

Typical Representative and Trend of Military UAV

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Abstract

Military UAV has incomparable advantages over manned aircraft and has been widely used in the military field. With the development of science and technology, military UAV presents a new development trend. This paper mainly introduces the characteristics and typical representatives of the current military UAV, and analyzes the future development trend to provide reference for the research of military UAV.

Keywords

Military UAV; Typical representative; Development trend.

1. Introduction

Military UAV is the application of UAV in the military field. Because of its good stealth, zero casualties and high efficiency cost ratio, its development is highly valued by all countries in the world. The Western military countries, led by the United States, spend a lot of money on the research of military UAV technology every year, and have made a lot of achievements. At present, there are many kinds of military UAVs in the world, and the military tasks they undertake are also different. Through comparative analysis of the main characteristics, performance index and shortcomings of representative military UAVs, the future development trend of military UAVs is predicted.

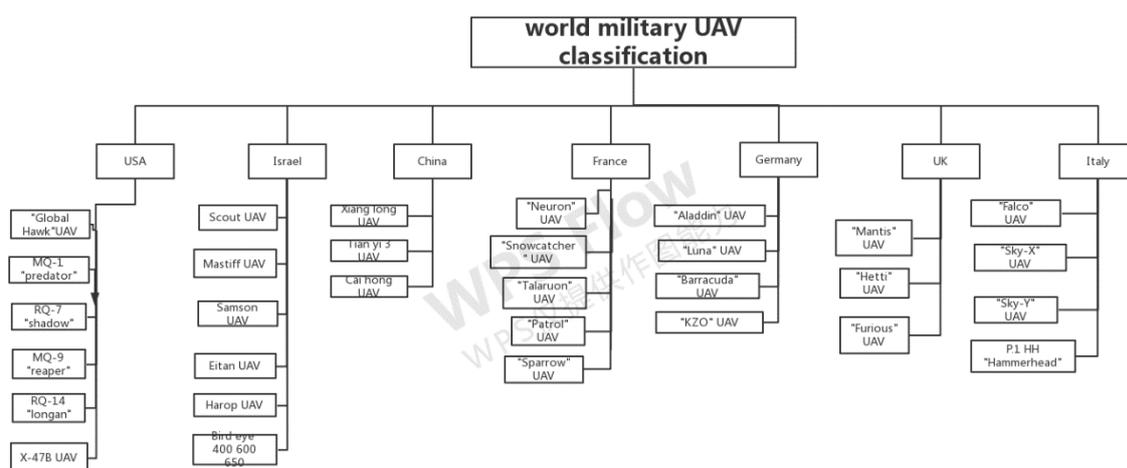
2. Main characteristics of military UAV

- 1) Zero casualties: military UAV can replace manned aircraft to carry out combat tasks in extremely harsh environment. In the process of combat, it is not necessary to consider the impact of physiological and psychological factors on the aircraft, and the most important thing is that no casualties will be caused.
- 2) Low cost: on the one hand, the retired aircraft can be transformed into UAVs. At present, many countries have adopted this method to save costs. In addition, the UAVs themselves can be recycled many times. On the other hand, compared with the manned equipment whose manufacturing cost is often tens of millions of dollars, the cost of developing and producing UAVs is relatively low, some of which only need tens of dollars, and the UAVs are small in size and low in fuel consumption, and the cost of later maintenance is very small.
- 3) Flexible mobility: military UAV does not need to carry the pilot, and has low requirements for takeoff and landing. It can be flexibly controlled according to the performance of tasks. A single soldier can operate by holding a radio remote control.
- 4) Strong Survivability: the UAV is small in size and equipped with stealth equipment, which is not easy to be detected by enemy radar on the battlefield, and can carry different equipment according to the mission changes, so it is easy to survive in the battlefield.

3. Military UAV classification and typical representative

At present, many countries in the world have UAVs, as shown in Figure 1, mainly including the United States, Israel, China, Russia, Britain, France, Germany and other European countries. At present, the main military UAVs can be divided into reconnaissance UAV, decoy UAV, electronic countermeasure UAV, communication relay UAV, drone and transport aircraft according to the combat tasks. Here are some typical military UAVs: MQ-9 Reaper UAV, "Global Hawk" UAV, "Avenger" UAV, "Neuron" UAV, "Heron" UAV, etc.

Fig. 1 Classification of military UAVs in major countries of the world



3.1 MQ-9 Reaper UAV

MQ-9 Reaper UAV is a 4.5-ton long endurance observation and combat integrated UAV developed by general atomics company of the United States. In 2002, research and development began on the basis of MQ-1 "Predator". The first test flight was completed in 2004, and then the UAV was mass produced in the United States. In 2006, MQ-9 Reaper UAV was officially named by the U.S. Air Force and entered the service stage. Recently, in addition to the 107 MQ-9 UAVs equipped by the US military, the RAF also has more than 10 of them. Due to the use of tpe331-10 turboprop engine, MQ-9 Reaper UAV has larger payload and faster flight speed than MQ-1 "Predator".

The MQ-9 Reaper UAV has a wingspan of 20 meters, a payload of 1360 kg, a maximum flight speed of 460 km / h, a sustainable preparation flight of 15 hours, a cruise flight altitude of 9000 meters (full load) - 15000 meters (no load), and can carry "helfa" missiles and more than 300 kg of attack ammunition. In spite of its stealth function, MQ-9, which is driven by propeller, has a large wingspan and poor maneuverability, and its comprehensive cost is up to 20 million US dollars, has been shot down many times. All of these show that the survival ability of large-scale long-distance UAV is very low in the battlefield and in the face of the regular army with perfect air defense system, and it can not dominate the sky at will.

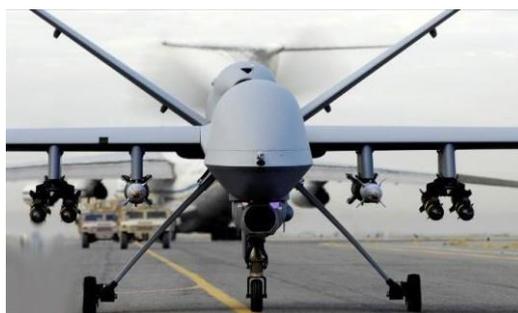


Fig. 2 MQ-9 Reaper UAV

3.2 Global Hawk

The global hawk, produced by Northrop Grumman, is the most advanced UAV of the U.S. Air Force and even the world, with a cost of US \$50-70 million. The Global Hawk has a body length of 13.4 meters, a wing span of 35.4 meters, a height of 4.6 meters, an empty weight of 3850 kg, and can carry a large amount of fuel to ensure its 42 hour endurance and a maximum range of 26000 kilometers, which is enough to carry out activities in the global scope, with little dependence on the ground base^[1,2].

The Global Hawk UAV has experienced many concept demonstrations and effectiveness evaluation before its service, and its performance is excellent. It can carry various reconnaissance equipment such as infrared, photoelectric sensing system and radar, and the band of different sensing systems work differently. Therefore, simultaneous interpreting the fixed target, the global hawk can also detect the mobile target of 20-200 kilometers per hour, and the accuracy of reconnaissance photos is within 1 meters^[3,4]. In addition, the Global Hawk also carries electronic countermeasures equipment, which can be used to attack enemy targets in real time. The Global Hawk has a flight altitude of tens of thousands of meters, so it is little threatened by the ground air defense system. Its advantage is that it can provide high-resolution intelligence, reconnaissance and surveillance images in near real-time, all-weather. The disadvantage is that the flight speed is not fast enough, it is difficult to avoid the pursuit of high-speed fighters, and the load is limited, so it can not carry a large number of equipment.



Fig. 3 Global Hawk UAV

3.3 Avenger UAV

"Avenger" UAV is a long-term, high and medium altitude, strong stealth, remote-control unmanned flight system, which is a new generation version improved on the basis of "Predator" and "Reaper". The payload that the UAV can carry will include all-weather ga-asi "lynx" multimode radar, ms-177 photoelectric / infrared sensor (EO / IR) and 2000 pound joint direct attack ammunition (JDAM). The Avengers have been tested on April 4, 13 and 14, 2009.

Avenger has increased its radar stealth function, with a payload of 136078kg and a maximum flight altitude of 18288 m. The UAV has more superior performance than the previous UAV. The weapon cabin can be equipped with additional fuel tanks, so it has a longer endurance and faster speed. At the same time, it can carry a variety of weapons and equipment. In addition to the reconnaissance and surveillance of marine and ground targets, it can also effectively attack time sensitive targets and complete many high-difficulty military tasks.



Fig. 4 Avenger UAV

3.4 Neuron UAV

"Neuron" UAV project is jointly completed by many European countries led by France. The project was initially undertaken by France independently. As the development of large and medium-sized UAVs involves many links such as scheme design, parts configuration, system integration and application test, it needs certain financial support. In order to reduce the development risk, France proposed to adopt multi-national cooperation mode, and finally Sweden, Spain, Italy, Switzerland and Greece also participated in it^[5,6,7,8,9,10,11,12].

The "Neuron" aircraft is about 10 meters long, with a wingspan of about 12 meters, a maximum takeoff weight of 7 tons, and a payload of more than 1 ton^[6,13]. Its shape design is similar to that of the b-2a stealth bomber. Its body is made of composite materials with less radar radiation, which has good stealth performance. In addition, it can carry attack ammunition. Under the cover of other manned reconnaissance aircraft, it will destroy the enemy when it is found.

The advantage of Neuron UAV is that it has the ability to identify the target independently. It can not only accomplish the task independently, but also cooperate closely with the UAV to carry out reconnaissance and strike flexibly. It is an integrated UAV with advanced technology. Its cost is lower than that of cruise missile, and it has higher efficiency cost ratio.

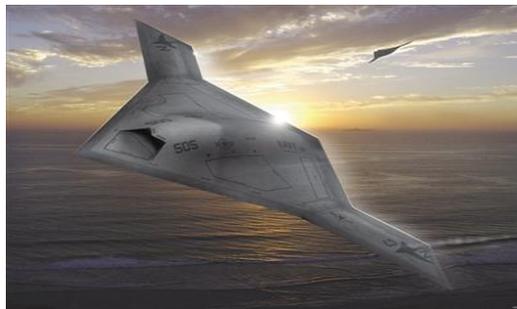


Fig. 5 Neuron UAV

3.5 Heron UAV

"Heron" UAV is an advanced hollow long endurance reconnaissance UAV developed by IAI company of Israel^[2]. It has independent take-off and landing capability, can carry a variety of reconnaissance equipment to search and identify targets, and is suitable for air sea operations and electronic warfare. The heron UAV made its first flight in 1994.

The "Heron" UAV is 8.5 meters long, 16.6 meters wingspan, with a maximum takeoff weight of 1100 kg. It uses a Rotax 914 turbocharged 4-cylinder 4-stroke engine, with a endurance of 52 hours and a mission radius of 350 km^[2,14]. According to IAI, the UAV can fly for 1000 kilometers autonomously, with a line of sight radius of up to 200 kilometers, and a line of sight data link of up to 350 kilometers. The "Heron" series UAV includes a variety of models, and the "Heron" I UAV can carry a 250 kg payload, such as a variety of radar and electronic or communication intelligence mission loads. Heron TP is a high altitude long endurance UAV jointly developed by Israel and France. It is equipped with a Pratt & Whitney pt6a-67a turboprop engine, which is about three times the size and weight of heron I UAV. It can carry spike and Hellfire anti tank missiles for combat, with superior performance.



Fig. 6 Heron UAV

4. Development trend of military UAV

- 1) Micro and miniaturization^[15]. Micro or small UAVs are small in size, low in noise, difficult to detect and identify, and hard to hit. They are very suitable for concealed operations and tracking, portable, convenient for storage and transportation, and suitable for urban operations and areas difficult for soldiers to enter.
- 2) Clustering. It will be a typical way of UAV combat in the future by imitating the behavior of biological groups in nature. UAV cluster operation has the characteristics of low cost, decentralization, flexibility and system robustness. It can carry different weapons to carry out a variety of combat tasks, including reconnaissance and surveillance, strike evaluation, deception and jamming, dispersed firepower, etc.
- 3) Intelligent^[16]. In the future, military UAVs can make full use of artificial intelligence, big data, distributed networking communication and other technologies to achieve intelligent operations. Through the autonomous intelligent system, the military UAV in the future can realize intelligent perception recognition, intelligent decision-making control and intelligent networking^[17,18].
- 4) Collaboration. In the face of complex and changeable battlefield environment, any kind of weapon and equipment can not be invincible. Only by combining multiple weapons and forming an efficient and cooperative combat system, can the overall combat capability be enhanced. The combination of military UAV, cruise missile, cruise missile and other highly lethal ammunition is more conducive to learn from each other and improve the odds.

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