Safety Performance and Analytics
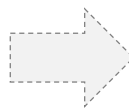
14 November 2018

Wallace Feerrar
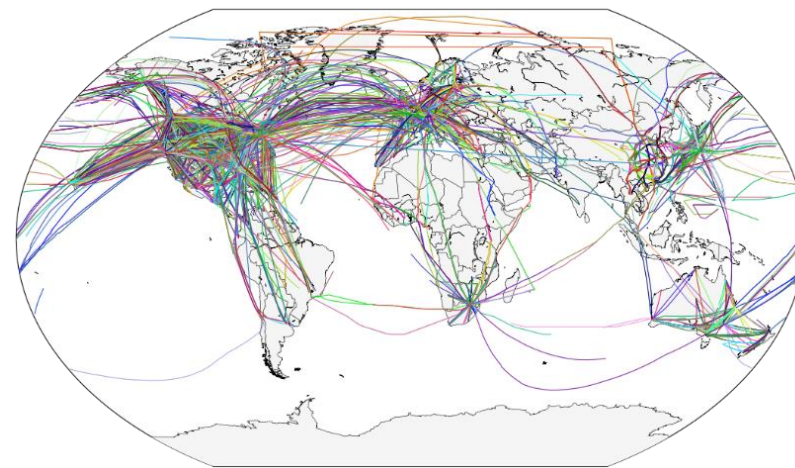**The MITRE Corporation**

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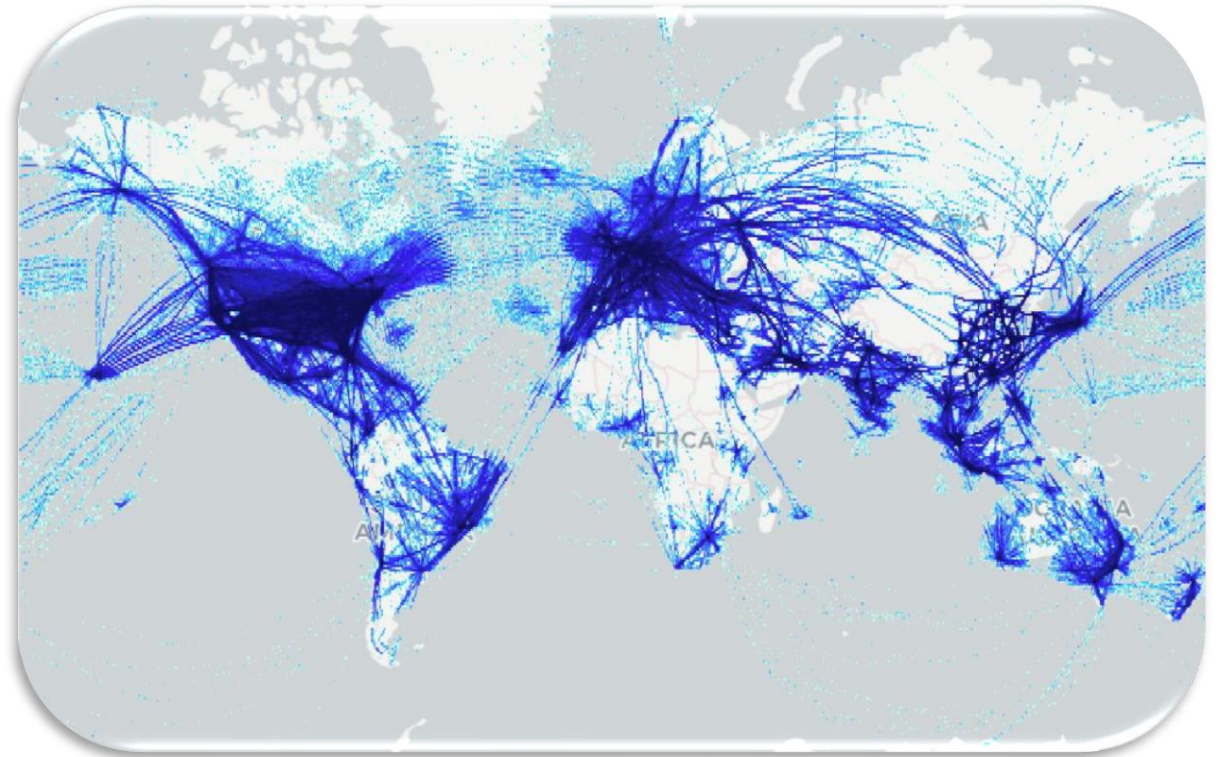
From…

Analog, "Silo'ed", Unaware

To…

Comprehensive, Data-Driven, Cognizance

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Operational Safety Performance Indicators

State Safety Programs

Reports of accidents / incidents from ATS, airlines

Accidents
Runway excursions
Runway incursions
TCAS RA events
Rejected takeoffs
Loss of separation

Operators

Airline reports of accidents / incidents

Accidents
Runway excursions
Runway incursions
TCAS RA events
Rejected takeoffs

Digital flight data

TCAS RA events
EPGWS alerts
Unstable approaches
Go around rate

Voluntary pilot reports

TCAS RA events
EPGWS alerts
Unstable approaches
Altitude deviations

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Operational Safety Performance Indicators

State Safety Programs

Reports of accidents / incidents from ATS, airlines

No counterpart for SSPs

Operators

Airline reports of accidents / incidents

Digital flight data

**Objective / quantitative
Comprehensive**

Voluntary pilot reports

**Provides context
Provides pilot perspective**

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Next Stage in the Evolution of Operational SPIs

State Safety Programs

Operators

Reports of accidents / incidents from ATS, airlines

Airline reports of accidents / incidents

Digital flight data

Voluntary pilot reports

Metrics from FLIGHT TRAJECTORIES + contextual information

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Global Flight Data

Sample Datasets in MGFI

- Aircraft Communications Addressing and Reporting System (ACARS)

- AirNav Flight Data

- Automated Surface Observing System (ASOS)

- Extended Meteorological Aviation Report (METAR)

- Flight Aware

- Flight Information Regions (FIRs)

- FlightRadar 24 Global Data Feed

- Geostationary Operational Environment Satellite -R Series (GOES-R) Mission

- Global Forecast System (GFS)

- National Elevation Dataset (NED)

- Rapid Update Cycle (RUC) / Rapid Refresh (RR)

- Shuttle Radar Topography Mission

- Special Instrument Approach Procedures

- Tropospheric Airborne Meteorological Data Reporting (TAMDAR)

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Analysis Using Flight Trajectories

Derive flight parameters

Energy state of aircraft on approach; missed approach; rejected takeoff

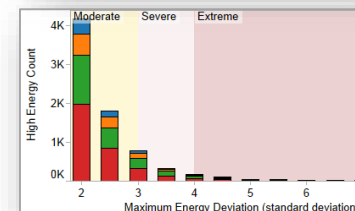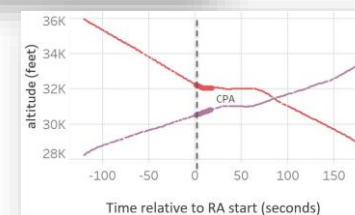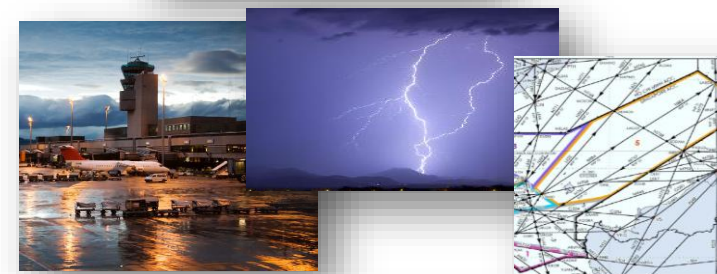**Fuse with contextual information**

Flight plans, weather, airspace boundaries, runway usage, required reports

Simulate and model (optional)

**TCAS RAs
EPGWS Mode 1, Mode 2 alerts**

Generate and analyze metrics

Rate of high energy events on approach; trend of missed approaches over time

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Benefits of Metrics from Flight Trajectories

State Safety Programs

Reports of accidents / incidents from ATS, airlines

Operators

Airline reports of accidents / incidents

Digital flight data

Voluntary pilot reports

Metrics from flight trajectories + contextual information

- **Objective, data driven, analytical**
- **Measures precursors, enabling monitoring of events before accident / incident**
- **Provides context for events and insight into local and system factors**
- **Supports common understanding of safety issue between SSP and operator**
- **Enables comparison across SSPs or operators**

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Missed Approach Initiation Points for Airport X

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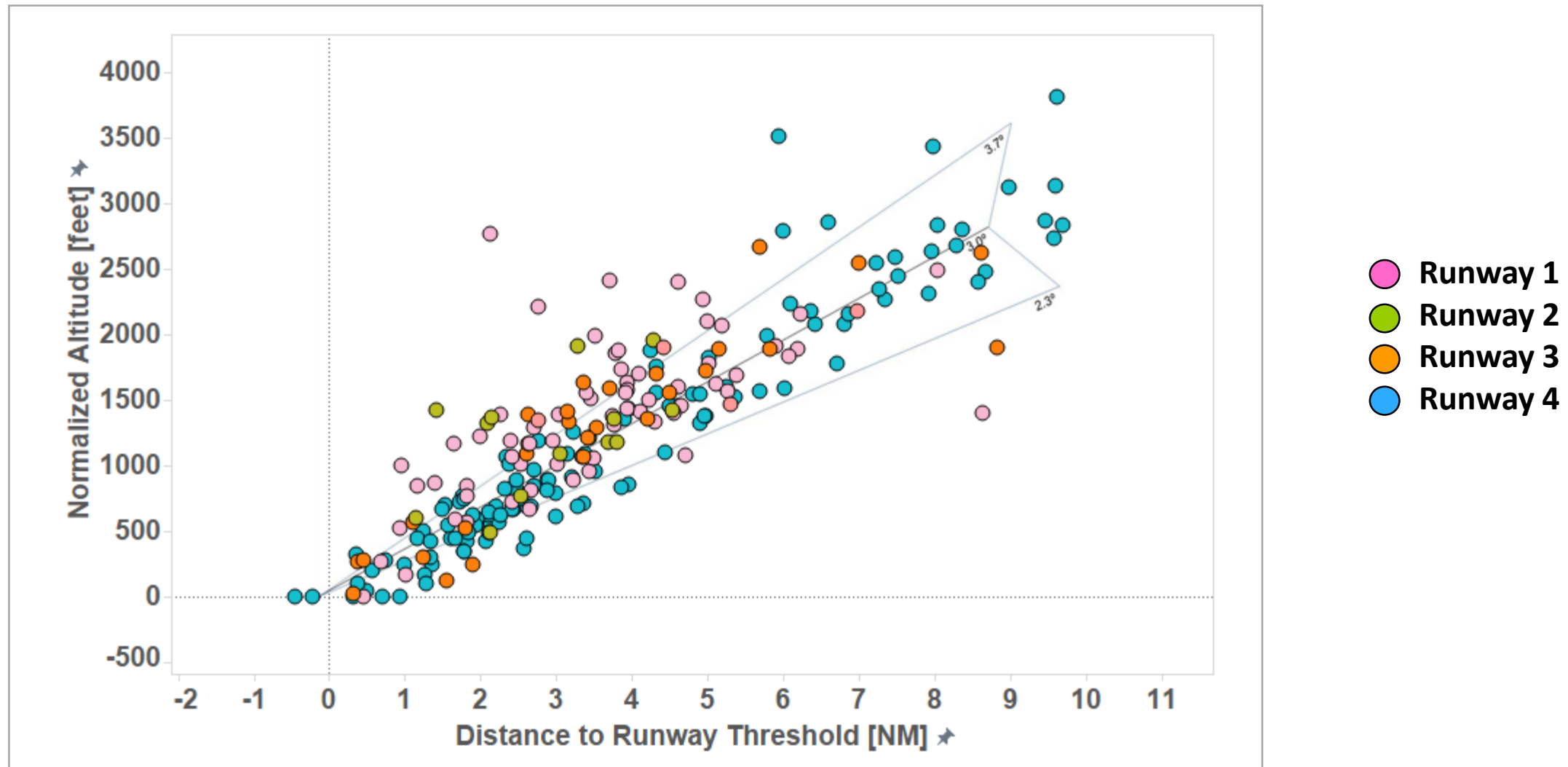
Ground Speed at Initiation of Missed Approach for Airport X

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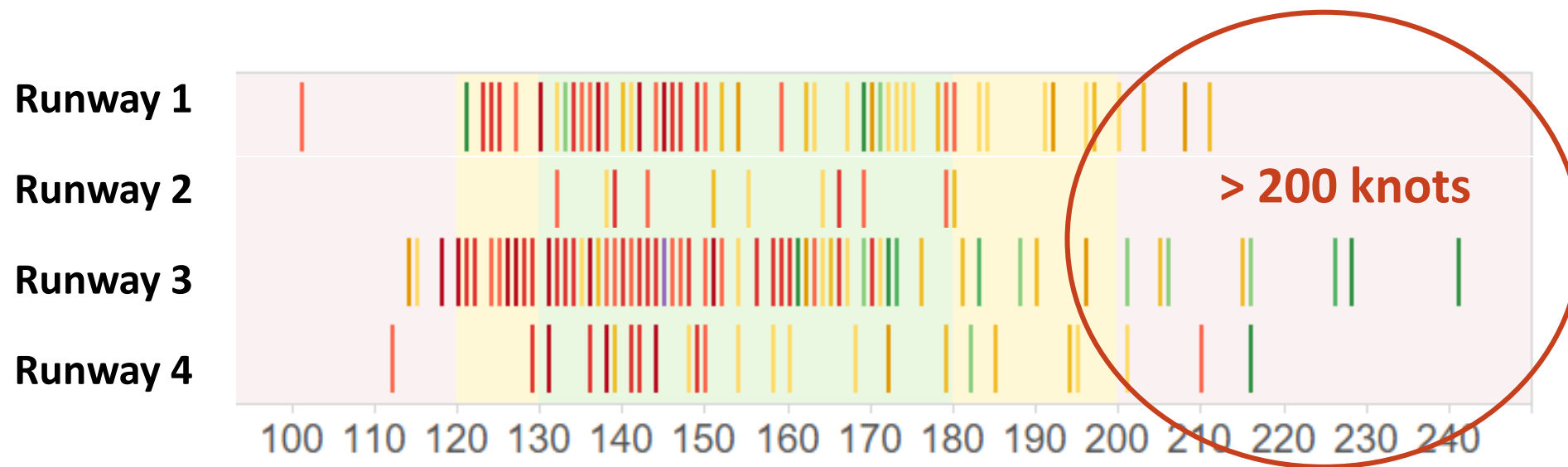
Missed Approach Initiation Points with Ground Speed > 200 knots at Airport X

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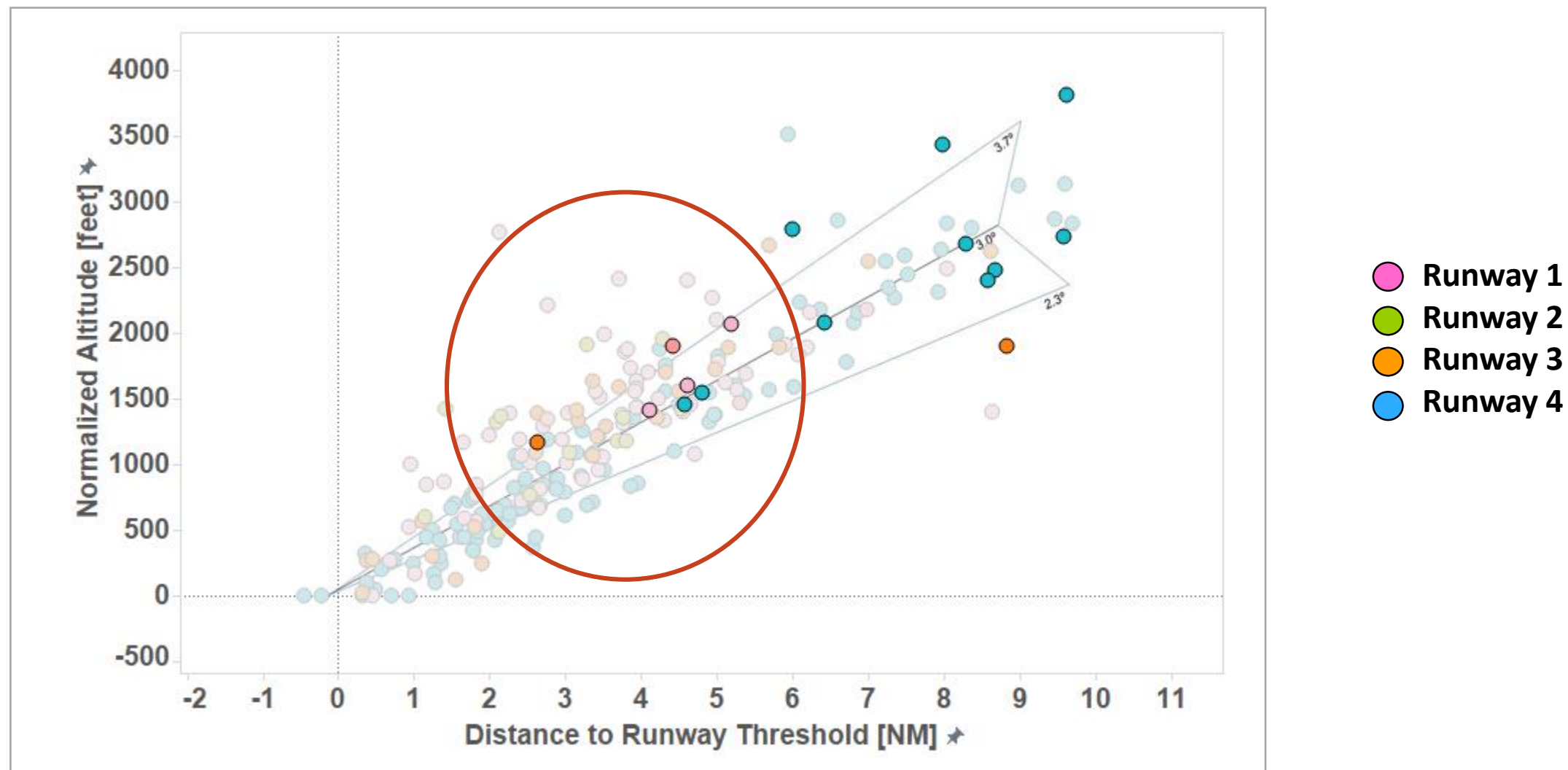
Comparing Missed Approach Rates Across All APAC Airports

Flights	Events	
42,430	1,037	24.4
25,587	121	4.7
20,155	87	4.3
29,270	123	4.2
31,125	128	4.1
20,382	81	4.0
88,416	339	3.8
32,901	124	3.8
87,654	325	3.7
36,890	136	3.7
20,932	74	3.5
33,322	114	3.4
62,139	202	3.3
137,327	443	3.2
90,285	291	3.2
35,117	104	3.0
25,776	74	2.9
141,033	395	2.8
91,554	256	2.8
128,825	356	2.8
20,139	54	2.7
25,435	67	2.6
113,498	290	2.6
27,327	69	2.5
26,347	61	2.3
32,245	74	2.3
47,249	105	2.2
21,458	47	2.2
75,502	155	2.1
67,562	135	2.0
29,035	57	2.0
118,136	230	1.9
53,112	103	1.9
93,280	170	1.8
157,237	280	1.8
29,339	52	1.8
46,976	83	1.8
27,457	48	1.7
210,641	355	1.7
64,545	102	1.6
22,375	34	1.5
63,380	94	1.5
87,775	124	1.4
147,979	209	1.4
48,219	68	1.4
44,238	61	1.4
43,601	60	1.4
35,210	48	1.4
120,646	163	1.4
55,321	74	1.3
78,795	104	1.3
37,574	49	1.3
142,474	176	1.2
102,856	123	1.2

Airport X

1.9

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Moving Forward

- **New quantitative SPIs and analytics are within reach**

- **Complementary information will be available to interpret traditional reports and metrics**

- **Comparisons across airports, airlines, and ANSPs will be possible to assist in establishing safety priorities**

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