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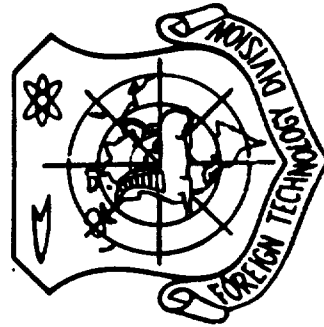
# FOREIGN TECHNOLOGY DIVISION



AN INTRODUCTION TO ROCKETS AND GUIDED MISSILES

by

Yeh Chia-K'ang



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FTD-HT-23-576-70

## EDITED TRANSLATION

AN INTRODUCTION TO ROCKETS AND  
GUIDED MISSILES

By: Yeh Chia-K'ang

English pages: 7

Source: Hang K'ung Chih Shih  
(Aeronautical Knowledge),  
No. 2, 1960, pp. 13-15.

Translated by: G. Hwang and J. Lockwood/NITHC

CH/0035/60/000/002

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PREPARED BY:

TRANSLATION DIVISION  
FOREIGN TECHNOLOGY DIVISION  
WP-478, ONTO.

FTD-HT - 23-576-70

Date 18 Nov. 19 70

## AN INTRODUCTION TO ROCKETS AND GUIDED MISSILES

Yeh Chia-K'ang

Rocket technology is one of the technical fields that have developed rapidly in recent time. But even so, it has a long history. According to records of the Sung Dynasty, in the year 1000 A.D. T'ang Fu suggested to the emperor that rockets be manufactured. At the time when the Sung armies defended against the invading Chin troops, rockets were already in wide application. China is the birthplace of rockets, which is a fact that is publicly recognized by all the nations of the world. But because of many years under feudal domination, this area of scientific technology in our country has never been developed.

At the beginning of the twentieth century, the Russian scientist K. E. Tsiolkovskiy made outstanding contributions to the problems of rocket technology and space navigation when he put forward plans for multistage rockets and man-made satellites, as well as theories on space navigation, etc. However, due to limits in technical levels at that time, his ideas were not realized.

During the last phases of World War II and in the postwar period many nations paid serious attention to the development of rocket technology. The Russians made magnificent contributions in this area.

Fig. 1. An ancient Chinese rocket.

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Since October 1957, the Soviets have successfully launched three man-made Earth satellites and three space rockets. On the basis of these significant scientific achievements, in order to prepare for the launching of large scale Earth satellites and to carry out space flight to the planets of our solar system, on January 20th of this year the Soviet Union again successfully launched a large multistage rocket into an area in the Pacific. Not counting the final stage, the range of the rocket was 12,500 kilometers and its impact point was less than two kilometers from the planned target. It can be said that this successful launch is a new giant step for mankind along the road to conquering the universe.

#### Types of Rockets

It has been only ten-odd years since the end of World War II, but rocket technology has had astonishing developments. Several nations have designed and manufactured many kinds of rockets. Basically, rockets can be divided into five major categories based on the various launching and target locations. They are air-to-air, air-to-ground, ground-to-air, ground-to-ground, and ground-to-space rockets.

Air-to-air rockets are carried on aircraft and are used to attack enemy aircraft in flight. It is very difficult to attack and hit an enemy aircraft by using ordinary artillery, since the flight speed and maneuverability of modern fighter planes are very high. However, when air-to-air rockets are used it is a very different story. Because there are control systems installed within this kind of rocket, it can be aimed at the enemy plane automatically or controlled by the pilot via radio. Therefore, we also call this type of rocket an air-to-air guided missile.

Air-to-ground missiles are launched from aircraft against targets on the ground or on the sea. Because antiaircraft firepower is stronger than ever, it would be very dangerous for an aircraft to bomb a target by direct overhead aiming as was done in the past. Moreover, it would be difficult to drop bombs accurately on the target. When an air-to-ground missile is used, it can be fired at a great distance from the

target by using control systems to direct its flight to the target. Distance from the target can be as far as several hundred kilometers. This is not only safe and reliable, but it also can increase firing accuracy.



Fig. 2. Air-to-air missiles mounted on an airplane.

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Ground-to-air rockets may also be called antiaircraft rockets. They are launched from the ground or warships against airborne targets. Due to the fact that the flight speeds and altitudes of modern bombers have been greatly increased, it is difficult to obtain good results by using ordinary antiaircraft artillery. But attack altitude and attack accuracy can be greatly boosted through the use of guided antiaircraft missiles. At the same time, because its attack range may reach several hundred kilometers, this type of rocket can protect a larger area against overhead attackers. Therefore, this type of rocket has drawn a good deal of attention.

Ground-to-ground rockets are launched from the ground (or warships) to attack enemy ground or sea targets. The firing range of this type of rocket may be less than one hundred kilometers (short range) or greater than ten thousand kilometers (long range). The famous Soviet Katyusha rocket launcher which frightened the German Fascists during World War II belongs to the class of unguided short-range rockets. The tactical mission of this type of rocket is usually to kill the enemy on the battlefield or to blow up enemy fortresses.

Ground-to-ground rockets are often used to attack strategically significant targets behind enemy lines. Because of their rather

long firing range, it is necessary that they be controllable. Moreover, they are sometimes mounted with powerful nuclear warheads.

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Fig. 3. Soviet long-range missiles on display in Red Square.

3.  
3 The "ground-to-space" type rockets have only appeared in the past  
7 three years. The rockets carrying man-made satellites and the space  
6 rockets successfully launched by the Soviets all belong to this category.  
5 A characteristic of this type of rocket is a very high flight speed.  
11 For instance, the speed of the three space rockets launched by the  
Soviets surpassed 11.2 km/s. If we add the operation of the final stage  
to the large type multistage ballistic rockets successfully launched  
at that time, their speeds would have been even greater. Another  
characteristic of this type of rocket is that it demands that the  
ps) control system operate very accurately. If there is the slightest  
error, it could lead to a launch failure.

#### General Structure of Rockets

he No matter how many types of rockets there now are, their components  
are basically the same. Generally speaking, rockets that use liquid  
fuels are composed of the following several parts.

Nose section: The nose sections on military rockets are filled  
with powerful explosives or mounted with nuclear warheads. Nonmilitary

rockets can carry measuring instruments used for various scientific research, man-made satellites, etc.

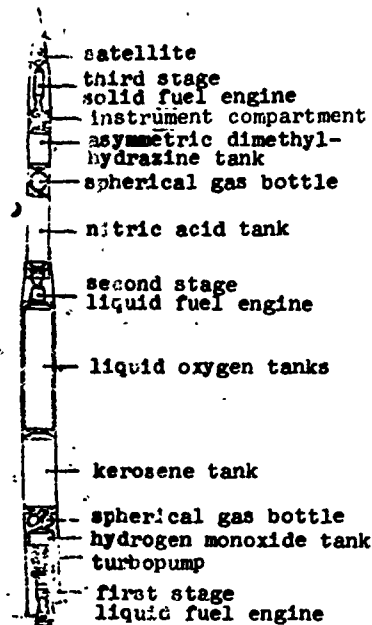


Fig. 4. Three-stage booster for man-made Earth satellite.

**Instrument compartment:** Used for placement of various instruments and energy sources for control of the flight of the rocket. When the flight of the rocket is controlled from the ground, it is used for placement of radio transceivers and other items. If the rocket is to fly automatically according to a predetermined trajectory (flight route), it must have a set of automatic control mechanisms installed on board to transmit commands at certain intervals to cause the rocket to make predetermined angular turns.

**Fuel compartment:** This part contains the two large oxidizer and fuel storage tanks. From a weight aspect, the fuel represents a large portion of the rocket's total weight.

**Fuel feed system:** The function of this system is normally to transport the fuel from the storage tanks to the engine for combustion. At present many rockets are using turbopumps to inject fuel into the engine.

Engine: This is the motive power source of the entire rocket. The operating time of a rocket engine is comparatively short, generally only about a few seconds to a few minutes. Burning a large amount of fuel in such a short time and ejecting the vapors from the engine at a very high speed (approximately 3000 meters per second) and thus producing a large amount of thrust causes the rocket to gain a high flight speed.

Control mechanism: This is a mechanism which controls the rocket's flight according to orders sent out from the control instruments. At present there are many types of rocket control mechanisms. For instance, the combustion chamber, rotary engines, small single oscillating engines, etc., can be used to control the flight. In addition to the above-mentioned components, air defense guided missiles and drone-type guided missiles should also have wings to produce lift.

Solid fuel rockets and liquid fuel rockets are not very different in structure. The structure of a solid fuel rocket is simpler in that it does not have a fuel feed system or a separate fuel chamber. Because the engine of the solid fuel rocket is a part of the rocket itself, it is used as both a storage tank and an engine.

#### Intercontinental Missiles

In modern weaponry the weapon that draws the most attention is the intercontinental missile. It can carry a nuclear warhead, which makes it a very powerful destructive strategic weapon. The range of this type of rocket can reach over 8000 kilometers. In order to launch the rocket to such a distance, it is necessary that the speed of the rocket will be 6.7 km/s or over when the engine stops. Computations show that if today's chemical fuels are used, single stage rockets are unable to reach this high speed. Thus, intercontinental missiles are all multistage. The Soviet Union was the first in the world to successfully test-launch an intercontinental missile in August 1957. Its range was over 8000 kilometers. At this great distance its error from the impact point did not exceed 20 kilometers. Such a slight deviation would not affect the battle results of such a powerful weapon. Because its speed is so great, up until now there



has been no way to defend against it. Presently the Soviet Union is already able to produce intercontinental missiles in quantity. This undoubtedly strengthened the Socialist camp and world peace power, which destroys the imperialist dream of starting wars. If the large multistage ballistic rocket successfully and accurately launched by the Soviets on January 20th of this year were used as an intercontinental missile, we can imagine what its power would have been.

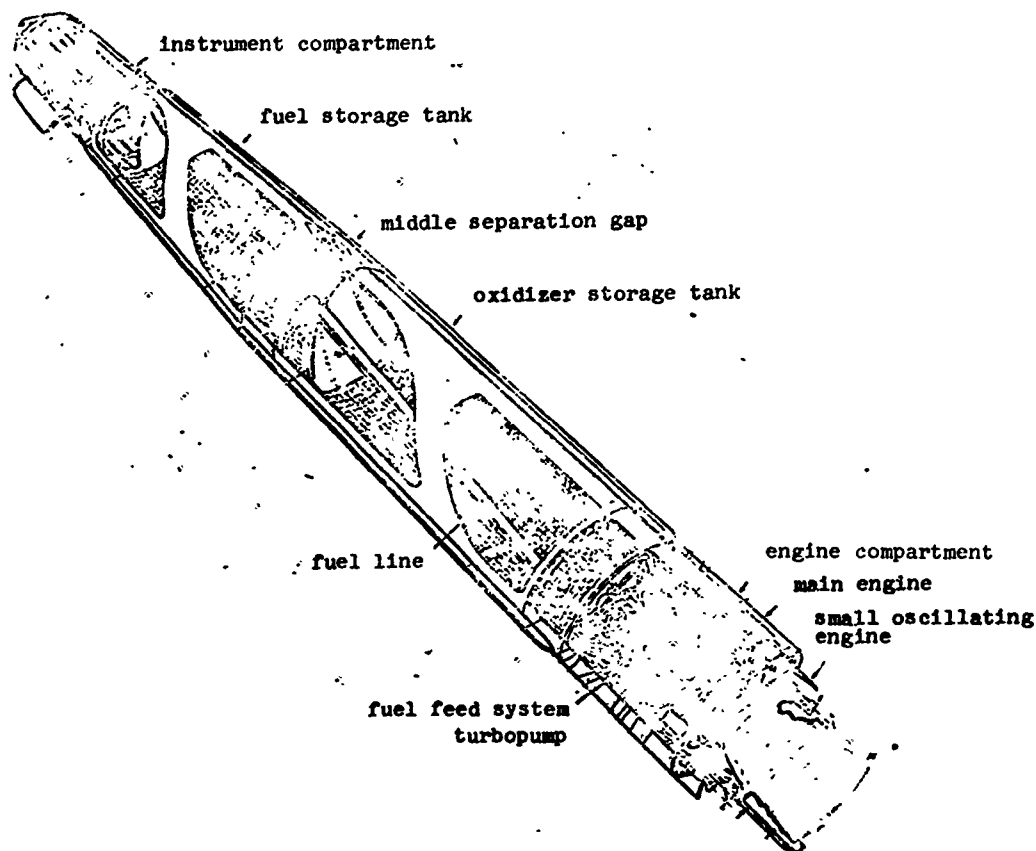


Fig. 5. Structural diagram of a Thor IRBM vehicle.

United States imperialism, in order to reach its aggressive objectives, has done its utmost to develop rocket weaponry in recent years and has constantly carried out testing. However, due to technical drawbacks, these tests always ended in failure. For instance, the "Atlas" missile about which America always boasts is well-known for its test failures. We can be sure that these missiles will never be able to rescue the imperialists from their "downward day-by-day" fate.

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Security Classification

DOCUMENT CONTROL DATA - R & D		
<i>(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)</i>		
1. ORIGINATING ACTIVITY (Corporate author) Foreign Technology Division Air Force Systems Command U. S. Air Force		2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED
		2b. GROUP
3. REPORT TITLE  AN INTRODUCTION TO ROCKETS AND GUIDED MISSILES		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Translation		
5. AUTHOR(S) (First name, middle initial, last name)  Chia- Pang, Yeh		
6. REPORT DATE 1960	7a. TOTAL NO. OF PAGES 7	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO.	8b. ORIGINATOR'S REPORT NUMBER(S)  FTD-HT-23-576-70	
b. PROJECT NO. 605020	8c. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
c.		
d. DIA Task No. T65-05-20		
10. DISTRIBUTION STATEMENT Distribution of this document is unlimited. It may be released to the Clearinghouse, Department of Commerce, for sale to the general public.		
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY Foreign Technology Division Wright-Patterson AFB, Ohio
13. ABSTRACT  A short description of the history of rocketry in China. Praise of Soviet accomplishments with satellites and rocket accuracy to 1960. Descriptions of capabilities, functions, and minor advantages and disadvantages of air-to-ground, air-to air, ground-to-ground, ground-to-air, and ground-to-space rockets. Explanation of the structure of rockets in general, including: nose section, instrument compartment, fuel compartment, fuel feed system, engine, and control mechanism. Short discussion of requirements and capabilities of intercontinental missiles. Structural diagram of a Thor IRBM.		

DD FORM 1 NOV 60 1473

UNCLASSIFIED  
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Guided Missile Rocket Rocket Technology Intercontinental Missile						