BLISS

Better Living through Intuitive Soft Surveillance

Identification No. 10063 • YEADON SPACE AGENCY

INTRODUCTION

Figure 1: Sentry Class Hummingbird MAV drones peforming surveillance within an urban botanical garden

Most of these changes were sound. Some caused inconvenience. But some, like expanded surveillance, raised difficult questions about the balance that we strike between our interests in security and our values of privacy.

Excerpt from remarks on national security delivered by President Obama on May 23, 2013, at National Defense University in Washington, D.C.

The Defense Threat Reduction Agency (DTRA) is the official agency that is responsible for countering weapons of mass destruction (WMD). As both a defense agency and a combat support agency at the Department of Defense, DTRA creates solutions that help our nation address the entire spectrum of chemical, biological, radiological, nuclear and high yield explosive threats.

DTRA aims to anticipate and mitigate future threats long before they develop in the United States and in the territories of its allies. Working with the U.S. Strategic Command Center, military services, combatant commands, the Joint Staff, and other elements of the United States government, DTRA is primarily engaged in counter-proliferation, non-proliferation, and WMD reduction activities. There is just one objective at DTRA:

Making the World Safer

To better serve The American People, DTRA unceasingly seeks to improve its current capabilities, while helping to ensure that military and civil authorities are properly resourced and prepared in advance of real-world events. The agency is involved in various initiatives that nurture cooperation between military services and civilian agencies. The Ardent Sentry program, for example, focuses on providing civil authorities with various military capabilities needed to save lives, prevent human suffering, and mitigate property damage.

In appreciation of DTRA's mission, ***Making the World Safer***, this open ideas competition asks architects to examine the implications of an entirely new kind of urban surveillance platform, called **BLISS**, and demonstrate how its integration into the built environment might strike a reasonable balance between our interests in security and our values of privacy.

Entrants are invited to show how architecture might negotiate between the public benefits of expanded surveillance, and the desire for privacy. The results will be shared with relevant elements of the United States government.

OBJECTIVE

Figure 2: Sentry Class Hummingbird MAV drones navigate a contained, but variable, Intuitive Soft Pilot test environment

BLISS is an acronym for ***Better Living through Intuitive Soft Surveillance***. The program is part of a larger initiative toward expanded domestic surveillance, and exploits various emerging technologies in its pursuit of real and illusory (e.g., diversionary) forms of information collection. The program does not engage in digital data collection and internet surveillance; rather, BLISS focuses on tangible assets and physical evidence. We look at things, and, like you, we try to understand them.

An important part of the BLISS initiative involves the incorporation of a new generation of Observational Unmanned Aerial Vehicles (O-UAVs) into the built environment, which introduces certain challenges with respect to balancing public interest and individual privacy. This open ideas competition has been organized to identify those challenges, and demonstrate how they might be overcome. It asks architects, our fellow Americans, to consider how our buildings and cities might be designed to accommodate O-UAVs, and afford a balance between the merit of surveillance and the value of privacy. But this competition also asks architects to go beyond ***Making the World Safer***. It asks architects to help BLISS ***Make our Lives Better***.

It should be stressed that the BLISS O-UAVs are only used for conventional forms of observation. Unlike Combat Unmanned Aerial Vehicles (C-UAVs), they cannot initiate any action that would be considered threatening to life and property, even though O-UAVs are very similar to C-UAVs and they both share a common origin.

The evolution of O-UAVs followed the long development of C-UAV programs, which began with the creation of the first "automatic airplane" for the U.S. Division of Chemical Warfare during the First World War. That pilotless plane was built to drop containers of severely toxic G-34 Lewisite on Germany, but Armistice arrived before it could be utilized in theater. However, despite the fact that only one automatic airplane was finished, its success proved that it was possible to build a cheap, fast fleet of aircraft that can be flown without a pilot onboard. Consequently, advancements continued, and by 1934 the British completed an unmanned biplane called the Queen Bee. It was this queen that gave us the now-familiar term for all of the C-UAVs that were to follow her: Drones.

Today's MQ-1 Predator, Gray Eagle and MQ-9 Reaper drones are base on a prototype that was first develop by Neal and Linden Blue, at General Atomics in 1986. Unlike standard

Figure 3: A Sentry Class Hummingbird MAV drone rests near two Nafion ion exchange membranes

O-UAVs that simply observe from the air, these combat drones are lethal tools that can render targets inactive. But apart from that, and the fact that C-UAVs are perhaps more exposed to counterattack, both O-UAVs and C-UAVs have a lot in common. In fact, the Predator XP is an unarmed version of the MQ-1 Predator drone; it is equipped with radar and sensors for wide-area surveillance, but does not feature any onboard weapons.

Both O-UAVs and C-UAVs may be launched from one location and controlled from another location, which is highly advantageous, but they also share a number of problems that have presented new challenges. The precision of the drones can vary, and the vehicles have become rather expensive, leading the Defense Department to request $1,908,600,000 for new drones in 2012. The Reaper, alone, costs around $12 million and Northrop Grumman's Global Hawk costs around $20 million.

Additionally, drone missions often require a large number of diverse specialists from a variety of fields. Single C-UAV events often involve four vehicles and 174 people to run the mission. O-UAV missions, such as the six drones that patrol the U.S. border with Mexico, also involve a number of people. Naturally, one of the key specialists is the drone operator. Research has shown that drone operators perform better when there are minor distractions to alleviate job monotony. Researchers have also discovered that, compared with onboard combat pilots, drone operators are more likely to suffer mental health problems.

To overcome these challenges, the BLISS program has engaged in the development of an utterly new generation of extraordinarily small O-UAVs, called Micro Air Vehicles (MAVs, or μAVs). Because of their diminutive size, MAVs are inexpensive, lightweight, discreet, and energy efficient. They are also relatively autonomous, and are capable of locating themselves in their surroundings. Additionally, MAVs are able to navigate even the most unpredictable local conditions, which is particularly helpful in disaster arenas where the environment has been physically changed.

MAVs have features that diverge dramatically from conventional aerial vehicles. They are light enough to take advantage of air currents and thermal updraft, which helps them conserve power. But this can also make MAVs vulnerable to high velocity air systems. To avoid threats, their flight has been designed to be random, unexpected. Their airborne movements are modeled on the Lévy flight of honeybees,

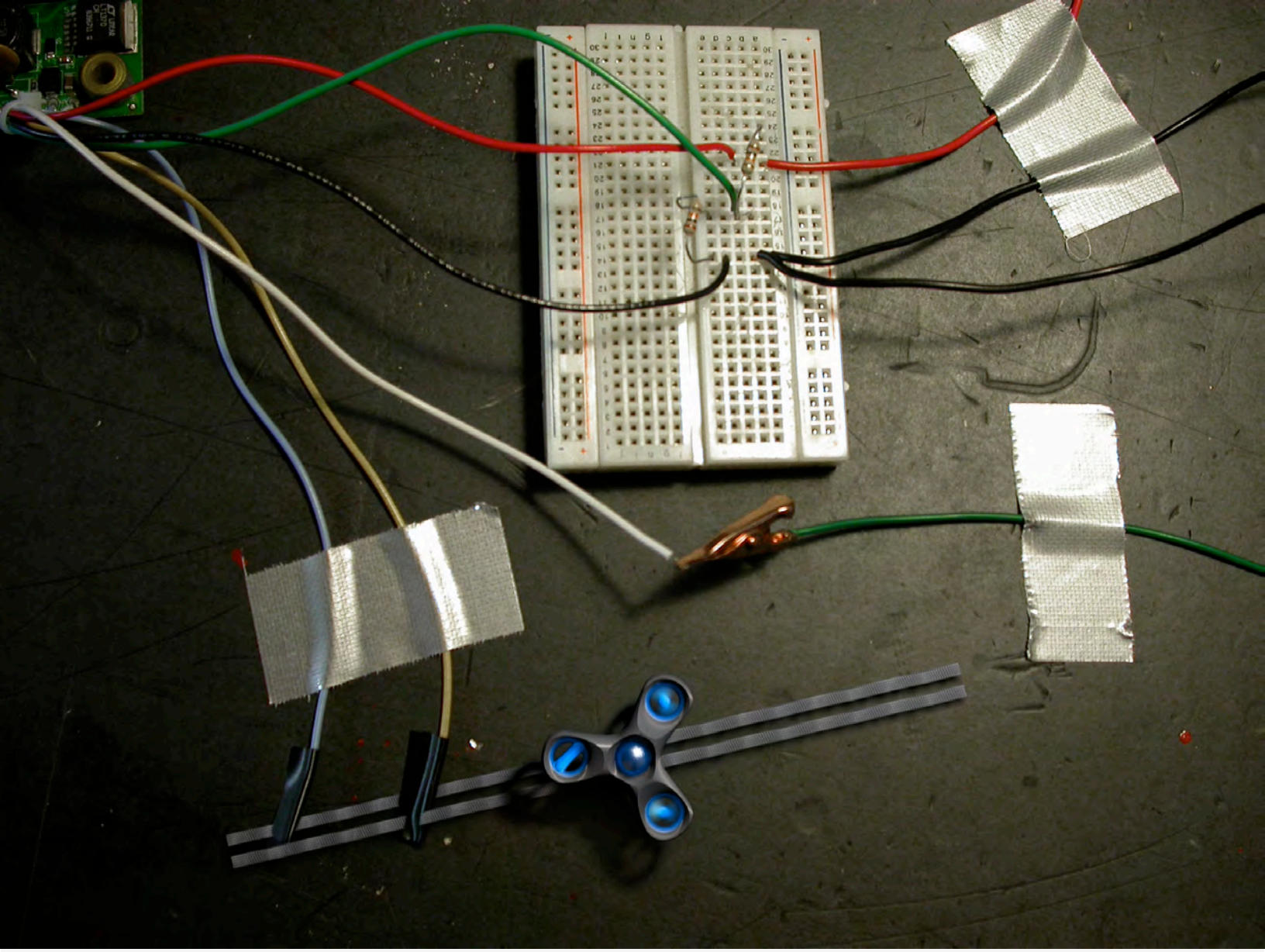


Figure 4: A Sentry Class Hummingbird MAV drone alights on a simple HV-DC capacitor recharge station

which adjust their flight patterns spatially to the environment and temporally to predation risk. This space-time function has been shown to be an optimal search strategy for bees and other organisms, even if their foraging is imprecise due to path integration errors or difficulties in responding to variable wind conditions. The behavior is designed to provide MAVs with short range randomness for survival, and long range accuracy for usefulness.

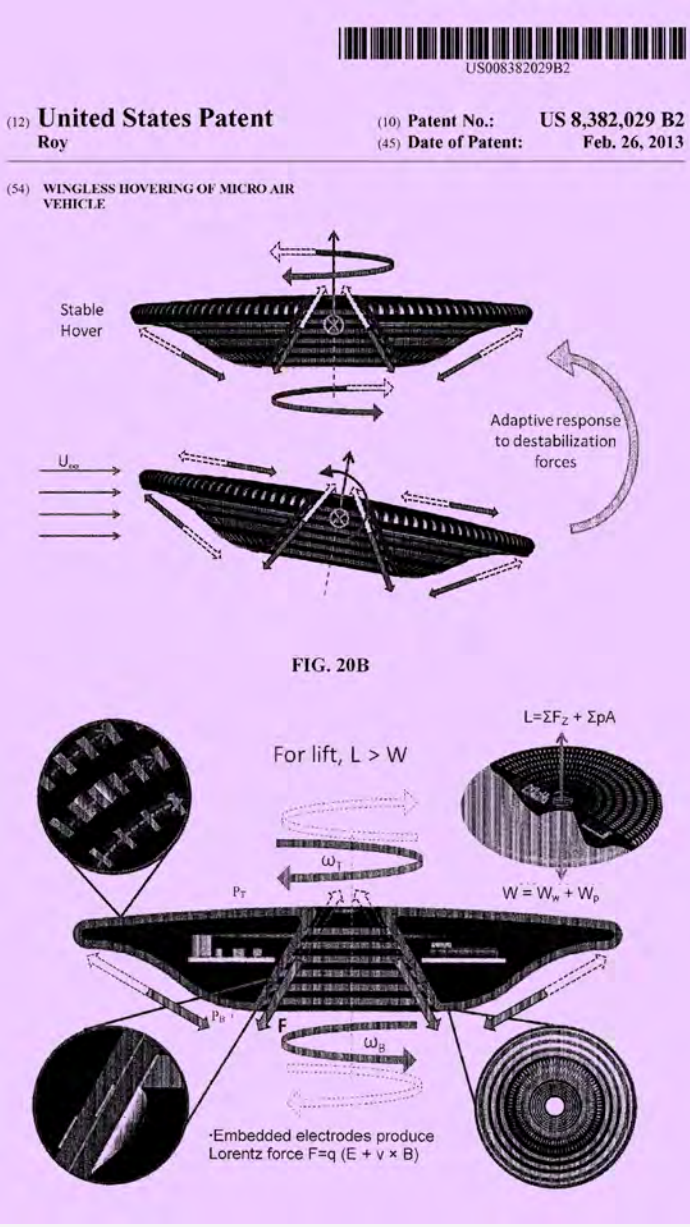
To address the unpredictability of Lévy flight, the MAVs have been designed to work well together as a team, which is sometimes referred to as a *swarm*. This is advantageous for certain missions, such as search-and-discover operations, and provides redundancy in case some vehicles fail. Swarm operations add complexity, in terms of collective communication and decision making. This is managed onboard by an entirely new "Intuitive Soft Pilot" that handles most functions and largely removes the need of a human drone operator.

The brain of an MAV, the new Intuitive Soft Pilot, is a clusters of approximately 25,000 living cortical neurons that self-organize into a living computer on a multi-electrode array. Built on the work of Professor Thomas DeMarse at the University of Florida, this "pilot" can rapidly learn how to fly aircraft as sophisticated as the F-22 fighter jet. Hence, all things considered, MAVs are nimble in both thought and action.

As a key part of the BLISS initiative, we are interested in how MAVs might be better integrated into the built environment, for observational purposes only. Hence, we ask American architects to submit proposals that first consider the problems and promises of MAVs, and then identify opportunities for incorporating MAVs into our buildings, neighborhoods and cities. It would be most helpful if submissions could demonstrate a consideration of the following:

- What is the value, nature, and boundary of privacy in the contemporary city? Has society's expectation of privacy changed? If so, how has that become manifest in our buildings and cities?

- Are there certain areas or zones of cities, and/or certain types of buildings, and/or certain kinds of interior spaces, that should provide total privacy or some other degree of respite from public scrutiny?



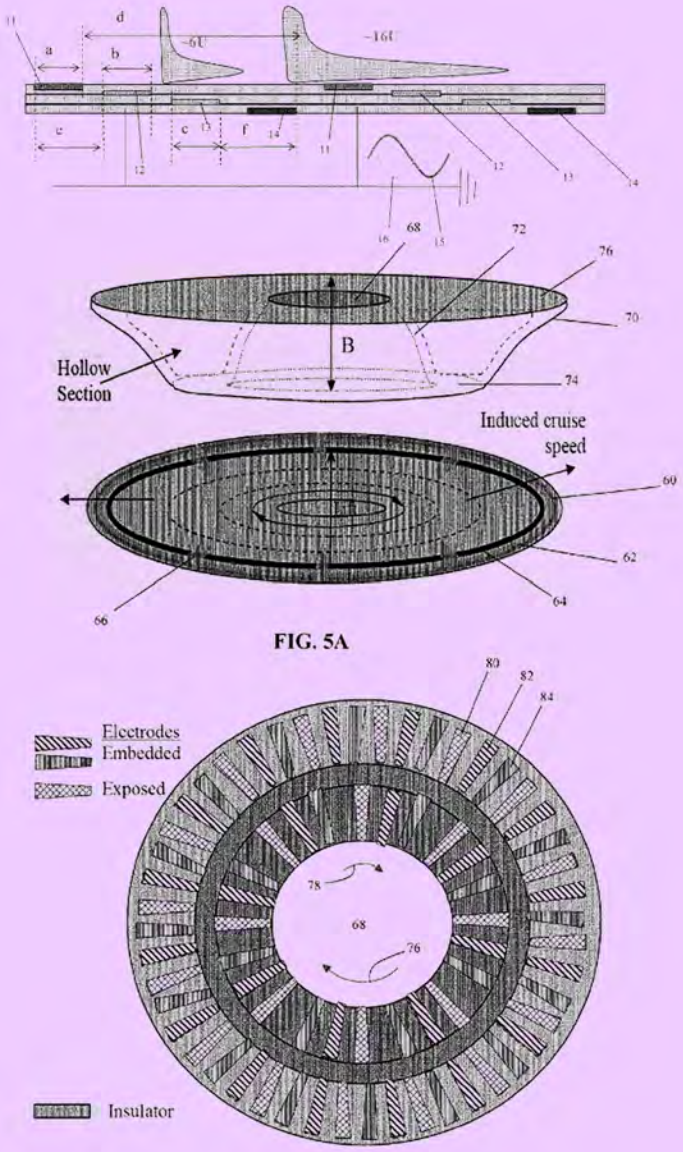
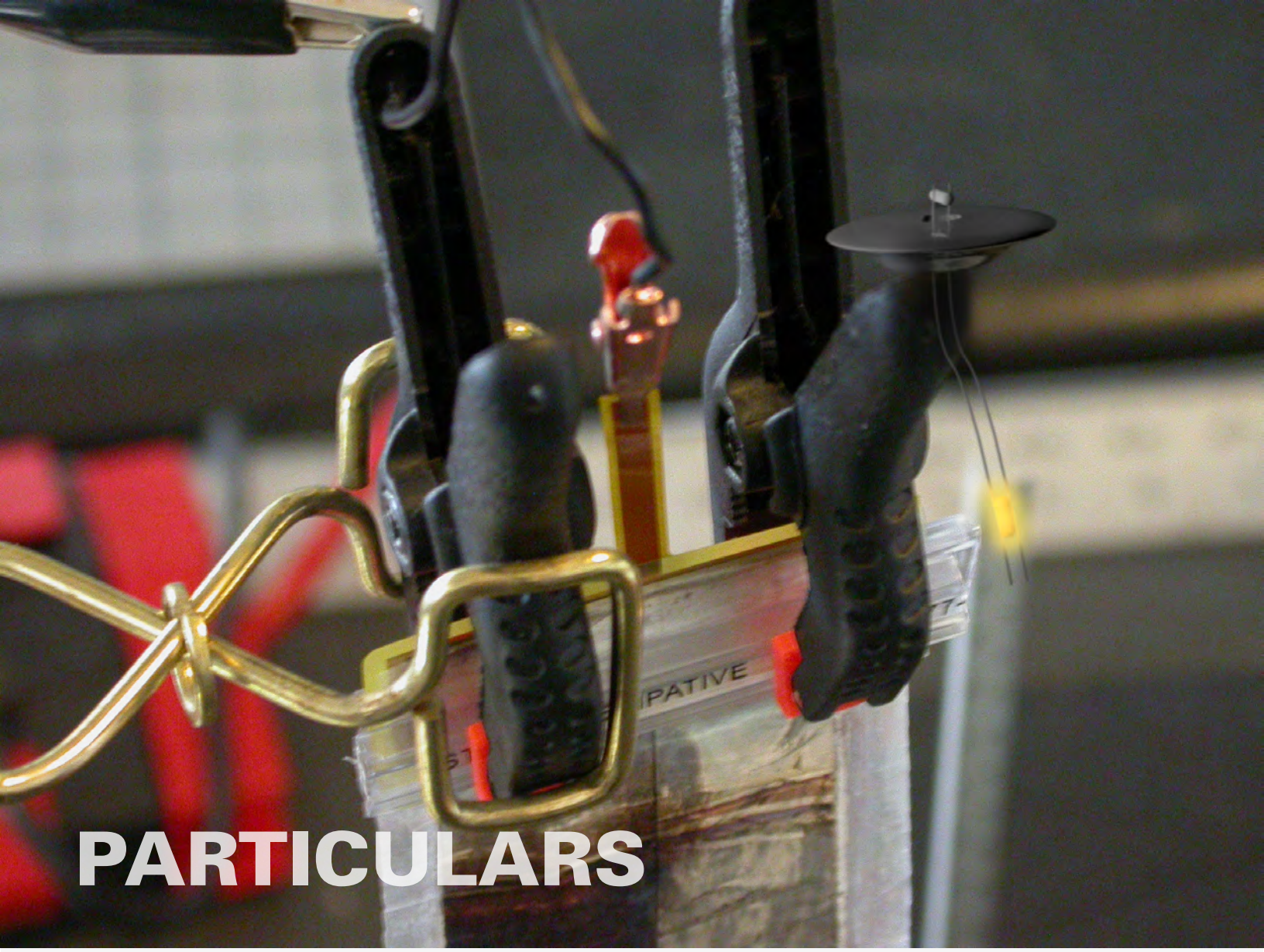


Figure 5: A new class of wingless MAV drones that utilizes dielectrics and is less sensitive to wind gusts

- Should information that is collected in spaces that are in "plain view" be made public? If so, how and when should that information be broadcast or made accessible?
- How might information that is not in plain view be conveyed? Can architecture be designed to enhance some aspects of surveillance while diminishing others; for example, conveying sounds, while blocking sights and smells?
- What is an architectural embodiment of a reasonable balance between public interest in security and private interest in freedom from interference?
- How might buildings and cities be designed to permit MAVs to freely navigate through them? What are the obstacles, and how might they be redesigned?
- Any other issues that the architect deems worthy of consideration



PARTICULARS

Figure 6: A Prototype Class Firefly MAV drone resting near a flexible capacitor recharge station

SITE & REGULATIONS ...

The sponsor has not identified a particular site for this project, and does not intend to imply that any particular location has been confirmed for the launch of the BLISS program. Instead, competitors are asked to identify, study, and propose a single city that might successfully serve the trial deployment of the BLISS program. Proposals shall show why that city is the best choice, and shall use the facts of that city to illustrate a general approach to incorporating MAVs into urban areas and buildings. In order to ensure a successful trial program, what needs to change? What needs to stay the same? Arguments shall be based on research and evidence, and any additional information on MAVs that will be provided by the sponsor.

Competitors may assume that local codes and regulations can be amended to accommodate the implementation of the BLISS program. However, it should be noted that this assumption does not, in any way, undermine the authority of the Foreign Intelligence Surveillance Court (also known as the FISA court), which is the final arbiter on surveillance issues.

ELIGIBILITY ...

The competition is limited to U.S. registered architects and teams/firms led by U.S. registered architects. Submitted proposals are not anonymous. Every individual that contributed to a submission must be identified. Each individual and every team member must be an American citizen living in the United States, and shall have no claim to citizenship elsewhere (e.g., dual citizenship).

Architects and team members that are, or have been, employees of the U.S. Government are not eligible. No member of the jury shall be eligible to compete or assist a competitor.

SCHEDULE ...

Competition Launched: 10.11.2013
Registration Deadline: 01.15.2014 at 4:00 PM ET
Eligibility Clearance Review Concluded: 02.14.2014
Non-Disclosure Agreements to Competitors: 02.17.2014
Additional Materials Released to Competitors: 02.21.2014

Simultaneous MAV Demonstrations at Undisclosed Sites: 04.01.2014 through 04.03.2014

Deadline for Questions: 04.16.2014
FAQ Released: 04.23.2014
Proposal Submission Deadline: 07.04.2014 at 4:00 PM ET
Announcement of Results: 09.11.2014

Figure 7: Prototype Class Blue Dragonfly MAV drones autonomously gathering in a test simulation environment

REGISTRATION ...

Entrants may register via an online registration form. The registration form must be completed and submitted on, or before, January 15, 2014 at 4:00 PM ET. There is no registration fee for this competition.

SUBMISSIONS ...

Submissions shall be received digitally. After registering and passing a Clearance Review, qualified individuals and teams will receive instructions for downloading and installing our proprietary software. This software application shall be used for all communication with the sponsor, and for competitors to submit their proposals to our secure, dedicated servers.

Individuals and teams may modify their submission up to the time and date of the proposal submission deadline. Competitors are to decide what documents and materials constitute a clear, effective, and compelling proposal. All materials are welcome, and may be submitted as any digital file type through our proprietary software.

The copyright of submitted materials will remain with the authors of the proposals; however, any agency, department, or element of the United States government may retain the right to use and publish materials submitted by competitors. Whenever materials are published, authors will always be mentioned by name.

Submitted proposals are not anonymous. Every individual that contributed to a submission must be identified. Each individual must identify their full name, former name(s), and the last four digits of their SSN on the registration form. Each individual must be an American citizen living in the United States, and shall have no claim to citizenship elsewhere (e.g., dual citizenship).

QUESTIONS ...

The official language of the competition is English. All questions shall be received and answered digitally, through the proprietary software that we will provide.

EVALUATION ...

Proposal evaluation will be based on:

- Originality
- Innovation
- Risk
- Adaptability

Figure 8: A Sentry Class Hummingbird MAV drone hovering in an urban environment

JURY ...

The jury will consist of representatives from:

- The U.S. Joint Special Operations Command
- The BLISS program
- The Hummingbird and Firefly MAV Units within BLISS
- The Blue Dragonfly MAV Unit within BLISS
- The Intuitive Soft Pilot Operations Team (iSPOT)
- The University of Foreign Military and Cultural Studies
- The U.S. Foreign Intelligence Surveillance Court
- The U.S. Federal Aviation Administration
- The U.S. Bureau of Overseas Buildings Operations
- The International Code Council
- The American Institute of Architects
- The American Institute of Certified Planners

PRIZES ...

The budget for implementing the BLISS program is confidential. However, the competition sponsor encourages competitors to generate innovative solutions that, wherever possible, demonstrate an elegant economy of means. The sponsor will accept the decisions and the awards of the jury, and agrees to pay the following prizes:

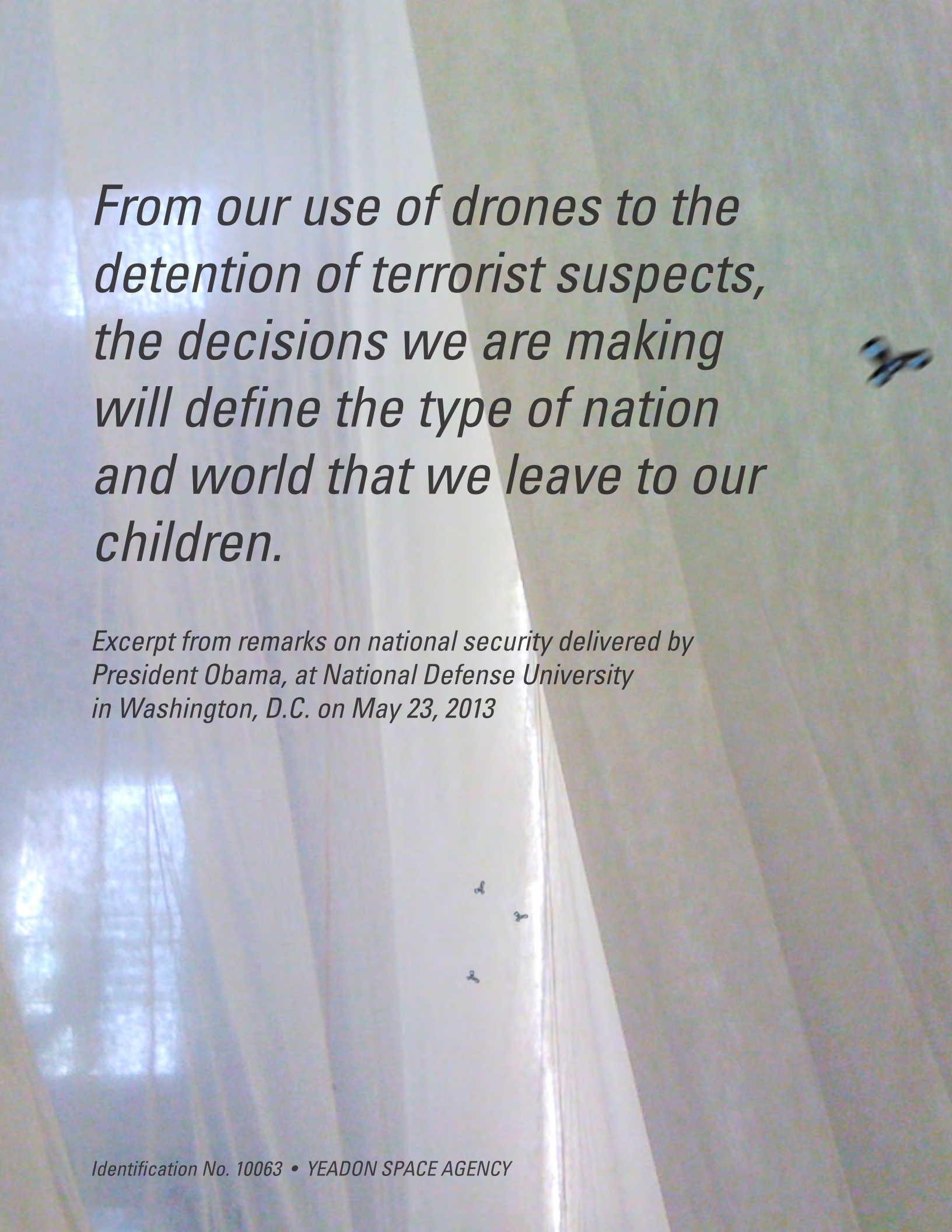
First Prize $600,000.00
and a contract offer to continue as a project consultant
Second Prize $300,000.00
and a contract offer to continue as a project consultant
Third Prize $150,000.00
and a contract offer to continue as a project consultant

The sponsor has also set aside funds for additional awards and mentions to be allotted at the discretion of the competition jury.

FUNDING ...

This competition is primarily funded by unclaimed coins that were left behind at airport checkpoints over the past few years. The Transportation Security Administration collected $531,392.22 in loose change during 2012, $487,869.50 in 2011, and $409,085.56 in 2010, totaling $1.43 million in unclaimed currency over the past three fiscal years.

Additionally, any unclaimed coins from 2013 will be added to a travel fund for bringing competitors to private MAV demonstrations at various undisclosed regional sites, near competitors. These demonstrations will occur across the country, simultaneously.



From our use of drones to the detention of terrorist suspects, the decisions we are making will define the type of nation and world that we leave to our children.

Excerpt from remarks on national security delivered by President Obama, at National Defense University in Washington, D.C. on May 23, 2013

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