

# K-MAX

A Revolutionary Unmanned Aerial System:  
Night Unmanned Aerial Firefighting



LOCKHEED MARTIN





# K-MAX

## Agenda

- K-MAX UAV Video
- Night Unmanned Firefighting
- Development & Capabilities
- Firefighting Trial Videos
- Future Commercial Service



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# Developing the K-max UAV



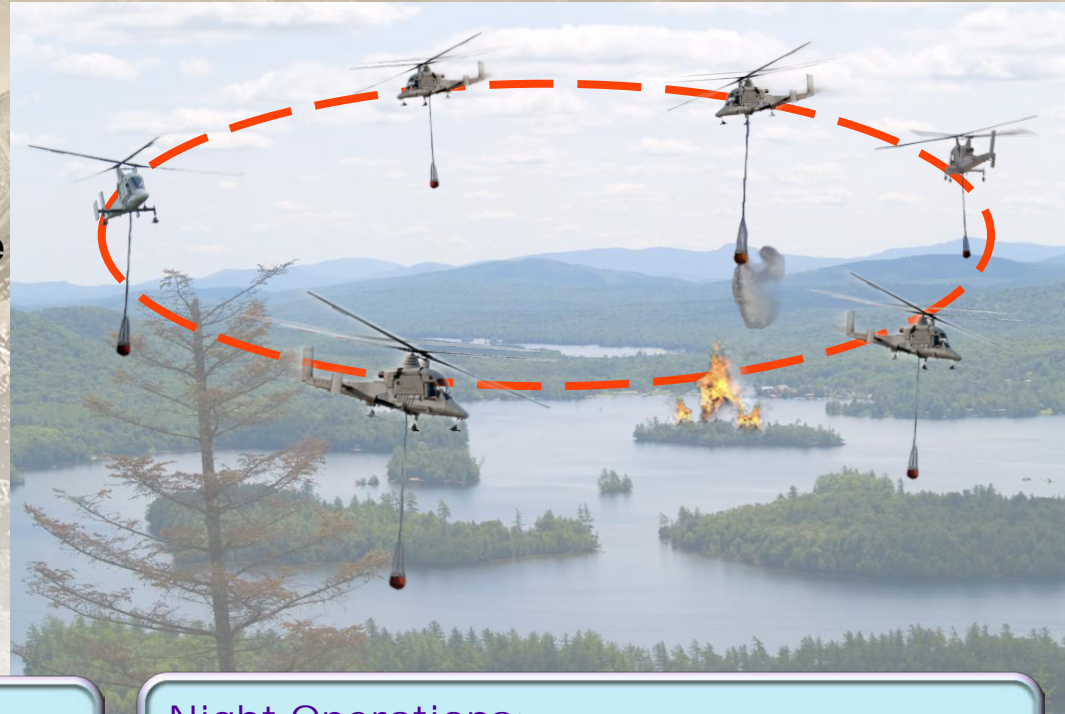


# Unmanned Firefighting Need



Many challenges exist when fighting fires including manned helicopters ability to only fly in visual flight conditions. Unmanned systems can shift this paradigm by enabling 24/7 fire suppression support.

Using the K-MAX Helicopter 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**

## Night Operations:

- **Sensors Package – Allows Night Operation**
- **High Risk Missions**
- **Allows 24/7 Continuous Operations**
- **Increases Situational Awareness**
- **Autonomous Resupply**
- **Not degraded by smoke**



# Innovation to Realize the Vision

## 1. The Right Aircraft – Easy to Maintain in Austere Environments

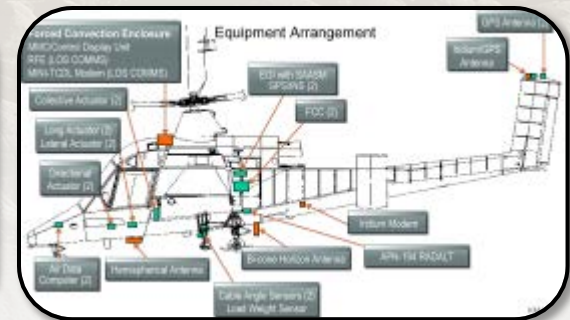
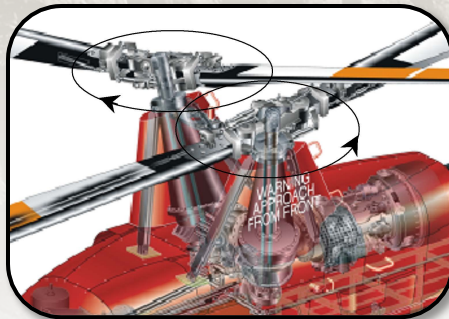
- Intermeshing main rotor = No tail rotor & 1:1 lift ratio
- Servo-Flap = No swash-plate or hydraulic system

## 2. Robust Unmanned Control System

- Redundant Mission / Flight Control Architecture
- Dual, dissimilar data link systems (LOS/BLOS)
- Rugged, portable ground control system

## 3. Practicality

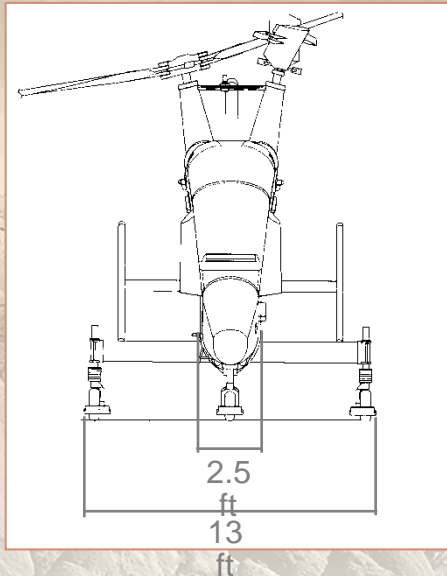
- Navigating the NAS in manned configuration
- Spares readily available – commercial support



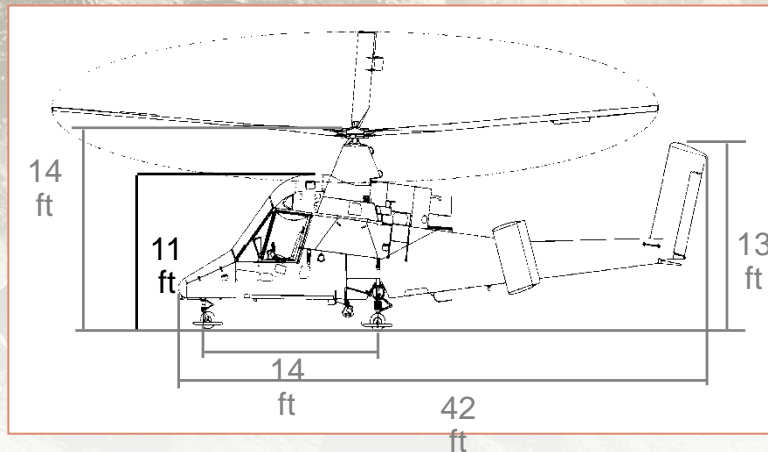
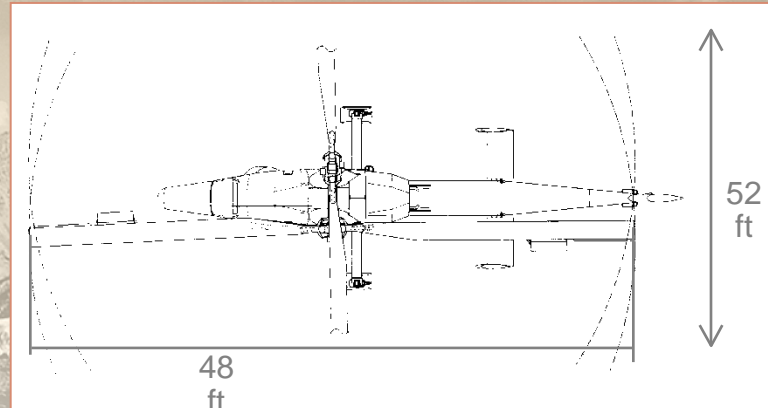
**Operational Necessity Driving Aviation Innovation**



# K-MAX Air Vehicle Overview



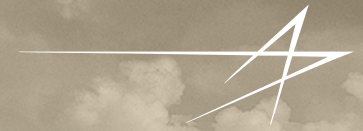
- Engine: One 1,800 shp Honeywell T5317A -1
- Internal fuel: 228 U.S. Gallons (1550 lbs)
- Empty weight: 5,500 lb. (2500 Kg)
- Maximum gross weight: 12,000 lb. (5,443 Kg)
- Hook/Multi -Hook capacity: 6,000 lb. (2,722 kg)



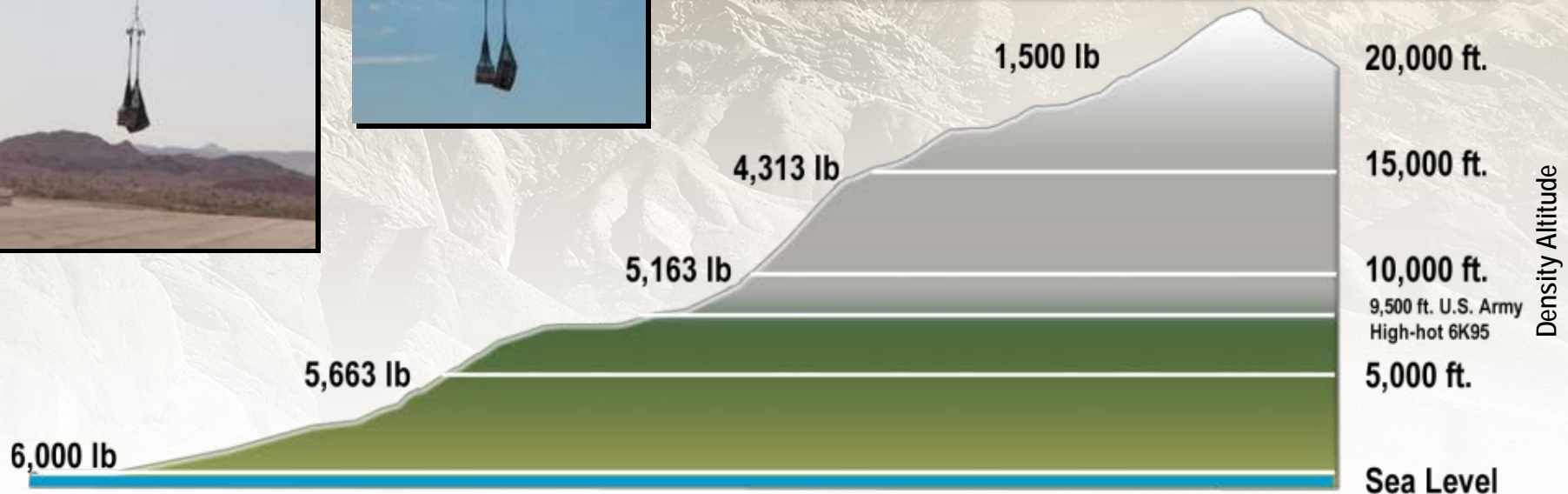
Over 300,000 fleet flight hours accumulated since 1994 FAA certification.



# K-MAX Aircraft Capabilities



Range:	267 nm
Endurance:	
Internal Fuel:	2hr 41 min
Aux Tank:	12 + hr
Multiple Delivery:	1 to 4
Payload:	6,000 lbs

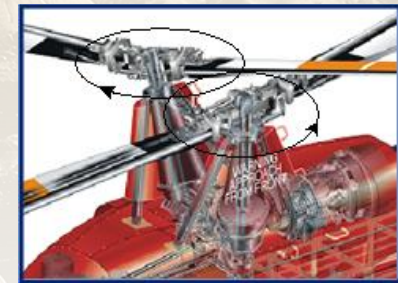


**K-MAX Maintains Performance in High/Hot Environment**



# K-MAX: Purpose Built for the Mission

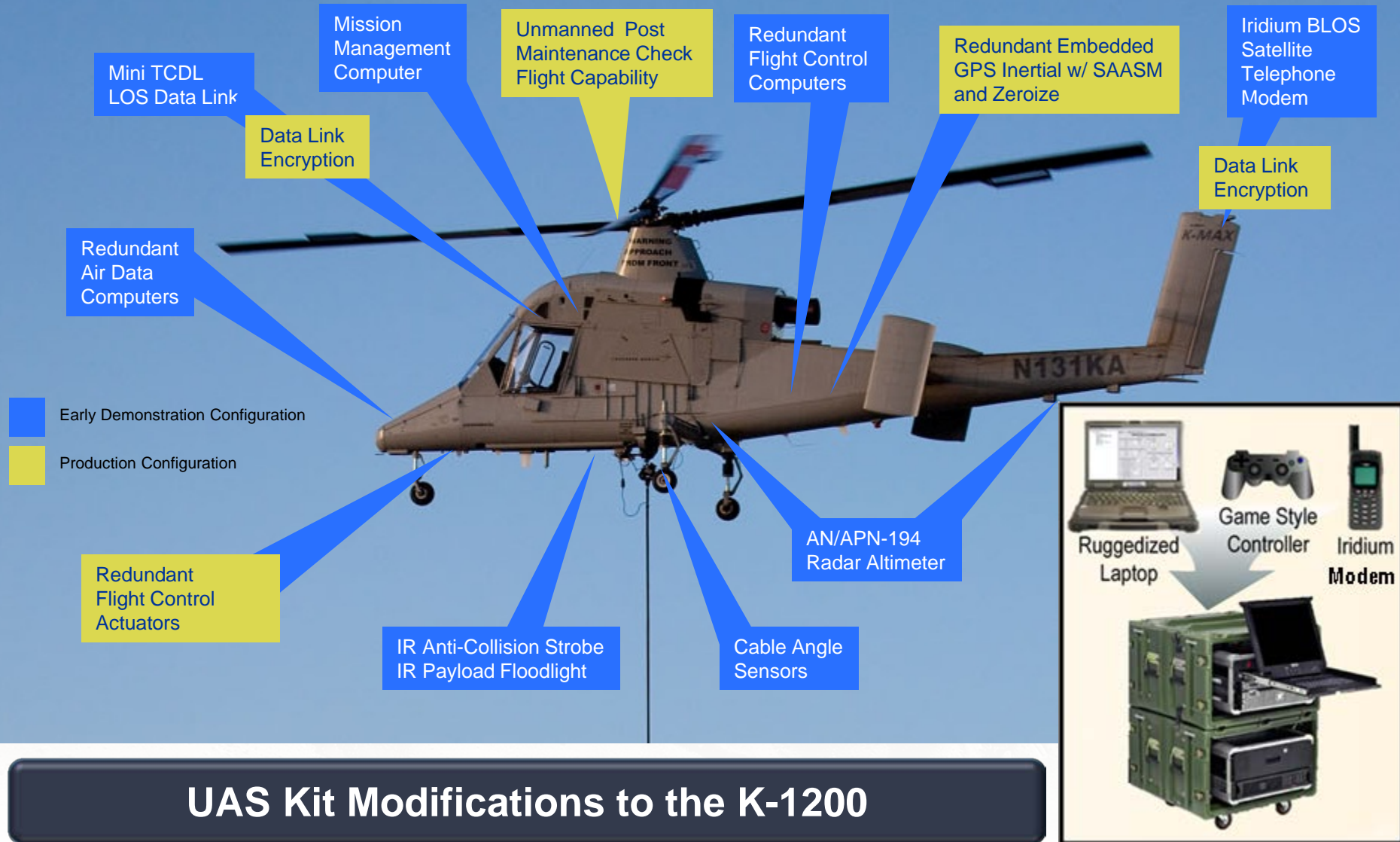
- K-MAX is the only helicopter designed, built, and tested for the repetitive lift industry
- K-MAX was designed and tested based on the logging mission
- Aircraft has proven itself with over 300K hrs on the K-MAX fleet
- Intermeshing rotors eliminate tail rotor and simplify maintenance
- K-MAX cost / maintenance / fuel burn < ½ manned rotary wing
  - 1.5 Maintenance Man Hours per Flight Hour (MMH/FH)
  - 85 gal / hr – Fuel Burn Rate



**Proven Performance & Affordable Solution**



# Cargo UAS Configuration



## UAS Kit Modifications to the K-1200



# Ground Control Station



KMAX024





# Unmanned K-MAX Capabilities



## Unmanned K-MAX Offers:

- Programmable waypoint navigation
- BLOS Control
- LOS and BLOS Data Link
- Dynamic re-tasking
- Control hand-off
- Auto-land/auto-takeoff
- Safety pilot for development/flights in national airspace
- 25kw of auxiliary power to energize payloads
- Precision delivery
- Low noise levels
- Low down-wash
- **Night-time operations**





# Unmanned K-MAX®

Lockheed Martin and Kaman Aerospace successfully transformed Kaman's proven K-1200 power lift helicopter into a Cargo Unmanned Aircraft System (UAS). The K-MAX® UAS can lift more than 4,300 lb at 15,000 ft density altitude with a robust autonomous control system.

Since 2011, the K-MAX UAS has been deployed in Afghanistan conducting 24/7 unmanned resupply operations for the US Marine Corps transporting >4.5M lbs in 2K sorties with mission capability rate >94% at less than 1.4 MMH/FH and \$1,300/HR direct operating costs .



## Achievements – World Firsts

- 4.5M lb Equivalent to 900 Cargo/Security Vehicles Taken Off Roads
- UAS Delivery of Munitions into “Hot” LZ in lieu of 2 H-53s (plus crew)
- Time Critical Deliveries within 2 Hours of Request
- Critical Deliveries by UAV Made with Armed Escort (Cobras)
- MOB to FOB and GPS Grid Delivery with <3m Accuracy
- Helicopter Support Team Hot-Hookup under Hovering UAV
- Unmanned Retrograde >30% of British FOB
- 30,000 lbs Delivered in 1 Day – 4,500 lb Water Pump Moved

### K-Max K-1200

By the Numbers

**300,000+**

Hours flown by global K-Max fleet

Average fuel burn  
per hour during lift  
operations (in gallons)

**85**

**6,000**

Maximum external  
load (in pounds)

**1900+**

Sorties flown by Unmanned  
K-MAX in Afghanistan

**\$1,300**

Direct operating cost  
of Unmanned K-Max  
(per hour)

**1.4**

Maintenance Man Hours per Flight Hour

**4,500,000+**

Pounds of cargo moved for US Marine Corps in Afghanistan

**46,000 → 0**  
Exposure hours eliminated  
using UAS vs convoy

**900**  
Convoy vehicles to  
move equivalent cargo



# Unmanned K-MAX Heavy Lifter



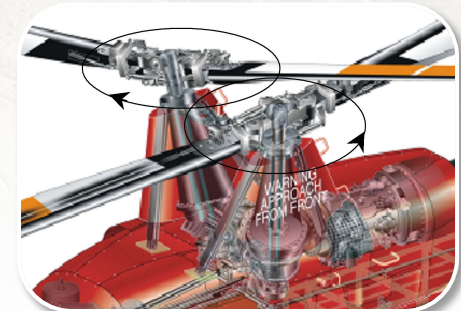
## Technology Overview



- **Optionally Piloted Vehicle (OPV)**
  - FAA Experimental Certified
- **Day/Night Operations**
- **Autonomous take-off/flight/land**
- **Intermeshing Rotor System**
- **Precision Delivery**
- **1:1 lift ratio – Minimal Ops Cost**

## Features & Benefits

- **Highly reliable logistics delivery**
  - >300K hrs on fleet
- **Designed/Tested for repetitive lift**
- **Proven in austere environments**
- **Operates in zero visibility**
- **Increased availability**
- **Reduced operating costs**
- **Reduced pilot exposure**
- **Simplified maintenance**
- **Precision delivery**
- **Small footprint**





# Commercial Utility



- Loads up to 4,500 lbs
- Distances up to 100 nm
- Technology has been proven
- Ready for use



## 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)

## UAS Resupply Benefits

- No intermediate transshipment / handling required
- No roads or transportation infrastructure required
- Multiple Loads with Carousel



# Unmanned Firefighting - Results





# K-MAX Future



- **Optionally Piloted Vehicle**
- **Inherent Reliability for Heavy Lift Missions**
- **Commercial Service for Fire Fighting**

## *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 – Flexibility

## *Navigating the NAS*

- Manned Configuration – Transit NAS
- Rapid Deployment – No need special airspace

## *UAS Missions*

### Fire Fighting

- Day/Night Capability
- Sensor Package Configurable
- Cargo Delivery

### Future Capability

- Commercial Service
- Contaminated Areas
- Integrate with other UAVs
- Concurrent Mapping





# Questions??

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