CHAPTER 1 : STATEMENT OF PROBLEM

1.1 INTRODUCTION

At the battle of Hastings in 1066, William the Conqueror equipped his mounted soldiers with stirrups, a new technology to enable them to remain stable in their saddles. Using this technology they were able to conduct their assault from a commanding height, leaving their enemy at a disadvantage. This competitive advantage offered by a new technology contributed to William the Conqueror to winning the battle.

The South African National Defence Force (SANDF) owns and operates a large inventory needed to execute its task. This inventory is both complex and costly because of its engineering content and requires a significant management effort to ensure that the SANDF sustains its capabilities.

The SANDF Products System life cycle starts with the acquisition process up to commissioning. It then progresses to the operational phase where it is used in service and ends with the phase during which the Products System is removed from service and disposed of.

Each phase has its own requirements for appropriately skilled personnel to ensure optimal utilisation of the resources at the disposal of the SANDF.

As engineers are concerned with the properties of matter and sources of power made useful in machines, structures and processes, this study concerns itself with the roles that they may play and the functions that they may have during the life cycles of Products Systems used by the SANDF.

1.2 SOUTH AFRICAN DEFENCE

1.2.1 SOUTH AFRICAN DEFENCE VISION AND MISSION

A. THE VISION OF THE DEPARTMENT OF DEFENCE (DOD):

To ensure the provision in accordance with the Constitution, of an effective defence system for maintaining democracy in South Africa and to enhance national, regional and global security, through balanced, modern, affordable and technologically advanced defence capabilities.

B. THE MISSION OF THE DOD:

To provide defence capabilities that are commensurate with the needs of South Africa, and to manage, prepare and employ these capabilities in accordance with the regulations of the constitution, national legislation, and parliamentary and executive direction.

1.2.2 CONSTITUTIONAL ASPECTS

The SANDF is charged with the duties defined as follows in paragraph 200 (b) of the Constitution of the Republic of South Africa "The primary object of the defence force is to defend and protect the Republic, its territorial integrity and its people in accordance with the Constitution and the principles of international law regulating the use of force."

1.2.3 DEFENCE WHITE PAPER

Chapter 5 of the draft memorandum entitled "Defence in a Democracy White Paper on National Defence for the Republic of South Africa", of May 1996, states that in terms of the Constitutional provisions that the SANDF may be employed in the following roles and for the following functions:

- Service in the defence of the Republic, and the protection of its sovereignty and territorial integrity;
- Service in compliance with the international obligations of the Republic towards international bodies and other states;
- Service with the view to the preservation of life, health or property;
- Service with the view to the provision or maintenance of essential services;

- Service in upholding of law and order in the Republic in co-operation with the South African Police Service under circumstances, as defined in law where the Police Service is unable to maintain law and order on its own;
- Service in support of any department of state with the view to socio-economic upliftment.

These functions do not carry equal weight. The primary function of the SANDF is to defend South Africa against external military aggression. The other functions are secondary.

The size, design, structure and budget of the SANDF will mainly be determined by its primary function. Provision will, however, be made for the special requirements associated with internal deployment and international peace support operations.

1.2.4 STRUCTURE OF DEPARTMENT OF DEFENCE

The Department of Defence includes the Defence Secretariat, the SANDF and ARMSCOR. The DoD has at its highest level the Chief of the SANDF (C SANDF), the Secretary for Defence and the chairman of ARMSCOR who report to and receive instructions and guidelines from the Minister of Defence. The Ministry of Defence (MoD) is located in an integrated head office. The MoD reporting responsibilities are shown in Figure 1. Parliament has a Joint Standing Committee on Defence (JSCD) advising the Minister.

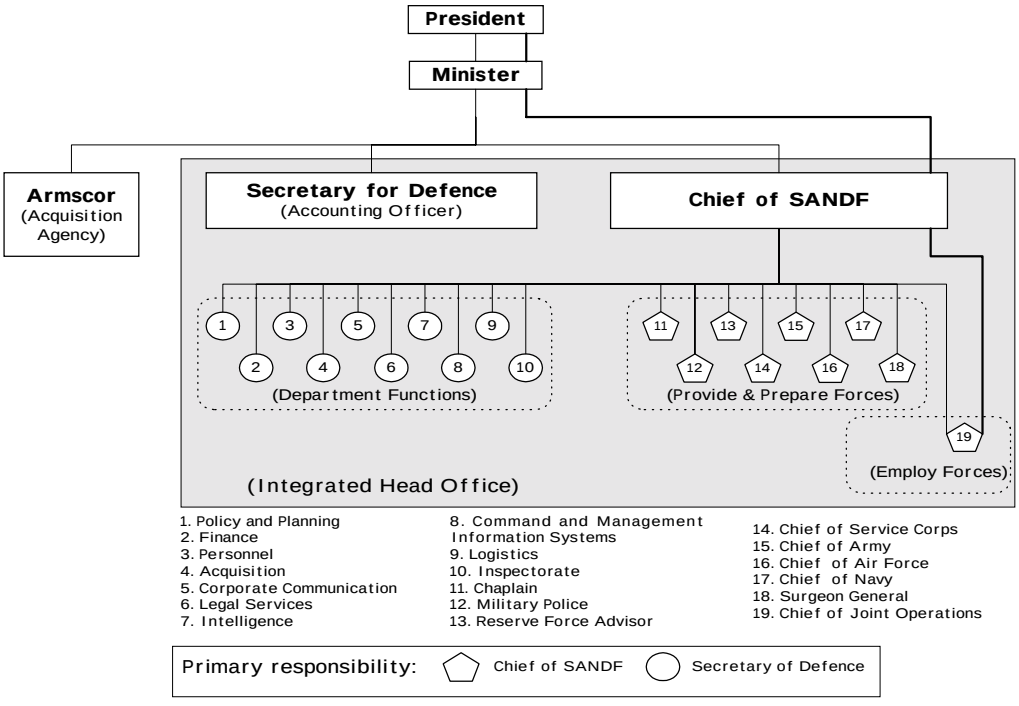

Figure 1: MoD Head Office Reporting Responsibilities.

The DoD is an organisation consisting of five levels in three tiers as illustrated in Figure 2 and as described in the following lines:

- The Minister is on level 0 and the DoD headquarters (DoD HQ) are on levels 1 and 2.
- The intermediate tier on level 3, houses task forces, type formations and support formations.
- The units are housed level on level 4.

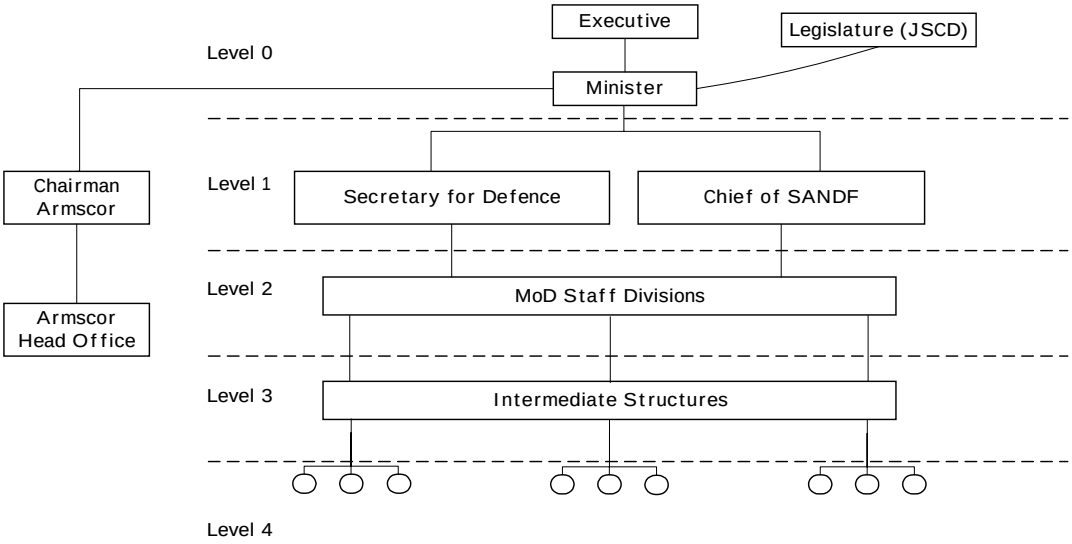

Figure 2: DoD Organisational Structure.

The systems approach to defence uses the four processes called, strategic direction, support forces, provide forces and employ forces.

The three processes known as support forces, provide forces and employ forces are executive processes. The DoD practices "jointness" in the conduct of its business (Defence Review 1996, paragraph 22.1 & 30). This approach is based on the decision to structure the organisation in such a way that common capabilities and functions may be shared by the Arms of Service (AoS). The business processes known as support, provide and employ forces may be defined as follows:

- Support Forces: The support forces process provides the combat forces with personnel and material for operational employment.
- Provide Forces: The provide forces process consists of the following three sub-processes:

- Integration and conversion of various force components into combat-ready units, or User Systems, such as battalions, squadrons and ships.
- Integration and conversion of combat-ready units into combat-ready AoS forces such as brigades and flotillas, known as higher order User Systems (HOUSs). Examples of this process include the SAAF's GOLDEN EAGLE exercise and the Army's SWEEPSLAG exercise.
- Integration and conversion of combat-ready forces from more than one AoS into combat-ready joint task forces or a Joint HOUS (JHOUS). An example of this process is the SOUTHERN CROSS exercise. This sub-process is also used to prepare a joint task force for missions.

- Employ Forces: The Employ Forces process consists of the operational deployment of combat-ready forces by the Chief of Joint Operations (C J Ops), who is responsible for force employment during missions. C JOps also is also responsible for mission preparation.

1.2.5 STRUCTURE OF THE SANDF

The SANDF consists of four AoSs, namely the Army, the SA Navy (SAN), the SA Air Force (SAAF) and the SA Military Health Services (SAMHS). The new term used in the DoD in lieu of "AoS" is "Service", but to avoid confusion with the normal meaning of the word service, the original term and its abbreviation AoS will be used in this document.

A User System consists of the personnel, Products Systems and methods doctrines as shown in Figure 3. The User System operates the Products Systems acquired by the Chief of Acquisitions, and is supported by the Chief of Logistics. The personnel supplied by Chief of Personnel are trained as part of force preparation and thus acquire the ability to perform operations from within the User System. A Naval User System could typically be a corvette; an Air Force User System could be a Cheetah squadron.

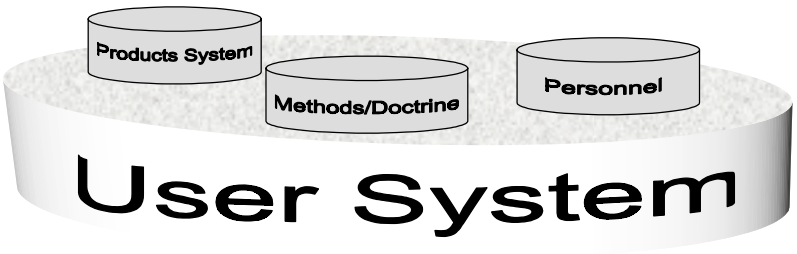

Figure 3: A Model of a User System.

Intermediate structures at Level 3 within the DoD include task forces, system groups or type formations (TyFs) and support formations. System groups are made up of User Systems with similar characteristics.

Combat-ready User Systems from more than one system group form a defence capability also referred to as a higher order User System (HOUS). C J Ops may use any appropriate mixture of combat-ready User System(s) or HOUSs for force application.

Combat-ready User Systems supplied by more than one AoS to C JOps form a joint combat force with defence capabilities.

When more than one AoS supplies HOUSs to C JOps they form a joint higher order User System (JHOUS). C J Ops will then perform force employment with a JHOUS task force.

1.2.6 SYSTEM HIERARCHY

South African defence systems are categorised in a hierarchical fashion for conceptual clarity that has proven to be useful in structuring thought processes in management. This approach is similar to that presented by Molas *et al* (1992: 16). These descriptions are intended as an aid to management and may change to suit requirements of the various AoS's environments. Table 1 presents the South African defence system hierarchy and a description of is given further down. Figure 4 illustrates the structure of the systems groups/TyFs, User Systems and units in the SANDF.

System Name	Level
Joint higher order User System	8
Higher order User System	7
User System	6
Products System	5
Product	4
Product subsystem	3

Component	2
Material/process	1

Table 1: South African Defence Systems Hierarchy.

The configuration of an item defines it by recording its form, fit, function and performance. Knowledge of the item's configuration makes it possible to predict its behaviour during development or to replace it with an exact equivalent when it fails during use. The management of systems is made possible by knowledge of their configuration.

A configuration item (CI) is a piece of equipment that is managed in terms of its status or configuration. An example of a CI is a radio, which is managed by the modification level of all its elements. If its power supply is upgraded in efficiency to provide a longer period of operation, this fact must be indicated by its configuration status. The user will then also know its capability and be able to plan operations and support accordingly. Failure to remain within the bounds of the baselines could result in the failure of a military operation, damage to or loss of equipment, injury or even loss of life.

- Level 6 is the User System. It is defined as all the elements of a combat-ready User System including the Products System(s), operational and support personnel, doctrine etc. which are permanently allocated to that User System. A model of a User System is shown in Figure 3. It also has interfaces to items shared between User Systems. A User System is the highest level of permanently assigned Products within the SANDF and cannot be acquired as a single entity. In the Air Force an example of this is the aircraft squadron, support systems, facilities, doctrine and flight and ground crew.
- Level 5 is the Products System, which is identified as a complete collection of Products forming its own configuration. In the Air Force an example of this is an aircraft with its weapons or a simulator with all the logistic support needed to sustain combat readiness.

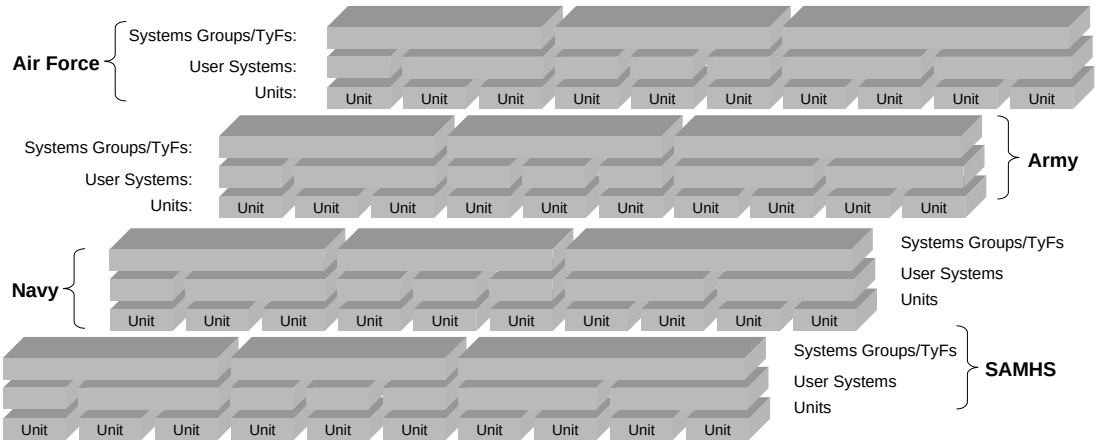

Figure 4: An example of the Application of the SANDF Systems Hierarchy.

- Level 4 is the Product, which is a single high-level configuration-managed item. In the Air Force an example of Products are a Cheetah airframe, a ground support unit, a piece of test equipment, or mission optional equipment such as a pylon or an external fuel tank. Products can be obtained by the acquisition process.
- Level 3 represents the Product Sub-systems, which constitute the Product. Typical Product Sub-systems are an electronic warfare subsystem or a weapon delivery subsystem of an aircraft or ship.
- Level 2 consists of components that make up the Product Sub-systems. A chaff dispenser and a radar warning receiver are components of an electronic warfare Product subsystem.
- Level 1 consists of the materials or piece-parts that constitute components.

1.3 PROBLEM DEFINITION

The Products Systems typically used by defence forces are highly complex, requiring high-level personnel to ensure their combat-readiness. This presents the following challenges:

- The acquisition, development, application and maintenance of knowledge of technology, Products, Products Systems and User Systems must be managed efficiently and effectively.
- Doctrines, procedures, Product capabilities and technology opportunities must be aligned to optimise defence capabilities.
- The ability of User Systems' to counter real or potential threats at the minimum life cycle cost must be optimised.
- Products System safety as required by the Occupational Health and Safety Act 85 of 93 and the Defence White Paper, chapter 3 paragraph 43.6 must be ensured.

1.4 GOALS AND OBJECTIVES

The aim of this study is to develop a strategy to optimise the value added to the SANDF by the services of the Engineering Technical Family (ETF).

1.5 SCOPE

This study is concerned with those ETF activities that contribute to sustaining the SANDF's capability to conduct military and other operations successfully and competitively.

1.6 CONSTRAINTS

1.6.1 SAFETY

Chapter 3, paragraph 43.6 of the Defence White Paper reads that "The government will not endanger the lives of military personnel through improper deployment or the provision of inadequate or inferior weapons and equipment." The government therefore undertakes to ensure that the Products Systems it provides are safe for deployment by members of the SANDF.

1.6.2 BUDGET

The Defence Review suggests that the DoD will be allocated 1,5% of gross domestic product (GDP) for the foreseeable future. The small size of the proposed defence budget is due to the greater socio-economic demands on the government. Efficient financial and asset management by the DoD is therefore a pressing issue if the SANDF is to carry out its duties.

1.6.3 SKILLS RETENTION IN THE SANDF

Chapter 9 paragraph 46 of the Defence Review states that it was foreseen that ARMSCOR would remain the State corporation responsible for the acquisition of defence equipment on account of the shortage of engineering specialists in the public service. The latter is due to inadequate public service salary scales offered to its engineering specialists.

The Republic of South Africa (RSA) is experiencing a flight of high-level skills by emigration. Experienced engineering personnel have become a scarce resource sought after by both local and international organisations.

The SANDF has a formidable challenge in the areas of recruitment, development and retention of suitable human resources for the engineering function.

1.7 METHODOLOGY OF STUDY

In the remainder of this study, the author proceeds with an environmental analysis, a literature survey, an overview of the SANDF's value chain/system, a strategic analysis, a discussion of strategy, an analysis of the ETF application. The study starts with an analysis to demonstrate the context of the SANDF and its engineering capabilities within its environment.

The paragraphs below briefly outline this study.

- Environmental Analysis: This study will start with a broad assessment of the environment in which the SANDF is required to operate, and identify real or potential threats to the RSA. A literature survey will follow, to set the theoretical basis for this study. The environmental assessment uses the following analyses:
    - An environmental dynamics assessment in terms of volatility and predictability.
    - An analysis of political/legal, economic, socio-cultural and technological (PEST) factors.
    - A market growth analysis.
    - A key success factor analysis.
    - A competitive industry analysis using: The five forces analysis and the four links analysis.
    - A competitor and product portfolio analysis.
    - Client analysis and market segmentation.
- Literature survey: The theoretical basis for this study, as extracted from literature, is discussed here. The topics used are as follows:
    - Theory of strategy.
    - Strategic management of technology and innovation.
    - Management of knowledge, expertise, skills and culture.
    - Value chain management.
    - Management of projects and programmes.
- Value Chain and Value System: The SANDF's value chain and value system are examined.

- A Strategic Analysis: Under strategic analysis the SANDF's environment and resources are compared.
- Strategy development: The basis of the strategy is developed.
- Acquisition Process: The acquisition life cycle phase of Products and Products Systems is analysed.
- Operational, Support and Disposal Process: Under this heading the life cycle phases of Products and Products Systems are analysed.
- ETF Application Analysis: The application of the ETF is analysed and an approach to its use is proposed.
- Alignment of Engineering Programmes: Under this heading the alignment of ETF activities and functions into programmes is discussed.
- Conclusions: This chapter presents the findings of this study.
- Recommendations: This chapter presents recommendations based on the findings of this study.