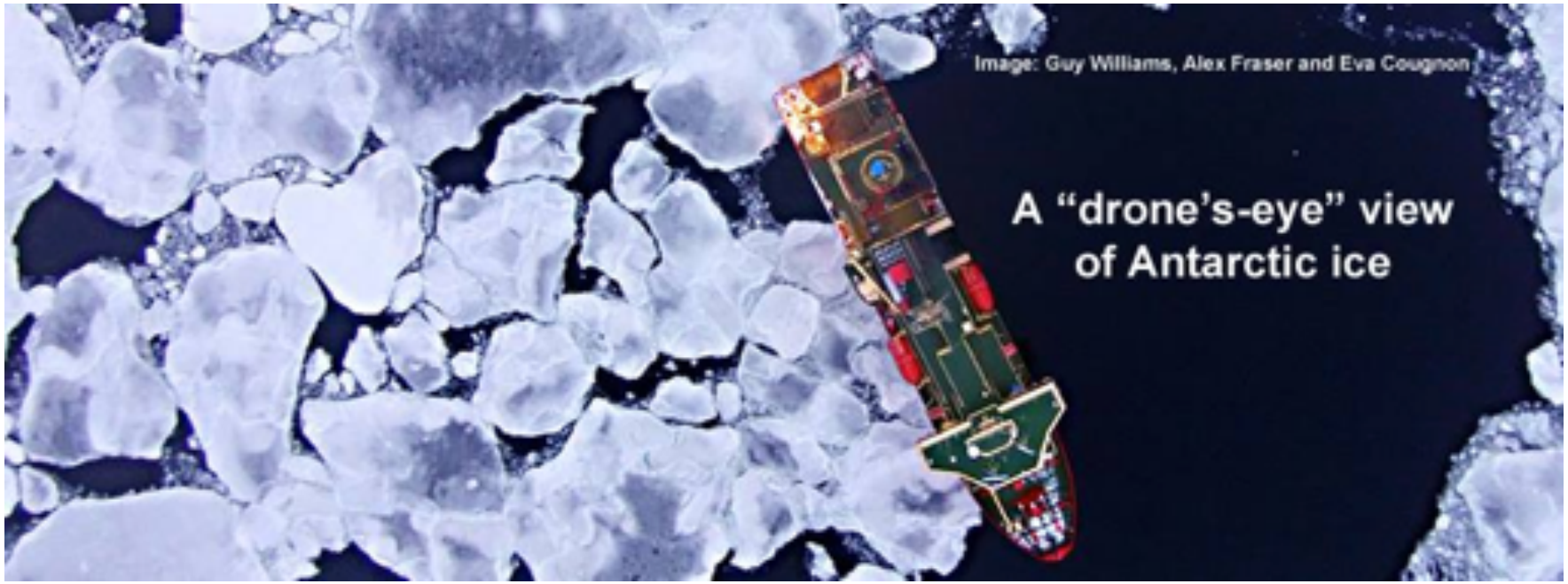
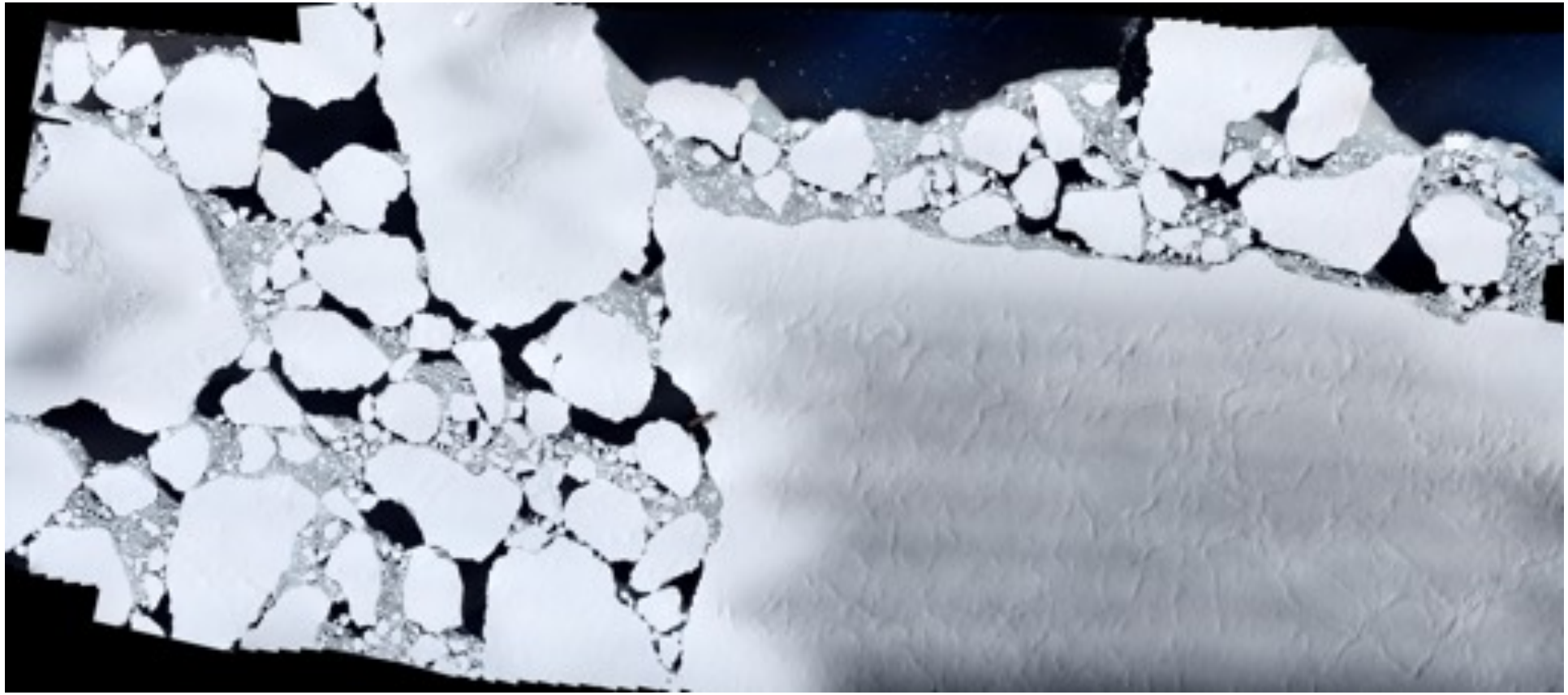
SCOAR 2019

Hanumant Singh

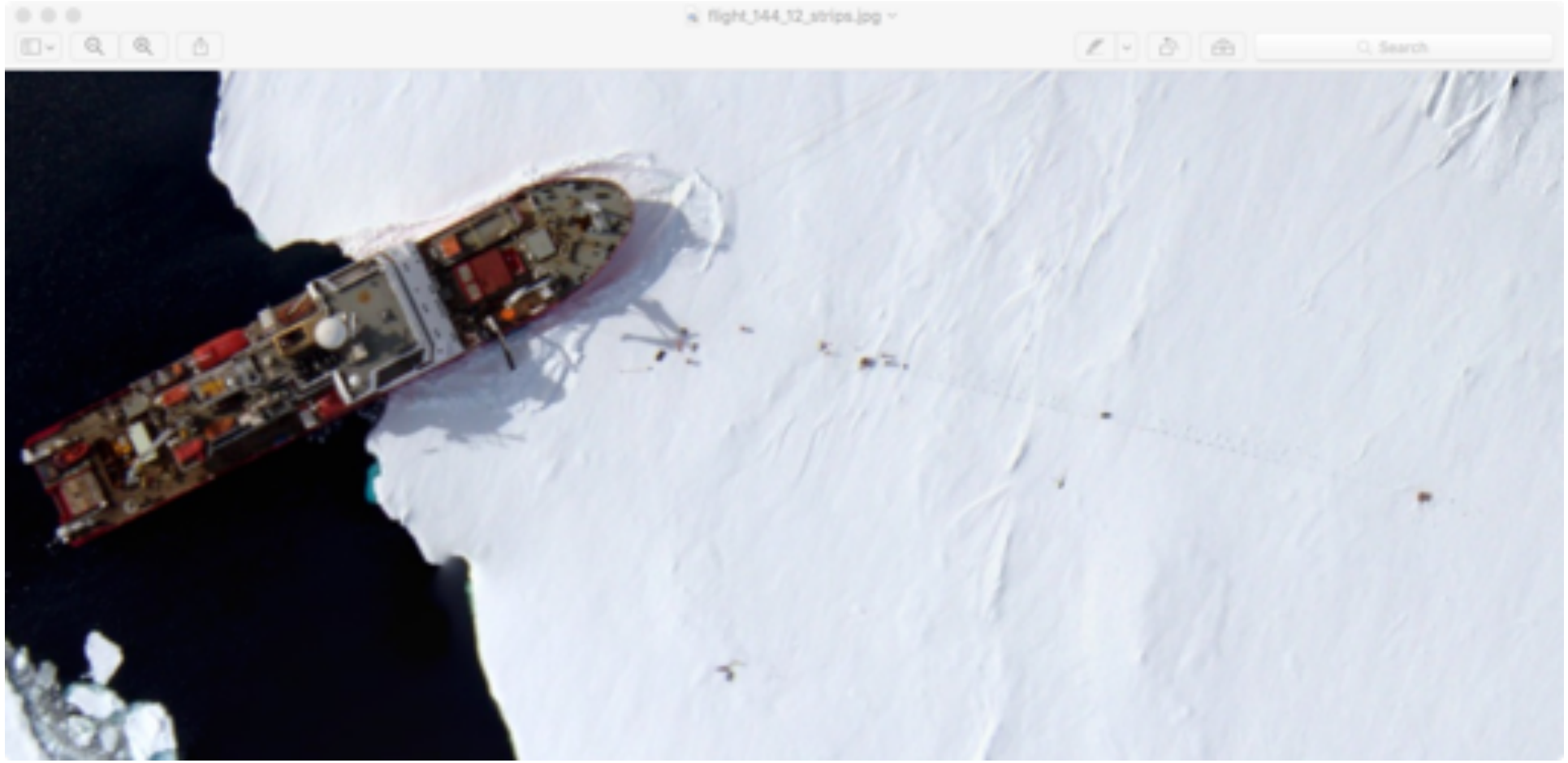
Northeastern University

Mapping with Drones



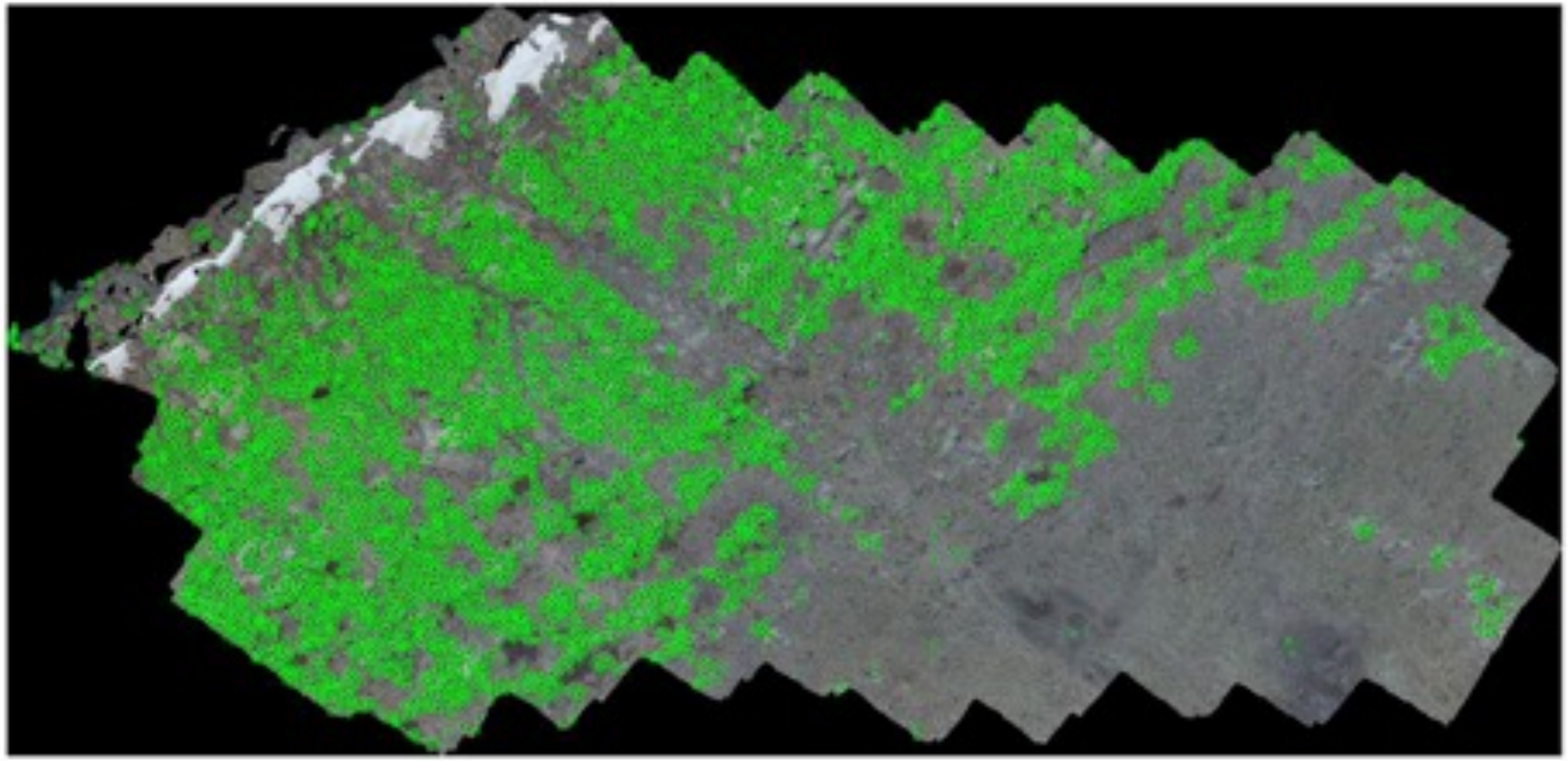


Flight 144 – Zoomed in

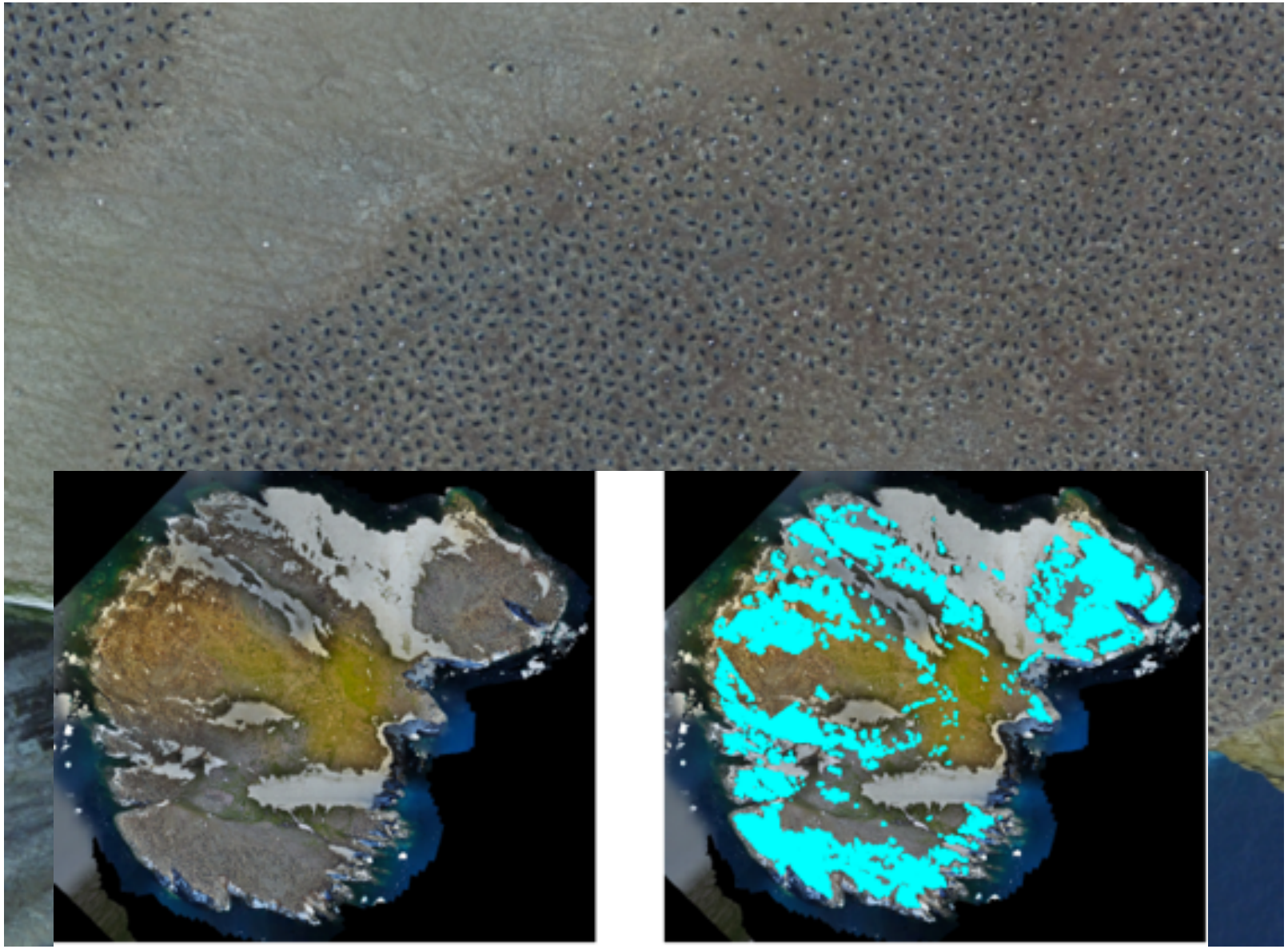


Brash Island

CNNs for Penguin Detection



Penguin Census – Danger Islands (Jenouvrier et al)



Penguin Census – Danger Islands (Jenouvrier et al)

The New York Times

SCIENCE

A Supercolony of Penguins Has Been Found Near Antarctica

Satellite images and a drone discovered about 1.5 million Adélie penguins living in the Danger Islands, one of two species whose habitats require ice.

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Penguin super-colony spotted from space

By Jonathan Amos and Victoria Gill
Science correspondents, BBC News

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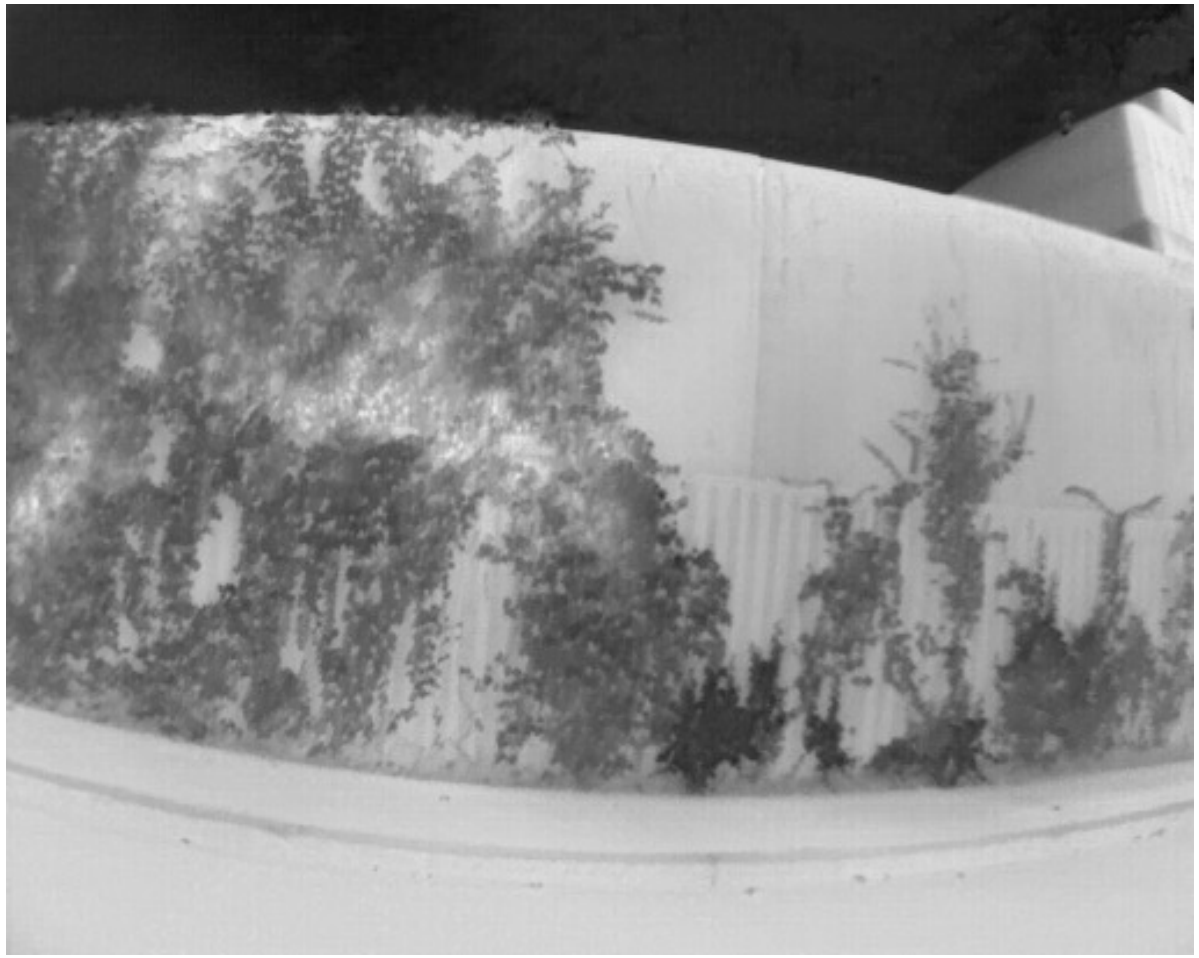
IR Camera



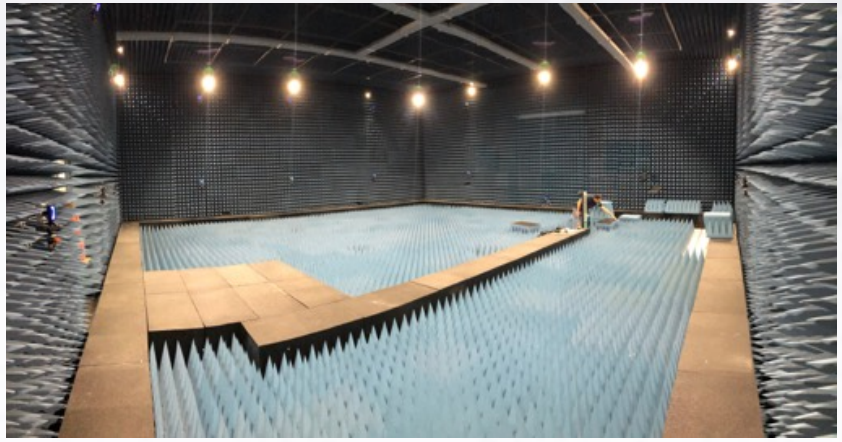
Calibration – Beam Pattern for IR Camera

IR Video

Burlington UAS Lab

Outdoor UAS Test Range

- Outdoor 150’x200’x60’ netted enclosure for GPS enabled flight testing
- Equipped with enhanced kinematic GPS for extremely precise centimeter positioning
- Steady state/gust wind test capability for small drones for performance characterization
- Interconnected flight path between outdoor and indoor test ranges for seamless transition
- 60’ observation deck in adjacent building for flight test viewing



Indoor UAS Test Range

- Large-scale Faraday cage/Anechoic Chamber (50’x50’x22’)
- 64 antenna/SDR array for jamming, interference, spoofing, communications testing, and Global Navigation Satellite System (GNSS) Simulator
- EMP test capability (RS105)
- Networking for autonomy, swarms and massive MIMO
- Able to test large drones up to 1300+ lbs
- RF testing from 300MHz to 18+GHz
- 24 camera HD optical tracking system for precise positioning

Institute for the Wireless Internet of Things
at Northeastern

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'Sustained' drone attack closed Gatwick, airport says

By Tom Burridge
Transport correspondent, BBC News

20 February 2019 Share

Gatwick drone shutdown

Sussex Police, the government and Gatwick airport say that the severe travel disruption last year was caused by a "sustained" drone attack.

The situation caused disruption for tens of thousands of passengers. Gatwick's decision to close was taken after a risk assessment with police.

The New York Times

Newark Airport Traffic Is Briefly Halted After Drone Is Spotted

Flights bound for Newark Liberty International Airport were halted on Tuesday evening after a drone was spotted flying nearby. Julio Cortez/Associated Press

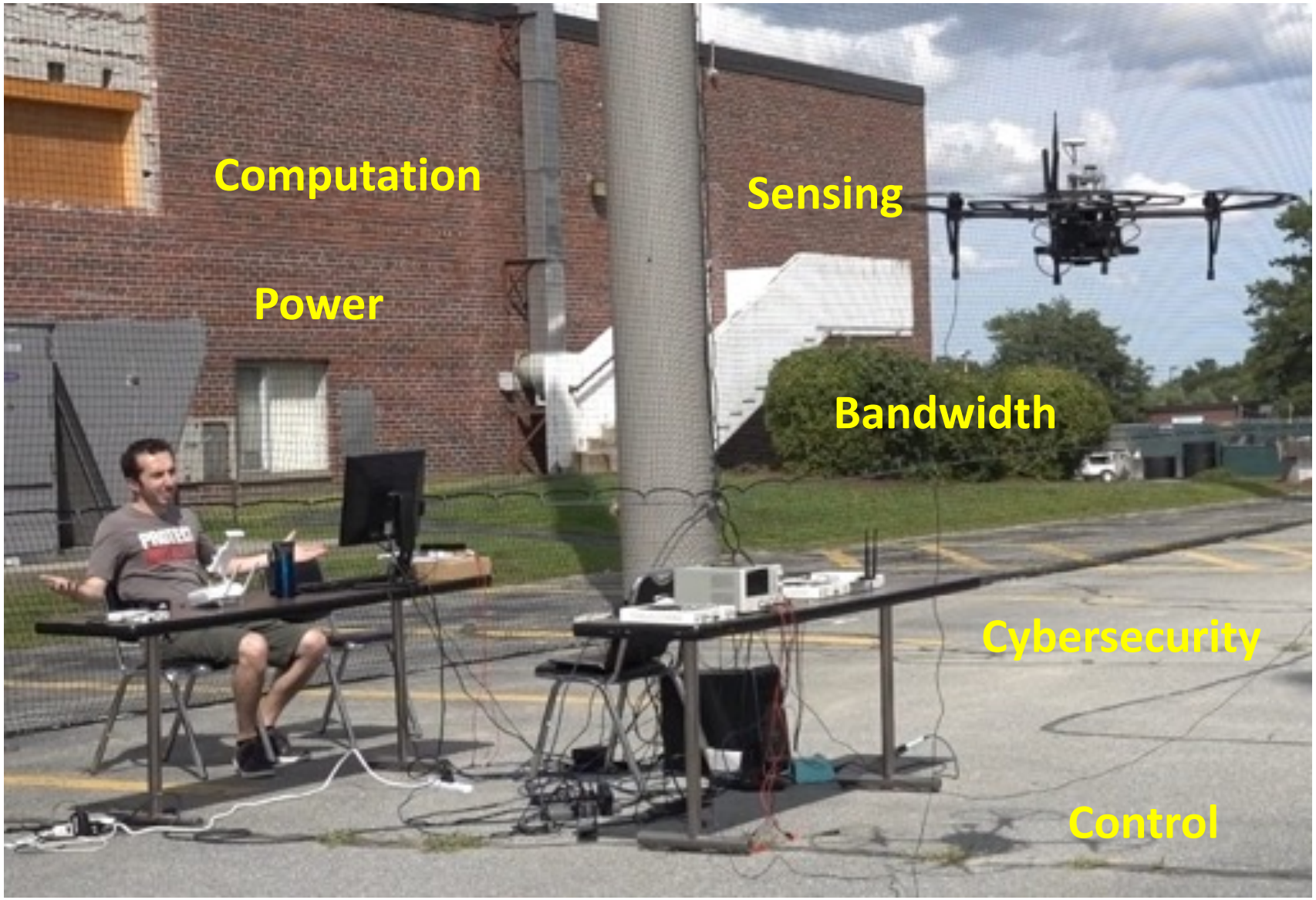
By Patrick McGeehan

Jan. 22, 2019

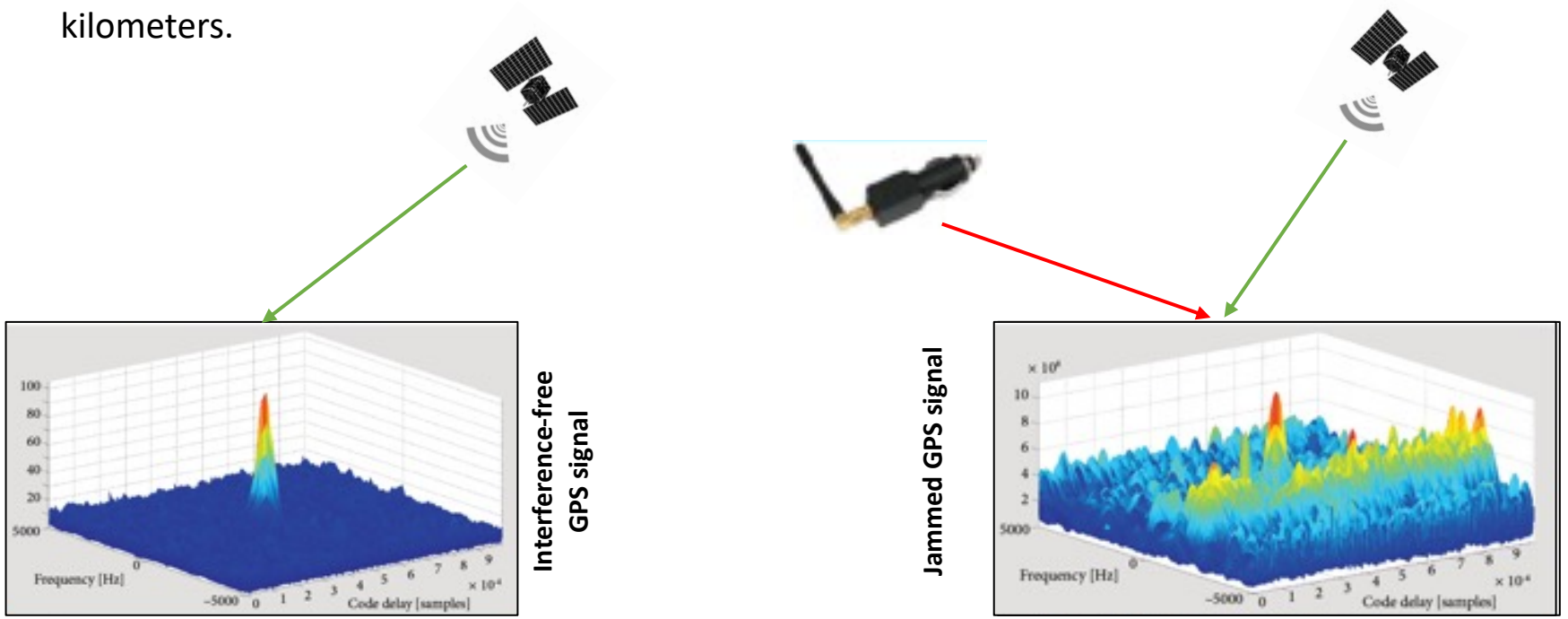
[What you need to know to start the day: Get New York Today in your inbox.]

All flights bound for Newark Liberty International Airport were halted on Tuesday evening after two pilots reported seeing a drone flying

UAS Areas of Interest



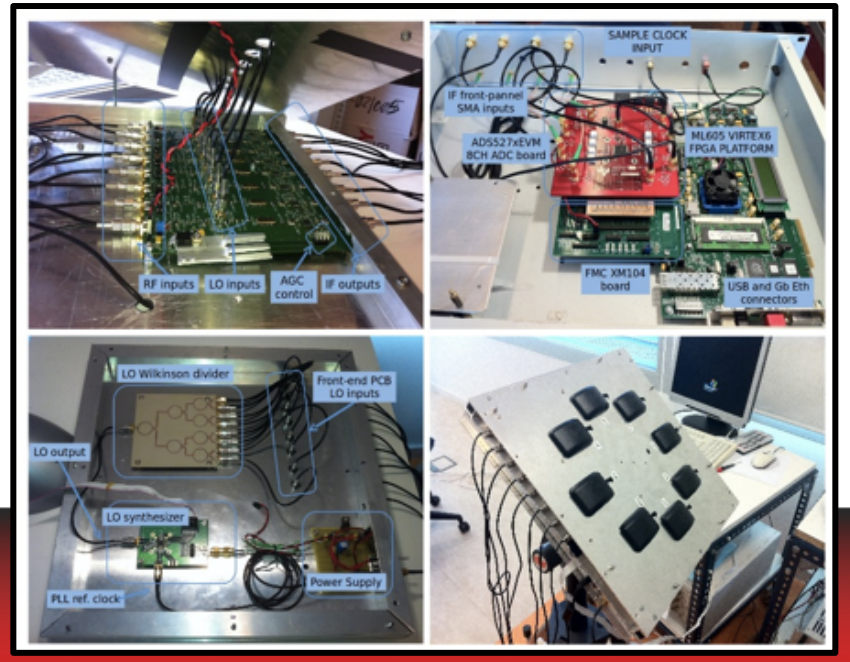
- Jamming signals are extremely simple to generate and broadcast.
- For instance, although illegal in some countries, it is fairly easy to buy a jamming device and cause Denial of Service (DoS) of GPS positioning and timing in an area of up to several kilometers.



- In the case of GPS, this vulnerability can cause catastrophic consequences since, according to US DHS, “15 of the 19 Critical Infrastructure & Key Resources Sectors have some degree of GPS timing/positioning usage”.

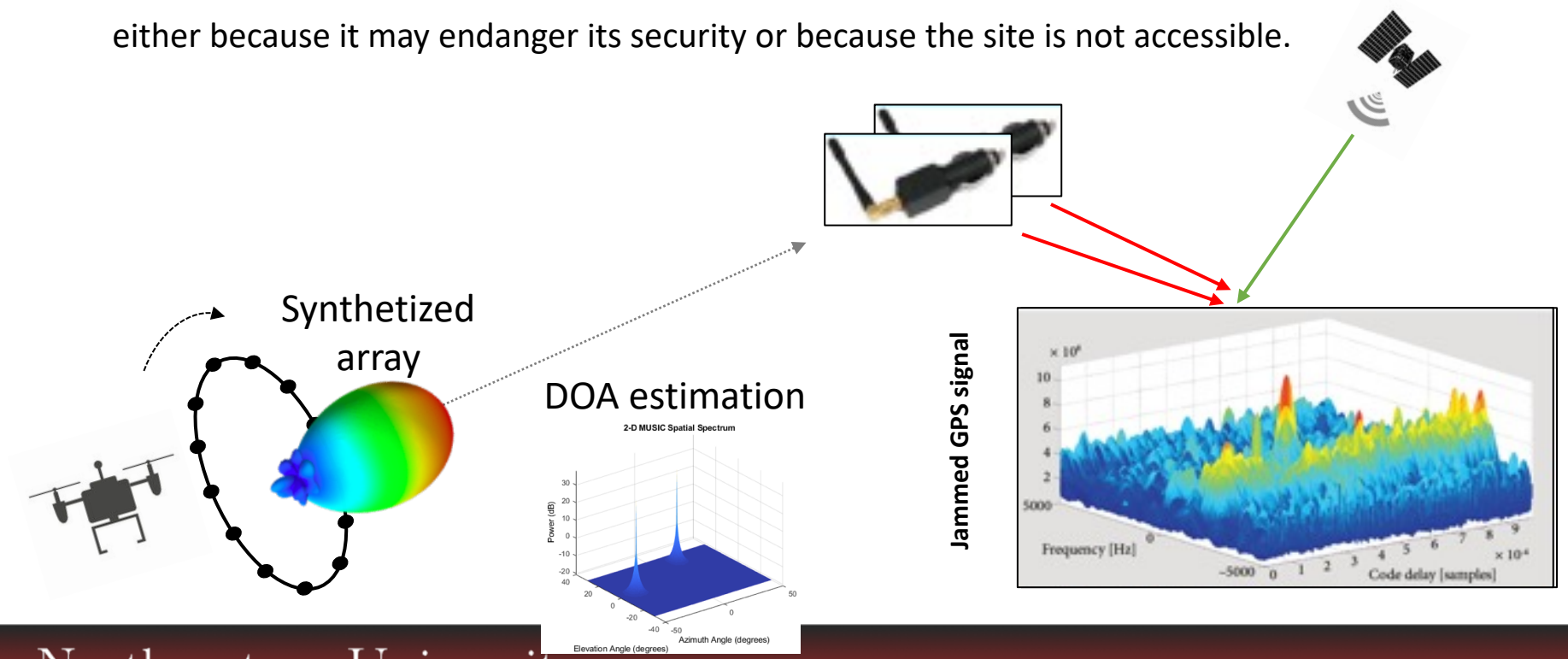
J. Merrill, ''Patriot Watch: Vigilance Safeguarding America,'' presented at the Presentation Telcordia-NIST-ATIS Workshop Synchronization Telecommun. Syst.(WSTS ’12), Mar. 20–22, 2012.

- Similarly, one could think of jamming attacks to other services (e.g., communications systems or radar) which could eventually lead to equally damaging effects.
- There is a need for **detecting and locating** sources of malicious transmissions, which are aimed at causing DoS of critical services and infrastructures.
- In high-grade applications, as those involving the security of critical infrastructure, interference sources are typically detected and located by **antenna array technology**. However, such approach is known to be
  - costly to prototype,
  - complex to implement,
  - power hungry, and
  - bulky to place in even mid-sized drones.



C. Fernández-Prades, J. Arribas and P. Closas, "Robust GNSS Receivers by Array Signal Processing: Theory and Implementation," in **Proceedings of the IEEE**, vol. 104, no. 6, pp. 1207-1220, June 2016.

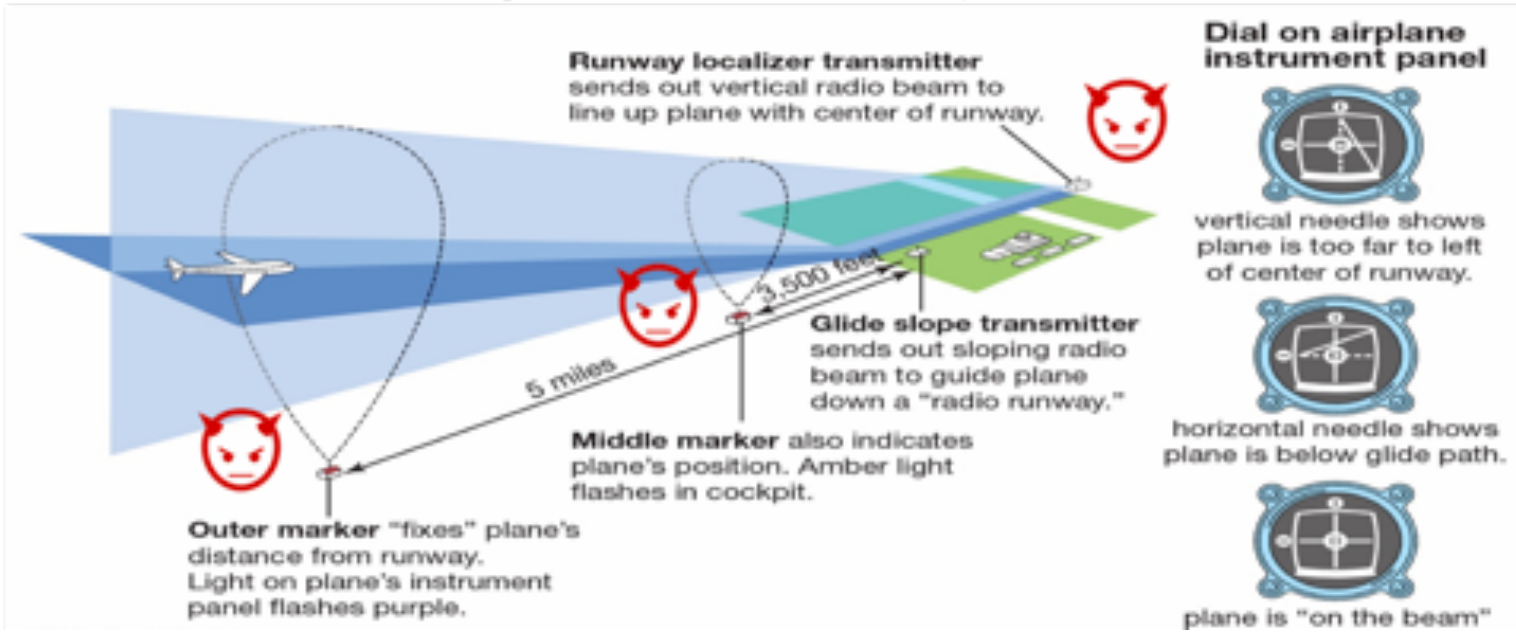
- On the other hand, popularity of **unmanned aerial systems** (UAS) is quickly increasing. The advent of such powerful platforms is paving the way to novel ways of combating the threats imposed by cheap, yet hazardous, jamming devices.
- In many situations, one does not want to physically send a squad to seek for the interferers, either because it may endanger its security or because the site is not accessible.



Wireless Attacks on Aircraft Landing Systems

Security of Aircraft Landing Systems

- **Marker beacon:** allow pilots to accurately guage their distance from runway (on off keying, 75 MHz
- **Localizer:** used to correctly center an aircraft during landing (two yagi antennas, transmitting a code continuously at 108.1 and 111.95 MHz)



Wireless Attacks on Aircraft Landing Systems

- ILS spoofing is possible using commercially available SDR, causing last-minute go around decisions, and even missing the landing zone in low-visibility scenarios.
- We developed a tightly-controlled closed-loop ILS spoofer with dynamic adjustment of the transmitted signals as a function of the aircraft GPS location, maintaining power and deviation consistent with the adversary's target position, causing an undetected off-runway landing.
- Demonstrated systematic success rate with offset touchdowns of 18 meters to over 50 meters on an FAA-accredited flight simulator's AI landing