ANALYSIS OF HOMELAND SECURITY AND ECONOMIC SURVEY USING SPECIAL MISSIONS UNMANNED AERIAL VEHICLE UTILITIES

[1]Victoria Moss
Alcorn State University-Department of Advanced Technologies
1000 ASU Drive 360, Alcorn State, MS 39096-7500: Phone: (601) 677 6669, (469) 358-1288.
E-mail: vmoss@mail.alcorn.edu

[2]Delandria Jones
lcorn State University-Department of Advanced Technologies
1000 ASU Drive 360, Alcorn State, MS 39096-7500: Phone: (601) 677 6669, (60) 1-493-7374
E-mail: delandriajones@mail.alcorn.edu

[3]Sam Nwaneri
Alcorn State University-Department of Advanced Technologies
1000 ASU Drive 360, Alcorn State, MS 39096-7500: Phone: (601) 677 6669, (256) 348 5432.
E-mail: snwaneri@alcorn.edu

Abstract: Infrastructure protection [1] has become obvious that the successful use of unmanned aerial vehicles is now a requirement in homeland security. The success lies with the fact that these vehicles collect and process data, gather intelligence, and execute commands with feedbacks. The feedbacks are sent to different platforms for further analysis, which reveals that the infusion of such technology into homeland security management is a strong statement of needs and purpose. To meet the challenges posed by technology modeling in homeland security, a mission that measures or countermeasures terror plots must deploy a vehicle of a transportation *system* against the target-and-delivery systems (TADS) terrorists use in plotting and reaching their targets. This paper examined threats and counter responsibilities that require the use of unmanned aerial vehicles (UAVs). The objective is to identify domestic/international threats and special missions of UAVs that measures or counter-measures defined threats, without collateral loss or compromise of the safety and privacy of the general public. The result restricted UAVs' special missions to border counties if/when necessary.

Acknowledgement: This material is based upon work supported by the US. Department of Homeland Security (DHS) under Grant Award Number 2008-ST-062-000003. The views and conclusions contained on this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. DHS

INTRODUCTION

Fiscal facilities, business and resource centers of a society and their events are for social and economic production. But terrorists do not usually make this distinction between military targets and these social centers. They misread and mishandle social tranquility. This is why terrorism should be condemned without any/further equivocation. Lack of civilities of urban and social cultures was one of many reasons the 1970s terror TADS were directed to vulnerable social facilities by Arab terrorists. An encounter was when the Israeli Olympic athletes were taken hostage in Munich, Germany [3]. The 1980 TADS were used by Islamic fundamentalists against America's interests around Europe: U.S. Embassy and marine attacks in Beirut, the murder of an American U.N. peacekeeper in Lebanon, Beirut; the murder of Leon Klinghoffer in a cruise ship off the coast of Egypt, and the Pan American Flight103, which was destroyed by a bomb over Lockerbie, Scot-Land [**4**]. In the 1990s the TADS were transportation-driven terror and devastations of U.S. global interests. Such instances included the truck bombing at the World Trade Center, truck

978-1-4673-1159-5/12/$31.00 ©2012 IEEE

bomb at Federal building Oklahoma, truck bomb at U.S. Military camp in Dhabran, Saudi Arabia, truck bomb at U.S. embassies in Nairobi, Kenya [**5**]. In the 2000s, the TADS evolved into technology modeling: the USS Cole was assaulted by a suicide bomber in Aden, Yemen, Arabian terrorists hijacked four U.S. domestic passenger airliners, crashed two into the World Trade Center in New York, crashed one into the Pentagon, and one into an agricultural field in west Pennsylvania [6]. The anthrax letter attacks in the United States were both transportation and technology models [**7**]. The United States, therefore, launched the war against terrorism, after the 911 attacks. This was a pressure to engage and execute commands against terrorism through the Department of Homeland Security (DHS), who now added unmanned aerial vehicles (UAVs) to their intelligence utilities. An UAV was first deployed in the search for Osama Bin Laden, after the 911 attacks [**3**].

This project presents the assumption that identification, differentiation, and suitability of UAVs for special missions are requirements for needs analysis. The purpose is to research the reliability, security, and economic logistics of recent proposals by the DHS to expand the use and deployment of UAVs to domestic surveys and intelligence gathering. Therefore, the objective of this project is to identify special missions' capabilities and deployment strategies that accurately measure and/or counter-measure defined threats without collateral damages.

METHODOLOGY

The basic methodology was a *Comprehensive Requirements Analysis* (CRA), which is described by the mission coverage--vehicle, design and target elements, equipment, and intended applications. This coverage constitutes requirement-1 (R_1) of the analysis. The mission slogan for the CRA is *requirement* associated with the statement of needs (SON). A USAF statement of need may include altitude range, V/H range, scan field of view, spatial and image resolutions, aircraft or platform, and deployment considerations [**8**]. The SON is requirement-2 (R_2). Five categories required for the objective premise: **interest** polarization, **detection** or measures and counter-measures of a threat, **content** of commands and execution, **forensic** feedback, and possible **solutions** (IDCFS) make up R_3. The solution premise or expected results of a special mission is R_4, which resolves the responsibilities and relationships associated with the target view.

The mission's requirements were technically transparent--must specify if mission is manned or unmanned, tactical or surveillance. This part of the project should be highly explored by the DHS in deciding mission types and suitability. Irrespective of the familiarity of a geographic location, data, and other facts of intelligence gathered, the DHS should create and fit some joint applications mission plans (JAMP) into a strategically non-redundant combination of tactical, reconnaissance, surveillance, single, or special missions. This specialist decision is efficiently resourceful.

The mission's expectations are technologically resolved through permissible scanning of non-evasive spatial and thermal targets that do not violate or compromise a posted, secured, or protected boundary. These boundaries signify the financial, business and resource centers that operate society and economic events, and constitute the missions boundary or target views. They are determined to support image resolution and distribute the probabilities of the mission's responsibilities for successful resolution of a defined survey or threat. This survey is none paramilitary intelligence or data gathering, for economic/engineering logistics (***e***log) and localized environmental evaluation services (***e***val). These two categories of special missions are the *legal descriptions* of a basic economic survey, which distributes responsibilities in homeland security special missions. In the target view, the criteria of probability of the spatial performance of these responsibilities: detection, recognition, classification, and identification, determine the success or spatial resolution of the survey. That means the probability or the ratio of pixel unity or spatial extent (S_e) to the pixel cardinality or fractioning (S_n). This is a type of normalization of the pixel in the target view. For example, the probability of detection, defined as a responsibility in a target view, is given by (D_p) = DS_e/DS_n, or the probability defined by any spatial responsibility (X_p) = $S_e/S_t = 1/S_t$, where (S_t = pixel cardinality or cycle in real time/distance). The subscript t and n are equivalent relations of pixel spatial cardinality *n* in the target view. Note that real time $(t_1 – t_0)$ is a composite resolution window. It modifies S_t to S_n such that in a static observation or IFOV, the $t_1 – t_0$ translates to $(n_1 – n_0)$ and the limiting resolution or composite contrast $= S_e/S_t \equiv 0 < 1/n \leq 1$. This confirms that in terms of cardinality $(S_n \geq S_e)$ is a resolution performance $(P_r) = (S_e/S_t)S_e \equiv (n_1 – n_0)/(n_1 + n_0) = S_e^2/S_t$. The quantity $(S_e^2/S_t = 1/S_t = k/S_{et})$ is the suffrage or spatial frequency switch (S_{et}), where S_{et} represents the waveform across unit pixel, $k = 1$ and $S_{et} = \lambda$; hence, $(1/\lambda)$. On the other hand, S_{et} represents the wave number across a derived pixel, $k = 2\pi$ and $S_{et} = \lambda$; thus $(2\pi/\lambda)$. This switch satisfies sinusoidal and square waves' applications in physical sciences and image processing. For example, in optical and/or radiator scanner technologies, this can resolve infrared, thermal, and microwave images [8]. Highest image resolution implies highest performance, with max. and min. values occurring simultaneously at $S_t = S_e = 1$ and $n_0 = 0$, respectively.

[10] constrained this relation with normalized spatial frequency (f/f_0), such that f is sensor spatial capability and f_0 is frequency across the critical target dimension with 50% success. The justification is thus: as the value modulation of S_{et} in the target view increases the probability of resolving a defined responsibility decreases, switching to zero. This challenge can also result from high cluttering due to data dynamics, which are frequently driven by artificial than natural agents. Cluttering does not support systems readiness to provide immediate judgment or decision, like the physical presence of a human response does. Therefore, the actual performance is infused in the logical statement of the switch, which can justify the analysis and performance of an UAV. Other UAV performance can be determined by the natural relations (N_r) in the target views. These relations are dependent on ecosystems dynamics, such as weather and terrain. In general, the composite requirements R_1 through R_4 and the anticipated or process results of an UAV special mission are determined by P_r and N_r. But the overall mission success is determined by R_x, P_x, and N_x values, which enable a special mission.

DATA AND PERFORMANCE ANALYSIS

This analysis assumes that the DHS's special missions reliably provide surveys like ***e***log and ***e***val; then, the use of UAVs can justify DHS recent proposal to use UAVs for domestic missions.

As the DHS invests in advanced technologies, and such services provided/operated by different agencies, like the U.S. Customs and Border Protection's (CBP's) Office of Air & Marine (A&M), the interest for UAVs is still focused on sensor technology and performance. For example, border patrol surveys may not be limited to sensor technology only but to include modern data and information technologies that are highly compatible with different database systems. This makes the deployment of UAVs technology-specific, for higher missions' performance rates.

This project, tested the drone UAVs and remotely piloted vehicles (RPVs), for performance. Figure 1 shows a lab model of RPV; Figure 2 is a model of a programmable autonomous drone [9].

Figure 1. HK-500GT model data collector, a performance UAV customized for classroom/Labs

The methodology showed that the expected performance of these UAVs was defined by the composite requirements, and the missions' success was described as functions of R_x, P_x, and N_x. In deciding the level of performance, the choice to deploy a drone or a RPV should be made. This choice is defined by the five required categories of the objective premise--IDCFS and R_4 of the solution premise. To achieve the IDCFS with a RPV requires many vector commands involving human responses and feedbacks from the vehicle. Our classroom and laboratory Micropter flight modeling revealed very short time lags between commands. This created flight attitudes that led to crashes of the RPV. Different models of the wireless remotely piloted Micropters were used and the same results were achieved. The characteristic problem with the RPVs was *flight attitude* that showed latent access to sensor information (LASI), in the control system. The LASI did not allow or provide immediate proxy knowledge or code for adjustments to failing flight conditions. This is one reason high accident and crash rates were associated with these laboratory RPVs. With this challenge, we resorted to drone tests, an autonomous UAV (figure 2). We tested the drones, where we substituted the remote commands with predefined flight programs. This approach limited/avoided the LASI effects on flight conditions. The programs were used to route flight missions, where the target view, ranges: (coverage/altitude) and (V/H) were defined, including scan type and rate. The drone operated at about 100 feet, 40 feet higher than the RPV. Significant rate of stability and little or no crashes were recorded with the drone. These results were provided during specific missions that were designed to support the resolution of some defined logistics--water quality improvement (***e***log) and a localized environment of soil moisture content determination (***e***val) [11]. This ***e***log and ***e***val are suitable economic surveys that fit the types of deployments the DHS uses for counter measures or to demonstrate the applications and results of different UAV models. This project is a demonstration of deployment applications, where the success of a special mission for economic survey depends on a specific choice of UAV. The general results are achieved through the IDCFS.

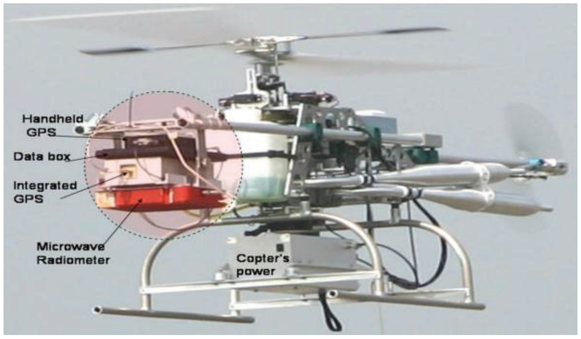

Figure 2. Autonomous drone model--a performance UAV for microwaves/infrared classroom/lab projects [11].

The result further showed that the *First Responders* of border counties can configure any of their responses into an ***e***log or ***e***val economic survey for quicker and more effective results. The reason to configure border counties is only because UAVs have great limitations with urban cultures.

CONCLUSION AND RECOMMENDATIONS

Recommendations for UAVs will depend on their limitations. The most significant limitation includes controversial security concerns, like cost and safety, congressional mandates, promise of technology, and aviation compliance. The conditions associated with the rates these UAVs crashed during test flight accidents are expected to improve with time and effective side-by-side use with human intelligence. These laboratory crashes can improve quickly because LASI is a severe relative error that improves simultaneously with quality. The drone test has lower crash rates than RPV because it needs little or no human response.

This project recommends UAVs to be strictly used for border security enforcement, where it creates higher transportation security. Border-counties, with less intricate airspace logistics, can deploy UAVs to countermeasure activities in inaccessible border terrains or remote border infiltration. Emergencies due to technological and natural hazards can also deploy UAVs.

REFERENCE

[1]. Lewis T, G., Critical Infrastructure Protection in Homeland security—defending a Networked Nation, Wiley Interscience, New jersey, 2006

[2]. Hartshorn, T., A. *Interpreting the* City--An urban geography, John Wiley & Son Inc., New York, 1992.

[3]. Martin, K., *Homeland Security--Two years after 911, are we safer?* The CQ Researcher, 13, 749772.

[4]. Wikipedia, the Free Encyclopedia. Pan Am Flight 103, http://en.wikipedia.org/wiki/PanAm_Flight_103, January 7, 2012 at 22:28

[5]. Ben S., and David J. *Primer on the Embassy Bombings and the U.S. Strikes on Sudan/Afghanistan.Jan.12, 2012*.

[6]. EPA and homeland Security. Emergency Preparedness and Hazmart Conference, Retrieved: http://www.2011conference.net/tours.html, Oct.30, 2011.

[7]. Wikipedia, the Free Encyclopedia, 2001 Anthrax, from: http://en.wikipedia.org/wiki/2001_anthrax_attacks, December 24, 2011.

[8]. Mccroken W. *Infrared Line Scanning Systems*. Campana S., Pasive Electro-Systems, Spie Optical Engineering Press, Virginia, 1993, Vol. 5. pp1-101.

[9]. Chad C., Gertler J. Unmanned Aerial Vehicles and Border Surveillance Congressional Research Service. Reretrieved:www.fas.org/sgp/crs/homesec/RS216.

[10]. Johnson, J., and Lawson W. R. “Performance modeling methods and problems,” in Proceedings of the IRIS Specialty Group on Imaging (1974).

[11].Nwaneri**, S.** Report on the Experiment: Remote sensing at microwave using autonomous helicopter and mobile landrover platforms. Joint collaboration between the (HSCaRS), Alabama A&M, Russian Academy of Sciences (RAS) and Institute of Radio Engineers (IRE) (2005).