China achieves first land-based rocket recovery

The Innovation News Team*
*Correspondence: reviews@the-innovation.org

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As the countdown reached zero, a red-and-white carrier rocket unlocked from its tower and ascended into the sky above China's Gobi Desert. Approximately 130 seconds after liftoff, the vehicle executed stage separation. While the second stage continued its flight to accurately insert its payload into orbit, the exhausted first stage initiated a high-altitude, large-angle attitude adjustment. At an altitude of roughly 80 kilometers, the booster performed a critical reentry burn to decelerate and correct its ballistic trajectory. In the final moments before touchdown, four landing legs equipped with two-stage buffering mechanisms deployed synchronously. The silver rocket body settled firmly onto the pad, triggering sustained applause throughout the mission control hall.

On August 19, 2026, the Zhuque-3 Y2 carrier rocket, manufactured by the Chinese private commercial aerospace company LandSpace, launched from the Dongfeng Commercial Aerospace Innovation Test Area. Following its pre-programmed sequence, the rocket's first stage successfully completed a land-based recovery (Figure 1). This milestone represents China's first successful implementation of a first-stage recovery utilizing deployable landing legs, signifying a major technological breakthrough in the nation's pursuit of reusable launch vehicles.

CHINA'S FIRST LEG-BASED ROCKET RECOVERY

The Zhuque-3 is designed as a heavy-lift, low-cost, and reusable liquid-propellant carrier rocket, tailored specifically by LandSpace for the deployment of large-scale satellite constellations.

The vehicle utilizes a single-core, two-stage tandem configuration with impressive specifications:

Total length: 66.1 meters
Stage diameter: 4.5 meters (for both first and second stages)
Fairing diameter: 5.2 meters

The successful vertical recovery of the first stage systematically validates the engineering feasibility of LandSpace's chosen technological pathway: utilizing a liquid oxygen-methane propellant system, constructing the airframe from stainless steel, and executing vertical recovery via deployable landing legs.

"The deployable landing leg recovery scheme offers a clear technological path with the highest degree of engineering certainty," a LandSpace representative told Chinese media. "It has been verified hundreds of times by SpaceX's Falcon 9 rocket and is fully capable of meeting the demands of high-frequency reuse."

However, this triumph was preceded by significant engineering hurdles. On December 3, 2025, China's first attempt at rocket recovery using the inaugural Zhuque-3 Y1 ended in failure. During that flight, while the second stage reached its target orbit, the first stage experienced abnormal combustion during the final deceleration phase. The booster crashed mere tens of meters away from the recovery pad, falling just "one step short" of a successful landing.

Figure 1. Zhuque-3 Y2 first-stage successful landing recovery Officially authorized by LandSpace

A DUAL-TRACK STRATEGY FOLLOWING SEA-BASED SUCCESS

LandSpace's achievement comes just 40 days after another historic milestone, highlighting a rapidly diversifying launch ecosystem in China.

On July 10, 2026, the Long March-10B carrier rocket successfully recovered its first stage via a sea-based net capture mechanism.[1] Spearheaded by the China Academy of Launch Vehicle Technology (CALT) under the state-owned China Aerospace Science and Technology Corporation (CASC)—often referred to as the "national team"—this mission made the Long March-10B China's first launch vehicle to achieve an orbital-class first-stage recovery, and marked the world's first successful "net-based recovery."

The two approaches represent fundamentally different engineering philosophies. Land-based recovery relies on the rocket's own landing legs, using engine thrust reversal to decelerate, low-altitude hovering for trajectory correction, and finally a vertical soft landing on a prepared pad. Sea-based net recovery, by contrast, uses engine deceleration followed by capture by a suspended net, effectively hanging the booster in mid-air above the ocean platform.

Industry analysts note that land recovery offers lower refurbishment costs and faster turnaround times, making it well suited to high-frequency commercial missions where rapid reuse is paramount. Sea-based recovery, while more expensive, can accommodate heavier boosters and is compatible with launch trajectories that do not permit overflight of land-based recovery sites. The two methods are complementary, together forming what Chinese officials describe as a "land-sea dual-line" reusable rocket technology system.

FUELING THE LOW-EARTH ORBIT ECONOMY

The push toward reusability is driven by stark economic realities and strategic national goals.

A LandSpace executive explained in an interview with Chinese media that a rocket's first stage accounts for approximately 70% of the entire vehicle's manufacturing cost. By successfully recovering and reusing the first stage multiple times, launch providers can significantly dilute the cost of individual missions while substantially boosting launch frequencies. The executive emphasized that low-cost, high-frequency launch capabilities are not only essential for commercial space companies to achieve profitability and sustainable development, but also provide crucial transport support for the construction of low-Earth orbit satellite internet networks.

For China's broader space ambitions, including its Guowang and Qianfan satellite internet constellations, the successful validation of two distinct reusable rocket architectures brings the country significantly closer to the economical, high-cadence launch capacity that has so far eluded all but one nation.

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DECLARATION OF INTERESTS

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