

Precision Guided Parachutes

Used to deliver critical cargo, these unmanned aerial vehicles (UAVs) provide unprecedented accuracies in flight.

The Onyx guided parachute designed and manufactured by Atair Aerospace (NY) is an autonomous precision airdrop system. Each system fulfills the precision airdrop requirements under the U.S. Army's Joint Precision Airdrop System (JPADS) program, which was developed to transition the U.S. military's WWII-era low-altitude, low-accuracy, high-vulnerability airdrop practices into the twenty-first century. Atair's Onyx is a family of fielded, commercial off-the-shelf systems designed with the capabilities of delivering payloads ranging from 0 lbs to 2200 lbs, through the use of a variety of sized UAVs.

Onyx systems can be likened to smart bombs, but are used for the safe, precision delivery of sensitive or essential cargo to difficult to reach or dangerous locations. Each system is deployed from the air using military fixed-wing and/or rotary aircraft, such as a C-130 or C-17. Deployment can happen at altitudes up to 35,000 ft and at speeds up to 150 KIAS. The systems autonomously glide over 44 km and land cargo within 100 m of its selected target. Onyx systems provide military planners with the capability of strategically and covertly positioning equipment and supplies for rapidly moving ground and special operations forces. Onyx systems can also be used for the precision emplacement of unattended ground sensors and small munitions deployed from military aircraft and UAVs.



Key Features of Onyx Systems

- Available in three payload configurations: Micro Onyx (0 to 20 lbs), Onyx 500 (0 to 500 lbs), and Onyx 2200 (500 to 2200 lbs)
- Accuracy of 100 m
- Patented 1 two-parachute ("hybrid") system uses a high-speed elliptical parafoil for autonomous guidance, and a round recovery parachute for a reliably soft landing
- Flocking/Swarming (formation flying) and active in-air Collision Avoidance for simultaneous deployment of up to 50 Onyx systems
- Adaptive Control, an advanced self-learning method for flight control, enables gross variances in cargo weights to be airdropped
- High glide ratio over 4.5:1 provides a horizontal standoff of 44 km from an altitude of 35,000 ft
- Deployable from military fixed-wing and rotary aircraft up to 150 KIAS
- Ultra fast flight speed (80 kts) increases accuracy and reduces vulnerability to wind-induced errors and detection
- Continuously dis-reefed guidance parafoil provides for lowest opening shock and high speed deployment capabilities
- Rigger-friendly, fully-recoverable, modular, and reusable system
- Onyx 2200 is fully compatible with A-22 CDS bundles

System Operation

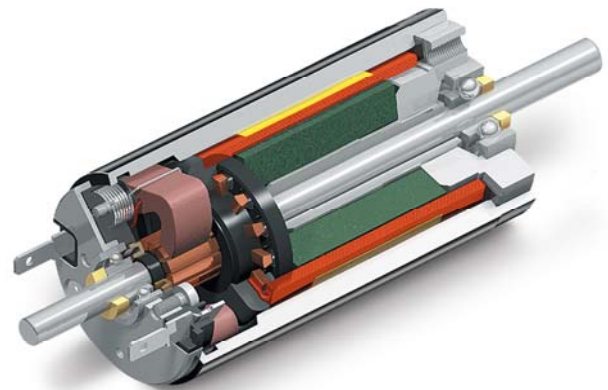
Onyx is a patented, two-parachute hybrid that uses a high-efficiency, ram-air elliptical parafoil for autonomous guidance. To provide a soft landing for sensitive cargo, the system uses a round recovery parachute. A proprietary on-board guidance, navigation and control system incorporates an integrated GPS and inertial navigation system to continually adjust to the flight characteristics of the system, as well as the weather conditions throughout the flight, to control the system to a pre-programmed altitude and position. The second, non-guided round Recovery Parachute deploys just prior to landing for a soft touchdown at its programmed point of impact.

Atair has developed an adaptive control designed to increase the mission critical capabilities and flexibility in deployment of Onyx systems. Adaptive Control enables Onyx systems to fly correctly with gross variances in wing loading, asymmetrically-rigged payloads caused by pre-flight rigging errors or cargo changes, and even correct for damage induced while in flight. In fact, using real-time collision avoidance and swarming/flocking flight algorithms Onyx can operate where multiple systems are deployed in the same air space. Dynamic payloads can be guided to one or multiple targets without the possibility of midair collisions. Each system controller operates in a decentralized fashion so that there is no need for a supervisory control.

Onyx flight patterns are controlled by having the controller interface with two steering winches, which are attached to the parafoil. The winches either draw in or pay out the parachute similar to that of the ailerons of an aircraft. The Onyx systems all use motors and planetary gearheads manufactured and modified by Maxon Precision Motors (MA). One motor/gearhead combination is used to adjust the right side of the parachute, and one combination maneuvers the left side.

“Customization was necessary for our use,” says Daniel Preston, CEO & CTO of Atair Aerospace. “The motors are actually used at up to six times its rated output power.” Customizations include special lubricants for high altitudes, and for full mil spec temperature ranges — from -50 degree to +85 degree C. Motor components that are typically press-fit had to be laser welded as well. “The motors needed to handle shock and vibration beyond what a typical motor would see,” Daniel says.

Even the planetary gearheads used in the systems had to be modified using special, non-standard materials to strengthen its capabilities. Different alloys and different heat treatments were used to provide the internal components of each gearhead. Although all customizations were initially completed by Maxon Motor at its factory, Atair has duplicated some of the specialized tooling needed so that elements of the customized motors can now be done in-house.



The Maxon RE motors are high-quality motors fitted with powerful permanent magnets. High efficiency, no cogging, low inertia drives.

“Maxon is extremely accommodating to our customization needs,” Daniel says, “that’s why it’s easy to work with them.” He added that Maxon’s customer service through local sales engineers was an additional factor in a long-term relationship with Atair. The company uses Maxon motors and planetary gearheads in all their Onyx systems from the lightest payload to the heaviest. They also use Maxon motors in 90 percent of the company’s other systems. “We’re happy with the quality of the motors and with the service we get from Maxon,” Daniel says in conclusion.

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