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# NAVAL POSTGRADUATE SCHOOL

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An Approach to Reduce Skill Loss of the Unrestricted  
Line Officer in the Venezuelan Navy

by

Mirko Markov Mikas

March 1982

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An Approach to Reduce Skill Loss of the Unrestricted  
Line Officer in the Venezuelan Navy

by

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Submitted in partial fulfillment of the  
requirements for the degree of

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## ABSTRACT

The readiness of the Venezuelan Navy relies in part on the skills of its personnel. The Unrestricted Line Officer (URL) is most frequently transferred to nonrelated billets which exposes him to skill loss. This thesis (1) reviews the literature in the area related to skill loss, (2) examines the billet assignment procedure in the Venezuelan Navy, and (3) proposes potential solutions to reduce the skill loss of the Unrestricted Line Officer.

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## I. INTRODUCTION

A large portion of the budget of any corporation or institution, civilian or military, is spent in training and personnel development programs. The reasons organizations are forced to make this investment are numerous, with perhaps the strongest motivation resulting from the impact of an increasingly complex and sophisticated technology on human performance. The dynamic nature of technology has created a situation wherein workers and managers must continually strive to update skills of the work force. Failure to keep up with technological advances frequently will result in "skill obsolescence". What may be considered innovative today most likely will be considered antiquated in a few years.

Lukasiewics [Ref. 1], in his study of the engineering profession, stated that the useful productive life of an engineer after graduation is only five years unless adequate retraining is provided. Associated with this notion of obsolescence is the shift from the situation wherein the need is for unskilled labor to a situation where a highly skilled or multi-skilled labor force is required. Further, occupational mobility also can contribute to skill loss, both between and within skills. Taylor [Ref. 2] indicated that members of the American labor force change jobs on the average of every three to five years. This vast occupational mobility can prove to be an asset if properly channeled via appropriate retraining practices, or an unmanageable liability if left unattended. Civilian careers involve limited changes of occupation, but more frequent changes of job and employer. In contrast, in military careers there are less frequent changes of employer, but frequent changes of jobs, and some changes of occupations [Stewart, ref. 3].

Retraining has been adopted as the panacea for worker obsolescence and skill loss. It is not, however, the only resource for skill maintenance and rehabilitation. Rather than using retraining almost exclusively to teach new skills, it is necessary to emphasize its use in retaining the previously learned skills, and to upgrade those skills necessary to keep workers abreast of changing requirements in their respective fields.

The Venezuelan Navy represents an excellent example of a situation where rapidly expanding technology combined with between job mobility can result in skill obsolescence, or even skill loss. The goal of this thesis is to examine the questions related to skill loss and/or skill obsolescence of the Venezuelan Navy Unrestricted Line Officer (URL) and analyze conditions which may promote skill degradation. Further, based on the findings, an attempt will be made to suggest methods for reducing skill degradation.

#### A. DEFINITIONS

An initial understanding of the need to train must begin with a definition of terms basic to the general area of training. These definitions also will be used as descriptors and indicators for the course this study intends to pursue.

Learning theory has evolved gradually along with man, and is an internal process in which the individual assimilates incoming stimuli and produces relatively permanent changes in behavior. Training is one process which can bring about learning. Training processes include the material to be learned, the method used to facilitate learning, and the evaluation of the learning process. The following terms are defined for the purpose of this study.

## 1. Skill

Skill has been defined in as many ways as there are sources. Therefore it is necessary to discuss this term and define it specifically as used in this study. One source is the Oxford New English Dictionary whose definition reads: "Knowledge of the means or methods of accomplishing a task. The ability to use one's knowledge effectively and readily in execution of performance: technical expertness." Another is "ease, rapidity, and precision (usually) of muscular action", found in the Dictionary of Psychology [Drever, Ref. 4]. A perhaps more useful definition was presented by Guthrie [Ref. 5]: "Skill consists in the ability to bring about some end result with maximum certainty and minimum outlay of energy and time." In the context of this study, the term skill needs to reflect not only a manual dexterity, but also intellectual processes. Salvendy and Seymour [Ref. 6] break these specialized abilities into four areas:

- a. Sensory reception of stimuli.
- b. Mental perception and organization of information necessary to perform the task.
- c. Cognitive decisionmaking to organize the proper response.
- d. The response involving motor actions.

The capacity to perform a given skill, consequently constitutes the combination of these stages into one operation. Several skills may be required to complete a single task, and several tasks may be required to perform a specific job. Therefore, a skill is strongly related to performance as defined by "how well an individual accomplishes his job".

To conclude, skill used in the context of this study reflects the individual's capacity to perform a task required by the job.

## 2. Nonutilization

Applied to an already learned and effectively employed skill, the term nonutilization will be used to express a period of disuse of that skill. During this period the skill (or skills) are not practiced. The term nonutilization generally refers to an extended period of time. For the present purpose, an extended period of time is a period of more than one year. These nonutilization periods may be caused by voluntary or involuntary actions such as extended periods of schooling, change of employer, promotion, or reassignment.

## 3. Skill loss

The condition resulting from nonutilization of an already learned skill is called skill loss. This definition refers only to the decline of proficiency in performing the skill, and this skill loss has an inverse connotation of skill retention. Naylor and Briggs [Ref. 7] have classified the variables related to skill loss as discrete and continuous. Learning variables have an important role in skill loss. These may include part or whole task learning approaches, and refer to the methods employed for the original learning. They also include the amount of training provided, and one of the most important variables is the length of the retention period. Recall variables such as environmental and mental conditions also are considered important for skill loss. The effect of the above mentioned variables determines the degree of skill loss.

#### 4. Skill Obsolescence

There is no universally accepted definition of skill obsolescence. Many approaches have been made and they are complementary to one another. To clarify the situation, let us first mention the factors which cause obsolescence.

The effect of technology rate of change is the easiest to notice within the modern work force. For example, at the turn of the century, life of professional education had a useful duration of 10-20 years. However, at present, professional education becomes outdated within a period of roughly five years [Rosenstein, Ref. 8]. Another important facet of obsolescence is multidimensional, and the separation line between competence and obsolescence is not clear. A person may show varying degrees of obsolescence in different situations, however it is rare for a person to be obsolete in all job-related characteristics simultaneously. A very complete description of obsolescence follows:

"Degree of obsolescence must always be a function of new knowledge and new techniques. Many fields of science and engineering are changing rapidly with the discovery of new facts, theories, viewpoints, and techniques; the rates of change vary both among fields and among their sub-specialties. There is also the important matter of which new development or new technique is relevant to a particular person's work. Not all changes affect all persons, and the impact varies in kind and degree for all those who are affected." [NSF, Ref. 9]

A definition of skill obsolescence that fits this study's purpose is the following: The failure of the once capable person to perform the skill to satisfy currently expected requirements or standards.

#### 5. Retraining

As stated earlier, retraining in the civilian employment sector refers mainly to teaching a new skill. The healthy economy relocates,

retrains, and reemploys workers frequently, as mentioned at the beginning of this study. This method is contrary to the one desired in this study due to the differences between civilian and military employer's manpower management. In keeping with the sequence for the definition of terms presented previously, retraining denotes a period of relearning following skill loss. Generally in the military, individuals are trained in the skill area required when accepting a new assignment, or when new equipment is received. If, for any reason, a period of nonutilization of a particular skill occurs, a period of retraining is required to reestablish the skill and alleviate the skill loss. Thus, in this study, retraining will not refer to learning a new skill; instead it will refer to relearning a previously learned skill.

#### B. FACTORS THAT AFFECT SKILLS

There are numerous factors that affect skills, and also numerous ways to classify them. For the purpose of this study, the author has adopted the classification scheme of C. Mazie Knerr, et. al. [Ref. 10]. The following are the factors and their effect on individual's skill retention:

<u>Factor</u>	<u>Hypothesized effect</u>
Original Learning	<ol style="list-style-type: none"> <li>1. The better the original learning, the greater the retention.</li> <li>2. The absolute loss of performance is not affected by amount of original learning; decay functions for different levels of original learning are parallel.</li> </ol>
Retention Interval	<ol style="list-style-type: none"> <li>1. Retention decreases with time.</li> <li>2. Interference (habits, activities</li> </ol>

both before and after original learning) decreases retention.

3. Practice or rehearsal increases retention.

#### Recall and Transfer

1. Increased similarity between the transfer task and the original task increases retention.

2. Similarity of task trained to the job increases amount of original learning.

#### Task

1. Continuous control tasks show superior retention (months/years) to discrete procedural tasks (days/weeks).

2. Degree of task organization increases original learning.

### C. TEMPORAL FACTORS IN SKILL RETENTION

In an extensive literature review, Johnson [Ref. 11] concluded:

"Although statistically significant experimental results lead to more secure conclusions, what the scientific community knows about retention is about the same as what the 'man of the street' knows; we can't remember what we didn't learn and we forget over time."

This conclusion is in some sense discouraging, but on the other hand, interesting findings about retention in general, and the effect of time in particular have been observed in other studies like the one by Knerr and associates. In their report, the authors found that many studies conclude in the common point that procedural tasks result in less retention over time than continuous motor tasks. Other variables that influence the time of retention are the individual's method of

recalling information. These findings and others which may arise give us hope and encouragement that future research will discover relationships in the area of skill retention.

#### D. NEED TO DIMINISH SKILL LOSS/SKILL OBSOLESCENCE

The need to diminish skill loss/obsolescence is obvious. To the extent an individual loses his skills his performance decreases, and as a consequence, the organization to which he is assigned is negatively affected. The higher the individual's position, the greater is the loss assessed. On the other hand, if this individual is one among many available, the loss may be acceptable to the institution. In the case where he is the only one with the specific skill, or in situations where people in possession of the skill are limited, any degree of skill loss may be unacceptable. In such a situation it is important to determine the best methods available for minimizing skill loss and updating skills.

This is the case of the Unrestricted Line Officer in the Venezuelan Navy. He is in short supply, and demand is continually increasing as a result of the Navy's expansion. Therefore, the retention and updating of the skills of the ULO is vital for the operative branch of the Navy, and it is worth the effort to find possible ways to maintain skills thereby minimizing overall performance degradation.

## II. INFORMATIONAL SOURCES

### A. SCOPE

The present effort has concentrated on information necessary to cover the field related to skills needed by the Navy, and particularly procedural job-oriented skills and their deterioration. Moreover, the greatest effort has been directed toward skill deterioration due to nonutilization because of the frequent mobility of people within the Navy. Although the final goal is to find alternatives to reduce skill loss in the Venezuelan Navy, information used in the present effort has been limited to data collected in the United States. It is important, therefore, to point out that the possible solutions may not always be directly applicable to the Venezuelan Navy. Generalizations can be dangerous, and caution is required in any attempt to transfer solutions from one place to another. However, the basic rules should at least be applicable. The objective is to suggest what should be done to reduce the skill loss due to nonutilization and the frequent mobility of the Navy personnel.

### B. LITERATURE REVIEW

Human performance is at least partially a result of the amalgamation of the components defined and described in the preceding chapter. This ultimately contributes to system performance. Hence, as mentioned above, this literature review was conducted to find what has been done, and what is left to be considered in relation to skill loss. To do that, the factors that contribute to human performance cannot be

considered in isolation; instead, they have to be studied as components of a whole.

Numerous research efforts have been related to skill. Naylor and Briggs [Ref. 7] performed a review which is of particular interest for the present effort. This was the first effort related to long term skill retention relevant to military tasks. Most of the recent reviews are consequences of this initial study. The Naylor and Briggs effort consisted of a comprehensive review of classical literature on long term skill retention. It is useful as a background for the understanding of retention. The literature was discussed in terms of tasks, original learning conditions, retention conditions, and recall conditions. The following is a summary of the results of this literature review:

1. Motor tasks are retained better than verbal tasks, and continuous tasks are retained better than discrete procedural tasks.
2. Retention is a direct function of the quality and amount of original learning.
3. Skill is lost over time and is retained in proportion to rehearsal.
4. Retention is directly related to the replication of the skill and warmup before tests favors retention.

One of the more recent studies by Prophet [Ref. 12], although restricted to flying skills, has to be considered in the present study because of its broad and detailed coverage of retention. Prophet's report includes the following:

1. Flight skill retention studies.
2. Non-flight retention studies
3. Miscellaneous aviation studies.

4. Literature review references.
5. General retention factors.
6. Task or skill factors.
7. Retraining factors.

The most important findings from this study related to the present effort are the evidences that the passage of time by itself is not the only variable that produces skill loss. In addition, habit or activity interference during the retention interval also contributes to skill loss.

Gardlin and Sitterley [Ref. 13] as well as Prophet emphasized the lack of a quantitative performance measure to establish skill loss, and they suggest that any such measure should be applied operationally, on the field, rather than in an artificial laboratory environment.

Given that we are interested in material related to URL's skills, interesting conclusions were found in Welford [Ref. 14] where the author analyzed mental skills. Welford stated that "all skilled performance in one sense or another is mental in the sense that perception, decision, knowledge, and judgment are required". He also stated that all skills require a coordinated activity.

There are many factors involved in the performance of a skill, and one which is vital to the decisionmaking process is feedback. Feedback provides the link between input and output, and consequently is the source of vital information for corrections and adjustments. Another important statement by Welford is that "the study of skills in its various forms has not led to the formation of any all-embracing grand theory." Instead, the author linked the many small theories into a more coherent structure and summarized them as follows:

1. It has been clearly recognized that sophisticated self-regulating machines can carry out many operations closely analogous to those performed by human beings, and that in turn it is an important aid to clear thinking about human behavior to consider the type of machine that would have characteristics similar to the human.

2. Substantial progress has been made toward a psychology which is truly quantitative, and thus toward the removal of what previously had been a serious deficiency.

3. This quantitative emphasis has given fresh impetus to the detailed analysis of the various mechanisms which go to make up the sensory-motor chain.

4. Finally, there has been a much fuller recognition than ever before that performance cannot be adequately studied in terms of discrete, isolated reactions.

In many experiments it has been found that continuous motor tasks result in better retention than procedural tasks. Fleichman and Parker [Ref. 15] observed that complex continuous tasks are retained for at least 24 months. Adams [Ref. 16] stated that procedural tasks are very poorly retained. One effective method to improve retention has been found to be rehearsal of the task during the retention period [Brown, Briggs, and Naylor, Ref. 17].

Another extensive literature review, this time centered on perceptual-motor skills was conducted by Annett [Ref. 13]. This review included over 120 items beginning with Effinghaus (1885), up to and including the mid-1970's. Annett found that most of the studies were concerned with artificial laboratory tasks using students or servicemen. However, the

few studies using real tasks supported the laboratory findings. The most important finding was the "lack of a method for comparing performance and retention on different types of tasks, and the lack of a generally agreed upon method of classifying real life and laboratory tasks". A summary of the findings follows:

1. Well-learned skills are generally well-retained over periods of a year or more without practice.
2. The generalization that motor skills are better retained than verbal knowledge cannot be supported due to methodological difficulties of comparing unlike tasks using different performance indices.
3. Procedures such as emergency drills seem particularly sensitive to skill loss through disuse. More coherent or integrated tasks appear to be better retained. However, little is known about the characteristics of tasks which favor retention.
4. Different training methods have not been shown unequivocally to result in different degrees of retention. More research is needed on the relationship between new training methods and retention.
5. Activities in the layoff period can either facilitate or interfere with retention, but little is known about the effects of unemployment or unrelated employment on skill retention.
6. A deteriorated skill is readily relearned in a fraction of original learning time. Skills also may be refreshed by rehearsal.
7. Retention is generally a function of the degree of original learning; the better the original learning, the better the retention. However, overlearning yields diminishing returns.
8. There are problems in exercise of skill after a long no-practice

period. Recalling an unpracticed skill may be stressful, and retention may be affected by stress. Some tasks seem to benefit from a rest, others from a warmup.

9. Task-specific and general individual ability probably affect retention, but there is little evidence relating age to skill loss. Further work on the effects of ability and age on skill loss and retention are needed.

Both Annett (1977) and Prophet (1976) agree that "there is no generally valid curve of retention, no single function relating degree of retention to the duration of the retention interval". They found that different measures of retention are not correlated, and said that probably the shapes of the curves depended on the nature of the task.

The closest study related to our area of interest was found in a report made by Arima and Neil [Ref. 19]. Although the authors dealt with enlisted personnel, they included the area of skill deterioration due to assignments outside the performer's specialty. The authors examined the problems of quantifying the expected skill loss due to nonutilization. They found that the existing independent programs for skill acquisition/retention often are directed toward developing skills for the same tasks. They are isolated and designed to serve immediate needs. There is no appropriate coordination between programs that deal with activities and functions for individuals of the same occupational category. Finally, recommendations are provided in the form of long term management of the problem which consists of an aggregated model of the manpower/personnel system. Also short term management of the problem is suggested in the form of a scheme of determining skill deterioration.

The assumption in the paper by Arima and Neil is that the necessary skills are lost as a result of disuse. A more appropriate contribution for the Venezuelan Navy URL is to attempt to ensure that the officer maintains necessary skills, thereby eliminating the need for the type of program suggested by Arima and Neil.

It is well-known that training is an effective alternative to avoid or to compensate for skill loss. An extensive study about training strategies was conducted by Johnson [Ref. 12]. He performed a thorough literature search including the period 1860-1977. The author was interested mostly in initial training, but in addition he found support for recent theories that "different individuals utilize different means of encoding and storing information". The large span of time covered in Johnson's investigation brought to surface other important findings which are contained in Table 1, e.g.:

1. The relationship between cognitive styles and the effectiveness of different training strategies.
2. Training devices' characteristics and training effectiveness.
3. Capabilities of humans to learn and retain skills, and to transfer skills from one task to another.

#### C. SUMMARY

Most of the research effort in this area has been done in relation to acquisition of new skills rather than to retention of already acquired skills. While little research has been done on the prevention of skill loss, the emphasis has been on recovering what has been lost by means of retraining. The absence of quantitative measures makes it difficult to evaluate the effectiveness of retraining, or any other solution

adopted, to diminish skill loss. Layoff time by itself does not appear to contribute to skill loss; in some cases, it may even facilitate skill retention. Nothing was found which directly related to URL's skills. Extensive work has been done related to flight skill retention--the reason for which is unclear. However, it can be hypothesized that the consequences of skill losses are somewhat less visible in the URL in comparison to aviation.

A summary of the results from the literature review is provided in Table 1, which follows:

TABLE 1: SUMMARY OF FACTORS THAT AFFECT SKILL RETENTION

<u>Summary of Findings</u>	<u>Author</u>
Task Variables:	Naylor and Briggs
--Continuous control skills are better retained than discrete procedural tasks.*	" "
--The greater the task integration the better the retention.	" "
Retention as a Function of Original Learning:	" "
--Retention is directly proportional to amount of original learning.	" "
--Verbal practice of a motor skill during acquisition results in better retention than no practice, but in poorer retention than actual task practice.	" "
--Whole task learning may lead to better retention than part task learning, especially for more complex tasks.	" "
Conditions During Retention Period:	" "
--Skill losses occur over time. The retention varies in each situation.	" "

Summary of Findings

Author

--Rehearsal facilitates skill retention.

Naylor and Briggs

--The higher the fidelity of the rehearsal task the more beneficial the rehearsal and the longer the retention.

" "

Recall Conditions:

" "

--Retention is directly related to the degree to which the operational environment was duplicated during original learning.

" "

--Warmup activity prior to retest facilitates retention.

" "

--Individuals vary in their preferred modes of processing information, and these modes can be referred to as cognitive styles. Retention is longer if the training matches the individual's cognitive styles.

" "  
& Johnson

--Mental imagery plays a role in learning and retention, and that it appears to be one means of encoding and/or storing information in memory.

"

--Training devices for the retention of procedural tasks need not be of high fidelity, indicating that the human can replace the cueing and feedback usually presented by such devices.

"

--Well-learned skills are generally well-retained over periods of a year or more without practice.

Annett

--Activities in the layoff period can either facilitate or interfere with retention.

"

--A deteriorated skill is relearned in some fraction of original learning time.

"

--There is little evidence relating skill loss to age.

"

--There are problems in the exercise of skill after a long no-practice period.

"

Summary of Findings

Author

--Recalling an unpracticed skill may be stressful, and retention may be affected by stress. Some tasks seem to benefit from a rest, and others from a warmup.

Annett

General Retention Factors:

Prophet

--Initial level of learning is the single most important factor in determining the absolute level of performance after periods of no-practice.

"

--Perceptual-motor skills deteriorate as a result of non-practice, but are retained for extended periods of time, and easily reinstated through retraining.

"

--Forgetting or performance decrement results from activity during the retention interval rather than the passage of time, per se.

"

--Rehearsal has shown to be beneficial for skill retention, even when involving simple representations of task elements.

"

Task/Skill Factors:

"

--If tasks are organized, there are no differences in learning and retention of procedural tasks and continuous control tasks; otherwise, the latter are less deteriorated and better retained.\*

"

--Instrumental control skill (IFR flying) with its heavy procedural task loading experience higher degradation than contact tasks with external visual and tractile cues.

"

\*These two aspects seem to be contradictory; task organization makes the difference.

### III. THE MODEL

The objective of the current effort was to examine methods designed to minimize the degree of skill loss in the Venezuelan Navy URL. Thus far, general considerations about skill loss and/or related topics have been examined. To apply what is known about skill loss to the Venezuelan Navy URL, it is necessary to analyze career patterns and performance requirements in that specialty. Once analyzed it will be possible to draw conclusions and make recommendations about what is necessary to reduce the potential for skill loss of the Venezuelan Navy URL.

The URL's career can be conveniently divided into three phases: basic, intermediate, and advanced. The first stage begins with the officer's commissioning, and continues until he reaches the grade of Lieutenant. During this time his career will concentrate on warfare qualifications and fundamental operational experience. Assignments will include operational billets primarily, with little job diversity.

The intermediate phase extends up to, and including the mid-grade of Commander. In this career stage, activities are directed toward qualifications for command at sea, with increased opportunity for non-naval billets. It is in this stage that the officer first encounters the possibility of skill loss due to nonutilization.

In the last phase, up to the grade of Captain, the officer sets command at sea as the ultimate goal. In contradiction to this goal, and due to the Navy's organization and service requirements, the opportunity for non-naval billets represents a major source of potential skill loss/degradation.

Admittedly, any change of job offers the potential for some degree of skill loss. However, if there are similarities between jobs, the loss is less severe. Therefore, the URL function can be characterized as unique and dynamic. This condition makes it difficult for an individual URL to develop competence in his work, and increases the potential for future performance degradation.

One potential method for reducing skill loss would be some degree of specialization, not necessarily technical, to aid in the maintenance of positive job attitude which will produce motivation, and hopefully, will improve overall performance. The tendency, however, is to use the URL to fill in different and unrelated billets. Frequently the job assigned does not seem to be considered important by the URL's superiors. This creates a potential morale problem, and should be eliminated. This morale problem, combined with the difficulty to develop pride in the job, is not easily quantified, but is widely acknowledged. It can be postulated that the overall effect is a reduction in the readiness of the Navy.

This thesis addresses the problem of skill loss in the Venezuelan Navy URL, and in the following sections, it will describe the assignment procedures.

#### A. REASONS TO TRANSFER

Due to the wide range of specialties, the URL is exposed to more occupational mobility than officers with other more limited specialties. They are expected to be Jacks-of-all-trades. They are transferred more frequently. The specific reasons for job transfers include:

1. Promotion,
2. Career pattern requirements,
3. Necessity to fill a nonrelated billet,
4. Training/Education,
5. Officer's Request,
6. Other (health, personal, legal, etc.).

As a reason for transfer, an individual's promotion is characteristic of the military because of its hierarchical organization. If someone is working in a billet specified for a determined rank, and is then promoted, his transfer is frequently imperative, and he should not be denied the promotion just to keep him at his current job. The career pattern related transfer originated in compliance with the pre-established needs of the service. That is, the officer is supposed to serve a tour ashore, followed by sea duty. When the necessity to fill in a more vital billet surfaces, another reason to transfer is encountered.

Another very common and frequent source of job mobility in the military is the assignment of the individual to a training/education billet. There are other reasons to transfer, i.e., (1) own request, for which the officer qualifies after six months of service on the specific job, and (2) health or legal reasons, for which it is convenient to have the individual in or close to some specific location.

### 3. AUTHORITIES INVOLVED

Once the need to transfer a URL is formulated, no matter what the reason, there are two authorities directly involved in the process. One is the Director of Naval Personnel (DNP) (Director del Departamento de

Oficiales), and the other is the Chief of Education (CE) (Jefe de Educacion de la Armada). The former is in charge of the movement per se while the latter is in charge of the preparation of the individual for a specific billet.

The DNP has all the information available about potential candidates for a given job. The main source of work history information is the Officer Data Form, which includes considerable information about the individual. The form contains the "Previous Billets", "Current Billet", and the individual's specialty.

For some billets, good job descriptions and specifications of tasks to be performed are available in regulations or in manuals such as the Manual de Organizacion de los Bugues Tipo (Ship's Organization and Regulations Manual). In other cases, job and task descriptions are not available other than a brief job title, which makes personnel selection more difficult. Once the decision about which tasks are to be performed is made, this authority selects the individual who fullfills most of the requirements for the job. In a case where no individual has all the skills assumed to be necessary, the DNP asks the CE about the availability of courses necessary to train the designated officer to fullfill the requirements for the job. If it is not feasible to train the individual before he is transferred, it reflects negatively on his performance on the job, and on-the-job training is implemented.

### C. SKILL ANALYSIS

To establish the degree of skill loss it is necessary to make use of human performance evaluation procedures. Such an evaluation requires the development of a skills inventory which is obtained through a skill

analysis. Skill analysis is complex and difficult to accomplish. For example, it took years of study by behavioral scientists to develop training requirements on the sonar target classification tasks [Smith et. al., Ref. 20]. It should not be expected that highly qualified personnel will be able to train others in complex skills without a previous skill analysis. Highly qualified personnel bring not only their skills to the training situation, but also their biases and assumptions. A thorough skill analysis is required to identify those skills necessary for satisfactory task performance. Once identified, a skill inventory is completed, and training is based upon identified requirements. Even if accomplishing this inventory is very detailed, on-the-job training always is required to guarantee a full transfer of the training, which is the ultimate reason for the performance of a skill analysis. After a skill analysis is performed, the Navy can: (1) better identify the URL whose skill and experience best matches the skill required, and (2) identify areas in which training is required.

#### D. PRE-TRANSFER TRAINING

On-the-job training is a useful tool as the final step of any training process. Even if the formal training process is well-designed, on-the-job training will occur when the individual arrives at the job. It is desirable to reduce this training to a minimum, because in most cases, low performance on the job represents a loss for the system as a whole.

To reduce this phase to a minimum, and therefore prepare the individual for the job in a more efficient way, another more convenient kind of training is available, pre-transfer training. This training is

universally applicable although here it is considered as a potential method to recover the skills lost during a period of non-practice.

Frequently the Navy prepares the URL for the assignment of the individual to probable jobs, in a general way, (e.g., basic, intermediate, and advanced courses). Considerable expenditure of money and time is made in general preparation. However, pre-transfer training in most cases could be accomplished with less money and time expenditure if a skill analysis had been performed. Unfortunately this resource is not always used.

This situation presents a conflict between the two major philosophies in the Navy, the traditionalists and the specialists. The first advocate the traditional generalist officer, while the latter believe that the specialist can best fulfill the Navy's requirements. Graduate education represents an "in between" position because it strengthens the officer's warfare specialties and increases his usefulness ashore and at sea. An officer with a solid background gained in graduate studies is more easily trained to any billet assignment by means of pre-transfer training.

#### E. DECISION TO TRANSFER

This decision is taken by the DNP, however the information available to him regarding skill requirements is minimal. Unless the DNP has had experience as an URL, and has served in similar jobs, the decision is completely subjective. Even if the DNP has had similar experience, a job with the same title could have undergone technology changes. Unfortunately this decision, which is essential for the officer's career, cannot always be based on objective information due to the lack of an adequate skill analysis.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

As a result of the generalist orientation of the URL, the requirement for trained/skilled officers represents a significant problem. At present the majority of billets in the Venezuelan Navy require educationally qualified URL's. Further, as a result of technological expansion in naval systems, the task of maintaining and updating skills is increasingly time consuming and costly.

Manpower influences the Navy's readiness in different ways; among those perhaps most noticeable are skill obsolescence and skill loss. The first is mostly a consequence of the rate of technological changes, and affects the individual's performance by itself, without external influence. The latter, which is the core of this thesis, is the consequence of the various factors discussed in the preceding chapters. Skill loss is critical because the Navy's readiness is ultimately based on human resources, as well as the material inventories.

Navy personnel managers control the variables that intervene in the skill loss process. Therefore, they must make decisions and execute the actions required to avoid or diminish skill loss. In the present effort, an attempt was made to find ways and methods of reducing skill loss. The approach consisted of an examination of literature in several interrelated areas including selection, training, and experience, as well as literature on skills and skills research. Skill loss cannot be examined as an isolated subject. The literature sources are rich in material related to skill retention, which is the inverse of skill loss, and the conclusions are based on these sources. The information

obtained can be properly adapted for use in the case of the skills required by the URL, however it is necessary to analyze each particular case and apply the appropriate principles. If he has not already done so, the reader should familiarize himself with the review of literature contained in Chapter II.

While extensive studies have been done in the area of skill loss/retention, the state of the art in preserving and updating skills is in its infancy. However, even this minimal knowledge is not applied as frequently as it should be to reduce the skill loss in the Venezuelan Navy URL. Most of the time, lost skills are recovered by means of retraining. However, before the deficiency is noted, preventive actions rarely are adopted.

Two approaches are suggested to diminish the skill loss in the Venezuelan Navy URL: personnel management, and training. The following steps are recommended to achieve the objective: (1) For personnel management,

- develop and utilize skill inventories,
- reduce potential billets for the URL,
- assign personnel only to URL related billets, and,
- assess URL performance,

and (2) for training,

- emphasize the initial training, and,
- emphasize pre-transfer training.

Two of the suggested solutions could be classified as short term solutions (the reduction of potential billets, and the assignment to non-related billets); while the others are considered long term solutions.

The solutions associated with personnel management are the responsibility of the DNP, while those associated with training are the responsibility of the CE. Each of the proposed solutions are examined in detail in the following discussion.

A. FOR PERSONNEL MANAGEMENT

1. Develop and Utilize Skill Inventories

At present, information about the tasks and skills needed for each billet is not appropriate or is nonexistent, and in other cases, it is not available in a convenient form for personnel managers use. Emphasis in initial training and performance assessment are driven by an appropriate skill inventory. Therefore, this step must be accomplished before any of the long term solutions can be determined. To compile this skill inventory, the Instructional System Development (ISD) [Ref. 21] procedures are recommended. The CE is the primary agent responsible for conducting the skill inventory, but some of the information can be provided by the DNP.

The elaboration of this skill inventory has to begin with a selection of tasks/functions. Some tasks are seldom performed, therefore the effort to train the URL in the skills necessary to perform those tasks has to be minimal. Other tasks are critical and the training effort has to be directed to the acquisition of the needed skills. Identification of the appropriate tasks to be included in the skill inventory requires the establishment of selection criteria. These criteria have to be based on percentage of time spent performing the task, task criticality, and task learning difficulty.

Having established the criteria, the office of the CE should proceed to collect and consolidate the required data. It is essential that this data be organized and presented in a usable format. At this point, the information provided by the DNP also is used. With the data in hand, the CE is ready to select the tasks for training based on:

- a. duties, tasks, and elements that make up the job,
- b. analysis of data collected from individuals who are familiar with the job, and an
- c. understanding of when and under what conditions the training is appropriate.

## 2. Reduce Potential Billets for the URL

To improve the URL's performance on the job, a selective reduction in the type of potential billets for the officer is recommended. This would result in increased specialization, and therefore facilitate the individual's familiarity with the job. This procedure should reduce the potential for skill loss. It also would provide the individual URL with a greater opportunity to develop pride in his job, and result in a boost of morale and an overall performance improvement. This short run solution may be applied by the DNP.

## 3. Assign Personnel Only to URL Related Billets

A better way to utilize the URL's skills is to assign the officer to related billets. While the list of potential billets may be extensive, it is possible to maintain certain personnel in a sort of subdivision, and break this rule only in case of extreme necessity. This solution exploits the commonalities that may exist between some jobs. Skill inventories in this case are very helpful. This decision

to maintain the URL within a cluster of assignments is within the DNP control, and may be implemented immediately, assuming a rough position description is available. A skill inventory still should be performed.

#### 4. Assess URL Performance

An indispensable tool to establish the existence of skill loss is the Job Performance Measure (JPM). This JPM is used for writing the learning objectives, and testing job performance. It has to be validated on actual job sites, or verified by experts. To develop the JPM, the CE has to consider validity, fidelity, administration cost, and the time it takes to be applied.

### 3. FOR TRAINING

#### 1. Emphasize the Initial Training

The level and amount of initial training have great influence on skill retention and on skill loss. Therefore, initial training has to provide sufficient detail, and has to be administered in the appropriate manner to avoid skill loss. This is particularly essential in the specific case when the URL is assigned to nonrelated billets to retain his skills better. If the initial training was properly taught, after a nonrelated billet assignment, the resulting skill loss will be insignificant. The decision about the level and amount of initial training is made by the CE, based on the skill inventory.

#### 2. Emphasize Pre-transfer Training

Although the best results in relating the URL's skills will, in most cases, be a combination of the suggested solutions, one action which will appear in most combinations is the pre-transfer training.

This type of training is tailored specifically for each case, although commonalities should be exploited. Obviously the commonalities are not included in the training; they are considered in planning.

Other solutions may arise. In the future, they must be included if optimum skills of the URL officer of the Venezuelan Navy are to be preserved.

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