UAS on the Leading Edge of Technology

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MSGIC
Maryland State Geographic Information Committee

Let's talk…

- Technology vs requirements
- Platforms & ground control stations
- Sensors
- Communications
- Data processing
- Continuum of Capability – Unmanned to AI
- Q & A


model
data
grants
privacy
spin-off
state
fly
spectrum
autonomy
enforcement
academia
MTech
UA
ground
GIS
UAS
toy
farm
build
IR
Ninja
pilot
optics
dirty
dull
design
333
visual
research
policy
law
government
FAA
dangerous
local
Crisfield
observers
industry
infrastructure
partners
station1stresponders
aircraft
history
cybersecurity
medical
airport
Marylandcontrol
future
unmanned
federal
StMary's
hobby
DHS
sensors
hangar
Gamera


10 foot wing span Talon 120 LE in action


Rescue Stick
Demo of life jacket drop system in action


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UAS TEST SITE

Who We Are

Research and operations group at the forefront of UAS rulemaking, commercialization, and national airspace integration.

Some of our research partners in government, academia, & industry

What *can* UAS do for public use cases?

- Speed
- Cost
- Convenience
- Safety
- Accuracy

What is it ***really*** all about?

Requirements-based UAS R&D and operations

- What Do Industry/Government/Academia **need** to implement effective use cases?
- What Does the UAS User **need** to Enable Safe and Cost-Effective Applications?
- What Does FAA **need** to Support Integration Rulemaking?
- **Solve** the challenges
- **Get** and **focus** the resources
- ***Fly!***

System Design & Integration

- System-of-systems
- Payload integration
- Airspace Integration
- Pathway to data collection

System Design & Integration: Case Studies

Payload integration
NASA GOES-R

Unique payload integration
UMMC/UMB/UMD

Mesh network radios integration
Navmar Applied Sciences Corp.

Systems - platforms





- COTS sUAS – DJI, Yuneec, etc.
  - Inspire, Mavic Pro, Phantom 4, Matrice 210/600, Typhoon H, H520
  - Pros – Cost ($1K-$3K…and up…), ease of use, sensors
  - Cons – Offshore sourcing, geo fence, varying degrees of flexibility

- Custom and more flexible sUAS – BFD, Latitude/L3, etc.
  - Capability vs. Cost

- Larger UAS – AeroVironment, Navmar, Insitu
  - Capability vs. Cost, Training, **Regulations**

Systems – controllers, displays

- All UAS come with integrated controller /display – “good”
- Supplied transmitters have limited feed connectivity
  - Need to share picture to command centers, other resources, etc.

- Older systems to do this elegantly >$10K
  - New lower cost, capable systems emerging
    - **Alaris VCC**

Systems – sensors

- Cameras – EO
- Infrared (IR)
- LiDAR
- Buyer/user beware – *training required*

i.e. LiDAR



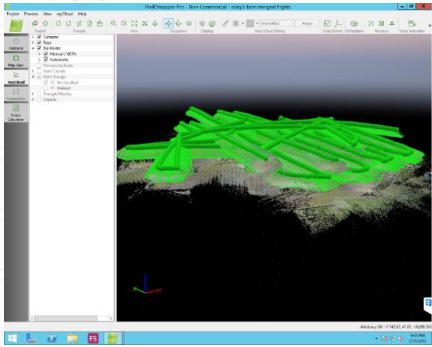

	Fixed-Wing	Helicopter	Mobile	Terrestrial Leica C10, P20 & P40
LiDAR Sensors	1	1	2	C10 = 1 P20 = 3 P40 = 1
Cameras	Digital Imagery & Video	Digital Imagery & Video	Digital Imagery & Video	Digital Imagery for RGB Point Colorization
Laser Classification	3R (IEC 60825-1)	3R (IEC 60825-1)	IEC/CDRH Class 1	C10 = 3R (IEC 60825-1) P20 = 2 (IEC 60825-1) P40 = 1 (IEC 60825)
Scanner Field of View	45° – 60°	45° – 60°	360° (horiz)	360° (horiz)
System Range	5780'	5780'	5' to 600' Radius	C10 = 975' radius P20 = 400' radius P40 = 900'+ radius
Laser Measurement Rate	400K points per second	400K points per second	Up to 1M points per second	C10 = 50K points per second P20/40 = Up to 1M points per second
Relative Accuracy of Laser	0.065'	0.065'	0.023'	0.01'
Absolute Accuracy	Project Driven - 0.25 to 1' - GPS Quality - Post-processing Techniques - Project Targeting	Project Driven - 0.1 to 0.5' - GPS Quality - Post-processing Techniques - Project Targeting	Project Driven - 0.06' at <50' to sensor - GPS Quality - Post-processing Techniques - Project Targeting	Project Driven - Primary Control - Post-processing Techniques - Project Targeting
Point Density	Up to 15 points per meter.	Up to 70 points per meter, depending on project needs.	Up to 3,000 points per meter, depending on project needs.	Completely user defined, based on project needs.

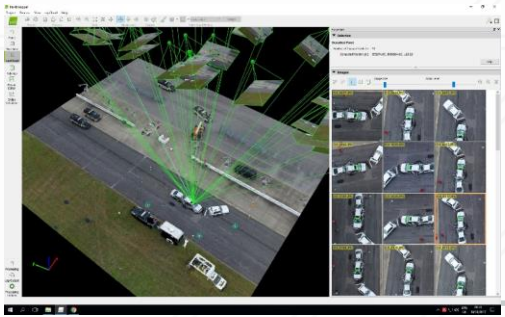
Systems – communications

- Command and control (C2) and data
- GPS dependent
  - RTK systems (DJI Matrice series)
- Radio frequency (RF) is the standard now
  - Radio line-of-sight
  - Spectrum challenges (power, frequency, etc.)
- Future
  - Mesh network radios
  - Laser directional communications – low probability of intercept/detection, power
  - 4G / 5G cell networks
  - Satellite
  - Flow navigation
- ***Cybersecurity***

Systems – data processing

- **Drone deploy** – simplistic, cheap, easy to use, limited 3D mapping
- A gap – stitching for incident reconstruction
  - **Pix4D** - very capable, $$$, difficult to use/learning curve
- Need to be able to see what you have before you leave the area, pre-analysis of pictures





- Onboard processing / algorithms
  - Future work, huge gains to be made
- Imagery/data gathering
  - Need to have a digital multimedia plan
  - Handling, storage, control

Continuum of capability

- Unmanned - automated - autonomy - AI
- Truly realize benefits of unmanned systems
- Based on training, understanding of requirements – and ***trust***

For public use - emerging trends

- Tethered units
  - Power and data = endurance
  - Still an aircraft
  - Cost
- BVLOS / Flight over Humans
- Larger than small UAS
- Improved sensors
- Improved post-flight processing
- Your imagination…

…but there are limits…

- Training
- Cost versus revenue
- Accuracy versus expectation

Is it the right tool for your job?

What are you an expert at?

Who do you partner with?

takeaways

- Requirement-based R&D
- Strengthening relationships
- Exercising leadership roles

Questions?

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FEARLESS FLIGHT

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