

Chapter I

INTRODUCTION

1.1 Historical Background

For a long time rockets have been used as fireworks and for signaling. Even before the eighteenth century some experimental work was done on rockets, and in 1805 the expedition of Sir Sydney Smith¹¹ against Boulogne included some boats fitted for salvo firing of rockets. Although some development work had been done on rockets at Aberdene Proving Ground, Maryland, as early as 1932, little interest was shown by the United States Armed Forces until World War II. In 1941 the British completed the development of a successful 3-inches antiaircraft rocket, and research in this country was begun on large scale. In fact, most of the principal advancements in rocket theories and their applications to practical design have taken place since 1940.

On the other hand a rocket would be any device propelled by the ejection of propulsive material originally constrained within itself according to Newton's law. It consists essentially of a container, usually cylindrical, in which gases are generated at high pressure, and some type of vent or nozzle through which the gases may escape in the form of a jet. The

combination of the gas chamber is called the rocket motor. Actually, this rocket motor can be added with some types of rocket-heads to form the special rocket. The rocket-head may be a high explosive or other material. This rocket is projected or launched from a rocket launcher which is open at both ends. Consequently, it is much simpler in construction and lighter than an ordinary artillery weapon of the same size. The rocket and the launcher described here is a special class of the projectile weapon.

1.2 Classifications

The general classifications of rocket system according to some common uses in the military point of views may be summarized below :

Normal Uses

These types of rockets may be divided into two groups.

(a) Service Rockets

The rockets which are fired against the enemy to perform all sorts of missions at various targets are called service rockets.

(b) Practical Rockets

The rockets which are used only for training purposes such as the operation of rockets, rocket-launchers and in marksmanship are named practical rockets.

Tactical Uses

These types of rockets may be divided into three groups.

(a) High-explosive Rockets

The rockets which have high-explosive heads and are used for demolition or fragmentation are classified as high-explosive rockets.

(b) Armor-piercing Rockets

The rockets which have various armor piercing noses and require smaller amount of high explosive are called armor-piercing rockets.

(c) Chemical Rockets

The rockets which have the heads loaded with various chemical substance, smoke mixtures, or incendiaries are named chemical rockets.

In addition, rockets may be designed for other special purposes, such as the target rocket for a training of anti-aircraft scheme.

1.3 Stabilization

The method of stabilization of a short-range rocket may be divided into two types as below :

(a) Fin-stabilized Rockets

The rocket is equipped with either fixed or folding fins for stabilizing the rocket. The technique used is similar

to smoothbore motor projectile, bombs and rifle grenades.

(b) Spin-stabilized Rockets

The rocket is equipped with several nozzles designed in order to create a torque for spinning the rocket about its axis. However, this technique is very complicated and difficult to analyse.

1.4 Outlines of the Work

The aim of this work is to study the behaviour of the rockets and the identification of the open-loop rocket systems. The mathematical analysis of the motion of a rocket after it leaves the launcher rail is considered and divided into two parts :

(a) The motion from the ignition until the powder is completely burnt.

(b) The motion after the powder is completely burnt.

It is known that the motion of the rocket after the propellant powder is completely burnt is like motion of an artillery projectile. However, the motion of the rocket before the powder is completely burnt requires a special analysis and a proper treatment.

The outlines of the research may be summarized as follows :

(a) Mathematical representation of a short-range rocket system is described in Chapter 2.

(b) A typical model of a fin-stabilized short-range rocket is presented in Chapter 3.

(c) The method of identification of the rocket system is described in Chapter 4.

(d) Conclusions and discussions are described in Chapter 5.

(e) Other important informations are also given in appendices.