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USE CASE EXPLORATION AND ANALYSIS OF PLANET SKYSAT VIDEO

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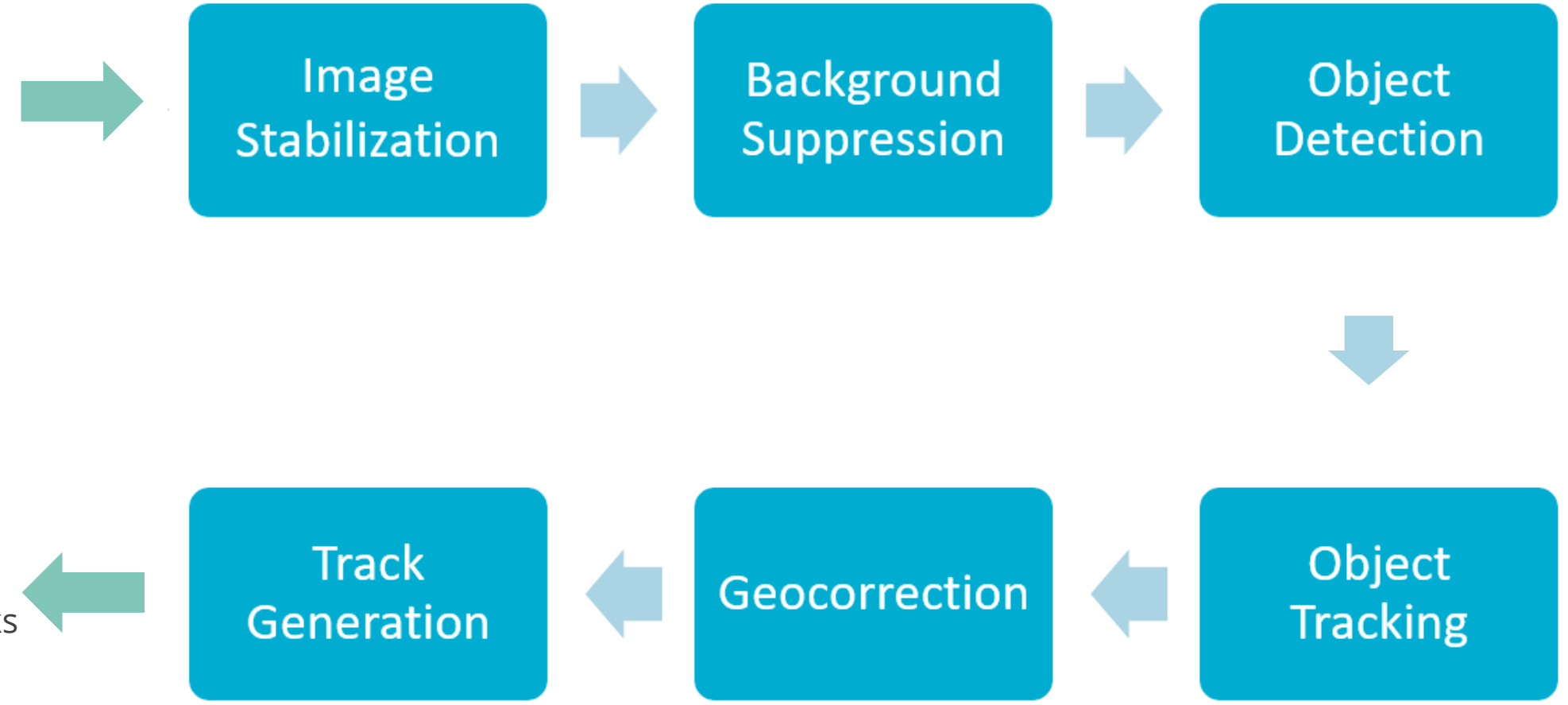
SKYSAT VIDEO PROCESSING STEPS

Inputs

- GeoTIFF
- ~~RPC~~
- Pinhole
- Frame Index



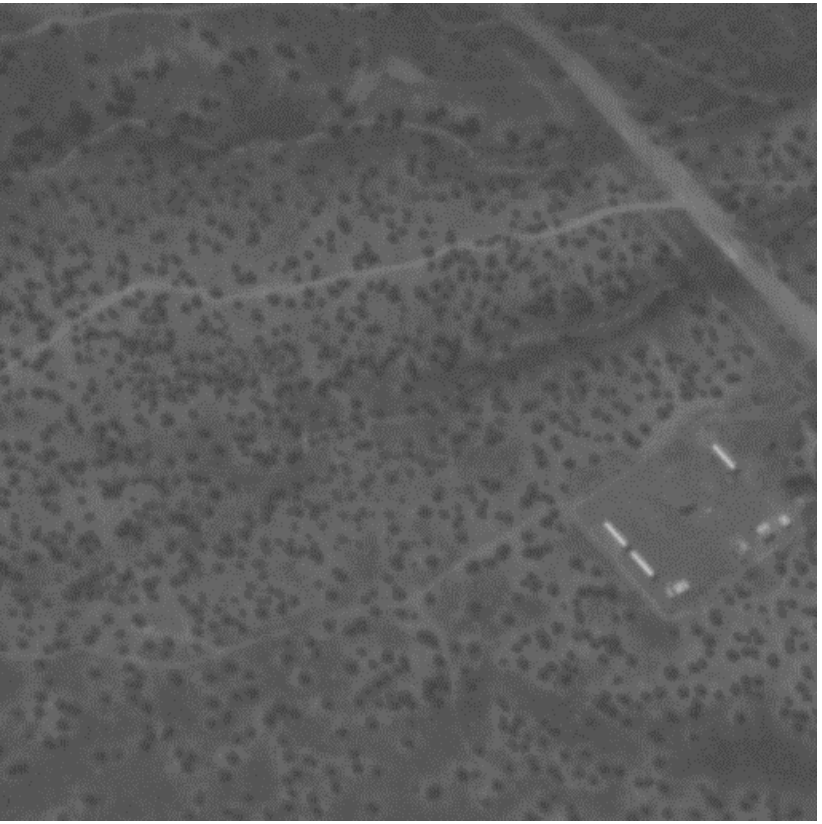
Outputs

- Background suppressed video
- Geocorrected tracks (KML, etc.)
- Video per track

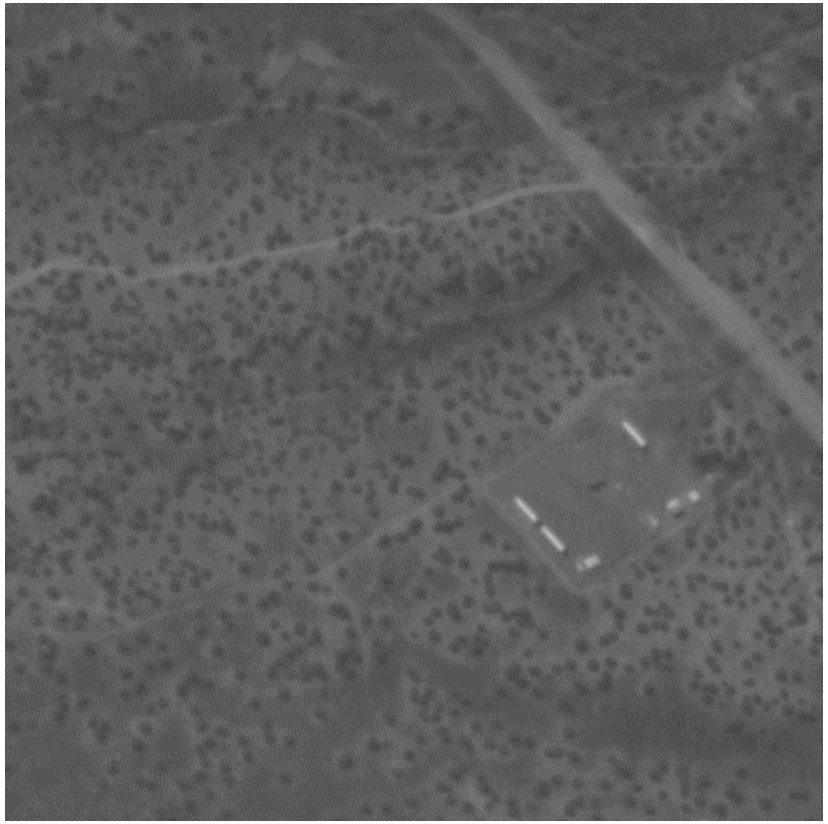
For more, see:
Ma, Tian J., and Robert J. Anderson. 2023. "Remote Sensing Low Signal-to-Noise-Ratio Target Detection Enhancement" Sensors 23, no. 6: 3314.

IMAGE STABILIZATION AND MOVING OBJECT DETECTION

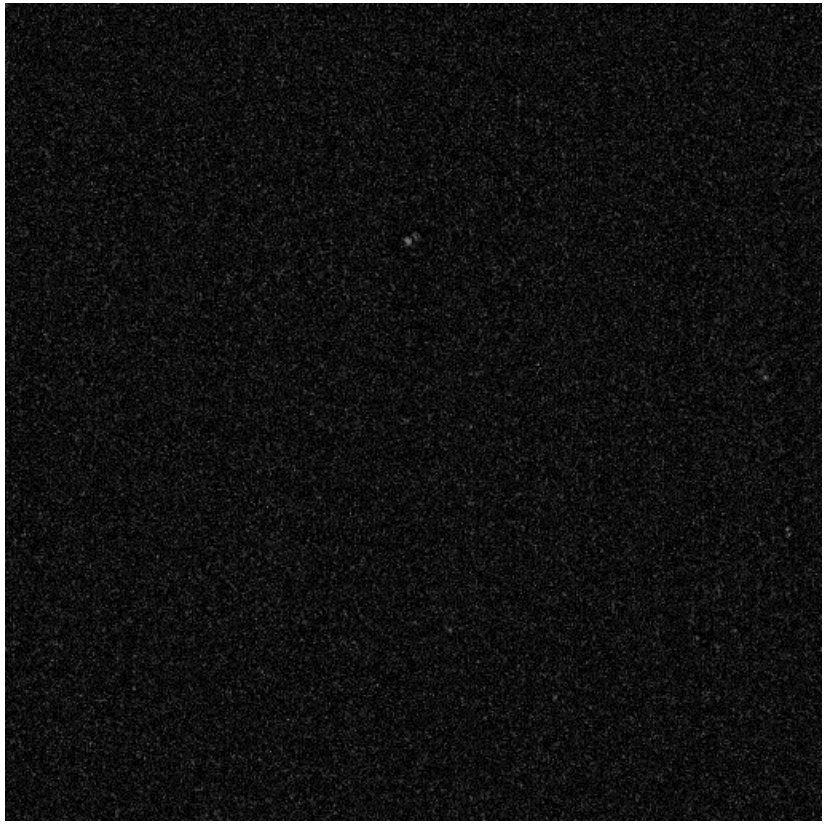
1. Stabilize frames so that physically stationary objects do not appear to move.
2. Model the background and detect objects by their motion relative to it.



Zoomed in region of raw video



Zoomed in region of stabilized video

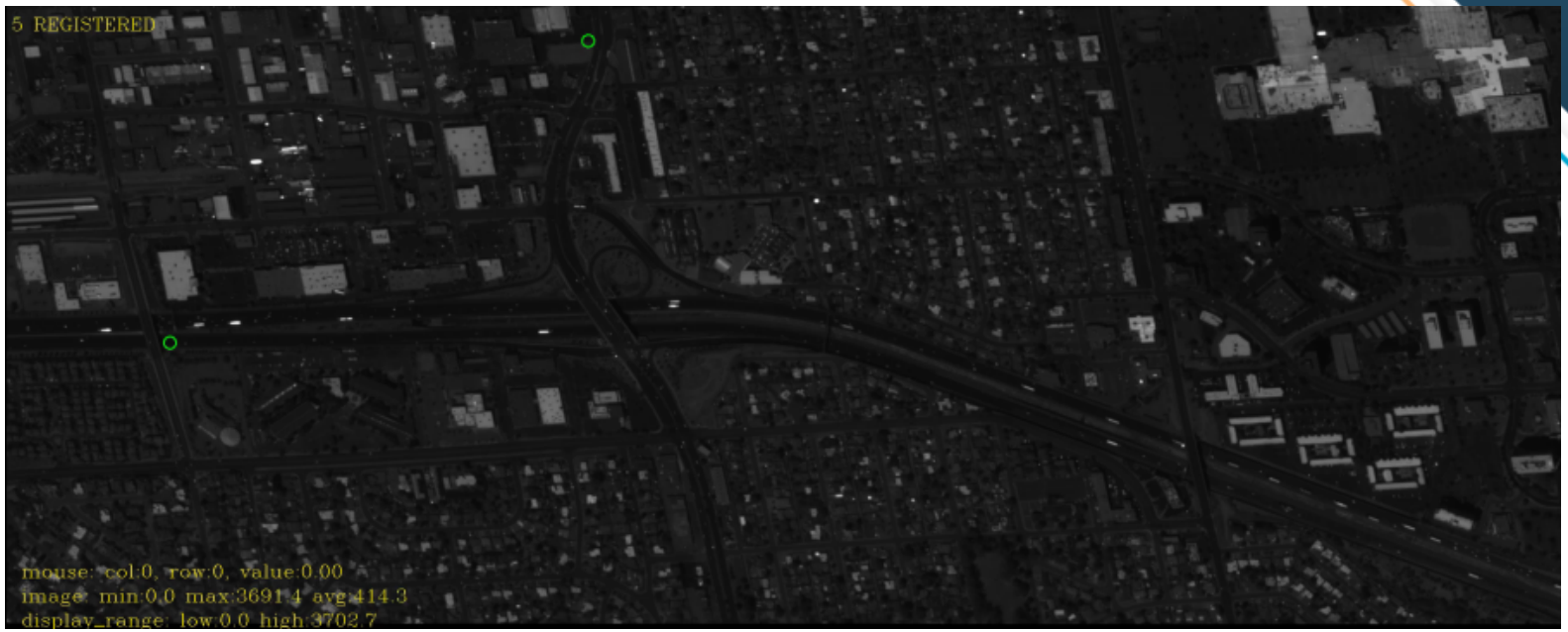


Background-subtracted video;
CYAN circles are detections

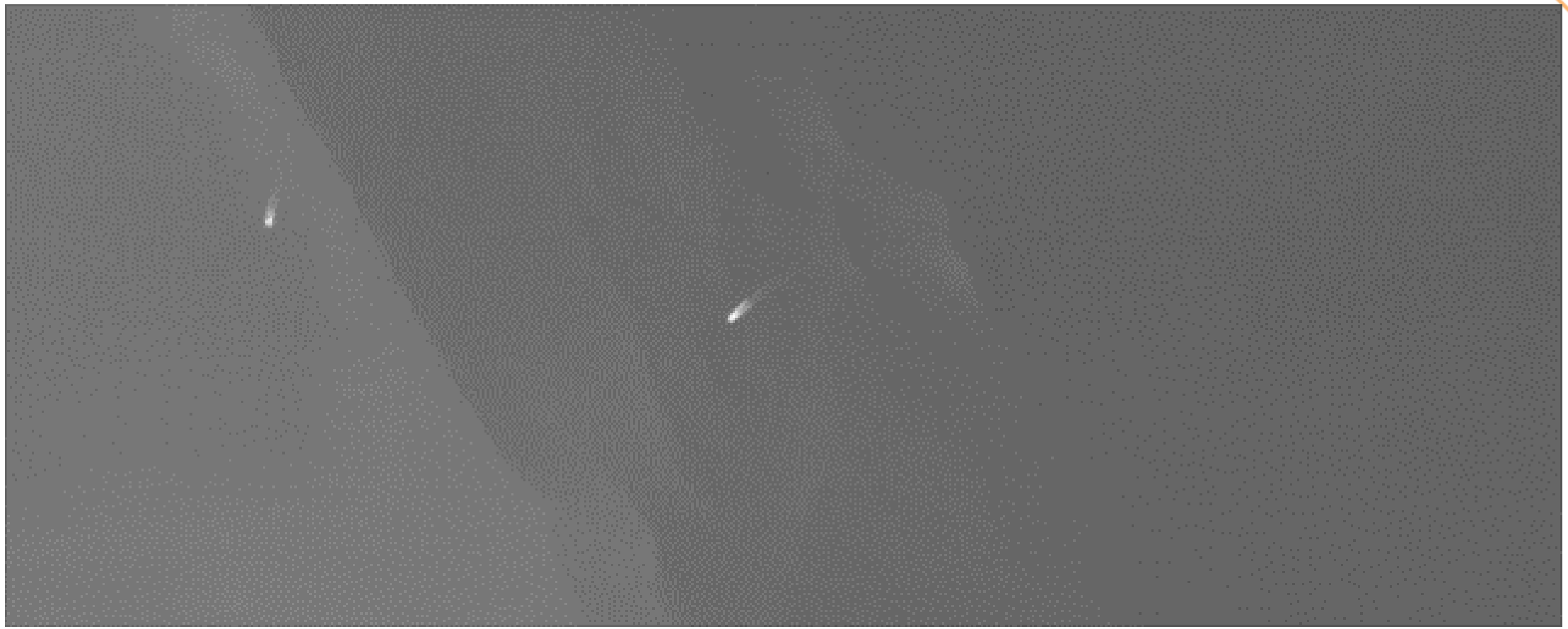
CAR AND TRUCK DETECTION AND TRACKING

Experiments in Albuquerque, NM

- Participants drove, recording GPS positions during Planet SkySat collection
- **GREEN** circles are GPS measurements
- **CYAN** circles are detections
- WHITE lines are tracks
  - Rendering turns on and off so tracks don't always cover the screen
- Changes in vignetting allude to stability of geodetic stare
- Able to detect and track all participants
- Nearly zero false positives (visually) observed



BOAT DETECTION AND TRACKING



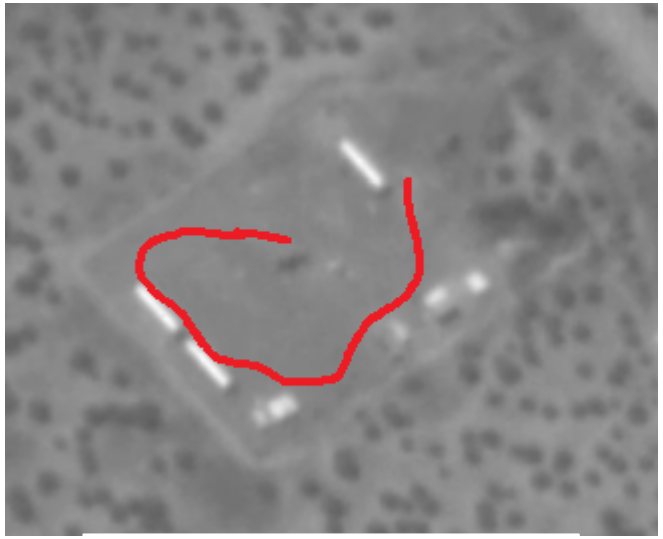
CYAN circles are detections; WHITE lines are tracks

Experiment in the Atlantic ocean near Florida

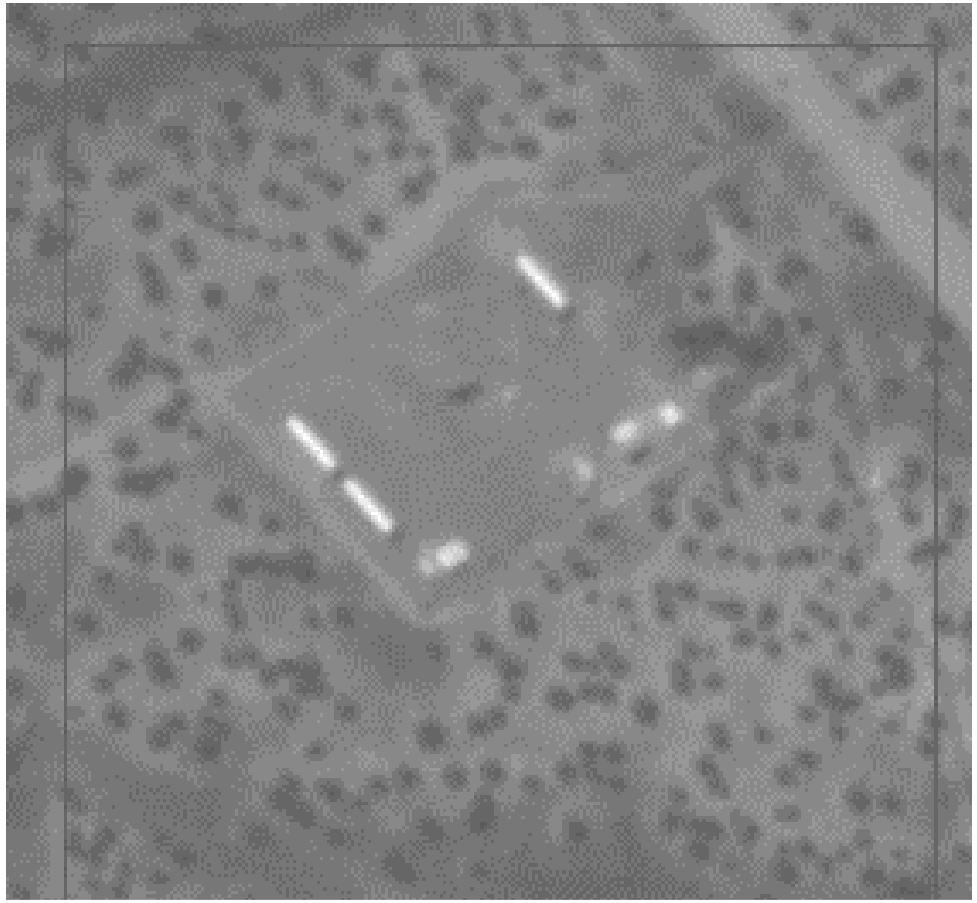
- Lack of in-scene fiducials prevents imagery-based stabilization
  - Instead depend on the provided metadata to partially remove camera motion
- Able to detect and track boats, but multiple (disparate) tracks generated due to uncorrected camera motion

CYCLIST DETECTION AND TRACKING

One experiment included a subpixel target (rider on a mountain bike) with GPS ground truth

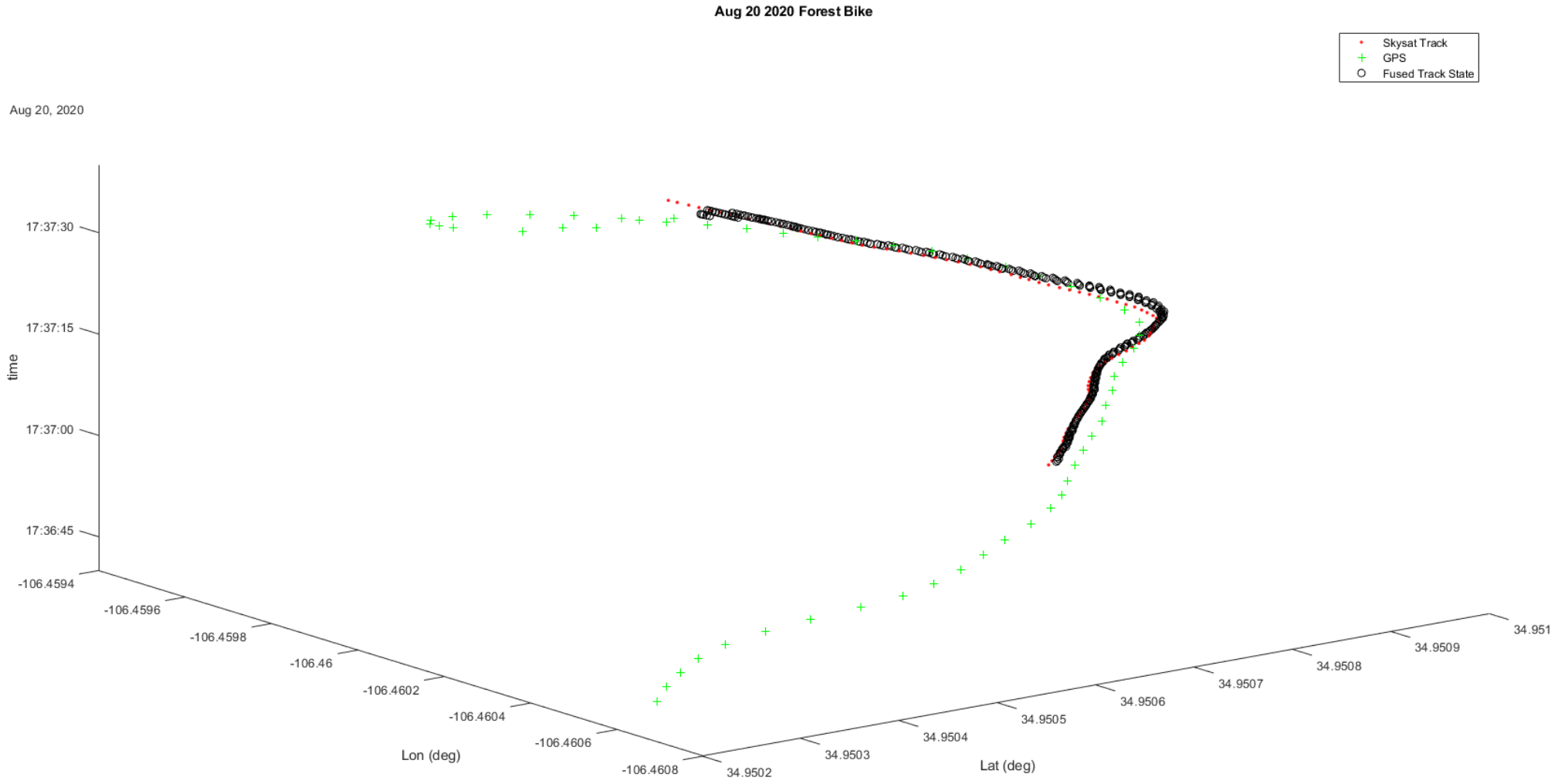


Path taken by cyclist



CYAN circles are detections; WHITE lines are tracks

CYCLIST DETECTION AND TRACKING

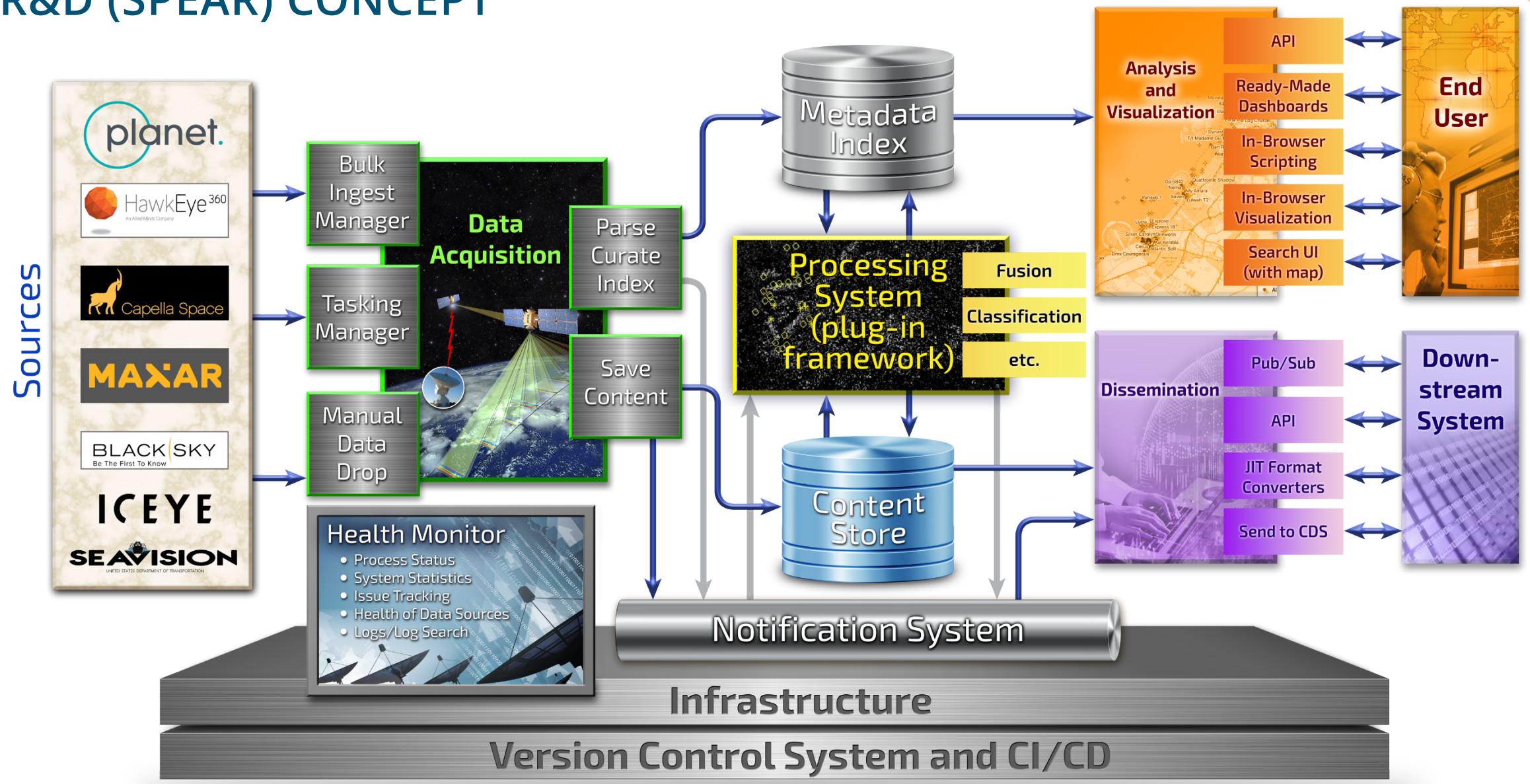


Comparison between extracted Skysat cyclist track and GPS
Fused product shown with ‘o’ markers

SPEAR – SENSE-MAKING PLATFORM AND EXPLOITATION ARCHITECTURE FOR R&D

- SNL-developed internal PaaS to reduce activation energy required for CRS experiments, i.e. seamlessly bring CRS data and algorithms into contact:
  - Automatically acquires and stores commercial remote sensing (CRS) data
  - Executes Sandia's conventional processing pipelines on the data
  - Houses toolbox of algorithms and provides composition to create novel processing pipelines
  - Facilitates data exploration (e.g. multi-int fusion)

SENSE-MAKING PLATFORM & EXPLOITATION ARCHITECTURE FOR R&D (SPEAR) CONCEPT



SPEAR – SENSE-MAKING PLATFORM AND EXPLOITATION ARCHITECTURE FOR R&D

- Intended to comprehensively cover the entire TCPED lifecycle for CRS data @ SNL