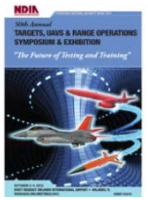
Presenter: W.”Skip” Parish / Director
*UATGlobal



TARGETS,UAS & RANGE OPERATIONS SYMPOSIUM AND EXHIBITION - *THE FUTURE OF TESTING AND TRAINING*. > Orlando Fla Conf. 2012

A “Sea Change” in technology creates new challenge's to test programs

A problem of Process

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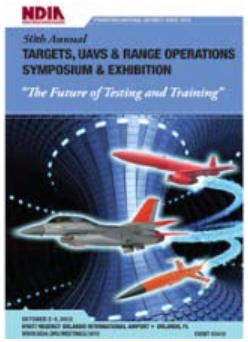

We will talk about …….Testing Problems…….
Of ..

"Collaborative intuitive behavior on a common target by multiple armed Unmanned Air Vehicles."

But first some background ……..

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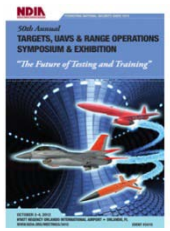
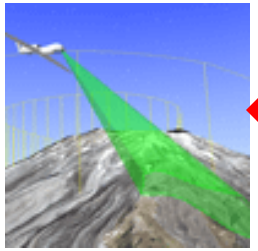
Background of the Problem..



- **Micro Electronics effect on operations..**
  - **Very Small sensor and arms payloads**
  - **Very small avionics payloads**
  - **Increased performance beyond non-computer controlled guidance.**
  - **Geometric increase in lethality due to new networking.**
  - **Extremely low cost entry**



CREATED ARE "THE CHANGE MASTERS"…

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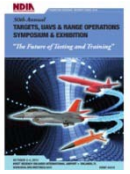
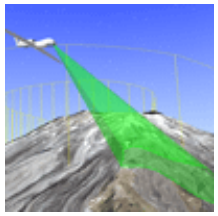
Duke Weatherington, deputy director for the Pentagon's Unmanned Aircraft Systems (UAS) Task Force ***(December 18, 2007 11:48 am Danger Room, Wired Magazine)***



- **"There's really no way that a system that's remotely controlled can effectively operate in an offensive or defensive air combat requirement,"**
- **Note the word "remotely controlled" and the Word "NO WAY".**



Change MASTERS at Work….

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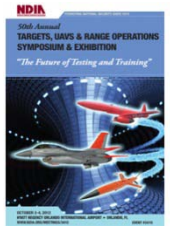
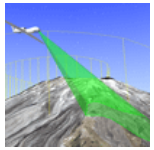


United States Air Force Unmanned Aircraft Systems Flight Plan2009-2047

Headquarters, United States Air Force Washington DC18 May, 2009

An unmanned aircraft is not limited by human performance or physiological characteristics. Therefore, extreme persistence and maneuverability are intrinsic benefits that can be realized by UAS.

- **Ultimately unmanned airpower can be carried in a backpack with commensurate capabilities.**
- **This tactical network system will be distributed, scalable and secure. It includes, but is not limited to, human interfaces, software applications and interfaces, network transport, network services, information services and the hardware and interfaces necessary to form a complete system that delivers tactical mission outcomes.**
- **As autonomy and automation merge, UAS will be able to swarm *(one pilot directing the actions of many multi-mission aircraft) creating a focused, relentless, and scaled attack….***



Change MASTERS at work…..

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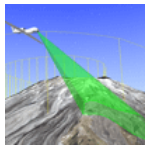

The "Change Masters" produce performance.

- **Computational Computing allows multiple chained iterations of "intuitive behavior" such as executable auto hunting algorithms onboard vehicles.**
- **Swarm Technology Networking allows Hubless wireless real time communication between autonomous vehicles. (Corrective Artificial Intelligence between UAS with autonomous C2)**
- **Size Matters> Computer controlled small UAS can go beyond real time human manual remote flight skill ability.**
- **Distributive Processing> Advanced micro communications provide real time intelligence and processing analysis from other assets.**

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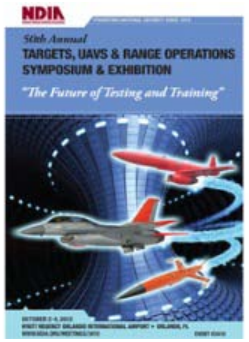
Performance



- Small 3-4 lb air frames with arms.
- Variable arms from non-lethal to lethal HE rounds. Mission specific.
- Air, sea, vehicle and hand launch.
- Integration with battlefield sensors, comms,
- Flight duration 2hrs plus
- Flight speed 25Kts – 60 Kts

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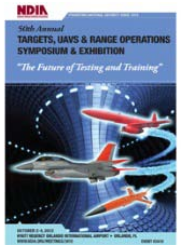
Performance 2



- Alt – Variable based on control by ground/air. Relay. +10,000 ft
- Turn @ 45Kts level flight 90 degrees in 25 ft of travel.
- Climb from 9,600 ft to 10,500 ft 35 seconds.
- IR/Day Sensors , Video streaming
- Lock on video targeting 5+ targets

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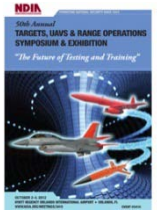

Skip's "Laws" of Small Unmanned Air System-ARMED (SUAS-A) Flight

- Arms recoil force vectors are overcome with power in flight, forward speed, mass of the projectile, and mass of the air vehicle, they "slide" to reacquire flight path as long as the WEAPON is firmly mounted to the frame and the airframe is in free flight
- Most questions can be answered by using a % or Ratio of size to known aircraft design, AND APPLYING A reduction RESULTANT … i.e.. Safe Wind speed effect, etc..
- It takes the same size SUAS or smaller to out maneuver another SUAS.
- Flying to a target is superior to stand off attack tactics with SUAS-A, this can be "pinpoint close with finite" proper force on target". (i.e... Less collrital damage, insurgent warfare friendly)
- SUAS-A compress DECESION time for humans by superior performance translated into diminished opportunity to defend .
- SUAS @ high performance levels require digital computer assisted flight controls for direct human interaction.
- Never rely on avionics power sources to operate weapons.

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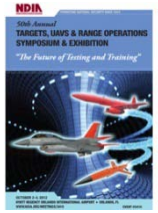
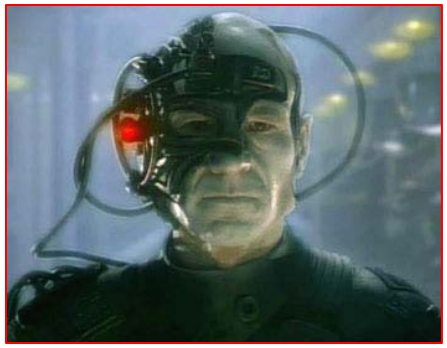


The Stage is set for testing…..

- Lab and Bench testing of auto C2 in Swarm clusters acted on by outside control factors.
  - Built visualizer to detect RF hops (comms between Swarm nodes based on actions external to the Swarm.) **(Similar to Biological conditioning simulation)**
  - Algorithms trigger functions with specific actions or missions .
  - Collision avoidance Algorithmic sensor feeds. (Rules)
  - Trust testing for Swarm networking .
  - SWARM Networking >Equivalent to the Star Trek “Borg” episodes.. **One knows all and all know one…(Real Time Sensor Fusion multiple vehicles)**



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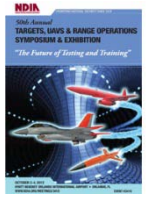
Testing Problems .. Flight..



- Confinement 3D space box boundary limits.
- Test slaved outside system sensors for tracking path of travel.
- Programed executable tactical mission parameters.
- Programed logic events
- Target sensor location and trigger for intuitive algrothmetic executable program file .

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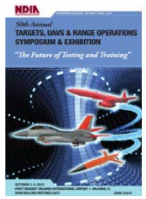
Testing Problems. Flight 2



- Time sequence *change down* for Radio Frq hops during executable file run (*visualization* for humans..)
- Video high speed frame capture and track on frame, of path of travel, matched to executable file run.
- Multiple UAS attack run plots on common target.
- Untangle the fur-ball of multiple vehicle air combat on air frames with very low Radar signature. .that can maneuver many times faster than piloted aircraft.

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Tactical algorithms

- Coyote stalk

- Wolf Pack

- Collision Avoidance
- Strong Signal Lock on
- Multiple Team Pack Rules

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A More Complicated Test: Coyote Stalking "Insurgent Warfare" Low Collateral Damage Probability using Swarm Networking

Big Bird & Sparrows

LAUNCH PLATFORM

Swarm 1

Swarm Networking Algorithm Relay Real Time Data to each other.

Swarm 2

SENSORS

Swarm 3

Sparrows are independent of big bird once launched and communication with each Sparrow in low power RF that can only be detected in the angle of sight between the two or more vehicles.
Each tracks the others and adjusts for the Stalking Algorithm on their chip sets with a pre-programed tactical kill box as they box a target in until the optimum programed kill shot range.. There is no hub to the communications links, and thus all instructions are immediate and all real time data from the combined sensors are fused for each Sparrow. One knows all and all know one. They hunt on their own.

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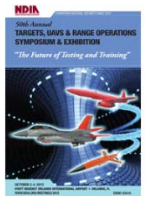
A More Complicated Test: Coyote Stalking "Insurgent Warfare" Low Collateral Damage Probability using Swarm Networking



Air launch Swarm 1&2
Mother Ship C2

TARGET LOCK ON

Swarm 1

Swarm Networking Algorithm
Relay Real Time Data to each other.

Swarm 2

Swarm 3

Using unique ID"s Sparrows from <u>other Swarms</u> can act together when common tactical algorithms are present . Sparrow 1&2 Join Sparrow 3

Ground launch
Swarm 3

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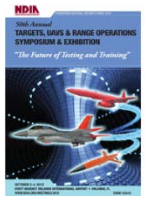

Open for suggestions on live air frame testing.. Be here next year for the results..

- Lab testing of Software> Done
- Live air testing of path to Swarm programing algorithms..
- Field testing under battle conditions.

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