

NL

DTIC

AD A105964

LL-11

12

REPORT

**DEFINING THE NATURE OF
TEAM SKILLS IN NAVY TEAM
TRAINING AND PERFORMANCE**

**PREPARED FOR THE
OFFICE OF NAVAL RESEARCH
CONTRACT N00014-80-C-0811**

**GP-R-43017-2
SEPTEMBER, 1981**

**APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED**

DTIC FILE COPY



GENERAL PHYSICS CORPORATION

FINAL

TECHNICAL REPORT

DEFINING THE NATURE OF TEAM SKILLS
IN NAVY TEAM TRAINING AND PERFORMANCE

by

John R./Turney

Stanley L./Cohen

GP-R-43017 - 2

11 Sep 1981

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

This research was sponsored by the Organizational Effectiveness Research Programs, Office of Naval Research (Code 452), under Contract No. N0014-80-C-0811 NR 170-91.

Approved for public release; distribution unlimited.

Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A	

15
DTIC
ELECTE
S
OCT 21 1981
D

404 420

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 2	2. GOVT ACCESSION NO. ADA105 964	3. RECIPIENT'S CATALOG NUMBER ---
4. TITLE (and Subtitle) Defining The Nature Of Team Skills In Navy Team Training And Performance		5. TYPE OF REPORT & PERIOD COVERED Final Technical Report
7. AUTHOR(s) John R. Turney and Stanley L. Cohen		6. PERFORMING ORG. REPORT NUMBER GP-R-43017 - 2
9. PERFORMING ORGANIZATION NAME AND ADDRESS General Physics Corporation 1000 Century Plaza Columbia, Maryland 21044		8. CONTRACT OR GRANT NUMBER(s) N00014-80-C-0811 ✓
11. CONTROLLING OFFICE NAME AND ADDRESS Organizational Effectiveness Research Programs Office of Naval Research (Code 452) Arlington, VA 22217		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NR 170-919
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) ---		12. REPORT DATE September, 1981
		13. NUMBER OF PAGES
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) ----		
18. SUPPLEMENTARY NOTES ---		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Team Skills Training, Team Coordination, Team Communications, Group Training, Navy Team Training, Team Performance, Intact Teams		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report examines Navy team training activities in order to identify specific team coordination skill indicators. Data collected from training staff interviews and team training rating forms were content analyzed. These analyses showed that team skills focused primarily on various aspects of proficiency in information transfer. The most popular content categories turned out to be the ability to get information (con't)		

Block (20 Abstract (con't))

cont → to the appropriate team members and the ability to get it there in a timely manner.)

→ These categories were refined and extended to incorporate a range of specific individual and team skills which are potential contributors to performance of the relevant team tasks. For example, achieving timely information transfer requires individual skills in collecting the information efficiently and team skills in expediting its transmission once it has been collected.)

→ A model describing team skill contributions to total team performance is presented which delineates between team and individual tasks. Recommendations are provided for addressing three basic team skills research issues which are directly relevant to team skills training. These issues include the intercorrelation of team skills and individual abilities, the transference of team skills, and the relationship between team skills and performance. Finally, it is suggested that these research issues be addressed in teams where information transfer team tasks are highly visible. Moreover, timeliness of information transfer should receive special attention in this research because of its likely impact on total team performance and its potential for being affected by a range of individual and team skills.

EXECUTIVE SUMMARY

This report examines Navy team training activities in order to identify specific team coordination skill indicators. Data collected from training staff interviews and team training rating forms were content analyzed. These analyses showed that team skills focused primarily on various aspects of proficiency in information transfer. The most popular content categories turned out to be the ability to get information to the appropriate team members and the ability to get it there in a timely manner.

These categories were refined and extended to incorporate a range of specific individual and team skills which are potential contributors to performance of the relevant team tasks. For example, achieving timely information transfer requires individual skills in collecting the information efficiently and team skills in expediting its transmission once it has been collected.

A model describing team skill contributions to total team performance is presented which delineates between team and individual tasks. Recommendations are provided for addressing three basic team skills research issues which are directly relevant to team skills training. These issues include the intercorrelation of team skills and individual abilities, the transference of team skills, and the relationship between team skills and performance. Finally, it is suggested that these research issues be addressed in teams where information transfer team tasks are highly visible. Moreover, timeliness of information transfer should receive special attention in this research because of its likely impact on total team performance and its potential for being affected by a range of individual and team skills.

CHAPTER 1. INTRODUCTION

The assumption underlying team training is that team performance is improved by bringing persons together to work through essential task elements as a unit under structured training conditions. These conditions are intended to increase the team skills of the persons. In an earlier report, Turney, Cohen, and Greenberg (1981) found research evidence which supported this assumption. The central team skill theme which they discovered running through the literature was coordination as practiced through team member communications. The exact content of these communications varied among the studies examined. However, three categories which frequently differentiated between high performing and low performing teams were organizing, exchanging task-related information, and evaluating options. More specification along these lines of the nature and form of team skills is essential to expand the rather sparse team training research literature noted by Collins (1977), Goldstein (1980), and Turney *et al.* (1981). The objective of this study is to identify more specific team coordination skill indicators by focusing on actual team training activities as they are conducted by the U.S. Navy. Since there is heavy reliance placed upon effective team performance in the Navy, there should be evidence of a range of team skills which are addressed as part of actual team training programs. Our purpose is to determine how these team skills are defined, how they are trained, how they are measured, and how their impact on team performance is evaluated.

The Importance of Clearly Defined Team Skills

As Meister (1976) has noted, distinctive team elements remain rather elusive. Experts in the team training field such as Hall and Rizzo (1975) and Thorndyke and Weiner (1980) have emphasized the importance of developing specific operationalizations and measures of coordination team skills in order to assure the effective utilization of team training to achieve team performance objectives. Three particular research issues which require sound team skills measures are discussed on the following page:

- Intercorrelation of team skills and individual abilities - This issue is important to team training because establishment of the magnitude of positive correlations between team skills and individual skills and abilities can help to determine the relative emphasis which should be placed on individual training versus team training. Available research evidence on this issue provides no clear guidance. For example, Hall and Rizzo (1975) reviewed the literature and indicated that the results are mixed on the value of team training versus individual training. Therefore, they concluded that the question of whether individuals functioning in a team setting required unique skills which could only be developed through team training remained unresolved. This conclusion echoed similar views expressed earlier by Alexander and Cooperband (1965) and Briggs and Johnson (1967). Hall and Rizzo went on to state that they saw a need for a set of "decision rules" for determining when or where a team training approach would be desirable versus individual training alone.

More recently, Goldin and Thorndyke (1980), in their summary of the proceedings of the Rand team performance workshop, concluded that much team training seemed to be devoted to improving individual task skills and did not distinguish skills best trained at the individual level from those requiring team training. Moreover, in these same proceedings, Rizzo indicated that he was convinced that there should be more emphasis placed on developing individual task proficiencies. This apparently is what already occurs in many team training activities which, as Meister (1976) puts it, provides "the operator with an opportunity to practice individual skills in a team context" (p. 267).

- Tranference of team skills - The basic issue which is of concern here focuses on the extent to which team training develops the team skills of individuals versus a skilled team. If there are team skills which are embedded within each team, then team training needs to focus on intact teams for acquisition of these skills. If this cannot be accomplished as part of formal training activities, then the

development of such skills needs to be targetted as part of on-the-job training when the team is able to function as an intact unit. This issue is particularly important in the Navy context because of the substantial personnel turnover and the frequent training of teams which do not remain intact. As Thorndyke and Weiner (1980) concluded, there has been little research on the impact of turnover on team performance. Moreover, as Goldstein (1980) indicated, there has been little consideration of which activities should be learned in training and which ones should be learned on the job. Certain team skills such as effective timing of information inputs may require both training and on-the-job experience within intact teams.

- Relationship between team skills and performance - Underlying the above research issues is the requirement for clearly defined and operationalized team skills in order to determine the contributions which they make to team performance separately or in combination with individual skills and abilities. Meister (1976) has reviewed research relating individual performance to team performance and concluded that "team performance variance is accounted for in some degree by individual performance but at least 50% of that variance cannot be attributed to individual member contributions" (p. 254). Hackman and Morris (1975) suggested that when tasks involve substantial team member interactions, individual skills and abilities are not very good predictors of team performance. Thorndyke and Weiner (1980) also noted that team training should especially improve performance when tasks rely heavily on team member interactions. Finally, team training research reviewed by Turney et al. (1981) noted that training in essential communications team skills does improve team performance.

Therefore, there is evidence that interactions which occur among team members do have an impact upon performance. However, it is also well documented that teams have built-in inefficiencies. Kelley and Thibaut (1969) pointed out that teams tend to be slow and initially uncoordinated. Given proper training and time they presumably develop more efficient structures and organization.

The issue in determining the contributions which team skills and individual abilities make to team performance is not to establish the superiority of individuals over teams or vice versa. Teams are a necessity for the types of complex tasks we are dealing with in Navy training activities. Rather, the essential issue is to delineate team skills which require special attention in training efforts because they account for significant performance variance beyond what is achieved through individual skills and abilities. The team skills are likely to have an impact because they serve to reduce the inherent inefficiencies in team interactions essential to task performance.

CHAPTER 2. METHODS

We used two basic strategies to explore how team skills are defined, measured, and related to team performance. First, we conducted interviews with training staff from representative Navy team training activities in the Atlantic and Pacific fleets. The facilities visited are listed in Table 1. At most facilities, the commander and several members of his training staff were contacted. A total of seventeen persons were interviewed with each session lasting approximately one hour. Some of the interviews were conducted in groups of 2-3 persons while the others involved one staff person at a time. A semi-structured interview guide was constructed to focus the discussion on specific team skill training topics through a combination of open-ended questions and questions with a given set of response alternatives. The open-ended questions provided the maximum opportunity for interviewees to expand upon the topic while the structured alternatives facilitated calculation of the frequency of occurrence of specific responses. The interview guide appears in Appendix A.

The second major data collection component focused on team rating criteria used by training staff to evaluate the proficiency of teams during training exercises. Items in scoring sheets used to make these evaluations were content analyzed to determine the nature and frequency of occurrence of team skills. A total of five sets of rating forms were included in these analyses. They represented team training activities of the Fleet Combat Training Center - Atlantic, the Anti-Submarine Warfare Training Center-Atlantic, the Fleet Training Group-Pacific, the Fleet Combat Training Center-Pacific, and the Submarine Training Facility-Pacific. The frequency of occurrence of different team skills evaluations across training rating forms for these five facilities was the central focus of these content analyses.

Table 1. Navy Team Training Facilities Visit

Pacific Fleet

- Fleet Combat Training Center
- Fleet Training Group
- Fleet Anti-Submarine Warfare Training Center
- Submarine Training Facility
- Mobile Training Team
- Naval Air Station - Moffet Field

Atlantic Fleet

- Fleet Combat Training Center
- Fleet Anti-Submarine Warfare Training Center

CHAPTER 3. RESULTS - TRAINING STAFF INTERVIEWS

The responses to the interview questions were divided into three categories including defining team skills, training team skills, and evaluating team skills. Several questions in the interview guide focused on each of these topics as described below.

- Defining team skills - The team skills which Navy training staff considered to be targets in their team training activities were determined through responses to two questions. The first question asked what were the primary reasons for training persons as part of teams rather than as individuals. The responses focused on four topics. They included: (1) to coordinate individual team member activities in order to avoid duplication of efforts; (2) to facilitate team member interactions and contacts; (3) to promote team cohesion; and, (4) to learn the strengths and weaknesses of different team members. While the first two reasons have possible transfer potential for team members who change teams, the third and fourth reasons are very clearly related to intact teams where members remain as part of the same team once training is completed.

The second question which addressed team skill definitions asked the training staff what were the primary team skills which they felt were learned during the team training programs they were familiar with. Six alternatives were presented along with the provision for responses not covered by these six. The two most popular team skills were information exchange with seven persons noting it and coordination with five persons referring to it. Other skills mentioned were feedback by two persons and adapting to new task conditions and team awareness by one person each.

- Training team skills - Given that the Navy team training staff placed heavy emphasis on coordination and information exchange, how did they see that these skills were trained? The first question which we asked addressed the training formats used for the development of team skills. No one alternative stood out among the six which were listed in the interview guide. Classroom training, structured exercises or scenarios, simulations, refresher courses, team discussions, and post-exercise instructor critiques were each mentioned by at least two persons. When asked how team skills were actually built into these formats, seven out of the eight persons responding indicated that they were a by-product of functioning as a team. The eighth person indicated that the skills were specifically targeted as one training element. No one said that team skills were the primary training target.

Another issue addressed in the interviews was whether there were team skills which needed more emphasis in team training programs. Two persons responded to this open-ended question by stating that the limited training time available made it impossible to focus more attention on any team skills. Two others suggested that more emphasis needed to be placed on basic individual skills and abilities prior to team training. The only recommendation for a team skill requiring more training emphasis was information transfer.

The final issue related to training team skills which was addressed deals with the interface between land training and sea team activities. One question asked whether teams were ever trained as intact units which would remain so on shipboard. While five persons indicated that the training of intact teams did take place, they also stated that it was most likely to occur for teams of a precommissioned ship. However, eight trainers stated that they felt greater team effectiveness would be achieved if more intact teams were subjected to team training. Moreover, two persons noted that teams from "better ships" were more likely to be trained intact.

Given that much land-based team training involves teams which do not remain intact, it would be expected that if there are team skills which are integral to intact teams, they must be developed on shipboard. In response to the question, to what extent do team skills get developed or sharpened during sea exercises, all nine trainers providing input indicated that team skill development was substantial at sea. For example, two persons stated that fully proficient or competent teams were only formed during sea maneuvers. Moreover, one training commander suggested that team success is a direct function of team stability times task exposure. These interview results emphasize the necessity for distinguishing between team skills which transfer from land-based team training and team skills which await full development within intact teams during actual on-the-job experiences.

- Evaluating team skills - In response to the question of how team skill competence is evaluated, seven out of eight persons selected the alternative, "as part of task performance". Only one indicated that team skills were separated out from task performance for evaluation. What the majority of the training staff seemed to be saying was that team skills competence was not given any special weight as a contributor to overall team performance. However, we shall see later in the examination of team performance rating sheets used to evaluate team training that certain team skills are singled out in that context.

A second question referred more specifically to indicators used by the training staffs to determine team skills proficiency levels. The factors listed included: (1) timeliness of internal or external communications; (2) absence of unnecessary communications including "silence" at critical points during task actions; (3) orderliness of the team activities or lack of confusion in working relationships; and (4) high frequency information flow when appropriate.

In response to the broader question of how the overall impact of team training was evaluated, the training staff listed: (1) timeliness in satisfying objectives or time taken for a team to respond to a given input; and (2) team performance in scenarios involving different combat conditions. Standards for these scenarios were developed by instructors based on their own performance of the tasks.

The central themes which run through team evaluation indicators obtained from interviews focus on various aspects of timeliness, communications, information exchange, and the orderliness or appropriateness of team activities. We will now turn to an examination of the rating forms used to evaluate the performance of teams in a range of Navy training activities. These forms provide additional input for expanding upon the team skills identified through the interviews and for describing how the skills are measured in team training evaluations.

CHAPTER 4. RESULTS - TEAM TRAINING RATING FORMS

The six sets of rating forms obtained from Navy training activities were content analyzed to determine the nature and frequency of occurrence of different team skills. A total of eleven categories were identified from the range of specific items in the rating forms. These categories reflect various aspects of team member contacts or interactions. They are listed in Table 2. Also provided are the number of actual items which fell into each category along with item examples. Certain items were scored in more than one category because they tapped several team skills. For example, "Initiates accurate and complete standard reports to 'AW'" was counted under Category #1, Appropriate contacts receive information as well as Category #4, Accurate information transferred.

Examination of the categories shows that primary emphasis is placed on the adequacy of the information transfer process. Of primary importance is the ability to get information to other appropriate team members which they need in order to carry out their own individual task requirements. Also of considerable importance as reflected in the rating items is the ability to transfer the information to other team members when they need it. This timing element may entail transmitting the information as soon as it is available. However, it may also involve providing the information at the most opportune time. Too early a contact may interrupt or interfere with on-going activities or produce input which is dated by the time it is used. Too late a contact may contribute to lower quality outputs as well as a less efficient team process when certain information must be repeated more than once.

The next three categories all address the content of the information transferred. They include the ability to provide appropriate information to other team members who need it, the ability to communicate accurate information, and the utilization of proper communications procedures and formats which facilitate the information transfer. These elements refer to the adequacy of the information communicated. Combined with the first two elements, they describe information transfer tasks which entail getting

Table 2. Team Skill Content Categories for Rating Items

<u>Content Category</u>		<u>Item Count</u>	<u>Item Examples</u>
1. Appropriate contacts receive information.		54	a. Disseminates evaluated information to TAO, bridge, and Weapons stations. b. Initiates accurate and complete standard reports to AW. c. Kept FCD informed of plan.
2. Timeliness of information transfer		36	a. Advise in advance when transfer or relief CAP required. b. Were recommendations given in time to allow for reaction? c. Update information to all plotters in a timely manner.
3. Appropriate information transferred		22	a. Range information passed to other plots. b. Informs AW of prosecution intentions, weapons deployment localization, and engagement status. c. Were contacts reported to the Force, including position, course, speed, CPA, and evaluation?
4. Accurate information transferred		21	a. Initiated accurate and complete reports to AW. b. Advised approach officer of correct weapons settings.
5. Proper procedures/format utilized		21	a. Follows proper format for Anti-Air Warfare R/T transmissions. b. Did RT Talker use proper communication procedures as in accordance with ACP-125?
6. Leadership		13	a. Did SWS supervise and utilize his personnel effectively? b. Leadership: How well did the TAO promote team work, encourage interest, maintain control, and coordinate efforts of team members? c. Were detectors/tracker stations adequately supervised?
7. Internal information flow		10	a. Information flow: Internally. b. Utilizes internal communications to coordinate with SWC and TAO. c. Initiates effective internal communications and ensures proper command and control.

Table 2 (Continued)

<u>Content Category</u>	<u>Item Count</u>	<u>Item Examples</u>
8. External information flow	9	a. Were effective external communications established to provide force training? b. Information flow: Externally. c. Demonstrates external communication proficiency.
9. Team Coordination	5	a. How well the SWC maintained control and coordinated efforts of team members? b. Did the LAAWC coordinate and evaluate reports from ships in the local group? c. Did TAO effectively coordinate the CIC team?
10. Clear, concise information transfer	4	a. Did R/T talkers demonstrate the use of Brevity Codes? b. Were all R/T transmissions concise? c. Did RT talker speak slowly/clearly?
11. Quiet, orderly information transfer	3	a. Was information flow in a quiet and orderly manner? b. The noise level was kept to a minimum.

appropriate and accurate information to the proper team members at the correct time.

Four of the remaining six categories also deal with some aspect of information transfer. The first one is similar to appropriateness of the procedures/formats utilized and refers to the ability to provide clear, concise information. The second one involves a general indication of the extent to which information transfer is quiet and orderly. The third and fourth categories address the balance between transmitting required information internal to the team and delivering essential information external to the team.

The remaining two categories deal with team leadership and coordination. They could very well be integrated into one category as they both address aspects of overall team control. However, very little in the way of specific skill or ability indicators of leadership or coordination are provided beyond "promoting teamwork", "encouraging interest", "coordinating efforts of team members," or "utilizing personnel effectively".

A number of all-inclusive team skill items were also in the rating forms which were not specific enough to code into content categories. For example, "Team harmony", "Team attitude", and "Information flow" are three items which team trainers used to evaluate team performance. The rating formats used for these items did not provide any additional specificity. For team harmony, raters were asked to assign a point total ranging from 1 to 50 while for team attitude and information flow, team trainers checked either "satisfactory" or "unsatisfactory". In fact, in general, the rating formats provided little specific guidance in how to assign ratings and there was no evidence in the rating forms of psychometrically sound rating scales. The formats utilized consisted of the assignment of points for each item representing a team skill or individual ability up to a maximum number. The maximum point total for an item ranged from 2 to 20. Other formats included "yes-no" and "satisfactory-unsatisfactory" alternatives. In addition, some items had no response format and simply provided space for team trainer remarks or comments.

The contribution which a team member made to overall team performance was determined through summations of points awarded, yes responses or satisfactoriness across all items rated for the individual. On rating forms where maximum point totals were assigned to each item, it was possible to get some idea of the relative weight attached to different factors. For example, disseminating evaluated information was worth 15 possible points while ensuring that a log was properly maintained yielded a maximum of only 5 points on one rating form.

Separate, end-result team performance items were also included in the rating forms. At the most general level, raters were asked to indicate whether they considered team performance to be satisfactory or unsatisfactory. At a more specific level, items focused on the overall effectiveness of teams in dealing with enemy threats. For example, was action taken to counter all engageable surface/air threats, were engagements and air contacts reported to the Force, and were the number of harpoons launched sufficient to kill the target? Or, how accurate were target course, speed, and range solutions to a target motion analysis problem?

Separate items also addressed individual team member performance. For example, the Tactical Action Officer was rated in terms of how successfully he countered threats to the force and whether he acted with necessary lead time to optimize the probability of effectively countering hostile contacts. It is interesting to note that the total possible points awarded to these two factors in overall effectiveness equalled the 20 points maximum assigned to how well the Tactical Action Officer promoted teamwork, encouraged interest, maintained control, and coordinated the efforts of team members. However, aside from this type of relative point assignment, there was no indication from the rating forms or interviews that different team skills or individual abilities were related to overall team performance through any systematic empirical process. Instead, they were considered as separate elements which made some contribution to total team performance.

CHAPTER 5. SUMMARY OF RESULTS

A number of objectives were set forth in the introduction which we planned to accomplish through the interviews of Navy team training staff and content analyses of the rating forms which they used. Provided below is a summary of the data in support of each objective.

Our first objective was to determine how team skills were defined in Navy team training activities. From the interviews, we found that information exchange proficiency and coordination were the most frequently mentioned team skills. Specific indicators of team skills proficiency mentioned by training staff included timeliness of information transfer, absence of unnecessary communications, and intensive communications activity when appropriate. These indicators were confirmed and expanded upon in the content analyses of the team training rating forms. The most popular content categories turned out to be the ability to get information to the appropriate team members and to do it in a timely manner. Seven of the other nine categories also directly dealt with aspects of information transfer. They included the ability to provide appropriate and accurate information using proper communications procedures and the use of formats which emphasized clarity and conciseness. The absence of unnecessary communications activity was also included among the rating items. Finally, coordination as a general team skill was referred to in the rating forms along with team leadership.

The second objective, to determine how team skills were trained, was directed at taking into account the extent to which team skills were targetted for specific attention during training. There was little evidence that such focused training took place. While a variety of training formats were utilized extending from the classroom to simulation scenarios, team skills were not specifically addressed in any of the formats. Instead, all team skills were embedded elements within training activities. The one exception to this was when trainers singled out specific team skill

deficiencies based upon ratings of team activities for special attention during team performance feedback sessions.

The third objective, to determine how team skills were measured, was accomplished primarily through examination of the formats used in the rating forms. These formats were found to provide the trainers with substantial latitude in making their ratings of team skills. Little guidance was provided in how to assign ratings. For many skills, discrete "yes-no" or "satisfactory-unsatisfactory" alternatives were provided. Where a numerical continuum ranging from 1-5, 1-10, 1-15 was used, no descriptions were provided to indicate what each number represented as a skill level.

The final objective, to determine the impact of team skills upon team performance, was considered in terms of input from both the interviews and the rating forms. There was little evidence from either source that team skills were related to overall team performance in any systematic manner. In the interviews, the majority of training staff indicated that team skills were assumed to relate to overall task performance. The rating forms did not provide much additional assistance. Rating items which referred to the accuracy and efficiency of enemy detections and engagements were not directly related to specific team skills and individual abilities.

CHAPTER 6. DISCUSSION AND EXTENSION OF RESULTS

Team Task Focus

The emphasis placed upon information transfer skills in the data collected from Navy team training activities is at least in part a function of the types of tasks involved. The majority of team training which we examined entailed various search and detection subtasks performed by individuals or subgroups within the team. These activities produce air radar information, surface and sub-surface radar and sonar information and/or electronic warfare information. This information must then be transferred to appropriate team members such as the Tactical Action Officer who is responsible for taking specific actions to address enemy threats. Other task contexts where the primary focus is on decision-making or problem-solving throughout the total team are likely to require different combinations of team skills. For example, information evaluation and team organization may be more critical requirements for teams constantly being confronted with new problems to solve as a group.

Defining team skill requirements as they relate to information transfer tasks represents a different focus than either task structure or task interdependence. These two dimensions were described by Nieva et al. (1978) as providing a way to determine the extent to which tasks require team skills. The more unpredictable and evolving the task and the greater the number of interrelated sub-elements, the more likely it is to need team skills. However, these dimensions are less helpful in specifying the type of team skills required. Task content such as information transfer addresses this issue by describing what actually must get accomplished and where and how team member coordinations and interactions fit into the total task process. In this report, we are considering team skills as they apply to team tasks which rely heavily upon information transfer among team members.

The information transfer team task and its components are integral to the command and control centers which Thorndyke et al. (1980) singled out for special attention in future Navy team performance research activities.

For example, they state that "the greatest leverage in team performance research can be attained by focusing research on teams that receive and evaluate dynamic information and perform time-stressed decision-making."

(p. 7) They refer to communications in such task contexts as the transportation system whose adequacy is determined by such factors as its efficiency, the timeliness of its deliveries, its ability to handle various content, and how it functions under stress load conditions. The team skills which are incorporated within Navy team training activities as we have described them here can be viewed as supporting and facilitating information exchange through this transportation system.

Team Skills Extension

A number of specific research issues were raised in the introduction which were said to require more clearly delineated team skill definitions and measures in order to address them satisfactorily. They included the extent to which team skills and individual abilities are intercorrelated, the establishment of the transference of individual team skills from one team to another, and the contribution of specific team skills to overall team performance. In this discussion, we intend to consider the utility of the team skills and measures that were derived from the Navy team training activities for addressing these research issues. We will also look at how they might be refined or extended to better reflect specific team skills required to conduct this type of research.

- Intercorrelation of team skills and individual abilities - As we indicated in our introduction, one important team training issue which requires sound team skill measures involves the determination of interrelationships between team skills and individual abilities. If we look at the team skills dimensions derived from the training interview and rating form analyses, we find that many of them are composed of individual ability as well as team skill elements. For example, in order for the appropriate team members to receive information, there are at least three requirements. First of all, the information must be held by the sender. This more than likely relies on individual skills and abilities. Secondly, the sender

must know who should receive the information, an individual knowledge. Finally, the sender must actually be able to transfer the information to the appropriate person. This last component is primarily where team skills come into play. Or take another example. In order for timely information transfer to occur, the transmitter must have the individual skills and abilities necessary to obtain the information efficiently in the first place. Once he or she has the information, team skills enter to assure that the information is transferred at the time when it will be of most use to the recipient.

What we are saying is that the "team skills" as they were defined in Navy training activities require further break-outs in order to actually reflect team skills. The Navy training "team skills" are more appropriately viewed as team task components of the information transfer process. Team skills were in fact being tapped indirectly when reference was made to proficiency in making appropriate information contacts, ability to transfer information in a timely manner, or skill in coordinating team activities. What these proficiencies or abilities actually consist of are left unspecified and may incorporate individual as well as team skills. For example, the team member who has an individual ability to collect information more rapidly is in a better position to assure that it gets to the appropriate persons in a timely manner than another team member who is less proficient. Similarly, appropriate and accurate information transfer is more likely to occur if a team member has the necessary individual skills and abilities.

As a consequence of the presence of such implicit individual and team skill elements within the content categories which we identified in Navy team training activities, it is necessary to redefine the categories and specify these elements. One approach is to delineate essential individual abilities and team skill elements which are likely to contribute to successful accomplishment of the team task described in each category. We have made an initial attempt to do this in Table 3. Here we have listed sets of individual and

Table 3. Individual and Team Skills for Information Transfer Tasks

<u>Team Task Components</u>	<u>Individual Skills/Knowledge</u>	<u>Team Skills</u>
1. Appropriate contacts receive information.	1. Collects adequate information. 2. Knows appropriate contacts both internal and external to the team. 3. Knows task/situational conditions where specific contacts are required.	1. Gains access to appropriate persons. 2. Assures that <u>all</u> appropriate persons receive information. 3. Confirms that information was received when not delivered directly.
2. Timeliness of information transfer.	1. Collects information efficiently. 2. Knows information priorities. 3. Is aware of other team member information priorities and requirements 4. Is aware of total team and system or internal and external information priorities. 5. Is aware of time requirements under different task conditions.	1. Uses most direct available communications channels. 2. Assures that priority information receives special attention. 3. Coordinates information flow to control contacts with other team members. 4. Minimizes unnecessary interruptions of other team members. 5. Provides clear, concise information. 6. Responds quickly to information requested. 7. Assures that delayed information is transmitted as soon as possible.
3. Appropriate information transferred.	• Collects appropriate information.	1. Confirms appropriateness of information transferred. 2. Expands information appropriately upon request.
4. Accurate information transferred.	• Collects accurate information.	1. Confirms accuracy of information transferred. 2. Requests feedback on accuracy. 3. Corrects information when feedback shows inaccuracies.

Table 3 (Continued)

<u>Team Task Components</u>	<u>Individual Skills/Knowledge</u>	<u>Team Skills</u>
5. Proper information transfer proceedings/format utilized	Knows proper proceedings/format.	- Confirms that proper proceedings/format have been used. - Requests feedback on proceedings/format. - Corrects proceedings/format when feedback shows improper usage.
6. Team coordination/leadership.	Awareness of total team and system or internal and external information transfer requirements.	- Prioritizes information transfer. - Assures quiet, orderly information transfer. - Provides support where needed in team information flow process. - Provides feedback to team members. - Adjusts information flow process to meet current task demands including "emergent emergencies".

team skills which we feel are possible contributors to satisfactory accomplishment of the team performance requirement set forth in each category. This list is not meant to be all-inclusive but it does serve to represent the types of individual and team skill elements which need to be measured in order to establish their interrelationships in information transfer tasks. The individual skill elements tend to represent task requirements for the team member prior to information transfer while the team skill elements involve aspects of the actual information transfer process.

If we look at the skills listed in Table 3 for the first team task category, "appropriate contacts receive information", we find that the initial individual skill refers to the collection of adequate information. This skill itself could be broken down into task specific elements which describe activities and products used to evaluate the adequacy of the team member's individual performance. Behavioral indicators as well as output indicators would serve this purpose and many such measures are already included within the training rating forms which we analyzed. The second and third individual skills under this category refer to knowledge levels which the team member has about team contact requirements. They include knowing whom to contact with certain information and being familiar with task and situational conditions which indicate that certain specific team members should be contacted. While at first glance, these latter two skills may seem more appropriately placed under team skills, they are included as individual abilities because they presumably involve knowledges which team members acquire alone or through individual training.

The team skills under this category refer to behaviors and actions that indicate the extent to which the team member is skilled in actually making the appropriate contacts. This entails such actions as gaining the full attention of the intended information recipient through effective introductory comments and vocal intensity. If direct

face-to-face transfer to the appropriate contact is not possible, then another team skill may consist of actions taken to confirm that the information does in fact reach the intended person through intermediaries or secondary channels. These are examples of a few team skills. Others may be added to this list which refer to activities supporting a team member's efforts to transmit information to appropriate persons.

The remaining team task categories in Table 3 have similar break-outs of individual and team skills. The timeliness of information task requirement has an extensive list of both sets of skills. The emphasis in individual skills/knowledge falls on skill in efficient collection of information and an awareness of total team and system information priorities. The team skill break-out lists possible behavioral indicators of skill in timely information transfer such as "uses most direct available communications channels", "minimizes unnecessary interruptions of other team members", and "responds quickly to information requests".

The next three team task components have fewer items listed under individual and team skills. However, they make the same distinction between individual skills or knowledge which are necessary prior to information transfer and team skills which support the actual transfer process. The individual skills/knowledge focus on collecting appropriate and accurate information and knowing proper procedures and formats. The relevant team skills involve determining the extent to which the information was received as intended and providing effective additional elaboration and clarification when it was not.

The final category which is listed refers to team coordination. This category also incorporates leadership from the set of categories identified in the Navy team training rating forms. It covers the coordination of all aspects of the overall team information flow process. Again, the distinction is maintained between individual abilities and team skills. Individual skills/knowledge refers to

awareness of total team and system requirements while team skill indicators include prioritizing information transfer, providing support to team members, and providing feedback to team members.

The types of individual and team skill elements which we have just described can be used as starting points for exploring inter-correlations between individual abilities/knowledges and team skills. Data on each set of elements can be collected in teams and inter-correlated as well as entered into regression equations to predict team member performance on the team tasks listed in each category. For example, "timeliness of information transfer" would be the dependent variable and "collects information efficiently", "knows information priorities", "uses most direct channels", and "minimizes unnecessary interruptions" plus the other individual and team skill elements in this category would be entered into the equation as possible predictor variables. In some cases, a significant predictor of team task performance may be a combination of an individual ability and a team skill. This would indicate that both factors are critical to task performance. If either one approaches zero, performance will be low regardless of the level of the other factor. For example, if a team member is unable to gain access to appropriate persons, they will not receive information regardless of how good he or she is in collecting adequate information in the first place. On the other hand, gaining access will do no good if adequate information has not first been collected.

Transference of team skills - One outcome of the determination of inter-correlations among individual and team skill elements is the provision of initial material to address this issue. If the data indicate that individual skills and abilities account for the major portion of variance in the team categories, then team skills may be defined as knowledge of appropriate contact requirements and awareness of team member and total system information priorities. These knowledges and awarenesses can be acquired through individual training and are more likely to transfer from one team to another. On the other hand,

to the extent that team skill elements account for unique variance in team task categories such as timeliness of information transfer, then more focused attention must be placed on the transference of team skills which only emerge during actual team activities. These skills would require training in a team setting.

However, the question would still remain as to the transference of these skills between one team and another. For example, gaining access to the appropriate persons may involve certain interpersonal skills such as proper timing of the contact so that other competing contact requirements are minimal or using effective "up-front" comments which gain the attention of the team member contact. Such skills may transfer effectively from one team to another. However, gaining access may also require familiarity with the personal work style and inclinations of the team member contact. Obviously, this type of familiarity is unique to a team although interpersonal sensitivity to cues required to gain such familiarity within a new team may transfer. Or such familiarity may develop rapidly enough in a newly formed team that on-the-job experience is an adequate substitute for formal team training.

In order to address the team skill transfer issue adequately, it will be necessary to consider each of the team skill elements in more detail than is provided in Table 3. For each one, there should be a distinction between aspects which are generic to teams and those which relate to characteristics of a specific team. For example, minimizing unnecessary interruptions from other team members in order to provide timely information transfer may include generic strategies for recognizing and avoiding or terminating superfluous communications. However, it may also require specific familiarity with other team members in order to anticipate and effectively deal with likely interruptions from certain individuals. The approach to this research issue entails determining the extent to which each team skill that accounts for significant performance variance in a team information transfer category is composed of factors which have high transfer potential from one team

to another because of their generic content and factors which have low transfer potential because of their embeddedness within specific teams.

Relationship between team skills and performance - In order to place overall team performance in perspective with what we have just addressed in the first two research issues, we have constructed the model presented in Figure 1. In this model, the team categories which we identified through the team training interview and rating form content analyses are incorporated under "C" as components of team task performance. Defining the individual and team skill elements of these team performance components takes us back one step to "B" in the model. We move back one more step to "A" in order to consider what is required in order to distinguish between team skills which transfer from one team to another and those which do not. At each step, more specific, finely delineated break-outs of team skills are required.

To complete the picture, it is necessary to move in the opposite direction from team task performance at "C" to bring in total team performance. This overall team performance at "D" is a function of the extent to which team task as well as individual task requirements are met. Team members may perform certain tasks which do not require any sort of teamwork. For example, ultimate team performance may be a function of the ability of an individual team member to fire a weapon properly or for a decision-maker to synthesize effectively the information generated and transferred to him by the team in order to make an appropriate individual decision. Individual skills and knowledges contribute to the performance of these tasks as well as to the performance of team tasks.

According to the model, team skills have their impact upon overall team performance through their contributions to or support of team task performance. Therefore, the direct relationship between the performance of team tasks such as the transfer of information to appropriate persons and total team performance measured by such dimensions

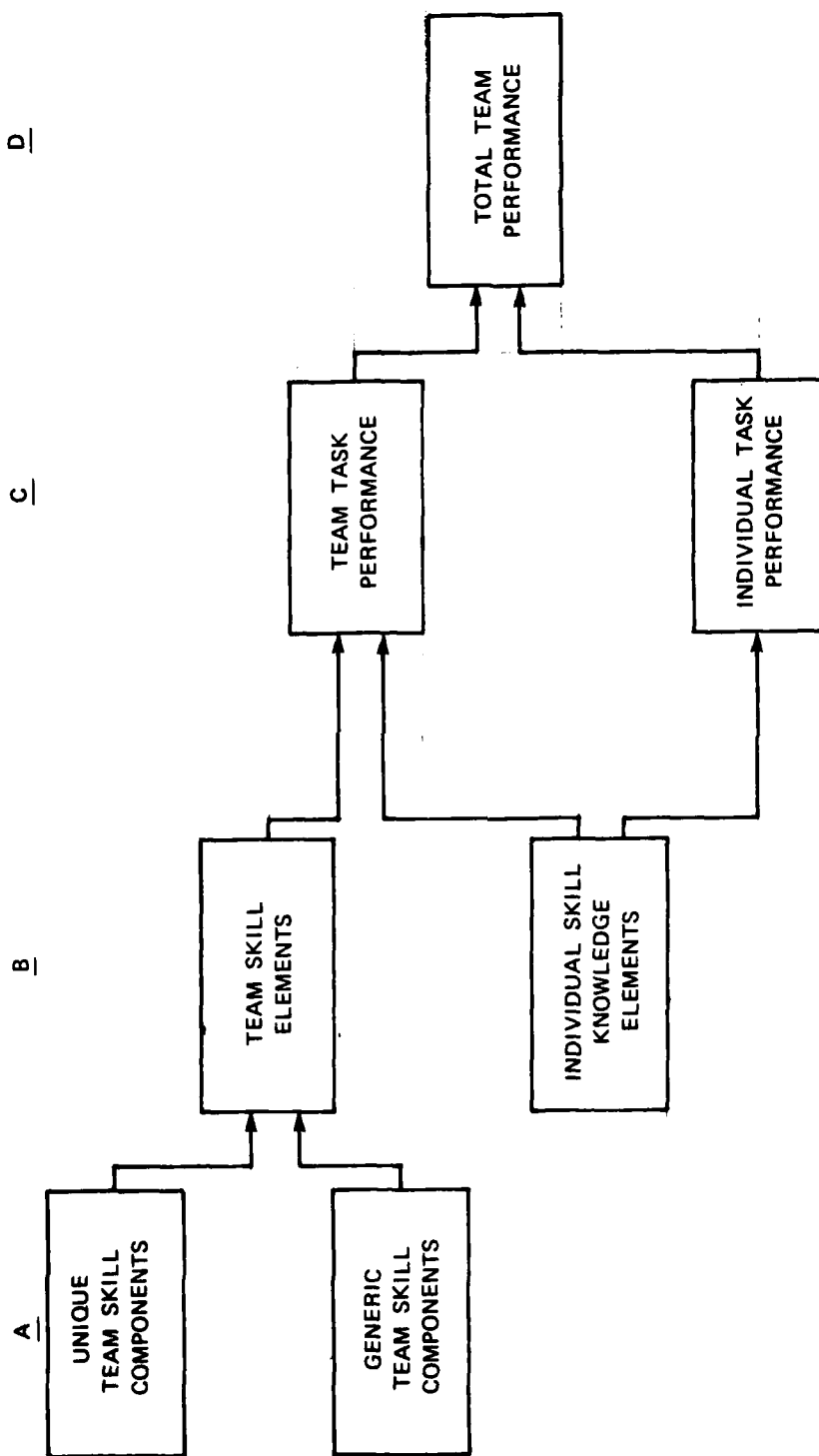


Figure 1. A Model of Team and Individual Skill Contributions to Team Performance

as enemy target intercepts completes the chain linking team skills to team performance. In other words, team skills are related to total team performance through team task performance.

In our description of team skills as they are laid out in the model, we are using separate team members performing their individual and team tasks as our measurement focus. Therefore, it is necessary to sum across these performances for each team member to arrive at indices of total team performance.

The manner in which team and individual task performances relate to total team performance is an empirical question. They may make independent additive contributions to performance or they may join together in a multiplicative relationship. Such a relationship would suggest that both factors are equally important to team performance. If either one approaches zero, then team performance will be low regardless of the level of the other factor. In other words, high team task performance may go to waste if there is low individual task performance. However, the central research issue here is not the type of relationship which exists but rather the amount of total team performance variance which is accounted for by members' performance of specific team tasks. Then team and individual skills which support these tasks will be given appropriate credit as contributors to team performance.

CHAPTER 7. CONCLUSIONS

In our earlier technical report (Turney et al.), we noted that coordination of individual team member activities served as the primary focus for team skills training research and other explorations into the nature of team skills. Operationalizations of coordination focused on communications content categories like exchanging task-related information and evaluating information. Many more questions about the impact of team skills and team skills training on team performance have been raised than answered. While training in verbal communications skills has been found to influence team performance, the results of the limited studies available are far from conclusive. Moreover, as we have noted, the relative impact of individual skills/knowledge and team skills on team performance, their transference from one team to another, and the utility of team training for developing individual and team skills separately or in combination have been raised on numerous occasions as important research issues without receiving subsequent attention.

The initial research requirement is to develop adequate definitions of team skills with likely relationships to effective team functioning and performance. We have attempted to lay the groundwork for this effort through a model which breaks out possible determinants of total team performance into a sequence incorporating team skills at two different points. Total team performance is divided into individual task performance and team task performance components. Team tasks are divided into individual and team skills. Finally, the team skills themselves are broken out into elements which are likely to be embedded within a particular team and elements which a team member is likely to carry from one team to another. At this stage, the model serves as an heuristic guide for empirical research. Not only may the relative contributions of individual and team dimensions shift as a function of different task requirements but also they may be extended or deleted as an empirical data base is developed.

Defining team skills in terms of information transfer tasks provides a content specific focus which often seems absent in discussions of team skills training. As we demonstrated in this report, it is possible to generate a range of team skills which may support performance of a team task if this task is given such a content focus. Moreover, it is possible to zero in on team components which are likely to be critical determinants of total team task performance. One example of such a component is timeliness of information transfer. The lists of potentially relevant individual skill/knowledge and team skill elements which we generated in our example were extensive. Moreover, timeliness of information transfer encapsulates many of the coordination and sequencing team skills described in the literature beyond those we covered in Chapter 5. In addition, both individual and team skills are likely to contribute to effective and efficient timing. Individual skills and knowledge contribute to information collection and team skills contribute to actual information delivery.

The tasks performed in Navy team training facilities place heavy emphasis on information transfer timeliness because of its importance to team performance under combat conditions. The urgent and emergent nature of these conditions places special strains on skills required to deliver timely information. Avoidance of unnecessary interruptions and delivering information as close to the time when the recipient can use it are likely to be especially salient team skills. Good examples of Navy team training activities where these kinds of team task conditions are created are the fleet combat and antisubmarine warfare training centers.

The measures of team skills which are developed need to tap various aspects of team member interactions. However, the traditional approach of relying on communications content categories has its limitations. A content analytical system such as the one developed by Bales (1950) is useful to study interactions in small groups where all members are together. However, substantial resources are required to collect the data through team observations. This is particularly so when sub-units of the team are physically separated and many interactions take place simultaneously. Moreover, the observational and analytical requirements make this

measurement approach impractical for use by training staffs. Therefore, it is necessary to generate behavioral and interaction indicators which describe the frequency of occurrence of various team skills as rated by observers or team members themselves. Valid numeric rating scales which are anchored with specific descriptive indicators of different levels of each team skill are required. Sound measures are most likely to result from appropriately conducted individual and team task analyses.

Once such measures are developed, it will be possible to collect data on team and individual skills which are related to team performance. As these skills and abilities are established, attention can be turned more and more to the delineation of appropriate contexts for skill acquisition. At some future time, it may be possible to prescribe blends of individual training, team training, and exposure functioning as an intact unit for achieving peak total team performance effectiveness for specific task requirements. However, achieving this stage will first require the generation of a fundamental team skill - team performance knowledge base.

BIBLIOGRAPHY

- Alexander, L.T. and Cooperband, A.S. *System Training and Research in Team Behavior*, Technical Memorandum 2581, System Development Corporation, August 1965.
- Bales, R.F., *Interaction process analysis: A Method for the Study of Small Groups*. Reading, Mass.: Addison - Wesley, 1950.
- Briggs, G.E. & Johnston, W. A., *Team Training*, Technical Report 1327-4, Orlando, Florida: Naval Training Device Center, June 1967.
- Collins, J.J., *A Study of the Potential Contributions of Small Group Behavior Research to Team Training Technology Development*. (Final Report ONR-0014-76-C-1076, NR-179-34). Alexandria, VA: Essex, August, 1977.
- Goldin, S.E. & Thorndyke, P.W. Proceedings of the Rand Team Performance Workshop: November 1979. (Report No. R-2606-ONR) Santa Monica, CA.: Rand Corp., August, 1980.
- Goldstein, I.L., "Training in Work Organizations," Annual Review of Psychology, 1980, pp. 229-272.
- Hall, E.R. and Rizzo, W.A., "An Assessment of US Navy Tactical Team Training: Focus on the Trained Man", TAEG Report No. 18, Training Analysis and Evaluation Group, March 1975.
- Hackman, J.R., & Morris, R.E. Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. In L. Berkowitz (Ed.), Advances in experimental social psychology (Vol. IX). New York: Academic Press, 1975.
- Kelley, H.H. & Thibaut, J.W. "Group Problem Solving". In The Handbook of Social Psychology, G. Lindzey & E. Aronson (Eds.), New York: Addison-Wesley, 1969.
- Meister, D. Behavioral Foundations of System Development. New York: Wiley, 1976.
- Nieva, V.F., Fleishman, E.A. and Rieck, A. Team Dimensions: their identity, thier measurement and their relationships. Advanced Research Resources Organization. Princeton, NJ: Response Analysis Corp., November 20, 1978.
- Thorndyke, P.W. and Weiner, M.G., "Improving Training and Performance of Navy Teams: A Design for a Research Program", Rand Corp., Santa Monica, CA., (Report ONR R-2607), 1980.
- Turney, J.R., Cohen, S.L., Greenberg, L. Targets for Team Skills Training. (Interim Report N00014-80-C-0811, NR170-919). Columbia, MD: General Physics Corp., April, 1981.

GP-R-43017

GENERAL PHYSICS CORPORATION

APPENDIX A
INTERVIEW GUIDE

INTERVIEW GUIDE - TEAM SKILLS TRAINING

Introduction: We are conducting a study for the Office of Naval Research to determine how team skills are incorporated into Navy training courses. Team skills involve competence in working with others to accomplish a task. Our specific interest is in establishing team skills to serve as targets for a major ONR team training research program. We have already conducted a review of the research literature and now we are interested in obtaining your input as a person familiar with Navy training. For this purpose, we have constructed a series of general questions to guide our discussion. However, they are not intended to restrict your comments in any way and so you should feel free to add to or expand upon any question.

1. What are the primary reasons for training persons as part of teams rather than as individuals as you see them?
2. What are the primary team skills which you feel are learned during team training programs you are familiar with?
 - a. ____ coordination
 - b. ____ information exchange
 - c. ____ adapting to new task conditions
 - d. ____ compensating for team errors
 - e. ____ structuring team activities
 - f. ____ leader - follower relations
 - g. ____ others (feedback; team awareness)
3. How are these skills built into the training material?
 - a. ____ by-product of functioning as team
 - b. ____ targetted as one training element
 - c. ____ primary training target (e.g. team building)

4. What training format(s) is used for development of team skills?
 - a. ____ classroom
 - b. ____ team discussions
 - c. ____ structured exercises
 - d. ____ role-playing
 - e. ____ simulators/siulations
 - f. ____ refresher course
 - g. ____ other
5. How is team skill competence evaluated?
 - a. ____ as part of task performance
 - b. ____ separate from task performance (e.g. interaction analyses)
6. What indicators do you use to determine the team skills proficiency of a team?
7. How is the overall impact of team training evaluated? (e.g. what performance measures or other indicators are used?)
8. Are teams ever trained as intact units which will remain so in the field? ____ Yes ____ No If yes, for what types of tasks?
9. To what extent do team skills get developed or sharpened during sea exercises?
10. What team skills need more emphasis in these programs?
11. How are team training objectives established and by whom?

GP-R-43017

GENERAL PHYSICS CORPORATION

DISTRIBUTION LIST

P4-5/A1
Sequential by Agency

452:KD:716:enj
78u452-883
24 June 1981

LIST 1
MANDATORY

Defense Technical Information Center (12 copies)
ATTN: DTIC DDA-2
Selection and Preliminary Cataloging Section
Cameron Station
Alexandria, VA 22314

Library of Congress
Science and Technology Division
Washington, DC 20540

Office of Naval Research (3 copies)
Code 452
800 N. Quincy Street
Arlington, VA 22217

Naval Research Laboratory (6 copies)
Code 2627
Washington, DC 20375

Office of Naval Research
Director, Technology Programs
Code 200
800 N. Quincy Street
Arlington, VA 22217

Office of Naval Research
Code 450
800 N. Quincy Street
Arlington, VA 22217

Office of Naval Research
Code 458
800 N. Quincy Street
Arlington, VA 22217

Office of Naval Research
Code 455
800 N. Quincy Street
Arlington, VA 22217

P4-5/A3
Sequential by State/City

452:KD:716:enj
78u452-883
24 June 1981

LIST 2
ONR FIELD

ONR Western Regional Office
1030 E. Green Street
Pasadena, CA 91106

Psychologist
ONR Western Regional Office
1030 E. Green Street
Pasadena, CA 91106

ONR Regional Office
536 S. Clark Street
Chicago, IL 60605

Psychologist
ONR Regional Office
536 S. Clark Street
Chicago, IL 60605

Psychologist
ONR Eastern/Central Regional Office
Bldg. 114, Section D
666 Summer Street
Boston, MA 02210

ONR Eastern/Central Regional Office
Bldg. 114, Section D
666 Summer Street
Boston, MA 02210

P4-5/A5
Sequential by OPNAV Code

452:KD:716:enj
78u452-883
25 June 1981

LIST 3
OPNAV

Deputy Chief of Naval Operations
(Manpower, Personnel, and Training)
Head, Research, Development, and
Studies Branch (Op-115)
1812 Arlington Annex
Washington, DC 20350

Director
Civilian Personnel Division (OP-14)
Department of the Navy
1803 Arlington Annex
Washington, DC 20350

Deputy Chief of Naval Operations
(Manpower, Personnel, and Training)
Director, Human Resource Management
Plans and Policy Branch (Op-150)
Department of the Navy
Washington, DC 20350

Deputy Chief of Naval Operations
(Manpower, Personnel, and Training)
Director, Human Resource Management
Plans and Policy Branch (Op-150)
Department of the Navy
Washington, DC 20350

Chief of Naval Operations
Head, Manpower, Personnel, Training
and Reserves Team (Op-964D)
The Pentagon, 4A478
Washington, DC 20350

Chief of Naval Operations
Assistant, Personnel Logistics
Planning (Op-987H)
The Pentagon, 5D772
Washington, DC 20350

P4-5/A7

452:KD:716:enj
78u452-883
24 June 1981

LIST 4
NAVMAT & NPRDC

NAVMAT

Program Administrator for Manpower,
Personnel, and Training
MAT 0722
800 N. Quincy Street
Arlington, VA 22217

Naval Material Command
Management Training Center
NAVMAT 09M32
Jefferson Plaza, Bldg #2, Rm 150
1421 Jefferson Davis Highway
Arlington, VA 20360

Naval Material Command
NAVMAT-00K
Washington, DC 20360

Naval Material Command
NAVMAT-00KB
Washington, DC 20360

Naval Material Command
(MAT-03)
Crystal Plaza #5
Room 236
2211 Jefferson Davis Highway
Arlington, VA 20360

NPRDC

Commanding Officer
Naval Personnel R&D Center
San Diego, CA 92152

(5 Copies)

Navy Personnel R&D Center
Washington Liaison Office
Building 200, 2N
Washington Navy Yard
Washington, DC 20374

P4-5/A9
Sequential by State/City

452:KD:716:enj
78u452-883
24 June 1981

LIST 5
BUMED

Commanding Officer
Naval Health Research Center
San Diego, CA 92152

CDR William S. Maynard
Psychology Department
Naval Regional Medical Center
San Diego, CA 92134

Naval Submarine Medical
Research Laboratory
Naval Submarine Base
New London, Box 900
Groton, CT 06349

Director, Medical Service Corps
Bureau of Medicine and Surgery
Code 23
Department of the Navy
Washington, DC 20372

Naval Aerospace Medical
Research Lab
Naval Air Station
Pensacola, FL 32508

Program Manager for Human
Performance
Naval Medical R&D Command
National Naval Medical Center
Bethesda, MD 20014

Navy Medical R&D Command
ATTN: Code 44
National Naval Medical Center
Bethesda, MD 20014

P4-5/All

452:KD:716:lab
78u452-883
30 May 1981

LIST 6
NAVAL ACADEMY AND NAVAL POSTGRADUATE SCHOOL

Naval Postgraduate School
ATTN: Dr. Richard S. Elster
Department of Administrative Sciences
Monterey, CA 93940

Naval Postgraduate School
ATTN: Professor John Senger
Operations Research and
Administrative Science
Monterey, CA 93940

Superintendent
Naval Postgraduate School
Code 1424
Monterey, CA 93940

Naval Postgraduate School
ATTN: Dr. James Arima
Code 54-Aa
Monterey, CA 93940

Naval Postgraduate School
ATTN: Dr. Richard A. McGonigal
Code 54
Monterey, CA 93940

U.S. Naval Academy
ATTN: CDR J. M. McGrath
Department of Leadership and Law
Annapolis, MD 21402

Professor Carson K. Eoyang
Naval Postgraduate School, Code 54EG
Department of Administration Sciences
Monterey, CA 93940

Superintendent
ATTN: Director of Research
Naval Academy, U.S.
Annapolis, MD 21402

P4-5/A13
Sequential by State/City/FPO

452:KD:716:lab
78u452-883
30 May 1981

LIST 7
HRM

Officer in Charge
Human Resource Management Detachment
Naval Air Station
Alameda, CA 94591

Officer in Charge
Human Resource Management Detachment
Naval Submarine Base New London
P.O. Box 81
Groton, CT 06340

Officer in Charge
Human Resource Management Division
Naval Air Station
Mayport, FL 32228

Commanding Officer
Human Resource Management Center
Pearl Harbor, HI 96860

Commander in Chief
Human Resource Management Division
U.S. Pacific Fleet
Pearl Harbor, HI 96860

Officer in Charge
Human Resource Management Detachment
Naval Base
Charleston, SC 29408

Commanding Officer
Human Resource Management School
Naval Air Station Memphis
Millington, TN 38054

Human Resource Management School
Naval Air Station Memphis (96)
Millington, TN 38054

P4-5/A14

List 7 (Continued)

452:KD:716:enj

78u452-883

24 June 1981

Commanding Officer
Human Resource Management Center
1300 Wilson Boulevard
Arlington, VA 22209

Commanding Officer
Human Resource Management Center
5621-23 Tidewater Drive
Norfolk, VA 23511

Commander in Chief
Human Resource Management Division
U.S. Atlantic Fleet
Norfolk, VA 23511

Officer in Charge
Human Resource Management Detachment
Naval Air Station Whidbey Island
Oak Harbor, WA 98278

Commanding Officer
Human Resource Management Center
Box 23
FPO New York 09510

Commander in Chief
Human Resource Management Division
U.S. Naval Force Europe
FPO New York 09510

Officer in Charge
Human Resource Management Detachment
Box 60
FPO San Francisco 96651

Officer in Charge
Human Resource Management Detachment
COMNAVFORJAPAN
FPO Seattle 98762

P4-5/A16
Sequential by State/City

452:KD:716:1ab
78u452-883
30 May 1981

LIST 8
NAVY MISCELLANEOUS

Naval Military Personnel Command (2 copies)
HRM Department (NMPC-6)
Washington, DC 20350

Naval Training Analysis
and Evaluation Group
Orlando, FL 32813

Commanding Officer
ATTN: TIC, Bldg. 2068
Naval Training Equipment Center
Orlando, FL 32813

Chief of Naval Education
and Training (N-5)
Director, Research Development,
Test and Evaluation
Naval Air Station
Pensacola, FL 32508

Chief of Naval Technical Training
ATTN: Dr. Norman Kerr, Code 017
NAS Memphis (75)
Millington, TN 38054

Navy Recruiting Command
Head, Research and Analysis Branch
Code 434, Room 8001
801 North Randolph Street
Arlington, VA 22203

Commanding Officer
USS Carl Vinson (CVN-70)
Newport News Shipbuilding &
Drydock Company
Newport News, VA 23607

P4-5/A18

452:KD:716:lab
78u452-883
30 May 1981

LIST 9
USMC

Headquarters, U.S. Marine Corps
Code MPI-20
Washington, DC 20380

Headquarters, U.S. Marine Corps
ATTN: Dr. A. L. Slafkosky,
Code RD-1
Washington, DC 20380

Education Advisor
Education Center (E031)
MCDEC
Quantico, VA 22134

Commanding Officer
Education Center (E031)
MCDEC
Quantico, VA 22134

Commanding Officer
U.S. Marine Corps
Command and Staff College
Quantico, VA 22134

P4-5/A20
Sequential by Principal Investigator

452:KD:716:enj
78u452-883
24 May 1981

LIST 10
DARPA

Defense Advanced Research (3 copies)
Projects Agency
Director, Cybernetics
Technology Office
1400 Wilson Blvd, Rm 625
Arlington, VA 22209

Mr. Michael A. Daniels
International Public Policy
Research Corporation
6845 Elm Street, Suite 212
McLean, VA 22101

Dr. A. F. K. Organski
Center for Political Studies
Institute for Social Research
University of Michigan
Ann Arbor, MI 48106

P4-5/A25
Sequential by State/City

452:KD:716:enj
78u452-883
24 June 1981

LIST 12
ARMY

Headquarters, FORSCOM
ATTN: AFPR-HR
Ft. McPherson, GA 30330

Army Research Institute
Field Unit - Leavenworth
P.O. Box 3122
Fort Leavenworth, KS 66027

Technical Director
Army Research Institute
5001 Eisenhower Avenue
Alexandria, VA 22333

Director
Systems Research Laboratory
5001 Eisenhower Avenue
Alexandria, VA 22333

Director
Army Research Institute
Training Research Laboratory
5001 Eisenhower Avenue
Alexandria, VA 22333

Dr. T. O. Jacobs
Code PERI-IM
Army Research Institute
5001 Eisenhower Avenue
Alexandria, VA 22333

COL Howard Prince
Head, Department of Behavior
Science and Leadership
U.S. Military Academy, New York 10996

P4-5/A27
Sequential by State/City

452:KD:716:enj
78u452-883
24 June 1981

LIST 13
AIR FORCE

Air University Library/LSE 76-443
Maxwell AFB, AL 36112

COL John W. Williams, Jr.
Head, Department of Behavioral
Science and Leadership
U.S. Air Force Academy, CO 80840

MAJ Robert Gregory
USAFA/DFBL
U.S. Air Force Academy, CO 80840

AFOSR/NL (Dr. Fregly)
Building 410
Bolling AFB
Washington, DC 20332

LTCOL Don L. Presar
Department of the Air Force
AF/MPXHM
Pentagon
Washington, DC 20330

Technical Director
AFHRL/MO(T)
Brooks AFB
San Antonio, TX 78235

AFMPC/MPCYPR
Randolph AFB, TX 78150

P4-5/A23
Sequential by Agency

452:KD:716:enj
78u452-883
24 June 1981

LIST 11
OTHER FEDERAL GOVERNMENT

Dr. Douglas Hunter
Defense Intelligence School
Washington, DC 20374

Dr. Brian Usilaner
GAO
Washington, DC 20548

National Institute of Education
ATTN: Dr. Fritz Mulhauser
EOLC/SMO
1200 19th Street, N.W.
Washington, DC 20208

National Institute of Mental Health
Division of Extramural Research Programs
5600 Fishers Lane
Rockville, MD 20852

National Institute of Mental Health
Minority Group Mental Health Programs
Room 7 - 102
5600 Fishers Lane
Rockville, MD 20852

Office of Personnel Management
Office of Planning and Evaluation
Research Management Division
1900 E Street, N.W.
Washington, DC 20415

Office of Personnel Management
ATTN: Ms. Carolyn Burstein
1900 E Street, NW.
Washington, DC 20415

Office of Personnel Management
ATTN: Mr. Jeff Kane
Personnel R&D Center
1900 E Street, N.W.
Washington, DC 20415

Chief, Psychological Research Branch
ATTN: Mr. Richard Lanterman
U.S. Coast Guard (G-P-1/2/TP42)
Washington, DC 20593

P4-5/A24
Sequential by Agency

452:KD:716:enj
78u452-883
24 June 1981

LIST 11 CONT'D

OTHER FEDERAL GOVERNMENT

Social and Developmental Psychology
Program
National Science Foundation
Washington, DC 20550

P4-5/A29
Sequential by State/City

452:KD:716:lab
78u452-883
30 May 1981

LIST 14
MISCELLANEOUS

Australian Embassy
Office of the Air Attache (S3B)
1601 Massachusetts Avenue, N.W.
Washington, DC 20036

British Embassy
Scientific Information Officer
Room 509
3100 Massachusetts Avenue, N.W.
Washington, DC 20008

Canadian Defense Liaison Staff,
Washington
ATTN: CDRD
2450 Massachusetts Avenue, N.W.
Washington, DC 20008

Commandant, Royal Military
College of Canada
ATTN: Department of Military
Leadership and Management
Kingston, Ontario K7L 2W3

National Defence Headquarters
ATTN: DPAR
Ottawa, Ontario K1A 0K2

Mr. Luigi Petrullo
2431 North Edgewood Street
Arlington, VA 22207

P4-5/B2
Sequential by Principal Investigator

452:KD:716:enj
78u452-883
24 June 1981

LIST 15
CURRENT CONTRACTORS

Dr. Richard D. Arvey
University of Houston
Department of Psychology
Houston, TX 77004

Dr. Arthur Blaiwes
Human Factors Laboratory, Code N-71
Naval Training Equipment Center
Orlando, FL 32813

Dr. Joseph V. Brady
The Johns Hopkins University
School of Medicine
Division of Behavioral Biology
Baltimore, MD 21205

Dr. Stuart W. Cook
Institute of Behavioral Science #6
University of Colorado
Box 482
Boulder, CO 80309

Dr. L. L. Cummings
Kellogg Graduate School of Management
Northwestern University
Nathaniel Leverone Hall
Evanston, IL 60201

Dr. Henry Emurian
The Johns Hopkins University
School of Medicine
Department of Psychiatry and
Behavioral Science
Baltimore, MD 21205

Dr. John P. French, Jr.
University of Michigan
Institute for Social Research
P.O. Box 1248
Ann Arbor, MI 48106

Dr. Paul S. Goodman
Graduate School of Industrial
Administration
Carnegie-Mellon University
Pittsburgh, PA 15213

P4-5/B3

LIST 15 (Continued)

452:KD:716:enj

78u452-883

24 June 1981

Dr. J. Richard Hackman
School of Organization
and Management
Box 1A, Yale University
New Haven, CT 06520

Dr. Lawrence R. James
School of Psychology
Georgia Institute of
Technology
Atlanta, GA 30332

Dr. Allan Jones
Naval Health Research Center
San Diego, CA 92152

Dr. Frank J. Landy
The Pennsylvania State University
Department of Psychology
417 Bruce V. Moore Building
University Park, PA 16802

Dr. Bibb Latane
The Ohio State University
Department of Psychology
404 B West 17th Street
Columbus, OH 43210

Dr. Edward E. Lawler
University of Southern California
Graduate School of Business
Administration
Los Angeles, CA 90007

Dr. Edwin A. Locke
College of Business and Management
University of Maryland
College Park, MD 20742

Dr. Fred Luthans
Regents Professor of Management
University of Nebraska - Lincoln
Lincoln, NB 68588

P4-5/B4

LIST 15 (Continued)

452:KD:716:enj

78u452-883

24 June 1981

Dr. R. R. Mackie
Human Factors Research
Santa Barbara Research Park
6780 Corton Drive
Goleta, CA 93017

Dr. William H. Mobley
College of Business Administration
Texas A&M University
College Station, TX 77843

Dr. Thomas M. Ostrom
The Ohio State University
Department of Psychology
116E Stadium
404C West 17th Avenue
Columbus, OH 43210

Dr. William G. Ouchi
University of California, Los
Angeles
Graduate School of Management
Los Angeles, CA 90024

Dr. Irwin G. Sarason
University of Washington
Department of Psychology, NI-25
Seattle, WA 98195

Dr. Benjamin Schneider
Department of Psychology
Michigan State University
East Lansing, MI 48824

Dr. Saul B. Sells
Texas Christian University
Institute of Behavioral Research
Drawer C
Fort Worth, TX 76129

Dr. Edgar H. Schein
Massachusetts Institute of
Technology
Sloan School of Management
Cambridge, MA 02139

P4-5/B5

LIST 15 (Continued)

452:KD:716:enj

78u452-883

24 June 1981

Dr. H. Wallace Sinaiko
Program Director, Manpower Research
and Advisory Services
Smithsonian Institution
801 N. Pitt Street, Suite 120
Alexandria, VA 22314

Dr. Richard M. Steers
Graduate School of Management
University of Oregon
Eugene, OR 97403

Dr. Siegfried Streufert
The Pennsylvania State University
Department of Behavioral Science
Milton S. Hershey Medical Center
Hershey, PA 17033

Dr. James R. Terborg
University of Oregon
West Campus
Department of Management
Eugene, OR 97403

Dr. Harry C. Triandis
Department of Psychology
University of Illinois
Champaign, IL 61820

Dr. Howard M. Weiss
Purdue University
Department of Psychological
Sciences
West Lafayette, IN 47907

Dr. Philip G. Zimbardo
Stanford University
Department of Psychology
Stanford, CA 94305