HOW A SHAPE-CHANGING DRONE WORKS

This go-anywhere unmanned aerial vehicle takes off like a drone but cruises like a plane

WORDS AILSA HARVEY

The Transwing P4 has a maximum takeoff weight of 41 kilograms

Is it a bird, a plane or a drone? The Transwing P4 by PteroDynamics is a unique vertical takeoff and landing (VTOL) drone, built for covering long distances. It combines the hovering ability of a multi-rotor drone with the speed and efficiency of a fixed-wing aircraft. Inspired by the way birds fold and unfold their wings, the Transwing changes shape during flight to adapt to different phases of its mission. Like a typical drone, the Transwing can take off vertically with its wings folded tightly against the fuselage. Once airborne, electric actuators unfold the wings into a fixed-wing configuration. This means it can hover like a standard drone as well as glide like a conventional fixed-wing aircraft.

The Transwing remains in cruise mode until the last moment, when the process is reversed and the aircraft returns to its hovering VTOL stance. By transitioning as late as possible, the wings are utilised for longer. When the wings fold, the motors need to work harder to have the drone perform a controlled landing. Holding off on this transition means that more energy is saved and hovering time is reduced.

The drone comes in different models and sizes – the Transwing P4 and Transwing P5 prototype. The P4 has a wingspan of four metres and can carry a maximum payload of 6.8 kilograms. It's mainly used for maritime cargo delivery between ship and shore. The Transwing P5 is a larger hybrid-electric model that can be used for flights up to 460 miles on a single tank of fuel. Its wingspan measures seven metres and it's capable of carrying 23-kilogram payloads. The Transwing's patented wing-folding design makes it unique among VTOL drones. With its combined ability to take off from almost any location and morph from hovering to long-range cruising, the Transwing challenges the limitations of traditional flight.

DID YOU KNOW?

The Transwing P5 can fly for ten hours at a time

IN-FLIGHT FOLDING

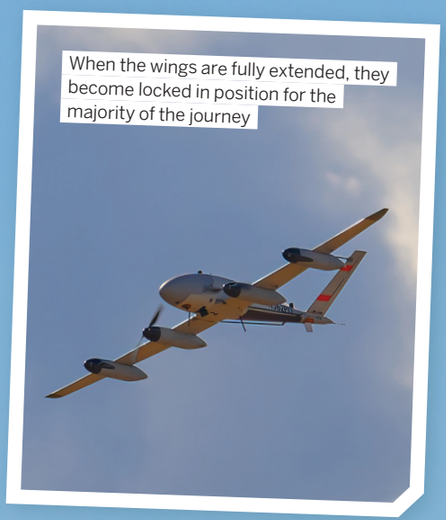
How a Transwing P4 transitions between three stages of flight

1 WINGS EXTENDED
When the wings are fully extended and the propellers are folded, the drone operates in efficient fixed-wing flight, with maximum aerodynamic lift providing a longer range. The fixed-wing flight range is 69 miles. In this configuration, the Transwing can carry payloads farther.

DID YOU KNOW? In 1954, a VTOL aircraft completed a transition from vertical takeoff to horizontal flight for the first time

TECHNICAL TRICKS

Transwing drones maintain stability through a technique called weathervaning. This feature sees the drone pivot its nose so that it's always facing oncoming strong wind. When facing the wind nose-first, it's more aerodynamic and can fly with increased stability. Weathervaning prevents unwanted lift being generated by the wind and can reduce the chances of drones flipping or losing altitude. For longer journeys, the drone can fly well in gustier conditions. Transwing drones have four motors mounted on the ends of the wings and fuselage. These motors are used to both lift and cruise the aircraft, rather than requiring a separate propulsion system. When cruising, all four motors can move and climb faster, at speeds up to 115 miles per hour.



When the wings are fully extended, they become locked in position for the majority of the journey

The Transwing P4 has a fuselage length of two metres

NO PILOT NECESSARY

The Transwing can operate in confined spaces and doesn't require a runway to launch. The aircraft can be used for military logistics, surveillance and reconnaissance, maritime resupply, intelligence, emergency response and environmental monitoring. The drone was originally developed for defence and logistics, making it best suited for operation from ships, remote military bases and disaster relief areas. When it's delivering a payload to a base, the drone autonomously releases it upon reaching the destination. For autonomous operation, a drone operator needs to upload a flight plan with waypoints, altitude and speed, which the Transwing follows during flight using GPS, accelerometers, gyroscopes and other sensors. Its flight computer processes data from its sensors hundreds of times per second. Depending on the mission, the drone can also autonomously operate cameras and surveillance sensors to focus on specific targets.

Payloads for different missions are inserted into the central fuselage so the drone's centre of gravity is maintained in all wing configurations

2 TRANSITION
The wings gradually unfold shortly after takeoff and fold before landing. During this transition, the drone remains in controlled flight on a smooth, flat trajectory. The propellers control both lift and thrust, enabling the aircraft to climb or descend while it's between flight stages.

3 WINGS RETRACTED
When folded, the wings are tight around the fuselage, meaning the drone's mass is distributed more centrally. This is deployed for takeoff and landing. The wings fold around hinged joints and, when fully retracted, the drone can hover with precision to take off and land in confined spaces.