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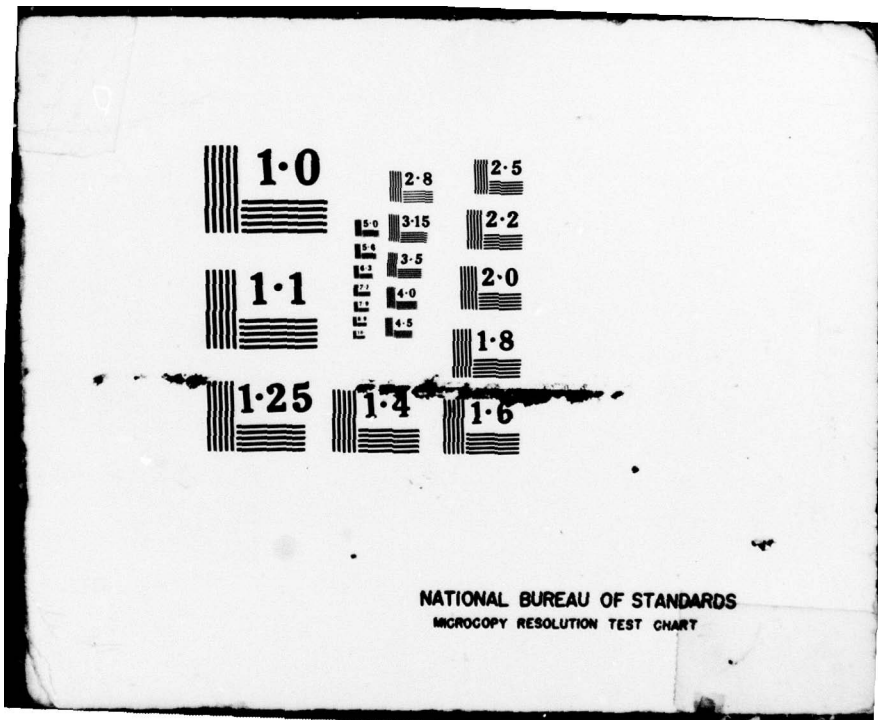
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SHOULDER FIRED MISSILE

by

Hsin Chun

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Shoulder Fired Missile

By

Hsin Chdn



A shoulder fired missile is a small ground-to-air missile, which can be launched conveniently by a single person. It has the characteristics of simple structure and launching equipment, easy to operate and good mobility. It can be suitably used by both professional army and citizen army. This article attempts to make brief descriptions of the structure, function, characteristics, usefulness and development of shoulder fired missile.

A single-man portable and shoulder fired ground-to-air missile (abbr. as shoulder fired missile) is a single-man air defence weapon created in the middle 1960's. The image of a ground-to-air missile in people's mind is usually a weapon of large size with confusing multiplicity of ground equipment. But a shoulder fired missile, on the contrary, is small and light, and it can be carried by a single person and launched on the carrier's shoulder (see the title illustration and Figure 1). So this kind of weapon is mostly used to equip an army so as to strengthen its anti-air ability. Because a shoulder fired missile is convenient to carry and simple to operate,



Figure 1

it will suit the need in an anti-aggression war of a country where every one is enlisted as a fighter. The following are brief descriptions of a shoulder fired missile.

The Composition and Function of an Armament System

A complete set of combating weapon is usually called an armament system. A shoulder fired missile armament system is composed of missile, launching tube, battery and launching mechanism (Figure 2).

The missile is a main component of the armament, and it is installed in the launching tube. Except for checking, is not allowed to remove from the tube. From

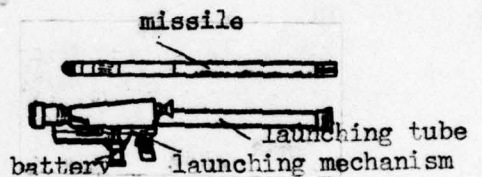


Figure 2 Composition of a shoulder fired missile armament system

Figure 3, it can be seen that, like a general missile, a shoulder fired missile consists of four connected cabins: target seeking head cabin, rudder cabin, warhead cabin and power cabin.

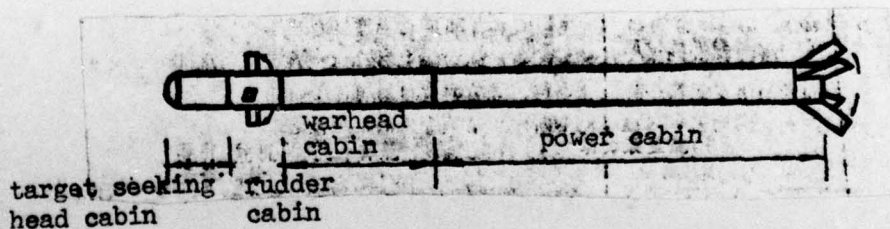


Figure 3 Components of a shoulder fired missile

The launching tube is a container to store the missile, and it is also used to carry and to transport the missile. On the outside of the tube, there are suspending rings attached with belt, so a launcher can

carry the missile like carrying a gun on his shoulder when he is on march. There is an aimer on the launching tube. When the missile is being launched, the launching tube can function as a missile director to show the missile direction as well as a launcher protector to prevent the launcher from being burned by the flames which come out from the engine.

A battery is the source of electricity, which is consumed in preparation for launching and the launching of a missile.

The launching mechanism looks like a gunlock, and inside it there are numerous electronic circuits. The trigger on the launching mechanism is in fact a switch, which is responsible for connecting the electronic circuits of both the launching mechanism and the missile when the missile is being launched.

The Operation and the Use of This Weapon

At present, a shoulder fired missile can only attack an airplane of low altitude. The so-called low altitude refers to an altitude that is lower than three kilometers. The operation as well as the use of a shoulder fired missile in a war is very convenient. Before attacking a target, the battery and the launching mechanism must be first of all connected to the launching tube. As a target has been found, the launcher places this weapon on his shoulder to take aim through the aimer at the target. As soon as the missile catches the sight of the target, it gives light and sound signals, then the launcher presses the trigger and the missile goes out immediately. If the missile is equipped with an automatic

target seeking head, after the missile has gone out, the launcher can begin to send another out or do some other fighting assignment, because the missile now can go by itself to the target. If the missile is a radio controlled one, the launcher has to send control order to the missile till it hits the target.

Characteristics of a Shoulder Fired Missile

The main characteristics of a shoulder fired missile are the smallness of its structure and the convenience in its operation. Since a shoulder fired missile can be carried and launched by a single person, of its launching environment, the limitation can by no means be very strict. It can be launched on a plain, a hill or a mountain, in a trench, on the roof of a building, on a ship or a slow moving vehicle on land. It can be launched singly to attack a target or, in order to score a high hitting rate, launched in group.

In order to enable a launcher to carry and to launch on his shoulder, a shoulder fired missile must be made small and light. Generally the length of a ground-to-air missile is about from a few meters to more than ten meters, but a shoulder fired missile according to the length of its launching tube is only about one to two meters long. The diameter of a ground-to-air missile is often from ten millimeters or so to half a meter, but the diameter of a shoulder fired missile is only about 7 or 8 millimeters. The weight of a ground-to-air missile is generally from several tens of kilograms to about 1,000 kilograms, but a shoulder fired missile weighs only no more than ten kilograms, and even the whole armament system weighs only about 14 or 15 kilograms. If it is not by applying new program design and

structural design, it is hardly possible to make such a small and light missile weapon.

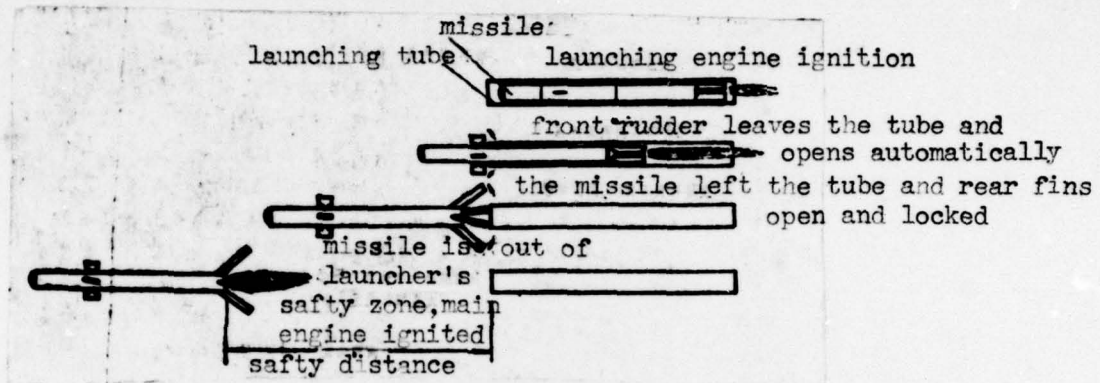


Figure 4 Diagram of the process of a missile leaving its launching tube

Because a shoulder fired missile is launched on a launcher's shoulder, the armament system must be very safe and reliable. For this very reason, the property of the engine must be steadfast. It usually uses a two-stage solid fuel rocket engine---launching engine and main engine. A shoulder fired missile depends on the launching engine to push it out of the launching tube, and as the missile leaves the launching tube, the fuel in the launching engine is about combusted up. When the missile inertially flies out of the launcher's safety zone, the main engine is then ignited. So the launcher is in no danger of being burned by the combustion heat from the main engine (Figure 4). Between the ignition of the launching engine and the ignition of the main engine, there is a time delay. Generally, this time delay is only less than one second, and it must be very accurate. In order to insure the launcher's safety, on the outside of the launching

tube, there is a shock-proof device and sometimes the missile is made to have no retroaction in launching. All these measures are for reducing shaking and eliminating retroaction.

The external look of a shoulder fired missile is generally an air-actuated "canard" layout and the fins are made elastic and able to fold. When the missile is launched from a launching tube, the fin will open automatically. The so-called air-actuated canard layout is that in front of the center of gravity of the missile there is a small controlling rudder, and the main lift force (generally called main fin or rear fin) is invested behind the center of gravity of the missile. In such a "canard" layout arrangement, the rudder is not the main lift force because of its inclination or stretching out, the lifting power produced on the rudder by the airflow is not great. But because the rudder is located at a distance away from the center of gravity of the missile, it can produce a rather strong control moment to the center of gravity. Under the effect of the control moment, the missile revolves around its center of gravity and forms attack angle, and thus the whole missile produces lift force. Then under the joint effect of this lift force and the thrust of the engine, the missile following a fixed track flies toward its target (Figure 5).

In addition to a radiocontrol system, a shoulder fired missile has a laser semiautomatic seeking director. At present, however, a system of infrared guided seeker is widely adopted. The function of this guidance system is that the target seeking head converts infrared ray radiated from a target into corresponding electric signals that can control the inclination (distend and shrink) of the fin of the missile (Figure 6). What

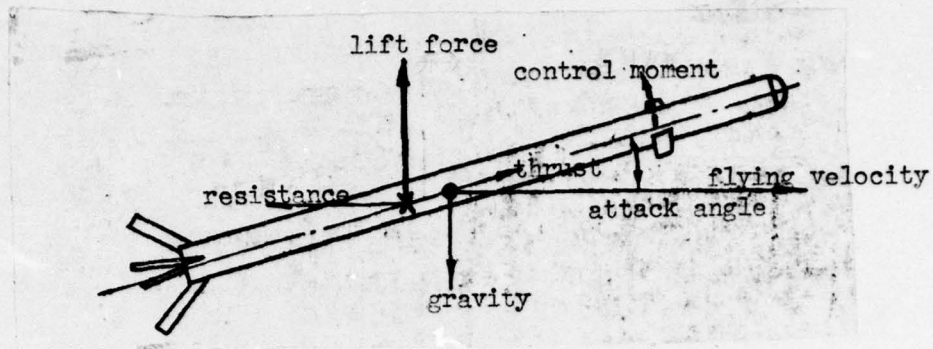


Figure 5 Diagram of force distribution in a missile

part of the target seeking head can receive infrared ray and convert the "ray" signals into electric signals? It is ^{the} infrared ray detectors, such as lead sulfide, lead selenide and indium antimonide, which do the conversion. Some of them can work only under low temperature, so the armament system has to include a cooling device. Because the infrared ray detector cannot perform its control function until it receives infrared pulse signals which have been through modulation. A modulation plate is therefore equipped in front of the infrared ray detector. On the modulation plate there are some "patterns" of certain forms. In fact, the patterns are

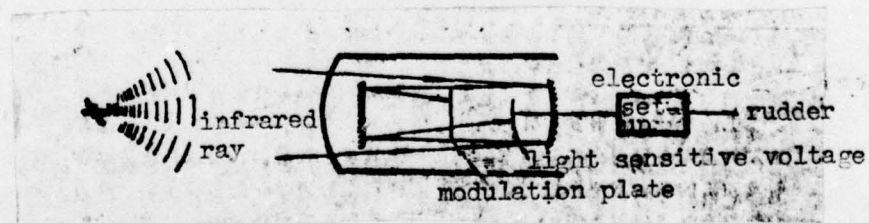


Figure 6 Diagram of an infrared target seeking head

tiny plots, which are according to certain rules classified as transparent, not transparent and semi-transparent. The function of the modulation plate

is to modulate the infrared ray reflected from the target into ray pulse signals which can reflect the position as well as the inclination value of the target. The electric pulse signals, which are converted from ray pulse signals by the infrared ray detector, after a treatment in the electronic set-up, begin to control the rudder. The diameter of the modulation plate mentioned above is only one or two millimeters. It is certainly not easy to make patterns on such a small plate.

Besides, a shoulder fired missile still has more characteristics, such as the short time needed in preparation for attacking and the application of new principles of aerodynamics and controlling in design. In short, a shoulder fired missile is not a ground-to-air missile taken down from its launching pad and, through a process of reducing its size, put into a launching tube; it is a new structure, each part of which is organically connected.

The Development of Shoulder Fired Missile

Like any other kind of weapon, the shoulder fired missile, a single-man anti-air weapon, is gradually becoming perfect through continuous improvements.

Because the size of a shoulder fired missile is small, the powder charge in its warhead part is much limited, so its killing power is far from sufficient. Sometimes when it hits an airplane, there cannot be much fatal damage made to the plane. Therefore, the new model of shoulder fired missile, in addition to the improvement of property of its fuse and warhead under

existing powder charge condition, the property of the rocket engine has been improved and the control part has changed to use solid state circuit. All these measures aim at increasing the amount of powder charge in its warhead part and strengthening its killability.

Previously, the target seeking head of a shoulder fired missile uses lead sulfide as sensor, but this sensor can sense only the infrared radiation produced by the engine nozzle of a plane, and, as a result, the missile can be only in the fashion of "trailing" launched to trace its target. Today, some shoulder fired missiles use lead selenide or indium antimonide as sensor, and these sensors can sense the infrared ray radiated from the cover of a plane. As a result, the missile can be launched in a position facing a target plane, and it has therefore become an anti-air weapon attacking from all directions.

Before launching the missile, a differentiation of enemy's plane from our own plane must be made correctly. But the fighters of today are all of high velocity, so the time of preparing for launching a missile is very short. It is therefore very difficult for a launcher to make a correct differentiation without any mistake. For this reason, in the newly made shoulder fired missile, there is a "target recognition inquisitor". When the launcher is taking aim at a target, the target recognizer begins to work automatically. If the plane, at which the launcher is aiming, is our own, the target recognizer will cut off the electric circuits of the launching mechanism. Consequently, even the launcher pushes the trigger, the missile can by no means be emitted out. Of course, it cannot be

considered absolutely reliable in differentiating a target although there is a target recognizer in the missile. Even though a target recognizer system is reliable, it can bring some new problems to a missile nevertheless. This is a proof of the duality of things. Should people's subjective capacity be applied fully in design as well as in use of some thing, many problems can be solved more easily.

Finally, due to the fact that there are many advantageous points, the tube launched missile has been used in the anti-air system of armoured vehicles. A few missiles can be launched simultaneously to attack one single target or a group of targets. In some submarine, this kind of missile has also been installed. When a target appears in the telescope of a submarine, the tube launched missiles comes out of water and is launched to the air. There is no need for the submarine to surface itself to launch the missile or to launch it from under water. Strictly speaking, this kind of anti-air missile no longer belongs to the shoulder fired missile armament system, however, they can be regarded as expansion of the shoulder fired missile.

This is a convincing testimony of the superiority of the shoulder fired missile, and, at the same time, it indicates that this single-man anti-air weapon is not only used by army, a armoured troop and navy need this missile as well.

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