Automated False Track Identification

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Kenneth Pack
Science Applications International Corporation
400 Virginia Avenue SW, Suite 800
Washington DC 20024
E-mail: kenneth.pack@saic.com

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Rules provided in this presentation have been used to analyze archived data from new and upgraded installations of Airport Surface Detection Equipment.

Data analysis was done for the Federal Aviation Administration under FAA Contract DTFA01-01-0-0021.

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Archived Data

- It exists and it can be reviewed by multiple analysts.

- Preserves
  - Track Initiation
  - Track Movement
  - Track Features
  - Track Death

- False track analysis can ignore operational system constraints
  - Identify airplanes and vehicles quickly
  - Maintain track continuity
  - (We want the planes and trucks to be on the display)

Reasons for Automating False Track Analysis

Time and Money

- The installation needs to be done by ????

Need to look at lots of Target of Opportunity Data

- Truth is not always available.
- It is what the end users work with.
- False track formation varies with
  - traffic flow,
  - traffic density, and
  - the relative geometry of aircraft, vehicles, fixed structures, radar, and multilateration sensor units

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False Track Examples

- The screen shows an icon where the controller sees nothing.
- The screen shows an airplane where the controller sees a truck.

ASDE-X

- Multilateration (MLAT)
  - Locates aircraft transponders, using time difference of arrival of the transponder's signal received at multiple sensors.
- Surface Radar
  - ASDE-3
  - Surface Movement Radar (SMR)
- Airport Surveillance Radar (ASR)
  - Covers Airport Approach

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Installation Challenge

- Minimize the number of false targets without losing real targets

- Since truth is usually not available, differentiating between real and false targets can be a time consuming process.

Real Airport Targets Characteristics

- Real targets enter and leave surveillance volume along its edge.
  - Planes enter / leave the gate areas
  - Planes depart / arrive on runways
  - Vehicles can also enter / leave via access roads

Aircraft Characteristics

- During their track life, aircraft typically travel on a runway.
- At sometime on a runway, they move quickly.
- Landing and departing aircraft have surface radar, ASR, and multilateration support during their track life.

Ground Vehicles

- Ground vehicles travel along taxiways, runways and access roads in the airport movement area.

- Get out of the way for aircraft.

Features Used for False Track Identification

- Track Life
  - How long did it live? How far did it travel?
- Track Proximity

  Were there other tracks ever near by? How many? For how long?
- Sensor Specific Features
  - SMR estimates target size
  - Multilateration provides unique transponder identifier
- Track Dynamics.
  - Where did the track go? How fast it did travel?

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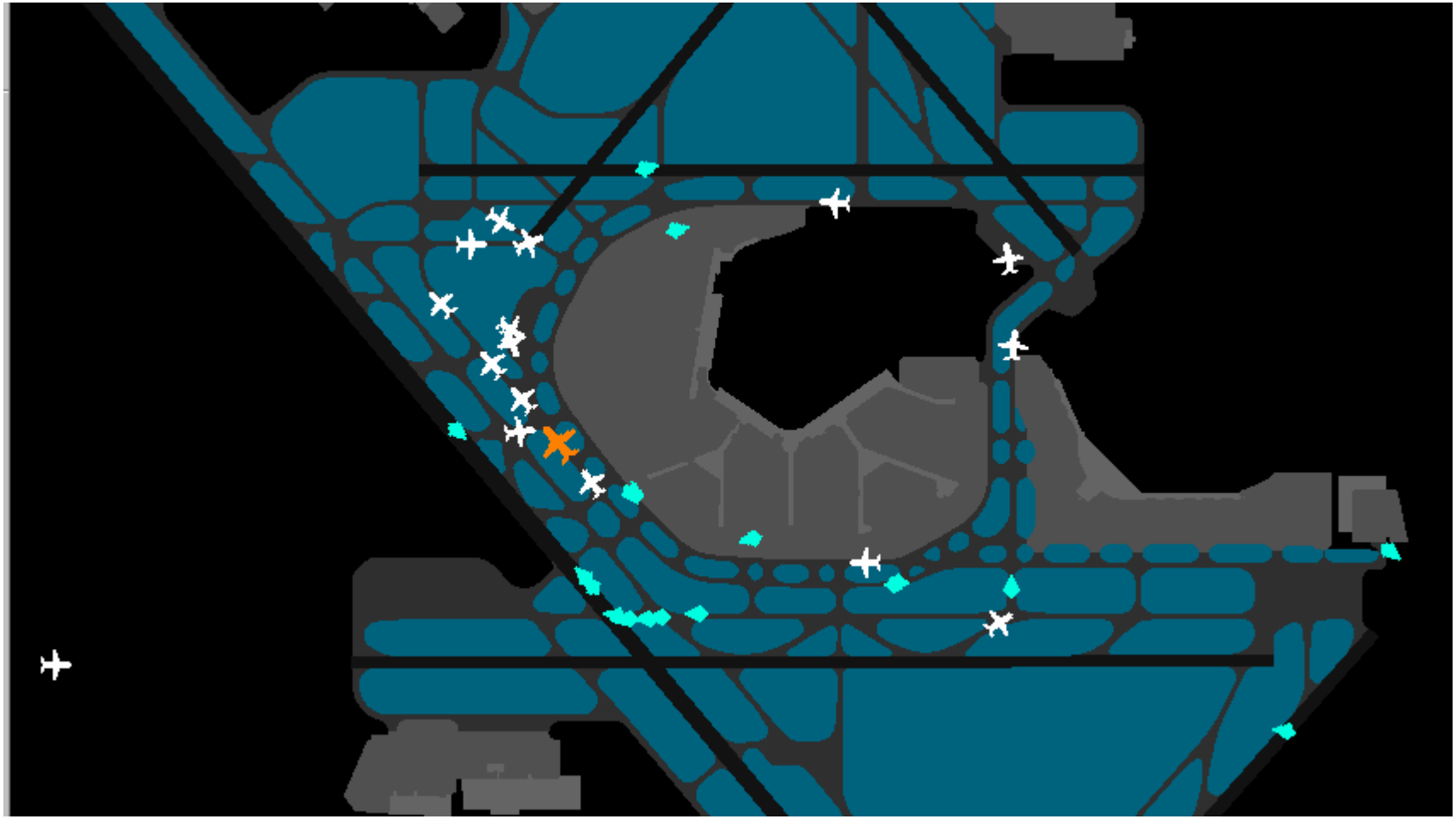
False Track Candidates

- Assigned High or Low Confidence
- Reviewed by Analysts

False Tracks?



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Some Rules Identifying Candidate False Tracks

- Other tracks pass through it.
- It starts on a runway.
- It is on the airport surface, but never had SMR support.
- Static SMR Multipath Rule
- Dynamic SMR Multipath Rule
- MLAT Multipath Rule
- ASR Misassociation Rule
- Misassociation Rule

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Static SMR Multipath Rule

- The track has SMR support,
- it is a small target,
- it ends near where it starts, and
- its average speed is below a slow speed threshold.

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Dynamic SMR MP Rule

- The track has SMR support,
- it is a small target,
- it is unsupported for multiple consecutive track updates,
- at least one of the unsupported updates is in a near runway region, and
- it is either unsupported for most of its life or its life is short.

Dynamic SMR MP Rule

- Not all false tracks are treated the same.
  - Those closer to or on a runway are more serious than those far from a runway.
- This rule misses dynamic SMR multipath tracks occurring outside the near runway region.
- Depending on time constraints, the analyst can expand or contract the near runway region to cover all taxiways or concentrate on the movement area closer to the runways.

MLAT MP Rule

- The track has MLAT support,
- it does not have a long series of consecutive MLAT updates,
- after the first MLAT supported update, less than a third of the track updates have MLAT support, and
- for much of its life, the track is unsupported by any sensor.

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ASR Misassociation Rule

- The track initiates with non-ASR sensor support,
- it has multiple updates before getting any ASR supported updates,
- it has only a few ASR supported updates, and
- most of its updates are unsupported.

Misassociation

- Airports can have a high target density.
- Misassociation occurs when sensor support for one target associates with the track of another target and causes the second track's position to be wrong.
- Misassociation rule has two parts.

Misassociation Part I

- First search pairs of tracks.

- If either track has many updates close to the other, the two tracks are flagged as a potential split track pair.

Potential Split Track Digression

- If one track starts where the tracks are first close to each other, and
- If the two are usually close for the remainder of either track's life, then
  - If both tracks have only radar support, the second track is a split track, else
  - If the first MLAT update occurs shortly after the second track starts, the second track is a dual.

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Misassociation Part II

Otherwise the pair is a misassociation if

- (1a) one of the tracks dies in the surveillance region, and
- (1b) after they are first close to each other, the tracks are close to each other more often than not, or
- (2) either track is an identified aircraft.

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Summary

- Some false track rules were presented
- More rules are provided in the Automated False Track Identification Paper submitted to the ICNS 2007 Conference Proceedings