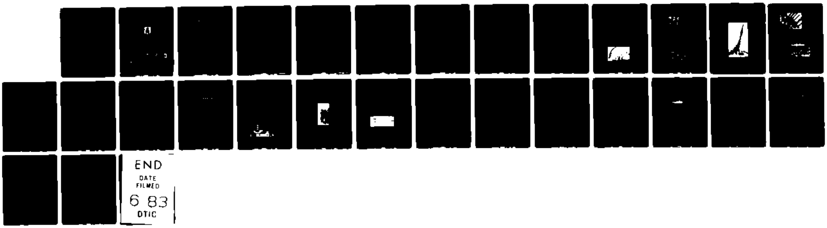
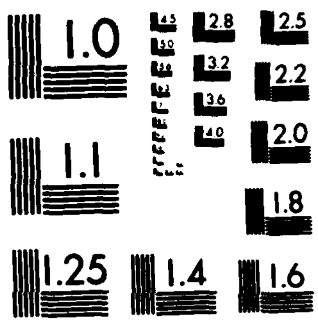
AD-A128 237 AERONAUTICAL KNOWLEDGE (SELECTED ARTICLES)(U) FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH L SHAOQIU ET AL. 11 APR 83 FTD-ID(RS)T-0289-83 1/1

UNCLASSIFIED F/G 16/4.2 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FTD-ID(RS)T-0289-83

AD A128237

FOREIGN TECHNOLOGY DIVISION

AERONAUTICAL KNOWLEDGE

(Selected Articles)

DTIC FILE COPY

DTIC ELECTE MAY 1 9 1983 S D A

Approved for public release;
distribution unlimited.

83 05 19 013

EDITED TRANSLATION

FTD-ID(RS)T-0289-83 11 April 1983

MICROFICHE NR: FTD-83-C-000428

AERONAUTICAL KNOWLEDGE (Selected Articles)

English pages: 24

Source: Hangkong Zhishi, Nr. 12, December 1982, pp. 2-7 plus Front Cover and Inside Front Cover

Country of origin: China
Translated by: LEO KANNER ASSOCIATES
F33657-81-D-0264
Requester: FTD/SDB
Approved for public release; distribution unlimited.

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITORIAL COMMENT. STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION.	PREPARED BY: TRANSLATION DIVISION FOREIGN TECHNOLOGY DIVISION WP-AFB, OHIO.

TABLE OF CONTENTS

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

AN UNDERWATER FLOOD DRAGON JUMPS OUT OF A BLUE GREEN SEA

From 7 to 16 October 1982, a Chinese submerged submarine successfully launched a carrier rocket to a circular (sea) area within 35 nautical miles in radius centering at 28 degree 13 minute north latitude and 123 degree 53 minute east longitude. This success marked a new development in China's carrier rocket technology.

On the vastness of the sea surface with light reflections on waves, a submarine on the mission of underwater launch test of a carrier rocket sailed toward a predetermined sea area amid waves and waves.

"Dive!" the captain ordered; then the bluish gray steel boat disappeared in a dark green sea. A moment later, the submarine restores the equilibrium as steady as over the land. At that time, the submarine carrying with a carrier rocket already moved at the predetermined depth.

In a Submarine Carrying a Carrier Rocket for Launch

In the command cabin, instruments and meters are scattered for battle command, communications, observations, and boat maneuvers. This is the key center of the entire submarine. Different colors and light shades of indicator lamps were blinking. The charge and discharge gas valves emit the sound "sisi", which together with words of commands here and there and humming of instruments composed a harmonious melody. With a pencil at his right hand and a glass rule at his left hand, the chief officer worked on a chart desk. A sailor foreman focused his eyes on a depth meter as his hand grasped a device controlling the elevator (helm). The captain wore dark blue work clothing standing at his battle station with a steady command atmosphere; closed circuit television screens were placed in front of him; screens showed the activities of the main combat stations of the launch cabin. While looking at the screens, the captain spoke to a loudspeaker, barking various commands resolutely.

Various kinds of instruments and crisscrossing cables for surveying and testing were placed around a silvery gray launch cylinder in the launch cabin. With perspiration on their faces, sailors and scientific and technical personnel concentrated their mind on the last tests of the carrier rocket.

From another cabin, sounds of "dida, dida" were heard--this is the navigation room. An operator busily touched a row of milky white switches on a computer. Groups of vermilion number codes incessantly flickered on a light blue display screen.

The submarine approached the launch point. There was a tense atmosphere in awed silence in the launch cabin. Clearly, sounds of "qiacha, qiacha" from the second indicator could be heard. Everybody fixed their eyes on the indicator lamp.

"Light launch lamp" reported a young launch operator maneuvering a launch control panel. The captain's resolute commands were transmitted through the loudspeaker "5--- 4--- 3--- 2--- 1" and then "launch!"

The thumb of the launch operator resolutely pressed down a red launch button. Almost at the same time, the submarine sank a little with a thunder like rumbling ......

Waves from the rocket's jumping from the water still did not quiet down; the submarine already floated out of the sea. Operators and scientists on the boat inspected once over the launch installation developed in China. All installations and equipment were perfect on the dot.

On a Surface Observation Ship in the Launch Sea Area

Blue sky and azure sea with light breeze and small waves were scenes of the launch sea area. In the bright day that the eyes can see, white sea gulls were flying. Clear sea water was wavy and rays of silvery light reflected from the water surface. Although the submarine was diving near the sea floor in the vicinity, there was not a single trace on the surface.

"One minute preparation!"--the command was transmitted from the loudspeaker. Everybody held their breath. All eyes fixed on the predetermined zone where a rocket would emerge. Movie photographers and reporter/photographers pointed their camera lenses toward the front in preparation for photographing this excited scene.

Suddenly, a break appeared on the blue ribbon like sea surface. A milky white rocket jumped from the depth of the sea and flew into the air. A long stream of flame ejected from the rocket tail, propelling the rocket roaring toward the azure blue sky. Waves embracing the rocket rose to a height of 20 to 30 meters before drops scattered onto the sea, making the sea water snowy white (in the vicinity) like a giant white lily from the bright blue sea.

The milky white "giant dragon [the rocket]" jumped out of the tall water column; water screens covered the rocket all over. The rocket flew upward and the water screens dropped like a hanging waterfall in the air. Water drops splashed like glittering crystals and emerald in the sunlight, crystallizing and clear.

Looking downward from a helicopter, the orange red flame ejected from the rocket displayed a glittering and bright scene in the blue sky and azure sea. Giant air waves split apart the ascending water column, like a giant white lily in full bloom. At that time, everybody had a heart filled with joy; enthusiastic shouting followed the rising of the "giant dragon [rocket]".

With rapid rising of the rocket, the flame ejected from its tail extended toward the remote sky like a ribbon. In an instant, the rocket soared out of the atmosphere; the bright spot gradually disappeared from view. Only the silvery chain like flight path became larger and lighter, remaining in the blue sky for a long time.

In the Predetermined Splashdown Sea Area

With rotor rotating and engine roaring, a helicopter carrying personnel for observation of rocket splashdown point and aviation photography rose from a warship into the air. The helicopter flew at a level altitude of 2500 meters while circling.

Today, it was the best climate and sea conditions since a fleet of surveying ships sailed to the sea. The bright sunshine and expanses of sea looked like a boundless dark green prairie. Spots of scattering white waves looked like flowers in a pattern on the prairie. From a distance, the milky white large surveying ships, "Yuanwang No. 1" and "Yuanwang No. 2", like a pair of swans, were pedaling on the dark blue sea (surface).

Suddenly, the light yellow radar screen on the high seas surveying ship "Yuanwang No. 1" showed a bright spot. "Target discovered!"--the operator shouted. A fire ball emerged from the cloud layer and flew like a shooting star, splashing down onto the vastness of the ocean amid mists and waves; a skyhigh water column formed in the wake. The dyestuff scattered from the nose cone produced jade green sea water, forming a circular dye region.

The helicopter began to fly forward using the data provided by the command in search of the splashdown point.

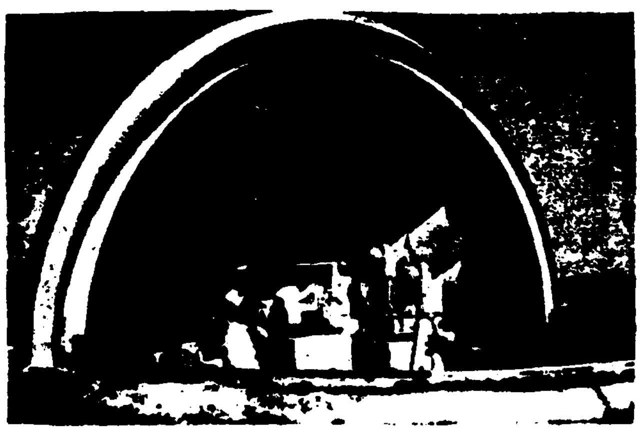
"Target discovered!"--the helicopter captain shouted to the command section. After the reentry body of the carrier rocket fell into the water, the dyestuff floating on the sea surface looked like a piece of jade green handkerchief, floating on the blue sea surface. When the aircraft formed a vertical angle with the dyestuff, the [aircraft] captain reported to the command post, "Aircraft passing the top!" Altogether three times, the aircraft photographed over the dyestuff area.

The testing personnel on the surveying ship fleet were joyful in their faces, working in tension. They made precise soundings by various means.

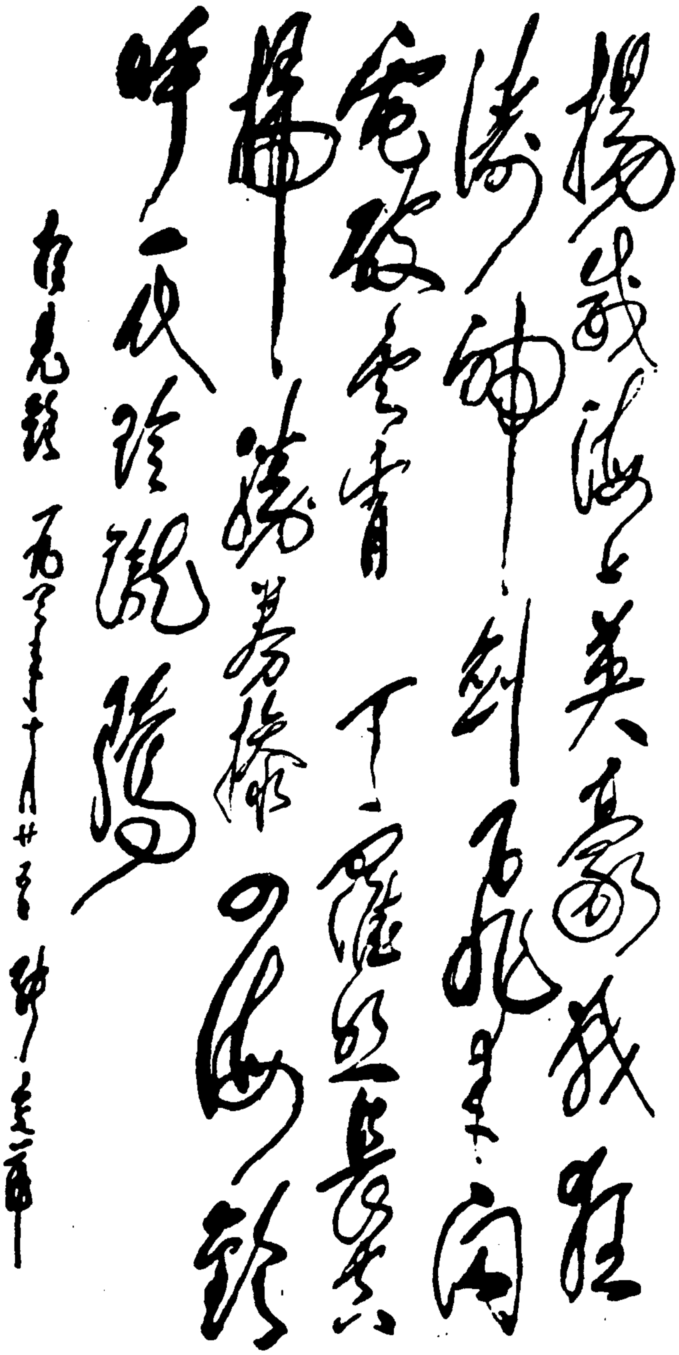
A loud voice reported to the launch headquarters: "the rocket splashdown position is xx degree xx minute east longitude and xx degree xx minute north latitude. The splashdown is precisely in the predetermined region."

Sailors sounded a steam whistle and the martial national anthem was played over a loudspeaker. All testing personnel bustled on the ship desk, shouting full of joy in celebrating a victorious launch.

The article is a report made by this journal based on reports from the New China News Agency, the People's Daily, and the Liberation Army Daily. Wen Chengcheng wrote the explanations to photographs.

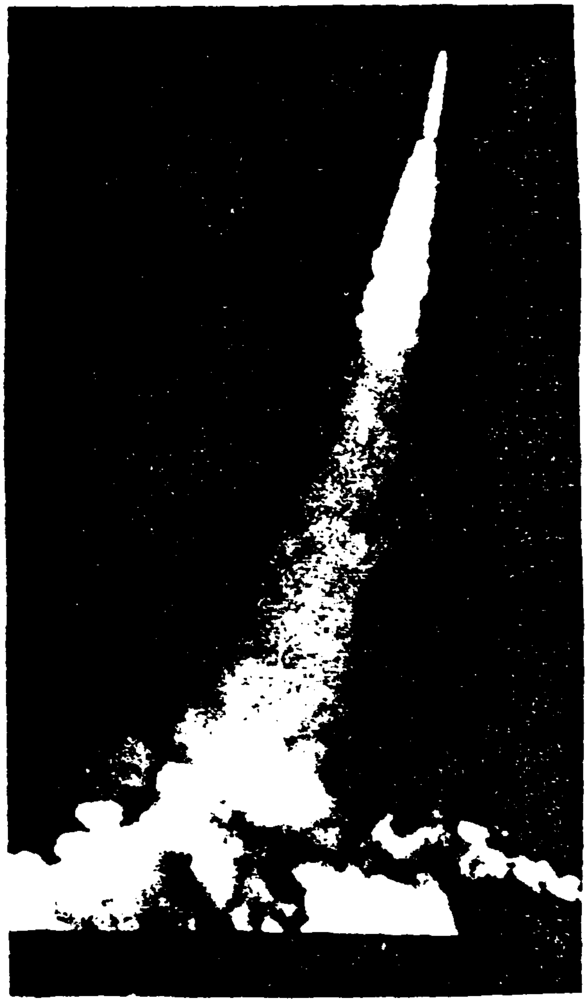


The equipment was an optical movie transit for tracking-photographing the flight trace of the carrier rocket.

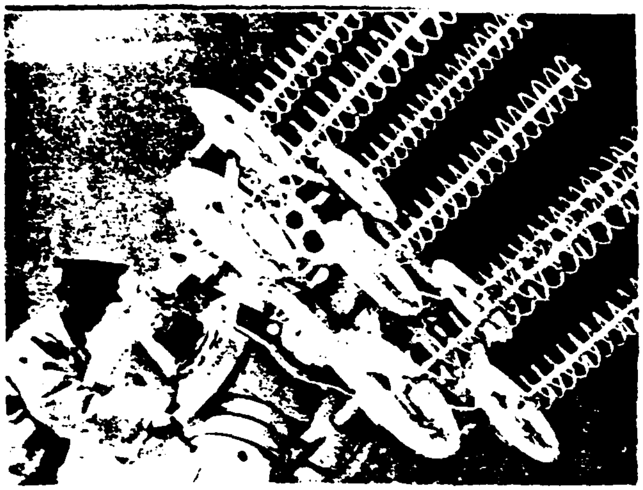


The deputy secretary general Zhang Aiping of the Central Military Affairs Commission attended the victory celebration meeting for the submarine launch of the carrier rocket. On the occasion,
[Continued on following page]

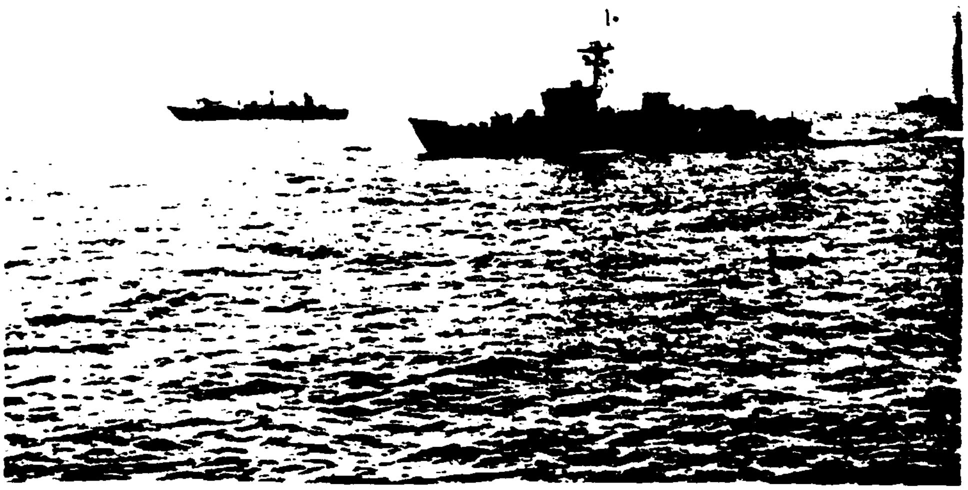
[Continuation from the preceding page]
Zhang wrote a poem, expressing his gladness in heart. The poem reads, "Heroes spreading influence over the sea; fighting against violent waves. An arrow of god flies over; lightning out of the cloud. Shining in the sky; sweeping with a long arc as the victory is at hand. All joyful shoutings over the four seas for a generation of pride." On this journal's request, Comrade Zhang Aiping presented his calligraphy to the journal for inclusion in the article.



A rocket jumps out of the sea surface, passing through the long space to the predetermined sea area.



Technicians made a final inspection to the surveying control equipment.



Participating fleet sailed toward the predetermined surveying sea area in a convoy.

From 7 to 17 October 1982, China achieved a launch success of a carrier rocket toward a predetermined sea region; predetermined purposes were achieved. This success marked the new development of China's carrier rocket technology.

Photographs were taken by Deng Junzhao and Duan Wenhua.

SUBMARINE LAUNCH OF BALLISTIC MISSILE

Liu Shaoqiu

The change in international struggle situations promote incessantly the development of submarine technology and underwater to ground guided missiles. The underwater struggle will be more concealed and complex.

In the world today, the military competition on land is ever intensifying, and the struggle in space begins to be violent. Even in the ocean occupying three quarters of the Earth's surface, a violent contest is also going on.

Struggle in the Sea

Not long ago, in the Pacific region the Soviet Union conducted new underwater to ground ballistic missile tests. This kind of guided missile is called the SS-N-20, a solid fuel ballistic guided missile with individual guidance reentry multiple warheads and the range is close to 8000 kilometers. The Soviet Union planned to install such missiles onto Typhoon class submarines with 20 missiles per boat. For many years, the Soviet Union spent considerable funds for development of underwater to ground guided missiles. Up to now, the developed underwater to ground guided missiles are SS-N-4, SS-N-5, SS-N-6, SS-N-8, SS-N-17 and SS-N-18; among these missiles, the SS-N-8 and SS-N-18 are of intercontinental ranges. Most of these underground to ground guided missiles are liquid fuel ballistic missiles. For example, the SS-N-18 is a two stage liquid fuel guided missile 14 meters long and 1.8 meters in diameter, installed with a high level guidance system of relatively high precision. The SS-N-18 missiles can directly hit the United States when launched in a sea region near the USSR.

The United States do not lag behind. In the development of underwater to ground ballistic missiles, a large sum of funds and manpower were spent to develop in sequence the Polaris (A1, A2 and A3), Poseidon C3 and Trident I models of guided missiles (Fig. 1). After more than 20 years of efforts, the underwater to ground guided missiles were developed from intermediate to intercontinental ranges with precision from 3.2 kilometers (circular medium deviation) to 0.23 kilometer. The third generation underwater to ground guided missiles trident II under development is one of the most important strategic weapons on the sea; this is a three stage solid fuel intercontinental ballistic missile 13.9 meters long, 2.08 meters in diameter, 57 tons in weight, and 11,000 kilometers in range. The Trident II is fitted with multiple warheads with maneuverable flight capability. Why should the strategic ballistic missiles go underwater for launch?

Underwater Maneuverability

The vastness of the sky is for birds to fly and the wide ocean space provides for fishes' activities. In order to prevent discovery by reconnaissance satellites which can see the autumn dawn (very minute) and to avoid being attacked suddenly and destroyed, maneuverability is used. There are multiple plans for maneuverability of ballistic missiles, such as ground shelter mobility, midair maneuverability, cross country maneuverability, and highway maneuverability. The underwater maneuverability is one of the ideal approaches. Nuclear submarines installed with ballistic missiles can be deployed in sea regions (of the motherland), such as inland seas and gulfs, not likely to be discovered by enemies. For war requirements, the underwater to ground guided missiles can be launched from a submarine under waves and precisely attack the strategic target in enemy territory.

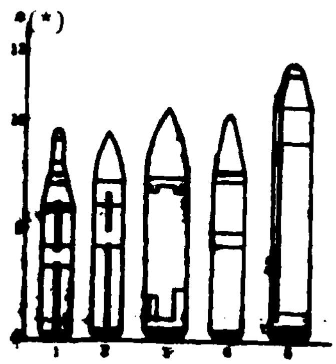


Fig. 1. Exteriors of several kinds of underground to ground guided missiles: 1. Polaris A_2; 2. Polaris A_3; 3. Poseidon C_3; 4. M-1; 5. SS-N-6.
Key: (*) Meters.

At present, generally the nuclear submarines carrying underwater to ground ballistic missiles are of fast navigation speed, low noise, deep dive, and good concealment. Generally, the submarine can carry about 20 long range or intercontinental ballistic missiles, capable of submerged navigation for more than two months. Since the construction of submarines by the Soviet Union in 1960, H and Y classes of guided missile nuclear submarines were installed and deployed. At present, the Soviet Union has 63 nuclear submarines.

Since the guided missile nuclear submarines can maneuverably launch ballistic missiles underwater, the missiles are subjected to more strict requirements.

Solid Fuel Ballistic Missiles

Because of limitations in underwater launch by a submarine, mostly the underwater to ground guided missiles used a solid propellent rocket engine for power. The solid propellent is familiar to most of us. Every celebration time we see fireworks (rocket powder) which have packed powder as a kind of solid propellent. However, the use of solid propellent in the underwater to ground guided missiles is only of a different kind than for fireworks.

There are many advantages for the solid fuel ballistic guided missiles: they are in combat readiness 24 hours of the day and can be launched at any time to attack the enemy. These guided missiles are simple in launch installation and convenient in application and maintenance. Hence, solid fuels are used in all underwater to ground ballistic missiles in the United States. The Soviet Union also developed the solid fuel rocket engines. With the exception of the SS-N-17 in deployment, in development the modern underwater to ground guided missile SS-N-20 also used solid fuels.

Generally, the underground to ground guided missiles are composed of the nose cone (nuclear warhead), rocket engine (power system), flight control system, and missile body. The missile body is a large diameter stunted body with pointed nose and flat tail. Since they are limited by submarine dimensions, these missiles are usually about 10 meters long, not exceeding 15 meters. The diameter is mostly about 2 meters (refer to Fig. 1). When launching a guided missile, generally compressed air or a steam catapult system pushes the guided missile from a launch cylinder to enable the guided missile to have an initial catapult speed of about 45 meters per second (Fig. 2). After the guided missile is out of the cylinder, it rises along a straight line from underwater to jump out of the sea. After the missile tail leaves the water, the solid fuel rocket engine ignites. Then the missile flies according to the predetermined projectile path to accurately attack the enemy target.

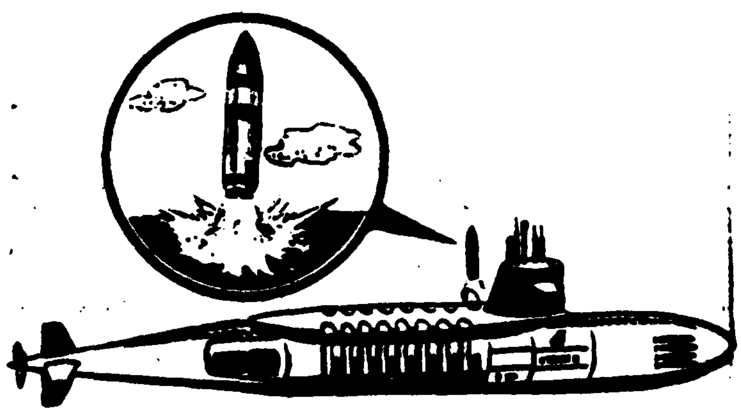


Fig. 2. Schematic diagram of nuclear submarine launch of ballistic guided missiles.

After flight tests of the underwater to ground ballistic guided missiles, generally we can divide them into three stages: the first stage is the development stage, including the land and sea tests. The second stage is the combat maneuver tactical tests, and the third stage is the combat training tests. From the first flight test on 16 August 1968 to January 1976, the flight tests of three stages mentioned above were conducted, launching 76 times in all before the missile entered batch production to be deployed in the armed forces. Figure 3 shows the scene of the launch test of Poseidon.

Fig. 3. Underwater to ground guided missile launch test by the United States.

The missile's state of motion underwater is more complex than in the atmosphere. Except for the motion of the guided missile itself, the missile is affected by factors of submarine motion and sea current and rising waves. Hence, a guided missile should be ignited under the overall influence of these motions, and then it flies and hits precisely a ground target.

Therefore, the underwater to ground ballistic guided missiles have a lower precision than the same range ground to ground ballistic guided missiles.

Mobile Launch Pad

Submarines sufficiently utilize sea and ocean as combat sea area and natural protective barrier in order to strengthen the survival capability of the strategic ballistic guided missile submarine, to let them act as one of the important nuclear weapons.

The new generation Ohio class submarines of the United States is a nuclear submarine with good concealment and high efficiency (Fig. 4). The kind of submarines can carry not only Trident I guided missiles, but also Trident II. In addition, the number of guided missiles carried by each submarine is increased to 24 with a service life of 30 years. A major overhaul and change of nuclear fuel are conducted every nine years. A voyage of continuous patrol can last as long as 70 days.

Fig. 4. Trident nuclear submarine of the Ohio class of the United States.

Except for the mobile launch in seas or oceans, a guided missile nuclear submarine can launch in a near sea base of the motherland to attack an enemy ground strategic target 10,000 li away. The Bange [transliteration] submarine base of Washington State of the United States is one of these bases. Bange is situated in the Jitesaipu [transliteration] Peninsula in the northwest United States with a total area of 33 square kilometers. The scenery is beautiful and climate is mild with excellent geographical position and deep navigation water. Wide mooring lines are provided for submarines' mooring, inspection and repair. The area is far away from the possible deployed sea area for antisubmarine weapons by the enemy. Hence, the base has an important military significance. Bange has a certain level of industrial foundation. As early as 1944, the US Navy established a navy ordnance depot in the area, being a transshipment point for Pacific coastal ordance and explosives. In 1962, the military facilities at Bange began to provide facilities for Polaris submarines. Later, an assembly plant of the Polaris A3 guided missiles was constructed with simultaneous usage by Trident guided missiles as their base. In 1977, the Bange navy base was formally established, providing accomodation for the first Ohio Trident submarine. In the Bange base, assembly, maintenance, repair, inspection and storage of Trident guided missiles are provided; this is also a training center of submarine sailors. This is a modernized base for guided missile nuclear submarines.

The change in the international struggle situation leads to emergence of more advanced nuclear submarine and underwater to ground guided missiles. Hence, the struggle underwater will be more skillful and complex.

Diagram titles were done by Wen Chengcheng.

STRATEGIC WEAPONS CONCEALED IN THE OCEAN

Zhu Yilin

In the development process of maneuverability performance and survival capability enhancement of strategic guided missiles, the gradual transfer of land based long range guided missiles to the ocean becomes an attractive trend.

With the incessant perfecting of the satellite reconnaissance technique and the ever higher increasing of missile hit rate, the land launched ballistic missiles are easier and easier to be hit. The survival of ballistic guided missiles is severely threatened. Beginning in the early 1960s, strategic guided missiles began to be transferred into underground shafts; the underwater launched ballistic guided missiles more and more indicate the superiority.

However, the underwater launched ballistic missiles have some shortcomings: the development of underwater launched guided missiles is connected with construction of submarines. Since the volume of a submarine is limited, dimensions of guided missiles cannot be too large. The range is relatively close and the combat sea area is relatively small. During underwater operation, the launch point that is the position of the submarine is not easily determined. Thus, the hit precision of the warhead is lower.

Structure

The exterior and structure of submerged launch ballistic missiles is fundamentally the same as the ground to ground ballistic missiles with only smaller dimensions. The length is generally around 10 meters and the diameter is 1.4 to 1.9 meters. The takeoff weight is 20 to 30 tons, and the range is 2000 to 8000 kilometers. In the warhead, there are nuclear explosives corresponding to hundreds of thousands of tons to one million tons of TNT. Most of the power installation uses a solid rocket engine, and few underwater launched guided missiles use a liquid rocket engine. The entire guided missile is composed of four parts: missile body structure, power installation, guidance system, and warhead.

Take an example of the Poseidon underwater launched guided missile of the United States. The Poseidon guided missile is composed of two stages with an overall length of 10.36 meters, diameter of 1.88 meters, takeoff weight of 29.5 tons, takeoff thrust of 74 tons, and range of 4600 kilometers.

The power installations of the first and second stages of the guided missile use solid fuel rocket engines. The engine shell is made of reinforced plastic materials. A flexible joint is used to connect the jet nozzle and engine; the jet nozzle can be swung to change the thrust direction. The first stage engine is 4.77 meters long with 1.88 meters in diameter and 18.84 tons in weight; polybutadiene acrylonitrile is used as propellent. The second stage engine is 2.47 meters long and 1.88 meters in diameter; the propellent used is denatured double radical powder.

The Poseidon guided missile uses an inertia guidance system, which includes two major components: the inertia guidance platform and guidance computer. The inertia guidance platform is composed of a universal support component, providing free rotation around three shafts. The universal joint component is spherical in shape with a solid structure and light weight. The internal universal supporting frame is used to stabilize the platform with firm support and is not affected by the missile's pitch, roll and yaw motions. Notwithstanding how the missile body is inclined, the universal supporting frame can maintain a stabilizing datum. On the internal universal supporting frame, an inertia datum integrated gyroscope and an acceleration table are installed. The inertia datum supporting frame provides the datum for the internal universal supporting frame; the acceleration table senses gravity weight at the launch instant and helps to stabilize the platform to maintain the vertical direction with the local perpendicular line.

The main mission of the guidance computer is to store the missile data transmitted from the control system before launch. In the powered sector flight, flight command is transmitted during flight.

Power

All modern ballistic missiles adopt individual guidance multiwarhead technique. The warhead is a completely supplied mother cabin, containing several subwarheads, release installation, guidance system, and microthrust engines. Under the control of the guidance system, the mother cabin can simultaneously release several subwarheads to concentratedly attack a single target or to attack different targets by individual release for guidance of individual subwarheads.

In the mother cabin of the Poseidon guided missile, there are 10 subwarheads. The weight of each subwarhead is 70 to 90 kilograms with a power of 50,000 tons of TNT equivalent. Therefore, the total weight of the warhead is approximately 1 ton and the total equivalent explosive power is 500,000 tons of TNT. When the second stage engine of the guided missile shuts off the power, the mother cabin and the engine separate. Under the action of microthrust engines, the subwarheads are thrown onto the predetermined trajectory according to the command of the guidance system to adjust the flight path.

At ordinary times, the guided missiles are stored in the launch tube of a nuclear submarine. With ocean patrol, 200 to 300 meters of sea water layer provide cover. When launch is required, the submarine floats toward surface. About 30 meters from the sea surface, the catapult power system pushes the guided missile out of the launch tube at a speed of 45 meters per second. Like a flood dragon, the Poseidon jumps out of the water surface. At 25 meters from the sea surface, the engine ignites to produce thrust.

Controlled by the inertia guidance system, the missile flies along a predetermined trajectory to attack the target. Figure 1 is a schematic diagram of underwater launch of a Polaris guided missile.

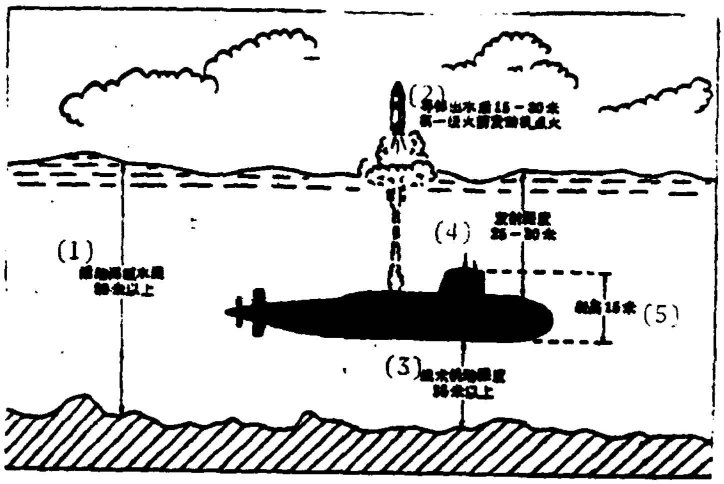


Fig. 1. Schematic diagram showing underwater launch of a Polaris missile.
Key: (1) More than 80 meters of water depth in the activity sea region; (2) After the guided missile leaves the water, the first stage rocket engine ignites; (3) Tactical maneuver depth of more than 35 meters; (4) Launch depth, 25 to 30 meters; (5) Height of submarine at 15 meters.

The hit precision of an underwater launched guided missile is not as good as that of a ground to ground guided missile. Even when the precision of the guidance system of two kinds of guided missiles is the same, due to the position of the submarine itself, the position measurement error of the missile launch point is relatively large and lowers the hit accuracy of the underwater launched guided missiles. The position of the submarine is mainly determined relying on the inertia guidance system in the submarine; the position is periodically revised by satellite guidance in order to eliminate accumulated errors due to gyroscopic drift of the inertia navigation guidance system. However, the use of positioning of a navigation guidance satellite leads to an error of 200 meters. The range of the Poseidon guided missile is 4600 kilometers; the hit precision, the circular probability error, is 540 meters (when a certain number of guided missiles are launched, 50 percent of the missiles fall onto a circle with a radius of 540 meters, centered on the target point); this is equivalent to 1.2 out of 10,000 in the relative precision. However, the range of the Minute III ground to ground guided missile of the United States is three times that of the Poseidon; the precision can attain 370 meters with a relative precision of 0.28 out of 10,000.

Present Situation

There are presently 41 guided missile nuclear submarines (of the United States), installed with a total of 656 underwater launched ballistic guided missiles fitted with 5024 subwarheads. The underwater launched guided missiles have been developed to the third generation: Polaris as the first generation, Poseidon as the second generation, and Trident as the third generation. The guided missile nuclear submarines are also correspondingly developed (refer to Fig. 3). Figure 3 shows a structural schematic diagram carrying Polaris guided missiles.

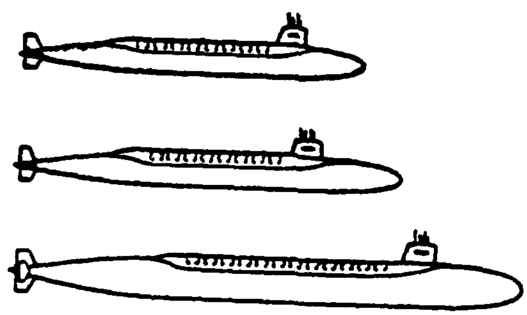


Fig. 2. Exteriors of several types of nuclear powered guided missile submarines. From top to bottom, there are the Polaris, Poseidon and Trident submarines. The Polaris nuclear submarine is 116 meters long, 10.1 meters wide and 8250 tons in displacement. The Poseidon nuclear submarine is 130 meters long, 10.1 meters wide and 8250 tons in displacement. The Trident nuclear submarine is 170 meters long, 12.8 meters wide and 18,700 tons in displacement.

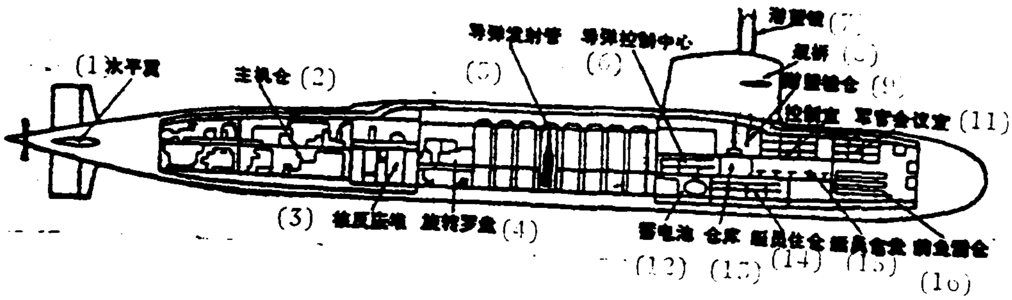


Fig. 3. Structural schematic diagram of Polaris guided missile nuclear submarine structure.
Key: (1) Horizontal fin; (2) Main engine cabin; (3) Nuclear reactor; (4) Rotating compass; (5) Missile launch tube; (6) Missile control center; (7) Submerged sighting lens; (8) Bridge; (9) Submerged sighting lens cabin; (10) Control room; (11) Officer's meeting room; (12) Storage battery; (13) Warehouse; (14) Sailor dormitory; (15) Mess hall; (16) Front torpedo cabin.

There are altogether 10 Washington class nuclear submarines, which are 116 meters long and have a displacement of 6888 tons. The diving depth is 270 meters, and it is capable of maintaining persistent navigation underwater for two months. The Washington class submarine is installed with 16 guided missiles. A Polaris A-3 guided missile has three clustered type subwarheads with an equivalent (weight of explosives) of 1,000,000 tons of TNT and a range of 4600 kilometers. There are 30 Lafayette class nuclear submarines (in the United States) 130 meters long and with a displacement of 8250 tons. Each Lafayette class submarine is equipped with 16 Poseidon guided missiles; this is the main underwater launch guided missile weapon system. In 1981, the first Ohio nuclear submarine of the United States was deployed on active duty; the submarine is 170 meters long with a displacement of 18,700 tons and carrying 24 Trident I guided missiles. The takeoff weight of the guided missile is 31.8 tons, carrying 8 individual guidance subwarheads. In February this year, the first Trident I guided missile was successful in launch underwater with a range of 7400 kilometers. In addition, an even newer long range underwater launched guided missile, the Trident II, was under development in the United States; the range is 11,000 kilometers and the hit precision is raised to 150 to 180 meters.

The Soviet Union has 62 nuclear submarines at present with 950 underwater launched guided missiles. Both these numbers exceed that of the United States; however, the total number of nuclear warheads (about 2000) is considerably smaller than that of the United States. The hit precision of the warhead is also relatively low; the circular probable error is over 1 kilometer.

The SS-N-6 guided missile of the Soviet Union has performance corresponding to the early Polaris guided missiles (of the United States) with a range of 2400 kilometers, carrying a 1 million ton TNT equivalent warhead. At present, the Polaris missiles are installed on a Y class nuclear submarine of 7000 tons in displacement, carrying 16 SS-N-8 missiles per submarine. The range of the SS-N-8 guided missile is 7800 kilometers, still with 1 million tons TNT equivalent single warhead, which is launched by a D-1 type submarine, carrying 12 missiles. The SS-N-18 is the newest USSR individually guided multiwarhead underwater to ground guided missiles, carrying three 200,000 tons TNT equivalent individually guided subwarheads with a range of 7600 kilometers; the missile is launched by D-III nuclear submarines. Last year, the Soviet Union successfully launched the SS-NX-20 guided missile, which has 12 individually guided subwarheads with a range of 8300 kilometers. The SS-NX-20 missiles are planned to be installed on a recently launched Typhoon nuclear submarine, which is 170 meters long with a displacement of 25,000 tons. This is the largest nuclear submarine at present; the submarine will be fitted with 20 SS-NX-20 missiles.

At present, the scale of nuclear submarines is expanding continuously; larger guided missiles will be carried. At the same time, because of adopting a silencing technique and sonar system, the detecting distance of a submarine is extended, capable of timely evading enemy search and attack. Therefore, the survival capability is further increased. With increasing range, higher precision, and higher survival capability, the future underwater launched guided missiles may possibly displace land based intercontinental guided missiles, occupying the first place in strategic weapons.

F

6