U.S. Geological Survey
Land Remote Sensing Program-
Unmanned Aircraft Systems (UAS)

arrier Pigeons Take Aerial Photos With New Camer

IT IS no longer necessary to send planes over enemy lines to get photos of troop operations—carrier pigeons have now been pressed into service for this hazardous task.

This unusual feat is made possible by the development in Germany of a new diminutive aerial camera which is strapped to the pigeon's breast, as illustrated in the accompanying photo. Two hundred views may be taken while in flight, the shots being made possible only after the bird has left the ground. Each bird also carries a message tube strapped to its leg.

The German government has opened a school to train carrier pigeons for service in aerial photography.

two remarkable panoramic views taken by pigeon carrying aerial camera. Insert shows how camera is

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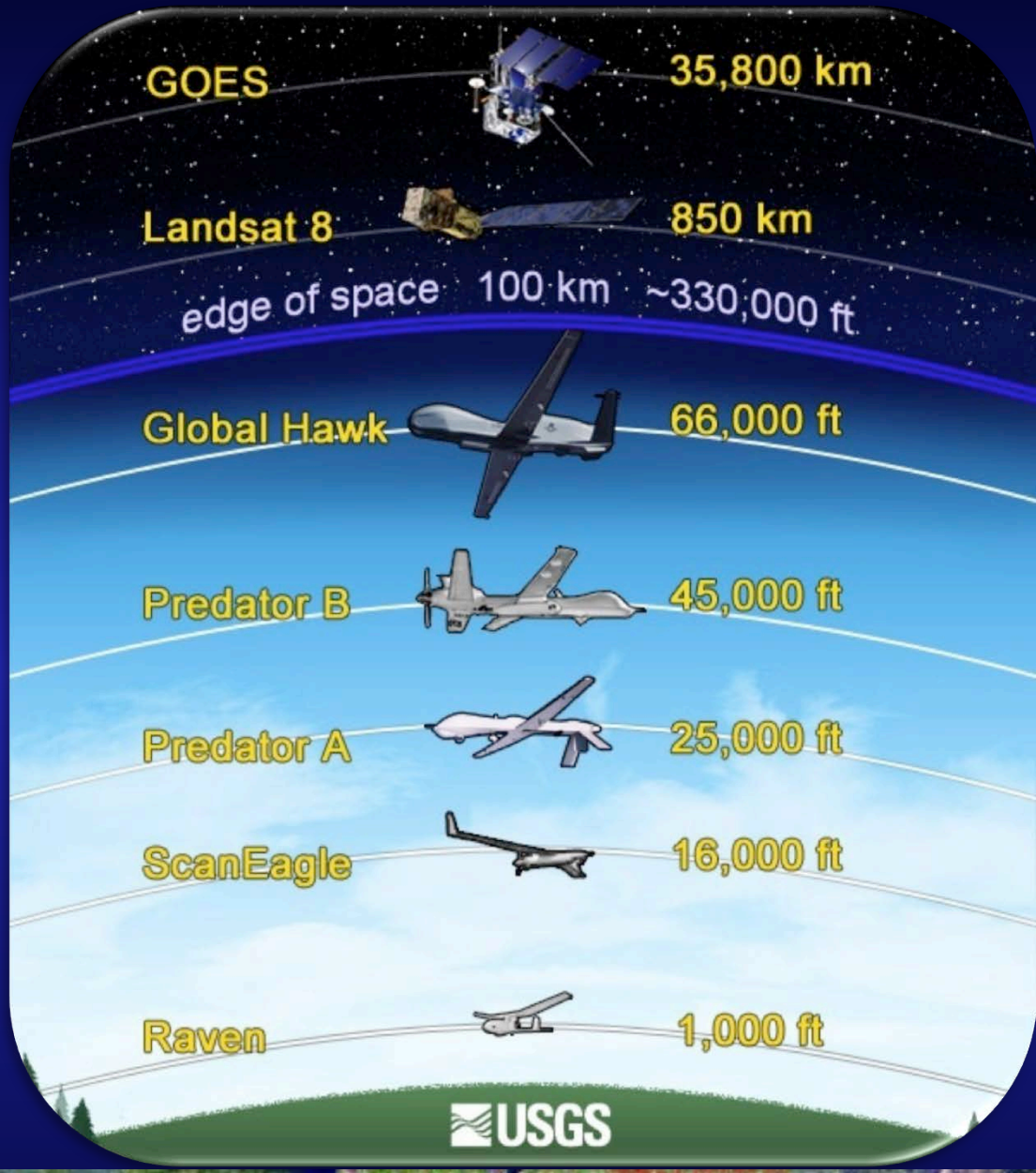
Problem – Observation Gaps

Gaps exist in acquiring remotely sensed data over the remote, scarcely populated and often volatile lands managed by the Department of the Interior

Manned aircraft flights can be problematic due to long flight durations, unpredictable weather, day & night data requirements and associated operating costs

Satellite based observations are hindered by static sensor capabilities, weather conditions and acquisition cycles that are often measured in days or weeks.

Field surveys can be expensive, logistically challenging and focus on a relatively small area



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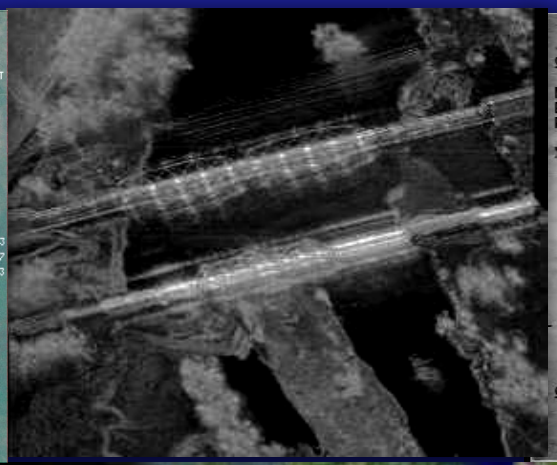
Solutions – Sensor Flexibility

- Full Motion Video
- Small Format Mapping Camera
- Thermal- Infrared
- Chemical- Gas Detection
- Meteorological- temperature
- Radio Telemetry
- LiDAR
- Hyperspectral
- Radars (SAR)
- Traditional Mapping Camera
- Laser Range Finder
- True Multispectral



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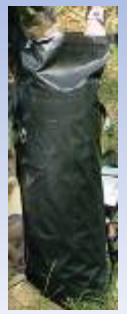
Where we are today-

Provides USGS and our partners with an enterprise level , low cost, low risk UAS capability to "cut our teeth"

- Operator training and certification
- Establish air worthiness inspection criteria
- Develop user applications and standard operation procedures
- GAP Analysis- sensors, platforms


Aircraft (3 Each)




GCS Components


Field Repair Kit


Day Payload (3 Each)


IR Payload (2 Each)

Description

Wing Span	4.5 ft
Air Vehicle Weight	4 lbs
Range	10+ km (LOS)
Airspeed	27-60 mph
Altitude	>300 AGL
Endurance	90 min Lithium
Payload	EO/IR Full Motion Video
	GPS- Radio uplink & down link
GCS/RVT	- Combined Weight – 14 lbs

Characteristics

- Rapidly deployed
- Decentralized planning and execution
- Cost effective
- Easily transportable

Raven Operational Mission Sets

- Remote reconnaissance and surveillance
- Damage assessment
- Resource inventory Support

Benefits/Capabilities

Provides enhanced situational awareness by providing expanded reconnaissance and surveillance coverage.

- Hand-launched
- GPS
- Manual or fully autonomous operations with in-flight retasking
- Commanded auto-loiter at sensor point of interest
- Executes lost link recovery procedures

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Department of the Interior Aviation Management Directorate

- Aviation Safety Programs
- Aircraft Management Services
- Procurement of Aircraft
- Service Contracts
- Coordination of Assets

Operational Procedures Memorandum 09-11

- Operator Certification
- Operator Currency Requirements
- Aircraft Safety Inspection Criteria
- Certificate of Authorization Process

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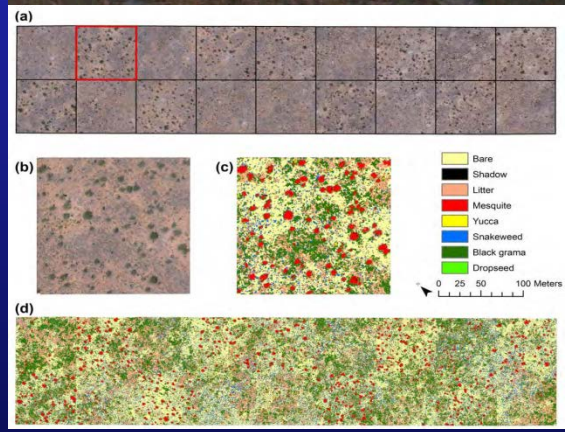
COA Project Descriptions

- Training COA- required to maintain operator currency
- Sandhill Crane Population Inventory
- Wildfire Support- prescribed burns- emergency COA*
- Marsh & Waterfowl impacts from Oil Spill
- Moose, Wild Horses & Burro Population Inventory
- Forest Health Inventory- pine beetle infestation
- Mapping Dinosaur Tracks
- Hydrographic Surveys- sediment transport
- Feral cat removal
- Glacier Temperature Study
- Rangeland Health Survey-sagebrush forage
- Surface Mine Reclamation- coal
- Acid Mine Drainage Identification
- Volcano- Hazards Monitoring
- Monitor River Bank Erosion
- Law Enforcement Support
- Thermal surveys of lakes and streams



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science for a changing world

Fire Demonstrations– Utah/ Florida/ Colorado/ California

Electro-Optical Video of Prescribed Burn

U.S. Department of the Interior
U.S. Geological Survey

Infrared Video of Prescribed Burn

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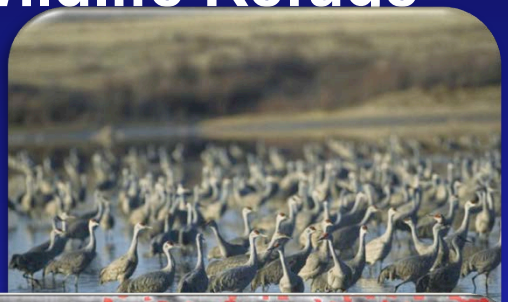
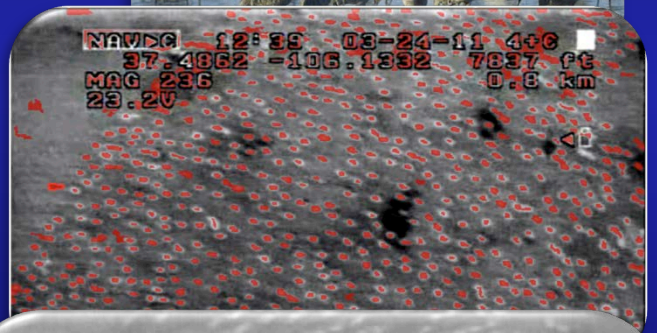
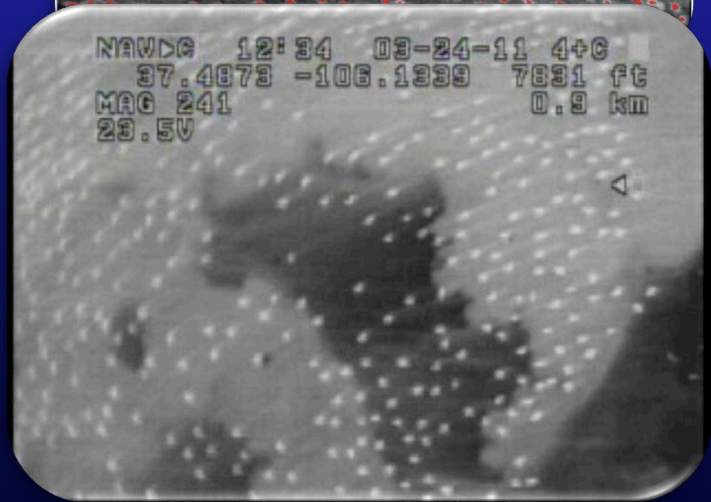
science for a changing world

Sandhill Cranes, Monte Vista National Wildlife Refuge

"ALCON - this is a great example of teamwork and the power of collaboration. My hat's off to each of you for a successful mission. The work you do is not only important, it is vital to the success of the Department and the nation! Good stuff! Thanks much!"
- Joseph Ward Director DOI National Business Center







U.S. Department of the Interior
U.S. Geological Survey

Way Forward-

Collaboration is the Key

- Identify common goals/ missions
- Improve awareness of projects

- Pool assets and leverage resources

- Develop Standard Tasking, Processing, Exploitation & Dissemination (TPED) Procedures)

- Develop Data Sharing Agreements across military, civil, private industry & academia

- Assist the FAA in collecting the data necessary to develop UAS operating plans and procedures

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Gasoline Micro Air Vehicle (gMAV)

Mission: Provide dedicated mission- configured, UAS to meet the small unit needs for a Reconnaissance and Surveillance (R&S) System with hover, persistent stare, and vertical launch/land capabilities.

Capabilities:

- Field level asset
- Single person portable
- Operates in complex terrain
- Manual or automated flight

Characteristics

AV Weight	18 lbs
System Weight	51 lbs
Range	10 km
Endurance	47 minutes
Payload	EO/IR/LD/LRF Sensor
Max Speed	45 mph
Flight Characteristics	Hover and Stare Capable

Potential Applications:

- Observing wildfire behavior
- Verification- Validation of test sites
- Archeological Site (cliff art) Mapping
- Small area photogrammetric projects
- Damage assessments
- Dam Inspections
- Monitoring Volcanic Activity

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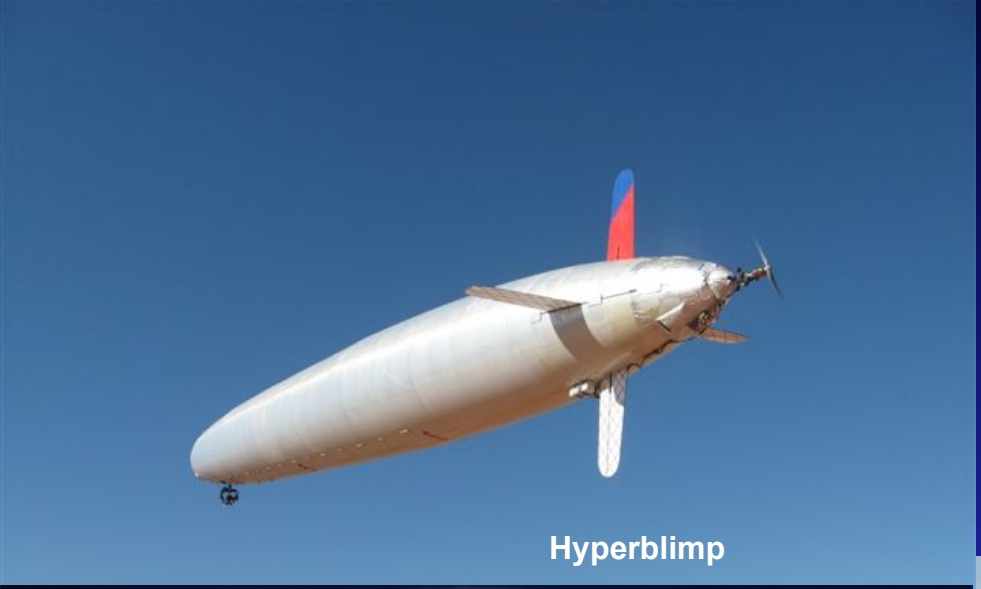
Lighter than Air



Hyperblimp

Long Endurance Multi-Intelligence Vehicle (LEMV)

Sofcoast

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Fiscal Year 2011 Objectives:

Publish Roadmap

Establish Formal Data Sharing Agreement with DHS-CBP

Simplify COA Process: DOI-FAA Memorandum of Agreement

- Delegates file & fly responsibility to DOI
- Currently under review at FAA

Conduct Additional Operator Training Sessions

- Alaska scheduled,
- Idaho or Montana site for second course

Modify sensor packages available on Raven platform

- Radio Telemetry,
- Temperature,
- Chemical/Biological,
- Nadir Camera

Host Department of the Interior UAS Workshop

- Pending resolution of budget

Support Real Missions- Achieve Real Results

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U.S. Geological Survey Roadmap

USGS is with many federal partners to develop a report that will serve as a roadmap for the development of UAS applications.

The intent of that report is to:

- Document potential future civil missions for UAS technology based on user defined requirements
- Document the technologies necessary to support those requirements
- Discuss the present state of the UAS capabilities
- Identify those technologies in development and those for which no current plans exist
- Serve as the foundation for USGS UAS related budget proposals
- Provide the foundations for development of a comprehensive civil UAS roadmap

http://rmgsc.cr.usgs.gov/UAS

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Summary

Much like Global Positioning System and Internet technology have changed the way we do business- Unmanned Aircraft Systems and related technologies will transform the methods and techniques employed across the Department of the Interior and the United States Geological Survey to conduct our missions. Cost effective remote sensing technology is currently available to support a wide variety of applications including:

- managing federal lands
- monitoring environmental conditions and natural resources use
- analyzing dynamic earth processes
- supporting global and climate change investigations (carbon trade)
- supporting law enforcement actions
- aiding search and rescue teams
- inventory of wildlife
- generating mapping, charting, and geodesy products
- conducting environmental impact assessments
- developing an archive of observations
- preventing, preparing for, responding to, and recovering from disasters