Operation Deep Freeze 2016

- NOAA and USCG
- Annual resupply mission to US National Science Foundation’s McMurdo base in Antarctica
- Coordination between National Science Foundation, Department of Defense and US Coast Guard
- Physical and environmental challenges:
- Interesting/impressive statistics:
- Administrative and regulatory challenges: number of organizations involved in planning, review and execution of UAS operations
Background: Arctic Support 2013 - 2015
Arctic Shield 2015 Milestones

- Autonomous net recovery on helicopter deck
- BVLOS (5nm) operations by exercising “Due Regard”
- Real-time operations coordinated with two manned helicopters
- Long range communications for C2
- Ice-sensing and de-icing system
- Real-time data transmission to the Internet
- Success led to AV and NOAA supporting ODF-16 to Antarctica
Puma “Due Regard” Ops & Recovery Testing

Due Regard Operations

Deck Landing  Water and Ice Landings  Net Capture System
ISR Missions, Including Oil Spill & SAR

- Sea ice ridge detection/monitoring
- Usefulness in search and rescue scenarios
- Detection and monitoring of oil spilled from ship
- Detection and monitoring of marine debris from ship
November 2015: Long Range Telemetry & Autonomous net capture testing

Testing aboard NOAA R/V Shearwater in the Santa Barbara Channel:

- Sea state 3
- 90+% Success Rate
- All Puma captures ended up in boat without significant damage to airframe or wings.
- This evolved from AS15 and set the stage for ODF-16.
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- Annual resupply mission to US NSF McMurdo base
- Coordination: NSF, DoD, USCG
- Physical and environmental challenges
- Administrative and regulatory challenges
Deep Freeze Mission Objectives

- Forward scouting for icebreaking
- Collect ice data (images) to validate satellite-based forecasts
- Continue development of shipboard TTPs for small UAS operations in Antarctic and Arctic environments
- Demonstrate effective deployment of small UAS in extreme maritime operations
- Test new Puma UAS i45 camera payload and autonomous net capture system
Deep Freeze Operational Challenges

- Regulatory and administrative
- Environmental
- Ship Design
- Communications
Deep Freeze Operations
Deep Freeze Achievements

• 20 flights, including 46 kilometer flight (BVLOS)
  – “12” hours of video
  – i45 high resolution nadir images

• Autonomous shipboard landings

• Concepts of operation developed and tested

• Performed missions in conditions in which helicopters could not operate
Key Requirements for Future Small UAS Operations

• General maritime operations
  – Pre-programmed operations with autonomous capabilities for data gathering and recovery
  – High wind capability (greater than 25 kts)
  – Safety and reliability
  – Range (BVLOS to 40+ kilometers)
  – Nadir mapping capability
  – Mode C or ADS-B transponder

• Polar maritime operations – most extreme conditions
  – Ice sensing and/or de-icing capability
  – Produce images and data of sufficient quality to support mapping
The Future of Maritime Small UAS in Polar Environments

- Routine BVLOS operations
- Improved safety
- Lower cost and lower risk solution than manned aircraft
- Regular, coordinated flight operations integrated with other air traffic
- Complemented by improved bandwidth & ability to transmit real-time data to decision makers