Leading the Way with Long-Range Unmanned Aerial Systems (UAS)

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Overview

- Introductions
- Classes of UAS Aircraft
- Myth-busting
- FAA and Utility BVLOS Operations
- Success Criteria
- Next Steps

Environmental Consultants Inc.

- 44 years providing vegetation and asset management services
- Consulting services for hundreds of utilities in North America and abroad
- Hundreds of professional, on-site, support personnel across the United States
- Pioneer in data collection and information management systems
- Environmental/utility research, benchmarking and litigation support/expert testimony
- Remote sensing and software selection/implementation

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FLōT Systems

- 16 years of experience with long-range, unmanned aerial systems (UAS) in United States
- Initial focus in oil exploration identifying airborne hydrocarbons and precision filming
- Non-utility client list includes BBC, Discovery Channel, National Football League and Chevron
- Successfully executed thousands of short and long-range UAS missions in the United States
- Zero incident safety record
- First-mover in electric & gas utility space
- The first FAA-approved beyond visual line of sight designation for electric utility infrastructure inspection

General Classes of UAS Aircraft

Quadcopter/ Small UAS

- $3k - $100k USD
- 2 – 25 lbs
- 20 – 60 minute endurance
- 400 foot ceiling
- ½ mile range
- Payloads: typically carry small video cameras
- Applications:
  - "Over-the-ridge" inspections

Medium Altitude / Long Endurance

- $300k-$5M USD
- ~25 – 500 lbs
- 8 – 40 hour endurance
- 8,000 - 20,000' ceiling
- BVLOS range – capable of operating over hundreds of miles
- Payloads: capable of carrying a variety of sensors
- Coverage Rate: ~100X > small UAS
- Multiple applications

Large UAS

- Uber expensive
- 1,000 – 12K lbs.
- 24 - 40 hour endurance
- 50,000' ceiling
- Global reach
- Payloads: 2,000 lbs.+ capacity
- Strategic national assets
- Civilian applications?

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Commercial UAS Technologies

(Potential for near real time/24/7/365 operations)

Vertical Take-Off and Landing UAS (VTOL)

- High precision
- Comprehensive assessments
- Greater take-off and landing flexibility

Short Take-Off and Landing UAS (STOL)

- Rapid assessment
- Linear asset compatibility
- Take off and landing requirements

What You May Have Read

- "a helicopter can fly and inspect between 400 miles and 440 miles per six-hour flight … between $1300 and $2000 per hour…" or **$30 per mile**.

- "Inspection with sUAS, which requires a two-man team….range of 0.2mph to 0.4 mph…" at $2000 and $6000 per day or **$5000 per mile**.

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What You May Have Read

- "The average speed between UAS Contractors was .33 mph. This is 5.15 times slower than the helicopter comprehensive aerial inspection and 1.74 time faster than comprehensive walking inspection."

- "…beyond-line-of-sight flights can travel up to 20 miles, compared to about 1,500 feet under the new FAA regulations."

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The Rest of the Story…

- “a helicopter can fly and inspect between 400 miles and 440 miles per six-hour flight … between $1300 and $2000 per hour…” or **$30 per mile**.
- Data quality is highly variable at this speed. “Check the box” inspection.

- “Inspection with UAS, which requires a two-man team….range of 0.2mph to 0.4 mph…” at $2000 and $6000 per day or **$5000 per mile**.
- Long-range BVLOS operations will be accomplished programmatically at similar cost to helicopter, providing greater value.

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The Rest of the Story…

- “The average speed between UAS Contractors was .33 mph. This is 5.15 times slower than the helicopter comprehensive aerial inspection and 1.74 time faster than comprehensive walking inspection.”
- Automation, long-range BVLOS, emerging technology and experience will drive down UAS total project times.

- “…beyond-line-of-sight flights can travel up to 20 miles, compared to about 1,500 feet under the new FAA regulations.”
- Efficient long-range UAS operations will involve day-long flights.

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FAA and Utility BVLOS Operations

July 15th, 2016 FAA Reauthorization Act passed in law

- Specific language mandating the FAA to fully integrate BVLOS operations over utility infrastructure

Rule-making for the good of industry

- Not In a Vacuum!
- Concept of Operations (Conops) that drive rule-making
- Include compelling utility safety & business cases
- Rule-making around automation
- Breaking the chicken & egg cycle = investment

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FAA and Utility BVLOS Operations

BVLOS Challenges

- Emerging technologies
- Technology is not enough
- DOD vs. civilian platform challenges
- Proof-based performance requirements
- Automation that satisfies multiple stakeholders

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FAA and Utility BVLOS Operations

BVLOS Challenges (continued)

- FCC / C2 / DAA / UTM / GPS
- Non-cooperative traffic
- Patchwork of local and state regulations
- FAA resources
- Rogue operations
- Airline pilots union

FAA and Utility BVLOS Operations

February 3, 2016

- FLōT Systems and ECI, in partnership with Xcel Energy, became the first to complete BVLOS operations over utility infrastructure.

Current Utility Beyond Line of Sight Operations:

- Blanket U.S. operations – require airspace development
- Proof based performance
- Programmatic, business case driven approach
- Platform agnostic
- Multi-partner approach

FAA and Utility BVLOS Operations

Scaled BVLOS operations

- Automated processes that support business cases
- Full integration
- Proven and cost effective risk mitigations for vast swaths of infrastructure

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Success Criteria

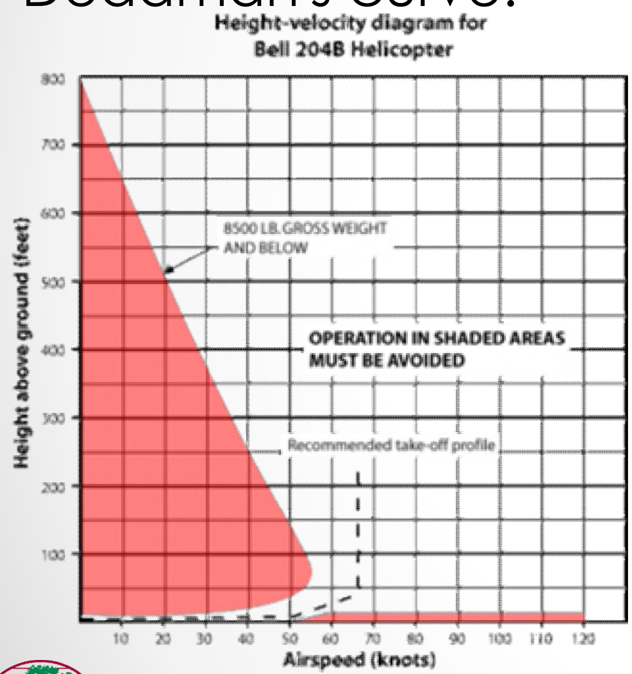
- ✓ Improve safety
- ✓ Reduce risk
- ✓ Improve reliability
- ✓ Reduce cost

Safety

Risk associated with helicopter inspections

Deadman's curve:

Jan 2010-June 2016
827 accidents/212 fatalities*



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*NTSB data

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Reduce Risk

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Success Criteria

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- ✓ Improve reliability
- ✓ Reduce cost

Improve Reliability

Success Criteria

✓ Improve safety

✓ Reduce risk

✓ Improve reliability

✓ Reduce cost

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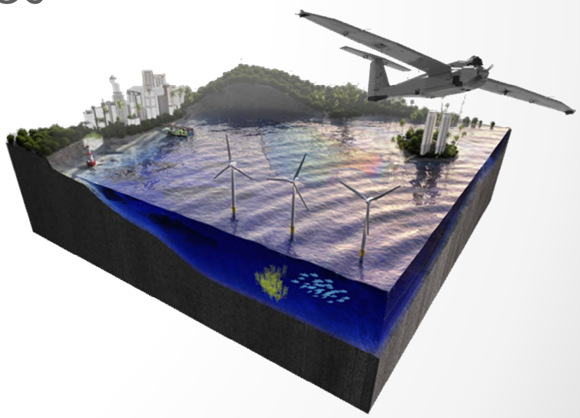
Reduce Cost

T&D Stakeholders	Remote Sensing Needs								Geospatial/Software Needs					Mobility
	LiDAR	Ortho	Oblique	Google Earth	Video	Radio Frequency	Thermal IR	Corona	PLS CADD	GIS	Work Scheduling	Work Management	Performance to Plan Tracking	Occasionally Connected Environment
Engineering	X	X	X	X					X	X	X	X	X	X
Vegetation Management	X	X	X	X	X				X	X	X	X	X	X
Asset Inspection		X	X	X	X	X	X	X		X	X	X	X	X
Construction	X	X		X					X	X	X	X	X	X
Maintenance		X	X	X		X	X	X		X	X	X	X	X
Siting & Land Rights	X	X		X	X					X	X	X	X	X
Security/Protection		X	X	X						X	X	X	X	X
Environmental	X	X		X	X					X	X	X	X	X

Future Direction

What's Next?

- ➢ Scaling outcomes
- ➢ Influence industry standards and best practices
- ➢ Identifying additional business cases
  - ✓ Three pillars



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Questions?

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