Cable Dragging Horizontal Takeoff Spacecraft Air Launch System

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Abstract

This paper proposed an Air Launch System which uses cables with auxiliary wing to drag spacecraft into upper air. This launch system can make air launch more effective and easier, and the launch devices can be recyclable and reusable. It is a potential and easy way to reduce the cost of space launch.

Key words: air launch, cable dragging, horizontal takeoff

1. Cable Dragging Horizontal Takeoff Spacecraft Air Launch System

Cable Dragging Horizontal Takeoff Spacecraft Air Launch System (CDHTSALS) is composed with Dragger(1), Cables(2), Auxiliary Wing(3), Upper Stage Carrier(4) and Upper Stage(5). The left points of Cables(2) are connected with the gravity center point of Dragger(1). The right points of Cables(2) are connected with the head of Auxiliary Wing(3).

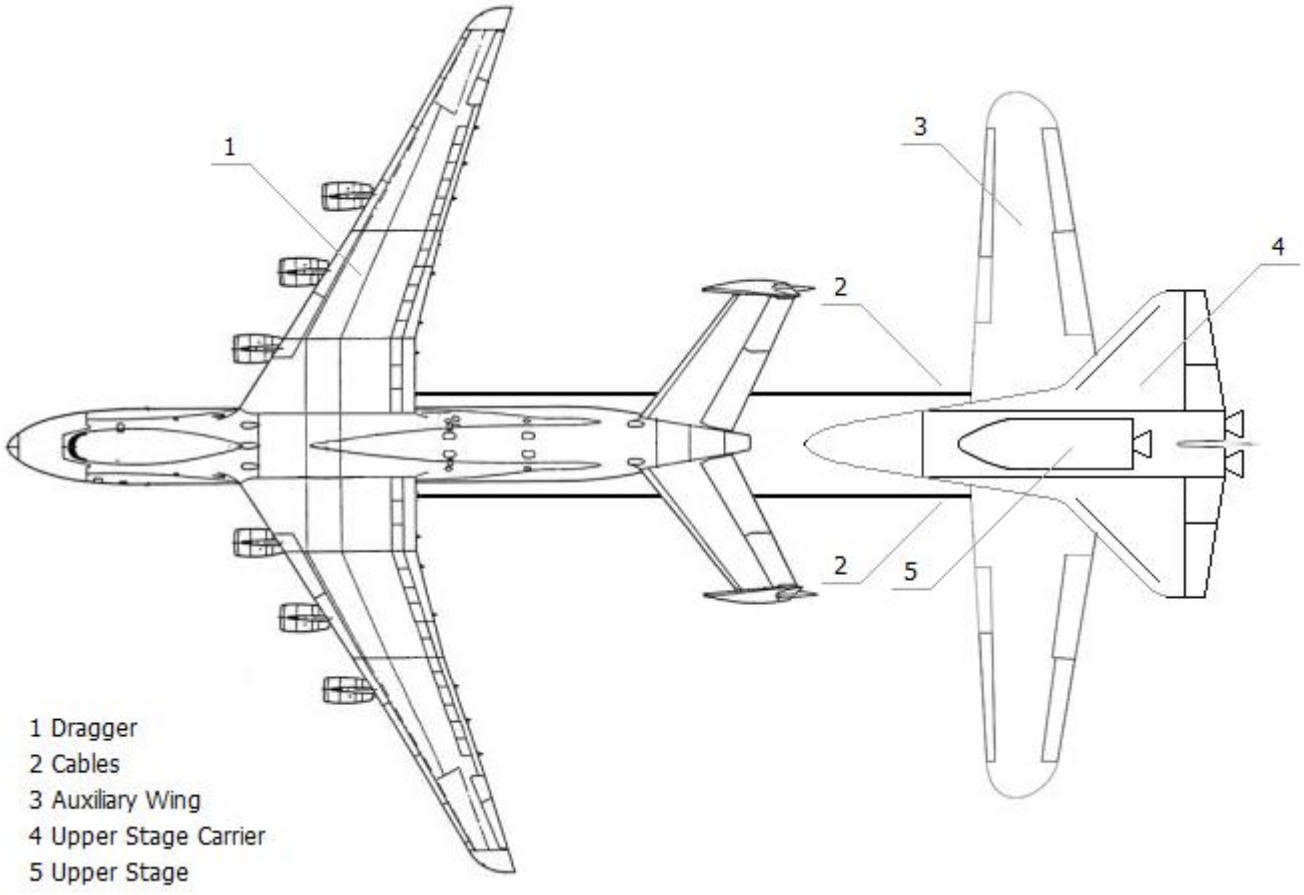

Figure 1: CDHTSALS Top View

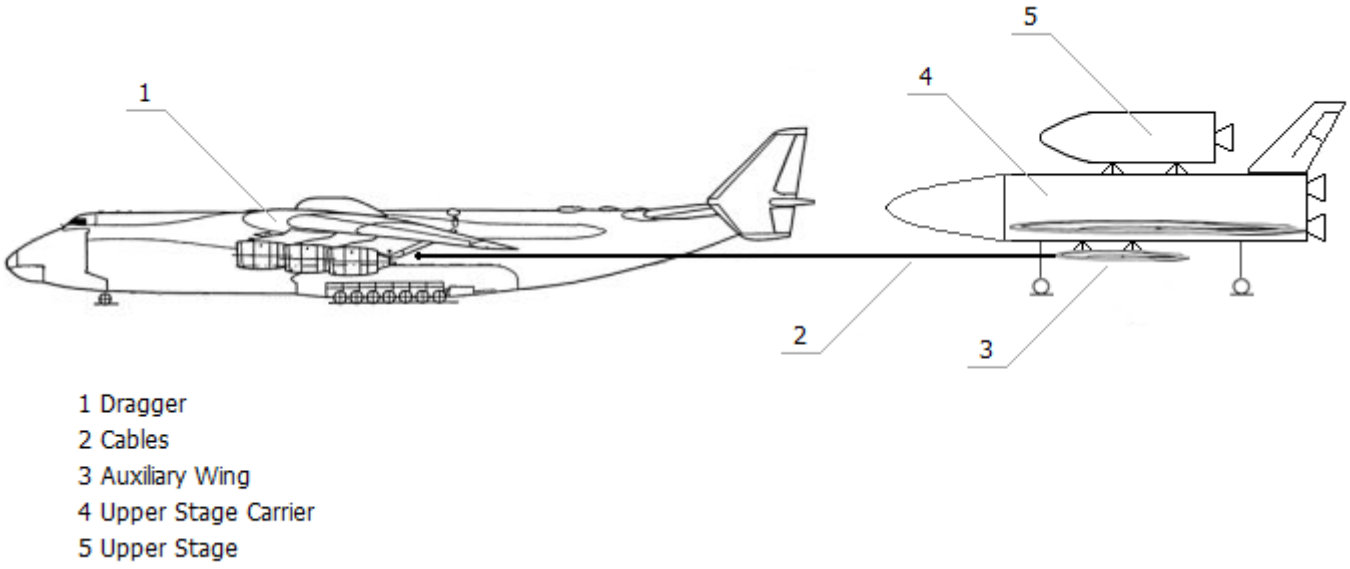

Figure 2: CDHTSALS Side View

2. The launch process of CDHTSALS

2.1 Take off from the ground horizontally

The figure 2 is the status when CDHTSALS is taking off horizontally from the ground. Only the engines of Dragger(1) are firing, the engines of Upper Stage Carrier(4) and Upper Stage(5) are not working. The Dragger(1) drags all the other devices with the Cables(2) and speed up on the ground. When the speed is high enough, CDHTSALS will take off from the ground. The Auxiliary Wing(3) can provide more lift force for the Upper Stage Carrier(4) to make it take off.

CDHTSALS will fly up to about 10 KM altitude and provide the Upper Stage Carrier(4) a initial velocity which under Mach One.

2.2 Separate with the Upper Stage Carrier

When CDHTSALS has speeded up to the target speed and altitude, the Upper Stage Carrier(4) will disconnect with the Auxiliary Wing(3). The Cables(2) and the Auxiliary Wing(3) will be recycled by the Dragger(1). And the Upper Stage Carrier(4) will carry the Upper Stage(5) and start it's engines, and continue to accelerate with its own engines. Because the Upper Stage Carrier(4) already has a initial velocity and

altitude, it is definitely possible that the Upper Stage Carrier(4) can continue to speed up to the speed over Mach Five with its own engines. The Dragger(1) will take with the Cables(2) and the Auxiliary Wing(3) and fly back to the ground.

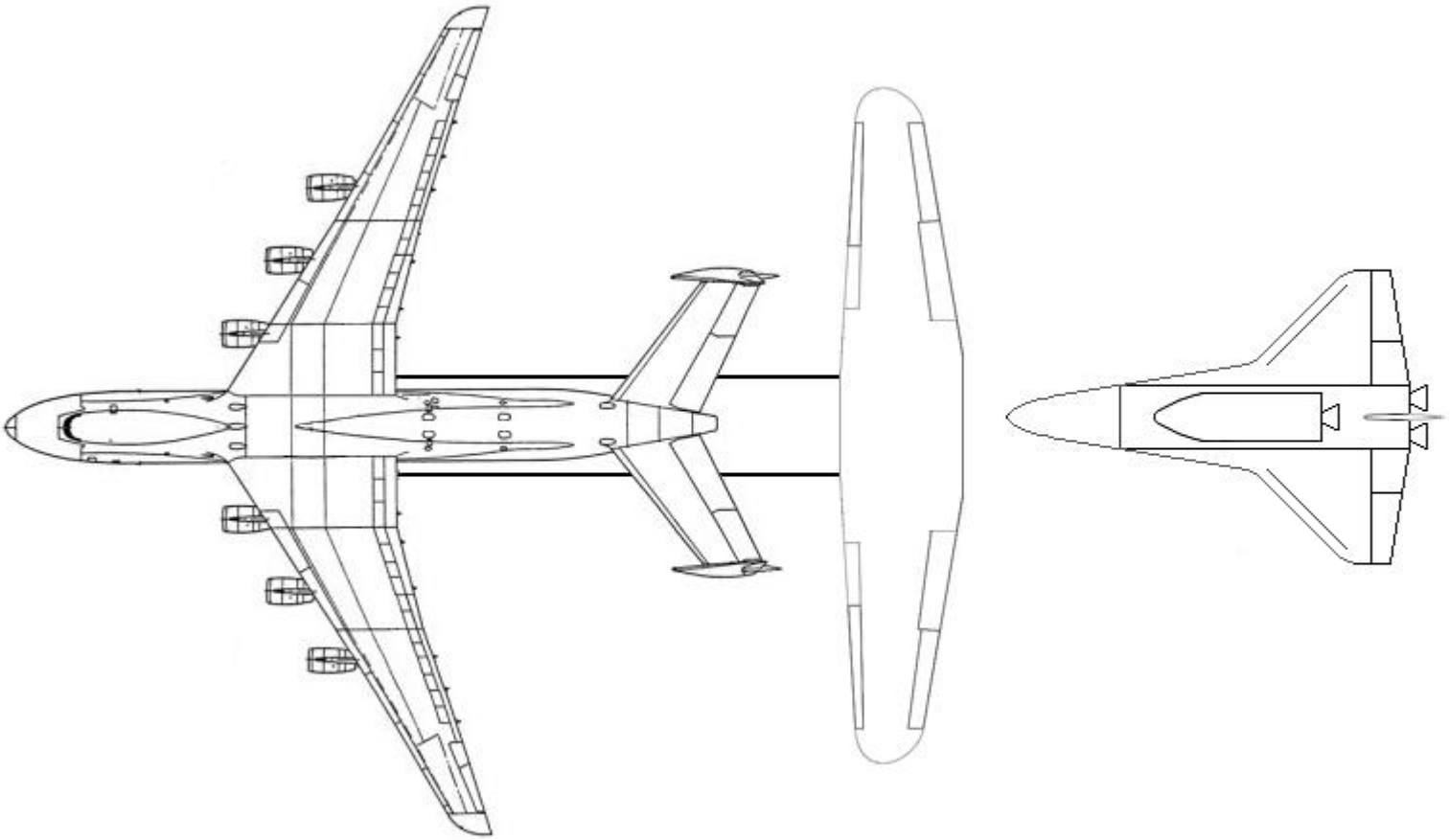

Figure 3: Separate with the Upper Stage Carrier

2.3 Separate with the Upper Stage

When the Upper Stage Carrier(4) has finished its acceleration work, it will separate with the Upper Stage(5). At this moment, the Upper Stage(5) has a initial velocity which over Mach Five. The Upper Stage(5) will start its own engine and continue to accelerate and finally enter an Earth orbit. The Upper Stage Carrier(4) will glide back to the ground without fuel. This means the Upper Stage Carrier(4) is reusable. The combination of the Dragger(1) and the Upper Stage Carrier(4) has the

same function with the first stage of a traditional rocket. But the difference is that the Dragger(1) and the Upper Stage Carrier(4) are both recyclable and reusable.

3. Why CDHTSALS is more effective

The traditional air launch systems do use cables, and the rocket is put on or hung on the aircraft. This leads to there is no enough place to install auxiliary wing and the lift force will not enough to carry a heavy rocket. And the structure of the aircraft must be very strong to carry a heavy rocket. But in CDHTSALS, the Dragger(1) does not bear the weight of the other devices, so the Dragger(1) in CDHTSALS can be lighter. And the Auxiliary Wing(3) can create more lift force.

With cables, the frontal area of CDHTSALS can be smaller than the traditional air launch systems. And the attack angle of the Auxiliary Wing(3) can be dynamically adjusted naturally. The cables can reduce the vibration which transferring from the engines of the Dragger(1) to the Upper Stage Carrier(4). This makes the Upper Stage Carrier(4) can use liquid fuel rocket easier which has higher specific impulse than solid fuel rocket. And in CDHTSALS, the Upper Stage Carrier(4) can be easily recycled and reused.

5. Conclusion

Cable Dragging Horizontal Takeoff Spacecraft Air Launch System is more effective than the traditional air launch systems. And the Dragger(1) and the Upper Stage Carrier(4) are both recyclable and reusable. This makes it a potential way to reduce the cost of space launch.