NIST Internal Report 8033

Deployment of Unmanned Aerial Vehicles to Texas under an Emergency Certificate of Authorization

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Colorado State University

National Institute of Standards and Technology
U.S. Department of Commerce

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Deployment of Unmanned Aerial Vehicles to Texas under an Emergency Certificate of Authorization

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December 2014

U.S. Department of Commerce
Penny Pritzker, Secretary

National Institute of Standards and Technology
Willie May, Acting Under Secretary of Commerce for Standards and Technology and Acting Director

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Deployment of Unmanned Aerial Vehicles to Texas under an Emergency Certificate of Authorization

by

Alexander Maranghides, Mike Hennig, Gene Robinson, and Karen Jackson

Abstract

Unmanned aerial vehicles (UAVs) enable the development of reliable fire behavior prediction tools and the evaluation of hazard mitigation solutions such as fuel treatments in the wildlands and the hardening of structures within a community.

This paper documents the emergency deployment of National Institute of Standards and Technology (NIST) UAV assets to address a specific request by a local government in Texas. On Wednesday, 10 September 2014, the Federal Aviation Administration (FAA) granted an Emergency Certificate of Waiver or Authorization (E-COA) to NIST to utilize an Unmanned Aircraft System (UAS) in the search for a missing person near Plano, Texas, just north of Dallas. The FAA processed this request and granted the Emergency COA in less than 24 hours. This was the first event for which the FAA granted permission for NIST UAVs to be flown for purposes other than fire research.

The primary objectives of this work were to conduct UAV operations providing high-resolution digital still imagery for the Plano Texas Police Department, in support of an active search and recovery operation for a missing person. The MLB Superbat is a small UAV that can operate autonomously and deliver high resolution still and video imagery. A preset flight pattern allowed detailed photographic documentation of the area of interest. This paper focuses on the coordination and field operations timeline of personnel involved in the deployment.

KEY WORDS: Certificate of Authorization, COA, fire research, MLB Superbat, Plano Texas Police Department, search and recovery, Wildland Urban Interface, WUI

1.0 Background

The National Institute of Standards and Technology (NIST) procured five MLB Superbat unmanned aerial vehicles in 2011 for the purpose of developing instrumentation to collect fire and weather data over prescribed burns.
NIST applied for and received a Federal Aviation Administration (FAA) Certificate of Authorization (COA) to conduct operations in the National Air Space in 2012. This was necessary in order to conduct the intended research. An aircrew team developed and maintained flight proficiency by executing test and training flights approximately every 4 to 6 weeks over a three-year period. Total flight time for the airframes was about 38 h during the proficiency periods up to, but not including the flight time of the Plano, Texas event. NIST developed data collection methods utilizing the airframe's electro-optical and infrared thermal imaging video system payloads, as well as high-resolution digital still imagery and low-resolution digital multispectral imagery payloads. The system was utilized for a series of controlled burns at Camp Swift, TX in 2014, providing information on fire propagation through vegetative fuels and demonstrating the utility of the UAVs for WUI fire research. Additionally, research was initiated to collect aerial wind data using instruments mounted on the UAVs.

A person went missing near Plano, Texas, just north of Dallas in September 2014. In an effort to locate this person, the Plano Police Department decided that it would be useful to perform an aerial search using UAVs and NIST was contacted regarding this matter. NIST had proficiency flights planned for this period and agreed to lend its aircraft to the effort. This event was conducted under the auspices of an existing NIST Certification of Authorization (COA) 2013-CSA-15, with issuance of an Emergency COA by the FAA to the National Institute of Standards and Technology on 10 September, 2014. The FAA issues COAs on an emergency basis when: 1) a situation exists in which there is distress or urgency and there is an extreme possibility of a loss of life; 2) the proponent has determined that manned flight operations cannot be conducted efficiently; and 3) the proposed UAS is operating under a current approved COA for a different purpose or location.

Required documentation outlining the Statement of Need from the Plano Police Department was submitted to the FAA as part of the request for an Emergency Certification of Authorization (E-COA). The FAA issued the Emergency COA on 10 September, 2014 to NIST for use of the NIST UAVs to conduct search and rescue in response to the missing person incident. The FAA authorization was based on NIST's pre-existing COA. Pre-event coordination was conducted collaboratively among the NIST WUI UAV team. Final team deployment and asset use approval was granted by NIST management.

2.0 E-COA Process and Timeline

Tuesday 9 September, 2014

1. The original contact was made by Texas Equusearch, a volunteer search and recovery group, on behalf of the Plano Police Department for unmanned aerial vehicle utilization. This contact was directed to Mr. Gene Robinson at RP Search Services, a 501(c) (3) non-

profit organization, who has supported Texas Equusearch on previous events, unrelated to the NIST WUI Project or its assets.
2. The Director of Texas Equusearch, Mr. Tim Miller, was contacted by Mr. Chris Doherty of the FAA Flight Standard District Office in Dallas, Texas, following a press conference by Mr. Miller announcing the desire to use UAVs in the search effort.
3. Gene Robinson, NIST WUI UAV Pilot in Command, contacted NIST WUI Project Manager Alexander Maranghides requesting authorization to deploy NIST assets and utilize the NIST WUI MLB Superbat UAVs under the existing NIST COA, as part of the Emergency COA Application. Mr. Maranghides began the approval process through NIST management. The request was to conduct the Search and Recovery (SAR) mission in lieu of proficiency flights scheduled for late September 2014. In this manner, the SAR response would not result in any additional costs to the NIST WUI Project.
4. Plano Police Department provided a Statement of Need to begin the E-COA submission process.
5. Per the direction of NIST, the UAV operations staff were notified and necessary travel was coordinated.

Wednesday 10 September, 2014

1. The NIST WUI UAV Pilot in Command (PIC) coordinated the submission of the required Statement of Need documentation, determined the intended search area in the Plano Texas area of interest, completed the E-COA checklist, and submitted to Mr. Mark Jordan at the FAA Unmanned Aircraft Systems Integration Office at 9:30 am.
2. Search epicenter coordinates were modified at 10:00 am per the Plano Police Department.
3. NIST was notified by the FAA of the E-COA approval at 2:30 pm. The E-COA would commence on 10 September 2014, providing four days of UAV operation.
4. The NIST WUI UAV operational unit was deployed from its base of operations in Wimberley, Texas. Equipment deployed included the command and control trailer and MLB Superbat UAV systems with the required support equipment.
5. NIST WUI UAV flight crew and equipment arrived at the search incident command center in Plano, Texas by 8:30 pm.

3.0 Mobilization and Integration into Incident Command

The arrival of the NIST UAV team occurred after the initial origination of the search and recovery with the NIST UAV team integration into the Incident Command occurring on Thursday 11 September, 2014. The National Incident Management System (NIMS) protocols for Incident Command System (ICS) were followed to integrate the UAV assets. The NIST WUI UAV Pilot in Command met with the search coordinator of Texas Equusearch and the Plano Police Department Lieutenant, acting incident commander (IC). The Pilot in Command briefed the search coordinators on protocols expected with the insertion of the NIST WUI UAV team to meet the overall incident objectives for both operational and support activities. It was requested that subsequent post event processing could be required in areas of higher interest to

produce mosaic maps to aid the search. The NIST WUI UAV team coordinated operations with Plano Police Department to employ the use of assets of marked units and/or officers for crowd control if necessary during flight events. Rally points and alternate emergency landing areas were identified for each search area of interest (AOI).

4.0 Mission Parameters

Field operations were conducted under the established NIST WUI UAV protocols for field deployment established under COA 2013-CSA-15. All particular flight operations were governed by the FAA granted Emergency COA supplemented provisions, as follows:

1) All flights to be conducted within the FAA provided area of operations covering a 4.8 km (2.6 nautical miles) radius[1], centered at coordinates provided by the Plano Police Department. See Figure 1 – Figure source is FAA E-COA Addendum, map overlay of McKinney Airport by NIST.
2) All flights to be conducted at or below 152 m (500 ft) Above Ground Level in Visual Flight Rule conditions in Class G Airspace (appendix A).
    a. Designated Class G airspace includes all airspace below flight level 183 m (600 ft) not otherwise classified as controlled.
    b. There are no entry or clearance requirements for Class G airspace, even for Instrument Flight Rules operations. Class G airspace is typically the airspace very near the ground (366 m (1200 ft) or less), beneath Class E airspace.
    c. Radio communication is not required in Class G airspace, even for Instrument Flight Rules (IFR) operations –when weather precludes flying visually. Class G is completely uncontrolled.
    d. Visual Flight Rules visibility requirements in Class G airspace are 1.6 km (1 mile) by day, and 5 km (3 miles) by night, for altitudes below 3050 m ft (10000) Mean Sea Level (MSL) but above 366 m (1200 ft) Above Ground Level (AGL). Beginning at 3050 m (10000 ft) MSL, 8 km (5 miles) of visibility are required, day and night. Cloud clearance requirements are to maintain an altitude that is 152 m (500 ft) below, 305 m (1000 ft) above, 610 m (2000 ft) horizontal; at or above 3050 m (10000 ft) MSL, they are 305 m (1000 ft) below, 305 m (1000 ft) above, and 1.6 km (1 mile) laterally. By day at 366 m (1200 ft) AGL and below, aircraft must remain clear of clouds, and there is no minimum lateral distance.
    e. It should be noted that there are certain exceptions where Class G extends above 366 m (1200 ft) AGL. This is usually either over mountainous terrain (e.g., some areas in the Rocky Mountains), or over very sparsely populated areas (e.g., some parts of Montana and Alaska).
3) Minimum fuel load on aircraft to meet mission requirements, plus 20 minute reserve to curb possible fly-away intrusion.
4) Follow Lost Link Procedures.

[1] Only units of the SI and those units recognized for use with the SI are used to express the values of quantities. Equivalent values in other units are given in parentheses following values in acceptable units only when deemed necessary for the intended audience.

a. In the event of a lost link, the Pilot in Command will immediately notify the Addison Air Traffic Control Tower (ATCT) at (972) 628-6420. The PIC must provide the location, maximum altitude, programmed lost link maneuvers, state pilot intent and comply with the following provisions.
b. In case of Lost Link the MLB Superbat UAS will land immediately.

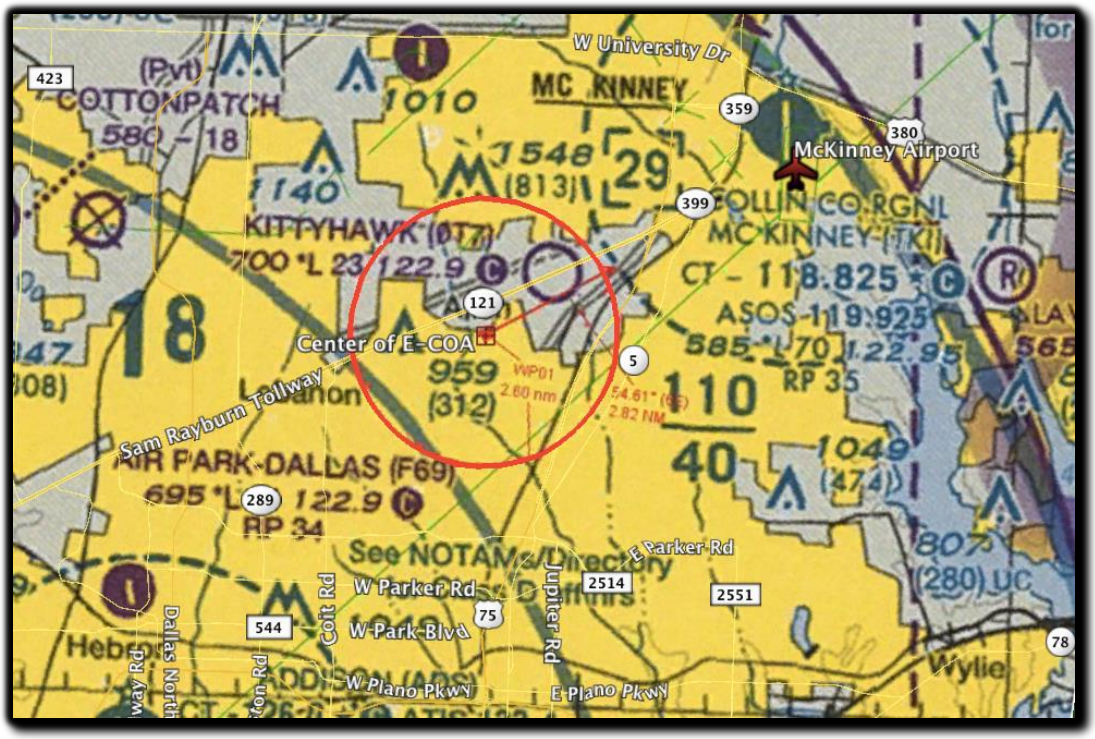

Figure 1: FAA provided area of operations covering a 2.6 nautical mile radius indicated by the red circle.

5.0 Missions Flown and Deliverables

Flight operations were conducted between 11 September and 14 September, 2014.

Selection of flight zones was determined in coordination with Plano Police Department investigators and the activities of the volunteer search and recovery organization Texas EquuSearch. Texas EquuSearch provided ground search coordination and resources.

Areas of interest were reviewed and assessed to determine they were within the E-COA designated flight area, and met additional criteria outlined in the E-COA addendum. See Figure 2.

Additional flight zones were requested by the Plano Police Department in coordination with the ground search efforts, but were denied by the NIST WUI UAV Pilot in Command due to the location and surroundings of the requested zones. The requested areas included sites outside of

the granted E-COA area of responsibility, sites that provided insufficient launch and recovery space, areas that were heavily populated and sites that presented potential incursion into McKinney Airport Class D Airspace.

Figure 2: Areas of interest for search are indicated in green on map. Map data Google ©2014. Map overlay of search area by NIST.

Thursday 11 September, 2014

One flight was conducted during this time period; the flight zone is shown in Figure 3. Flight preparations commenced at 16:16 UTC (Coordinated Universal Time) with aircraft autonomously launched at 17:05 UTC per PIC clearance. UTC is also the time standard used in aviation, for flight plans and air traffic control clearances to avoid confusion about time zones and daylight saving time. Central Standard Time (CST) is 6 h behind UTC. The aircraft covered an approximate 463 m (0.25 nautical mile) by 704 m (0.38 nautical mile) area of interest during its autonomous 00:37:25 total flight time recorded by a flight timer in the following format, hours:minutes:seconds. The aircraft was manually landed by the PIC at

17:43 UTC. Airframe was powered down at 18:07 UTC. All flight activity was within normal parameters with no general aviation traffic observed during the flight.

Figure 3: Flight conducted in this search area on 11 September, 2014. Map data Google© 2014. Map overlay of search area by NIST.

Friday 12 September, 2014

Inclement weather did not permit flight activities on Friday.

Saturday 13 September, 2014

Two flights were conducted during this time period; the flight zones are shown in Figure 4 and Figure 5.

- Flight 1

  Flight preparations commenced at 14:56 UTC with aircraft autonomously launched at 16:17 UTC per PIC clearance. The aircraft covered an approximate 667 m (0.36 nautical mile) by 952 m (0.50 nautical mile) area of interest during its autonomous 00:14:27 total flight time recorded by a flight timer (in the following format: hours:minutes:seconds). The aircraft was manually landed by the PIC at 16:31 UTC. The airframe was powered down at 16:42 UTC. All flight activity was within normal parameters with no general aviation traffic observed during the flight.

- Flight 2
  Flight preparations commenced at 19:11 UTC with aircraft autonomously launched at 19:33 UTC per PIC clearance. The aircraft covered an approximate 407 m (0.22 nautical mile) by 463 m (0.25 nautical mile) area of interest during its autonomous 00:10:37 total flight time recorded by a flight timer in the following format, hours:minutes:seconds. The aircraft was manually landed by the PIC at 19:44 UTC. Airframe was powered down at 19:57 UTC. All flight activity was within normal parameters with no general aviation traffic observed during the flight.

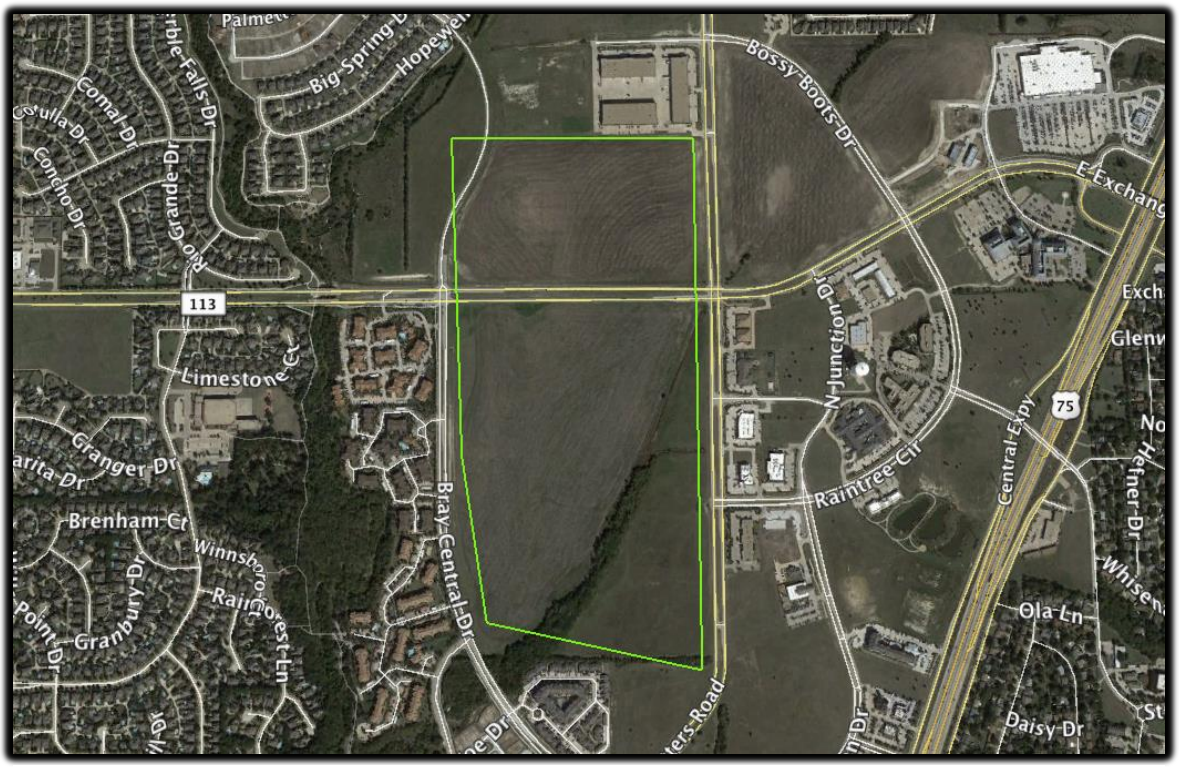

Figure 4: Flight 1 conducted in this search area on 13 September, 2014. Map data Google© 2014. Map overlay of search area by NIST.

Figure 5: Flight 2 conducted in this search area on 13 September, 2014. Map data Google© 2014. Map overlay of search area by NIST.

Sunday 14 September, 2014

One flight was conducted during this time period; the flight zone is shown in Figure 6. Flight preparations commenced at 17:42 UTC with aircraft autonomously launched at 18:38 UTC per PIC clearance. The aircraft covered an approximate 741 m (0.40 nautical mile) by 833 m (0.45 nautical mile) area of interest during its autonomous 00:20:31 total flight time recorded by a flight timer in the following format, hours:minutes:seconds. The aircraft was manually landed by the PIC at 18:59 UTC. Airframe was powered down at 19:02 UTC. All flight activity was within normal parameters. General aviation traffic was observed, identified and fell within sufficient separation requiring no deviation from the flight plan.

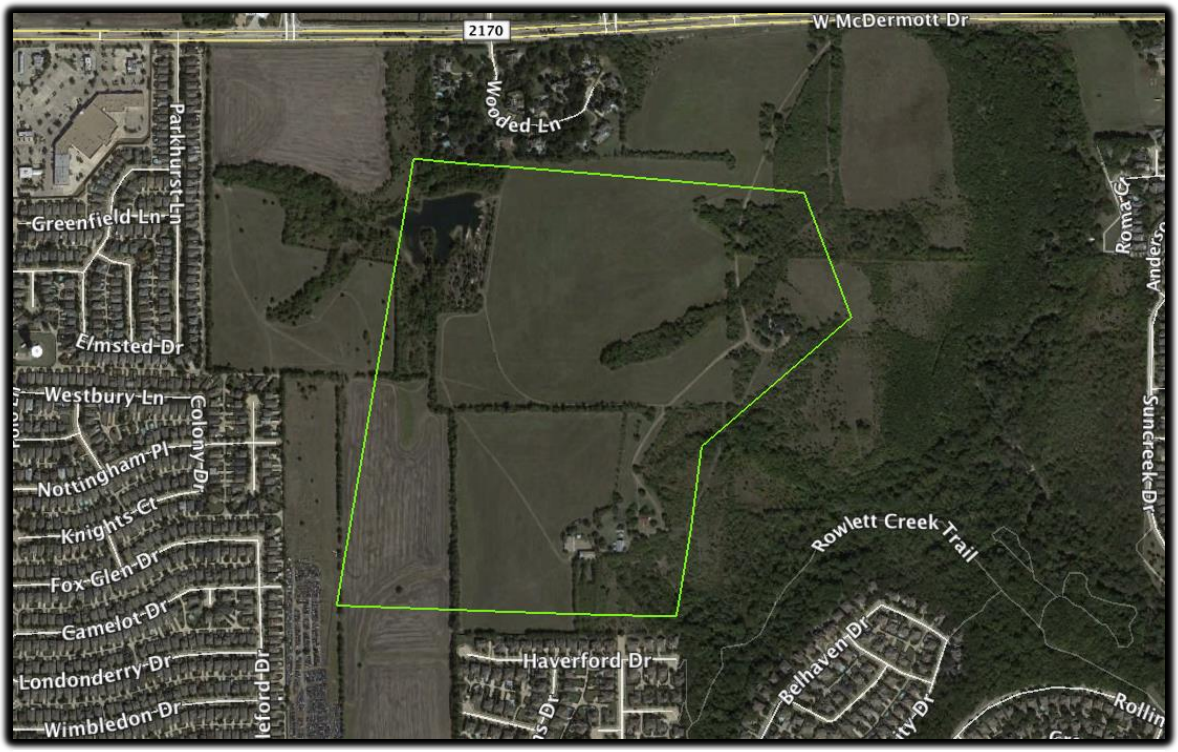

Figure 6: Flight conducted in this search area on 14 September, 2014. Map data Google© 2014. Map overlay of search area by NIST.

Imagery review process:

Following flight activity on 11, 12 and 14 September, 2014 and once field operations were completed, the UAV crew conducted imagery review. Initial review procedures were for each team member to identify imagery with anomalies, those being unnatural ground formations, ground disturbances, unusual debris, or visible aspects that matched the missing persons last known clothing description. Imagery selected by the above criteria was reviewed by the UAV team collectively to assess relevance before geo-locating imagery and providing it to the search ground team coordinator. Imagery was not distributed in any manner (copied, electronically transferred, or printed) to any parties outside of the UAV team during the review process. Geo-referenced imagery of interest was shown, but not distributed to, the Plano Police Department investigators and the ground search team coordinator for use in directing ground personnel to clear areas of identified interest.

6.0 Mission Summary

It is important to stress that the deployment and the operation of NIST unmanned aircraft assets was no different than had been accomplished on every other occasion during the NIST WUI project time frame. The procedures and protocols developed in the designated training area followed by the NIST aircrew required no modification other than following the guidelines set forth by the FAA for safety purposes. This situation would be similar to operations under Incident Management System under the direction of Air Assets Coordinator. The internal safety procedures for the actual field operation of the aircraft were validated in an environment different than what would normally be encountered in a fire situation. This reflects a thorough, documented understanding of insertion of the assets into varied ICS situations.

7.0 Conclusions

The paper documents the emergency deployment of the NIST UAV assets to address a specific request by local government in Texas. The NIST COA made the E-COA application possible since it is a requirement for E-COA issuance. FAA issued the E-COA in less than 6 hours, expediting the time sensitive deployment of the aerial resources. The deployment demonstrated the effective use of the E-COA process.

8.0 Acknowledgments

On behalf of the NIST UAV team we would like to express our thanks to Plano Police Department Lieutenant David Tilley and the Plano Police Department; FAA Unmanned Aircraft Systems Integration, Mark Jordan, ATCS NISC Contract Support, Richard Kervin, Dallas Flight Standard District Office, Chris Doherty, and the Federal Aviation Administration; and Director of Texas Equusearch, Mr. Tim Miller and his entire staff. Finally, a special thanks goes out to Christina Morris's family and friends for the support they provided at every moment to our team throughout this difficult time.

Appendix A

Class G Airspace

3-3-1. General

Class G airspace (uncontrolled) is that portion of airspace that has not been designated as Class A, Class B, Class C, Class D, or Class E airspace.

3-3-2. VFR Requirements

Rules governing VFR flight have been adopted to assist the pilot in meeting the responsibility to see and avoid other aircraft. Minimum flight visibility and distance from clouds required for VFR flight are contained in 14 CFR Section 91.155.
(See TBL 3-1-1.)

3-3-3. IFR Requirements

a. Title 14 CFR specifies the pilot and aircraft equipment requirements for IFR flight. Pilots are reminded that in addition to altitude or flight level requirements, 14 CFR Section 91.177 includes a requirement to remain at least 1,000 feet (2,000 feet in designated mountainous terrain) above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown.

b. IFR Altitudes.
(See TBL 3-3-1.)

TBL 3-3-1

IFR Altitudes
Class G Airspace

If your magnetic course (ground track) is:	And you are below 18,000 feet MSL, fly:
0° to 179°	Odd thousands MSL, (3,000; 5,000; 7,000, etc.)
180° to 359°	Even thousands MSL, (2,000; 4,000; 6,000, etc.)

Appendix B

Addendum Letter Plano COA 2013 CSA- 15

U.S. Department
of Transportation
Federal Aviation Administration

September 10, 2014

National Institute of Standards and Technology (NIST)
100 Bureau Drive
Gaithersburg, MD 20899
Attn: Alexander Maranghides
Gene Robinson

ADDENDUM TO CERTIFICATE OF AUTHORIZATION (COA) 2013-CSA-15.

ISSUED TO: National Institute of Standards and Technology (NIST)

DESCRIPTION: The Plano Police Department has requested an Emergency COA Addendum to COA 2013-CSA-15 for UAS operations within the National Airspace System (NAS) for the purpose of local law enforcement mission using a MLB SuperBat Unmanned Aircraft System (UAS). The UAS will operate in Class G airspace centered around 33.04. 42.29 latitude by 96.50.32.53 longitude within the confines of the operational area as described in attachment 1 at or below 500 ft. AGL in VFR conditions. The Plano Police Department has declared that there is an emergency mission necessity to operate outside the Area of Responsibility (AOR) authorized in the primary COA for the purpose of assisting law enforcement and this mission **meets the requirement of distress or urgency.**

DATES OF USE: This addendum is valid September 11, 2014 to sunset, September 15, 2014.

PROCEDURES:

This procedure supplements all provisions contained in the primary COA.
The proponent is authorized to operate in Class G airspace within the confines of the operational area as described in attachment 1 at or below 500 ft. AGL in VFR conditions.

1. Flight over populated or congested areas is not authorized, including lost link procedures.

2. Place only minimum fuel on board UA to meet mission requirements plus 20min for reserve to help curb possible fly-away intrusion.

3. Lost Link (LL) Procedures

In the event of a lost link, the PIC will immediately notify the Addison ATCT at (972) 628-6420, The PIC must provide the location, maximum altitude, programmed lost link maneuvers, state pilot intentions, and comply with the following provisions.

In case of Lost Link the MLB SuperBat UAS will land immediately.

Sincerely,

Randy Willis
Air Traffic Manager,
Unmanned Aircraft Systems Integration Office

Appendix C

Statement of Need Plano

Plano
City of Excellence

Police Department
909 14th Street
Plano, TX 75074
Tel: 972.424.5678
planopolice.org

City of Plano
P.O. Box 860358
Plano, TX 75086-0358
Tel: 972.941.7000
plano.gov

Date: September 9, 2014

To : Whom it may concern

From : Lt. Jeff Wise, Plano Police Department

Subj: Statement of Need – Unmanned Aircraft for Search of Missing Person

Dear Sir,

We have an immediate need for the unmanned aircraft capabilities and the active Certificate of Authorization they are currently being flown under. The Federal Aviation Administration has agreed to review and approve an application for an Emergency Certificate of Authorization for use in this effort in the Plano Texas area.

This request is for immediate assistance and will be required for 5 days from tomorrow 09/10/2014.
Your assistance and consideration in this urgent requirement is appreciated.

Respectfully,

Lt. Jeff Wise
Criminal Investigations Services Division –
Crimes Against Persons
Plano Police Department

Harry LaRosiliere, Mayor | Lissa Smith, Mayor Pro Tem | Ben Harris, Deputy Mayor Pro Tem | Pat Miner, Place 1 | André Davidson, Place 3 | Jim Duggan, Place 5 | Patrick Gallagher, Place 7 | David Downs, Place 8 | Bruce D. Glasscock, City Manager

Appendix D

Instrumentation: SUPER BAT

TASE 200 Duo -Gimbal System Configuration	
Aircraft Type	MLB SuperBat III
Gimbal Mounting Type	Nose mounted, fixed environmentally sealed gimbal payload- Goodrich **TASE 200 Duo** series camera.
User Interface	**ViewPoint, Version 2.x.x (to be provided)**
	Geo Point: Click map or video to autonomously point gimbal at specific GPS location on the ground
	Moving Map: Interactive map displays location and gimbal sensor footprint on ground. Satellite, streets and maps, or any user supplied map supported
	SD Video Capture & Display: Analog NTSC or PAL video supported
	Record & Replay: NTSC or PAL recording. Playback includes video, GPS time, plus gimbal and sensor footprint GPS locations
	Make Video Files: Create video file (AVI output or MPEG2 encoded) from digitally recorded files
	Plug-in Support: Supports CCT plug-ins and 3rd party plug-in architecture
	MJPEG Axis Client: Supports IP connection and web serving using MJPEG compression
Advanced Software Options	Path Track, or breadcrumb trail, can be viewed during flight. ViewPoint based screen captures acquired by a manual user interface keystroke during flight. Extracted frames are mosaiced over loaded map base layer within Viewpoint.
Developers Kit	
Onboard GP/IN	

Camera Configurations Summary	Camera format: NTSC or PAL capability. Standard used in North America is NTSC 29.97 frames per second, comprised of 525 individual scan lines.
IR Camera (Long wave):	Goodrich TASE Duo 200 series
	Image Resolution : 640x480
	HFOV : 10.5 degrees
Standard electro-optical	Goodrich TASE Duo 200 series
	Image Resolution : 1280x720
	HFOV : 55.7 to 1.94 degrees
Aircraft altitude	1500 feet above ground level
Aircraft loiter	300 meter loiter radius
Slant range	?
Image resolution (pixels)	Reflected in camera specifications of what sensor provides.
Ground sample distance	?

AutoPilot – Cloudcap Piccolo II	
Aircraft Type	MLB SuperBat III
AutoPilot	Piccolo II
Radio Frequency	900 MHz for ground control station, telemetry feeds. 2.4ghz for all video transmission
User Interface	Piccolo Command Center
	Dockable windows, context menus for common functions
	Complete support for all Piccolo controlled vehicles
	Primary Flight Display and graphical EFIS with the ability to change airspeed, altitude and heading
	Real-time flight planning. Flexible drag and drop flight plan generation and updates
	Integration with web mapping servers for elevation imagery data
	Terrain aware flight planning and warning system. 3-D views, high performance mapping with the profile viewer. Terrain database supporting DTED and SRTM
	Geo-Fence: Airspace boundary definition and warning system
	PCC Software supports a growing number of plug-in applications that can be purchased separately
	TASE Gimbal plug-in for TASE or servo pan/tilt cameras
	Strip Chart displays plug-in adds graphical display of telemetry data
Advanced Software Features	Advanced flight planning: updates during flight, drag and drop, lost com and landing plans
	Supported by full HW in Loop and Software Simulators
	Support of TASE stabilized gimbal
	Support for DGPS and WAAS corrections for built in GPS
	Gimbal stabilization control for servo based pan-tilt cameras
	Magnetometer, payload pass-through, etc.
Ground Station Kit	Ground control station is secured inside of the command and control trailer.
Aircraft Integration Accessories	

Appendix E

NIST Flight Profile Information

Aircraft Type	**MLB SuperBat**
Wing Span (ft)	8.5
Length (ft)	5.0
Gross Take Off Weight (lbs)	35 with payload
Propulsion	26cc internal combustion
Fuel on Board (lbs)	6.9 lbs (gas/oil mix)
Duration (typical)	10 hours/ 400 miles
Take Off Type	Catapult launch
On board electrical	3 X 5Ah Lithium Polymer
Electrical Duration (typical)	10 hours
Guidance/Avionics	Cloud Cap Piccolo II
Pilot-In-Loop/Manual Over ride	Yes
Launch Type	Catapult
Landing Type	Conventional/Skid
Failover Recovery	Parachute
Aircraft Performance	----------
Max Climb (fpm)	1000
Max Descent (fpm)	800
Airspeed (max, kts)	60
Airspeed (cruise, kts)	39
Max Altitude (ft)	10,000
Active Frequencies (Transmitted)	----------
Primary Command & Control Frequency	900 Mhz Spread Spectrum/Microhard
Telemetry Frequency	900 Mhz Spread Spectrum/Microhard
Secondary Frequency	N/A
Range (typical)	3-6 miles VLOS
Payload Frequency	1 watt, 2.4 Ghz (consumer)
Range (typical)	Up to 10 miles VLOS
Passive Frequencies (Received)	----------
L1 (1575.42 Mhz) and L2 (1227.60 MHz)	GPS navigation

Field safety operations procedures (FSOP) contained in Certificate of Authority issued by the Federal Aviation Administration 2011-CSA-63.

Aircraft operations per manufacturers manual (MLB Super Bat) dated 04/29/12 amended 05/08/2012

NIST Point of Contact: Alexander Maranghides, alexm@nist.gov
Cell: (301) 252-8747

Appendix F

Certificates of Waiver of Authorization -COA

		ASN	2013-CSA-15-COA
		Case Status	APPROVED
		Date Created	01/16/2013
		Date Submitted	01/20/2013
Proponent Organization		**Sponsor**	**NIST**
		Attn Of	**Alexander Maranghides**
		Address	100 Bureau Drive
		Address2	
		City	Gaithersburg
		State	MD
		Postal Code	20899
		Telephone	(301) 252-8747
		Email	alexander.maranghides@nist.gov
Declaration		**Declaration(a)**	**Yes**
		Declaration(b)	Yes
Point of Contact		**Representative**	**Gene Robinson**
		Address	290 Brunson Lane
		Address2	
		City	Wimberley
		State	TX
		Postal Code	78676
		Telephone	(512) 665-9990
		Email	texhills@verizon.net
Operational Description	**Requested Effective Period**	**Beginning**	
		End	
		Light out operation	No
		VFR operation	Yes
		IFR operation	No
		Day operation	Yes
		Night operation	No
		Program Executive Summary	UA asset to be for utilized fire support, research, and in disaster mitigation. EO/IR/near-IR images will be collected for predictive fire/fuel analysis. Procedures for UA use under NIMS protocols developed solely for fire mitigation.

		Operational Summary	Flights are on an "as needed" basis dependent upon weather. Average duration of flight 30-45 minutes. Average operational altitude in training area will average 400' AGL.
	Location	State	TX
		County	Hays
		Nearest Airport	WINN RANCH
		AOR	Texas - Central
	Class Of Airspace	Class-A	
		Class-B	
		Class-C	
		Class-D	
		Class-E	
		Class-G	Yes
System Description		**Aircraft Type**	**102154739 - Other**
		Aircraft Type And Model Description Attachment	1
		Control Station Attachment	1
		Communications System Attachment	1
		List Certified Components (TSO) Attachment	1
		Other Attachment	0
Performance Characteristics		**Climb Rate (feet/Minute)**	
		Descent Rate (feet/Minute)	500
		Turn Rate (Degrees/Second)	750
	Cruise Speed	Maximum	5.0
		Minimum	62
		Approach Speed	34
	Operating Attributes	Maximum MSL	34
		Minimum MSL	400
		Gross Takeoff Wt	200
		Launch/Recovery Attachment	34.0

Airworthiness		**FAA Type Certificate**	**1**
		If No FAA Certificate (Public Aircraft Only) Attachment	
Procedures		**Lost Link/Mission Procedures Attachment**	**1**
		Lost Communications Procedures Attachment	1
		Emergency Procedures Attachment	1
Avionics/Equipment		**Equipment Suffix Type**	**1**
		GPS	D
		Moving map indicator (Command Station)	Yes
		Tracking capability	Yes
		TCA/MCAS	Yes
		ELT	No
	Transponder	Transponder	No
		On	No
		Off	
		Standby	
		Ident	
		Mode S	
		Mode C	
		Transponder Retuneable in Flight	
Lights		**Landing**	
		Position/Navigation	No
		Anti-collision	Yes
		Infrared (IR)	No
Spectrum Analysis Approval		**Data Link**	**No**
		Data Link Attachment	No
		Control Link(s)	0
		Control Link	No

		Attachment	
		Operations utilizing Radio Control (R/C) frequencies as described in Title 47 CFR 95	0
		NTIA/FCC Authorization Attachment	No
ATC Communications	**Transmitter VHF Band**	**VHF Band**	**0**
		Quantity	Yes
		In-Flight Retunable	1
	Transmitter UHF Band	UHF Band	Yes
		Quantity	No
		In-Flight Retunable	
	Transmitter HF band	HF Band	No
		Quantity	No
		In-Flight Retunable	
	Receiver VHF Band	VHF Band	No
		Quantity	Yes
		In-Flight Retunable	1
	Receiver UHF Band	UHF Band	Yes
		Quantity	No
		In-Flight Retunable	
	Receiver HF band	HF Band	No
		Quantity	No
		In-Flight Retunable	
	Guard (Emergency) Frequencies VHF Band	VHF Band	No
		Quantity	Yes
	Guard (Emergency) Frequencies UHF Band	UHF Band	1
		Quantity	No
	Instantaneous Two-Way Voice	Direct to pilot	

		SATCOM	Yes
		Relay via aircraft	No
Electronic Surveillance/Detection Capability		**EO/IR**	**No**
		Terrain detection	Yes
		Weather/icing detection	No
		Radar	No
		Other Attachment	No
		Electronic detection systems	0
		Electronic detection systems attachment	No
		Radar observation	0
		NAS Operational Capability Attachment	No
Visual Surveillance/Detection Capability	**Maximum Distance from UA**	**Vertical**	**0**
		Horizontal	400 Feet
		Airborne based (Chase Aircraft)	1.0 Nautical Miles
		Ground based	No
		Visual observation from one or more ground sites	Yes
		Forward or side looking cameras	Yes
		Attachment for All	Yes
Aircraft Performance Recording		**Flight data recording**	**2**
		Control station recording	Yes
		Voice Recording	Yes
Flight Aircrew Qualifications	**Pilots**	**Private (Written)**	**No**
		Private (Certified)	Yes
		Instrument	Yes
		Commercial	No
		Air Transport	No
		Unique Trained Pilot	No

		Unique Trained Pilot Description	Yes
		DOD certified/trained	Pilot shall have unique training by manufacturer in respect to UA operation and flight characteristics. Shall be NIMS certified 100, 300, 700
		Other Certified Training	No
		Trained on Part 91 Requirement	No
		Medical Certification Class (FAA or DOD equivalent)	Yes
		Currency Status	2
		Duty Time Restrictions	Pilot in Command (PIC) shall maintain a Class II flight medical.
		Single UAS Control	None
		UAS Description	Yes
		Total Numbers of UAS Controlled	No multi-agent flights are intended under this COA
	Observers	Private (Written)	1
		Private (Certified)	No
		Instrument	No
		Commercial	No
		Air Transport	No
		Unique Trained Pilot	No
		Unique Trained Pilot Description	Yes
		DOD certified/trained	Shall be NIMS certified 100, 300, 700
		Other Certified Training	No
		Trained on Part 91 Requirement	No
		DOD Certified Training Attachment	Yes
		Medical Certification Class (FAA or DOD equivalent)	0

		Currency Status	2
		Duty Time Restrictions	Observers require a class II flight medical
		Single UAS Control	None
		UAS Description	Yes
		Total Numbers of UAS Controlled	n/a
Special Circumstances		**Special Circumstances**	**1**
			Every circumstance shall be considered a special circumstance. No operations will be conducted without briefing and approval by the Incident Commander in each situation. Observers will be required to have a Class II flight physical.