# NEXTGEN Incident Response Communication System

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HUMBER POLYTECHNIC | B²C Lab

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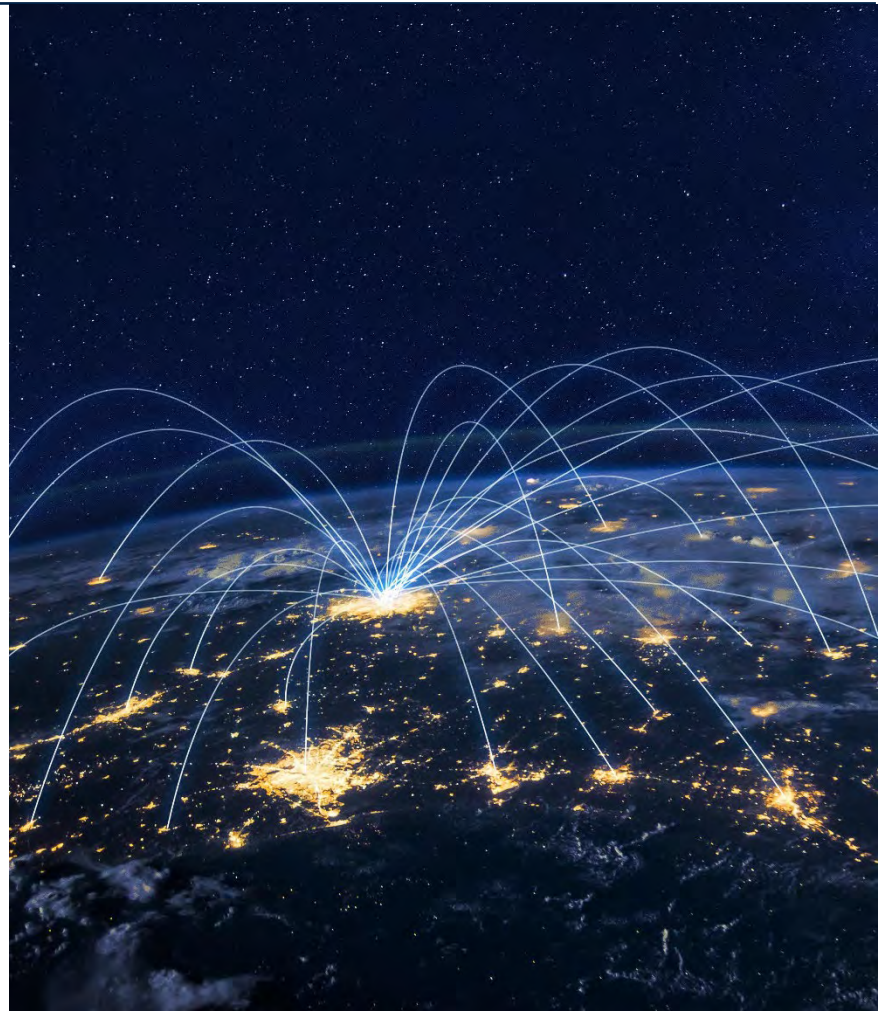

# Acknowledgements


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- Mark Corl, Triveni Digital
- Jim Stenberg, Over the Air RF Consulting, LLC
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- Chris Pandich, PBS North Carolina

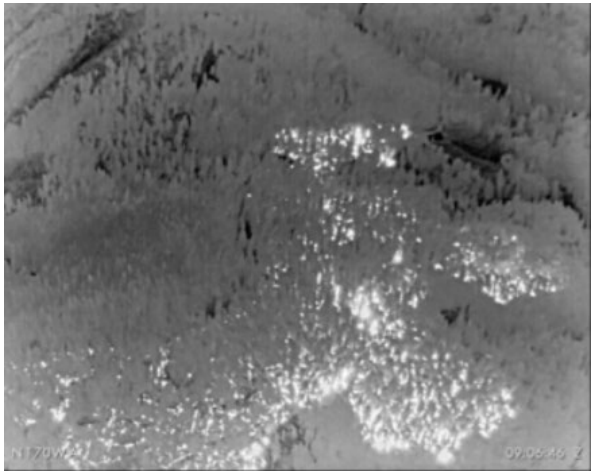
# Project Background

- Six-month NASA Small Business Innovation Research project
- Target NASA program: Advanced Capabilities for Emergency Response Operations (ACERO)
  - ACERO explores the use of uncrewed aircraft systems (UASs) and other advanced aviation technologies to improve wildland fire operations

https://www.nasa.gov/directorates/armd/aosp/acero-wildfire/

# Project Background Cont.

- UAS are increasingly being used in wildland firefighting
  - Real-time intelligence gathering, photography, video, thermal mapping, and aerial ignition



Thermal Mapping

UAS Aerial Ignition Mission

# Project Background Cont.

- Problem: **Applications of UAS in firefighting efforts are limited due to poor situational awareness**

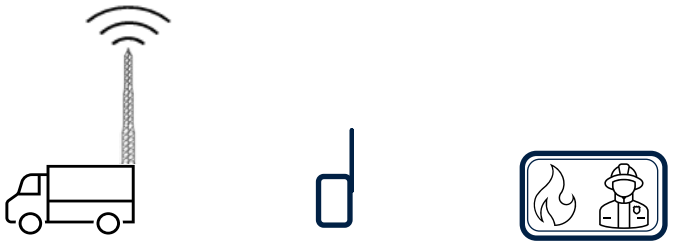
- Crewed firefighting aircraft do not know active UAS locations
  - Causes aircraft to be separated in time or space
    - Time: UASs fly at night; Crewed aircraft fly in the day
    - Space: UASs fly in areas away from the fight
  - Limits UAS firefighting efficacy


Canadair CL-415 Super Scooper

# Proposed Innovation

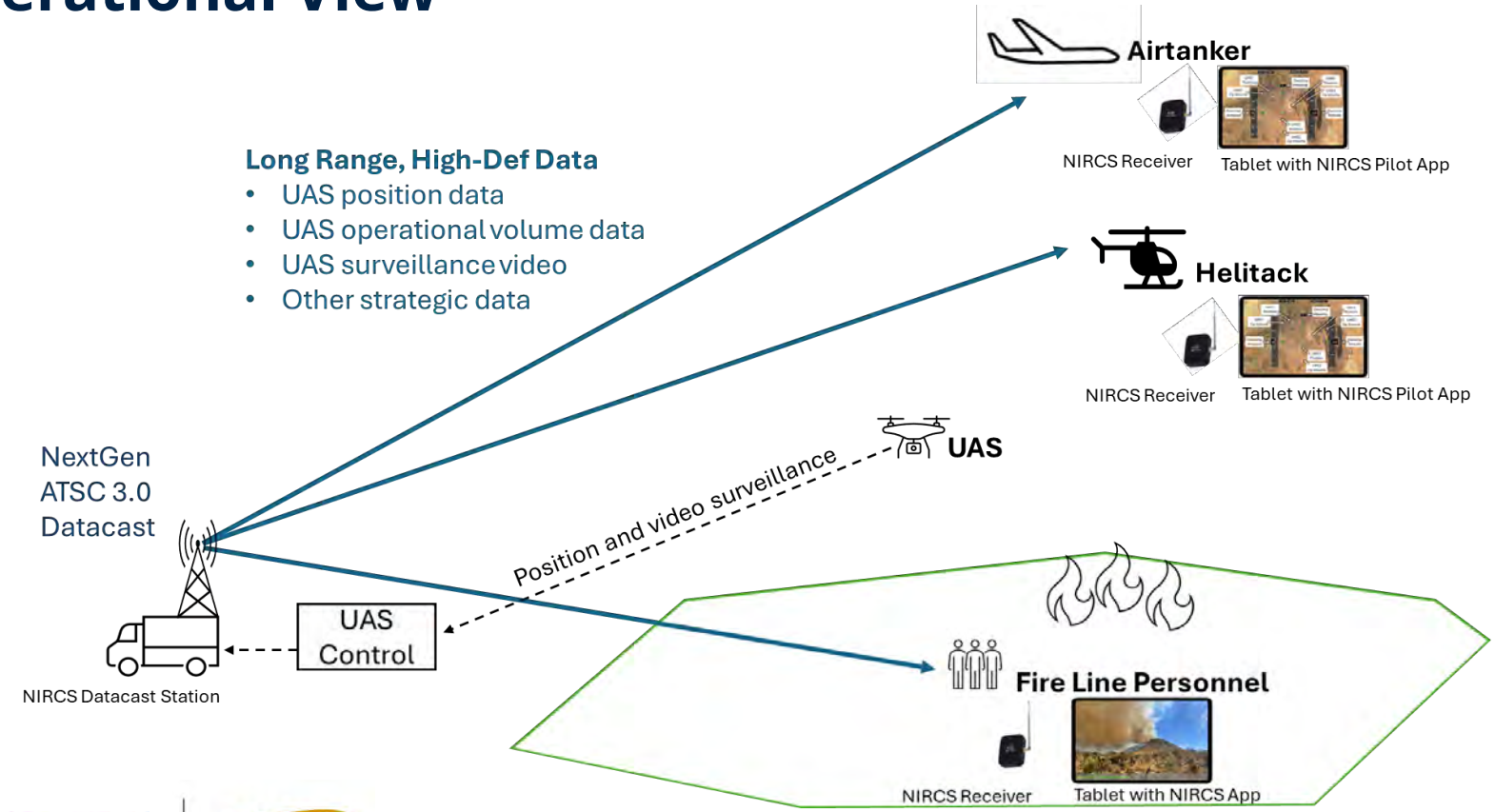
## NIRCS: NEXTGEN Incident Response Communication System

- An “on the go” ATSC 3.0 broadcast station ready to support emergencies on demand
- Supports critical information flow during wildland firefighting operations or other incidents
- NIRCS enables one-way communication of essential operational data:
  - Aircraft position and operational volume data
  - Temporary flight restrictions (TFRs)
  - Notices to Airmen (NOTAMs)
  - Airspace procedures, structure, and adaptation
  - Weather information
  - UAS and other surveillance video
  - High-fidelity audio and ultra-high-definition video




NIRCS entails three innovations.

# Operational View



# NIRCS Datacast Station

- “On the go” broadcast station: Essentially a portable digital TV station
- Includes a mix of advanced ATSC 3.0 software and hardware
- Two primary components: media studio and transmitter
  - Media studio ingests multiple streams of multimedia content (e.g., UHD video, HD video, and non-video data) and prepares it for ATSC 3.0 broadcast by transforming it into IP packets
  - Transmitter converts the IP content into a UHF waveform and broadcasts it from a transmit antenna
- Power and cooling are significant design factors


NIRCS Datacast Station

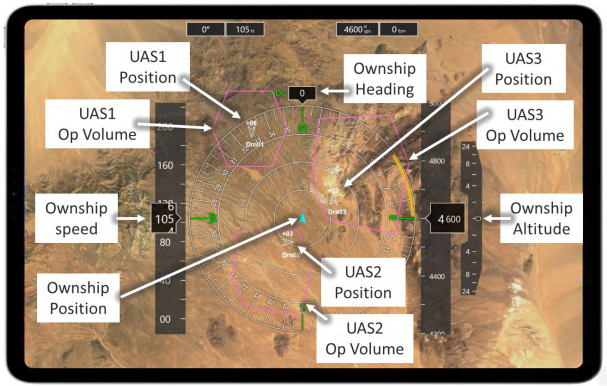
# NIRCS Receiver

- Small, low-mass, portable, self-powered receiver capable of receiving the ATSC 3.0 NextGen datacast emitted by the NIRCS datacast station
- User mobile devices (e.g., iPads) connect to the receiver via a wireless connection
- Receiver relays ATSC 3.0 data to the connected devices via the local Wi-Fi network

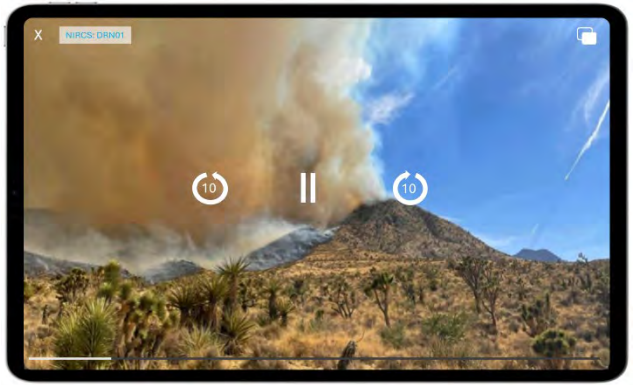
Example ATSC 1.0 Receiver

# End User App

- Conveys datacast content to the user
- Name is intentionally generic as NIRCS receiver APIs support interoperability with all major operating systems: iOS, Android, Windows, and Linux




NIRCS Pilot App



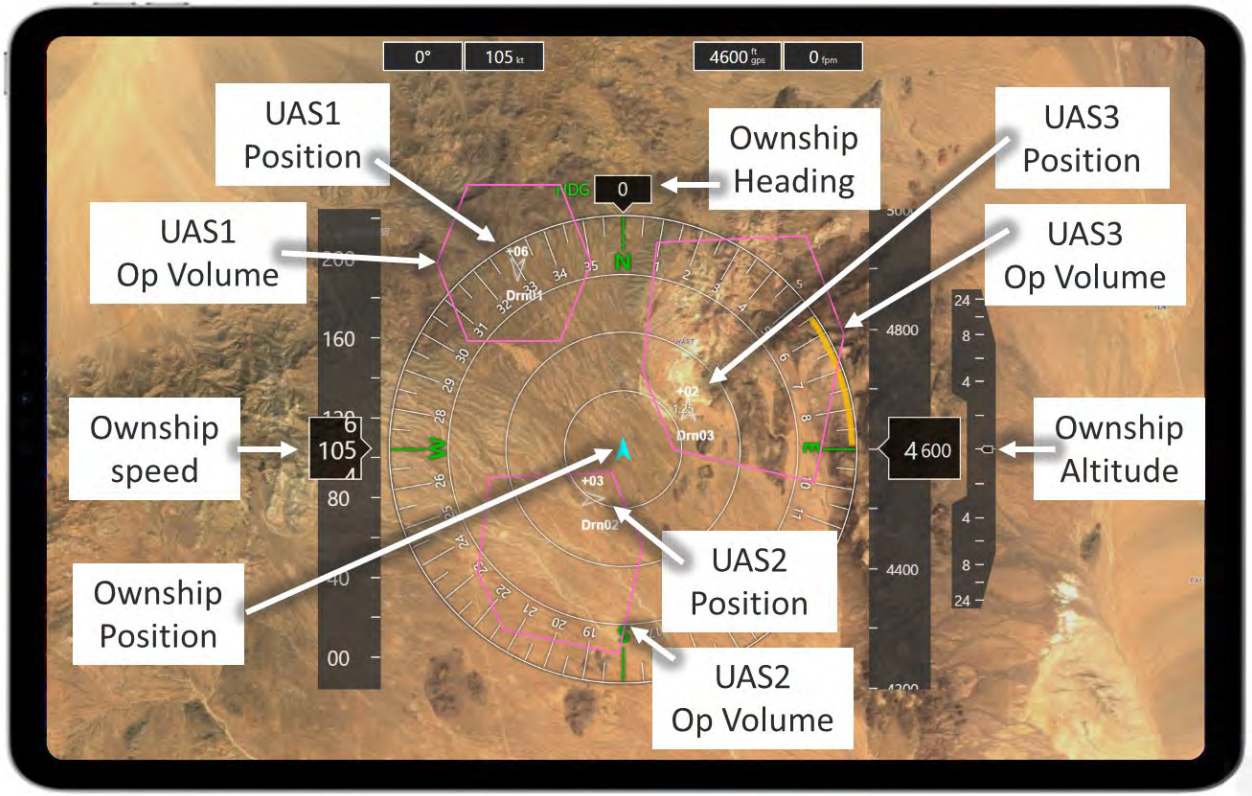
NIRCS Media Viewer App

ForeFlight App

# Cockpit Configuration

- The pilot mounts the NIRCS receiver to the interior cockpit windshield in an unobtrusive space.
- The tablet computer connects to receiver to ingest ATSC 3.0 datacast content.

# NIRCS Pilot App




NIRCS Pilot APP conveys:

- Ownship speed, heading, altitude, and altitude rate
- Ownship position
- Relative UAS position
- Relative UAS operational volume
- Guidance for avoiding other aircraft

Uses NASA software: https://nasa.github.io/daidalus/

# NIRCS Media Viewer App


- A stream of high-fidelity sUAS surveillance video or other critical public safety video

# NIRCS-ForeFlight Integration


- ForeFlight is the industry leading flight tracking software app
- Met with over 30 wildfire UAS SMEs across government and industry
  - Feedback influenced resulting designs and Phase II plans
  - U.S. National Interagency Fire Center endorsed proposal
- Mosaic established relationship with ForeFlight tech leads

# ATSC 3.0 Considerations

- Aircraft speed and receptibility/decoding of signal
  - Existing ETRI research is promising
    - https://www.atsc.org/wp-content/uploads/2025/01/6.-ATSC-3.0-Direct-to-Vehicle-D2V-Field-Evaluation-Results.pdf
- Available channel capacity
  - “White Space use?”
  - Utilize existing ATSC 3.0 transmission facilities?
- Beam tilt – need to get energy into the air
- Regulatory considerations

# Conclusion

Natural disasters are causing increased fatalities, infrastructure damage, and recovery costs. ATSC 3.0 broadcast technology has been proven to provide wide area and robust data delivery to address these needs. Questions need to be answered regarding RF propagation patterns, high-speed mobile reception quality, and FCC authorization, the initial work of Mosaic ATM and its technology partners, Device Solutions Inc, Triveni Digital, and other consultants shows NIRCS is a worthy effort to continue to explore and fund.

# Questions

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