Suborbital Systems
Pflugerville Texas

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Summary:

Reusable, low cost, high altitude balloon flight system. (working code name is albatross)
Payload package is provided by the end user
We estimate a cost of USD 5 to 10 million and 10 to 12 months for a flyable prototype

Key aspects of our company:

We are a startup that is self funded and ruthelessly efficent
Very low cost (targeting between USD 5k - 10k MSRP per unit)
100% focused on industrial scale deployment vs one off flights
Many test flights on shoestring budget to test all the various subsystems

We are headquartered in Pflugerville Texas (just north of Austin). Why is this significant?

- Raven Aerostar is in RoundRock TX which is just a few minutes north of our HQ location They were (are?) google loon technology partner. We've got some contacts and connections with them.

- Winzen engineering is located in san Antonio (about two hours from us) . Our R&D/engineering offices are in San Antonio. Winzen wrote many of the seminal papers and research (under contract to USG) on super pressure and floating balloons in the jet stream.

RFI responses:

1. Improved survivability of current AISR platforms.

2. Next generation AISR platforms that can effectively and safely operate manned and/or unmanned in a CT/COIN and peer to peer environment.

3. Improved sensor capabilities that allow for operations at longer ranges to enhance standoff and survivability. Sensors that can collect modern signals, sense deep, and offer flexible platform options. This includes integrated Intelligence / EW / Cyber sensors.

If the current platform(s) can be deployed in the approved FAA part 101 regulation, and are usable at high altitude, we could greatly improve the survivability.

We've not focused on payload too much, other than ensuring we can host a cubesat payload on the albatross. However we have put quite a bit of effort into avionics , which are often part of many HAB payloads. We separate the avionics from payload to ensure regulatory compliance.

From our reading of the literature re current ISR packages/platforms (from raytehon etc), most of them are rather large and power hungry.

It stands to reason that the intelligence community is working on smaller/cheaper/higher effectiveness platforms (perhaps pushing the COTS equipment to higher levels of effectiveness etc). If these are packaged in a cubesat compliant form factor, operational personnel could host them on a standardized flight platform.

In particular, since we split the payload/flight system, the customer could have a classified payload in a standardized package, the operations personnel wouldn't need to have clearance re the payload.

That's something SOCOM has expressed a desire to procure (standardized flight system that is payload agnostic).

We have flown various COTS comms and imaging payloads numerous times as part of our testing. We closely follow and participate in the amatuer HAB community , across the full spectrum of development, from envelope innovation to various payload and avionics development efforts. In particular we closely follow imaging payload development as that's of great interest to commercial and intelligence customers.

We don't have any particular innovations to offer in the AISR payload space, but could certainly make introductions into the HAB community if the DOD would like some.

4. Non-conventional platforms such as High Altitude Balloons, Swarming UAS systems or other concepts that allow operations beyond the forward line of troops (FLOT). This can also include concepts for light weight, effective sensing in all operational conditions including adverse weather.

This is what we are well positioned to offer, perhaps now exclusively due to Google project loon being massively scaled back, we are looking to actively step into the gap.

We've founded the company (Suborbital Systems) on the basis of delivering an industrial scale, inexpensive, long duration, fuly regulatory compliant (worldwide) flight platform.

In short, a suborbital/near space satellite constellation.

The objective continues to get closer , with the biggest remaining challenge being the envelope.

5. Estimated schedule and cost associated to deliver a flyable system prototype for testing.

10 to 12 months
5 to 10 million

If an RFP comes out of this, we could provide a detailed budget.

6. Maturity levels for the technology.

7. Size, Weight, Power, and Cooling (SWaP-C) constraints.

We'll answer the above questions together, as they are deeply inter related.

A) Power (solar cells/batteries)

Key vendors/suppliers under consideration:
AltaDevices
Gaerospace

SWap-C:

Size: undetermined, but it would cover the entire parafoil (with exception of bottom)
Weight: 5 lbs of battery/solar cell.
Power: Well this is the power system.
Cooling: That's a big unknown. Very little air at above 75k feet. Many small scale solar
projects have flown without issue , but only for short duration. Our test flights of floaters
have all been in low altitude.

requirements:
Power the command/control/telemetry (always)
Power the payload (air to air, air to ground) (payload specific, maybe no transmission is required)

Battery technology remains somewhat of an open question, due to the extreme temperature ranges.

TRL:
6 to 8.

B) Parafoil (for return to a launch/service/collection center)

Key vendor under consideration:

None at this time. Research required.
Austin does have local kite/parafoil fabrication vendor.

SWap-C:
Size: Currently undetermined , need to build a full size mock up
Weight: same answer as size
Power: none required (but will host the solar cells)
Cooling: none required, fully exposed to elements, perhaps some internal cooling for the payload

TRL:
Parafoil itself: 7 to 8
Parafoil deployment system (for emergency or operator initiated cut down) 4 to 5

C) envelope

Key vendor/suppliers under consideration:
None at this time. We are still performing material assessment and building supply chain expertise, developing RFI/RFP etc

SWap-C:
Size: Currently undetermined , need to build a full size mock up
Weight: same answer as size
Power: none required
Cooling: none required, will be inside the parafoil so protected from elements somewhat

TRL:
2 to 4

D) gondola

Key vendor/suppliers under consideration:
None at this time. We are still performing material assessment and building supply chain expertise, developing RFI/RFP etc

SWap-C:
Size: Currently undetermined , need to build a full size mock up
Weight: same answer as size
Power: none required
Cooling: none required, will be inside the parafoil
Will be made of carbon fiber tubing
Need to develop CAD sketches, make a mock up, go through a few iterations

TRL:
4 to 5

E) avionics

Key vendor/suppliers under consideration:
    http://www.dragino.com/ for lora/gps
    https://www.rtl-sdr.com/ for ads-b and other sdr applications
    https://www.arduino.cc/ for parafoil steering deployment/control

SWap-C:
Size: Currently undetermined , need to build a full size mock up
Weight: same answer as size

Power: this will be the most critical, but hopefully smallest power user. We've not fully determined the power usage, we have the prototype pieces and instrumentation gear, just need to finish mock up. We plan to iterate and develop a fully integrated avionics PCB , in the lab it's various sub systems (lora/gps/imu/ads-b etc)

Cooling: Somewhat known, but we need to test. With batteries, electronics etc.

8. Concept of operations at a system view level

http://iopscience.iop.org/article/10.1088/1742-6596/1005/1/012048/pdf

That's really close to our system. There isn't much variance in HAB.
You've got the envelope, the avionics, the payload.

Majority of the variance is typical in the avionics, in particular how the flight is tracked. Generally that uses APRS for HAM licensed flights, however we use lora so we can operate on a commercial basis.

Our recovery system is somewhat different from the standard (a requlars parachute) in that we plan to use a steerable parafoil system for directed descent.

and details of specific flight profiles, tactics, techniques and procedures.

This is complicated to answer.

http://predict.habhub.org/ is probably the most used site for flight path / predictions
https://tracker.habhub.org/#!mt=roadmap&mz=10&qm=1_day&f=DRAGINO&q=!RS_*; is an example flight

Prep/launch/track procedures are pretty mature. The NWS has a good overview
https://www.weather.gov/ilx/ua-tour

A large part of our focus after prototype development is a comprehensive training and certification program for the flight system.

The other major component which isn't discussed in depth for the RFI is the ground station component. The particulars are highly dependent on the payload. However we've got an early version of a standardized avionics downlink and tracking array which would be required regardless of payload.

Thank you very much for reading this response. We are happy to provide any additional information or answer any questions.