

CHINESE STEALTH UAV CH - 7

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Abstract: The air show "Zhuhai 2024" was held from November 12 to 17, 2024 in Zhuhai (Guangdong Province - PR China). The fifteenth edition of the air show coincided with the celebration of the 75th anniversary of the People's Liberation Army of China. As the country's largest biennial aviation fair, the event attracted a huge number of visitors, who witnessed an impressive display of China's military and commercial aviation. 1022 companies from 49 countries of the world participated in the fair. At the fair, the People's Liberation Army of China presented 36 different types of equipment for aerial demonstrations and static displays, including the largest stealth unmanned aerial vehicle CH-7 (Cai Hong 7) in the form of a prototype. It was developed by the China Aerospace Science and Technology Corporation (CASC) [2]. The model of this stealth drone was premiered in Zhuhai at the 2018 fair. At the time it was designed to be a stealth armed reconnaissance drone. The aircraft was capable of carrying out bombing missions against the enemy's strategic targets. Its design is constantly adapted and improved for greater autonomy and stealth characteristics. Several versions of the CH-7 were produced. Six years later, the CH-7 unmanned aerial vehicle project underwent a change. From a strategic flight drone, it has become an advanced tactical drone capable of performing various missions. The CH-7 model shown at the "Zhuhai 2024" air show is significantly larger than the models shown at previous air shows and has a "flying wing" design.

Key words: PR China, Air Show, Unmanned Aerial Vehicles, Drones, Stealth Technology.

1. INTRODUCTION

At Zhuhai 2024, the Air Force of the People's Republic of China demonstrated its capabilities in air combat, air strikes, anti-drone combat, strategic delivery and landing, early warning and air defense, using new equipment that was shown publicly for the first time. A total of 26 aircrafts from seven different classes, including the J-20 fighter, the J-16 multirole fighter and the Y -20A tanker, performed flying demonstrations alongside the Bayi and Red Falcon aerobatic teams.

At the fair, the following were presented: the SkyHawk unmanned aerial vehicle with long autonomy and stealth characteristics, the GJ-11 Sharp Sword unmanned combat aircraft, which is projected as a "faithful wing companion" to the Chinese J-20 stealth aircraft, then the multipurpose drone CH-YH1000, CH-9 a heavy drone armed with KD-21 air-launched ballistic missiles. China's latest J-35A stealth aircraft (also known as FC-31 and J-31) was premiered at the show, making the PRC only the second country in the world to have two different fifth-generation fighters with reduced radar visibility technology[1].

The CH-7 Stealth Unmanned Aerial Vehicle represents a significant milestone in China's unmanned aerial vehicle development, reflecting its broader ambitions to enhance its reconnaissance and strategic attack capabilities against the enemy, using next-generation aircraft that have distinct stealth characteristics.

The development of the final version of the CH - 7 is in line with the continued efforts of the People's Republic of China to expand its inventory of long-range, low-visibility drones for reconnaissance and attack operations, that is, to improve and perfect the fleet of stealth drones.

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2. STEALTH TECHNOLOGY

Stealth technology (low-observable technology - LO technology) is a sub-discipline of military science and electronic countermeasures (active and passive), which includes a range of methods used to make personnel, aircraft, ships, submarines, missiles, satellites and all-terrain vehicles less visible (invisible) for radar, infrared, sonar and other detection methods. Corresponds to military camouflage for these parts of the electromagnetic spectrum.

The development of modern stealth technologies began in 1958 in the USA. Designers turned to developing specific shapes for aircraft that tended to reduce detection by redirecting electromagnetic radiation waves from radar. A material was tested and created that absorbed the radiation and reduced or blocked the radar signals that bounced off the surface of the aircraft.

The concept of stealth is to act or hide equipment and personnel without giving enemy forces an indication of their presence. This concept was originally explored through camouflage to make the appearance of the object blend into the visual background. As detection capabilities and interception technology increased, so did changes in equipment design. Some military uniforms are treated with chemicals to reduce their infrared signature. A modern stealth vehicle is designed to have the desired spectral signature[2].

Stealth consists of two main things: manufacturing weapon systems (plane, tank, ship) in a different form than conventional and painting those systems with a special coating, in order to affect the radar. In order for the weapon system to be covert, it needs to be designed so that its main surfaces are not rounded or oval, but with multiple angles to convey a broken shape, closer to the horizon. Special coating - in order to be a stealth weapon system, in addition to a different shape, it must be covered with a coating, a material that absorbs radiation. A radiation absorbing material is a material that is specially designed and shaped to absorb incident radio frequency radiation and absorb radio waves [3].

The principle of operation is as follows: When the radar sends radio or radar electromagnetic waves to an object that is round or oval, they are reflected in the direction from which they came, i.e. they return to the radar. If the object is made of many angles, broken and non-standard shapes, the waves are also reflected, but they do not return in the same direction. In order to prevent the radar's electromagnetic waves from accidentally returning to the radar, a radiation-absorbing material is used to absorb and not reflect the waves. In this way, the radar does not receive "feedback information". Stealth does not mean invisible to the human eye, but invisible to radar.

It is difficult to achieve zero detection of stealth objects, because the high speed of radar and radio-electromagnetic waves may return to the radar at some point, or the radar-absorbing material may not be able to absorb everything. A metamaterial is a substance designed to have a property not found in nature. He is able to manipulate electromagnetic waves by blocking, absorbing, enhancing or bending them to make things invisible. The metamaterial can be widely used in the development of new types of weapons and computer design, where conventional electrical signals will give way to photonic ones.

3. CHARACTERISTICS AND CAPABILITIES OF THE CH-7 STEALTH UAV

The CH-7 stealth drone is one of China's most sophisticated drones designed for high-risk missions. It has a flying wing configuration that minimizes detection by radar, reduces thermal signals, reduces the acoustic detection of the aircraft, that is, it has all the features necessary for covert flight in missions over territory that is saturated with anti-aircraft defense systems. It is designed for long-duration, high-altitude missions, including reconnaissance, intelligence gathering and precision strikes on high-value targets. It is a subsonic aircraft for high-altitude flight, which was developed on the basis of advanced aerodynamic, stealth technologies and control techniques [3].

Missions the CH-7 can perform include combat zone surveillance, electronic support and electronic jamming of adversaries at tactical aerial ranges, and detection of large warships.

CH-7 unmanned aerial vehicles are the "eyes" for other combat systems that will carry out the attack (fighter planes, bombers), which enter deep into the area controlled by the enemy using their own stealth technology and the ability to locate enemy warships, including aircraft carriers [1].



Figure 1 - CH-7 - stealth drone

The CH-7 (also known as the Rainbow-7, Figure 1) is a stealth unmanned aerial vehicle that can easily penetrate enemy airspace to conduct intelligence, surveillance and reconnaissance missions or armed attacks, without being detected by radar. Even if the CH-7 stealth drone is detected by the enemy's radar and shot down by air defense systems during the mission, it has already transmitted valuable information about the enemy to the command system. The stealth unmanned aerial vehicle CH-7 will be used primarily for early warning and for various types of maritime missions, in accordance with the requirements of the Chinese Navy.

It is equipped for reconnaissance and combat operations, including electronic warfare and precision strikes on targets such as command centers and missile launch sites. Internal weapons bays allow the aircraft to carry anti-radar, air-to-surface missiles and anti-ship missiles, thus preserving its stealth stability.

The CH-7 stealth drone has a length of about 10 m, a wingspan of 26 m (Figure 2), a maximum take-off weight of 10,000 kg, a maximum speed of 926 km/h and an autonomy of 15 h. It works effectively at altitudes of up to 13,000 m, and its operational range is up to 2,000 km. The maximum mass at take-off is about 13,000 kg, which is at the level of multipurpose combat aircraft (e.g. the Chinese-Pakistani JF-17) [1].



Figure 2 - CH-7 - stealth drone on the runway

New notable features of the stealth drone include a new "kite" wing design, new flaps, flat exhaust and sharp slanted wingtips. It is powered by a single turbofan engine with an internal weapons bay (to achieve low radar visibility). The aircraft can effectively reduce the detection range of enemy radars and perform reconnaissance, intelligence gathering and target indication for long-range weapon strikes in a highly confrontational combat environment.

4. CONCLUSION

Thanks to its stealth design, the CH-7 stealth drone reduces the detection range of enemy radars, avoids enemy anti-aircraft systems and significantly increases its effectiveness in demanding combat missions. It can fly at higher altitudes, detect enemy targets for longer periods of time and focus on surveillance and reconnaissance around the clock in very risky conditions.

It stands out for its intended ability to penetrate enemy airspace at high altitudes, gather intelligence and strike strategic targets. It can stay in the air for a long time, scout and engage the target. In a maritime environment, the CH-7 could extend China's influence over the Pacific, tracking enemy ships and delivering data on targets. Stealth unmanned aerial vehicle CH - 7 is also intended for export, like other unmanned aerial vehicles in the Caihong (Rainbow) series, except for the described larger variant, which is intended exclusively for the Chinese market [3].

The stealth capabilities of the CH-7 UAV are approximately at the same level as the stealth capability of the American-made RQ-180 UAV. The price of the CH-7 drone is affordable because it is in the HALE (High Altitude Long Endurance) category.

The stealth drone CH-7 is part of the wider strategy of the People's Republic of China to improve the capabilities of stealth drones. The CH-7 Unmanned Aerial Vehicle Development Program is a testament to the PRC's growing capabilities in unmanned aerial vehicle (UAV) technology and its commitment to developing a powerful fleet of drones for reconnaissance and combat missions, as well as its impact on the global arms market.

The Chinese Army plans to introduce the CH-7 stealth drone into operational use in the near future, which will complement the existing arsenal of drones.

5. REFERENCES

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