NOAA Unmanned Aircraft Systems (UAS) Program Activities

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Where? – Dangerous, Dull, Dirty and Denied (Arctic) Missions
Why? – Efficient, Effective, Economical, Environmentally Friendly
NOAA UAS Program Strategic Vision and Goals

• **Vision**
  – UAS will revolutionize NOAA observing strategies comparable to the introduction of satellite and radar assets decades earlier

• **Goals**
  – Goal 1: Increase UAS observing capacity
  – Goal 2: Develop high science-return UAS missions
    • *High impact weather monitoring,*
    • *Polar monitoring*
    • *Marine monitoring*
  – Goal 3: Transition cost-effective, operationally feasible UAS solutions into routine operations
Program Progress

Conducted UAS market survey and developed data base of UAS performance capabilities and costs

Developed UAS Analysis of Alternatives:
- High altitude long endurance – Global Hawk
- Medium altitude long endurance – Predator or Ikhana
- Low altitude long endurance – ScanEagle
- Low altitude short endurance – Puma or Vertical Take Off and Landing (VTOL)
- Air-Launched – Coyote, Cutlass, GALE, SBIR

Developed technology review process for funded projects

Supported operator training and initial concept of operations
Key Accomplishments

- Observations of oceanic weather systems in Atlantic, Arctic, and Pacific using NASA Global Hawk
- Development of Global Hawk dropsonde system with NSF
- Lower Mississippi River Forecast Center demonstration with Puma and Aircraft-launched UAS development through SBIR Phase I
- Development of Fire Weather UAS through NSF collaboration
- Development of EMILY unmanned surface marine vehicle
- Two peer-reviewed journal articles published in 2014
Overall Goal

• Demonstrate and test prototype UAS concept of operations that could be used to mitigate the risk of diminished high impact weather forecasts and warnings in the case of polar-orbiting satellite observing gaps

Objective 1

• Conduct data impact studies
  • Observing System Experiments (OSE) using data from UAS field missions
  • Observing System Simulation Experiments (OSSE) using simulated UAS data

Objective 2

• Evaluate cost and operational benefit through detailed analysis of life-cycle operational costs and constraints
Example of Weather Observations Being Collected During NASA Hurricane Severe Storm Sentinel (HS3) Experiment

**Environment Observations**
- Profiles of temperature, humidity, wind, and pressure
- Cloud top height
- Cloud top temperature and profiles of temperature and humidity

**Over-storm Observations**
- Doppler velocity, horizontal winds, and ocean surface winds
- Profiles of temperature and humidity and total precipitable water
- Ocean surface winds and rain
Polar Monitoring

Key Accomplishments

- Peer-reviewed journal article based on black carbon mission using Manta in Norway
- Deployment of three different UAS during Marginal Ice Zone Experiment in partnership with NASA
- Puma UAS deployed from US Coast Guard Healy Ice Cutter ship for marine awareness and oil spill detection
- Development of partnership with Conoco Philips for ScanEagle flights in the Arctic
ScanEagle Operational Assessments (2009-2014)

• (Goal) Fly a combination of different types of remote sensing instruments for atmospheric research, marginal ice zone, polar & marine monitoring

• (Outcomes) Operational Coordination and Operations
  - Maritime and Ice Seal Survey from MacArthur (2009)
  - Atmospheric Testing from NSWC Dahlgren (2012)
  - Atmospheric Research Deployment from R/V Revelle (2012)
  - Atmospheric Testing from NSWC Dahlgren (2013)
  - Atmospheric Research Deployment from R/V Knorr (2013)
  - Marginal Ice Zone Experiment (MIZOPEX) for Oliktock Pt (2013)
  - Data Management and Coordination with ERMA (2014)
  - Maritime survey Data Exchange with Conoco Philips (2013-2014)
  - Government and Industry Platform Updates and Coordination (2014)
Marine Monitoring

Key Accomplishments

- Acquisition and deployment of two Puma UAS
- Two years of Puma missions in partnership with National Marine Sanctuaries Program
- Development of Puma Transition Plan in collaboration with OMAO and NOS
- Demonstration of NASA Ikhana and observing capabilities for long distance monitoring of Hawaiian marine monument
- Development of medium altitude UAS observing capabilities for gravity measurements and coastal mapping through SBIR Phase II study
Hawaii Activities

Papahanaumokuakea Marine National Monument

362,073 square kilometers of the Pacific Ocean

NOAA PUMA

NASA IKHANA
Marine Resource Monitoring
Issues & Barriers to Success

- Unmanned Systems have been “Wildly successful!”
- Plenty of issues but, “We have chosen to admire the problem.”
- Issues & Barriers to Success
  - Privacy
  - FAA Regulations & Access – Airspace, Airworthiness, Quals
  - Program Management
    - Engineering, Logistics, T&E, Operations, Contracting…
    - Cost, Schedule, Performance, Risk, Requirement Traceability, Commonality
  - Administrative hurdles to cooperation & asset pooling
    - MOUs & IAAs
    - Buying data or capability (assets, personnel, infrastructure)?
    - Understanding utilization rates and metrics
      - S&T… R&D… “Three months of install and ground test for 1 Flt-Hr
      - Flt Hours vs On-station Hours vs Sensor Hours vs Data Hours vs Used DH
Success!!!

- R&D to Operations
  - Optimized existing infrastructure
  - Airspace Access
    - Dangerous, Dirty, Dull, Denied
    - Efficient, Effective, Economical and Environmentally Friendly
  - Common and Pooled Assets & Operators
    - Logistic, Configuration Management, Training
    - Data Standardization, Quality, Storage and Cataloging
- Affordable & Environmentally Friendly
  - Autonomous
    - Multiple platforms controlled by single operator
  - Uses 10% of the fuel or “new fuels” or “no fuel”
Contact Information

UAS Web Site: http://uas.noaa.gov/

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