3rd Class	4th and 5th Class and Apprentices	Total
	45	265	2,333	861	333	500	4,337

<u>OTHER RATINGS</u>	FCPO	CPO	PO	LDG	AB and Below	Total
Total FAA and GS	290	3,146	7,548	11,087	27,681	49,752

12.3 The total number of "Officers" in terms of their pay level is shown in table 12.3 and it will be seen that the ratio of leader to led is approximately 3:5.

Table 12.3:- Numbers serving on 1 April 1972

OFFICERS	FCPO PAY LEVEL	CPO PAY LEVEL	PO PAY LEVEL	TOTAL
8,455	531	9,935	11,541	30,462

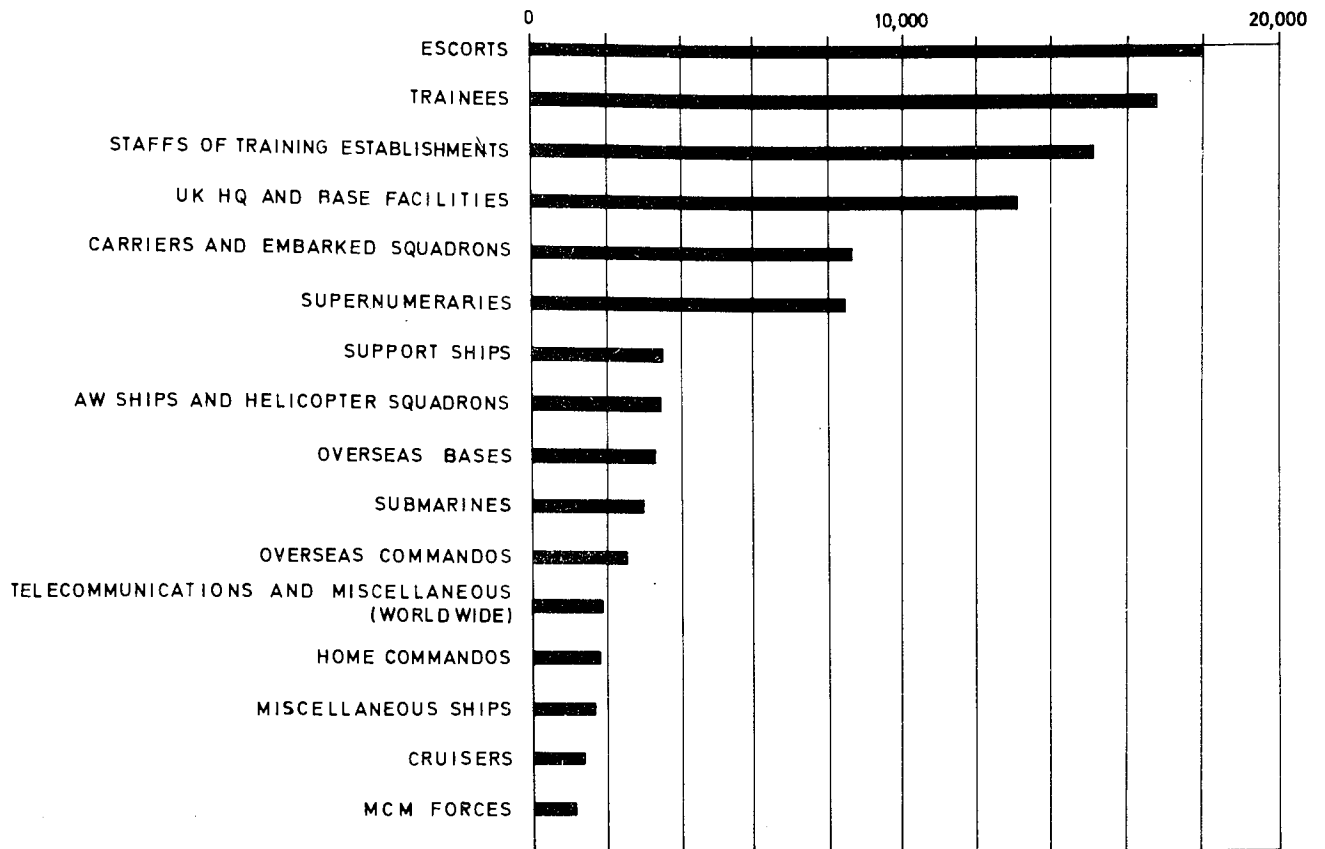


Fig 12.1 Employment of manpower in a typical year in the 1960's

12.4 In order to give an idea of the type of employment of the majority of people in the service, Figure 12.1 was prepared showing this against some broad headings. The big employers are seen to be escorts (which included frigates and destroyers) and the training environment followed by Headquarters. Thus the sample dipped into areas which together employ more than half the Naval manpower.

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SECTION 13

PSYCHOMETRIC MEASURES IN SELECTION AND TRAINING

13.1 The presentation of the results has been divided into two sections. This section reports on the use of the EPI and Cattell 16PF as a tool in selection at the AIB and for measuring training effects at HMS ROYAL ARTHUR. A concentration on the training environment was partly for administrative convenience and partly to enable the researcher to get a 'feel' for the interpretation of results. Section 14 reports the results from the attitude questionnaire and relates this with other measures. The third section in Part III is devoted to discussing the significance of these results. The data, in the form of summary tables, have been put into an Annex where these would otherwise have interrupted the flow in the main body of the report.

Selection at the Admiralty Interview Board

13.2 A sample of 113 candidates who offered themselves were given the Cattell 'A' test and this data was analysed using both the candidates' choice of branch and the outcome of the selection process as criteria. These results were examined to see if the selection process was discriminating along any dimension of personality, and also to see if any self selection process was at work along similar dimensions. Table 13.1 gives the results from the total group compared

TABLE 13.1

Personality Differences between Candidates offering themselves at the Admiralty Interview Board and British Standardisation Group (Saville).  
Cattell 16PF Raw Scores - Version A.

Factor	AIB CANDIDATES (N = 110)		BRITISH MALES		Difference + if AIB higher	T Value	Significance of difference *  t > 2.59 at p ≥ 0.01 for two tailed
	Mean	S.D.	Mean	S.D.			
A	9.31	2.85	9.35	3.09	0.04	0.14	
B	8.72	1.39	7.17	2.14	1.55	10.50	✓
C	14.98	3.42	15.25	3.88	0.27	0.77	
E	14.91	3.71	12.28	4.28	2.63	6.98	✓
F	16.24	4.33	12.39	5.05	3.85	8.75	✓
G	12.65	3.36	12.47	3.73	0.16	0.47	
H	12.85	4.64	13.25	5.51	-0.4	0.85	
I	8.16	3.31	9.16	3.42	-1.0	3.03	✓
L	10.37	3.18	8.64	3.43	1.73	5.21	✓
M	11.51	3.05	12.37	3.45	-0.86	2.77	✓
N	11.61	2.46	10.52	3.06	1.09	4.36	✓
O	9.84	3.41	10.27	4.27	0.43	1.22	
Q1	10.24	2.83	10.12	3.23	-0.12	0.41	
Q2	10.99	3.28	11.60	3.48	-0.61	1.85	
Q3	10.87	3.11	12.79	3.30	-1.92	6.19	✓
Q4	11.44	4.53	11.99	4.99	-0.53	3.79	✓

✓ Significant at p = 0.01 for two-tailed test  
if t greater than 2.59.

\*See Sect 23

with the British Male sample who took the A version in Saville's standardisation study. Use of the card bookmark printed with the high and low score descriptions of the factors will possibly assist in interpretation. The group is seen to be brighter (B+) more assertive (E+) more enthusiastic (F+) less trusting (L+) and more careless of protocol (Q<sub>3</sub>-) than the standardisation group at the p = 0.01 level of significance. Further, the group were more tough-minded (I-) more conventional (M+) and more shrewd (N+) at this level of significance on a two-tailed test.

13.3 An examination of the group on the basis of success or failure, was undertaken. Sten scores were compared using the norms calculated from the sample of naval officers and senior ratings. This comparison is summarised in table 13.2. It will be seen that there are some significant differences between the two groups and in particular the successful candidates were more assertive (E+) less tough minded (I+) more self assured (O-) and less smug than those who were rejected by

TABLE 13.2

Significant Personality Differences between Successful and Unsuccessful Candidates at the Admiralty Interview Board

	Successful (N=32)		Unsuccessful (N=78)		Difference between Means	Value of t	Significance
	MEAN	S.D.	MEAN	S.D.			
A	5.47	1.79	5.44	1.86	+0.03	.08	
B	5.81	1.46	5.68	1.39	+0.13	.43	
C	6.16	1.46	5.64	1.91	+0.52	1.4	
E	6.32	1.74	5.69	1.68	+0.63	1.68	✓
F	6.09	2.09	6.31	2.15	-0.22	.49	
G	5.37	1.87	4.93	1.69	+0.44	1.14	
H	6.03	1.68	5.82	1.71	+0.21	.58	
I	6.35	1.73	5.65	2.11	+0.70	1.80	✓
L	6.22	1.52	6.03	2.08	+0.19	.53	
M	4.88	1.77	5.41	1.82	-0.53	1.43	
N	5.56	2.15	5.02	1.70	+0.54	1.46	
O	4.69	1.63	5.56	1.98	-0.87	2.35	✓
Q1	5.59	2.03	5.56	1.97	+0.03	.07	
Q2	4.50	1.75	5.09	1.91	-0.59	1.55	
Q3	5.81	2.49	5.05	1.88	+0.76	1.90	✓
Q4	5.00	2.05	5.50	1.89	-0.5	1.2	

✓ Significant at p = 0.1 for two tailed test when 't' is greater than 1.61

the board.

13.4 The analysis of the results according to the branch selected by the candidates is summarised in table G.2 in Annex G. The samples were too small to justify detailed study but some interesting points emerged. The groups were homogeneous on seven factors. Potential airmen were more reserved and more self

sufficient than the others. Potential Engineer officers were more intelligent, more diffident and less self-reliant than the remaining groups. Potential Seaman Officers were less mature, less self-reliant, markedly more apprehensive and more conservative than the rest of the sample. No equivalent analysis was attempted of the successful candidate on this basis because the numbers were insufficient but it would be worthwhile on the further data being collected in Spring 1973, and it is understood that this is planned.

### LEADERSHIP TRAINING

#### Longer term effects of training

13.5 The sample of 150 petty officers who in 1970 had completed the leadership course at HMS ROYAL ARTHUR and had also taken the test batteries were invited to take part in a follow-up study two years later as described in Section 9. The method used to gather information was found to be successful. Feedback indicated that no large problems were encountered in its administration on board ships or in establishments. N = 142 (95%) of the original sample were approached through their commanding officer and N = 124 (83%) replies were received. The scores from

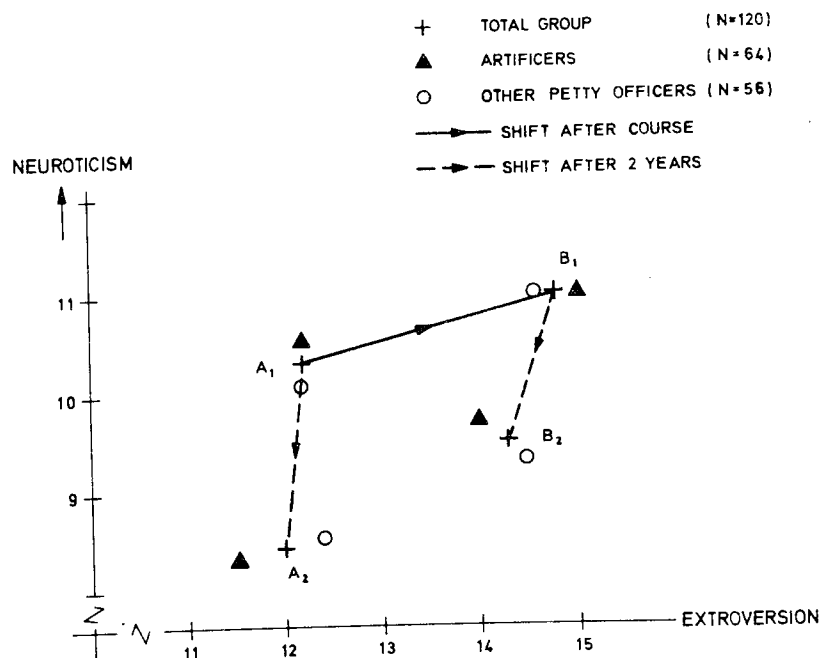


Fig 13.1 E.P.I. Scores for Royal Naval Petty Officers taken on four occasions.

E.P.I. Form A and Form B were added to the original data and additional statistics were extracted. These results are shown graphically in Figure 13.1. Results are also given in Tables G.3 to G.6.

13.6 A measure of change after a six week course may indicate a temporary effect and in examining this a repetition of the tests after a two year period, might show higher correlations with the 'post-test' scores than were found with the 'pre-test' scores if the change was not transitory. The null hypothesis states that there will be no significant difference when comparing the results of tests given after two years and those of tests given either before or after the course of leadership training. It will be seen that the correlations are in the predicted sense. The difference of scores in various occasions were tested for significance.

TABLE 13.3

E.P.I. Tests examined	Value of t					
	N			E		
	ALL	ARTS	REST	ALL	ARTS	REST
A <sub>1970</sub> compared with B <sub>1970</sub>	2.09	1.04	1.83	8.0	6.17	5.16
A <sub>1970</sub> compared with A <sub>1972</sub>	5.13	4.37	3.09	0.79	1.9	.82
B <sub>1970</sub> compared with B <sub>1972</sub>	4.89	3.03	3.99	1.68	2.56	.24

13.7 It had been noted that the results in 1970 had contained a tendency for artificers and other petty officers to react in dissimilar ways so their results were separated. This tendency was seen to persist in the effects over time on the extroversion score and would be explained by the process of maturation, because the mean age of the group of artificers was 22.0 years at the time of the first tests compared with 26.8 for the other petty officers. To examine these effects a graphical presentation was undertaken based on the shift experienced as a result of the course of leadership training. The total sample was divided up into five nearly equal groups based on the direction of the shift as shown in figure 13.2. Each group was then considered separately and the difference in score between A tests after two years was plotted as a polar diagram. A similar vector for the shift in the B test after two years was plotted on the same diagram and the resultant parallelograms were examined. This graphical representation is shown in Figure 13.3.



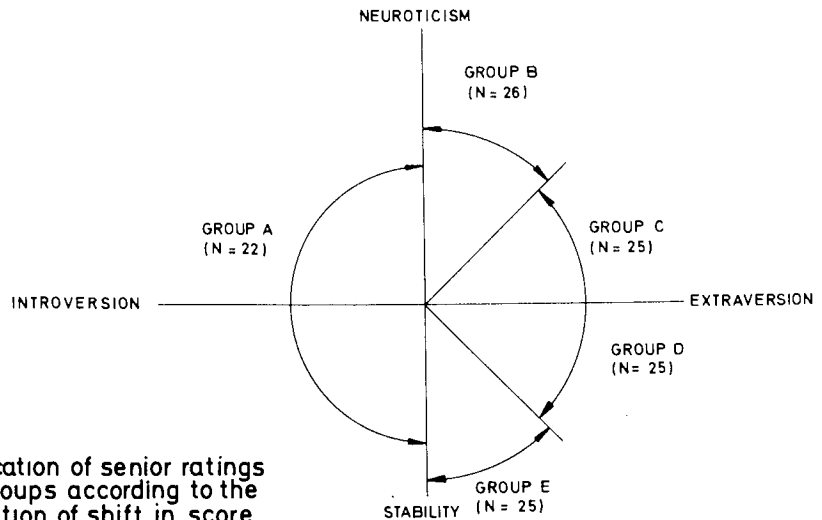
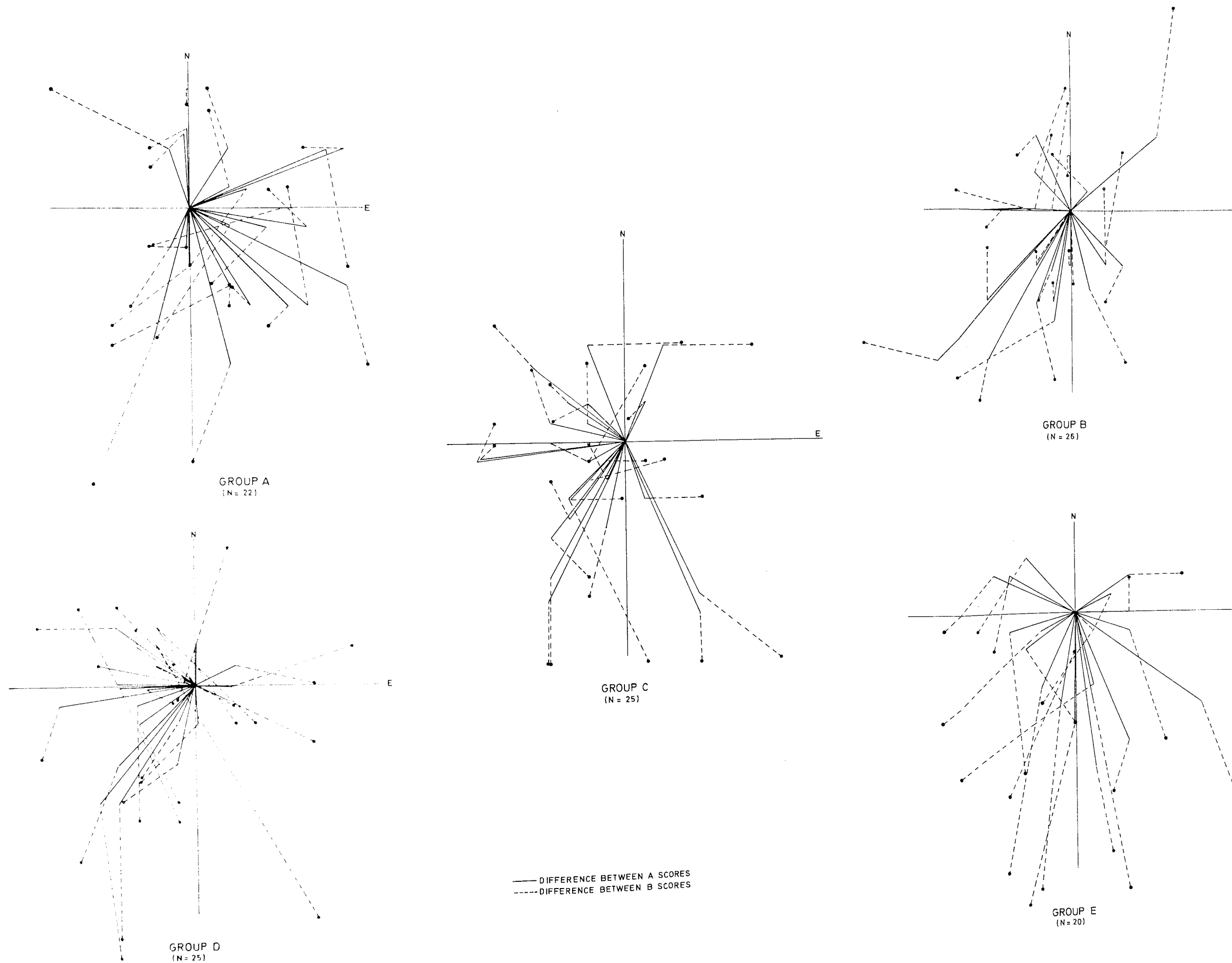


Fig.13.2 Allocation of senior ratings to groups according to the direction of shift in score on EPIS taken before and after the course at HMS Royal Arthur

13.8 Very distinctive patterns were obtained from these spider charts displaying a cohesive behaviour pattern within the groups. Those in Group A were noted as moving into the Introvert quadrants as a result of the course, shifted in the stable, extrovert direction, two years later. Group B, made more neurotic by the course tended to become more stable and more introvert with the passage of time. Group C had been selected because they had become more extrovert and less stable as a result of the course. This trend was reversed in the case of the A tests over the two year period. Group D also became more extrovert as a result of the course but with additional stability. Passage of time caused this to decrease with a shift towards introversion. Group E was noted for being more stable as a result of the course along with more extrovert. This group was the only one to continue with the general direction of the change. This pattern formation is seen as containing a key to the interpretation of changes in personality measures, on the basis that the direction of change is more important than the absolute score or the size of the change.

SECOND SAMPLE OF PETTY OFFICERS TESTED AT HMS ROYAL ARTHUR (1972)

13.9 The Raw Score results obtained from the repetition of data collection at HMS ROYAL ARTHUR are presented, showing both the 1970 and 1972 groups for ease of comparison. These are reproduced in Annex G tables 7 to 21. The completed questionnaires were examined for any obvious mistakes or sabotage. Subsequently, the raw data presented to the computer for processing was examined. In particular the scoring program 'PERSON' version 4, for the Cattell 16 P.F.Q. identified subjects who had submitted multiple answers or had omitted questions. In addition



'SPIDER' Charts showing direction and size of differences in EPI Scores for Forms A and B (Subjects grouped according to effects of Training)

a warning was given if a chi-square test of the split-half results indicated an unacceptable level so that follow-up action could be taken. Histograms of factor scores sub divided by course, showing the shift as a result of the course were examined to disclose any unforeseen effects. These are reproduced as Figures 1 to 16 in Annex G. It will be noted that considerable reliance has been placed on graphical representation of data. It was a bias that was caused by the author's engineering background combined with a warning against the dangers of examining 'groups' rather than collections of individuals (Singleton 1969) inherent in statistical analysis of small samples. For this reason, the data collected was examined in two ways. EPI scores were plotted graphically and examined according to the rules devised in the pilot study. The scores from the 16PF were compared using computer based statistical analysis.

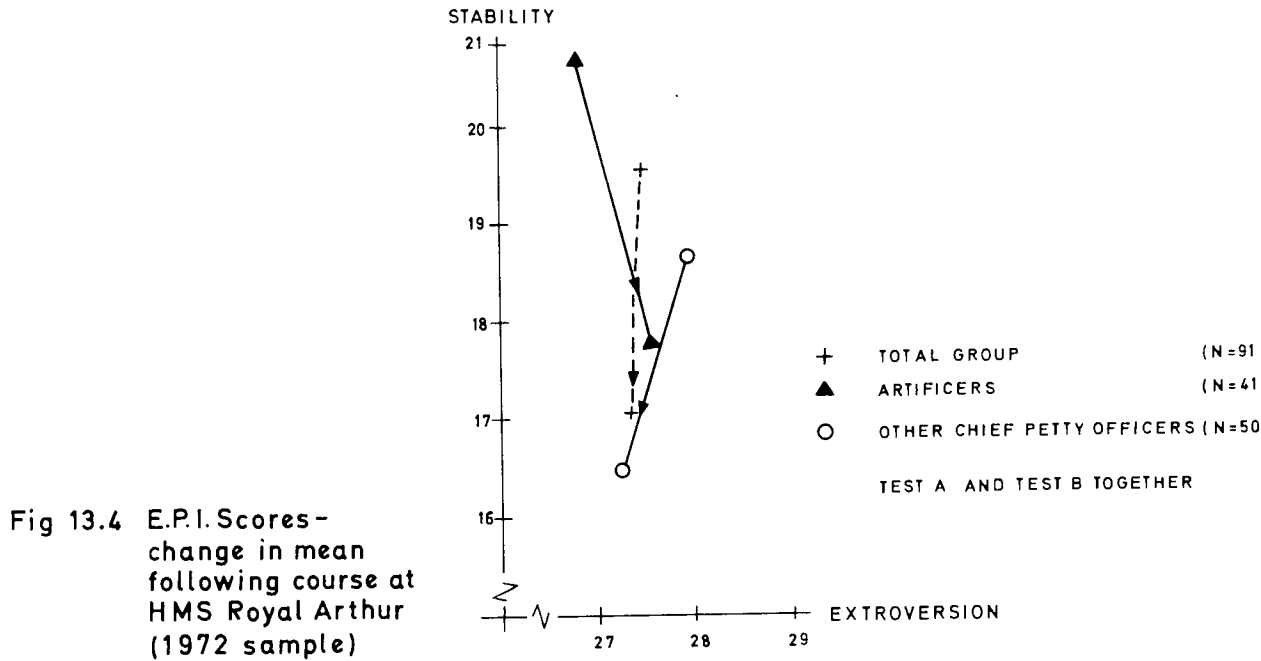
### Hypothesis Testing

13.10 In paragraph 6.29 it was stated that on the assumption that a man's personality changes with experience, it seemed reasonable to expect that any such change can be measured by a suitable personality test. An intensive course in leadership may result in a change of attitudes by the student, and a personality measure will detect these changes. The null-hypothesis in this case states that the difference between means of tests taken before and after the course will not be significant at the 0.01 level. Table 13.4 gives the result of this analysis

TABLE 13.4

	FACTOR	1970 Sample		1972 Sample	
		t score	SIGNIFICANCE at P < 0.01 (t = 2.57) d.f. = 144	t score	SIGNIFICANCE at P < 0.01 (t = 2.63) d.f. = 90
E.P.I.	N	3.24	/	2.59	
	E	8.81	/	3.05	/
	L	6.65	/	7.03	/
16PFQ	A	4.43	/	0	
	B	1.42		1.27	
	C	0.58		2.85	/
	E	2.74	/	2.37	
	F	1.87		1.72	
	G	3.75	/	2.28	
	H	4.4	/	4.75	/
	I	1.83		1.05	
	L	1.95		1.1	
	M	1.12		.52	
	N	10.0	/	.70	
	O	1.47		1.14	
	Q1	2.12		1.05	
	Q2	4.74	/	2.67	/
	Q3	2.46		.34	
Q4	2.38		2.5	/	

and it will be seen that EPI scores were significantly changed by the course as were factors H and Q2. Thus the hypothesis can be supported to the extent that the course results in candidates being more extrovert, less spontaneous and more resourceful. Figure 13.4 shows how the total group became more stable and less extrovert over the period of the course. It also shows that artificers as a group became more extrovert.



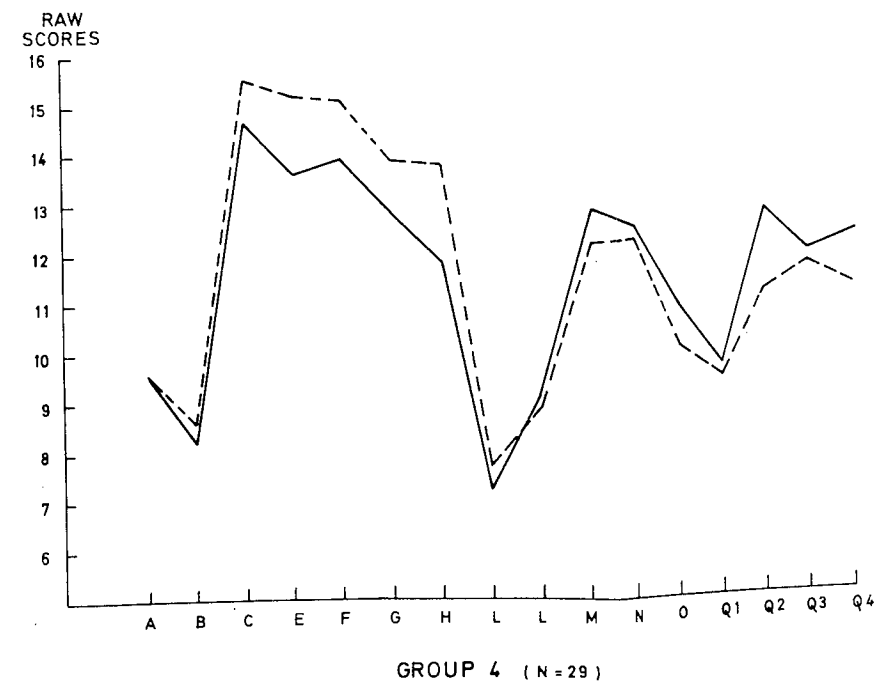
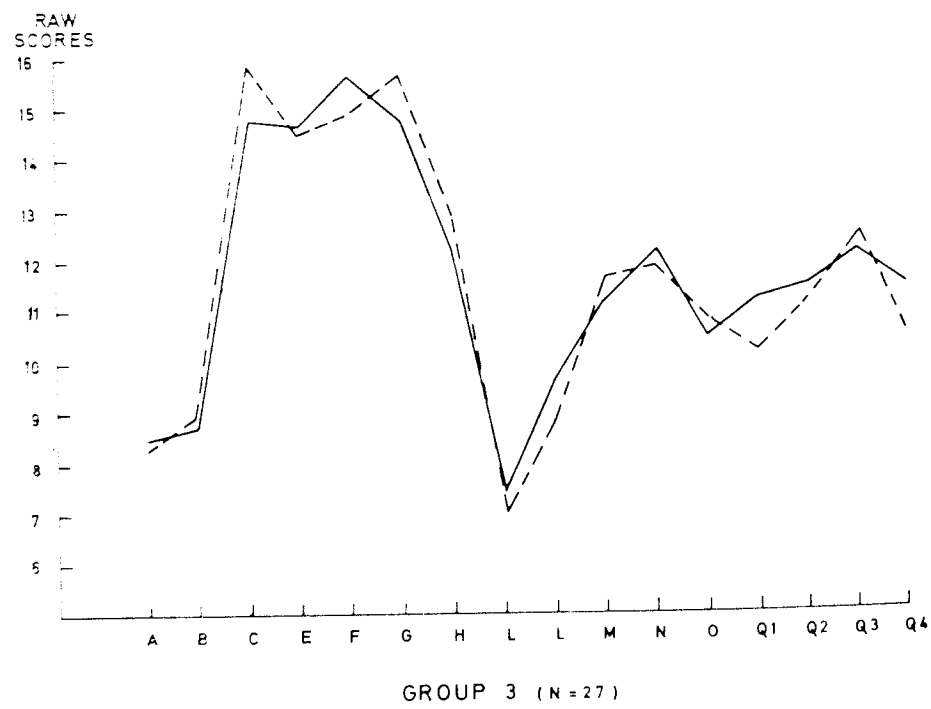
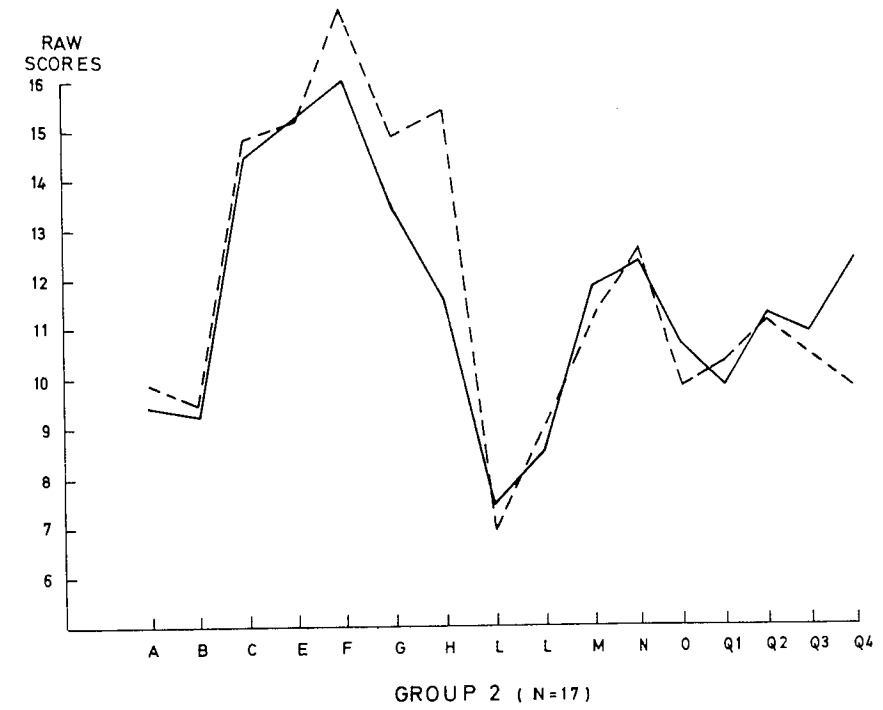
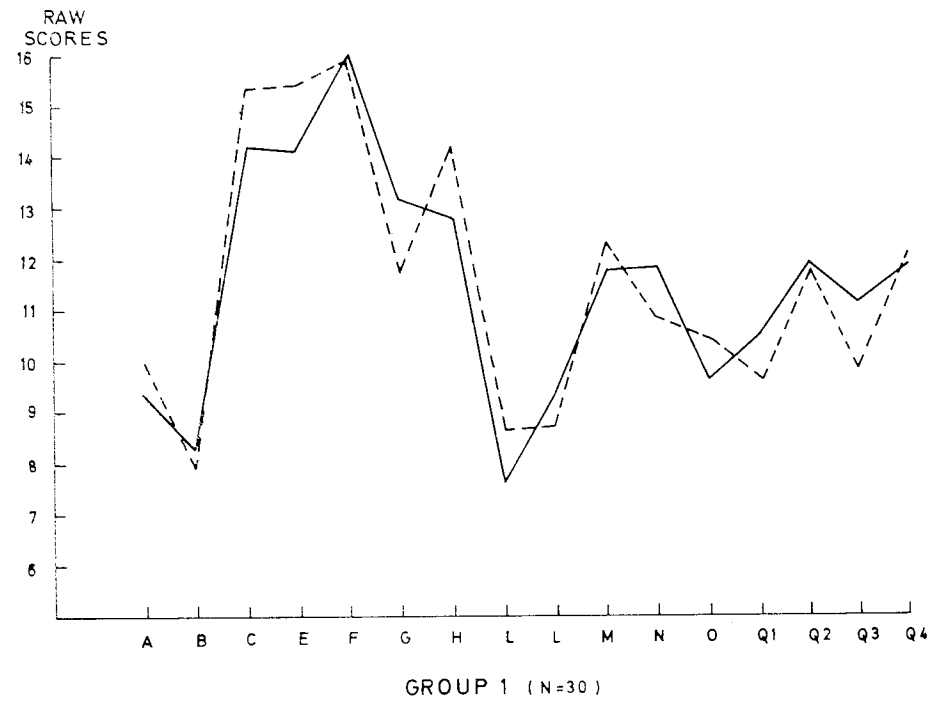
COMPARISON OF GROUPS

13.11 The Cattell 16 PFQ Scores for the groups on course at HMS ROYAL ARTHUR were compared using the function coefficient of similarity 'f' described in paragraph 7.13. A group from a working environment ashore and one afloat were added to the analysis and the results are shown in Table 13.5.

TABLE 13.5 VALUES OF 'f' FOR GROUPS TAKING 16 PF Form A

		HMS ROYAL ARTHUR								
		BEFORE				AFTER				
COURSE		1	2	3	4	1	2	3	4	
Before	1									If 'f' less than 72 groups or similar.  If 'f' greater than 182 groups are different at p = 0.1 level
"	2	76								
"	3	85	87							
"	4	98	127	167						
AFTER	1	149	155	317	244					
"	2	140	107	109	284	297				
"	3	178	119	54	226	380	93			
"	4	82	72	79	135	191	82	82		
TRAINING SCHOOL		75	90	80	115	278	143	93	60	TRAINING SCHOOL
DLG		166	249	130	165	589	326	251	167	179

13.12 It will be seen that with the exception of group 3, the groups are not statistically similar when comparing scores obtained before and after the leadership training course. The third group is seen to be statistically similar despite the course. This may be considered further in the light of the assessment of the course reports where the independent assessor said that those for that particular group were less well prepared than the others. It is possible that the benefits obtained by the group as a whole are very dependent upon the commitment by the course officer. It may also be that the group takes on an independent characteristic which holds the ratings together giving them a certain cohesiveness resulting in them considering themselves cohorts. It will be noted that the training staff, and groups 1, 2 and 3 after they had completed the course were significantly different from the sample from a warship. This may have relevance in the context of the comment frequently heard to the effect that the training at HMS ROYAL ARTHUR is in advance of the views held in the fleet. To complete the presentation of data for the sample as groups, the profiles of raw scores before and after the course for each group is shown in figure 13.5 and the distribution on each score is shown in Annex G, figures 1 - 16.



——— 16 PFQ BEFORE COURSE  
 - - - 16 PFQ AFTER COURSE

16 PFQ - mean scores of groups of Petty Officers before and after course at HMS Royal Arthur

## Cattell second order Factors

13.13 A comparison of the second order factors was undertaken, and these were calculated on the following basis as described in Cattell (1957).

$$\begin{aligned} \text{Anxiety} &= 0.18 \times \text{Factor C} - 0.17 \times \text{Factor H} \\ &+ 0.19 \times \text{Factor L} + 0.3 \times \text{Factor O} - 0.2 \times \text{Factor Q3} \\ &+ 0.38 \times \text{Factor Q4} \end{aligned}$$

$$\begin{aligned} \text{Exvia} &= 0.17 \times \text{Factor A} + 0.33 \times \text{Factor E} + 0.41 \times \text{Factor F} \\ &+ 0.48 \times \text{Factor H} - 0.16 \times \text{Factor Q1} \end{aligned}$$

$$\begin{aligned} \text{Tough Poise} &= - 0.42 \times \text{Factor A} + 0.19 \times \text{Factor C} \\ &+ 0.17 \times \text{Factor E} + 0.23 \times \text{Factor F} - 0.55 \times \text{Factor I} \\ &- 0.19 \times \text{Factor M} + 0.2 \times \text{Factor N} \end{aligned}$$

$$\begin{aligned} \text{Independence} &= - 0.27 \times \text{Factor A} + 0.44 \times \text{Factor E} \\ &- 0.16 \times \text{Factor G} + 0.32 \times \text{Factor M} + 0.39 \times \text{Factor Q1} \\ &+ 0.36 \times \text{Factor Q2} \end{aligned}$$

The results for the two samples are given in table G.23 and Correlations with EPI scores are given in table G.24

Two points emerge from a study of these results. Both courses show shifts in the same direction as a result of the course of leadership training, and there is a close positive correlation with the equivalent E.P.I. factors in the case of Anxiety and Stability and Exvia and Extraversion. Should it be decided to continue research into training effects, the use of Cattell 2nd order factors would provide similar data to the E.P.I. and would have other benefits and therefore is to be the preferred instrument.

13.14 An assumption that group Characteristics were predominant suggested that because of age and selection differences, Artificers, and non technical petty officers when compared would show significant differences in performance on course and that this might be explained by personality differences between the groups. Paragraph 6.31 stated that these differences would be displayed, both in terms of total scores on personality inventories, and by a different response to the training which was measured by the assessment of the training staff. The null-hypothesis stated that there would be no significant difference between total scores, the change in scores or course assessments for Artificers compared with the rest of the group. Results of Analysis of the data to examine this is given in table 13.6.

TABLE 13.6

	OTHER PETTY OFFICERS (N = 50)	ARTIFICERS (N = 41)	difference	Value of t	Significant at P = 0.01
Assessment of Leadership	5.1	4.1	1.0	14.29	✓
Assessment of Leadership Potential	6.6	6.2	0.4	5.4	✓
Eysenck Factor N	2.2	2.8	0.6	2.43	✓
Pre tests - E	0.7	-0.5	1.2	5.06	✓
Post tests L	-0.8	0.0	0.8	6.35	✓
Cattell A	0.8	-0.8	1.6	9.41	✓
16PF B	-0.3	-0.1	0.2	1.89	✓
Pre test - C	-0.6	-1.2	0.6	2.88	
Post test E	-0.8	-1.0	0.2	.83	
F	-1.0	-0.2	0.8	.91	
G	-0.7	-0.5	0.2	-1.18	✓
H	-1.4	-2.4	1.0	3.86	
I	-0.3	-0.3	0	0	
L	0.3	0.3	0	0	
M	-0.3	0.4	0.7	2.92	✓
N	-0.1	0.5	0.6	3.3	
O	0.1	0.5	0.4	2.4	
Q1	0.4	0.2	0.2	1.09	
Q2	1.2	0.6	0.6	2.74	
Q3	-0.1	-0.1	0	0	
Q4	0.6	1.4	0.8	3.16	
AGE	28.3	23.5	4.8	20.43	✓

It may be seen that the results of EPI scores, for extroversion and neuroticism, and the 16PF Factors A, C, H and M showed significant differences at the p = 0.01 level. Similarly tests of the assessments gained and the average ages indicate that the two groups are not taken from the same population.

13.15 Predictive use in Training Environment

It was proposed in the rationale that a measure of personality could assist in making training more effective by enabling the school to predict the likely response and adjust the training given accordingly. It would also help in career planning as stated in paragraph 6.30. On the assumption that there is a significant difference between the scores in tests before and after completing the course, this hypothesis stated that the change in attitudes can be used as a predictor of the success on course as measured by the subjective assessment of the course officer and his staff. The null-hypothesis was that there would be no significant correlation between the predictor scores and the intermediate criteria of performance. To test this, the results of the EPI tests taken before and after



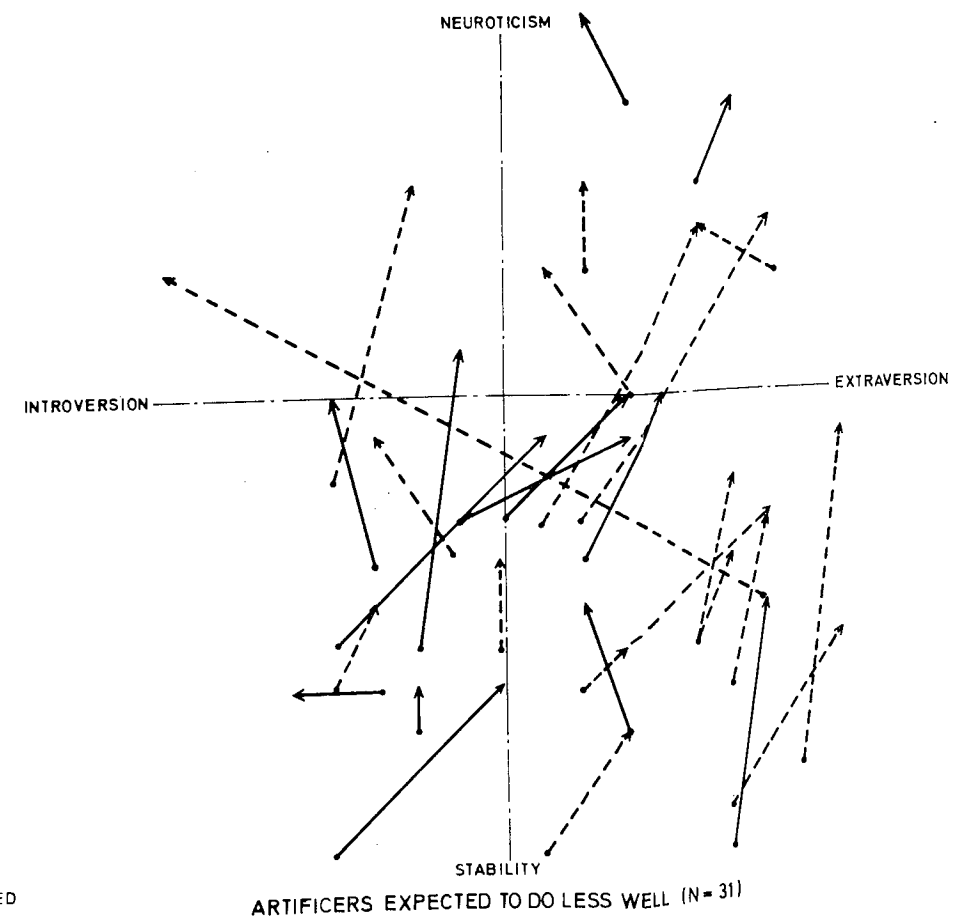
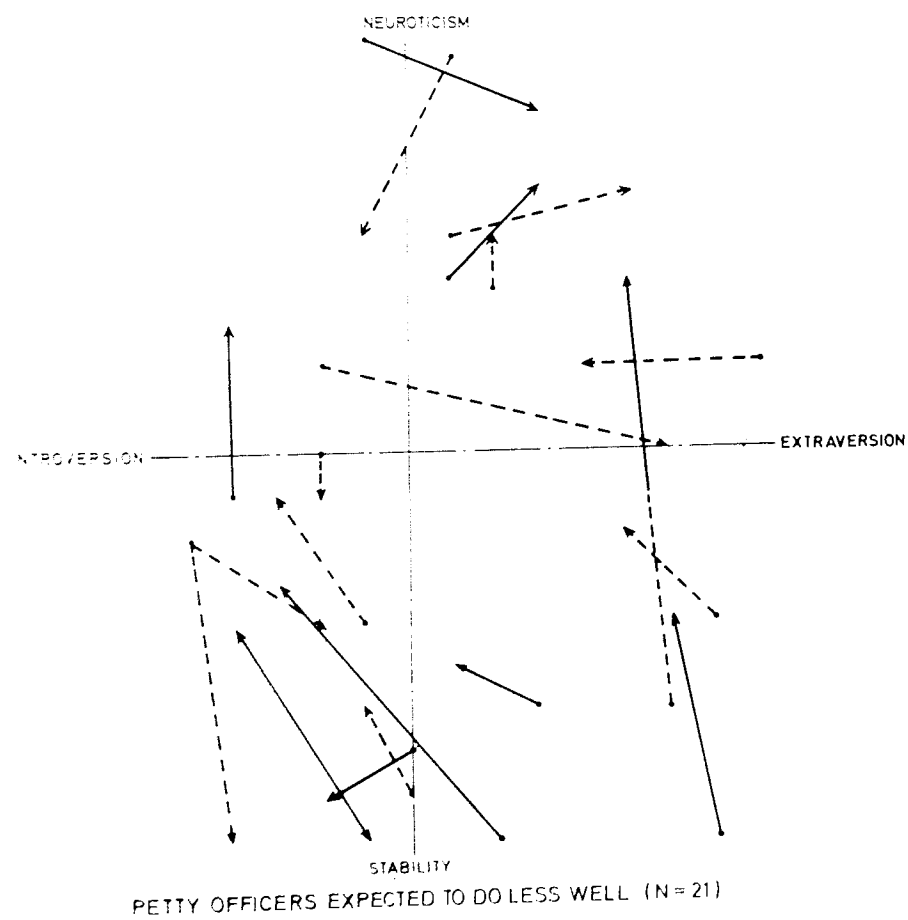
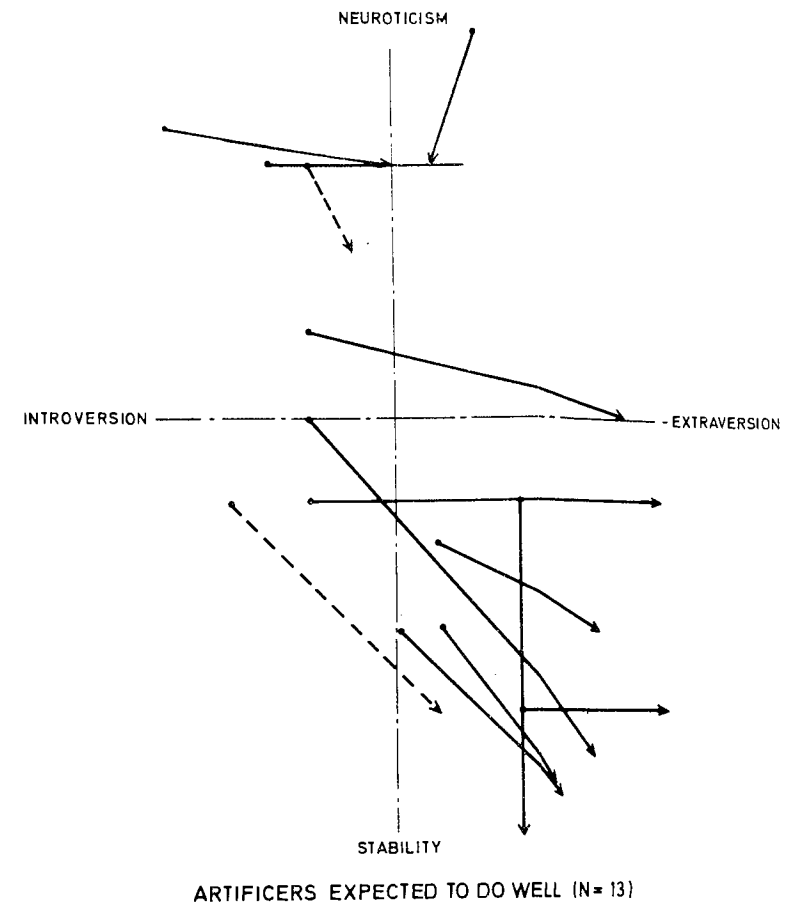
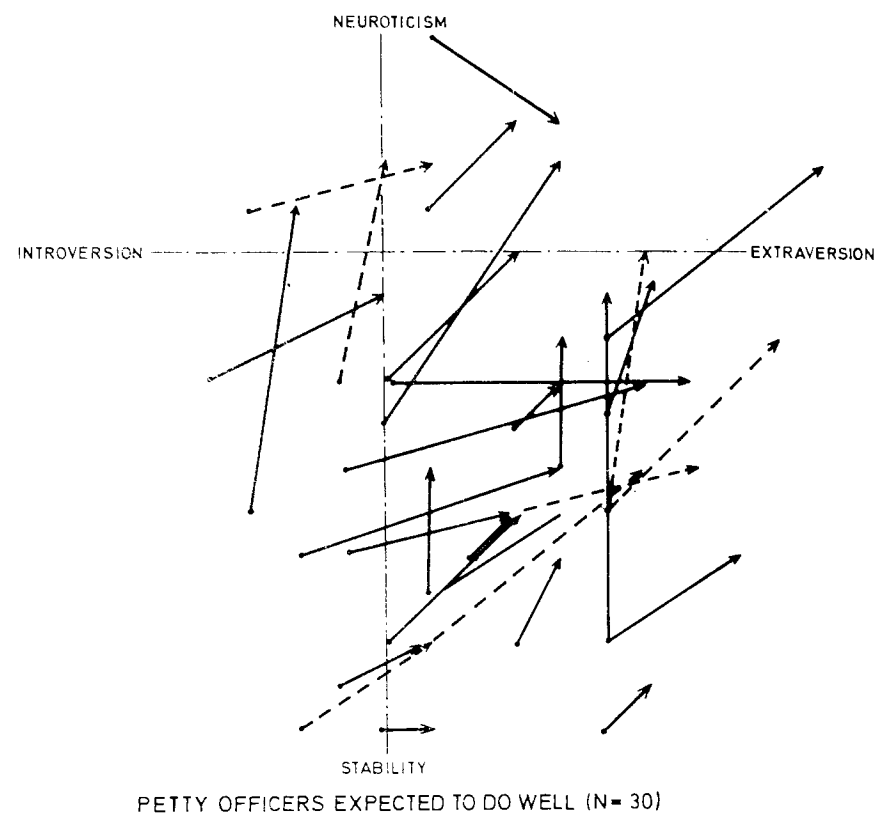
the course were compared for individuals as was done in the 1970 sample and as on that occasion, the results were examined to test whether they provided a predictor of success on the course. It had been observed in the previous experiment that Petty Officers who had been rated as good leaders had shown a shift from the more stable to the less stable and from the introvert to the extrovert end of the scales. A quite different response was observed in those who were rated less good as leaders. The leadership criterion chosen had been the score given by the course officers on completion of the six weeks at HMS ROYAL ARTHUR.

13.16 It had also been observed that the younger, more intelligent artificer who did well had shifted in the directions of greater stability and a more extrovert response. To examine whether these were viable predictors, vectors were plotted for the artificers and other Petty Officers on separate charts and each vector was judged according to the direction of shift. The resulting plot is shown in figure 13.6. The rule adopted to judge the accuracy of prediction was that a score of greater than 5 in both leadership and leadership potential classed a man as good whereas a score of less than 5 in either categorised him as less successful. Subsequently, a study of the results showed that no rating was given a score of less than 5 in leadership potential. This was raised with the staff at HMS ROYAL ARTHUR who explained that since the document reporting upon the Petty Officer was shown to him as a means of feed back from the course it was a matter of principle to encourage everybody with a respectable score for "potential" even if their performance during the six weeks was in itself not satisfactory.

TABLE 13.7 Prediction of success on Course using Shift in EPI Score 5

		Assessed Good by Course Officer	Assessed less Good by Course Officer	Total
P R E D I C T I O N S	Good Artificers	11	2	13
	Less Good Artificers	18	13	31
	Other Petty Officers Predicted Good	23	7	30
	Other Petty Officers Predicted less Good	12	9	21
		64	31	95

It will be seen that 56 correct predictions were made in 95 opportunities.



———— AS PREDICTED  
 - - - - NOT AS PREDICTED

Plots of EPI vectors for use as prediction of success on course - 1972 group

Only 31 of the sample were judged less good by the Course Officers. A chi squared test on the results gave 2.87 for Artificer (1.42 using Yate's correction for Continuity) and 2.19 for Other Petty Officers (1.39 when corrected). There was 1 degree of freedom so the results for artificers were significant at the  $p = 0.1$  level. The results overall were not significant and it was concluded that the rules for prediction were not valid.

### Summary

This section reports on various applications of the 16PF and EPI in the selection and training fields, where various hypothesis have been examined and the use of the tests assessed. The next section reports on a wider application.

SECTION 14

RESULTS OF PERSONALITY AND ATTITUDE MEASURES.

14.1 The results obtained from the 16 PF test were combined to produce a set of normalized Stens. Where a particular subject took an A and a B test, the A test result was used. Where a subject took the A test twice, the results obtained on the first occasion were used. Results for all subject (N = 484) were combined and are presented as Raw scores in a Sten Table. For ease of comparison, this matches the presentation used in the NFER report of British Norms (Saville 1972).

Table 14.1 - RAW SCORES - CATTELL 16 PF QUESTIONNAIRE (1962 Edition)

ROYAL NAVAL OFFICERS AND SENIOR RATINGS: Form A.N = 484 (Mean Age 28.1 Years SD 6.5)

Factor	Sten Score										Factor	Mean	SD
	1	2	3	4	5	6	7	8	9	10			
A	0-2	3-4	5	6-7	8	9-10	11	12-13	14-15	16-20	A	9.3	3.1
B	0-4	5	6	7	8	9	10	11	12	13	B	8.7	1.8
C	0-6	7-8	9-10	11-12	13-14	15	16-17	18-19	20-21	22-26	C	14.6	3.8
E	0-5	6-7	8-9	10-11	12-13	14-15	16-17	18-20	21	22-26	E	13.9	4.0
F	0-5	6-7	8-9	10-11	12-14	15-16	17-18	19-20	21-22	23-26	F	14.6	4.3
G	0-4	5-7	8-9	10-11	12-13	14	15-16	17	18	19-20	G	13.3	3.5
H	0-2	3	4-5	6-8	9-11	12-14	15-17	18-19	20-21	22-26	H	11.9	5.3
I	0-1	2	3	4-5	6	7-8	9-10	11	12-14	15-20	I	7.6	3.3
L	0-2	3-4	5	6-7	8	9-11	12	13	14-15	16-20	L	9.6	3.3
M	0-5	6	7-8	9	10-11	12-13	14	15-16	17-18	19-26	M	11.8	3.3
N	0-6	7	8	9-10	11	12	13-14	15	16	17-20	N	11.9	2.7
O	0-3	4	5	6-7	8-9	10-11	12-13	14	15-16	17-26	O	10.2	3.5
Q1	0-4	5	6	7-8	9	10	11-12	13	14	15-20	Q1	10.0	2.7
Q2	0-4	5-6	7	8-9	10-11	12-13	14	15-16	17	18-20	Q2	12.0	3.4
Q3	0-5	6	7	8-9	10	11-12	13	14	15	16-20	Q3	11.2	2.9
Q4	0-2	3-4	5	6-8	9-11	12-13	14-16	17-18	19	20-26	Q4	11.8	4.7
	1	2	3	4	5	6	7	8	9	10			
	Sten Score												

14.2 The results presented in table 14.1 are considered to be an important contribution in so far as they provided the framework on which later analysis was based. The total sample was also compared with other norms. Paragraph 6.33 set up an hypothesis by stating that the results of personality measures using psychometric techniques might be expected to reflect the effects of a careful selection and training procedure for producing the leaders of the Naval Service. This would be demonstrated by a significantly different profile for the group when compared with the total population. The null hypothesis states that there is no significant difference between the mean scores of the Naval sample and the mean from the total British population, on the Cattell 16 PF.

14.3 Using the data from the total group to examine this, a series of tests for significance were calculated. Table 14.2 shows the results obtained on the 16PF compared with the raw scores for the A test quoted in the NFER report of results from a carefully balanced sample from the British population (Saville 1972).

TABLE 14.2

Significant Personality Differences between the Naval Sample of leaders and British Standardisation Group. Cattell Form A.

NAVAL SAMPLE (N=484)			BRITISH MALES (N=1057)		Difference in Means + if RN Higher	Value of 't'	Significance*
Factor	Mean	SD	Mean	SD			
A	9.3	3.1	9.3	3.1	0	-	
B	8.7	1.8	7.2	2.1	+ 1.5	14.4	✓
C	14.6	3.8	15.2	3.9	- 0.6	1.79	
E	13.9	4.0	12.3	4.3	+ 1.6	7.14	✓
F	14.6	4.3	12.4	5.1	+ 2.2	8.83	✓
G	13.3	3.5	12.5	3.7	+ 0.8	4.1	✓
H	11.9	5.3	13.3	5.5	- 1.4	4.8	✓
I	7.6	3.3	9.2	3.4	- 1.6	8.69	✓
L	9.6	3.3	8.4	3.4	+ 1.2	6.52	✓
M	11.8	3.3	12.4	3.4	- 0.6	3.26	✓
N	11.9	2.7	10.5	3.1	+ 1.4	9.0	✓
O	10.2	3.5	10.2	4.3	0	0	
Q1	10.0	2.7	10.1	3.2	- 0.1	0.6	
Q2	12.0	3.4	11.6	3.5	+ 0.4	2.13	
Q3	11.2	2.9	12.8	3.3	- 1.6	9.7	✓
Q4	11.8	4.7	12.0	5.0	- 0.2	.46	

$p > .01$  when  $t > 2.58$

\*See Section 23

14.4 It can be seen from this comparison of samples that the Naval leader is more assertive (E+) more enthusiastic (F+) more conscientious (G+) more restrained (H-) more tough minded (I-) less trusting (L+) and more shrewd (N+) than the general population. A high score on Q3 has been interpreted in the literature as indicative of smugness, thus the naval leader is less smug (Q3-) and brighter (B+) than the group from which he was selected. The author suggests that these results support the hypothesis that Naval leaders differ significantly along dimensions of personality from the general male population. In subsequent discussion, working groups are discussed in relation to this Naval population so these norms have been included in the library of Norms stored in the computer at the Middlesex Hospital Medical School. They were also used in the determination of personality profiles for individuals where this was required for an examination of smaller groups.

14.5 Figure 14.17 at the end of the section shows the distribution of raw scores for the 16 factors of the Cattell Personality Inventory, for the 484 officers and ratings included in the Naval Sample. Each factor will be discussed in turn.

Factor A shows a close approximation to a normal distribution matching the general population. The occupational performance associated with this factor is that of success in dealing with people for cyclothymes and dealing with things or ideas for schizothymes. The factor is 'co-operative' with Factors F, H and L and all of them contrast sociable, outgoing, genial behaviour with desurgent trends, and contribute to the second order factor, extraversion. Artificers and S D engineer officers scored lower on this factor.

Factor B measures a form of what Cattell calls 'crystallised' intelligence and has been included because it has systematic personality associations as the following bipolar descriptions indicate. Thoughtful and cultured vs unreflective and boorish; persevering, conscientious vs quitting, conscienceless; smart and assertive, vs dull and submissive. The group from which this sample was drawn were all selected against measures which took note of intelligence and this is reflected in the distribution of scores which shows a skew towards the high end of the scale. The mean scores for the various classes in the sample were in the expected order.

14.6 Factor C measures Ego strength vs proneness to neuroticism. There is a noticeable skewness towards the positive end of this distribution, described as emotionally stable. A freedom from neurotic symptoms, being realistic about life, steadfast, calm, loyal and dependable fits the image of the leader. This factor

is found to be high in people employed in occupations where there is a need for resistance to the wear and tear of emotional situations. It is correlated with success in leadership activities.

Factor E measures Dominance. A positive score indicates self-assertive vs submissive, adventurous vs timid. The mean for the total sample falls slightly towards the positive descriptors and this is to be expected in a profession which encourages self-sufficiency. It is associated with a general temperamental forcefulness modifiable partly by experience. Artificers were the lowest scorers on this factor.

14.7 Factor F measures surgency and the distribution is skewed towards the high end. Descriptors include cheerful, responsive, energetic, humorous, resourceful, sympathetic and open. The descriptors for a low score include pessimistic, retiring, introspective, anxious and slow to accept a situation bound by habit, suspicious, brooding and narrow. Surgency has been found significantly associated with initial choice as a leader in new groups (Cattell 1957). Surgency shows a steep downward age trend between 20 and 30 years of age. The lowest scoring group was special duties Engineer officers who also had the highest average age.

Factor G measures Super-ego strength. Again in this factor the Naval Officer and senior rating sample shows a skew towards the high end of the scale. This corresponds with descriptors such as persevering, determined and responsible. At the other end of the scale descriptors such as frivolous, immature, unscrupulous, neglectful of social duties, changeable, have been identified. This again fits in with the stereotype. Associated with these descriptors are emotional maturity, slowness to anger and a readiness to co-operate arising from self-assurance and a practical, logical and realistic approach. Artificers were the lowest scorers while the officer groups were at the higher end.

14.8 Factor H measures parmia or the 'thick-skinned'. The distribution of scores for this factor is widely spread throughout the range. This represents recognition of some contradictory descriptors when considered in the context of the Naval profession. High scores on this factor would be associated with the man who likes meeting people, gregarious, kindly, self confident, showing strong interest in the opposite sex; descriptors which well fit the image of "a girl in every port". Some of these descriptors bear a strong superficial resemblance to both Factors A and F, but have a boldness vs shyness connotation. H increases with age. Artificers were the low scorers and the General list officers were high scorers.

Factor I measures Premia. The distribution for this factor is notably skewed towards the negative end of the scale. This matches descriptions such as hard, lacks artistic feeling, practical, logical and self sufficient and free from hypochondria. This is a list which would probably be accepted as part of the stereotype of a Naval Officer. The positive loading of this factor is identified with fastidious, introspective, gentle, and effeminate. It is of interest that the negative pole correlated with a man who is capable, self reliant, not a good follower and suffers fewer illnesses.

14.9 Factor L examines Protension. The distribution of scores is approximately normal and covers the full range of the factor, which represents a trustful, understanding, composed characteristic, compared at the other end with a suspicious, careless, self-sufficient and withdrawn nature. Both ends of the spectrum are seen in members of the profession and are unlikely to be related to success but high L has been found to correlate with low morale (Cattell 1957).

Factor M measures Autia. The distribution displays leptokurtosis being more peaked in the middle than the normal distribution. Low descriptors such as conventional, practical and conscientious contrast with the positive loading. This is linked with unconventional eccentricity and occasional hysterical emotional upsets. It is to be expected therefore that one would find a cut off at the higher end of this factor amongst a population of Naval Officers and Senior Petty Officer and this can be observed.

14.10 Factor N measures Sophistication. The distribution is skewed towards the positive end of the factor where descriptors include socially skilful, insightful regarding self and others, cool and aloof, compared with low scores equating with socially clumsy, vague and lacking self insight. The N positive person is a clear thinker with a trained realistic and expedient approach to problems. The N negative person is vague, sentimental, and gets along with people in a primitive heart to heart understanding but has no skills in anticipating personality and socially expected needs and reactions. This factor demonstrated a wide difference between General list and special duties list engineer officers.

Factor O examines guilt proneness. The distribution clusters towards the negative end of this scale which corresponds to self confident, self sufficient, tough, accepting behaviour. The positive pole of the scale corresponds with worrying, discouraged, suspicious reactions. The O+ person does not attempt to lead and is not selected as a leader. It contributes to the second order factor of general anxiety. Officers scored lower than the Senior rates.



14.11 Factor Q1 measuring radicalism is the first of four generated from questionnaire analysis and the designer makes special mention of the limitation of motivational distortion. Numerous studies have shown that the subjects perception of the relation of the answers he gives to the task for which he is being considered, significantly distort his response. Even if the tester is aware of this distortion it means that the scores obtained remain less stable than those extracted for the factors discussed earlier. In this case, where the data was not collected in a selection situation, the distribution clusters around the mode. The highest scoring group was the G.L. Engineers.

Factor Q2 measures self sufficiency. The distribution is biased towards the higher end of the scale but the fact that low scores are identified with group adherence and a penchant for teamwork tends to make this factor contradictory in leadership terms.

14.12 Factor Q3 claims to measure will-power and Cattell (1957) identifies high Q3 with choice as a leader. Mothram (1972) equates a low score with managerial success and a high score with smugness. The distribution is centrally disposed and clusters around the median. SD engineer officers score highly as a group while artificers are at the other extreme.

Factor Q4 is closely related to factor O and measures ergic tension. High scores indicate excitability and low scores the phlegmatic, composed person. The distribution is flat (platykurtosis) and biased towards the lower end of the scale. SD engineer officers are the lowest scoring group and artificers are the highest.

#### The E.P.I.

14.13 The Eysenck Personality Inventory in form A and B was administered to 237 officers, 159 Artificers and 167 other Senior Ratings. Scattergrams of the results are shown in figure 14.18 at the end of this section. An analysis of the distribution compared with the general male population (Eysenck & Eysenck 1964) is given in table 14.3 by dividing the data space by the sum of the British male means of Forms A & B combined. ( $E = 26.22$ ,  $N = 19.58$ ).

TABLE 14.3 Distribution of E.P.I. Scores for Naval Sample

	Stable Extrovert Quadrant	Stable Introvert Quadrant	Neurotic Extrovert Quadrant	Neurotic Introvert Quadrant
Officers (N = 237)	75	84	28	50
Other Senior Ratings (N = 167)	54	27	42	44
Artificers (N = 159)	42	34	40	43
Total	171	145	110	137

14.14 A chi square test of this distribution gave a result of 31.23 which with six degrees of freedom was significant beyond the  $p = 0.001$  level. Thus the null hypothesis that there is no significant difference between the EPI scores expected of the Naval sample and the general population was rejected and the EPI judged to be a discriminating measure.

14.15 In paragraph 6.34, it was stated that Selection procedures for officers are more rigorous than those for senior ratings and it must be expected that an accurate measure of personality would indicate this difference. Thus, group statistics for officers could be expected to differ significantly from results for Senior Ratings. This was tested on the total sample using the facilities described in Annex C. All officers were grouped and compared with the group of all artificers and other senior rates. The value of mean stens for these groups using the Naval Norms are given in table 14.3.

TABLE 14.4 Values of Mean stens for All Officers and All officers and All Senior Rates.

(STENS X 100)

FACTOR	A	B	C	E	F	G	H	I	L	M	N	O	Q1	Q2	Q3	Q4
ALL SENIOR RATES (N = 324)	540	544	533	556	554	536	530	538	583	549	555	578	530	556	532	573
ALL OFFICERS (N = 158)	564	632	594	575	546	581	597	561	503	547	523	480	556	520	577	509

The value for  $f$  calculated using all 16 factors was 1076 and thus the groups were significantly different beyond the  $p = .01$  level.

The null hypothesis states that there is no significant difference between the group means of the scores of officers and senior rates as measured on the Cattell 16PF and can be rejected. The officer sample was also compared with Artificers (f = 888) and other senior rates (f = 686) separately as a check.

14.16 It was said in paragraph 6.35 that the work of the technical branches might be expected to attract a different sort of person from the seaman branches. It was hypothesised that leaders with a high technical content to their work would display significantly different mean scores compared with those who belong to the seaman branches. The null hypothesis stated that there are no significant differences between the means of scores of technical and non technical leaders when measured by Cattell 16 PF. Table 14.4 gives these results.

TABLE 14.5 Values of Mean Sten Scores of Officers and Senior rates by categories (Stens X 100)

Factor	A	B	C	E	F	G	H	I	L	M	N	O	Q1	Q2	Q3	Q4
Senior Ratings (N = 160)	574	521	543	564	544	546	562	566	582	564	567	585	522	553	552	565
Artificers (N = 154)	507	568	524	548	564	527	498	511	584	534	544	571	537	559	513	581
G.L. Seaman Officers (N = 53)	566	613	621	583	579	591	617	625	511	560	534	513	515	494	574	547
S.D. Engineer Officers (N = 33)	521	582	582	515	476	630	552	485	467	545	564	500	524	512	645	470
G.L. Engineer Officers (N = 72)	582	669	579	596	554	551	604	549	513	539	496	447	601	543	549	500

14.17 These sten scores were compared using PERSON4 and Table 14.6 gives the result of the comparison of function 'f' calculated for each pairing on all sixteen factors. It will be seen that all groups are dissimilar at the p 0.01 level with the exception of the comparison between the two groups of general list officers, and the null hypothesis may be rejected.

TABLE 14.6

Values of f for comparison between group of naval leaders

	ARTIFICERS	GL Seamen	SD Engineers	GL Engineers
GL Seamen	723			
SD Engineers	770	257		
GL Engineers	820	202	334	
Other Senior Rates	306	430	666	772

14.18 It was said in paragraph 6.36 that promotion to commissioned rank is a significant organisational recognition of superior performance by leaders and that a personality difference could be expected between such a group and the rest of their naval peers. The null hypothesis states that there will be no significant difference between the mean scores on 16PF achieved by the source group and those selected for promotion. SD Engineer Officers are selected almost exclusively from among the Artificers and Mechanics and it will be seen from table 14.6 that they are dissimilar at a level of significance in excess of  $p = 0.01$  and the null hypothesis may be rejected in this case. Individual profiles of ratings selected for a commission are presented in figure 15.5.

#### ATTITUDE MEASURES IN THE WORK ENVIRONMENT

14.19 Work attitudes would be expected to reflect both the individual's commitment to his task and the satisfaction he obtains from it. Where this also reflects the effectiveness of the leadership, it could be extended to examine the relationship between work attitudes, personality factors and effectiveness. Work attitudes could be expected to vary between the different environments. Data was gathered by both interviews and questionnaire.

Table 14.7 - Interviews with Naval Leaders

RANK	CAPTAINS	COMMANDER	LT CDR	L.T + BELOW	CPO	PO	TOTAL
Number	7	26	29	29	18	14	135

Presentation of Results of Questionnaire

14.20 A general statement was made in paragraph 6.37 but no specific hypotheses were established to test work attitudes. The presentation of the results of the questionnaires analyses the answers and shows them in comparative form for the four environments examined. Comment, where appropriate is included from data collected in the structured interviews.

QUESTION 1 - HOW MUCH DO YOU LIKE THE SORT OF WORK YOU ARE DOING ?

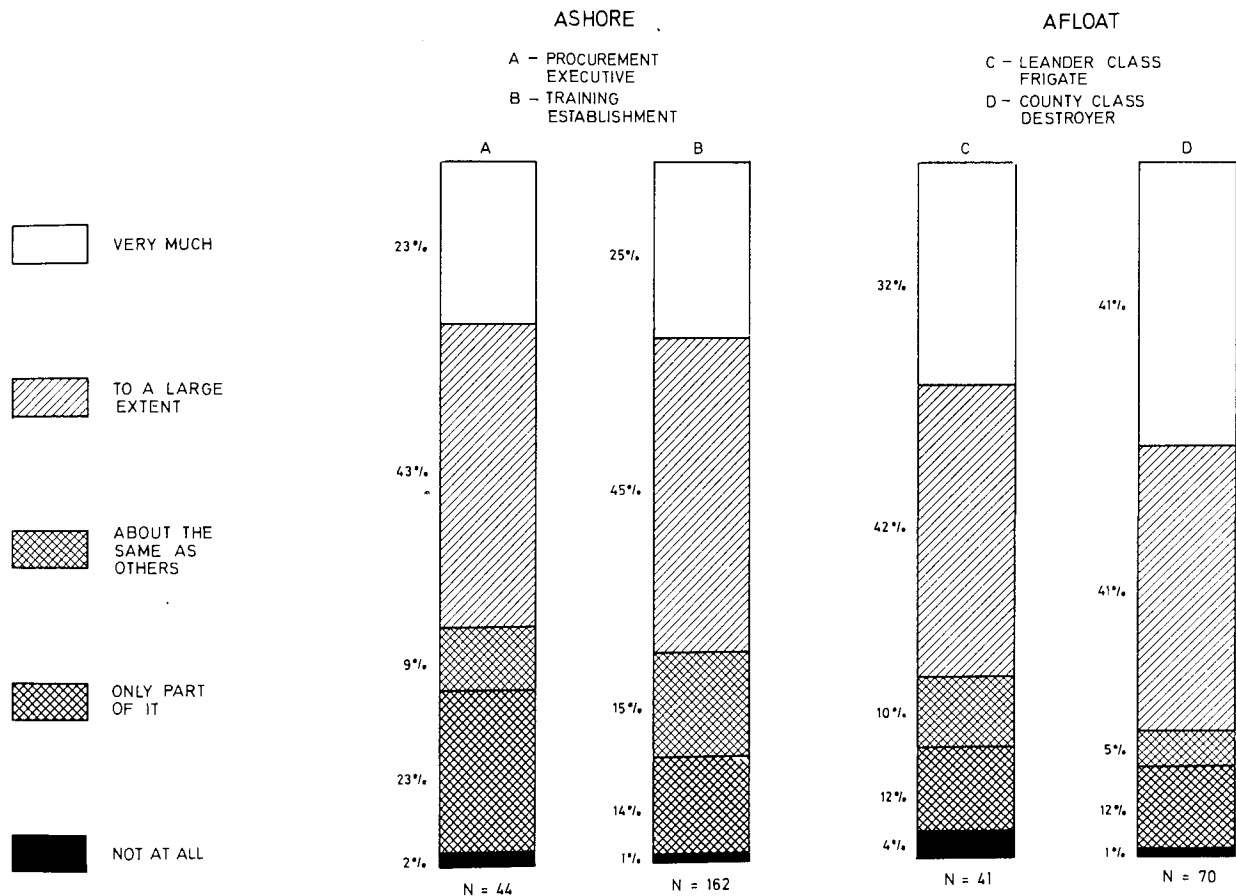


Fig 14.1 Results from a questionnaire on attitudes to work - Question 1

From 14.1 it can be seen that more than 2/3rds of the total sample liked the work they were doing to a large extent. Work afloat was preferred to work ashore. Those employed in the Procurement Executive were least enthusiastic and this was reflected in answer to how well they were trained for their job. A number felt insecure and ill prepared for the work they thought they were expected to master. This must be considered in the context of much change in the total organisation at that time. A chi-square test gave 20.42 which with 12 degrees of freedom was not significant at the .01 level.

QUESTION 2 – WHEN YOU ARE AT WORK, HOW DOES THE TIME PASS?

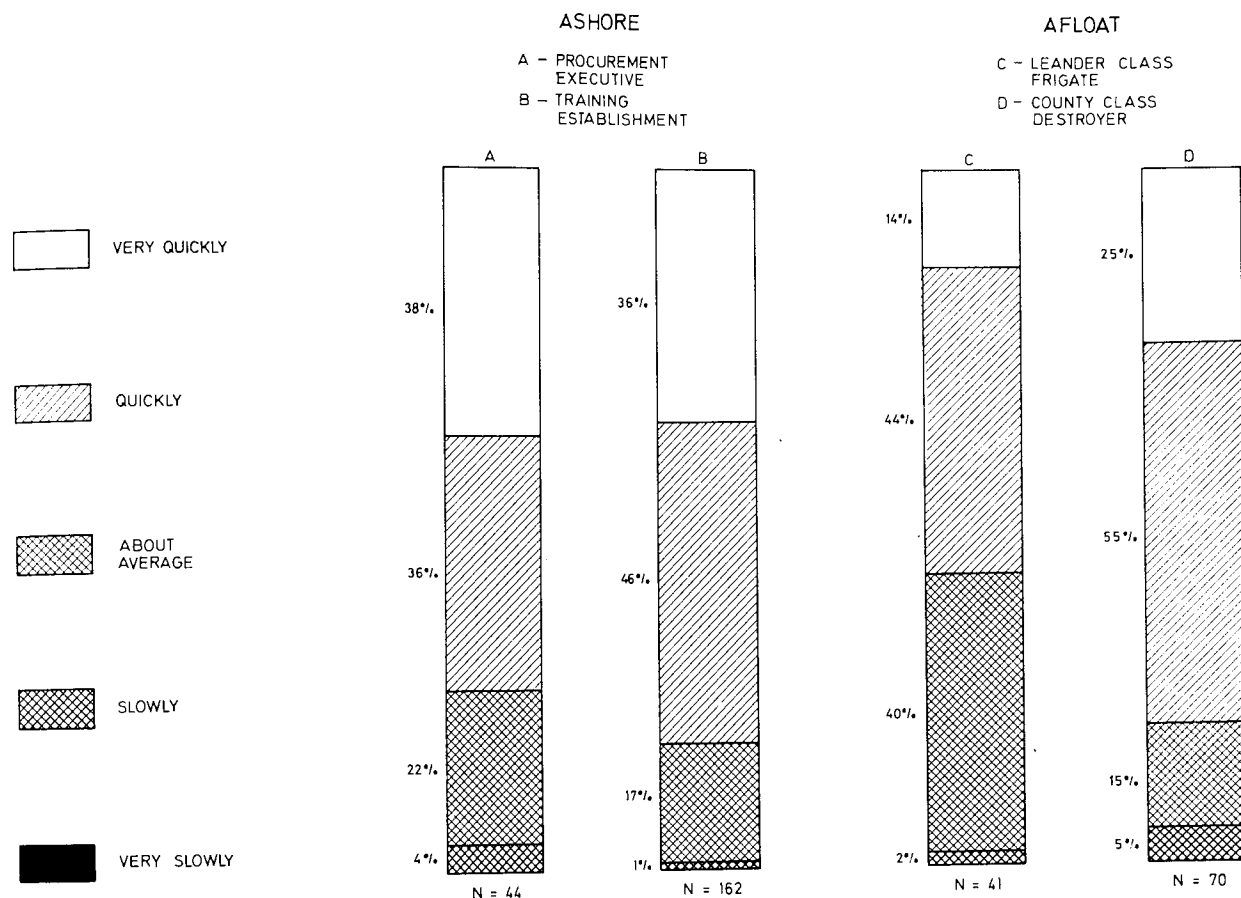


Fig 14.2 Results from a questionnaire on attitudes to work – Question 2

14.21 This question subsumed that the involvement and satisfaction obtained from the work in hand would be reflected in the feeling of time dragging or flying by. Rather unexpectedly, the people at sea reported time as passing more slowly than those on shore. This, on reflection, was not related to the actual work content but to the autonomy enjoyed by the individual. Thus, Captains, 1st Lieutenants and Heads of Departments felt time pressing while the "middle management", the section officers in a large ship or Senior Rates in a frigate were more non-committal. It will be seen, however, that no one used the end of the scale to report that time dragged very slowly by. A test for Chi-square gave 35.28 with 12 degrees of freedom. This was a significant result at  $p = 0.001$ . That is to say, work passes significantly more quickly ashore than afloat.

QUESTION 3 – DO YOU GET ANY FEELING OF ACCOMPLISHMENT FROM THE WORK YOU ARE DOING ?

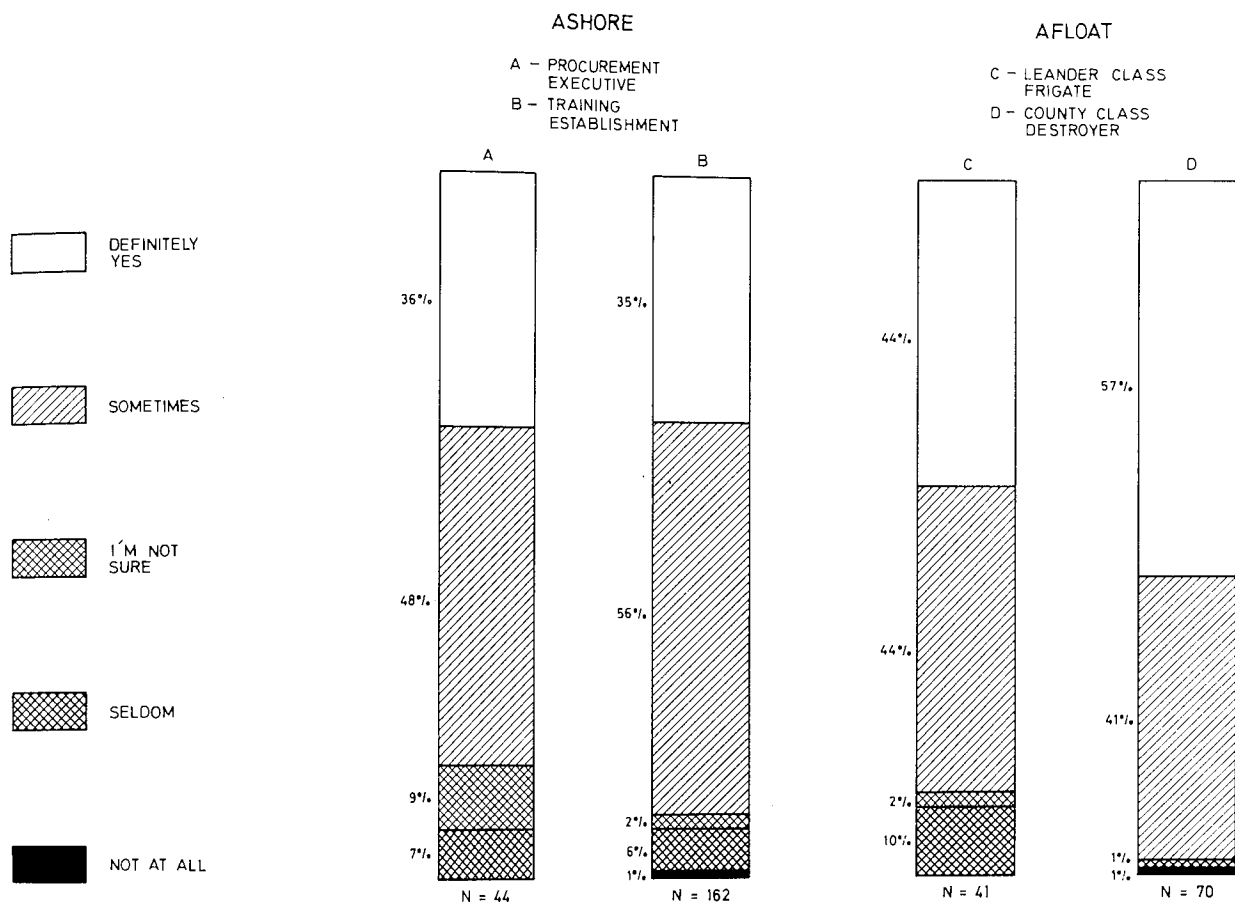


Fig 14.3 Results from a questionnaire on attitudes to work - Question 3

14.22 The response to this question indicated a considerable involvement in the work in hand, and would not have been expected a few years ago. Comments like "We were probably the most efficient ship in the squadron" from a Radio Supervisor and "We could tackle anything with the super team I've got, especially the Senior Rates" from a Technical Commander were typical of the attitudes found in the interviews afloat. Ashore, the response was more diffuse and many of those interviewed saw their work as bureaucratic in character preventing any feeling of accomplishment. This was particularly apparent where results were not likely to be visible for many years. The transition from "command" to "influence" was not well understood nor enjoyed. The chi square test gave 39.94 which was significant at the  $p = 0.001$  level. The Seagoers response was significantly more satisfying.

QUESTION 4 – HOW IS YOUR JOB CONSIDERED BY PEOPLE AROUND YOU ?

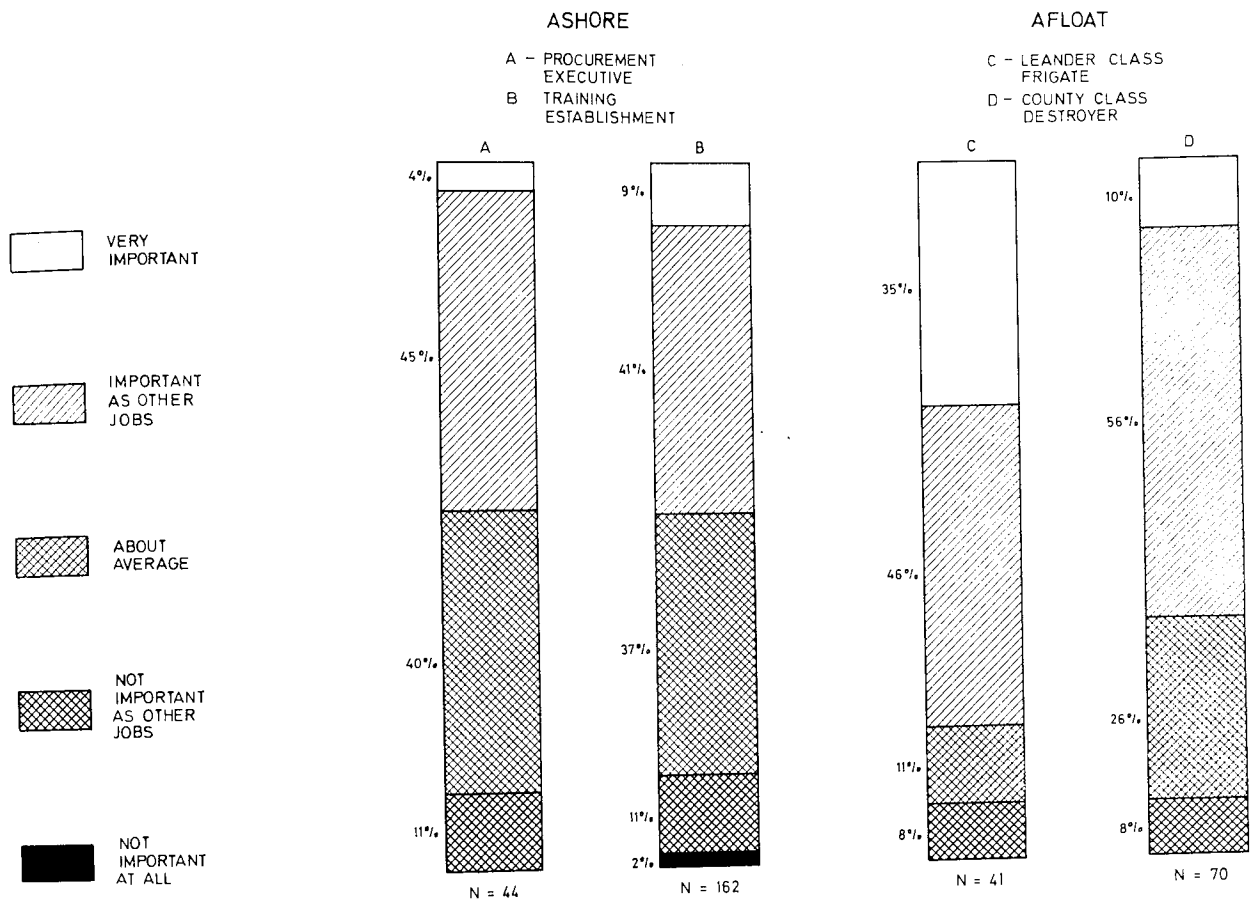


Fig 14.4 Results from a questionnaire on attitudes to work – Question 4

14.23 The small community of a frigate had no spare fat in the organisation and those interviewed reflected the impression gained of quiet and efficient self confidence. Onboard the D.L.G., some of those interviewed felt they were superfluous to the true needs of the ship and were therefore inclined to write down their own contribution. The shore organisations were both large and tended to overshadow the individual. Such reports as "I am not happy and I am not fruitful - If I went tomorrow I would not be missed", were encountered at all levels. The chi square test gave a value of 67.91 which with 12 degrees of freedom is significant at the  $p = 0.001$  level.



QUESTION 5 — WHY DID YOU DECIDE TO JOIN THE NAVY?

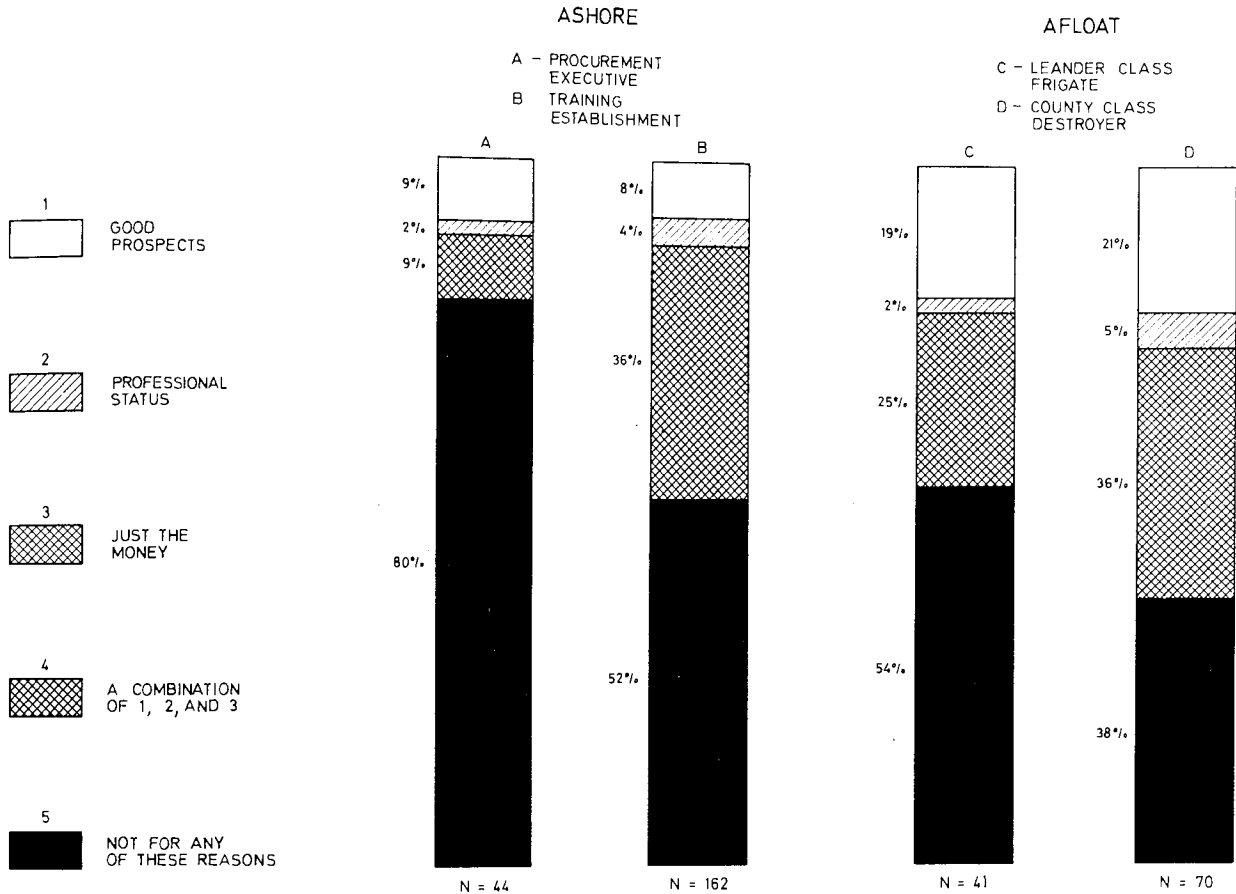


Fig 14.5 Results from a questionnaire on attitudes to work — Question 5

14.24 Everyone expects to be asked why they joined the service. Hobson's choice was reported quite frequently. One respondent elaborated to say that having joined "he had insufficient Maths or Physics to be an Executive Officer and was invited to be an Engineer". He went on to say that "it was the best thing that ever happened". One person said that having been brought up in an orphanage, the service was a natural continuation and had become his "family". The chi square test was not applied to this question because of the preponderance of "not for any of these reasons" in the answers would have made such an analysis meaningless.

QUESTION 6 - WOULD YOU ADVISE A FRIEND OF YOURS TO JOIN THE NAVY?

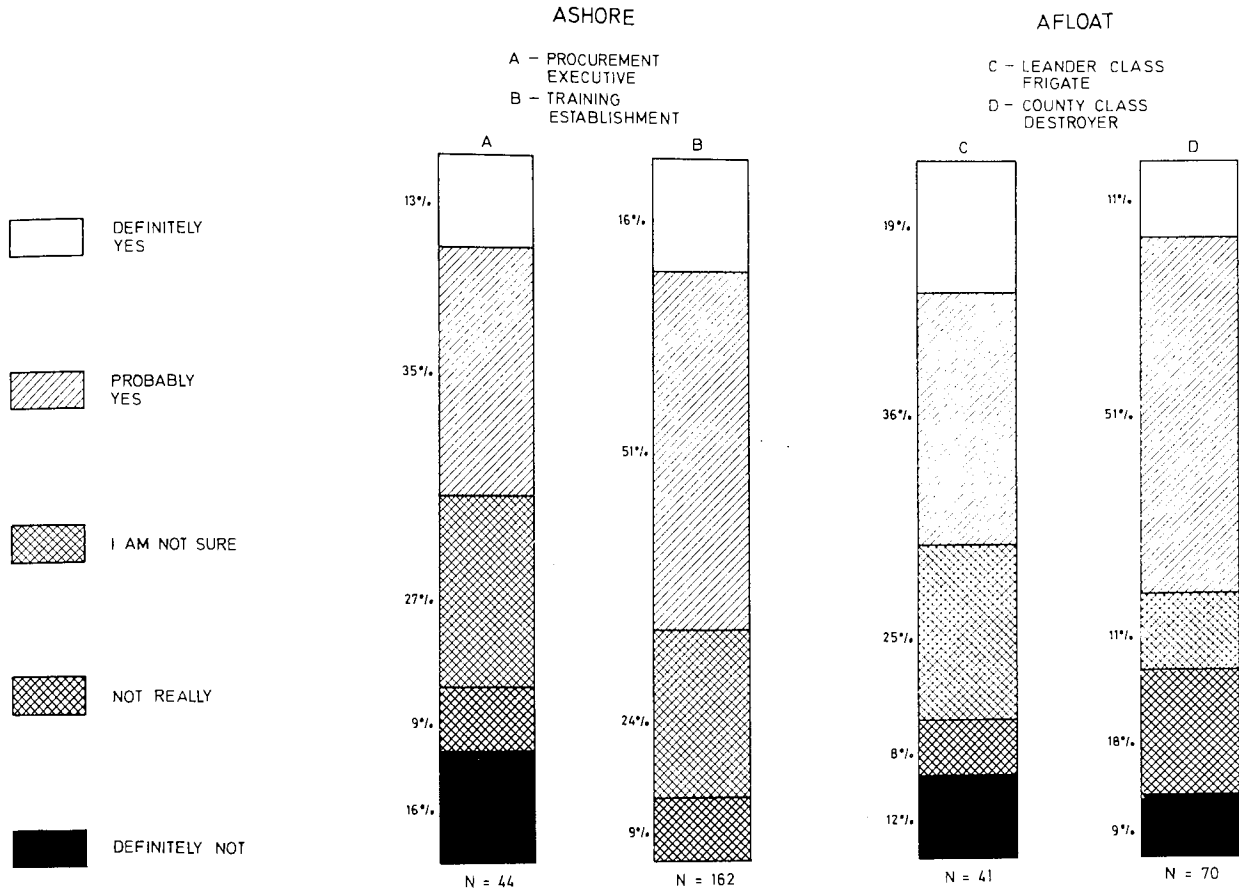


Fig 14.6 Results from a questionnaire on attitudes to work - Question 6

14.25 More than half the sample would probably advise a friend to join the navy but it came out clearly in the interviews that "it depended very much on the person involved". This recognition that service life has a limited appeal reflected a frequently encountered defence mechanism excusing the then current publicity drive. Particular exception was taken to the advert which suggested that Naval officers joined as a way of opting out of the rat race. One late comer, recently joined as an engineer officer at nearly 40 said that he was already telling all his friends (but not mentioning the incomprehensible mass of rules, regulations and procedures). He admitted that no one had taken his advice so far! One of the main reasons given for not advising a friend to join was that the scope for individual development was being whittled away as everything was centralised. A Chief Petty Officer said in this context: "It hasn't been the same since they introduced planned Maintenance". The training establishments difference from the rest was confirmed by a Chi Square test result of 40.11 which was significant at the  $p = 0.001$  level

QUESTION 7 — ARE THERE GOOD FACILITIES TO HELP YOU IN YOUR WORK?

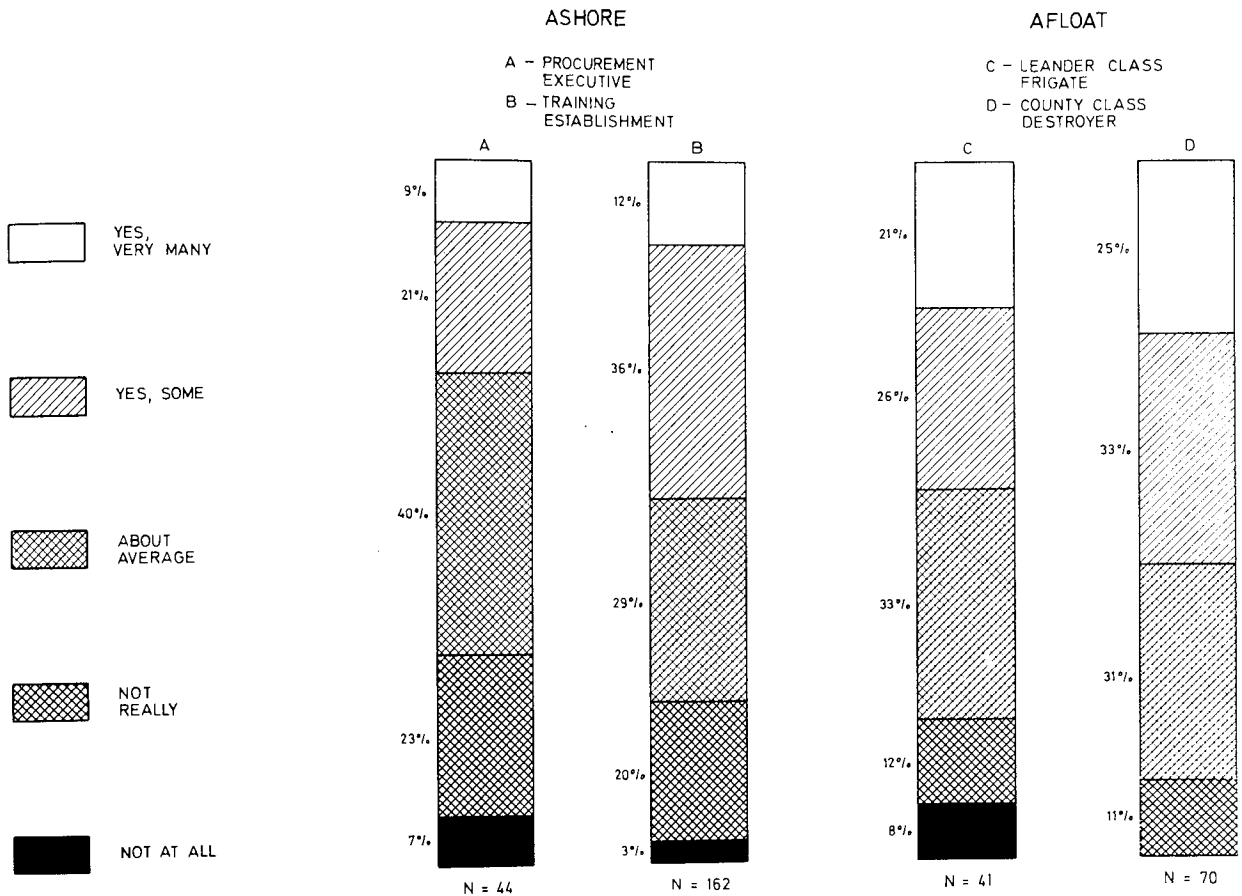


Fig 14.7 Results from a questionnaire on attitudes to work—Question 7

14.26 The response to this question tended to be neutral. Most people considered the detailed aids to their job adequate. A few criticised the size and shape of the navy or the rate of provision of new equipments. This was clearly not a dissatisfier in Herzburg's terms but there was an element of strong criticism in both the P.E. ashore and in the frigate about the control of resources. Nobody in the County Class destroyer thought the facilities bad and the Chi square test gave 36.28, showing that there was a difference in response which was significant at the  $p = .001$  level.

QUESTION 8 - DO YOU FEEL YOU GET ENOUGH INFORMATION ABOUT WHAT GOES ON IN THE ESTABLISHMENT?

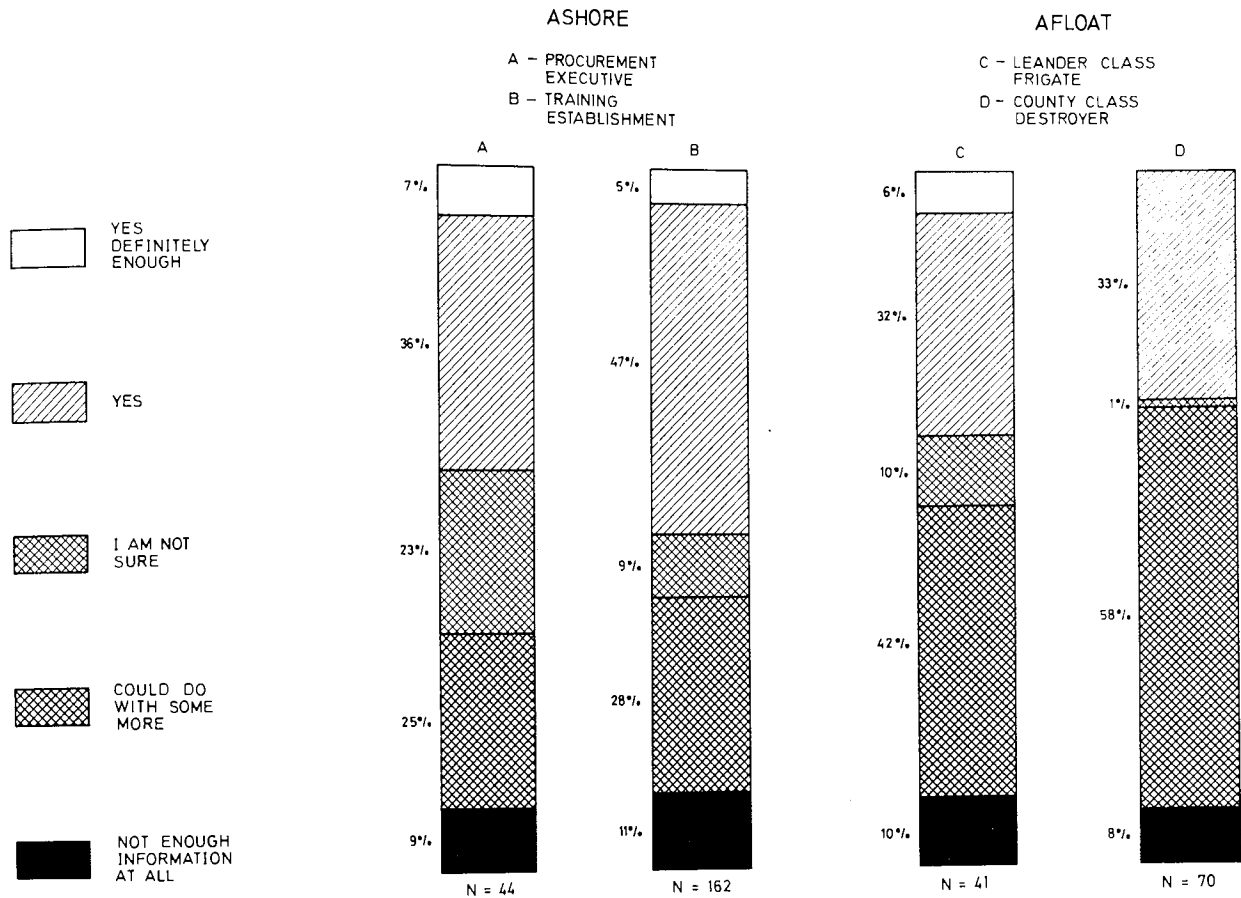


Fig 14.8 Results from a questionnaire on attitudes to work - Question 8

14.27 The training establishment provided the best service in keeping people informed. This was identified as being a direct result of the considerable effort committed to reorganising in line with Management by Objective techniques. A majority of the sample in the DLG said they could do with more information but this was seen to be a function of the long chain of command and the conscious efforts made to make delegation work effectively. The chi square test gave a result of 45.98 which was significant beyond the  $p = 0.001$  level with twelve degrees of freedom.

QUESTION 9 - DO YOUR "SUPERVISORS" DISCUSS MATTERS WITH YOUR GROUP BEFORE DECIDING WHAT TO DO ABOUT THINGS THAT COME UP ?

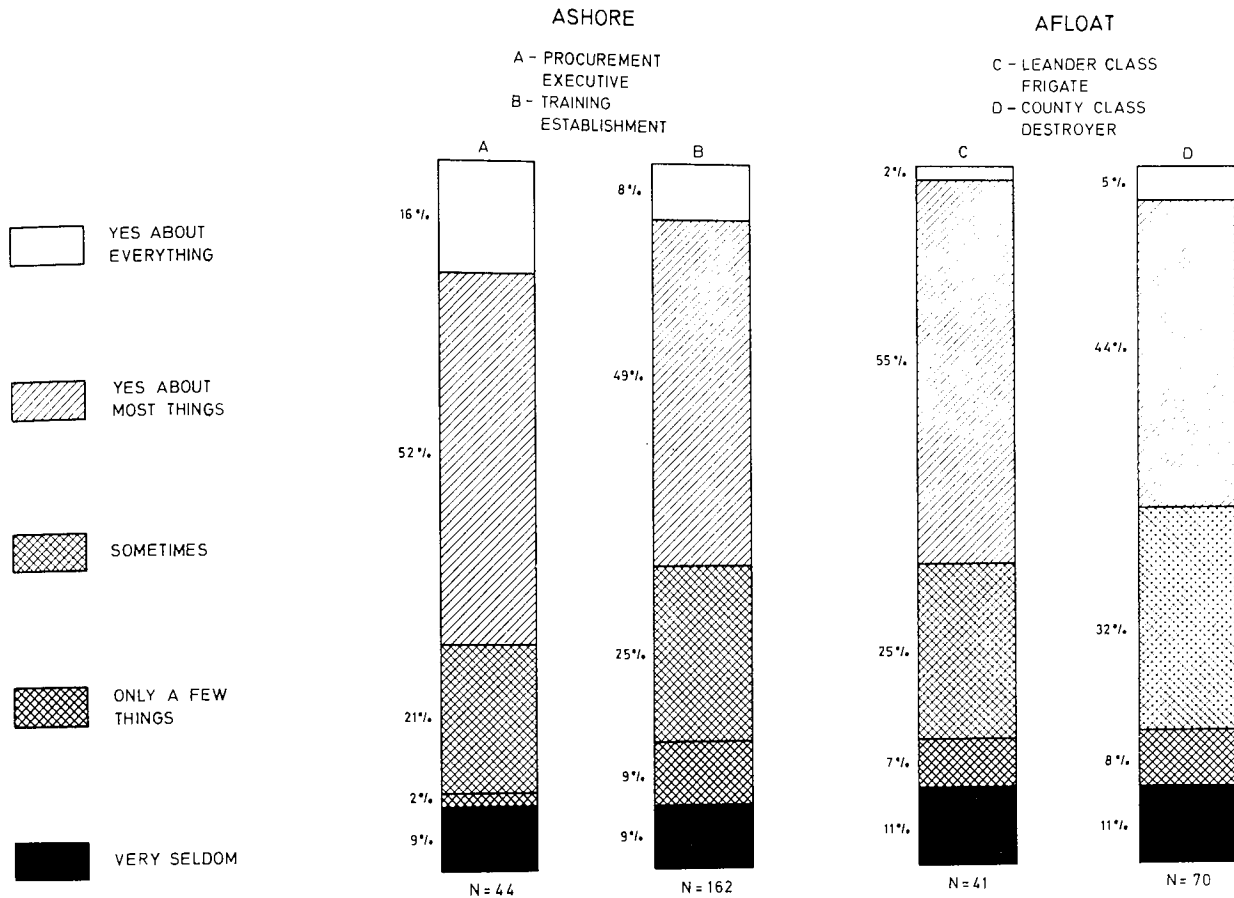


Fig 14.9 Results from a questionnaire on attitudes to work - Question 9

14.28 The answers to this question reflects a difference in style of leadership which was brought out quite plainly in the structured interviews. One captain described his approach as "There is a cut off below which I do not want to know. It is extremely bad for the ships company if I know everything". Another said "I issue directives and do not expect to interfere unless I have been misunderstood". The second-in-command generates as much discussion as he feels necessary for morale. The technical departments, however, reported a much more discursive style in controlling the work of the group and this applied both ashore and afloat. The chi square test gave 22.64 which with twelve degrees of freedom was not significant at the  $p = 0.01$  level.

QUESTION 10 - HOW WELL DOES YOUR "SUPERVISOR" EXPLAIN THE NEW JOBS OR METHODS THAT COME ALONG ?

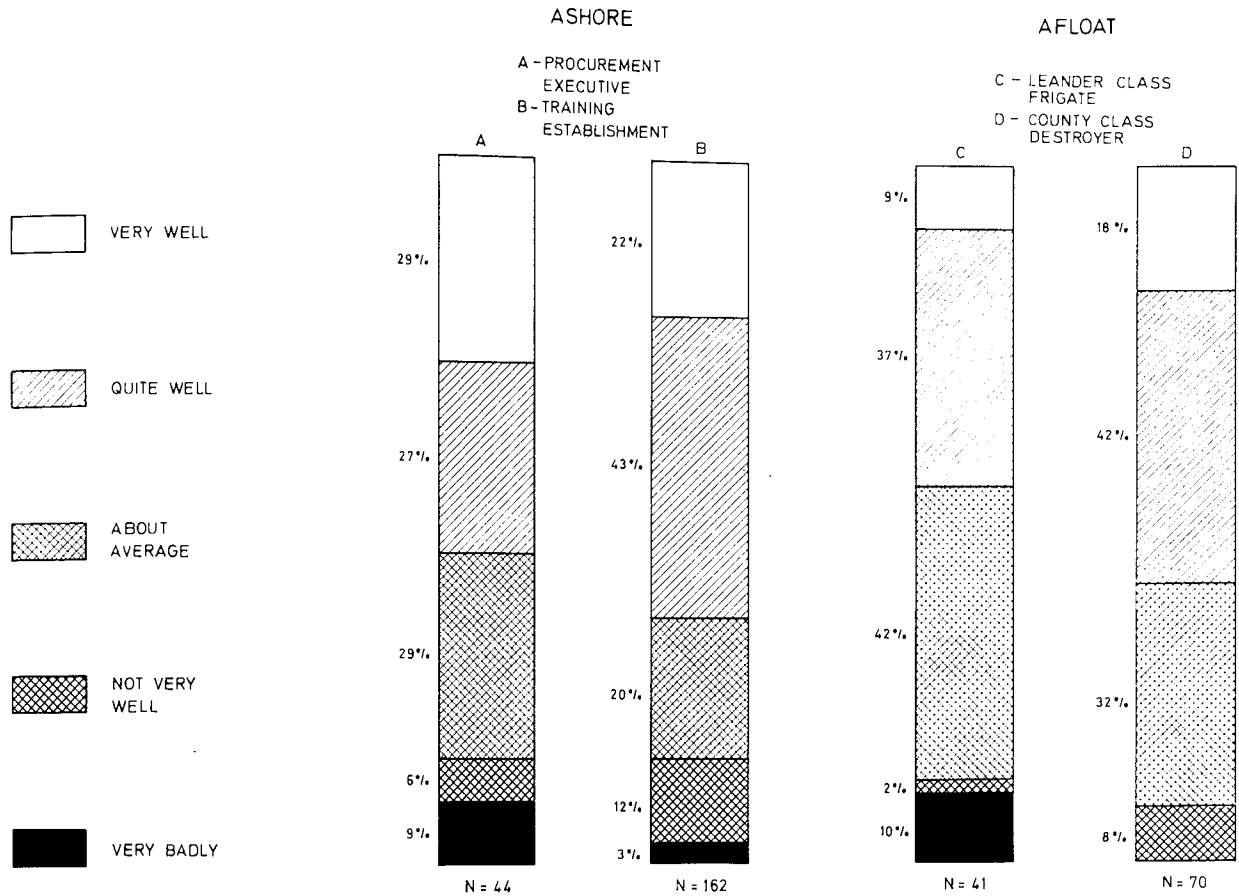


Fig 14.10 Results from a questionnaire on attitudes to work - Question 10

14.29 Not more than 15% of respondents were dissatisfied with the way change was handled and almost a third of these in Headquarters thought it was handled "very well". The frigate reported less favourably than any of the others. There was a trend observed in interviews which suggested that the subordinate was frequently unsure of what was expected of him yet his superior felt that he was delegating responsibility and giving freedom of action. This was less apparent where the two people were in the same mess or connected informally in some other way. The chi square test gave a value of 42.54 which was significant at the  $p = 0.01$  level and thus the level of communication was significantly different ashore and afloat.

QUESTION 11 - HOW DO YOU FEEL ABOUT THE WAY YOU WERE TAUGHT YOUR JOB ?

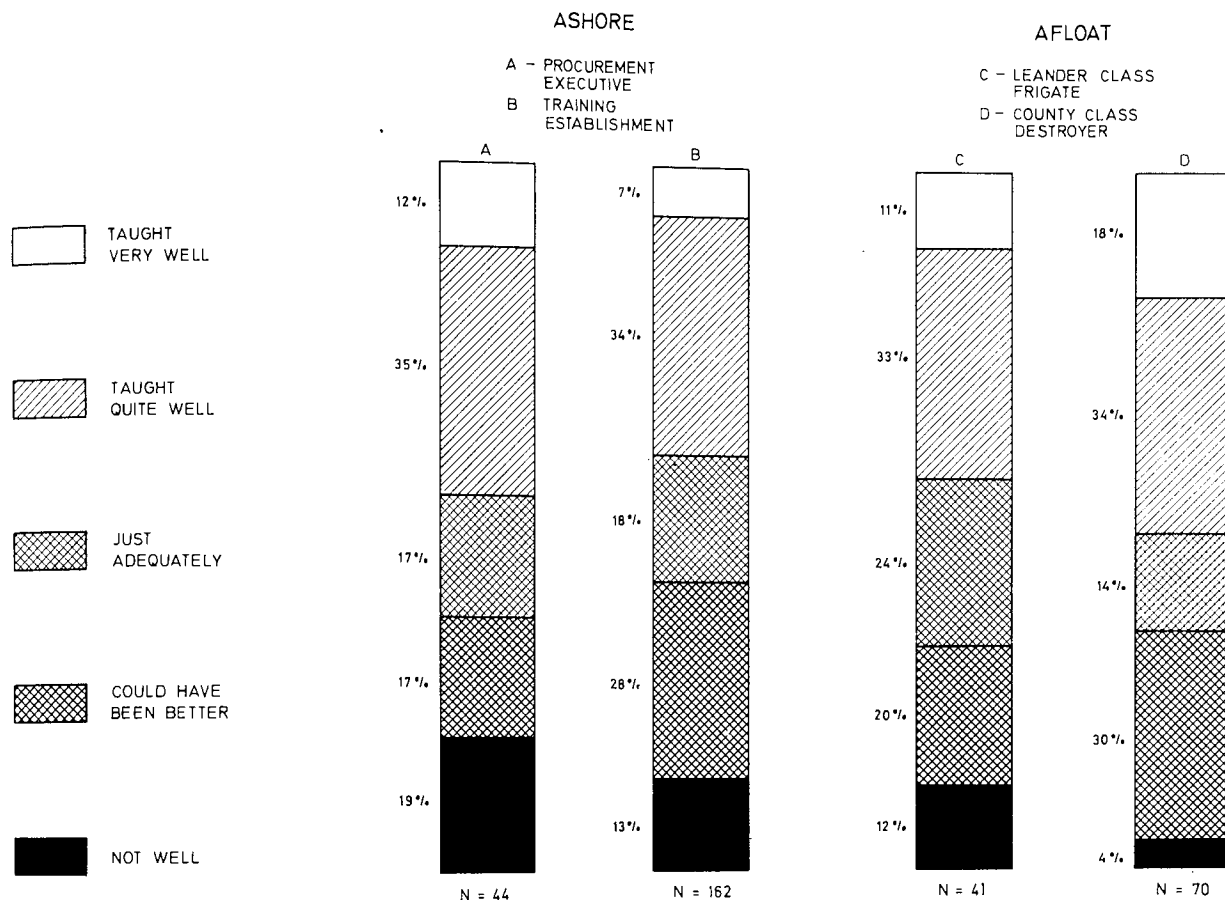


Fig 14.11 Results from a questionnaire on attitudes to work - Question 11

14.30 The most demanding area of work, technically was the D.L.G. and this is recognised by lengthy pre joining training for the crew. It was not a surprise, therefore, to find the greatest satisfaction in that environment. Conversely, there is very little preparation of people for work in the R&D field and this also was reflected in the response. Captains of Ships identified a dichotomy in this area. Most preparation came through previous experience and one reported a long series of earlier commands. At the same time, the need for technical updating was stressed and it was claimed that this was being neglected. A Chi square test gave a value of 23.42 which was not significant at the .01 level suggesting that in general there was a common view about the training given.

QUESTION 12 — HOW WELL ARE WORRIES OR PROBLEMS, WHICH INDIVIDUALS FACE, HANDLED ?

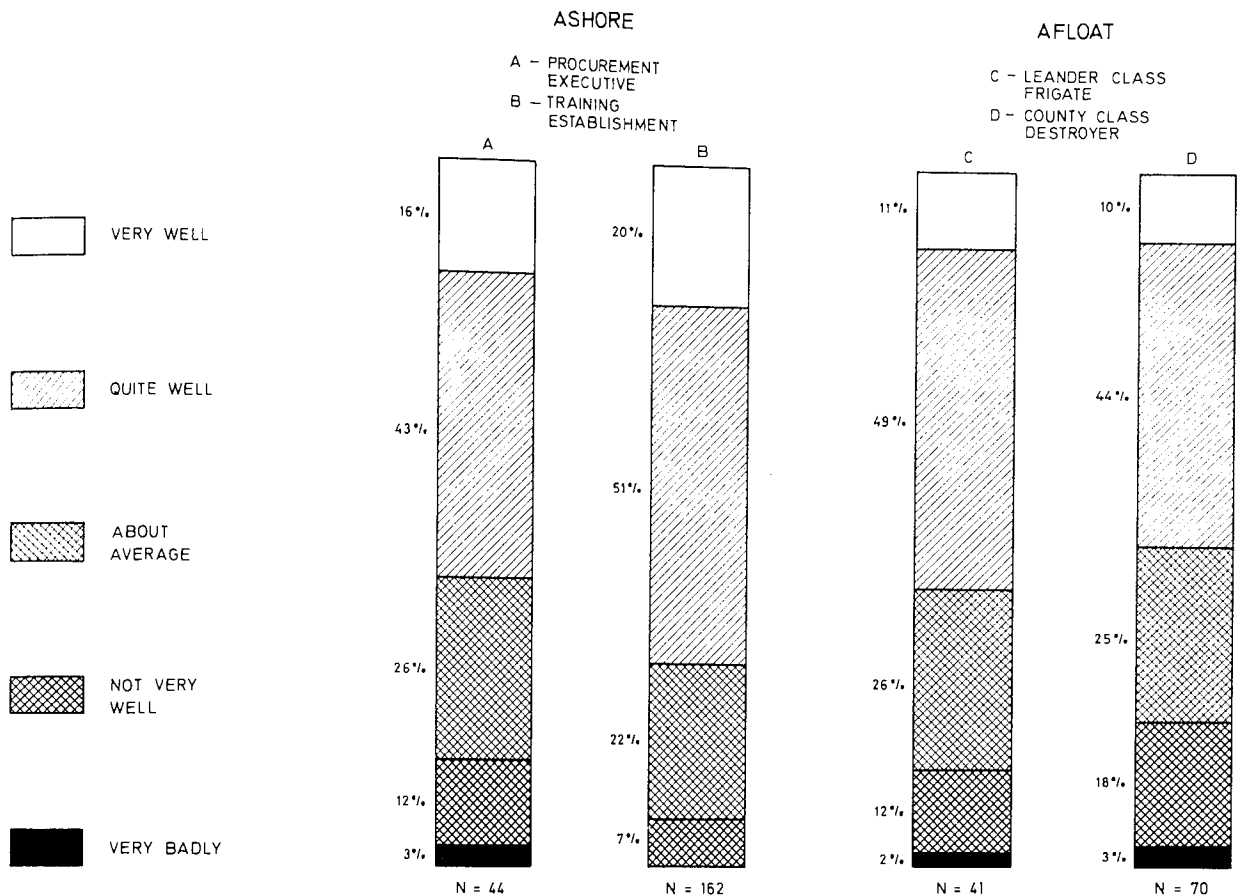


Fig 14.12 Results from a questionnaire on attitudes to work — Question 12

14.31 Less than a quarter of the sample felt cause to complain about the handling of individual problems and this is in line with a highly developed divisional system. A small number felt very badly treated and in the interviews, cases were encountered where for organisational or interpersonal reasons, a problem had "gone sour". In most cases the next level of leadership had resolved the difficulty but there was an element of insensitivity to individual's expectations and prejudices which sheltered behind the rank structure. The training environment was noticeably better than the other three, but the chi square test of the answers to the question gave a result of 12.09 which was not significant.



QUESTION 13—HOW SATISFIED ARE YOU WITH YOUR PRESENT PAY?

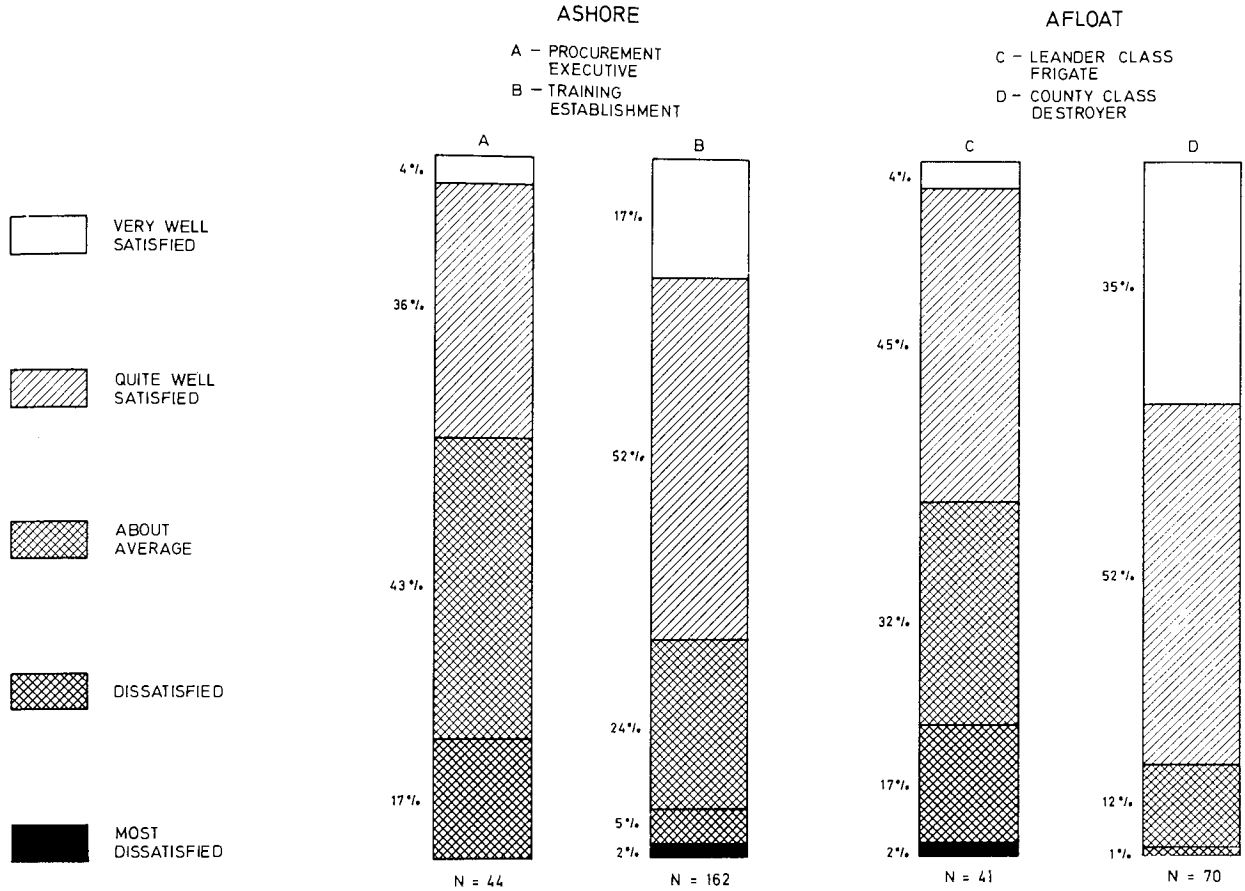


Fig 14.13 Results from a questionnaire on attitudes to work — Question 13

14.32 A third of the sample in a DLG were very well satisfied with their pay! Perhaps this was related to the Local Overseas Allowance and the warm sun. Less than 20% of the total sample said that they were dissatisfied. There was no question on money in the structured interviews and it was never raised by the subject. In a closed society such as the Royal Navy, pay only becomes a serious dissatisfier when the sailors are shore based or a change is proposed and comparison with other groups is made easier. The value of chi square was 84.9 and was significant at the  $p = .001$  level.

QUESTION 14 - HOW DO YOU EXPECT TO PROGRESS (GET PROMOTION) ?

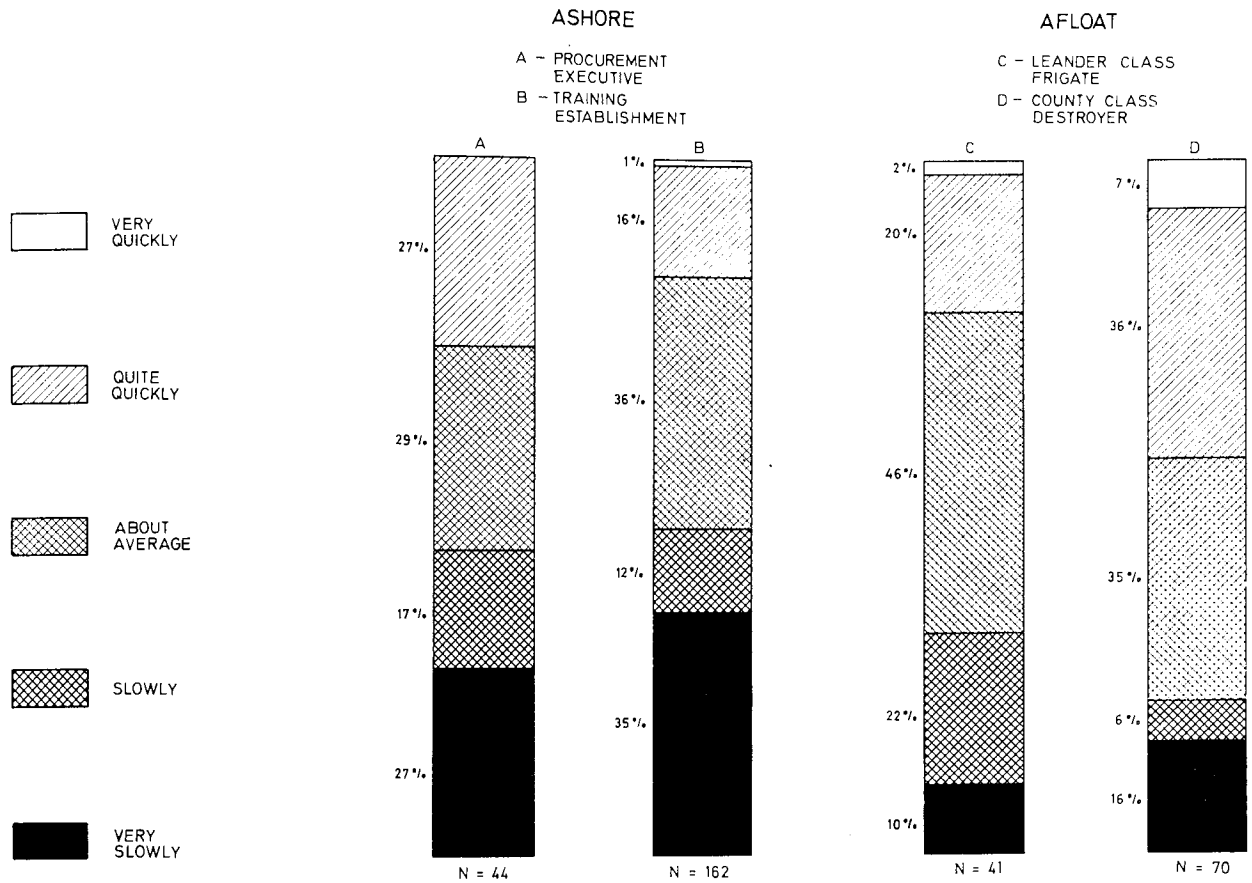


Fig 14.14 Results from a questionnaire on attitudes to work – Question 14

14.33 The dissimilar distribution of results reflects the larger number of older people in the sample taken ashore, including a higher proportion of officers passed-over for promotion. 43% of the D.L.G. sample expected to progress quickly and this is explained by a widely held belief that there is some selective allocation which ensures that the more able go to the more taxing jobs. A limited follow up showed that their expectations were confirmed. The result of a chi-square test of 54.45 confirmed at the  $p = .001$  level of significance that the samples were from different populations in terms of their expectation of promotion.

QUESTION 15 – HOW IS MORALE OR GROUP SPIRIT ?

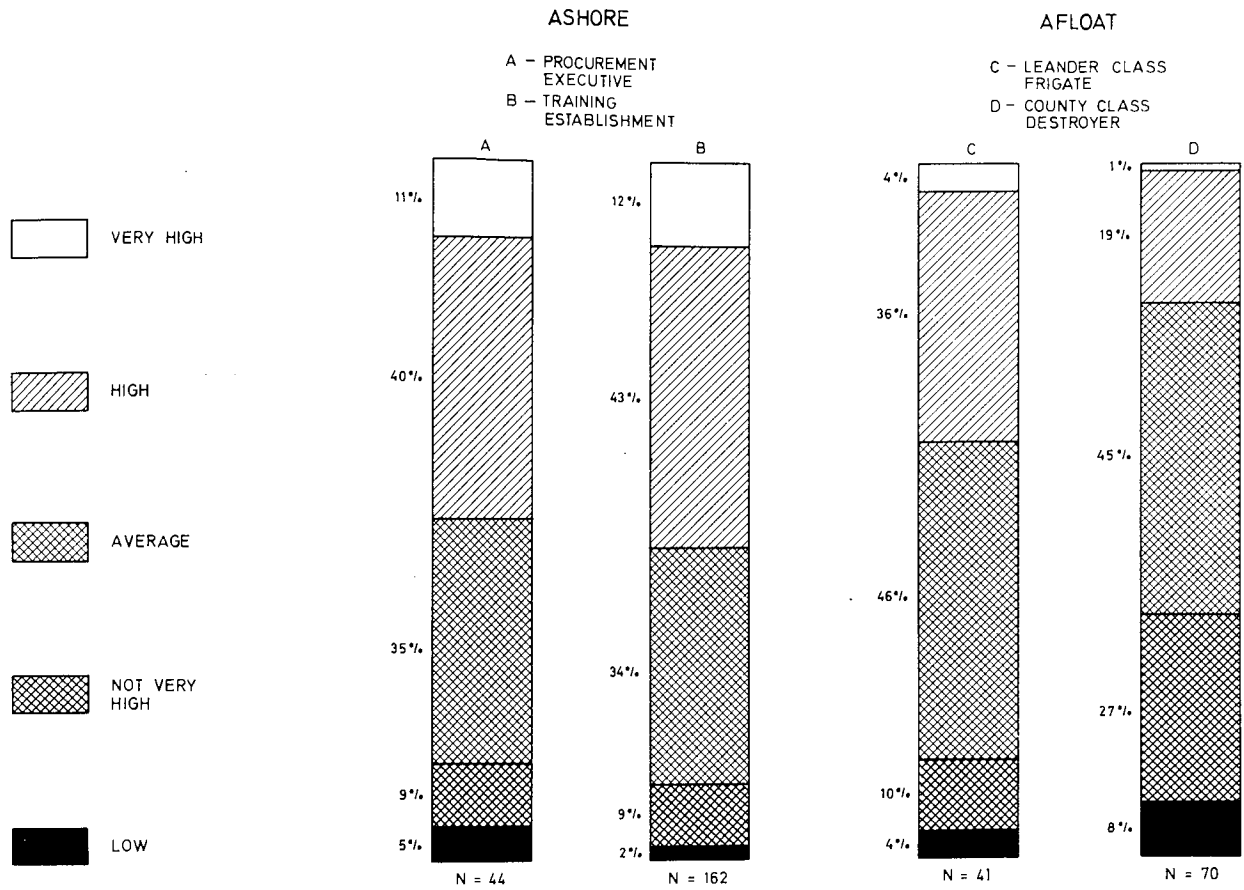


Fig 14.15 Results from a questionnaire on attitudes to work – Question 15

14.34 This result was a surprise. The interviews disclosed a low level of morale in the Headquarters sample which was confounded by the questionnaire, where over half said morale was high. It may of course reflect reluctance to commit a derogatory view to paper. The other distributions confirm the impressions gained from interviews. The difference between frigate and destroyer results from the larger community and longer chain of command in the bigger ship. The chi square test gave a value of 46.36 which with twelve degrees of freedom was significant at the  $p = .001$  level of significance, suggesting that the populations sampled were different ashore and afloat in this respect.

QUESTION 16 - HOW USEFUL TO SOCIETY DO YOU SEE THE WORK YOU DO?

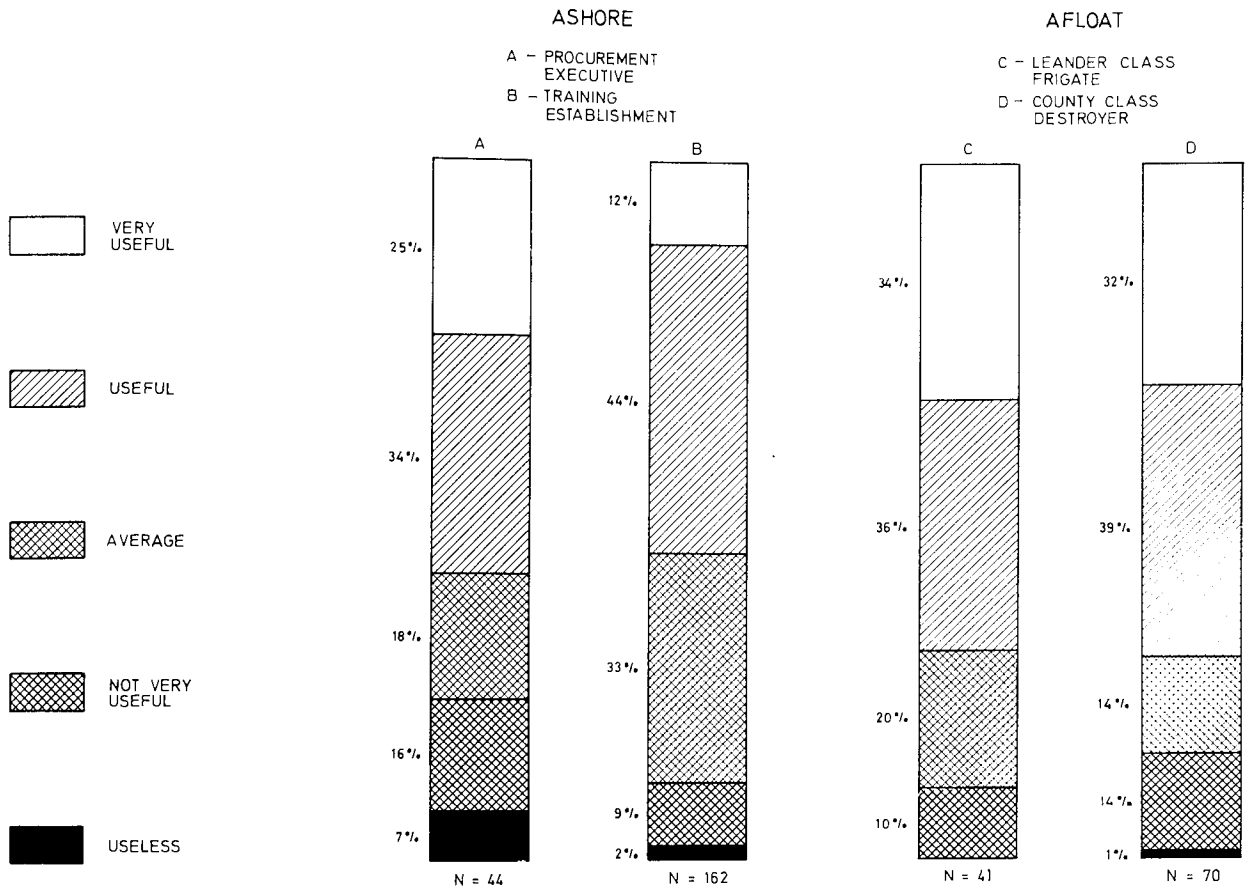


Fig 14.16 Results from a questionnaire on attitudes to work - Question 16

14.35 The response to this question indicates that a large proportion of the Naval leaders sampled consider their work useful to society, and in the case of seagoers this represented 70%. The response in Headquarters reflects the difficulty reported in interviews of naval officers failing to identify with the task in terms of influence and the changing of attitudes. They therefore feel that they are not contributing because they are prevented from taking charge. This difference was reflected in the result of the Chi square test of 37.0 which was significant at the  $p = 0.001$  level.

## SOCIOMETRIC MEASURES

14.36 The intention described in the rationale was to examine the formal and informal structures to identify any disparity and to draw conclusions from this. This aim was forwarded by questionnaire (example given in Annex A) and from the analysis of the interviews. The questions asked individuals to identify co-workers who they spoke to frequently about work and about leisure activities. The numbers of people mentioned by each subject were counted and these were added to the data for comparison with other statistics. The results are shown in tables H.5 to H.7 in Annex H.

## ORGANISATIONAL FACTORS

14.37 A means of comparing the results of the data collection about the structure of the organisation of each unit studied was required. The one finally chosen was that used by the Industrial Administration Research Unit at the University of Aston (Pugh et al (1968)). Doubts have been cast upon certain aspects of the Aston methodology (Child 1972) but it was stated that even so the scores are the end product of probably the most thorough and rigorous attempt yet made to measure aspects of organisational structure. The meaning of the main structural scales were defined thus:-

- a. 'Functional specialisation' indicates the number of special functions from the list of sixteen performed by a specialist as a significant full time activity.
- b. Centralisation indicates the locus of decision - making along a hierarchical scale.
- c. Standardisation indicates the number of rules and procedures from a given list which are extant in the organisation.
- d. Formalisation indicates the extent to which paperwork is used to execute procedures and to pass information.
- e. Configuration refers to a number of measures of the shape of the organisation such as vertical span and subordinate ratio.
- f. Traditionalism incorporates items from the standardisation and formalisation scales expressed as a percentage.

14.38 The results of this analysis are presented in Annex G and a summary is given below. As was expected the two ship environments produced figures which were very similar on all scales. The analysis of functional specialisation identified

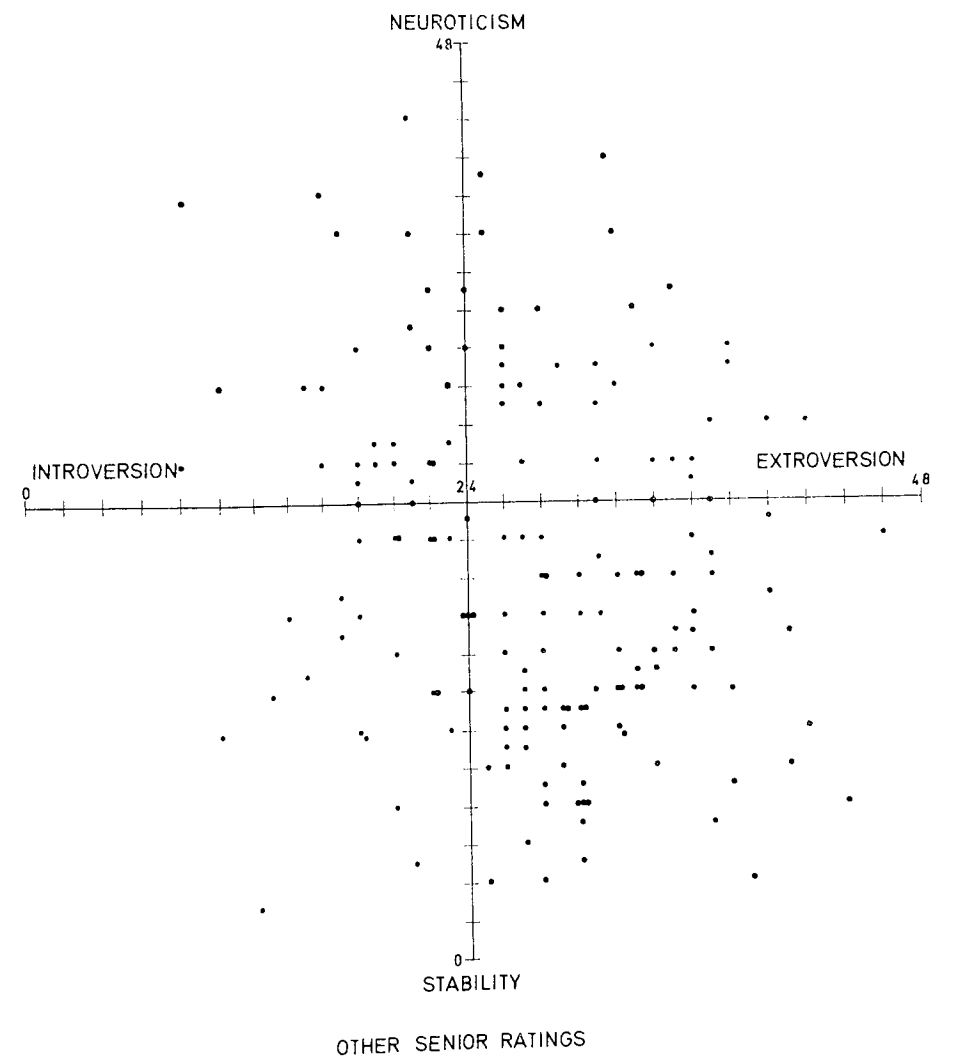
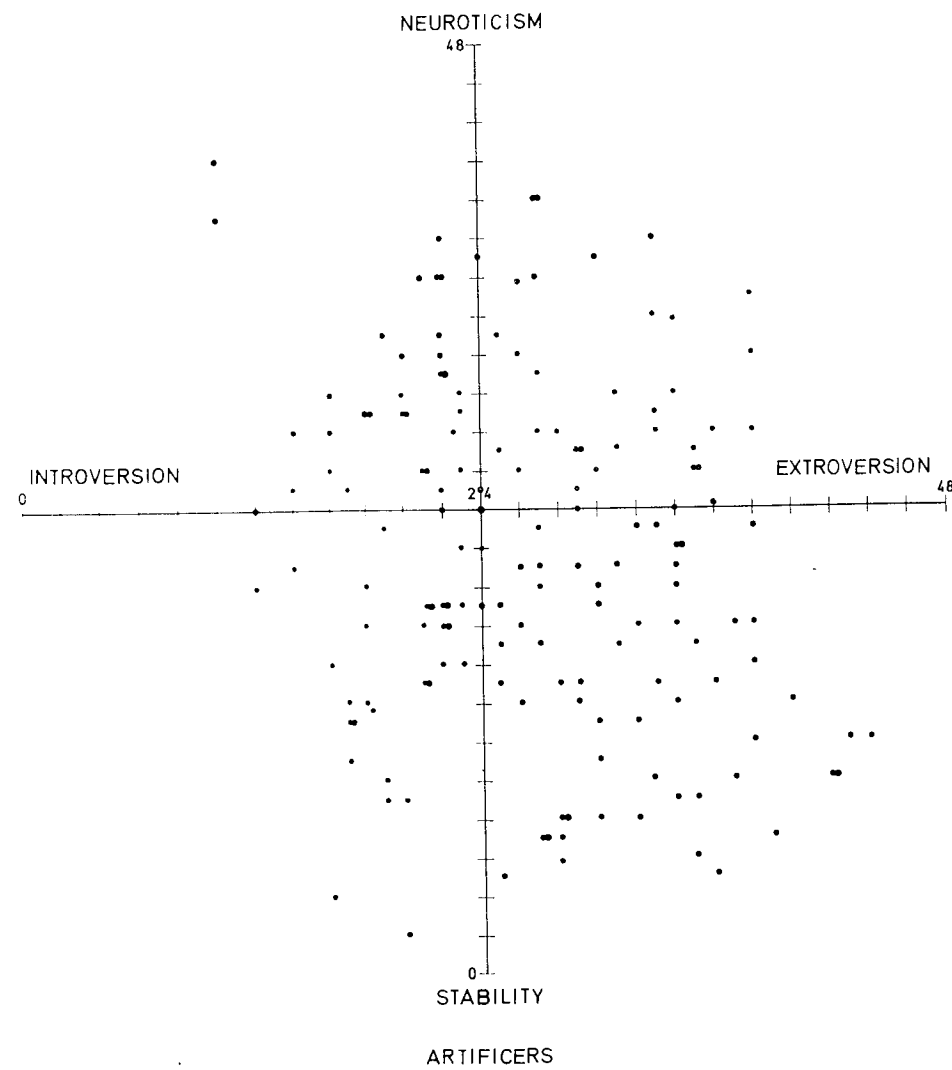
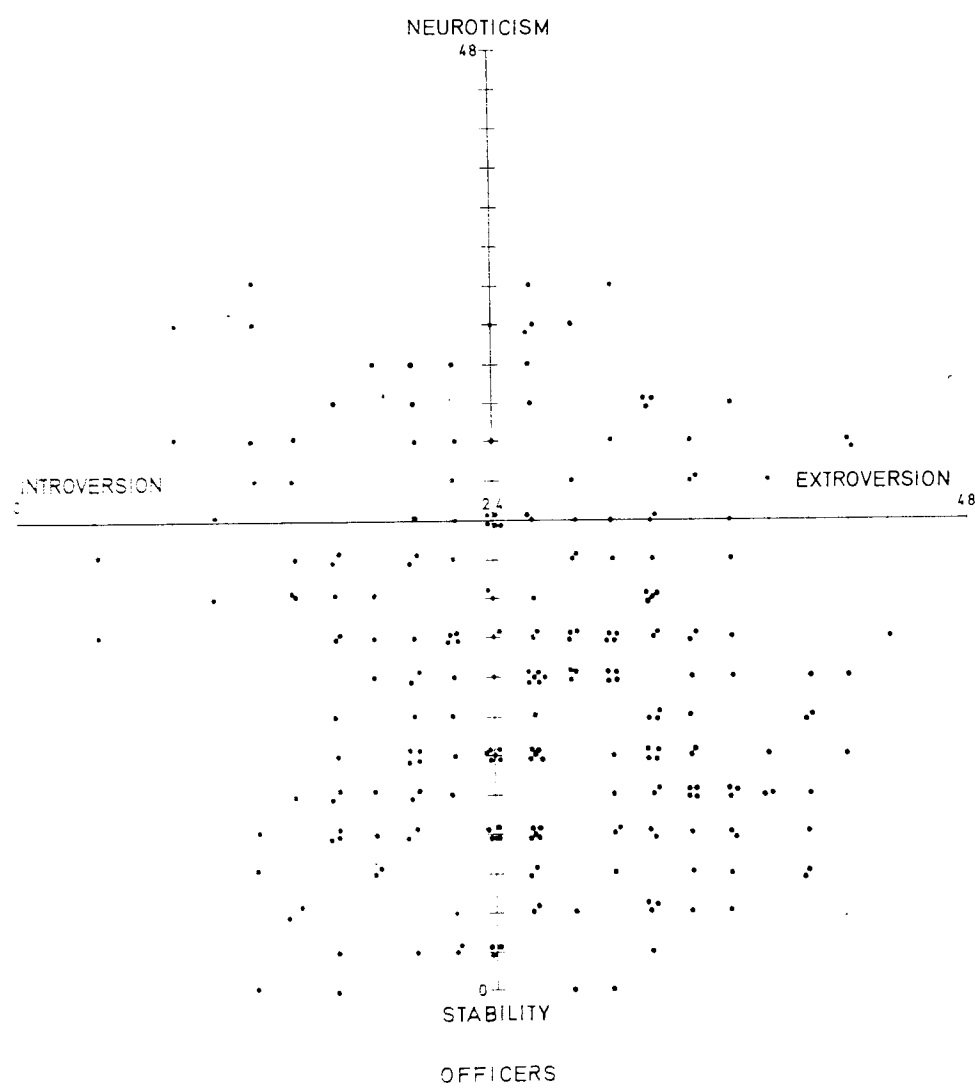
the training task as being most diverse in its ramification while the procurement function was most specialised. Analysis of centralisation reversed the pattern, because the training establishment enjoyed more autonomy.

Table 14.8 Summary Table of Organisation Measures

MEASURE	ASHORE		AFLOAT	
	SCHOOL	P.E.	DLG	FF
ANALYSIS OF FUNCTIONAL SPECIALISATION	12	4	8	8
CENTRALISATION	16	25	25	26
STANDARDISATION	44	25	33	31
FORMALISATION	31	21	27	27
TRADITIONALISM	41.9	19.0	22	14.8

14.39 Functional specialisation was highest in the training school but because of its large size this was expected. The frigate scored highest on centralisation, and this again was related to her size, having the smallest complement. The degree of standardisation was most marked in the training environment as was the measure of formalisation. These both reflect the stereotype view of naval training establishments embraced in the term "PUSSER". The configuration analysis gives a feel for the different styles of management but does not indicate the inherent problem in the shore organisations where there is a serious condensing of the rank structure to fit the overall requirements for career development. Thus the P.E. organisation concentrated five captains in one area of activity. Similarly, the training environment had struggled with this problem and resolved it in part by clearly identifying the boundaries of each area. The reorganisation to achieve this had clearly relieved the pressures inherent in a top heavy structure. It was noticed that in some areas, however, the signs of such pressures building up again were being reported.





Distribution of EPI Scores for Total Sample



## SECTION 15

### DISCUSSION OF THE RESULTS

15.1 The results reported in the preceding sections support the initial hypothesis that psychometric techniques provide a different dimension for comparing the various groups of leaders. The significant differences observed have relevance in examining the place of the individual in the total organisation and, as the principal justification for Naval Officers is to lead the ship's companies of warships at sea, this will be taken first.

15.2 Fryer (1971) in the context of 'Management by objective' and other Systematic management techniques said:-

"If the shore-based officers discovered it was difficult thinking of themselves as middle-managers, those on ships, such as the Leander-class frigate which docked at Portsmouth last week, find it really hard going.

This view of the Royal Navy's attitude to modern management methods failed to reflect an awareness that there is a problem, even if no-one looks to MbO as the great panacea. An ability to manage is an essential but not sufficient attribute of the efficient naval officer. This has been recognised for some time and is seen in many aspects of the way the service conducts its affairs.

15.3 The naval officer performs in an environment with a large measure of uncertainty which must be inherent in a life at sea. At a course in Operations Research, the lecturer said "In my experience, naval officers are magnificent in crises but do very little to avoid them." He implied a criticism. It could be a compliment to a group which has recognised its true role and played it successfully. The naval officer is frequently in no position to do more than respond to crises. He must develop a repertoire of response and be sensitive to situation. Provided he is selected and trained with this in mind, the Royal Navy will prosper. A slavish adoption of 'technique' in leadership can result in a naive concentration upon the obvious to the exclusion of the important.

15.4 The different demands placed upon the leadership will be appreciated by examining the range of activities involved in the many roles played by a frigate, shown in figure 15.1.

Beyond the dichotomy of peace and war there is the need to balance the demands of the material with the reasonable expectations of the men. Thus although frigates are running with what Fryer described as "poor management systems" the fact that they are achieving satisfactory results reflects that they are well led. This was the impression gained during data collection in a frigate. The total experience of

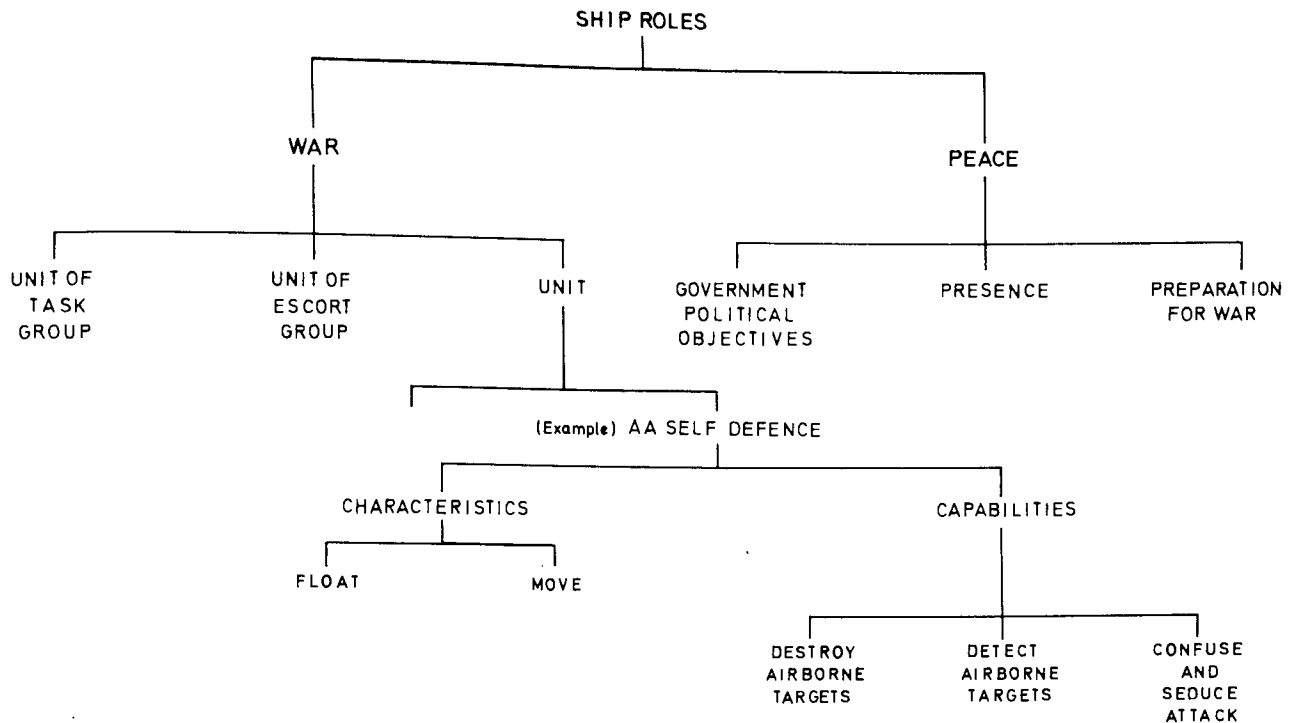


Fig.15.1 The hierarchy of ship roles

the officers and senior rates was not very high at the start of the commission but the leadership style exercised by the command had clearly provided an environment for rapid development of group cohesiveness and competence.

#### THE PLACE OF LEADERSHIP ON BOARD SHIP

15.5 Discussion about leadership and management has continued as more thought was given to what was meant in a Naval setting. How much influence does an act of leadership have when the principal actor might be at one end, the Captain, and the other end of the scale, a Leading Rate. A measure of this would be to consider the influence of each member. Then it becomes apparent that for leadership to act satisfactorily it has to be constrained within small groups. Once the Captain tries to lead his ship's company by regularly addressing them over the broadcast, or by clearing lower deck, he whittles away his subordinates' powers. This may be necessary occasionally to establish a common bond and to make certain that everyone is on the same wavelength. As a general rule and especially in emergencies, the 'chain of command' should be used and encouraged. The cliché that the 'anchor chain is as strong as the individual links' applies because each leadership act at each level, from the Captain through the Officers, the Chief Petty Officers, to the leading rates and other junior rates are of equal importance. The more these links can be balanced, the more likely the ship is to function in an efficient, quickly responsive way.

15.6 The outsider often questions how leadership exercised by a leading rate can fit into this overall picture. What must be remembered is that the Navy has many more leading rates than there are roles within the Navy for them to fill. This is an unfortunate consequence of linking pay with rank, rather than linking it with

the task done. It was reported that in 1972 there was a requirement to train between 1300 and 1500 leading rates at the Leading Rate Schools. This is in addition to those already trained and still serving. It must make nonsense of the concept of leading rates being leaders. Most of them have no 'face to face' leadership task put upon them during the course of their working day. Therefore they have no chance to practice their skills in Leadership. They lack the motivation to learn and the general view of leading rates tends to be a poor one. On the other hand, those who are actually called upon to lead have a most important, often a vital task to do. Of these, the most crucial is as leading hand of the messdeck. He is the key to a scheme whereby the management have a representative within the small peer group who live, eat and sleep together on the messdeck. The ship's company is usually divided on the basis of a divisional system, but are occasionally divided on functional lines according to the job they do. In either case, the leading hands of the mess are living amongst men of their own age group, doing the same work and, in many cases, with others on the messdeck who have the same rate. A messdeck may have five or six leading hands, a similar number of able seamen and a few ordinary seamen. The man put in charge, responsible for all sorts of decisions about communal life, is given a very narrow path to tread, and if he does it successfully the ship is a long way to being a happy and efficient one. He provides the ears for the management. Further, the leading rates interpret the management's view for the majority of the ship's company. When there is a close relationship between the leading hands of the messdecks, their divisional Petty Officers and the 1st Lieutenant, there is no reason at all why grievances should develop or why demands for unexpected action should appear unreasonable.

15.7 The central position of the 1st Lieutenant matches the discussion in paragraph 6.21 where the 1st Lieutenant (who is second in command) is shown to have a vital role in creating the environment for leadership to flourish. He will be dependent upon his captain's wishes and his success will rely on the other heads of department as well. This identified the role holder as possibly the most important person in the ship. As a closer examination of the personality measures of typical leaders may provide some insight into ways of shaping the organisation to make the most of the available talent, a case study of this was undertaken in a second frigate. The individual 16 PF profiles of these four officers is shown in figure 16.3. Interpretation of these using the overlay provided will show that the 1st Lieutenant fulfils most of the specification for a 2nd in Command. He was an intelligent, gregarious and very self-confident officer if a trifle smug. There is also a very good match with the other three predictors of success in other roles and it was noted that subsequently he was successful in sea command.

15.8 The Commanding Officer was higher on three and lower on four factors than the cautionary overlays would predict as desirable. However the position power in

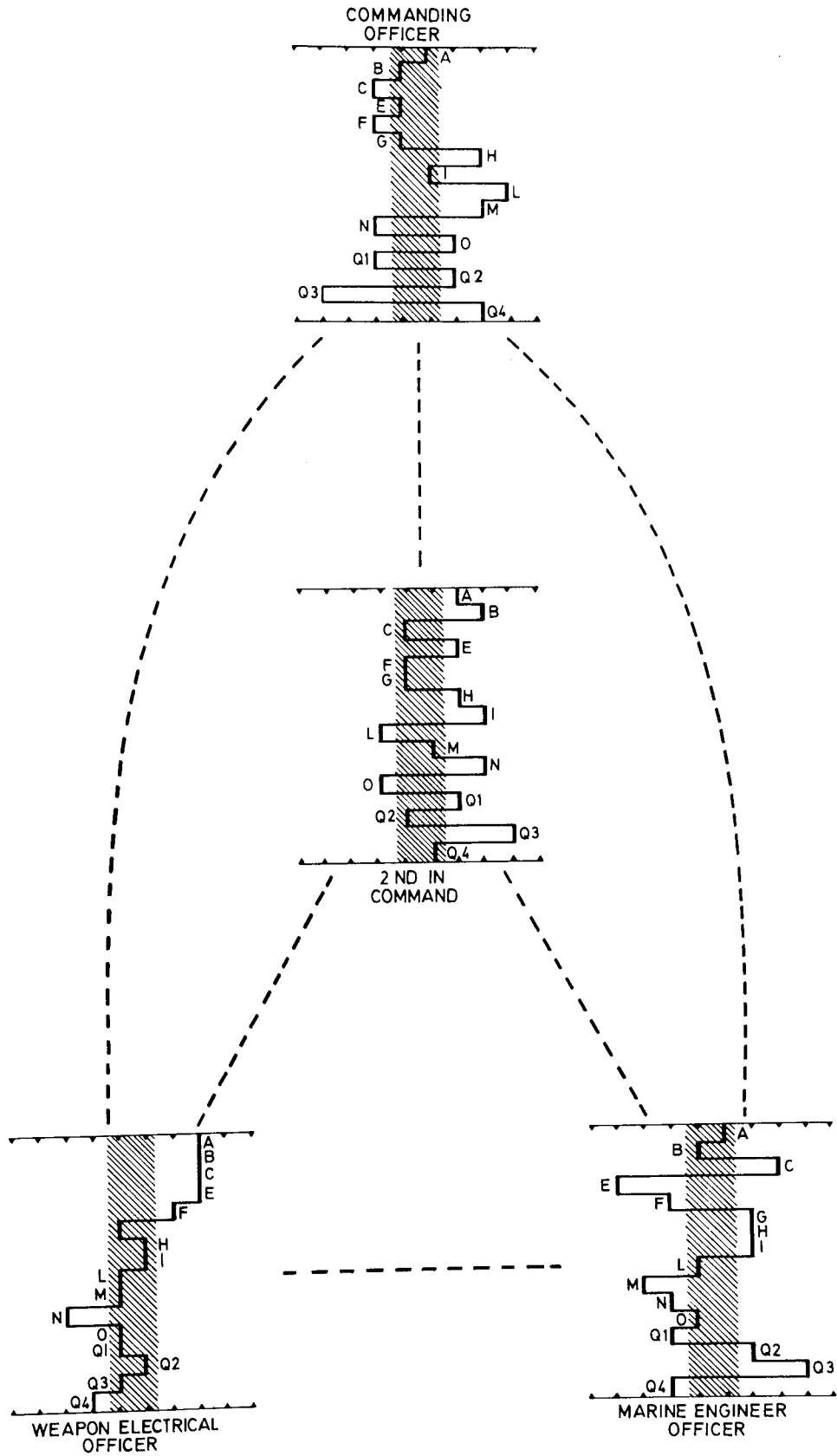


Fig. 15.2 16 PFQ profiles of Frigate Leadership

a ship makes the leader's role less demanding as seen by the role holder than an equivalent task ashore. Thus, self sufficiency (Q+) and boldness (H+) were complimentary to the attributes of the 1st Lieutenant and the combination was most successful. The diads CO - WEO and the WEO - 2iC were congruent. The WEO matched the leader overlay and that of the ideas man. Impulsiveness (F+) and realism (C+) were counter-indications of a good applicator. He would predictably make a satisfactory project leader. The MEO displayed the most extreme profile and warning indications were observed on a number of factors when using the overlay. In particular, a controlled (Q3<sup>+</sup>) conventional (M+) and conforming (E+) approach did not match the imaginative (M+) venturesome (H+) approach of the CO.

The group can be considered as containing a leader (2 iC) an applicator (MEO) and an ideas man (WEO) with the CO, organisationally removed from the group. This matches the requirement and it is concluded that the upper end of the traditional hierarchy on board ship is well suited and requires no adjustment because of other pressures.

#### NAVAL OFFICER EMPLOYMENT IN HEADQUARTERS

15.9 The clarity and fitness of purpose observed in the ships organisation was not apparent from the results of data collection in Headquarters which were rich in information but difficult to interpret. This must be recognised in some measure as being inevitable because the interviews took place just prior to the announcement of the Rayner Report (Command 4641) which was accepted by the Prime Minister who invited Sir Derek Rayner to become the Chief Executive of the organisation he had recommended setting up. In the introduction to his report, Rayner stressed 5 points:-

- a. The high quality of Service officers, particularly their understanding of line management and the value of good human relations.
- b. Service loyalties which, although they can lead to duplication of effort and parochialism, properly channelled are capable of making a very valuable contribution to a new organisation.
- c. The enthusiasm of those employed at the Research and Development Establishments and the actual and potential management qualities of some of the scientists.
- d. The Services' and scientists' search for quality and their contempt of the second best; provided that they can be persuaded not to allow 'the best to stand in the way of the good', their standards are a worthwhile input to prevent complacency in a procurement organisation.

e. The unique experience of civil servants in coping with political changes of emphasis and in working to give satisfaction to Parliament and politicians.

15.10 These when combined with interviews with a representative sample of 57 serving officers discussing their work and aspirations resulted in the development of a frame of reference. In particular, the place of the general list engineer officer which had always been identified as contributing to the research and development of ships aircraft or weapons was questioned. It became increasingly apparent that there was a serious mismatch between the claims made in justification of having serving naval engineer officers in staff appointments and the way in which they were seen to be employed.

The interviews with Naval officers at a Development Establishment threw this mismatch into sharp relief and in this connection it was decided to pay particular attention to these points:-

- a. The effectiveness of the organisational structure at the time.
- b. The desirability or otherwise of the integration of technical officers within a Project.
- c. The level at which decisions were taken, and advice given.

It became clear, however, during the course of the interviews that it was difficult to identify a precise pattern in the employment of Naval Officers or to draw conclusions with regard to the effectiveness of the tasks they performed.

15.11 It was noticeable that the organisation which has evolved as a result of the several reports mentioned in section 9 did not achieve the expected results because the detailed examination of the consequences of reorganisation stopped at quite a high level. The re-allocation of tasks and the organisation for working level relationships was left to develop in a random manner. This development was not always fortunate and sometimes merely grafted new complications on old bad practices. For example overlapping or imprecise responsibilities were apparent because it was not clear to some of the staff for whom, or to whom they were responsible. A number of officers said that they did not know precisely what was expected of them. Equally the qualifications or experience required were not agreed because opinion differed as to the need for professional qualifications or differed just as much on the role the individual played. For instance, one officer thought he was not being used effectively, was not accepted by or allowed to assist the Project to which he was allocated and was thoroughly frustrated. Another, with similar qualifications was fully accepted by the Project as a useful member of the team, and as a result thought his training was put to good use and

felt that he was doing an effective job. There was also a complete range of opinion regarding desirability or otherwise of the integration of the Naval Officer into the Project. It tended to polarise positively with the role held by the person being interviewed.

### The Organisation

15.12 The information obtained from the interviews pointed unmistakably to an organisation which had not clearly defined the role each individual had to play. This had resulted in undesirable variation in the way the task was done depending upon the ability, background and inclination of the individual. Since the qualifications and experience of the technical officers covered the spectrum of long practical experience combined with limited academic qualifications on the one hand to limited experience coupled with post graduate qualifications on the other, the result was a variation of performance which was wider than should have been expected. Since the interpretation of each post depended so strongly on personality, it was not possible to make any assessment of the loading or effectiveness of the individuals. Identification of the true place of an individual during the interviewing was made more difficult by the large number of re-adjustments made within the organisation just prior to, or during the study. An additional difficulty was created by the fact that a high proportion of the Officers had recently joined and in some cases, after a period with nobody in the job to give a turnover to provide continuity. As a result there was a tendency towards lack of precision in the definition of the task and its main objectives. Also there was a high degree of uncertainty about the chain of command.

15.13 These random gaps in the filling of the formal organisation did not seem to be in the long term interests of the service. However it was felt that there appeared to be a natural justice in cutting the complement when the total number of Naval Officers available is reduced. It would seem that a solution to this problem would be a more flexible deployment of naval expertise. This more flexible approach would need to recognise certain constraints, in particular any hope of reducing work associated with new projects is unrealistic. However, the quality of the input can be maintained with a reduction in the effort involved if organisational changes could be made to improve the working environment, in particular the stress levels generated by the chain of command. It was clear from interviews that the chain of command shown in figure 10.1 was virtually unworkable. This impression was confirmed by many Commanders who indicated that their need to seek advice or direction from the AD to whom they were responsible was small. Their contact with their superiors was generally limited to keeping them informed of progress. This matched an impression of a general under-utilisation of Senior Officers at Headquarters. Some of this was recognised in the new reorganisation.

## Integration within Projects

15.14 It was proposed that the high academic qualifications combined with sea experience of WE officers could be most effectively employed by their integration into the projects. However, there were practical obstacles to the implementation of this as a general policy, particularly in the case of numbers of small equipments being grouped together but it was felt that this practice should be followed wherever possible. It also emerged from the interviews that chance played too big a part in the manning of Naval Officer posts in this area of employment. It was equally clear that resolving these problems was impossible in isolation. Where Naval Officers were employed on development tasks high motivation and good morale were apparent. Naval Officers within the Trials Party Organisation also appeared satisfied with their work. Apart from this there appeared to be too little scope for deploying Naval Officers' expertise to the task where it would be most effective.

15.15 There is, however a danger in assuming that total integration would be the answer to all problems. For example, the process of reaching compromise solutions where there was a conflict of interest between the R & D Establishment, the Naval Staff and Director General Ships relies upon a dialogue between Directorates and Divisions. The reasons for difficulty in this were seen to include the pressures that the formal organisation of an R & D Establishment and the informal links based on professional esteem generate. These would militate against a trade-off in favour of a compromise solution necessary in the interest of the Navy as a whole. Pressures for change will only be exerted by men motivated by some identification with the active Fleet. This probably means serving Naval Officers who have a further expectation of a tour of duty afloat. The number of these so employed tends to be small.

15.16 The actual allocation of tasks within an organisation is a dynamic process linked to individual differences and is progressively modified by time in such a way that it will depart inevitably from the official view of the allocation of function. The strongest leadership influence was expected to emerge from the Scientific Civil Servants with the most position power. The use of Senior Ratings was seen to be attractive but one of the prime advantages of Naval involvement in the R & D field would be lost if those were used in any number because the acceptance of naval staff as equals in terms of professional competence by the designers would be unlikely. During data collection civilian project managers were outspoken about some aspects of the employment of serving officers. In particular, the cost of such a person was queried. When a project has to identify all life cycle costs, the extra price of a naval engineer compared with his



civilian counterpart was found to be at variance with their relative efficiency. "Why pay more for a man who is not very efficient - to be blunt - just does not know his job?" was asked in the context of a younger officer who was, in reality, there to gain experience.

15.17 This difficult area was discussed in the Rayner Report, "we attach great importance to procurement being treated as a specialised function and to there being continuity of service in it. A procurement organisation must contain all the specialist skills that are needed and must offer a full and attractive career for those who enter as specialists and whose contribution will be best made by staying broadly within their specialisations. But it is essential also that the organisation should deliberately set out to provide its own middle and top managers who, although they may have entered as specialists, are given the broader experience within the organisation, and in some cases in industry and elsewhere in the Ministry of Defence, necessary for this. Senior posts must be open to officers of all specialisations who develop the necessary capabilities." It has been stated (Annex J) that this includes serving officers. They must therefore have the opportunity to make equipment design and production their main contribution if their talents are suitable. But a look at the numbers involved

Table 15.1 Numbers of staff employed on Naval procurement (from Cmd 6461)

Service Officers	Non-Industrials	Industrials	Total
190	8,300	3,900	12,390

shows that there is likely to be considerable pressure militating against the acceptance of significant numbers of this minority group entering the higher posts. The real problem rests with the acquisition of relevant experience. Where the naval officer is well-found on this criterion it is likely that he will fall short in some other area needed to fit him for promotion within this special field.

15.18 The quality of decision-making is inevitably improved by earlier experience. The civil servant who has worked in London has developed a political perspective and inner working rhythm which is attuned to parliamentary questions and Ministers' needs. The Professional civil servants involved in technical matters in the design departments will have seen frequent examples of careful work rejected at a stroke after years of preparation. They are unlikely to feel that "with all dispatch" is an appropriate tempo for work. The Naval Officer in the

seaman branch of the general list will be well trained in decision-taking under conditions of uncertainty and risk. He has unique experience, and will have had or aspire to command. The transition into the procurement environment is usually unpleasant and sometimes painful. The Naval Engineer however, sees that it offers him his chance of self-actualisation. The fact that he is in a practically powerless minority rarely receives recognition. He brings with him special skills and possibly unique and vital experience. It is only infrequently that the system finds a way to put this to full use. It can only be assumed that the real value of sea experience is very small compared with other constituents in the multi-disciplinary process of naval equipment procurement. The younger engineers have noticed this lack of opportunity, however and among those who choose to leave some explain it in succinct terms.

15.19 A case study of a Successful Project Group was conducted on a team of six with a small age spread working for an Assistant Director on a clear cut project. The leader and the six workers in this close knit group were all invited to complete the 16 PF. The profiles after scoring were plotted as stens and examined to discover whether they fitted the hypothesis proposed as a result of the Henley experiments described in Section 5. The profiles are shown in Figure 15.3. It will be seen that one fits the description of a "plant". In particular this person is detached, critical and quite reserved (A-) as is predicted for the creative personality. His intelligence is high and matches the Leader of the group. He is prudent and serious, (F-) and self sufficient (Q<sub>2</sub>+) as required by the concept of a plant. The profiles of other five members of the group show a fairly close resemblance to that of the applicator. Because the group was well motivated and because there was no "position power" within the group it was observed that they tended to look to the plant as the natural leader in most situations. This was possible perhaps, because the controller of the work of the group showed a specific awareness of his role as a co-ordinator and developer of the various talents of those in the team. In particular he was trusting (L-) making him easy to get on with which combined well with plenty of imagination (M+). These in combination with abstract thinking on (B+) and independent approach (E+) meant that he was prepared to give his staff the opportunity and the environment to do their work successfully. This was encouraged by high enthusiasm (F+) and an openness of mind (Q<sub>3</sub>-). This analysis of a situation which brought about a high level of productivity within the group was agreed in large measure by the group members.

15.20 It was interesting to note that the suggestion of promoting the "plant" away from the group created a problem of succession. On the basis of the Henley theory it was suggested that the best person to succeed him in this particular project team would be the person labelled "next in succession". It was hypothesised

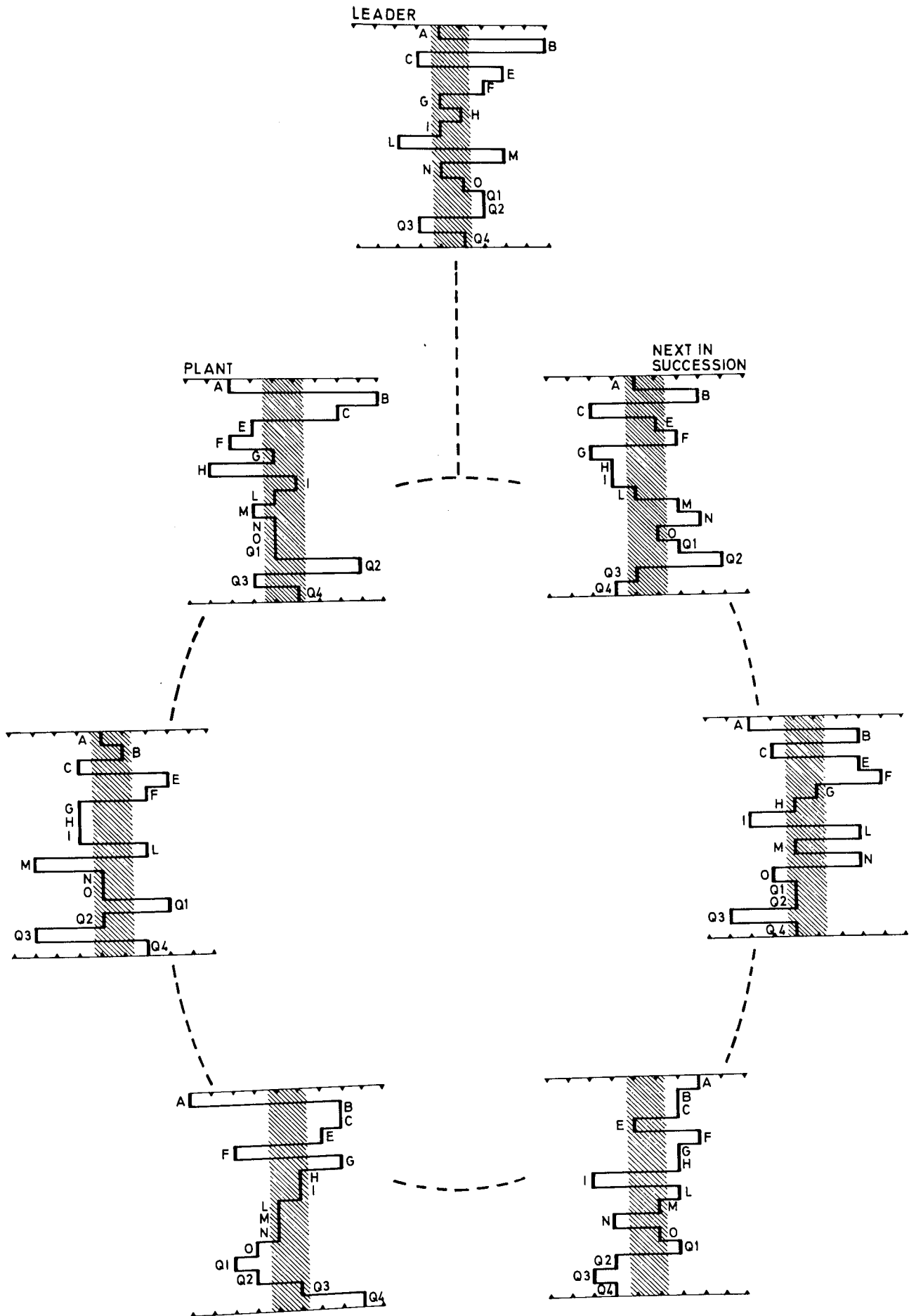


Fig.15.3 16PFQ profiles of a successful project group

that although his profile did not represent such a good match with the plant stereotype he would provide a reasonable focus for the group to continue with the plan prepared under the earlier regime. In these circumstances he would provide a satisfactory leader for the follow-on stages of the activity in question. It was agreed however that only if the present patron remained could the group remain truly productive without the original plant. It was considered that under a less sympathetic master the remaining five would tend towards an adequate output which would lack innovation and insight.

15.21. The author discussed the potential of using personality measures in team formation with one head of establishment. Interest was sincere but the opinion was extremely pessimistic. Existing constraints on obtaining suitably qualified staff are judged to be so severe that any further limitation was seen to be unthinkable. It is suggested that perhaps the return on the employment of fewer men who are better grouped would more than match the cost of such placement.

#### The Rank of Officers at Headquarters

15.22 A problem which was reported was identified as choosing the appropriate level at which advice should be given by the service officers to the scientific and engineering staff involved in equipment design. The individuals involved must experience the situation as congruent if any effective influence is to be achieved. Thus, not only must the naval officer see himself as a contributing at a relevant level but the expectations of the Civilian staff must also be met. This immediately creates a difficulty. Appropriate naval experience and expertise are probably linked to rank at a level lower than is acceptable to the permanent staff if it offered as a formal external contribution. A case study will illustrate this point. One Officer interviewed was occupying a post which he claimed should be declared redundant. He said "I cannot pat myself on the back. You may feel I am being over-modest but having been whisked off from my previous job early, to find that my new job was a non-job, I am not happy." The 16 PF profile for this officer shows no significant departures from the Naval norm, and in discussion a picture emerged which is not uncommon among officers having to serve in Headquarters departments. By the very nature of their previous experience they expect to see quick results from decisions made and are not well-equipped to cope with opposition.

15.23 The special skills identified by the role holder to do this job were good administrative ability; combined with an adequate technical understanding, and an ability to get on with people. This last was elaborated to include the ability to get people to do work when there was no real authority to call for that work to be done, thus using 'contacts' to extract the best from scientists, civil servants and industrialists, in the interests of the Navy. He said "If I went away tomorrow

what I do could be done by a Commander, I do a Commander's job and he does that of a Lieutenant Commander. If you have got a dog you do not bark yourself." He suggested that as the direct result of a number of hard working Naval Officers being employed in Headquarters, they had built up a structure to justify their being there, and by inference they suggested to the permanent staff a lack of trust in the civilian engineers producing equipment for the Navy. He saw this in its turn as an inconsistent and incompatible stance to take when most of the decisions were not within the Naval Officer's control. This viewpoint is interesting to compare with the policy declared by Rayner, recorded in annex J where he sees a very special role for the Serving Officer.

15.24 This was typical of the response encountered among officers with little experience of the Headquarters environment. Subsequently another Officer took over the majority of the duties. He was interviewed some 9 months later and reported that he was interested and fully occupied with his duties. He was well motivated and felt he was usefully employed. It was significant that this officer had no further opportunity for promotion. He enjoyed a flair for handling people, and had considerable previous experience in working with the scientific civil service. In any activity which depends upon influence, a great deal of time is occupied in apparently unproductive tasks. This was brought out in interviews with other officers along with these additional points. Directing staff agreed that there was scope to undertake more work individually, but it was difficult to identify a pattern of involvement which recognised the true role. At the next level there was a distinct measure of dissatisfaction with the responsibility enjoyed by the role holders. This was indicated by such comments as "I do not consult with my Assistant Director; I inform him of what is going on". Or in the terms of another "I only keep my Assistant Director informed. I did not lack assistance when the post was temporarily vacant for some time".

15.25 This inequality of tasking was reflected in a comment that 50% of the officer's time seemed to be spent on mundane tasks which were well within the competence of an officer one rank lower down. In one case, the view was that 80% of his work was mundane, failed to extend him and gave him little job satisfaction. There was a view that briefing for committees and to keep 'in the picture' created an enormous amount of work which was not productive and in all respects appeared to be unnecessary. The general impression, obtained after 67 interviews, was of widespread dissatisfaction with the work and the organisation for directing it. There were some areas where this did not apply and there were some individuals who were clearly highly motivated and thoroughly enjoying what they were doing. At the time when the data collection was carried out the level of morale was low and the combined effectiveness of the talent employed was equivalently small. One well

qualified engineer officer gave as his considered opinion that he was neither using his skills as a leader nor his skills as a professional engineer in any way whatsoever. He was of the opinion that his task could be done by a Chief Petty Officer with the exception of one small element of his work which required the acceptance of professional responsibility. Another officer said that his task was 75% clerical and only 25% technical and that he did not get satisfaction from the activities on which he was employed. An analysis of this general discontent in terms of the needs of the navy indicated that some degree of under-employment at the appropriate level was inevitable as insurance against the likelihood of advice being required when no one was available. The long time scale of project development implies wide fluctuations in load on the Naval Officer contribution. Linking Naval advice with an engineering contribution as a member of the project is the preferred solution and is being introduced to some extent in the latest reorganisation.

#### The TRAINING ENVIRONMENT

15.26 By comparison with Headquarters, the training environment was well ordered. However, it did disclose a patchwork of enthusiasts working with a large proportion who saw the training task as a necessary but uninspiring one. This, however, was not acceptable to the self image, so it was frequently rationalised into a competitive spirit mixed with some malice between the various disciplines involved. The Seamen officers and petty officers saw the weapon electrical branch as posing a very real threat to their stability. The engineers claimed that they were being placed in an impossible situation by training demands that failed to recognise the nature of their problems. The instructor branch found cause to comment upon the whittling away of their powers. It was considered appropriate to examine personality and attitude differences between Instructor Officers and other Staff at a training establishment. These are presented in table 67. None of these differences were significant at the  $p = 0.01$  level. Cattell (1969) predicted that the training staff in a teaching situation would be more effective in encouraging creativity if they were not anxious ( $Q_4 - 0 -$  and  $L^-$ ), experimenting  $Q+$  Imaginative ( $M+$ ) and not too demanding ( $E^-$ ). Compared with the sample from afloat ( $n = 112$ ) the training staff measured demonstrated all these characteristics with the exception of factor M where they were more conventional than the sample from ships.

15.27 The pressures at work on the leaders in the training environment were very different from those in the earlier ones described. The situation was far more structured than in the Procurement Executive and there was much less uncertainty than in the environment afloat. The leadership faced problems, however, and a case study of one successful team was undertaken. Figure 15.4 shows the 16 PF profiles

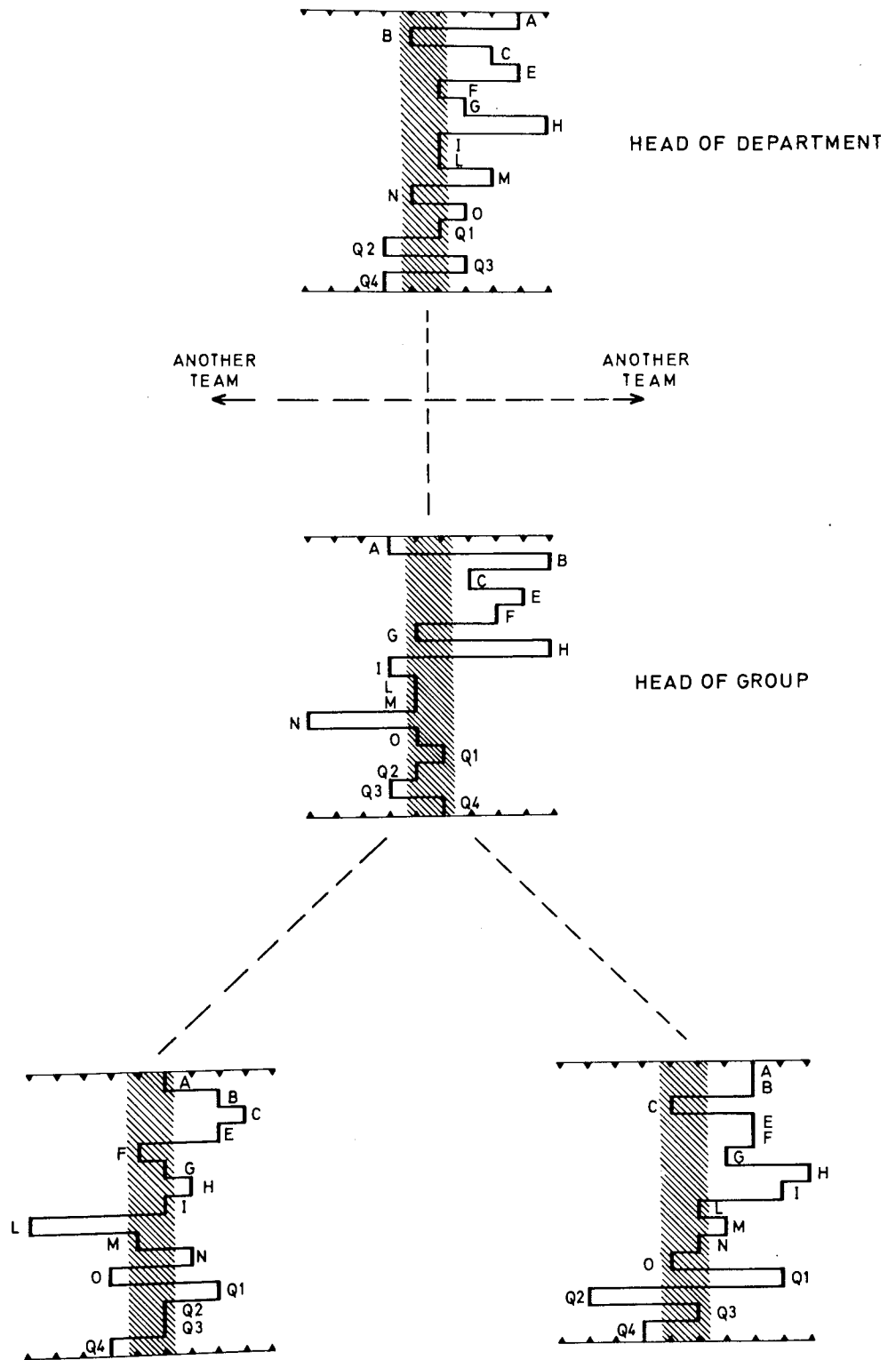


Fig.15.4 16 PFQ profiles of effective group in a training environment

for the four principal members. The head of department has a 16 P.F. profile which apart from B- and O+ Matches the leader overlay. The head of the group matches the requirements of both a leader and an applicator so that he could play both roles required of him by the organisational arrangement. It should be noted that he was not cast in the role of 2nd in Command to the head of department and would not have suited it. The person who acted as second in Command produced the profile on the right hand side of the diagram and this generated cautionary overlaps for independence (E+) impulsiveness (F+) and carelessness for detail (H+). The profile for the other subordinate closely matched that of the creative 'ideas' man with the exception of a low score on L which might be interpreted as lacking in ambition and uncompetitive. It will be noted that in addition to being well matched to their tasks the subordinates were all bright and uninhibited. The success of the group was probably linked to this reacting to the favourable environment created by the Head of Department.

15.28 Training is intended to transform the individual in the direction of the required stereotype. Selection makes the process more or less difficult. It is of interest therefore to examine the profiles of Ratings Promoted to Commissioned Rank. In the course of the follow up of the Petty Officers reported in paragraph 13.5 four of the original sample were reported as having been subsequently commissioned. The profiles are presented in figure 15.5, and the following features may be noted. Using the transparent overlays. All except the bottom right hand profile generate no serious cautionary overlaps. Factor B (Intelligence) may be disregarded in favour of other intelligence measures. A high score is a positive sign but a low score need not show low intelligence. Thus three of the four men can be expected to fill the roles of leader, 2nd in Command or applicator in a satisfactory way. The fourth will probably make a good leader but could be too impulsive as a 2nd in Command or applicator (F-). The profiles showed a marked tendency towards more extreme scores and one displayed swings giving 3 scores of 2, 4 of 8, and 1 of 10. Also he had a very dissimilar profile between his pretest and his post test during the course at HMS ROYAL ARTHUR. The leadership scores awarded on completion of the course do not show any great insight into their potential in two of the cases. In fact one would have been graded "not successful on course", in the analysis of shifts in EPI scores before and after the course, reported in paragraph 13.16.

15.29 A reading of the comments made by the Course Officers in the report on completion of the course indicated that their potential had been recognised. Quoting from one "he is ambitious and is keen to get on in the Service, he is still very young and rather immature which occasionally leads him to adopt a slightly irresponsible attitude. However, he has on his showings here the qualities to



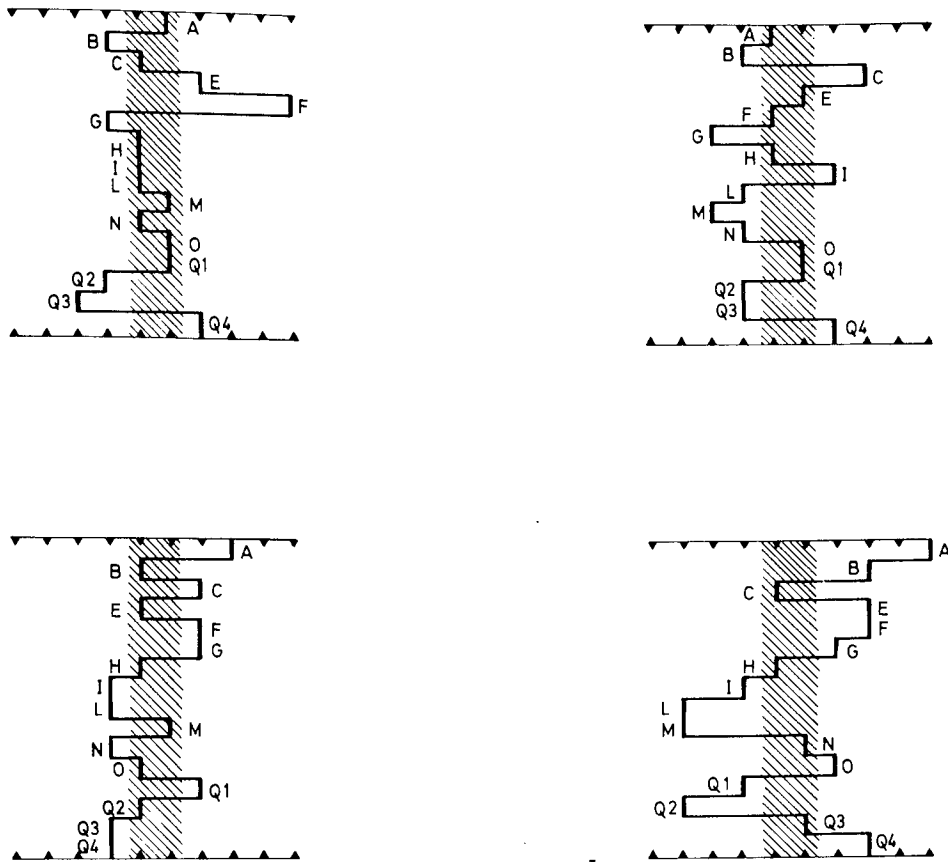


Fig.15.5 16 PFQ profiles of Petty Officers selected for commissioned rank

develop into an excellent Senior Rate and when he has qualified educationally he should be well worth consideration for a commission." Of another one it was said "he is a rather serious minded, pleasant, polite young rating who is self assured, confident in his own abilities without being over-confident. He is determined to get on in the Service and on his showing here is a strong candidate for a commission." The one who had a low score had similar remarks to support it. "He is inexperienced and a little shy but he is determined and quick to learn. On his showing here he should develop into a sound Senior Rate." There was no inkling in the report that he had officer potential. A prediction which proved accurate was made for the 4th man, "he is an intelligent and pleasant man, he has been a co-operative member of his course and has shown himself to be in possession of all the qualities required of a Senior Rate. He is keen to progress in the Service and on his showing in the establishment he could develop into a possible candidate for commissioned rank".

### Reporting Systems

15.30 There is a feature of psychometric measurement which is related to the reporting system. The discussion of these results has highlighted the fact that a

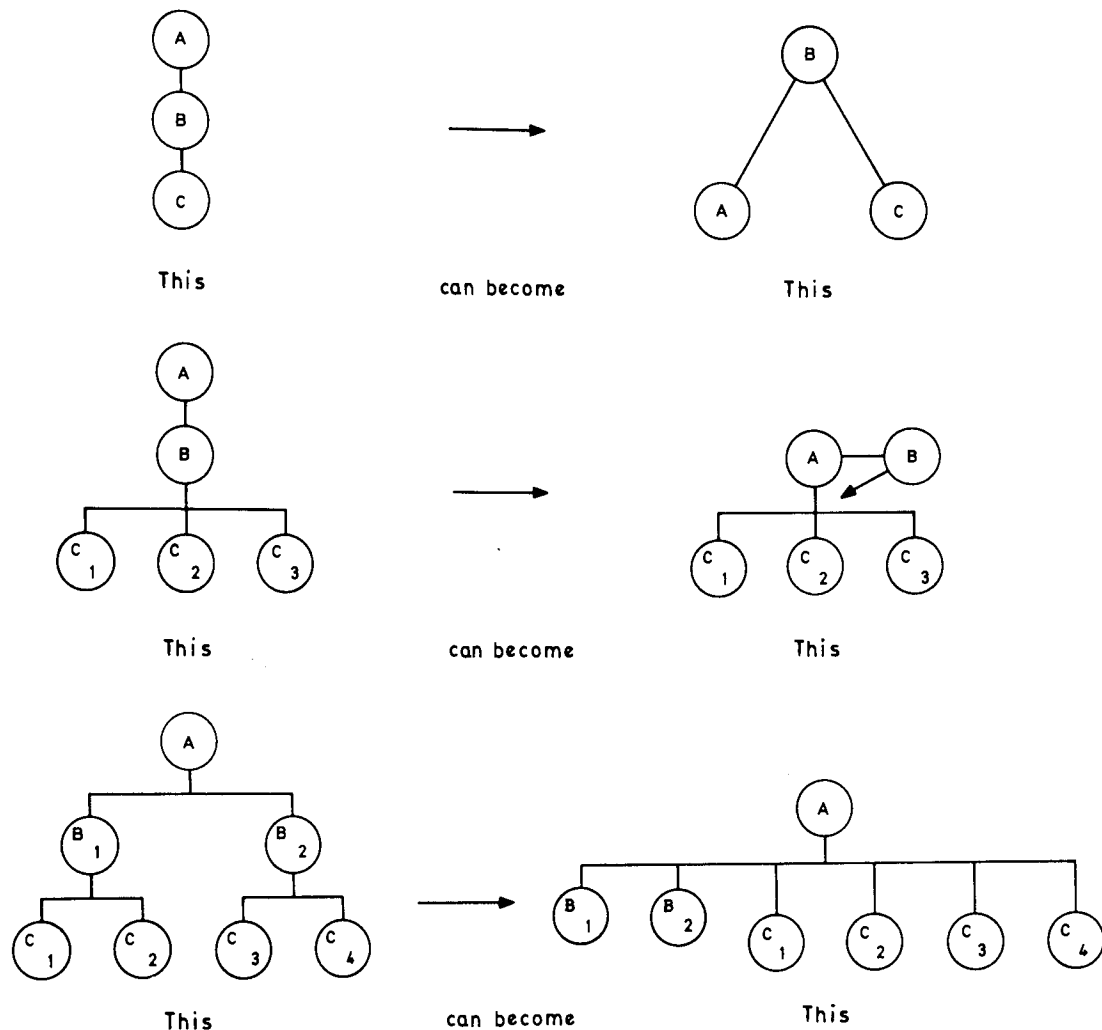
number of dimension of personality contribute differently to dissimilar tasks. This can be seen by examining the behaviour pattern of different types of leaders listed in Annex K, and considering the contribution such factors make. For example, the maintainer needs to feel committed to his task to monitor his own work. This calls for conscientious (G+) and critical (A-) (Q<sub>1</sub>+) attitudes. This does not apply to the same extent to the more traditional leader who should be outgoing (A+) and cannot afford to be rulebound (G-). The present reporting system for officers described in paragraph 2.19 is based on dimensions which go from high to low (for example most reliable through to unreliable) on a scale of 9 to 1. While there is undoubtedly a place for such descriptors they do not lend themselves to reinterpretation and are subject to halo effect. It is believed that the discipline of considering the individual in terms of his potential for a wide variety of jobs could be enhanced by the adoption of dichotomous variables such as the ones used in this research.

### Organisational Distortion

15.31 A number of cases were observed where the personalities of the individuals involved in an organisational anomaly had generated stress and were not suited to resolving the problem. Usually, they were otherwise well suited to normal requirements of the service. Figure 15.6 shows some of these distortions. Where technical knowledge is required in an advanced field, the expert may well be the deputy, and this gives him power which threatens the leader of the group, as shown in the first case. A lack of understanding can result in a temporary role reversal which will generate much ill-feeling. It is unlikely to be tolerated in a stable environment so any expert knowledge held by a deputy is likely to be treated with suspicion. This explains why projects feel threatened when Naval Officers join the team. It is not helped by such remarks as "It is time some one took charge."

15.32 The second case illustrates a frequently seen situation where the deputy was forced to act as a staff officer because the principal was unwilling to delegate. A then complains of overwork and B is justifiably frustrated. One reason for this was identified as the timing of jobs in the individuals' career. For example the deputy WEOs in Leander Frigates frequently reported being in this situation but usually when the WEO was a Lt Commander in what was generally recognised as his promotion job.

The final case is a simplification of what happens when the formal structure is not matched to the needs of the task. Then, the intervening levels are squeezed out onto a limb and complain of being under employed. This was reported in the DLG where the need to involve the Fleet Chief Petty Officers in managing the department's meant that the divisional officers were frequently underemployed.



**Fig 15.6 Organisational distortion**

The trend to Over-Management was noticeable from interviews and from reports of various studies which showed that the ratio of Officer to Ratings and Senior Ratings to Junior Ratings has been going up. Paragraph 12.3 showed that this ratio of officers and senior rates combined to junior rates stands at 3:5.

Style of Leadership

15.33 In an examination of leadership in a technical environment, the leader is studied interacting with a man who is either using or maintaining a machine. Crossman (1967) discussed the flow of information in such a situation and figure 15.7 shows an adaptation of this. Data collection from structured interviews suggested that the "motivation system" of the operator requires more study but it was outside the scope of the present work. Acceptable standards have to be internallized more in the case of the maintainer because feedback between output and the command is practically non-existent. A current exercise on the development of Command System Checks recognises this shortcoming but is unlikely to change an intrinsic characteristic. In the user role, the operator is far more likely to be handling information available to the Command and therefore subject to monitoring.

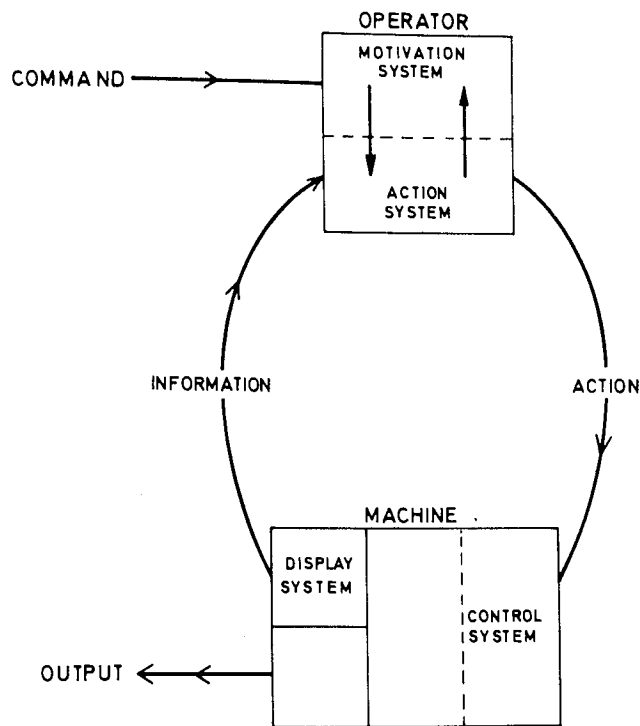


Fig.15.7 Information flow for a skilled operator (after Crossman 1967)

Motivation techniques opens to the command are quite different in each case so the sort of person required as an operator might be quite different from the person who maintains equipment. This is developed in part IV.

Summing-up

15.34 This section has discussed some of the facets of the results collected in many different environments. The exercise represents a patchwork which probably had greatest value in making the many people involved with the research aware of the potential benefits of a behavioural science approach. 985 people were involved in one way or another and this represents over 1% of the naval strength. Inevitably, some aspects of current problems were seen to have special relevance and these were given attention which is reported in Part IV.

PART IV      CONTRIBUTION TO PROBLEMS FACING THE PARENT ORGANISATION

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SECTION 16

WHERE IS THE PROBLEM?

16.1 As discussed earlier the formal organisation has identified the existence of a serious problem in the manpower field. There is however an apparent mismatch between this view and some of the opinions encountered during data collection. This merits further examination. Figure 3.1 showed the reason for the pessimistic predictions of a shortage of volunteers in the 1970's. In particular, the downturn in the 1969 numbers of recruits gave strong support to this interpretation. At the same time, the cost of these reduced numbers rose alarmingly as can be seen from figure 16.1 prepared from defence estimate statistics.

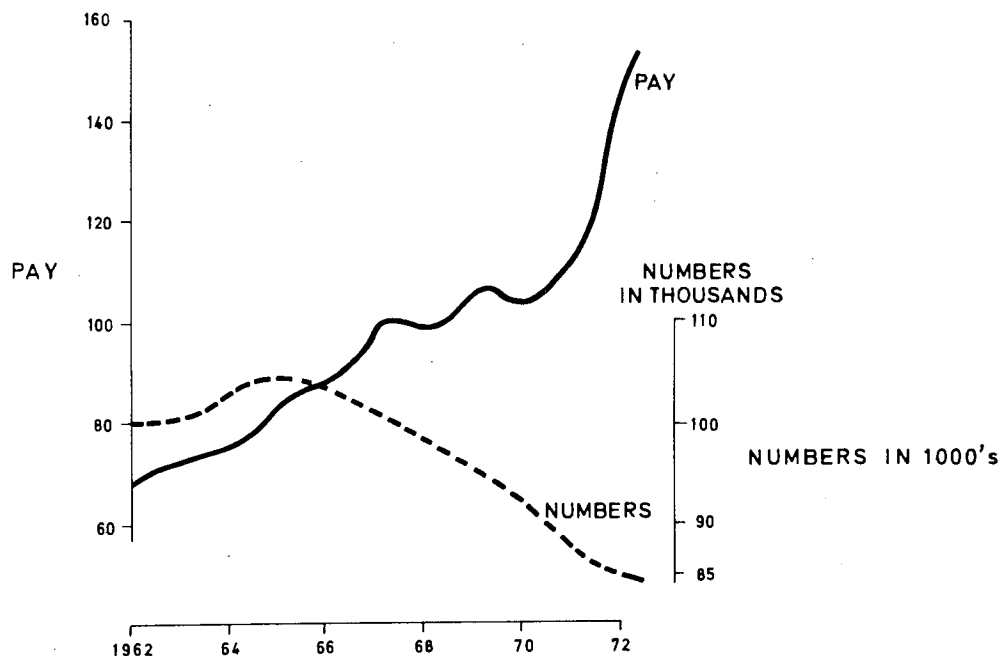


Fig 16.1 Trend diagram showing rising costs with falling numbers

16.2 The financial pressures on the Defence Budget from increasing costs of Ships and equipments were increased still further by manpower costs rising just as fast. At the same time, Life cycle costing studies had shown that in the course of a 20 year life span, 50% of the cost of keeping a ship in the firing line is represented by the money spent on the crew. The realisation of this fact combined with the increasing difficulty in recruiting the men necessary to maintain the Vote A strength, generated a number of schemes to reduce the complements of ships. Work done and techniques used in pursuit of this aim included:

- a. Dictat from the Admiralty Board, unilaterally decreeing the complements for new design warships.
- b. Temporary manning standards for the current fleet.

- c. Piece-meal Work Study activities aimed at reducing the total work load.
- d. Global Studies of manpower utilisation such as the work of the Naval Manpower Utilisation Unit.
- e. The introduction of standardised management methods for organisation of ships.
- f. Major studies to redistribute the necessary skills to fight and maintain the Ships of the fleet. In particular
  - (1) The Principal Warfare Officer Scheme.
  - (2) The User-Maintainer Scheme.
- g. New design philosophies for total ship systems which recognised that savings in manpower were vital to the viability of the future fleet.

Examples of this were

- (1) A change to all gas turbine main propulsion.
- (2) Introduction of automation in weapon systems.
- (3) A re-appraisal of hull construction to reduce periodic maintenance.

16.3 All this activity resulted in the identification of areas where work could lead to a reduction in complements. These included:

- a. More attention to be paid to reliability and maintainability aspects at the equipment development stage to reduce maintenance manpower.
- b. Reduction of time spent on corrective maintenance and reduction of level of skills required to complete this maintenance by:-
  - (1) improving test equipment and diagnostic techniques
  - (2) placing greater emphasis on repair-by-replacement of both machinery and weapon equipment
  - (3) improving documentation.
- c. Ship management organisation to be improved
- d. Reduce the need for user personnel by increasing the automation of weapons and machinery, accepting extra costs in design and procurement, and additional maintenance manpower.

16.4 The introduction of such widespread activity created considerable problems for the policy makers who were attempting to make wise decisions in the long term, while maintaining a viable fleet to meet the problems of the day. The re-organisation of the three services' relationships with the central staff of the Ministry of Defence did not make the pressure any less.

It was reasonable to suppose that the decision to reduce the Vote A strength of the service was irreversible. At the same time the changes being introduced in the employment of uniformed personnel were enabling the navy to meet its task with smaller numbers. A mismatch occurred however in equating the new requirements with the existing task. This appears to have arisen because the experience of the decision makers is not aligned with the facts pertaining in the future fleet. This may sound a harsh judgment but if it is accepted that the Navy has just passed through a very extensive technical change such a mismatch is inevitable and should not be considered in any way reprehensible.

16.5 This difficulty in understanding the developing situation has meant that the organisation has experienced a period of over-training and over-complementing for most jobs both ashore and afloat. This has resulted in large numbers of people being under utilised in both their talents and their needs. Figure 16.2 shows how the management ratio has changed markedly in the past decade and this may explain some of this phenomenon. The ratio of officers to ratings has gone up by 15% in five years and the proportion of senior ratings to juniors has increased by a similar amount in the same period. This increase has occurred at the same time as the total number has fallen and may be an indication of the different

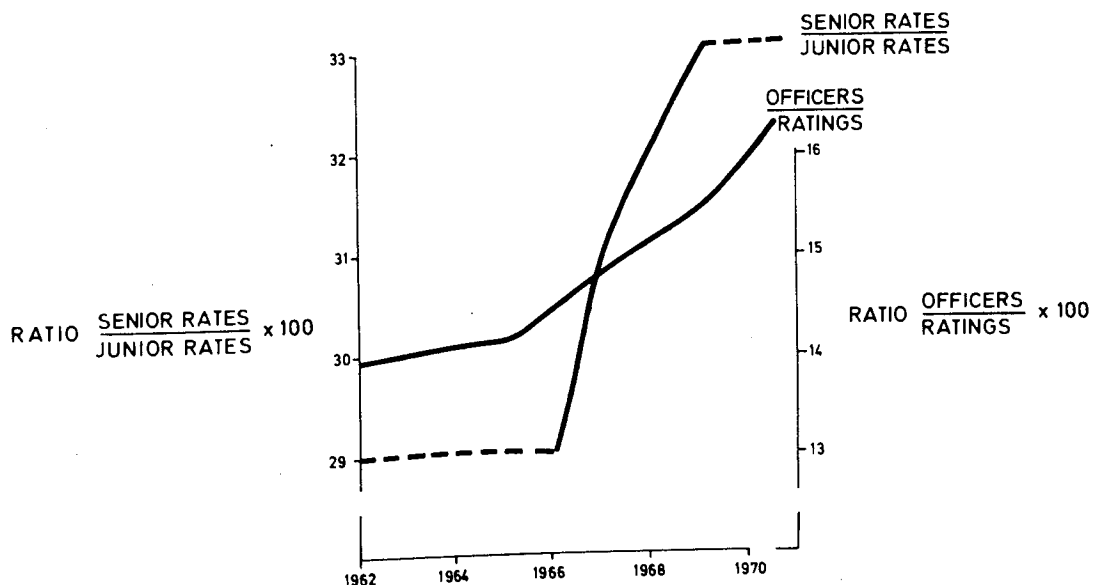


Fig. 16.2 Changing management ratios in the Royal Navy



time constants in officer and rating manpower systems. Whatever the cause, the delegation of responsibility has been discouraged and it has been more difficult for leaders to gain adequate experience. A philosophy for saving manpower would have to stress the acceptance of a large cut in every rank pyramid resulting in the chopping of the age and experience required for each post as well as cutting the numbers allowed for tackling any given task.

16.6 In line with this an attempt must be made to cut bureaucracy and to liberalise the approach to the minor administrative errors which will occur with a less experienced work force. This would help to avoid an attitude which would allow a trained officer to make the following statement. "I was particularly badly trained for my job. I failed in a submarine because I was supposedly fully trained at the age of 22. In fact maturity, management and tact can only be gained by experience and no one of this age should have been in such a responsible position." This view that accepts incompetence in a man of that age can only have been generated by the attitudes developing within the group. This man was an acknowledged failure and should not be able to rationalise this failure at the expense of the traditions of the service.

Similar attitudes were expressed during the court martial of the CO of a submarine which was damaged beyond repair after undocking at Portsmouth. The dilution of experience and the changing of attitudes was severely criticised in the press (Times 1971). No data was collected within the special area of the submarine service but it has been noted that the only way the special requirements can be met is by drawing on the larger body of people in the general service. Such adverse comments are indicative of a change which must be investigated in leadership terms.

16.7 The programme for saving manpower could develop in a number of ways. It may be sensible and appropriate to identify those attributes of the uniformed personnel which are most valuable and in a short supply so that some sort of account can be kept of progress. From such a study for example, it may be possible to identify those factors which are included in the training to enable the man to do his service job and those elements which are included in the training as a necessary requirement to attract a man into the service in the first place. If this separation were possible, a case could be made for leaving the second sort of training until later in the man's career. This could extend to the degree course. Certainly some aspects of his professional training could be phased in later. There would be some advantage in this such as getting men to sea at a very much younger age than is happening now. The arguments for and against this are very finely balanced. It is believed that the formulation of attitudes has not been given sufficient weight in the past and that this may

rapidly become the most important ingredient in any future consideration of the problem. The potential richness of the naval environment in providing for this has been undervalued in the assessment of personality development.

16.8 There is a parallel to be drawn between the situation developing in the general service with that which developed in the medical services. The training required of a competent medical officer was very demanding and yet the opportunities for exercising these skills once acquired were very limited. The solution to the problem was to identify the minimum commitment permissible and then reorganise with that as the central feature. This has resulted in a number of attractive approaches. The medical practitioner joins on a very short commitment and can extend it depending on his inclination and experience. The next step will be to allow free flow between the uniformed medical officer and the National Health Service. A similar practice might well provide the solution to the unsatisfied professional engineer after he has gained his essential experience at sea. It would not apply to the seaman branch which requires the unique experience gained only at sea.

16.9 There is no doubt that the Navy faces a difficult period in recruiting the right sort of people and in deciding how to allocate them. It is almost certain that in terms of total numbers we are not short of the men to run the fleet efficiently. The problem is one of balance and how to allocate the resources of men and of training opportunity. This balance is not only difficult in terms of annual requirements but is also complicated by the needs to balance branch structures and to balance the long term expectations of the individual. The problem is magnified by the lack of insight which is inevitable because of rapid developments in the technical fields. It is believed that the problem is less serious than is stated and that it would respond to the application of basic principles aimed at making a man most effective while in the service and confident and well satisfied when he returns to the outside world. There is difficulty in finding acceptable definitions for general discussion of the problem, however, and a different taxonomy of tasks and individual skills would help in clarifying the fundamental shortages.

16.10 The service has used rank structure successfully as a frame of reference for manpower planning and control. The national trend to less formal structures has tended to soften boundaries between ranks. This in turn has resulted in the reduction of the effectiveness of this taxonomy as a predictive tool. This success in the past relied on the relationship between individual characteristics and rank. If it is truly no longer useable, one solution would be to identify a more accurate measure of individual difference. One such dimension is 'experience' and another is 'personality'. Both of these are abstracted into

the concept of rank. Separating these constituents would provide freedom to examine the contribution which each makes to effectiveness. More important perhaps, it is considered that a more meaningful interpretation of likely consequences from proposed actions would be possible.

16.11 It is proposed that an evaluation of the changes discussed in the preceding paragraphs would be more profitable using an individual's personality and experience as separate dimensions. It would be possible to measure, personality on the parameters used for officer reporting (para 2.19) but this is an unvalidated scale and subsequent analysis is not fruitful (Gardner 1970). The most promising measure is probably the Cattell 16 P.F. for the reasons given in Section 7.

It is concluded that the use of the Cattell 16 PF in the collection of data needed for manpower planning and control would be possible, and it is recommended that such an approach be considered for those areas where conventional decision making using the rank structure has proved to be unsatisfactory.

16.12 As an example of how the use of this tool might assist, it has been applied to some of the current problem areas and these case studies are reported in the later sections of part IV.

## SECTION 17

### THE USER-MAINTAINER PROJECT

#### Introduction

17.1 As described earlier, the user-maintainer project was one of a number of activities forced upon the Navy by the shortage of manpower in ships of the fleet. It was the culmination of protracted theoretical analysis of the problem by the Naval Manpower Future Policy Division combined with a task analysis of a Leander Class Frigate by the Naval Manpower Utilisation Unit. Much of the early work was directed at making better use of the men likely to be available. It became clear, however, that other pressures, regardless of manpower shortages would result in fewer users being required in the fleet. Further, the jobs that they would have to do would be of a different character. The aim of the study was stated as being

"To achieve the effective operation and maintenance of ships' weapons and electrical systems within the forecast manpower available and in the knowledge of future trends in equipment design and capability".

The first interpretation of ways of achieving this aim resulted in studies directed at the optimisation of the use of manpower.

#### Development of the Philosophy of User Maintainer

17.2 Early investigations, aimed at a trial at sea, were centred on a LEANDER Class Ship. The basis on which proposals for the trial were developed differed from that of earlier studies in that no attempt was made to apply the principle throughout the ship but rather to confine it to those areas in which rapid benefits could be seen to be possible. For this reason, it became a Study of the use of Maintainers in the operator role. Although the name was retained, the concept of training users to maintain their own equipment was not given serious consideration.

17.3 A Steering Committee was formed of thirteen representatives, most at senior Captain's level, of all Authorities with an interest in the matter. In addition ten Sub-Committees were established with some 25 Commanders from Headquarters Divisions, Schools, and Commands. The author served on two of these sub committees.

#### Difficulties Foreseen

17.4 The committee recognised three major problem areas. These were:

- a. Would the additional load placed upon the Weapon Electrical Engineer Officer be acceptable?

b. How would shipboard responsibilities be redistributed among the Officers?

c. How would skilled operators be provided without a formal branch structure?

The first two areas became central to the work of the author and some effort was put into understanding the underlying factors in order to advise on the longer term benefits and dangers inherent in the solutions being considered.

#### Research Contribution

17.5 As a member of two of these sub-committees established to investigate the impact on officer interfaces, the researcher was intimately involved in the analysis of the possible outcome of the introduction of proposed changes. In particular an investigation was carried out into the inter-action between the Marine Engineer Officer and the Weapon Electrical Engineer Officer in ships of the fleet. The problems identified in this sub-committee were dependent upon decisions in allied fields such as the reallocation of responsibility for power generation and distribution. No obvious solution to the problems identified was possible without an iteration but it was clear that without some change in the alignment of responsibility, the Weapon Engineer Officer was liable to face an overload in the working of his department onboard the ship. This was the main conclusion of this working party and it was passed to the central committee for further examination.

17.6 The problem reappeared when examining the WEO and his sharing of responsibility with the Seaman Officer who in the environment under discussion would be the Principal Warfare Officer. It was in this sub-committee that the research provided a framework for discussing possible areas of unacceptable stress. An attempt was made to clarify those activities and involvements which must be uniquely allocated to the maintainer or the operator in a complex man-machine system such as a modern warship. Particular difficulty was encountered at this and subsequent stages in the discussion because of a general reluctance to accept the fact that a large number of any body of people are significantly less able than the average for that group. The reason for the rejection of this aspect of individual difference has grown up in the traditions of the service. It is normal practice to over-insure in all plans for response to a stimulus. These traditions do not encourage the acceptance of failure as a possibility.

17.7 Meetings were held in an attempt to reach an objective assessment of the possible overload of the WEO in a frigate of the Leander Class which might occur as a result of implementing those recommendations and assumptions included in the original study. The background and the logic behind this is worth further consideration. It was thought necessary to examine the assumptions, and recommendations of the user maintainer study in the context of the PWO scheme with the object of assessing the change in WEO responsibilities, and the consequential effects on the characteristics of his total task. There is as much anecdotal evidence to support views on the total task facing the WEO afloat as there are individual officers to recall their own experiences. An attempt was made to break down the individual judgements to smaller elements to enable a consensus to be reached and Figure 17.1 shows the typical demands made upon a WEO of a Leander using Reddin's model.

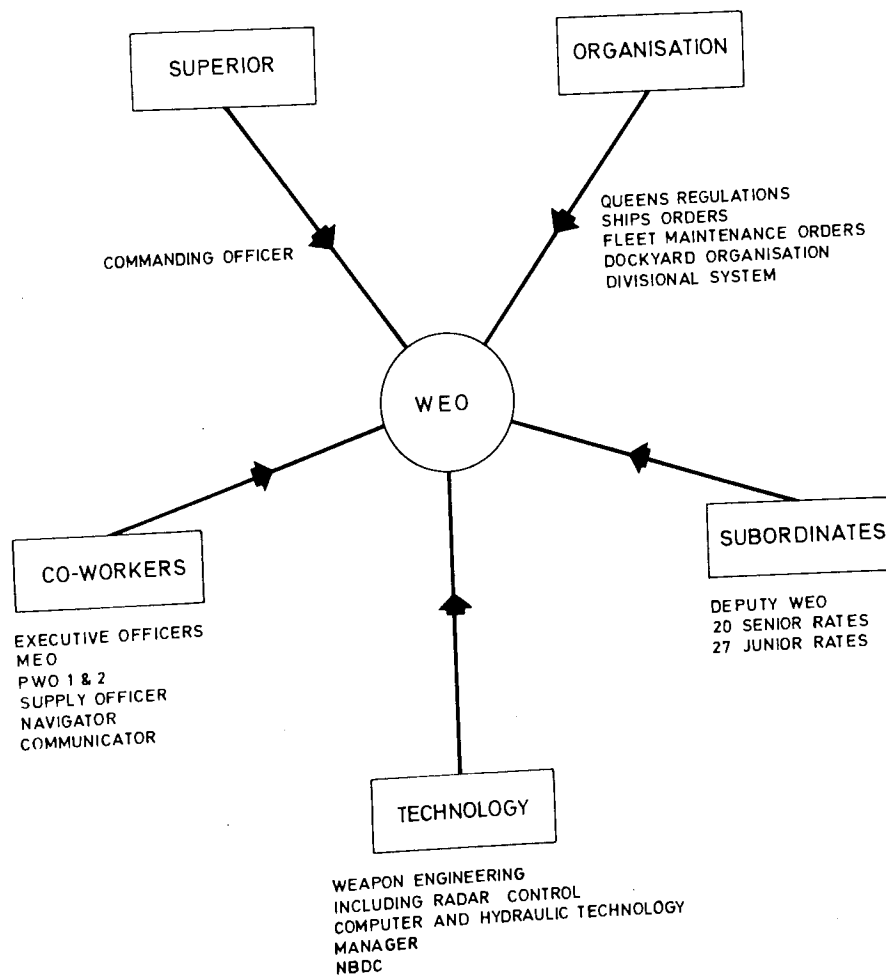


Fig 17.1 Situational demands on the Weapon Electrical Officer in a Leander Class Frigate

17.8 This may be compared with Figure 17.2 showing the situation for a PWO. An estimate was made of the likely increase in stress along these dimensions which would be generated by the user maintainer scheme as then conceived. The problem was to quantify the increase and to judge whether the training and development of the officer holding this position was likely to prepare the average man to cope with the task.

The author claimed that it could be shown that:

- a. The WEO, with the experience to be expected of the typical officer, would be overstretched.
- b. The PWO, assuming equal abilities would have spare capacity and be dissatisfied.

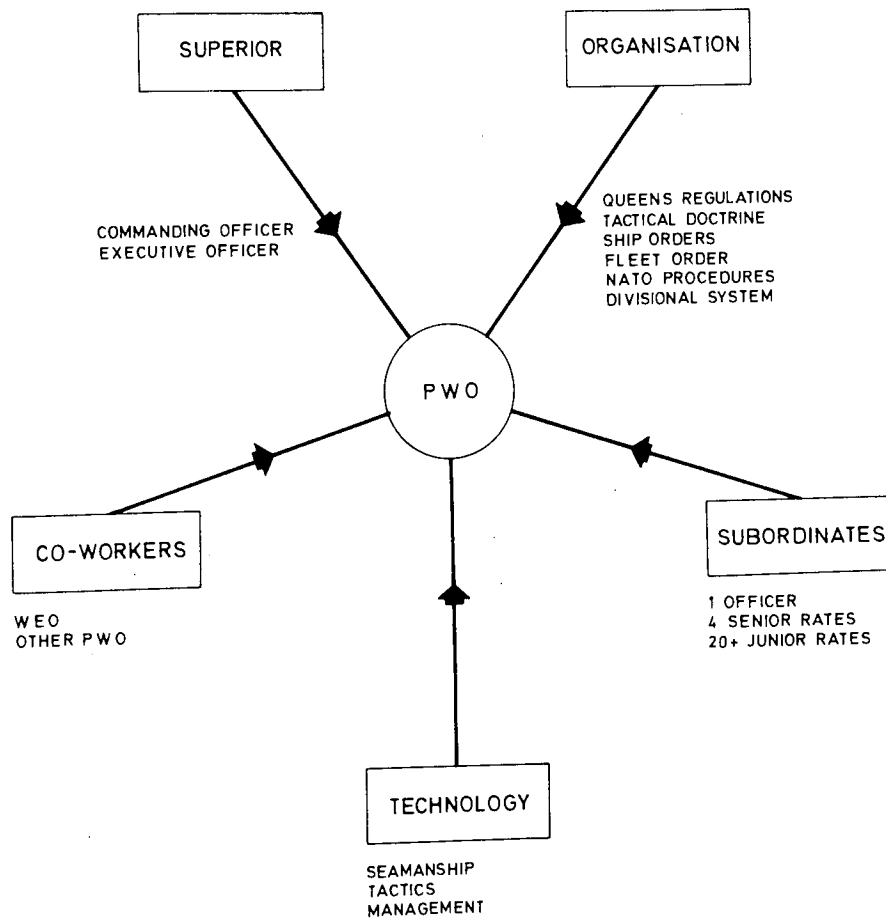


Fig 17.2 Situational demands on the Principal Warfare Officer in a Leander Class Frigate

More serious than this was the bringing together in one man of the resolution of conflict between operational and maintenance needs. It was considered to be unlikely that WE Officers at sea would have had sufficient experience to resolve these conflicts. The development of "enabling skill" and hence self-confidence, leading to an adequate competence among individual officers was though unlikely to match the increase in the size of the task.

Experience

17.9 The WE Department will be led by an officer in his second or third job afloat. Examining the ships at sea in the 70's suggest that it may be difficult to ensure that an officer has had relevant experience before going to a charge job in a frigate. It will be particularly difficult to ensure that he has absorbed adequate standards for the conduct and direction of activities not directly associated with maintenance.

Workload in a Frigate

17.10 While the workload of PWO and WEO at sea, at 2 watch defence stations is comparable, it is considered that on passage and in harbour the 2 PWOs may be seriously underemployed at an appropriate level. Difficulties created by an unbalanced workload tend to be under estimated. They can be suppressed or compensated for in autonomous sub groups but any out-of-balance becomes more critical as the interactions are increased.

17.11 The researcher suggested that the user maintainer concept threw an additional strain on to the WE Officer as shown in Figure 17.3.

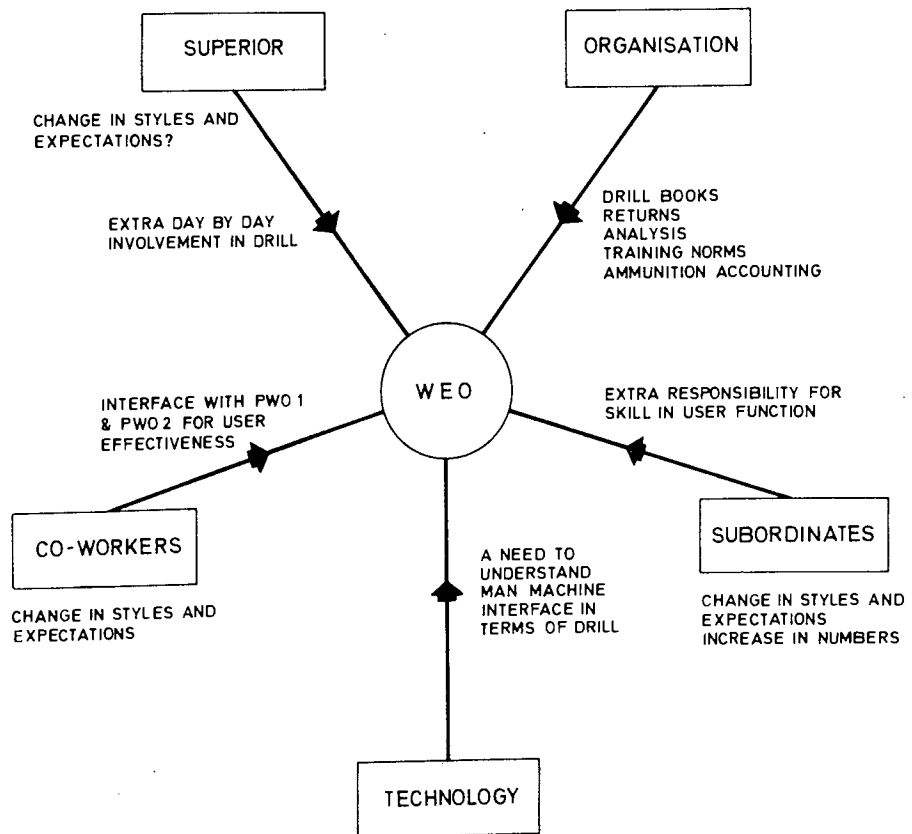


Fig 17.3 Situational demands on Weapon Electrical Officer - increases resulting from PWO and user-maintainer schemes



- a. The WEO experiences high inter-personal demands.
- b. The WE department has total involvement with all other departments in the ship.
- c. There is a very wide range of types of activity, such as:-  
 creative work, eg planning, forecasting and fault diagnosis;  
 directing activities, eg general management duties;  
 bureaucratic activities, eg administrative duties including much paper-work  
 supportive activities, eg divisional duties

Where overloading occurs in one area the result will be that all the other activities will be done less effectively. In particular there could be a tendency to withdraw into an "I'm an engineer first" approach. Alternatively, the operational side may receive undue attention.

#### Officer Characteristics

17.12 It was claimed that the characteristics required of a Seaman Officer differ from those of a maintainer; this is not to deny that the same man on different occasions can play either role. What it does mean is that to expect one man to play both roles simultaneously will create a high stress level. It is believed that the User Maintainer concept implies that the WE Officer and some senior rates would have to attempt to play more than one role concurrently. The results of the data collection on personality would support this contention. For example the tables in Annex Q indicate that WE Officers were found to be less mature (C-), and more submissive than their PWO counterpart. They displayed the characteristics of good problem solvers (G- and Q<sub>3</sub>-) which also indicates less dependability and discipline than that shown by the PWO profile. There was an indication that the average WEO is more timid (low H) but more trusting (low L) than the PWO, who was typically more conservative (Q1-) and required more group support (Q2-).

#### 17.13 Maintenance of Standards.

It was said that if all the proposals were accepted and introduced the question of who will maintain fleet standards must be asked. For example, who will decide the criteria of acceptable performance and who will teach the knowledge to enable this performance to be reached? If this is to be a large measure of the total task of the more senior WE Officers afloat this will create an interaction with their principal maintenance tasks. This may be neither desirable nor indeed attainable.

## Benefits

17.14 Large scale change in any organisation causes an initial fall in effectiveness. To counterbalance this, expected long term benefits must be correspondingly larger. The argument put forward to justify the User Maintainer Scheme was two-fold:

- a. the change is inevitable in new classes of ship because of equipment design
- b. the rate of change is justified by a predicted shortfall in available manpower.

The solution was examined to see whether the promised benefits in saving in manpower were compatible with maintaining Fleet efficiency.

The opportunity was taken in this examination to reconsider some of the variables inherent in the situation. The experience of other navies and other organisations were examined, in particular the Canadian Armed Forces and Royal Australian Navy, to add another level of insight into the problems to be expected, as well as the benefits to be gained. This led to the formulation of questions about the outcome in the longer term.

## New Technology

17.15 In the new classes of ships coming into service in the next decade, the weapon systems and the fighting of them must be considered in total ship terms. There is a requirement to have some competent systems engineers among the officers. In considering the definition of such an engineer it became apparent that, in shipboard terms only, there is little to choose between the potential competence of a seaman general list officer with the correct experience and his WE counterpart. This does not apply during the activities required of the technical officer during the harbour maintenance periods particularly refitting and post refit setting to work. This mis-match between the role played at sea and the role played in harbour is closely related to the allocation of function.

If it is assumed that the majority of tasks in a sea going ship do not require the full professional training given to a general list WE officer, a more careful examination of the role he is playing must be attempted. It is believed that his function is two-fold. The first is to contribute towards the effectiveness of the ship. The second part of his function is to acquire the essential experience necessary for subsequent employment. Accusations that the weapon and electrical engineering branch is overtrained, overborne, and "hogging" the opportunities is a recognition of these dissimilar aims. The researcher concluded that the description of a leader in a new generation complex man-machine system does not correspond with the present WEO or PWO but is a hybrid of the two.

### Allocation of Function

17.16 In arriving at this view it was necessary to consider the skills required of technical officers, the officer of the watch and the Principal Warfare Officer at various levels of effectiveness of the ship. There is a natural tendency among well-established groups to build an aura around what they do. This is enhanced and embroidered if there is any threat to their position. It is possible that this is being done within the various specialisations of the Navy. For this reason a closer examination may be necessary for the various skills involved. Roskill (1970) made some very pertinent comments on aspects of seamanship. It is worth remembering that in a period of expansion such skills are possibly among the more easy to come by through the recruitment of reserves because such skills are not 'dated' by changes in technology. In the final analysis the success of a ships company in its task will depend upon the skill of the captain, his heads of department and the key technicians in whatever guise they are provided. It is the provision of these which must be considered.

17.17 The Captain is in a line of succession from the officer of the watch and the PWO and his function is all embracing. A Weapon Electrical Officer in a Navy with an integrated 'systems' approach to weapon material must expect an overlap between the duties of users and of maintainers. What has still not been resolved is the balanced distribution in the seagoing fleet of the higher level of skills expected of the engineer, engineering technicians and the traditionally trained users. It would seem that the Weapon Electrical Branch faces a danger from being over-trained and over-borne to fulfill its true function in the future. This would result in the Branch taking too much of the available talent from amongst both the officer and rating entry into the service. It would then follow that Weapon Electrical Officers take too great a share of management opportunity, because their departments were embracing too many facets of the life of a ship. Already there is some confusion about the capabilities and expectations of general list officers of both the seamen and the engineering branches. The interviews with officers both ashore and afloat indicated a recognition of this confusion about the true role of the WE Officer, and a number of seaman officers complained of a threat of a "takeover".

### Career Development

17.18 There is more than a grain of truth in these criticisms because a number of WE officers claim that they have access to all the essential experience which would prepare them for sea command. There has been a small number of officers who, but for reasons of organisational quirks, might equally well have been

seaman officers and who despite their engineering training have a background of very general experience, including in some cases the obtaining of a bridge watchkeeping certificate. In an emergency (for example, rapid expansion of the fleet) it is probable that these officers would make very able Captains of ships. This is not to say, however, that theirs was the ideal way of producing such a person for command. Further it is considered that the current programme of research has demonstrated that there are significant differences in the developing personality and in the expectations of engineer officers which would generally disqualify them from being considered for such command. It is expected that the divergence of the developing personality occurs quite early in the process of training and in gaining early experience at sea, re-inforcing the differences introduced by self selection on entry. Differences in personality which are generated by different career patterns are potentially crucial and could merit deeper study. The fact that they exist raises questions about the long term effects of a change in role.

#### Possible Solutions

17.19 The User-maintainer concept is a natural development of total system design. The danger rests in choosing the incorrect allocation of overall responsibility. It will not show itself until some years after the introduction of the scheme because of the long time constant associated with all manpower activities. When it does, failure could occur for one of these reasons:-

- a. WE Officers in ships were not sufficiently experienced
- b. WE Complements could not be increased as expected because of recruiting or retention problems.
- c. Morale deteriorated because of inequitable distribution of work
- d. The assumption that maintainers can perform user functions to the same standard proves erroneous.
- e. Captains of ships and PWOs lacked sufficient understanding of the total systems.

17.20 It is believed by the researcher that there is a requirement for a new breed of officer on the general list who will be concerned with weapon aspects. They should keep watches being part of the seaman branch so that at mid career they could decide between aiming for sea command or the higher posts within the Procurement Executive. A degree with strong systems bias would enable them to comprehend, at the system level, the complexity of weapon systems of the future. In addition they will have the other facets of experience necessary to fit them for high command. This is close to the specification of the long course officer

from the executive branch of 25 years ago. The technical comprehension demonstrated by that type of officer was comparable with the engineers of his day. Statistics show that where he also embraced sea command the specification provided a large proportion of the flag officers at the centre of policy making in the Royal Navy. This approach would encourage a greater understanding of systems by seaman officers, and would pay handsome dividends at a later stage when exercising military command or in the procurement of equipment. The first step must be taken on board the ship. It would be a natural consequence of a trend which can also be noted nationally of encouraging greater interdisciplinary involvement. A general weakening of branch homogeneity follows from this but this is probably inevitable.

17.21 The discussion so far has demonstrated the difficulty in considering future plans using rank and branch descriptors. The sort of person needed can be better described in terms of his personality, the training he received and the experience he has had. Job definitions in these terms could be matched and strung together to form careers but first it is necessary to know something about the impact made on a personality by the job experience. It is claimed that this supports the analysis in section 16 and is justification for the effort expended in the present research.

17.22 It is concluded that the user-maintainer concept is a logical development in the allocation of function to the crew of a warship. The way it is implemented must be examined in the light of other pressures and psychometric data provides an insight which is of value. In particular, it can be shown that the Weapon Electrical Officer has become a focus for a large range of skills calling for broad talents and wide experience, and it may be unreasonable to expect such a level of ability from a peacetime officer corps, especially if at the same time there is no outlet to sea command. Sea command calls for special skill and experience and that these are mutually exclusive with the normal development of a Weapon Electrical Officer. It is suggested that some seaman general list officers should be qualified systems engineers having access to the command and control aspects of naval warfare as well as opportunity to specialise in Weapon Procurement. There would still be a place for the "Salt Horse" or non-specialist but he would have to be exceptionally well qualified in other ways to reach high rank.

It is recommended that the User-Maintainer concept be recognised as containing a threat to the long term stability of the Royal Navy and that ways of countering the threat include the re-allocation of function and hence expectation among officers and senior rates. This re-allocation should be examined in the Engineer Officer study set up in DCI T.126/73.

## SECTION 18

### COMPUTER AIDED DECISION MAKING

18.1 The researcher has been working with either analogue or digital computers for twenty years and is still wary of them in the same way that a Swiss guide is wary of the mountains: not for what they are but for what they can do to people. The allocation of function between man and machine in weapon systems has moved from simple rate-aiding of the skilled operator using analogue techniques to the complete automation of the response of a total system with only the 'override' allocated to the human operator. The power of the digital computer was the essential element which made this second application an engineering possibility. It probably represents the threshold of progress in terms of military response, and could possibly have underestimated the importance of the human operator in the decision-making chain.

18.2 The optimum contribution of the man to a complex weapon system is a subject which is outside the scope of this work but there is an interaction with the style of leadership which must be mentioned. It is the aim of this section to examine possible trends affecting the leadership task. A most difficult trend to predict, but potentially the most important is "who will emerge as the adviser to the command on system capability?." This has many ramifications and is closely linked to the allocation of function between Engineer Officers and Seamen Officers as was described in the previous section.

18.3 The balance of power between user, technical adviser and computer has been recognised in many contexts. In a recent work, Martin and Norman (1970) describe a number of potential dangers facing society on the Macroplane. Singleton (1973) described difficulties facing the individual in counselling where the guidance is linked to a computer facility. The quality of the service may be greatly improved in terms of information provided by using Computer techniques but unless the man-machine interface is introduced in the correct position, the information format may prove unacceptable to the customer.

18.4 The author claims that the task oriented leader is more likely to ignore such second order effects arising from the use of computers. Because these will take a long time to react on the effectiveness of the service it could take many years before such a reaction was detected. It is possible to examine proposals to avert this danger and it is recommended that the necessary techniques should be developed.

18.5 The introduction of central processors to aid decision making in ships has resulted in systems like ADAWS (Action Data Automation Weapon Systems) and CAAIS (Computer Aided Action Information System) being developed and installed in the fleet. These in turn have made it essential to develop the Principal Warfare Officer concept and its introduction is likely to have far reaching effects. Most of these will be beneficial but one presents a danger. The massiveness and rigidity of the hardware and software packages between them present a considerable challenge to the inexperienced officer. There is the possibility that fluency in use will never develop beyond a shallow, mechanistic level. This danger will be in inverse proportion to the general ability of the P.W.O.

18.6 A similar threat exists in the establishment of computer based systems at Headquarters. An increasing number of Information Systems contribute to a very ambitious concept which its authors promise will provide all departments of the Ministry of Defence with the facts and figures needed for proper fleet management and planning. One such system received Board approval at a time when the need was being acutely felt for more hard information on operational availability of ships, their capabilities and characteristics. Some understanding of the relationship between these and costs in terms of manpower and money was also required. The case for it was discussed in a comprehensive report which was nevertheless written in broad terms and based on many assumptions. It left a formidable task to be done in working out what in practice the scheme would do for each customer and how it could be set up to do it. The size of this task was revealed by the large permanent team to be employed notwithstanding the work contributed by departments.

18.7 The scheme was so vast, and had gained such an independent momentum, that most of those involved in its various ramifications found it difficult to judge even in the perspective of their own departmental interests. Consequently doubts have been muted, and criticism was easily deflected by the scheme's protagonists. The author was required to examine the concept from the viewpoint of DGW(N) and in discussion with directorates arrive at a consensus. In this process, various factors peculiar to the use of large computer systems in decision making became apparent. Some of these had a bearing on the way leadership was exercised in the fleet and the impact of individual personality on a complex technical decision making process was reduced.

18.8 The consequences of introducing a bad data collecting information system would be comparatively unimportant except for one consideration. In the process of establishing a more complex reporting system, another step has been taken along the path of limiting the freedom of action of the individual officer at sea. This process always occurs in a period of extended peace, but excessive

bureaucratic measures should be avoided, for the ultimate good of the service. Other examples of this tendency have been noted in the application of Management by Objectives in Headquarters Departments. The danger lies in the inertia which such techniques build into the system. Once established it is exceedingly difficult to reverse the process, should it be decided that from a total systems view, the gain is not worth the price of gathering so much information.

### Consequences

18.9 Technical leadership consists of a continuous choice-making process that permits the organisation as a whole to proceed towards its objectives despite all sorts of internal and external perturbations. As every officer knows, problems occasionally arise that are not amenable to the available and customary methods of analysis and solution. Although uncertain about which choice to make, an officer may nevertheless have to make a decision. It is in situations of this kind that many of the popular traits attributed to leaders find their justification: quickness of decision, the courage to take risks, coolness under stress, intuition, and, even, luck. There is no doubt that quick, effective, and daring decisions are a highly prized commodity in a crisis, but just as precious a commodity is the art of planning and organising so that such crises do not occur. The trend of the Navy has been to remove as many of its decisions as possible from the area of hunch and intuition to that of rational calculation. More and more it is choosing to depend less on the unique abilities of rare individuals and to depend instead on the orderly process of analysis. The occasions and opportunities for personal leadership in the old sense still exist, but they are becoming increasingly rare and circumscribed.

18.10 This trend does not eliminate the role of personal leadership, but it has significantly redefined it. Under normal conditions both afloat and ashore, leadership in today's Navy no longer consists of personal decision-making but of maintaining the effectiveness of the decision-making system. The picture of the leader who "keeps his cool and in the nick of time pulls the rabbit out of the hat" is out of date. The popular stereotype now is the thoughtful officer discussing information supplied by a staff of experts. It is possible that the brilliant leader is becoming as much an organisational embarrassment as he is an asset.

18.11 This trend, reasonable though it may appear on the surface, conceals two serious dangers. First, we may be systematically giving up the opportunity of utilising the highest expressions of personal leadership in favour of arrangements which, although safer and more reliable, can yield at best only a high level of mediocrity. And second, having committed ourselves to a system that thrives on



the ordinary, we may, in the interests of maintaining and improving its efficiency, tend to shun the extraordinary.

18.12 In the context of data collection about the material use of the fleet this discussion may seem quite unimportant. Considered in terms of developing a philosophy for the fighting of the ships and the managing of the fleet, it presents, it is believed, a much more alarming picture. It is seen as being a sufficiently serious threat to justify a programme of aimed research to identify what will happen to the small number of "agents of change" in a computer-based Navy. To do this it would be necessary to study the characteristics of those who achieved success in this field and use of the 16 P.F. would be strongly recommended as the preferred instrument. The Simulation techniques described later could also be used in this application.

18.13 There is no known work being done on this problem and no one has shown an interest in picking up the ball. It is a relatively long term problem and the Author intends to follow it up himself.

## SECTION 19

### A MANPOWER MODELLING TECHNIQUE

#### Introduction

19.1 This section briefly explains why the author became involved with simulation techniques, how the work developed and who will be making use of the results of the pilot study. At various stages during the research, the author became associated with mathematical modelling activities in a number of forms, so an understanding of some of the facets of analytical and simulation modelling techniques was found to be necessary. One approach employed by DGW(N) in new equipment studies leading from Naval Staff requirements to agreed characteristics has been developed to a high level. For example, Weapon Assessment Groups rely on generalised models to predict a given system performance while at the same time changing operational or material parameters. Later the Project develops the model and validates it for use in system evaluation and post design work. Much work has also been done on financial models of DGW(N) activity to help in the task of controlling financial and production activities.

19.2 Manpower models were not so well advanced but various attempts have been made in the past to put the Weapon maintenance Manpower Costing of ships on a firmer and more mathematical basis. They all aimed at providing a standard method of costing which would minimise variations in manpower figures due to subjective judgement. This was necessary because the equipment designer is responsible for manpower costing and DGW(N)'s long established procedure was to provide manpower costs of equipment under development on a fractional basis related to skills.

19.3 A need recognised during discussions of the user-maintainer study, reported in Section 17 was for a Method of estimating changes in load when extra tasks were added to a mans' job. A model existed in FORTRAN IV developed by SIMPSON (1972) but the manipulation of data was not amenable to rapid amendment. A language developed by PE Consultants presented a better prospect. This system called HOCUS (Hand or Computer Universal Simulator) provides a discipline which can be understood by line management. This meant that the Model of the problem being simulated can be proved and agreed by working through in hand before investing in the time and expense of computer runs. Subsequent changes can also be agreed by discussion of an easily understood format.

19.4 It is the responsibility of Second Sea Lord's Departments to produce weapon complements for individual ships. DGW(N)'s involvement in weapon complementing had been limited to specific tasks in support of ship designs, but there has been growing pressure on DGW(N) to undertake ship weapon complementing.

The author, in collaboration with J. SIMPSON attempted to design a manpower model which set out to provide a method of examining equipment parameters supplied by project leaders, using the model to generate a valid complement.

### Background

19.5 It had been recognised for some time that a requirement existed for some objective method that relied on factors other than judgement and experience. In 1968 the Controller of the Navy directed that an improved method should be produced which would estimate the manpower of ships' technical departments to a higher degree of accuracy than before. Objective criteria were chosen as the basis for a new method. Thwaites (1968) produced a computer program to estimate WE Dept manpower tied to both an assumed relationship between corrective and preventative maintenance for individual equipments; and the actual maintenance ratings employed on the equipments. Since the assumptions could not be regarded as valid for all equipments, his method has not been used. Young (1970) continued these investigations and produced a more sophisticated model based on assumed failure and repair distributions. A number of factors relating to outside resources, administration time and system linking time were also taken into account. Unfortunately, this model also included a factor relating preventive to corrective maintenance and because there is no evidence to suggest that they are related to any simple way the model and its results were considered to be unacceptable and the model has not been used.

19.6 A new model was built which looked only at Corrective Maintenance undertaken on a 100 day mission (SIMPSON 1971) since the failure and repair function lent itself to an analysis using Queuing Theory. The model was written in FORTRAN IV. In order to make programming as easy as possible, a number of assumptions were made:

- a. All maintainers to be interchangeable.
- b. No maintainer works longer than 10 hrs without a break for 8 hr rest.
- c. Jobs are dealt with on a first come first served priority.
- d. No planned maintenance to be undertaken during the mission.

A number of simulation runs were undertaken based on the LEANDER Frigate.

19.7 In analysing the results it was obvious that the results were logically correct, but did not reflect a real-life situation. The basic problems with the model and its input data were identified as

- a. Input data was not complete and came only from small samples.

- b. Only the longer repair times were reported from ships and hence defects involving short repair times were not included resulting in the figures for MTBF and MTTR being too high.
- c. The model made unrealistic assumptions.

19.8 At this stage, a course on HOCUS was attended and simulation seemed to offer a more valid approach. Simulation is recommended for tackling those problems which cannot be satisfactorily modelled by the use of mathematical formulae, because it is not yet possible to describe the mathematical relationships between variables. Simulation as a technique has two principal virtues. Firstly it helps in understanding a problem and secondly it provides a means of solving a problem.

a. Understanding the Problem

The setting up of a logic diagram, collection of data and testing the model is the period when the investigator begins to understand the problem. It is at this stage when a problem is found to differ from the original concept. Sometimes a simple solution is discovered during this early stage of model building.

b. Solving the Problem

When the logic of the problem has been defined and understood, simulation may be the appropriate technique for solving the problem. Simulation models are appropriate to seek answers to the following questions:

- (1) Are the resources in balance? What would be the effect of increasing or decreasing the resources in the system?
- (2) Are the correct procedures being used? If priorities need to be established and controlled by some planning function the alternatives can be tested. In this way the need for control can be established and the decision rules to be used can be selected.
- (3) Is the performance of each resource right? What would be the effect of speeding up a repair cycle? How would reduction of breakdown frequency affect system availability?

### Other Uses

19.9 Simulation can also be used in the study of new systems as follows:

- a. Establishing the amount of data to be collected. Initially estimated times can be given to activities in a model and the sensitivity of the total system to variations in these estimates studied. In this way the apportionment of effort between the various data collection points can

be set, in order to ensure the model will provide results within certain confidence limits.

b. Building a simulation model is a basic form of systems analysis. If it is intended to control a system, then the systems analysis should begin as early as possible and contribute to the design as well as to the control of the system.

c. Simulation models can be used to explain simply the principles of a new system prior to a decision being taken.

19.10 The great advantage of simulation as a technique is that it permits many alternative courses of action to be tested prior to taking a final decision, and this testing can be done quite quickly. In determining the degree of complexity that can be justified in a simulation model, the benefits expected from the study must be evaluated. These benefits naturally depend upon the cost of resources involved and the value that can be attributed to the improvements in operating efficiency. In decision making in the manpower field, an error can be very costly and slow to show itself so some expenditure on modelling would be appropriate.

#### Principles of HOCUS

19.11 HOCUS is concerned with the utilisation of resources in pursuit of stated objectives, using the simple concept of considering the resources, called ENTITIES, as being in one of two discrete states, Active or Idle. The changes that entities undergo from time to time are from one discrete state to another. There are no continuous gradual changes.

The distinction between the two is as follows:

- Idle or waiting, is when an entity is waiting for something to happen. This state is recorded by making the entity a member of a QUEUE.
- Active is when entities are engaged in some operation, or ACTIVITY, with a definite TIME span. Often several entities will be bound together in a common activity. When the activity ends they are all released into queues.

19.12 Each entity may exist in several discrete states. In HOCUS it is necessary to specify how they all move from state to state in order to describe how the model will change with time. To do this the 'life' of each entity is formulated as consisting of alternative activities and queues. This is called the Activity Life Cycle. Each entity type will have its own life cycle but often these will overlap when different entity types share queues or engage together in activities.

During the simulation it must be possible to predict the life, or duration of an activity at its start. Often the times will not be constant, but will be random by nature, or may vary in some pre-determined manner.

On the other hand, it is not possible to predict the time that an entity waits in a queue, because the time is dictated by the activities.

19.13 The activity life cycle of an entity may take the form of a single loop or it may be more complex. The latter case raises the question of priority between activities. In cases of conflict; the priorities can be specified in HOCUS, and the priorities changed to test the effect of such changes. (Often the purpose of simulation is to find out the effect of altering priority rules). The entities have attributes which can be changed during an activity. The output at the end of a simulation run is structured to report on the pattern of activities, queues and how these attributes have changed.

#### Model of a Maintenance Task

19.14 The model shown in Figure 19.1 represents a team of maintainers looking after a group of weapon electrical equipments. The diagram represents the path taken by the entities in various lifecycles. Events, which might be a repair, a service or planned maintenance on one of the equipments are allocated a start time in the appropriate generator. They are then taken in sequence and given a duration selected from an appropriate distribution. If suitable men are available, the task is completed and the entities recycled to wait in the appropriate queue. Simulation time moves on and the cycles are repeated until the mission is completed. The entities will have collected data in their attribute cells and the output from the simulation provides a range of statistics listing work done on, and down time of equipments, the utilisation of maintainers and any delays while equipment was waiting for maintainers to become available. A sample of the results is given in Table 19.1.

Table 19.1 SAMPLE RESULTS

<u>Equipment</u>	<u>Manpower utilisation (%)</u>	<u>Mean repair time (hr)</u>	<u>Mean downtime (hr)</u>
FOUR RADARS	23.4%	10.2	10.4
FOUR DISPLAYS	48.6%	6.61	8.51
TWO RADIO EQUIPMENTS	8.95%	9.0	9.0

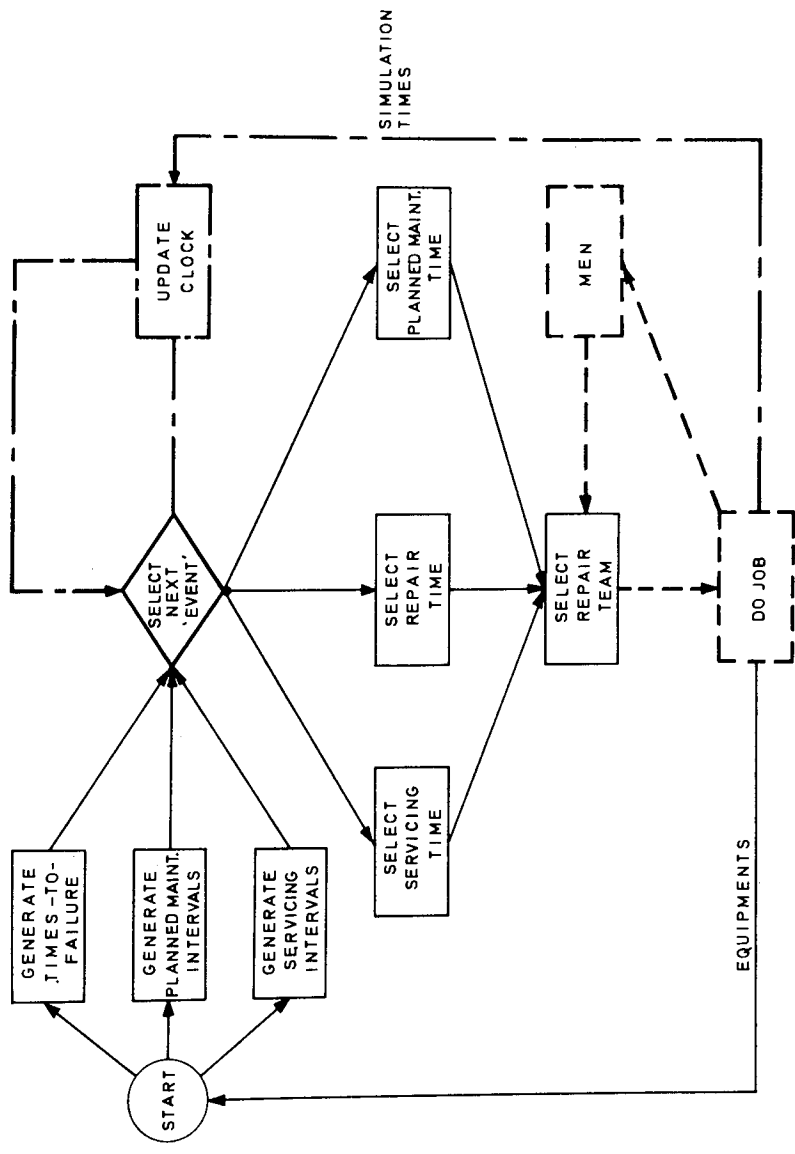


Fig 19.1 Manpower/equipment model (schematic)

19.15 Results from the prototype model using input data supplied by the SMA, have been encouraging and justified further development. In addition to extending to other equipment and repair team mixes, the model has been modified to examine the impact of user duties being added to the maintainer's task. Results from a rudimentary study of the impact of user duties indicate that queues are not created when the maintainer is employed on a single system. This was expected because earlier simulations show a lower utilisation in such circumstances than the average. However, where a user function was given to maintainers looking after a range of equipments or sub-systems, the down time was increased.

19.16 This application of Hocus has been taken over by a group in DWCA(N) under the umbrella of the Management Services Steering Committee. It is expected to be a useful tool and a presentation describing its development was given to a group of potential users at a seminar and to the DGW(N) Management Board.

19.17 While this model has been developed to the greater extent, a second model was written to tackle a problem in a much wider context. The outline of this can be stated in a simple form as follows: The recruitment, training and employment of leaders is a process which is critically dependent upon the opportunities to gain experience. This long term requirement must be balanced with the short term need to fill a job with a competent person. Changes in the parameters may result in long term shifts which are not apparent for many years because the cycle time for each individual is measured in units of about 2 years. The balance of short term and long term requirements may be so grossly in error that the system is potentially unstable, but because the interactions are complex and rich in variety, it is difficult to foresee the outcome.

Two particular aspects concerned the researcher:

- a. The training and opportunities to gain experience may not match the requirement of potential leaders.
- b. Even supposing they did, the number competing for such opportunities may present insoluble problems.

19.18 Naval manpower planning considers this aspect in global terms and while the Fleet was large and numbers high, the danger of instability was slight. The actuarial approach is not acceptable when numbers are small; then an examination is required on the basis of unique combinations of individual characteristics. Such an investigation would be more meaningful if simulation techniques were used. To test the truth of this claim, an attempt was made to model the effects of competition upon the small number of opportunities for gaining sea experience



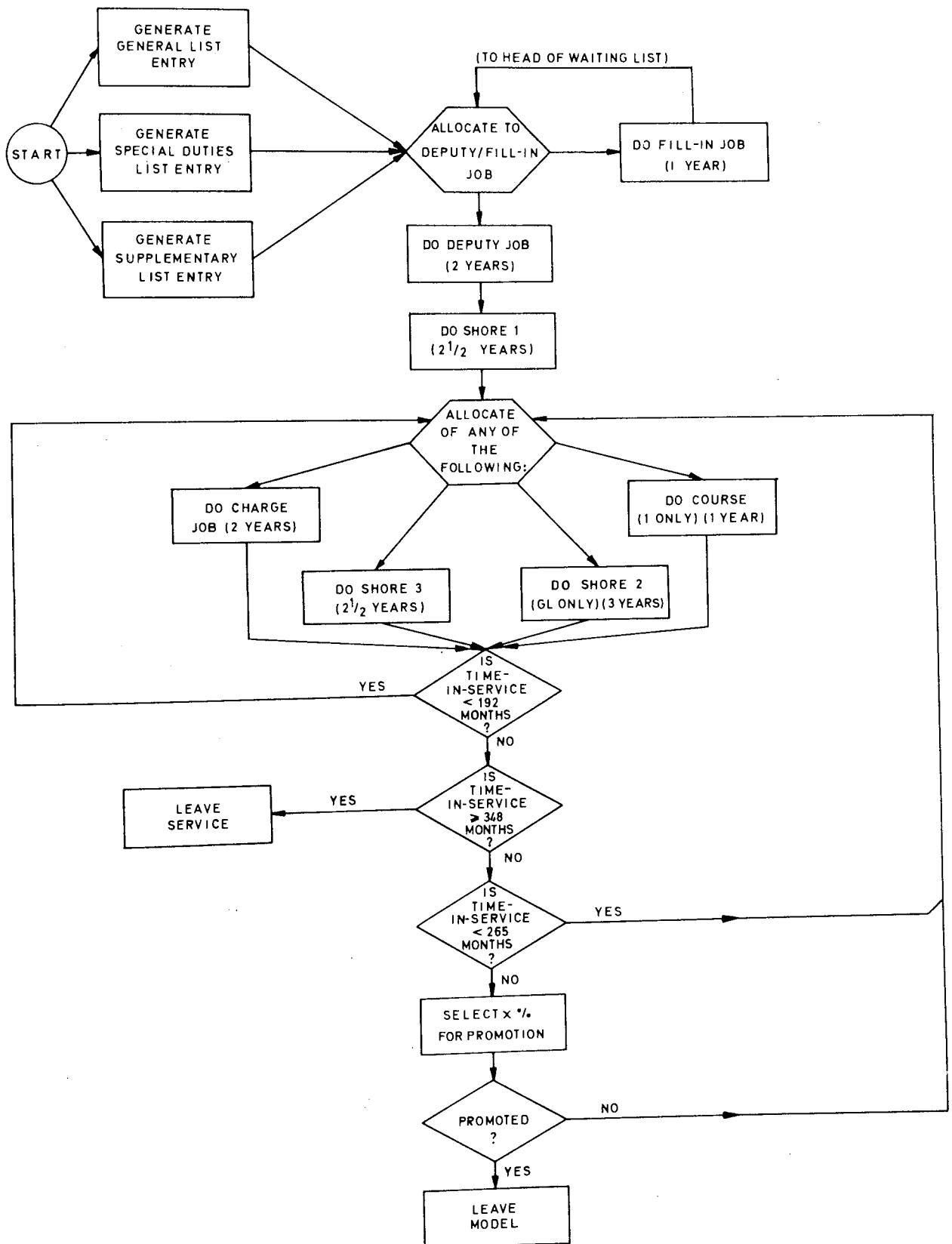


Fig 19.2 Steady-state manpower model (schematic)

among WE officers. The aim was to build a model and examine the sensitivity of the paradigm to changes in ratio between those of General List, Special Duties List and Supplementary List officers. A schematic is shown in Figure 19.2.

#### Steady State Manpower Model

19.19 In this model the entities were officers of the 3 lists and jobs of different sorts. The objective was to examine the steady state provision of:

- a. Experienced WE officers for charge jobs in ships.
- b. General List officers for the staff and R & D appointments.

It was assumed that jobs would remain unfilled or officers would queue for jobs depending on the size of the 3 entries and the job specifications for the critical activities. It was the sensitivity of the system to these variables which was considered to be of prime importance.

19.20 The model operates as follows: Entrants are timetabled to appear as the output from the training system and join a priority queue to go to sea as a deputy. This is the first point of argument. Should the General List officer, take priority to enhance his career, or should the Supplementary List Officer, so the Navy gets the best return on his short service. If no ship is available, the officer does a fill-in job for 1 year and tries again, this time with undisputed priority.

19.21 After sea time all officers do a shore job and then join a queue at the next decision point. It is here that jobs are matched with attributes and priorities are important. For example, should he have priority in taking one of the limited number of charge jobs at sea? Such questions were not discussed with the people who take these decisions, because the model was only built to prove its value as a technique. On completion of each job, the officer goes through a screen which selects a percentage for promotion and identifies those who are due for retirement. A facility was included to allow for casual wastage. The outputs provided data on which to base discussion of options in making changes to the balance.

#### Further Models

19.22 The next stage in the development of this model would be to extend its capability in matching jobs to people in other branches. This is the concern of Second Sea Lord's Department and an Assistant Director attended the seminar on the technique to assess its value. It is understood that the response was favourable and further work would be put in hand.

19.23 The author considers that the use for which the technique holds most promise is simulating the effects of training and experience on the individuals employed in the service. Briefly, entities - men with attributes (probably personality) would combine with jobs and training courses which would result in changes to these attributes. After the model had settled down from the initial transients which could take perhaps 20 years simulation time, the steady state stability could be examined in terms of individual development. The attributes could be described as factor scores achieved on the 16PF. The transfer quantities used to simulate for example a course of leadership training, would be based on the changes measured in real life. The outputs would indicate whether typical entrants for various branches, after experience in a selection from the ranges of jobs available, would develop the attributes required of leaders in ships and ashore.

19.24 This extension of the model has not been discussed and has no "taker" at present. The author believes its development would provide an ideal basis for a future IHD project because it both embraces a number of disciplines and attempts to model a problem which is central to the future of the Royal Navy.

## SECTION 20

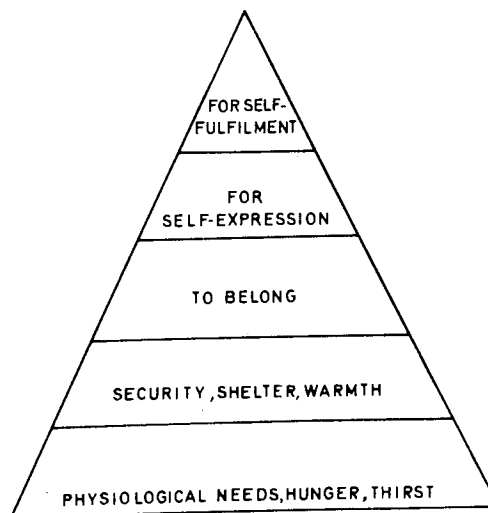
### THE PLACE OF LEADERSHIP TRAINING

#### Introduction

20.1 It was not long before the author was drawn into discussion about the place of training in the development of leadership. A number of questions were identified and as the research progressed, various activities were encountered which were attempting to find answers. Samples of these questions are:-

- a. What elements of leadership are most critical and for which, therefore, is training most necessary?
- b. What skills should be trained on the job and which off?
- c. What kind of "on the job" training needs close supervision and what kinds can be learned simply by doing?
- d. Should a man be overtrained (for a critical task), or undertrained for one on which he will improve with experience?
- e. What costs are involved?

20.2 The Petty Officer's leadership school had recognised the importance of individual motivation and was using Maslow's hierarchy of needs as a framework for discussing the skills need in the leadership of men at sea.



**Fig 20.1 Maslow's hierarchy of needs**

The author became involved in a number of such activities attempting to improve the understanding of the problems.

- a. Discussions at HMS Royal Arthur on the findings from the study of training effects undertaken in 1970.

- b. Collaboration with the author of a booklet designed as an Introduction to Leadership for newly joined Officers.
- c. Involvement in the analysis and redesign of the course of leadership training for Leading Rates at HMS COLLINGWOOD.
- d. Discussions and lecturing to the Weapon Electrical Officers Application Course at HMS COLLINGWOOD.
- e. Consultation with the External Quality Control Organisation at HMS COLLINGWOOD into the follow-up of the training given in the course at d. above.
- f. Involvement with the PAMT course given by the Procurement Executive for potential Project Managers and others.
- g. Discussion with the RN School of Management and Work Study and the Naval Manpower Utilisation Unit concerning the preparation of job descriptions and task analyses and other topics.

20.3 The most critical elements of Leadership were discussed in the context of (c) above and the analysis of the views of training staffs described the tasks they considered most important for a Leading Rate. This indicated a deep commitment to rules and procedures as is reported in Annex E. The key to all this debate was seen to be the focusing of the aims and aspirations of the group. Figure 20.2 which is adapted from HORMANS (1965) captures this in an elegant way. In declaring an aim, the leader communicates his views and helps to generate

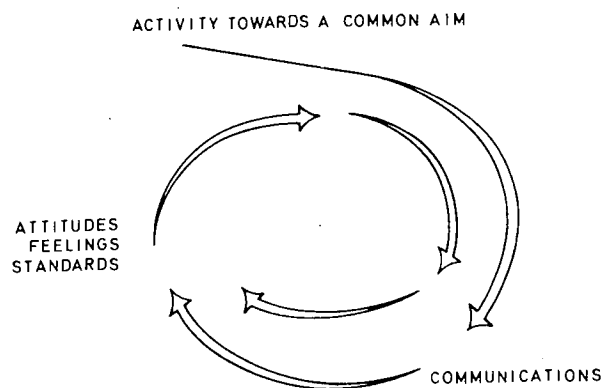


Fig 20.2 The development of group cohesion

standards which the group adopts. This in turn brings them closer together in shared attitudes and feelings. The diagram also demonstrates how as each successful stage is achieved the group becomes closer-nit. This type of concept can be learnt in a classroom but can only be seen to happen in the environment of work.

20.4 The question of when and how should leadership be learnt? produce the apparently simple answer that it should be learnt progressively throughout each persons service both from courses and as part of the feed back process of learning from experience, For example training in leadership for officers of all branches should be phased so that initial training can be designed for the posts to be filled as a Lieutenant. This would be primarily the teaching of how to be a Divisional Officer, covering the basic principles of leadership, motivation, and management of men and equipment. The purpose and procedures of the Divisional System would be explained and some simple techniques in inter-personal relations would be practised. Later as Senior Lieutenants, more detailed theory and practice of leadership and management on the lines of the Engineering Management Course would prepare the officer for more complex situations. Updating by very short courses or seminars on specific subjects, and the inclusion of some leadership and management subjects in other courses such as the Staff Course could provide the opportunity for keeping standard high and aligned throughout the fleet.

20.5 In practice, individual performance will depend in large measure upon the guidance given by more senior officers. The ability to give constructive criticism at the appropriate moment is very important. One captain said in this context that an officer who was not given a formal opportunity to discuss his performance with his captain after six months in a new job and regularly thereafter, had real cause for complaint. As an aside it is worthy of note that a formal appraisal system has recently been instituted for officers.

20.6 Ratings should learn how to be leaders in a similar way. First comes learning on the job by observation and practice, backed up by the recognition by superiors that feed-back is essential. Progress is more likely to be rapid and successful if it is based on a theoretical ground work. Herein, however, lies a danger. Too much theory before practical experience is gained can be counter productive. Certain ground rules have been identified and accepted to avoid these difficulties. For example

- a. teaching in Leadership should be tied to a man's rating, not to his specialist qualification;
- b. Courses for Petty Officers qualifying should concentrate on the ratings functional duties, including the planning and control aspects of management. The Petty Officers' course at HMS ROYAL ARTHUR must continue to concentrate on the inter-personal aspects;

20.7 There is a good case to be made for some form of T Group training of complete teams from a ships company at selected points in the commission. This would be intended to improve inter-personal understanding and sensitivity in the same way as command team training helps to meld the different personalities at work in the operations room. Figure 20.3 shows how there are three basic skills required of a leader, and skill with people is one of them. Technical skill and

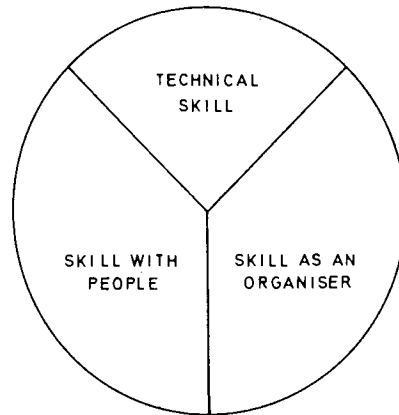


Fig 20.3 Skills needed by a leader

organising skill can be acquired in the classroom but interpersonal transactions are more dependent on the nuances of the real environment. For this reason, everyone recognises that a man should be given opportunities to exercise his powers of leadership after training. Otherwise, not only will the training be a waste of time and money, but a lack of such opportunity may lead to frustration, with consequent dissatisfaction and loss of morale. This should include adequate feedback to the man at a meaningful level. There is a need for standardization of reports on leadership behaviour and potential, both from Leadership Schools and from the Fleet, so that the effects of training can be assessed and validated.

20.8 There is also a need, which has been recognised in some ships, to provide more formal supervision of leadership activities at the junior level. There is a natural place for the Fleet Chief Petty Officer in this feed back loop because he has the authority and experience to give his advice sufficient credibility, while at the same time he is not too far removed in sociological terms from either the young petty officer or the newly commissioned officer.

20.9 Can Experience be taught? was a question asked to draw attention to the value of task analysis in a series of articles by Walman (1969). It would seem very appropriate in the context of leadership training. HMS COLLINGWOOD has studied this problem in terms of training aims for the WE Officers Application Course. The main facts observed were:

- a. The course has apparently succeeded in changing attitudes sufficiently to make officers aware of the difficulties of and their responsibilities in, the management and leadership of their men.
- b. The course has not succeeded in giving an adequate grounding in the practical engineering knowledge which some older technical officers considered essential for doing the job at sea.
- c. The course had led the young officers to expect to be placed in positions of authority as soon as they got to sea. In the 1 over 1 system common in most small ships they do not get this responsibility or authority and some have become disheartened or frustrated as a result.
- d. The course had lead the majority of those interviewed to express the opinion that primarily they are managers and as such should not concern themselves, or be concerned with, technical matters. When asked how they could manage effectively something about which they were basically ignorant, a variety of highly emotive responses were obtained.
- e. Very few of the officers interviewed looked upon their sea job as an opportunity to acquire technical experience which they would depend upon in subsequent appointments.

20.10 In seeking views on the real task of leading a technical department, middle ranking engineer officers tended to claim that they would welcome the chance to take more responsibility for policy ashore and for fighting the ships afloat. However, junior technical officers saw their role with a considerably stronger technical bias and rejected the opportunity to branch out in to more generalised roles. This ambivalence is reflected in the attitudes to staff courses and general naval training. The unwillingness to be appointed to a staff course is reflected in the smallness of the total numbers so qualified. The recent policy decision to increase two fold, the total numbers being trained is an indicator of official concern. It is probable that the naval service will follow the other two services and make this qualification a pre requisite for promotion to higher rank. It is concluded from this that on-the-job training for weapon engineer officers is not as effective as it could be because the role of the officer is ill defined and diversive expectations are generated both ashore and afloat.

20.11 Although it is unlikely to be true that leaders are born and not made, as in so many of the nature/nurture type of discussion, both innate abilities and learning experience contribute to subsequent behaviour. Among the interpersonal complexities of a leadership situation it is probable that some personality



traits would exclude the person possessing them from success as a leader. Similarly, the response to the training given will vary dependent upon the personality factors of the student. As an interesting aside, Eysenck (1955, 1957) predicts that introverts learn more quickly in any situation than do extraverts because inhibition at a cortical level is set up more quickly in extraverts. Later theoretical statements (Eysenck, 1963, 1967) rely more on the assumption of greater cortical arousal in introverts. This is in accordance with Walker's theory of greater arousal leading to more eventual consolidation and would again predict superior learning in introverts (Walker, 1958). Most experimental investigations confirm this superior learning of introverts in a classroom situation. Eysenck went on to suggest that the Neuroticism (N) rating reflects an arousal mechanism in the visceral brain. For any learning task it is assumed that there is an optimal level of arousal; individuals high on N are aroused more readily and more extremely than those low on N. Learning to handle people can be a highly arousing situation. It is therefore suggested that individuals high on N might be aroused well beyond the optimal level for learning the task.

20.12 It is further noted that N is subject to a shift with maturation. This suggests that the training given should be modified to take account of individual difference. This may be particularly important in the readiness of training of young officers and ratings. It was suggested from the analysis of results from HMS ROYAL ARTHUR that some ratings were not ready for the course of training. Now that this course is compulsory for all rates, a failure on course presents the organisation with a potentially embarrassing situation. If a preliminary test is given to assess the rating's preparedness to do the course and the answer was negative, some pre-course training might be given to make up for possible difficulties and deficiencies.

20.13 The navy has traditionally over-trained for any task which is sufficiently important to be identified, with the one exception of leadership training for officers. Here, the emphasis has been on careful reporting of progress made in learning by experience. The logic behind this can be explained by reference to Blake's grid shown in figure 20.4. Officers are selected with a bias towards the 1.9 style. That is to say, a significant weighting is given to the individuals' potential ability to be an effective team member and have concern for people. Professional training for both technical and managerial skills tends to produce a task oriented attitude in the officer which ideally results in a person with a balanced outlook. In Blake's terms, he would use the 5.5 style. As his competence and confidence increased with experience and

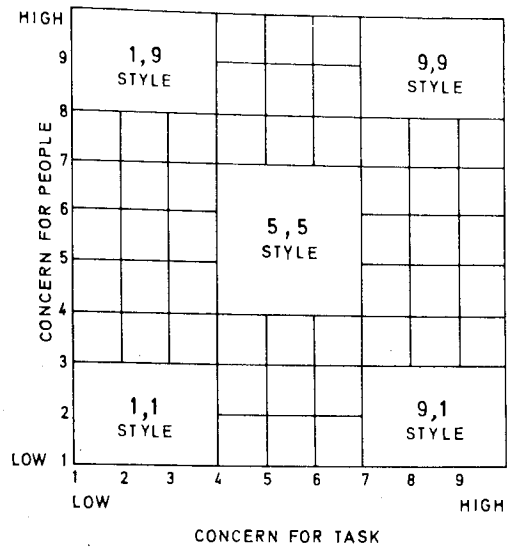


Fig 20.4 Blake's grid

maturity, his style would approach the ideal style of leadership, the 9,9 style, as his propensity for interpersonal relationships is moderated by his high technical involvement. This process at work was noted in the results reported in Section 14.

20.14 The cost of leadership training can be considered in a narrow way as that of running the various leadership schools. An alternative, and potentially useful approach would be to estimate the damage which would result by not providing so much training. Sea experience in a training billet must be included in the balance sheet. A large number of compliment billets at sea are in reality provided to give wider experience to trained men. As one head of department put it in describing his deputy: "He knows everything but lacks experience". It is probable that the leadership needs of the service would be met adequately without the training programme. The real achievement is in the alignment of standards and reduction of interpersonal stress which would be generated by more on the job training.

20.15 It is concluded from the author's involvement in these diverse activities allied to leadership training that a series of formal and standard courses of training is the most effective method of generating a climate in which leadership can flourish. The generation of a suitable environment in which leaders might operate successfully is a dynamic process which itself depends upon good leadership. Research into the working of this mechanism is very necessary and the studies going on in a number of centres is most encouraging. However, there is still a lack of a universal focal point to be a clearing house for these naval

activities and provide a review of the very recent work completed or in hand. It is recommended that this be considered by a sub-group of the Naval Manpower Executive Committee or some similar central body with wide representation.

## SECTION 21

### SELECTION PROCEDURES

21.1 Selection has two major connotations within the Royal Navy. There is selection for service by the Admiralty Interview Board or by the recruiting organisation and there is selection for promotion within the service. It is believed that there is a place for psychometric techniques in both applications and this chapter sets out to discuss what this place might be.

21.2 At the outset of the research programme an aim was identified to examine historic data on selection for Naval Officers within the Admiralty Interview Board and to draw conclusions from which a plan of further research would have evolved. This came as a direct influence from the supervision provided by a psychologist who had previously served on the Admiralty Interview Board. This particular line of research was not followed because before any significant progress was made Gardener (1970) completed his analysis of the same topic. His research showed that occupational success was closely related to factors of personality which were in turn closely aligned to the various descriptors used at the Admiralty Interview Board and also in periodical reports prepared about the officers serving in the fleet. The availability of this analysis of the working of the Admiralty Interview Board over the previous two decades has meant that the problems faced in officer selection can be considered with considerably more insight than was otherwise available. Gardener described the selection procedure as concerning itself with the identification of individuals who would benefit from an intensive and lengthy training period and who would eventually become effective leaders in the service environment. He described prediction of success in these two distinctive roles of "student" and "practitioner" as being a gamble. However, the gamble was based partly on educational achievement and partly on judgement of the candidate's performance in the battery of tasks and psychological tests during the interview procedure.

21.3 A second stage in the selection of the fully qualified leader occurs during the training process when a small but significant number are withdrawn from training. This interpretation of the selection procedure recognises that the onus is on the candidate to prove himself acceptable to the organisation but does not recognise the individual expectations of the person offering himself. This tendency to ignore the consequences of a selection decision in terms of the individual is acceptable while those who offer themselves know what is involved and while the consequences of subsequent failure are considered small. This may not be the case if the rules were changed and the selection procedure was turned into a two stage process with a long probationary period during training. This

point has been raised because there has been discussion of such a change in recent attempts to solve the problem of fewer suitable candidates coming forward. It is intimately related to the establishment of criteria for selection.

Identification of Criteria

21.4 An examination of the numbers of general list officers illustrated in Figure 21.1 will show that about one third are of Commanders rank and a third of those are Captains rank, a very small percentage are of Flag rank. It would therefore appear fair to assume as Gardener does that one of the aims of the selection procedure is to provide material for promotion to Commander. It follows that a criterion for the success of the selection procedure could be promotion. In fact however the organisation requires a certain number of more senior officers and it is a closed system which can only draw for candidates for promotion from within its own ranks. Therefore the process of identifying the ones most likely to fill the higher ranks is more akin to the process of allocation and therefore is governed by different considerations from the ones facing the Admiralty Interview Board. It also has to be recognised that there is considerable elapsed time between the initial selection for service and the successful completion of the first career leading to eligibility for promotion. One stage in the provision of the high command demands the identification quite early of those likely to be suitable for it. These selected few have to be given experience at an accelerated

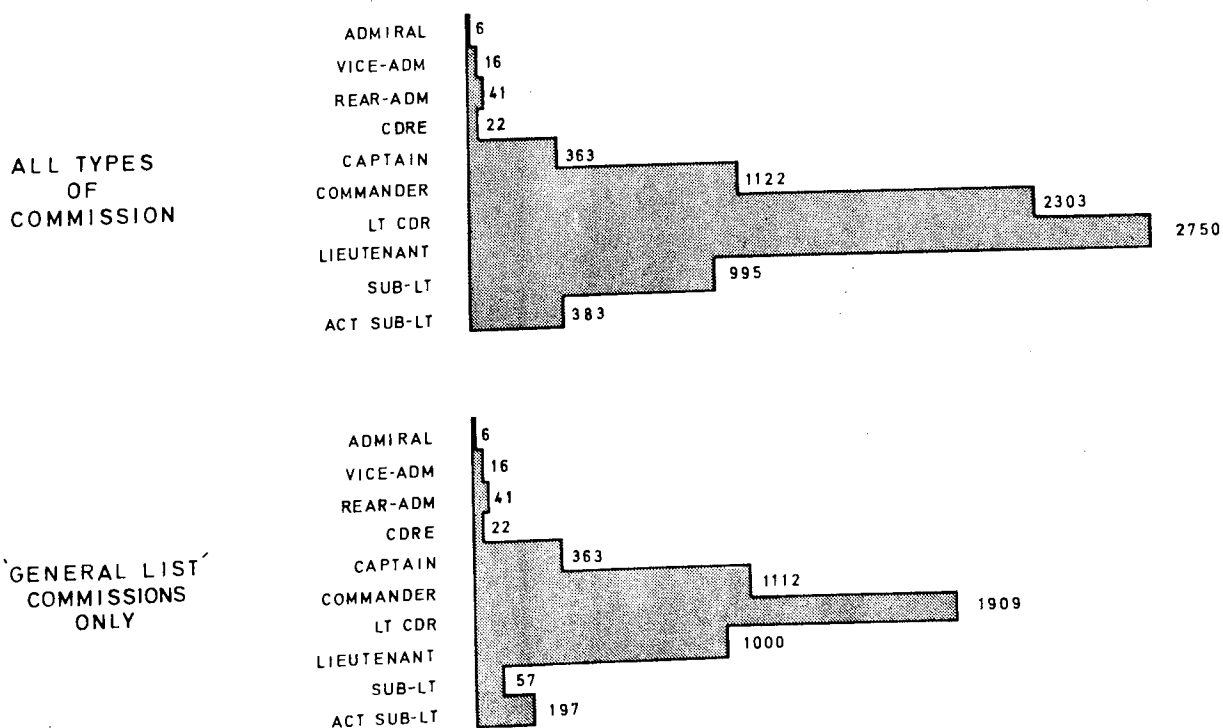


Fig 21.1 Distribution by rank of serving officers of the main branches

rate to enable them to fit the profile of the potential Flag Officer. To illustrate what is meant: the operational commander of a seagoing fleet has himself to have had sea command. As has been mentioned earlier, consideration of experience as a resource makes it necessary to restrict the number of individuals who can be allowed sea command. The identification of the officer suitable for an early appointment to command of a ship therefore commits the system to considering him and not his less fortunate peers in a subsequent selection process for Flag rank.

21.5 This long lead time and early closing of options in the deployment of the leaders within the Navy make it necessary to identify consequences as early as possible. The difficulty in recognising these consequences in its turn suggested the possible usefulness of the simulation model described in the Section 19. It also makes it apparent that a consideration of the individual personality variables and the part each has to play in the make up of a successful officer in the various ranks would allow a more meaningful discussion of the forces acting in this dynamic situation. Some of these are examined below.

#### The General List

21.6 To quote again from Gardener, his analysis identified a shift in the weightings for Engineer Officers between 1957 and the 1963 intakes. This variation was not explained in his analysis but it is considered that the introduction of the general list concept in 1957 does. After that date, those officers entered for a full career were to be considered on a common list and this in turn meant that as they became more senior in rank they would be competing with all other specialisations for consideration for promotion. Thus where in the past an engineer was considered against a criterion of competence in exercising his engineering profession, from that day greater emphasis was put on his competence as a Naval Officer. The merit of this change in values is not appropriate to this particular report but there is no doubt that this explains the difference in the personality which emerges as the typical quality for success. Psychomatic Data collected on the basis of a research programme could monitor this tendency and help by predicting the need for any change.

#### Reporting Methods

21.7 There is another force acting as a result of the promotion process being a closed system which Gardener makes no allowance for in his report. This could be described as a bias in reporting which is recognised as a weakness but which is caused by an individual reporting officer's commitment to an individual subordinate. This results in subsequent overmaking to secure that officers promotion during the period he works for him. The system has, built-in, a measure

for counteracting this bias where the Flag Officer occasionally applies an index error to accommodate and correct for this tendency. This in turn is recognised by a more experienced reporting officer who in an attempt to keep his averages within bounds will mark up his favourite and proportionately mark down the rest of his subordinate officers. This can produce some unfortunate results. For example, where two equally able officers are under report by the same person the one who is given the edge over the other will possibly be awarded much higher marks in the confidential report. This is designed to ensure that at the next stage of selection he will stand out quite clearly. If his contemporary in absolute terms was also equally eligible they might both have been successful if separate reporting officers had been involved. This difficulty in the system has been recognised and discussed elsewhere (Wright (1970)) and it will always be difficult to avoid. The use of psychometric techniques for monitoring trends in selection for promotion would give the organisation early warning of maladaptive tendencies.

#### Technical Officers

21.8 It is possible to deduce that the characteristics welcomed in a Technical Officer in his first career are not the same as those required for high command. In this case it may be necessary to restructure the employment pattern of the small number recognised as suitable for consideration for promotion and earmark them in the early stages in the same way as those identified for sea command. If this is necessary it may prove difficult to find suitable employment for this special group which allows them to progress through the ranks without becoming disenchanted or having the features in their personality which are required later blunted by the intervening experiences. In considering the characteristics required in a successful project team for example it is recognised that there are different parts to play and that each player has a different set of attributes. It is conceivable that an "uncomprehending" selection process could exclude all those who embrace the necessary mix of attributes for a particular role in a given area of employment. When it is recognised that the total officer corps of the rank of Commander and above is selected on the basis of confidential reports it is quite conceivable that the multi-stage selection process will have weeded out all those who have an essential quality. Alternatively it is possible that because of the regenerative process involved, the trend in selection creates a shift towards an extreme in some attributes. Disregarding any judgement about which shifts would be acceptable, it is considered that an unrecognised shift of this nature could be very dangerous for the long term well-being of the service. Comments received during exit interviews with young officers who were leaving the service prematurely to take up another career suggest that such a trend has

already occurred. One subject said "I was forced into considering leaving when I found I was completely unable to identify myself with the sort of person who became a senior officer, not only could I not see myself in that mould but I could not find it in me to do the sort of job they were doing". This attitude was reported a number of times.

#### Selection for High Command

21.9 The existence of this mismatch between the actual holders of the senior posts in the service and the image held by a new generation brings into question the whole process of selection for the top. It may be that we should adopt a concept of selecting men suitable for high command or project management and consciously protecting them during the intervening stages of development during which they gain the appropriate experience and maturity. This is based on the premise that men who are required as leaders at that level are unlikely to succeed in the types of job which demands their attention in a peacetime environment. It is the lack of such favourable conditions in peacetime which generates the high stress levels reported by so many of the middle ranking officers who were interviewed during this research. It was noticeable that Seaman Officers who were chosen for command and Engineers who were closely integrated in project management both reported a high degree of involvement with their work and a satisfaction with the prospects offered by the service. Where an officer was unable to find this involvement because he was not selected for these jobs a greater degree of frustration was reported and there was a marked tendency to report an inclination to leave the service and find employment elsewhere.

#### Rejection

21.10 One factor which bears very heavily in the service is not so blatantly obvious in civilian employment. This is the public recognition of failure when an officer passes through the zone for promotion. When this has occurred the individual has to make some deep readjustment in his aims for himself and his family which determines his approach to the service thereafter. There is undoubtedly an important part to be played by experienced officers who nevertheless are not eligible for further promotion. There is a danger however in having too many of such people in the organisation. The means of controlling this proportion is difficult to arrange but it is considered that progress would be made if there was greater flexibility in allowing officers to leave the service while being eligible subsequently for re-employment within the civil service on contract when a need occurred. The service could be expected to gain in two ways by this approach. Firstly officers feeling a temporary disillusionment could gain experience in the outside world. Secondly the pool employing ex officers would be filled with people with a broader experience.



## Personality as a Predictor

21.11 Gardener (1970) provided an understanding of selection for the service which is comparable with the work of Vernon and Parry (1945). However because it was casting its perspectives into the past, its predictive power was limited in value. This was reflected in the discussion where recommendations were made to look into these problems of prediction. This present study took up that aim and by accepting the findings attempted to read across into psychometric techniques. In particular the use of the 16 PF to predict the behaviour of leaders in changing groups and changing situations is believed to hold considerable promise. Figure 21.2 shows how this might work by indicating how results could be

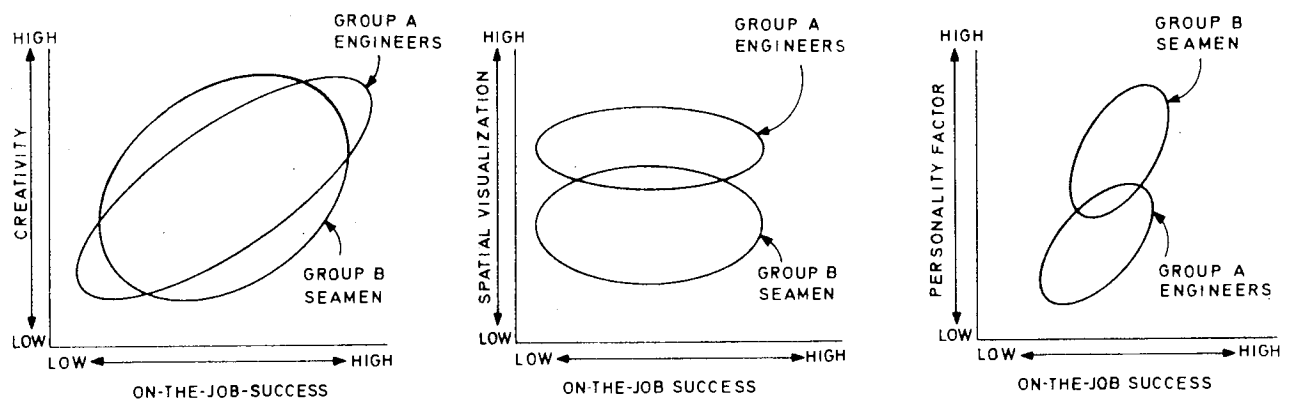


Fig 21.2 The value of predictors

interpreted. A hypothetical measure of creativity would be a predictor of success among engineers but not among seaman. Also it would not differentiate between groups. Spatial visualisation is shown as better among engineers than seamen, but it not related to job success. The hypothetical personality factor shown in the right hand diagram is not only related to job success in both groups but also differentiates between seamen and engineers. This is therefore the ideal measure to be used in prediction for selection and allocation.

21.12 Collection of data at the selection stage for entry and also during allocation for special tasks would provide the means for establishing such predictors. This is already being done in one large public corporation. The aim must be to select individuals with attributes known to be linked to better performance. Cronbach and Gleser (1965) provided the economic justification for a more complicated selection process and Stainer (1971) gave corroboration when the relationship of utility to cost of selection is high. For this reason, a test of low validity but good discrimination would be worth adding to the testing process, to assist in the allocation of those selected by the use of the original tests. This could be extended to assist in decisions about the sort of training required by each candidate who was selected. On this basis alone, it

would be cost effective to continue the pilot study of psychometric testing at the Admiralty Interview Board. Success in developing such predictive techniques would also make it less difficult to identify the needs of the service in terms of the task 15 years hence.

21.13 The work done in this area does not merit recommendations, but the potential value of such data as was collected, the proving of the method and the activities of other people working in the field have been discussed with the resident psychologist at the Admiralty Interview Board. He is continuing testing to increase the sample to about 400 and will then decide on the next step.

#### Allocation to Special Teams

21.14 The author believes that the greatest utility will emerge from the use of psychometric data during the allocation of individuals to special teams. Such allocation is already a very complicated and difficult task requiring much skill particularly when the individuals concerned are not part of a homogeneous group. Various techniques can be invoked, (Benjamin 1973) but few look at personality factors except as a subjective check on the basis of "hunch". It is most unlikely that any attempt to match personality factor profiles against an "ideal" would be a viable method of allocation. It is probable that it would prove repugnant to the individuals concerned if it was. However, the post-decision screening of selected teams for incompatibility as a group should be feasible now. It is unlikely that there would be the same objection to this approach because it would only involve interference if it was thought that there was a real likelihood of disaster. Most leaders have seen the unhappy consequences of a violent clash of personalities in close proximity and would be only too happy to avoid a similar experience. In the initial stages of such a procedure, any interpretation of psychometric measures would be on a cautionary basis. As experience was gained in predicting the likely interactions it would be more likely that the gross mismatch could be identified and averted. No recommendation can be made at this stage but it is intended to carry on with work in this area with particular reference to the attributes of a project team in the various stages of a project in development.

PART V REVIEW OF RESEARCH

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## SECTION 22

### INTRODUCTION OF CHANGE

22.1 Aimed research should be expected to result in change. Figure 6.3 identified 3 areas for making recommendations - leadership training, the leadership climate and the selection of leaders, and assumed that a change would lead to improvements. This section deals with two aspects of the introduction of change. Firstly changes which have taken place during the period are identified and discussed and those which might be influenced by this research are examined to see if the aims of the IHD scheme can be considered to have been met.

22.2 The biggest change seen by the author came about as a result of the Rayner reorganisation of Weapon Procurement and the impact of this new organisation within DGW(N). The reasons for this change were covered earlier but lessons in handling change can be learnt. In particular the difficulties experienced by management at the higher levels in meeting their obligation to provide information to their subordinates during the introduction of the change is worth study. There were some areas where because the uncertainties generated by the new proposals were great the organisation became unworkable. From this followed a spiral of frustration and dissatisfaction which will take a considerable time to erase. It must be claimed that the benefits to be obtained from a reorganisation are so great that the turmoil involved in putting into effect the original recommendations is acceptable. This is the same logic which causes one to accept the wastage associated with take-over bids in industry. It is believed that the same potential danger exists in both situations. It might be shown that despite the accelerating improvement in output the ground lost will not be regained in the foreseeable future. A detailed analysis of the process of introduction of change within the Weapons Procurement field might prove that the Naval Service has to realign its attitude to the contribution it can offer to this process.

22.3 The researcher had the longest association with HMS ROYAL ARTHUR. The period included the changing of the Commanding Officer three times. A careful note was made of changes in approach which could be attributable to the presence of a research activity. This change was quite marked following presentations and the publication of the results of the pilot study. It manifested itself in a more open and relaxed approach by the staff to the Petty Officer Students. It also manifested itself in a greater awareness of what was available from outside bodies and as a result, links with the University of Bristol were strengthened and enriched, to the benefit of both.

## STRATEGIES FOR CHANGE

22.4 These clear examples showed that change as a process merited separate study and while there are a number of ways of thinking about strategies for introducing change into an organisation, one, based on Reddin's work will serve to bring out the major points. Procedural methods provide guidance in detail on a wide variety of situations and before any change can be introduced a whole host of orders, procedures, regulations and guides must be prepared and agreed. It is characteristic that there is considerable emphasis on equity in arriving at the new organisation. This emphasis on procedures, rules, systems and organisational charts highlights the need for quantification. There is a tendency for these systematic and procedural changes to override individual initiative. There is a marked tendency to integrate vertically. This was the approach taken post - Rayner.

22.5 Related strategies lay emphasis on the need for inter-personal skills and the encouragement of relationships recognising that group forces are a major determinant of the behaviour of individuals. Emphasis is placed upon the unconscious elements in motivation towards achieving the change required. There is a recognition of the irrational and subjective elements in the behaviour of those experiencing the change. There is minimal formal structuring in the programme for the change and therefore the programme provides the minimum necessary amount of information. Emphasis is placed on the need to learn by experience and the processes of change is adjusted to recognise this. There is an enrichment of meaningful relationships between the formal and informal organisation of the working group. Finally there is a recognition that the change agent will need high skills in inter-personal relations and a high degree of competence. Such strategies are rarely seen in a military environment.

22.6 A dedicated strategy lays emphasis on an idealised management style, authority, commitment and the requirement of the people to identify with the organisation. There is considerable stress on following the lead of more senior managers. Emphasis is laid upon formal management roles and on giving loyalty to the organisation. There is a tendency in this mode of introducing change to integrate activities horizontally. Finally there is considerable emphasis on the goals and objectives of the organisation. A recent example is the report for the introduction of management systems into the fleet. The success of this technique depends upon less senior people identifying closely with the leaders.

22.7 The integrated method stresses both tasks and relationships. It relies upon structuring the change and utilising the personal skills of the change agent. It identifies both quantitative and qualitative elements in evaluating the results and suggesting adjustments to the techniques. The programme for introducing changes under this strategy recognises and differentiates between the performance expected

of individual managers and the effectiveness of the organisation when it finally achieves the steady state. Having differentiated these two elements there will be a formal relationship between the individual managers objectives and the objectives of the total organisation. These strategies tend to integrate both horizontally and vertically by simplifying and pruning the organisation. There is considerable emphasis upon the skills and disciplines required of the individuals within the organisation and upon the importance of decision making and in particular on the need for effective decision making. The remodelling of HMS COLLINGWOOD followed this strategy.

22.8 Having chosen a strategy, another dimension must be considered. Human-beings are not always logical and emotion must not be stifled. This must be recognised by avoiding too rigid a structure. As rigidity increases, flexibility decreases, commitment decreases, responsibility is avoided, there is less effective problem-solving, self expression is discouraged and finally self-actualization is prevented. Thornley (1971) at a British Psychological Society's meeting discussing the introduction of change identified a dichotomy which he attributed to the improvements in information technologies. From these there followed a reduced requirement for delegation of authority which in turn resulted in less need for trust between individuals and their organisation. Out of this developed a crystalline structure which reduced the potential for any dynamic interaction between a job and the man filling it. The chances of participation by the employee in the structuring of any change was likely to reduce while at the same time the risk of confrontation between those seeking change and those suffering it increased. In the extreme case in production engineering he quoted the case of computer aided production planning, where the computer and the operatives on the shop floor are continually interchanging information without any apparent direction from the supervisor. This is closely analogous to the situation with ADAWS and CAAIS.

#### THE LEADERSHIP CLIMATE

22.9 Making the right choice is the leaders' responsibility, and considering the Navy as a whole, leadership determines the system effectiveness. A standard analysis with a Material bias shown in figure 22.1 can be used to discuss this. Worth is the measure of how well the Nation's money is spent in meeting the total task. Supporting Worth, performance is a direct function of military leadership in the traditional sense and availability is a direct function of technical leadership. Cost is the key and falls uncomfortably between the two. Finance has historically been the task of the civilian but this has changed recently and the peacetime environment makes it very difficult for military leadership to identify its true role. In fact one must question if it is still possible for Naval Leaders

to develop in a peace-time environment such that they will prove adequate for war.

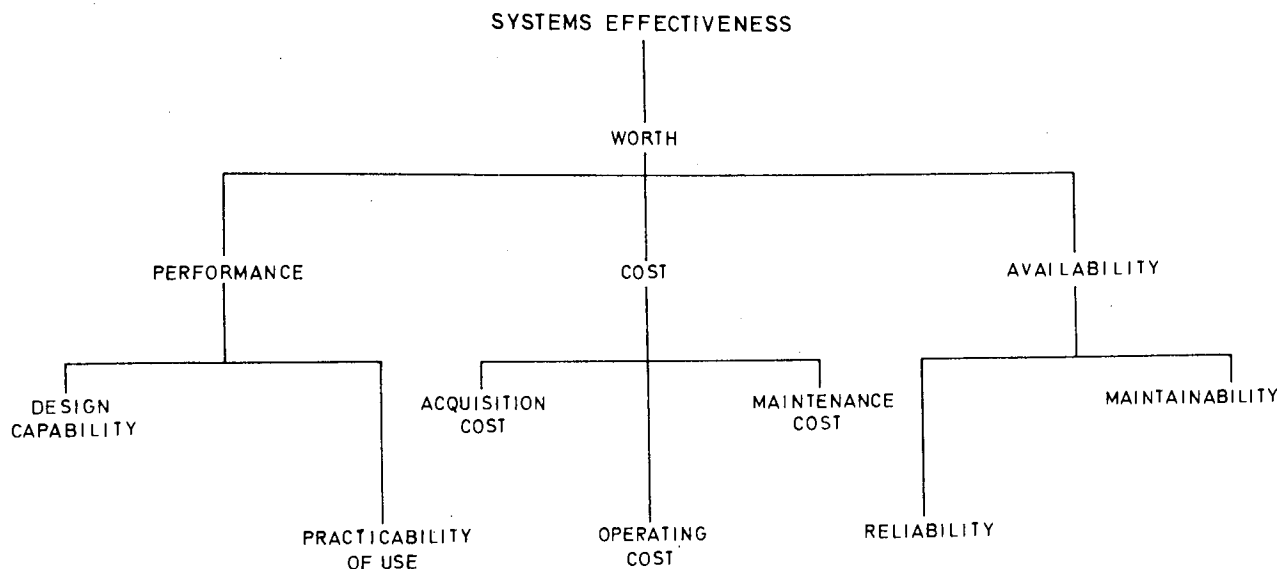


Fig 22.1 Elements of a systems effectiveness analysis

Many senior officers are preoccupied with financial responsibilities for which they have not enjoyed supporting experience. Loyal advisers ensure that sound information is available for decision making but it is difficult to generate charisma in such circumstances. Change is indicated.

22.10 The results obtained and the discussion which developed from the work of collecting raw data led to the conclusion that the Royal Navy's approach to people is entering a period of significant change and it is reasonable to expect some recommendations. Reports such as this are usually criticised for making no recommendations except for more research. This lack of decisiveness is linked to a remoteness from the immediate problems of line management. This forces the report writer to direct his conclusions at a general area in the hope that someone may pick upon significant points and develop them. In this case the researcher was better placed to see the way problems were developing and therefore has been prepared to suggest what he would do if given the opportunity. Top priority would be given to regrouping the critical tasks to make the future pattern of employment of Naval leaders more cost effective. This is a long term aim which must recognise the importance of individual difference especially in key posts. As a first step a training programme would be needed to change attitudes such that long term objectives could be agreed in isolation from short term practicalities.

22.11 The climate for growth and development of appropriate leaders needs careful attention and a long term plan to provide stability. It requires just as much discipline as in procurement but is less well understood. To illustrate what is meant, Figure 22.2 shows the decision points in the introduction of a new weapon equipment.

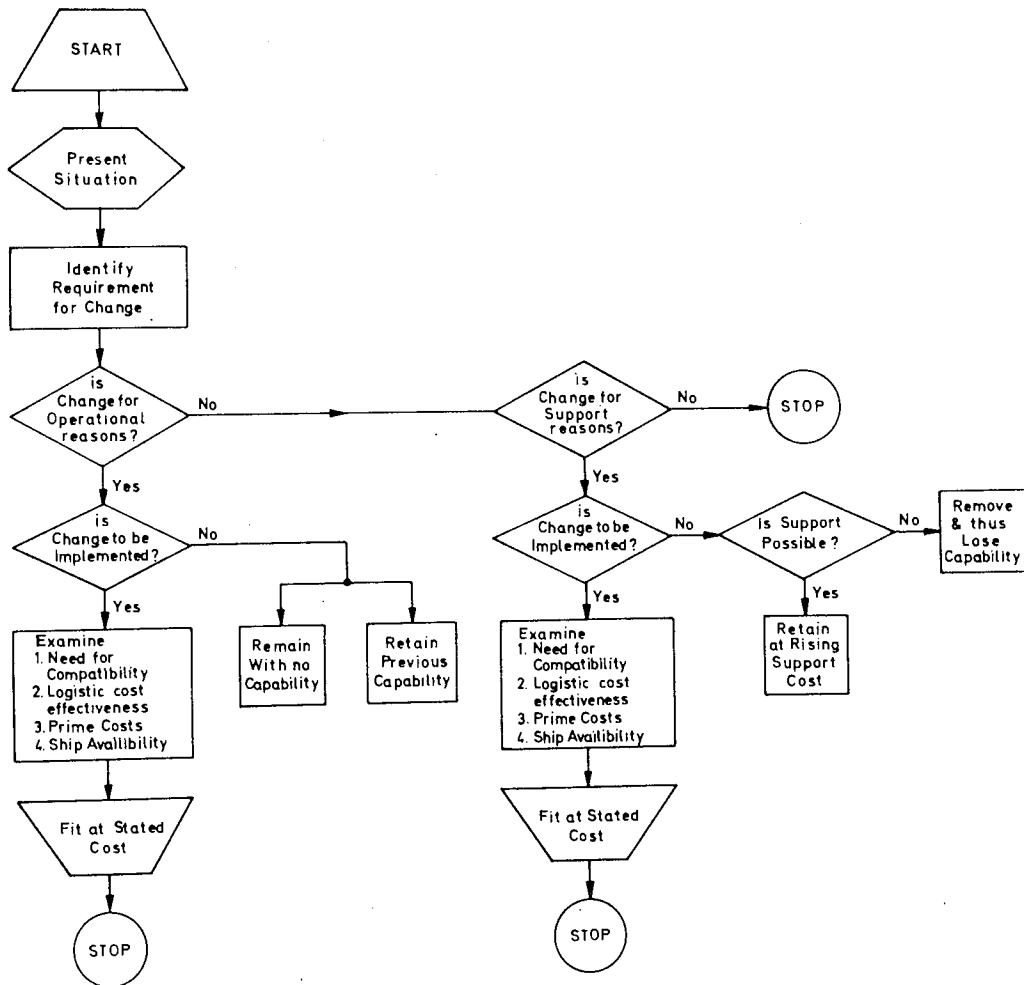


Fig.22.2 Decision points in the introduction of a change to a Naval weapon system

Manufacturing lead time might take less than 5 years but external constraints could mean three times that before the change is finally introduced into the whole fleet. The equivalent process in the manpower field is linked to a similar time delay. The Navy has at last recognised the problem in terms of equipment, by accepting that disciplines such as batching of ships combined with greater availability carry the hidden cost of ships being less up-to-date. This "systems-insight" is less widely understood in the manpower field. Thus, a review of the leadership climate ought to focus on the situation in twenty years time. When that is clarified, ways of attaining the optimum mix will throw up the selection and training decisions which must be implemented now to achieve that state.



Simulation should be used in testing the worth of the proposed solutions.

### Leadership Training

22.12 The closed system which represents the Royal Navy and was shown in figure 6.7 must respond to external change if it is to adapt. To achieve this most effectively, the leadership should adopt the integrated strategy described in paragraph 22.7. A problem arises though. How are leaders produced who will think in these terms? The behaviour pattern of leaders described in Annex K gives an indication that the command stream may well not produce the sort of person required in a situation depending on influence which is typically the environment in Headquarters. The author claims that by taking note of data about the present leadership the restructuring of the organisation to match the needs of the Navy in the next two decades is possible and will create a favourable leadership climate. Having identified the different sorts of leaders required the process of training them for the critical activities will be highlighted. An essential feature will be the recognition of training opportunity as a valuable resource. This in its turn means that experience gained in a job must be seen as an asset in economic terms. Such an analysis will immediately throw up problems to be solved, eg overmanning reduces the value of the experience gained by each individual and there is no way of recombining the elements to produce the same effect as that of someone who was matched to the task. Under-manning is simply the waste of resources by a lost opportunity. Psychometric techniques offer a discipline for discussing this approach; there are others but the need is to get to grips with the problem.

### Selection

22.13 Selection has been more thoroughly researched by service Psychologists and there is little extra that should be said here. The continuing examination of psychometric methods at the Admiralty Interview Board and other studies in hand will keep the topic alive. Allocation, though, has not been put under the searchlight and there is scope for more work on career development and selection for special tasks. This merits another post graduate study to provide clearer definition of the extent of the problem and the value of potential solutions.

### Summing up

22.14 Leadership is seen as impinging on the way the Navy tackles jobs. This in its turn depends upon the rank structure and the allocation of function to individuals. At the formal level this creates an environment which reacts with the informal structure on board ship and ashore to motivate people to achieve the output called for by the leaders. It also provides more or less satisfaction to

to the individuals concerned. Changing the balance of this dynamic situation is easily achieved. Prediction of the outcome is less easy and the naval leadership should apply itself to this on a systems level.

## SECTION 23

### SHORTCOMINGS OF THE STUDY

23.1 Eysenck (1961) in reviewing a work by Cattell said

"The contents cover such a wide variety of subjects, and are strung together so loosely in conformity with an over-all plan which is not always apparent to the reader, that any attempt to discover precisely what the evidence is for a given statement, or how it fits in with the general scheme, becomes extremely difficult"

This researcher sympathises with both.

The results reported here are fragmented and the criticism of diffuseness already made is accepted as valid. In mitigation it must be stated that the work was designed as a reconnaissance in depth into an area which had not previously been the subject of study by a serving Naval Officer. It is offered as a feasibility study for work by a properly constituted multi-disciplinary team. For this purpose it is claimed that it would be capable of providing the basis for examining specific problems of Naval leadership in an integrated and coherent manner.

### The Use of Psychometric Measures

23.2 A central theme of the research was to examine ways of codifying personality to permit discussions of the variation observed in work groups. The EPI as a measure was straightforward and valuable but limited in potential interpretation. Jessop (1971) examined its use in pilot selection and had to rotate the axes to propose that one of these be called "tendency to learn". This need for complexity was also noted by this researcher. It was met by the 16 PF but this complexity in its turn made interpretation difficult. One of these difficulties was identified as the differences observed in the many versions of the tests and the dangers involved in attempting to compare groups across cultures and on different editions of the same version of the measure. This difficulty does not apply when the study is based on internally generated norms but is a very serious problem when attempting to draw comparisons with other research. To test that the measure was consistent in the version used with the total sample when compared with the validation sample a test of Intra correlation was undertaken. The 15 x 15 matrix was compared with the data given in Cattell (1970). All significant correlations were of the same order and in the same direction with the exception of one, Factor N to Q<sub>1</sub>. Similarity of results was also obtained when comparing the intra-correlations obtained on the A version and the B version of the test taken by the 14.6 subjects in the 1970 sample.

23.3 The statement that questions in the A and B version of the test measured the same factor in the same direction was taken on its face value. This was assumed to apply also to the various editions because, for example, the same hand scoring key was useable. It was then decided that where no norms were available to make comparisons between groups, a meaningful comparison could be made on the basis of the means and standard Deviations of the raw scores. This was used in Tables 13.1 and 14.1 where samples from this research were compared with the British sample selected by Saville (1972). The dangers in doing this was highlighted by the comparison of all the sub-groups making up this sample using the profile similarity coefficient (rp) recommended by Tatsuoka (1970). The basis of the comparison was normalised sten scores but even so the groups who had taken the B version of the measure were markedly dissimilar from the others as can be seen from table 23-1. Comparisons of individual questions in some of the editions of the measure and recent discussions with corporate users in the selection field confirmed that there were unexplained shifts which were caused by semantic interpretation that had not been examined. For example "Queer" has homosexual connotations which completely altered the interpretation put upon question No 38. This question was changed in the 1967 edition. Many of the reworded questions contributed to a different factor in the new edition. For example, Question 3 (1962) belonged to the set for Factor A. The same question was numbered 15 in 1967 and contributed to Factor M. The re-allocation of this question was judged to represent a shift from measuring a critical, detached approach (A-) to a loading at the imaginative, bohemian end of factor M. This was considered to be a disturbing rearrangement of the questionnaire. It was thus essential to consider all editions as entirely independent, unrelated tests and to discount comparisons made with studies using unspecified or different versions of the questionnaire. The validity of comparisons where all are based on the 1962 edition was not undermined. Fortunately this was the basis for the major part of the study.

23.4 The question was raised on a number of occasions, "is it really ethical to measure personality dimensions which may not be apparent to the subject?" There has been much criticism in the press and elsewhere about psychological testing in general and personality measurement in particular. The criticism has taken one of four forms:

- a. Tests dictate a permanent status and therefore undermine the self esteem and limit the motivation of the individual.
- b. Tests tend to decrease the diversity of talent by focusing attention on the more narrowly conceived and more easily measurable attainments.
- c. The widespread use of tests gives the tester a potential control over educational practice as well as over the destinies of the individuals.

d. Tests foster impersonal and mechanistic evaluations and decisions at the expense of individual freedom of choice.

23.5 These criticisms are widespread and appeal to the inherent sense of fair play of the average Englishman. The place of testing in the guidance situation where the individual presents himself of his own choice to the tester would appear to be more acceptable than that of the selection situation where the tests are considered to be an unwarrantable intrusion. It is not clear at the present moment at what stage it would be acceptable to introduce any form of wide spread psychometric testing of personality for the purposes of selection or allocation. It should be acceptable however to conduct a broad based programme of research in parallel with any existing procedures in an endeavour to judge whether such a technique would be valuable. As in so many other areas policy makers are faced with both a dilemma and a responsibility. They face a dilemma because they must decide what is acceptable, for the general good, to expect of a man once he has offered himself as a member of a disciplined service. Would such testing be an invasion of privacy or would it be a legitimate enquiry for advancing both the individual and the general welfare. Clearly there are no correct answers, there are only opinions as to what a good answer might be. The weight which they carry is related to the shift of opinion which will result from such a decision. It will possibly lead to a greater awareness of individual differences but in concentrating upon it, the ability of the less conservative individual to survive within the Service may be undermined. This responsibility must be accepted.

#### Stress and Motivation

23.6 A dimension that was lacking was some measure of the individual stress level and individual motivation experienced by leaders in various appointments. The interviews brought out a high level of stress generated by a lack of identification with the parent organisation in Headquarters. A study of these factors would have made a valuable addition to the data available for discussing the appropriate style of leadership. (Paragraph 15.33).

#### Analysis Techniques

23.7 There is a close analogy between the use of psychometric techniques for gaining an insight into organisations and the use of diagnostic radiation by surgeons. In both cases, the isolated pattern tells very little but the acquisition of experience enables the skilled user to interpret more and more accurately, on the basis of observed changes. Thus in the course of this research, the author has developed a feel for the tools available. The 16 PF is recognised as a powerful aid in discussing and identifying topics concerning the Naval

workforce provided its strengths and weaknesses are recognised. The greatest difficulty encountered was in recognising patterns in the data.

23.8 The classification or comparison of groups using coefficients of similarity such as those given in table 23.1 were satisfactory up to a point but were not helpful in developing insights for the prediction of the future behaviour of leaders. Principal component analysis was also unable to offer any help because the environment of the leaders was so rich in cross-currents of influence that no strong patterns emerged. This was examined at a simple level using the E.P.I. measure by various plotting techniques and the 'Spider' charts in Figure 13.3 showed some promise. It will be noticed that if the extreme points in each of these plots are joined with an enveloping line that an approximation to a niquist diagram is obtained. The relative orientation of these plots is then seen to be related to the direction of shift identified in figure 13.2. The theoretical interpretation of this result has not been crystallised but it represents a combined measure of the influence of training and the post training development of these five types of person.

23.9 The author met no one during this research who was using measures such as the 16 PF in a really confident manner. This was attributed to the difficulty of interpretation of results for predictive purposes. However, like radiology, there is much to be gained by persevering. Groups can be examined as was done in table 23.1, to show a number of features:-

- a. the group is homogenous because random sub-division creates groups which are neither significantly similar or dissimilar.
- b. Sub-sets are similar or dissimilar at a significant level.

This can lead on to examination of individual factors for the group or alternatively the single members. In each case the interpretation can be no stronger than cautionary and this is probably the great potential use for such tests. Much more work is needed before the full potential can be realised. The statistical package for the social sciences offered by Nie et al (1970) is available on the S.I.A. terminal at DG Ships and offers scope for further manipulation of the data should interest be sustained. The author will continue his enquiries in collaboration with the D.R.S.E (Harris and Buckley-Sharp 1973).

#### Attitude to the Research

23.10 The inter-disciplinary higher degree scheme required that the work be done in the environment of the parent organisation and this was found to be a very stimulating and worthwhile concept. It does, however, introduce an extra level of stress on the researcher which is not usually a problem with the more conventional

student. This is generated by the necessity to work with people who are slightly suspicious of the motives of the worker; are not familiar with the terminology nor with the real aim of the work and frequently consider that there is some ulterior motive in it all which has not been explained to them and which in some way is harmful. At the same time as this process of breaking down barriers is going on the researcher has to retain the acceptance of the academic world in which he has one leg. This game of mental gymnastics involving quite a considerable change in role from one area to the other generates a reluctance to pass information across this barrier. Attempts to overcome this difficulty met with little success. This was not a problem which was unique to this research and it has been reported elsewhere.

Table 23.1 Comparison of 16 PF Scores of Groups using function 'f'(using 1962 Ed. Form A. Except Group 11)

	1	2	3	4	5	6	7	8	9	10	11	12	Number
GROUP 1	RANDOM HALF OF ALL	166											238
GROUP 2	2ND HALF OF ALL	342	533										244
GROUP 3	OFFICERS (4+5+6)	279	571	128									158
GROUP 4	SEAMEN OFFICERS	703	653	323	257								53
GROUP 5	S.D. ENGINEERS	516	659	103	202	334							33
GROUP 6	G.L. ENGINEERS	376	153	888	723	770	820						72
GROUP 7	ARTIFICERS	161	209	686	430	666	306						164
GROUP 8	OTHER SEN RATES	247	120	1076	927	1233	113	116					160
GROUP 9	ALL CPO's (7+8)	551	305	1146	777	954	92	310	195				324
GROUP 10	PRE-COURSE 1970	2323	2084	2346	1521	1845	1500	1934	2503	1222			146
GROUP 11	POST-COURSE 1970	62	89	337	237	301	156	99	113	260	1321		88
GROUP 12	PRE-COURSE 1972	259	534	231	96	358	674	407	795	770	1693	192	88
GROUP 13	POST-COURSE 1972												

Table of Probability levels for  $r_p$  for 16 factors. (Cattell et al 1970)

p	.01	.02	.05	.1	.1	.1	.05	.02	.01
f2	45	52	62	72	183	205	232	257	



## SECTION 24

### CONCLUSIONS

24.1 A number of conclusions have been drawn from this research and they are listed in two main categories. The first includes detailed observations substantiated by data analysis and these are given with reference to the supporting argument in the text. The other groups some conclusions drawn from the argument which are more general but nevertheless important to the evaluation of this research programme. The principal conclusion is that this study of leadership particularly through the inclusion of psychometric techniques has generated a new perspective for the author which has proved of interest to other authorities such as the AIB, HMS Royal Arthur and the Staff Course. This has in its turn opened up discussion and made a number of proposals a possibility. This breaking down of barriers was seen as one of the most valuable results of the work in the short term.

24.2 The measures used showed that personalities between groups were different and styles of appropriate leadership were equally different. The 16 PF (1962 Edition) was found to be a sensitive discriminant of groups of naval personnel (Section 14) and also gave a clear indication of a measure of change between the start and completion of a course of Leadership Training (Section 13). Its use as a predictive instrument was not demonstrated in the training situation but its application as a screen in allocation to key posts was examined and merits further research (Section 15). Cattell's taxonomy has many other potential uses apart from these. It would provide a language for describing the attributes of individuals in simulation modelling (paragraph 19.22). Equally it could provide a basis for validating officer reporting (paragraph 16.11) where it was concluded that the use of Catell 16 PF in the collection of data needed for manpower planning and control would be possible.

24.3 Group differences between Officers, Artificers and other Chief Petty Officers were demonstrated on the 16 PF and the EPI where it was shown that Officer groupings were significantly different from groups of Ratings. It was also shown that the group of General List Engineer Officers was different from the group of Special Duties List Engineer Officers. This was explained by reference to the general list concept where in the past an engineer was considered against a criterion of competence in exercising his engineering profession, but to-day greater emphasis is put on his competence as a Naval Officer. It was concluded in paragraph 17.12 that the characteristics required of a Seaman Officer differ from those of a maintainer and that the results of personality data offered supporting evidence that the individuals did display such differences. The fact that these differences could be identified and measured offered another dimension for understanding the

leadership structure. While a number of conclusions were drawn from the observed differences, the most important is that successful technical involvement implies a different personality-profile from others in a normally distributed population.

24.4 Leadership training was examined and it was concluded that psychometric techniques offer one way of judging the effectiveness of the courses provided. In paragraph 20.15 it was concluded that a series of formal and standard courses of training is the most effective method of generating a climate in which leadership can flourish. The generation of such an environment is a dynamic process which itself depends upon good leadership. Because a higher proportion of ships of the fleet are "small ships" there is a need to provide formal supervision of leadership activities at the more junior level. Here is a natural place for the Fleet Chief Petty Officer because he is not too far removed in sociological terms from either the young petty officer or the newly commissioned officer and can provide valuable feedback to the man at a meaningful level. It was also concluded that there is a need for some standardisation of reports on leadership behaviour and potential, both from Leadership Schools and from the Fleet, so that the effects of training can be assessed and validated.

24.5 The help afforded by simulation techniques was discussed in the context of maintainers of equipment in ships and the provision of competent leaders for these men. A model was put forward which it was claimed could make it possible to judge alternative career patterns before implementation (paragraph 19.23). It was concluded that the technique holds promise for simulating the effects of training and experience on the individuals employed in the service. The outputs would indicate whether typical entrants for various branches, after experience in a selection from the ranges of jobs available, would develop the attributes required of leaders in ships and ashore.

#### Selection

24.6 Selection procedures were examined both in connection with selection at the Admiralty Interview Board and the selection for promotion within the Service. Results from a pilot study at the AIB indicated that the 16 PF discriminated between successful and unsuccessful candidates (paragraph 13.18) but the sample was small and further work needs to be done. It was also concluded that these techniques could provide a monitor for the longer term effects of unintentional bias in the selection process resulting in the exclusion of certain personality characteristics. It was said in paragraph 21.13 that while the work done in this area does not merit recommendations, the potential value has been discussed with the Admiralty Review Board. Testing is continuing to increase the sample. A further use was identified in the allocation of individuals to special teams (paragraph 21.14).

It was concluded that it is most unlikely that any attempt to match personality factor profiles against an "ideal" would be a viable method of allocation. However, the post-decision screening of selected teams for incompatibility as a group should be feasible. A simple, unvalidated example of the use of one type of screen that might be used was given in paragraph 15.17.

24.7 The Effects of Computer Technology and a trend towards computer aided decision-making were examined. The threat they posed to the development of leadership skill was discussed in the context of ship systems and headquarters provision of management information. It was concluded that the trend merited further study (paragraph 18.12). In particular it was recognised that the massiveness and rigidity of the hardware and software packages between them present a considerable challenge to the inexperienced officer. There is the possibility that fluency in use will never develop beyond a shallow, mechanistic level. This danger will be in inverse proportion to the general ability of the people concerned. It was concluded that a task oriented leader is more likely to ignore such effects arising from the use of computers and because these will take a long time to react on the effectiveness of the service it could take many years before such a reaction was detected. Where it is possible to examine ways to avert this danger the necessary techniques should be developed.

#### Allocation of Function

24.8 The concept of individual personality differences was used to examine the proposal for the implementation of the User maintainer study. Risk of failure was linked to a number of possible causes and it was concluded that the mix of skills and roles applicable to the present General List Officer was not matched to the future needs of the Service. In paragraph 17.22 it was concluded that the user-maintainer concept is a logical development in the allocation of function to the crew of a warship. However, the Weapon Electrical Officer has become a focus for a large range of skills calling for broad talents and wide experience. Similarly, sea command calls for special skill and experience and it was suggested that some seaman general list officers should be qualified systems engineers having access to command as well as opportunity to contribute to Weapon Procurement.

#### Work Attitudes

24.9 It was concluded that the leaders identified with the organisation in terms of their approach to work. The data collected about attitudes to work showed a high level of involvement with the service and the work it made necessary. (paragraph 14.20). The overall response matched the expectation from a volunteer service but those employed in Headquarters reported a high level of stress generated

potential for growth. The men who will be taking charge in 1995 are entering the service now, and training opportunity must be seen as a resource (paragraph 22.12).

#### Cost

24.12 The cost of this research programme was examined in the context of traditional consultancies and it was concluded that post graduate training of serving officers provided a very effective way of building up cells of expertise in specialist areas. In particular, it was concluded that this work represents a cost effective way of tackling a problem which extends across administrative boundaries and is ill defined. It will be noted that the work has brought together considerable information in one place and although the conclusions drawn may not be agreed, the basis for further research must inevitably prove acceptable to those whose main responsibility it is. Consultant fees for work in this field usually run at about £12,000 per year for one man with the necessary back up from his principal. It would be claimed that this study is at least comparable with work done by consultants in their examination of aspects of the Procurement organisation. On that basis it is considered reasonable to cost this work as representing at least 9 months of consultancy full time, giving a value of £9,000. The actual cost was estimated at less than £1,000, because the officer was employed in a full-time complement billet in parallel with the research study. Therefore his pay and other expenses were not attributable to the research.

## SECTION 25

### RECOMMENDATIONS

25.1 It is recommended that the results of this research be accepted as an indication of the value of post-graduate study in generating an understanding of naval problems. In particular it is recommended that the concept of inter-disciplinary research be extended as an opportunity for widening the horizons of general list engineer officers in mid-career.

25.2 It is recommended that SP(N) examines the uses of psychometric measures to monitor the effects of officer training and the extraction of officers for the S.D. list. A number of large organisations use the 16 PF in selection and it is recommended that the value of the knowledge gained by these bodies be recognised and cooperation encouraged.

25.3 It is recommended that the User-Maintainer concept be recognised as containing a challenge to the long term stability of the Royal Navy unless there is a re-allocation of function and hence change in expectations among officers and senior rates. It is recommended that this re-allocation be examined in the forthcoming Engineer Officer study.

25.4 The mechanism for adjusting the Royal Navy to its role in terms of the people employed is very complex. Provision of adequate leadership is a key activity and research into the working of this mechanism is necessary. Studies still lack a universal focal point to be a clearing house and provide a review of work completed or in hand. It is recommended that this gap be considered by some central body with wide representation.

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References

The annexes are bound separately in the Report for the Royal Navy.

FLEET SURVEY

This questionnaire is part of a study to find out about people's jobs; we want to know more about your attitudes towards and feelings about your work.

The replies you give will be treated in absolute confidence. We are interested in the picture given by the results as a whole. Please feel able to answer freely. For example, give replies at the ends of the scale, if you feel like it.

1. How much do you like the sort of work you are doing?

- |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| very much                | to a large extent        | about the same as others | only part of it          | not at all               |

2. When you are at work, how does the time pass?

- |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| very quickly             | quickly                  | about average            | slowly                   | very slowly              |

3. Do you get any feeling of accomplishment from the work you are doing?

- |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| definitely yes           | sometimes                | I'm not sure             | seldom                   | not at all               |

4. How is your job considered by people around you?

- |                          |                          |                          |                           |                          |
|--------------------------|--------------------------|--------------------------|---------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> |
| very important           | important as other jobs  | about average importance | not as imp. as other jobs | not important at all     |

5. Why did you decide to join the Navy?

- |                              |                              |                              |                              |                              |
|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| (a) <input type="checkbox"/> | (b) <input type="checkbox"/> | (c) <input type="checkbox"/> | (d) <input type="checkbox"/> | (e) <input type="checkbox"/> |
| good prospects               | professional status          | just the money               | a combination of 1, 2 and 3. | not for any of these reasons |

if (e) what? .....

6. Would you advise a friend of yours to join the Navy?

- |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| definitely               | probably                 | I am not                 | not really               | definitely not           |

7. Are there good facilities to help you in your work?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
yes, very many	yes, some	about average	not really	not at all

8. Do you feel you get enough information about what goes on in the establishment?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
yes, definitely enough	yes	i am not sure	could do with some more	not enough information at all

9. Do your "supervisors" discuss matters with your group before deciding what to do about things that come up?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
yes about everything	yes about most things	sometimes	only a few things	very seldom

10. How well does your "supervisor" explain the new jobs or methods that come along?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
very well	quite well	about average	not very well	very badly

11. How do you feel about the way you were taught your job?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
taught very well	taught quite well	just adequately	could have been better	not well

12. How well are worries or problems, which individuals face, handled?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
very well	quite well	about average	not very well	very badly

13. How satisfied are you with your present pay?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
very well satisfied	quite well satisfied	about average	dissatisfied	most dissatisfied

14. How do you expect to progress (get promotion)?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
very quickly	quite quickly	about average	slowly	very slowly



15. How is morale or group spirit?

very high       high       average       not very high       low

16. How useful to society do you see the work you do?

very useful       useful       average       not very useful       useless

17. Who do you think is the most "stretched" officer on board?

.....

18. Any other comments.

Name .....

Date .....

Please put a tick against the name of each person with whom you frequently discuss work or leisure interests.

I discuss aspects of my work with him	NAME	I talk to him about our outside interests
	(Name of each member of the Group under study was typed in)	

STRUCTURED INTERVIEW - SHIPS

Work

1. How would you describe your work to some one who knows nothing about it?
2. How do you find out what you are supposed to do?
3. Who is your immediate boss? (prompt) what is his "title".
4. Is there anyone else you report to.
5. Who reports directly to you.
6. Are there other people you have to consider.
7. What aspects of your work do you discuss with your boss? (prompt) Is it clear what he expects of you.
8. Do you discuss work with your subordinates.
9. Do you think you get enough information about what is going on onboard?
10. What are your major qualifications for this job?  
(prompt) Do you think you were well trained for it.
11. Your job requires more than technical skills - what other characteristics could you describe as essential?
12. What sort of person might fail in your job?

Job Satisfaction

13. Do you get satisfaction and pleasure from your work? (prompt) How do you feel about your present job? (prompt) What have you liked doing most in the past year.
14. What do you think was the most important thing you achieved in the past six months or so?
15. Are there any problems you have to face? (prompt) Tell me about them.

General

16. Did you always want to be in the Navy? (prompt) How did it come about.
17. Do you have a busy private life? (prompt) Socially, or Sporting.
18. What are your plans for the future? (prompt) Are you staying in the Navy?
19. Finally - who is the most stretched officer on board?

## ANNEX C

### Computer Processing of the 16PF Questionnaire

1. A computer assisted method for processing the 16PF personality factor questionnaire and its use in differentiation between groups of persons has been developed by the Department of Research and Service in Medical Education at the Middlesex Hospital Medical School (Stern, Harris & Buckley-Sharp 1971). The description which follows is of the computer system developed to facilitate the scoring of the 16PF, but this in no way implies that this system is available for use outside the research areas with which DRSE are immediately concerned. It is known as the PERSON4 Program.

#### The Test

2. The test comprises a number of questions designed to elucidate measures of personality along 16 mutually independent scales, and it is particularly applicable to normal, rather than clinically derived populations. The test exists in several dated editions, and several versions within each edition. The main editions are the 1962, and the 1967 editions, and the main versions are termed Form A, and Form B. Form C is a shortened form of the test. Both Forms A, and B have 187 questions, and use the same scoring key, as do both the 1962, and the 1967 editions. Either Form of either Edition could be analysed using PERSON4, although development work has been confined to Form A of the 1962 Edition.

#### Norms

3. Part of the purpose of the 16PF test is to compare the results of any one individual with some form of reference population. This is done by converting the scores which the individual obtains on the factors into 'stens' (standard ten scores) using a translation table called a norm table. Norm tables are established by studying defined groups, and the individual may then be compared with whichever group the tester considers appropriate. Many norm tables have been published, but in particular there are tables for each Form, for each Edition, and for a general population, and a college population for the United States. Recently, norms for a British general population have been published using an anglicised 1970 edition of the Forms. DSRE have developed norms particularly appropriate to higher education in Britain. Norm tables should not be regarded as static, or as absolute definitions of a population. They are subject to errors of sampling. The advantage of having the test data in computer readable form is of great advantage when it is desired to construct or update norm tables rapidly and accurately. This facility was used to develop the Naval Norms in Section 14.

Data Collection

4. DSRE designed a card whose principal purpose is to collect data from the 16PF test (TRIPLE card). This card has space for 100 answers to three-choice questions, so that two cards are needed for the 16PF test data. A further card with subject identification is optional for the program. The subject answers the questionnaire by filling in one of three possible answers for each question. Figure G-1 shows the front of one of the cards.

The image shows a scan of a 16PF test card. The card is rectangular and divided into several sections. On the left side, there is a header area with some text and a logo. The main body of the card is a grid of 100 numbered questions. Each question is followed by three small circles representing possible answers (A, B, C). To the right of the questions, there are two vertical columns: 'CANDIDATE CODE' and 'CARD'. The 'CANDIDATE CODE' column contains a series of small circles, and the 'CARD' column contains a series of small circles. On the far right edge, there is a large vertical label '1ST SIDE' with an arrow pointing to the left. The card is slightly tilted and has some noise from the scanning process.

Program Application

5. Certain checks are applied to the subjects' data to reduce errors, and to notify problems to the user. A subject who omits more than 10 questions is excluded. A subject who marks more than one answer to a question is noted and action is taken: for a question in any factor other than the B scale, one mark only is awarded for a multiple response; for a question in the B scale, no marks are awarded for a multiple response. Experimentally, an internal check is applied for consistency within the subjects data, using a chi-square test. Once the program has obtained the raw scores for each subject, it refers to norm tables to translate the scores to stens. Norm tables are held in a special library: up to three tables may be specified for each program application, and the norm table names are part of the program running options which are decided for each set of data. After scoring and reporting each subject, the program calculates general purpose statistics for raw scores, and for sten scores. Frequency tables may be printed for raw scores and sten scores. Histograms may be printed for each factor and for raw and sten scores.

### Subgroup Analysis

6. A particular facility of PERSON4, not possessed by earlier versions of PERSON, is its ability to undertake a subgroup analysis. Four card columns on the subject's identifier card can contain codes according to any system convenient to the user. Conventionally, column 3 is reserved as a sex code (1 = female, 2 = male). Subjects can be assembled into groups using these codes under the control of subgroup heading cards. These cards define a group in terms of its codes, and supply an associated heading for result tables. Subgroup statistics are assembled during program running, and the statistics for each group can be printed. These statistics may be for raw scores, or for any of the sten scores. Subgroups are compared for similarity using a formula developed by Tatsuoka and the results of comparing every subgroup with every other subgroup are printed for all the sixteen factors.

### Use in this Research

7. The cards proved suitable for all the required uses. These included candidates seated under relaxed conditions in a comfortable class-room and subject to no overt stress. The above candidates upon return from a 48 hour mountain exercise under conditions of stress and weariness. Conditions included restricted space onboard Ship. Individuals completed questionnaires under widely differing expectations and no difficulty was encountered. On completion the cards were posted to the DRSE. The processing and analysis were satisfactory and results are reported in Part III.

8. One facility offered included an individual print-out which could be used as feedback to the subjects. This was taken up and an example is given in figure C-2. The letter sent to each person is also included.

9. This facility which was most generously offered, proved a very valuable tool and has been much appreciated.

\*\*\*\*\*  
#  
\*\*\*\*\*

SYMBOL 1 IS FOR STEN SCORE AGAINST NORMS : FURN A: 1962 EDITION: GENERAL POPULATION (CONVERT)  
SYMBOL 2 IS FOR STEN SCORE AGAINST NORMS : FURN A: 1962 ED.: COLLEGE STUDENTS (CONVERT)  
SYMBOL \* IS FOR STEN SCORE WHEN BOTH VALUES COUNT FOR

DESCRIPTION	STEN	STEN	(T.M.)	STEN	DEFINITION					
RESERVED, CRITICAL, DETACHED, CIRCUMSPECT	1	2	3	4	5	6	7	8	9	10
LESS INTELLIGENT	.	*	.	.	.	.	.	.	.	.
AFFECTED BY FEELINGS, LESS STABLE	.	.	*	.	.	.	.	.	.	.
UNBLESSED, CONFIRMING, MILD	.	.	.	.	1	2	.	.	.	.
ORBITAL, SEPIOUS, PRUDENT, FACILITARY	.	.	*	.	.	.	.	.	.	.
IMPEDIENT, FEELS FEW OBLIGATIONS	.	.	.	.	.	.	.	.	.	.
SHY, DIFFIDENT, TIMID, RESTRAINED	.	.	.	.	.	.	.	.	.	.
STUBBORN-MINDED, REALISTIC	.	.	.	.	.	.	.	.	.	.
TRUSTING, ADAPTABLE, NOT JEALOUS	.	.	.	.	.	.	.	.	.	.
IRRATIONAL, CONVENTIONAL, PROPER	2	1	.	.	.	.	.	.	.	.
ERTHRIGHT, NATURAL, SENTIMENTAL	?	1	.	.	.	.	.	.	.	.
TRACID, CONFIDENT, SELF-ASSURED	.	.	.	.	.	.	.	.	.	.
CONSERVATIVE	.	.	*	.	.	.	.	.	.	.
GROUP DEPENDENT	.	.	.	.	.	.	.	.	.	.
INDISCIPLINED SELF-CONFLICT	.	.	.	.	.	.	.	.	.	.
RELAXED, UNFRUSTRATED, TRANQUIL	.	.	.	.	*	.	.	.	.	.

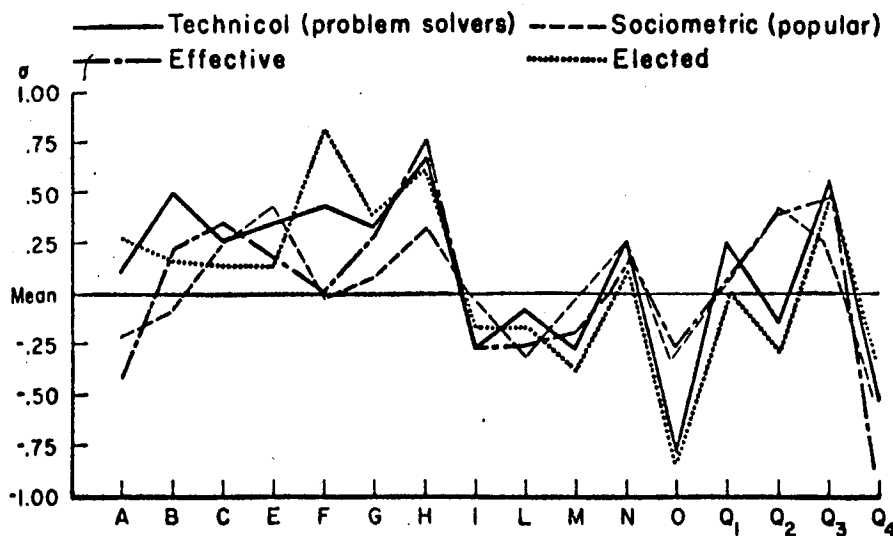
TEST REFERENCE = R GOALS  
 SCORING PROGRAM IS "PERSON" VERSION 4.0 M.D. BUCKLEY-SHARP (AFTER STERN & HARRIS)  
 MIDDLESEX HOSPITAL MEDICAL SCHOOL, LONDON, N.Y.

From Commander Michael Page

Attached is the 16 p.f. printout promised to you when you answered my questionnaires and below are some notes on it.

### THE CATTELL SIXTEEN PERSONALITY FACTOR QUESTIONNAIRE

1. This questionnaire, known as the 16 p.f. is an attempt to provide a measure of a person's overall personality. It is applicable to members of either sex older than seventeen years of age. It is claimed to have greater utility in this general form rather than attempting to concentrate on any one aspect of personality.
2. The questionnaire was designed by the English-born psychologist, R B Cattell, working in Illinois, and is closely related to his research into personality structure. Cattell says that personality is composed of natural unitary structures and each individual will possess all these basic components in varying amounts. Hence one way of measuring personality is to identify these basic factors of personality, and then to measure their presence in different people. This is what the 16 p.f. does and the answers to the questions are scored and the result compared with the general population to provide a comparative measure. Cattell claims that these sixteen factors are sufficient to account for all the major variations in personality.
3. Each person obtains a personality profile from this measure, which can be used in vocational guidance, selection or clinical situations. Obviously the close links between the test and personality theory greatly increase its scope and predictive power in all these fields. It also enables the results to be interpreted meaningfully. As a result of co-operative research, a collection of known profiles is being built up. An example is given in the diagram below.



TYPICAL PROFILES OF 4 TYPES OF LEADERS



4. A comparison can be made between the person's profile, and a typical profile of someone already successfully employed in the area where he wants to work. A prediction can then be made as to his suitability. A statistical coefficient provides a measure of the degree of similarity between profiles.

5. The 16 p.f. is a widely used and respected measure in the fields mentioned, and can be expected to become better established as time goes on and information about it accumulates.

6. A few words now to help you interpret your own profile.

7. Against each factor, you will see that an \* has been marked against your score showing how you compare with a reference group. Join up the \*'s to form a "profile".

8. The profile is produced by comparing your score with norms established by testing a large number of American college students. The result should be recognised as something of interest but not something to be taken too seriously.

9. I hope you find this printout interesting. For those who did the test twice, it is the one you took the first time. As I said before when I asked you to do the test, the results are kept quite separate from Naval records and remain entirely anonymous.

10. Finally, I would like to thank you again for co-operating in this research, which I hope will prove of value to the Naval service.

POSTAL FOLLOW-UP OF INITIAL  
SAMPLE OF PETTY OFFICERS

These petty officers were distributed throughout the fleet and were approached in March 1977 having completed the leadership course at HMS ROYAL ARTHUR in the spring of 1970.

Commanding Officer  
HMS

March 1972

LEADERSHIP TRAINING AT HMS ROYAL ARTHUR

1. An investigation into methods for measuring the effectiveness of the training given to Petty Officers at HMS ROYAL ARTHUR was conducted in 1970. A follow up study is now in hand to examine the longer term pattern of the changes which were identified on completion of the Course.

2. As part of this study it is requested that the rating named in the Annex be asked to complete the two short questionnaires enclosed in the sealed envelope. This will take about a quarter of an hour and it is requested that his Divisional Officer arrange a suitable time and place where it can be completed without interruption.

*Page*

FOR DIVISIONAL OFFICER OF

1. In the envelope attached are two short questionnaires the answer to which will provide an insight into the effectiveness of the Leadership Training given at HMS ROYAL ARTHUR.
2. It is requested that you give it to the rating to open and ask him to complete these questionnaires and then return them to me in the envelope provided.
3. There is no compulsion for these answers to be given but it is hoped that all those asked will co-operate because it is believed that this type of research is proving of value to the Service.
4. During earlier testing, ratings were promised some information on the results of the research and this has not been overlooked. An abstract of the research findings is attached which should be passed to the rating after he has finished answering the questionnaires.
5. Please make sure that the rating can give his answers in complete privacy. Finally, stress that the answers given will be seen by no-one in the Naval Service other than myself.
6. It would help me if this was completed as soon as possible.

From: Commander William H. ...

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(To: Patient by Name)

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My research into the training given at the RICAL CENTER is still progressing and as a final contribution from you I would like to ask you to complete these two SPI questionnaires which you met at the beginning and end of your Course.

When you have completed them will you please return them to me in the envelope provided. I would like to stress that the results will be treated in confidence as were the previous ones.

Until I get the answers to this follow-up survey I will not be able to let you have a report on the outcome of my work but your Divisional Officer has a note on the first stage which he will pass to you when you have finished the questions. I will let you know the final outcome in due course.

Progress Report of an Investigation of the Effects of a Six Week Course of Leadership Training on Petty Officers of the Royal Navy

This is a study of the effect of a six week course of Leadership training provided for Petty Officers in the Royal Navy. An attempt was made to investigate the development in personality as measured by the Cattell 16 PF questionnaire and the Eysenck Personality Inventory. A relationship was sought between this shift and the performance on course as assessed by the training staff.

The longer term effects were investigated by seeking a measure of job satisfaction and job effectiveness after the Petty Officer had been back at work for about 3 months. The sample consisted of six intakes joining at weekly intervals totalling 151 ratings. Seventy-four of these were artificers who had just completed technical training lasting nearly five years.

The difference in response to the training by this group and the remainder were investigated with reference to their age, their aptitudes and their success on course. An examination was made of the hypothesis that a self-selection process results in the two groups having significantly different personality profiles. These profiles were compared with leader profiles quoted in the literature.

The results showed that a significant change of attitudes as measured by these questionnaires occurred as a result of the course of training.

The results also showed that the two groups were different but that this could have been explained in terms of maturity and motivation.

The value of psychometric testing as an additional predictor in assessing leadership potential was examined, and recommendations for further work proposed.

This further work is now in hand and the present survey forms part of this.

THE STUDY OF LEADING RATINGS LEADERSHIP TRAINING

1. An investigation of leadership training in Leading Ratings Leadership Schools, and in particular that at HMS COLLINGWOOD was carried out by I S Williams and A R Wells of the Applied Psychology Unit Admiralty Research Laboratory Teddington Middlesex. The author collaborated with this work, and was invited to be an assessor for all the practical tests.
2. This investigation was a particularly valuable exercise because when it was begun there was practically no official thinking about leadership training as a generality and there was a clearly recognisable need for some research in this field.
3. The study began as part of an overall investigation into the training of Seamen Ratings, with special reference to
  - a. future needs in the light of the shortage of Seamen Ratings,
  - b. the lowering of the RT score for entry,
  - c. shorter periods of engagement, with a resulting need for a more clearly defined job role for such men,
  - d. the prospect of introducing accelerated advancement,
  - e. the overall need to provide evidence which might help in the formulation of policy to reduce the Discharge by Purchase rate and to encourage men to re-engage.
4. One of the areas identified for investigation within this larger plan was leadership. Work on this began in May 1970, and was completed in December 1971.
5. Because of the project's general terms of reference, an initial review was made of the organisation of leadership training in the Service. An investigation of Leading Ratings' leadership training was chosen for study in depth. The original aim of restricting the study to the Seaman Branch proved to be inappropriate, since Leading Ratings of all branches undergo the same training - the two weeks course run by the five schools in HMS COCHRANE, HMS COLLINGWOOD, HMS EXCELLENT, HMS PEMBROKE and HMS RALEIGH. Further the types of leadership tasks performed are common to all Leading Ratings irrespective of Branch.

6. As a preliminary, the published Royal Naval views on leadership were consulted. These were:

- a. The Naval War Manual, BR 1806, 1969 edition.
- b. Principles of Leadership BR 2138, 1964 edition.
- c. Leadership of Men BR 1970.
- d. Introduction to Naval Leadership, undated, HMS ROYAL ARTHUR publication.
- e. Queens Regulation Article 1854.

7. It was thought at that time that there was the likelihood of a serious shortage of Leading Seamen due to shorter engagements. Therefore there was a need for more effective training to allow earlier advancement from able to leading rate.

8. Three main findings emerged from the preliminary phase:-

- a. There is a need for clarification of objectives in the various Leadership Training Schools, some of which concentrated on the use of manpower in Structured Situations, while others used "Functional Leadership" techniques for developing personal qualities rather than management skills.
- b. Leadership training schools should have a common "philosophy" so that training for Leading Rates should be compatible with training for Petty Officers.
- c. It was considered practicable for the Applied Psychology Unit to devise a syllabus, using modern techniques, for a management and leadership course which could be compared experimentally with a control using the existing methods.

9. From this first stage it was concluded that there was almost no criterion testing of the validity of the existing methods of teaching leadership.

10. It was also noted that there was no formal training of instructors and that there was very little formal leadership training at the Royal Naval College Dartmouth.



11. The following actions were recommended:

Step One An experimental course should be designed taking account of the views of leadership instructors on essential elements, being

- a. The relative importance of tasks common to leading rates of all branches.
- b. The relative importance of personal qualities to be developed at Leadership Schools.

The results of an analysis of these views is given in Annex F.

Step Two Objectives should be identified and suggestions made to introduce a philosophy of leadership to be adopted at all Leadership Training Schools. For this, it should be assumed that Leading rates would be sent to a Leadership School as soon as possible after promotion.

It was recognised that a course should be developed for training the leadership instructors.

#### THE EXPERIMENTAL COURSE DESIGN

12. A modified training syllabus was designed taking account of the views of existing training staff. For example, Instructors considered most important those relatively unstructured tasks which call for a sense of duty, responsibility and confidence, and considered less important these relatively structured tasks which call for smartness, alertness and physical fitness.

13. It was recognised that the existing procedures should be disrupted as little as possible so that changes in administration or equipment required would be minimized.

14. Emphasis was to be placed on solving the problems recognised by the Leading Rates' themselves.

15. A prime aim was that training should be directed, as far as possible, towards getting the personal involvement, emotionally as well as intellectually, of each man undergoing training.

### Differences between Control and Experimental Courses

16. The chief differences between the traditional course and the redesigned course are described below:

- a. An introductory session, attempted to gain the confidence of the Leading Rates by finding out and discussing the difficulties and problems they, themselves had met.
- b. Feature length films were used to stimulate discussion. These were "Don't Let him Die" and "Twelve O'Clock High".
- c. Questions and discussions during lectures between the Instructor and the class were encouraged.
- d. Leading rates were encouraged to judge their own performance and criticise it, in the practical unstructured tasks forming part of the syllabus.
- e. "Role Playing", was introduced as a training aid.

### Choice of Establishment

17. HMS COLLINGWOOD Leading Ratings Leadership School was chosen as the most suitable for the experiment because, there, men were all Electrical Ratings whereas other Schools trained men of all Branches. At HMS COLLINGWOOD it was possible to have Control and Experimental groups which were reasonably comparable as to age, experience in the RN, technical ability and, to a certain extent, education and intelligence. Visits to other Schools showed very marked differences in these respects.

### The Sample

18. Two Courses ending 21 May 1971 and 4 June 1971 formed the Control group consisting of 34 men, 24 of whom were Acting Leading REMs and OEMs. The Course ending on 9 July 1971 formed the first Experimental group: it consisted of 20 men, 11 of whom were Acting Leading REMs and OEMs. The second Experimental group, was formed from the Course ending on 8 October 1971. It consisted of 11 men, 9 of whom were Acting Leading REMs.

19. Criteria. Formulating criteria was the most critical and the most difficult part of the experiment. After long consideration it was decided to use two criteria: a written test and a practical unstructured test. These were each divided into 2 parts, a pre-test and post-test which were tried out in February 1971. Consideration of the results showed that it was impracticable to use both pre- and post-tests. It was decided to use one practical test, and to combine the written tests.

### The Results

20. On both criteria the Experimental groups performed significantly better than the Control groups.

21. No definite conclusions were reached awaiting a response from the Fleet; because the Ratings tested were still on courses at HMS COLLINGWOOD. However, the results suggested that modifications to the existing Leading Ratings Leadership Schools methods were practicable and could be useful in the short term.

22. The investigation resulted in suggestions that various aspects of Leadership Training needed further consideration. The principal ones are discussed below.

23. Leadership Training Schools should have a common "philosophy" so that training for Leading Ratings should lead naturally towards training for Petty Officers and subsequently for SD Officers.

24. This common "philosophy" should be applied at all schools which train Officers in leadership and management. In this way Officers and Senior Ratings could learn not merely what was expected of themselves but also what they could expect from others.

25. There is a need for the careful selection of Instructors for Leading Ratings Leadership Training Schools. This should also apply to other Leadership Training Schools. These instructors should be given adequate training prior to their posting to Leadership Training Schools.

ANALYSIS OF VIEWS OF TRAINING STAFF AT LEADING RATE LEADERSHIP SCHOOLS

1. As a first step, an Analysis of Present Opinion among the training staff was undertaken. The intention was to assess which of those tasks were common to all Branches and which personal qualities, Instructors at Leadership Training Schools considered most important for Leading Rates. It was also hoped to identify which of those qualities were most important when carrying out specific responsibilities.
2. Forms were filled in by all the Instructors at HMS RALEIGH, COLLINGWOOD, EXCELLENT and PEMBROKE numbering 5 Officers and 11 POs and CPOs under the personal supervision of Instr Lt A R Wells or Dr I S Williams.
3. The instructors were invited to consider the tasks shown in table 1 and, using their own experience, list them in order of importance for the Leading Rate. They were then asked to consider the personal qualities shown in table 2 and list them recommending a man for advancement, assuming that he had the required professional and technical knowledge and skill. Finally the group identified the two most important personal qualities required to perform successfully each task individually.

RESULTS

Table 1 showing Personal Qualities placed in Order of Importance by Training Staff

<u>Order of Presentation</u>	<u>Rank Order</u>		<u>Sum of Rank Orders</u>
D	1	Has a sense of duty, is responsible and industrious. Gets things done.	38
F	2	Has the Confidence of his men. Is patient and considerate of their feelings; considers their safety. Is fair in his dealings.	45
B	3	Is Self Confident, can make decisions quickly; can praise or blame those under him.	55
C	4	Power of Command, can express himself verbally and in writing. Can teach younger rates and explain reasons for action.	62

<u>Order of Presentation</u>	<u>Rank Order</u>		<u>Sum of Rank Orders</u>
E	5	Has the Confidence of his Superiors, is tactful, is not reluctant to ask for help when it is needed.	67
A	6	Is enthusiastic, ambitious to do well in the RN, does more than just "get by". Is interested in other SQs and Branches.	83
H	7	Is Smart and Alert, sets a good example in dress and bearing. His mess is neat and clean. Observes Ceremonial duties.	89
G	8	Is physically fit. Has determination and endurance.	98

TESTS FOR SIGNIFICANCE

N = 16     $X^2 = 47.75$ ,    7 d.f.,    P    .001

Coefficient of Concordance Among Officers    W = .64    N = 5  
 $X^2 = 22.4$ , 7 d.f., P < .01

Coefficient of Concordance Among Senior Rates    W = .204    N = 10  
 $X^2 = 14.4$ , 7 d.f., P < .05

Table 2 showing Tasks placed in Order of Importance by Training Staff

<u>Order of Presentation</u>	<u>Rank Order</u>		<u>Sum of Rank Orders</u>
6	1	Ensures regulations and instructions are observed by junior rates.	61
1	2	Maintains order and regularity in his mess.	67
13	3	Interprets regulations and instructions to junior rates.	78
18	4	Maintains morale.	79
9	5	Informs Seniors if discontent among junior rates (if he himself cannot put it right).	89
3	6	Maintains safety.	118
10	7	Maintains proper hygiene in his mess.	120
15	8	Instructs junior rates.	127
2	9	Acts as professional assistant to his superior.	140
16	10	In charge of a working party.	172

<u>Order of Presentation</u>	<u>Rank Order</u>		<u>Sum of Rank Orders</u>
17	11	Maintains order when in plain clothes.	200
11	12	In charge of a fire party.	202
12	13	Maintains equipment (as appropriate to Branch).	208
4	14	Maintains rosters.	209
14	15	In charge of NBCD party.	214
20	16	Applies First Aid as may be necessary.	221
5	17	In charge of a shore patrol.	234
7	18	In charge of an escort.	244
8	19	The senior man in a liferaft.	261
19	20	Performs Storekeeping duties (as appropriate to Branch).	296

#### TESTS FOR SIGNIFICANCE

Coefficient of Concordance Among Officers	W = .645	N = 5
	$X^2 = 613$	P < .001
Coefficient of Concordance Among Senior Rates	W = .586	N = 11
	$X^2 = 123$	P < .001

The Spearman Rank Correlation Coefficient between Officers and Senior Rates was .885, P < .01. From these results it was concluded that instructors rated highly those tasks which require personal qualities of leadership in relatively **unstructured** situations and rated as less important those tasks which are met infrequently and require knowledge of regulations rather than personal leadership qualities.

ANNEX G

Summary Tables of results - Selection and Training

- Table G.1 - 16PF Scores of AIB Candidates Classified by results.
- Table G.2 - 16PF Scores of AIB Candidates Classified by choice.
- Table G.3 - EPI Scores of Total Group of 1970 Sample of PETTY OFFICERS at  
HMS ROYAL ARTHUR
- Table G.4 - EPI Scores of ARTIFICERS in 1970 sample of PETTY OFFICERS at  
HMS ROYAL ARTHUR
- Table G.5 - EPI Scores of Other PETTY OFFICERS of 1970 Sample at  
HMS ROYAL ARTHUR
- Table G.6 - Correlation Matrix of EPI Scores taken on Four Seperate  
Occasions
- Table G.7 - Summary of Raw Scores at start of course All Subjects
- Table G.8 - Summary of Raw Scores on completion of course All Subjects
- Table G.9 - Summary of differences between Pre Test and Post Test All Subjects
- Table G.10 - Summary of Age and Assessment at HMS ROYAL ARTHUR - All Subjects
- Table G.11 - Summary of Results of Content Analysis of course report - All  
Subjects
- Table G.12 - Summary of Raw Scores at start of course - Other Petty Officers
- Table G.13 - Summary of Raw Scores on completion of course - Other Petty  
Officers
- Table G.14 - Summary of differences between Pre Test and Post Test. Other  
Petty Officers
- Table G.15 - Summary of Age and Assessment at HMS ROYAL ARTHUR - Other Petty  
Officers
- Table G.16 - Summary of Results of Content Analysis of course report Others  
Petty Officers
- Table G.17 - Summary of Raw Scores at start of course - Artificers
- Table G.18 - Summary of Raw Scores on completion of course - Artificers
- Table G.19 - Summary of Difference between Pre Test and Post Test - Artificers
- Table G.20 - Summary of Age and Assessment at HMS ROYAL ARTHUR - Artificers
- Table G.21 - Summary of Content Analysis of course reports - Artificers
- Figure G1-G16. Histograms of Raw Scores Before and after course.
- Table G.22 - Means of Raw Scores before and after course - 16PF Form A
- Table G.23 - Comparison of 16PFQ - Second order Factors for two groups of  
Petty Officers Under Training.
- Table G.24 - Correlations between EPI and 16PF Second order Factors.

TABLE G.1. 16 PF Scores of AIB Candidates Classified by Results - Naval Stens

CATEGORY	FACTOR																
	A	B	C	E	F	G	H	I	L	M	N	O	Q1	Q2	Q3	Q4	
HIGH PASS (N=4)	MEAN	6.00	6.75	6.25	6.00	5.00	6.50	7.25	7.00	5.50	5.75	7.25	4.50	5.50	3.25	6.25	4.75
	SD	0.71	1.79	0.43	1.22	0.71	0.87	1.48	0.71	0.87	1.09	1.09	0.50	1.80	1.48	2.59	1.30
PASS (N=10)	MEAN	5.60	5.40	6.00	6.90	6.50	5.00	5.70	5.70	6.20	4.50	5.20	4.10	5.20	5.40	5.80	5.20
	SD	1.74	1.28	1.10	2.02	2.66	1.79	1.79	1.42	1.54	2.06	2.40	1.51	1.47	1.96	2.27	2.23
BARE PASS (N=18)	MEAN	5.28	5.83	6.22	6.06	6.11	5.33	5.89	6.56	6.39	4.89	5.28	5.06	5.83	4.28	5.72	4.94
	SD	1.79	1.34	1.65	1.51	1.73	1.89	1.52	1.89	1.50	1.56	1.99	1.72	2.17	1.52	2.38	1.90
NARROW FAILURE (N=14)	MEAN	5.36	5.50	5.86	5.71	5.93	5.00	6.29	5.50	5.93	5.36	5.64	5.64	5.79	5.14	5.14	6.00
	SD	1.76	1.45	2.53	1.71	1.94	0.85	1.22	1.45	1.44	1.63	1.63	1.29	2.04	1.92	2.36	1.85
FAILURE (N=39)	MEAN	5.26	5.67	5.59	5.74	6.62	5.10	6.03	6.15	5.85	5.69	5.10	5.54	5.51	4.95	5.03	5.21
	SD	1.76	1.46	1.64	1.66	2.01	1.68	1.78	2.27	2.15	1.73	1.65	1.85	2.11	2.10	1.99	1.83
LOW FAILURE (N=25)	MEAN	5.76	5.80	5.60	6.40	6.04	4.64	5.24	4.72	6.36	5.00	4.56	5.44	5.52	5.28	5.04	5.68
	SD	1.97	1.13	1.77	1.60	2.34	1.94	1.75	2.05	2.15	1.96	1.70	2.35	1.65	1.43	1.66	1.85

NB. The Stens used are those given in Paragraph 14.1 for Naval sample of Officers and Senior Rates.



TABLE G.2. 16PF Scores of AIB Candidates Classified by Choice of Branch - Naval Stens

CATEGORY	FACTOR																
	A	B	C	E	F	G	H	I	L	M	N	O	Q1	Q2	Q3	Q4	
FLYING DUTIES (N=32)	MEAN	4.84	5.38	5.72	6.44	6.59	5.19	6.09	5.53	5.91	5.31	5.59	4.47	5.81	5.44	5.38	5.06
	SD	1.84	1.29	1.72	1.58	2.18	1.79	1.40	2.36	2.08	1.29	1.78	1.70	1.93	1.80	2.18	2.29
SEAMAN (N=16)	MEAN	5.81	5.63	5.31	6.25	6.25	4.75	6.19	6.50	6.31	5.31	5.25	6.38	5.25	5.06	5.19	5.56
	SD	1.38	1.32	1.72	1.68	1.79	1.48	1.13	2.00	1.49	1.69	1.82	2.09	2.33	1.52	2.10	2.09
ENGINEERING (N=35)	MEAN	5.51	6.23	5.74	6.00	6.34	5.03	5.63	5.57	6.34	5.46	4.86	5.46	5.69	4.83	5.11	5.49
	SD	1.68	1.33	1.81	1.85	2.29	1.84	1.93	1.89	1.87	1.92	1.74	1.68	1.58	2.02	1.86	1.71
TOTAL (N=110)	MEAN	5.45	5.72	5.79	6.05	6.25	5.06	5.87	5.80	6.08	5.25	5.16	5.28	5.57	4.92	5.27	5.35
	SD	1.80	1.39	1.76	1.69	2.11	1.72	1.72	2.07	1.91	1.81	1.86	1.89	1.96	1.88	2.12	1.90

N.B. The Stens used are those given in Paragraph 14.1 for Naval Sample of Officers and Senior Ratings.

TABLE G.3 - EPI Scores of Total Group of 1970 Sample of PETTY OFFICERS  
at HMS ROYAL ARTHUR (N = 124)

EPI		FACTOR	MEAN	STANDARD DEVIATION
I	FORM A Test taken Before Course 1970 (N=124)	N	10.3	4.7
		E	12.3	4.1
		L	2.5	2.0
II	FORM B Test taken After Course 1970 (N=124)	N	11.0	5.1
		E	14.9	3.5
		L	1.5	1.8
III	FORM A POSTAL SURVEY 1972 (N=124)	N	8.5	4.8
		E	12.0	4.1
		L	2.5	1.7
IV	FORM B POSTAL SURVEY 1972 (N=124)	N	9.5	4.6
		E	14.4	3.8
		L	1.3	1.3
I - II (Measure of effect of the course)		N	-0.7	3.7
		E	-2.6	3.6
		L	1.0	1.8
I - III (Measure of effects of course and passage of time)		N	1.9	4.1
		E	0.2	2.8
		L	0.0	2.0
II - IV (Measure of effects of passage of time)		N	1.5	3.4
		E	0.5	3.3
		L	0.2	1.7

TABLE G.4 - EPI Scores of ARTIFICERS in 1970 sample of PETTY OFFICERS  
at HMS ROYAL ARTHUR (N = 64)

EPI		FACTOR	MEAN	STANDARD DEVIATION
I	FORM A Test taken before course 1970 (N= 64 )	N	10.5	4.7
		E	12.2	4.5
		L	2.5	2.4
II	FORM B Test taken after course 1970 (N= 64 )	N	11.0	5.2
		E	15.0	3.6
		L	1.4	1.6
III	FORM A POSTAL SURVEY 1972 (N= 64)	N	8.3	4.5
		E	11.5	4.4
		L	2.6	1.7
IV	FORM B POSTAL SURVEY 1972 (N= 64)	N	9.7	4.1
		E	14.0	3.9
		L	1.2	1.2
I - II (Measure of effect of the Course)		N	-0.5	3.8
		E	-2.8	3.6
		L	1.1	1.4
I - III (Measure of effects of course and passage of time)		N	2.2	4.0
		E	0.7	2.9
		L	-0.2	2.3
II - IV (Measure of effects of passage of time)		N	1.3	3.4
		E	1.0	3.1
		L	0.2	1.5

TABLE G.5 - EPI Scores of Other PETTY OFFICERS of 1970 Sample  
at HMS ROYAL ARTHUR (N = 60)

EPI		FACTOR	MEAN	STANDARD DEVIATION
I	FORM A Test taken before course 1970 (N= 60)	N	10.1	4.7
		E	12.4	4.3
		L	2.5	2.2
II	FORM B Test taken after course 1970 (N= 60)	N	11.0	5.1
		E	14.9	3.4
		L	1.6	1.7
III	FORM A POSTAL SURVEY 1972 (N= 60)	N	8.7	4.7
		E	12.5	4.3
		L	2.5	1.7
IV	FORM B POSTAL SURVEY 1972 (N= 60)	N	9.3	4.6
		E	14.8	3.7
		L	1.4	1.1
I - II  (Measure of effect of the Course)		N	-0.9	3.8
		E	-2.4	3.6
		L	1.0	1.9
I - III  (Measure of effects of course and passage of time)		N	1.6	4.0
		E	-0.3	2.8
		L	0.2	2.2
II - IV  (Measure of effects of passage of time)		N	1.7	3.3
		E	0.1	3.2
		L	0.2	1.6

TABLE G.6 - TRAINING EFFECTS - Correlation Matrix of EPI Scores  
taken on Four Seperate Occasions  
(N=124)

EPI Test		FORM A-1970			FORM B-1970			FORM A-1972		
		N	E	L	N	E	L	N	E	L
FORM B 1970	N	69	-14	-26						
	E	-22	56	-03						
	L	-09	02	43						
FORM A 1972	N	63	-14	-06	70	-22	-07			
	E	-27	75	-08	-20	63	0			
	L	-06	-09	43	-23	-14	43			
FORM B 1972	N	59	-12	-12	75	-12	-18	70	-20	-23
	E	-34	70	0	-33	61	05	-22	63	-14
	L	02	-09	34	-12	-07	45	-07	0	43

NB Decimal Points Omitted

N.B. This gives a possible measure of the permanence of training effects  
(Para 13.7)

TABLE G.7

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
<u>CATTELL 16 PF</u>								
FACTOR A	9.0	9.3	2	2	17	18	3.2	3.0
FACTOR B	8.4	8.5	4	4	13	12	1.8	1.8
FACTOR C	14.3	14.5	5	6	24	22	3.4	3.6
FACTOR E	13.4	14.2	3	3	24	22	3.8	3.7
FACTOR F	14.7	15.1	5	7	26	23	4.5	3.7
FACTOR G	12.4	13.4	4	6	20	20	3.3	3.1
FACTOR H	10.4	12.1	0	3	20	22	4.8	4.7
FACTOR I	7.3	7.3	0	2	17	17	3.1	3.1
FACTOR L	10.4	9.2	4	2	17	18	3.0	3.3
FACTOR M	11.5	12.0	5	5	20	20	3.4	3.2
FACTOR N	11.8	12.1	6	3	19	19	2.7	2.8
FACTOR O	11.0	10.6	2	3	19	18	3.3	3.9
FACTOR Q1	9.7	10.1	4	4	18	16	2.6	2.6
FACTOR Q2	11.9	12.1	3	5	18	18	3.6	3.0
FACTOR Q3	10.4	11.4	1	1	18	18	2.9	3.1
FACTOR Q4	13.1	12.0	3	2	24	24	4.4	4.9
<u>EYSENCK PERSONALITY INVENTORY FORM A</u>								
FACTOR N	10.7	8.3	2	0	22	23	4.7	5.3
FACTOR E	12.2	12.9	3	6	22	20	4.2	3.4
FACTOR L	2.4	2.5	0	0	5	9	2.0	1.8

SUMMARY OF RAW SCORES AT START OF COURSE ALL SUBJECTS

(1970 - N=151)

(1972 - N= 91)

N.B. Tables G7 to G 21 are included to permit comparisons between the samples taken in 1970 and 1972 as required.

TABLE G.8

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
<u>CATTELL 16 PF</u>								
FACTOR A	7.4	9.4	0	4	18.	17	4.3	3.0
FACTOR B	8.7	8.7	4	5	15	13	1.9	1.9
FACTOR C	14.5	15.4	4	8	24	26	4.0	3.8
FACTOR E	12.4	15.1	4	5	20	24	3.4	4.1
FACTOR F	15.3	15.8	7	6	27	23	4.2	4.0
FACTOR G	11.2	14.0	2	5	19	20	3.0	3.5
FACTOR H	12.0	14.0	0	5	24	25	5.4	4.8
FACTOR I	7.8	7.5	0	1	18	14	3.0	3.2
FACTOR L	11.0	8.9	1	2	18	16	3.0	3.0
FACTOR M	11.1	11.8	4	1	19	22	3.4	3.3
FACTOR N	8.8	11.9	2	4	15	18	2.5	2.7
FACTOR O	11.5	10.3	2	4	21	18	4.2	3.4
FACTOR Q1	10.3	9.8	4	4	20	15	2.6	2.5
FACTOR Q2	10.4	11.2	4	1	18	17	2.6	3.4
FACTOR Q3	11.3	11.4	0	0	20	18	3.3	3.1
FACTOR Q4	13.8	11.0	4	2	23	24	4.1	4.9
<u>EYSENCK PERSONALITY INVENTORY</u>								
FACTOR N	11.6	10.0	1	0	23	21	5.1	5.1
FACTOR E	14.8	14.5	6	0	23	22	3.5	4.0
FACTOR L	1.4	1.4	0	0	6	9	1.5	1.5

SUMMARY OF RAW SCORES ON COMPLETION OF COURSE      ALL SUBJECTS

(1970 N=151)

(1972 N= 91)

TABLE G.9

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
<u>CATTELL 16PF</u>								
FACTOR A	1.6	0.0	-12	- 7	11	8	4.1	2.7
FACTOR B	-0.3	-0.2	- 7	- 4	6	4	2.5	1.5
FACTOR C	-0.3	-0.9	-13	-10	10	5	4.3	3.0
FACTOR E	1.0	-0.9	-10	-10	13	7	4.4	3.6
FACTOR F	-0.7	-0.6	-13	- 9	9	8	4.5	3.3
FACTOR G	1.1	-0.6	-11	- 7	11	8	3.5	2.5
FACTOR H	-1.7	-1.9	-15	-13	11	7	4.7	3.8
FACTOR I	-0.5	-0.3	-10	- 6	8	6	3.3	2.7
FACTOR L	-0.6	0.3	-13	- 6	13	6	3.7	2.6
FACTOR M	0.4	0.2	-11	- 8	8	11	4.3	3.6
FACTOR N	3.0	0.2	- 7	- 6	14	7	3.6	2.7
FACTOR O	-0.5	0.3	-10	- 7	10	7	4.1	2.5
FACTOR Q1	-0.6	0.3	- 9	- 7	9	7	3.4	2.7
FACTOR Q2	1.5	0.9	- 7	- 4	11	13	3.8	3.2
FACTOR Q3	-0.8	0.1	-11	- 6	11	7	3.9	2.8
FACTOR Q4	-0.8	1.0	-10	-10	12	8	4.2	3.8
<u>EYSENCK PERSONALITY INVENTORY</u>								
FACTOR N	-1.0	-2.0	- 9	-10	12	7	3.7	3.5
FACTOR E	-2.6	-1.1	-13	- 8	6	15	3.5	4.2
FACTOR L	1.0	1.2	- 3	- 7	11	5	1.8	2.0

SUMMARY OF DIFFERENCES BETWEEN PRE TEST AND POST TEST ALL SUBJECTS

(1970 N=151)

(1972 N= 91)



TABLE G.10

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
	Leadership	4.2	4.6	2	3	7	8	1.0
Leadership Potential	5.7	6.4	3	4	8	9	1.1	1.1
Age	24.3	26.1	20	20	36	38	10.5	4.4

SUMMARY OF AGE AND ASSESSMENT AT HMS ROYAL ARTHUR - ALL SUBJECTS

TABLE G.11

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
	Motivation	3.3	3.6	1	2	5	5	0.9
Maturity	2.8	3.3	1	2	5	5	1.2	0.9
General Ability	3.3	3.4	2	2	5	5	0.7	0.8
Interest in course	3.1	3.5	1	2	5	5	1.0	0.8
Co-operation	3.1	3.2	1	2	5	5	0.9	0.6
Physical presence	2.8	3.5	1	1	5	5	1.0	0.9
Potential	3.4	3.3	1	2	5	5	0.9	0.6
Course Impact	3.2	3.4	1	2	5	5	1.0	0.6

SUMMARY OF RESULTS OF CONTENT ANALYSIS OF COURSE REPORT ALL SUBJECTS

(1970 N=148)

(1972 N= 91)

TABLE G.12

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
<u>CATTELL 16 PF</u>								
FACTOR A	9.7	10.1	4	2	15	18	2.5	3.2
FACTOR B	8.1	8.5	4	5	13	12	1.9	1.8
FACTOR C	14.6	14.6	8	6	21	21	3.1	3.2
FACTOR E	13.2	14.6	4	8	21	22	3.9	3.8
FACTOR F	14.3	14.8	5	7	26	23	4.6	3.9
FACTOR G	12.7	13.4	5	6	19	20	3.3	3.3
FACTOR H	11.0	13.0	0	4	20	22	5.0	4.5
FACTOR I	8.0	7.7	2	2	17	17	3.4	3.3
FACTOR L	10.7	9.2	4	2	17	17	2.9	2.8
FACTOR M	11.9	12.1	5	6	20	20	3.5	3.1
FACTOR N	12.1	11.9	6	3	19	19	2.7	2.8
FACTOR O	11.0	10.9	2	3	18	18	3.1	3.9
FACTOR Q1	9.6	9.8	4	5	15	15	2.5	2.6
FACTOR Q2	11.9	12.3	3	5	18	18	3.2	3.3
FACTOR Q3	10.7	11.3	1	6	18	16	3.3	3.0
FACTOR Q4	13.1	11.9	4	3	24	24	4.2	5.1
<u>EYSENCK PERSONALITY INVENTORY</u>								
FACTOR N	10.5	7.8	2	1	21	23	4.6	5.2
FACTOR E	12.7	13.2	4	7	19	20	3.8	3.5
FACTOR L	2.4	2.5	0	0	8	7	1.6	1.6

SUMMARY OF RAW SCORES AT START OF COURSE - OTHER PETTY OFFICERS

(1970 N=71)

(1972 N=50)

TABLE G.13

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
<u>CATTELL 16 PF</u>								
FACTOR A	8.7	9.4	1	4	18	17	4.0	3.0
FACTOR B	8.6	8.8	4	5	12	13	1.9	1.9
FACTOR C	14.1	15.3	6	8	24	26	3.9	3.7
FACTOR E	12.2	15.4	5	7	20	24	3.6	4.3
FACTOR F	15.7	15.8	8	8	25	23	3.7	4.0
FACTOR G	11.8	14.1	6	5	19	20	2.9	3.4
FACTOR H	12.3	14.4	3	5	22	25	4.9	5.1
FACTOR I	7.9	8.0	2	1	18	14	3.2	3.2
FACTOR L	11.6	8.9	4	3	18	16	2.8	2.9
FACTOR M	10.4	12.4	4	1	17	22	3.3	3.7
FACTOR N	9.3	12.0	5	4	15	18	2.5	2.7
FACTOR O	11.4	10.8	2	4	20	18	3.7	3.3
FACTOR Q1	10.3	9.3	4	4	17	15	2.6	2.4
FACTOR Q2	10.0	11.1	5	3	16	17	2.4	3.1
FACTOR Q3	11.5	11.4	2	5	18	17	3.1	2.9
FACTOR Q4	13.9	11.3	4	3	21	24	3.7	4.6
<u>EYSENCK PERSONALITY INVENTORY</u>								
FACTOR N	12.1	9.8	3	0	22	20	5.1	5.1
FACTOR E	15.1	14.3	7	0	21	22	3.2	4.4
FACTOR L	1.4	1.3	0	0	6	9	1.5	1.6

SUMMARY OF RAW SCORES ON COMPLETION OF COURSE - OTHER PETTY OFFICERS

(1970 N=71)

(1972 N=50)

TABLE G.14

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
<u>CATTELL 16 PF</u>								
FACTOR A	1.1	0.8	- 8	- 6	9	8	4.0	2.9
FACTOR B	- 0.5	- 0.3	- 5	- 3	6	2	2.3	1.4
FACTOR C	- 0.5	- 0.6	- 10	- 10	10	5	4.0	2.8
FACTOR E	- 0.9	- 0.8	- 10	- 10	13	6	4.3	3.4
FACTOR F	- 1.4	- 1.0	- 13	- 9	9	5	4.6	3.2
FACTOR G	- 0.9	- 0.7	- 6	- 7	11	4	3.6	2.4
FACTOR H	- 1.3	- 1.4	- 9	- 9	11	6	4.6	3.5
FACTOR I	- 0.1	- 0.3	- 10	- 6	8	5	3.2	2.9
FACTOR L	0.9	0.3	- 13	- 6	13	6	3.8	2.8
FACTOR M	1.5	- 0.3	- 10	- 8	8	11	4.0	3.7
FACTOR N	2.8	- 0.1	- 7	- 6	14	7	3.7	2.7
FACTOR O	- 0.4	0.1	- 9	- 7	10	7	4.3	2.8
FACTOR Q1	0.7	0.4	- 7	- 7	8	7	3.4	2.9
FACTOR Q2	1.9	1.2	- 7	- 3	11	9	3.9	2.9
FACTOR Q3	- 0.7	- 0.1	- 11	- 6	8	7	4.0	3.0
FACTOR Q4	0.8	0.6	- 9	- 10	12	8	4.5	3.9
<u>EYSENCK PERSONALITY INVENTORY</u>								
FACTOR N	- 1.6	- 2.0	- 9	- 10	7	7	3.6	3.5
FACTOR E	- 2.4	- 1.1	- 10	- 3	5	15	3.3	4.2
FACTOR L	1.0	1.2	- 2	- 7	5	5	1.5	2.0

SUMMARY OF DIFFERENCES BETWEEN PRE TEST AND POST TEST. OTHER PETTY OFFICERS

(1970 N=71)

(1972 N=50)

TABLE G.15

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
Leadership	4.2	5.1	2	3	7	8	0.9	1.3
Leadership Potential	5.7	6.6	3	15	8	9	1.1	1.1
Age	26.8	28.3	22	21	36	38	3.5	4.5

SUMMARY OF AGE AND ASSESSMENT AT HMS ROYAL ARTHUR - OTHER PETTY OFFICERS

TABLE G.16

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
Motivation	3.5	3.9	1	3	5	5	0.9	0.7
Maturity	3.7	3.6	2	2	5	5	0.9	0.8
General Ability	3.2	3.5	2	2	4	5	0.7	0.8
Interest in course	3.3	3.7	1	2	5	5	1.0	0.8
Co-operation	3.3	3.4	1	3	5	5	1.0	0.6
Physical presence	3.0	3.7	1	2	5	5	0.9	0.8
Potential	3.3	3.4	1	2	5	5	0.9	0.6
Course Impact	3.3	3.5	1	2	5	5	1.0	0.6

SUMMARY OF RESULTS OF CONTENT ANALYSIS OF COURSE REPORT OTHERS PETTY OFFICERS

(1970 N=73)

(1972 N=50)

TABLE G.17

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
<u>CATTELL 16 PF</u>								
FACTOR A	8.4	8.4	2	4	17	16	3.5	2.5
FACTOR B	8.7	8.4	5	4	13	11	1.8	1.7
FACTOR C	14.0	14.3	5	6	24	22	3.7	4.0
FACTOR E	13.6	13.6	3	3	24	21	3.8	3.7
FACTOR F	15.0	15.5	6	8	24	21	4.4	3.4
FACTOR G	12.1	13.4	4	6	20	18	3.3	2.9
FACTOR H	9.9	11.0	1	3	20	20	4.7	4.7
FACTOR I	6.9	6.8	0	2	16	12	2.8	2.7
FACTOR L	10.2	9.2	4	2	17	18	3.1	3.8
FACTOR M	11.3	12.0	5	5	19	20	3.3	3.3
FACTOR N	11.6	12.4	6	7	18	18	2.6	2.8
FACTOR O	10.9	10.2	3	3	19	17	3.5	3.9
FACTOR Q1	9.8	10.6	4	4	18	16	2.7	2.5
FACTOR Q2	11.8	11.9	4	6	18	16	3.8	2.6
FACTOR Q3	10.2	11.4	4	1	18	18	2.7	3.2
FACTOR Q4	13.0	12.1	3	2	24	24	4.6	4.8
<u>EYSENCK PERSONALITY INVENTORY</u>								
FACTOR N	10.7	8.9	2	0	22	21	4.7	5.4
FACTOR E	11.8	12.7	3	6	22	19	4.5	3.3
FACTOR L	2.4	2.6	0	0	15	9	2.3	1.9

SUMMARY OF RAW SCORES AT START OF COURSE - ARTIFICERS

(1970 N=79)

(1972 N=41)

TABLE G.18

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
<u>CATTELL 16 PF</u>								
FACTOR A	6.5	9.4	0	4	18	16	4.4	3.1
FACTOR B	8.8	8.5	4	5	15	12	1.9	1.9
FACTOR C	14.8	15.6	4	8	24	24	4.1	4.0
FACTOR E	12.4	14.8	4	5	19	24	3.3	3.9
FACTOR F	15.2	15.7	7	6	27	22	4.4	4.2
FACTOR G	10.8	13.9	2	5	17	20	3.0	3.6
FACTOR H	11.8	13.4	0	7	24	23	5.6	4.4
FACTOR I	7.7	7.0	0	2	16	14	2.9	3.1
FACTOR L	10.6	8.9	1	2	16	16	3.1	3.2
FACTOR M	11.5	11.1	4	6	19	18	3.3	2.7
FACTOR N	8.4	11.8	2	6	13	17	2.5	2.7
FACTOR O	11.4	9.7	2	4	21	15	4.4	3.5
FACTOR Q1	10.2	10.4	5	4	20	15	2.6	2.6
FACTOR Q2	10.6	11.4	4	1	18	17	2.8	3.8
FACTOR Q3	11.2	11.4	0	0	20	18	3.4	3.4
FACTOR Q4	13.7	10.7	4	2	23	24	4.3	5.2
<u>EYSENCK PERSONALITY INVENTORY</u>								
FACTOR N	11.1	10.3	1	2	21	21	5.0	5.2
FACTOR E	14.6	14.8	7	7	23	21	3.7	3.4
FACTOR L	1.4	1.4	0	0	6	6	1.5	1.5

SUMMARY OF RAW SCORES ON COMPLETION OF COURSE - ARTIFICERS

(1970 N=79)

(1972 N=41)

TABLE G.19

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
<u>CATTELL 16 PF</u>								
FACTOR A	-1.9	-1.0	-12	- 7	11	3	4.2	2.2
FACTOR B	-0.1	-0.1	- 7	- 4	5	4	2.6	1.7
FACTOR C	-0.8	-1.3	-13	- 8	10	5	4.4	3.3
FACTOR E	-1.2	-1.2	- 9	-10	13	7	4.4	3.7
FACTOR F	0.2	-0.2	-11	- 7	8	8	4.3	3.3
FACTOR G	1.2	-0.5	-11	- 4	11	8	3.4	2.6
FACTOR H	1.9	-2.4	-15	-13	9	7	4.3	4.1
FACTOR I	0.8	-0.2	-10	- 6	8	6	3.3	2.6
FACTOR L	0.4	0.4	- 8	- 5	8	6	3.7	2.5
FACTOR M	0.2	0.9	-11	- 6	8	11	4.4	3.4
FACTOR N	3.2	0.6	- 5	- 5	11	5	3.5	2.7
FACTOR O	0.4	0.5	- 9	- 5	9	4	3.9	2.2
FACTOR Q1	0.5	0.2	- 9	- 5	9	5	3.5	2.5
FACTOR Q2	1.2	0.5	- 6	- 4	10	13	3.8	3.5
FACTOR Q3	1.0	0	- 9	- 6	11	5	4.0	2.5
FACTOR Q4	-0.6	1.5	-10	- 9	9	8	4.0	3.6
<u>EYSENCK PERSONALITY INVENTORY</u>								
FACTOR N	-0.3	-1.4	- 9	- 7	12	8	3.7	3.8
FACTOR E	-2.8	-2.1	-13	- 9	6	2	3.5	2.8
FACTOR L	1.1	1.2	- 3	- 2	11	8	2.0	1.8

SUMMARY OF DIFFERENCE BETWEEN PRE TEST AND POST TEST - ARTIFICERS

(1970 N=79)

(1972 N=41)



TABLE G.20

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
	Leadership	3.9	4.0	2	3	7	6	0.8
Leadership Potential	5.7	6.2	4	4	8	9	1.1	1.1
Age	22.0	23.5	20	20	29	30	1.5	2.3

SUMMARY OF AGE AND ASSESSMENT AT HMS ROYAL ARTHUR - ARTIFICERS

TABLE G.21

	MEAN		MINIMUM VALUE		MAXIMUM VALUE		STANDARD DEVIATION	
	1970	1972	1970	1972	1970	1972	1970	1972
	Motivation	3.1	3.4	1	2	5	4	1.0
Maturity	1.9	3.0	1	2	3	4	0.5	0.7
General Ability	3.4	3.2	2	2	5	5	0.7	0.7
Interest in Course	3.0	3.2	1	2	5	4	1.0	0.7
Co-operation	3.0	3.0	1	2	5	4	0.9	0.5
Physical presence	2.7	3.2	1	1	5	5	1.0	0.9
Potential	3.5	3.1	2	2	5	5	0.9	0.6
Course Impact	3.1	3.2	1	2	5	4	1.0	0.6

SUMMARY OF CONTENT ANALYSIS OF COURSE REPORTS - ARTIFICERS

(1970 N=75)

(1972 N=41)

TABLE G. 22 MEANS OF RAW SCORES BEFORE & AFTER COURSE - CATTELL 16PF FORM A

FACTOR	GROUP 1			GROUP 2			GROUP 3			GROUP 4		
	BEFORE	AFTER	DIFF	BEFORE	AFTER	DIFF	BEFORE	AFTER	DIFF	BEFORE	AFTER	DIFF
A	9.38	10.00	-.62	9.35	9.82	-.47	8.48	8.23	.25	9.47	9.54	-.07
B	8.24	7.83	.41	9.18	9.47	-.29	8.67	8.95	-.28	8.19	8.54	-.35
C	14.14	15.25	-1.11	14.41	14.88	-.47	14.78	15.85	-1.08	14.63	15.46	-.83
E	14.03	15.58	-1.55	15.24	15.18	.06	14.70	14.41	.29	13.53	15.18	-1.65
F	16.00	15.83	.17	16.00	17.47	-1.47	15.07	14.86	.21	13.94	15.11	-1.17
G	13.07	11.67	1.40	13.35	14.88	-1.53	14.78	15.68	-.90	12.78	13.89	-1.11
H	12.79	14.25	-1.46	11.59	15.35	-3.76	12.19	12.86	-.67	11.84	13.71	-1.87
I	7.55	8.54	-.99	7.18	6.88	.30	7.37	7.00	.37	7.13	7.61	-.48
L	9.38	8.63	.75	8.47	8.88	-.41	9.63	8.91	.72	9.06	8.89	.17
M	11.79	12.21	-.42	11.76	11.24	.52	11.11	11.64	-.53	12.84	12.14	.70
N	11.86	10.83	1.03	12.24	12.59	-.35	12.15	11.95	.20	12.50	12.29	.21
O	9.52	10.33	-.81	10.65	9.76	.89	10.48	10.86	-.38	10.94	10.04	.90
Q1	10.59	9.54	1.05	9.76	10.24	-.58	11.15	10.14	1.01	9.69	9.57	.12
Q2	12.00	11.83	.17	11.24	11.18	.06	11.44	11.18	.26	12.78	11.18	1.60
Q3	11.10	9.88	1.22	10.94	11.76	-.82	12.07	12.41	-.34	11.97	11.71	.26
Q4	11.93	12.17	-.24	12.41	9.76	2.65	11.44	10.41	1.03	12.22	11.21	1.01

(N = 30)

(N = 17)

(N = 27)

(N = 29)

TABLE G.23

TRAINING EFFECTS - Comparison of Cattell 16PFQ - Second order Factors  
for two groups of Petty Officers Under Training.

2ND ORDER FACTOR		NA = 148 NB = 91	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STANDARD DEVIATION
<u>INVIA</u>	A	PRE COURSE	3.9	- 5.1	11.1	3.7
		POST COURSE	3.7	- 5.1	14.9	3.9
	B	PRE COURSE	2.6	- 6.5	14.8	4.1
		POST COURSE	1.5	- 6.2	12.1	4.0
<u>EXVIA</u>	A	PRE COURSE	15.0	2.7	27.5	4.7
		POST COURSE	15.8	3.2	27.7	4.5
	B	PRE COURSE	16.3	6.7	25.7	3.9
		POST COURSE	17.9	8.5	27.3	4.4
TOUGH POISE	A	PRE COURSE	0.6	- 9.5	7.1	3.1
		POST COURSE	0.6	- 8.3	10.5	2.8
	B	PRE COURSE	0.9	- 7.7	8.3	3.2
		POST COURSE	1.2	- 5.9	7.5	3.2
INDEPENDENCE	A	PRE COURSE	13.2	6.1	22.4	3.1
		POST COURSE	12.8	5.3	20.9	3.1
	B	PRE COURSE	13.7	5.8	20.5	3.1
		POST COURSE	13.5	6.3	22.0	3.2

N.B. These second order factors are defined in Section 13  
paragraph 13.21

TABLE G.24

		Pre-Test			Post Test		
		EPI Test A			EPI Test B		
Cattell Factor Second Order		N	E	L	N	E	L
Invia	1970	68	-16	-36	63	-30	-31
	1972	65	-04	-52	70	-04	-31
Exvia	1970	-38	-64	0	-26	59	02
	1972	-17	62	-10	-01	57	0
Tough Poise	1970	-23	28	-02	-37	22	-02
	1972	-30	14	21	-27	08	23
Independence	1970	-11	-03	-13	0	-11	-13
	1972	03	-01	-10	0	0	-13

(Decimal Points Omitted)

TABLE 13.20 - Correlations between EPI Scores and Cattell 16PF Second order Factors. Total Sample (1970 N = 148)  
(1972 N = 91)

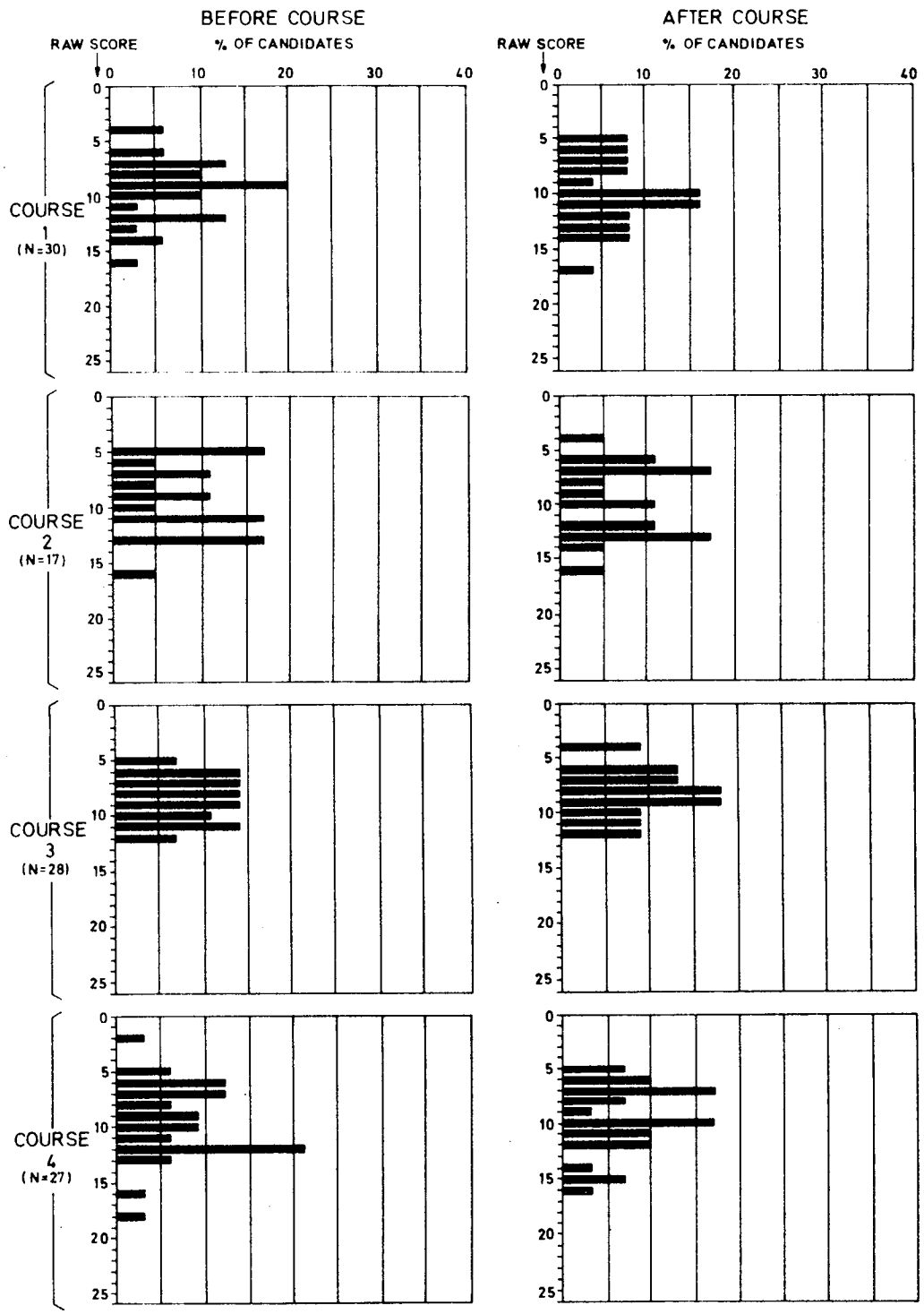


Fig. G.1 Training effects - Cattell 16 P.F.Q. - Histogram of raw scores - Factor A

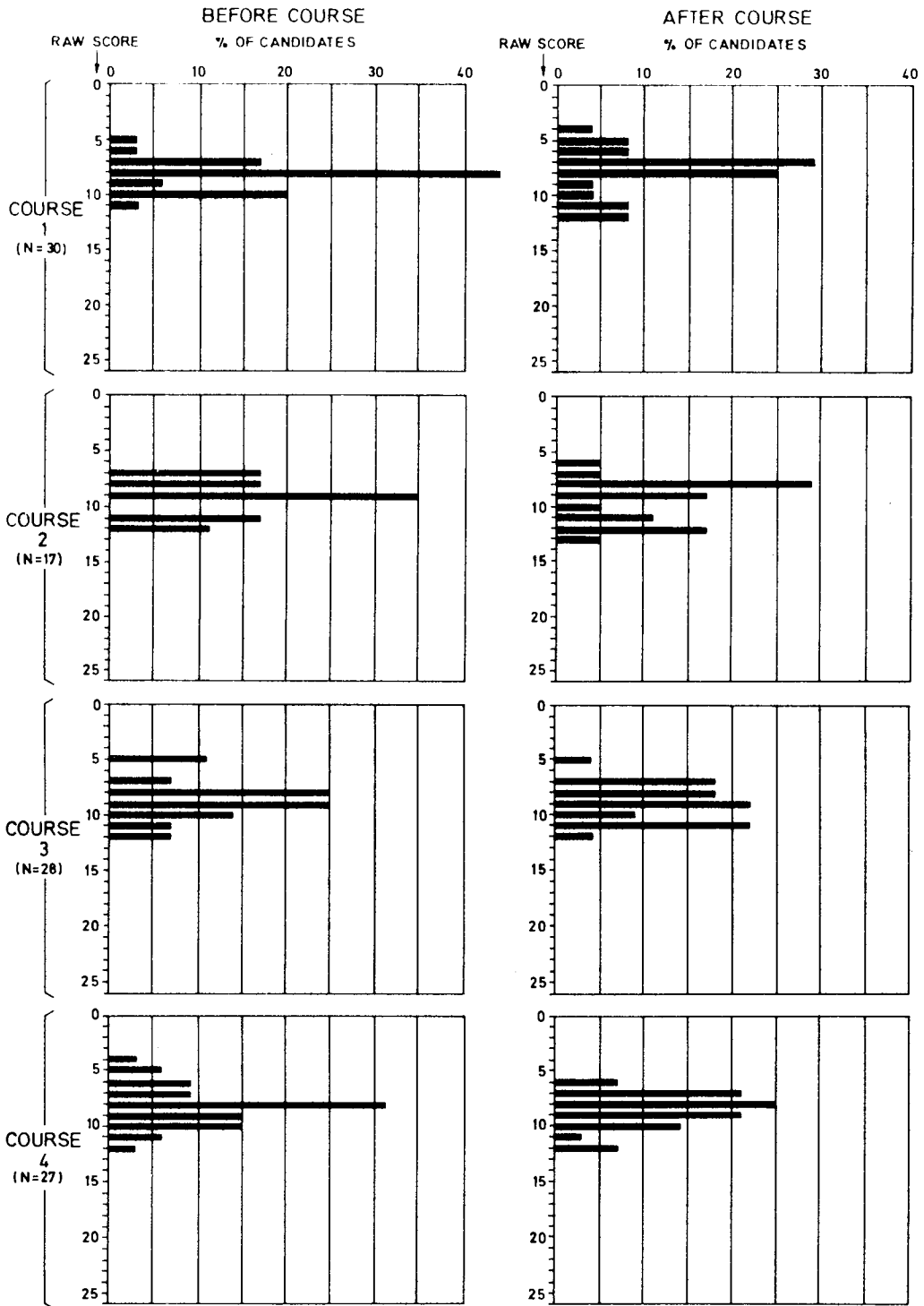


Fig. G.2 Training effects - Cattell 16 P.F.Q. - Histogram of raw scores - Factor B

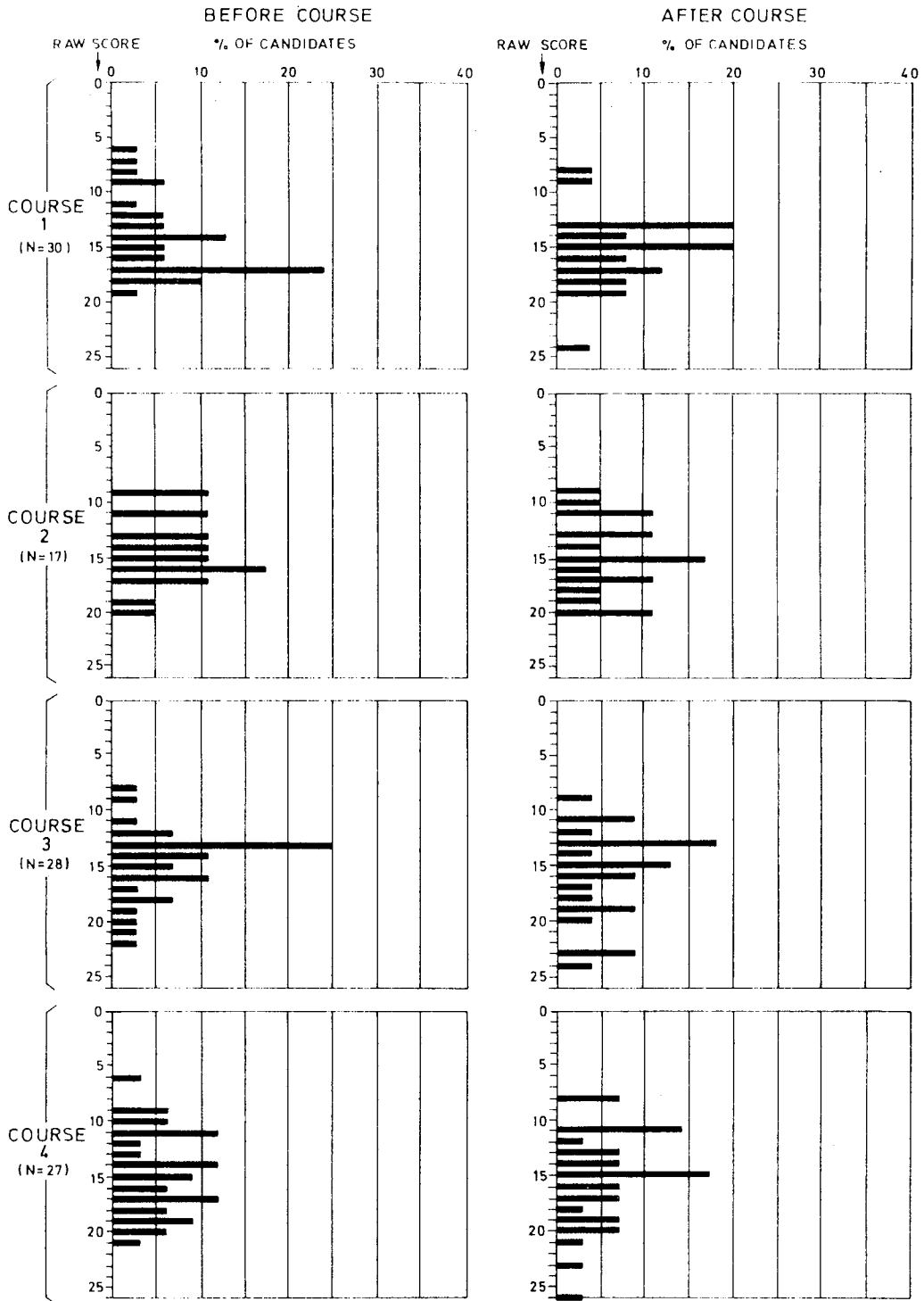


Fig. G.3 Training effects - Cattell 16 P.F.Q - Histogram of raw scores - Factor C

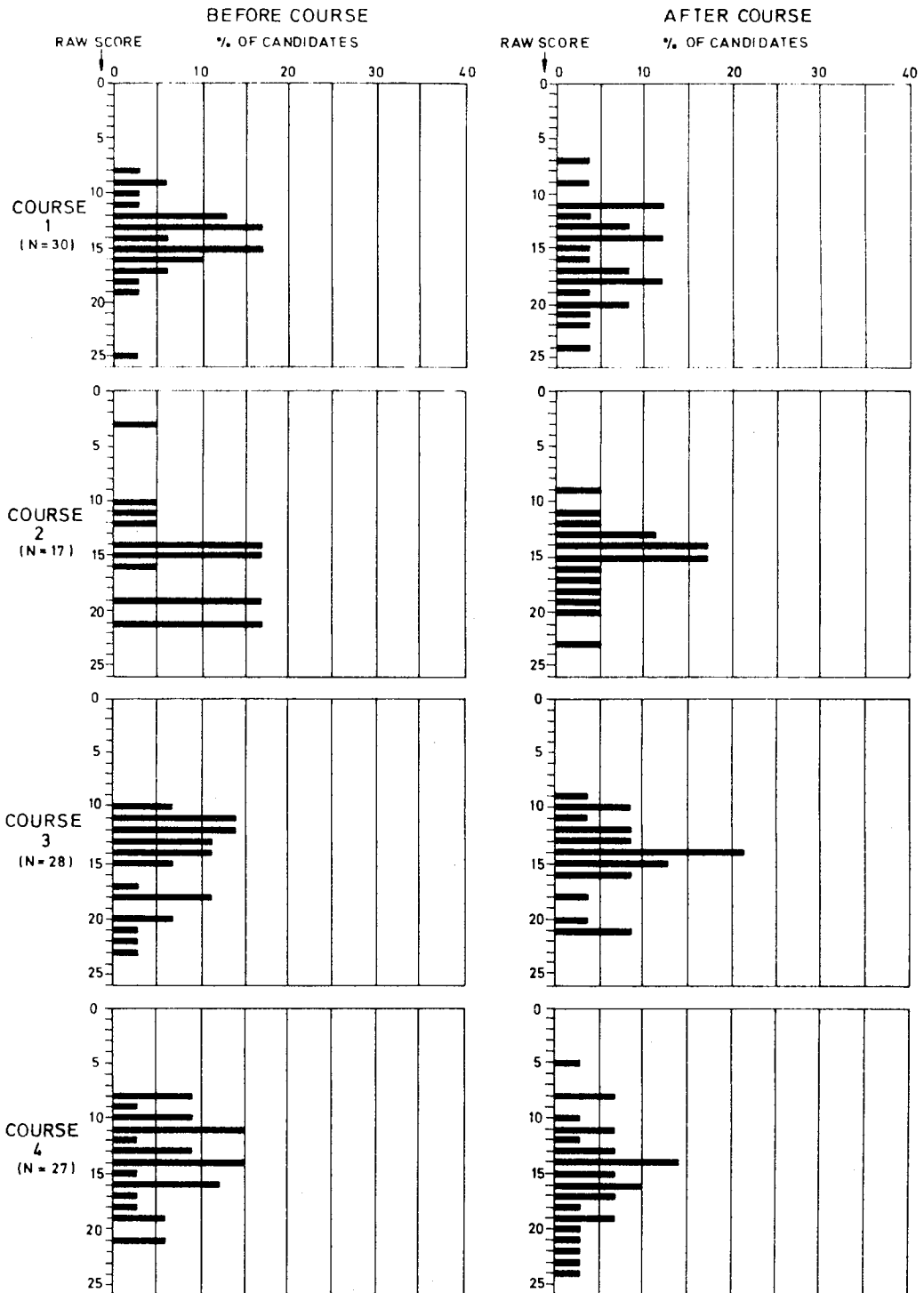


Fig. G.4 Training effects - Cattell 16 PFQ. - Histogram of raw scores - Factor E



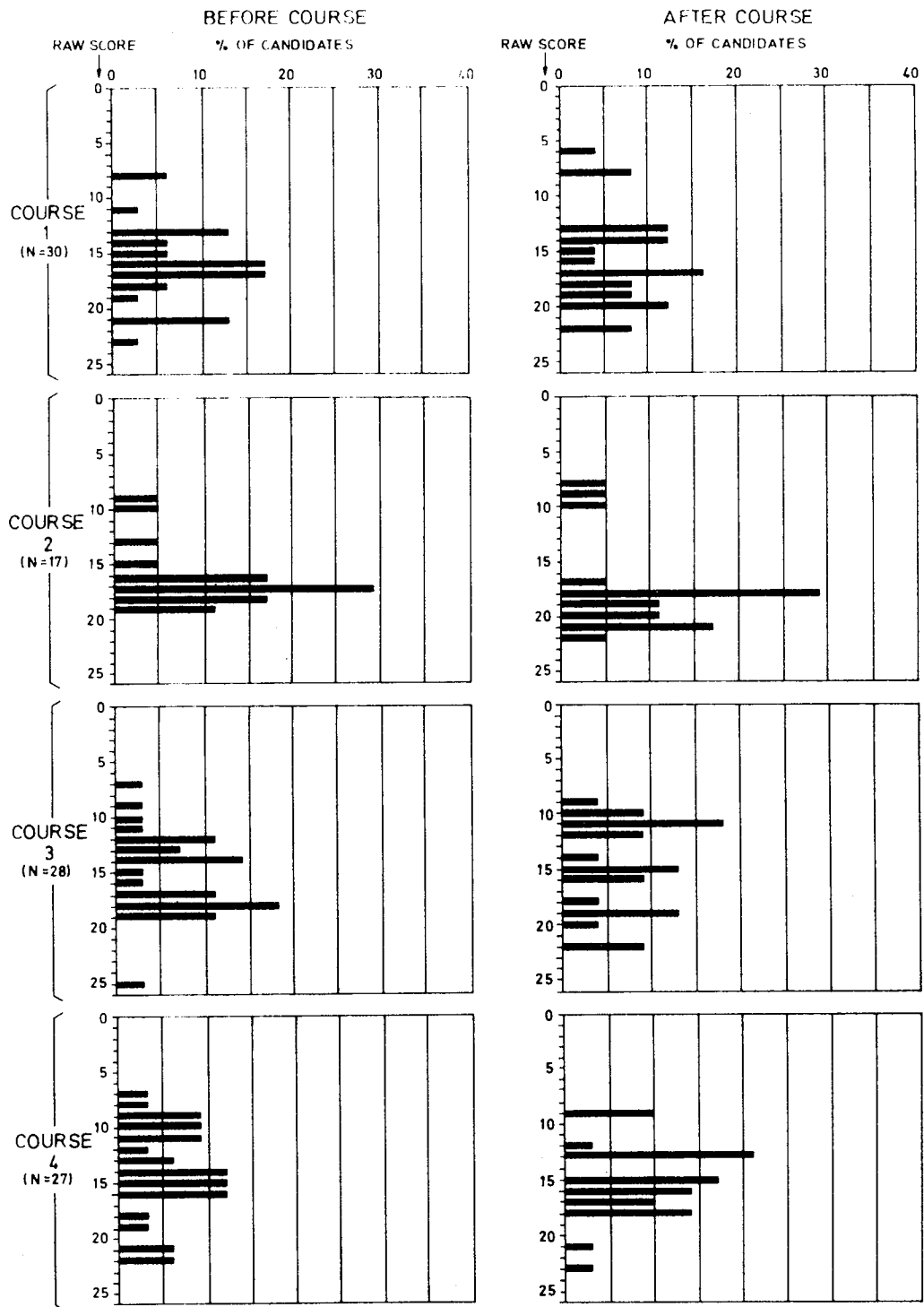


Fig. G.5 Training effects - Cattell 16 P.F.Q. - Histogram of raw scores -Factor F

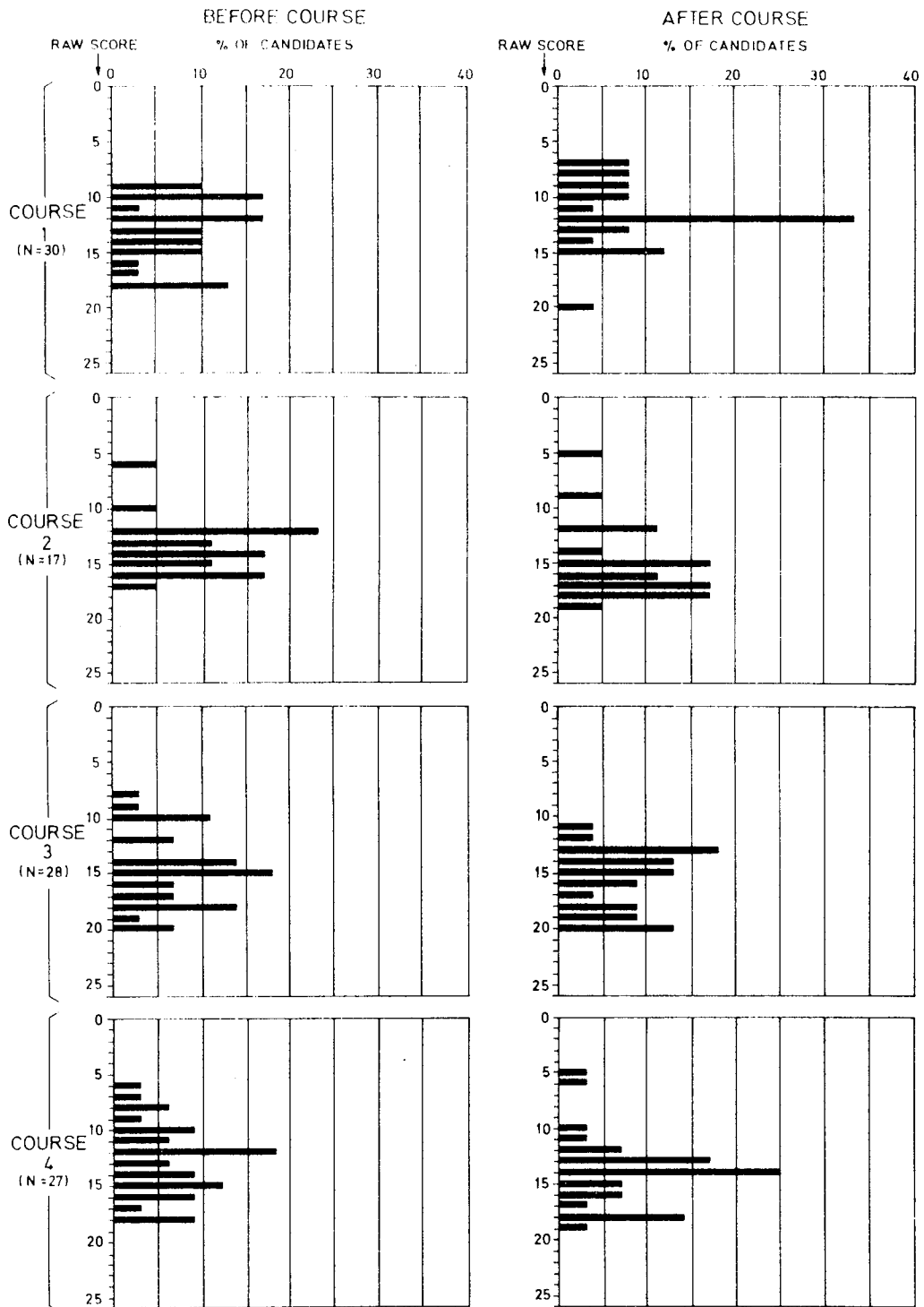


Fig. G.6 Training effects -Cattell 16 P.F.Q. -Histogram of raw scores -Factor G

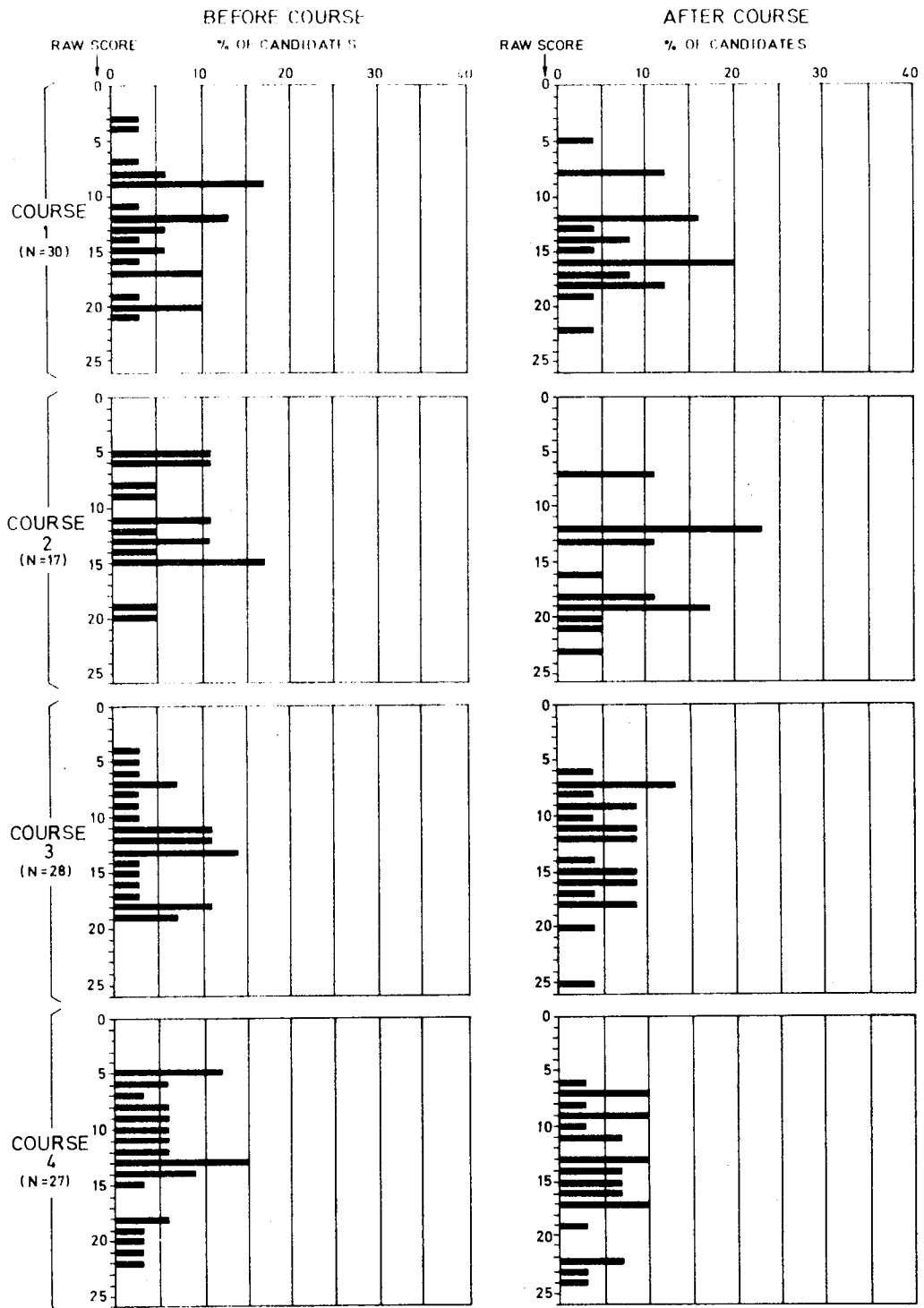


Fig. G.7 Training effects - Cattell 16 P.F.Q. - Histogram of raw scores - Factor H

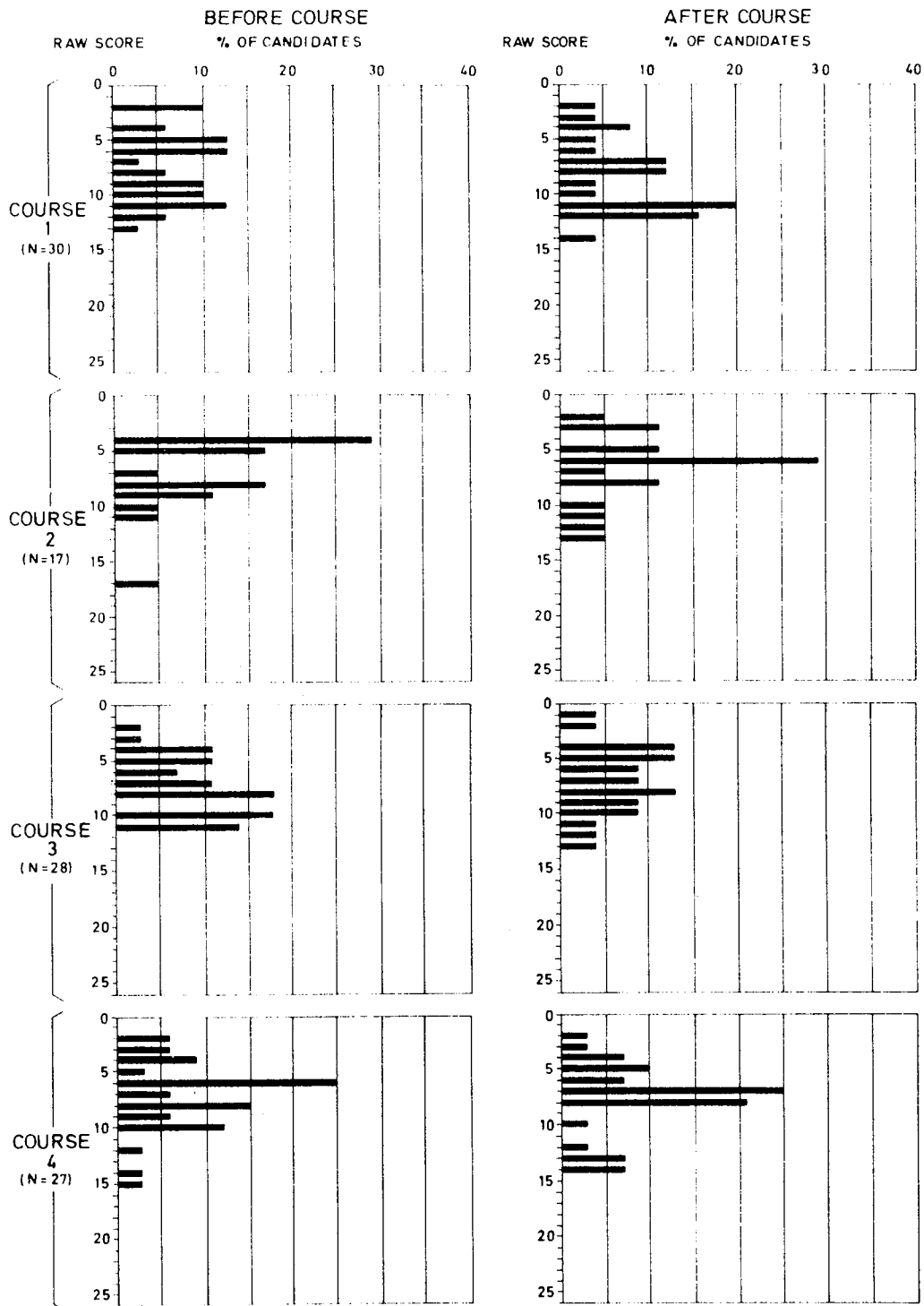


Fig. G.8 Training effects - Cattell 16 P.F.Q. - Histogram of raw scores - Factor I

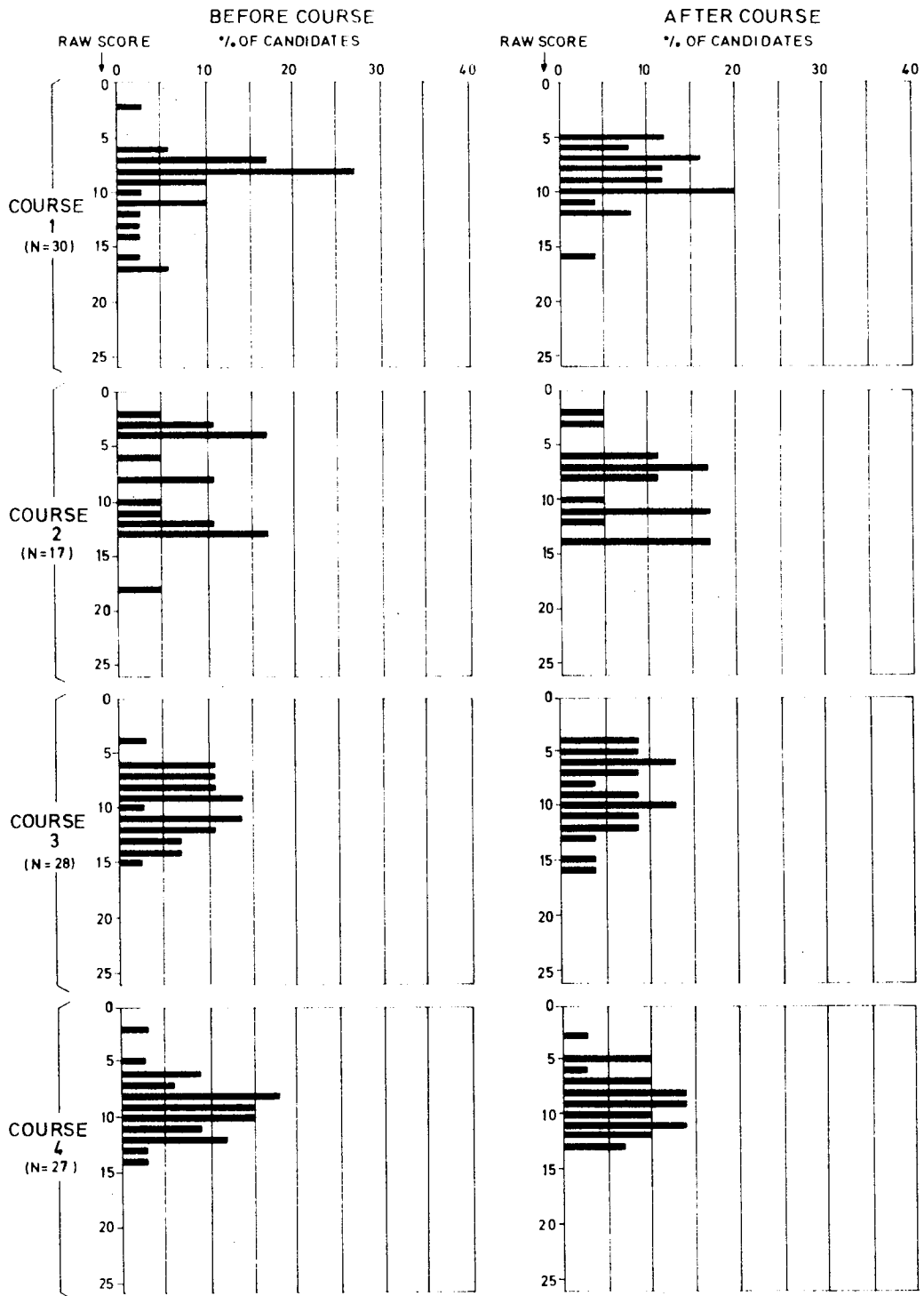


Fig. G.9 Training effects - Cattell 16 P.F.Q - Histogram of raw scores - Factor L

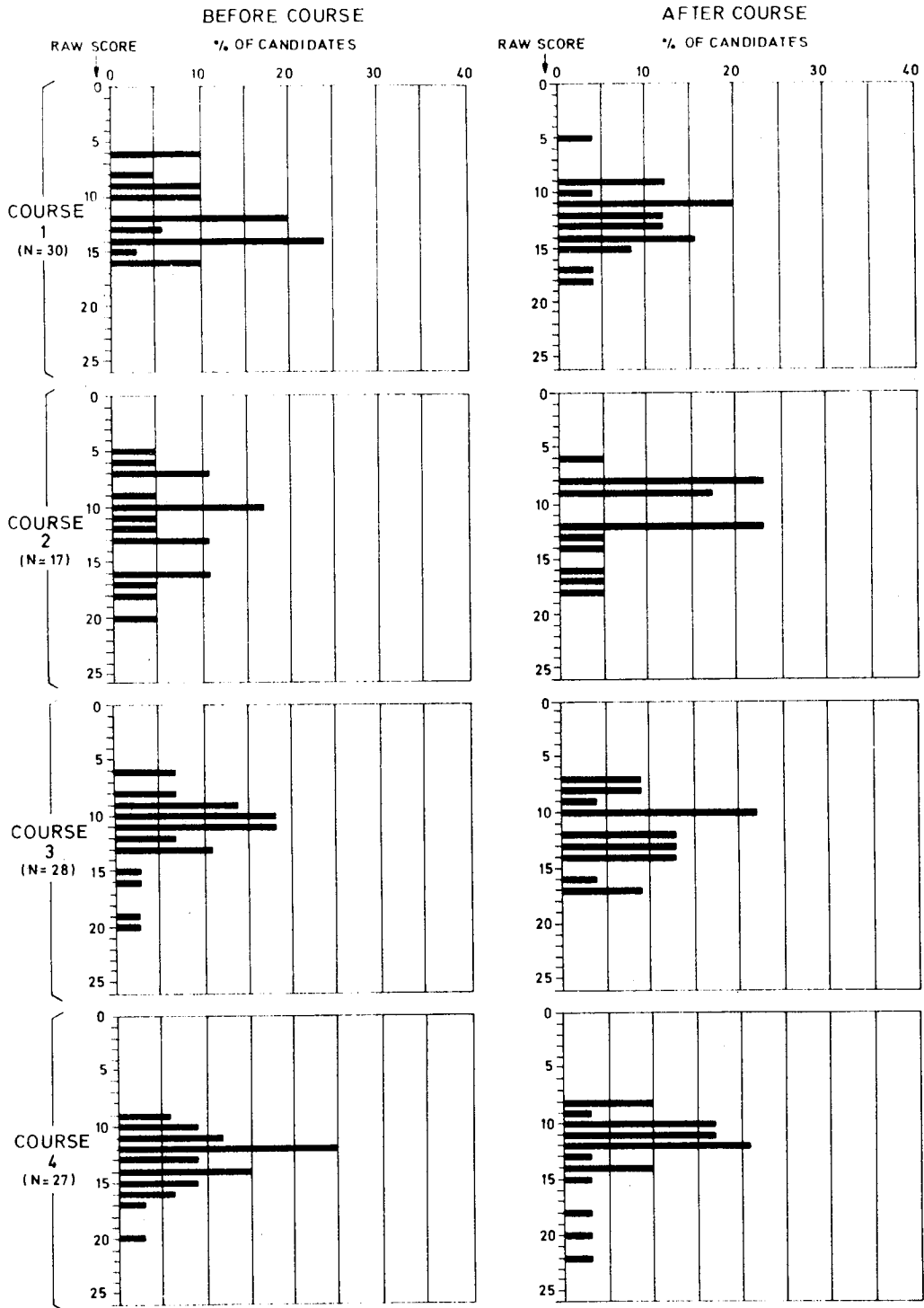


Fig. G.10 Training effects - Cattell 16 P.F.Q. - Histogram of raw scores -Factor M

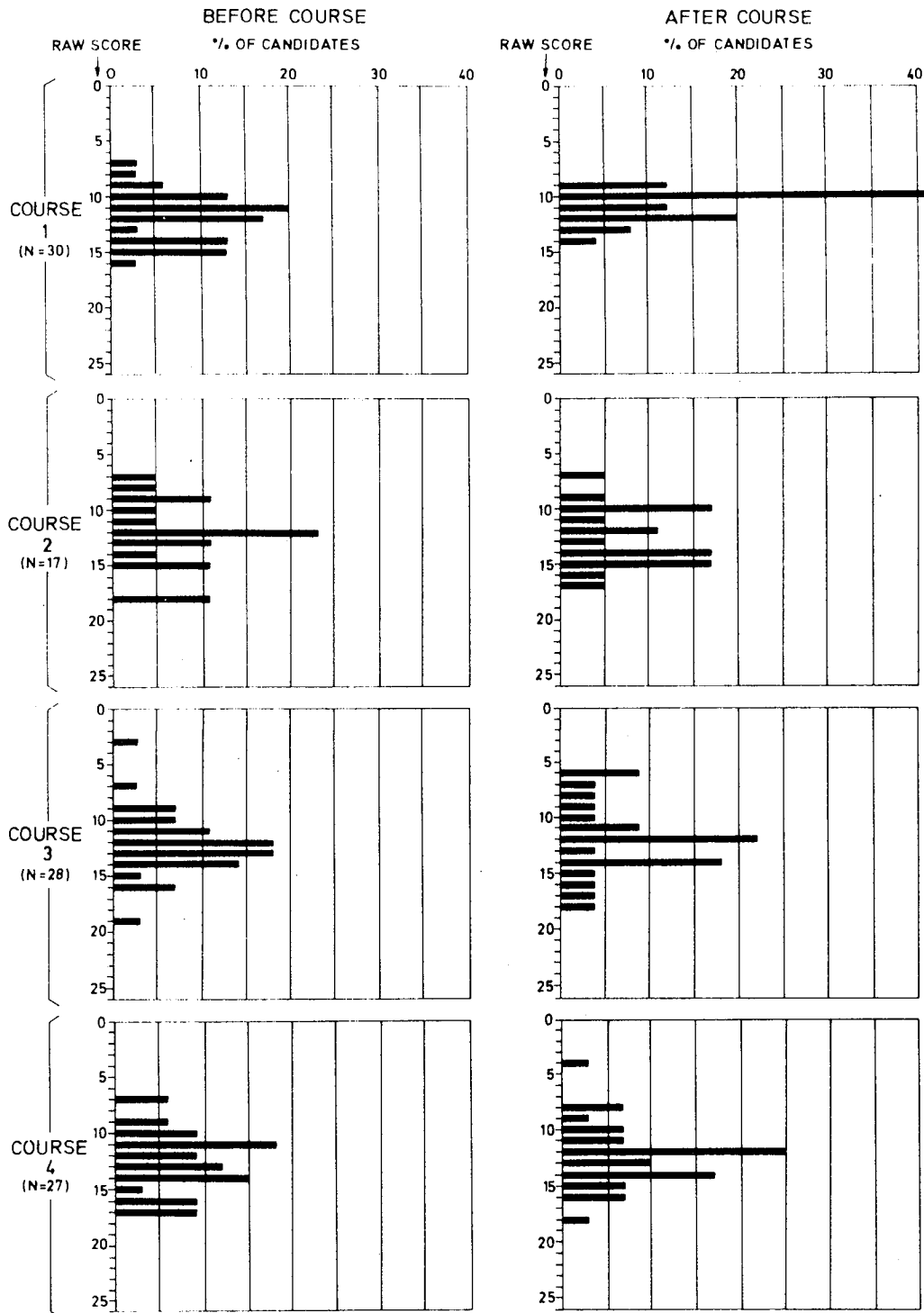


Fig. G.11 Training effects - Cattell 16 P.F.Q. - Histogram of raw scores - Factor N

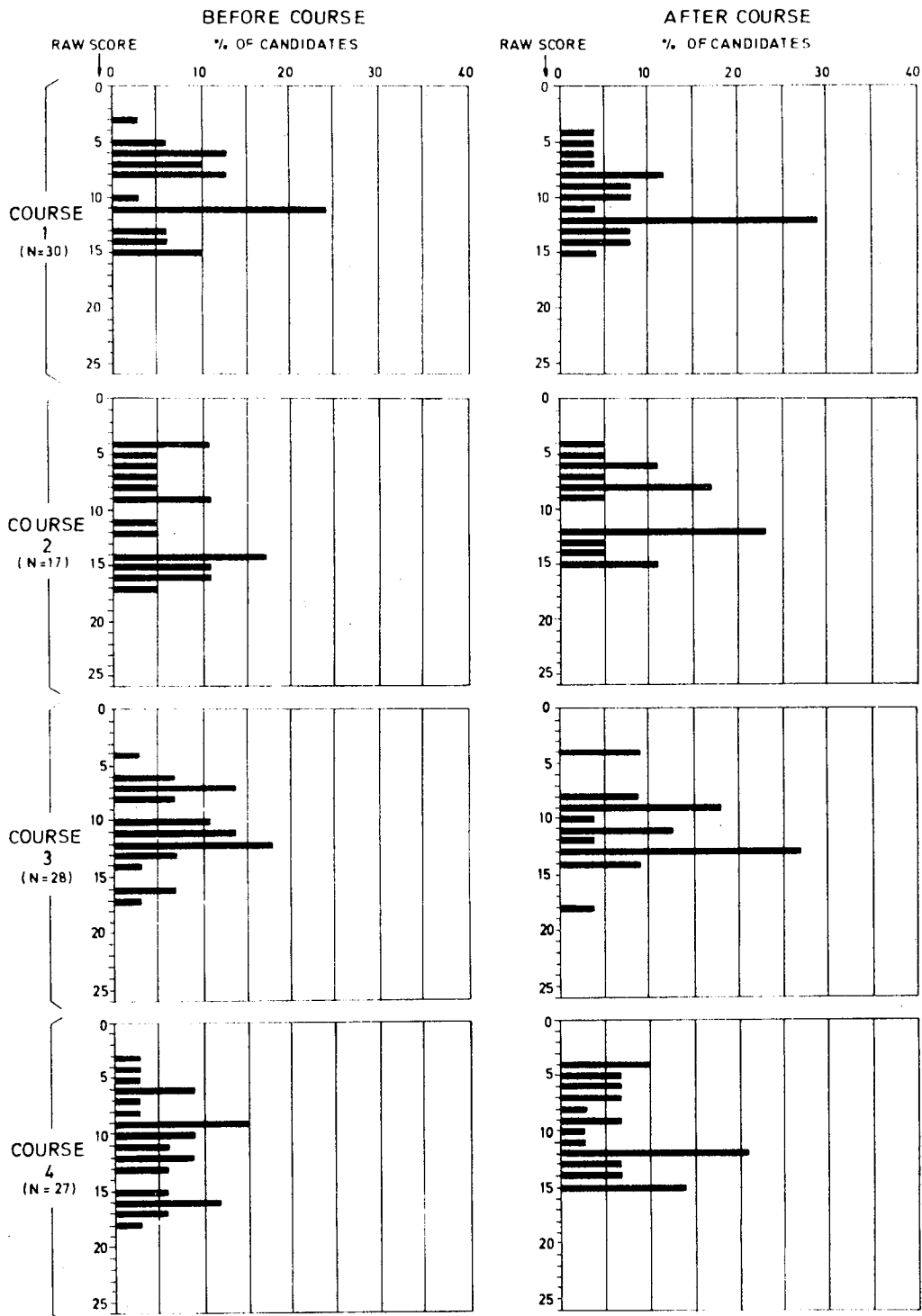


Fig. G.12 Training effects - Cattell 16 PFQ. - Histogram of raw scores - Factor 0



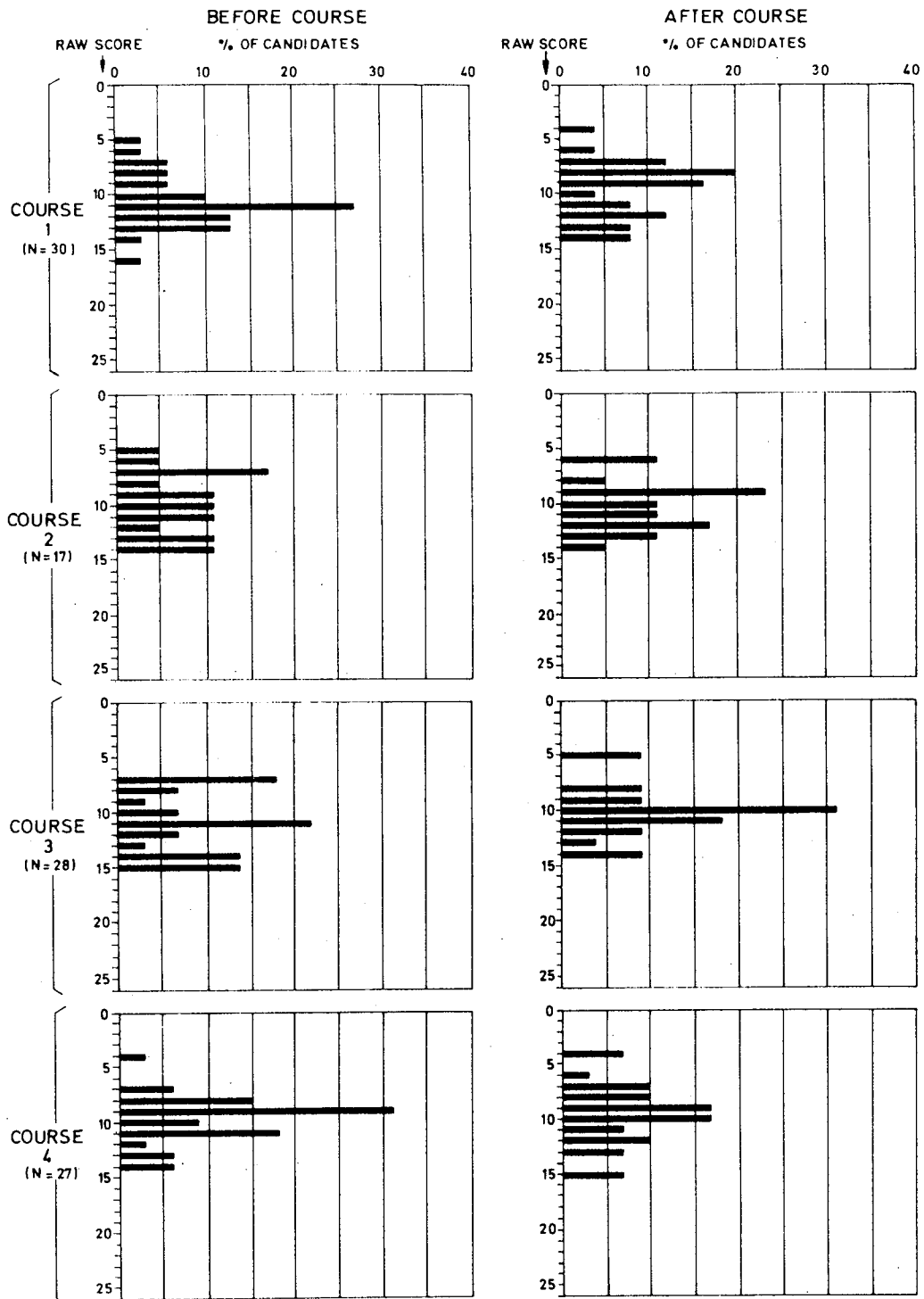


Fig. G.13 Training effects -Cattell 16 P.F.Q. - Histogram of raw scores -Factor Q1

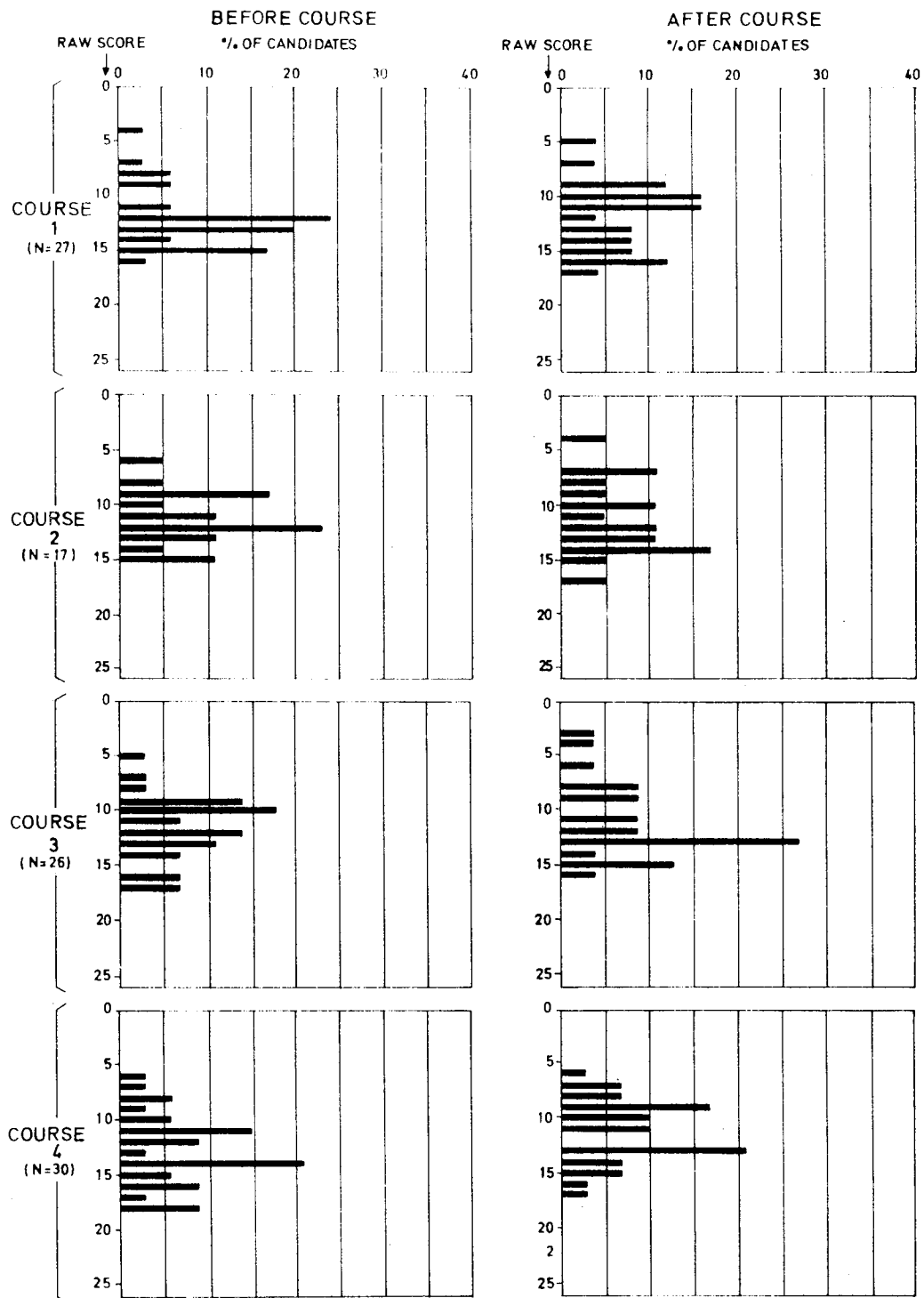


Fig. G.14 Training effects-Cattell 16 P.F.Q. - Histogram of raw scores -Factor Q2

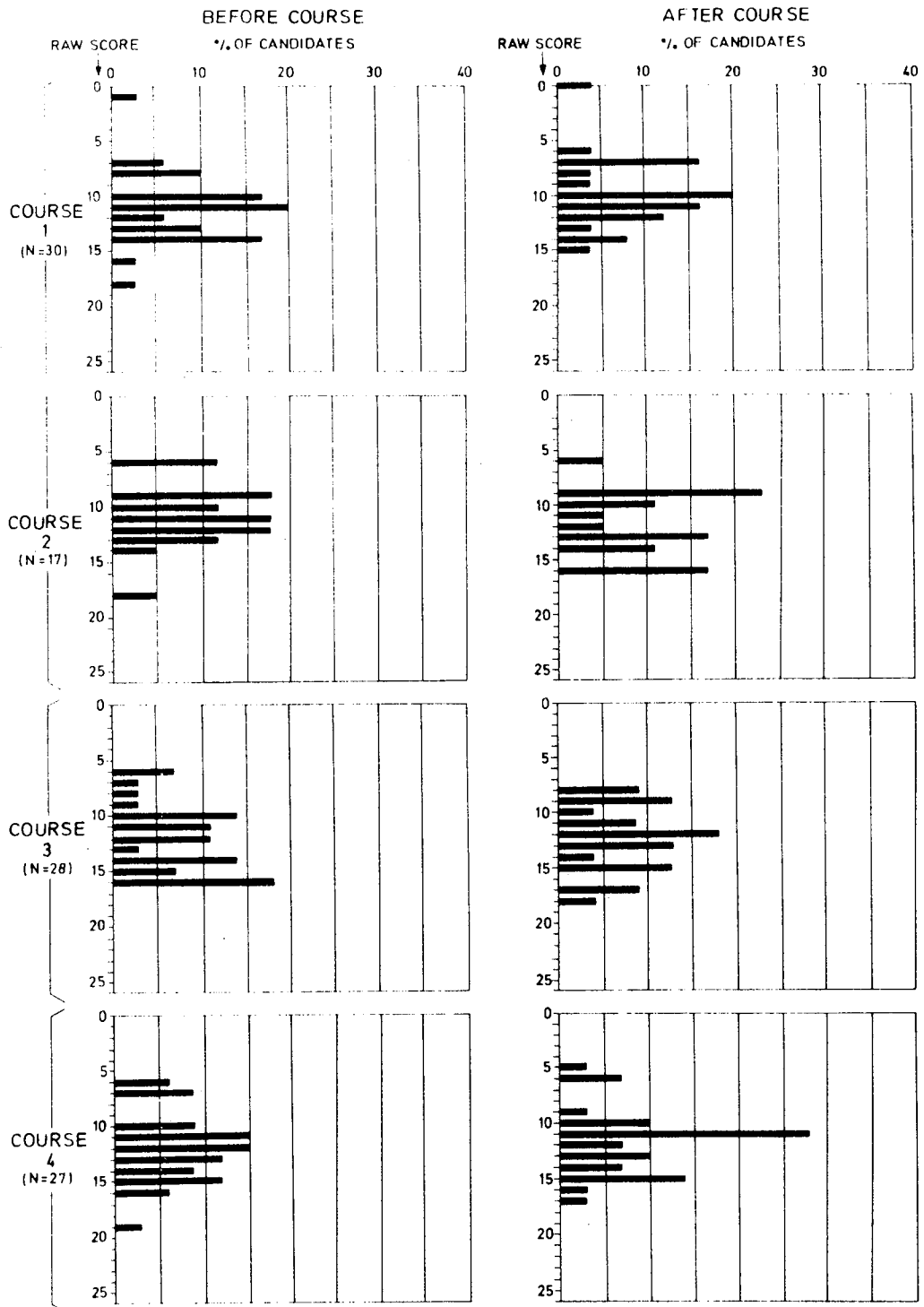


Fig. G.15 Training effects - Cattell 16 P.F.Q. - Histogram of raw scores - Factor Q3

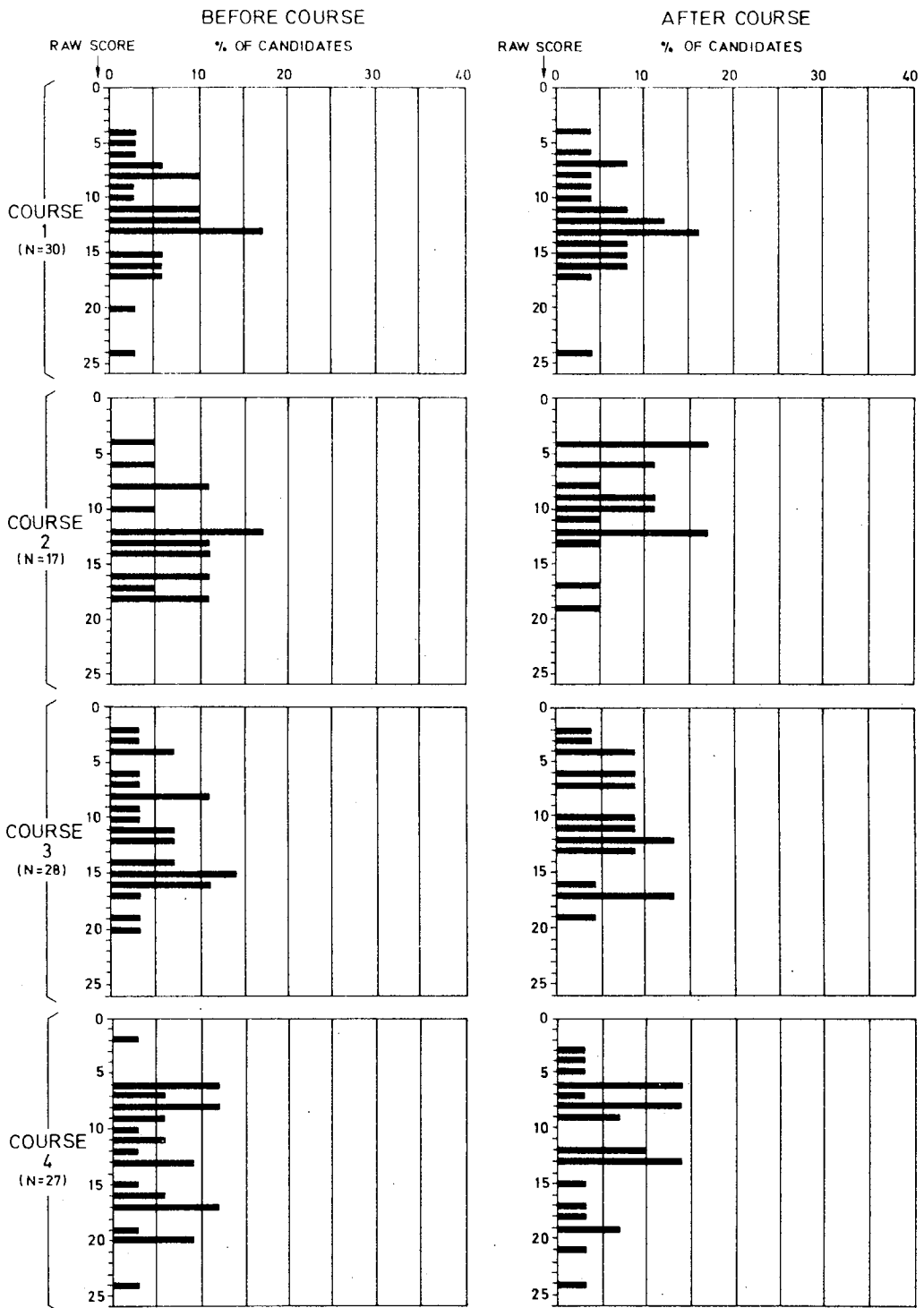


Fig. G.16. Training effects - Cattell 16 P.F.Q. - Histogram of raw scores - Factor Q4

ANNEX II

Tables of Results from A Study of Personality and Leadership

Table H.1	- Mean Cattell 16PF Raw Scores for working groups Ashore and Afloat
Table H.2	- Cattell 16PF Raw Scores for Leaders under Training
Table H.3	- Personality and Attitude Measures Ashore and Afloat
Table H.4	- Comparison of Correlation of Personality Scores and Work Attitudes Ashore and Afloat
Table H.5	- Statistics extracted from Sociometric Questionnaire
Table H.6	- Correlations between numbers of persons contacted and personality factors
Table H.7	- Comparison of Attitude Measures of Instructor Officers with other Officers at a Training Establishment
Table H.8	- Organisational Measures - Analysis of Functional Specialization
Table H.9	- Organisational Measures - Centralisation
Table H.10	- Organisational Measures - Standardization
Table H.11	- Organisational Measures - Formalization
Table H.12	- Organisational Measures - Configuration
Table H.13	- Organisational Measures - Traditionalism

TABLE H.1 MEAN CATTELL 16PF RAW SCORES FOR WORKING GROUPS ASHORE AND AFLOAT

FACTOR	ASHORE						AFLOAT					
	Training (N=50)		P.E. (N=44)		CIVIL SERVANTS (N=27)		DLG (N=71)		FF (N=41)			
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.		
A	9.6	3.3	10.0	3.5	10.7	3.1	9.7	3.0	9.5	1.9		
B	9.1	1.6	10.7	1.4	9.1	1.8	8.7	1.8	8.0	1.8		
C	15.4	3.8	13.1	1.9	16.2	2.9	14.1	4.0	13.5	3.6		
E	13.7	4.3	12.7	3.0	14.5	3.7	13.8	4.3	14.4	3.4		
F	14.3	4.9	11.6	3.7	12.2	3.2	13.7	4.1	15.8	3.4		
G	13.3	3.9	14.4	3.8	13.3	3.4	14.6	2.9	11.8	3.5		
H	12.3	4.9	13.7	3.7	12.7	4.6	11.6	3.0	12.4	4.8		
I	8.0	3.5	6.7	2.9	9.9	3.2	8.1	3.4	7.7	2.5		
L	8.6	3.8	7.2	3.6	7.3	2.9	9.9	2.8	9.4	2.6		
M	11.8	3.8	11.1	3.7	12.6	3.9	12.2	3.1	13.1	3.2		
N	11.5	2.5	13.0	0.8	11.6	3.2	12.6	2.8	11.9	2.4		
O	8.6	3.0	7.7	2.7	8.7	3.8	10.5	3.4	11.3	3.2		
Q1	10.8	2.6	9.7	1.8	10.6	2.0	10.0	2.6	9.2	2.0		
Q2	12.3	2.5	12.4	2.7	11.4	3.2	12.7	3.4	12.3	2.9		
Q3	11.3	2.5	12.2	2.7	11.9	3.1	11.7	2.9	10.8	2.8		
Q4	10.7	4.1	9.1	3.2	10.7	5.2	11.3	4.8	12.7	3.2		

TABLE H.2 CATTELL 16PF RAWSCORES FOR LEADERS  
UNDER TRAINING

Factor	Weapon Electrical Officers (S.D.)		Weapon Electrical Officers (General list)		Principal Warfare Officers		ARTIFICERS		Petty Officers	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
A	9.3	3.2	9.6	3.3	9.8	2.8	8.4	3.5	9.7	2.5
B	8.6	2.2	9.1	1.6	8.9	1.9	8.7	1.8	8.1	1.9
C	15.3	3.6	15.4	3.8	16.3	3.1	14.0	3.7	14.6	3.1
E	13.8	4.3	13.7	4.3	15.2	3.5	13.6	3.8	13.2	3.9
F	14.4	3.2	14.3	4.9	14.9	4.2	15.0	4.4	14.3	4.6
G	13.7	3.9	13.3	3.9	15.3	2.7	12.1	3.3	12.7	3.3
H	12.3	4.9	12.3	4.9	14.5	5.4	9.9	4.7	11.0	5.0
I	6.9	2.9	8.0	3.5	8.5	2.8	6.9	2.8	8.0	3.4
L	9.1	3.0	8.6	3.8	9.5	2.9	10.2	3.1	10.7	2.9
M	11.9	2.5	11.8	3.8	12.1	3.1	11.3	3.3	11.9	3.5
N	12.0	2.5	11.5	2.5	12.0	2.8	11.6	2.6	12.1	2.7
O	9.5	3.4	8.6	3.0	9.1	3.0	10.9	3.5	11.0	3.1
Q1	10.2	2.6	10.8	2.6	9.2	3.0	9.8	2.7	9.6	2.5
Q2	10.8	3.4	12.3	2.5	10.8	3.3	11.8	3.8	11.9	3.2
Q3	11.4	2.9	11.3	2.5	12.3	2.4	10.2	2.7	10.7	3.3
Q4	10.9	5.0	10.7	4.1	11.0	4.6	13.0	4.6	13.1	4.2
Number of Persons	33		45		20		79		71	

TABLE H.3 PERSONALITY AND ATTITUDE MEASURES ASHORE AND AFLOAT

	ASHORE				AFLOAT			
	TRAINING (N=162)		P.E. (N=45)		DLG (N=71)		FRIGATE (N=41)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
E.P.I. FACTOR N	7.8	4.1	7.3	4.4	10.2	4.1	10.0	4.9
FACTOR E	12.8	4.0	13.0	3.9	13.5	4.1	13.3	4.3
FACTOR L	1.8	1.6	1.0	1.2	1.5	1.2	2.0	1.5
1. How much do you like the sort of work you are doing?	2.2	1.0	2.3	1.2	1.9	1.0	2.2	1.2
2. When you are at work, how does the time pass?	1.8	0.7	1.9	0.9	2.0	0.8	2.3	0.7
3. Do you get any feeling of accomplishment from the work you are doing?	1.8	0.8	1.8	0.9	1.5	0.7	1.8	0.9
4. How is your job considered by people around you?	2.5	0.9	2.4	0.9	2.3	0.7	1.9	0.9
5. Why did you decide to join the Navy?	4.2	1.2	4.0	1.8	3.6	1.6	3.9	1.6
6. Would you advise a friend of yours to join the Navy?	2.2	0.9	2.7	1.4	2.6	1.2	2.6	1.2
7. Are there good facilities to help you in your work?	2.6	1.0	2.9	1.1	2.3	1.0	2.6	1.2
8. Do you feel you get enough information about what goes on in the establishment?	2.9	1.2	2.8	1.3	3.4	1.0	3.1	1.2
9. Do your "supervisors" discuss matters with your group before deciding what to do about things that come up?	2.6	1.1	2.3	1.1	2.8	1.1	2.6	1.1
10. How well does your "supervisor" explain the new jobs or methods that come along?	2.2	1.1	2.1	1.3	2.3	0.9	2.5	1.1
11. How do you feel about the way you were taught your job?	2.8	1.4	2.8	1.5	2.7	1.2	2.9	1.2
12. How well are worries or problems, which individuals face, handled?	2.1	0.9	2.3	1.1	2.6	1.0	2.5	0.9
13. How satisfied are you with your present pay?	2.2	0.9	2.6	0.9	1.8	0.7	2.7	0.9
14. How do you expect to progress (get promotion)?	2.7	1.6	2.2	1.6	2.7	1.3	3.2	0.9
15. How is morale or group spirit?	2.4	1.0	2.5	1.0	3.2	1.0	2.8	0.9
16. How useful to society do you see the work you do?	2.0	0.9	2.4	1.3	2.1	1.1	2.0	1.0



TABLE H.4 COMPARISON OF CORRELATION OF PERSONALITY SCORES AND WORK ATTITUDES ASHORE AND AFLOAT

QUESTION	CORRELATION WITH E.P.I. SCORES											
	FACTOR N				FACTOR E				FACTOR L			
	ASHORE SCHOOL	PE	AFLOAT DLG	FF	ASHORE SCHOOL	PE	AFLOAT DLG	FF	ASHORE SCHOOL	PE	AFLOAT DLG	FF
1. How much do you like the sort of work you are doing?	07	25	16	47	0	-13	-22	05	-06	10	-06	-32
2. When you are at work, how does the time pass?	14	14	19	27	02	-02	-11	-17	-09	17	-25	-20
3. Do you get any feeling of accomplishment from the work you are doing?	07	13	07	33	-07	08	-18	-20	09	15	16	-08
4. How is your job considered by people around you?	05	06	01	29	-04	15	-22	-10	-03	-01	-04	14
5. Why did you decide to join the Navy?	-10	0	-23	07	-06	-25	-02	18	-08	-18	-19	-07
6. Would you advise a friend of yours to join the Navy?	07	38	-07	13	-03	-24	-16	-07	-13	-14	06	-02
7. Are there good facilities to help you in your work?	-02	02	14	24	-06	16	-20	0	09	08	-05	-14
8. Do you feel you get enough information about what goes on in the establishment?	04	13	24	32	14	-09	-03	10	-12	0	-04	-20
9. Do your "supervisors" discuss matters with your group before deciding what to do about things that come up?	-10	-08	09	22	02	-19	02	-07	-05	07	21	06
10. How well does your "supervisor" explain the new jobs or methods that come along?	-03	05	0	12	-07	23	-08	12	-06	13	17	-13
11. How do you feel about the way you were taught your job?	18	21	04	30	0	-26	-23	-07	07	-09	-03	0
12. How well are worries or problems, which individuals face, handled?	07	-04	-09	23	05	01	-22	03	-08	-17	03	09
13. How satisfied are you with your present pay?	12	13	09	-24	14	08	-17	12	02	12	02	17
14. How do you expect to progress (get promotion)?	12	-27	01	-11	21	04	-09	-54	-16	08	-04	13
15. How is morale or group spirit?	08	16	-05	21	-08	-06	-07	-04	-02	-14	26	-14
16. How useful to society do you see the work you do?	16	11	20	04	13	02	-42	05	-06	03	-03	-10

NB: DECIMAL POINT OMITTED

Training Establishment (School) N = 162  
 R&D Establishment (PE) N = 45  
 Guided Missile Destroyer (DLG) N = 70  
 Leander Frigate (FF) N = 41

TABLE H.5 STATISTICS EXTRACTED FROM SOCIOMETRIC QUESTIONNAIRE

	ASHORE (N=162)				AFLOAT (N=41)				
	Mean	Max. Value	S.D.	Mean	Max. Value	S.D.	Mean	Max. Value	S.D.
Number of people who are frequently spoken to about Work	24.8	124	20.4	16.7	62	14.9			
Number of people who are frequently spoken to about leisure	21.8	90	16.2	15.5	41	12.4			
Number of people who are frequently spoken to about work and leisure	11.6	77	11.0	8.8	25	8.2			

TABLE H.6 CORRELATIONS BETWEEN NUMBERS OF PERSONS CONTACTED AND PERSONALITY FACTORS

	EPI Scores					
	Neuroticism		Extraversion		L. Scale	
	Ashore	Afloat	Ashore	Afloat	Ashore	Afloat
Number of Persons Contacted frequently about Work	- 05	- 22	02	- 15	14	11
Number of Persons Contacted frequently about leisure	- 07	- 07	22	08	0	01
Number of Persons Contacted frequently about both work and leisure.	- 05	- 17	13	- 03	0	0

N.B. Decimal points omitted

TABLE H.7 COMPARISON OF ATTITUDE MEASURES OF INSTRUCTOR OFFICERS WITH OTHER OFFICERS AT A TRAINING ESTABLISHMENT

EPI Scores	Instructor Officers (N=92)		Other Officers (N=70)	
	Mean	S.D.	Mean	S.D.
FACTOR N	7.9	4.2	7.6	4.1
FACTOR E	12.6	4.0	13.2	4.1
FACTOR L	1.9	1.6	1.6	1.5

Question	Correlations with E.P.I. Score														
	Factor N			Factor E			Factor L			MEAN			S.D.		
	Instr	Others	Instr	Others	Instr	Others	Instr	Others	Instr	Others	Instr	Others	Instr	Others	
How much do you like the sort of work you are doing?	12	-01	04	-05	-19	12	2.3	2.1	2.3	2.1	1.1	0.9	0.9	0.9	
When you are at work, how does the time pass?	20	04	08	-05	-13	-03	1.8	1.8	1.8	1.8	0.8	0.7	0.7	0.7	
Do you get any feeling of accomplishment from the work you are doing?	11	01	-05	-09	-06	31	1.8	1.8	1.8	1.8	0.8	0.8	0.8	0.8	
How is your job considered by people around you?	-01	15	-03	-06	-09	04	2.5	2.5	2.5	2.5	1.0	0.8	0.8	0.8	
Why did you decide to join the Navy?	07	-16	-09	0	-03	-18	4.3	4.0	4.0	4.0	1.2	1.2	1.2	1.2	
Would you advise a friend of yours to join the Navy?	05	08	01	-05	-17	-12	2.4	2.0	2.0	2.0	0.9	0.9	0.9	0.9	
Are there good facilities to help you in your work?	-06	0	-11	01	04	14	2.7	2.5	2.5	2.5	1.1	1.0	1.0	1.0	
Do you feel you get enough information about what goes on in the establishment?	05	04	23	0	-13	-09	2.8	3.2	3.2	3.2	1.2	1.2	1.2	1.2	
Do your "supervisors" discuss matters with your group before deciding what to do about things that come up?	-16	-01	04	0	-08	-03	2.7	2.5	2.5	2.5	1.2	1.0	1.0	1.0	
How well does your "supervisor" explain the new jobs or methods that come along?	0	-07	0	-17	-15	07	2.2	2.1	2.1	2.1	1.2	1.0	1.0	1.0	
How do you feel about the way you were taught your job?	21	15	0	00	08	08	2.8	3.0	3.0	3.0	1.4	1.4	1.4	1.4	
How well are worries or problems, which individuals face, handled?	14	-02	11	-03	-17	05	2.1	2.1	2.1	2.1	0.9	0.8	0.8	0.8	
How satisfied are you with your present pay?	23	-05	10	26	05	-07	2.4	2.0	2.0	2.0	0.9	0.8	0.8	0.8	
How do you expect to progress (get promotion)?	12	14	16	29	-11	-23	2.5	2.9	2.9	2.9	1.7	1.4	1.4	1.4	
How is morale or group spirit?	18	-01	07	-08	-02	-03	2.4	2.3	2.3	2.3	0.9	1.1	1.1	1.1	
How useful to society do you see the work you do?	17	15	08	-20	-16	06	2.0	2.0	2.0	2.0	0.9	0.9	0.9	0.9	

NB - Decimal Points Omitted

	Mean			Max Value			S.D.		
	Instr	Others	Others	Instr	Others	Others	Instr	Others	Others
Number of people who are frequently spoken to about work	23.9	26.0	124	95	124	19.3	21.9	21.9	21.9
Number of people who are frequently spoken to about leisure	17.5	27.7	71	90	71	14.7	16.4	16.4	16.4
Number of people who are frequently spoken to about work and leisure	9.8	14.0	62	77	62	11.0	10.7	10.7	10.7

TABLE 11.8 ANALYSIS OF FUNCTIONAL SPECIALIZATION

Specialization Aston Code No.	Activities	ASHORE		AFLOAT	
		SCHOOL	P. E.	DLG	FF
1	Develop, legitimize, and symbolize the organization's charter	1	1	0	0
2	Dispose of, distribute, and service the output	1	0	1	1
3	Carry outputs and resources from place to place	0	0	1	1
4	Acquire and allocate human resources	1	0	1	1
5	Develop and transform human resources	1	0	1	1
6	Maintain human resources and promote their identification with the organization	1	0	1	1
7	Obtain and control materials and equipment	1	0	0	0
8	Maintain and erect equipment	1	0	1	1
9	Record and control financial resources	0	0	0	0
10	Control workflow	1	0	1	1
11	Control quality of materials and equipment and outputs	1	1	1	1
12	Assess and devise ways of producing output	1	0	0	0
13	Devise new outputs, equipment, and processes	1	0	0	0
14	Develop and carry out administrative procedures	0	1	0	0
15	Deal with legal and insurance requirements	0	0	0	0
16	Acquire information on operational field	1	1	0	0
TOTAL		12	4	8	8

1 = Activity is undertaken to a significant extent

0 = Activity is not undertaken to any significant extent

TABLE II.9 CENTRALISATION

1 = Action prescribed  
0 = Action taken ad hoc.

	ASHORE		AFLOAT	
	SCHOOL	P. E.	DLG	FF
Labour requirements	1	1	1	1
Appointments to direct worker jobs	1	1	1	1
Promotion of direct workers	1	1	1	1
Representing the organization in disputes	1	1	1	1
Number of supervisors allowed	1	1	1	1
Appointment of supervisory staff from outside the organization	1	1	1	1
Promotion of supervisory staff	1	1	1	1
Salaries of supervisory staff	1	1	1	1
Spending of unbudgeted money on capital items	1	1	1	1
Spending of unbudgeted money on revenue items	0	1	0	0
Selection of type for new equipment	0	0	1	1
Overtime to be worked	0	0	0	0
Delivery dates or priority of orders	0	0	0	0
New product or service	1	1	1	1
Extent of operational field to be aimed for	1	1	1	1
What costing system, if any, will be applied	1	1	1	1
To what items, the inspection system, will be applied	1	1	1	1
Operations to be work studied	0	1	1	1
Plans to be worked on	0	1	1	1
Outputs to be scheduled against given plans	0	0	1	1
Dismissal of operative	0	1	0	0
Dismissal of supervisor	0	1	0	0
Methods of personnel selection	1	1	1	1
Training methods	0	1	1	1
Suppliers of materials to be used	0	1	1	1
How a job is to be done	0	0	0	0
Machinery or equipment to be used for a job	0	0	0	0
Allocation of work among available workers	0	0	0	0
Welfare facilities to be provided	0	0	1	1
Altering areas of work of functional specialist departments	0	1	0	1
Altering areas of work of line department	0	1	1	1
Creation of a new department	1	1	1	1
Creation of a new job	0	1	1	1
Chief executive has deputy	1	0	1	1
TOTAL	116	25	25	26

TABLE H.10 STANDARDIZATION

This table gives a list of procedures, each rated for degree of standardization.

Unless otherwise stated 0 = No 1 = Yes

Inspection  
 Frequency (0-none, 1-Systematic)  
 Range (0-none, 1-Full)  
 Method \* (0-none, 1-measurement)

Stock control  
 Stock taking (0-never, 1-Periodically)

Operational control  
 Firm plans (0-No, 1-Yes)  
 Scheduling \* (0-as needed, 1-continuous)  
 Progress checking (0-none, 1-regular)  
 Maintenance (0-no procedure, 1-planned maintenance)

Financial control  
 Type (0-historical, 1-marginal costs)  
 Range (0-Global, 1-Life cycle)  
 Comparison with budgets (0-none, 1-continually)

People: control  
 Definition of operator's task (0-custom, 1-work study and task description)  
 Work study (0-none, 1-some)  
 Job evaluation  
 Discipline (set offences)  
 Discipline (set penalties)  
 Discipline (procedure for dismissing staff)  
 Salary review  
 Personal reports by superiors  
 Staff establishment

Communication  
 Decision seeking (0-as needed, 1-standardized)  
 Decision conveying (0-as needed, 1-standardized)

Ideas  
 Research and development (0-none, 1-R&D Programme)  
 Obtaining ideas (0-none, 1-Formal Scheme)

	ASHORE		AFLOAT	
	SCHOOL	P. E.	DLG	FF
1	0	1	1	
1	0	0	0	
1	0	1	1	
1	0	1	1	
1	0	0	0	
1	0	1	1	
1	1	0	0	
1	0	1	1	
0	0	0	0	
0	0	0	0	
0	0	0	0	
1	0	1	0	
1	0	1	1	
1	0	1	0	
1	1	1	1	
1	1	1	1	
1	1	1	1	
1	1	1	1	
1	1	1	1	
1	1	1	1	
0	1	0	0	
1	1	0	0	
0	1	0	0	
0	0	0	0	

TABLE H.10 (Cont)

	ASHORE		AFLOAT	
	SCHOOL	P. E.	DLG	FF
People: recruiting				
Promotion procedure (0-as needed, 1-selection)	1	1	1	1
Selection of Staff (0-interview, 1-Outside appointer)	1	1	1	1
Selection of executives(0-interview by superior, 1-outside appointer)	1	1	1	1
Recruitment policy (0-locally decided, 1-Standardized)	1	1	1	1
Central recruiting procedure	1	1	1	1
Central interviewing procedure	1	1	1	1
Standard procedure for getting increases in staff	1	1	1	1
Standard procedure for getting increases in work	1	1	0	0
People: training				
Apprenticeships	1	0	1	1
Day release	0	0	0	0
Operator training	1	0	1	1
Evening classes encouraged	0	0	0	0
Courses arranged for management	1	1	1	1
Courses arranged for supervisors	1	1	1	1
Management trainees	1	1	1	1
Graduate apprentices	1	1	0	0
Block release	1	1	0	0
Activities				
House journals (0-none, 1-regular)	1	0	0	0
Ceremonies (0-none, 1-regular)	1	0	1	1
Sports and social activities (0-none, 1-regular)	1	1	1	1
Participation in displays and exhibitions (0-none, 1-regular)	1	0	1	1
Conference attendance (0-none, 1-regular)	1	1	0	0
Induction courses (0-no employees, 1-all)	1	0	1	1
Organisation Handbooks provided (0-for none, 1-for all)	1	0	0	0
Uniforms provided (0-for none, 1-for all)	1	0	1	1
Miscellaneous				
Personnel reports and statistics (0-few, 1-full records)	1	0	1	1
Operations research	1	0	0	0
Central discipline procedure	1	0	1	1
TOTAL	44	25	33	31



TABLE H.11 FORMALIZATION

	ASHORE		AFLOAT	
	SCHOOL	P.E.	DLG	FF
Role definition				
Written contracts of employment (formal letter of appointment)	1	1	1	1
Do proportion of employees have handbooks	1	0	1	1
Organization chart	1	1	1	1
Written operating instructions available to direct worker	1	0	1	1
Written terms of reference or job descriptions	1	0	1	1
Manual of procedures or standing orders	1	1	1	1
Written policies	1	0	1	1
Workflow schedules or programs				
Research programs or reports	0	1	0	0
Information passing				
Management approval in writing required for certain decisions	1	1	1	1
Suggestion scheme	1	0	1	1
Memo forms	1	1	1	1
Notification of engagement of direct workers	1	1	1	1
Minutes for senior executive meeting	1	1	0	0
Conference reports	1	0	0	0
Agenda for senior executive meeting	1	1	1	1
Agenda for workflow meeting	1	1	1	1
Minutes for workflow meeting	1	1	0	0
Written reports submitted for workflow meeting	0	0	0	0
Welfare documents for direct workers on engagement	1	1	1	1
Dismissal form or report recording or communicating the dismissal	1	1	1	1
House journal	1	0	0	0
Recording of role performance				
Record of inspection performed	1	1	1	1
Work assessment record (work study)	1	0	1	1
Record of maintenance performed on workflow equipment	1	0	1	1
Record of direct worker's work	0	0	0	0
Record of direct worker's time	0	0	0	0
Document stating tasks done or to be done	1	0	1	1
Voucher recording petty expenditure	1	0	1	1
Written application for, or sanction against, spending £1,000	1	1	1	1
Requisition for engagement of direct worker	1	1	1	1
Application or engagement form for direct worker	1	1	1	1
Records of direct worker's work	1	1	1	1

TABLE H.11 (Cont)

General

- Appeal form against dismissal
- Document identifying units of output
- Dispatch note communicating dispatch of unit of output
- Written procedures for negotiation, raising grievances, etc.
- Written history of the organization

TOTAL

ASHORE		AFLOAT	
SCHOOL	P.E.	DLG	FF
1	1	1	1
1	1	1	1
0	0	0	0
1	1	1	1
1	0	0	0
31	21	27	27

TABLE H.12 CONFIGURATION

Definitions	ASHORE		AFLOAT	
	SCHOOL	P.E.	DLG	FF
Chief executive's span. Number of subordinates who report directly to chief executive with no intervening level, irrespective of the status of the subordinates.	12	6	9	5
Subordinate ratio. Number of workflow subordinates (direct workers) per first-line supervisor (ie, the lowest job that does not include prescribed direct work).	7	NA	9	10
Height. Number of jobs in the longest "line" between direct worker and chief executive (inclusive of both), excluding assistants to, and secretaries.	6	5	8	5
Workflow superordinates. All employees in supervisory or managerial jobs responsible for work on outputs, with assistants and deputies, but excluding supervisors whose jobs include prescribed direct work.	17	5	4	1
Non-workflow personnel. All employees with no direct or supervisory responsibility for work on the outputs.	40*	19	NA	NA
* estimated				

TABLE H.13 TRADITIONALISM

Traditionalism, incorporates items from standardization, formalization. Each item is scored 1 for all scores of 1 on the original scales. Scores are calculated by the following formula:

$$\frac{\text{score on standardization items} - \text{score on formalization items} \times 100}{\text{score on formalization items}}$$

ASHORE		AFLOAT	
SCHOOL	P.E.	DLG	FF
41.9	19.0	22	14.8

Verified transcript of speech by Sir Derek Rayner to 1972 COLLINGWOOD dinner -  
12 May 1972

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## ANNEX K

## Types of Leader behaviour (after Reddin 1969)

Area of comparison	Typical Behaviour Pattern			
	Type I	Type II	Type III	Type IV
Preferred way of interacting	Correcting	Accepting	Dominating	Joining
Preferred way of communicating	Written	Conversations	Verbal directions	Meetings
Direction of communication	Little in any direction	Upward from subordinates	Downward to subordinates	Two-way
Time perspective	Past	Unconcerned	Immediate	Future
Identifies with	Organization	Subordinates	Superior and technology	Coworkers
System emphasis	Maintains procedural system	Supports social system	Follows technological system	Integrates sociotechnical system
Judges subordinates on	Who follows the rules?	Who understands people?	Who produces?	Who wants to join the team?
Judges superior on	Brains	Warmth	Power	Teamwork
Committee activity	Clarifying, guiding, and channeling	Supporting, harmonizing, and coaching	Initiating, evaluating, and directing	Setting standards, testing, and motivating
Work suited for	Administration, accounting, statistics and design	Managing professionals, training, and coordination	Production and sales management	Supervising interacting managers
Work not suited for	Nonroutine	Low personal contact	Low-power	High-routine
Employee orientation	Security	Cooperation	Performance	Commitment
Reaction to error	More controls	Pass over	Punish	Learn from
Reaction to conflict	Avoids	Smothers	Suppresses	Utilizes
Reaction to stress	Withdraws and quotes rules	Becomes dependent and depressed	Dominates and exploits	Avoids making decisions
Positive source of control	Logic	Praise	Rewards	Ideals
Negative source of control	Argument	Rejection	Punishments	Compromise
Characteristic problem of subordinates	Lack of recognition	Lack of direction	Lack of information	Lack of independence
Punishments used	Loss of authority	Loss of interest by manager	Loss of position	Loss of self-respect by subordinate
Under-values	Need for innovation	Needs of organization and of technology	Subordinates' expectations	Need for independent action

Area of comparison	Typical Behaviour Pattern			
	Type I	Type II	Type III	Type IV
Main weakness	Slave to the rules	Sentimentality	Fights unnecessarily	Uses participation inappropriately
Fears about himself	Emotionality, softness and dependence	Rejection by others	Loss of power	Uninvolvement
Fears about others	System deviation, irrationality	Conflict	Low production	Dissatisfaction

N.B. This classification for describing the behaviour of four different types of leader may be used to see where the strength of an officer in one sort of job carry with them the liabilities which are critically maladaptive in another job. Thus the shipborne W.E. Officer is typically Type IV, while the PWO/Command is Type III. It will be seen that type III leaders are unsuited for work with low-power which is the usual situation in Headquarters.

ANNEX L

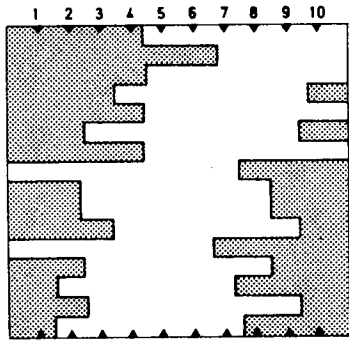
High and Low Descriptors for 16PF  
(Also included as bookmark)

**DECODE FOR FACTORS**

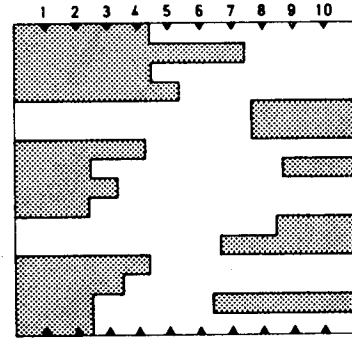
LOW SCORE DESCRIPTION	FACTOR	HIGH SCORE DESCRIPTION
RESERVED, DETACHED, CRITICAL, COOL	A	OUTGOING, WARMHEARTED, EASY-GOING, PARTICIPATING
DULL, CONCRETE-THINKING	B	BRIGHT, ABSTRACT-THINKING
AFFECTED BY FEELINGS, EMOTIONALLY LESS STABLE, EASILY UPSET	C	EMOTIONALLY STABLE, FACES REALITY, CALM, MATURE
HUMBLE, MILD, ACCOMMODATING, CONFORMING	E	ASSERTIVE, INDEPENDENT, AGGRESSIVE, STUBBORN
SOBER, PRUDENT, SERIOUS, TACITURN	F	HAPPY-GO-LUCKY, IMPULSIVELY LIVELY, GAY, ENTHUSIASTIC
EXPEDIENT, EVADES RULES, FEELS FEW OBLIGATIONS	G	CONSCIENTIOUS, PERSEVERING, STAID, RULE-BOUND
SHY, RESTRAINED, DIFFIDENT, TIMID	H	VENTURESOME, SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS
TOUGH-MINDED, SELF-RELIANT, REALISTIC, NO-NONSENSE	I	TENDER-MINDED, DEPENDENT, OVER-PROTECTED, SENSITIVE
TRUSTING, ADAPTABLE, FREE OF JEALOUSY, EASY TO GET ON WITH	L	SUSPICIOUS, SELF-OPINIONATED, HARD TO FOOL
PROPER, CAREFUL, CONVENTIONAL	M	IMAGINATIVE, WRAPPED UP, CARELESS OF PRACTICAL MATTERS, BOHEMIAN
FORTHRIGHT, NATURAL, ARTLESS, SENTIMENTAL	N	SHREWD, CALCULATING, WORLDLY, PENETRATING
PLACID, SELF-ASSURED, CONFIDENT, SERENE	O	APPREHENSIVE, WORRYING, DEPRESSIVE, TROUBLED
CONSERVATIVE, RESPECTING ESTABLISHED IDEAS, TOLERANT OF TRADITIONAL DIFFICULTIES	Q <sub>1</sub>	EXPERIMENTING, CRITICAL, LIBERAL, ANALYTICAL, FREE-THINKING
DEPENDENT, A "JOINER" AND SOUND FOLLOWER	Q <sub>2</sub>	SELF-SUFFICIENT, PREFERS OWN DECISIONS, RESOURCEFUL
UNDISCIPLINED, FOLLOWS OWN URGES, CARELESS OF PROTOCOL	Q <sub>3</sub>	CONTROLLED, SOCIALLY-PRECISE, FOLLOWING SELF-IMAGE
RELAXED, TRANQUIL, TORPID, UNFRUSTRATED	Q <sub>4</sub>	TENSE, FRUSTRATED, DRIVEN, OVERWROUGHT

ANNEX M

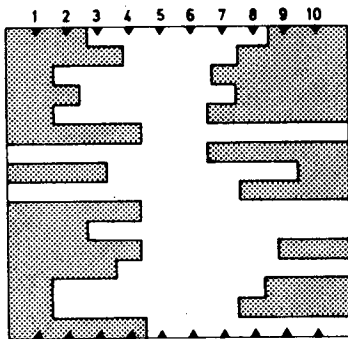
Overlays for use in examining members of a group  
(This is also provided as a transparency in some copies of the report)



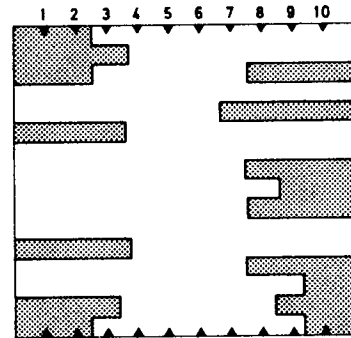
PF TEST PROFILE LEADER



PF TEST PROFILE IDEAS MAN



PF TEST PROFILE 2nd. IN COMMAND



PF TEST PROFILE APPLICATOR

Overlays for use in Prediction

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