K-MAX Cargo Unmanned Aerial System

October 2011

Bud Sauvageau
Agenda

- K-MAX Capabilities
- Resupply Need
- K-MAX History → Manned / Unmanned Variant
- K-MAX Demos
- Cargo UAS Program
- Emerging DoD Programs
- Questions
K-MAX: Purpose Built for the Mission

- K-MAX is the only helicopter designed, built, and tested, for the repetitive lift industry. Made for the logging industry

- K-MAX manned version is FAA Certified!

- Aircraft has proven itself with over 260K hrs on the K-MAX fleet

- Intermeshing rotors eliminate tail rotor and simplify maintenance

- K-MAX cost / maintenance / fuel burn < ½ manned cargo RW
  - $1,100 / hr – Direct Operating Cost
  - 2 Maintenance Man Hours per Flight Hour (MMH/FH)
  - 85 gal / hr – Fuel Burn Rate

Proven Performance & Affordable Solution
# K-MAX Aircraft Capabilities

<table>
<thead>
<tr>
<th><strong>Speed</strong></th>
<th>with load: 80 kt</th>
<th>without load: 100 kt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range</strong></td>
<td>internal fuel: 267 nm</td>
<td></td>
</tr>
<tr>
<td><strong>Endurance</strong></td>
<td>internal fuel: 2 hr 41 min</td>
<td>ext. aux tank: 12+ hr</td>
</tr>
<tr>
<td><strong>Max Payload</strong></td>
<td>6,000 lb</td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Max Gross: 12,000 lb</td>
<td>Max Take-Off: 7,000 lb</td>
</tr>
<tr>
<td><strong>Lift</strong></td>
<td>at sea-level: 6,000 lb</td>
<td>(ISA +15°C) at 15,000 ft: 4,313 lb</td>
</tr>
<tr>
<td><strong>Multiple Delivery</strong></td>
<td>1 to 4</td>
<td></td>
</tr>
</tbody>
</table>

K-MAX Maintains Performance in High/Hot Environment
Resupply Need

• Mission Critical / Time Sensitive (MC/TS) resupply to any unit

• Routine resupply to a single company-size unit or several smaller units in a 24 hr period

• Difficulty transporting heavy loads over unimproved roads, inhospitable terrain and IED susceptibility on supply convoys

• Limited numbers of utility/cargo helicopters are conducting logistical resupply missions and are not able to focus on combat operational support missions

• Threat to manned aircraft and personnel

• Insufficient rotary wing resupply capabilities caused by extreme heat and high altitudes

• Inability to conduct precision aerial delivery and retrograde

Unmanned K-MAX is the Solution!
K-MAX History

K-MAX Development

- Intermeshing Rotor System
- Designed, Built, Certified for Repetitive Lift Applications: Logging, Construction, Fire Fighting, Mining Surveys
- FAA certification '94
- >244,000 flight hrs.
- Unique Intermeshing Rotor System
- 6000 lb lift capability
- One to one lift ratio
- Low noise signature
- Low Maintenance Cost

K-MAX Production

- 6,000 lb Cargo Hook with Integral Trolley

Early UAS

- High Power RF LOS
- Range ~50 nmi
- Close proximity control
- Limited authority Control Station

Successful Demos

- Ft. Eustis
- Eglin to Rucker
- Ft. Benning
- Endurance – Bloomfield CT (12+ hrs)
- Ft. Eustis
- Quantico

Robustness

- 900+ UAS Flight Hours to Date
- Mission Planning
- Dynamic Retasking
- Contingency Mgmt
- GCS Simplified Interface
- Automated Load Delivery
- Level 5 Control
- Full Authority Autopilot
- Communications
  - Enhanced LOS
  - BLOS
- NAVAIR: USMC
- Immediate Cargo Re-supply
- AATD: USA JCTD

Contracts!
Cargo UAS Program

Cargo UAS Requires Minimal Modifications to the K-1200

- Mini TCDL LOS Data Link
- Mission Management Computer
- Unmanned Post Maintenance Check Flight Capability
- Redundant Flight Control Computers
- Redundant Embedded GPS Inertial w/ SAASM and Zeroize
- Iridium BLOS Satellite Telephone Modem
- Data Link Encryption
- Redundant Air Data Computers
- AN/APN-194 Radar Altimeter
- Redundant Flight Control Actuators
- IR Anti-Collision Strobe IR Payload Floodlight
- Cable Angle Sensors
- Blue Force Tracker Interface
- Reduced FOB GCS Software Functionality
- Ruggedized Controller
- Game Style Modem

Distribution Statement A - Approved for public release; distribution is unlimited, as submitted under NAVAIR Public Release Number 11-571
Ground Control Station

- LoS Data Link
- TCDL Directional Antenna & Radome
- Hand Control Unit
- Backup Hand Control Unit
- Iridium Hand Held Satellite Telephone
- Rugged Laptop Computer
- Iridium BLoS Data Link Antenna
- Iridium BLoS Data Link Modem
- Command & Control Subsystem Case
- Interface Panel
- Power Supplies
- Generator
- LoS Data Link TCDL Modem & Radio Frequency Equipment
- Hand Held GPS Receiver
- Power Subsystem Case
Concept of Operations

- NAVAIR RFP (N0019-10-R-0020) – 22 Sep 2010

- 24/7 Operations
- 6,000lbs per day
- 108nm round trip per sortie
- Re-program enroute
- GOCO
- 1 on mission, 1 “hot spare”
- Night, all weather, NVG Compatible
- Marines Integrated throughout
- Support to 3 FOBs
Emerging DoD Programs

• NAVAIR RFP (23 Sep 2010)
  – USMC Immediate Cargo Re-supply - Awarded in Sep 2011

• Joint Capability Technology Demonstration (JCTD)
  – AATD (Aviation Applied Technology Directorate) ATUAS
    (Autonomous Technologies for UAS)

• Proposed Naval Research
  – ONR (Office of Naval Research) AACUS (Autonomous Aerial
    Cargo/Utility System)
Summary

- Unmanned Cargo Resupply emerging mission
- Requirements are established to address the need
- K-MAX proven platform for repetitive lift
- Lockheed Martin and Kaman Aerospace making unmanned cargo capability forward
- Near term deployment will demonstrate utility in theater

K-MAX is the right aircraft for unmanned Logistics Resupply!