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The Advanced Tactics *Black Knight Transformer* Successfully Completes First Flights

EL SEGUNDO, California, 10 April 2014 – Advanced Tactics Inc. announced that it has successfully completed the first flight test of the *Black Knight Transformer*, a modular and roadable vertical takeoff and landing (VTOL) aircraft. Advanced Tactics is at the forefront of large scale multicopter design, production, and testing and the successful flights of the Black Knight Transformer open the door to a number of future aircraft designs that leverage Advanced Tactics' patented and patent-pending technologies.

Figure 1 – The AT Black Knight Transformer during its first flight demonstrating a stable and controlled hover.

The patented AT Transformer technology combines the capabilities of a helicopter, such as the ability to take off and land anywhere, with the capabilities of an off-road automobile. The *AT Black Knight Transformer* completed driving tests in December 2013 and completed its first flight tests in March 2014. The Black Knight Transformer is the world's largest multicopter that is controlled and stabilized with propeller speed. The aircraft has a maximum takeoff weight of 4,400 lb.

Figure 2 - The AT Black Knight Transformer has a large interior volume (similar to a BlackHawk helicopter) allowing it to transport cargo to the front lines and to carry wounded soldiers from the battlefield.

The flight test was performed at a private location in Southern California and the aircraft was remotely piloted for safety. The stability and attitude of the aircraft was controlled entirely by the autopilot. The only commands from the remote (human) pilot were to increase or decrease power. Outrigger landing gear was attached to the aircraft to prevent it from rolling over in case of any mishaps. The aircraft completed multiple short hover flights. Although the aircraft is capable of hovering at thousands of feet above the ground, the altitude was limited to less than 10 feet above the ground for safety. The aircraft was stable, controllable, and performed as expected. An electric quadcopter drone was used to capture aerial footage of the flights as seen in Figure 3.

The development of the AT Transformer concept was spurred by several things: the growing popularity and acceptance of "multicopter" aircraft, the military's need for a low-cost platform for casualty evacuation and cargo resupply missions, and our passion for developing game-changing military and civilian vehicle technology. The aircraft is designed specifically for autonomous casualty evacuation and unmanned cargo resupply missions. Its unmanned capabilities keep pilots out of harm’s way during dangerous missions while a pilot-optional capability allows it to be flown like a conventional helicopter. Advanced Tactics began work on the AT Black Knight Transformer in 2010 with funding from the United States Congress. In 2012, Advanced Tactics began work on the *AT Panther Transformer*, a similar vehicle designed specifically for Special Operations missions. It is a low-cost vehicle that carries two passengers and their gear, is transportable in a CV-22 Osprey cargo hold, and is operable with minimal training. Advanced Tactics is also currently developing a modular, cargo carrying aircraft capable of delivering up to 3,500 lb payloads in a detachable cargo pod. The AT Transformer technology is scalable and reconfigurable.

Figure 3 – Snapshot from aerial footage of the aircraft in hover filmed by a quadcopter drone. The quadcopter weighed approximately one thousandth of the weight of the *Black Knight Transformer*.

The Black Knight and Panther Transformers both utilize the *AT Transformer* technology, which leverages the simplicity and robustness of a "multicopter" helicopter at a full-scale size. Like the small electric multicopters that are prevalent today, the AT Transformer uses engines with a direct drive connection to prop-rotors. The propulsion system and airframe structure are made of low cost, field-replaceable components.

Like an electric multicopter, the vehicle is stabilized and controlled by differential thrust between opposing sets of prop-rotors. This design is simple and robust, eliminating the mechanical complexity and cost of the articulated rotor system that stabilizes and controls a conventional helicopter and replacing it with a high-speed computerized feedback control system. Additionally, the configuration negates the need for a tail-rotor or engine transmission. The AT Transformer has the ability to perform controlled engine-out flight in case of a critical component failure.

Figure 4 - The Black Knight Transformer during its first flight. Notice the attached electrical cable under the aircraft, which provided an emergency shutdown capability in case of a malfunction.

The design benefits from a large interior volume compared to the overall footprint of the vehicle, which makes it an ideal candidate for unmanned cargo resupply missions as well as civil missions such as package delivery and fire-fighting. Both the Black Knight and the Panther Transformers have automotive suspensions and drive-trains similar to those used in off-road trucks. Large truck tires and shocks provide excellent terrain handling and soften the vehicles' landings. The wheels are driven by an independent engine and transaxle for speeds up to 70 mph. The engines stow along the side of the vehicle to reduce to driving width to less than 8.5 feet, also allowing it to be transported in a C-130 Hercules without disassembly.

The AT Transformer design is highly modular for rapid repair and reconfiguration. For instance, each of the propulsion subsystems can be replaced in the field by two people and the mission package can be rapidly reconfigured from casualty evacuation to cargo resupply. Additionally, the modular automobile portion of the vehicle can be removed for additional payload capacity or replaced with a boat hull or an amphibious hull for water operations.

Figure 5 - AT engineer, Rustom Jehangir, is standing next to the vehicle for scale. He is six feet tall.

Figure 6 - The Black Knight Transformer is larger than a Ford F350 crew cab truck, shown for scale. The engines are stowed against the side of the vehicle in driving configuration.

The AT Black Knight and Panther Transformer aircraft have been developed through an iterative prototyping process starting with small scale electric prototypes in 2010 and moving to larger internal combustion powered vehicles including a 2,000 lb aircraft in 2012. A scaled electric prototype of the Panther vehicle has been tested and the full-scale internal combustion powered version is in the design phase.

Figure 7 – Currently available for sale, the *AT Transformer sUAS* is the world's first air- and ground-mobile surveillance robot.

Advanced Tactics has also announced that the *AT Transformer sUAS* is currently available for sale. This rugged VTOL vehicle combines the capabilities and technology of Advanced Tactics' larger vehicles into a small, low-cost platform that weighs less than 55 lb. Its driving and flying capabilities allow it to perform unique missions such as exploring plateaus or rooftops, jumping over extreme terrain and obstructions, and performing ground-based reconnaissance for several days in the field. It is the world's first air- and ground-mobile surveillance robot. With the optional ground drive-train removed, it can serve as a cargo delivery vehicle for heavy payloads.

The AT Transformer technologies are available worldwide and can be configured and customized to the customers' needs. Advanced Tactics is actively seeking investors as well as U.S. and foreign government and commercial opportunities. Please visit Advanced Tactics' website for more information:

www.advancedtacticsinc.com

About Advanced Tactics:
Advanced Tactics Inc. (AT) is a small business based in El Segundo, CA specializing in research and development of next-generation military and civilian vehicle technologies. A unique set of patented vehicle designs drive the company's progress toward providing a game-changing capability to the military force. For more information, please visit www.advancedtacticsinc.com.

Updated April 2014