WHITE PAPER

SMALL TACTICAL MULTI-PAYLOAD AEROSTAT SYSTEM (STMPAS)

A New Surveillance and Communications Capability
For
Homeland Security
Border Control and Maritime Security

Low Cost

Long Mission Duration

Minimum Manpower

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1.0 BACKGROUND Department of Homeland Security (DHS) agencies such as Customs and Border Protection and the Coast Guard need overhead EO/IR surveillance of border crossings, seaports, and maritime borders that is both less costly and intrusive than aircraft or Unmanned Aerial Systems (UAS) while providing around the clock coverage. DHS agencies also need low cost, responsive, and mobile equipment for wide area resilient and durable communications after a natural disaster, accident, or terrorist act that degrades existing communications systems.

The most efficient means to meet these needs is an aerostat system. Mobile towers are height limited, providing only short range coverage. Aircraft or UAS are expensive and have limited endurance. Aerostats provide coverage of large area, comparable to aircraft or UAS, but with persistence of days and weeks instead of hours. However, traditional aerostats are large, manpower intensive and cannot operate in adverse weather conditions. Their ground equipment has very limited mobility and lengthy set-up times, restricting use to a few fixed sites and almost precluding shipboard operation.

To remove these limitations Carolina Unmanned Vehicles (CUV) developed the **Small Tactical Multi-Payload Aerostat System (STMPAS)**, creating a mobile cost effective aerostat system. STMPAS was deployed by the Army to Afghanistan, with earlier versions built for the USAF, Sandia National Lab, and Lockheed Martin. STMPAS consists of a small specially designed tethered blimp, called a Helikite, mounted on a single HMMWV trailer Carrier, operated by a two person crew (Fig. 1).

The STMPAS blimp, flown at several hundred to thousand feet altitude, provides coverage 24 hours a day for a week or more without maintenance or downtime. Surveillance versions up to 1,000 feet can cover a 20 mile radius, depending upon terrain. A STMPAS relay at 4000 feet provides communication coverage out to 60 miles from its location. STMPAS is very mobile and cost-effective through use of unique designs to reduce the need for ground crews to handle the blimp during launch and recovery. Operating and maintenance cost is a fraction of the cost of using aircraft or UAS to lift surveillance or relay payloads. It does not require the complicated flight clearances needed for UAS deconfliction with manned aircraft.

2.0 MAJOR SUBSYSTEMS STMPAS consists of several unique components that, taken together, comprise a system far smaller and more versatile than any comparable unit. Each component emphasizes the strengths of the others to produce a small, highly mobile capability unequalled by other aerostat systems. STMPAS consists of three major subsystems: The Helikite, Carrier, and Payloads

2.1.1 Helikite The key to making a small, mobile and cost effective aerostat system is to use a Lifting Aerostat, which is an aerostat with aerodynamic lifting surfaces. STMPAS uses the most mature and efficient lifting aerostat on the market, the Helikite developed and patented by Allsopp Helikites Ltd. The patented Helikite combines helium and wind lift so even very small sizes operate easily in high wind, allowing STMPAS to be a

Fig 1 **Small Tactical Multi-Payload Aerostat System (STMPAS)**

DHS Missions:

Border Control

Maritime and Port Security

Post Disaster / Remote Area Communication

Secret Service Large Event / VIP Security

Attributes:

High Mobility Off-Road Trailer

Helikite Launched From Carrier For Safe Operation, Move While Inflated

Rugged Diesel Generator, Electric Winch, Helium Racks and Inflation Manifold

Operable by 2 Persons

C-130 Roll On – Roll Off Capable

fraction of the cost and manpower of traditional lighter-than-air designs. Helikites are lighter-than-air like a blimp but are not knocked down by the wind. Wind forces on the kite wings generate lift to counteract the wind side force. With this force to counteract the wind drag the Helikite does not need a large buoyancy margin and we can design the STMPAS to use modern lightweight electronics. The STMPAS Helikites are able to fly in winds up to 70 mph. Other aerostats must be considerably larger to withstand wind forces, so they cannot be designed for small payloads and mobile ground equipment. Helikite performance is the key that allows STMPAS to be very compact, use minimum helium and be operable by only two people.

A Helikite is almost invisible at few hundred feet altitude and so is very difficult to detect and shoot at altitude. It is radar transparent, and has a very small IR signature. The Helikite has only about ½ psi pressure and is a non-stretch material, so even if hit with multiple bullets it does not "pop" and only slowly deflates over several hours. It remains operational during that time, and is easily repaired and returned to service. The non-flammable helium cannot burn. For safety to aircraft the aerostat can be equipped with standard lights visible to aircrew, or with IR lights visible only with night-vision goggles.

2.2 Carrier The Helikite allows even a small aerostat to withstand real world wind conditions, means STMPAS does not require the large, clumsy pivoting mooring system used by other aerostats. Until launch the uninflated STMPAS Helikite is contained in a mobile Carrier with helium tanks, electric generator, and a winch. Use of a single military HMMWV trailer provides good ground clearance for off road capability, ensuring the brakes, tires, etc. are in the government supply system for maximum ruggedness and maintainability. Many comparable aerostat handling systems require multiple trucks for carriage. Carriers are off road capable, air transportable and can respond to any location accessible by a HMMWV and trailer. The Carrier can be made C-130 Roll-on / Roll-off capable in 15 minutes.

The Carrier can operate Helikites of varied sizes, optimized for the particular payloads and operating conditions. Tethers can be non-power for battery powered payloads, or powered with data / power wires and fiber-optic lines, for continuous 24 / 7 operation. A rugged diesel generator provides low fuel consumption and safe operation. All operations are done by a two person crew, minimizing operating cost.

The STMPAS Carrier provides a Launch Box atop the trailer, allowing Helikite launch directly from the trailer. This also allows stowage of the inflated Helikite on the trailer top when not aloft, so that it does not have to be deflated in the event of adverse weather. In areas without overhead obstructions the inflated Helikite can be moved while stowed atop the Carrier and quickly elevated after stopping, for a "quick look" at an area of interest. It can even be kept aloft during movement, for total surveillance and communications coverage.

2.2.5 Field Operations Basic operation is versatile since STMPAS is completely self-contained, with electrical power and all essential equipment on one trailer. The Carrier is towed to an operating location by a HMMWV or pickup truck. A typical operating site is a clear area approximately 90 feet across without trees, power lines or other overhead obstructions. Once on site the two person crew inflates and launches the Helikite. The primary crew tasks during while the Helikite is aloft are operating the surveillance payloads and periodically refueling the generator or running the winch. It carries helium for one inflation and several weeks of helium to "top-off" every 3 to 5 days. It can remain aloft for a week or more if using a power tether, or brought down about once every 12 to 24 hours to change batteries if using a non-power tether.

We have designed a Carrier version for application to small ships, such as Coast Guard Cutters, to provide extended line of sight for communications relay and surveillance payloads. The naval Carrier is a wheeled dolly with all equipment to inflate and launch the Helikite, including winch and helium tank racks but draws electrical power from the ship. It can also be used for ashore missions that do not require extended mobility.

2.3 Payloads STMPAS provides a unique and cost effective overhead capability for many electronic payloads. The main usage categories are surveillance and communications. The system may be ordered with or without payloads, with the customer providing their own payloads. In the latter case we can include development of the payload interface, and integration testing.

2.3.1 Persistent Surveillance Payloads Airborne surveillance is critical for border and port. A typical airborne surveillance payload is a gryo stabilized pan-tilt-zoom Electro-Optical (EO) and/or Infrared (IR) surveillance cameras with day / night capability, with an included portable Ground Control System.

2.3.2 Networked Communications Payloads STMPAS can act as a relay platform for voice communications, as a network bridge for interconnecting ground computers and networks, and as relay point for dissimilar communications systems, particularly in mountainous border terrain.

2.3.3 Other Payloads STMPAS is also an ideal platform to detect low power control signals for UAS crossing the border, and potentially carry anti-UAS jamming equipment, for 24/7 coverage of large areas. Dangerous chemical clouds released by terrorism or industrial accidents usually arrive overhead at altitude before they reach an area at ground level, due to the higher winds aloft. We have identified a lightweight wireless chemical sensor that can be placed along the tether to provide early warning to personnel. Acoustic gunfire detectors on STMPAS can locate any gunfire after the first shot. The acoustic gunfire detectors and chemical detectors are often a pound or less so they can be easily added to STMPAS employed for other missions.

1.2 STMPAS Operational Advantages Compared to towers, UAS and aircraft STMPAS has significant operational advantages for mobile surveillance and communications relay:

Mission Duration	Duration of weeks or more, requiring only a helium "top-off" about once a week
Acquisition Cost	Under $300,000 for the basic version. (Total cost depends on the payload)
Operating Cost	Low cost per operating hour. No pilot proficiency flying, etc.
Manpower	Very low, requiring only two persons to launch and retrieve the system. These can be the same people as the communications / sensor operators.
Deployment	Road and off-road mobile, no fixed infrastructure, C-130 and CH-47 transportable
Operating Restrictions and Impact	Minimal FAA restrictions, No noise, unobtrusive, no danger of falling on civilians, not detectable by targets under observation
Coverage Area and Capabilities	Several miles radius for surveillance, limited by camera resolution. Up to 60 miles radius for communications relay. Can function as a translator node and a network-bridge-in-the-sky, providing seamless multi-agency interoperability and connection of computer / networks across a wide area.

2.4 Operation STMPAS requires a much lower level of skilled personnel than UAS or manned aircraft systems, and requires fewer of the skilled personnel. This makes it ideal to provide to smaller agencies with fewer personnel. For many applications such as disaster response STMPAS could be operated by part time National Guard personnel. For border or port security it could be operated by Border Protection or contractor personnel. As a ground based system it presents fewer deconfliction problems than UAS.

5.0 SUMMARY STMPAS has great potential to as a platform for various communications relay concepts, local area security / surveillance and other missions. It can provide low cost, highly mobile platform with a mission duration of a week or more. It can operate in weather conditions too severe for many UAS or aircraft, or other aerostats, and does so without endangering an aircrew. It is a cost effective solution to many Homeland Security missions, for the Border Patrol, FEMA, etc. Specific versions can be quickly developed by integrating off the shelf subsystems. STMPAS platforms can be developed and produced in six months or less.

For further information, or to discuss technical, cost or other issues, please contact us.

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