Chapter 6 – EVIDENCED-BASED JOB ANALYSIS AND METHODOLOGY TO DETERMINE PHYSICAL REQUIREMENTS OF SPECIAL MILITARY OCCUPATIONS

by

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Diagnostic analysis of the individual physical performance and statistical group analysis of Austrian Special Forces soldiers (Jagdkommandosoldaten). Derivation of a model identifying the optimal weighted sports motor components with regard to the physical demands of the military missions

ABSTRACT

Minimal requirements, selection procedures and training recommendations concerning Special Forces (Jagdkommando) are to be in accordance with mission demands. This is especially true for the physiological performance of the soldiers: Therefore sports motor profiles are the basis for all physiological military assessments, minimal requirements and all specific training recommendations.

With this current study for the first time we were able to identify the relevant sports motor components for Special Forces operators and describe their influence on a soldier's mission performance. A comprehensive quantitative test battery was applied to 26 Austrian Special Forces soldiers and actual sports motor profiles

were established from the results. Furthermore a qualitative investigation (experts rating) enabled to develop task specific target profiles.

Finally, a synopsis of all results led to sports motor key-qualifications for Special Forces soldiers: ***coordinative abilities****,* ***reaction speed****,* ***aerobic endurance****,* ***strength endurance*** *and* ***anaerobic endurance****. This knowledge enabled:*

1) *The development and accordingly;*
2) *The evaluation of precise and valid selection procedures;*
3) *The derivation of minimal requirements;*
4) *The development of task specific;*
5) *Individual; and*
6) *Group training recommendations.*

Besides the high practical significance of this knowledge the authors have herewith also invented and empirically tested a methodology that proved to be highly useful for establishing comprehensive (target and current-status) sports motor profiles for (Special Forces) soldiers.

6.1 INTRODUCTION[1]

Specially trained and equipped soldiers are required for special military operations. Those soldiers are characterized by special tactical and psychological skills as well as above-average physical capacity. In describing those physical skills by means of sports motor components, characteristic sports motor profiles for Special Forces operators can be derived.

Evidence-based physical sports motor profiles for Special Forces soldiers have not been established yet. However, the availability of profiles of sports motor requirements is of great importance. Valid selection criteria and procedures can only be established through the knowledge of the physical requirements of Special Forces operations. Furthermore sports motor requirement profiles serve as substructures for the development of precise individual and group training recommendations.

The Austrian Special Forces (Jagdkommando) are formed of rather small but specially trained, equipped and organized units to undertake military operations of high strategic and political significance. These units are in a permanent state of readiness and can be engaged on short notice. Austrian Special Forces missions are usually limited in time and space but provide the Austrian government a flexible and precise option for conducting sensitive missions across the entire spectrum of conflict.

Austrian Special Forces conduct special reconnaissance to gain information of high relevance; conduct direct action operations (hostile liberation operations, neutralizing enemy personnel of strategic importance, destroying military infrastructure, etc.); provide VIP-protection; conduct combat search and rescue operations; evacuate Austrian citizens from foreign hostile areas; fight subversives and terrorism; and support the conventional Austrian Armed Forces on international and exceptionally dangerous missions [1].

[1] This article is the outcome of a joint research project of the Research Group on Physical Performance of the Army Hospital Vienna, the Army Sports Science Service, the Austrian Special Operation Command, the Austrian Special Forces (all Departments of the Austrian Armed Forces) and the University of Vienna. The project was initiated by the leading author who investigated the outlined area as a doctoral candidate of the named University. Therefore the results presented in this article are descended from the doctoral thesis which was approved by the respective committee of the University of Vienna in October 2006. As this is true for the complete paper and as it is stated here we do not quote each passage of the article. However, for detailed information and a comprehensive view we suggest studying the original literature (EISINGER, 2006).

In order to be able to accomplish these comprehensive military tasks all Austrian Special Forces soldiers are trained in:

i) Shooting with all relevant weapons;

ii) Close combat;

iii) Using explosives;

iv) Amphibious fighting;

v) Cooperating with other military forces (especially the Air Force);

vi) Parachuting;

vii) Mountaineering (winter and summertime);

viii) Paramedic;

ix) Orienteering;

x) Close quarter battle; and

xi) Survival techniques [2].

Based upon the wide variety of Special Forces operations, it is unrealistic to describe such complex Special Forces scenarios by single military activities (like marching or digging). For this reason we have chosen a totally different approach. Instead of looking at single military activities, we identified relevant sports motor components (such as endurance, muscular strength, etc.). In earlier work of RSG 4 and 17 *muscular strength*, *muscular endurance* and *aerobic endurance* were already identified as relevant components of fitness in military task performance. We investigated parameters of the physical performance in Special Forces soldiers who were declared as ready for mission by their Commanding Officers. This methodology enabled us to describe the key-sports motor components of complex mission demands in Special Forces operations.

Objectives of the present paper are to analyse the physical requirements of the military tasks of Special Forces; to examine whether the current physical selection procedures and assessment criteria agree with the physical mission demands; and to establish a model of optimal weighted sports motor components as a basis for the development of task specific individual and group training recommendations. Besides the high practical significance of this knowledge the applied and now empirically tested methodology has proved to be highly useful for establishing comprehensive (target and current-status) sports motor profiles. The method furthermore seems applicable not only for Special Forces soldiers but for any group of soldiers regardless of nationality.

6.2 METHODS

In order to be able to produce complete sports motor profiles we invented a threefold (hermeneutical and empirical [qualitative and quantitative]) methodical approach.

Although a comprehensive literature review was conducted limited information could be obtained since most investigations dealing with Special Forces are held confidentially or are simply not for public release. However, basic information on the physical performance of soldiers was available.

Besides the literature review we developed a qualitative and a quantitative approach.

Objectives of the qualitative approach were to identify the **relevant sports motor components** for Special Forces soldiers by means of guided expert interviews and to derive sports motor **target profiles** by having experts weight the relevant components by means of questionnaires.

In the quantitative approach we tested 26 Austrian Special Forces soldiers on a complete test battery. A group analysis of the physical performance of the tested soldiers with other soldier populations led to **actual sports motor profiles**. The 10th percentile was considered to be a suitable cut-off value for **minimal requirements** for combat ready Special Forces soldiers.

Finally, a synopsis of all results enabled us to identify sports motor **key qualifications** for Special Forces operators.

An overview is given by the following picture:

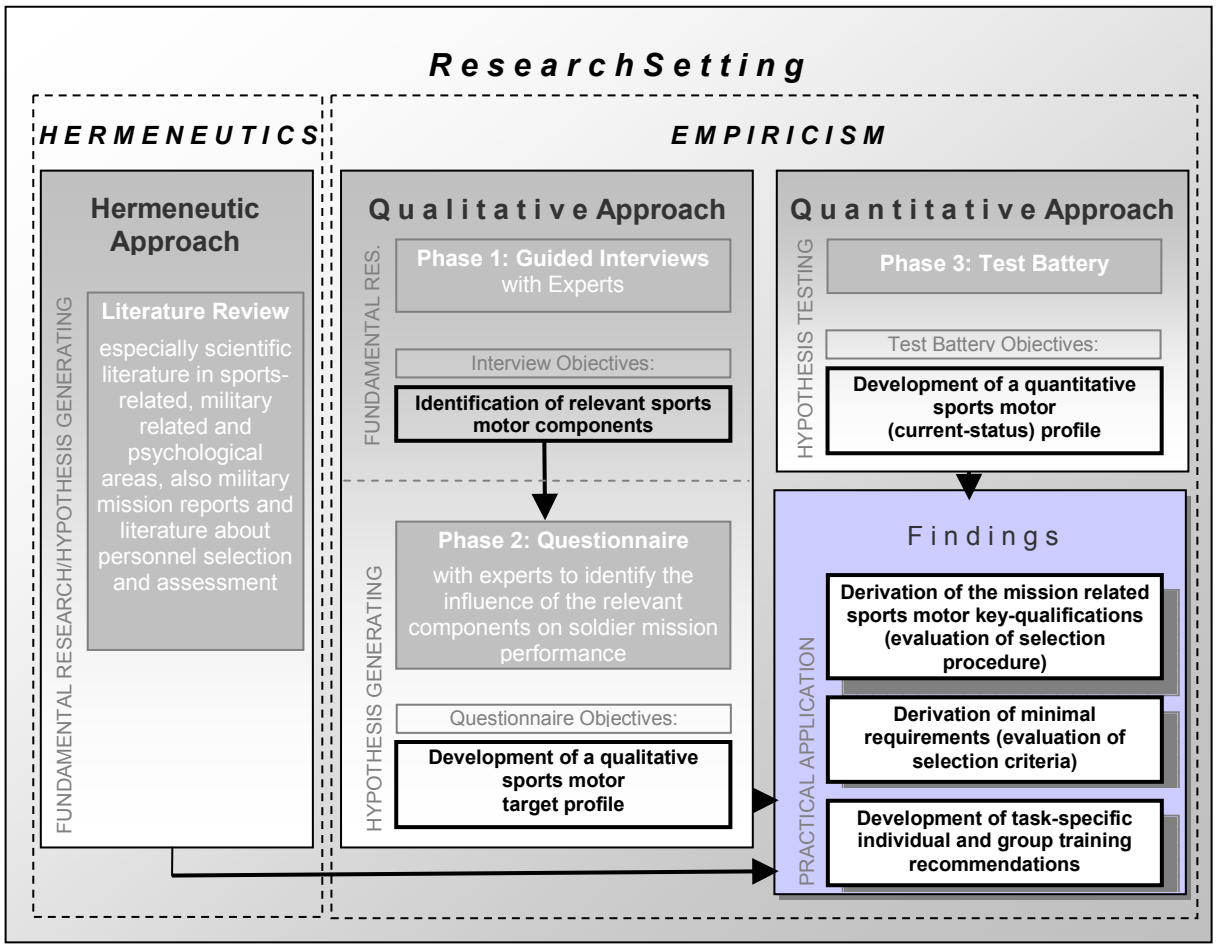


Figure 6-1: Overview of the Applied Research Setting (Source: According to Eisinger et al., 2007).

6.2.1 Qualitative Approach

There were three main reasons for using a qualitative approach: First of all we intended to find not only a current-status profile but also target profiles. Second we aimed to investigate whether there were differences in Special Forces internal specifications (like Direct Action [DA], Close Combat [CC], Combat Diving [CD], Alpinism [Alp] and Sky Diving [SD]). Third, only by the use of qualitative methods could hidden structures and unknown potentials be discovered.

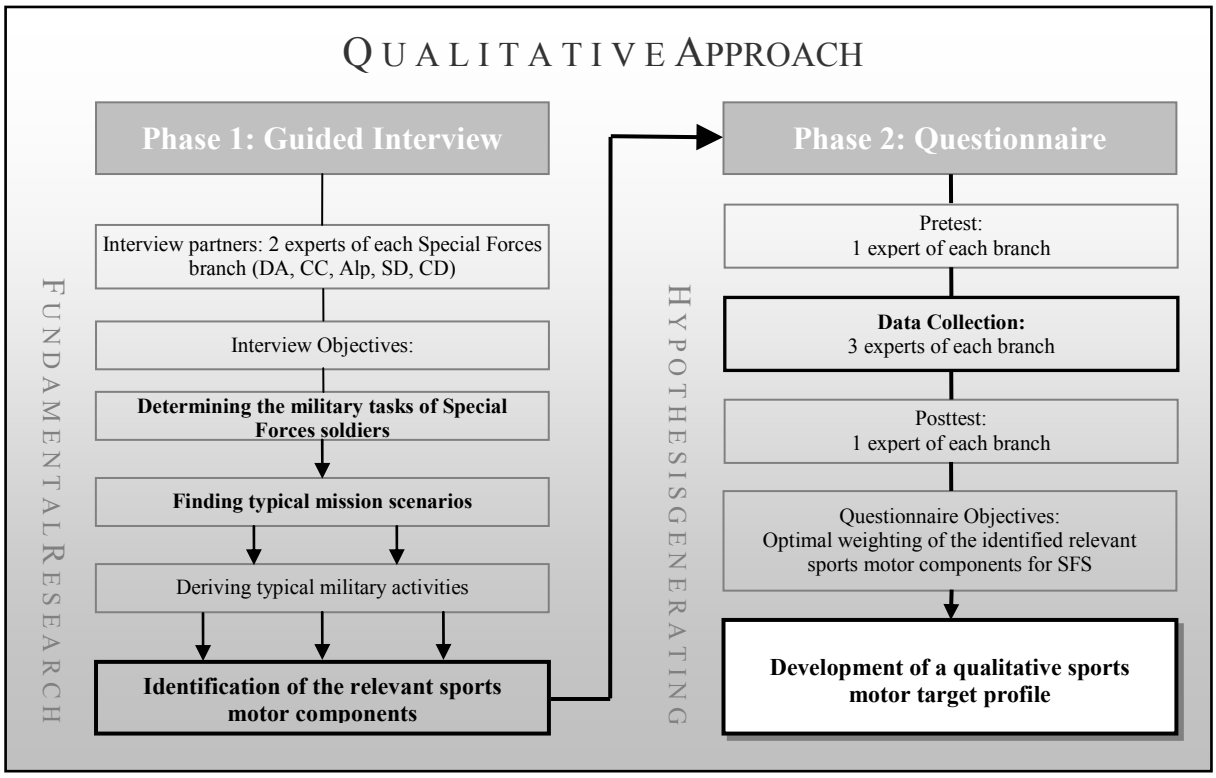


Figure 6-2: Detailed Description of the Qualitative Approach (Source: According to Eisinger, 2006).

As can be seen from the above picture, the qualitative investigation can be divided into two phases. In a phase one, the relevancy of different sports motor components for Special Forces specialities (DA, CD, CC, Alp. and SD.) was assessed. By means of guided interviews[2] with two military experts from each branch, we determined the *military tasks*, *typical military mission scenarios* and *task specific activities*. By identifying the sports motor components which were dominantly influencing the performance of those task specific activities, we were able to mark the relevant sports motor components. In other words we were looking which sports motor components actually influenced the military performance of the soldiers. This seems worth emphasizing since the main interest is not the physical performance alone but the military performance of the soldiers.

Once the relevant sports motor components were identified we produced a structured questionnaire for use in stage two. After having pre-tested the questionnaire, we had three experts from each branch weight the relevant components regarding their influence on the military performance of soldiers. From that ranking we developed precise sports motor target profiles (see Section 3.2).

6.2.1.1 Questionnaire

As was mentioned above, the questionnaire[3] was set-up with the knowledge of the guided interviews. In order to examine construct validity we subdivided the questionnaire into two sections (LIKERT [19] like scale/pair comparison [4]). If the experts weighted the relevant components similarly in both approaches, we assumed valid constructs.

[2] The complete guided interview can be found in Appendix 6A-2.

[3] Find the applied questionnaire in Appendix 6A-3.

In the first section the experts were instructed to weight the sports motor components as either "not necessary at all", "not important", "important" or "very important" regarding their influence on the military performance of the soldiers. We assumed that the scale complies approximately with a LIKERT scale [19] (which means that the intercepts between the items are equal).

In the second section of the questionnaire we arranged pair comparison. Every questionnaire item was confronted with every other questionnaire item. The experts were asked to decide which of the two items had a higher impact on the military performance of a soldier in their branch.

From that we obtained a clear ranking which enabled the derivation of precise task specific target profiles.

Objectivity was addressed by comparing the expert's estimations of each branch, and reliability was examined via pre- and post-tests.

Due to the fact, that the military experts were not experts in sports sciences, the questions were presented in a non-scientific style, and did not contain terms of sport scientific nomenclature. Therefore we used the task specific activities, which predominantly represented the sports motor components in question.

The arithmetic mean of the answers provided by the three experts in their respective military fields were computed and used as a baseline for the target profiles.

6.2.1.2 Experts

The military experts who participated in this research were Officers and Non-Commissioned Officers with long time experience in their speciality. Examples of experts are given as follows: Mountain guides with over 20 years of active alpine experience; skydiving instructors with more than 3000 thousand jumps in all types of terrain, in full battle gear, under extreme weather conditions and at night; diving instructors with up to 1000 hours under-water-experience, and so on.

6.2.1.3 Used Terminology/Sports Motor Components

As sport scientific terminology is not understood uniformly we give brief definitions of the used sports motor components:

Aerobic endurance is defined as the ability to conduct low intensity physical work over a long period of time [30] (over 30 min, usually over hours or in extraordinary situations even over days) and the ability to recover quickly after physical exhaustion [11].

Anaerobic endurance is the ability to undertake high intensity work for a short period of time (not more than 2 min) [11].

Strength endurance is a subcategory of muscular power. It is understood as being resistant against exhaustion in long time power performance (more then 15 repetitions) [26].

Maximum strength is also a subcategory of muscular strength. It is the ability to contract muscles once against a very high resistance [30].

Rapidity is defined as the ability to conduct body movements within the shortest period of time [3].

The term ***reaction speed*** (synonym: reaction) stands for being able to react as quickly as possibly upon a signal [21].

Coordinative ability (synonym: coordination) is a collective term for spatiotemporal adjustments of different muscular activities [25], the ability to work efficiently and to learn new techniques quickly [10].

The term ***constitution*** (synonym: physique) is used for the description of a candidate's body composition (by means of body measurements like body height, body weight, body circumferences, body width, etc.).

6.2.2 Quantitative Approach

In a third phase a test battery was established to derive a current-status profile of the Austrian Special Forces soldiers to identify key-qualifications by comparing the physical performance of the Special Forces soldiers with other groups of soldiers, and to establish minimal requirements.

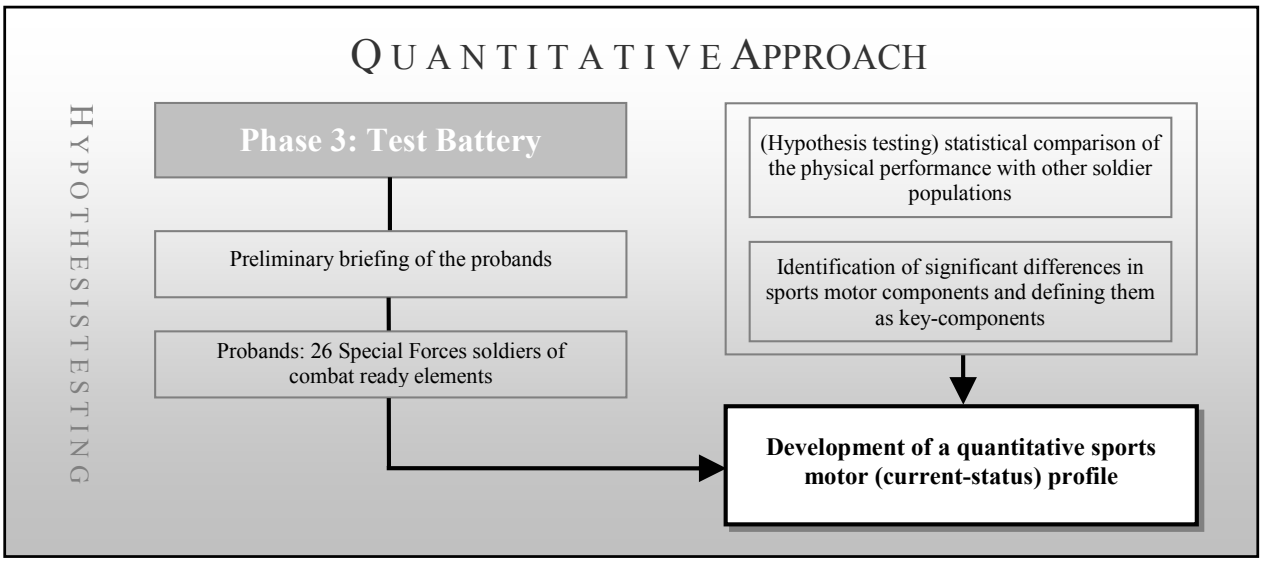


Figure 6-3: Detailed Description of the Quantitative Approach (Source: According to Eisinger et al., 2007).

The applied test battery need not necessarily be used in exactly the same way in future investigations. All standardized test methods which are suitable for examining the relevant sports motor components seem applicable. The following test battery therefore is given as an example, and the complete test standards can be found in Appendix 6A-1.

6.2.2.1 Test Battery

The test battery was performed on two different occasions (13th, 14th and 15th July 2004 and on the 19th, 22nd and 23rd November 2004). All tests were conducted in standardized training areas on military bases and were supervised by educated sport science personnel.

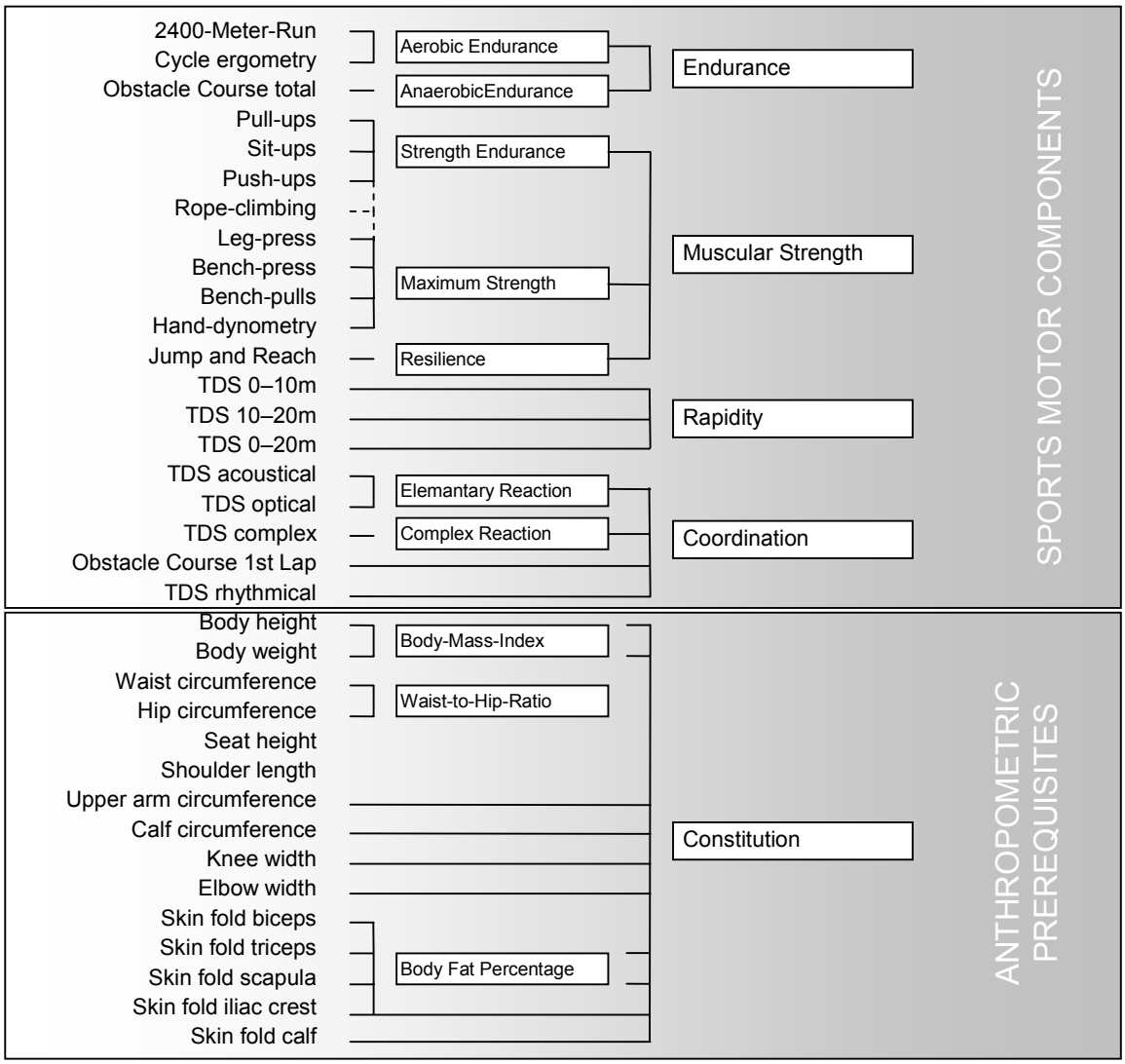


Figure 6-4: Quantitative Test Battery (Source: According to Eisinger, 2006).

6.2.2.2 Probands

The examinations were performed exclusively among 26 Austrian Special Forces soldiers of combat ready elements. These soldiers stand in a permanent training process and are ready for immediate response. Consequently, all soldiers tested are able to accomplish the military tasks successfully. On average the soldiers were 26.8 (SD = 4.9) years old. The distribution of ranks was as follows: 6 Privates, 18 Non-Commissioned Officers and 2 Officers. The probands were selected by the Commanding Officers of the elements. The number of soldiers who just came back from missions and those who were in training for missions was equal. The probands were included after full information and after their voluntary consent was obtained. The probands were all highly motivated to participate in the course.

6.2.2.3 Data Processing

The recorded data were digitalized. All statistics were computed via *SPSS 11.5 for Windows*. For descriptive analyses the arithmetic mean and the standard deviation (SD) were computed. For the comparison between the Special Forces soldiers and the other groups of soldiers the *T-test for one sample* was performed, as only

mean values of the other soldier collectives were available. An alpha level of $p<0.05$ was considered to be significant.

The 10th percentile was computed and declared as the minimal requirements for Special Forces soldiers of combat ready elements (detailed information on that rationale can be found in Section 3.3.6).

6.3 RESULTS

The following presentation of the results is subdivided into qualitative and quantitative outcomes.

6.3.1 Qualitative Results

6.3.1.1 Sports Motor Target Profile for Direct Action Operators

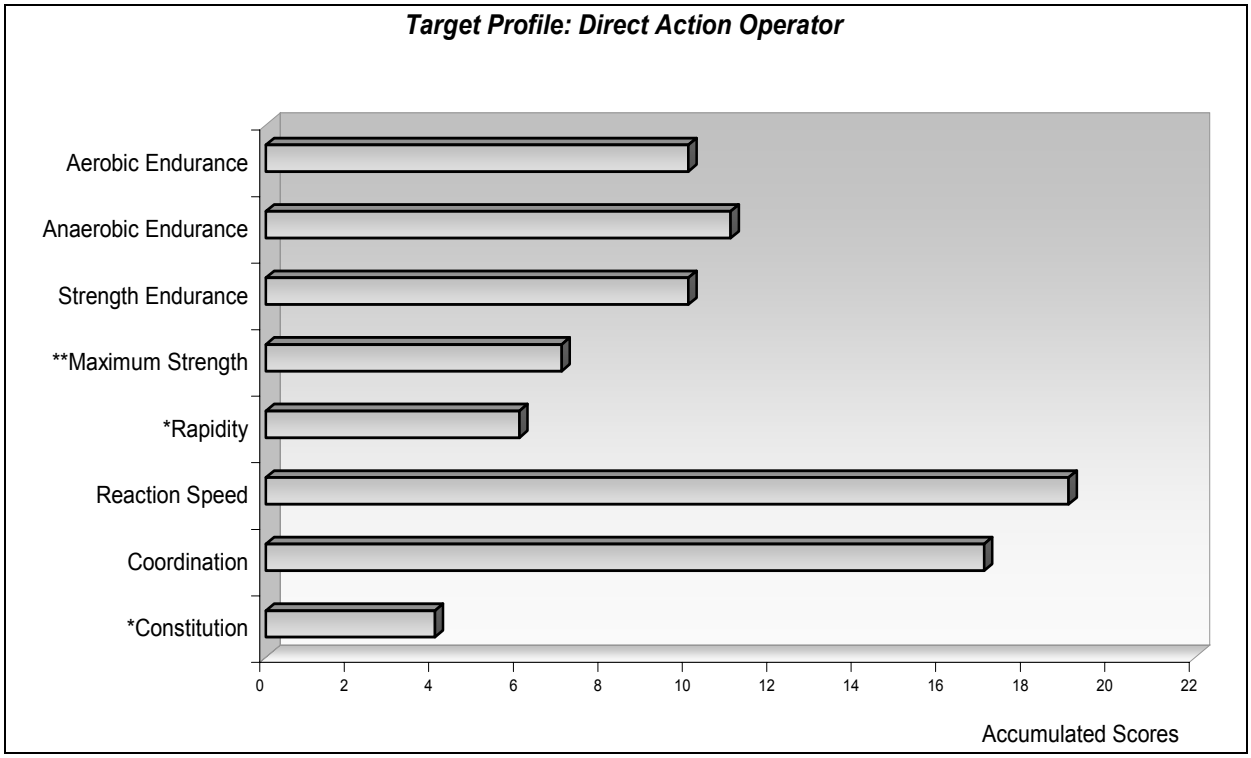


Figure 6-5: Relevancy of Sports Motor Components for Direct Action Operators (Source: According to Eisinger, 2006).

Direct Action specialists weighted reaction speed (19 scores out of 21) and coordinative abilities (17 scores) as the components that have the highest impact on the military performance of Direct Action operators. It is interesting to note that those nervous dominated components seem to be more important than the conditional dominated components.

In addition, experts rated aerobic (10), anaerobic endurance (11) and strength endurance (10) as important components that influence the performance of the operators in that speciality, whereas maximum strength (7), rapidity (6) and constitutional prerequisites (4) were rated as being less important.

6.3.1.2 Sports Motor Target Profile for Close Combat Specialists

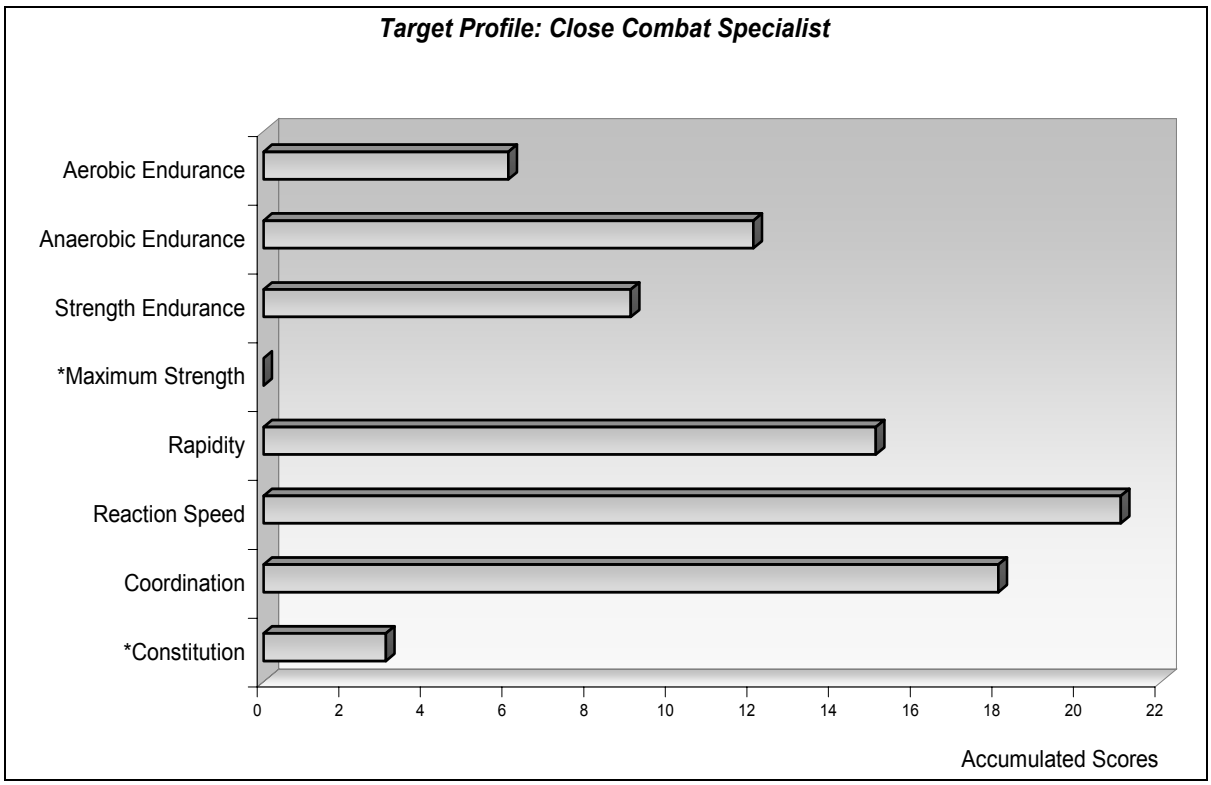


Figure 6-6: Influence of the Relevant Sports Motor Components on the Military Performance of Close Combat Specialists (Source: According to Eisinger, 2006).

According to close combat instructors, reaction speed and coordinative abilities dominantly influence the close combat performance of the soldiers. Rapidity also seems to be very important. The conditional dominated components of aerobic endurance and maximum strength, as well as the physique of a soldier were interestingly enough not of great relevancy. This finding is not supported in the literature [5, 18], where certain correlations between the constitution and the military performance has been reported.

Due to the fact that close combat scenarios generally are limited in time but of high physiological intensity, anaerobic and strength endurance were weighted important as well.

6.3.1.3 Sports Motor Target Profile for Alpine Specialists

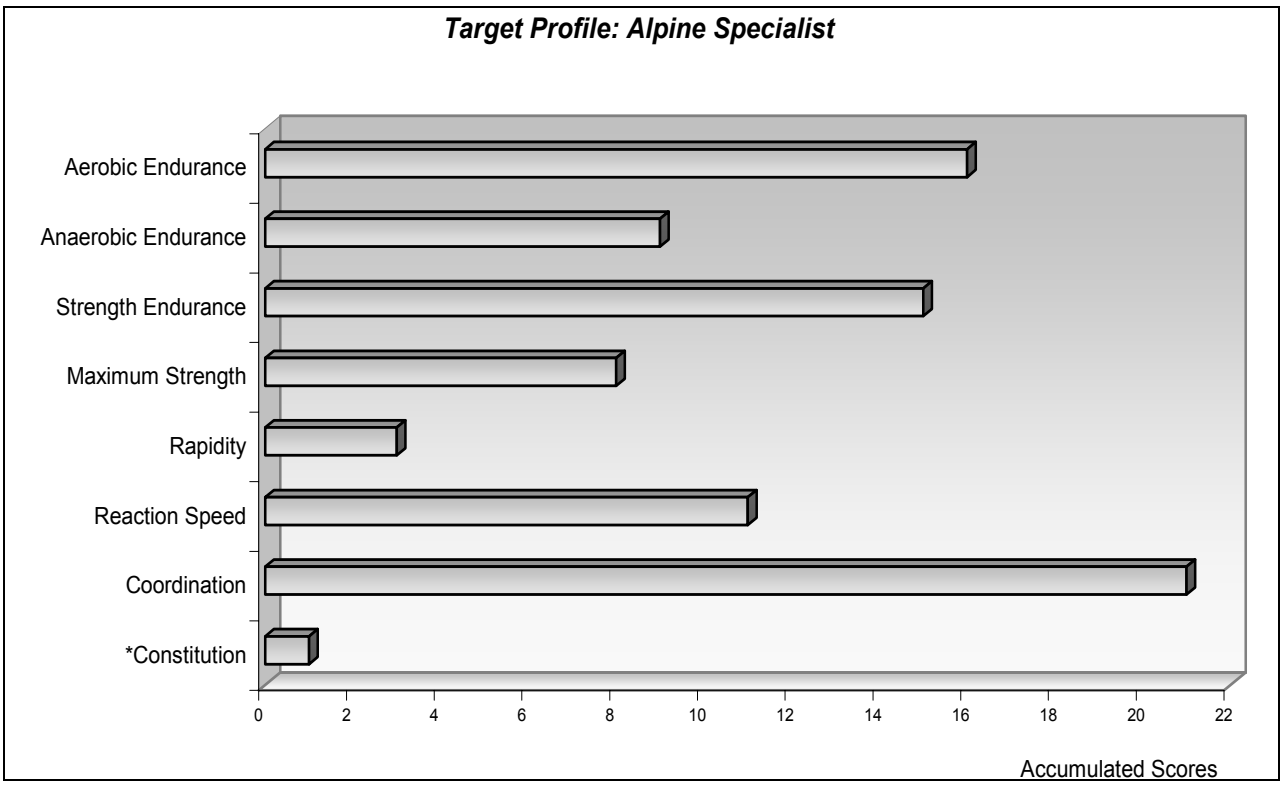


Figure 6-7: Relevancy of Sports Motor Components for Alpine Specialists (Source: According to Eisinger, 2006).

Experts identified coordinative abilities (21 scores), aerobic endurance (16) and strength endurance (15) as the key-components for alpine specialized soldiers. All experts identified coordination as the most important sport motor skill. This might be due to high technical skills necessary for typical activities (skiing or climbing in alpine terrain) in that branch.

Anaerobic endurance (9), maximum strength (8) and reaction speed (11) were identified as being of medium significance, whereas rapidity (3) and constitutional prerequisites (1) were identified as being less important for alpine specialised soldiers.

6.3.1.4 Sports Motor Target Profile for Combat Diving Specialists

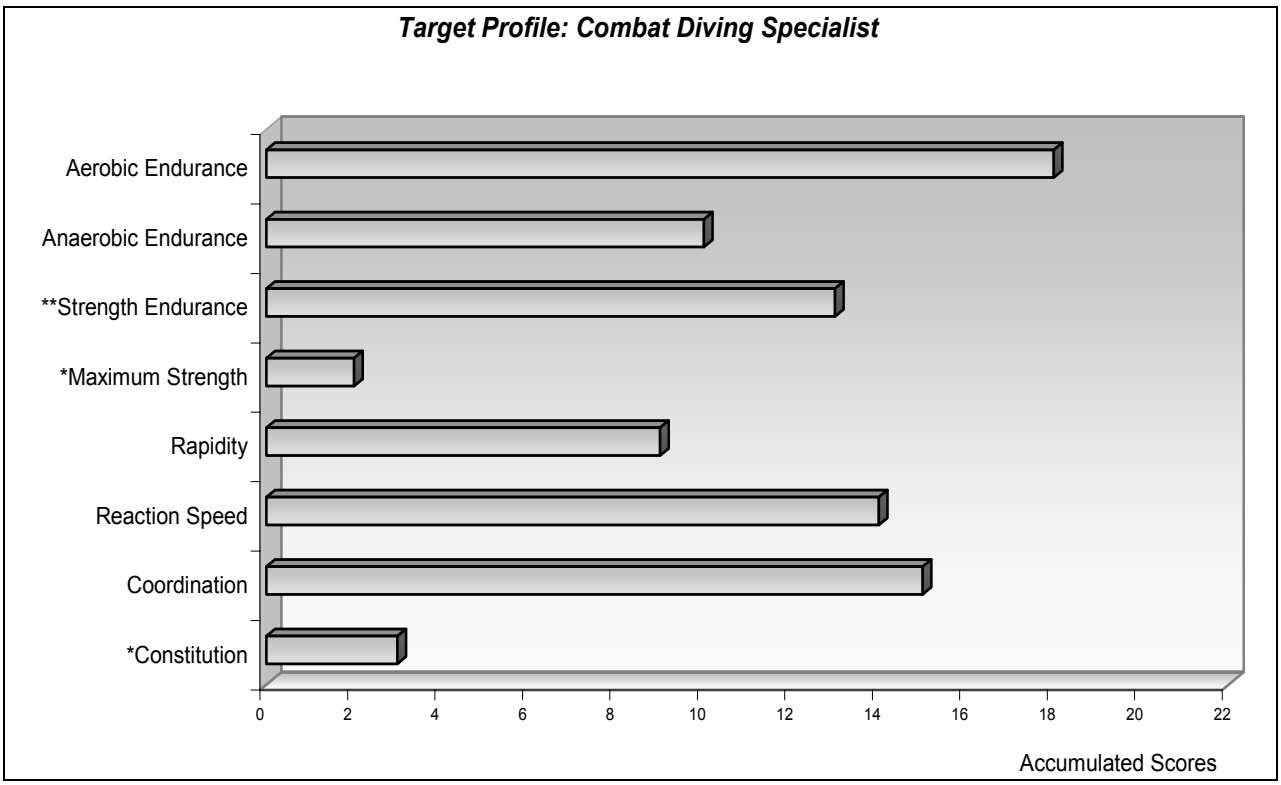


Figure 6-8: Relevancy of Sports Motor Components for Combat Diving Specialists (Source: According to Eisinger, 2006).

It was reported by the experts that aerobic endurance (18), coordinative abilities (15), reaction speed (14) and strength endurance (13) strongly influence the military performance of combat divers. Furthermore it is interesting that in the combat diving section, the conditional dominated aerobic endurance was assessed as being most important, which was not the case in any other area.

Anaerobic endurance (11) as well as rapidity (9) seems to have a medium impact on the combat diving performance. Constitutional prerequisites (3) and maximum strength (2) are of low relevancy.

6.3.1.5 Sports Motor Target Profile for Sky Diving Specialists

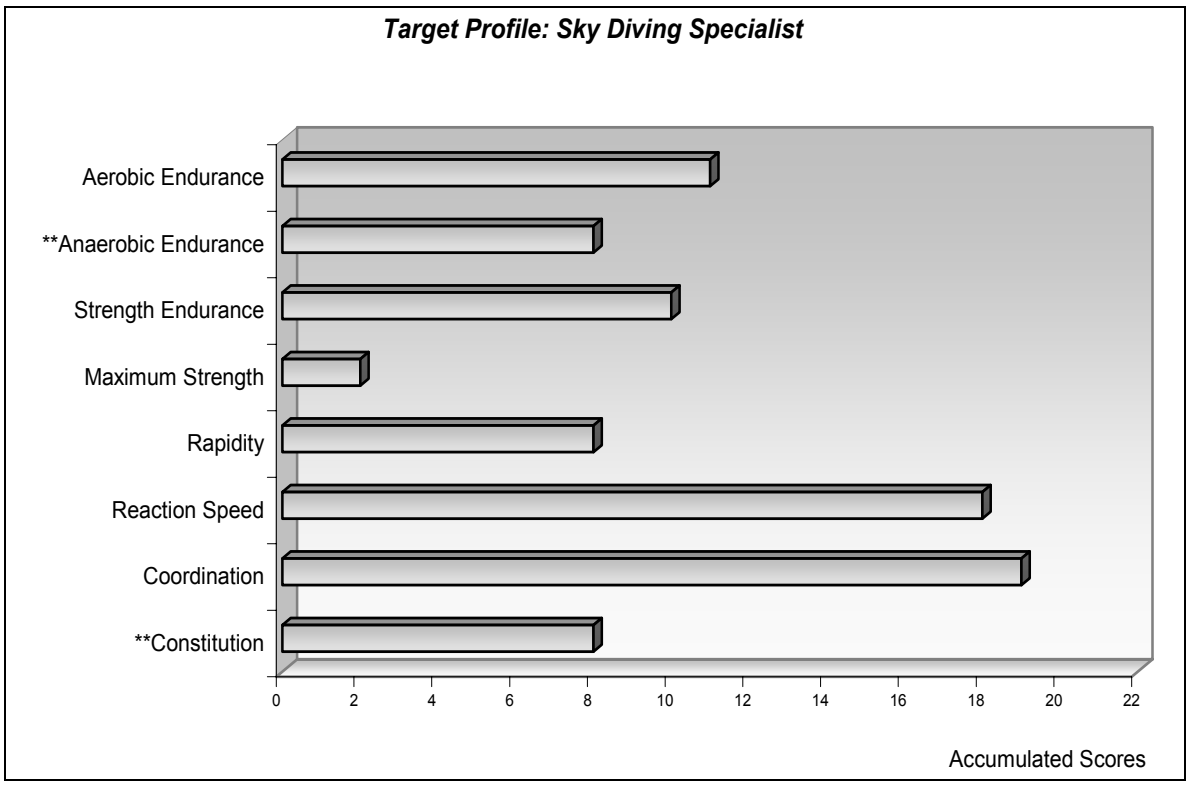


Figure 6-9: Relevancy of Sports Motor Components for Sky Diving Specialists (Source: According to Eisinger, 2006).

As can be seen from Figure 6-9 the performance of military sky divers is dominantly determined by coordinative abilities (19) and certainly by being able to react quickly (18). This finding is not surprising since both components are obviously needed in sky diving specialist. Apart from this finding, the sky diver profile is somewhat balanced. Aerobic, strength, anaerobic endurance, rapidity and physique (all scores between 8 and 11) are of medium significance. It is remarkable that the body measurements are weighted relatively high in this speciality; however, this might be due to aerodynamic reasons. Maximum strength (2) is of less importance in this specialty.

6.3.1.6 Overview of the Derived Sports Motor Target Profiles

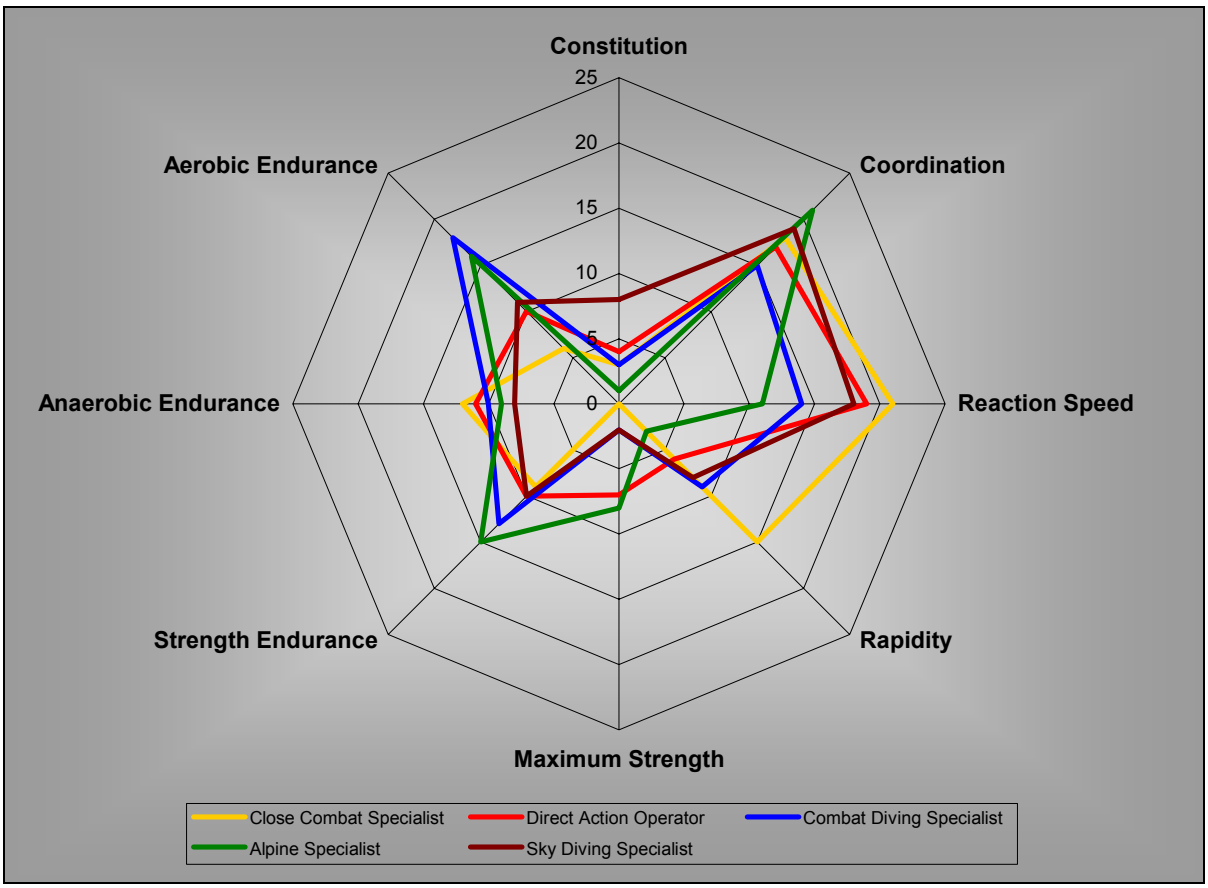


Figure 6-10: Net Diagrams of the Derived Sports Motor Components (Source: According to Eisinger, 2006).

The presented overview (in Figure 6-10) clearly depicts the differences of the target profiles in the investigated specialities. These findings are of great practical significance as selection procedures and training recommendations may be optimized by understanding the derived profiles.

6.3.1.7 Sports Motor Target Profile for Special Forces Soldiers

Under the premise that all Austrian Special Forces soldiers have at least basic skills in all investigated areas, we assumed that the accumulation of all profiles must lead to a general profile for the Special Forces soldier [9].

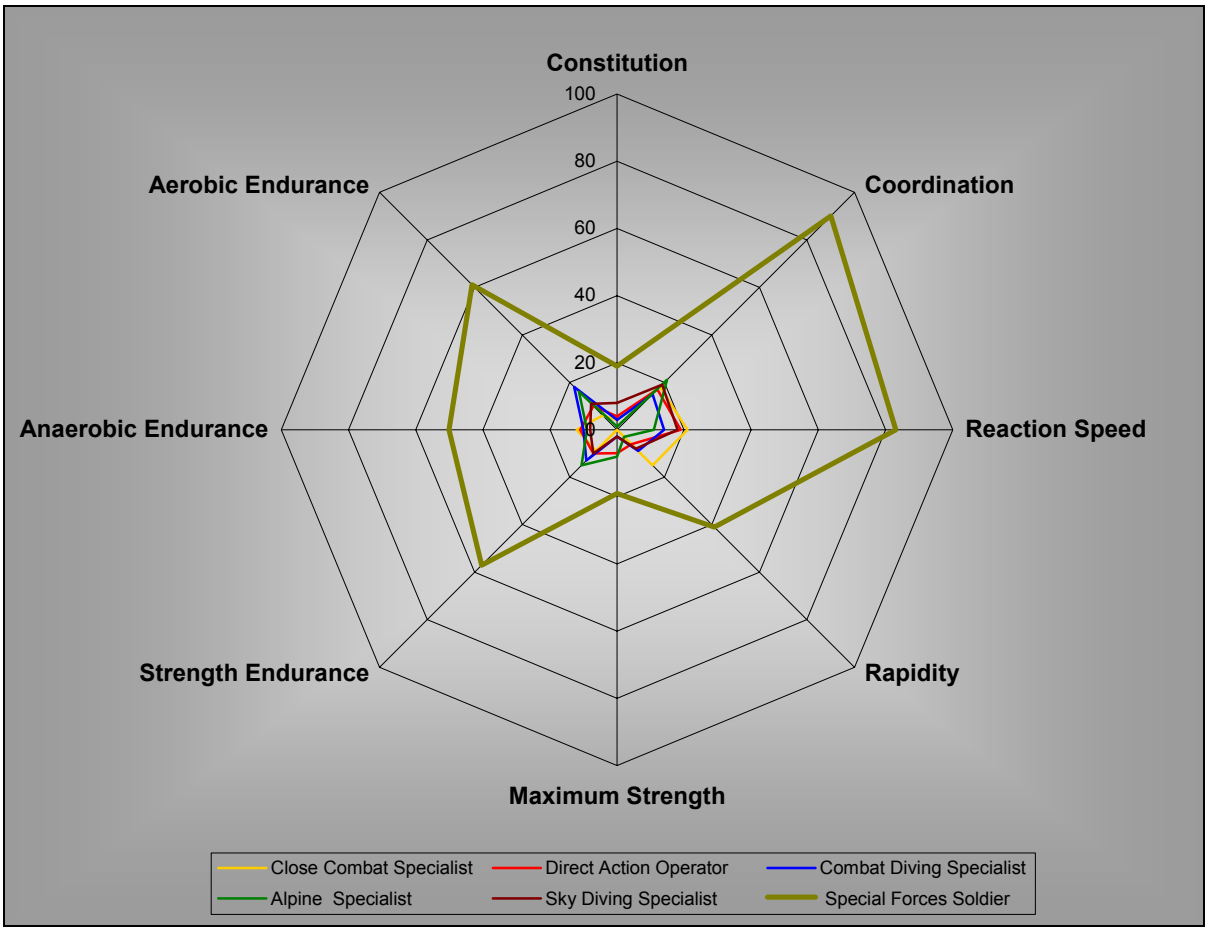


Figure 6-11: Accumulation of the Task Specific Sports Motor Profiles to a General Profile for the Special Forces Soldier (Source: According to Eisinger, 2006).

The summation of the profiles is indicated by the green line in Figure 6-11 respectively in the following figure:

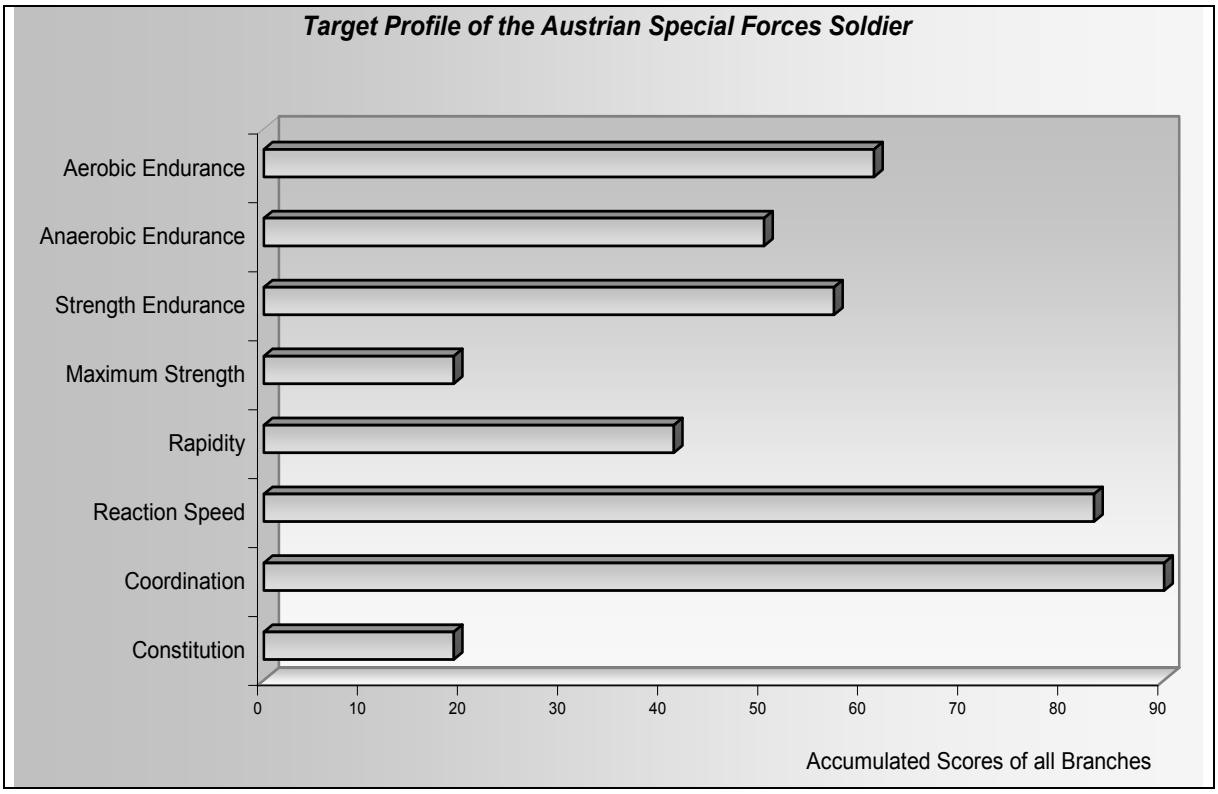


Figure 6-12: Influence of the Relevant Sports Motor Components on the Military Performance of the Special Forces Soldier (Source: According to Eisinger, 2006).

Figure 6-12 presents the general sports motor profile of Special Forces soldiers. Coordinative abilities (90 scores out of 105) and reaction speed (81) have the highest influence on the military performance of the operators. Remarkably those nervous system dominated components seem to have a higher impact than the conditionally dominated components. However, aerobic endurance (61), strength endurance (50) and anaerobic endurance (57) must also be developed very well in Special Forces soldiers.

According to the experts, rapidity (41) is of medium significance whereas maximum strength (19) and constitutional prerequisites (19) are of less importance.

6.3.1.8 Summary of the Qualitative Approach

In a first phase through identifying the military tasks, typical mission scenarios and typical military activities in the investigated areas via guided interviews, we were able to exclude those sports motor components which had a certain influence on the military performance of the Special Forces operators. Those relevant components are: aerobic endurance, anaerobic endurance, strength endurance, maximum strength, rapidity, reaction speed, coordinative abilities and constitutional prerequisites.

Based upon this information, we developed a questionnaire in phase two, and had military experts weight the relevant components regarding their impact on the military performance of the soldiers. By doing so, we obtained a clear ranking and the key-components identified were: coordination, reaction speed, aerobic endurance, strength endurance and anaerobic endurance.

These findings enabled the researchers to evaluate current selection procedures and to establish task specific training recommendations. The qualitative approach also enabled the researchers to discover hidden correlations. It therefore has hypothesis generating character (see the following chapter). However,

to test these hypotheses and to produce quantitative information (e.g. minimal requirements) we applied quantitative methods. These methods will be summarized in the following pages.

6.3.2 Generation of Hypotheses Based on the Findings of the Qualitative Approach

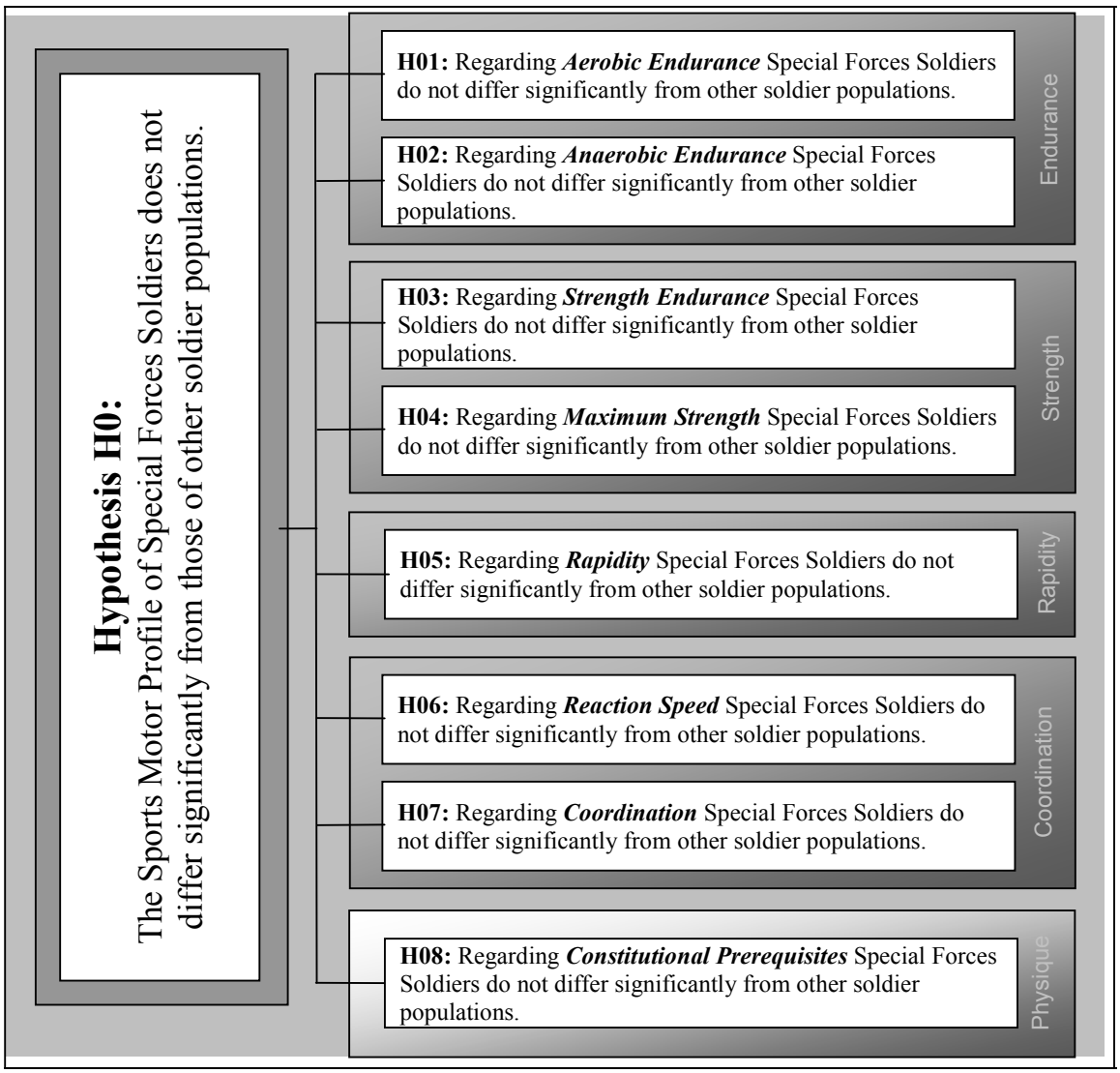


Figure 6-13: Framework for Identifying Key-Qualifications (Source: According to Eisinger, 2006).

6.3.3 Quantitative Results

Examination of Reliability, Validity and Objectivity of the Test Battery

Due to the fact that the applied test battery was established by the Austrian Army Sports Science Service in the past few years, the repeated determination of reliability and validity were not explicitly examined again. However, reliability was indirectly addressed since the tests were performed on two different occasions, and construct validity was indirectly examined via statistical correlation and factor analyses.

Objectivity was ascertained since only scientifically educated personnel were drawn on performing the tests and personnel rotation did not cause any differences whatsoever in the results.

6.3.3.1 Results of the Test Battery

Table 6-1: Average Mean Value and Standard Deviation of the Quantitative Testing of 26 Austrian Special Forces Soldiers (Source: According to Eisinger, 2006)

Results of the Test Battery						
Test Procedures and Test Parameters	**Short Cuts**	**Results [Mean Average Value]**	**Standard Deviation**	**Measurements**	**Number of Probands**	**Tested Sports Motor Components**
Cycle Ergometry absolute	Cycle Ergo abs	**337.2**	(54.4)	[W]	26	**Aerobic Endurance**
Cycle Ergometry relative	Cycle Ergo rel	**4.26**	(0.58)	[W/kg]	26	
Cycle Ergometry: Oxygen consumption (computed according to HABER, 2001)	Cycle Ergo VO_2 abs	**3938.1**	(588.5)	[ml/min]	26	
Cycle Ergometry: Oxygen consumption per kg body weight (computed according to HABER, 2001)	Cycle Ergo VO_2 rel	**49.8**	(5.9)	[ml/kg/min]	26	
2400-Meter-Run	2400 m-Run	**9.20**	(29.9)	[min,sec]	25	
2400-Meter-Run: Oxygen consumption per kg body weight (computed according to NELSON, 1995)	2400 m-Run VO_2 rel	**52.8**	(2.0)	[ml/kg/min]	25	
Obstacle Course 2nd Lap	Obst. C. 2nd Lap	**35.2**	(3.8)	[min,sec]	25	**Anaerobic Endurance**
Obstacle Course total	Obst. C. total	**69.6**	(6.5)	[min,sec]	25	
Pull-ups	Pull-ups	**26**	(6.4)	[repetitions]	26	**Strength Endurance**
Push-ups	Push-ups	**50**	(12.5)	[repetitions]	26	
Sit-ups	Sit-ups	**49**	(18.2)	[repetitions]	26	
Rope-climbing	Rope-climbing	**10**	(5.7)	[sec]	26	**Strength Endurance/ Resilience/ Maximum Strength**

Results of the Test Battery

Test Procedures and Test Parameters	Short Cuts	Results [Mean Average Value]	Standard Deviation	Measurements	Number of Probands	Tested Sports Motor Components
Bench-press absolute	Bench-press abs	**93.4**	(16.6)	[kg]	26	**Maximum Strength**
Bench-press relative	Bench-press rel	**1.18**	(0.15)	[kg/kg]	26	
Bench-pulls absolute	Bench-pulls abs	**97.9**	(14.6)	[kg]	26	
Bench-pulls relative	Bench-pulls rel	**1.24**	(0.15)	[kg/kg]	26	
Leg-press absolute	Leg-press abs	**224.5**	(41.3)	[kg]	26	
Leg-press relative	Leg-press rel	**2.83**	(0.47)	[kg/kg]	26	
Hand Dynometry absolute	Hand Force abs	**178.8**	(17.4)	[kg]	14	
Hand Dynometry relative	Hand Force rel	**2.35**	(0.23)	[kg/kg]	14	
Jump and Reach	J&R	**56.3**	(7.0)	[cm]	26	**Resilience**
Talent-Diagnosis-System 0 – 10 Meter Sprint	TDS 0 – 10 m	**1.77**	(0.08)	[sec]	26	**Rapidity**
Talent-Diagnosis-System 10 – 20 Meter Sprint	TDS 10 – 20 m	**1.31**	(0.06)	[sec]	26	
Talent-Diagnosis-System 0 – 20 Meter Sprint	TDS 0 – 20 m	**3.08**	(0.12)	[sec]	26	
Talent-Diagnosis-System Elementary Reaction acoustical	TDS acoustical	**199.7**	(17.9)	[ms]	14	**Elementary Reaction**
Talent-Diagnosis-System Elementary Reaction optical	TDS optical	**230.7**	(22.4)	[ms]	26	
Talent-Diagnosis-System Complex Reaction	TDS complex	**18.4**	(2.1)	[sec]	26	**Complex Reaction/ Co-ordination**
Obstacle Course 1st Lap	Obst. C. 1st Lap	**32.2**	(3.5)	[min,sec]	25	**Coordination**
Talent-Diagnosis-System Rhythmical Sprint	TDS rhythmical	**2.1**	(0.22)	[sec]	26	

Results of the Test Battery

Test Procedures and Test Parameters	Short Cuts	Results [Mean Average Value]	Standard Deviation	Measurements	Number of Probands	Tested Sports Motor Components
Body Height	Height	**178.9**	(6.0)	[cm]	26	**Anthropometric Measures**
Body Weight	Weight	**79.2**	(8.7)	[kg]	26	
Hip Circumference	Hip Circum.	**95.2**	(7)	[cm]	26	
Waist Circumference	Waist Circum.	**83**	(5)	[cm]	26	
Upper Arm Circumference	Upper Arm Circum.	**32.9**	(3.2)	[cm]	26	
Calf Circumference	Calf Circum.	**39.2**	(2.1)	[cm]	26	
Seat Height	Seat Height	**92.6**	(3.5)	[cm]	26	
Shoulder Length	Shoulder Length	**39.8**	(2.7)	[cm]	12	
Elbow Width	Elbow Width	**7.4**	(0.4)	[cm]	26	
Knee Width	Knee Width	**9.6**	(0.5)	[cm]	26	
Body Mass Index	BMI	**24.8**	(1.9)	[kg/m^2]	26	**Anthropometric Parameters**
Waist-to-Hip-Ratio	WHR	**0.87**	(0.04)	[Ratio]	26	
Body Fat Percentage (computed according to DURNIN/WOMERSLEY, 1974)	Body Fat Percentage	**12**	(4.7)	[%]	26	
Endomorphy (computed according to HEATH/CARTER, 1967)	Endo	**2.5**	(1.1)	[Index]	26	**Body Composition**
Mesomorphy (computed according to HEATH/CARTER, 1967)	Meso	**5.6**	(1.1)	[Index]	26	
Ectomorphy (computed according to HEATH/CARTER, 1967)	Ecto	**1.9**	(0.9)	[Index]	26	

6.3.3.2 Identification of Key-Qualifications

The purpose of this section was to investigate whether significant differences exist in sports motor components between Special Forces Soldiers and other groups of soldiers. It was discovered that differences existed, and were due to military training and to the military performance of the Special Forces soldiers. Based upon this information, we assumed that those differences are a strong indication for the component in question to be a key-qualification.

6.3.3.3 Characteristic of the Other Soldier Population

Table 6-2: Overview of the Other Groups of Soldiers (Source: According to Eisinger, 2006)

Overview of the other groups of soldiers drawn form the literature						
Groups of Soldiers: categorised in –		**Literature**	**Number of Probands**	**Age**	**BMI**	**VO_2** [ml/kg/min] according to NELSON (1995)
Rank	**Privates**	MAYER (2002)	102	21.2	20.8	50.6
	Non-commissioned officers (NCO)	MAYER (2002)	259	27.5	21.6	51.6
	Non-commissioned officers	HÖLZL (2005)	75	29.5	25.7	–
	Officer cadets	HÖLZL (2005)	80	21.1	23.9	–
	Officers	MAYER (2002)	102	26.1	21.2	52.7
Branch	**Recruits**	MUCHA (2002)	397	20.2	23	–
	Paratroopers	WITTELS et al., (2005)[4]	36	23.7	23.7	53
	Force for International Missions	WITTELS et al., (2005)[5]	132	23.5	24.6	49.3
Function	**NCOs (office duty)**	HÖLZL (2005)	33	29.9	26.2	–
	NCOs (field duty)	HÖLZL (2005)	40	29	25.3	–
Other Criteria	**Male Soldiers**	HÖLZL (2005)	72 – 167	–	–	–
	20 – 40-years aged soldiers	RAUSCH (2004)	305	20 – 40	25.2	–

With the table above an overview is given of the other groups of soldiers, which are used as the reference group for statistical comparisons. The samples used are representative for their home units.

[4] Source of the Data: Austrian Army Sports Science Service.

[5] Source of the Data: Austrian Army Sports Science Service.

6.3.3.4 Hypotheses Testing

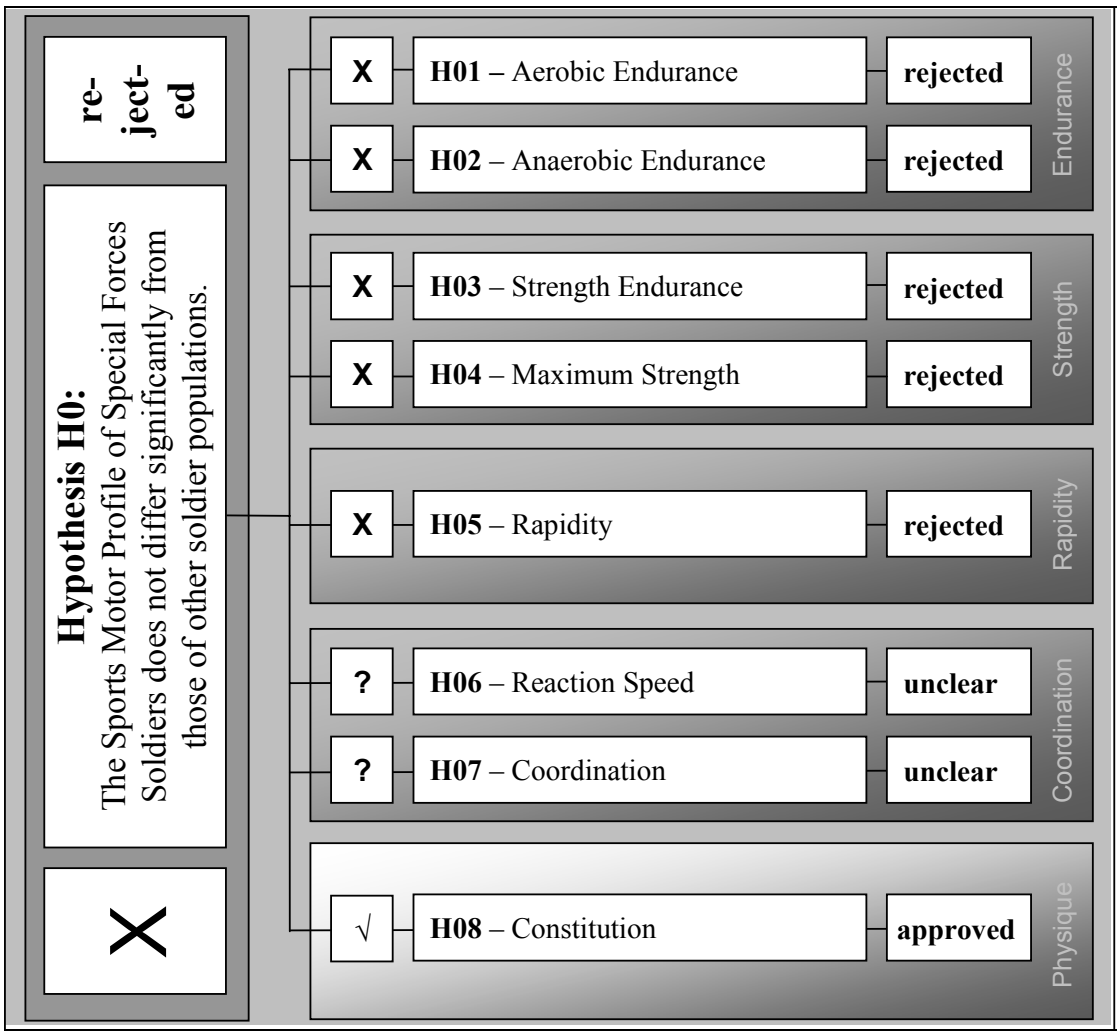


Figure 6-14: Results of the Statistical Comparison (Source: According to Eisinger, 2006).

As summarized in Figure 6-14 the formulated hypothesis that there would be a difference in the sports motor profile between Special Forces soldiers and other groups of soldiers is rejected. Specifically, the physiological performance of the Special Forces soldiers was significant higher than the other groups of soldiers tested with respect to aerobic endurance, anaerobic endurance, strength endurance, maximum strength and rapidity.

Hypotheses 6 (reaction speed) and 7 (coordination) could for several reasons not be explicitly clarified and is therefore a matter for further investigation.

Regarding the physique of Special Forces operators and other soldier collectives we could not find any differences. Consequently hypothesis 8 is approved.

A graphical synopsis of the physiological performance of all soldier populations is presented in the following figure. In order to be able to display all measurements in one graph it was necessary to *standardise* them. Therefore the sets of data were transformed so that the mean value of the distributions was 0 and the standard deviation was 1. Furthermore, the algebraic sign of the data were manipulated so that scales on the periphery of the graph mean better performance (except anthropometric data and age).

6.3.3.5 Current-Status Profiles of Special Forces Soldiers Compared to Other Soldier Collectives

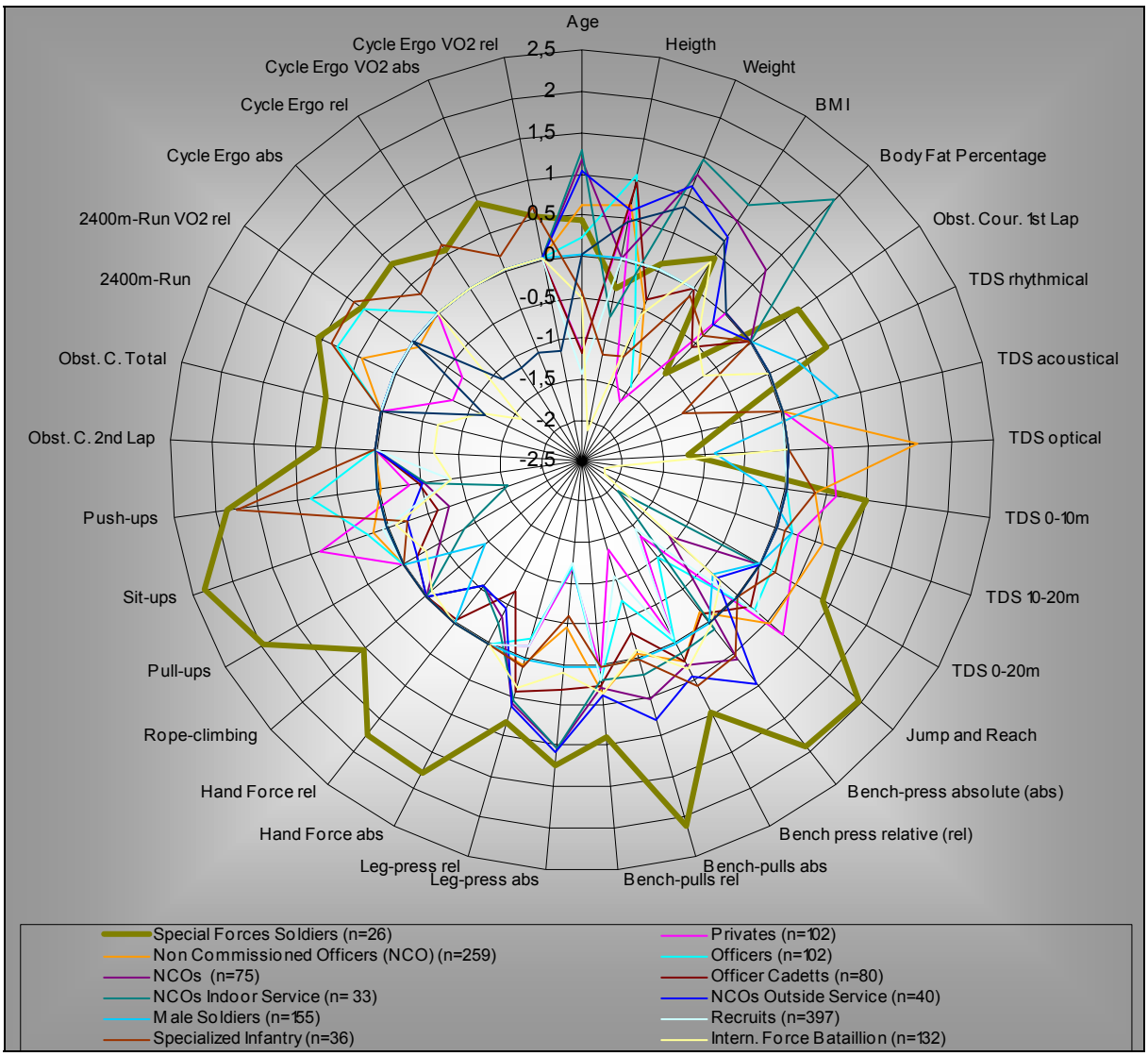


Figure 6-15: Current-Status Sports Motor Profiles of the Special Forces Soldier (Source: According to Eisinger, 2006).

This data indicates the above average performance of the tested Special Forces soldiers compared to other groups of soldiers. Furthermore, the results clearly outline that Special Forces operators perform better almost throughout the whole spectrum of physiological performance.

Only the soldiers of a specialised infantry battalion demonstrated as good achievements as the Special Forces soldiers in some areas. This might be due to the fact that those soldiers are also in a permanent state of readiness and are part of very well trained infantry units.

It was interesting to note that the Special Forces soldiers showed poor reaction speed abilities, which is of special interest as this findings does not conform with what was observed via the qualitative approach. A detailed analysis of this result showed that the applied reaction tests (TDS acoustical and optical) are not valid if we want to examine the influence of reaction on the military performance of a soldier.

The signified tests were established to measure *elementary reaction*[6] speed whereas *complex reaction*[7] speed is dominantly needed in Special Forces scenarios respective operators. We also know from literature sources that there is no correlation between these two kinds of reaction abilities [17, 28, 30].

Also, slightly different standards in the conduction of the tests for the different populations might have led to the poor reaction abilities of the Special Forces collectively. As this statement is speculative and as only little referential material was available, hypothesis 6 could neither be rejected or approved. For similar reasons the coordinative area must also be left unanswered. Both components are certainly important for successful mission accomplishment but must be further investigated in the future.

6.3.3.6 Development of Minimal Requirements

Minimal requirements like selection procedures and training recommendations must be reflective of mission demands. Nevertheless, even when minimal requirements are derived from the actual mission demands criticism exists. This criticism is often rooted in the fact that at a certain point even when on a scientific basis the cut-off level must be set somehow arbitrarily.

Under that premise and after long debating with military and scientific experts we have chosen the 10th percentile as a suitable selection criterion for Special Forces soldiers of the combat ready elements. The idea was that the tested operators were declared to be able to accomplish all requested military task successfully. Consequently even the very lowest measured physiological performance could be defined as minimal requirement. Since we aimed to exclude outliers and since individual weaknesses can be compensated we found the 10th percentile to be adequate.

6.3.3.7 Summary of the Quantitative Findings

As was shown in Figure 6-14 (results h0-testing) the formulated hypothesis, according to which the sports motor profile from Special Forces soldiers alters from other groups of soldiers, had to be rejected. The tested Special Forces operators performed significantly better in the sports motor dimensions of aerobic endurance, anaerobic endurance, strength endurance, maximum strength and rapidity. However, we could not clarify whether there are differences with respect to reaction speed and coordinative abilities. We did not find clear differences concerning the physique of the soldier collectives; hence hypothesis 8 had to be approved.

The quantitative approach also enabled us to derive plausible minimal requirements (see Table 6-3) for Special Forces soldiers of combat ready elements.

[6] The term *elementary reaction* stands for a reaction which is started by a known signal and performed by a known movement.

[7] Under the term *complex reaction* a reaction is understood which is initiated by an unknown signal and followed by an unknown action. In this case the subject has to make a decision which alternative amongst a number of alternatives is the best answer in a specific situation. Quite obviously complex reaction abilities are very much needed in Special Forces scenarios rather than pure elementary reaction abilities.

Table 6-3: Minimal Requirements for Special Forces Soldiers of the Combat Ready Elements (Source: According to Eisinger, 2006)

10th Percentile as Minimal Requirement					
Test Procedures and Test Parameters	**Short Cuts**	**10th Percentile**	**Measurements**	**Number of Probands**	**Tested Sports Motor Components**
Cycle Ergometry absolute	Cycle Ergo abs	**256**	[W]	26	**Aerobic Endurance**
Cycle Ergometry relative	Cycle Ergo rel	**3.56**	[W/kg]	26	
2400-Meter-Run	2400 m-Run	**10.4**	[min,sec]	25	
2400-Meter-Run: Oxygen consumption per kg body weight (computed according to NELSON, 1995)	2400 m-Run VO_2 rel	**49.92**	[ml/kg/min]	25	
Obstacle Course 2nd Lap	Obst. C. 2nd Lap	**40.4**	[min,sec]	25	**Anaerobic Endurance**
Obstacle Course total	Obst. C. total	**79.7**	[min,sec]	25	
Pull-ups	Pull-ups	**19.1**	[repetitions]	26	**Strength Endurance**
Push-ups	Push-ups	**35.7**	[repetitions]	26	
Sit-ups	Sit-ups	**22.1**	[repetitions]	26	
Rope-climbing	Rope-climbing	**11.7**	[sec]	26	**Strength Endurance/Resilience/ Maximum Strength**
Bench-press absolute	Bench-press abs	**68.7**	[kg]	26	**Maximum Strength**
Bench-press relative	Bench-press rel	**0.96**	[kg/kg]	26	
Bench-pulls absolute	Bench-pulls abs	**77.7**	[kg]	26	
Bench-pulls relative	Bench-pulls rel	**1.05**	[kg/kg]	26	
Leg-press absolute	Leg-press abs	**172.0**	[kg]	26	
Leg-press relative	Leg-press rel	**2.15**	[kg/kg]	26	

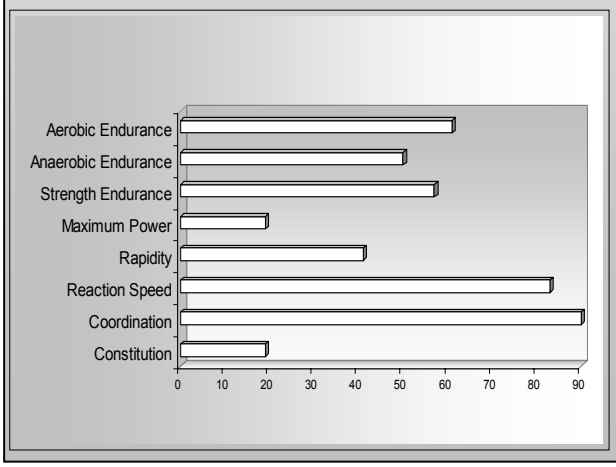
10th Percentile as Minimal Requirement					
Test Procedures and Test Parameters	**Short Cuts**	**10th Percentile**	**Measurements**	**Number of Probands**	**Tested Sports Motor Components**
Hand Dynometry absolute	Hand Force abs	**152.5**	[kg]	14	
Hand Dynometry relative	Hand Force rel	**2.05**	[kg/kg]	14	
Jump and Reach	J&R	**43.0**	[cm]	26	**Resilience**
Talent-Diagnosis-System 0 – 10 Meter Sprint	TDS 0 – 10 m	**1.9**	[sec]	26	
Talent-Diagnosis-System 10 – 20 Meter Sprint	TDS 10 – 20 m	**1.38**	[sec]	26	**Rapidity**
Talent-Diagnosis-System 0 – 20 Meter Sprint	TDS 0 – 20 m	**3.26**	[sec]	26	
Talent-Diagnosis-System Elementary Reaction acoustical	TDS acoustical	**234.5**	[ms]	14	**Elementary Reaction**
Talent-Diagnosis-System Elementary Reaction optical	TDS optical	**255.1**	[ms]	26	
Talent-Diagnosis-System Complex Reaction	TDS complex	**21.15**	[sec]	26	**Complex Reaction/ Co-ordination**
Obstacle Course 1st Lap	Obst. C. 1st Lap	**37.56**	[min,sec]	25	**Coordination**
Talent-Diagnosis-System Rhythmical Sprint	TDS rhythmical	**2.37**	[sec]	26	
Body Mass Index	BMI	**26.94**	[kg/m^2]	26	**Anthropometric Parameters**
Body Fat Percentage (computed according to DURNIN/WOMERSLEY, 1974)	Body Fat Percentage	**18.27**	[%]	26	

6.3.4 Declaration of Key-Qualification for Special Forces Operators

In order to finally identify sports motor key-qualifications for Special Forces operators both the qualitative and quantitative findings are confronted and a conclusion is drawn as outlined in the following picture:

Key-Qualification

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
	Aerobic Endurance	+	+	+
	Anaerobic Endurance	+	+	+
	Strength Endurance	+	+	+
	Maximum Strength		+	
	Rapidity		+	
	Reaction Speed	+		+
	Coordination	+		+
	Constitution			



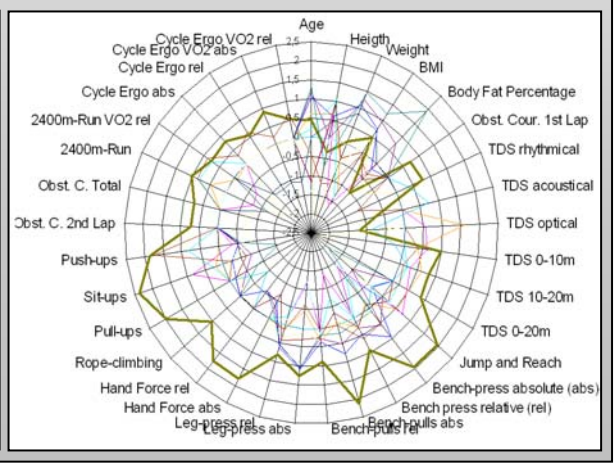


Figure 6-16: Identification of Sports Motor Key-Qualification for Special Forces Soldiers (Source: According to Eisinger, 2006).

By means of qualitative instruments, coordinative abilities, reaction speed, aerobic, strength and anaerobic endurance were identified as having the highest impact on the military performance of the soldiers. In contrast the quantitative approach revealed significant differences in aerobic, anaerobic, strength endurance as well as rapidity and maximum strength. From these findings aerobic endurance, anaerobic endurance and strength endurance can explicitly be declared as key-qualifications.

The found differences in maximum strength and rapidity are possibly due to the training habits of the tested soldiers. In the authors opinion these differences are not caused by military demands and are therefore classified relevant but not key-qualification. At this point it seems worth highlighting the importance of the qualitative approach, which worked well as corrective 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 we defined them to be key-qualifications too. The decision was based on the fact that all military experts of all branches weighted the respective components as highly important.

6.4 PRACTICAL APPLICATIONS OF THE GENERATED KNOWLEDGE

6.4.1 Evaluating or Establishing Military Selection Procedures

Earlier in this chapter, the key-qualifications for Special Forces operators were identified. We now know which components must be developed in a Special Forces candidate. That knowledge associated with the computed minimal requirements brings us to a position where we can precisely investigate whether the currently applied selection procedures are valid[8] and whether they are complete[9].

Figure 6-17 exemplifies this framework. The confrontation of the derived key-qualifications with the selection tests revealed that aerobic, anaerobic and strength endurance is examined during the process. However, we cannot find reaction or coordination tests. Consequently the selection procedures are incomplete. From a scientific point of view it is recommended that tests to evaluate reaction speed and coordinative abilities be implemented. This is especially true since we know from the literature that the dimensions in question are to a high degree genetically determined and trainability is limited [11, 15, 27, 29, 30].

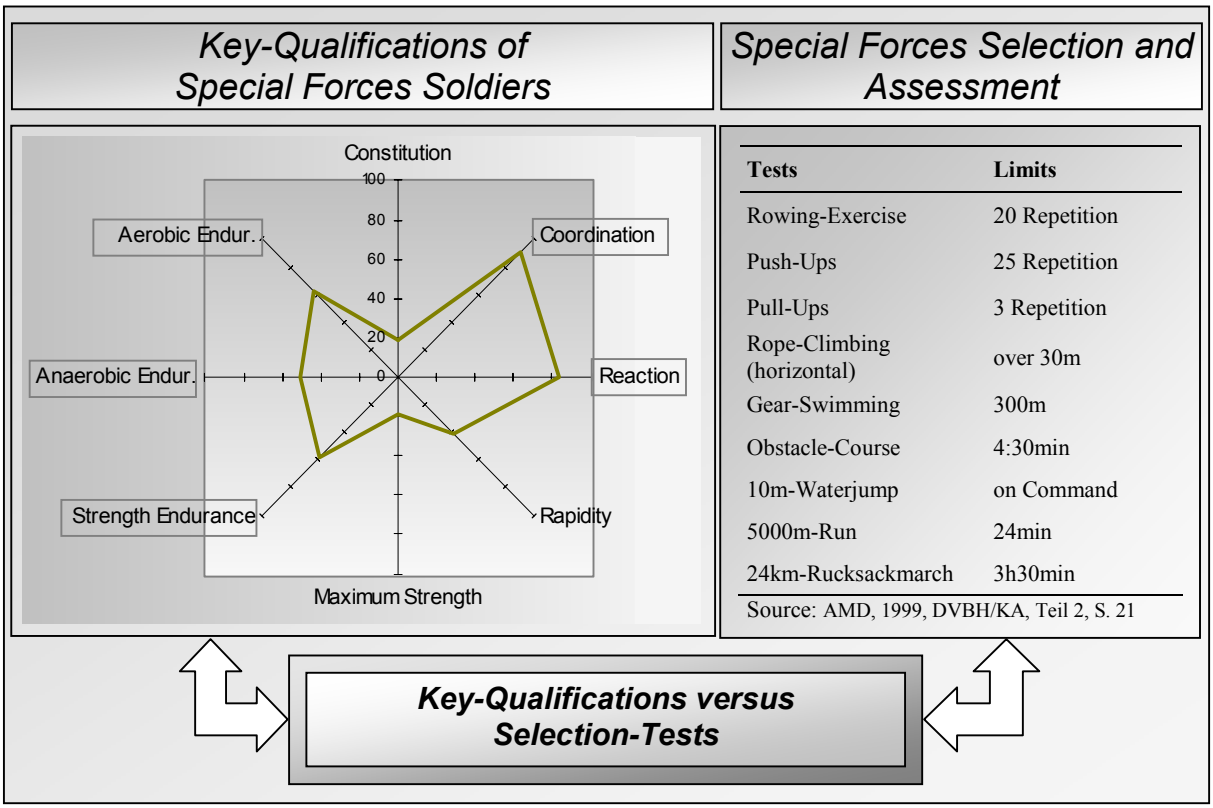


Figure 6-17: Framework for Analysing Selection Procedures and Assessment (Source: According to Eisinger, 2006).

[8] Do the selection procedures actually test those (key-) components which are influencing the military performance of soldiers?

[9] Are all relevant sports motor components examined?

6.4.2 Development of Individual Training Recommendations

Amongst other reasons the quantitative investigation was also conducted in order to gain referential material for performance diagnostic and training recommendation purposes. As stated earlier, the soldiers tested were able to accomplish the requested military tasks successfully. Therefore it is plausible to use the mean average value as reference and compare this collective performance with the individual performance of soldiers. By doing so physiological performance deficits can be identified and precise training recommendations given.

In Figure 6-18 two probands are exemplified: Proband j20 (blue line) is relatively poorly trained. In order to fit the Special Forces profile training across almost the whole spectrum is indicated (except rapidity and reaction). An average BMI associated with a high body fat percentage shows additionally low skeletal muscle mass. The graph also shows extremely poor abdominal force which makes the proband prone to back injuries.

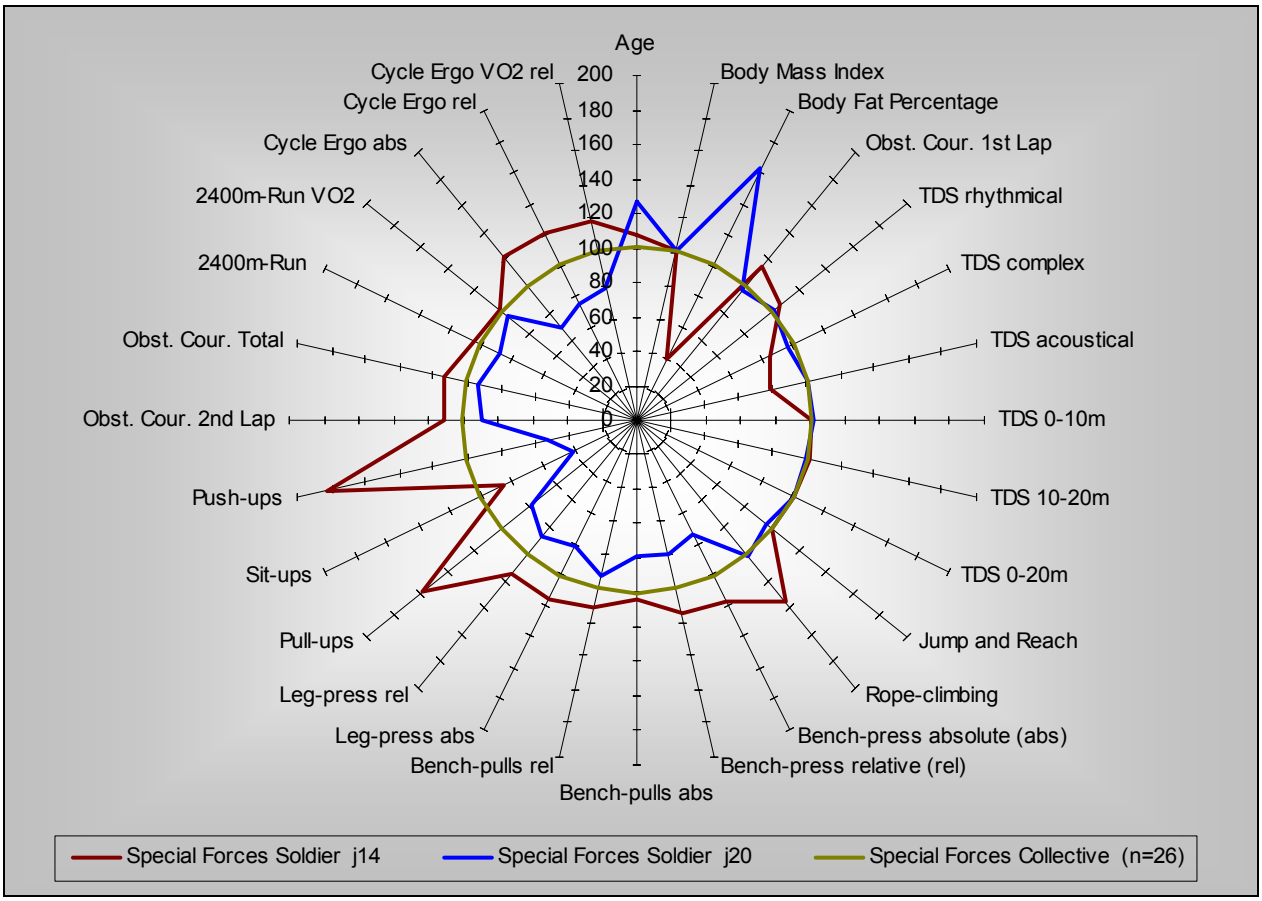


Figure 6-18: Framework for Identifying Individual Training Deficits (Source: According to Eisinger, 2006).

In contrast proband j14 (red line) is in a good shape. The graph clearly demonstrates an average BMI and a low body fat percentage, which is due to high lean skeletal muscle mass. However, we also found weak abdominal force. Again the abdominal region must be trained and should be a matter of muscle function testing in order to clarify whether muscular disbalances are profound.

6.4.3 Development of Special Forces Specific Individual and Group Training Recommendations

If we extend the model exhibited in Figure 6-18 by the sports motor target profile for Special Forces operators and compare the actual performance of a soldier (proband j20) with that profile respectively with the marked key-qualification we are in a position to give Special Forces specific training recommendations. In the shown case we would have to suggest the candidate to focus on improving aerobic, anaerobic, strength endurance as well as reaction and coordination whereas maximum strength and rapidity can be neglected.

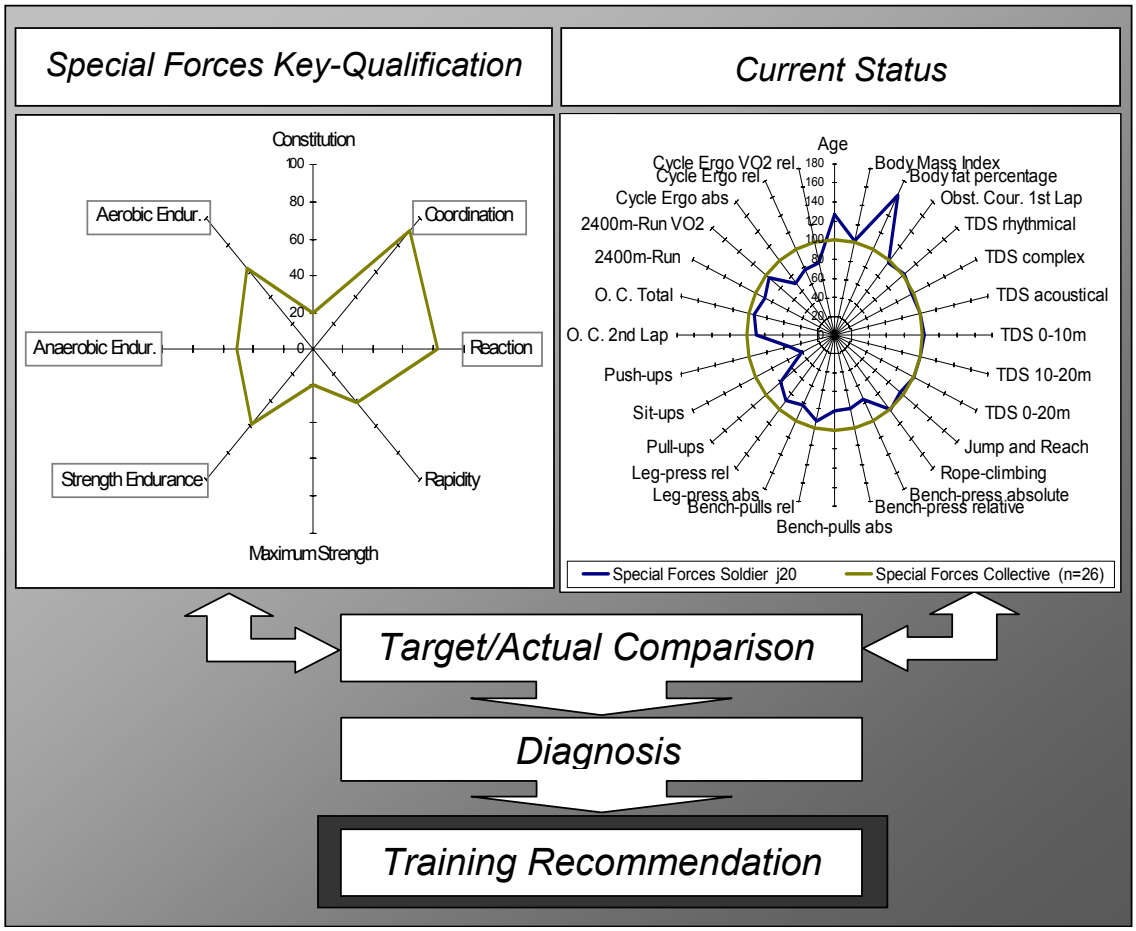


Figure 6-19: Model for Special Forces Specific Training Recommendations (Source: According to Eisinger, 2006).

Additionally this model enables us to not only give general Special Forces training recommendations but also precise task specific training recommendations. Therefore we replace the profile for Special Forces operators with a task specific qualitative sports motor target profile – as exemplified in Figure 6-20. In this case we would not recommend to emphasis anaerobic training as it seems not to have a great influence on the military performance of combat divers. Instead, it would be recommended that the candidate concentrate on aerobic training, strength endurance, reaction speed and coordination as such. Again maximum strength and rapidity need not to be developed further if the candidate plans to specialise in combat diving.

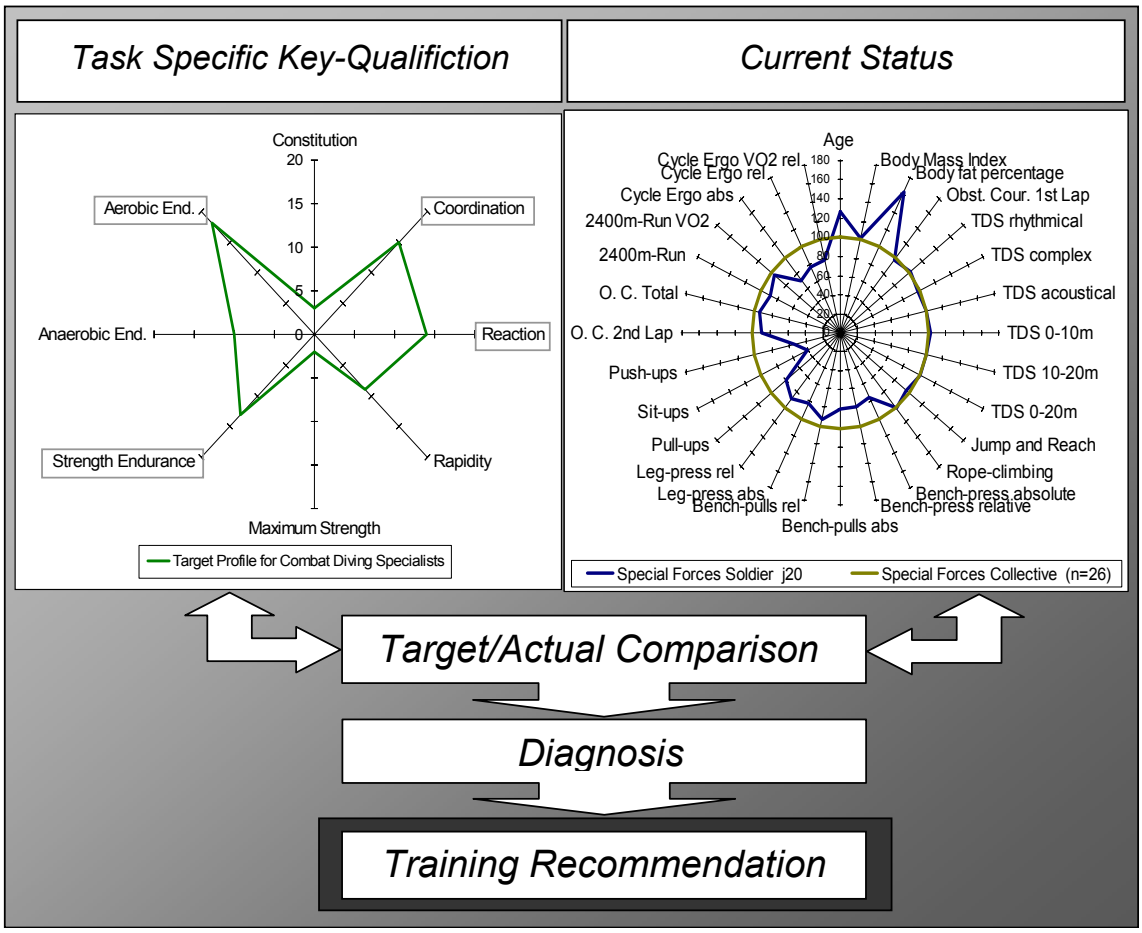


Figure 6-20: Model for Task Specific (Combat Diver) Training Recommendations (Source: According to Eisinger, 2006).

6.5 DISCUSSION

Complex military mission demands like those of Special Forces operators cannot be described conclusively via single military activities (marching, digging, etc.). In order to get a comprehensive view we invented a different methodology. Instead of looking at single military activities we identified relevant sports motor components (as endurance, muscular strength, etc.) and investigated data of the physical performance of Special Forces soldiers who were declared as ready for mission by the commanding officers. This methodology enabled the description of complex Special Forces mission demands.

Coordinative abilities, **reaction speed**, **aerobic endurance**, **strength endurance** and **anaerobic endurance** were identified as key qualification for Special Forces soldiers. Whereby, the conditional dominate components (aerobic, strength and anaerobic endurance) were found to be key qualifications both by the qualitative and the quantitative approach. However, coordination and reaction were declared to be key qualifications based on qualitative findings only. Although our argumentation is conclusive and the qualitative reports are very strong this conclusion can be criticised; therefore coordination and reaction are certainly an issue of further research.

Furthermore, our findings have to be seen in context with the premises made and the Austrian conditions of the investigated field. Whether the results of the Austrian Special Forces operators are applicable to other foreign Special Forces units could not be clarified in this paper and therefore is also a matter of further investigation.

In this context the small number of subjects involved in this study should be considered. In fact, the sample is, in respect of the small main unit, representative of Austrian Special Forces. However, international statements based on this study have to be interpreted carefully.

A further point of criticism is that currently no international standards or definitions of the studied operational areas exist. The term Special Forces as well as the operational areas of direct action, close combat, mountaineering, combat diving and parachuting are on the international scene not understood uniformly. From a scientific point of view this is highly problematic and should be resolved at least within NATO.

Knowing that there is no linear correlation between the physiological performance and the military performance of a soldier the definition of minimal requirements is essential. The 10th percentile was found to be a suitable cut-off level for Special Forces operators to be declared combat ready. These computed minimal requirements (e.g. 49.9 ml/kg^{-1}/min^{-1} [2400 m-run]; 3.6 Watt/kg [cycle ergometry]; Pull-ups 19; Push-ups 36; Sit-ups 22)[10] have again to be associated with the stated premises. The level is only accurate if the drawn sample satisfies the given prerequisites. Whether respective cut-off values match with Special Forces operational demands must be evaluated in practice.

In general, the authors indicated that in order to accomplish the applied methodical approaches successfully the given premises must be met by the investigated population. We furthermore remarked that the applied methods are not exclusive. However, the solely developed and herewith presented research setting was empirically tested and was proven to work exceptionally well for establishing sports motor profiles for (Special Forces) soldiers.

6.6 ACKNOWLEDGEMENT

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The views, opinions, and/or findings contained in the report are those of the authors and should not be construed as an official position of the Austrian Ministry of Defence, unless so designated by other official documentation. The study was conducted in accordance with current laws in Austria regarding research with human subjects.

We would like to thank the participating Special Forces soldiers. Additionally we would like to thank the staff of the Research Group on Physical Performance Medicine and the staff of the Army Sports Science Service for performing the test battery.

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[10] The test standards can be looked up in Appendix 6A-1.

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Appendix 6A-1 – Test Standards

The 2400-meter run was performed outdoor. Cycle ergometry, indoor obstacle course, the 20-meter sprint and the tests for strength endurance as well as maximum strength were performed indoor, in a gym.

6A-1.1 TESTS FOR AEROBIC ENDURANCE

To examine aerobic endurance a 2400-meter run (reversed Cooper test) and a cycle ergometry were conducted.

6A-1.2 2400 M RUN

For the 2400 m-run a standardized 400-meter outdoor runway with sand surface was used. When testing the Special Forces soldiers, the temperature during the test was 20° C on the first recording date and 9° C on the second. The weather was similar at both dates: cloudy with drizzle. Wind speed was 1 m/s and 4 m/s at the respective dates. The strength and the direction of the wind were constant at both dates.

The soldiers were instructed and motivated to run 6 rounds with their individual highest speed possible. Time was recorded with standard stop watches by educated sports trainers.

From the results of the 2400-meter run the absolute and relative VO_2max was computed via the following regressions equations after NELSON [23]:

$VO_2max(L/min) = 2.683+(0.2812*sex)+(0.035*BW)–(0.1749*t)$

$VO_2max(ml/kg/min) = 88.02+(3.716*sex)–(0.1656*BW)–(2.767*t);$

whereas:	sex:	1 for men
		0 for women
	BW	body weight in kg
	t	time in min

6A-1.3 CYCLE ERGOMETRY

For the cycle ergometry standardized ergometers (Schiller Medizintechnik Ergoline Ergometrics 800 S) were used. The ergometers were equipped with an eddy current break; the hinge moment was measured independently from the rotation speed. The operating range for the ergoline was from 25 to 990 watt, the accuracy of measurement was about 3 watt. After the heart rate monitor was checked for full functionality, the subjects were advised to start the warm-up phase. The seat of the cycle ergometry was adjusted to the subject's height. The probands were advised to perform the ergometry until exhaustion to get adequate results. For the warm-up phase the ergometer was set 3 minutes at 50 watt. The test was started with 100 watt for 3 minutes. Every 3 minutes the strain was raised by 50 watt, the subjects were advised to keep the rotation speed by 60 – 70 revolutions per minute. The rotation speed was monitored on a display, when the subject was not able to keep the given rotation speed, the test was broken off.

The heart rate was measured via commercial acquirable heart rate monitors (Polar Vantage NT/Polar Electro, Kempele, Finland). The device consists of a chest belt with a sensor and a watch with an

integrated microcomputer. The sensor is sending the data telemetrically to the microcomputer from where the data can be uploaded to a personnel computer for further processing.

From the results of the cycle ergometry the absolute and the relative VO_2max was computed via the formula by HABER [12]:

VO_2max(ml/min) = BW*6.3 +10.2*watt

VO_2max(ml/kg/min) = (BW*6.3 +10.2*watt)/BW

whereas: BW body weight in kg

6A-1.4 ANAEROBIC ENDURANCE AND COORDINATIVE ABILITIES

For assessment of anaerobic endurance and coordination under time-pressure we used a standardized indoor obstacle-course. The obstacle course consisted of 9 obstacles: start-four-leg-stand, rhythm sprint, network of wires, pull-bar, slalom, balance beam, double beam, grid ladder and beam wave. Every subject had to pass the course twice. The subjects were advised to overcome the obstacle course as fast as possible with correct performance of the given obstacles. If an obstacle was not overcome correctly, penalty seconds were added. Every obstacle was introduced to the soldiers and everyone had the possibility to test the course by himself. The equipment used for the obstacle course is shown in Table 6A-1-1 and the arrangement of the obstacles is outlined in Figure 6A-1-1. Figures 6A-1-2 – 6A-1-10 are showing the obstacles 1 – 9.

Table 6A-1-1: Description of the Obstacles of the Indoor Obstacle Course

Order	Description	Equipment
Obstacle 1	Start-four-leg-stand	2 long benches 1 gym mat (1 m x 2 m) 1 hurdle (7 parts)
Obstacle 2	Rhythm sprint	4 long benches
Obstacle 3	Network of wires	3 mats 3 hurdles
Obstacle 4	Pull-bar	1 long bench
Obstacle 5	Slalom	4 slalom rods
Obstacle 6	Balance beam	1 balance beam 1 slalom-rod
Obstacle 7	Double beam	2 gym boxes 1 mat 1 slalom rod
Obstacle 8	Grid ladder	1 grid ladder (2 m) 1 low jump mat
Obstacle 9	Beam wave	2 gym boxes 2 mats 2 hurdles 1 slalom rod

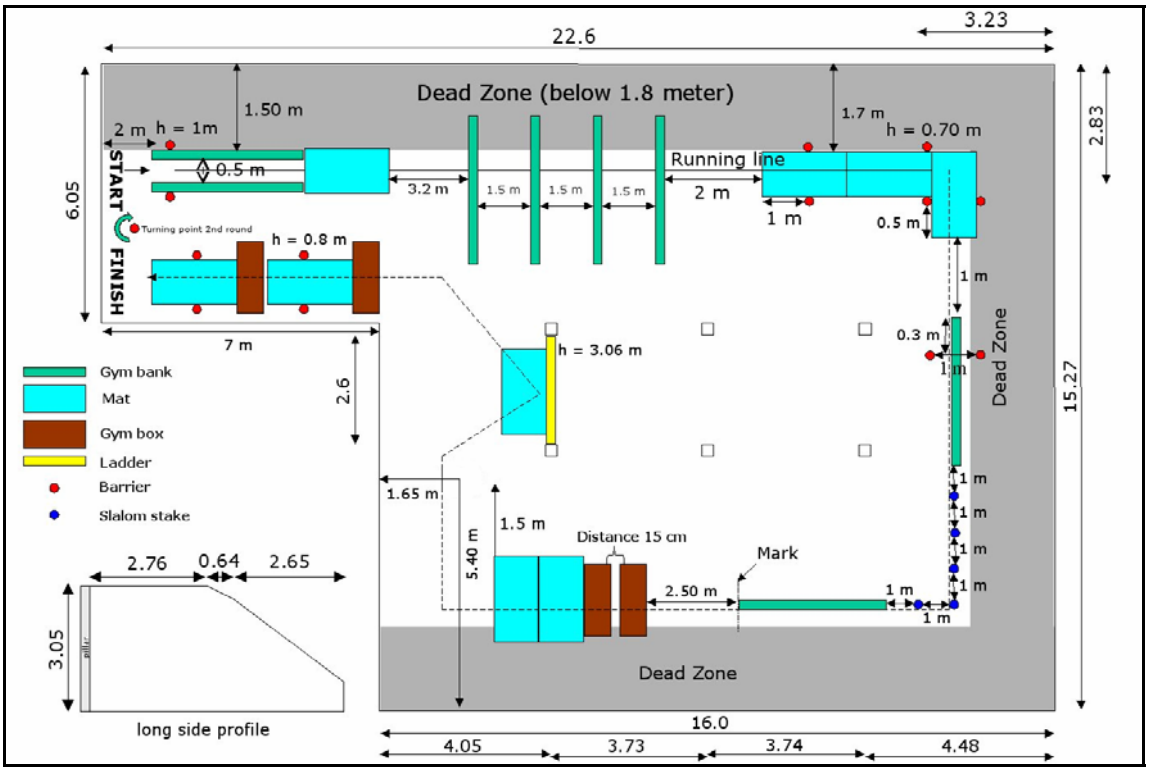

Figure 6A-1-1: Arrangement of the Obstacles of the Indoor Obstacle Course.

Figure 6A-1-2: Obstacle 1 – Start-Four-Leg-Stand.

Figure 6A-1-3: Obstacle 2 – Rhythm Sprint.

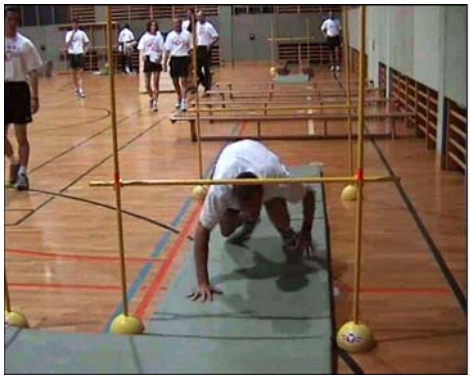

Figure 6A-1-4: Obstacle 3 – Network of Wires.

Figure 6A-1-5: Obstacle 4 – Pull-Bar.

Figure 6A-1-6: Obstacle 5 – Slalom.

Figure 6A-1-7: Obstacle 6 – Balance Beam.

Figure 6A-1-8: Obstacle 7 – Double Beam.

Figure 6A-1-9: Obstacle 8 – Grid Ladder.

Figure 6A-1-10: Obstacle 9 – Beam Wave.

6A-1.5 COORDINATIVE ABILITIES/REACTION SPEED

6A-1.5.1 Rhythm Sprint

Five long benches (height 31.5 cm) were placed across the running direction between the second and third light barrier. The space between the first, second and third light barriers were 10 m. The position of the first long bench was one meter after the second light barrier, the second to fifth long bench were placed 2 m after each (light bars are at 1 m, 3 m, 5 m, 7 m, 9 m).

With 11 m run-up the five long benches had to be overcome as fast as possible with the following movement presetting: The probands were asked to touch the floor twice in between the long benches. Consequently one leg was used as "free" and the other leg as "trail leg". The test had to be done twice. The fastest run was recorded. Time was measured electronically by a light barrier. A run was not counted if the proband could not meet the rhythm-task (2 contacts in between the benches, see Figure 6A-1-11).

Figure 6A-1-11: Rhythm Sprint.

6A-1.5.2 Velocity

Velocity was measured by a 20-m sprint. The test was performed in a straight course of the gym. Light barriers were placed 1 m, 11 m and 21 m after the starting line. So, the measured course was 20 m. The subjects were advised to run as fast as possible through this course. Every subject had the possibility to complete the course twice. The best result was recorded.

6A-1.5.3 Strength Endurance

Strength endurance was tested by means of push-ups, chin-ups with inclined body, sit-ups and a three meter rope-climbing test.

6A-1.5.4 Push-ups

For push-ups the subjects were advised to pose in the press up position, legs extended, and arms supporting upper body. The arms were to be brought shoulder-wide and the legs hip-wide outstretched put on the ground. The body had to be fully stretched; head, shoulders, hips and heels had to build an imaginary straight line (no dip of the hip); fingers should be pointing forward, thumbs had to be on the height of the acromion; the elbow joint had to be stretched; the look should be on the ground (see Figures 6A-1-12 and 6A-1-13).

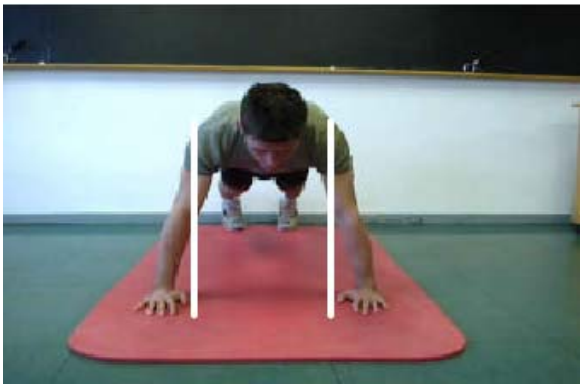

Figure 6A-1-12: Start Position of Push-ups, en Face.

Figure 6A-1-13: Start Position of Push-ups, en Profile.

The subjects were now instructed to bend the arms in the elbow joint until chin and chest almost touched the floor (body and arms built an imaginary straight line); the body tension had to be kept all the time; then the subjects were asked to stretch their arms to get into the starting position. The movement had to be dynamically done – movement breaks were not allowed. Every correctly performed push-up was counted. Breaking off criteria were a not fully stretched elbow joint, not enough flexion in the elbow joint (body and arms not in a straight line), loss of body tension (head, shoulders, hip, heels not in a straight line) and a stop of the movement fluency.

6A-1.5.5 Inclined Chin-ups

For setting of the height of the bar the subject had to sit down under the bar with extended legs, his arms stretched out vertically (straight back, hip directly vertical under the bar). The height of the bar was adjusted, so that the wrist of the subject was a few centimetres higher than the bar. At the height of the plantar pedis a tight resistor (e.g. a part of a cupboard) was placed to brace the feet. The subjects had to grab the bar shoulder broad with the wrist grip. Then they had to take the inclined position, the feet were supported, arms were stretched, from the inclined position the subjects had to bend the elbow till they reached the bar with the chest or the chin. After touching the bar the starting position had to be taken in. The body tension had not to be lost. A short break was allowed in the starting position, but the body tension had to be kept. Every correctly performed chin-up was counted. Break off criteria were loss of body tension, a movement upwards initiated by the hips and not from the arms and inability to pull the chin up to the height of the bar. The inclined chin-ups are shown in Figures 6A-1-14 and 6A-1-15.

Figure 6A-1-14: Start Position of Inclined Chin-ups.

Figure 6A-1-15: Inclined Chin-ups.

6A-1.5.6 Sit-ups

To allocate the starting position the test person had to lie down in dorsal position on the floor. The legs had to be bent, heels on the ground, knee angle was 90 degrees; the arms were stretched diagonally in front of the body, the stanchions are located in hip height of the lying test person. To setup the reaching height individually, the test person had to erect the body until the distance between floor and the inferior scapula angle was 15 cm. A string was stretched at the end of the fingertips. The test person was instructed to lift the scapulas slowly off the floor and to erect the body to touch the string with the fingertips. The body had not to be completely dropped onto the mat afterwards – the base tension in the frontal abdominal muscles had to be kept. The whole movement had to be dynamically (without breaks) and to be repeated as often as possible. The heels had to be kept on the floor all the time. The arms had to be stretched diagonally straight front upwards. Every correctly performed sit-up was recorded. Break-off criteria were heels lifted off the floor, no fluent movement, when the test person could not keep the arms stretched to the front, when the upper back of the test person touched the floor and a stop of the movement fluency. Starting position and performance of sit ups are shown in Figures 6A-1-16 – 6A-1-18.

Figure 6A-1-16: Start Position of Sit-ups.

Figure 6A-1-17: Sit-ups.

Figure 6A-1-18: Sit-ups.

6A-1.5.7 Rope Climbing

For the rope climbing test a marker was set on the rope at a height of 2 m and another one at 6 m. A mat was placed under the rope. The subjects were advised to climb the course of 4 meters as fast as possible. On the command, “On your mark”, the subjects had to go into the starting position: hands had to be placed

on the first mark, both arms had to be stretched and the legs must not touch the mat. On the command "Go" the subjects were asked to start climbing. Break-off criteria was a wrong start position and a duration of the test longer than 20 seconds.

6A-1.5.8 Maximum Strength (Jumping Power)

Maximum strength was assessed via the CONCEPT2 DYNO power measure device, using seated bench press, leg press and bench pull. Maximal jumping power was assessed by the jump and reach-test.

6A-1.5.9 Seated Bench Press

With the exercise "seated bench press" the maximum strength of the upper extremity was measured. The resistance was adjusted with six open dampers. Started was in a seating position, whereas the bench press device was fixed for the upper body directly under the sternum. Hands were placed in a broad wrist grip, the feet had to be put flat on the floor, the legs ha to brought wide enough so that the skid could slide between them. At the beginning the subjects had to warm-up by doing three movements with any desired power. Then the starting position had to be taken in; the probands must not begin until the resistance wheel stopped (display at Rep-Timer approximately 6 sec). Then the bench press device had to be pressed away from the chest until the arms were fully stretched. The test procedure was repeated three times. The best result was recorded. The exercise is shown in Figure 6A-1-19.

Figure 6A-1-19: Seated Bench Press.

6A-1.5.10 Leg Press

The exercise "leg press" was used to measure maximum strength of the lower extremities. The resistance was adjusted with six open dampers. The footplate was adjusted. The hands grabbed the hand grip under the seat. The subjects had to sit in the starting position, the angle between femoral and lower leg had to be 90°. At the beginning the subjects had to warm-up by doing three movements with any desired power. Then the starting position had to be taken in; the probands must not begin until the resistance wheel stopped (display at Rep-Timer approximately 6 sec). Then the leg press device had to be pressed away until the legs were fully stretched. The test procedure was repeated three times. The best result was recorded. The exercise is shown in Figure 6A-1-20.

Figure 6A-1-20: Leg Press.

6A-1.5.11 Bench Pull

The exercise "bench pull" was applied to measure maximum strength of the upper extremities. The resistance was adjusted with six open dampers. Started was in a seating position, whereas the bench pull device has to be fixed one track lower then the bench press device. Hands were placed in a broad wrist grip, and the feet had to be positioned flat on the floor, legs wide enough that the skid could slide between them. From the starting position were the arms were stretched the subjects had to pull the device to their chest. At the beginning the subjects had to warm-up by doing three movements with any desired power. Then the starting position had to be taken in; the probands must not begin until the resistance wheel stopped (display at Rep-Timer approximately 6 sec). Then the bench pull device had to be pulled to the chest and back until the arms are fully stretched. The test procedure was repeated three times. The best result was recorded. The exercise is shown in Figure 6A-1-21.

Figure 6A-1-21: Bench Pull.

6A-1.5.12 Jump and Reach

Here the subjects were advised to stand in front of the wall; the toes had to contact the wall, the arms had to be elevated parallel as indicated in Figure 6A-1-22. The subjects had to stand sideways in a distance of 20 – 30 cm to the wall. Then the soldiers were instructed to jump as high as possible and to place a mark (sticky tape) with their middle finger of the arm nearer to the wall on the highest position they could reach. The jump had to be done with both legs and the arms could be used to have a better drive (see Figures 6A-1-22 – 6A-1-24). The subjects had three attempts; the best one was recorded. The difference between jumping height and reaching height was measured. Break-off criteria were jumping with only one leg, jumping out of the striding position, rotation of the body in the air and floundering before the jump.

Figure 6A-1-22: Jump and Reach 1.

Figure 6A-1-23: Jump and Reach 2.

Figure 6A-1-24: Jump and Reach 3.

6A-1.5.13 Anthropometric Parameters

Finally we recorded the anthropometric parameters body height and body weight. The body-mass-index was computed as kg/m².

For computing the total body fat, the Caliper method according to DURNIN and WORMERSLEY [6], using skin fold measurements was applied. The measurements were recorded at four points (inferior angle of the scapula, biceps brachii, triceps brachii and iliac bone). The skin fold in the region of the inferior scapula angle was measured on the crease one fingerbreadth under the lower scapula angle. The skin fold of the biceps was measured centrally, between the acromion and the cubita, per building a vertical fold. Skin fold of the triceps was measured centrally between acromion and olecranon, per building a diagonal fold. And finally the skin fold at the iliac bone was measured one fingerbreadth proximal the iliac bone, per building a horizontal fold. The measurement was done by a special trained sports scientist. By summing up the four measurements and looking up the result in a respective list (established by DURNIN and WORMERSLEY [6], see Table 6A-1-2) the body fat percentage was determined.

Waist circumference and hip circumference were measured with a measuring tape. Waist to hip ratio (in accordance with HEYWARD and STOLARCZYK [14]) was computed per dividing the waste circumference and the hip circumference. The waste circumference was measured at the narrowest part of the trunk, between rips and iliac crest during expiration. The hip circumference was measured at the maximal extent of the gluteal region.

Table 6A-1-2: 4-Point-Skinfold Measurement (Calipometry) by Durnin and Wormersley [6] for Assessment of Total Body Fat Mass

men	29	39	49	50
15	4,8	-	-	-
16	5,5	-	-	-
17	6,2	-	-	-
18	6,9	-	-	-
19	7,5	-	-	-
20	8,1	12,2	12,2	12,6
21	8,6	12,6	12,8	13,2
22	9,1	13,0	13,4	13,8
23	9,6	13,4	14,0	14,4
24	10,1	13,8	14,5	15,5
25	10,5	14,2	15,0	15,6
26	11,0	14,6	15,6	16,2
27	11,5	15,0	16,2	16,8
28	12,0	15,4	16,7	17,4
29	12,5	15,8	17,2	18,0
30	12,9	16,2	17,7	18,6
31	13,3	16,5	18,1	19,1
32	13,7	16,8	18,5	19,6
33	14,1	17,1	18,9	20,0
34	14,4	17,4	19,3	20,4
35	14,7	17,7	19,6	20,8
36	15,1	18,0	20,0	21,3
37	15,5	18,3	20,4	21,7
38	15,8	18,6	20,8	22,1
39	16,1	18,9	21,1	22,5
40	16,4	19,2	21,4	22,9
41	16,7	19,5	21,8	23,3
42	17,0	19,8	22,1	23,7
43	17,3	20,0	22,4	24,1
44	17,5	20,2	22,7	24,4
45	17,7	20,4	23,0	24,7
46	18,0	20,7	23,4	25,1
47	18,3	20,9	23,7	25,5
48	18,6	21,1	24,0	25,9
49	18,8	21,3	24,3	26,2
50	19,0	21,5	24,6	26,5
51	19,3	21,7	24,9	26,8
52	19,5	21,9	25,2	27,1

men	29	39	49	50
53	19,7	22,1	25,5	27,4
54	19,9	22,3	25,7	27,7
55	20,1	22,5	25,9	27,9
56	20,4	22,7	26,2	28,2
57	20,6	22,9	26,5	28,5
58	20,8	23,1	26,7	28,8
59	21,0	23,3	26,9	29,0
60	21,2	23,5	27,1	29,2
61	21,4	23,7	27,4	29,5
62	21,6	23,9	27,6	29,8
63	21,8	24,1	27,8	30,0
64	22,0	24,2	28,0	30,2
65	22,2	24,3	28,2	30,4
66	22,4	24,5	28,5	30,7
67	22,6	24,7	28,7	31,0
68	22,8	24,9	28,9	31,2
69	23,0	25,0	29,1	31,4
70	23,1	25,1	29,3	31,6
71	23,3	25,3	29,5	31,9
72	23,5	25,5	29,7	32,1
73	23,7	25,7	29,9	32,3
74	23,9	25,8	30,1	32,5
75	24,0	25,9	30,3	32,7
76	24,2	26,1	30,5	33,0
77	24,4	26,3	30,7	33,2
78	24,6	26,4	30,9	33,4
79	24,7	26,5	31,1	33,6
80	24,8	26,6	31,2	33,8
81	25,0	26,8	31,4	34,0
82	25,2	26,9	31,6	34,2
83	25,3	27,0	31,8	34,3
84	25,4	27,1	32,0	34,6
85	25,5	27,2	32,1	34,8
90	26,2	27,8	33,0	35,8
95	26,9	28,4	33,7	36,6
100	27,6	29,0	34,4	37,4
105	28,2	29,6	35,1	38,2
110	28,8	30,1	35,8	39,0

men	29	39	49	50
115	29,4	30,6	36,4	39,7
120	30,0	31,1	37,0	40,4
125	30,5	31,5	37,6	41,1
130	31,0	31,9	38,2	41,8
135	31,5	32,3	38,7	42,4
140	32,0	32,7	39,2	43,0
145	32,5	33,1	39,7	43,6
150	32,9	33,5	40,2	44,1
155	33,3	33,9	40,7	44,6
160	33,7	34,3	41,2	45,1
165	34,1	34,6	41,6	45,6
170	34,5	34,8	42,0	46,1
175	34,9	-	-	-
180	35,3	-	-	-
185	35,6	-	-	-
190	35,9	-	-	-

	age
	Recorded skin fold value
	Total body fat in %

Appendix 6A-2 – Guided Interview

GUIDANCE FOR THE INTERVIEWS (PHASE 1)

(To identify the sport-motor components relevant to Special Forces soldiers)

INTRODUCTION

Secrecy Regulations: This project is approved and supported by the Austrian Special Operation Command and the Special Forces Headquater. Data protection: data collected here will be subject to utmost discretion and will be used for scientific evaluation only. Interviewees will remain anonymous (personal data will not be passed on to scientists, comrades, and superior commanders). Tape recordings are welcome, but not mandatory.

Involved research institutes and military commands:

- Austrian Special Operation Command
- Austrian Special Forces Headquater
- Army Sports Science Service
- Research Group on Physical Performance Medicine and Defence Ergonomics
- Centre for Sports Science and University Sport/University of Vienna
- (NATO HFM-080/RTG 019 – Optimizing Physical Performance)

Brief description of the study:

Objective:

Determination of **physical requirement profiles for commando soldiers** (including individual specialties: Direct Action, Close Combat, Mountain Warfare, Paratrooping, Combat Diving) in order to, subsequently, develop well-founded **selection criteria** and **procedures** as well as **objective-tailored training recommendations**.

Procedure:

- Phase 1 (guideline-based interviews by experts):
  - Analysis of the mission
  - Deduction of typical operational scenarios
  - Deduction of typical military activities
  - Deduction of sport-motor components relevant to commando soldiers

- Phase 2 (written inquiry by experts):
  - Revision of information obtained in Phase 1 and development of a **standardised questionnaire** with the aim to weigh the significance of relevant sport-motor components
  - Written inquiry
  - Evaluation of data and deduction of requirement profiles; first presentation of results at international NATO summit; discussion of results in an international context.

- Phase 3 (sport-motor components testing profile)
  - **Comprehensive testing to determine the athletic performance** of Special Forces soldiers of the respective operational specialty
  - Evaluation of data and deduction of actual requirement profiles

- Phase 4 (recommendations to the unit)
  - Practical implementation of experiences in the unit

Guidelines for the interviewees

- Answers should be as **objective** as possible
- Answers should focus on relevant areas only
- The assessment should be made with the **operation** (worst case scenario) in mind

INQUIRY (PROTOCOL)

What is the **military mission** of your operational specialty (record in writing; source)?

……...
……...
……...

How are direct action, close combat, mountain warfare, paratrooping, and combat diving defined in the militarily context?

……...
……...
……...

Are there position or workplace descriptions for soldiers of your type of unit? If yes, what do they specify?

……...
……...
……...

Which **operational scenarios** does the mission entail?

……...
……...
……...

Please describe a typical operation in your specialty.

……...
……...
……...

In your opinion, what must a commando soldier's physical capabilities be in order to accomplish his missions? (performance in marching, swimming, climbing, lifting, etc.)

……...
……...
……...

What is the main emphasis in training?

……...
……...
……...

What is especially observed in the course of training?

……...
……...

……...

What are the **typical physical military activities** for a soldier specialised in direct action, close combat, etc.? (e.g., marching, climbing, diving, etc.)

……...
……...
……...

For how long must a solder be capable of carrying out such activities?
……...
……...
……...

Which demands must a soldier primarily meet during an operation or in training?
……...
……...
……...

What are the most demanding physical activities?
……...
……...
……...

What are the usual equipment loads for these activities?
……...
……...
……...

Are there any situations in which physically weaker and stronger soldiers perform differently?
……...
……...
……...

Personal data:

Rank: …….
First name, last name:…….
Function: …….
Age: …….
For how long have you been active in this field (training courses in operational specialty, diving hours, parachuting, participation in international training courses, experience in operations, etc.):
……...
……...
……...

Conclusion, thanks, inquiry whether examination results of Phase 1 and 2 should be mailed to interviewees, and **invitation** to the presentation of the results and their practical implementation in the unit.

Appendix 6A-3 – Questionnaire

- UNIVERSITY OF VIENNA
INSTITUTE FOR SPORTS SCIENCE AND UNIVERSITY SPORTS
- ARMY SPORTS SCIENCE SERVICE
- RESEARCH GROUP ON PHYSICAL PERFORMANCE MEDICINE AND DEFENCE ERGONOMICS
- AUSTRIAN SPECIAL OPERATION COMMAND
- SPECIAL FORCES HEADQUATER
- (NATO HFM-080/RTG 019)

QUESTIONNAIRE FOR THE DEVELOPMENT OF A SPORT MOTOR COMPONENT *REQUIREMENT PROFILE* FOR SPECIAL FORCES SOLDIERS

Mark your operational specialty!

☐	☐	☐	☐	☐
Close Combat	Direct Action	Mountain Warfare	Paratrooping	Combat Diving

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Interviewees remain anonymous!
Data will be used for scientific evaluation only!

INTRODUCTION

The following questionnaire consists of two parts. Please read the questions carefully and rate how important you think the individual athletic components (endurance, strength, rapidity, etc.) are for your activity. For this survey, it is important that your assessment focuses on your particular **operational specialty** rather than on the commando soldier in general. Therefore, it will be of relevance whether for a combat diving (close combat, direct action, mountain warfare or paratrooping) specialist endurance is rated as *not required, less important, moderately important* or *very important*. Please try to be **objective** in your grading. Of course, all characteristics below are relevant for a soldier's athletic performance. Nevertheless, only grade those abilities as *very important* which you believe are particularly significant for your specialty either during an **operation** or in **training**. Please mark the appropriate box

PART 1

---

1) Aerobic endurance

How important is it to be able to march, run, climb, ski-hike, swim or do other physical activities **over one or several hours without interruption**?

☐	☐	☐	☐
not required	less important	moderately important	very important

---

2) Anaerobic endurance

Is it important to be able to do **high-intensity activities for up to 2 minutes** (e.g. withdrawal and attack actions, combat tracks of all types, obstacle course, etc.)?

☐	☐	☐	☐
not required	less important	moderately important	very important

---

3) Rapidity

Is it necessary to be able to cover/overcome short distances (of up to about 50m) and/or carry out **activities** (e.g. combat shooting or emergency procedures) in your operational specialty **at very high speed**?

☐	☐	☐	☐
not required	less important	moderately important	very important

---

4) Reaction

Is it important for your commando specialty to **react** to various situations (combat situations, such as recognising friends, foes, dangers, contingency or emergency situations etc.) **as quickly as possible**?

☐	☐	☐	☐
not required	less important	moderately important	very important

---

5) Coordination/Agility

During an operation or in training, is it necessary to be able to **do different activities** with your hands and feet **simultaneously**, expertly overcome obstacles, avoid moving obstacles or orientate and balance well?

☐	☐	☐	☐
not required	less important	moderately important	very important

---

6) Strength endurance

Is it necessary to be able to carry **medium-weight loads** (e.g. ammunition box, your own body weight or when evacuating wounded persons in the group) over longer distances (100m and more) or repeatedly lift such loads over a **period of up to 30 minutes**?

☐	☐	☐	☐
not required	less important	moderately important	very important

---

7) Maximum strength

How important is it to be able to lift **very heavy loads** (just about within one's capacity) with **maximum effort** (e.g. removing obstacles, loading heavy equipment onto vehicles, etc.)?

☐	☐	☐	☐
not required	less important	moderately important	very important

---

---

8) Body constitution

Do you believe that body constitution (being rather small and squat, tall and slender or robust and muscular) influences the performance during an operation or in training? If yes, which constitution-type fits your specialty best?

☐	☐	☐
, squat/small high body fat	slender/tall low body fat	robust/muscular medium body fat

Are there any small or large body sizes that significantly interfere with task accomplishment in your operational specialty? If yes, which sizes do you consider as the upper and lower limits?

Size does not affect a soldier's performance ☐

Size does affect a soldier's performance ☐

Minimum size: …....cm, upper limit: …....cm

How important do you think is body constitution for a soldier's performance?

☐	☐	☐	☐
irrelevant	less important	moderately important	very important

---

PART 2

Which of the two motor components (and/or activities or constitution types) do you think are more important for **your operational specialty** (close combat, direct action, mountain warfare, paratrooping, combat diving), please mark the appropriate box. If you are not certain which of the two components is more important, please choose one. Please take your decision always with the **operation** or **operational training** in your specialty in mind. If you are not sure about sport-scientific terms, please read the descriptions below.

---

1) Aerobic endurance ☐

Description: doing physical activities over several hours (e.g. marching, running, climbing, swimming, skiing, ski-hiking as well as close combat or weapons drill etc.)

Anaerobic endurance ☐

Characteristic activities: doing **high-intensity activities for up to 2 minutes** (e.g. withdrawal and attack actions, combat tracks of all types, obstacle course etc.)?

---

2) Aerobic endurance ☐

Description: doing physical activities over several hours (e.g. marching, running, climbing, swimming, skiing, ski-hiking as well as close combat or weapons drill, etc.)

Reaction ☐

Description: reacting to various situations (combat situations, such as distinguishing between friends and foes, identifying dangers, ordnance etc. as well as identifying and reacting to contingency situations) as quickly as possible

---

3) Aerobic endurance ☐

Description: doing physical activities over several hours (e.g. marching, running, climbing, swimming, skiing, ski-hiking as well as close combat or weapons drill, etc.)

Rapidity ☐

Characteristic activities: covering short distances (up to about 50m) or carrying out activities (e.g. combat shooting, emergency procedures) as fast as possible

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4) Aerobic endurance ☐

Description: doing physical activities over several hours (e.g. marching, running, climbing, swimming, skiing, ski-hiking as well as close combat or weapons drill, etc.)

Coordination/Agility ☐

This is the capability of **doing different activities** with one's hands and feet **simultaneously**, expertly overcoming obstacles, avoiding moving obstacles as well as orientating and balancing well.

---

5) Aerobic endurance ☐

Description: doing physical activities over several hours (e.g. marching, running, climbing, swimming, skiing, ski-hiking as well as close combat or weapons drill, etc.)

Strength endurance ☐

Characteristic activities: repeated lifting of medium-weight loads (e.g. one's own body weight, ammunition boxes, evacuation of a wounded person in the group over distances over 100m or repeated lifting of such loads over a period of up to 30 minutes)

---

6) Aerobic endurance ☐

Description: doing physical activities over several hours (e.g. marching, running, climbing, swimming, skiing, ski-hiking as well as close combat or weapons drill, etc.)

Maximum strength ☐

Characteristic activities: lifting **very heavy loads** just about within one's capacity with maximum effort (e.g. removing obstacles, loading heavy equipment onto vehicles, etc.)

---

7) Aerobic endurance ☐

Description: doing physical activities over several hours (e.g. marching, running, climbing, swimming, skiing, ski-hiking as well as close combat or weapons drill, etc.)

Body constitution ☐

Significance of body constitution types

---

8) Anaerobic endurance ☐

Characteristic activities: doing **high-intensity activities for up to 2 minutes** (e.g. withdrawal and attack actions, combat tracks of all types, obstacle course, etc.)

Reaction ☐

Description: reacting to various situations (combat situations, such as distinguishing between friends and foes, identifying dangers, ordnance etc. as well as identifying and reacting to contingency situations) as quickly as possible

---

9) Anaerobic endurance ☐

Characteristic activities: doing **high-intensity activities for up to 2 minutes** (e.g. withdrawal and attack actions, combat tracks of all types, obstacle course, etc.)

Rapidity ☐

Characteristic activities: covering short distances (up to about 50m) or carrying out activities (e.g. combat shooting, emergency procedures) as fast as possible

---

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10) Anaerobic endurance ☐

Characteristic activities: doing **high-intensity activities for up to 2 minutes** (e.g. withdrawal and attack actions, combat tracks of all types, obstacle course, etc.)

Coordination/Agility ☐

This is the capability of **doing different activities** with one's hands and feet **simultaneously**, expertly overcoming obstacles, avoiding moving obstacles as well as orientating and balancing well.

---

11) Anaerobic endurance ☐

Characteristic activities: doing **high-intensity activities for up to 2 minutes** (e.g. withdrawal and attack actions, combat tracks of all types, obstacle course, etc.)

Strength endurance ☐

Characteristic activities: repeated lifting of medium-weight loads (e.g. one's own body weight, ammunition boxes, evacuation of a wounded person in the group over distances over 100m or repeated lifting of such loads over a period of up to 30 minutes)

---

12) Anaerobic endurance ☐

Characteristic activities: doing **high-intensity activities for up to 2 minutes** (e.g. withdrawal and attack actions, combat tracks of all types, obstacle course, etc.)

Maximum strength ☐

Characteristic activities: lifting **very heavy loads** just about within one's capacity with maximum effort (e.g. removing obstacles, loading heavy equipment onto vehicles, etc.)

---

13) Anaerobic endurance ☐

Characteristic activities: doing **high-intensity activities for up to 2 minutes** (e.g. withdrawal and attack actions, combat tracks of all types, obstacle course, etc.)

Body constitution ☐

Significance of body constitution types

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14) Reaction ☐

Description: reacting to various situations (combat situations, such as distinguishing between friends and foes, identifying dangers, ordnance etc. as well as identifying and reacting to contingency situations) as quickly as possible

Rapidity ☐

Characteristic activities: covering short distances (up to about 50m) or carrying out activities (e.g. combat shooting, emergency procedures) as fast as possible

---

15) Reaction ☐

Description: reacting to various situations (combat situations, such as distinguishing between friends and foes, identifying dangers, ordnance etc. as well as identifying and reacting to contingency situations) as quickly as possible

Coordination/Agility ☐

This is the capability of **doing different activities** with one's hands and feet **simultaneously**, expertly overcoming obstacles, avoiding moving obstacles as well as orientating and balancing well.

---

16) Reaction ☐

Description: reacting to various situations (combat situations, such as distinguishing between friends and foes, identifying dangers, ordnance etc. as well as identifying and reacting to contingency situations) as quickly as possible

Strength endurance ☐

Characteristic activities: repeated lifting of medium-weight loads (e.g. one's own body weight, ammunition boxes, evacuation of a wounded person in the group over distances over 100m or repeated lifting of such loads over a period of up to 30 minutes)

---

17) Reaction ☐

Description: reacting to various situations (combat situations, such as distinguishing between friends and foes, identifying dangers, ordnance etc. as well as identifying and reacting to contingency situations) as quickly as possible

Maximum strength ☐

Characteristic activities: lifting **very heavy loads** just about within one's capacity with maximum effort (e.g. removing obstacles, loading heavy equipment onto vehicles, etc.)

---

18) Reaction ☐

Description: reacting to various situations (combat situations, such as distinguishing between friends and foes, identifying dangers, ordnance etc. as well as identifying and reacting to contingency situations) as quickly as possible

Body constitution ☐

Significance of body constitution types

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19) Rapidity ☐

Characteristic activities: covering short distances (up to about 50m) or carrying out activities (e.g. combat shooting, emergency procedures) as fast as possible

Coordination/Agility ☐

This is the capability of **doing different activities** with one's hands and feet **simultaneously**, expertly overcoming obstacles, avoiding moving obstacles as well as orientating and balancing well.

---

20) Rapidity ☐

Characteristic activities: covering short distances (up to about 50m) or carrying out activities (e.g. combat shooting, emergency procedures) as fast as possible

Strength endurance ☐

Characteristic activities: repeated lifting of medium-weight loads (e.g. one's own body weight, ammunition boxes, evacuation of a wounded person in the group over distances over 100m or repeated lifting of such loads over a period of up to 30 minutes)

---

21) Rapidity ☐

Characteristic activities: covering short distances (up to about 50m) or carrying out activities (e.g. combat shooting, emergency procedures) as fast as possible

Maximum strength ☐

Characteristic activities: lifting **very heavy loads** just about within one's capacity with maximum effort (e.g. removing obstacles, loading heavy equipment onto vehicles, etc.)

---

22) Rapidity ☐

Characteristic activities: covering short distances (up to about 50m) or carrying out activities (e.g. combat shooting, emergency procedures) as fast as possible

Body constitution ☐

Significance of body constitution types

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23) Coordination/Agility ☐

This is the capability of **doing different activities** with one's hands and feet **simultaneously**, expertly overcoming obstacles, avoiding moving obstacles as well as orientating and balancing well.

Strength endurance ☐

Characteristic activities: repeated lifting of medium-weight loads (e.g. one's own body weight, ammunition boxes, evacuation of a wounded person in the group over distances over 100m or repeated lifting of such loads over a period of up to 30 minutes)

---

24) Coordination/Agility ☐

This is the capability of **doing different activities** with one's hands and feet **simultaneously**, expertly overcoming obstacles, avoiding moving obstacles as well as orientating and balancing well.

Maximum strength ☐

Characteristic activities: lifting **very heavy loads** just about within one's capacity with maximum effort (e.g. removing obstacles, loading heavy equipment onto vehicles, etc.)

---

25) Coordination/Agility ☐

This is the capability of **doing different activities** with one's hands and feet **simultaneously**, expertly overcoming obstacles, avoiding moving obstacles as well as orientating and balancing well.

Body constitution ☐

Significance of body constitution types

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26) Strength endurance ☐

Characteristic activities: repeated lifting of medium-weight loads (e.g. one's own body weight, ammunition boxes, evacuation of a wounded person in the group over distances over 100m or repeated lifting of such loads over a period of up to 30 minutes)

Maximum strength ☐

Characteristic activities: lifting **very heavy loads** just about within one's capacity with maximum effort (e.g. removing obstacles, loading heavy equipment onto vehicles, etc.)

---

27) Strength endurance ☐

Characteristic activities: repeated lifting of medium-weight loads (e.g. one's own body weight, ammunition boxes, evacuation of a wounded person in the group over distances over 100m or repeated lifting of such loads over a period of up to 30 minutes)

Body constitution ☐

Significance of body constitution types

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28) Maximum strength ☐

Characteristic activities: lifting **very heavy loads** just about within one's capacity with maximum effort (e.g. removing obstacles, loading heavy equipment onto vehicles, etc.)

Body constitution ☐

Significance of body constitution types

Thank you very much for your active support!

The evaluation of all questionnaires will show whether characteristic profiles can be identified. The questionnaires will be evaluated and their results discussed in the weeks to come. Findings will be made available to all participants. If you should have any questions, please do not hesitate to contact me (0660/XXXXXXX).

Wm. Mag. Mag. Günther Ch. EISINGER