**RED Font: The Challenge Criteria for Phase 1**

Your Challenge:

One of the barriers for UAS used in a public safety realm is payload versus flight time. Vertical takeoff and landing (VTOL) UAS provide many different mission capabilities, but their flight time is limited. The payload capacity, energy source and flight time are linked through design trade-offs that can be optimized for efficiency and flexibility. This challenge is designed to keep the UAS and its payload airborne for the longest time possible to support first responders’ communication technology on the ground while they conduct their search. The advancement of UAS research will help search and rescue operations support payloads for wireless communications or other life-saving goods to save lives.

**Judging Criteria**

**Criterion 1: Strategic Alignment & Technical Outcome** - 50%

This criterion involves consideration of the following factors:  
  
Strategic Alignment – The extent to which the proposed approach meets the objectives listed in the goals of the challenge; the responsiveness to the firefighter and law enforcement scenarios; the likelihood that successful implementation of the proposed solution will have a significant real-world impact.  
  
Technical Outcome – Extent to which the proposed approach will result in significant improvement in commercially available technology and will potentially result in a technical outcome which enables considerable progress toward the challenge goals.

**Criterion 1**

**Concept: Dramatically Enhance Useful UAS mission time via use of methods similar to those of birds**

The concept of this submission is that these methods will enable and extend search and rescue operations UAS to support payloads for wireless communications or other life-saving goods to save lives over long durations by *shutting off the UAS motors for extended time periods*, while continuing to perform communications, surveillance and reconnaissance, and when needed, delivery missions.

The typical UAS mission in this realm needs an elevated viewing and/or line of sight communication position to create more situational awareness for the first responders. The typical method for maintaining the awareness or communication link is hovering the UAS at a desirable location. As there are dozens of well financed companies offering expensive and elegant solutions such as VTOL transition to fixed wing flight, this proposal will avoid that incremental and highly competitive market. The goal of this submission is to create a method and then deliver nearly the same capability at a *much lower cost*, across a wide array of quad/hex/octo-copter style platforms. The improvement goal of this proposal is NOT the drone-delivery mission. That which is proposed will not improve current performance levels for longer range operations. Instead, it focused on the localized surveillance missions of interest.

The great majority of first responder scenarios are in urban or industrial built-up areas. The concept is to take advantage of this by using the environment like a red-tailed hawk or peregrine falcon might, by taking advantage of perching locations, or in some cases creating them. These birds select useful locations to perch giving them broad line of sight views over their areas of interest. Our UAS submission prototype, if chosen, will offer a similar capability. The UAS will retain the ability to reposition and deliver payload once target locations are identified.

1st Possible Embodiment: A downward facing remotely operated perching mechanism will provide for operator monitored video. The UAS is flown above desired perch location and is hovered down until perching mechanism is clamped on target location and flight motors can be shut down. By shutting down the motors, then the ability to operate on payload power alone is greatly enhanced as compared with normal continuously hovering operations. The payload for communications and observation can operated from the Perch position. Examples: on top of a part of a bridge truss, building gutter, power pole top, etc..

2nd Possible Embodiment: Upward facing remotely operated perching mechanism, with operator monitored video. UAS is flown below desired perch location and is hovered up until perching mechanism is clamped on target location and flight motors can be secured, leaving the UAS suspended from the target. The payload for communications and observation can operated from this Perch position. Examples: Hanging from a utility wire or tower guy wire.

3rd Possible Embodiment: Same upward facing remotely operated perching mechanism as 2nd embodiment, with operator monitored video, to a UAS-created perch. 2 part mission. UAS is first flown to deploy a strong, light, braided line, using a line deployment system between 2 locations, at least one suitably elevated, to be able to place a highline that will support the UAS equipped with embodiment 2. Example: Drop a hook and one end of the line on nearby tall building roof and fly back, spooling off the line as the UAS returns the line to a near launch point place to tie off and then tension. Change Payload to the main mission load. Fly the UAS up near the line to desired hanging perch point, clamp on and secure motors, leaving the UAS suspended from the target. Portion of Payload for communications or observation can operated from Perch position. Example: Hanging from UAS deployed line from a nearby high building to the elevated firetruck bucket.

In all 3 embodiments a motor operated robotic clamping mechanism, integrated with available UAS control channels, will be employed to give the drone a safe operating location. The 1st and 2nd embodiment clamp designs will be slightly different as the 1st will need to perform like standing on legs, and the second will be like hanging from arms. The primary focus of our prototype work would be the development and integration of a perching system add-on, onto an affordable, suitably capable, current technology, open-market UAS to demonstrate the capability within the budget.

The real-world impact of this approach would be a transformational increase of mission endurance from the first responder UAS platforms at very low cost. Using these features should be well within the capability of existing UAS operators, as the controls will be simple, and would make the UAS useful for all-day, full event, planned security deployments for monitoring parades, concerts, ballgames, or demonstrations for example. On the perch, they will be silent as well. Once this capability is ready, a first responder team could map out useful deployment locations in advance of need as resources are available.

Technically, this perching approach will be scalable from a small UAS to your maximum size UAS specification, and *will enable very long endurance from much smaller UAS assets than would be expected*. Also since actual flight time will be reduced, battery sizing or boosting in the payload relative to UAS size could be scaled up to make for very long endurance perching if desired.

Example Perching Reference: Mechanical analysis of avian feet: multiarticular muscles in grasping and perching

Spencer B. Backus, Diego Sustaita, Lael U. Odhner, Aaron M. Dollar

Published 25 February 2015.DOI: 10.1098/rsos.140350

<http://rsos.royalsocietypublishing.org/content/2/2/140350>

Simpler methods are under consideration as well.

Criterion 2: Feasibility and Team 50%

This criterion involves consideration of the following factors:  
  
The Team – The extent to which the capability of the contestant(s) can address all aspects of the proposed project with a high chance of success, including, but not limited to, qualifications, relevant expertise, and time commitment of the contestants. Reviewers will evaluate: (a) The relevance of the qualifications and experience of the key staff, leadership, and technical experts. (b) The extent of the applicants’ prior experience and the quality of the results achieved in leading programs similar in nature to the purpose, scope, etc.  
  
Plan – Contestant(s) plan to manage the limited schedule, resources, project risks and other challenges, and produce high quality project outcomes, in pursuit of the challenge goals.

**Criterion 2:**

**Our Team Members:**

**All 3 members are independent contractors operating small consulting companies, and are excited to compete and improve the technology for the first responder community.**

**Dan Enloe- Concept leader and Materials**

**Retired US Navy Captain (2009) and 31 Year Engineer and Manager (2015) at Intel. Highly experienced in use and integration of classified remote sensor technology at the Joint Task Force level. Used to hold TS/SCI clearance. Experienced project manager – was responsible for procurement and installation of capital equipment for Intel’s massive and successful Wafer Fab construction projects. Commanded 6 Navy Reserve Units. 2 Meritorious Service Medals.**

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**Tim Sweeney – Communications and Integration**

**Retired Intel Communications and Demonstrations expert,** Primary role was to deliver POC demos for the various elements that make up the 5G umbrella; mmWave, NB-IoT, Anchor-Booster, MAA....delivered main public Intel demonstrations of technology for Intel CEOs at industry trade shows with new prototypes, that resulted in Billions of dollars of sales growth over the years.

[**https://www.linkedin.com/in/tim-sweeney-4774003/**](https://www.linkedin.com/in/tim-sweeney-4774003/)

**Gary Viviani – Control Architecture and User Interactions**

**R&D, product development, Software and UAS Engineering Expert. Drove Development and enhanced performance of the Insitu Scan Eagle UAS and other products as Vice President and Chief Scientist, that resulted in many successful military contracts.**

[**https://www.linkedin.com/in/gary-viviani-0992496/**](https://www.linkedin.com/in/gary-viviani-0992496/)

**Should we be chosen, we will quickly design and prototype a simple perching system and integrate it with the UAS to begin quickly designing performance experiments to improve the design. We look forward to the opportunity.**

**Best Regards,**

**Tim Sweeney, Dr. Gary Viviani, and Captain Dan Enloe**