Unmanned Aircraft Systems (UAS) Overview

Shawn Meyer
smeyer@usgs.gov

Department of the Interior
U.S. Geological Survey

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Topics

• Unmanned Aircraft System or UAS
  o How, Why & Why Now

• FAA – Policy and Privacy

• Department of the Interior
  o Strategy
  o Technology
  o Applications and Products

• Summary

T-Hawk Ground Station, Charleston, West Virginia
How a UAS Works

**Line-of-Sight (LOS)**

DOI mode of operation

**Beyond-Line-of-Sight (BLOS)**

An aperture camera is used primarily for navigation, while an infrared camera and radar allow it to observe at night and through haze, clouds or smoke.

Communication satellites are used to control the predator when there is no direct link available. They also transfer data back to other military facilities.
How does UAS Technology Work

- Onboard computer
- Onboard real-time data processing
- Real-time mapping & analysis
- Real-time trajectory planning and control

- ‘Mothership’ sends updated flight commands to swarm
- terrain avoidance
- anomaly-seeking
- maximizing data return…
Factors in Increased UAS Usage

- Technology is rapidly advancing
- Safety continues to be a major concern
- Can provide much-needed cost savings (i.e. agriculture industry)
The tangible benefits of the Department’s UAS activities can be summed up in three words: Science, Safety, and Savings.

Science
• UAS are far less disruptive to sensitive animal species than manned aircraft. They carry high tech sensors and possess the ability to transmit real-time data that can also be recorded for future analysis. These unique characteristics enable UAS to gather repeatable, scientifically valid observations. Better science leads to better policy decisions, which benefits all Americans.

Safety
• Reduced safety risk on rough terrain, especially during times of inclement weather conditions.

Savings
• Increased safety will provide cost savings.
FAA and UAS

- Federal Aviation Administration (FAA) Modernization and Reform Act of 2012 establishes a 2015 deadline for integration of UAS into the National Airspace System (NAS)
- Exemptions, Section 333, for commercial UAS operations, over 400 submitted, 29 approved (film, oil and gas, real estate, agriculture)
- Satellites provide periodic observations over regional/continental areas at low spatial resolutions
- Manned aircraft can collect data over large spatial areas with a variety of sensors
- Field surveys acquire many types of information over small spatial areas
AeroVironment – Raven RQ-11 A

19 systems, 3 aircraft per system, 57 total, 30 operational
39 Raven B, none fielded

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wing Span</td>
<td>55 inches</td>
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<tr>
<td>Air Vehicle Weight</td>
<td>4.2 lbs</td>
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<tr>
<td>Range</td>
<td>10+ km (LOS)</td>
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<tr>
<td>Airspeed</td>
<td>27-60 mph</td>
</tr>
<tr>
<td>Altitude</td>
<td>&lt;400 AGL</td>
</tr>
<tr>
<td>Endurance</td>
<td>90 min Lithium Battery</td>
</tr>
<tr>
<td>Payload</td>
<td>EO/IR Full Motion Video</td>
</tr>
<tr>
<td>GCS/RVT</td>
<td>- Combined Weight – 14 lbs</td>
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</table>

Honeywell – T-Hawk RQ-16

22 systems, 2 aircraft per system, 44 total, 42 operational, 1 with new radio

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tr>
<td>AV Weight</td>
<td>18 lbs</td>
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<tr>
<td>UAS System Weight</td>
<td>51 lbs</td>
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<tr>
<td>Range</td>
<td>10 km</td>
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<tr>
<td>Endurance</td>
<td>47 minutes - Gas Powered</td>
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<tr>
<td>Payload</td>
<td>EO/IR Sensor</td>
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<tr>
<td>Max Speed</td>
<td>45 mph</td>
</tr>
<tr>
<td>Flight Characteristics</td>
<td>Hover and Stare Capable</td>
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Procuring new commercial systems, 3 sizes of rotorcraft and 2 sizes of fixed wing, RFP this month, aircraft by spring, ops by summer
UAS Technology - Sensors

Existing
• Natural Color Video
• Thermal IR Video

Current Enhancements
• GoPro Hero 2 & 3 - 1080P HD camera (still frame and video)
• Canon SX260HS & S100 – GPS enabled (RGB and IR) – CHDK
• Sony ActionCam – GPS enabled
• Ricoh GR – no GPS
• I-buttons (temp. & humidity)

Future Investigations
• Multispectral, Hyperspectral
• LIDAR, RADAR, Thermal
• Chemical/Air Sampling
• Radio Relay/Tracking
UAS Applications

**Wildlife Management**
- Migratory Birds (Sandhill Cranes, Trumpeter Swans)
- Pygmy Rabbit Landscape Habitat
- Grizzly Bear Monitoring
- Elk Population Survey
- Sea Turtles
- Sage Grouse Inventory

**Public Safety**
- Abandoned Mine Lands Survey
- Coal Seam Fire Detection
- Wildfire Incident Support
- Monitor Volcanic Activity
- Monitor Landslides
- **Flood Mapping**
- Law Enforcement Support

**Inspections-Mapping**
- Fence, Pipeline, Power lines
- Mine Reclamation
- Vegetation - Invasive Surveys
- Archeological Site Surveys
- Environmental Survey - Palmyra Atoll
- Damage Assessments
- Easement Verification
- Volumetric Calculations

**Research**
- Assess Impacts of Dam Removal
- Hydrographic Survey
- Fire Science Research
- Monitor Forest & Rangeland Health
- **River Bank Erosion Studies**
- Geologic Resource Mapping
- Sensor & Imaging Processing
Observing Surface Coal Mining Activities

Drainage Control Structures

Highwall

Potential drainage problems

Large surface features

Excess Spoil Fills (aka Valley Fills)
UAS images can be used for channel change assessment

- Assess dimensions of channels and bars

Repeat data sets from UAS platforms

- Provide qualitative and quantitative data on channel dynamics
- Estimate incision or aggradation rates

Eliminates the need to physically perform transects

- Increased safety and precision of measurement
- Quick, safe assessment for decision making when dealing with bank erosion
Emergent Sandbar Habitats
Platte River, Nebraska

Mapping the spatial extent and elevation of emergent sandbars along two reaches of the Platte River for endangered or threatened nesting birds (least terns and piping plovers)
Elwha Dam Removal and River Restoration
Olympic National Park, Washington

Monitoring sediment volumes eroded from the reservoir and deposited downstream, where the mobile sediment can potentially affect salmon habitat and flood-stage elevation.
Monitoring erosion rates of the Missouri River over a 7 mile stretch near Lower Brule. Stretches of the river have seen high rate of bank loss of up to 8 feet per year.
Current Events
MEANWHILE, IN KENTUCKY
FACED WITH MOUNTING REDNECK SKEET SHOOTING, AMOUNT ZONE DEPLOYS NEW ARMED ESCORT DRONES
Questions?

DOI UAS Mission Hours by Fiscal Year

Kern NWR 2013