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System Options and Sizing

The basic LAS / STMPAS design is available in a number of configurations, depending upon the customer requirements. All use the same configuration, trailer and general layout but differ in a number of areas. These include aerostat size, tether configuration and related items. These are all related to the customer requirements in terms of payload, altitude, and operating conditions.

Aerostat Size

It is not sufficient to simply state "I need to lift 15 pounds, what size aerostat do I need?" In the first instance, the payload is not the only thing that must be lifted aloft. There must be payload power, mounting equipment, safety items, and finally the tether. As the payload is lifted, more and more tether weight is lifted also, so it must be taken into consideration when determining the size.

All aerostat lift capability is reduced by anything that reduces air density, so both increased ground elevation and air temperature reduce available lift. For example, a standard 34-cubic-meter Helikite (34M3) can lift 30 pounds at Sea Level Standard Day conditions but only 15 pounds at 6,000 feet and 120 degrees F, typical of many regions of the world, including the US Southwest border. At higher elevations and temperatures, LAS uses the larger 64M3 or 75M3 Helikites for greater performance.

Safety Items

The airborne equipment includes several safety items. Most countries require various safety devices. The US FAA requires tether banners, lights and a system to automatically deflate the aerostat if the tether breaks. Although not required in all overseas areas, use of a deflation device is prudent to quickly deflate the aerostat if the tether breaks, to avoid drifting into open airspace, capture or loss of a valuable payload. CUV systems include these necessary items, and they must be accounted for in the lift calculations.

Tether

Our standard Spectra tether is very strong and lightweight, and can be a non-power or power version. Some power tethers have only wires and can pass power and perhaps data over wire to the payload. Other versions include fiber-optic lines to pass greater data bandwidth. With a non-power tether, the aerostat has to be brought down periodically for short intervals to change out payload batteries or refuel fuel cells. A typical non-power tether weighs between 5 and 12 lbs. per 1000 feet, depending upon the size of the aerostat and therefore the tether loads in winds. Power tethers that transmit data and/or electrical power provide continuous 24/7 operation, but range from 18 to 40 lbs. per 1000 feet, or three times heavier than a non-power tether. Obviously, available aerostat lift is affected.

In wind, all aerostats create drag. Drag increases as the square of wind speed. For example, a 10% increase in wind, say from 20 to 22 mph, increases drag by 21%. An increase from 20 mph to 24 mph, a 20% increase, creates a 44% greater tether load! At even modest wind speeds, the drag loads are considerable, increasing the required strength of the tether. Note that increasing aerostat size also increases drag and therefore tether loads.

Winch

The winch must be designed to overcome the tether loads mentioned above. If a power tether is used the winch must be specially designed for the tether. It must include power slip rings and possibly fiber-optic rotary joints.

Synergy

These parameters interact with each other. For example, if the mission requires complete 24/7 operation with no downtime to change power sources (Batteries, fuel cells, etc.), then a power tether may be the required choice. However, if high operating altitude is required, the power tether may become so heavy it overshadows the basic payload weight and the aerostat cannot lift it, or a very large Helikite will be required. Larger aerostats require more onboard helium tanks, a larger winch, and perhaps even a bigger generator. So balancing the requirements and the configuration can be challenging. CUV has developed evaluation tools to help customers determine the actual total lift required, including tools to account for available lift due to ground elevation and temperature. We can help customers optimize a LAS / STMPAS to meet their requirements. Contact us to let us assist you in this process.