

**WHITE PAPER**  
**SMALL TACTICAL MULTI-PAYLOAD AEROSTAT**  
**SYSTEM (STMPAS)**

**Persistent Surveillance, Communications and Force  
Protection Capability For Military Operations**

**Low Cost**

**Long Mission Duration**

**Minimum Manpower**



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**Category: Small Woman Owned Business**

**Prepared: 25 January 2019**

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**Classification**

**Unclassified**

## Small Tactical Multi-Payload Aerostat System (STMPAS)

**1.0 Mission** Both ongoing military operations and emerging “Near-Peer” threats highlight requirements for low cost, responsive, and mobile systems to elevate electronic payloads to a few thousand feet altitude. Needed are Persistent Surveillance for 24/7 EO/IR surveillance and Networked Communications Relays for Beyond Line of Sight (BLOS) communications to dispersed forces without using scarce satellite bandwidth. Forward deployed units need surveillance and communications with lower logistics and manpower than satellites, aircraft, or UAS but with more coverage and fewer blind spots than towers. “Near-Peer” threats require solutions with rapid air deployment, high ground mobility, stealthy operations, minimum manpower and low support requirements.

The most efficient means to meet these needs is an aerostat (Tethered helium balloon). Mobile towers are height limited, providing only short range coverage. Aircraft or UAS are expensive, have limited endurance and cannot operate in some restricted flight zones. 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. They are expensive while their ground equipment has very limited mobility and lengthy set-up times, precluding, making them ill-suited to expeditionary operations.

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, while earlier versions were 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 80 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.

Typical surveillance uses would be weeks-long 24/7 coverage of supply / logistics centers, command posts and similar locations. Communications operations include extended BLOS communications from command posts to forward units and for shore-to-ship communications. Persistent signals intelligence collection and dissemination and Positioning, Navigation, And Timing (PNT) support are also vital missions to be supported by STMPAS.

**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.

<b>Fig 7</b>		<b>Small Tactical Multi-Payload Aerostat System (STMPAS)</b>	
Mobile, Deployable For:	Rapidly Capability		Road and Off Road Mobile
Persistent Surveillance	24/7 EO/IR		C-130 Roll On – Roll Off Capable
Long Range (120+ Km)	C3 Relay		Helikite Launched From Carrier For Safe Operation, Move While Inflated
Joint / Coalition Translation Node	C3		HMMWV Trailer, All Replaceable Parts in Military Supply System
PNT Support			Rugged Diesel Generator (JP-8 Fuel), Electric Winch, Helium Racks and Inflation Manifold
ELINT / Collection, Dissemination	SIGINT		Tank Racks For 15 Tanks, For Up To One Month Operation
			Operable by 2 Soldiers

**2.1.1 Helikite** Key to a small, mobile and cost effective aerostat system is to use of a Lifting Aerostat, which is a balloon with aerodynamic lifting surfaces. STMPAS uses the most mature and efficient lifting aerostat on the market, the Helikite. Helikites are lighter-than-air like a blimp but are not knocked down by wind. Wind forces on the kite wings generate lift to counteract the wind side force, so even very small sizes operate easily in high wind. This allows STMPAS to be designed with modern lightweight electronics and be a fraction of the cost and manpower of traditional lighter-than-air designs. 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.

Helikites are inherently safe, with only about ½ psi pressure and 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. If the tether breaks it does not fall on people but floats upward. An automatic GPS based deflation device is carried to safely deflate the aerostat if it breaks from the Carrier, before it can drift into unsafe airspace. 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, meaning 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 built on a single military HMMWV trailer, providing good ground clearance for flood and off road capability, also ensuring maximum ruggedness and maintainability. All required equipment is on the single trailer, including generator, winch, helium system and stowage for payloads and auxiliary equipment. 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 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.

**2.3 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** A typical airborne surveillance payload is a gyro stabilized pan-tilt-zoom Electro-Optical (EO) and/or Infrared (IR) surveillance cameras with day / night capability, with an included portable Ground Control System. These lightweight payloads can still detect and identify threats at up to out to several kilometers for persistent surveillance and force protection.

**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 joint and coalition operations.

**2.3.3 Other Payloads** STMPAS is also an ideal tactical ELINT / COMINT / SIGINT platform, to maintain continuous coverage providing a long endurance electronic intercept system that provides covert 24/7 coverage of large areas. With no control systems to the payloads or vehicle the system is inherently stealthy, with no electronic emissions. With no emissions of its own STMPAS is ideal to carry payloads to detect low power cell phone or IED trigger devices and hostile drone operations, including low power control signals. It can potentially carry anti-drone jamming equipment for 24/7 protection 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 light enough to be easily added to STMPAS employed for other missions.

**3.0 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 C-130 Roll-On / Roll-Off in operational configuration so it is easily deployed in expeditionary operations. Once deployed it can be quickly towed to its operating locations 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 in under 30 minutes. Operational altitude is 1,000 to 4,000 feet, depending on the mission.

The primary crew tasks while the Helikite is aloft are operating the payloads and periodically refueling the generator or running the winch. The Carrier holds 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. STMPAS requires a much lower level of skilled personnel than UAS or manned aircraft systems, and requires fewer of the skilled personnel.

Survivability against Near-Peer threats is enhanced by the Helikite’s radar transparency and very small IR signature. It is almost invisible at few hundred feet altitude. Multiple easily redeployed systems are more robust than a few high value single point systems. With payload communication via the tether, the RF signature can be minimized, and with highly directional antennas, controlled in ways not possible for aircraft or UAS.

**4.0 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	Considerably less than aircraft or multiple mobile towers. (Total cost highly dependent on which payloads employed.)
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	On and off-road mobile, no fixed infrastructure, C-130 and CH-47 transportable
Operating Restrictions and Impact	Minimal flight restrictions, No noise, unobtrusive, no danger of falling on civilians, not detectable by targets under observation
Coverage Area and Capabilities	10+ miles radius for surveillance, limited by camera resolution. Up to 80 miles radius for communications relay. Can function as a translator node and a network-bridge-in-the-sky, providing seamless multi-agency / multinational interoperability and connection of computer / networks across a wide area.
Survivability	Inherently stealthy against radar, visual, RF detection. Quickly redeployed, affordable in redundant numbers

**5.0 SUMMARY** STMPAS is a cost effective solution to many military missions, capable of various communications relay concepts, local area security / surveillance and other missions. A low cost, highly mobile platform with a mission duration of a week or more, it has better viewpoint and line of sight than towers. It can operate in weather conditions too severe for many UAS or aircraft, or other aerostats, and does so without endangering an aircrew. By integrating off the shelf payload subsystems, specific versions can be quickly developed. Most versions the STMPAS platform can be developed, produced and tested in six months or less.

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