

## Feasibility Study for USSOCOM Cubesat Payload: “Using GPS Tracking for Tagging, Tracking and Locating SOF missions”

A. Concept of operations: We use GPS chips that could be embedded almost anywhere you may creatively think like on using it on currency bundles, bags, clothes, food, ammunition, guns, electronic appliances, smartphones (most popular) and other similar things. The GPS chip tracker sends out GPS signals to the cube satellite or can also be relayed via VHF/ UHF radio, unmanned aerial vehicle or drone quadcopters. The chip could have unconventional power sources like through vibration, movements, magnetics, radio, thermal or solar power so as to have a 24 hour tracking capability and redundancies. The GPS chip could also be powered by radio signal and would only need to have minimal radio power since we will be using sensitive receivers. The cube-sat will function like a GPS receiver to track the different GPS location data of the various GPS trackers that were deployed by SOF operatives around the world that may be using this GPS tracking cube-sat.

B. Analyze and quantify potential data that can be provided:

The potential data that can be provided are the GPS signals that can be received on different GPS tracking devices that were deployed by SOF operators. Each GPS tracking device should be identified by the cube-sat software so as the ground commanders can make sense and quantify the potential data provided.

C. Initial payload design:



D. Address all viable system design options with respective specifications

The initial design option specification is the use of a GPS location logging cube-sat payload. Since most GPS trackers send traditionally, signals to GSM (microwave signals) cellphone towers that are connected to the internet, servers and eventually to different data users, the proposal is geared towards using GPS trackers which emits VHF/ UHF that can be directly received by our cube-sat orbiting our planet. Another option is using traditional GPS trackers which emit GSM

signals and using cell towers, drones or other ground stations or UGS devices (unattended ground sensor) that converts the GSM signals to VHF or UHF signals that our cube-sat can tune-in to and relay the data to our SOF operators or ground commanders at a different locations on the planet.

Tasks under this phase could include:

E. Develop the technology design:

The development of compact GPS location transmitters is of paramount importance, there is a need to miniaturize these devices so that it may not be obvious to the targeted person or object and will be hard to find and disabled. The signal it emits should also be encrypted so as to prevent any suspicion of being tracked by the target or should not easily be detectable using anti-bugging devices sweep.

The cube-sat should ideally be sensitive or have good receiving antennas so as to accurately receive the ground signals from different signal sources like UGS (unattended ground sensors) devices, UAVs, drones, and ground base stations that tries to relay the location signals to the cube-sat and eventually to the different users of the data.

F. Predict payload performance using modeling and simulation or other tools

GPS tracking using satellites are already a proven technology, it is the purpose of this feasibility study to propose the said proven technology a much smaller form factor but will have the same or hopefully much better performance.

G. Estimate mass, power, processing and volume requirements.

The mass requirement for the cube-sat will be at most 2.7 kgs.

The power requirement will be at least 45 watts from the batteries and solar panels.

The processing power needed will be at least that of the latest power of a smartphone this year so as to take advantage of the latest technological developments.

The volume requirement will be that of a 3U form factor with at most 1.5U dedicated for the communications payload which is the GPS location signal receiver.

H. Detail payload interaction required with the host satellite.

The payload interaction or the way the GPS location signal receiver interacts with the satellite is by first decoding the signal received using a military standard signal decoder (for data security) this will then be logged in to an app in the cube-sat software that records these locations with the corresponding time stamps for tracking. These will eventually be again encrypted using a military standard signal encoder (for data security). Eventually

these encoded signals will be transmitted either to the ground stations or to another satellite within the constellation of tracking satellites (to enable beyond the horizon communication).

- I. Define how operators would task, process, interpret, and disseminate payload data and/or control the payload. (Note that automated operations is the objective, minimizing direct operator control and interaction required.)

Operators on the ground (after SOF operators put the GPS tracking device on the target persons or objects) will just use their assigned data terminals (smartphones, ipads, tablets, or laptops, or pc) to monitor (anytime, anywhere) the movements of their selected targets on the display with the GPS locations indicated on a map. It is just a matter of operational policy how the operators interpret and disseminate the GPS location data of the target persons or objects.