



Autonomous Systems for Humanitarian Assistance and Disaster Response

Sydney, Australia
July 2015

LOCKHEED MARTIN



Corey A. Cook
Logistics and Sustainment

LOCKHEED MARTIN



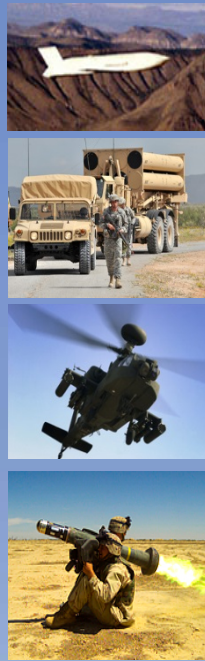
Aeronautics



Information Systems & Global Solutions



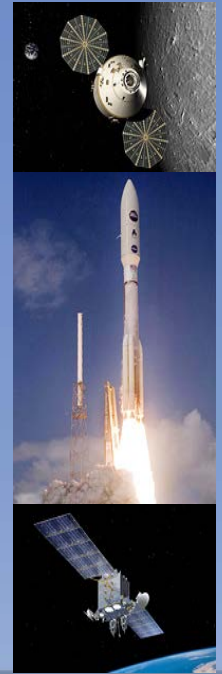
Missiles & Fire Control



Mission Systems & Training



Space Systems



Agenda

- AS Trends, Barriers, and Enablers
- AS Portfolio Examples
- HADR Exercise Process

Societal Trends, Barriers & Drivers



Societal and Technology Trends

- Growing Cultural Acceptance (Social Media, Gaming, Daily Familiarization)
- Service Oriented
- Ageing Society
- Computational Power
- Advanced Manufacturing
- Tech Fusion

Barriers

- Technological Limitations
- Implementation Costs
- Perception
- Human Self-preservation
- Government Regulation
- Cyber Security
- Education & Skill Sets

Drivers

- Dirty, Dull and Dangerous
- Environmental Factors
- Tech Advancements
- Rising Manpower Cost
- Budget Constraints
- Decreasing Production Costs
- Operational/ROI Analysis

Current Gaps in Autonomy



- 4 “Ps” of Robotics
- Command , Control, & Communications
- Operational Analysis
- Skill Sets and Education















Trusted Remote Operation of Proximate Emergency Robots

Mastering the 4 “Ps” of Robotics

PERCEPTION • PROCESSING • POWER • PLANNING

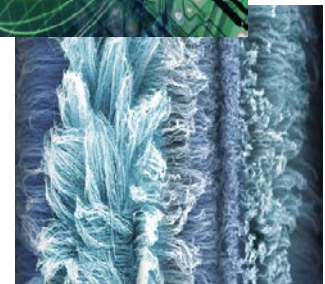
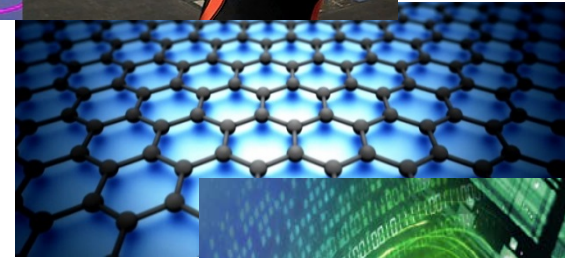
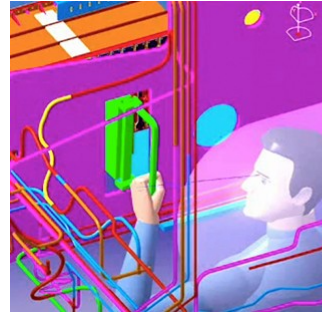
Engineers are working toward the next great leap in robotics. These are the technology factors that will be critical to driving robotic capabilities forward:

 PERCEPTION	Robots must understand their surroundings so they can infer how to interact with and impact the environment. 	Perception isn't just about cameras and sensors, it's programming that allows the robot to represent, sense and navigate their world. 
 PROCESSING	Robots need incredible processing capability to manage their movement in and manipulate their environment. 	While no match for the human brain, cloud computing increases processing power and allows robots to share experiences. 
 POWER	Robots need improved power sources that provide affordable, portable, long-lasting energy. 	Power also refers to the control of the robot's movements to improve mobility and processing. 
 PLANNING	Robots need planning capabilities— what is their task and how do they respond in the event of the unexpected? 	Without planning, a robot may not have the tools necessary to solve the problem of an unknown situation. 

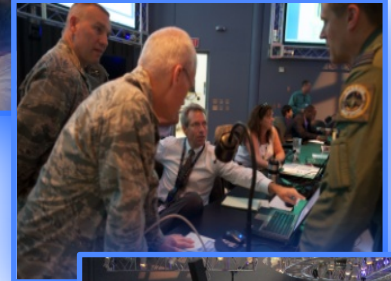
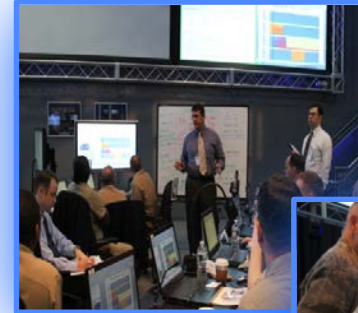
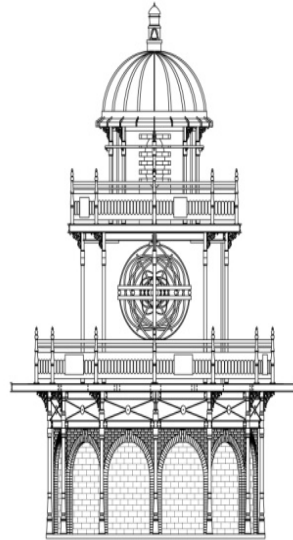
AS Enabling Technology



- **Energy**
- **Nanotechnology**
- **Quantum Computing**
- **Virtual Reality Augmentation**
- **Synaptic Control/ Neuro-hacking**
- **Additive Manufacturing**
- **Self Diagnosis, Repair, and Replication**



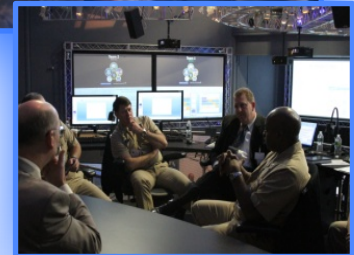
Disaster Response Work Shops, War Games & Experimentation Process



**Experiments &
Exercises**

**Analytical
Workshops &
Investigations**

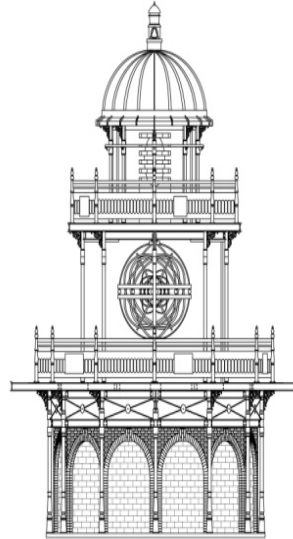
**Concept Development ,
Capability Demos, & Technology
Integration**



Disaster Response Work Shops, War Games & Experimentation Process



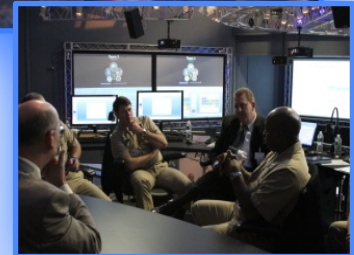
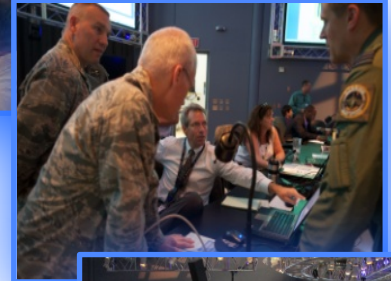
Experiments & Exercises



Concept Development ,
Capability Demos, & Technology
Integration



Analytical
Workshops &
Investigations



Autonomous Systems Portfolio



2015

2025

2035



SMSS



ExoSkeleton



AMAS/Aplique'



MULE



F-35



FALCON



Stalker



Indago



KMAX



FURY



UCLASS



ROVER



Marlin USV



Hybrid Air



ARES



USV



MAVEN

Squad Mission Support System (SMSS)



Description/Requirements

- Support Light Infantry and Early Entry Forces.
- Lighten The Soldier's Load
- Primary design is transport; evolving family of MEPs: CIED, RSTA, Resupply, Mobile Power, Maintenance, Armed
- 1500 lbs. payload
- All weather, Day And Night Operations
- Highly Mobile 6X6 Drive
- Air transportable: CH-47 Internal, UH-60 External
- Control modes: Drivable, Teleoperation, Supervised Autonomy, SATCOM



Fire Ox

K-MAX Unmanned Helicopter



Adaptability

- Multi-Mission UAS – 24/7 Operations
- Reliable, Heavy Lift Airframe – 1.5 MMH/FH
- Minimal Deployment Footprint

Innovative UAS

- Robust / Redundant Unmanned Control
- Dual Dissimilar Communication Links
- Optionally Piloted – Accelerated Testing

Life Saving Capability

- Reduces threat of IEDs to Ground Convoys
- Augments Manned Aviation Assets

UAS Missions

Cargo Resupply

- Precision Delivery
- Unmanned Retrograde Multi-Drop Carousel

Inherent Missions

- Special Operations
- Humanitarian Assistance / Disaster Relief

Future Capability

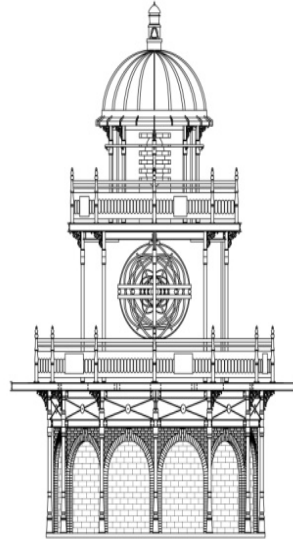
- Maritime Operations
- Forestry / Construction
- Ship-to-Ship/Shore
- Intelligence, Surveillance, Reconnaissance



Disaster Response Work Shops, War Games & Experimentation Process



Experiments & Exercises



Analytical Workshops & Investigations



Concept Development,
Capability Demos, & Technology
Integration

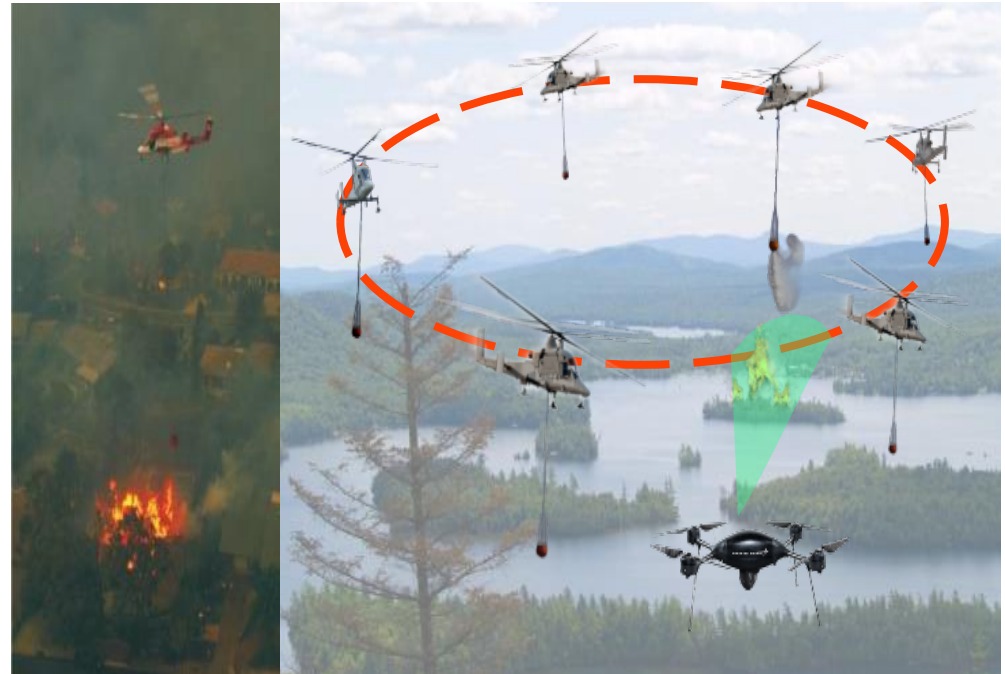


Unmanned Firefighting



- Emergency Response Benefits
- Fire Fighting – Wildfires, Vehicular, High Rise and Structures
- 24/7 Operations when manned fleet is grounded due to visibility
- Disaster Recovery without required infrastructure (delivery / extraction)

Using the K-MAX Helicopter and Indago Quad-rotor Unmanned Aerial Systems (UAS) specifically tailored to this unique mission can provide significant benefit to firefighting efforts.



Capabilities:

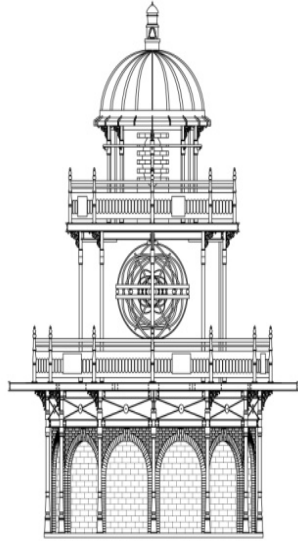
- Autonomous Water Pickup
- Hotspot Identification
- Dynamic UAS Retasking
- Autonomous Water Delivery
- Delivery Effects Evaluation
- Cooperative UAS Operations
- Precision Resupply Operations
- Personnel Recovery & Equipment Delivery



Disaster Response Work Shops, War Games & Experimentation Process



Experiments & Exercises



**Concept Development ,
Capability Demos, & Technology
Integration**



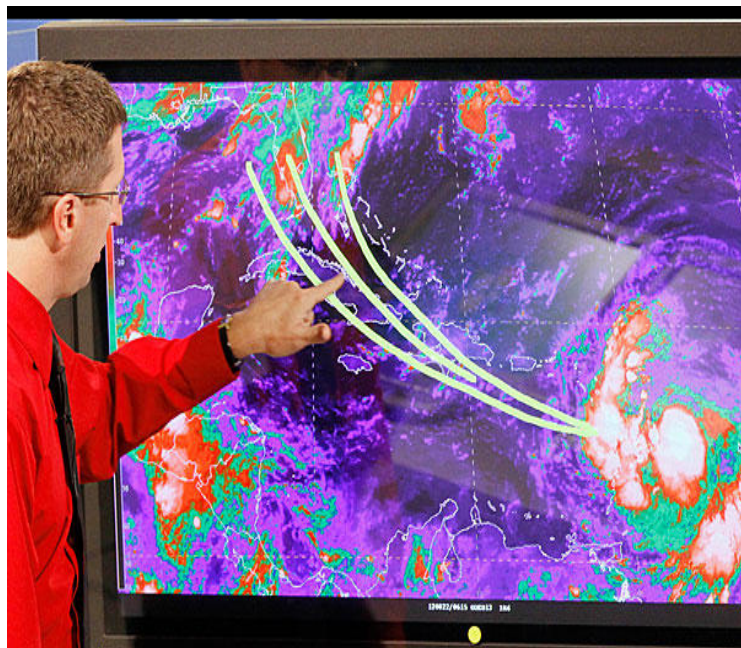
**Analytical
Workshops &
Investigations**



The background is a complex collage of images related to disaster response and military operations. It features a large American flag, a soldier in a helmet, a woman behind a window with a grid, a van on fire, a Coast Guard ship with two crew members, a soldier holding a woman, and a soldier with a rifle. The text is centered in a bold, yellow font.

Disaster Response Integrative Logistics (DRIL) Exercise

The DRIL Exercise



“Whole of Society” Exercise Day 0 +120

- Category 5 Hurricane devastates the Caribbean and East Coast, impacting Miami, migrating to New York
- Severe infrastructure devastation. Major transportation networks severely impeded.
- General public unrest developing quickly due to lack of information, power, and communications.
- Industrial supply chains are greatly diminished and supplies hoarded.

Objectives:

- Demonstrate coordinated collaboration, define integrated logistics processes, and implement technological solutions.



DRIL Participation

Distribution

- Crowley Maritime
- DHL
- American Trucking Assoc.
- Maersk
- DLA
- Erudite
- uSHIP
- SEKO
- UPS

Infrastructure

- Florida Power and Light
- Fluor
- Verizon
- American Logistic Network
- Adapx
- SPS

Suppliers

- Home Depot
- ISOA
- Walmart

Government (Domestic)

- FEMA
- NORTHCOM
- DHS
- HHS
- GSA
- DLA
- USCG
- National Guard (FL)
- FL Emergency Management
- National Guard (V.I.)
- JTF - CS

Government (International)

- SOUTHCOM
- TRANSCOM
- NAVSUP
- Department of State
- J7 , J4
- USACE
- UN/WFP
- USN (HA/DR Expeditionary)
- NATO
- National Defense University

NGO/IO

- Red Cross
- Operation Blessing
- Catholic Relief Services
- Americas Relief Team
- International Medical Corps
- PADF
- Convoy of Hope
- CARE

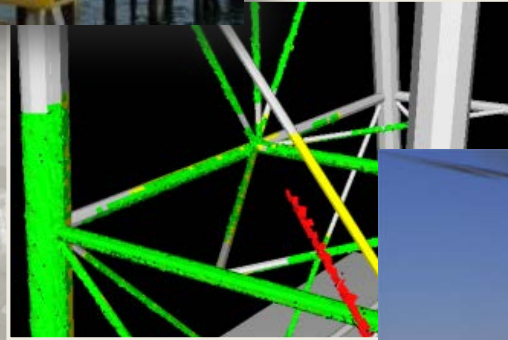
Academia

- UNC Chapel Hill
- Harvard Humanitarian Initiative

83 Enrollees from 52 Organizations



AS Insertion



Why this Process?

- Education/Collaboration across enterprise centers of excellence
- Develop/Socialize future operational concepts and technical applications
- Affordable, efficient relevant/credible solutions
- Leverage industry labs and resources
- Insights into “Operational” needs
- Customer relationship – Enduring trust

