Real-time autonomous monitoring using unmanned aircraft systems (UAS)

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Drone Research Themes

- Platforms, navigation and control, autonomy, weatherization, safe operations, airworthiness, seaworthiness.
- Sensor systems, algorithm development, real-time data distribution, analytics.
- Middleware for payload control, control of communication, indexing and dissemination of data.
Flying Drone Platforms

**CW Roamer (Pneumatic catapult) x 5**
- MTOW: 35kg (10 kg payload)
- Wingspan: 3.8 meter
- 62 cc 2-stroke gas
- Cruise speed: 27 m/s
- Micropilot autopilot
- Iridium, 433Mhz, 5.8GHz and 4G
- 5 hours

**CW Explorer (Catapult) x 2**
- MTOW: 65kg (20 kg payload)
- Wingspan: 5.2 meter
- 110 cc 2-stroke gas
- Cruise speed: 30 m/s
- Piccolo autopilot

**CW Scout (Bungee catapult) x 3**
- MTOW: 11kg (2 kg payload)
- Wingspan: 3 meter
- Twin electric (56 Ah Li-ion, 4S)
- Cruise speed: 22 m/s
- Pixhawk, 433Mhz, 5.8GHz and 4G
- 3 hours

**CryoCopter x 2**
- 2.5 kg payload in 15 minutes
- Pixhawk, 433Mhz, 5.8GHz, 4G

**CW Scout (Bungee catapult) x 3**
- MTOW: 11kg (2 kg payload)
- Wingspan: 3 meter
- Twin electric (56 Ah Li-ion, 4S)
- Cruise speed: 22 m/s
- Pixhawk, 433Mhz, 5.8GHz and 4G
- 3 hours
Surface Drone Platforms
Operational support systems for autonomous systems

Built on challenges facing UAS operations in remote and harsh environments (Arctic, Antarctic, Greenland, North Sea, …)

• Unstable and intermittent communication systems
• Limited bandwidth/data reduction
• Distribution of data to stakeholders in real-time
• Temporal and spatial data prioritization
• Need for interaction with end users
Is the future intelligent self optimizing autonomous forecasting, monitoring and surveillance systems?
If so, we need a real-time feedback system.
Communication needs and challenges
Critical System Software and Hardware components

Middleware - Cryocore
• Controls all onboard processes and hardware through services.
• Communication
• Sensors

ChainDB
• Stores data and provide data to Nlive
• Stores sensor configurations

Cryocase
• Ground station communication and metadata

Nlive and Enlighten-web
• Ground control station, planning, analytics and collaborative tools
EasyIce Realtime Onboard Processing

Ice sheet area distribution

- Ice coverage = 3.9%
- Max size in view = 456.4 sqm
Drone System Software
Onboard processing and Chain database

- All data processed onboard and indexed in local database
- Optimized to work over “fragile” communication links
- Data is synchronized with priority
  - User requests (Areas, objects), metadata, images
  - Works with video (Nlive demo)
  - Within frame synchronization between all users
Summary

A system of model driven autonomous platforms capable of collecting, analyze and distribute data in near real time, allow for optimizing cost benefit of the system

To enable such a system one depends an adapted middleware that ensure real-time flow of critical data for system decision making.

Powerful onboard computing capability crucial to reducing bandwidth requierments

Allow for efficient distribution and interaction with stakeholders increase learning