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CNS Solutions for Low-Altitude Airspace

2023 ICAO DRONE ENABLE SYMPOSIUM

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A Proven Pathway to BVLOS: FAA Exemption / NTAP

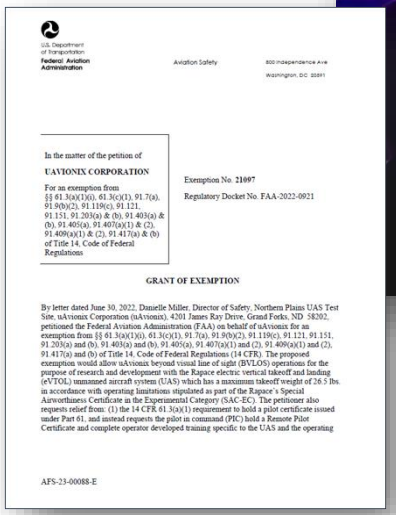
> FAA has approved BVLOS exemption with the VANTIS Network

- Lead site designation for the Near-Term Approvals Process (NTAP)
- Approved third-party service provider for UTM in low-risk areas

• Why is this exemption different?

COMMON-USE INFRASTRUCTURE & SERVICES	FOUNDATIONAL BUILDING BLOCKS, TAILORED TO CONOPS
Operators can incorporate VANTIS services into its ConOps to **FAST-TRACK BVLOS** operations.	FAA acknowledges that VANTIS can be **REPLICATED ELSEWHERE** to streamline approvals.

Jeffrey Vincent, Executive Director, FAA UASIO, Announces NTAP approval for VANTIS



In the matter of the petition of
UAVIONIX CORPORATION
For an exemption from §§ 61.3(a)(1)(i), 61.3(c)(1), 91.7(a), 91.9(b)(2), 91.119(c), 91.121, 91.151, 91.203(a) & (b), 91.403(a) & (b), 91.405(a), 91.407(a)(1) & (2), 91.409(a)(1) & (2), 91.417(a) & (b) of Title 14, Code of Federal Regulations

Exemption No. 21097
Regulatory Docket No. FAA-2022-0921

GRANT OF EXEMPTION

By letter dated June 30, 2022, Danielle Miller, Director of Safety, Northern Plains UAS Test Site, uAvionix Corporation (uAvionix), 4201 James Ray Drive, Grand Forks, ND 58202, petitioned the Federal Aviation Administration (FAA) on behalf of uAvionix for an exemption from §§ 61.3(a)(1)(i), 61.3(c)(1), 91.7(a), 91.9(b)(2), 91.119(c), 91.121, 91.151, 91.203(a) and (b), 91.403(a) and (b), 91.405(a), 91.407(a)(1) and (2), 91.409(a)(1) and (2), 91.417(a) and (b) of Title 14, Code of Federal Regulations (14 CFR). The proposed exemption would allow uAvionix beyond visual line of sight (BVLOS) operations for the purpose of research and development with the Rapace electric vertical takeoff and landing (eVTOL) unmanned aircraft system (UAS) which has a maximum takeoff weight of 26.5 lbs. in accordance with operating limitations stipulated as part of the Rapace's Special Airworthiness Certificate in the Experimental Category (SAC-EC). The petitioner also requests relief from: (1) the 14 CFR 61.3(a)(1) requirement to hold a pilot certificate issued under Part 61, and instead requests the pilot in command (PIC) hold a Remote Pilot Certificate and complete operator developed training specific to the UAS and the operating

AFS-23-00088-E

FAA Grant of Exemption

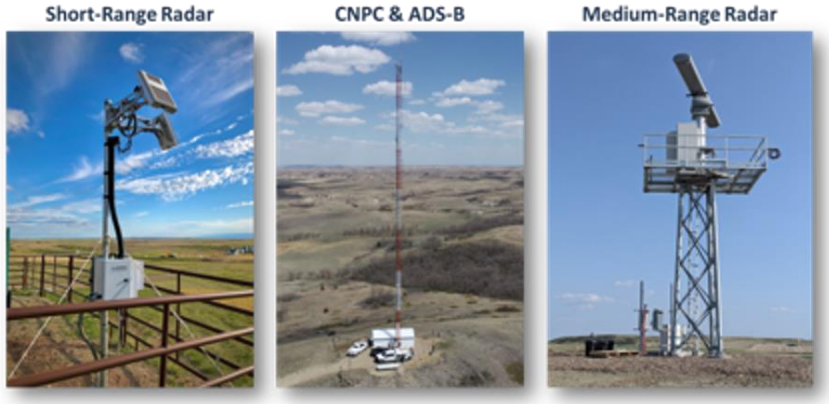
Vantis: CNS Infrastructure & Services to Align to the FAA Safety Process

> North Dakota's BVLOS program

> A systems integrator approach

> Comprised of both CNS infrastructure & secure, cloud-native managed services

- surveillance sensors to detect cooperative and non-cooperative manned targets (i.e., Ground-based surveillance (GS))
- radios to provision command and control (C2) links (i.e., Air-to-Ground Communications (AGC))
- a backhaul data network (to enable scalability)
- a Mission and Network Operations Center (MNOC).
- Monitoring and control service (MCS) monitors the health status system and all managed services



WHAT WE'VE LEARNED

A systems integrator approach to CNS infrastructure and airspace services unlocks BVLOS in a scalable way.

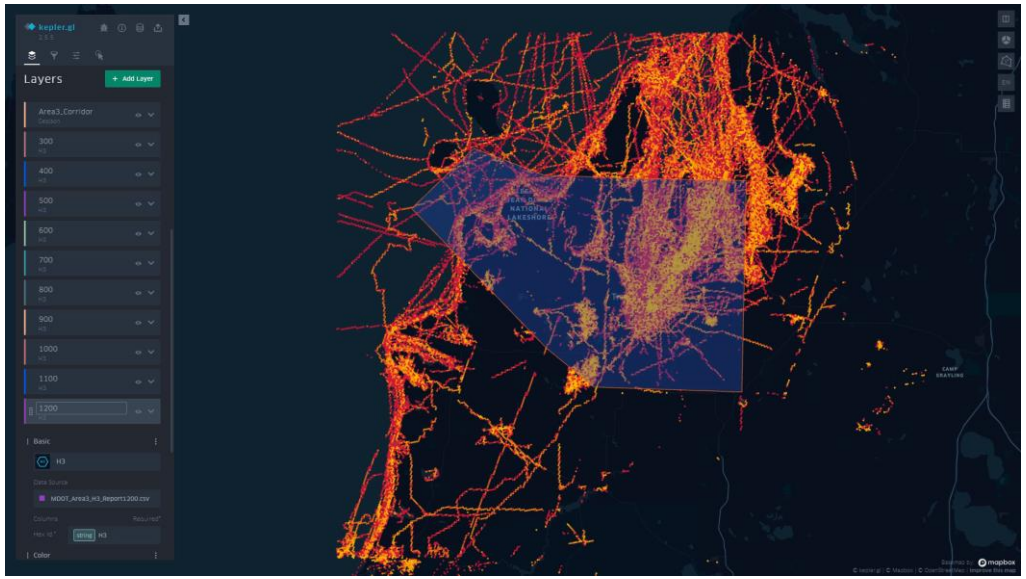
There is no one-size-fits-all solution for operations in urban and/or low-level airspace.

> Other CNS technologies may include:

- radar, ADS-B, optical sensors, and when mature, 5G/LTE technologies to support the integration of dynamic communication mesh networks.
- On-board Remote ID (RID) capabilities for UAS < 25 kg is another technology that should be considered.

> Data generated by CNS systems enables other airspace management tools that are required for UAS integration in urban environments.

- For example, advanced services required for scaling AAM include air and ground risk modeling and monitoring, feasibility studies, corridor planning, vertiport siting, management of weather disruptions, and more.



Mitigation measures: Active monitoring of CNS infrastructure

1

BLEND OF TECHNOLOGIES

- A blend of technologies (i.e., surveillance, communications, GPS, telemetry, etc.) to track UAS positions and navigation routing.

2

HEALTH & STATUS MONITORING

- A second mitigation requirement for CNS monitors the health and status of the CNS infrastructure for baseline performance.

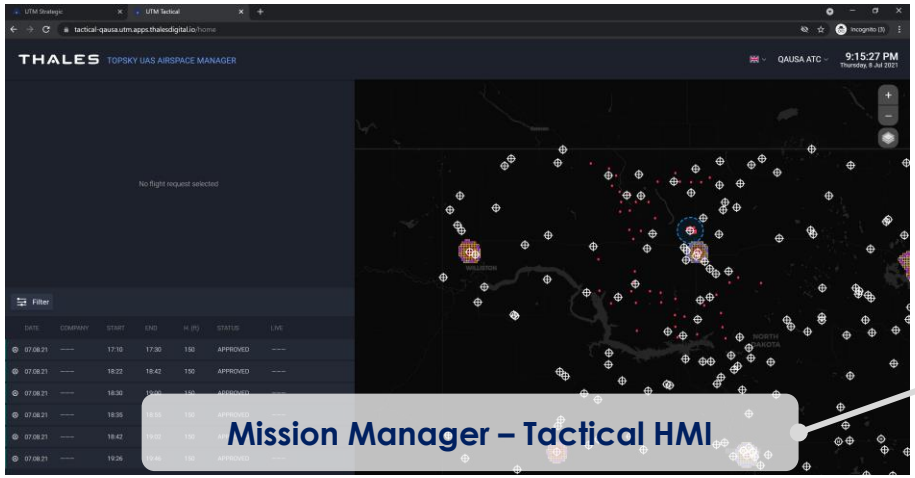
3

LOSS LINK PROCEDURE

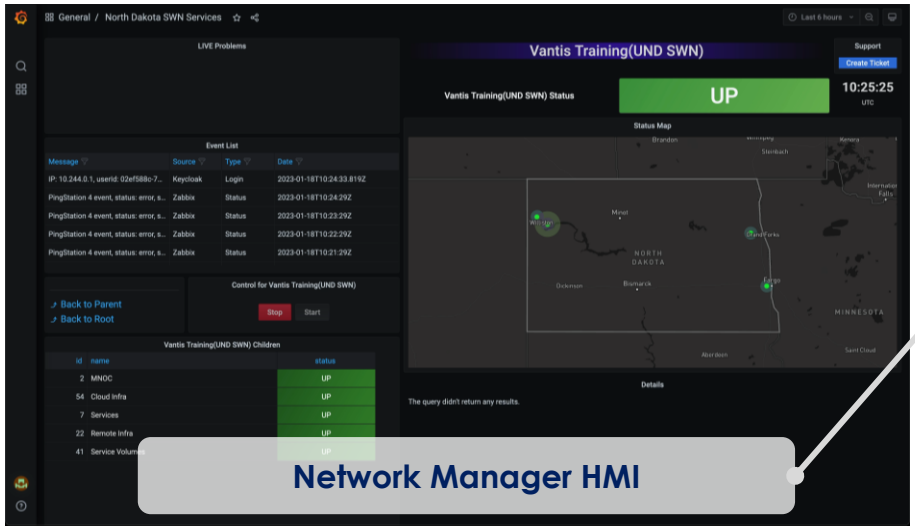
- A loss link procedure on the UAS is understood and communicated to impacted stakeholders.
- For example, notifying air traffic, military, local law enforcement, and other safety and/or airspace stakeholders of the event.

Reinforced by cyber-security standards (i.e., NIST compliance) & the International Aviation Trust Framework to ensure resilient and secured ground-ground, air-ground, and air-air exchange of digital information among stakeholders.

Mission & Network Operations Center (MNOC) & Interfaces



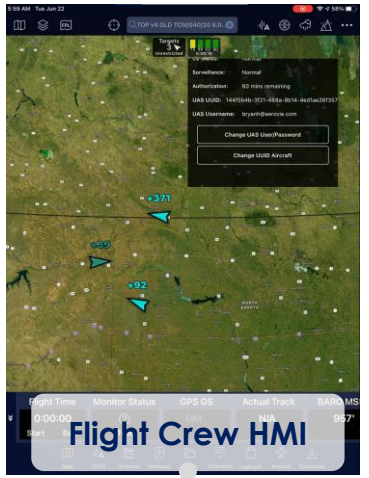
Mission Manager – Tactical HMI



Network Manager HMI

MNOC at Grand Forks, ND

- Additional interfaces:
  - Mission Planner / Ground Control System
  - Remote Pilot Display
  - Emergency Chat Function



Flight Crew HMI

RPIC & EO in the field

Limited spectrum availability

- Today: Unlicensed, unprotected, ISM spectrum band to support broader A/G communications for commercial UAS use cases is shared with everyday IoT devices
- Industry & regulations must mature towards licensed spectrum for comms to support the riskier / more complex operations, incl. BVLOS and flights in controlled airspace.
- Objective: leverage protocols that can minimize the message size / overhead per packet while meeting performance requirements.
- Example: Vantis AGC services are protocol-agnostic. UAS operators can leverage a secure traffic & surveillance service via open APIs to satisfy e-conspicuity functions. This service serves as the means to collect RID information from *any* RID source (e.g., UA/module, USS, network) & distribute fused air situational picture to authorized users.

Concluding thoughts

- The industry has made considerable progress in **leveraging existing** commercial ATM and UTM systems and software capabilities **as well as emerging technologies** to **safely integrate** UAS at low altitudes.
- North Dakota's Vantis BVLOS Network provides **shared-use CNS and digital infrastructure** to support safe BVLOS operations for **public and commercial UAS operators**. Lessons learned will inform Vantis' anticipated expansion to more complex operating environments, including urban airspace.
- More work is needed to address **ATM-UTM integration architectures**, which must consider **conditions unique to UAS**, such as many-to-one command-and-control; geographically limited coverage / service volumes; high cost to deploy "custom" UTM systems; **delegated authority** among new and diverse stakeholders; human-in-the-loop traffic management; and **global alignment** of CONOPS for advanced operations.

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Thank you

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