

Demonstration of development needs for near space and aerospace aircraft

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Abstract

On the basis of expounding the concept, classification and military application of the near space platform and the characteristics and military influence of the aerospace aircraft, it focuses on the demonstration of the requirements for the cooperative combat capability of the near space platform and aerospace aircraft in future wars. Coordinated reconnaissance and surveillance, coordinated early warning, and interception of anti-satellite weapons in key areas, using near space platforms as launch platforms for aerospace aircraft, and using aerospace aircraft as a means of transportation to and from near space platforms. It is foreseeable that the synergy between the near space platform and the aerospace aircraft will occupy an important place in future wars.

Keywords

Near space platform, aerospace aircraft, development demonstration, coordinated operations.

1. Introduction

Near space refers to the airspace 20-100 km from the ground. It can also be called suborbital or aerospace transition zone, which roughly includes the stratospheric region, the middle atmosphere region, and some ionospheric regions. As far as the current level of aerospace technology development is concerned, this part of the airspace is higher than the maximum altitude of ordinary aerospace vehicles and lower than the minimum altitude of orbital vehicles. Therefore, it is of special significance for the development of high-tech space and military applications.

Near space is an important strategic area of integrated air and space operations. It lies between traditional air and space. The area below it is usually called the "sky" and is the main activity space of traditional aircraft; the airspace above it is commonly referred to as "space". "It is the operating space of the spacecraft. Military equipment deployed in near space can threaten space-based platforms upwards, attack space-based platforms such as aircraft, and even ground targets downwards, and can complete communications, telemetry, intelligence, reconnaissance, and surveillance at a relatively low cost. Military mission. As an emerging research field, near space links traditional aerospace and aviation together, and has important application value and special military strategic significance in future space offensive and defense, information confrontation, and integrated joint operations. The world's major military powers are conducting in-depth research on the military applications of near space platforms, so as to gain advantages and dominance in future military confrontations^[1]. Therefore, it is of great significance to demonstrate the development needs of near space platforms and space aircraft.

2. Definition and classification of near space platform

2.1. Definition of near space platform

Near space platforms refer to aircraft such as balloons, airships, and gliders that work in near spaces. On the whole, the near space platform has the characteristics of low cost, fast response time, and high cost-effectiveness. It is also difficult to be discovered and tracked by the enemy's air defense surveillance system, and most traditional strike methods are also difficult to track and strike. If it can coordinate operations with ground and outer space systems, it will be possible to provide the command center with timely, stable, and reliable battlefield intelligence, which meets the requirements of efficient and rapid modern warfare. This is also one of the reasons why the coordinated operations of near space platforms and other systems have become the focus of attention and research of all countries in the world [2].

2.2. Classification of near space platform

From the perspective of military use, near space platforms can be divided into floating air balloons, stratospheric airships, mobile aircraft, and high-altitude long-endurance drones.

The floating air ball relies on the lighter than air filled material to provide lift. It is the simplest kind of near space platform. It is low in cost, but due to insufficient power equipment, its mobility and position retention capabilities are relatively poor, and the recovery of floating air balls is also difficult, resulting in fewer applications for floating air balls.

The stratospheric airship adopts the design concept of aerospace vehicles and relies on air buoyancy to balance its own gravity. Compared with floating air balloons, stratospheric airships are equipped with propellers, which can be used as power to achieve maneuvers such as hovering and low-speed horizontal flight. That is to say, the maneuverability of stratospheric airships is far superior to that of floating air balloons.

The mobile aircraft has the greatest military value among the near space platforms. The mobile aircraft is a semi-autonomous, new-type UAV concept that is lighter than air. Mobile aircraft can fly for a long time in the uppermost layer of the atmosphere and can be used as a communication relay and tactical surveillance platform; mobile aircraft are mainly used to support battlefield commanders and provide combat personnel with communications and intelligence, surveillance and reconnaissance. Mobile aircraft will be used as existing People monitor the addition of aircraft, not replace them, but many new technologies such as propulsion still need to be addressed.

High-altitude long-endurance drone refers to an unmanned aerial vehicle with a life span of ten hours, tens of hours, days, months, or even years. It is very suitable for intelligence in high-tech local wars. Reconnaissance and surveillance missions.

3. The characteristics of the near space platform and its combat mission analysis

3.1. The characteristics of the near space platform

The near space platform has the following advantages: large information perception range, high information resource detection accuracy, long continuous working time, wide coverage, fast response time, good stealth performance, strong survivability, large task load, and strong emergency combat capabilities.

3.2. Combat mission analysis of near space platform

3.2.1. Used as a reconnaissance monitoring and communication relay platform

In a war or battlefield environment, the near space platform can give full play to its characteristics of fast response time, long duration and wide area coverage, and successfully

complete reconnaissance, surveillance and other tactical tasks. Both near space platforms and low-altitude UAVs are suitable for this tactical mission, but the coverage area of near space platforms is much larger than that of low-altitude UAVs and lasts for several months, which is very suitable for battlefield and tactical applications.

Compared with the satellite platform as a communication relay, the near space platform has the advantages of easy realization of miniaturization, mobility, low cost, and short construction period of communication terminals. Compared with terrestrial wireless communication, the near space communication platform has a large coverage area, low transmission power, and is not restricted by terrain, and can work continuously around the clock. After the near space platform is configured with a communication load, it can provide strong communication capabilities for the ground, the sea and even the satellites. Communication and support play an important role in the connection between war zones on the battlefield^[3].

3.2.2. Used as a missile early warning platform

Another important application of the near space platform is to act as an airborne early warning platform. The near-space platform early warning aerostat can make up for the deficiencies of the ground, air, and space early warning systems, and track, monitor and locate ground, sea, and low-altitude flying targets around the clock. Combining spacecraft with nearby space platforms in the future information warfare can realize the integration of space and space reconnaissance and early warning, greatly improving the existing space reconnaissance, monitoring and regional early warning capabilities.

3.2.3. Used as a transportation supply and small attack platform

The near space platform has a huge effective volume, which can transport large-volume and high-quality weapons and equipment to the front lines of war, which is more cost-effective than air transportation and maritime transportation. The near-space platform can build a near-space space station as a replenishment and maintenance platform for near-space vehicles. At the same time, the near space platform has a certain combat capability after carrying certain weapons and equipment. It can defend and attack weapons and payloads that threaten the near space platform, and can also threaten the safety of the enemy's near space platform.

3.2.4. Used as an electronic countermeasure platform

The near space platform stays over the target for a long time and can conduct uninterrupted electronic countermeasures. The near space platform has a certain degree of maneuverability, and the flying height can be adjusted. Lowering the altitude of the near space platform can interfere with the enemy's ground electronic equipment and ground radar, and interfere with the time for the enemy's radar to find targets and early warning. It is for combat aircraft, missiles and satellites. Provide stable electronic countermeasures to improve the penetration capability, combat effectiveness and survival probability of these combat weapons during combat; increase the height of the near space platform, and launch high-intensity satellite reconnaissance and navigation jamming signals, thereby reducing the enemy. At the same time, nearby space platforms can also launch enhanced satellite navigation signals to suppress the enemy's interference with satellite navigation signals.

3.2.5. Used as a weapon launch platform and scientific research base

After the near space platform is equipped with certain weapon launching equipment and weapons, it can cruise over the theater for a long time. Once needed, it can launch weapons and strikes against enemy ground strategic targets, nearby space targets and space vehicles quickly from the air. This suddenness Attacks can greatly shorten the early warning response time, improve penetration capabilities, and have a strong strategic deterrent effect. Due to the special geographical location of the near space, it becomes a link connecting all resources inside and outside the atmosphere. The near space platform can be used as a "transit station" between the

earth, the air and the space, which can provide a stable flight environment and carry instruments closer to the real air and space. Perform some scientific experiments under environmental conditions.

4. The characteristics of aerospace aircraft and their military influence

4.1. Features of aerospace aircraft

Aerospace aircraft refers to an aerospace vehicle system that can repeatedly travel between the earth's surface and the space orbit, and can perform various payload transportation tasks between orbits. It takes off like an ordinary airplane and flies in the atmosphere at hypersonic speed. The flight speed can reach $Ma=12-25$ at an altitude of 30-100km, and it directly accelerates into the earth's orbit and becomes a spacecraft. After returning to the atmosphere, it will fly like an airplane. Landing at the airport. Prior to this, aviation and aerospace were two different technical fields. Aircraft and aerospace vehicles moved in and out of the atmosphere respectively. Air transportation systems were reusable, while space delivery systems were generally not reusable. The aerospace aircraft can achieve the goal of complete reuse and greatly reduce space transportation costs.

Compared with space shuttles, unmanned aerial vehicles, satellites and other aircraft, aerospace planes have their own characteristics, which are specifically manifested in the following aspects.

4.1.1. Powerful function, wide application range

The space plane can travel between the sky and the earth freely. It can send large satellites into the earth's orbit, or drop multiple satellites at one time; it can repair or recover satellites in orbit, and of course it can also attack enemy countries. The satellite destroys or even collects itself; it can transport or retrieve astronauts and various materials to the space station; more importantly, it can also perform various military tasks such as interception, reconnaissance, and bombing, making it a powerful air space. Heavenly weapons.

4.1.2. High flying speed and good maneuverability

The aerospace aircraft flies very fast, which facilitates rapid reconnaissance and strikes on a global scale, and can reach any area on the earth within two hours.

4.1.3. Simple deployment and strong emergency combat capability

The space shuttle is different from the space shuttle in that it has simple ground facilities, easy maintenance and use, and low operating cost. It can take off and land horizontally at ordinary large airports and has the flight frequency of general airlines. Aerospace aircraft can often be deployed in large numbers in a short period of time due to their relatively easy take-off and reusability. The preparation time is often no more than one day, and the cost will be greatly reduced. It is estimated that the cost of launching a near-Earth satellite with it is only 1/5 of the space shuttle, while the cost of launching a geostationary satellite can be reduced by half.

4.1.4. Strong survivability and great deterrent effect

In combat, due to the extremely fast flight speed of the aerospace aircraft, the radar will have greater difficulty in capturing its traces, thereby weakening the function of the opponent's anti-missile system; the aerospace aircraft is also equipped with a "manipulator" that can capture satellites at any time. Can strike or interfere with satellites. Since many aerospace aircraft do not need to consider aerodynamic layout, the aerospace aircraft can be loaded or mounted with a variety of weapons; when equipped with missiles, the aerospace aircraft can become a standard aerospace fighter, deterring other countries' spacecraft and space facilities.

4.2. Military influence of aerospace aircraft

The aerospace aircraft has a wide range of military application prospects and will be able to carry military missions in the future, and then it will truly evolve into an aerospace fighter. If the aerospace aircraft develops into an aerospace fighter, it will lead to the following changes in future wars.

4.2.1. Combination of air and space theater of war, faster warfare and higher war space

Due to technical limitations, the two battlefields of space and air have not yet merged into an integrated battlefield. If aerospace fighters appear, they will effectively and organically integrate the combat areas and battlefields of the sky and space; because the aerospace planes have very good speed and maneuverability, countries with aerospace planes will almost have a rapid global attack. Capabilities and systems will make the speed of war faster; air-space fighters may slowly develop the field of combat from the ground, sea, and air to the earth's orbit or even higher and farther places, making war truly develop into "Four-in-one" all-round war.

4.2.2. Air defense will develop towards the integration of air, space and ground

In modern warfare, the application of stealth aircraft and precision-guided weapons has made air penetration, ground air defense and even space air defense develop in an integrated direction. However, if aerospace aircraft are used in warfare, this integration will increase. The flight speed will greatly reduce the interception probability of the air defense system due to the short reaction time, and can effectively restrict the overall functions of the early warning system, ground air defense weapon system, and space air defense weapon system. Therefore, the aerospace aircraft will have an impact on the overall The air defense system puts forward higher requirements.

4.2.3. Space support will be faster and more effective

The aerospace aircraft can be launched at a lower cost, enabling it to rapidly deploy small satellite clusters and recover satellites, and can repair orbit spacecraft, which will greatly supplement the guarantee of space operations.

5. Analysis of coordinated combat missions of near space platforms and aerospace aircraft

Due to the huge military significance and military influence of the near space platform and the aerospace aircraft, if the two work together in future wars, they will have a huge impact on future warfare methods.

5.1.1. Reconnaissance and surveillance of targets in key areas

For moving targets outside the key areas, various optical imaging reconnaissance, radar and other reconnaissance equipment of near space platforms are used to carry out reconnaissance, detection, surveillance and positioning with high time resolution; while for moving targets within the key areas, air space is mainly used. Skyplane conducts continuous and real-time monitoring, detection and positioning, and transmits the detected target information to the combat command department in real time. At this time, the role of aerospace aircraft is equivalent to a fast-response low-altitude reconnaissance drone.

5.1.2. Early warning and interception of anti-satellite weapons or missiles

In the early warning of anti-satellite weapons and missiles, ballistic missile early warning satellites and radar detection satellites can be used for long-range, high-altitude and low-altitude target detection. Satellites and missile early warning near space platforms form an early warning detection system, and near space platforms and satellites are used to target key areas. Carry out large-scale continuous surveillance and detection. Once a suspicious military

situation is found, the aerospace plane will be used to quickly and real-time warn the small-scale key suspected areas and intercept them.

5.1.3. The near space platform can be used as a launch platform for aerospace aircraft

Aerospace aircraft need to enter and exit the atmosphere many times, each time they will generate a lot of aerodynamic heating due to the violent friction with the air, especially when returning to the atmosphere at hypersonic speed, aerodynamic heating will make the surface reach extremely high temperature. The heat-proof structure and materials of the aerospace plane are subject to huge wear and tear, and the aerospace aircraft needs about a week of maintenance time after completing a flight mission to take off again, which will greatly reduce the reusability of the aerospace aircraft in a period of time. And rapid response; and if launched from a nearby space platform, it will reduce the abrasion of the aerospace aircraft's thermal structure and materials, thereby reducing the requirements for the aerospace aircraft's thermal structure and materials in the process of development and use. The launch of the space plane on a nearby space platform can also greatly shorten the start-up time of reconnaissance and surveillance missions in future wars, as well as the response time of the space plane to satellite launch, satellite repair or recovery, and damage to enemy satellites and spacecraft. Therefore, the launch of aerospace aircraft on a nearby space platform will more satisfy the requirements of the speed and integration of future wars.

5.1.4. Can be used as an organic supplement to the foundation and space-based rapid response system

At present, rapid response technology has been widely valued by military powers in the world, given the huge potential advantages of space rapid response technology. It is foreseeable that space rapid response technology will play an increasingly important role in future space exploration, space development and space applications. The development of rapid response in space is a complex system engineering involving ground support, transportation and space. The concept of rapid response in near space has not yet been proposed. The stability of near space platforms and the maneuverability of aerospace aircraft can be used as foundations. With the organic supplement of the space-based rapid response system, it has become an alternative way for the rapid response space system to achieve fast, low price, and simple operation requirements.

5.1.5. As a military transportation tool near the space platform

The near space is in the transition zone between space and space, making it a link connecting the ground, ocean, sky and outer space resources. The near space platform can be used as an experimental platform to provide a more realistic aerospace environment for military scientific experiments; at the same time, the near space is in a blank area of human military transportation, and the near space platform can be used as a military base. Due to its advantages in flight height, flexibility, flight distance, safety and reliability, the aerospace aircraft can be used as a military transportation tool near the space platform.

6. Conclusion

Due to its potential military value, the nearby space platform has become a hot spot of recent research in various countries. On the whole, the near space platform technology is still in the key technology research and demonstration stage, while the research on the synergy between the near space platform and other aircraft carried out by various countries is still in its infancy, but its huge military value has already caused the United States The military powers in the world attach great importance to it. As far as the synergy between the near space platform and the aerospace aircraft is concerned, it may include coordinated reconnaissance and surveillance of key areas, coordinated early warning and interception of anti-satellite weapons,

so that the near space platform can be used as a launch platform for the aerospace aircraft, and the aerospace aircraft can be used as a means of transportation to and from near space platforms.

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