ALL-DOMAIN ANOMALY
RESOLUTION OFFICE

Leveraging Data, Analysis, and AI to Identify UAP

Presentation to the Defense Space, Geospatial & Intelligence Leadership Conference

Mr. Tim Phillips

Deputy Director, AARO

All-Domain Anomaly Resolution Office
Chief of Staff, AARO
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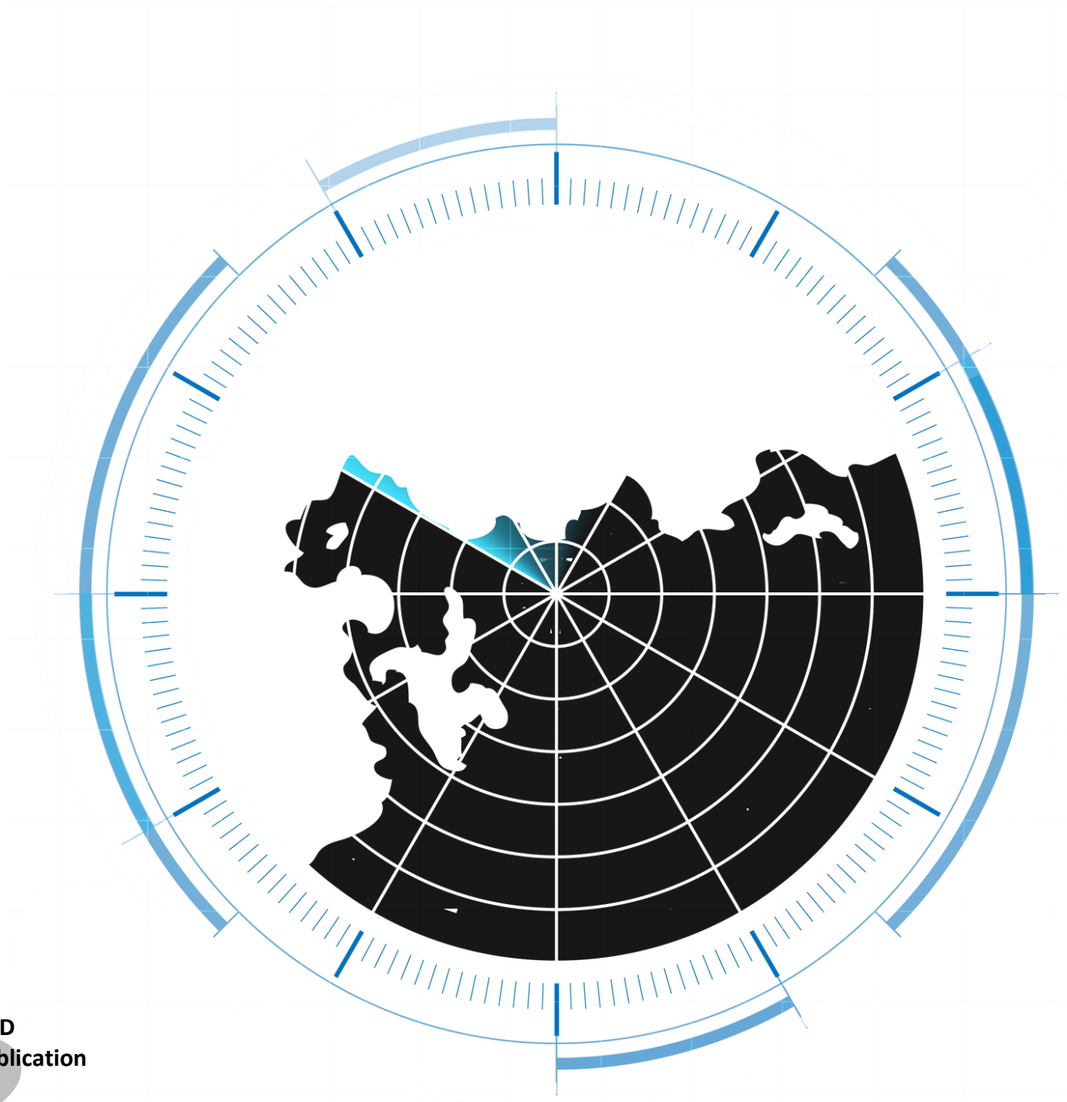
UNIDENTIFIED ANOMALOUS PHENOMENA

Unidentified Anomalous Phenomena **(UAP)** are sources of anomalous detections in one or more domains (i.e., airborne, seaborne, spaceborne, and/or transmedium) that are not yet attributable to known actors ***and*** that demonstrate behaviors that are not readily understood by sensors or observers.

"Anomalous detections" include, but are not limited to, phenomena that appear to demonstrate performance characteristics or material properties that exceed the known state-of-the-art. Most anomalous detections reported to AARO lack sufficient data to conclusively assess. Of those that do, most resolve to mundane objects.

A UAP encounter may consist of one or more unidentified anomalous objects and may persist over an extended period of time.

- UAP are primarily attributable to domain-awareness gaps
- UAP may represent advanced capabilities operating in our domain-awareness gaps



MISSION, VISION, & FUNCTION

Congress established AARO to investigate what hazards or threats UAP might present across service, regional, and domain boundaries.

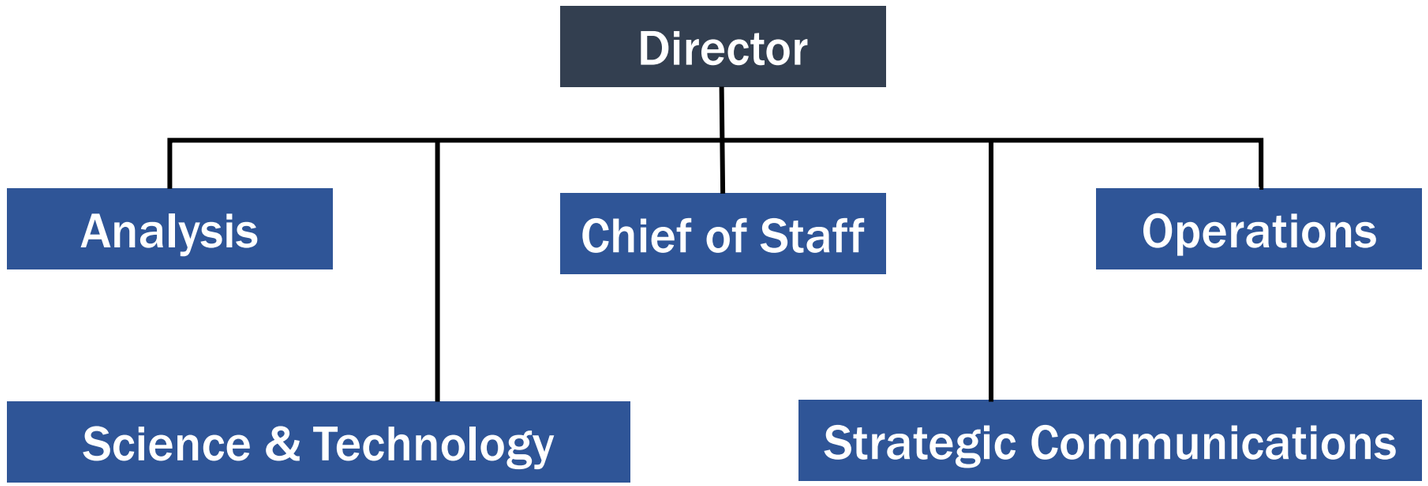
MISSION:

Minimize technical and intelligence surprise by synchronizing identification, attribution, and mitigation of UAP in the vicinity of national security areas.

VISION:

Effectively and efficiently detect, track, analyze, and manage anomalous detections and UAP via normalized and systematized DoD, IC, and civil business practices adhering to the highest scientific and intelligence-tradecraft standards with transparency and shared awareness.

AARO DIVISIONS AND ORGANIZATION



UAP ANALYTIC TRENDS

AARO analyses confirm only a very small percentage of UAP reports display anomalous signatures. Most anomalous detections reported to AARO demonstrate ordinary characteristics of readily-explainable sources.

LACK OF DATA HINDERS COMPREHENSIVE ANALYSES

- Many cases in AARO's holdings remain unresolved because of a lack of verifiable data. Cases lacking sufficient data to inform a rigorous analysis cannot be resolved.
- High-quality empirical data is necessary for AARO's adherence to the scientific method and intelligence tradecraft, modeling, simulation, and peer review.

TRENDS CORRELATE TO LOCATION OF REPORTING COMMUNITIES AND SOURCES

- AARO's reliance on DoD-sourced reports leads to a collection bias near major range and test facilities, special use airspace, and operational areas.
- Interagency cooperation and partnerships with civil aviation authorities lessens military-centric collection bias by incorporating reports from commercial pilots, thus broadening collection area over a greater geographic area.

INCREASED CIVIL REPORTING SHIFTING COLLECTION BIAS, MORPHOLOGY TRENDS

- AARO received more than 100 reports from the FAA, contributing to analyses of UAP trends over the United States and its territorial waters.
- Most civilian reports lack sufficient data to inform a conclusive analysis—i.e., sightings of "lights" without notes on objects' morphology/characteristics, geospatial location, or anomalous behaviors.

MT. ETNA OBJECT

- **Event:** In 2018, a US UAS platform captured video of an unidentified object while observing an eruption of Mt. Etna in Italy. The object appeared to pass through the volcano's plume without any impact on its performance, altitude, or trajectory.

- **Findings:** AARO, in coordination with IC and S&T partners, assesses with moderate confidence that the object was a balloon drifting with the wind approximately 170 kilometers from the volcano.

- **Analytic Factors:** AARO's IC partner employed full-motion video analysis software, 3D modeling, and pixel examination to assess the object's performance characteristics. AARO also applied novel speed and distance calculation techniques to determine the object's location.

- AARO estimated the distance between the UAP and the UAS using weather analysis of the cloud deck and wind speeds.

- AARO found that the object's flight path did not intersect with the ash plume by analyzing pixel luminosity against its surroundings.

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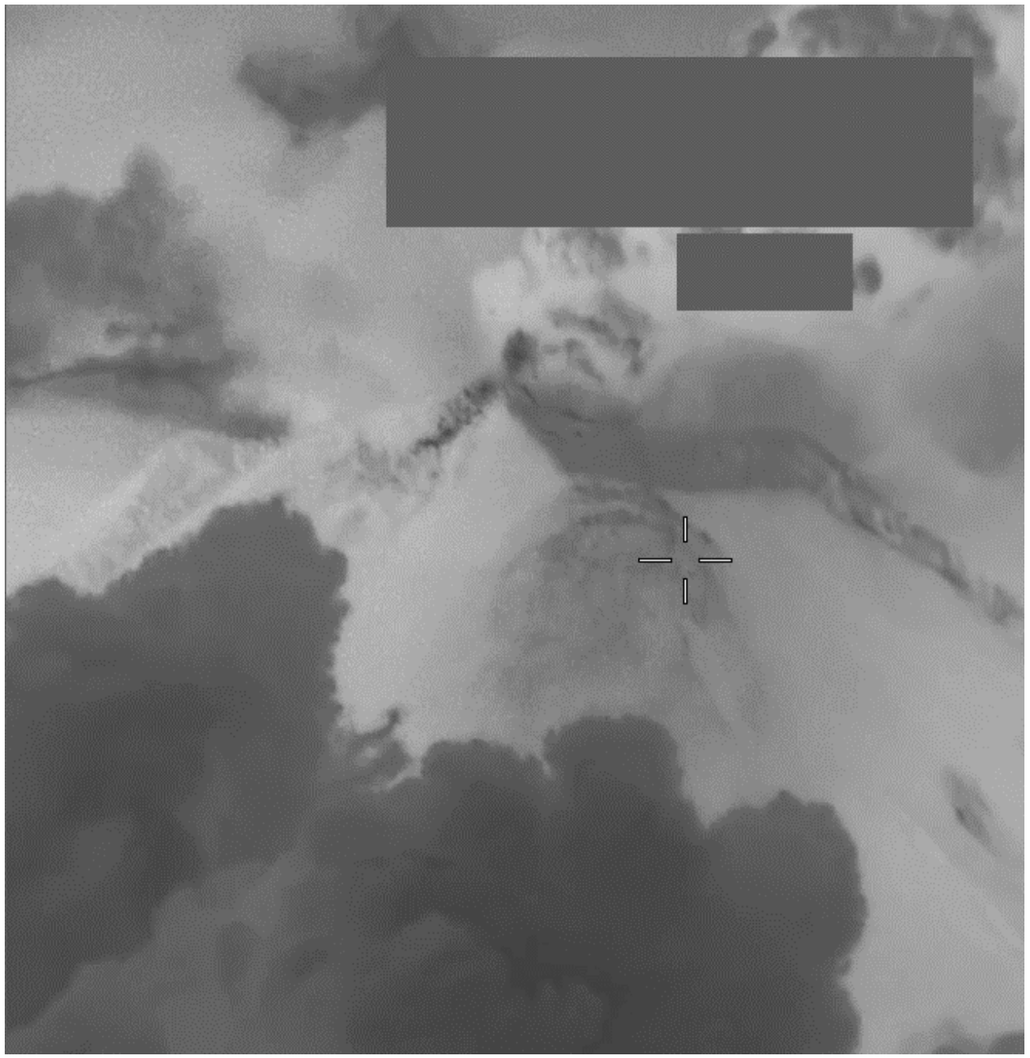

(U) Video of the Mt Etna Object video that can be found on www.aaro.mil.

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APPLIED GEOINT METHODOLOGY

- **AARO's IC partner applied FMV techniques to calculate the object's speed, altitude, and direction of travel.**
  - During observation, the object seemed to transit the ash plume.
  - AARO's IC partner used photogrammetry, vector analysis, and 3-D visualization to calculate the object's 3-D flight path.
- Applying the predictive model revealed the object's location later in the video.
- Successful prediction of the object's location validated AARO's methodology.
- These findings demonstrate the utility of applying GEOINT techniques to resolve anomalous detections.

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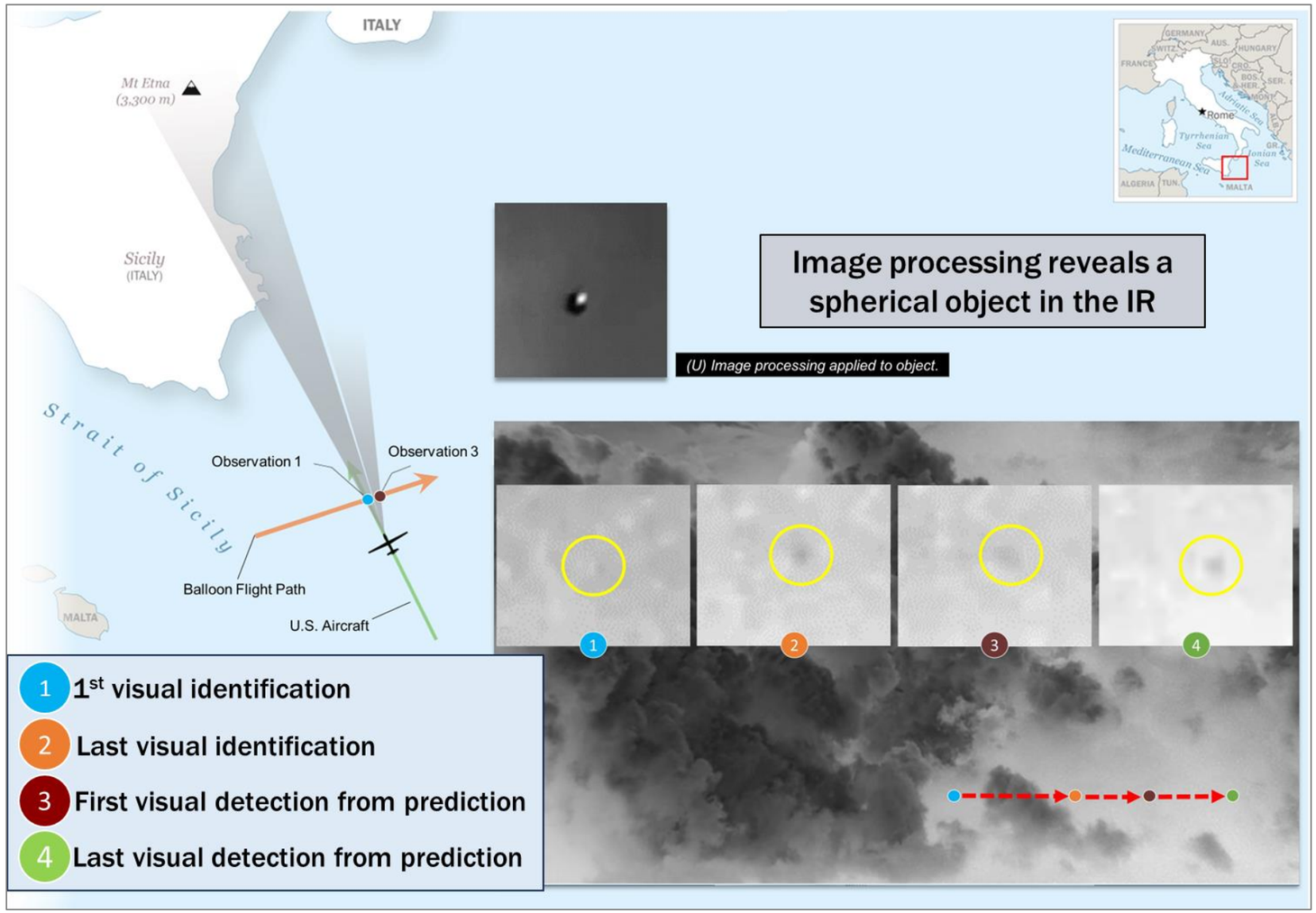

(U) Collection geometry of the Mt Etna object. Image is not to scale. (UNCLASSIFIED)

Applying these techniques yielded an accurate prediction of the object's location, validating AARO's methodology for trajectory calculation.

VERIFICATION & VALIDATION OF NEW METHODS AND ALGORITHMS

- AARO is incorporating new methods into its GEOINT tradecraft.
- AARO conducted controlled experiments at Camp Grafton, North Dakota, using telemetered airborne surrogate targets.
  - 10,000 acres of federal land (UAS training area)
  - Coordinated airborne collections of surrogate targets
  - Over two hours of unclassified FMV collection
  - Surrogate targets exhibited similar behaviors and morphologies as widely reported UAP behaviors, such as being “hot,” “high-speed,” “orb-like,” “star-like,” “highly maneuverable,” or “transmedia.”
- AARO is working to release its complete data collection from this event to educate the public and the civil aviation community on commonly encountered apparent behavior that might seem anomalous to unprepared observers.

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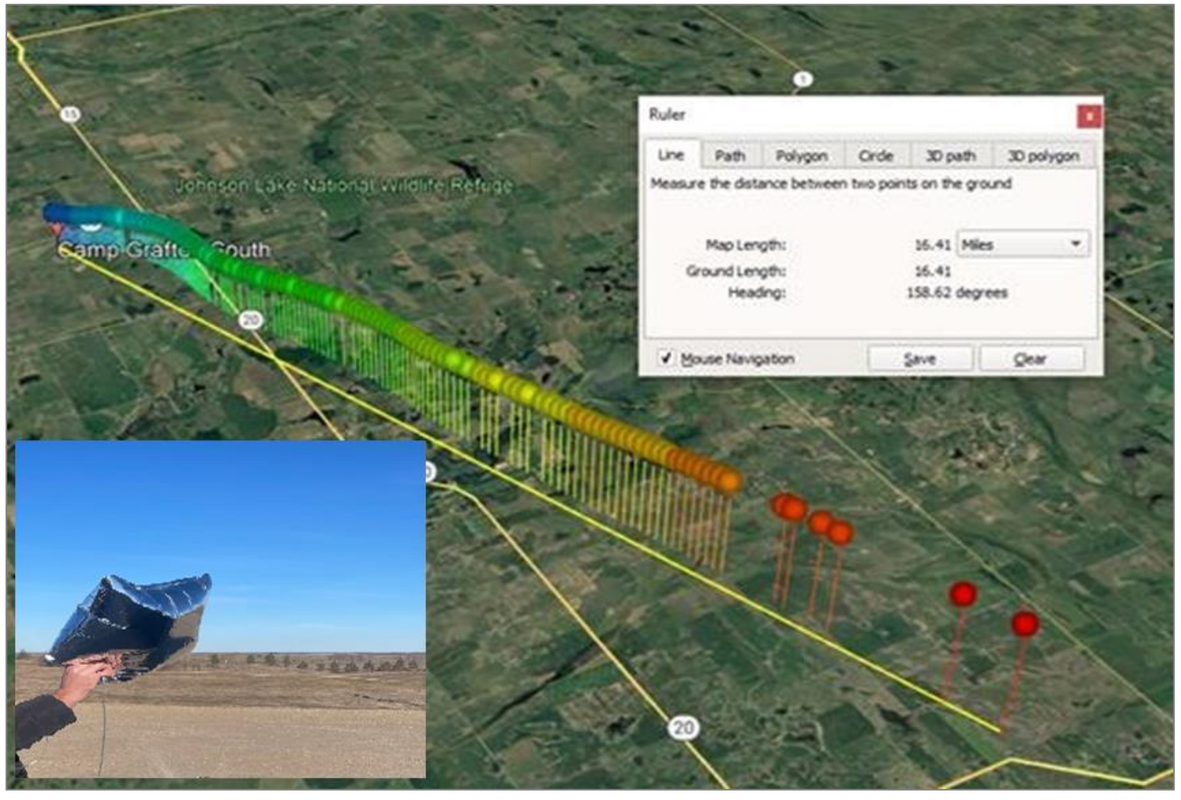

(U) Balloon example with telemetered track plotted on map. (UNCLASSIFIED)

AARO FOOTAGE FROM CAMP GRAFTON FIELD TESTING

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(U) Video of FMV collected during testing.

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EXPANDING TO THE SPACE DOMAIN

- **AARO convened a Space UAP Tiger Team to address space domain awareness**
  - AARO's cross functional team addressed foundational questions and provided recommendations
    - Development of automated detection algorithms
    - Improved tipping and cueing to unknown or anomalous objects
    - Automated reporting processes
- **Space Domain Community of Interest to implement Tiger Team recommendations**
  - Stakeholders in the space domain operational environment such as US Space Force and SPACECOM
    - Community of interest will continue to refine the definition of Space UAP and develop TTPs for addressing UAP
    - Identify potential data sources relevant to Space UAP problem set
    - Identify domain awareness gaps where Space UAP may go undetected or unreported
- **Human Observation of perceived Space UAP**
  - AARO has received 81 UAP cases from observers related to Space Domain
  - Of these, 74 were reported by the FAA
  - AARO has closed 62 Space-based UAP cases

SCIENTIFIC ANALYSIS OF SPACE UAP: STARLINK FLARING

- **Pilots and ground-based observers report unusual "orbs"**
  - Unlike Starlink "trains", these are very bright and short-lived
  - Reddish orange to white with spatial extent
  - Appear to suddenly change directions
- **Possible cause: Starlink Satellite Flaring**
  - Not the trains which are higher in the sky, many lights in a row
  - Flaring is bright specular reflection off nadir surface;
    - Occurs just above horizon after sunset and before sunrise;
    - Several can appear at once and move in diverse directions; appearance of a single object changing directions
- **AARO employed mathematical tools to predict when and where flaring events would occur; observed and validated the predictions**

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(U) Above: Imagery of Starlink "trains"[1] (UNCLASSIFIED)

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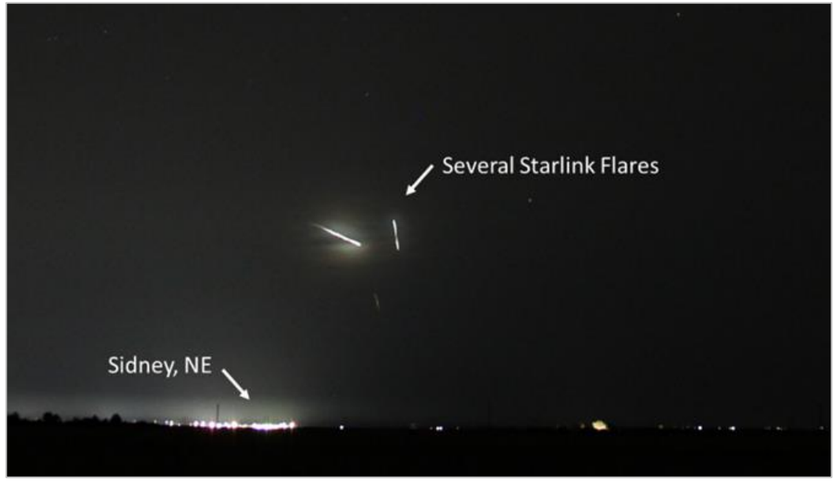

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(U) Above: Time-lapse imagery of Starlink "flaring" captured by AARO.

1 - J. Hsu, "New Scientist," 4 10 2023. [Online]. Available: https://www.newscientist.com/article/2394949-starlink-carbon-footprint-up-to-30-times-size-of-land-based-internet/.

SCIENTIFIC ANALYSIS OF SPACE UAP: STARLINK FLARING - ANIMATION

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(U) Animation created by AARO to demonstrate Starlink flaring as observed from commercial aircraft.

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