Enhancing

Crime Scene Team

Capabilities

with

Quadcopter Systems

Danny Eylon

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1. **Scope:**

This document presents a phase approach to enhancing Crime Scene team capabilities by introducing drone systems. It is divided into two parts: the body of this document describes the principals of enhancing team capabilities, and the Annex provides practical solutions that can be implemented by the team.

In this article we address Quadcopters as the platform in use, yet for the purpose of generality, please note that drones are included as well under this term.

2. **Concerns:**

Crime Scene teams face several concerns when required to perform their tasks. Among the main concerns:

- The need to map or reconstruct a crime scene and mark each and every piece of evidence in a meticulous way.
- Finalizing the task quickly since in many cases there is a need to re-open main traffic routes or publicly used areas (especially in the case of car accidents, a quick accident reconstruction can result in a quicker clearance of the scene).
- Creating an image of the scene for later use (e.g. presentation in court, internal review of scene, analysis of causes, file in records for future review, etc.).
- Information sharing with non-agency parties like officers of the Court, service providers (i.e. insurance companies) and others.

3. **The Concept:**

3.1. **Background:**

Answering the concerns raised above can be done efficiently by using quadcopter systems accompanied by the right software tools.

Quadcopter systems are high-tech state-of-the art systems. These systems have certain characteristics stemming from the fact that the evolution and applications are currently evolving.

An organization that wishes to explore the Quadcopter and use its capabilities to enhance its performance along with optimal ROI, has to face the following:

- Evolving airborne platforms that improve their performance at a rate of one generation per year.

- New and sophisticated software applications that are upgraded and released at a rate of one generation per quarter.

- Ongoing regulations and licensing considerations that prompt the near constant release of new rules and limitations.

- The need for well-trained pilots that can keep up with the advancement in professional applications and the rapid pace of change in the technology.

3.2.   How to tackle the issue:

Based on the above mentioned background issues, the optimal approach is a "structured phase" approach which ensures spiral development of capabilities along with incremental acquisition of assets that result in a "best value" solution. The diagram below illustrates this gradual implementation, which will assure a growing footprint of the capabilities, along with the acquisition of matching hardware and software.
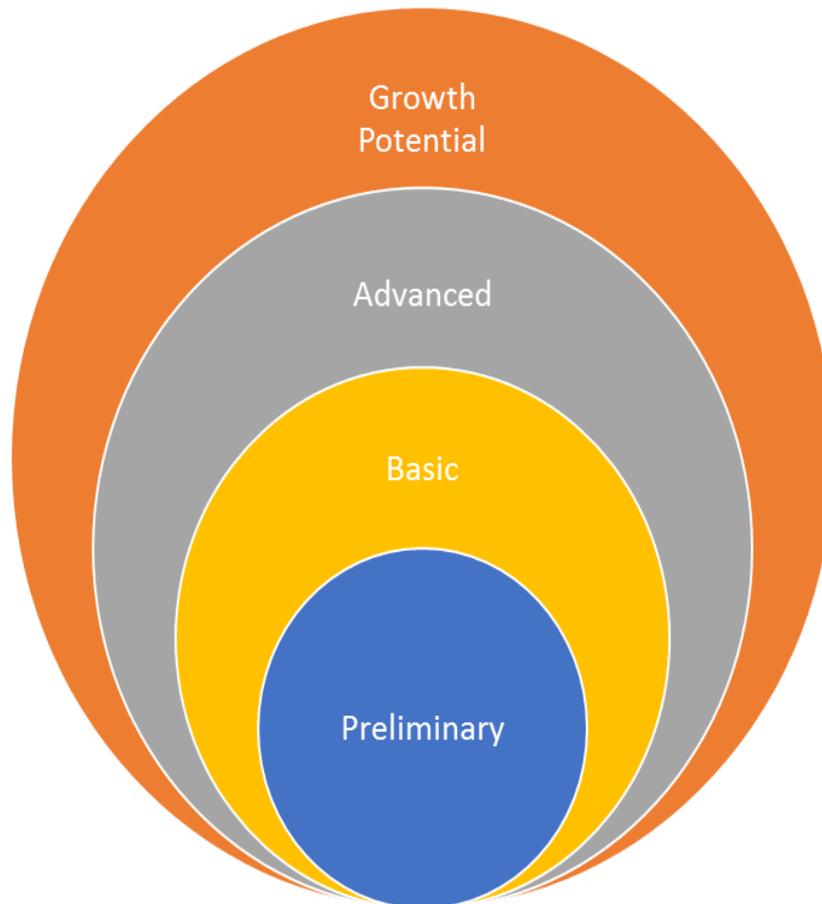
4. **The proposed "stepping-stones" – phases:**

Following the conceptual diagram in para. 3 above, here is a detailed explanation of each phase and its required inputs:

4.1. **Preliminary:**

The preliminary phase is a definition and concept phase. It is proposed to prepare a system requirement study that will result in an operational requirement document for the desired system. Aspects to be addressed in this document are (among others):

- Types of missions
- Required data, format, quantity, resolution, accuracy, etc.
- Environmental conditions at which system shall perform, i.e.: wind, rain, temperatures
- Terrain to be covered: size, type (urban, rural etc.)
- Range and time to station and on station
- Command and Control (local, remote, combined)

- Deployment type (fixed, mobile, relocatable etc.)
- Manpower (type and quantity) for operation, maintenance, analysis, reporting

Based on the operational requirement document, a system requirement document has to be prepared. The issues addressed in this document are:

- Specifications of hardware and software available and capable to be performed so that operational requirements will be covered.
- Quantity of systems.
- Manpower allocation.
- Budgets required.

It is strongly recommended to structure the specification requirements and the resulting acquisition, in a three-phase program. This approach is essential to handling the changing technical and operational environment of the Quadcopter world, as indicated in para. 3.1 above.

The three phases to be considered are:

- Basic (1st year)
- Advanced (2nd and 3rd year)
- Growth Potential (3rd to 5th year)

4.2. Basic, Advanced & Growth Potential Phase:

The following capabilities are suggested to be implemented in three phases:

- Phase 1 – Basic
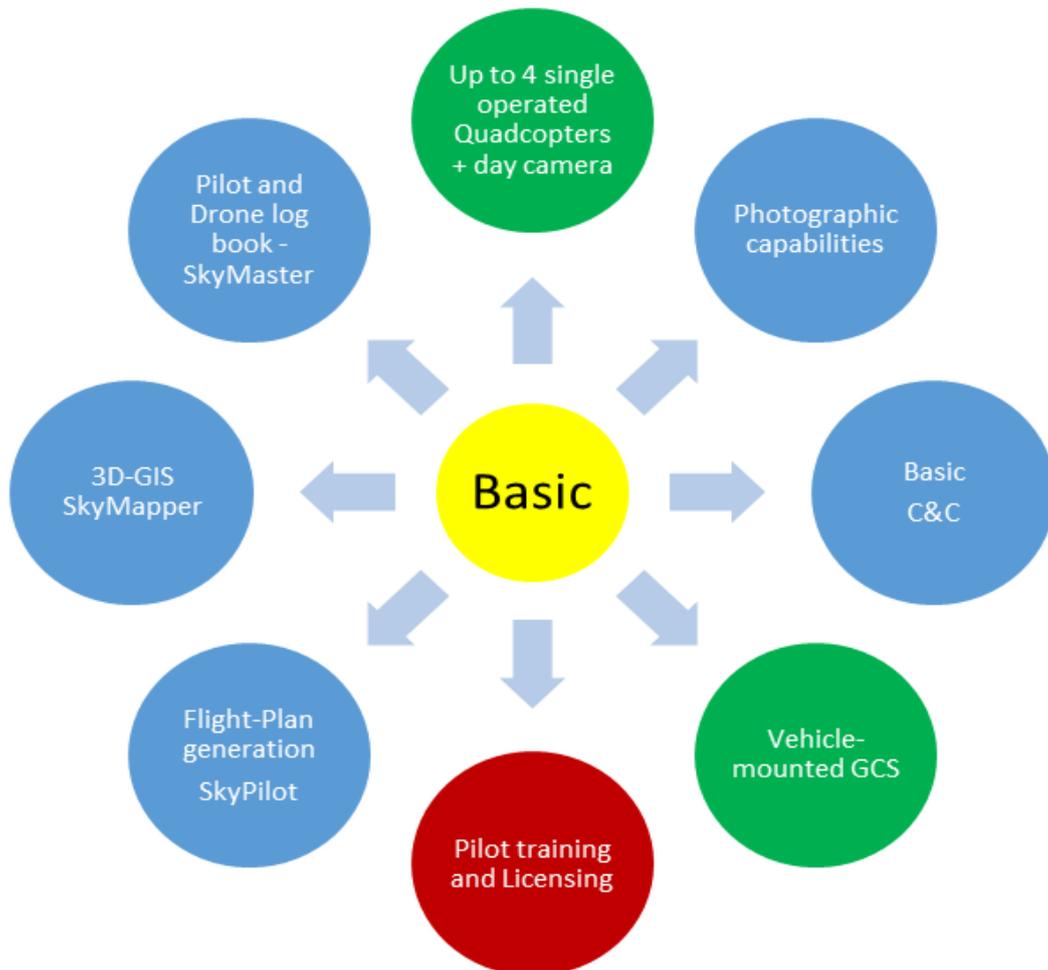- Phase 2 – Advanced
- Phase 3 – Growth Potential

The suggested implementation and acquisitions are for reference only and are generic in nature. Once operational requirements and resulting specifications will be generated, these building blocks have to be altered accordingly.

Legend:
- Hardware ●
- Software ●
- Manpower ●

For further clarification and detailed discussion, the phases with associated capabilities and operational assets are detailed in a diagram, followed by a tabular format:

Phase 1 – Basic

Phase	Capability/Asset	Details
Basic: This is the baseline phase for drone operations which will enable essential but limited operations	**Up to 4 single operated Quadcopters with day cameras**	Quadcopters operated individually (up to 4 units) by pilots upon request, at different sites and tasks. No coordination and/or exchange of information and data between these sites is required. The payload daylight camera images will be downlinked to the operator ground station and stored on its memory device.
	Photographic Capabilities	In order to assure adequate pictorial data (resolution, angle, coverage, format etc.), the Quadcopter system has to be instrumented with appropriate camera operating software, downlink and storage. Most Quadcopter manufacturers provide these capabilities upon request.
	Basic Command and Control	No command and control assets for higher echelon data sharing and/or decision making are required. All decisions should be made on scene and reported off-line.
	Vehicle Mounted GCS	Quadcopter carrying case, GCS, cables and accessories will be packaged into the patrol car using dedicated brackets and mounting accessories to assure safe and secure driving and operating conditions.
	Pilot Training and Licensing	To comply with FAA licensing requirements and assure quadcopter and camera performance, the operator/pilot has to be trained and licensed. To this end, training facilities and procedures shall be prepared and a standard licensing process should be according to FAA requirements. A ratio of 1.5 pilot per platform, as standard, shall be used for 2 Quadcopters and above (2 pilots in case of 1 Quadcopter).
	Flight Planning (SkyPilot)	For optimal camera coverage and picture taking, the Quadcopter flight path has to be carefully planned and executed. Pre-planning an optimal flight plan and executing it is ensured by the use of Skytech's SkyPilot software.
	3D GIS (SkyMapper)	For Crime-Scene analysis and documentation, optimal camera data must be collected and downlinked from the Quadcopter. This data converted into 3D GIS data including geolocation and 3D measuring capabilities is the baseline for mentioned analysis and documentation. SkyMapper by Skytech is a quasi-real-time software package to collect data and generate 3D GIS assets at the scene for optimal use and result retrieval.

Phase	Capability/Asset	Details
Basic: (Cont'd.)	**Pilot and Drone Log-Book (SkyMaster)**	Each airborne mission, platform and pilot has to be documented in an official logbook including maintenance and licensing data. SkyMaster is a drone-oriented, easy-to-use logbook software provided by Skytech. SkyMaster allows online access to the logged information from any device at any time.

Phase 2 – Advanced

Phase	Capability/Asset	Details
Advanced: After successful implementation and operation of the "Basic" phase, upgrading to "Advanced" phase is suggested in order to explore the full Quadcopter capabilities and enhancements.	**Up to 10 single operated Quadcopters with day/night cameras**	Quadcopters operated individually (up to 10 units) by pilots upon request, at different sites and tasks. No coordination and or exchange of information and data between these sites is required. The payload day/night camera images will be downlinked to the operator ground station and stored on its memory device.
	Photographic Capabilities	In order to assure adequate pictorial data (resolution, angle, coverage, format etc.), the Quadcopter system has to be instrumented with appropriate day/night camera operating software, downlink and storage. Most Quadcopter manufacturers do not provide dual day/night capabilities. Special attention should be given, and specifications have to be issued accordingly.
	Fleet Management Command and Control (SkyC2)	A 10-unit Quadcopter fleet, operated at different sites by separate teams, requires coordination of time and space; in some cases, even air traffic coordination will be necessary. In order to streamline these assets, a software package assisting the coordinating echelon is strongly suggested. SkyC2 will provide an optimal solution accordingly.
	Database Management (SkyBase)	Data collected from sites, including photographic data, 3D and GIS data (SkyMapper), flight data (Sky Pilot), logbook data (SkyMaster) and all resulting reports and documentation will accumulate and have to be handled so that retrieving is possible. Skytech will provide SkyBase, an online database, for this purpose.
	Multi vehicle mounted GCS	Quadcopter and associated GCS and accessories, have to be interchangeable, so that any GCS can operate any Quadcopter in the fleet. Hardware and software have to be modified to provide this flexibility and logbook reports have to reflect this option.
	Pilot Training and Licensing	See Basic phase
	Pilot Refresh and Advanced Training	For pilots to maintain their licenses, they have to refresh and re-qualify periodically. In addition, pilots have to be trained and licensed to use advanced payloads, drones and software applications.
	Flight Planning (SkyPilot)	See Basic phase.
	3D GIS (SkyMapper)	See Basic phase.
	Pilot and Drone Log-Book (SkyMaster)	See Basic phase.

Phase 3 – Growth Potential

Phase	**Capability/Asset**	**Details**
Growth potential: This 3rd phase is an indication where the future might take us. The capabilities and details listed are only for those that are add-on to previous phases.	**Multiplatform operated Quadcopters + day/night cameras**	Airborne platforms (one or more quadcopters carrying one or more sensors), and missions assigned to each platform will allow undefined quantities of platforms, each tasked to perform several missions. Acquisition and specifications of hardware shall reflect this capability.
	Multiplatform and Autonomous flight (SkyFleet)	Quadcopters operating autonomously in swarms will require special purpose command and control as well as flight planning software. Skytech's vision includes the next generation software (SkyFleet) for that purpose.

Annex

Skytech Systems
Your One-stop Service Provider

Skytech is a solutions and services provider, specializing in:

- Operational, managerial, technical and logistic analysis for Quadcopter system implementation and operation.

- Quadcopter "power by the hour" based services and training.

- State-of-the-art software tools specially tailored for Quadcopter operations and capabilities to public safety organizations throughout the United States.

The team at Skytech is comprised of ex-military and police from the US and Israel, as well as highly experienced engineers with years of combined experience in radar, communications, bomb disposal, warfare systems and more.

Based in Farmingdale NY, Skytech's services are tailored to a wide range of Public Safety Organizations, including Police, Fire, EMS, Parks and Public Works.

As service and capability provider, Skytech has no vendor preference thus providing optimal solutions tailored to customer requirements.

Skytech has teamed with leading software houses worldwide to provide optimal solutions for the Quadcopter world. While most software tools have emerged from the manned and/or UAV world thus modified for Quadcopter applications, our software tools were developed and optimized for Quadcopter applications in mind.

The following is a list of special purpose software packages as mentioned in the Basic Phase above, which operate with almost all vendor systems:

SkyMapper (3D GIS Software Package) provides the user 360-degree accurate orthophoto data, geo-located and DTM registered for actionable intelligence in real-time.

The information is generated from oblique pictures collected by regular quadcopter platforms.

Among the advantages of SkyMapper:

- Measurements on oblique images in real-time, on scene.
- Creation of a 3D model.
- Measurements on orthophotos and 3D models in quasi real-time.
- Export jpeg with measurements.
- Share 3D models with others, using a free, easy to install, 3D viewer.
- Stand-alone local version. No cloud communication performed.

SkyMapper is using special purpose mapping software as an image capturing, handling and analysis tool, designed to combine the benefits of orthophoto with the rich detail of oblique photos. As indicated, it is designed to transform visual data into accurate, meaningful and actionable intelligence for any real time application.

In order to "best serve" our customers, SkyMapper provides a full "turn-key" service. All the customer has to provide is the area-of-interest for which the orthophoto data is required.

SkyMapper provides the imaging drone flight, image capturing and geolocation, and the images accurately geo-located and DTM registered for the customer to be used on his computer.
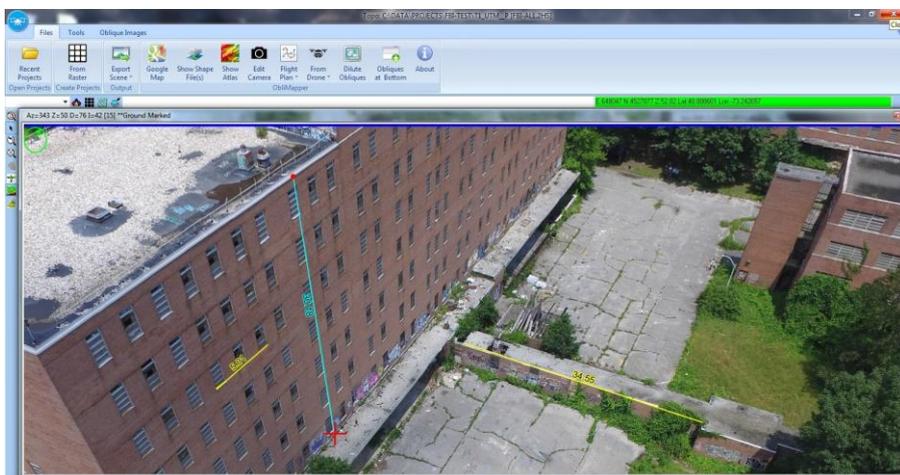
SkyMapper services are provided in one of two ways:

1. Mapping software resident on customer's computer, enabling autonomous use
2. Imaging service, with case-by-case use
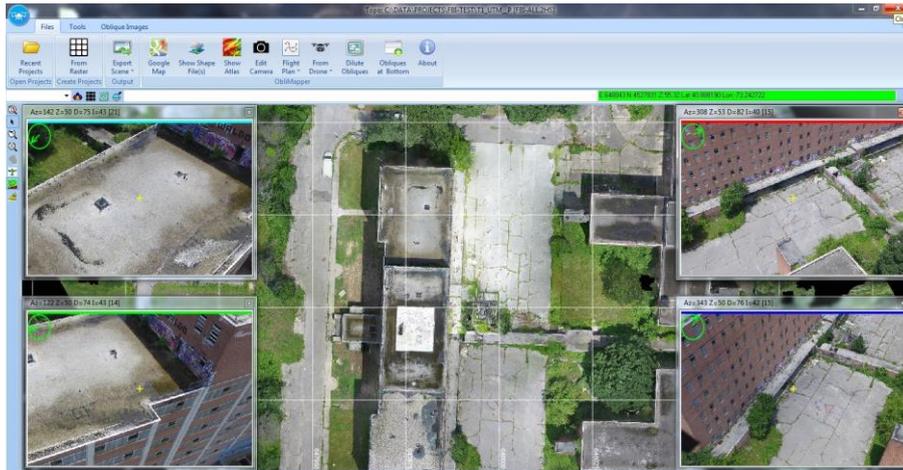
SkyMapper Multi-Angle Orthophoto Analysis

SkyMapper 3D Rendering

***SkyMapper Oblique Image Measuring Capabilities***

SKYPILOT

SkyPilot (Flight Plan Generation Software Package) operates above the GCS controls and enables the operator to plan and execute any flight profile and flight plan autonomously, without worrying about "stick" operations, winds, altitude, paths etc.

The Quadcopter will perform, from takeoff to landing without operator intervention, and "do its thing." Despite all, "emergency override" is always available, including the RTH function that can be initialized at any time.

Creating pre-defined flight plans will dramatically reduce the time needed to fulfill crime scene reconstruction tasks at the site.

SkyPilot will ensure that the appropriate images are created, as required by a GIS software (i.e. SkyMapper).

Whether one is a beginner that has to gain confidence or an expert that does not want to bother with airframe operations, using SkyPilot is the best solution.
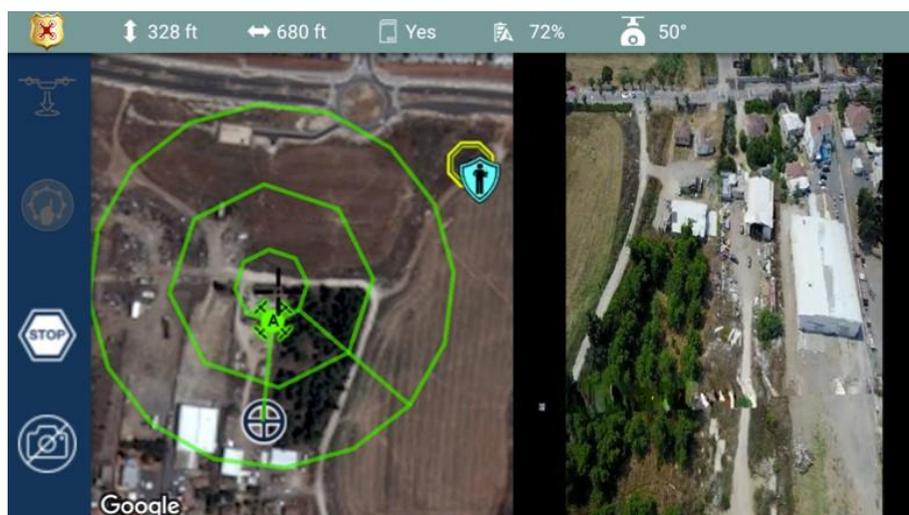

SkyPilot Remote Display

skytech

SKYMASTER

SkyMaster (Pilot and Drone Logbook Software Package) is a great new way to manage Quadcopter operations. Whether it's flight operations, technical maintenance activities, flight planning including assignment, tasking and reporting, aircraft log, pilot log or event handling, SkyMaster is a one-stop shop logbook solution from planning to reports.

SkyMaster is a smart tool that helps you run your operation effectively and safely, and exactly according to Civil Aviation Authorities' requirements. Plus, no need to worry about manually gathering data about flight activities, managing logbooks and cross checking between different databases. Now you can run your drone fleet from one place and get a wide perspective of the various aspects regarding all activities.

You can access SkyMaster online from any device and through any platform.
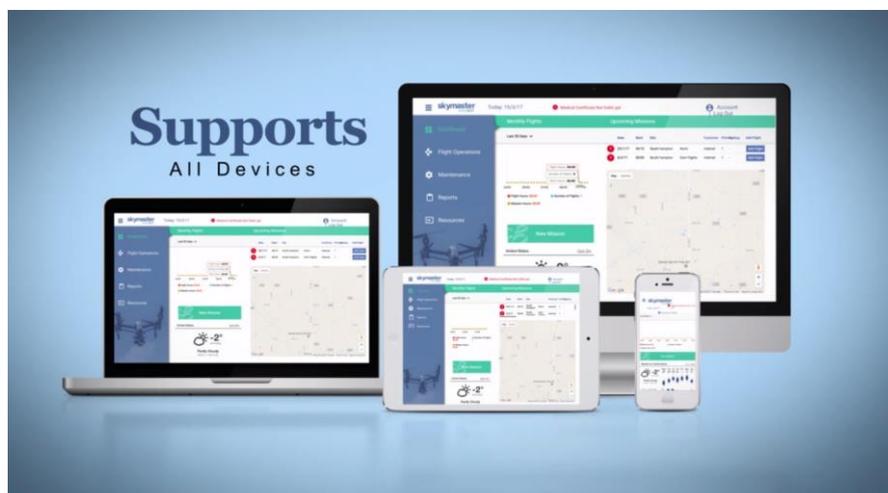
SkyMaster is easily accessible on all of your devices