THE UNIVERSITY OF SOUTHERN MISSISSIPPI

NATIONAL CENTER FOR SPECTATOR SPORTS SAFETY AND SECURITY (NCS⁴)

LABORATORY ASSESSMENT REPORT

Hoverfly Technologies Inc.

LiveSky™ Secure Plus Tether-Powered UAS

Foreword

The National Center for Spectator Sports Safety and Security (NCS^4) at the University of Southern Mississippi has established the National Sports Security Laboratory (NSSL) dedicated to sports safety and security to assist sport and event venue operators in assessing and validating systems and technologies for safety and security use.

The NSSL provides a mechanism to aggregate specific safety and security requirements for the spectator sports domain as developed by security and venue operator practitioners through participation in a National Advisory Board. The NSSL, using industry requirements and operational needs, develops:

- Impartial and operationally relevant assessments and validations of safety and security solutions (systems and products) based on the community of interest (COI) requirements
- Evaluation reports that enable venue operators and security personnel to select and procure suitable solutions; and to deploy and maintain solutions effectively. In some cases, process evaluations will be performed to devise new procedures.

The evaluation program follows principles currently adopted by standing DHS validation programs (such as SAVER[1]) that are meant to assist end operators with objective, quantitative reviews of available commercial systems and solutions. Information obtained in the course of the assessments (including this report) will be made available to subscribers of NCS^4 publications and to the U.S. Department of Homeland Security for their use.

[1] System Assessment and Validation for Emergency Responders (SAVER) was established by DHS to assist emergency responders in making procurement decisions through the publication of objective assessments and validations of commercial equipment. This process was used as a reference guide for the evolution of NCS^4 Lab process.

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1.0 Introduction

1.1 Analysis of the Need

The NCS[4] National Advisory Board identified the investigation of drone technology and surveillance as a priority for sports safety and security. In an ever-changing threat environment, drone technologies offer public safety personnel the ability to conduct surveillance and crowd monitoring from positions unavailable to traditional surveillance. In addition to public safety operations, drone technologies can supplement facility inspections, damage assessments, and marketing efforts; further solidifying a place for drone technologies in the sports and entertainment industry.

This report presents a summary of the evaluation and demonstration of the LiveSkyLiveSky Tether-Powered Unmanned Aerial System. The system evaluation focused on functionality and overall performance capabilities.

1.2 Overview of Hoverfly

Founded in 2010, Hoverfly Technologies Inc. (www.hoverflytech.com) designs and manufactures tether-powered aerial drones and autonomous tether-power systems designed for persistent security and public safety applications. Hoverfly drones capture persistent, broadcast quality video from up to 200 ft. and capable of flying continuously for hours, days and weeks at a time using mobile/ground power transmitted over the tether. Hoverfly's tethered systems operate in defense, security, public safety, sports, media, and large industrial markets where reliability, persistent aerial flight and durability are paramount. Hoverfly's range of sensors and payloads provide actionable intelligence and high-bandwidth communications. Hoverfly drones send RF secure data and operate from fixed base installations or "on the move" vehicles. The Unmanned Aerial Systems (UAS) fly autonomously and require no special piloting skills, making them practical for all types of users, applications, and missions. Customer applications include equipping their drones with a variety of payloads including high definition video, infrared cameras, cellular transmitters and receivers, detectors, multi-spectral and acoustic sensors and more. Hoverfly drones and autonomous tether-power systems are American made and supported in the U.S.A.

1.3 LiveSky™ Overview

The LiveSky Tether-Powered Unmanned Aerial System (UAS) is next generation aerial technology providing persistent "eyes in the sky" observation to monitor and deliver actionable intelligence to all stakeholders. Ideal for intelligence, surveillance and reconnaissance (ISR) operations where there are mass gatherings of people, LiveSky features unlimited flight time, simple 5-button operation, precision landing and network interoperability for distributed real time video feeds. LiveSky uses high definition electro-optical pan, tilt, zoom and infrared cameras to provide a persistent aerial view at up to 200', allowing safety and security personnel to see danger from vantage points that were not available before.

Powering the system by tether solves the problem of limited flight time associated with free-flying drone's short battery life. LiveSky allows users to maintain persistent perch and stare intelligence, surveillance and reconnaissance activities. With tether-power coming from a standard ground or mobile power source, flight time is no longer a concern.

Safety - Based on Hoverfly's five-button fully automatic flight control system, proven positive control power-tether technology, and non-GPS operating capability, the Hoverfly LiveSky is the only tether powered persistent flight UAV currently approved by the FAA to routinely fly in Class B airspace. The LiveSky features several safety systems that monitor the health, life and safety of the vehicle. In the event of dangerous flight conditions or power interruption, the system will autonomously land to prevent flight safety related incidents and damage. Additionally, the tether removes the requirement for RF, eliminating the potential for interception, jamming or spoofing of control systems or video data.

Ease of Operation - Hoverfly's five-button fully automatic flight control system provides a straightforward approach to operating LiveSky. Push the "Arm" button to implement the UAS launch sequence, "Launch" to command the drone to start its ascent, "Up" button to increase altitude, "Down" button to decrease altitude and "Land" button to precision land on its landing point.

Fast Deployment – The LiveSky system comes in three self-contained pelican shipping cases and a launch pad. Simply plug the Autonomous Tether-Power System (ATS) to a standard 110V A/C outlet or DC converter, connect the ethernet cable from the ATS to the Mission Flight Control kit, turn power on and you are ready to fly. The LiveSky System can also be installed in vehicles

Mobility – LiveSky has its own self-contained cases allowing it to be set up in minutes. Whether it's set up from its cases on the ground, a rooftop, the back of a vehicle or even integrated into a vehicle, LiveSky is a "pop-up" on demand ISR technology allowing you to put the system where you want and easily move it to a different location.

Using Hoverfly's software application, LiveSky also has "On the Move" capability when it is integrated into a vehicle and be used in motion with its "Follow Me" mode, meaning the UAV will follow, flank or lead the vehicle while it is moving up to 20mph.

1.4 LiveSky Components

The LiveSky Unmanned Aerial Vehicle is manufactured in Orlando, Florida. The airframe and blades consist of carbon fiber construction for lightweight rugged durability. The aircraft comes with vehicle navigation lighting for nighttime operations, a 3-axis gimbal for stabilized optical pan-tilt-zoom (PTZ) and infrared (IR) video payloads. Composite water-resistant canopy and military-grade construction provides lasting durability for long flight missions.

Figure 1: LiveSky Controllers. Mission Control Kit (Left), Hand-Held Control (Center), Toughbook (Right)

LiveSky Controllers

LiveSky comes with several controller options for maximum flexibility. Controllers use five buttons to fly the aircraft – ARM, LAUNCH, UP, DOWN, LAND.

LiveSky controllers consist of Mission Kits that are equipped with optional sunlight built in displays, hand-held controllers or as software loaded onto a Toughbook or other tablet with a simple Graphical User Interface (GUI) with point and click or touch-screen commands.

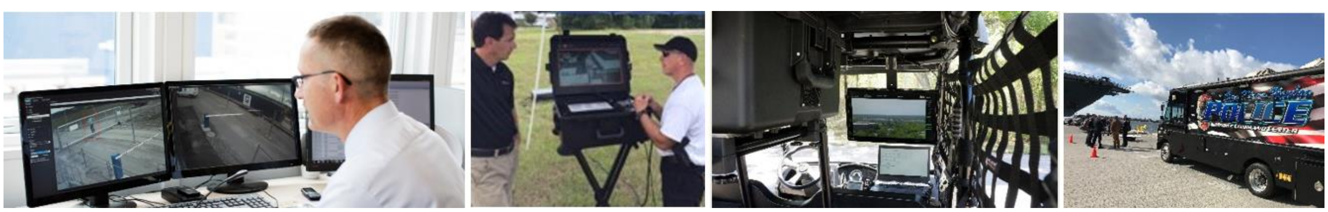

Figure 2: Video Capability

LiveSky Video Capability

LiveSky can record full HD 1920 x 1080 video at 30 fps to third party off-the-shelf devices or video management systems either through its HDMI outputs, h.264 video streams for remote viewing or relayed using third-party streaming devices. Video payloads include electro-optical PTZ cameras and FLIR IR with Picture in Picture switching and can be collected, streamed and relayed securely to multiple stakeholders either wirelessly, over LTE, cellular or Wi-Fi.

Figure 3: LiveSky Tether System

LiveSky Autonomous Tether System

Tether-Powered Flight System autonomously manages the functions of the LiveSky systems through its tether management system. The system is comprised of power through tether management, automated controls, pre-programmed maneuvers, precision landing, No RF secure communications with data and video streams fed securely through the tether and “Follow Me” technology that utilizes its tether tension and automatic tracking system to lead, flank or follow a vehicle.

Figure 4: Vehicle Integration

LiveSky Vehicle Integration

The LiveSky system can be mounted to a wide range of vehicles, allowing users to customize the integration for the operational environment. Using its “On the Move” Advanced Tether Automation Kit (ATK) and tether management system, LiveSky can either lead, flank or follow moving vehicles; controlled with the software GUI on a Toughbook from inside the vehicle.

2.0 Objectives

This report serves the following purposes:

- Provides the description of the methodology employed during the evaluation, the scoring system and the role of evaluators in the evaluation process.
- Outlines the full set of solution requirements identified as functional capabilities by Hoverfly regarding the LiveSky system.
- Publishes the evaluation scoring results as well as the comments and additional information provided by the evaluators and Hoverfly.

Note. This evaluation is intended only to validate LiveSky's capabilities and functionality, as claimed by Hoverfly. The goal of this assessment report is to validate Hoverfly's advertised features and functions. The intent is not for comparison purposes with similar technologies or products.

3.0 Methodology

3.1 General Approach

The methodology described below was developed to be repeatable so that it could be used in the evaluation and assessment of a variety of technologies and processes. By employing this methodology the results become verifiable and quantifiable, and can be used subsequently for an entity's individual analysis and/or procurement decisions.

The methodology for this evaluation began with a discussion between Hoverfly and NCS4 to define the capabilities and functional requirements of the LiveSky system for the evaluation. Once Hoverfly provided a description of capabilities and functions to demonstrate, NCS4 worked with Hoverfly to create a list of executable requirements for the evaluation process.

Evaluators assessed the LiveSky system only against the company's chosen requirements. No evaluation criteria were considered outside of Hoverfly's own operational requirements. The evaluation criteria were composed of functional requirements that were grouped into the four main categories below:

1. Application and Capability
2. Ease of Use
3. Mobility
4. Safety and Security

3.2 Evaluators

A select group of subject matter experts (SMEs) from the sports security and information technology domains evaluated the LiveSky system. This group consisted of professionals from public safety, facility operations and networking. The collective group of SMEs had a base of experience that encompassed collegiate and professional sporting and major event safety and security operations.

3.3 Collecting Results

Each SME/evaluator was provided with the LiveSky system requirements matrix and scoring definitions. Facilitators and evaluators received a briefing prior to the evaluation to ensure a thorough understanding of the evaluation process and the expectations of each participant. Immediately following each part of the evaluation, evaluators were allotted time to document qualitative comments to supplement the quantitative scoring. At the conclusion of the evaluation process, all quantitative scoring data were taken by the facilitator and used to tabulate the results in the Scoring and Results section.

4.0 Setup, Demonstration and Evaluation

4.1 Training

The evaluation took place at the National Sports Security Laboratory (NSSL) and M.M. Roberts Stadium in Hattiesburg, MS. Hoverfly provided a technology overview to the evaluation team at the NSSL. Following a one-hour technology indoctrination at the NSSL, the evaluation team proceeded to the stadium for setup, hands-on training and evaluation.

4.2 Setup

Figure 5: Setup

One Hovefly representative concluded setup of LiveSky in approximately 30 minutes. The setup entailed connecting the unmanned aerial vehicle (UAV) to the vehicle mounted tethering system. Additionally, the onboard Toughbook and external Mission Control Kit were connected and operationally checked.

4.3 Implementation

All testing and demonstrations took place at M.M. Roberts Stadium at the University of Southern Mississippi. Temperatures ranged between 45-50 degrees Fahrenheit, with wind speeds recorded between 2-2.5 m/s at an elevation of 6’. For the purposes of testing, the UAV was operated at altitudes between 50’- 200’. A logarithmic wind profile estimated the minimum sustained winds at 9mph, with a maximum of approximately 12mph.

Figure 6: Mission Control Kit

Figure 7: PTZ and FLIR IR Picture in Picture Video

The LiveSky system validation began with the Mission Control Kit. After a brief introduction, evaluators took turns operating the UAV and onboard surveillance system. All operation of the UAV took place in the presence of a pilot with an FAA Part 107 License. A minimum of 3 personnel was used during the operation of the LiveSky "On the Move" system: driver, operator, spotter.

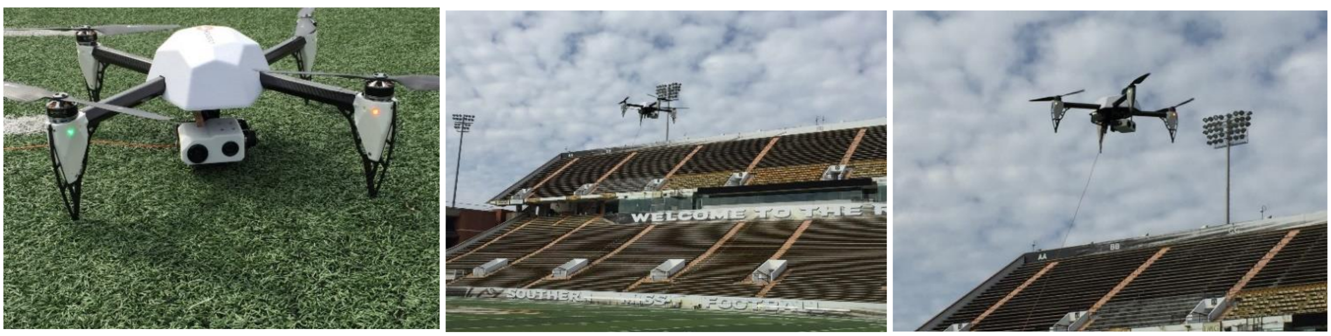

Figure 8: Surface Launch

The UAV was then operated using the hand-held controller and vehicle mounted Toughbook. Evaluator injected power interruptions triggered the systems autonomous safety landing. The UAV operated without error during fixed launches, emergency shutdowns and while attached to a ATV in motion at a speed of 10 mph. There were no safety incidents or system failures experienced throughout the evaluation.

Following a comprehensive review of LiveSky capabilities, each evaluator was provided the opportunity to revalidate demonstrated capabilities and expand on the evaluation criteria. A description of capabilities examined during the demonstration and evaluation can be reviewed in Section 5. Evaluator feedback is available in Section 6.

5.0. Scoring and Results

5.1 Scoring System

As outlined in Section 3.1, the evaluators scored the performance of the LiveSky based on the specific requirements within three functional areas, as defined by Hoverfly. Evaluators scored each functional area in three ways: 1) through observation/documentation during training, 2) interaction with the system, and 3) observed Hoverfly demonstration of system functions. All evaluators were instructed to compare the LiveSky platform against the requirements and not against other evaluator's result (technical leveling). Table 5.1 below depicts the scoring definition.

Table 5.1: *Scoring Definitions*

Definition	Score	Equivalent %
Does not meet the requirement	0	0%
Partially meets the requirement	1	50%
Meets the requirement, with comments/recommendations	2	75%
Meets the requirement	3	100%

Each functional area was of equal weight. The average evaluator score was used to rate individual requirements within each functional area. Functional area scores represent the average score of requirements within each specific functional area.

5.2 Results

5.2.1 Application and Capability

Table 5.2.1: *Application and Capability*

Function #	Functional Area	Function/ Specification to Score	Score
1. Application and Capability			
1.1	**Video Display**		
1.1.1	Situational Awareness	Video can be displayed locally over HDMI.	3.0
1.1.2	Send Video and Data Over Networks	Relay video with third party streaming devices.	3.0
1.1.3	Video Recording	Video can be recorded onto external video recording device.	3.0
1.1.4	Local Video Output	The LiveSky is capable of HDMI of Full HD 1920 x 1080 output to video display.	3.0
1.1.5	Complex Scene Understanding	Dual stream from both cameras simultaneously. View in PIP capability and separately on external monitors.	3.0
1.1.6	24 Hour Video Collection	LiveSky is equipped with EO low-light capability and IR views.	3.0
1.2	**Video Functionality**		
1.2.1	Day Operations	10X Optical PTZ HD video camera (Sony).	3.0
1.2.2	Night Operations	IR; 640 x 512 resolution video output (FLIR).	3.0
1.2.3	Image Stability	Provides stabilized video imagery over range of flight conditions.	3.0
1.3	**Persistent Flight Operations**		
1.3.1	Installation Power	120VAC ground or vehicle inverter power is converted to higher voltage and transmitted over Kevlar-reinforced tether.	3.0
1.3.2	Anti-Jam (No RF) Command and Control	System includes communications and video over power wire circuitry for secure command and control.	3.0
1.3.3	Altitude	Tether Kit operates automatically to control tether length based on altitude commanded by user.	3.0
1.3.4	Winds	System will adjust to operate in winds. **Winds did not exceed 12.3 mph during testing.**	3.0
1.3.5	On-the-Move Operation	Tether Kit automatically manages tether tension so that tether does not touch the ground.	3.0
1.4	**Hand-held Control**		
1.4.1	Hand-Held Control Connection	Hard-wire control cable for hand-held controller.	3.0
1.4.2	Hand-Held Control	Controls include: ARM, LAUNCH, LAND, UP, DOWN, plus Pan, Tilt, Zoom camera functions.	3.0

1.5	**Mission Kit Control**		
1.5.1	Built-in Display	LiveSky is equipped with optional portable Mission Kit for on-site field control and monitoring.	3.0
1.5.2	Controls	Controls include: ARM, LAUNCH, LAND, UP, DOWN, plus Pan, Tilt, Zoom camera functions.	3.0
1.5.3	HD Sunlight Readable Display	21" Sunlight readable display for monitoring video on the scene.	2.33
1.5.4	Displays Live Video for LiveSky	1080p video display with PIP and full-screen features for visible and IR feeds.	3.0
1.5.5	HDMI and Network Ports	Ability to port video and network data remotely or share in other locations.	3.0
1.6	**Navigation**		
1.6.1	Autonomous Tracking System	Autonomous precision landing CEP less than 6" of take-off position with ATS.	3.0
1.6.2	Follow-ME Technology	"On the Move" Follow-Me technology allows LiveSky to Lead/Flank/Follow vehicle.	3.0
1.6.3	Vehicle Navigation Lighting	Drone has aircraft lighting for flying in the evening and nighttime hours.	3.0
1.7	**Software Development Kit Control**	Command and Control Interface over Ethernet for local Computer or Remote (Network) Operations.	3.0
		Average score	**2.97**

SME matrix Comments/Recommendations:

1.4.2 – There is a 3-4 second delay in controls. Users will need to train in targeting locations to master.

1.5.3 – Screen had glare issues with the sun. The monitor used during demonstration was not the standard matte display sold to users.

5.2.2 Ease of Use

Table 5.2.2: *Ease of Use*

2. Ease of Use			
2.1	**Built-in-Test (Automated)**		
2.1.1	Monitor System Integrity	Various sensors monitor temperature, communications paths and others.	2.42
2.1.2	Monitor Motor Performance	Motor voltage and current are measured and monitored.	1.88
2.1.3	Perform Automatic Tests	System tests are automatically and continuously performed.	1.88
2.2	**Automatic Precision Landing**		
2.2.1	One Button Landing	Pushing land button land aircraft without any skills.	3.0
2.2.2	Safety/Autonomous Landing	If system is compromised, LiveSky will trigger autonomous landing.	3.0
2.2.3	Precision Landing	Autonomous precision landing CEP less than 6" of take-off position with ATS.	3.0
2.3	**Simple Control System**		
2.3.1	Buttons	Large buttons and joystick allow both aircraft and camera to be operated with gloves.	3.0
2.3.2	Interface	The system is equipped with single button controls: Arm, Launch, Landing, Up, Down.	3.0
2.4	**Technical Skill Requirements**	Operating the LiveSky requires very little technical skill. **Note: Operating the LiveSky requires the presence of a pilot with an FAA Part 107 License.**	3.0
		Average score	**2.69**

SME matrix Comments/Recommendations:

2.1 - All monitoring was internal, with a color indicator indicating status. A green indication is present when there are no operational issues present. A red indicator is present for all failsafe landings. Recommend providing an interface for users to check the status of voltage, temperature, moisture, and battery life.

2.4 - The system is easy to use, with minimal training required to operate. To fly under the FAA's Small UAS Rule (14 CFR part 107), you must: get a Remote Pilot Certificate from the FAA, register your UAS as a "non-modeler," and follow all part 107 rules.

5.2.3 Mobility and Setup

Table 5.2.3: *Mobility and Setup*

3. Mobility			
3.1	**Mobile configuration**	LiveSky can be setup and deployed using the mobile kit; containing a tether kit, UAV, and hand-held controller.	
3.1.1	Hand-Held Remote System Controller	Hoverfly Wired (Ethernet) Hand-held Remote System Controller.	2.93
3.1.2	Ground Control Flight Kit	21.5" (0.55m) HD high-brightness sunlight readable display in weather resistant hard transit case.	2.5
3.2	**Vehicle Mounted configuration**	LiveSky can be mounted on and configured for vehicle operations.	
3.2.1	Integrate LiveSky System into Range of Vehicles	System components are in three (3) self-contained deployment cases designed for vehicle installations.	3.0
3.2.2	LiveSky System Mounts onto Variety of Vehicle Types	The LiveSky system can be vehicle mounted.	3.0
3.2.3	Operate from Moving Vehicle at Speeds Up of 10 mph.	The LiveSky system uses its "On the Move" technology to operate from moving vehicles.	3.0
3.2.4	Capable of Lead/Flank or Follow When Mounted on Vehicle	"On the Move" technology allows LiveSky to Lead/Flank/Follow vehicle.	3.0
3.2.5	Uses Advanced Tether Automation Kit (ATK) with LWII Series Automatic Tether Management System	"On the Move" operations uses automatic tether system to perform missions.	3.0
3.3	**Fixed-base configuration**	The LiveSky system can be configured for use from a fixed location.	
3.3.1	Operate from Fixed Position using Mission System Controller(s)	Mission System controllers provide on-site vehicle functions.	3.0
3.3.2	Operate from a Fixed Position with Command and Control Interface over Ethernet for Local Computer or Remote (Network) Operations	Command and Control Interface allows for vehicle operation from remote location.	3.0
3.3.3	Controllable with Automatic and Manual Tether Kit.	Delivers continuous power and secure video and data streams.	3.0
3.3.4	Self-Contained Deployment Cases	System components are in three (3) self-contained deployment cases.	3.0
3.4	**Software Development Kit (SDK)**	LiveSky can be operated using the SDK Command and Control Interface over Ethernet for Remote (Network) Operations.	3.0
		Average score	**2.95**

SME matrix Comments/Recommendations:

3.1.1 – A 3-4 second delay is present when operating the hand-held controller. Also, recommend considering a wireless remote control.

3.1.2 – Screen had glare issues with the sun. The monitor used during demonstration was not the standard matte display sold to users.

5.2.4 Safety and Security

Table 5.2.4: *Safety and Security*

4. Safety and Security			
4.1	Autonomous Landing	The LiveSky will trigger landing if tether power is interrupted, weather conditions are not conducive to flight, or when directed by pilot.	3.0
4.2	Video over Tether w/o RF Signals	Video can be collected, streamed and relayed securely with no RF signals.	3.0
4.3	Anti-Jam (No RF) Command and Control	Tether Kit allows the LiveSky System to carry both continuous power and secure video and data streams.	3.0
4.4	Health Life and Safety Monitoring	LiveSky continually monitors system life and safety.	2.5
4.5	Night Operations	LiveSky is equipped with vehicle navigation lighting.	3.0
4.6	Kevlar Strength Tether	Tether member is Kevlar strength.	2.5
4.7	Secure COMM'sOver Tether	Video and Control over Tether Electronics Package for secure communications and operations.	3.0
4.8	Emergency Power Cut Off	System has emergency power cut off.	2.67
4.9	Power Systems	LiveSky is equipped with a back-up battery system.	3.0
4.1	Autonomous Landing	The LiveSky will trigger landing if tether power is interrupted, weather conditions are not conducive to flight, or when directed by pilot.	3.0
4.2	Video Over Tether w/o RF Signals	Video can be collected, streamed and relayed securely with no RF signals.	3.0
4.3	Anti-Jam (No RF) Command and Control	Tether Kit allows the LiveSky System to carry both continuous power and secure video and data streams.	3.0
4.4	Health Life and Safety Monitoring	LiveSky continually monitors system life and safety.	2.5
4.5	Night Operations	LiveSky is equipped with vehicle navigation lighting.	3.0
4.6	Kevlar Strength Tether	Tether member is Kevlar strength.	2.5
4.7	Secure COMM's Over Tether	Video and Control over Tether Electronics Package for secure communications and operations.	3.0
		Average score	**2.85**

Composite Score	**2.87**

SME matrix Comments/Recommendations:

4.5 – Additional information would be beneficial to operators. Currently limited to green/red indicators.

4.7 – Tensile strength of tether was rated by Hoverfly at 65 lbs. nominal, 80 lbs. maximum. Recommend having a third party validate.

4.10 – Emergency power cut off is not available on all control panels. System was tested at 1’ above the landing surface to prevent damage to the aircraft.

5.3 Description of Results

Tables 5.2.1, 5.2.2, 5.2.3, and 5.2.4 display the four functional areas and associated requirements that were demonstrated and scored. Each of the four functional areas has an average score at the bottom of each section. A composite score, representing the average of all four functional area scores, can be found at the bottom of Table 5.2.4.

The average scores for each of the four functional areas, Application and Capability, Ease of Use, Mobility and Safety and Security were scored as 2.97, 2.69, 2.95 and 2.85 respectively.

Functional Area 1: Application and Capability had a mean score of 2.97. No single application or capability failed to meet the requirement. Comments and recommendations are listed by function number below that scored functional area.

Functional Area 2: Ease of Use had a mean score of 2.69. The automated built in test (item 2.1) partially met the requirement. No single capability failed to meet the requirement. Comments and recommendations are listed by function number below that scored functional area.

Functional Area 3: Mobility had a mean score of 2.95. No single capability failed to meet the requirement. No single capability failed to meet the requirement. Comments and recommendations are listed by function number below that scored functional area.

Functional Area 4: Safety and Security had a mean score of 2.85. No single capability failed to meet the requirement. Comments and recommendations are listed by function number below that scored functional area.

6.0 Evaluator Comments

NCS[4] asked each evaluator provide feedback relative to the LiveSky platform following the evaluation. The SMEs were given time to make notes and record details of each demonstrated requirement.

Evaluator 1:

"The tethered drone was an impressive piece of technology. The design philosophy of simplicity for the user shone through with their implementation of a certain level of automation to the system, creating a simple button layout to perform complex actions such as landing on the roof of a vehicle or staying in a stable position and coordinating the camera with the craft to create a stable viewing experience. I was impressed with the utilization of the tether itself to perform many tasks such as keeping the craft stable by calculating its angle from the bottom of the drone and even accounting for the cable bowing out due to wind with high degrees of accuracy. The input lag between the camera and the drone was a little difficult to get used to, though the lag was unavoidable and under most conditions averaged only about 3 seconds. I could see this being a useful tool due to its short deployment time and mobility."

Evaluator 2:

"Interesting technology with field applications across disciplines. The system requires staffing of 2-3 personnel based on the most recent part 107 guidelines. It has the capability to interface through an open API to send video wirelessly to mobile devices over Wi-Fi or LTE connection. Video can interface with existing video management system platforms to provide customers with flexibility. Additionally, H.264 technology is used to compress video and reduce bandwidth. The dual camera configuration provides users with the ability to operate and monitor simultaneously, without manually changing devices. Lastly, a major positive to the system is its ability to continuously operate without concern of battery changes. The tethering system provides continuous power to the UAV. The system can be powered by the equipped generator, backup battery, or receptacle; providing flexibility to end-users."

"The system does have some lag time in responding to commands, which seems to be increased slightly when switching to the SDK controller. Additionally, The SDK usage is somewhat confusing to use compared to the Mission Kit or hand-held."

Evaluator 3:

"Hoverfly has a good, forward-thinking technology. Overall, the unit tested and performed very well. The areas of concern were the glare with monitors and the 3-4 second delay with the controls. However, both of these concerns are easily correctable or can be resolved with training. Another consideration should be the current wired remote. The current wired hand-held control option for the system is not necessary. However, a wireless hand-held remote could be the venue choice for feeding back to the Emergency Operation Center."

7.0 Summary

The specific functions and features of this product were observed and evaluated by a team of sport security professionals, assembled at the University of Southern Mississippi's National Center for Spectator Sport Safety and Security. The NCS[4] staff facilitated the product evaluation and compiled the evaluation results listed in this report. The NCS[4] staff did not have any input into the scoring of the evaluation criteria or evaluator comments.

The evaluation requirements centered on the four functional areas of Application and Capability, Ease of Use, Mobility and Safety and Security. The overall composite score, 2.87 out of a possible 3.0, of the measured functions indicates that this product overall performed at or above the levels considered by the evaluators to fully meet each requirement. Section 6 contains additional evaluator comments and recommendations.

NCS[4] would like to thank the SME's and Hoverfly for their participation in the evaluation and demonstration process.

This report is available on the NCS[4] website at http://www.ncs4.com/labportal/lab-testing/evaluated-product-list.