



***Special  
Reconnaissance/Unconventional  
Warfare---***  
***How about an UxV for a  
Teammate?***

**...Collaborative Unmanned Operations for Maritime Security...**

***Dr. Miles Libbey***

***Dr. Robby Harris***

***Lockheed Martin MS2***



# Overview

- **ECCHO: Edge C2 and Hybrid Operations**
- **Autonomous Operations...will take decades to achieve**
  - Instead: Think about levels of autonomy
  - Don't you really want teams, not autonomy?
  - Or better: machine teams working with human teams
- **Today: Control, i.e. fly & drive**
- **Tomorrow: Command sensors and missions**
- **Working to skip a generation in edge & unmanned C2**
- **Heterogeneous Ops UxVs= UAV, USV, UGV, UUV**
  - + unattended sensors, e.g. ground= UGS
- **Small footprint, powerful info sharing and**
  - Teams of warriors USV / UAVs / Unattended Sensors

# ECCHO Program Priorities



- **Face fire first** to reduce human vulnerability;
- **Work collaboratively with other machines** to reduce humans “driving/flying” platforms & relieve humans from simple non-lethal problem/mission execution/logistics solving;
- **Work collaboratively with humans** provide persistent, meaningful ISR, tailored to dismounted SO/LIC warriors needs;
- **Provide timely, geo-marked, fused info** to team & higher echelons in open format like Google earth;
- **Reduce Edge & TOC footprint** for people & equipment

UxVs May Gradually Replace/Empower Squad  
Members

# Program Goals



- **Autonomous Operations**

- Operate with only safety riders
- Multiple vehicles, single commander
- Automated recommended tasking & retasking
- Evaluate optionally manned vehicle value

- **Operations with unmanned air & surface vehicles**

- **Command environment = 1 laptop**

- Dismounts = PDA

- **Perform combat edge ops maximizing ISR/Tactical coverage & minimizing staff**

- Collaboration between USV / UAVs / Unattended Sensors

# Edge Command and Control/Hybrid Operations (ECC/HO)



Enable Ability To Pass Command & Control Across Network

# Autonomous Operations



- USV following mission paths
- Maneuvering and adjusting velocity based on conditions
- Testing in Riverine Operations

# Desert Hawk UAV



- **Small electric UAV**
- **Normally run with a single laptop control environment**
- **Integrated with collaborative environment**
- **Opportunity for many UAVs to be commanded by single warrior**



# Mobile Command Center for Experiments



- **Command easily passed between fixed, mobile, & dismounts**
- **Used similar networking equipment for testing**



# Command Environment: Graphical User Interface



File View Zones Planning Mission Objectives

4 No Controlled Vehicles EOIR-1

DM\_Video

Range 2.4 Alt 300  
IPo 120 SE IGA 111 E

0 19 09F 1900000 000  
03/14/2003 11:08:33

-180 -120 -60 0 60 120 180

Health Capability Nav Imagery  
USV\_Video DH\_Video Mission

Steerpoint-1 Index 12 Index 11  
Mission Control Handoff-5 Index 5  
Mission Control Handoff-4 Index 13  
USV Index 1 Range: 0.0  
Steerpoint-2 Index 4 Index 5  
EOIR-15 Index 6  
EOIR-13 Index 9  
DH Index 8

Lat: 36°45'41"N Lng: 75°57'48"W Zoom: 1:40,000 Range: 0.0NM 000 0 Time: 11:08:06

Objectives

Vehicle	Order	Name	Status	Type	Priority	Predecessors
USV	1	Steerpoint-2	New	Steerpoint	10	None
DH	3	Steerpoint-1	New	Steerpoint	10	None
DH	3	Mission Control H...	New	Mission Control H...	10	None

+ - Edit Show Completed

Zones Decluster Filter Color Autonomy Simulator Event Log Objectives

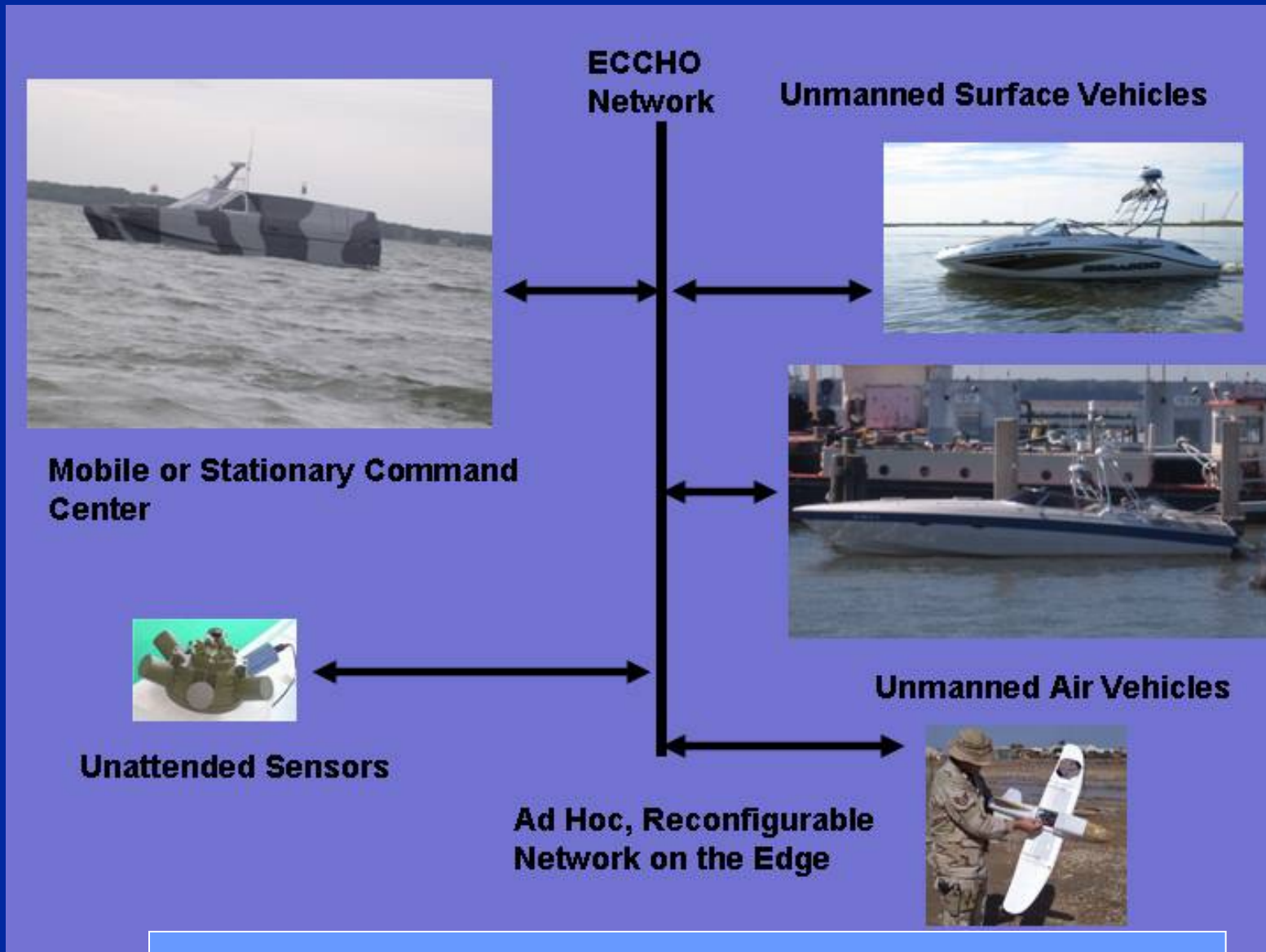
# Command – Vehicle Shared Models



- **Key: share mission plan between ops command dismounts & UxVs**
  - Permanent network communications not required
  - Mesh network concept borrowed from SO/LIC
  - Allows multiple UxVs tasking
- **Retasking: command center or directly with UXV**
- **Automatic replanning flexible: individual vehicle level, team, or group level.**
  - Compensates for: fuel, sensor performance on failures, completion of other tasks.....

Flexibility: LCS or ashore TOC; Concept adapts to TTPs

# Live Components – 3 '08 Experiments



**Stiletto Used as LCS Surrogate in Spiral 1**

# Operations Outside Normal Comm. Range; Mesh Network Allows Daisy Chaining





# Flexible Ops: Boarding Party Support



- USV / (UAVs) provide SA while Edge forces board suspect ship
- Commanded from environment on shore or manned boat
- Coordinated through local boarding party interested in “different views”

# ECCHO Summary



- **Multiple missions run using collaborative resources**
  - Automatic retasking based on sensors/info, not data
  - Not just riverine: SO, HA/DR, first responder
  - Persistent Tactical Surveillance
- **Multiple users can command assets temporarily**
- **Increases commander's influence range & coverage**
- **Allows battlefield resource sharing: e.g., LCS squadron**
- **COTS Hardware maximizes cost, reuse & flexibility**

**Goal: Make UxV Squads Powerful SO/LIC Teammates**



# Questions?

*Dr. Miles Libbey*  
*Lockheed Martin*  
*Advanced Solutions MS2*  
*202.863.3444*