

# Increasing Mission Endurance for unmanned aerial vehicles (UAVs)

## Position paper by Neah Power Systems and Silent Falcon UAS Technologies

### Background and Problem Statement

Unmanned Aerial Vehicles (UAVs) are either privately, military or government owned. They are getting more ubiquitous, whether for monitoring farmland, forests for early detection of forest fires, international borders, stealth missions, and possibly for package deliveries to homes! UAV usage falls into two main categories: surveillance purposes or carrying sensors for a wide variety of commercial purposes. The popularity of these UAVs, also known as drones, lies in their ability to remain in air for hours on end. Most UAVs are powered by batteries, solar panels, internal combustion engines (diesel or gasoline) or a combination of these. Increasing the time the UAV is airborne is critical for mission duration and thereby reducing cost of ownership. Increasingly, UAV developers have started evaluating fuel cells as a power source for the UAV.

**Fuel Cell benefits:** Fuel cells are one of the cleanest methods of converting a fuel into electricity. This allows fuel cells to operate with minimal to no noise and thermal signature, and the mission duration can be significantly increased by merely increasing the amount of fuel that is carried. Most fuel cells operate using hydrogen as a fuel, with oxygen from the air as an oxidant.

Hydrogen, in the presence of oxygen, can also catch fire and cause life-threatening burns. Compared with gasoline, hydrogen can catch fire with only a tenth of the energy. According to the American National Standards Institute, a single spark of static electricity from a person's finger is enough to ignite compressed hydrogen.

Liquid hydrogen is extremely cold and can cause frostbite when out of the tank.

Furthermore, breathing pure hydrogen can cause asphyxiation because it deprives them of oxygen. Because hydrogen is odorless, invisible and flavorless, like oxygen, the person may not necessarily know that they are even breathing pure hydrogen until it is too late. This also creates various challenges with refueling with compressed hydrogen in field operations.

**Neah/Silent Falcon Solution:** The key difference between the proposed solution and other fuel cell implementations is the use of a liquid fuel (formic acid) that is employed in place of compressed hydrogen. Formic acid is a high energy density fuel (more energy per unit weight or volume) that is safe, relatively non-toxic, low cost and easy to handle and distribute. With millions of dollars being invested into the commercial and military UAV industries, having a safe, reliable fuel is of paramount importance. Exposing costly technology to an unstable fuel such as compressed hydrogen can have devastating repercussions. Neah has published a detailed white paper on the merits of this technology that is currently covered by two patent applications:

[Click here for Formira™ white paper.](#)

### Contrast to incumbent technologies:

**Fuel cells vs. solar panel – battery hybrid:** Formic acid based fuel cells have ~ 3 times

higher energy density than batteries, thereby reducing the weight (payload), and thereby increasing the mission duration with the incorporation of fuel cells. Also, as the mission increases, the energy density increases, since the additional (incremental) formic acid needed has much higher energy density than the fuel cell and the formic acid combined. The fuel cell would typically be integrated with a smaller set of batteries / panels allowing the best of both worlds - batteries with their ability to respond near instantly with burst loads, solar panels to harvest energy when solar energy is available and fuel cells with their high energy density to keep the batteries constantly charged, and increase mission endurance by merely increasing the amount of fuel that is carried.

**Fuel cells vs. IC Engines (ICE):** The formic fuel cell has equivalent or better energy density than ICE on a fully integrated solution, due to the higher efficiency of fuel cells where the fuel is directly converted into electricity, whereas ICE convert fuel, typically diesel or gasoline, into thermal (heat) energy by combusting the fuel, which is then converted into mechanical energy (moving pistons), and then into electrical energy (via an alternator type of device). Furthermore, due to these various intermediate steps, ICE tend to have thermal and noise signatures, which do not permit stealth operations. For these reasons, the fuel cell is more attractive alternative to ICE.

### Summary:

Silent Falcon UAS and Neah Power Systems have entered into an agreement to integrate Neah's proprietary formic acid reformer based fuel cell into a Silent Falcon UAS. The UAS is currently powered by battery / solar hybrid

solution, and in its current configuration provides up to 8 hours of operation. This development would allow the use of a low cost, widely available, easy-to-handle and transport fuel that can be used to re-fuel UAVs in field operations for a variety of commercial and military missions domestically and internationally. Silent Falcon's UAS targets commercial for mining surveys, mineral exploration, pipeline monitoring for the oil and gas industry, and monitoring and inspection for infrastructure (dams, levees, bridges, etc) and power grids. The Formira-based fuel cells biggest advantage for Silent Falcon will be the extra endurance and the additional ability to carry heavier and power hungry payloads. This is already one of Silent Falcons key differentiators, and will now offer a much stronger platform with extended night endurance.

### **About Neah Power Systems, Inc.**

#### *About Neah Power Systems, Inc*

Neah Power Systems, Inc. is an innovator and supplier of cutting-edge power solutions for the military, transportation and portable electronics industries. Neah Power's long-lasting, efficient, and safe solutions include patented and patent pending PowerChip®, Formira® and the BuzzBar Suite® of products. Most recently, Neah Power Systems was a 2012 ZINO Green Finalist, 2010 WTIA Finalist, and 2010 Best of What's New Popular Science Award. For more information visit [www.neahpower.com](http://www.neahpower.com).

### **About Silent Falcon UAS Technologies**

Silent Falcon UAS Technologies was established in 2010 to develop patent pending, state-of-the-art small Unmanned Aircraft Systems, components and sensors for the global commercial, public safety and military ISR markets. The company is headquartered in Albuquerque, New Mexico. For more information visit [www.SilentFalconUAS.com](http://www.SilentFalconUAS.com).

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Certain of the statements contained herein may be, within the meaning of the federal securities laws, "forward-looking statements," which are subject to risks and uncertainties that could cause actual results to differ materially from those described in the forward-looking statements, and the Company does not undertake any responsibility to update any of these statements in the future. Please read Neah Power System’s Form 10-K for the fiscal year ended September 30, 2013 and its Quarterly Reports on Form 10-Q filed with the SEC during fiscal 2014 for a discussion of such risks, uncertainties and other factors.