



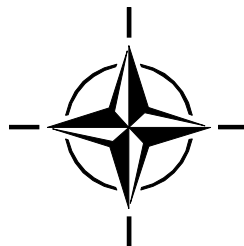
RTO TECHNICAL REPORT

TR-HFM-171

# Psychological and Physiological Selection of Military Special Operations Forces Personnel

(Sélection psychologique et physiologique des  
militaires des forces d'opérations spéciales)

Final Report of Task Group HFM-171.



Published October 2012





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## Foreword

This document represents the deliberations and final product of Research Technical Group (RTG) – 171: “Psychological and Physiological Selection of Military Special Operations Forces Personnel”. As explained more fully in the Executive Summary, the overall objective of this RTG was to set guidelines to improve personnel selection processes for Special Operations Forces (SOF) personnel. These guidelines are derived from best practices and evidence-based research, including both psychological and physiological elements and their interaction. This report summarizes our efforts toward meeting this objective.

The successful completion of a Research Technical Group is typically attributed to the significant contribution of a number of personnel, and this final compilation is no exception. Without the efforts, commitment, and resourcefulness of all members of RTG-171, the preparation of this final report would not have been possible. We are truly indebted to all members of RTG-171 for their participation, and for their contribution to this final product. A special thank you is also extended to the Nations who graciously offered to host our meetings, and to our guest speakers.

Amber Vos  
Co-Chair RTG-171  
Netherlands

Esther Beezemer  
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## **AUSTRIA**

Captain Dr. Günther Eisinger  
Presentation: 'Approach to Selection of Special Forces Personnel'

## **BELGIUM**

Commandant (Cdt) John Taverniers  
Presentation: 'SF HR Support Program'

## **GERMANY**

Professor Dr. Harald Schaub  
Presentation: 'Modelling for Personnel Assessment'

## **NETHERLANDS**

Dr. Gerard Rietjens  
Presentation: 'Physical Demands SOF'

## **UNITED STATES**

Dr. Harris Lieberman, USARIEM  
Presentation: 'Cognitive Function during Stressful Military Training'

Lieutenant-Colonel Tony Littrell  
Presentation: 'Overview of USASOC'

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# Psychological and Physiological Selection of Military Special Operations Forces Personnel

(RTO-TR-HFM-171)

## Executive Summary

The operational deployments of NATO **Special Operations Forces (SOF)** demand a high level of performance in counter-terrorism and asymmetrical warfare. This requires SOF personnel to be extremely fit *both mentally and physically*. NATO member countries have each developed methods to ensure SOF units attract, select and retain the best performers. However, there has been limited sharing of knowledge within NATO regarding the psychological and physiological qualities required of SOF personnel. Each nation has its own selection methods which, to date, remain confidential.

The ultimate objective of this Task Group is to promote the sharing of knowledge of selection methodology, evidence-based research results and best practices in order to improve personnel selection processes. This is done by identifying physical and psychological attributes required to maximize SOF performance and mission success. In addition, the most appropriate ways to measure these attributes are reported.

This report expands on the work of the HFM-107/RTG on Recruitment and Retention of Military Personnel, which was completed in January 2007. All information related to the objectives of this task group is available on the unclassified security clearance level. To this end, the following topics are covered:

- 1) A description of SOF selection procedures in terms of western industrial psychology guidelines. The development of a valid SOF assessment and selection system is documented step-by-step, with an emphasis on job analysis and multiform assessment. This document can be used as a source for NATO countries interested in designing an SOF assessment and selection system or those wishing to strengthen an existing system.
- 2) A review of available research on physical aspects of SF Soldiers selection and physical performance challenges that are presented to SF candidates by NATO countries during selection.
- 3) New trends of research and development in selection testing of SOF operators are reported. For success on the battlefield in the next decade, it is essential to identify the future requisite SOF competencies and the appropriate measurement techniques. While current diagnostic methods are viewed as successful, selection procedures should be as efficient as possible. Personnel selection must be cost-effective, because funds are currently scarce.

# Sélection psychologique et physiologique des militaires des forces d'opérations spéciales

## (RTO-TR-HFM-171)

### Synthèse

Le déploiement opérationnel des **forces d'opérations spéciales (SOF)** exige un niveau de performance élevé en matière de lutte contre le terrorisme et de guerre asymétrique. Cela nécessite que les militaires des SOF possèdent *des aptitudes mentales et physiques* extrêmement développées. Chaque état membre de l'OTAN a mis au point des méthodes visant à garantir que les unités des SOF attirent, sélectionnent et retiennent les meilleurs éléments. On peut toutefois remarquer que le partage du renseignement reste limité au sein de l'OTAN, au regard des qualités psychologiques et physiologiques requises chez les militaires des SOF. Chaque nation possède ainsi ses propres méthodes de sélection qui, à ce jour, demeurent confidentielles.

L'objectif ultime de ce groupe de travail est de promouvoir le partage du renseignement relatif aux méthodologies de sélection, aux résultats de recherche basés sur des données probantes et aux meilleures pratiques, en vue d'améliorer les processus de sélection des personnels. Pour ce faire, il est essentiel d'identifier les aptitudes physiques et psychologiques requises permettant d'optimiser les performances des SOF et le succès des missions. En outre les meilleurs moyens pour mesurer ces aptitudes sont signalés.

Le présent rapport présente les travaux réalisés en complément de ceux fournis par le HFM-107/RTG, achevés en janvier 2007, et relatifs au recrutement et à l'engagement des personnels militaires. Toutes les informations concernant les objectifs de ce groupe de travail sont non classifiées et peuvent être consultées. A cette fin, les tâches suivantes ont été réalisées :

- 1) Description des procédures de sélection des SOF au regard des orientations psychologiques appliquées dans les pays industrialisés occidentaux. Le développement d'une évaluation des SOF et d'un système de sélection valides est documenté pas à pas, et met en avant l'analyse de l'emploi et l'évaluation multiforme. Ce document peut servir de référence aux pays de l'OTAN désireux de concevoir une évaluation et un système de sélection des SOF ou à ceux qui souhaitent renforcer leur système existant.
- 2) Revue des recherches disponibles concernant les aspects physiques de la sélection des soldats des Forces Spéciales (FS) et les défis en termes de performances physiques qui sont présentés aux candidats des FS par les pays de l'OTAN au cours de la sélection.
- 3) Il est fait état de nouvelles tendances de recherche et de développement des tests de sélection des éléments des SOF. En vue d'assurer des succès sur le terrain au cours de la prochaine décennie, il est indispensable d'identifier les futures compétences requises des SOF et les techniques d'évaluation appropriées. Même si les méthodes de diagnostic actuelles sont considérées comme satisfaisantes, les procédures de sélection devront à l'avenir se révéler aussi efficaces que possible. La sélection du personnel doit être rentable, car les financements font actuellement défaut.

## **Chapter 1 – INTRODUCTION**

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### **1.1 HISTORY**

In light of current global issues, NATO receives an increasing number of requests to send troops to unstable regions such as Iraq and Afghanistan. Special Operations Forces (SOF) Units are the ‘force of choice’ for counter-terrorism and asymmetrical warfare. In these multi-national operations, cooperation and trust are essential. However, there is limited sharing of knowledge within NATO regarding the psychological and physiological qualities required of SOF personnel; each Nation has their own selection methods which, to date, remain confidential. Accordingly, a forum is required to allow for the exchange of selection methodology and research results. This will facilitate and optimize the efficient identification and measurement of the attributes required to maximize SOF performance. The ultimate objective of this forum would be to ensure that SOF personnel possess the necessary competencies to achieve mission success.

During the International Military Testing Association meeting in Kingston, Canada, in October 2006, the Dutch delegation proposed inter-NATO cooperation in which research methods and results could be exchanged with respect to the psychological selection of military SOF personnel. Subsequent discussions identified the need to integrate the physiological aspects of personnel selection. Various Nations such as Canada, USA, Belgium, and Germany have identified the requirement to exchange best practices and selection research. The objective is to improve personnel selection processes derived from evidence-based research. This report focuses on the process of selection and expands on the work of the HFM-107/RTG on Recruitment and Retention of Military Personnel, which was completed in January 2007.

### **1.2 DEFINITION**

It appears that on the unclassified level there is no official NATO SOF available. SOF are mentioned and described in various documents that define SOF operationally. The following definitions were found:

- SOFs are versatile and agile military assets capable of providing discreet reconnaissance, surveillance and capacity building to other states’ security forces. They are suited to operating against informally structured, irregular and asymmetric forces, and capable of operating independently or in direct support of either conventional military forces or other government

## INTRODUCTION

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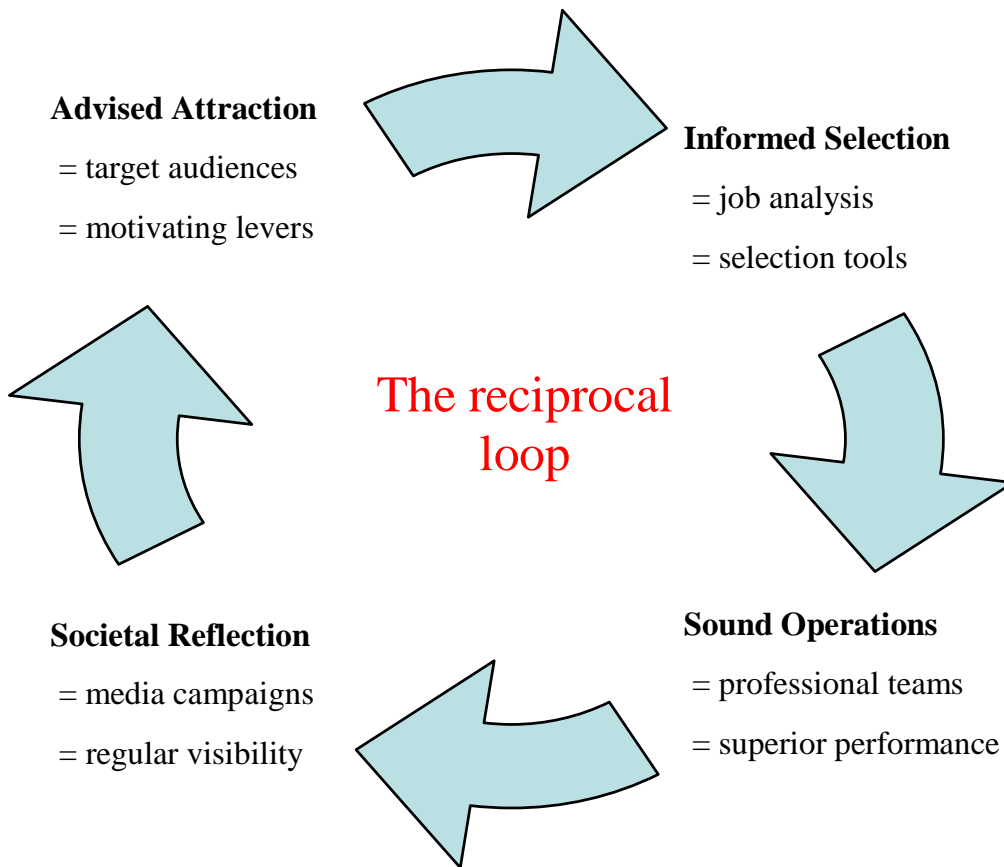
departmental requirements. They are high value assets commanded at the strategic level that deliver effects disproportionately to their size.

- Special Operations Forces (SOFs) are military units with specialized skills, versatility and effectiveness in contemporary conflicts. Operating as small, readily deployable units that capitalize on speed and surprise, they can operate independently or in support of conventional forces. Their unique skills, training and scalable capabilities provide decision-makers with the ability to tailor responses accordingly, given the dynamics of today's international security environment.
- Special Operations Forces (SOFs) is a term used to describe relatively small military units raised and trained for reconnaissance, unconventional warfare and Special Operations.

### 1.3 RECRUITMENT

A properly selected, well-equipped and highly trained SOF is very valuable for the armed forces. With an increasing complexity of SF tasks, the needs for suitable SOF candidates are increasing. Promotion and compensation models, resettlement and transition regulations are not only important attractors of suitable SOF personnel, but also reduce their early attrition. Armed forces around the world are experiencing remarkable budget reductions and, thus, cost-effective marketing campaigns that engage a target audience are becoming increasingly important. Costs for digital, interactive and social media campaigns must be justified against the increased number of applicants. Attention has been given to enhancing the attraction of this job by offering higher incomes, different bonus systems and faster promotion. However, higher salaries and bonuses alone cannot be considered a guarantee of success in attracting personnel. Economic and other social factors are found to affect the recruitment environment over time. Effective SOF recruitment advises and implementation strategies must be identified and monitored on a regular basis in order to react adequately to changes in social and economic environments.

The role of motivation in goal achievement is widely acknowledged. In the SOF selection process, personal motivation can easily overrule candidates' physical preparedness. For cost-effective SOF recruitment, sophisticated selection methods and detailed assessment inventories should not only be considered but advised, to attract an appropriate potentially motivated target audience. There is a reciprocal loop in the SOF personnel recruitment process, including elements of advised attraction (directed to pre-selected audiences), informed selection (multi-form assessment according to job analysis), sound operations (professionalism of teams executing high-priority tasks), and societal reflections (well-timed media shoots and regularly available information) (see Figure 1-1).



**Figure 1-1: The Reciprocal Loop of SOF Recruitment Process.**

A short survey describing types and methods of SOF Force job attractions currently in use was administered among national experts in participating NATO countries. Results revealed that there is a high consensus of ideal candidates with required psychological, cognitive and physical qualities. SOF candidates are expected to be sensation seekers who are open to risky, new experiences, flexible enough to adapt their mindset in an unnatural environment. They must be quick and daring elitists with high morale and a sense of duty motivated by goal achievement. They have to be able to function autonomously and independently with high self-confidence while being good team-members and operating as an integral part of their unit. SOF operators must be in good physical health and strength, and have the outstanding ability to overcome physical pressures with quick recovery. In addition, they must be stable and stress-resistant, able to overcome fears, and endure and maintain cognitive abilities (e.g., attentiveness, reaction speed and accuracy) in persistent, physically and psychologically demanding environments.

Most media means are actively used to attract SOF personnel: newspapers, radio, TV, internet and information brochures. Informal chains of communication (e.g., social circles, friends and relatives) are also used as information providers are mentioned. Countries differ, where some attraction campaigns are conducted only inside of Armed Forces, and some are conducted outside engaging people from civil structures. In the first case, attraction affairs are directed only to military units by info sessions (and pamphlets), static displays and participation offers in national exercises. When civilian?? Population is entrained, the same attraction methods (info sessions, posters and brochures) are used in common areas such as gymnasiums. Briefings are organised including videos and question/answer sessions. In special campaigns, weapons/equipment are introduced and service-related opportunities in SF units are explicitly emphasised.

## INTRODUCTION

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### 1.4 OBJECTIVES

The overall objective of this Task Group (TG) was to set guidelines to improve selection processes for SOF personnel derived from best practises and evidence-based research, including both psychological and physiological elements and their interaction.

To this end, the topics to be covered were as follows:

- 1) The exchange of information regarding national selection methods and instruments. This included the job analyses approaches employed by different countries, selection system design, pre-selection (i.e., prerequisites and screening), selection criteria and methods (e.g., assessment centres, interviews, physical fitness tests).
- 2) The introduction of new methodologies to improve SOF personnel selection, including the use of simulation.
- 3) The identification of SOF competencies required for success on the future battlefield.

All information related to the objectives of this Task Group is available on the unclassified security clearance level.

### 1.5 DATA COLLECTION

The Task Group used several methods of data collection to gather information on the topic of SOF selection. First, the group developed a questionnaire that was designed to cover the SOF selection and attraction topics. This questionnaire (see Annex A) was sent out to all Task Group members and Nations that were not able to attend but were interested in sharing information. Second, relevant literature was collected and reviewed using open sources such as public databases, books and articles concerning SOF (see Annex B). Moreover, guest speakers on related topics were invited. Unfortunately, due to the initial decision to work at the unclassified level, the group was not able to report specific and detailed information on SOF selection.

### 1.6 STRUCTURE OF THE REPORT

The final report is structured as follows. After Chapter 1 – Introduction, an overview is given of the ‘Special Operations Forces Selection: Job Analysis and Multi-form Assessment’ (Chapter 2). This chapter is a source document for NATO personnel interested in designing an SOF assessment and selection system, or for those interested in strengthening an existing system. In Chapter 3, ‘Physical/Physiological Selection of Special Forces Soldiers’ information regarding the physical selection methods and instruments will be described. This paper ends with Chapter 4, ‘Future Selection’, focusing on considerations, new trends of research and developments in selection testing of SOF operators.

Due to the previously mentioned decision to work on the unclassified level, the Task Group was forced to work only with open sources. This limited the amount and depth of information available which we based this paper on. In order to overcome this problem, we decided to describe information in this paper on an abstract scientific level. For example, we were not able to specifically identify unique and common SOF personnel tasks, or to identify the best practices in the definition and measurement of training and job performance criteria. However, we can present general guidelines for improving the personnel selection processes.



## **Chapter 2 – SPECIAL OPERATIONS FORCES SELECTION: JOB ANALYSIS AND MULTI-FORM ASSESSMENT**

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The opinions expressed in this paper are those of the authors and should not be interpreted as the official position of the Canadian Forces, the Canadian Department of National Defence, or the Dutch Ministry of Defence.

### **ABSTRACT**

*Notwithstanding the risky, unconventional, and demanding nature of Special Operations Forces (SOF) missions, the assessment and selection of SOF candidates should be governed by the same principles that prevail in the selection of candidates in other sophisticated organizations. This chapter applies western industrial psychology guidelines and procedures to SOF by providing a general overview of the steps that may be applied in developing a valid SOF assessment and selection system, with an emphasis on job analysis and multi-form assessment. This chapter is a source document for NATO personnel interested in designing an SOF assessment and selection system, or for those interested in strengthening an existing system.*

### **2.1 INTRODUCTION**

Day and Horn [20] describe Special Operations Forces (SOF)<sup>1</sup> as “containing specially selected personnel that are organized, equipped, and trained to conduct high-risk, high-value Special Operations to achieve military, political, economic, or informational objectives by using special and unique operational methodologies in hostile, denied, or politically sensitive areas to achieve desired tactical, operational and/or strategic effects in times of peace, conflict, or war” (p. 74). They suggest that Special Operations differ from conventional operations in “the degree of physical and political risk, operational techniques, modes of employment, independence from friendly support, and dependence upon detailed operational intelligence” (p. 74). Accordingly, SOF personnel require skills and abilities beyond those who comprise the general body of the military.

Notwithstanding the risky, unconventional, and demanding nature of SOF operations, the assessment and selection of Special Forces candidates should be governed by the same principles that prevail in the selection of candidates in other sophisticated organizations. That is, an SOF assessment and selection system should

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<sup>1</sup> Also known as, and sometimes referred to herein as, Special Forces (SF).

be based on job analysis; it should identify bona-fide Knowledge, Skills, Abilities, and Other characteristics (KSAOs) that predict successful performance; it should employ multi-form procedures to assess those KSAOs; and it should be a collaborative effort between Subject-Matter Experts (SMEs), personnel selection specialists, and clinical professionals. Doing so will enhance the validity, reliability, and legal defensibility of the system.

The purpose of this chapter is to provide an overview of the steps involved in developing an SOF assessment and selection system. It was written as a source document for NATO personnel with an interest in designing an SOF assessment and selection system, or for those interested in strengthening an existing system. We begin with an example of how the job analysis process<sup>2</sup> can be employed for SOF jobs. Next, we provide examples and options for measures that can be used to select in or screen out SOF candidates with the requisite attributes identified during the job analysis. We conclude with a brief discussion about system validation and legal defensibility.

## **2.2 JOB ANALYSIS**

The selection of personnel with unique attributes for special military duties can be traced back centuries, though the criteria were often limited to physical attributes and military skills. Recall the infamous form of eugenics employed by Sparta from the 8<sup>th</sup> to 4<sup>th</sup> centuries BC, whereby puny or deformed newborns were tossed from Mount Taygetos, thus ensuring for themselves a powerful force [12]. While physical capabilities are still a prominent prerequisite for many SOF jobs today, many SOF organizations select in and/or screen out candidates on the basis of intelligence, personality, and other attributes.

One of the most popular and comprehensive examples of multi-form and multi-phase psychological assessment of Special Operations candidates was that of the U.S. Office of Strategic Services (OSS) who, during the Second World War, sought to develop a system of procedures that would reveal the personalities of recruits to the extent of providing ground for reliable predictions of their usefulness to the organization for Special Operations [26]. Recognizing that general intelligence and military skills alone were not sufficient attributes for success in the activities performed by clandestine operatives, psychologists and psychiatrists employed a combination of organismic and elementalistic methods for assessing recruits on a broad range of dimensions. However, the lack of job analyses for the variety of jobs candidates were being assessed for made it difficult to assign specific attributes to specific jobs. This resulted in a system that measured a short list of attributes and abilities essential to the performance of most overseas OSS assignments. Today, many SOF organizations *are* identifying critical skills and attributes through a job analysis process (e.g., [31];[40];[52]).

### **2.2.1 Integrated Job Analysis Process Overview**

To accurately identify the specific competencies of interest for SOF selection, two processes may be integrated. The first process, the Combination Job Analysis Method (CJAM) [42]), utilizes work-oriented processes contained in a Functional Job Analysis (FJA) [25] to provide information about the outputs, tasks, and relevant KSAOs required for the job. This procedure is combined with an importance analysis, whereby SMEs rate the importance of each task and KSAO for selection [7]. The second process involves the Cognitive Task Analysis (CTA) method of process tracing, which takes standard task analysis one step further by decomposing the tasks to the underlying cognitive processes [69]. In addition, all cognitively loaded critical tasks and sub-tasks may be assessed using the Object-Oriented Cognitive Task Analysis And Design (OOCTAD) model [69];[70] to assist in identifying core cognitive competencies required for successful performance in an SOF role. For a more detailed reading of the integrated job analysis process, see [29].

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<sup>2</sup> The job analysis process outlined in sub-Section 2.2 was adapted from a template utilized by Girard [28].

### **2.2.2 Step 1: Identification of Outputs, Tasks and Sub-Tasks**

A job analysis for unique occupations is often conducted without the benefit of a common reference point. In these cases, SMEs are required to generate outputs and tasks from scratch, which can be a time consuming process. Where applicable, existing documentation related to roles (e.g., assaulter, sniper, assault boat driver, medic) may be utilized as a starting point for discussion. Job outputs can be entered into an electronic job analysis template and, as part of a focus group comprised of SMEs, identified as a functional category of work under which various tasks fall. Tasks are defined as collections of activities directed toward the achievement of a specific output [25]. Where source documents are used, SMEs may be asked to specify if the outputs identified are relevant to the target job. Only those outputs for which group consensus can be reached should be retained.

SMEs are then consulted to identify job outputs not presented in the source documentation. All generated tasks are recorded in the electronic job analysis template under the applicable output. SMEs are asked to determine:

- 1) The relevance of each task to the job; and
- 2) Whether each task is pertinent to the output of discussion, another output, and/or multiple outputs.

Only those tasks for which group consensus can be reached should be retained.

Next, utilizing process tracing, cognitively loaded task statements are decomposed by SMEs to identify the task process. SMEs are instructed that cognitively loaded tasks should entail those tasks that require difficult cognitive skill (e.g., judgements, assessments, thinking skills, abilities). The usual approach to process tracing is to have job incumbents provide a running commentary of what is seen and done during the conduct of the task [69], though this process can be modified by having SMEs, as a group, describe the process for cognitively complex tasks.

Sub-tasks are entered under the applicable task statements. SMEs discuss each sub-task to determine its overall relevance to the task process. Again, only those sub-tasks for which group consensus can be reached should be retained. Since it is plausible to decompose a task down to firing a single bullet, parameters can be established at the outset (e.g., to decompose a task into six or fewer steps) in order to avoid wasting time on minutia. A final review by a senior SME (e.g., chief instructor, senior incumbent) confirms the applicability of identified outputs, tasks, and sub-tasks to the job.

#### **2.2.2.1 OOCTAD Model Integration**

Cognitive-based tasks can be defined as a group of related mental activities directed toward the completion of an overall task [69]. To discern the cognitive skills and/or mental demands required to perform a task effectively, CTA is utilized. While CTA is used primarily to design human interface and training systems, the use of CTA in selection is also documented [36];[54];[58]. Wei and Salvendy [69] propose that traditional job analysis methods lack sensitivity to cognitive complexities and result in less satisfactory results for cognitively oriented jobs. While traditional job analyses are useful in identifying cognitive processes required for selection, description of these processes provides little detail beyond a global definition (e.g., situational awareness). To this end, all critical cognitively complex tasks and sub-tasks can be assessed using CTA to identify critical cognitive requirements not normally identified in a traditional job analysis.

Based on human information process theory, the OOCTAD model is a CTA model that focuses on the design of object-oriented human information processing [69]. The model uses defined cognitive facets to classify cognitive-oriented task performance into modules that are logically linked to other critical cognitive facets. While the literature does not discuss the use of the OOCTAD model for assessment purposes, it can be intuitively linked to selection. Specifically, those decomposed tasks identified as

crucial for selection through process tracing are assessed using the model to identify cognitive facets of interest. To this end, the OOCTAD model assists in recognizing the underlying cognitive subtleties which, in turn, can be employed to identify measures more relevant to the cognitive complexities of the job. Simply put, the OOCTAD model can help translate SME terminology into cognitive psychology terminology, which can then be used to identify appropriate cognitive-based tests for selection.

It is important to note that the authors do not advocate the use of the OOCTAD model as the sole means of identifying potential cognitive measures. While the OOCTAD model will assist in the classification of critical tasks and linked KSAOs (see Section 2.2.3 below) into cognitive groupings, we refer the reader to the cognitive psychology literature, which is better suited to:

- 1) Identify key cognitive theories underlying those groupings; and
- 2) Identify tests to assess those cognitive competencies.

For further detail on the OOCTAD model, refer to [69];[70].

### **2.2.3 Step 2: Identification of KSAOs**

After identification of task statements and applicable sub-tasks, SMEs generate relevant KSAOs for each task and sub-task. It is important to make the distinction between knowledge, skills, abilities, and other characteristics by defining them for the SMEs. The following definitions are offered by Brannick et al. [7]:

- **Knowledge** – The existence in memory of a retrievable set of technical facts, concepts, language, and procedures directly relevant to job performance.
- **Skills** – The developed or trained capacity to perform tasks that call for the use of tools, equipment, or machinery.
- **Abilities** – The relatively enduring capacity to acquire skills or knowledge, and to carry out tasks at an acceptable level of proficiency where tools, equipment, and machinery are not major elements.
- **Other Personal Characteristics** – Job-relevant interests, preferences, temperament, and personality characteristics that indicate how well a job incumbent performs on a routine day-to-day basis.

Once all generated KSAOs are listed under the applicable output and displayed, SMEs discuss each one to determine:

- 1) Its overall relevance to the job; and
- 2) Its relevance to the task under discussion, another task, and/or multiple tasks.

Only those KSAOs for which group consensus is reached should be retained. A final review by a senior SME confirms the applicability of identified KSAOs to the target job.

### **2.2.4 Step 3: Rating of Tasks and Sub-Tasks**

All tasks and sub-tasks identified by SMEs are entered into a rating form, and SMEs rate all tasks and sub-tasks along the following criteria:

- 1) *Task Difficulty* – What is the difficulty level in performing this task correctly relative to all other tasks?
  - a) One of the easiest tasks – 1;
  - b) Considerably easier than most tasks – 2;

- c) Easier than most tasks performed – 3;
  - d) Average difficulty – 4;
  - e) Harder than most tasks performed – 5;
  - f) Considerably harder than most tasks – 6; or
  - g) One of the hardest tasks – 7.
- 2) *Task Criticality* – To what degree will incorrect performance of the task result in negative consequences?
- a) Consequences of error are not important at all – 1;
  - b) Consequences of error are of little importance – 2;
  - c) Consequences of error are of some importance – 3;
  - d) Consequences of error are moderately important – 4;
  - e) Consequences of error are important – 5;
  - f) Consequences of error are very important – 6; or
  - g) Consequences of error are extremely important – 7.

The purpose of the task rating form is to score tasks in order to calculate the *task importance value*. The task importance value represents the sum of task difficulty and task criticality [7]. There is no guidance in the job analysis literature for utilizing the task importance value for identifying the critical tasks and sub-tasks as part of the CTA process. As a general guideline, any task or sub-task with a task importance value of 6 or greater is retained for consideration in the selection model. This value is based on the probability that a task or sub-task rated as 6 or greater is likely to be considered relatively complex, and/or consequences of error are relatively important. Brannick et al. [7] indicate that tasks may play an important role in the design of work sample tests [14];[27]. As such, to help establish the content validity of any measures developed from the job analysis, task importance analysis must be employed to ensure measures are representative of the important aspects of the job.

#### **2.2.5 Step 4: Rating of KSAOs**

All KSAOs identified by SMEs are entered into a rating form, and SMEs rate them along the following criteria:

- 1) Is it necessary for an applicant to possess this KSAO for selection? (Yes – 1 or No – 0).
- 2) Is it practical to expect this KSAO in the applicant pool? (Yes – 1 or No – 0).
- 3) To what extent is trouble likely if this KSAO is ignored in selection?
  - a) Not at all – 1;
  - b) Very little – 2;
  - c) To some extent – 3;
  - d) To a great extent – 4; or
  - e) Trouble definitely likely if ignored in selection – 5.
- 4) To what extent do the KSAOs distinguish the superior from the average worker?
  - a) Not at all – 1;

- b) Very little – 2;
- c) To some extent – 3;
- d) To a great extent – 4; or
- e) Definitely distinguishes the superior from the average worker – 5.

Average, or mean, scores on each criterion are calculated for each KSAO. For inclusion in selection, a KSAO must meet three criteria [7]:

- 1) A clear majority of SMEs must indicate that it was necessary for an applicant to possess the KSAO for selection.
- 2) A clear majority of SMEs must indicate it is practical to expect the KSAO in the applicant pool. While Brannick et al. [7] indicate that a clear majority must agree, the literature does not specify what constitutes a clear majority. As such, a mean score of .75 or greater can be used to identify a clear majority in both instances discussed above.
- 3) The mean rating on ‘trouble likely’ must be 3 or greater. Brannick et al. [7] recommend a mean rating on this item of 1.5 or greater for inclusion in selection.

However, practical use of this method by the authors has found that, on average, SMEs tend to rate KSAOs at 2 or above on ‘trouble likely’. This noticed trend creates the possibility that a vast majority of KSAOs will need to be included in selection, an outcome that is not practical. As such, the average rating was adjusted to 3 or greater in order to identify the more critical KSAOs (i.e., trouble is likely to some extent).

As an example of the above process, consider that one of the identified outputs required of an SOF operator is to conduct tactical air and close air support operations. One of the many tasks associated with this responsibility is coordinating with the air asset. This task may have several sub-tasks, including communicating needs with the pilot, receiving information from the pilot, communicating courses of action, and communicating the mark plan. Accordingly, KSAOs associated with this output may include oral communication skills, the ability to visualize the battle space from different perspectives, the ability to work quickly and accurately, and situation awareness, among others.

### **2.2.6 Step 5: Identification of Competency Groupings**

While it would be ideal to assess every KSAO, a well-designed selection process must also balance detailed assessment with time and resource efficiency. As such, it is often impractical to design selection tools that assess a multitude of KSAOs within a reasonable timeframe. One way to balance these competing needs is to organize related KSAOs into distinct competency groupings. The *Guidelines and Ethical Consideration for Assessment Center Operations* [38] support the classification of KSAOs into meaningful and relevant dimensions. Thornton III and Byham [65] indicate that competency groupings can be defined as clusters of behaviour that are specific and observable, which can logically be classified together. As an example, KSAOs deemed critical for SOF selection may be rationally sorted under three broad common competency groupings: physical ability, cognitive ability and personality.

## **2.3 ASSESSMENT**

Once KSAOs and core competency groupings have been identified, the next step in the development of an assessment and selection system is to identify appropriate measures to assist in screening and selecting candidates. Because physical ability assessment is already a common practice in SOF organizations, this chapter will focus on the cognitive and personality competency domains<sup>3</sup>.

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<sup>3</sup> Much of the information presented here was adapted from a template utilized by Girard [30].



### 2.3.1 Cognitive Ability Domain

The selection literature supports the use of General Mental Ability (GMA) as a valid measure of performance [37]. The GMA model is grounded in the work of Spearman [61] and other early intelligence theorists, and advocates a general factor (g) of intelligence that relates to the ability to think about ideas, analyze situations, and solve problems. By and large, GMA is the capacity to learn and is normally measured utilizing intelligence tests. GMA is widely recognized as an excellent predictor of training and job performance based on several large meta-analyses [35];[37];[43];[55];[56].

While GMA represents a valid predictor of performance, other cognitive facets, not necessarily captured using typical GMA tests, may be equally or even more important for the selection of certain Special Forces candidates. To this end, the Cattell-Horn-Carroll (CHC) framework [15] may be of more utility to the SOF selection specialist striving to identify cognitive requirements for the purpose of achieving greater precision in the prediction of successful performance. Accordingly, critical KSAOs linked to the OOCAD model process may identify cognitive facets that are rationally sorted under this domain. As examples:

- *Fluid reasoning* is the use of controlled mental operations to solve novel problems that cannot be performed automatically. Specifically, fluid reasoning deals with drawing inferences, concept formation, identifying relationships, comprehending implications, solving problems, extrapolation, and transforming information [49].
- *Spatial ability* may be a relevant screening or selection criterion for the SOF candidate who requires the ability to call in tactical air support, among other applicable tasks. Lohman [45] defined spatial ability as the ability to generate, retain, retrieve and transform visual images. Several published studies of spatial ability (e.g., [10];[44];[47]) have identified a number of different spatial abilities factors. Hegarty and Waller [32] differentiate between spatial visualization and spatial orientation. In particular, spatial visualization is the ability to make object-based spatial transformations in which one's egocentric (i.e., self) reference frame does not change. An example of this would be mental manipulation of a pattern to identify which shape it represents when folded. In contrast, spatial orientation is the ability to make egocentric spatial transformations in which one's egocentric reference frame changes such that they view things from a different perspective [41]. Given the above, it could be posited that the ability of an SOF operator to rapidly change his/her egocentric frame of reference from one perspective (e.g., how they view the battle space) to another perspective (e.g., how an incoming pilot may view the battle space) may be important for successful performance of that task.
- *Situation awareness* is, simply put, knowing what is going on around you. However, situation awareness applied in the context of operations is more complex. Endsley [23] indicated that situation awareness in an operational setting is more concerned with what an individual needs to know during a given task. Integral to the accuracy and completeness of situation awareness is working memory [23]. Specifically, individuals must attend to new information and integrate this with information already residing in memory. This represents a heavy demand on the finite resources of working memory. Jones and Endsley [39] found that working memory losses resulting from task distractions and interruptions explained 8.4% of situation awareness errors in pilots. Smith [59] indicates that working memory is often considered an aspect of executive functioning. While there is considerable debate regarding the definition of executive functioning, most definitions are quite compatible and generally include aspects of higher order cognitive processing. By and large, it is agreed that executive functioning includes areas related to planning and organization, initiation and inhibition of behaviour, strategizing, problem solving, flexible thought processes, behaviour monitoring, self awareness, and judgment.

#### 2.3.1.1 Cognitive Ability Measures

There are a myriad of cognitive and neuropsychological tests designed to assess aspects of higher cognitive functioning. Many militaries have their own GMA measure for recruiting and selection

purposes. The Canadian Forces (CF), for example, utilizes the Canadian Forces Aptitude Test (CFAT). The CFAT is a 60-item timed test comprised of three sub-scales:

- 1) Verbal Ability (15 items);
- 2) Spatial Ability (15 items); and
- 3) Problem Solving (30 items).

To be selected into the CF, applicants must achieve a minimum cut-off score. Because GMA is supported as a valid predictor of performance, the CFAT could be used to assess GMA in Special Forces applicants. However, given the cognitive complexities associated with SOF operations, it could be argued that a minimum cut-off score needs to be identified to ensure success. There are different methods for establishing cut-off scores, such as the Angoff method [13];[46] and regression (e.g., [51]). Regardless of the method employed, cut-off scores must ultimately be selected to meet the needs of the organization.

As discussed above, however, for some SOF jobs, it may be prudent to consider the use of tests grounded in more contemporary theories of intelligence (e.g., [11]) to ensure all aspects of the cognitive domain are properly assessed. Historically, human spatial ability has been measured using tests that require mental manipulations of small figural stimuli such as blocks, cards, flags, or other symbols [68]. As noted above, person-centred (egocentric) frame of reference may be relevant to Special Forces operatives who must be cognizant of the battle space around them from their perspective and that of others. Change in perspective is the result of rotation, which changes one's direction [34]. For example, an operative could be facing east directing air assets, then rotate his/her orientation west to attend to other assets. Once rotated, the operative still requires the ability to know where everything is in relation to this new perspective. In addition to changing his/her direction, the operative must also be able to mentally place his/herself in the perspective of an incoming air/ground asset and have a mental image of what is seen in relation to that perspective. The Revised Object Perspective Test [32] is a timed test (5 minutes) that measures an individual's ability to imagine different perspectives or orientations in space. The test presents an individual with a configuration of seven objects drawn on the top half of an 8.5 x 11 inch sheet of paper. The participant is asked to imagine being at the position of one object in the display facing another object and is asked to indicate the direction to a third object. The bottom half of the page contains a circle in which the imagined station point (e.g., the flower) is drawn in the centre and the imagined heading (e.g., direction to the tree) is drawn as an arrow pointing vertically up. The individual must draw another arrow from the center of the circle indicating the direction to the target object (e.g., the cat) from this new perspective.

To our knowledge, at present, there are no identified measures of situation awareness in the research literature. However, as discussed above, it is argued that situation awareness draws heavily on cognitive areas related to fluid reasoning. While there are many neuropsychological and cognitive psychological tests designed to assess aspects of fluid reasoning, synthesizing these tests into a single battery would be labour intensive and time consuming. Because several studies have demonstrated a strong link between working memory, fluid intelligence, and executive functioning [24];[17];[16], as cited in [59], a test of executive functioning may be considered as a measure of the cognitive load associated with fluid reasoning, working memory, and situation awareness. ExamCorp, a measure of executive functioning, is a 90-minute self-administered computerized series of tasks. ExamCorp has demonstrated validity against job performance for factory workers (.23) and managers (.42) at a manufacturing company [33]. Although ExamCorp has not been used to assess the population of interest, its demonstrated validity for job performance makes it potentially suitable for research purposes. The Pre-Frontal Cortex (PFC) tasks measured by ExamCorp include tests to measure an individual's ability to achieve the following:

- Determine what is important in a rapidly changing situation;
- Modulate emotional responses appropriately while engaged in varying tasks;
- Make intelligent long-term decisions;



- Sequence complex activities;
- Generate new ideas and construct novel behaviors;
- Organize disparate elements into smoothly functioning hierarchies; and
- Respond rapidly and intelligently to situations of crisis in which plans fail unexpectedly and new variables emerge and demand attention.

### **2.3.2 Personality Domain**

Costa and McCrae [18] define personality as enduring emotional, interpersonal, experiential, attitudinal, and motivational styles that explain behaviour in different situations. The most commonly accepted taxonomy of personality in the selection literature today is the Five Factor Model (FFM) or “Big 5” model of personality. This model includes:

- 1) Openness;
- 2) Conscientiousness;
- 3) Extraversion;
- 4) Agreeableness; and
- 5) Emotional Stability.

Meta-analytic studies have found the FFM of personality to be predictive of job performance [2];[64]. As such, the use of personality testing in selection is widely accepted and logical.

Through an extensive literature review and consultation with SMEs, Picano, Williams, and Roland [53] reported that the higher order factors of emotional stability and conscientiousness were the most consistently associated with personnel in high-demand operations jobs. More specifically, relative to the general population, elite Soldier candidates report being lower in negative affectivity; more resilient, dominant, assertive, energetic, reliable, responsible, competitive, emotionally closed, methodological, and disciplined; and stronger in their drive for mastery and achievement. More recently, along with the need for candidates who are agile thinkers and creative (i.e., cognitive abilities), Day and Horn [20] suggest that SOF organizations seek individuals who are risk-accepting, adaptive, self-reliant, eager for challenge, naturally oriented to the pursuit of excellence, relentless in their pursuit of mission success, and culturally attuned. Given the prominence of personality attributes in the SOF literature, SMEs should be instructed to carefully consider required personality attributes during the KSAO identification step (i.e., other characteristics).

#### **2.3.2.1 Personality Measures**

The NEO PI-R is a self-report measure of the FFM that has demonstrated reliability and validity in numerous studies [18]. Another FFM measure, the Trait Self-Descriptive Personality Inventory (TSD-PI), originated from the 163-item U.S. Air Force Self Description Inventory (SDI) [67] and has been adapted for use within the CF. Available in pencil-and-paper and electronic formats, the 75-item TSD-PI has demonstrated reliability and criterion-related validity that is comparable to other mainstream measures of personality [6];[8];[19], and it is currently being incorporated into the CF selection model.

Using the 30-item Dispositional Resilience Scale (DRS) [3], as cited in [4]. Bartone et al. [4] reported that, relative to non-graduates, U.S. Army Special Forces candidate school graduates scored higher in hardiness, a personality dimension characterized by commitment to life and work, a belief that they can control or influence what happens to them, and an affinity for new challenges. Similarly, upon reviewing

data that Soldiers were successfully completing the U.S. Special Forces Assessment System (SFAS) despite lower cognitive and physical abilities scores, Beal [5] suggested that “there must be an element of individual perseverance that reinforces a Soldier’s willingness to stay in the SFAS course, in spite of perceived or real limitations” (p. 1). Accordingly, Beal [5] introduced a measure of perseverance to the SFAS, the Grit Scale [22], and analyzed whether perseverance was able to predict success above and beyond the other KSAOs. Perseverance did significantly predict success, but the strength of the prediction was weak. Beal concluded that perseverance should not be measured on its own. Rather, it should be incorporated with other predictors.

While evidence exists for the validity of specific personality measures, KSAOs pertaining to personality should be assessed using a variety of methods, such as self-report measures, file reviews (e.g., history of misconduct and disciplinary problems), selection interviews, and through the observation of behaviour during SOF work sample tests [14];[27];[56]. Multi-form assessment and consistent evaluations across techniques can give those responsible for selection more confidence in the accuracy of their assessments.

### **2.3.3 Work Sample Tests**

According to Schmidt and Hunter [56], a work sample test combined with a measure of GMA has the highest multi-variate validity and utility for job performance. Work sample tests are “hands-on simulations of part, or all, of the job that must be performed by applicants” (p. 267). These are consistent with Thornton III and Rupp’s [66] conceptualization of simulation exercises employed in assessment centres, whereby participants are “faced with a complex set of conditions representing a situation that may actually occur on the job” (p. 40). SOF work samples might be applied to the assessment of physical, personality, and cognitive abilities. Room clearing, whereby Soldiers enter a room and rapidly distinguish between hostile forces and impartial civilians and react appropriately, is an example of a work sample test that assesses cognitive functioning, physical reaction time, and performance under stressful conditions, in addition to the more obvious marksmanship skills. Work sample tests may be useful for identifying phobias as well. Rappelling or rope crossing, for example, may detect fear of heights, in addition to physical agility. For further information on work sample tests, refer to [14], [27], or [56].

### **2.3.4 Screening Prerequisites**

It is possible that, upon review of the job analysis data, certain critical KSAOs may not be rationally sorted under specific competency domains. Depending on the nature of the KSAOs, they may be better utilized as pre-screening requirements. As examples, KSAOs that may not fit into a competency domain may include basic physical/physiological standards (e.g., psychological and medical fitness, visual and hearing acuity), language requirements (e.g., the ability to fluently speak and comprehend specific languages), and military experience.

Normally, prerequisites serve as “go / no go” criteria. That is, if an applicant does not possess the prerequisite, they do not continue with further assessment. However, until it can be demonstrated that prerequisites are valid predictors of success in SOF training or task performance, caution should be exercised in using them in this manner. In these instances, legal defensibility would be better served if prerequisites were assessed and considered within the context of the overall selection decision. Of course this is not always practical, especially in large SOF organizations that rely heavily on screening to provide for a more manageable and efficient assessment and selection process (e.g., [71]).

Language competencies and certain medical requirements can be easily screened for prior to selection. Psychological fitness (e.g., absence of psychopathology) may be screened for using self-report measures such as the Minnesota Multi-phasic Personality Inventory 2 Restructured Form (MMPI-2 RF) [62]. While most credible psychopathology assessments require administration and interpretation by trained professionals, including the MMPI-2 RF, psychopathology should also be assessed in a clinical interview,

and through the observation of behaviour, during the selection process (e.g., stress tolerance). Similarly, while physical fitness and endurance will surely be tested throughout selection (i.e., during work sample tests), candidates can be screened out prior to selection based on minimal levels of achievement.

McDaniel, Schmidt, and Hunter [48] and Schmidt [57], as cited in [56] suggest that the best predictor of future performance is past performance, according to the behavioural consistency method of evaluating training and experience. There is some evidence to suggest that this notion applies equally to SOF selection. For example, Teplitzky and DeMatteo [63], as cited in [21] reported that the SFAS select rate for U.S. Ranger-qualified candidates was much higher than that among those without Ranger training. And, along with the Armed Services Vocational Aptitude Battery General Technical Score [71], concluded that the Army Physical Fitness Test, previous Branch type, and the Airborne qualification were the best predictors of SFAS success. Accordingly, depending on the pool of candidates and the nature of the SOF job, relevant military experience and performance standards may be worth considering in screening decisions. Identifying military experience and performance can easily be assessed through leadership recommendations and a thorough personnel file review. The file review should concentrate on confirming aspects of person-job fit [9], such as military training, previous jobs held, and operational experience.

## **2.4 OTHER CONSIDERATIONS**

### **2.4.1 Future Requirements**

It is a commonly accepted tenet that SOF cannot be mass-produced, and effective SOF cannot be created quickly after emergencies occur. In determining KSAOs, SMEs should not only focus on present day outputs, but consider, as well, future requirements (e.g., anticipated tasks, new equipment). KSAOs such as adaptability, flexibility, and the ability to learn and apply new information should be considered to help SOF prepare for the unexpected.

### **2.4.2 System Validation**

Even sophisticated selection systems based on multi-form assessment comprised of valid tests should be considered experimental until the process in its entirety has been validated. While the process can be used to make selection decisions, it should be based on a preponderance of evidence. In other words, an applicant should only be screened out due to multiple areas of concern across various assessment measures, and preferably not due to the results of one test. An interim option is to employ a screen-out strategy when making selection decisions. A screen-out strategy reduces the applicant pool by eliminating individuals predicted to be the poorest performers. In contrast, a screen-in strategy employs a rank ordering of applicants on the basis of test scores, and selects the individuals with the highest scores until the positions are filled [50]. In utilizing the screen-out strategy for selection decisions, assessment centres can use suitability assessment reports to risk manage the applicants in order to assign training slots. Once the measures have been validated and defensible cut-off scores have been established, the use of the appropriate strategy can be revisited.

*Standards for Educational and Psychological Testing* [1] identifies several forms of evidence that must be considered together to form conclusions about test validity, including test content, evidence of internal structure, response processes, convergent and discriminant relationships, validity generalization, consequences of testing, and test-criterion relationships. Test-criterion validation involves ensuring that the KSAOs selected through job analysis and the measures/methods chosen to assess those KSAOs effectively predict the criterion variable(s), such as performance (i.e., training performance or future job performance). This research usually involves a combination of descriptive statistics, means comparisons (e.g., to test for differences in assessment scores across course grades), correlations (i.e., to examine

relationships between assessment scores and performance), multiple regression (i.e., to determine the incremental validity of the various assessment measures in predicting performance), and the determination of optimal cut-off scores (e.g., for cognitive ability tests).

The principles and methods of test validation that prevail in western industrial psychology literature and civilian organizations apply to SOF. For further details on these principles and methods, refer to *Standards for Educational and Psychological Testing* [1], *Principles for the Validation and Use of Personnel Selection Procedures* [60], *Guidelines and Ethical Considerations for Assessment Center Operations* [38], and *Assessment Centers in Human Resource Management* (Ch. 10; [66]).0

### **2.4.3 Legal Defensibility**

An essential feature of any selection process is that it can be legally defended if challenged by an unsuccessful applicant (e.g., grievance, human rights challenge). Legal defensibility is assured when it can be demonstrated that a candidate did not possess the required competencies for a job as identified through a thorough job analysis. Conversely, in the absence of a job analysis that links the competencies to the tasks, defence of the selection process would be more difficult and could fail.

Given the risks associated with SOF tasks, very high standards of individual and team performance are required, which may dictate the employment of unconventional and/or hazardous assessment techniques and high selection standards (depending on the size of the applicant pool and the level of risk the organization is willing to assume). A risky and/or stringent SOF assessment and selection system may be more vulnerable to outcome grievances, making the need for a legally defensible system that much more important. The legal defensibility of the assessment and selection process presented here is strengthened by incorporating the following steps:

- SMEs are utilized in the job analysis process;
- KSAOs used for selection purposes can be linked back to the required tasks;
- Core competency domains are determined by utilizing critical KSAOs rated as necessary for selection purposes;
- Valid and reliable measures of the core competencies are selected; and
- Evidence with respect to the validity of the process is obtained.

## **2.5 CONCLUSION**

The purpose of this chapter was to highlight the link between western industrial psychology literature and SOF requirements by providing an example of how to develop a valid and legally defensible SOF selection system. We are not suggesting that this is the one and only solution. As mentioned previously, SOF cannot be mass produced. There are a variety of SOF jobs that require unique KSAOs. Some SOF jobs are more cognitively complex than others, thus supporting the utility of the cognitive abilities analyses presented here. Other SOF selection processes may need to focus on language and sensitivities associated with cross-cultural differences. A selection system's level of sophistication is contingent on the quality and quantity of assessments used. How multi-form or multi-phase a system is may depend on demand, time, and the availability of resources, including budget and personnel (e.g., candidates, SMEs, selection, and clinical specialists). Regardless of constraints, those charged with developing SOF selection systems should ensure their system is sufficiently robust to meet SOF requirements. As the former Commander and former Deputy Commander of Canadian Special Operations Force Command have suggested, "the effectiveness and success of SOF are not exclusively contingent upon the special equipment, 'cutting edge' technology, or even the special training of SOF personnel. The key factor of SOF success is its people" (p. 70; [20]).

## 2.6 REFERENCES

- [1] American Educational Research Association, American Psychological Association, and National Council on Measurements. (1999). *Standards for educational and psychological testing*. Washington, D.C.: American Psychological Association.
- [2] Barrick, M.R. and Mount, M.K. (1991). The Big-Five personality dimensions in job performance: A meta-analysis. *Personnel Psychology*, 44, 1-26.
- [3] Bartone, P.T. (1995). *A short hardiness scale*. Paper presented at the American Psychological Society Annual Convention, New York.
- [4] Bartone, P.T., Roland, R.R., Picano, J.J. and Williams, T.J. (2008). Psychological hardiness predicts success in U.S. Army Special Forces candidates. *International Journal of Selection and Assessment*, 16(1), 78-81.
- [5] Beal, S.A. (2010). *The roles of perseverance, cognitive ability, and physical fitness in U.S. Army Special Forces Assessment and Selection*. Research Report 1927. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- [6] Black, L.E. and Skomorovsky, A. (2007). *An investigation of the psychometric properties of the Trait Self-Descriptive Inventory using an Air Force sample*. Technical Report 2007-11. Ottawa, Ontario, Canada: Director Human Resources Research and Evaluation.
- [7] Brannick, M.T., Levine, E.L. and Morgeson, F.P. (2007). *Job and work analysis: Methods, research, and applications for human resource management*. Thousand Oaks, CA: Sage Publications.
- [8] Boyes, F.A.J. (2006). The Trait Self-Descriptive Inventory: An examination of the psychometric properties and exploration of an abbreviated version. Technical Note 2006-02. Ottawa, Ontario, Canada: Director Human Resources Research and Evaluation.
- [9] Carless, S.A. (2005). Person-job fit versus person-organization fit as predictors of organizational attraction and job acceptance intentions: A longitudinal study. *Journal of Occupational and Organizational Psychology*, 78, 411-429.
- [10] Carroll, J.B. (1993). *Human cognitive abilities: A survey of factor-analytical studies*. New York: Cambridge University Press.
- [11] Carroll, J.B. (1997). The three stratum theory of cognitive abilities. In D.P. Flanagan, J.L. Genshaft, and P.L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests and issues* (pp. 122-130). New York: Guilford.
- [12] Cartledge, P. (2001). *Spartan reflections*. London: Duckworth.
- [13] Cascio, W.F. (1998). *Applied psychology in human resource management, 5<sup>th</sup> Edition*. Upper Saddle River, NJ: Prentice-Hall.
- [14] Catano, V.M., Wiesner, W.H., Hackett, R.D. and Methot, L.L. (2010). *Recruitment and selection in Canada, 4<sup>th</sup> Edition*. Toronto, Ontario, Canada: Nelson Education Ltd.
- [15] Cattell, R.B. (1963). Theory of fluid and crystallized intelligence: A critical experiment. *Journal of Educational Psychology*, 54, 1-22.



- [16] Colom, R., Rebollo, I., Palacios, A., Juan-Espinosa, M. and Kyllonen, P.C. (2004). Working memory is (almost) perfectly predicted by g. *Intelligence*, 32, 277-296.
- [17] Conway, A.R.A., Kane, M.J. and Engle, R.W. (2003). Working memory capacity and its relation to general intelligence. *Trends in Cognitive Sciences*, 7, 547-552.
- [18] Costa, P.T. and McCrae, R.R. (1992). Revised NEO Personality Inventory (NEO PI-R) and NEO \ Five-Factor Inventory (FFI) professional manual. Odessa, FL: Psychological Assessment Resources Inc.
- [19] Darr, W. and Kemp, C. (2011). *A psychometric examination of the e-version of the Trait Self-Descriptive Personality Inventory (TSD-PI)*. Technical Memorandum 2011-010. Ottawa, Ontario, Canada: Director General Military Personnel Research and Analysis.
- [20] Day, D.M. and Horn, B. (2010). Canadian Special Operations Command: The maturation of a national capability. *Canadian Military Journal*, 10(4), 69-74.
- [21] DeMatteo, J.S., White, L.A., Teplitzky, M.L. and Sachs, S.A. (1991). *Relationship between temperament constructs and selection for Special Forces training*. Paper presented at the 33<sup>rd</sup> conference of the International Military Testing Association, San Antonio, TX.
- [22] Duckworth, A.L., Peterson, C., Matthews, M.D. and Kelly, D.R. (2007). Grit: Perseverance and passion for long term-goals. *Journal of Personality and Social Psychology*, 92, 1087-1101.
- [23] Endsley, M.R. (2000). Theoretical underpinnings of situation awareness: A critical review. In M.R., Endsley and D.J. Garland (Eds.), *Situation awareness, analysis and measurement*. Mahwah, NJ: Lawrence Erlbaum Associates.
- [24] Engle, R.W., Tuholski, S.W., Laughlin, J.E. and Conway, A.R.A. (1999). Working memory, short-term memory and general fluid intelligence: A latent variable approach. *Journal of Experimental Psychology*, 128, 309-331.
- [25] Fine, S.A. and Cronshaw, S.F. (1999). *Functional job analysis: A foundation for human resources management*. Mahwah, NJ: Lawrence Erlbaum.
- [26] Fiske, D.W., Hanfmann, E., MacKinnon, D.W., Miller, J.G. and Murray, H.A. (1997). *Selection of personnel for clandestine operations: Assessment of men*. Walnut Creek, CA: Aegeon Park Press. (Original work published in 1948).
- [27] Gatewood, R.D. and Field, H.S. (2001). *Human resource selection, 5<sup>th</sup> Edition*. Orlando, FL: Harcourt, Inc.
- [28] Girard, M. (2009a). *Job analysis: Forward Air Controllers (FAC) and Joint Terminal Attack Controllers (JTAC)*. Technical Note 2009-001. Ottawa, Ontario, Canada: Director General Military Personnel Research and Analysis.
- [29] Girard, M. (2009b). *Integration of traditional job analysis and cognitive task analysis for selection purposes*. Technical Note 2009-005. Ottawa, Ontario, Canada: Director General Military Personnel Research and Analysis.
- [30] Girard, M. (2009c). *Selection of Forward Air Controllers (FAC) and Joint Terminal Attack Controllers (JTAC). Assessment of core competencies*. Technical Note 2009-024. Ottawa, Ontario, Canada: Director General Military Personnel Research and Analysis.

- [31] Hartmann, E., Sunde, T., Kristensen, W. and Martinussen, M. (2003). Psychological measures as predictors of training performance. *Journal of Personality Assessment*, 80, 87-98.
- [32] Hegarty, M. and Waller, D. (2004). A dissociation between mental rotation and perspective-taking spatial abilities. *Intelligence* 32, 175-191.
- [33] Higgins, D.M., Peterson, J.B., Pihl, R.O. and Lee, A.G.M. (2007). Prefrontal cognitive ability, intelligence, Big Five personality, and the prediction of advance academic and workplace performance. *Journal of Personality and Social Psychology*, 93(2), 298-319.
- [34] Hintzman, D.L., O'Dell, C.S. and Arndt, D.R. (1981). Orientation in cognitive maps. *Cognitive Psychology*, 13, 149-206.
- [35] Hirsh, H.R., Northrop, L.C. and Schmidt, F.L. (1986). Validity generalization for law enforcement occupations. *Personnel Psychology*, 39(2), 399-420.
- [36] Hunt, E. and Joslyn, S. (2000). A functional task analysis of time-pressured decision making. In J.M. Schraagen, S.F. Chipman and V.L. Shalin (Eds.), *Cognitive task analysis* (pp. 119-134). Mahwah, NJ: Lawrence Erlbaum Associates.
- [37] Hunter, J.E. and Hunter, R.F. (1984). Validity and utility of alternate predictors of job performance. *Psychological Bulletin*, 95(1), 72-98.
- [38] International Task Force on Assessment Center Guidelines (2000). Guidelines and ethical considerations for assessment center operations. *Public Personnel Management*, 29(3), 315-331.
- [39] Jones, D.G. and Endsley, M.R. (1996). Sources of situation awareness errors in aviation. *Aviation, Space and Environmental Medicine*, 67(6), 507-512.
- [40] Kilkullen, R.N., Mael, F.A., Goodwin, G.F. and Zazanis, M.M. (1999). Predicting U.S. Army Special Forces field performance. *Human Performance in Extreme Environments*, 4, 53-63.
- [41] Kozhevnikov, M. and Hegarty, M. (2001). A dissociation between object-manipulation spatial ability and spatial orientation ability. *Memory and Cognition*, 29, 745-756.
- [42] Levine, E.L. (1983). Everything you wanted to know about job analysis. Tampa, FL: Mariner.
- [43] Levine, E.L., Spector, P.E., Menon, S., Narayanon, L. and Cannon-Bowers, J. (1996). Validity generalization for cognitive, psychomotor, and perceptual tests for craft jobs in the utility industry. *Human Performance*, 9, 1-22.
- [44] Lohman, D.F. (1988). Spatial abilities as traits, processes, and knowledge. In R. J. Sternberg (Ed.), *Advances in the psychology of human intelligence* (pp. 181-248). Hillsdale, NJ: Lawrence Erlbaum Associate, Inc.
- [45] Lohman, D.F. (1993). *Spatial ability and G*. Paper presented at the first Spearman Seminar, University of Plymouth, July 21.
- [46] Maurer, T.J. and Alexander, R.A. (1992). Methods of improving employment test critical scores derived by judging test content: A review and critique. *Personnel Psychology*, 45, 727-762.
- [47] McGee, M.G. (1979). Human spatial abilities: Psychometric studies and environmental, genetic, hormonal, and neurological influences. *Psychological Bulletin*, 86, 889-918.

- [48] McDaniel, M.A., Schmidt, F.L. and Hunter, J.E. (1988). A meta-analysis of the validity of methods for rating training and experience in personnel selection. *Personnel Psychology*, 41, 283-314.
- [49] McGrew, K.S. (2009). CHC theory and the human cognitive abilities project: Standing on the shoulders of giants of psychometric intelligence research. *Intelligence*, 37(1), 1-10.
- [50] Mueller-Hanson, R., Heggstad, E.D. and Thornton III, G.C. (2003). Faking and selection: Considering the use of personality from select-in and select-out perspectives. *Journal of Applied Psychology*, 88, 348-355.
- [51] Nasser, R.N. and Naimy, V. (2010). Using regression to establish weights for a set of composite equations through a numerical analysis approach: A case of admission criteria to a college. *Journal of Mathematics and Sciences*, 6(3), 300-305.
- [52] Patterson, J.C., Brockway, J. and Greene, C. (2004). *Evaluation of an Air Force special duty assessment and selection program*. Contract F41624-00-6/1001/0001. San Antonio, TX: Conceptual MindWorks.
- [53] Picano, J.J., Williams, T.J. and Roland, R.R. (2006). Assessment and selection of high-risk operational personnel. In Kennedy, C.H. and Zillmer, E.A. (Eds.), *Military Psychology* (pp. 353-370). New York, NY: The Guilford Press.
- [54] Reynolds, R.T. and Brannick, M. (2002). *Thinking about work/thinking at work: A cognitive task analysis*. A paper delivered at the 17<sup>th</sup> annual conference of the Society for Industrial and Organizational Psychology, Toronto, Ontario, Canada.
- [55] Salgado, J.F. and Anderson, N. (2002). Cognitive and GMA testing in the European Community: issues and evidence. *Human Performance*, 15, 75-76.
- [56] Schmidt, F.L. and Hunter, J.E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implication of 85 years of research findings. *Journal of Applied Psychology*, 124, 263-274.
- [57] Schmidt, F.L., Caplan, J.R., Bemis, S.E., Decuir, R., Dinn, L. and Antone, L. (1979). *Development and evaluation of behavioural consistency method of unassembled examining*. Technical Report 79-21. Washington, DC: U.S. Civil Service Commission, Personnel Research and Development Center.
- [58] Schraagen, J.M., Chipman, S.F. and Shalin, V.L. (2000). Cognitive task analysis. In J. M. Schraagen, S. F. Chipman, and V. L. Shalin, (Eds.), *Cognitive task analysis* (p. 394). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- [59] Smith, A. (2009). *Literature review on executive functioning*. Contract Report 2009-004. Ottawa, Ontario, Canada: Director General Military Personnel Research and Analysis.
- [60] Society for Industrial and Organizational Psychology Inc., American Psychological Association. (1987). *Principles for the validation and use of personnel selection procedures, 3<sup>rd</sup> Edition*. College Park, MD: Author.
- [61] Spearman, C.E. (1904). General intelligence objectively determined and measured. *American Journal of Psychology*, 15, 201-293.



- [62] Tellegen, A., Ben-Porath, Y.S., McNulty, J.L., Arbisi, P.A., Graham, J.R. and Kaemmer, B. (2003). *The MMPI-2 Restructured Clinical Scales: Development, validation, and interpretation*. Minneapolis, MN: University of Minnesota Press.
- [63] Teplitzky, M.L. and DeMatteo, J.S. (1991). *SFAS the first two years*. Unpublished manuscript.
- [64] Tett, R.P., Jackson, D.N. and Rothstein, M. (1991). Personality measures as predictors of job performance: A meta-analytic review. *Personnel Psychology*, 44, 703-742.
- [65] Thornton III, G.C. and Byham, W.C. (1982). *Assessment centers and managerial performance*. New York, NY: Academic Press.
- [66] Thornton III, G.C. and Rupp, D.E. (2006). *Assessment centers in human resource management: Strategies for prediction, diagnosis, and development*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- [67] Tupes, E.C. and Christal, R.E. (1961). *Recurrent personality factors based on trait ratings*. Technical Report 61-97. Lackland Air Force Base, Texas: Aeronautical Systems Division, Personnel Laboratory.
- [68] Waller, D. (2004). The WALKABOUT: Using virtual environments to assess large-scale spatial abilities. *Computers in Human Behavior*, 21, 243-253.
- [69] Wei, J. and Salvendy, G. (2004). The cognitive task analysis methods for job and task design: Review and appraisal. *Behavior and Information Technology*, 23, 273-299.
- [70] Wei, J. and Salvendy, G. (2006). Development of a human information processing model for cognitive task analysis and design. *Theoretical Issues in Ergonomics Science*, 7(4), 345-370.
- [71] Zazanis, M.M., Hazlett, G.A., Kilcullen, R.N. and Sanders, M.G. (1999). *Prescreening method for Special Forces selection and assessment*. Technical Report 1094. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.



## **Chapter 3 – PHYSICAL/PHYSIOLOGICAL SELECTION OF SPECIAL FORCES SOLDIERS**

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Special Forces (SF) Soldiers must be strong, both mentally and physically. Selection of these special units typically involves a number of physical fitness and physical performance tests. One of the best predictors of a Soldier's chance of being selected for training, as well as succeeding in training, is the Soldier's physical fitness. The purpose of this paper is to summarize the available research on the physical aspects of SF Soldiers selection and to describe some of the physical performance challenges presented to SF candidates by the various NATO countries during the selection process.

### **3.1 PHYSICAL/PHYSIOLOGICAL SELECTION OF SPECIAL FORCES SOLDIERS**

SF personnel are elite Soldiers with unique operational and mission capabilities that require high levels of both physical and psychological competencies. Physical capacity is rigorously tested during the SF selection and training process, often referred to as "Hell week" by many countries. The level of attrition from the selection and training process is difficult to determine, as little is published. The Royal Netherlands Army reports 60 – 70 % attrition in experienced Soldiers attending the pre-selection and selection courses [1]. Attrition rate for the Romanian SF selection is reported to be 80 – 85 % in the Acvila unit [3] and as much as 95 – 99 % in the Vulturii unit [4]. A study of Belgian Special Forces candidates reported a 45% pass rate, a 33% fail rate and a 22% drop due to injury or illness [16]. A unit of Soldiers entering the Israeli Defence Forces Special Forces training experiences a 37.4% attrition rate [12]. In this sample, Soldiers were not allowed to quit, so all attrition was mandatory and determined by the Commanding Officers and training cadre. British Army Special Forces selection pass rate is reported to be only 10% [17], and British Special Air Service selection pass rate is reported to be 15% [18]. The success rate for U.S. SF training varies by occupational specialty ranging from 70 – 85 % [5]. Historically, SF medics have the longest specialty training and the highest attrition rate. Attrition from training carries a high economic cost. Optimally, SF candidates would be selected based on a high probability for success in training.

### **3.2 PHYSICAL REQUIREMENTS OF SF SOLDIERS / JOB ANALYSES**

There is little published information regarding the job description of SF Soldiers. Russell et al. [11];[13] conducted a job analysis of U.S. Army SF Soldiers and produced a list of 11 job roles and 26 associated

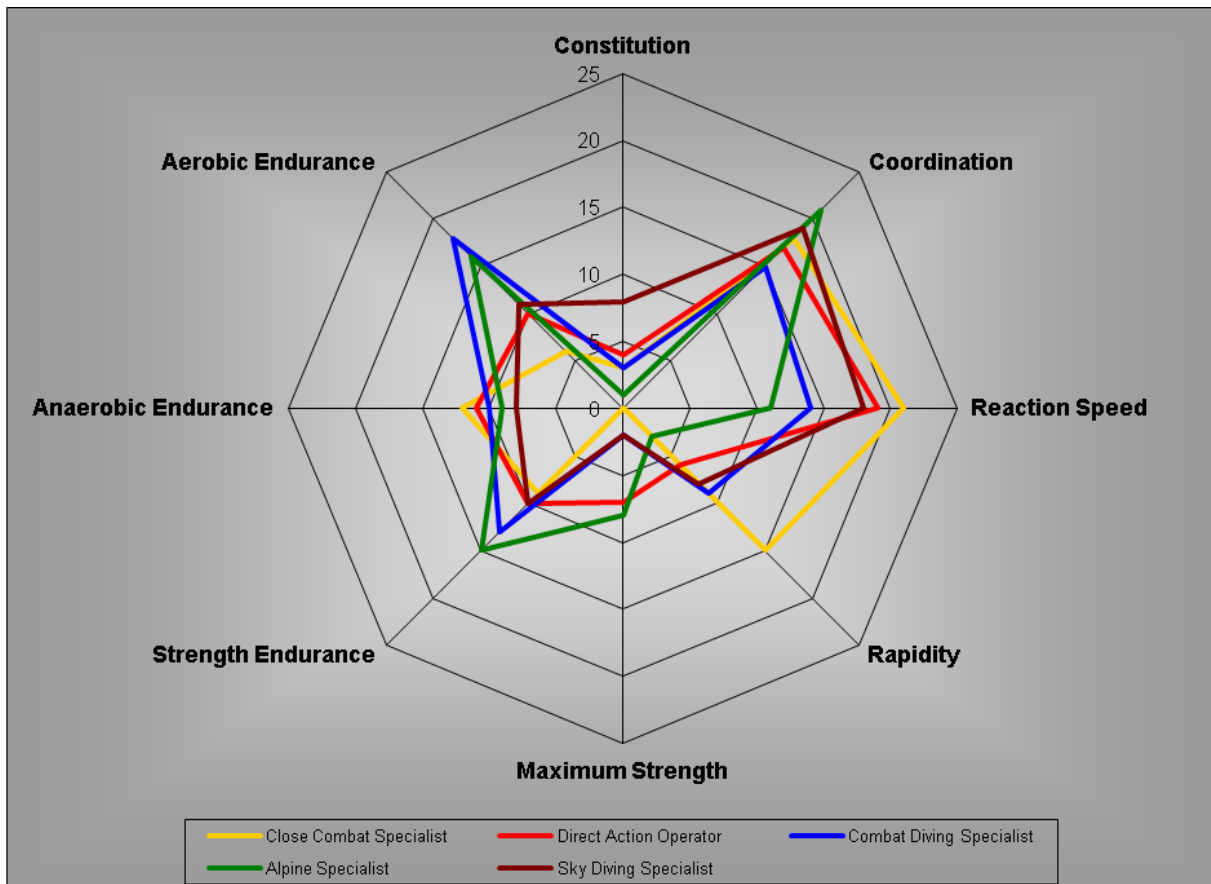
job performance categories, which are outlined in Table 3-1. Subject-Matter Experts (SMEs) used this information to develop a list of SF job performance attributes (Table 3-1). A separate group of psychologists developed a list of individual attributes to predict successful SF job performance [11]. These attributes were divided into four general predictor categories: physical skills and abilities (strength, swimming, endurance, flexibility, and balance), demographic characteristics, cognitive skills, and aptitudes and motivational attributes.

**Table 3-1: Special Forces Roles and Job Performance Categories  
(As Determined by Russell et al. [13]).**

<b>ROLE</b>	<b>PERFORMANCE CATEGORIES</b>
Teacher	Teaching others
Diplomat	Building and maintaining effective relationships with indigenous populations Handling difficult interpersonal or intercultural situations Using and enhancing own language skills
Professional	Contributing to the team effort and morale Showing initiative and extra effort Displaying honesty and integrity
Planner	Planning and preparing for missions Decision making
Solider/Survivor	Confronting physical and environmental challenges Navigating in the field Trouble shooting and solving problems Being safety conscious Administering first aid and treating casualties
Administrator	Handling administrative duties
Weapons Expert	Operating and maintaining direct-fire weapons Employing indirect-fire weapons and techniques
Engineer	Employing demolitions techniques Constructing mission-related requirements
Communications	Following communication procedures and policies Assembling and operating common equipment
Medic	Evaluating and treating medical conditions and injuries Determining and administering medications and dosages Ensuring standards of health-related facilities, conditions and procedures
Leader	Considering subordinates Providing direction

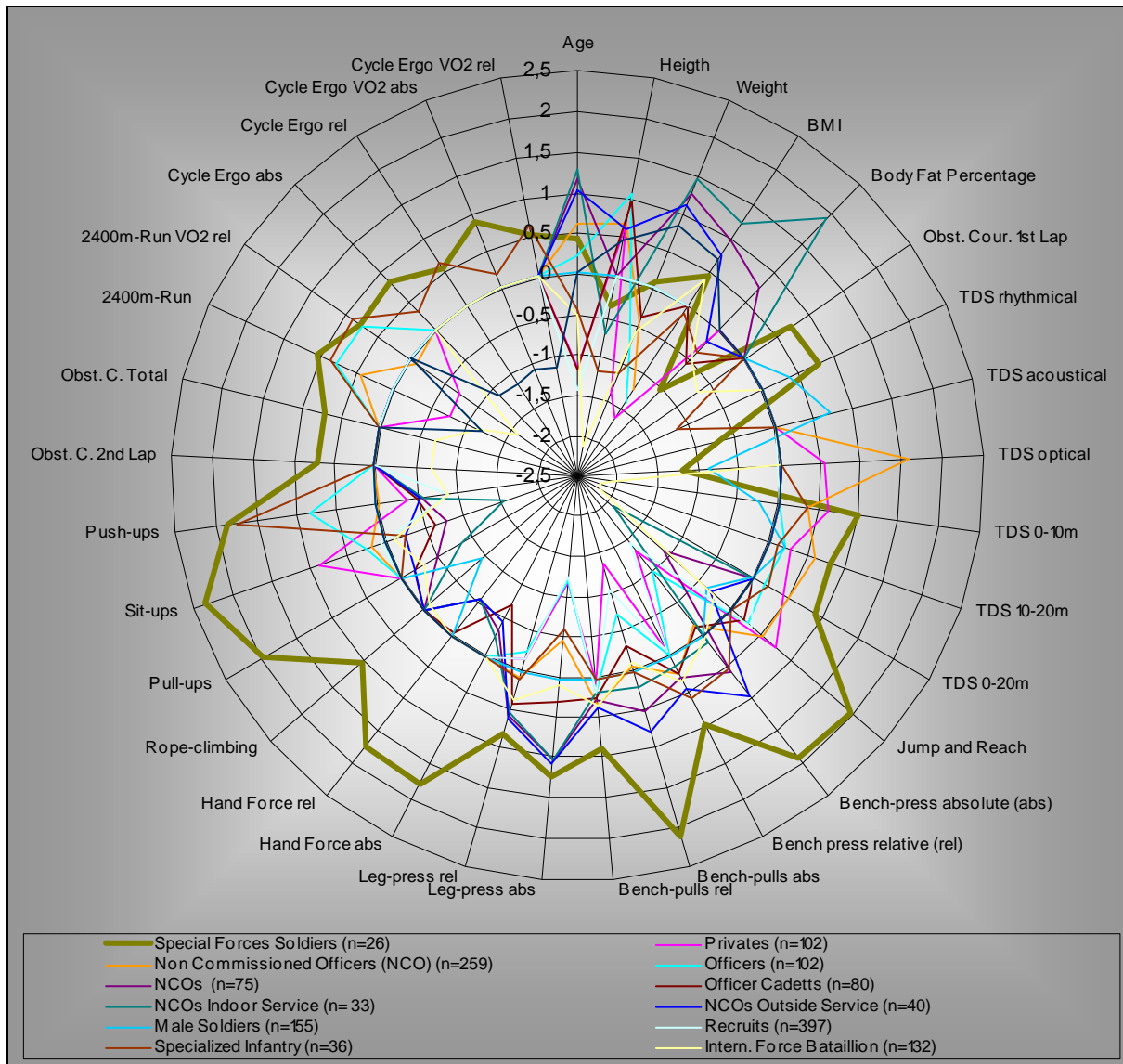
A task analysis was conducted to identify the important physical components of the duties within each Austrian SF specialization, which included Direct Action, Close Combat, Combat Diving, Alpinism and Sky Diving [9];[10]. SF operators served as SMEs and identified the military tasks, typical mission scenarios, and task specific activities. This information was used to identify the “sports motor” or physical components

important to Soldier performance in each specialization, as well as tests of those components. The sports motor components (and tests) included aerobic endurance (2400 m run or cycle ergometer test), anaerobic endurance (obstacle course), strength endurance (pull-ups, sit-ups, push-ups), maximum strength (bench press, leg press), speed (10 and 20 m sprints), coordination/agility (simple and complex reaction time, obstacle course) and body size / composition (height, weight, circumferences, skinfolds). An additional group of experienced SF operators served as SMEs and rated the importance of each of the sports motor components from “not important at all” to “very important” for their specialty. These ratings were used to develop a target profile of the sports motor components essential to each specialty (see Figure 3-1). The specialty ratings were added together to produce a generalized SF operator sports motor target profile.



**Figure 3-1: Net Diagrams of the Derived Sports Motor Components for Each SF Specialty [9];[10].**

A group of 26 SF operators were tested on the measures representative of the generalized SF sports motor profile, and the data were compared to that of non-SF Soldiers (Figure 3-2). It was determined that SF Soldiers had higher aerobic and anaerobic endurance, strength endurance, maximum strength, and speed. There was insufficient data to examine differences in reaction time and coordination, and there were no differences in body size or composition between SF and non-SF Soldiers. The data from the SF Soldiers were used to set cut points for each component of the sports motor profile. The objective of this was to identify SF operators who were deficient in some aspect of their optimal profile and then train them to meet standards.



**Figure 3-2: Current-Status Sports Motor Profiles of Austrian Special Forces Soldiers Compared to Ten Groups of Non-Special Forces Austrian Soldiers [9];[10]. [TDS = reaction time tests; abs = absolute, rel = relative; Obst C = obstacle course; Cycle Ergo VO<sub>2</sub> = cycle ergometer VO<sub>2</sub>max test].**

In order to more accurately identify sports motor key-qualifications for SF operators, both the qualitative (SME opinions) and quantitative findings (comparison to non-SF personnel) were compared, as outlined in Table 3-2. The qualitative instruments (guided interview and questionnaire) indicated that coordination, reaction time, aerobic endurance, strength endurance, and anaerobic endurance had the highest impact on the military performance of SF Soldiers. In support of these data, the quantitative approach (performance testing) revealed significant differences in aerobic, anaerobic, and strength endurance, as well as speed (rapidity) and maximum strength. From these findings, aerobic endurance, anaerobic endurance, and strength endurance were declared to be key-qualifications [9];[10].

Table 3-2: Identification of Sports Motor Key-Qualification for SF Soldiers Based on Qualitative and Quantitative Approaches [9].

		<b>Key-Qualification</b>		
Methodical Approach	Qualitative Approach		Quantitative Approach	Conclusion
Instruments	Guided Interview	Questionnaire	Test Battery	
Importance of the Results	Relevant (sports motor) Components		Key-Components	Key-Qualifications
	<b>Aerobic Endurance</b>	+	+	+
	<b>Anaerobic Endurance</b>	+	+	+
	<b>Strength Endurance</b>	+	+	+
	<b>Maximum Power</b>		+	
	<b>Rapidity</b>		+	
	<b>Reaction Speed</b>	+		+
	<b>Coordination</b>	+		+
	<b>Constitution</b>			

The differences found in maximum strength and speed may be due to the training habits of the tested Soldiers. These differences were not thought to be caused by military demands and were therefore classified as relevant but not key-qualification [9]. This distinction was based on the findings of the qualitative approach, which worked well to correct for the quantitative methods and findings. Although the results of the quantitative testing do not support the qualitative findings regarding reaction speed and coordinative abilities, Eisinger [9] determined them to be key-qualifications as well. The decision was based on the fact that all military experts of all branches weighted these components as highly important. It is possible that the tests used for these abilities were not adequate to differentiate between SF and non-SF Soldiers.

### 3.3 SF PHYSICAL SELECTION TESTS

In order to attend the three week U.S. Army SF Assessment and Selection course (SFAS), Soldiers must meet a set of cognitive and physical prerequisites. The primary physical prerequisite is the ability to pass the Army Physical Fitness Test (APFT) standards for 17 – 21 year old men (42 push-ups, 53 sit-ups, and 15:54 for a 2-mile run). The APFT is conducted during the first few days of the SFAS to ensure the Soldiers meet the standard. As is true of most NATO countries, once accepted into the formal SF selection process, there are further physical demands and challenges to meet. For example, U.S. Army SF candidates undergo arduous physical training daily. They perform timed runs, loaded marches and obstacle courses, and must successfully finish land navigation challenges. They must complete seemingly impossible physically demanding tasks that are designed to challenge their intellect, will, and physical capacity. These challenges will often cause the physically unprepared Soldier to voluntarily withdraw. During the course, the instructors continuously assess the candidates to determine which Soldiers will ultimately be selected for further training in the U.S. Army SF Qualification Course (SFQC). SF candidates from the Netherlands are



subjected to a similar process including an 8-week pre-selection course, a Basic Commando Course, and an Operator Training course [1].

Across NATO countries, some of the common physical requirements for entry into the SF include tests of physical fitness (running, push-ups, sit-ups, pull-ups, swimming), measures of Soldier performance (land and/or underwater navigation, loaded marching, weapons firing, rope climbing, repelling, litter carries) and physical challenge tasks (obstacle courses, problem-solving exercises). A number of these are listed in Table 3-3. The selection process for the UK Army and Special Air Service SAS are similar. Candidates for selection to the UK Army SF must first pass their Personal Fitness Test (PFT), which consists of a minimum of 44 push-ups and 50 sit-ups in 2 minutes each, followed by a 1.5-mile run in under 9.5 minutes. The selection process begins with a 4-week course of loaded hill runs, navigation exercises, and hill climbs carrying an unsupported weapon. The tests include loaded marches, a 22-mile land navigation course, and a 40-mile, 55-lb loaded march, which must be completed in less than 20 hours. They also must complete 6 weeks of jungle training and 4 weeks of Survival, Evasion, Resistance, and Escape training (SERE) [17]. For selection into the UK Special Air Service (SAS), in addition to the PFT, candidates must pass a Combat Fitness Test (CFT), which involves a 6 – 8 mile, 15 – 25 kg loaded march (full combat gear) at a 15-minute per mile pace across rough terrain and roads. After the first phase of selection, they must be able to swim 2 miles in 90 minutes and run 4 miles in 30 minutes [18]. Selection for Canadian Special Operations includes a physical fitness evaluation (MPFS) involving a 20 meter shuttle run, 40 consecutive push-ups, 40 sit-ups in 1 minute, 5 pull-ups, and a handgrip dynamometer test. This aptitude test predicts the candidate’s ability to perform 5 military tasks in an operational setting to include sea evacuation, land-stretcher evacuation, low and high crawl, entrenchment dig, and sandbag carry. They also must complete a 25-meter combat swim test in uniform carrying a rifle, a 13-km loaded (35 kg) march in 2 hours and 26 minutes, and a 100-meter casualty rescue of a Soldier of similar weight, which must be completed in less than 60 seconds [14].

**Table 3-3: Summary of Physical Tests Used for SF Selection by NATO Countries.**

Strength/Muscular Endurance	Push-up	44 in 2 min (UK [17];[18])
		40 consecutive (Canada [14])
		1 min continuous (Germany [7])
		42 in 2 min (US [19])
	Sit-up	50 in 2 min (UK [17];[18])
		40 in 1 min (Canada [14])
		1 min continuous (Germany [7])
		53 in 2 min (US [19])
	Pull-up	5 (Canada [14])
	Rope climb	
	Dive	(Turkey [15])
	Standing jump	(Germany [7])
	Sprints	(Italy [6])
		3 – 10 m (Germany [7])
	Handgrip strength	(Canada [14])



Aerobic Endurance	Shuttle run	20 m (Canada [14])
	2800 – 5000-m run	
	1.5-mile Run	< 9.5 min (UK [17])
	2-mile run	< 15:54 min (US [19])
	4-mile Run	< 30 min (UK SAS [18])
	12-min run	(Germany [7])
	500-yard swim	
	Underwater swimming	
	Gear swim	
	25-m loaded swim	(Canada [14])
	500-m swim	< 15 min (Germany [7])
	2-mile swim in uniform with weapon	< 90 min (UK [18])
	5.5-mile open ocean swim	
	Skiing	(Italy [6])
Body Size/Composition	Weight, Height, Percent Body Fat	Weight for height standard (US [19])
Soldier Tasks	6.7-km – 24-km road march	(US [2];[19])
	6-8-mile loaded march with 15-25-kg load across rough terrain	15 min/mile pace (UK [18])
	40-mile road march with 55-lb load	< 20 h (Canada [14])
	13-km loaded march with 35-kg load	2 h, 26 min (Canada [14])
	100-km terrain march	With 40-kg load (Turkey [15])
	7-km field run with a 20-kg load	< 52 min (Germany [7])
	Speed marches	(Netherlands [1])
	Loaded hill marches and climbs	(UK [17])
	Land navigation	(US – 12 mile [19],UK – 22 mile [17], Italy [6])
	Water navigation	(Italy [6])
	10-m jump into water	
	Land and sea evacuation	(Canada [14])
	Combat field survival exercises	(Turkey [15], Italy [6])
	Search, Evade, Rescue and Evacuate (SERE) training	(Romania [3];[4], Italy [6], UK [17], US [20])

Soldier Tasks (cont'd)	Patrol	(Netherlands [1], Italy [6], US [20])
	Live fire exercises	(Netherlands [1], US [20])
	Jungle training	6 weeks (UK [17])
	100-m casualty rescue	< 60 sec (Canada [14])
	Search and rescue missions	(Turkey [15])
	Mountain warfare, skiing	(Italy [6])
	Parachuting	(Romania [3];[4], Italy [6], UK [18], US [19])
	Entrenchment dig	(Canada [14])
	Underwater demolition, small boat handling	(Italy [6])
	Sandbag carry	(Canada [14])
Physical Challenge Tasks and Courses	Obstacle course	(Turkey [15], US [20])
	Team challenges	(US [20])
	Martial arts	(Turkey [15])
	Close quarters combat	(Turkey [15])

During the 8-week selection phase for the Korps Commandotroepen, the elite SF of the Royal Netherlands Army, candidates are required to complete elements such as live fire exercises, long range patrolling, and speed marches, during which the candidates are subjected to extreme temperatures, hunger, and exhaustion [1]. Candidates for admission to the Romanian SF Eagle Unit must endure a 30 – 45 day process of physical training lasting 16 – 20 hours per day, followed by a 3 – 4 day field training exercise [3]. They must master mountaineering, parachuting, hand-to-hand combat, weapons firing, and land navigation skills. Selection for the *Ozel Kuvvetler Komutanligi* (OKK), the Special Operations unit of Turkey, is similar to the U.S. Green Berets. In addition to physical fitness tests, candidates must complete a 2.5-year training period, which includes obstacle courses, martial arts, close quarters combat, search and rescue, stealth seek and destroy, diving, sniping, parachuting, and survival missions. Candidates must perform a 100-km terrain march with a 40-kg load [15]. Italy’s 9<sup>th</sup> Para-Assault Regiment is the Special Forces of the Italian Army. Their selection process includes physical fitness tasks such as timed speed and endurance marches, land and water navigation, and patrolling. Over the course of a year, they also must complete combat field training, SERE training, boat handling, mountain warfare techniques and skiing [6]. Candidates for selection into the *Kommando SpezialKraefte* (KSK), the special forces unit of Germany, must complete a physical fitness test of sit-ups and push-ups, four 9-m sprints, standing jumps, a 12-min run, a 500-meter swim in <15 min, a 7-km field run in <52 min with a 20-kg load, and a 160-km loaded march in 4 days, which includes river crossings, orienteering, and ambushes. They also must complete SERE training [7].

### 3.3.1 Predicting Successful Completion of the SF Assessment and Selection Course (SFAS)

A number of studies have been conducted to examine predictors of success in the U.S. SFAS course. In a study of Belgian Special Forces Soldiers, candidates who participated in sports, did not smoke, and drank less were more likely to successfully complete SF training [16]. In addition, successful candidates tended to have higher HDL cholesterol. There was no difference in the body size or VO<sub>2</sub>max between successful

and unsuccessful candidates. Van Hoof et al. [16] concluded that they could not adequately identify successful candidates from the measures made. Zazanis et al. [20] reported that the APFT, time in service, Wonderlic score, and Airborne qualification were most predictive of success in the SFAS course for one historical sample of lower ranking Soldiers (E4 and below). There was a 30% difference in selection rate between Soldiers scoring in the lowest tertile (20% selection rate) vs. the highest tertile (50% selection rate) for APFT score. The results were similar, though less dramatic for time in service, Wonderlic, and Airborne qualification tertiles. In a second sample of junior non-commissioned officers (NCOs, rank E-4), the variable most correlated with selection for SF was Infantryman ( $r = 0.24$ ), followed by APFT score ( $r = 0.19$ ). A predictive equation was developed using APFT score, branch type (Infantryman-11B, Infantry not-11b, Other), Armed Services Vocational Aptitude Battery (ASVAB) General Technical Score, and Airborne qualification. Examination of the distribution of scores from this equation revealed that 66% of Soldiers in the top quartile were selected, while only 24% of those in the bottom quartile were selected to go on to the SFQC.

In a more recent study of Soldiers attending the SFAS course, it was again determined that physical performance tests were the best predictors of selection, followed by cognitive tests, the APFT and, lastly, a measure of perseverance referred to as the Grit Scale [2];[8]. Of all the physical performance and fitness measures, time on the second ruck march was determined to have the highest predictive strength, followed by time on the first ruck march, the first 4-mile run time, the APFT, the second 4-mile run time, pull-ups and, finally, the obstacle course time. The physical fitness variables accounted for 22% of the variance when used in a binary logistic regression model. These same data were analyzed to determine how a 10% increase in the acceptable APFT score would affect the success rate. It was found that if the acceptable APFT score was increased to exclude the lowest 10<sup>th</sup> percentile of Soldiers, 83% of those who would have been rejected initially were Soldiers who voluntarily withdrew [2]. Therefore, increasing the cut scores used for the physical performance entrance standards is one method to increase the success rate and reduce the voluntary withdrawal rate in the selection process.

In a recent study of Israeli Defence Forces SF Candidates, it was determined that nearly 70% of the attrition cases were predicted by an equation that included a self-confidence score and percent body fat [12]. The predictive capacity was increased to 75% when the equation included a variable indicating the Soldier's perception of his commander's appreciation at the fourth month of training. As noted by the authors, this equation is not entirely practical, as it could only be used after the Soldiers had been training with the unit for 4 months.

Although physical predictors were demonstrated to be of primary importance during the selection process [2];[20] they were not as important during the SFQC, in which the cognitive demands of learning a language and new concepts becomes more important. Zazanis et al. [20] reported that physical fitness was not predictive of success in the SFQC. It is likely that a requisite level of physical fitness had already been reached by most of the candidates entering the SFQC. For this reason it is no longer a discriminator. In addition, physical fitness can be improved with a good physical training program, while cognitive ability is far less trainable. Therefore, cognitive performance standards are of critical importance in the selection process for the long-term success of the SF candidate.

### **3.3.2 Beyond Selection: Physical Requirements of Special Forces Qualified Soldiers**

The training of SF Soldiers is designed to prepare them to perform during real military operations. The connection between the procedures used to select Soldiers for training and ultimate job performance is rarely made. In a study by Kilcullen et al. [11], SF supervisors rated the field performance of SF Soldiers. Physical tests (road marches, land navigation, obstacle course, APFT, running, and swimming) and cognitive tests (Armed Services Vocational Aptitude Battery, Defence Language Aptitude Battery, Wonderlic) conducted during the selection and initial training process were then used to predict SF field performance. Motivational questionnaires were also completed. Measures of motivation were more

important for predicting supervisor ratings of field performance than physical fitness and cognitive measures. These authors hypothesized that SF operators are all high scoring on physical and cognitive abilities, thus reducing the range of scores and subsequently reducing the predictive power of these measures. It may be possible to identify a baseline level of physical fitness required for successful performance as an SF Soldier. This baseline level of fitness could be used for selection and to ensure adequate physical training to maintain or increase fitness as suggested by Eisinger et al. [10].

Physical fitness and performance are important for both selection of SF Soldiers and job performance for SF operators. While they are important predictors of early performance and need to be maintained throughout an SF operator's career, these measures were not as good at predicting Soldiers who would complete the qualification course on the first attempt. Physical performance and fitness variables did not differentiate between poor, average, and superior SF performance in experienced operators; however, this may be due to the lack of variation in fitness among the operators. Adequate physical fitness enables a Soldier to successfully complete the physically demanding aspects of training without injury. Data from Austria [9];[10] indicate that SF operators are at a higher level of physical fitness than non-SF Soldiers. The authors recommended setting minimal acceptable standards for their sports motor profile at the 10<sup>th</sup> percentile for SF Soldiers. The assumption was that these SF operators were capable of performing all the job requirements, so the 10<sup>th</sup> percentile was adequate to ensure acceptable performance. SF operators would be required to conduct remedial training for any deficiencies in the sports motor profile [10].

### 3.4 SUMMARY

- Most physical performance requirement tests for SF selection involve aspects of physical fitness (running, push-ups, sit-ups, pull-ups, swimming), measures of Soldier performance (land and/or underwater navigation, loaded marching, weapons firing, rope climbing, repelling, litter carries) and physical challenge tasks (obstacle courses, problem-solving exercises).
- Physical performance assessment appears to have higher predictive ability for selection vs. qualification.
- By increasing the difficulty of physical performance minimal standards, Special Forces selection courses can decrease their attrition.
- Following selection and in preparation for the qualifying course, SOF candidates should augment their training with coordination and reaction time in addition to traditional methods of physical training.
- Future physical performance tests should include tests specifically aimed at evaluating coordination and reaction time.

### 3.5 REFERENCES

- [1] Ask.com (2011, March 8). *Korps Commandotroepen*. Retrieved from [http://www.ask.com/wiki/Korps\\_Commandotroepen#Selection\\_and\\_training](http://www.ask.com/wiki/Korps_Commandotroepen#Selection_and_training).
- [2] Beal, S.A. (2010). *The roles of perseverance, cognitive ability and physical fitness in the U.S. Army Special Forces assessment and selection*. Research Report 1927. Alexandria, VA???: U.S. Army Research Institute for the Behavioural and Social Sciences.
- [3] Crasmarelu, Sorin A. Grupul Special de Protectie Si Interventie "Acvila." *Romanian Special Forces*, 2003 – 2006. Retrieved from <http://romanianspecialforces.com/acvila.html>.
- [4] Crasmarelu, Sorin A. Batalionul 1 Operatii Speciale "Vulturii." *Romanian Special Forces*, 2003 – 2006. Retrieved from <http://romanianspecialforces.com/vulturii.html>.

- [5] Diana, M., Teplitzky, M.L. and Zazanis, M.M. (1995). *Special Forces Qualification Course graduation and attrition statistics for Soldiers selected for training in FY89-FY91*. Technical Report 1023. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- [6] Dominique, S. *Italy's*. Retrieved from [http://www.specwarnet.net/europe/italy\\_9th\\_parabat.htm](http://www.specwarnet.net/europe/italy_9th_parabat.htm).
- [7] Dominique, S. *Germany's KSK*. Retrieved from <http://www.specwarnet.net/europe/ksk.htm>.
- [8] Duckworth, A.L., Peterson, C., Mathews, M.D. and Kelly, D.R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology*, 92, 1087-1101.
- [9] Eisinger, G.C. (2006). *Sportsmotor profile of Special Operations Forces Operators of the Austrian Army*. Dissertation, University of Vienna, Austria.
- [10] Eisinger, G.C., Wittels, P., Enne, R., Zeilinger, M., Rausch, W., Holzl, T., Dorner, G. and Bachl, N. (2009). Chapter 6: Evidenced-based job analysis and methodology to determine physical requirements of special military occupations. In: *Optimizing Operational Physical Fitness*. NATO Technical Report, ISBN 978-92-837-0052-4, pp. 1-64.
- [11] Kilcullen, R.N., Mael, F.A., Goodwin, G.F. and Zazanis, M.M. (1999). Predicting U.S. Army Special Forces field performance. *HPEE*, 4, 53-63.
- [12] Moran, D.S., Evans, R.K., Arbel, Y., Hadid, A., Laor, A. and Fuks, Y. (2011). Prediction model for attrition from a combat unit training program. *Journal of Strength and Conditional Research*, 25, 2963-2970.
- [13] Russell, T.L., Crafts, J.L., Tagliareni, F.A., McCloy, R.A. and Barkley, P. (1994). *Job analysis of Special Forces jobs*. ARI Research Note 96-76. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- [14] ShadowSpear Special Operations (2011). *ShadowSpear Special Operations*. Retrieved from <http://www.shadowsppear.com/canada-special-operations>.
- [15] ShadowSpear Special Operations (2011). *ShadowSpear Special Operations*. Retrieved from <http://shadowsppear.com/turkey-special-operations>.
- [16] Van Hoof, R., Dubois, P., Leysen, J. and Francois, R. (1992). Predictability of the individual outcome of a physical training program of an Army Special Forces Unit. *Military Medicine*, 157, 207-210.
- [17] Wikipedia, the Free Encyclopedia (2011, January 25). *United Kingdom Special Forces selection*. Retrieved from [http://en.wikipedia.org/wiki/United\\_Kingdom\\_Special\\_Forces\\_Selection](http://en.wikipedia.org/wiki/United_Kingdom_Special_Forces_Selection).
- [18] Wikipedia, the Free Encyclopedia (2011, March 23). *Special Air Forces*. Retrieved from [http://en.wikipedia.org/wiki/Special\\_Air\\_Service](http://en.wikipedia.org/wiki/Special_Air_Service).
- [19] Wikipedia, the Free Encyclopedia (2012, August 19). *United States Army Special Forces Selection and Training*. Retrieved from [http://en.wikipedia.org/wiki/United\\_States\\_Army\\_Special\\_Forces\\_selection\\_and\\_training](http://en.wikipedia.org/wiki/United_States_Army_Special_Forces_selection_and_training).
- [20] Zazanis, M.M., Hazlett, G.A., Kilcullen, R.N. and Sanders, M.G. (1999). *Prescreening methods for Special Forces selection and assessment*. Technical Report 109. Alexandria, U.S. Army Research Institute for the Behavioral and Social Sciences.



## Chapter 4 – FUTURE SELECTION

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### **ABSTRACT**

*Special Operations Forces (SOF) operators have specialized skills, equipment and tactics intended for extreme and extraordinary operations. It is difficult to select such groups of individuals because they have to meet extreme demands. The diagnostic instruments applied up to now have surely rendered practicable predictions, irrespective of test-theoretical and statistical considerations. Practical experience shows this. However, the requirement should be, and continue to be, the elimination of deficits and the readjustment of procedures. New trends in personnel selection have to be economic because funds are currently scarce. From an economic perspective, sequential strategies have the best prospects. This chapter focuses on considerations, new trends of research, and developments in selection testing of SOF operators.*

### **4.1 INTRODUCTION**

SOF operators are utilized for extreme and extraordinary operations. Consequently, the selection procedures for SOF personnel must be more stringent than those for general service personnel. Characteristics like physical fitness, commitment, reliability, team spirit, mental resilience, persistence, and consistently high performance standards are essential prerequisites to accomplish the mission. Hence, individuals are required who can continue to do their job precisely, despite sleep deprivation, prolonged irregular nutrition, poor sanitary conditions, extreme psychophysical demands, and life-threatening conditions. Therefore, SOF operators who work under extreme pressure must undergo a unique selection of tests and standards. Extreme stresses and strains require specific test procedures.

SOF selection tests and procedures must be scientifically validated. Selection tests are important specifically because of their prognostic capability. Valid selection procedures will reduce costly errors in the selection of personnel, and reduce attrition rates.

### **4.2 SPECIAL JOBS REQUIRE SPECIAL SELECTION**

The rising number of terrorist activities has led to an increased number of military operations, to include Direct Action (DA) operations. The volatile situation in Iraq and Afghanistan persists and, in some militaries, the number and length of deployments is increasing. These demands have placed more stress on SOF operators. Consequently, efficient and effective approaches to selection, training, and education of SOF personnel is crucial.

The interest in stress research, especially research on high risk groups, has gained importance during the past few years [5];[1]. Many people feel overstrained, and even comparatively minor errors or performance



deficits may have devastating consequences. Extreme situations challenge occupational groups like policemen, firemen, or Soldiers up to the limits of what they can bear. Recently in Germany, it has become more frequent that policemen who had been involved in an exchange of fire and had been afraid of losing their lives contracted a so-called *post-shooting trauma* [7].

Similarly, many Soldiers (U.S. military personnel) who deployed on operations in Iraq and Afghanistan are suffering from Post-Traumatic Stress Disorder (PTSD) [2]. Therefore, stress limits are currently the focus of selection, training, and operational questions. The goal of a post-modern Soldier should be the precise and prompt handling of operations in extremely stressful situations.

To behave according to his survival strategy, the SOF operator in combat depends on quick exploration, assessment of the situation, decision-making, and action. This requires a way of information processing that works precisely under a great deal of pressure. The SOF operator's internal information processing should therefore be characterized by psycho-cerebral stability, cognitive flexibility, little fatigue under high stress, and a differentiated and emotionally stable behavior pattern. In extreme situations, he must still have resources at his disposal to perceive, think, and act according to the situation. In short, combat power must not decrease because of multiple stressors.

SOF needs individuals who can cope with extreme stress. The goal of selection is to identify individuals whose limits are higher than those of other people. That is, they start to feel stressed later, and their efficiency remains the same despite multiple or extreme strain. The diagnostic instruments must be tailored to the "high performance clientele".

### 4.3 NEW TRENDS

As mentioned above, a serious problem in all subjective procedures (e.g., personality tests) is that several distortion tendencies may play a role in their processing (e.g., social desirability). Hence, mainly objective personality tests should be used to select SOF operators. Prof. Dr. Harald Schaub (IABG<sup>1</sup>) and his research team from Germany currently work on virtual simulation technology in order to objectively determine personality traits. A validation study on this topic is currently being carried out with German SOF operators.

Extreme strains and the resulting stress reactions may cause the destabilization of an act or action. We can distinguish four levels in this context [4]:

- Changes in performance characteristics;
- Changes in emotional reactions;
- Changes in hormonal reactions; and
- Changes in physiological activity parameters.

Except for the recording of emotional reactions, objective methods can be applied to determine the individual tolerance to stress of SOF operators.

Extreme situations may evoke stress up to limits that cannot be reached using the standards of usual measuring methods and tests. Therefore, an arbitrary use of usual diagnostics in order to determine the suitability profile for SOF operators is extremely problematic. The prognostic validity is questionable.

More substantiated results could therefore be provided, for example, by specific Combat Assessment Centers using defined operative stress segments (ambulatory assessment). These have to correspond to

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the expected combat strains with regard to time intervals, stress specifics, and action demands required (true to the motto: “Train *and select* as you fight”). They should be arranged according to physical, psychological, and cognitive stress principles. The prognostic validity of statements will only increase if precise analyses of mission-specific demands are available and consequently lead to an optimum relation of predictors and criteria.

A measuring system must be developed that is designed to record data in action and to make process analyses. For this purpose, the processes to be measured must be defined and related to the operations required. Necessary key operations should be recorded in this process. Practical aspects of measurement should be observed. The behavior to be measured should be defined according to the expected situations (i.e., future situations). Furthermore, operations must be clearly defined and feasible. To record the course of the process, it is recommended to record data in an objective and multi-methodological way.

Psycho-physiological parameters have repeatedly been discussed in the framework of selection. However, they should only be recorded in connection with perceptive-cognitive-actional data. It is not at all efficient if, for example, only quick action is required in the field and the stress experienced by the Soldier is assigned to the heart rate measured. These are no “stress” indicators, but only values to determine exertion while running.

One example for recording psycho-physiological parameters in action would be the Varioport [3]. The individual being assessed wears the Varioport in a carrier around the mid-section while the data are recorded. The system includes inter alia, a universal channel with differentiations for the Electrocardiogram (ECG), Electromyography (EMG), and Electroencephalogram (EEG). Furthermore, a channel for electrodermal activity with an especially high resolution is integrated to simultaneously record the phasal and tonic share (EDA). Besides further channels for skin temperature and respiration, there is a marker to determine the stages of the analysis. The device is connected to a computer system via a serial interface.

Besides the registration of psycho-physiological parameters, further data should be recorded that allow for conclusions to be drawn concerning the applicant’s quality of performance [6]. These could be based, for instance, on the results of coordinative or sensomotoric tests, or on the applicant’s firing performance. Cut-off values should be stipulated for this purpose. The criteria of the course of action must be standardized and categorized in advance during an expert workshop. If a Soldier is strained with additional tasks while performing another task, these additional tasks will bind resources in his brain. The volume of the information budget is restricted, and the limits are often reached quickly. If the Soldier regards the additional task as more important than the ongoing main task, then the minor task primarily binds the resources. Mistakes may occur. Accordingly, additional tasks are a suitable means to analyze strain and overstrain of an individual. The additional tasks should be inserted in fixed measuring phases. They may consist of simple arithmetic exercises or memory tests. Here again, cut-off values should be determined. The time the applicant needs to cope with the actions required can be considered as a further objective data collection and can be related to the applicant’s quality of performance.

In addition to the collection of the above mentioned parameters (e.g., while performing combat tasks or during simulation), further procedures should be used to determine the stress profile. Salivacortisol could be used as a further indicator to cover hormonal parameters, for example. For this purpose, the cortisol level is measured via saliva secretion. As a consequence of the adaption of the organism, peak values can be observed at any time of the day. Occurrences like psychological threat, and new and unpredictable situations are the central components of a psychologically provoked cortisol reaction. This procedure has already been used successfully for the selection of firefighters [8].

The collection of the above mentioned objective data in action (ambulatory assessment) allows for statements about the change of hormonal reactions, psycho-physiological activity parameters, and performance parameters under pressure and under the influence of additional tasks. They may be

considered for SOF selection as a supplementary factor, or subsequent to a close examination and evaluation. Further research in this matter is surely indispensable.

#### **4.4 CONSEQUENCES FOR SOF SELECTION**

Not only should new or untested physical and psychological assessment methods for SOF operators be assessed on their validity and reliability, symmetry principles and their systematic application are important preconditions for successful prediction. The more specialized a job and its incumbents, the more necessary are the specific and symmetric alignment of the diagnostic instruments. The Brunswik Lens Model illustrates these kinds of symmetry principles [10].

We can distinguish four cases of asymmetries for the evaluation of SOF selection. In case of complete asymmetry, we make the mistake of measuring the wrong effects or predictors. We always run the risk of making this mistake, for example, if assessment tools are chosen solely because of their easy availability and high reliability and regardless of their theoretical reference.

The following example illustrates this case (Case 1):

The Assessment Center claims the specificity of exercises, specifically relating to the respective company for which the Assessment Center is designed. However, this claim is not consistent with the fact that common exercises like group discussions, presentations, and in-basket exercises are included in every assessment, notwithstanding the adaptation of their contents to the specific question, such as the assertiveness or the determination of a future SOF operator, for example.

Case 2 shows a relatively narrow criterion that we want to predict based on a clearly general predictor. This case is typical of the field of personality psychology in which people often try to predict a behavior specific to the situation based on general trait scales. For example, sociability is supposed to be predicted based on broad predictors like extraversion.

Case 3 shows the opposite situation. The number of criterion components is more powerful than the number of predictor components. A broad criterion is supposed to be predicted from a narrow predictor. This would be typical of laboratory experiments and only scarcely applies for SOF selection.

Case 4 is a mixture of cases 1 – 3. Our predictors and criteria overlap slightly. Sticking to the symmetry principle is an important precondition for a successful prediction. In this context, it is the breadth of the measures used and their overlaps that count. Only in a situation of optimum symmetry is it possible to obtain maximum correlation coefficients. The assessment tools chosen should be specifically tailored to the questions or requirements. Furthermore, a multi-methodological and multi-dimensional data collection (i.e., referring to several predictors) is recommendable. For example we would want to measure the dimensions perceptual speed and concentration, as well as physical and psychological hardiness in an SOF candidate with an adequate combination of valid methods.

In general, the combination of several selection procedures mostly yields a higher validity if predictors, which are independent of each other and relevant for the criterion, are gathered using the corresponding measuring methods apart from suppression effects. This can explain a major part of the criterion variance. Prognostic validity depends, inter alia, on random errors (i.e.,  $\alpha$  and  $\beta$  errors), the quality of the assessment tools, and the competence of the persons in charge of the decision-making process. However, validity is also dependent on sampling.

Another example will illustrate this. The validity of an intelligence testing procedure is lower for scientists than for adolescents. This is attributable to the fact that scientists as such are a pre-selected group regarding their cognitive capabilities and, therefore, variance is lower.

This example can also be applied to SOF operators. With regard to “physical resilience”, if we suggest that SOF operators are conscious of their potential job and accordingly regard themselves as “more resilient” than the average population, and if this is in fact the case, the variance in a resilience test should be lower than in the average population.

Because funds are currently scarce and many militaries are experiencing financial constraints, new trends in personnel selection also have to be economically efficient. At the beginning of the selection process, a sub-group of eligible applicants should be screened in from a wider pool of applicants. For screening purposes, tests that demonstrate high correlations with the criterion are generally used. For prediction purposes, a regression equation is used in most cases. The weights of such a regression equation are based on pure statistics and often do not correspond to the real requirements during operations. For instance, the model is based on the assumption that talents can, in principle, compensate one another.

However, cut-off criteria, minimum conditions that cannot be made up for by other characteristics, occur rather frequently during operations. One example is the visual fitness of pilots or the physical fitness of SOF operators – an essential but not sufficient precondition for the “job”.

An alternative to the compensatory model is the multiple cut-off approach. A minimum performance is required for important traits. All applicants who do not reach this minimum will be rejected. Based on this discussion, the sequential pre-selection strategy or pre-reject strategy seems to be appropriate for the future, because after a first procedure, all applicants who have not reached a certain cut-off value will be excluded from all further examinations and will be terminally rejected. The remaining applicants will take part in further tests or selection procedures. Financially, this strategy is advantageous because the reduction of candidates during the screening phase results in reduced costs during the selection phase given the reduced applicant pool. The problem is that the validity of this test strategy may decrease because the variance has diminished due to the selection [9].

## **4.5 OBSTACLES TO BE EXPECTED**

During recent decades conflicts have changed from large conventional conduct of war to “asymmetric warfare” conditions, wherein the resources of the enemy parties differ so much that the “weaker” combatant has to use special tactics, like improvised explosive devices, to offset deficiencies in quantity or quality. The international community has witnessed an increase in terrorist activities, including aircraft hijackings, hostage taking, embassy seizures, and suicide attacks. To counter these threats, there has been a greater reliance on SOF skills. Simultaneously, military operations have become more transparent to the public as a result of the emergence of internet platforms like “wiki-leaks”. This serious political impact of conducting military operations under a NATO or UN mandate anywhere in the world is therefore increasing the moral and juristic impact not only on the higher command level, but also on every single operator in theater.

Furthermore, the technical equipment and the specialized tasks of SOF operators, similar to forward air control, explosives handling, the provision of medical support, and the operation of communication systems, are getting more complex and require longer and more intense training.

Many SOF units complain about the demand of suitable personnel. The renunciation of the compulsory military service of nearly all NATO members is presenting a decline in the recruitment of qualified and suitable personnel. The ideal SOF candidate is a physically and psychologically resilient NCO/officer who can operate effectively in a hostile environment for long periods without decreasing performance and conducts his operations with a sure awareness of legalities and virtue. That means that personnel selection and recruitment are facing an increasing demand of personal skills requirements and personnel itself on the one hand, and decreasing attractiveness of military service and improper personnel on the other hand.

Exposure to warfare conditions result in a number of outcomes including physiological, emotional, cognitive, behavioral reactions, and performance effects. In high-demand settings, the stress level is critical and impacts effective task performance. Thus, a follow-up process concerning not only physical skills, as it is already implemented by most SOF units, but also an accompanying check-up of mental health and mental performance is a necessary asset to ensure the sustainability of SOF personnel.

#### **4.6 REFERENCES**

- [1] Bonanno, G.A. (2004). Loss, trauma, and human resilience. *American Psychologist*, 59, 20-28.
- [2] Hoge, C.W., Castro, C.A. and Messer, S.C. (2004). Combat duty in Iraq and Afghanistan, Mental health problems, and barriers to care. *The New England Journal of Medicine*, 1, 13-25.
- [3] Jain, A. and Stephan, E. (2000). Stress in patrol duty: *How stressed are police officers*. Berlin: Logos.
- [4] Schandry, R. (1998). *Psychophysiology*. München: Urban and Schwarzenberg.
- [5] Solomon, Z. (1993). *Combat stress reaction*. New York: Plenum Press.
- [6] Ungerer, J. (1999). *Psychophysiological study on the influence of Operational Tempo on SWAT – Unit members*. Diploma Thesis, University Mannheim, Cologne.
- [7] Ungerer, D. and Ungerer, J. (2008). *Life threatening situations WORDING as challenge in law enforcement*. Frankfurt: Verlag für Polizeiwissenschaft.
- [8] Wagner, D., Heinrichs, M. and Ehlert, U. (1998). Prevalence of symptoms of posttraumatic stress disorder in German professional fire fighters. *American Journal of Psychiatry*, 155, 1727-1732.
- [9] Wiggins, J.S. (1973). *Personality and prediction: principles of personality assessment*. Massachusetts: Edition-Wesley.
- [10] Wittmann, W. (1990). Brunswik Lens Model and the conception of the Five-Data-Box. *Zeitschrift für Pädagogische Psychologie*, 4, 241-251.

## **Chapter 5 – CONCLUSIONS AND RECOMMENDATIONS**

The objective of this Task Group (TG) was to improve the selection processes for Special Operations Forces (SOF) personnel by developing guidelines from best practices and evidence-based research, including the relevant psychological and physiological factors and the interactions between them. However, two important restrictions were placed on the TG, which represent limitations on its conclusions and recommendations: The TG was restricted to using unclassified material and to only report unclassified information. The first restriction meant that the working group could only draw on open sources, which limited the amount and the depth of information available.

In order to overcome the second restriction, the TG decided to describe its findings on an abstract scientific level. In other words, this paper discusses the best practices for selection procedures for participating countries, but with little specific and descriptive information, so that all information reported here can remain at the unclassified security clearance level.

As a result of the security restrictions on specifics, this paper primarily focuses on evidence-based research and general guidelines for selection processes for SOF personnel. Chapter 2 illustrates the more abstract analysis necessitated by the restriction to open sources. It is stated in this chapter, for example, that Special Operations differ from conventional operations in “the degree of physical and political risk, operational techniques, modes of employment, independence from friendly support, and dependence upon detailed operational intelligence”. Accordingly, SOF personnel require skills and abilities beyond those of the general body of the military. It is then concluded that the assessment and selection of Special Forces (SF) candidates should be governed by the same principles that prevail in the selection of candidates in sophisticated civilian organizations – notwithstanding the risky and unconventional nature of SOF operations. This means that an SOF assessment and selection system should be based on a job analysis: It should identify bona fide Knowledge, Skills, Abilities, and Other characteristics (KSAOs) that predict successful performance, employ multi-form procedures to assess those KSAOs, and it should be a collaborative effort between Subject-Matter Experts (SMEs), personnel selection specialists, and clinical professionals.

With these caveats in mind, this TG recommends that the following factors be considered when constructing or improving a personnel selection process for SOF personnel.

### **5.1 JOB ANALYSIS**

The tasks to be performed in a specific SOF role need to be precisely identified in order to predict and select successful candidates. A comprehensive and detailed job analysis should therefore be conducted to determine and describe the job characteristics as realistically as possible. Once the job analysis is complete, essential KSAOs can be identified and used in predicting how well applicants will perform on these specific tasks. Valid predictions depend on the accuracy of the KSAOs; thus, it is recommended that KSAOs be as closely related and as specific as possible to these tasks. It is further recommended that the job analysis be kept up to date. This is especially important in the case of SOF personnel, because the SF job content has continuously evolved over the last decade as a result of technological advances, political decisions, and geographical reallocations.

### **5.2 MEASUREMENT OF KSAOs**

KSAOs are commonly assessed in individuals using one or more of the following methods: cognitive abilities measures, personality measures (e.g., interviews, questionnaires), physical tests, and work samples. The TG found that there are a variety of assessment methods available and that countries differ considerably in the kind of tests they use and the way they are applied. However, the TG also concluded

## CONCLUSIONS AND RECOMMENDATIONS

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that countries more or less measure the same KSAOs in their selection procedures, and that there are a lot of similarities in measurement methods. Most countries use a selection procedure made up of the following elements:

- A medical check-up, including weight, height, eye-sight, over-all health;
- Endurance tests, such as a Cooper test or obstacle course;
- Cognitive tests for General Mental Ability (GMA); and
- Personality tests to measure characteristics such as resilience, hardiness, and lack of neuroticism.

The majority of the selection procedures also seem to require a prerequisite of several years of military experience in an operational setting.

### 5.3 VALIDATING THE USE OF SELECTION METHODS

Selection procedures are put into practice in different ways. Some countries use select-in strategies to reduce the drop-out rate during initial training. This method presupposes that sufficient evidence was gathered to validate and establish defensible cut-off scores, in order to ensure that the selection procedure screens out applicants on multiple areas of concern across various assessment measurements, and not just on the results of one test. In contrast, other countries set cut-off scores relatively low to reduce the risk of turning down “false-negatives.” This strategy can be used when a selection procedure is still in the experimental phase.

The choice of selection procedure differs across countries and depends on the quantity and overall quality of applicants, availability of training facilities, economic constraints, and means for validating a selection procedure. When constructing or improving a selection procedure, it is important to keep these considerations in mind. It is strongly recommended, therefore, that these validation principles be incorporated into the process, regardless of who is responsible for selection and hiring decisions.

### 5.4 RECRUITMENT

The success ratio is greatly improved when recruitment is targeted at a specific group of potential applicants. In other words, identifying populations containing likely candidates (e.g., infantry units) is an effective strategy. This research did not specifically focus on recruitment. However, this TG has observed that effective selection of the most suitable applicants requires a thorough consideration of the relation between recruitment and selection before putting a selection procedure into use.

Several other aspects regarding the selection of SOF personnel have to be taken into consideration. These considerations are less scientific, speaking more to the practical implications of psychological selection procedures and their applicability.

### 5.5 FACE VALIDITY

The face validity accorded to selection procedures for SOF operators by military personnel must be taken into account. Face validity is the apparent value of a test (i.e., at “face value”). In other words, whenever a test looks like it will measure what it is supposed to measure, it is perceived to be valid. Face validity is especially important when using methods of measurement for SOF operators that are also used to test civilians. Because of the specialized nature of their work and the high risks involved, SMEs tend to be sceptical of measurements developed by outsiders. An alternative is job-oriented measurements, which possess high face validity because of their realistic nature.



Outsiders also have to be included in testing to ensure the objectivity of the selection procedures for SOF operators, which cannot be guaranteed when it is the sole responsibility of the unit itself. Unbiased specialists and scientists, therefore, are needed to contribute to the construction and improvement of SOF selection procedures. It is recommended that these professionals stay in close contact and cooperation with the SOF unit in order to connect scientific knowledge with best practices. It is also hoped that countries will be more willing to share their selection procedures on a detailed level in the future, in order to better develop international best practices. The information that is gathered here will provide the necessary face validity for innovative, up-to-date SOF selection procedures.

## **5.6 EXPERIENCE**

Although military experience predicts successful performance as an SOF operator, more research should be done to determine what kind and what length of experience is most useful. Specifically, the following questions need to be answered: “What kind of operational experience is relevant?” and “In what way does experience add to successful performance as an SOF operator?” It can easily be inferred that having combat experience means one possesses specific skills that cannot be obtained during peace time. In addition, it is also possible that combat experience strengthens one's psychological reserves and promotes resilience. Conversely, a disadvantage of a candidate's having military operational experience could be the greater likelihood of having also experienced traumatic events, since previous trauma is one of the indicators for PTSD.

## **5.7 LEARNING ABILITY**

Apart from cognitive abilities, such as GMA, an even more important factor is learning ability. SOF operators often verbally receive a large amount of complex information that they have to remember in a short period of time. Moreover, materials and equipment are becoming more and more sophisticated, and the settings in which they operate are constantly changing. Being able to absorb standard procedures easily is not enough; a good SOF operator must also be able to quickly apply lessons learned to new situations and integrate new information.

## **5.8 ETHICS**

One issue that has not been addressed so far is the ethical aspect of selecting SOF operators. The SF job places extremely high demands on an operator's physical and psychological resources. What psychological damages are inflicted on those candidates who do not meet these extremely high standards? Job samples are good predictors, but how realistic do they have to be? Other specific questions include “Is the ‘select as you fight’ concept too farfetched?” and “Is fake hostage kidnapping a realistic job sample?” Countries differ a great deal on what they consider ethical, depending on tradition, history, and culture. One approach to safeguarding ethical boundaries is to make sure there is always a psychologist observer present to monitor the psychological well-being of candidates. In this light, it would be very valuable to share viewpoints and procedures from different countries in order to develop best practices.



## CONCLUSIONS AND RECOMMENDATIONS

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## **Annex A – QUESTIONNAIRE**

The purpose of this NATO Task Group is to discuss the psychological and physiological selection of Special Operations Forces (SOF). The intent is to provide a best practices guide for selecting SOF operators based on current practices across various nations. In an effort to obtain information about best practices with regards to selection of SOF operators, we are seeking feedback from your country regarding current SOF selection.

**Any Countries that are able to provide us with information will receive an overview of all information received and a copy of the Task Group RTG-HFM-171 report.**

Owing to the Operational Security (OPSEC) surrounding SOF, any information you can provide will be synthesised into general information. Specifically, no country would be identified in the final report and selection will be discussed in general terms only. To aid in this, we would ask that you do not identify any specific unit.

Please take a moment to respond the questions below in as much detail as you can. If you do not possess the answer to a specific question, we would ask that you refer it to someone who may be able to provide this information. If possible, we would ask if you could complete this questionnaire and provide it to the contact below no later than the end of November.

Should you have any concerns or queries about this questionnaire, please do not hesitate to contact us using the email address below.

Questions:

- 1) What do you consider to be the definition of a Special Operations Force/Unit?
- 2) What do you consider to be a good SOF operator?
- 3) What types of people are generally attracted to Special Forces Units?
- 4) Do you currently carry out any active recruitment for SOF?
- 5) What is done to attract recruits?
- 6) Is there currently any selection for your SOF?
- 7) What criteria do you use to select SOF operators?
- 8) What process was used to identify these criteria?
- 9) What measures are used?
- 10) What future developments do you anticipate with regard to SOF selection?
- 11) What obstacles do you (expect to) encounter?

Would you mind if we contact you at a later date for further information?

Many thanks for your answers and your time. RTG-HFM-171.



## **Annex B – LITERATURE REVIEW**

### **Literature on Special Forces Selection and psychological dimensions related to SOF personnel selection.**

Barrett, G.V., Polomsky, M.D. and McDaniel, M.A. (1999). Selection tests for firefighters: A comprehensive review and meta-analysis. *Journal of Business and Psychology*, 13(4).

Bartone, P.T., Roland, R.R., Picano, J.J. and Williams, T.J. (2008). Psychological hardiness predicts success in U.S. Army Special Forces candidates. *International Journal of Selection and Assessment*, 16(1).

Bilgiç, R. and Sümer, H.C. (2009). Predicting military performance from specific personality measures: A validity study. *International Journal of Selection and Assessment*, 17, 231-238.

Borman, W.C. and Motowidlo, S.J. (1997). Task performance and contextual performance: The meaning for personnel selection research. *Human Performance*, 10, 99-109.

Brooks, J.E. and Zazanis, M.M. (1997). Enhancing U.S. Army Special Forces: Research and applications. Alexandria: U.S. Army Research Institute for the Behavioral and Social Sciences.

Busciglio, H.H. and Teplitzky, M.L. (1994). *Predicting land navigation performance in the Special Forces Qualification Course*. Technical Report 1015. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Campbell, J.P. (1990). An overview of the Army Selection and Classification Project (Project A). *Journal of Personnel Psychology*, 43, 231-239.

Campbell, J., Castaneda, M. and Pulos, S. (2010). Meta-analysis of personality assessments as predictors of military aviation training success. *International Journal of Aviation*, 20, 92-109.

Campbell, S.K. and Catano, V.M. (2004). Using measures of specific abilities to predict training performance in Canadian Forces operator occupations. *Military Psychology*, 16 (3), 183-201.

Carpenter, T.D., Wisecarver, M.M. Deagle III, E.A. and Mendini, K.G. (2005). Special Forces Interpersonal Performance Assessment System. Research Report 1833. Alexandria: U.S. Army Research Institute for the Behavioural and Social Sciences.

Carretta, T.R. (1992). *Predicting pilot training performance: Does the criterion make a difference?* Interim Technical Paper. Human Resources Directorate Manpower and Personnel Research Division, Brooks Air Force Base.

Carter, R.C. and Biersner, R.J. (1987). Job requirements derived from the Position Analysis Questionnaire and validated using military aptitude test scores. *Journal of Occupational Psychology*, 60, 311-321.

Clancy, T. (YEAR). *Special Forces*. New York: Berkley Books, 2001.

Crust, L. (2008). A review and conceptual re-examination of mental toughness: Implications for future researchers. Personality and individual difference. (Article in Press).

DeMatteo, J.S., White, L.A., Teplitzky, M.L. and Sachs, S.A. (1991). *Relationship between temperament constructs and selection for Special Forces training*. Paper presented at the International Military Testing Association (IMTA), San Antonio, TX.

## ANNEX B – LITERATURE REVIEW

---

Diana, M., Teplitzky, M.L. and Zazanis, M.M. (1995). *Special Forces Qualification Course graduation and attrition statistics for Soldiers selected for training in FY89-FY91*. Technical Report 1023. Alexandria: U.S. Army Research Institute for the Behavioral and Social Sciences.

Driskell, J.E., Hogan, J., Salas, J. and Hoskin, B. (1994). Cognitive and personality predictors of training performance. *Military Psychology*, 6, 31-46.

Driskell, J.E., Salas, E., Johnston, J.H. and Wollert, T.N. (2008). Stress exposure training: an event-based approach. In P.A. Hancock, and J.L. Szalma (Eds.), *Performance under stress* (pp. 271-286). Hampshire, UK: Ashgate Publishing Ltd.

Donohue, J.J. (2006). *Validating the parallel Canadian Forces Aptitude Test: Two plans*. Paper presented at the 48<sup>th</sup> Annual Meeting of the International Military Testing Association (IMTA), 2-6 October, Kingston, Ontario, Canada.

Ewert, A. and Hollenhorst, S. (1989). Testing the adventure model: Empirical support for a model of risk recreation participation. *Journal of Leisure Research*, 21, 124-139.

Ferro, G., Wisecarver, M.M., White, S.S. and McPherson, W.A. (2006). *Recruitment and accession of Special Forces warrant officers*. Research Report 1851. Alexandria: U.S. Army Research Institute for the Behavioral and Social Sciences.

Gaillard, A.W.K. (2008). Concentration, stress and performance. In P.A. Hancock, and J.L. Szalma (Eds.), *Performance under stress* (pp. 59-75). Hampshire GU: Ashgate Publishing Ltd.

Griffith, J. (2002). Multilevel analysis of cohesion's relation to stress, well-being, identification, disintegration and perceived combat readiness. *Military Psychology*, 14, 217-239.

Gruber, K.A., Kilcullen, R.N. and Iso-Ahola, S.E. (2009). Effects of psychosocial resources on elite Soldiers' completion of a demanding military selection program. *Military Psychology*, 21, 427-444.

Hancock, P.A. and Szalma, J.L. (2008). Stress and performance. In P.A. Hancock, and J.L. Szalma (Eds.), *Performance under stress* (pp. 1-18). Hampshire GU: Ashgate Publishing Ltd.

Hanton, S., Evans, L. and Neil, R. (2003). Hardiness and the competitive trait anxiety response. *Anxiety, Stress and Coping*, 16, 167-184.

Harris, W.C., Hancock, P.A. and Morgan, C.A. (2005). *Cognitive change in Special Forces personnel following stressful survival training*. Proceedings of the Human Factors and Ergonomics Society 49<sup>th</sup> Annual Meeting, Orlando.

Hartmann, E., Sunde, T., Kristensen, W. and Martinussen, M. (2003). Psychological measures as predictors of military training performance. *Journal of Personality Assessment*, 80, 87-98.

Hartmann, E. and Grønnerød, C. (2009). Rorschach Variables and Big Five Scales as predictors of military training completion: A replication study of the selection of candidates to the Naval Special Forces in Norway. *Journal of Personality Assessment*, 91(3), 254-264.

Hartmann, E., Sunde, T., Kristensen, W. and Martinussen, M. (2003). Psychological measures as predictors of military training performance. *Journal of Personality Assessment*, 80(1).

Hazlett, G. and Morgan, C.A. (2003). *Special Forces Soldier: Model of high performance under stress*. Paper presented at the Peak Soldier Performance Conference, Santa Barbara, CA, October.

Hoedebecke, E.L. and Wells, J. (2002). *Army campaign plan for injury control*. Paper presented at the 8th Annual Recruit and Trainee Healthcare Symposium, Towson, MD, April.

Kilcullen, R.N., Mael, F.A., Goodwin, G.F. and Zazanis, M.M. (1999). Predicting U.S. Army Special Forces field performance. *HPEE*, 4, 53-63.

Krueger, G.P. (2008). Contemporary and future battlefields: Soldier stresses and performance. In P.A. Hancock and J.L. Szalma (Eds.), *Performance under stress* (pp. 19-44). Hampshire GU: Ashgate Publishing Ltd.

Larsson, G. (1989). Personality appraisal and cognitive coping processes, and performance during various conditions of stress. *Military Psychology*, 1(3).

Matthews, M.D., Strater, L.D. and Endsley, M.R. (2004). Situational awareness requirements for infantry platoon leaders. *Military Psychology*, 16(3), 149-161.

Mautner-Markhof, F. (1989). The reality, management and simulation of complex systems. In Klabbers, J.H.G., Scheper, W.J., Takkenberg, A.T. and Crookall, D. (Eds.), *Simulation-gaming: On the improvement of competence in dealing with complexity, uncertainty and value conflicts* (pp 24-37). Oxford: Pergamon Press.

Miller, L.T. (1999). Psychometric and information processing approaches to measuring cognitive abilities: Paradigms in military testing. *Canadian Psychology*, 40, 241-254.

Mills, L.J. and Held, J.D. (2004). *Optimizing U.S. Navy Seal selection* Retrieved from <http://www.imarksweb.net/aws>.

Moran, D.S., Evans, R.K., Arbel, Y., Hadid, A., Loar, A. and Fuks, Y. (2011). Prediction model for attrition from a Combat Unit Training Program. *Journal of Strength and Conditional Research*, 25(11), 2963-2970.

Morgan, C.A., Southwick, S.M., Hazliett, G. and Dial-Ward, M. (2008). Baseline dissociation and prospective success in Special Forces assessment and selection. *Psychiatry*, 5(7).

Neria, Y., Solomon, Z., Ginzburg, K. and Dekel, R. (2000). Sensation seeking, wartime performance, and long-term adjustment among Israeli war veterans. *Personality and Individual Differences*, 29, 921-932.

Picano, J.J., Roland, R.R., Rollins, K.D. and Williams, T.J. (2002). Development and validation of a sentence completion test measure of defensive responding in military personnel assessed for non-routine missions. *Military Psychology*, 14 (4).

Prusaczyk, W.K. and Goldberg, G.M. (2002). Organizational, psychological and training aspects of Special Operations Forces. *Medical Aspects of Harsh Environments*, 1166-1193.

Saier, W.E. (1995). *An assessment of assessment: Is Selective Manning right for USAF Special Operations Aircrew?* A research report submitted to the faculty in fulfillment of the curriculum requirement, Maxwell Air Force Base, Alabama.

Salgado, J.F. (1998). Big Five personality dimensions and job performance in Army and civil occupations: A European perspective. *Human Performance*, 11, 271-288.

Sandal, G.M., Grønningsæter, H., Eriksen, H.R., Gravraakmo, A., Birkeland, K. and Ursin, H. (1998). Personality and endocrine activation in military stress situation. *Military Psychology*, 10, 45-61.

## ANNEX B – LITERATURE REVIEW

---

Schaub, H. (2009). *Modelling for personnel assessment*. NATO Unclassified Unlimited.

Scholtz, D.C., Girard, M.L. and Vanderpool, M.A. (2004). *The development of a psychological screening program for sniper selection*. Ottawa, Ontario, Canada: National Defence Headquarters.

Vaisman-Tzachor, R. (1997). Positive impact of prior military combat exposure on terrorism prevention work: Inoculation to stress. *International Journal of Stress Management*, 4(1).

Van Hoof, R., Dubois, P., Leysen, J. and Francois, R. (1992). Predictability of the individual outcome of a physical training program of an Army Special Forces unit. *Military Medicine*, 157, 207-210.

Wai Leng, L.O.W. (2005). *Validating a selection system for reconnaissance troops in the Singapore Armed Forces*. Presented during the International Military Testing Association (IMTA) conference, Singapore.

White, S.S., Mueller-Hansen, R.A., Dorsey, D.W., Pulakos, E.D., Wisecarver, M.M., Deagle III, E.A. and Mardini, K.G. (2005). *Developing adaptive proficiency in Special Forces officers*. Research Report 1831. Alexandria: U.S. Army Research Institute for the Behavioral and Social Sciences.

Zazanis, M.M., Hazlett, G.A., Kilcullen, R.N. and Sanders, M.G. (1999). *Prescreening methods for Special Forces selection and assessment*. Technical Report 1094. Alexandria: U.S. Army Research Institute for the Behavioral and Social Sciences.

Zazanis, M.M. and Lappin, M.S. (1998). *Predicting performance ratings using motivational antecedents*. Technical Report 1077. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Zuckerman, M. and Kuhlman, D.M. (2000). Personality and risk-taking: Common biosocial factors. *Journal of Personality*, 68, 999-1029.



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<b>14. Abstract</b>	<p>The operational deployments of NATO Special Operations Forces (SOF) demand a high level of performance in counter-terrorism and asymmetrical warfare. This requires SOF personnel to be extremely fit <i>both mentally and physically</i>. The ultimate objective of this Task Group is to promote the sharing of knowledge of selection methodology, evidence-based research results and best practices in order to improve personnel selection processes. This is done by identifying physical and psychological attributes required to maximize SOF performance and mission success. In addition, the most appropriate ways to measure these attributes are reported. This TG recommends that the following factors be considered when constructing or improving a personnel selection process for SOF personnel: Job analysis, Measurement of KSAOs, Validating the use of selection methods, Recruitment, Face validity, Experience, Learning ability and Ethics.</p>		





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