

# **Vertical Ascent Situational Awareness, Targeting & GPS/RF Retransmission Drone**

By:

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Introduction

By:

Lt. Col. Thomas Henthorn, USA-Ret.  
HENTHORN & ASSOCIATES

"The Squad 2020 Consortium

*"Dedicated To The Goal Of An Integrated Future Small Unit Combat Structure"*

Topic:

***Designing The Future Force:***

***Roles, Goals & Objectives For An Organic Squad Based  
Unmanned Aerial Vehicle***

## Contents:

### *Page, Topic:*

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## The Problems:

**Cause:** Organic, squad based situational awareness systems currently available or proposed require training; displace equipment, fuel, water or ammunition; are sensitive to high winds, precipitation and icing or snow accumulation; and finally...are incapable of self deploying and stowing.

**Effect:** Existing or proposed systems will frequently be left behind, or have their capabilities reduced due to weather, training or other issues.

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**Cause:** Terrain or urban structure features frequently prevent direct radio communications or GPS location due to interruption of line of sight.

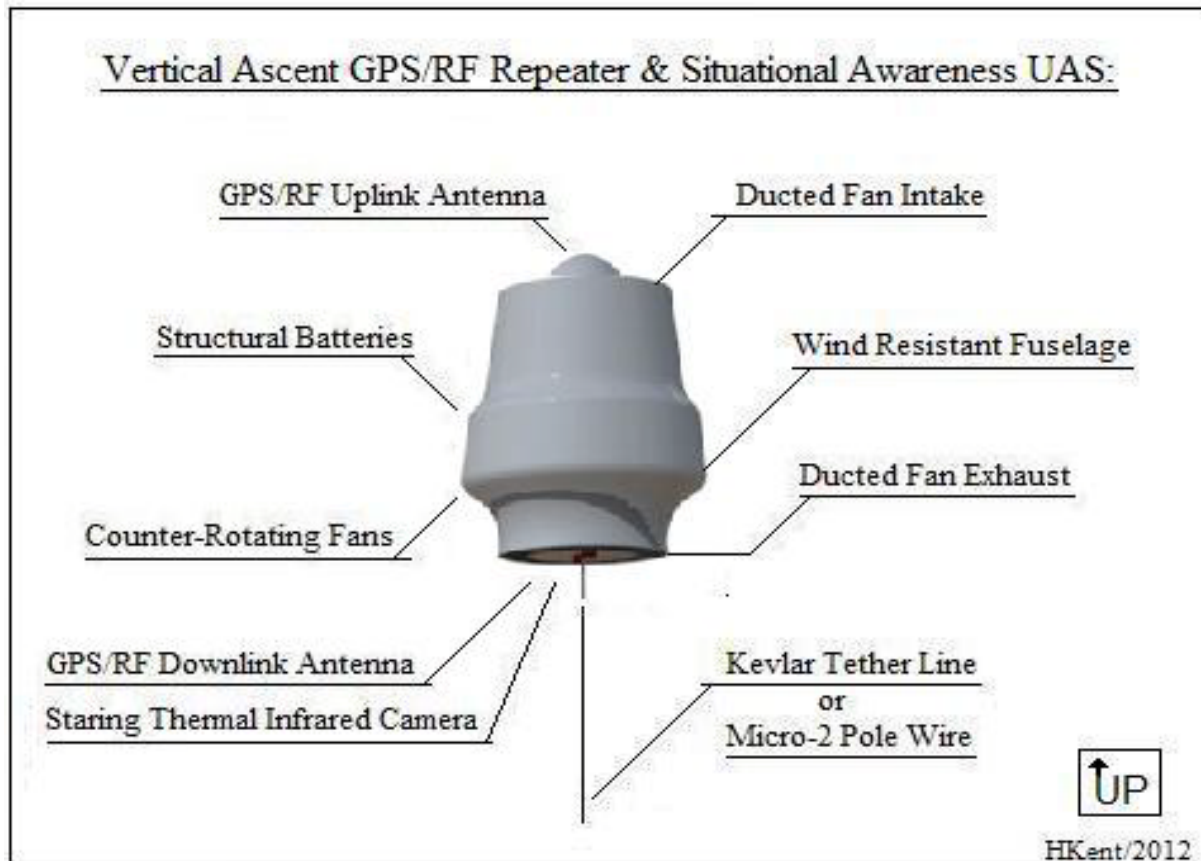
**Effect:** The impact is greatest where the enemy has learned to take advantage of the inability of a small force to call for assistance, or to call for air delivered or artillery support.

## Recommended Features Of Organic Squad Based RF/ISR Drone:

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- 1) Able to ascend and hover above terrain obstacles in all weather.
- 2) Re-usable, self deploying and stowing operation, low training level.
- 3) Simple, graphic operating controls; Up - Stop - Down.
- 4) Imagery handling and RF relay to be compatible with existing systems.
- 5) Rechargeable battery electric motor or heavy fuel engine powered.
- 6) GPS and RF antenna arrays in upper modular cargo bay.
- 7) Wide angle day/thermal camera/RF relay in lower modular cargo bay.
- 8) Equipment rack mountable, optionally dismountable container.
- 9) Low cost, field repairable/replaceable.

## Features Of Proposed Organic Squad Based RF/ISR Drone:



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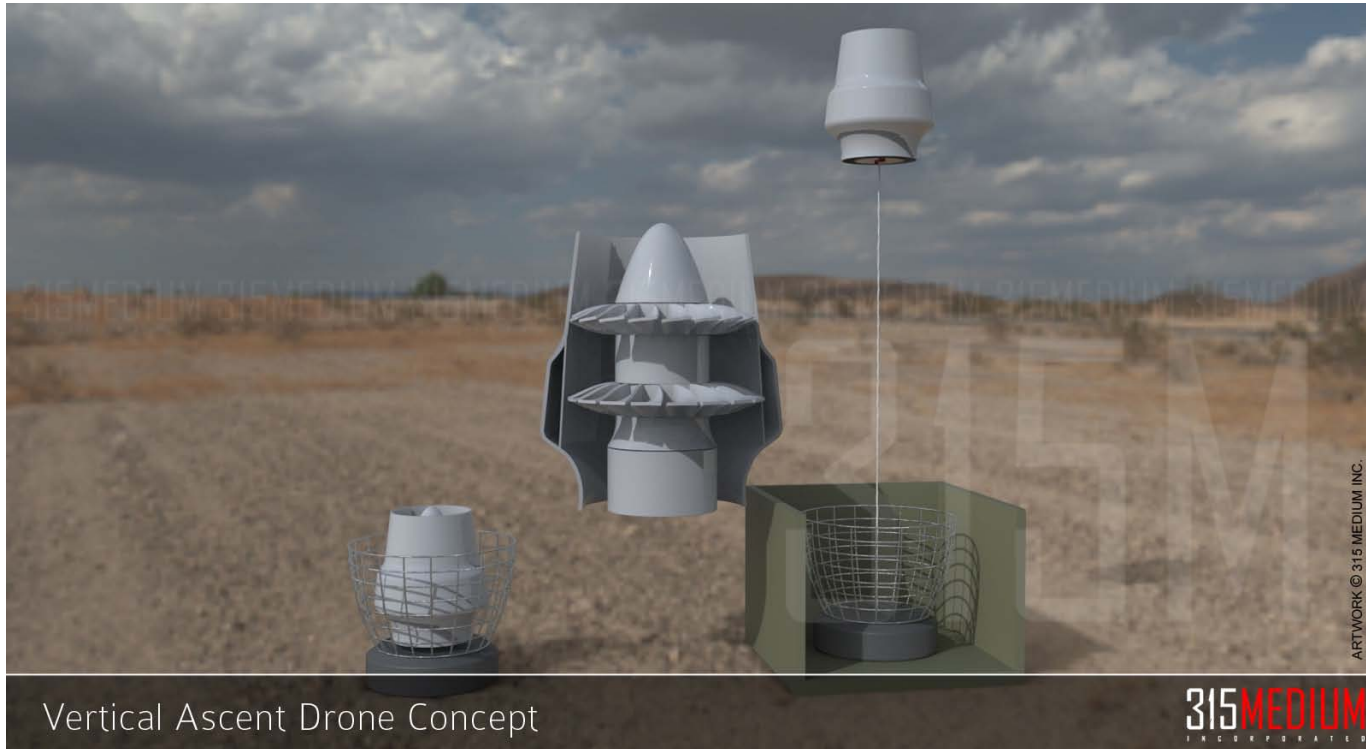
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- 1) Tethered, self deploying & stowing from launch container.
- 2) Dual counter rotating, advanced propulsor blade ducted fan drive.
- 3) Scalable aerodynamic cross-wind resistant fuselage design.
- 4) Blade tip vs. shaft speed alternator power scavenging system\*.
- 5) Adaptable to a variety of shaft type propulsion systems:
  - a) Counter Rotating/Hub Integrated Electric Motors
  - b) RC Model Internal Combustion Engine
  - c) RC Model Micro-Turboshaft Engine

\*WindTronics Corporation reverse alternator pattern patent.

## Features Of Proposed Organic Squad Based RF/ISR Drone:

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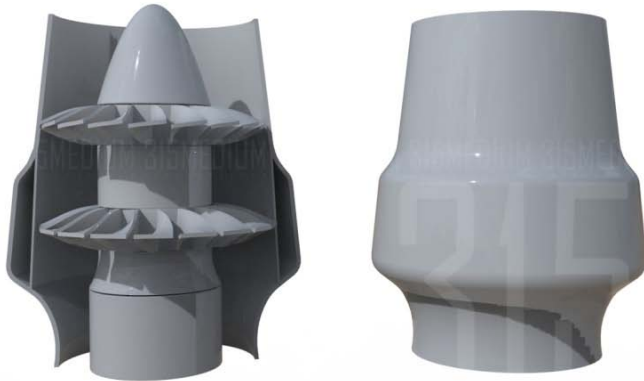


Vertical Ascent Drone Concept

Aerodynamic, wasp waisted shape resists cross-wind deflection while the internal design optimizes super-critical intake and exhaust ports. Provision within fuselage for large structural 400WH/Kg battery or fuel capacity storage. Existing design may be augmented with deployable stub wing aero-structures or para-foils for increased mission endurance.



## Features Of Proposed Organic Squad Based RF/ISR Drone:



Left:

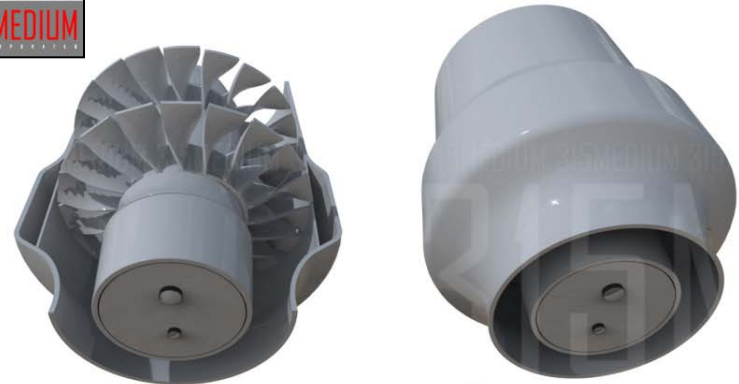
- Multi-Stage Axial Flow Compressor Design
- Internal Battery Or Fuel Sidewall Stowage
- Upper & Lower Payload Bays

Vertical Ascent Drone Concept

315MEDIUM  
DESIGN

Right:

- Curved, Case Profile Matching Blades
- Downward Staring Thermal & Day Cameras
- Central Or Yoke Type Tether Attachment

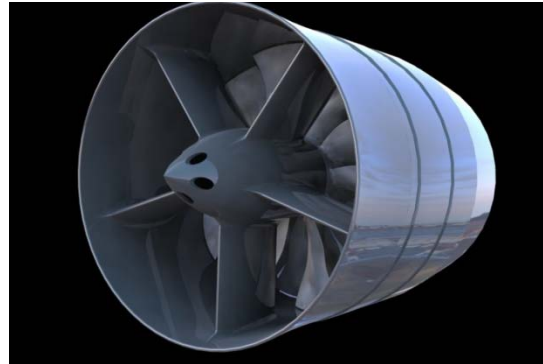


Vertical Ascent Drone Concept

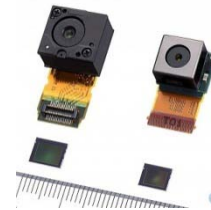
315MEDIUM  
DESIGN

## Features Of Proposed Organic Squad Based RF/ISR Drone:

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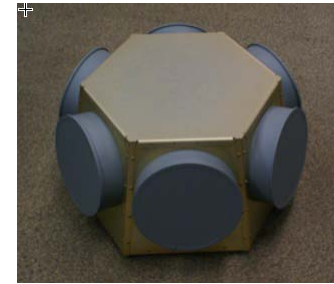
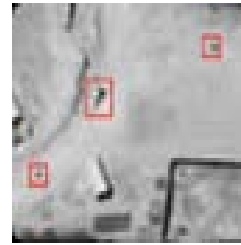
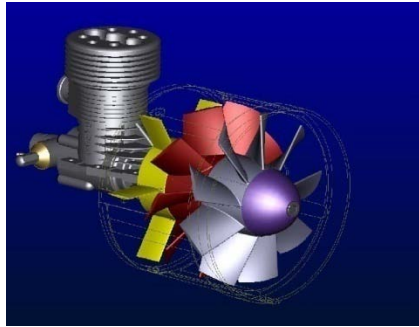
**Clockwise From Top Left: AXi Counter Rotating Motor, 315M Ducted Fan Fuselage, FLiR TAU Thermal Camera, Sony EXMOR Cameras, Envia 400 WH/Kg Battery, Freewave Radio Relay, Lucent Polaris GPS Link, Electramate Reel**



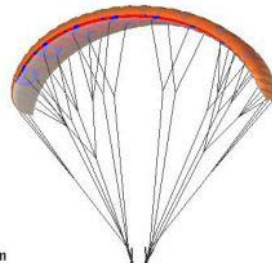
NDIA White Paper Series, Joint Small Arms Conference 2012

## Features Of Proposed Organic Squad Based RF/ISR Drone, Options:

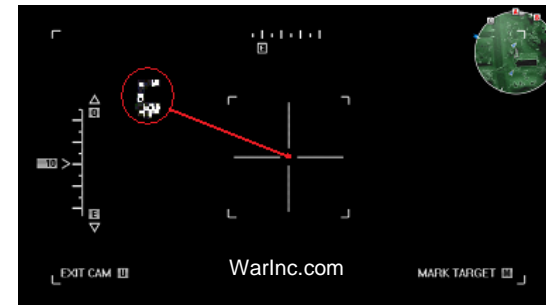
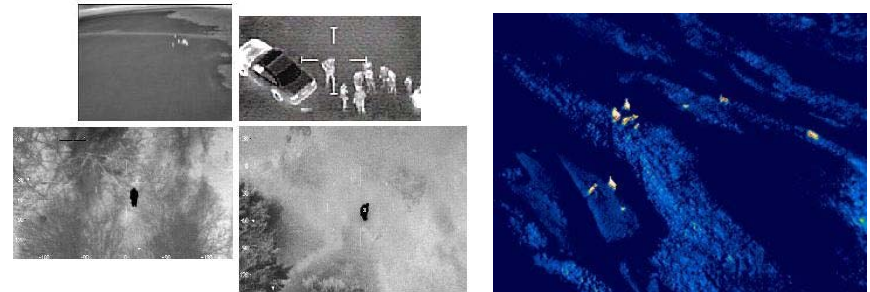
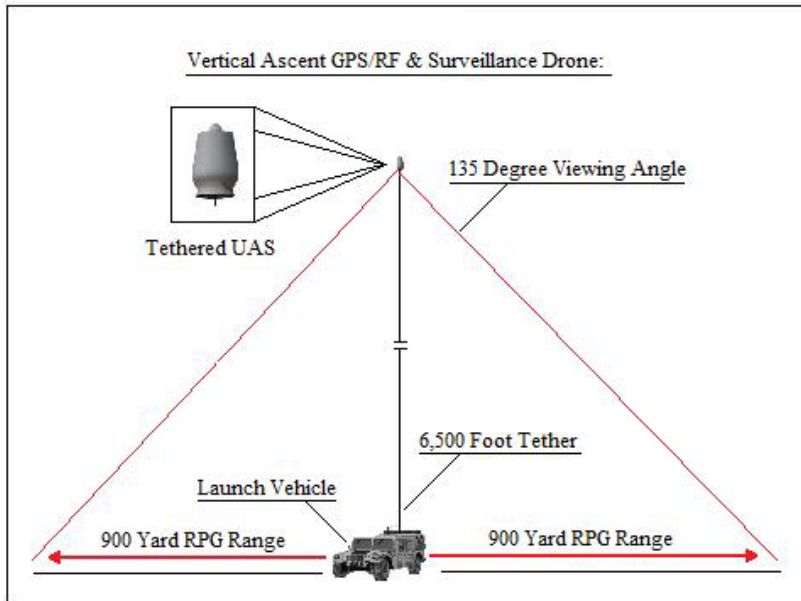
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Counter-Clockwise From Top Left:  
**RC World** Piston Contra-Rotating  
Blade Drive, **JetCats** Turbofan,  
Para-Foil Lift Device, **L-3 MX**  
Series Ball Turret TI/Day/LFR-D,  
**Smith's** NBC Detector, **Rawood**  
Radio Direction Finder Array,  
**Sentient** MTI, **Meyers** GLARE.

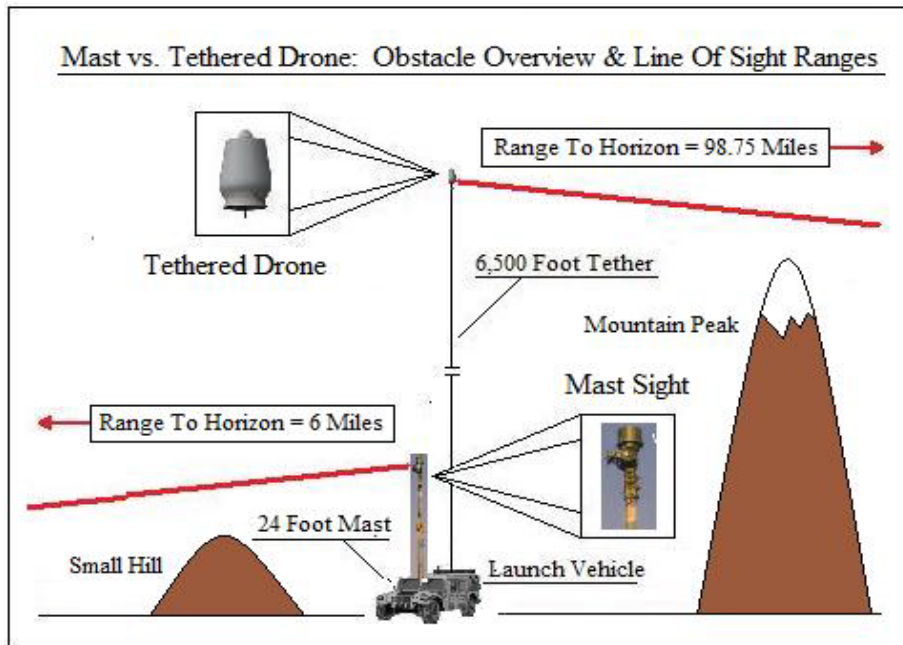


## Battlefield Ground Surveillance Mission:



- ❑ Ground Surveillance Footprint At 6,500 Feet = 1,800 Yards In Diameter.
- ❑ Human Targets Are Highly Detectable In Overhead Thermal Images.
- ❑ Thermal Images Are Optimal For Moving Target Indication Software.
- ❑ Uses Fixed Camera Or Turret Imager/Laser Rangefinder/Designator.

## Battlefield Ground Surveillance Mission:

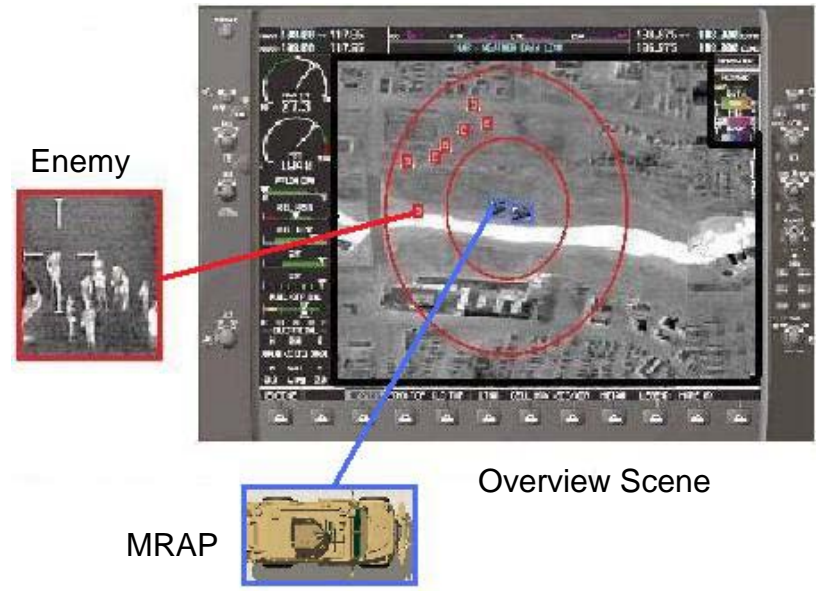


- Tethered Drone Visual Range To Horizon At 6,500 Feet = 98.75 Miles.
- 8 Meter Mast Visual Range To Horizon = Less Than 6 Miles.
- Tethered Drone Is Able To Overcome Terrain Obstacles; e.g. Mountains.
- 8 Meter Mast Able To Use Terrain Masking...Although: Not All Obstacles May Be Approached For Vehicle Mast Mounted Sight Viewing.

# Battlefield Ground Surveillance Mission Operational Scenario: Perimeter Security for Mobile Forces



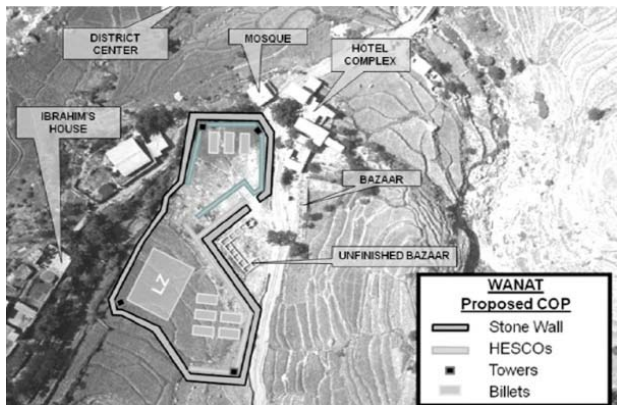
VS.



# Battlefield Ground Surveillance Operational Scenario:

## Defense of Forward Operating Base (Example: FOB Wanat)

Terrain Masked Situational Awareness

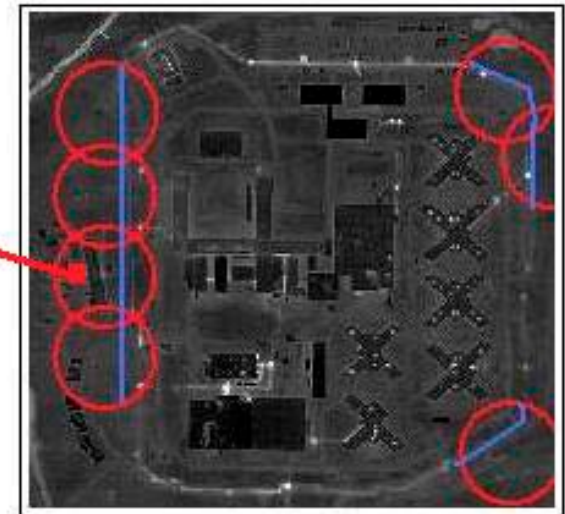


Staring Overhead Surveillance



VS.

Enemy



# Battlefield Communications Relay Mission:

## Air & Artillery Support



## Airborne Relays



## Open vs. Obstructed Terrain



L.O.S.  
← →

L.O.S.  
← →

Blocked  
← X →

**NOTE:** L.O.S. = Line Of Sight, necessary for radio frequency communications.



## Battlefield Communications Relay Mission: Available & Proposed Methods:

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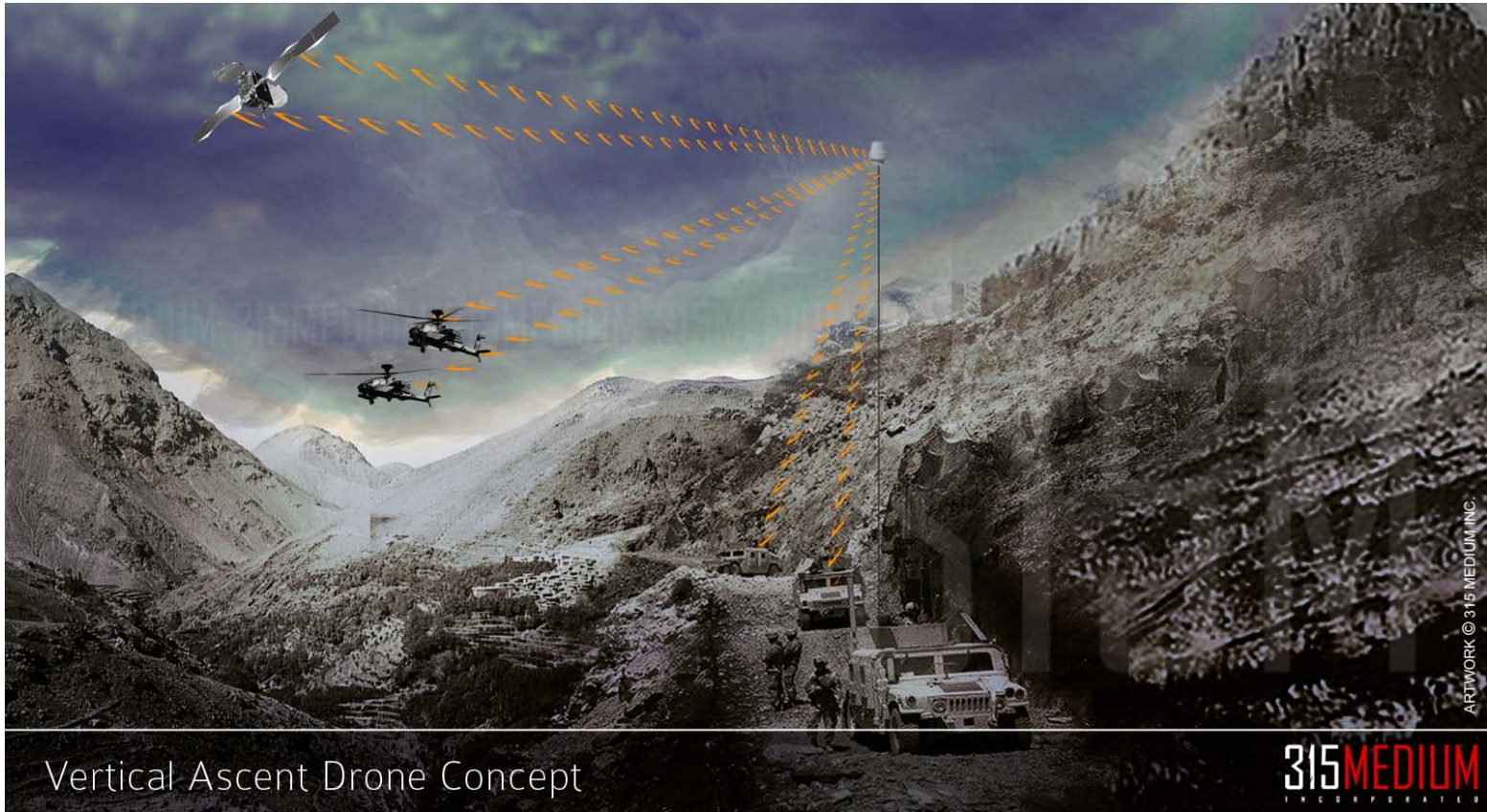
Balloon, FCS Class 2 UAS, **NGC** Helicopter UAS & **AAI** Fixed Wing UAS

### Problems With Available & Proposed Methods:

- 1) All unable to hover in place in all weather conditions.
- 2) Helicopter & Fixed Wing UAS are Battalion level assets.
- 3) Balloon relay disposable, vulnerable asset with low endurance.
- 4) All systems unable to self deploy, launch, recover and stow.
- 5) Class 2, Helicopter & Fixed Wing UAS require training.
- 6) Class 2 UAS on right track...but not tethered.

## Battlefield Communications Relay Mission:

### Operational Scenario: Airborne Uplink Relay & Retransmission



# Vertical Ascent Drone Targeting Operational Scenario:

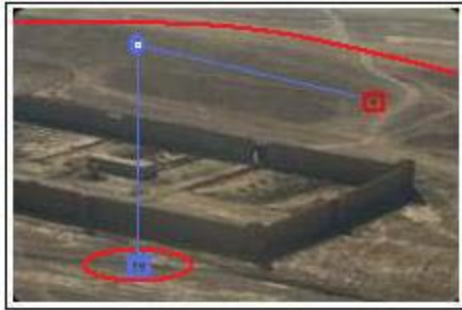
## Slant Laser Designation & GPS Geo-Location PGM Guidance

Exposed Personnel



VS.

Stand-Off Targeting



# Vertical Ascent Drone Operational Scenario:

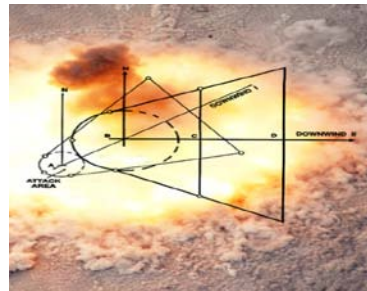
## Photo Reconnaissance, Electronic Surveillance, NBC Monitoring



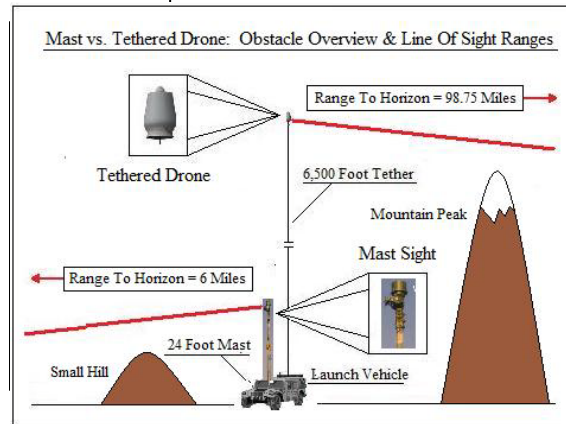
Increased standoff distance for lightly armed reconnaissance forces with Vertical Ascent Drone, enables terrain masking.



VS.



ESM/ISR



## Conclusions:

- The Vertical Ascent Drone Concept Addresses Currently Missing Squad Based Situational Awareness, RF/GPS Relay, Laser Designation And Geolocation Targeting Capabilities.
- Vertical Ascent Drones Offer A Means Of Implementing Computer Based Moving Target Indication (MTI) Fire Control, Automated Threat Weapons Detection & IED Disturbed Soil Pattern Detection Software Integration.
- The Concept Does Not Overlap Existing Remote Piloted Airborne Reconnaissance Assets While Adding Staring Hover, Electronic Surveillance, Communications Relay, Non-Lethal Threat Escalation And Precision Munitions Targeting.

Credits:



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With Special Thanks To:

Mr. David Broden, President

**Broden Resource Solutions LLC**

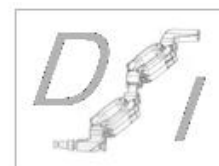
**KOPIN**



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I N C O R P O R A T E D



*Defense  
Stabilization  
Industries  
LLC*