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(Selected Articles)

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HN HAND HELD AIR DEFENSE GUIDED MISSILE SYSTEM

HN-5A hand held air defense guided missile is an improved model from the Soviet SA-7 hand held ground-to-air guided missile. This guided missile is capable of tracing and following jet aircraft or attacking head-on the propeller aircraft or helicopters. Compared with the original Soviet model, the major improvements HN-5A had adopted were: a more powerful high-energy war head; an improved cooling device for the infrared detector, a background noise suppressing device which was installed in the infrared target searching head to reduce the sensitivity to the infrared background such as the white cloud and to extend the effective distance for the infrared sensor.

HN-5A composed of the following components:

Launching Tube: to be used as the aiming device, launcher, and packaging tube.

Ignition Device: to provide launching signal and ensure proper ignition of the guided missile. The ignition device was underneath the front section of the launcher.

Thermal Cell: situated on top of the front section of the ignition device.

Guided Missile: composed of four parts: infrared target-searching head equipped with cooling and background noise suppressing devices; actuator-controller equipped with a gas generator; war head and detonator; and the rocket engine equipped with the tail fin.

The function of the infrared target-searching head was to detect the thermal radiation emitted from the engine of the

target aircraft and transfer the thermal radiation signal to the control signal for the guided missile. The target was approached and intercepted by the guided missile with proportional approaching method. A vehicle-carried model derived from the basic HN hand held air defense missile is briefly introduced below.

HN-5C was installed on the HRB-230 (4x4) armored all-terrain vehicle. The firing control electronic device was placed in the control cabin at the front of the vehicle. A rotating seat was installed to the rear of the cabin and 4 ready-to-launch HN-5A guided missiles were placed at each side of the seat. The firing control system was installed between the bases of two guided missiles. The firing control system composed of an infrared tracing device, a layer distance-sensing device, and a TV camera. The detection, tracing of the target and launching of the guided missile could be carried out in automatic or manual mode. Even though the original model was installed on the HRB-230 vehicle, it could also be installed on the frames of other vehicles if its weight were about 2 tons. Except for the 8 ready-to-fire missiles, 8 more spare missiles were also on the vehicle. Evaluation of HN-5C was completed in June 1986 but production had not commenced yet. In all, the main purpose of this system was to protect mechanized infantry troops and to provide adequate defense to air strikes for important targets in the battle field such as airports or infantry divisions.

Major Performance Data:

Maximum ceiling:	2500m
Minimum ceiling:	50m
Maximum sloping distance:	4000m
Minimum sloping distance:	800m
Maximum target speed (for tracing and following):	260m/s (950km/hr)
Maximum target speed (for head-on attack):	150m/s (550km/hr)
Response time:	less than 5 seconds

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Fig 1: Ready-to-fire HN-5A missile

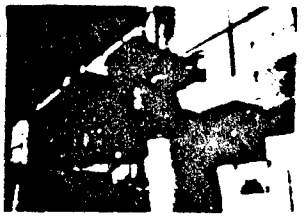

Fig 2: Close-up view of HN-5C system

THE EFFECT OF CHEMICAL WARFARE ON THE AIR FORCE PILOTS AND THE PROTECTION

Abstract

This article explains the purpose of the three types of chemical protection personnels in an airborne division, based on the threat of chemical warfare on air force units, in case of a chemical warfare. Several chemical protection equipments, including personal and integral protection equipments, used by various air forces were introduced.

In the future chemical warfares, spraying of chemical agents such as yellow-rain or plant killing agents or environmental chemical weaponry will all require the service of aircraft. Other than the fighter, attacker, striker which were all used in deploying of chemical bomb or agents, helicopter and remote-control aircraft are already used in these capacities. Because of the capabilities of accurately penetrating the frontline targets and deep targets, large ordinance capacity, and short response time, an assortment of chemical bombs were developed by USA and USSR to be used with aircraft. Hence, it is clear that air force is an essential element in chemical warfare and tremondous threat and impact of chemical warfare on the protection, strategy, technology, communication, and commanding is expected.

Threat of Chemical Warfare

The threat of chemical warfare exhibited in the chemical agents such as chemical vapor, vapor-dissolvable glue, liquid, and liquidous glue (capable of the spreading of persistent chemical agent). In future warfares, possible chemical agents are: nerves poison (Salin, Tabon, Soman, Weller), poisonous mustard gas, function-retarding poison, blood poisoning cyanhydric acid, cyanogen chloride, choking poison and vomiting poison, and biological poisons such as X and T-2. Based on related reports, when the Salin vapor concentration was 0.001mg/l (in air), an exposure of 2 minutes caused shrinkage of pupil; exposure of 15 minutes caused severe poisoning; if the concentration were 0.1mg/l, exposure of 1 minute would cause death. If the Salin liquid dropped on the skin (25mg/kg body weight), severe poisoning would result. The toxicity of Tabon was approximately 1/3 to 1/4 of that of Salin but the toxicity of Soman was 3-4 times of that of Salin. The toxicity of Weller agents was even more, especially the hypodermic toxicity (severe poisoning would be caused for a concentration of 0.05-0.1 mg/kg body weight). For example, if a unprotected troop were to be exposed to a Salin concentration of 70mg/m^3 for one minute and the inhaling was 15 liters per minute, death of 50% of the personnel would result if no adequate medication were administered. For troops engaged in heavy activity, due to the increased inhaling, the half death-causing dose would be reduced to 20mg-min/m^3. For troops in normal activity, the half function-losing dosage for inhaling of Salin agent was approximately 35mg-min/m^3. The symptoms are primary vomiting, diarrhea, blurred

vision, convulsion and paralysis. If enough amount of Salin vapor were absorbed by skin, loss of bodily functions or death would be caused. For the troops without the protection of face mask, the effect of mustard gas would be first felt in the eyes and loss of combat capability of the troop would be result. Temporary loss of eyesight would be resulted when the mustard gas concentration is 100mg-min/m^3, but no injuries should be received by respiratory ducts and no skin burn should occur. For the troops in normal activity, the half death-causing dosage was 1500mg-min/m^3 and the half function-losing dosage was 200mg-min/m^3.

Usage of the aircraft at an airport which was affected by the chemical agent would cause great threat and safety concern for the ground crew and pilots. Even if a thorough cleaning and decontamination were carried out after the attack, significant effect would still persist even for the personnel with protective clothing. Of course, the most dangerous chemical agent for the pilots was the nerves poison which was capable of causing shrinkage of the pupils even for a very dilute concentration. Handling and control of the aircraft would be greatly endangered if the eyesight of the pilots were limited.

When a large scale chemical warfare is conducted on the ground troops, a poison concentration cloud cluster will be formed. This could cluster migrates along the profile of the ground geography and is diffused by air current. Since the poisonous cloud clusters are generally lower than 50m and stable cloud clusters are generally lower than 10m, contamination of aircraft is only possible if super-low flight is conducted.

Therefore, at the normal combat altitude, aircraft engaged in warfare will not penetrate any poisonous cloud cluster. When grounded, the possibility of chemical agent attack, especially the persistent poisonous agent, received by combat aircraft is much greater and the extent of danger is also more severe. The contaminated aircraft is a tremendous threat to the ground crew and pilots. /3

Airport as the Main Target for Chemical Attacks

A strategic principle of Soviet Army states that "Victory of a war depends on the accomplishment of air superiority at the early stage of the combat." and "The basic tactics for the acquiring of air superiority is to destroy or suppress the aviation forces at enemy air fields.". This principle applies to both conventional and nuclear warfares. As a result, Soviet Army chemical warfare tactics commands large-scale chemical attack to troop agglomeration spots, nuclear launching fields, air-defense system, commanding devices, airports, and ammunition and supply lines. When the airports are contaminated the activity of the aviation forces is slowed down, the capability of quick-response and persisting combat is affected. On a poisoned airport, pilots will need to wear a complete set of protecting suit and the combat capability is lowered. It was estimated that 30-50% of the combat capability will be lost if a soldier wears protective clothing. For less well trained troops, the loss is even greater. Furthermore, if the equipment and material at the airport were damaged by the chemical bomb and were contaminated with death-

causing agent, death of combat personal may result if these equipments were used. Therefore, the protection of airport is of ultimate importance when the execution of combat command and survival of aviation forces in a chemical warfare is concerned.

It was also postulated by the United States Air Force that chemical attack with persistent or non-persistent agents on the airport is possible when the enemy troops is near the air force base. The purpose is to cause disturbance and interference of the activities on the airport while at the same time, the target can be kept intact for future application. Therefore, USAF adopted the combination of personal and selective integral protective measures to facilitate the NBC (nuclear-biological-chemical) protection. The emphasis is on the personal protection. Integral protection, on the other hand, is only carried out on some of the most important facilities such as commanding quarter and the rest and preparation areas for the combat pilots.

The Purpose of the Three Categories of Protection Personnel in an Airborne Division

To cope with the future requirement of chemical warfares, the air forces of many countries have already expanded the capacity of their NBC (nuclear-biological-chemical) personnel so that cleaning and decontamination of airports, development of protective devices, and execution of related protective measures can be accomplished effectively. USAF established their Air Force Chemical Protection Planning Office in 1980 to develop and coordinate the research of chemical warfare related technologies.

Also, each United States airborne division is equipped with a chemical protection company which has three platoons and each platoon has three decontamination squads and one chemical detection squad. Total personnel of a typical chemical protection company is 116 at present but can be expanded to 156 in the future. With the expanded personnel, the chemical protection company can have four decontamination platoons and one smoke-generating platoon and the chemical detection squad can be expanded to the air maneuverable flight squadron. The main function of the smoke-generating platoon is to generate smoke to cover the landing area for helicopters. Except for the chemical protection company, there is also a chemical dispatching unit of the supporting division commanding center. The officers and sergeants of the mobile units of the airborne division act as the chemical observers. Each regiment has two chemical officers and one chemical sergeant, each battalion has one chemical officer and one chemical sergeant, each company has one chemical sergeant. All these positions are filled by officers and specialists specially trained in schools. Each platoon is also equipped with a decontamination squad and a radiation detection squad. All the officers served as chemical observers and the new recruits should complete a two-week NBC training course held in military bases in order to carry out their duties effectively. As required by USAF, all the air and ground crews should receive the theoretical training of chemical warfare and chemical protection with an aim to update their knowledge and to alert the potential threat of chemical warfares.

Soviet airborne divisions and airborne regiments are equipped with one decontamination company and one decontamination platoon, respectively, to carry out cleaning of airport, aircraft and personnel.

Hence, it is clear that the establishment of chemical protection company and chemical personnel in the airborne divisions is one of the most effective measures to protect and guarantee the survival of airborne and aviation troops and to sustain ground attack missions under the condition of a chemical war.

Chemical Protection Equipment of an Air Force

As mentioned earlier, the protection of pilots is of utmost importance based on the premises of possible attack of NBC weapons received by aircraft. The protection measures can be divided into personal and integral protection measures. Under the category of personal protection there are respiratory duct protection and skin protection.

Face Mask -- Face masks usually use absorptive carbon for the absorption of poisonous gas and can provide adequate protection for most of the known chemical agents. The AR5 face mask used by Royal Air Force of United Kingdom (figure 1) can be used not only in NBC warfares but also provide oxygen for high-altitude pilots. The face mask was an assemblage nose-mouth mask and oxygen can be supplied from gas oxygen source. The mask was plated with polycarbonic acid ester of good optical quality to guard against wear and to provide adequate vision. Fresh air is

Fig 1: AR5 face mask used by UK forces

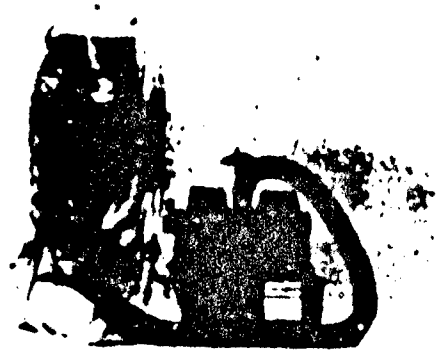

Fig 2: M43 face mask used by American forces

circulated through the goggle to prevent fogging. The mask was connected with a miniature venting fan to provide fresh air and to ensure a proper positive pressure within the mask so that no contaminated air would be inhaled if leak occurred and no fog formation on the goggle. This mask was equipped with an NBC internal communication device to allow the pilot to communicate with outside world using internally installed microphone and earphone.

The NBC protective device of USAF had undergone some modifications in the early 80's and no more modification took place afterwards. The face mask currently used was the MBU-13/P chemical-biological-oxygen mask. This face mask was an improved model from the one used by fire fighters. Not only can it provide oxygen, it can also provide protection to respiratory duct, eye, and skin under the condition of contamination. The helmet was the HGU-55/P helmet and was used in accompany with the face mask. The head mask is manufactured from butylene rubber and was laid on the helmet and shoulders to act as a sealing device. CRU-8/P poison filter can was connected to the oxygen line and was capable of protection against any known poisons.

Since the AH-64A attack helicopter of United States Army was recently equipped with a helmet indicating device capable of showing and controlling the target information and weaponry system, the face mask currently used could not match with the new helmet. As a result, a M43 face mask (figure 2) was recently developed by the Dover International Rubber Company of USA. Inside the face mask, a optical illuminating tube similar to the

helmet indicating device was installed and the design of the mask was so that the vision would not be interfered by the tube. The face mask can be equipped with M133 or M166 microphones. The head mask covering the face mask was very thin. Communication with outside world was possible with the earphone and microphone equipped within. A water drinking tube matching the military canteen was installed. M43 face mask provided for the pilot a clean environment with positive net pressure. Hand held venting fan pumped air to the two NATO standard poison-filter cans and the clean air was sent to the nose-mouth, goggle, and head mask regions of the M43 face mask to provide for inhaling and guard against fogging. At the same time, the contaminated air was prevented from entering the head mask and the exhaled air was expelled through the valves on the face mask and head cover. Convection of air provided cooling for the head cover. During emergency entry or exit, the poison filtering can was automatically cut off from the venting fan (the venting fan was installed on the aircraft during flight period). Under the condition of negative pressure, air was supplied directly to nose-mouth region and goggle and the exhaled air was expelled through the valves on the face mask and entered into the cooling duct of the head cover. In order to maintain a positive pressure in the head cover, exhaling valve was adjusted manually to control the flow speed. The manufacturer's commercial data for this face mask was: protection factor greater than 20,000 and 6,700 when used under the conditions of positive and negative pressures, respectively. The material of the face was butyl

rubber and the face mask came with four sizes which were capable of adequate protection for 6 hours. Capacity of the venting fan was 3.4-6.8m^3/hr and power supply was either battery or the power supply of the aircraft. All the components of this face mask could be washed with standard washing solution and decontamination could be carried out with M258A1 decontamination pack. Auxiliary parts were anti-freezing pack, eye-protection goggle, canvas mask pack, and comforting pad.

Skin Protection Devices -- The skin protection equipments for the Royal Air Force were MK1 protection suit (figure 3), poison-protection head cover, and socks. All these equipments were manufactured from ventilating poison-protecting textiles containing carbon. The weight of the entire suit was 0.75kg.

The USAF planned to modified the protection suit for air crew from the currently used three-piece suit to the single-piece CWU-66/P suit in early 1988. The new suit has the special feature of light weight, durability, fire-protective capability, and obvious improvements were found on the area of physiological functions. It is re-usable, washable, and easy to wear and take off. The glove used by USAF is the butylene rubber glove. When in use, a cotton inner glove is first worn, then the poison-protecting glove, and finally the standard pilot glove. Boot cover and cape were made of plastic materials and were worn when crossing the contaminated area of the airport. They would be taken off before boarding the aircraft with the assistance of the ground crew. /5

Fig 3: MK1 protection suit used by Royal Air Force of UK

Fig 4: French AMF80 protective shelter

Integral Protection -- NBC filtering device was installed on the aircraft of RAF to provide adequate positive pressure and clean and dry air for pilots wearing AR5 face mask. This filtering device was composed of a motor venting fan, voltage regulator, danger alarm system, and filtering can and was capable of guarding against decay, dust, and water. Service altitude of this system was 18300 meters and service temperature was -40 to +70C.

XM48 filter was equipped on the aircraft of USAF with rated air flow of $170m^3/hr$, weight of 13.62kg, and capacity of $2.27m^3$.

The integral protection device installed in 1981 for air bases of French Air Force was the AMF80 assembly poison-protecting shelter (figure 4). The basic elements composed of the 6 pre-stressed concrete pipes which were 2.35m in length and 2.5m in diameter. In the center of the pipe was the hall way and seats and supporting racks were at the two sides. Sanitary equipments were installed within the shelter and protection door, seal door, personnel entrance, explosion-proof door were all placed at the end of the pipe. Filtering and venting equipments were installed within. The venting fan could be operated in manual or electrical modes with a rated flows of $480m^3/hr$ and $120-240m^3/hr$ when operated in the electrical and manual modes, respectively. The air-tightness of the shelter was excellent, positive pressure could be maintained during entrance or exit of personnel, guard against chemical and biological agents and radiation protection were both excellent. The capacity of the shelter was 60 persons with 50 seats and 10 sick beds.

The integral protection device for Netherlands Air Force could provide NBC protection for half of the personnel of an Air Force base. 70% of the aircraft could be protected in the impact-proof structure. Commanding quarter and flight briefing room were adequately protected and were connected with the aircraft protective structure via ducts. Air Force pilots could enter into the protective structure from the flight briefing room through the duct without the concern of any contamination in the way.

In all, chemical warfare presented a tremendous threat for the Air Force pilots and even for the most mobile forces, encountering of the poisoned area is always a possibility. Therefore, except for providing adequate equipments for air force pilots and airports, the chemical protection training should be given in order to carry out combat flight missions effectively when complete protection suit is worn.

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