HySWARM Autonomous Vehicle
Medium Agnostic (Air, Land or Maritime) Low Cost, High Velocity UAS

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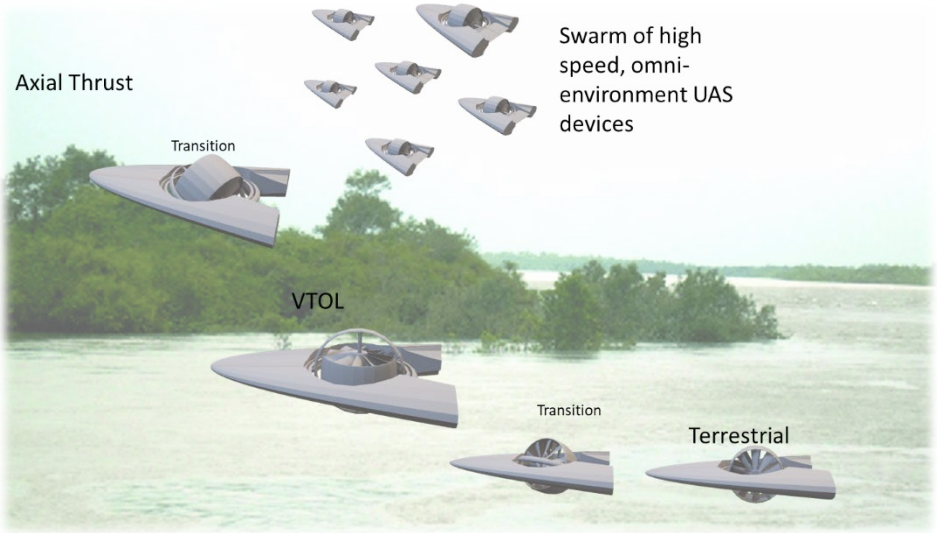
The Evolution of the Autonomous Vehicle

HyALTA Aeronautics Inc has developed a series of products and technologies in the area of unmanned systems. For sensor deployment, surveillance, communications and reconnaissance we offer a unique capability by combining a number of our patented technologies into a single transformational UAS with unparalleled capabilities.

The HySWARM™ (Hybrid Single-drive, Water, Air, Road Machine) design is a hybrid Unmanned Vehicle that allows a single vehicle to operate in all mediums (air, water and land) using a single set of drive motors. This transformational design is enabled by innovative gimballed propulsion system (US patents pending). Using a set of actuators, the HySWARM™ can act as a ducted fan propeller in air or water or engage the ducted shroud to serve as a wheeled vehicle on any surface. Actuation of the propulsion and steering system allows forward (or backward) thrust, vertical thrust and steering in any medium.



HySWARM™ delivers these capabilities through an elegantly simple minimalist actuation system that engages or disengages the correct combination of clutches to achieve the drive and steering modality desired. The unique capability is achieved through a patent pending gimballed system to produce the correct orientation required for all modes as well as thrust vectoring for attitude control for all configurations. The best analog for the gimbal mount system is the common gyroscope. In that case, the spinning inertial torus is suspended in a pivoting ring system to facilitate freedom of movement in any axis. For HySWARM™, a similar set of gimbaled rings interact to provide thrust orientation and thrust vectoring of the centrally mounted ducted fan motor. The innovation is threefold:

1) The interface between the rings, instead of passive pivots are driven to achieve the desired orientations for thrust and control;

2) The central shrouded fan has two operating modes: first it can operate as a ducted fan (axial or VTOL propulsion) , secondly, it can be coupled (electrically or mechanically) to the shroud that, when in contact with a surface (or terrestrial mode), will act as a drive wheel;
3) Innovative yet not imperative, the central motor/fan system is a counter-rotating to cancel the torque that must be countered for air or aquatic operations. This is not imperative as other methods can be used to counter yaw (in VTOL mode) and roll (in axial mode).

HySWARM™ provides a low-cost vehicle that can take on any mission that current UAV products can, and far more. There is no "magic" is in the design, no high-cost/hard to acquire/manufacture materiel or components. This allows the use of commercially available, low-risk materials and technologies to achieve unprecedented yet affordable and scalable capabilities in a single vehicle design. This scalability allows the design to accommodate a wide range of payloads and accomplish a wide range of missions to include:

1) **Observation, Surveillance and Sensor Deployment** missions requiring rapid transit combined with vertical take-off and landing (VTOL) in multiple mediums with minimal cost**.**
2) **Payload Delivery and Manipulator** abilities facilitated by the broad range of configurations. Imagine a craft that can take off and land vertically and fly rapidly to a location but can change to a "delivery truck" to drop off a package; or a surveillance submarine that can take off and fly to a landing site and taxi into a hanger.
3) **Swarm** missions that require rapid deployment of low-cost air vehicles. HySWARM's combination of low cost, high speed, payload and simplicity provides a wide range of options for fast-response active or passive swarm missions such as UAV detection, interdiction and destruction.

Other inherent design features provide additional benefits. Embedding the electric drive motors onto a ducted fan not only improves performance but also means there are no exposed spinning blades to endanger ground personnel. The single drive system reduces procurement and logistics costs.

Problem Solution: HySWARM™ provides a low-cost UAV for sensor delivery with the versatility to operate in the water, land and air environments. This completely unique and patented capability allows a single autonomous vehicle to transition at speeds 4 to 5 times faster than conventional rotor craft by air but still land in a VTOL configuration. Without additional drive systems, the HySWARM™ can transition to a land vehicle to silently deploy sensors at a distance from its landing site. Alternatively, HySWARM™ can be deployed as a surface or submersible marine vehicle, transitioning to either land or air. Due to its simple design, it is rugged enough to take advantage of many deployment methods.

Differentiators:

- Single UAS can operate in the air as a VTOL or airplane, on the land as a terrestrial vehicle and on the water or as a submersible using a single drive system.

- Low SWAP achieved through the patented single drive system design

- Axial propulsion and terrestrial modes extend the speed, range and duration far above standard rotorcraft designs.

- Small weight makes the system highly portable and requires no infrastructure for launch or recovery.

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