Quadcopters - A Game Changer in SWAT Team Response

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1. Scope:

This document is a case study, analyzing the revolution that Quadcopters/Drone applications has initiated in SWAT Team operations, training and response.

In this document we address SWAT, yet for the purpose of generality, please note that ERT, ESU and SRT are included as well under this term.

2. Highlights:

The Quadcopter, as an "eye in the sky," has proven to be a revolutionary tool in numerous operational aspects, while SWAT team missions are one of the most applicable applications for such a tool.

Following are areas of operational response that are dramatically enhanced by introducing Quadcopter operations:

- *Response time:* Relevant real-time aerial surveillance, mapping and awareness, by and for the operators on the scene, shortens response time and enhances effectiveness.
- *Safety*: Introduction of the aerial assets provide an undetected set of eyes looking from any position in the sky. The information is incorporated into tactical movements and planning, providing a safer environment for operators and ultimately resolving the situation safely.
- *Optimal use of tools, assets, manpower and force:* Due to relevant real-time surveillance and awareness, the use of the above mentioned resources is optimized.
- *Tools for optimizing the operation:* Pictorial data collection, 3D GIS and on-line situational analysis optimize the entire operational process.
- *Minimize duration of operations:* Since the information gathering process of the scene and scenario is minimized, and the assets and manpower use is optimized, the length of the operation can be minimal and "normal life" is restored as quickly as possible.
- *Command and Control:* Data from the scene is relayed to higher echelons for decision making, situational awareness and reporting.
- *Data logging:* All information is recorded and made available for reporting and future analysis and training purposes.

3. Quadcopter for SWST Teams – System Performance

3.1. Baseline

SWAT teams, by definition, are professionals specialized in missions where they have to act at a moment's notice and have no "second chance." The introduction of tools and assets has to comply with those requirements and should not be compromised in any parameter. The result has to be a top level solution with top level capabilities to be operated by top level specialists.

The introduction of Quadcopter systems into SWAT operations has to be based on an "operational requirement document," specifying (among others):

- Types of missions
- Required data, format, quantity, resolution, accuracy, etc.
- Terrain and environmental operating conditions
- Range and time to target and on target
- 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 issued that addresses:

- Hardware and software specifications
- Manpower skills
- Training

3.2. What is Required?

Dealing with this specialized topic, other organizational and operational aspects that become obvious by Quadcopter introduction, are and will be covered separately. Such considerations to be covered separately include: the ability of SWAT teams to operate and command its own aerial surveillance and analysis tool, control of the scene's real-time intelligence, optimize use

of weapons and operational capabilities due to real-time situational awareness, minimize time to scene and time to meet objective due to on-line visual capabilities, etc.

Following is a graphic presentation addressing overall aspects to be considered regarding SWAT Team quadcopter applications:

Legend:

- Hardware
- Software
- Manpower

3.2.1. Quadcopters + Day & Night Camera:

Each operational SWAT team will own and fully operate an operational quadcopter system. Such a system consists of:

- Quadcopter – ready to use and operational with at least 4 sets of airborne batteries.
- Ground Control Station (GCS) – to be used by pilot/operator with communication and data transfer capabilities.
- On board day and night camera – high resolution day camera + IR night camera. The dual (Electro Optical + Infra-Red) capability is required not only for night operation but for enhanced detection performance.
- Command and control capabilities – The GCS system will enable visual and voice communication with remote terminals for scene/scenario sharing and for command and control purposes.

3.2.2. Photographic Capabilities:

Basic photographic capabilities, airborne and GCS based, shall be installed to enable:

- Video photography of designated scenes with zoom and tracking
- Follow-me
- E/O – I/R mode selection and data overlay
- Search within predefined polygons
- Still image capture
- Recording

3.2.3. Command and Control:

SWAT team operations require real-time, 'at the scene' decisions and response. Effective visual and audio real time information exchange with higher echelons enhances optimal decision-making. Software packages for C2 activities shall be installed and operational for each SWAT team.

3.2.4. Package and Deployment

Since SWAT teams are deployed and should be operational at a moment's notice and at any type of scene, the Quadcopter hardware shall be packaged into suitable transit cases, enabling deployment and power-up within minutes. At the same time, software initialization and flight preparations shall be streamlined and operable quickly.

3.2.5. Pilot Performance:

One of the most critical topics in regards to Quadcopter operations is the pilot training, refresh procedures and the maintaining of top-level competency.

As in every airborne platform, the pilot's competence is a major factor in the overall performance of tasks such as flight planning, navigation and actual flying. SWAT team pilots have to be able to take-off, fly and provide results, at the scene with minimal preparations, in any environment (urban, rural, with all kinds of tree canopy) in all-weather etc. Special attention has to be paid to these aspects, from the very beginning (recruitment, certification etc.) and through the entire operational training process.

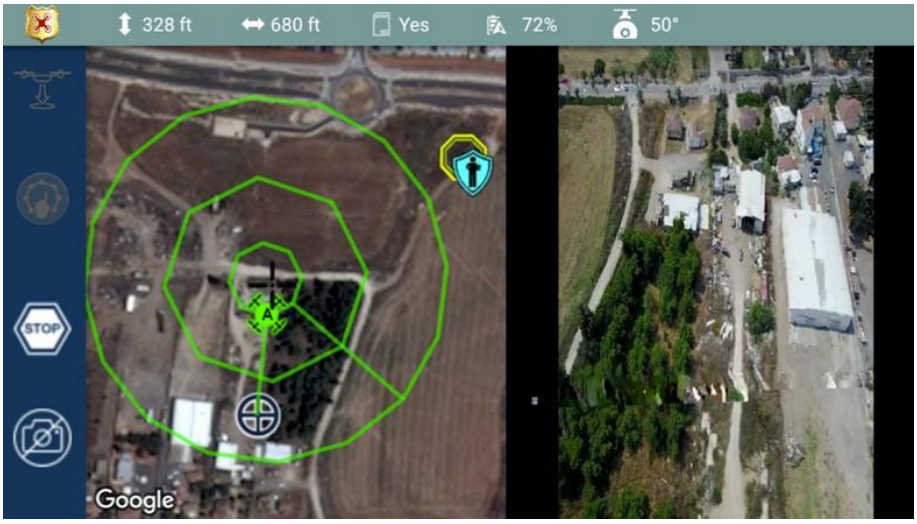
3.2.6. Flight Plan Generation – *SkyPilot:*

Swift and quasi-automatic flight planning is essential for the fast response of a SWAT team pilot.

SkyPilot is a flight planning software package that 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 autonomously, from takeoff to landing without operator intervention, and "do its thing," with manual override enabled at any time.

SkyPilot will ensure that the appropriate images are created, as required by all SWAT team tasks, such as visual reconnaissance, GIS and geolocation (i.e. SkyMapper below), continuous surveillance and target tracking.



SkyPilot Remote Display

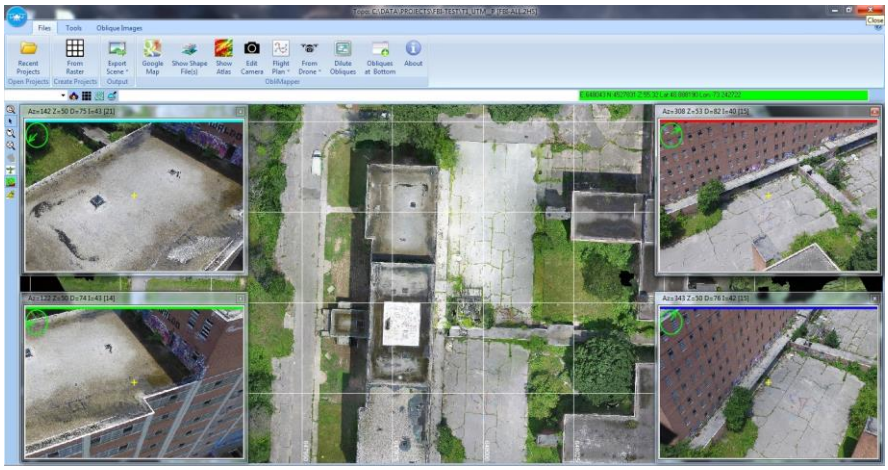
3.2.7. 3D GIS – *SkyMapper*:

Actionable real-time aerial intelligence information is gathered by SkyMapper, a software package that provides the user 360-degree accurate orthophoto data, geo-located and DTM registered.

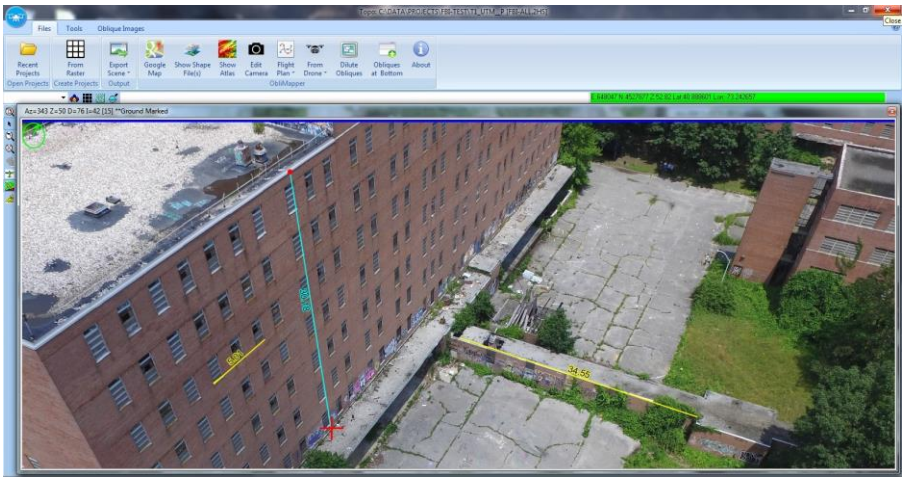
The information generated from oblique pictures collected by the Quadcopter platforms and the capabilities that SkyMapper offers, includes:

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

As indicated, SkyMapper provides visually accurate, meaningful, actionable and measurable intelligence data for any real time, 'on scene' operation.



SkyMapper Multi-Angle Orthophoto Analysis



SkyMapper Oblique Image Measuring Capabilities

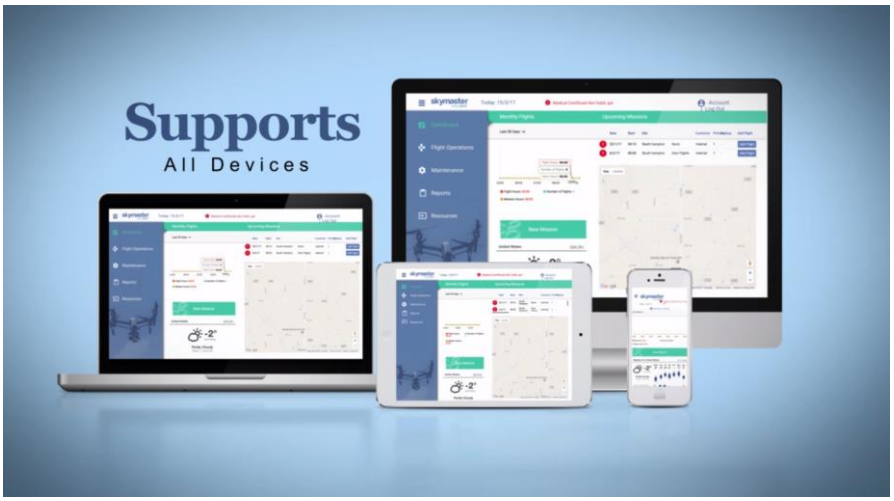
SkyMapper 3D Rendering

3.2.8. Pilot and Drone Log Book – *SkyMaster:*

SkyMaster is an all-in-one logbook solution from planning to reporting, well devised for a SWAT team's time-pressing activities.

SkyMaster is a smart tool that helps run Quadcopter operations effectively and safely, and exactly according to requirements. No need to worry about manually gathering data about flight activities, managing logbooks and cross checking between different databases. The drone fleet is managed from one central software, online, verifying all operational and maintenance aspects for optimal reliability performance.

You can access SkyMaster online from any device and through any platform.



SkyMaster is easily accessible on all of your devices

3.2.9. Multi-platform Operations:

In case more than one quadcopter is required for persistent surveillance, and more than one platform will be assigned to a specific SWAT team, Skytech has all the necessary software packages to handle these operations, including:

- Multiplatform flight management from a single command and control center
- Persistent on-target surveillance, achieved by a "hot-swap" of airborne assets
- Multiplatform data handling
- Multiplatform applications that require hardware and software integration, including integrated flight control for the airborne assets