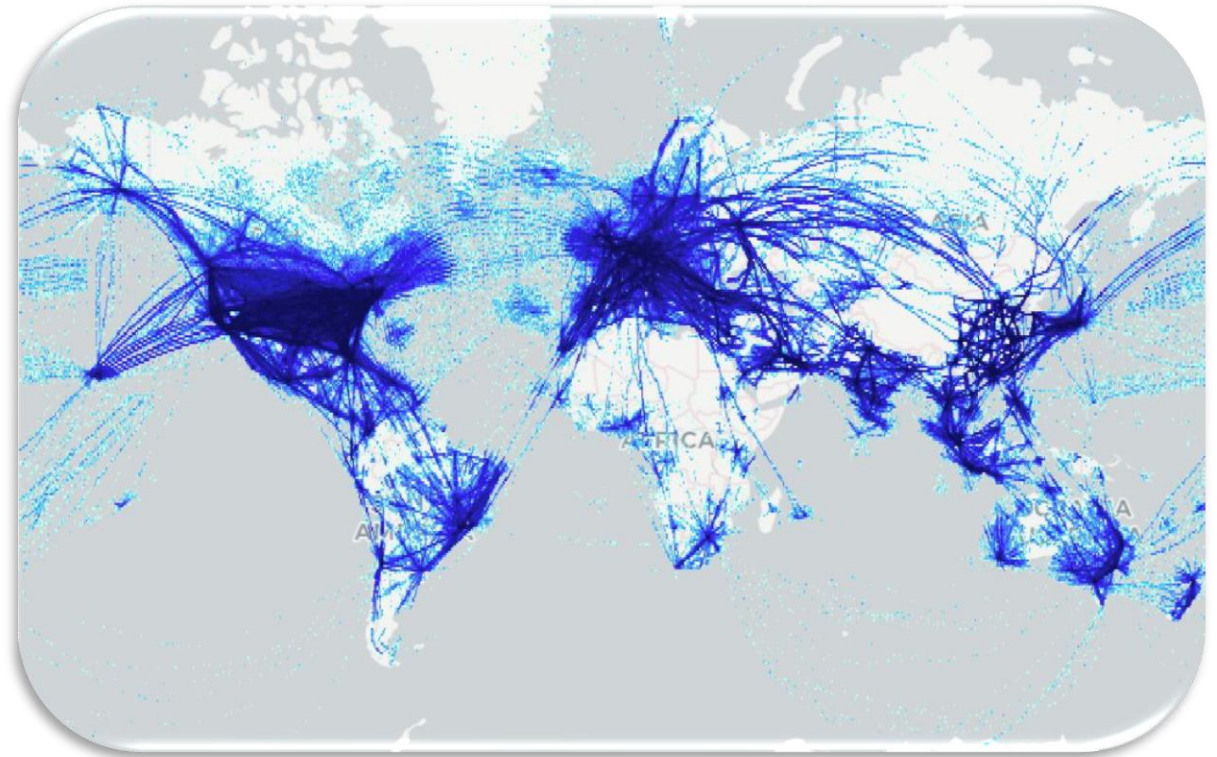


# Safety Performance and Analytics

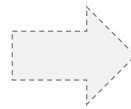
14 November 2018

Wallace Feerrar  
The MITRE Corporation



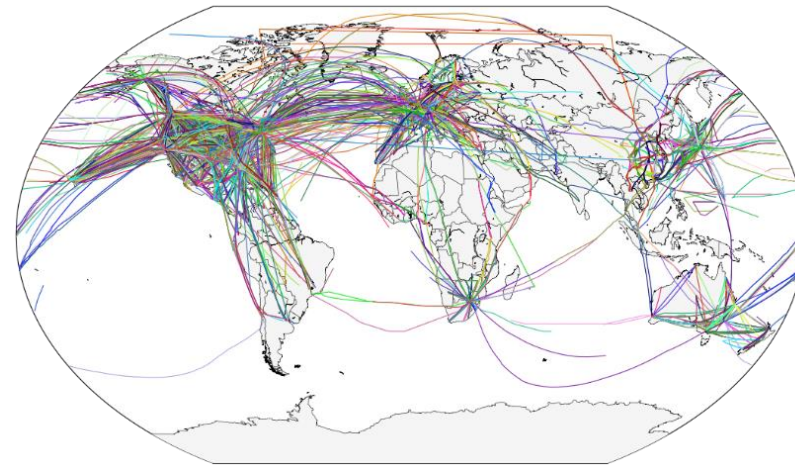
# From...

*Analog, "Silo'ed", Unaware*



# To...

*Comprehensive, Data-Driven, Cognizance*



# 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

Digital flight data

Voluntary pilot reports

- Accidents
- Runway excursions
- Runway incursions
- TCAS RA events
- Rejected takeoffs

- TCAS RA events
- EPGWS alerts
- Unstable approaches
- Go around rate

- TCAS RA events
- EPGWS alerts
- Unstable approaches
- Altitude deviations

# 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

Voluntary pilot reports

Objective / quantitative  
Comprehensive

Provides context  
Provides pilot perspective

# Next Stage in the Evolution of Operational SPIs

## 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

# 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)

# Analysis Using Flight Trajectories

Derive flight parameters

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

Fuse with contextual information

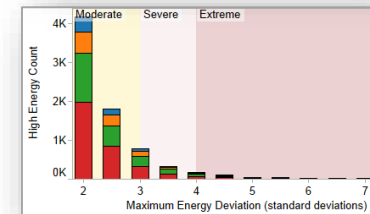
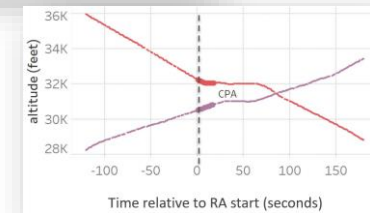
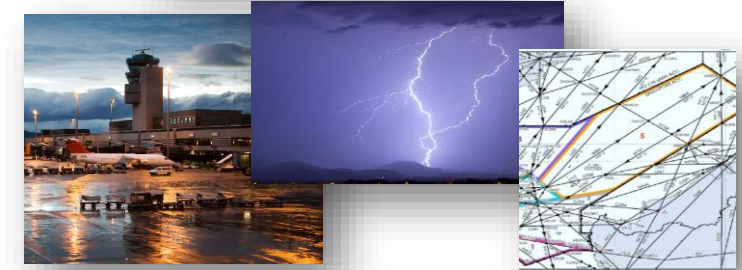
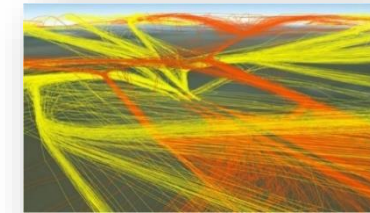
Flight plans, weather, airspace boundaries, runway usage, required reports

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



# 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

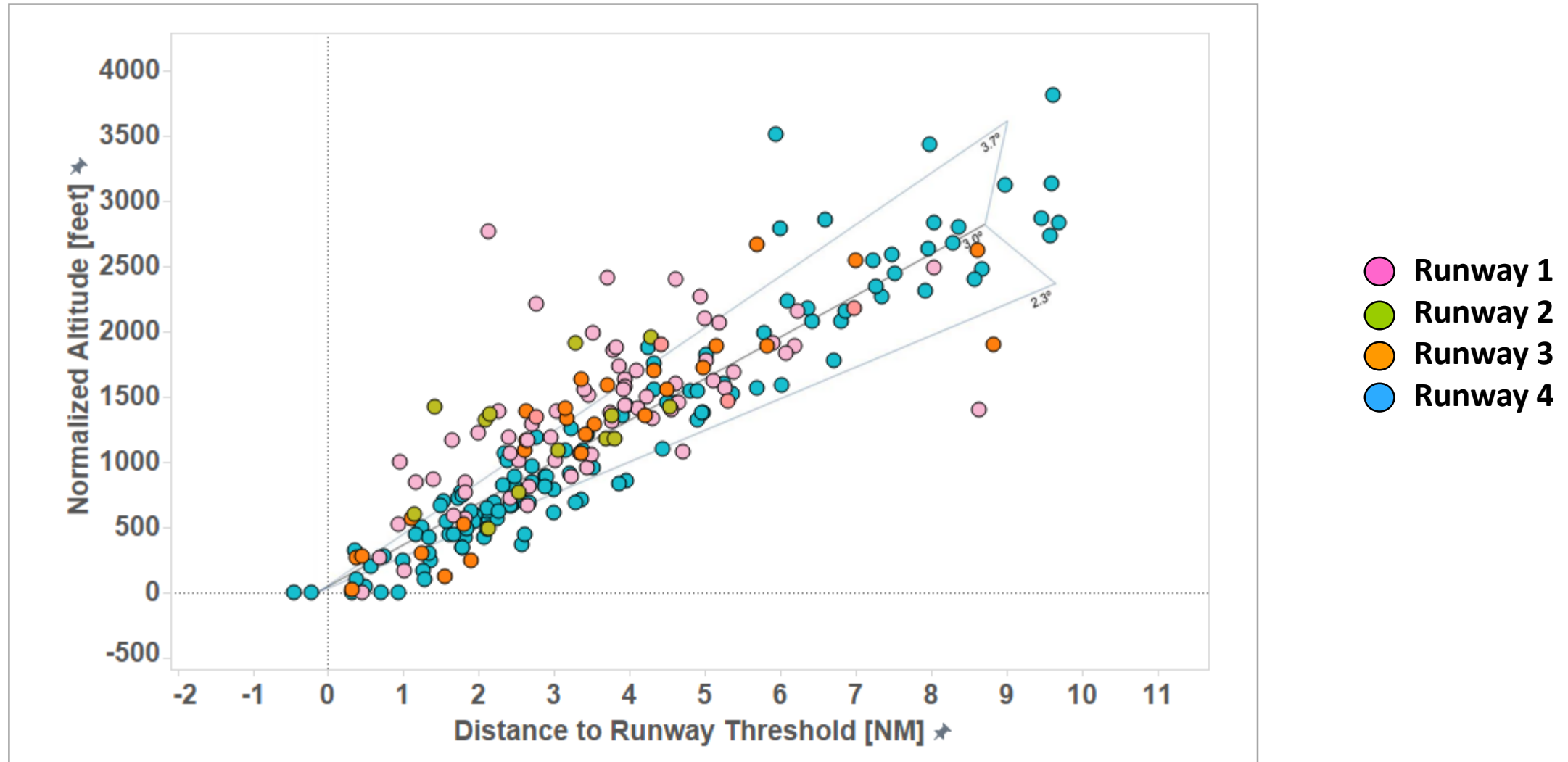
Voluntary pilot reports

Metrics from flight trajectories  
+ contextual information

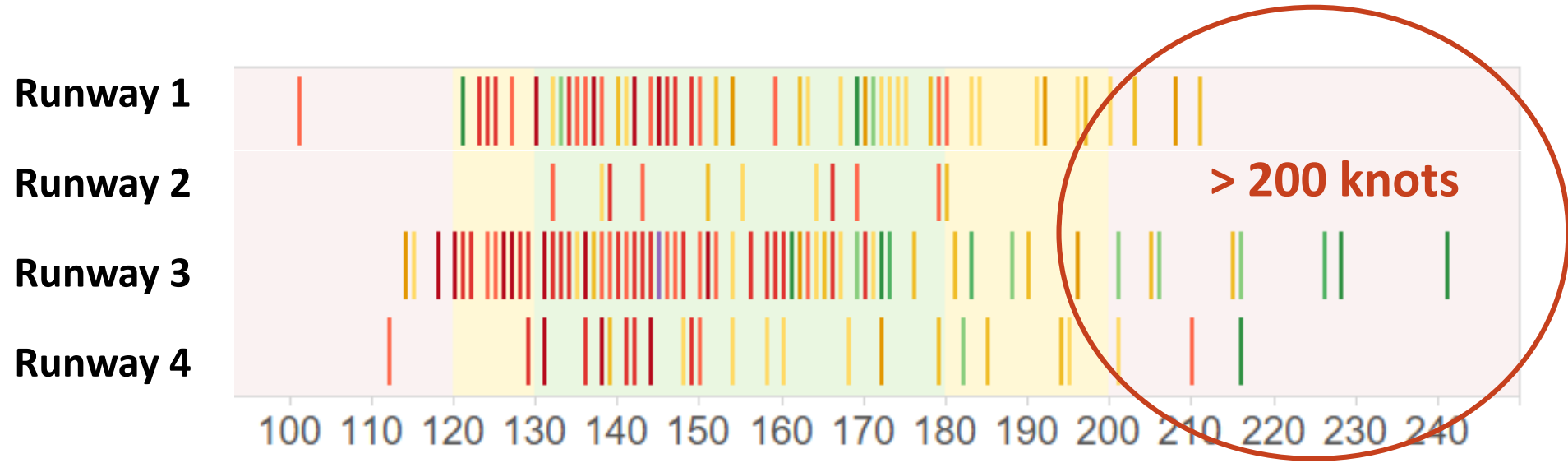
- **Objective, data driven, analytical**
- **Measures precursors, enabling monitoring of events before accident / incident**
- **Provides context for events and insight into local and system factors**
- **Supports common understanding of safety issue between SSP and operator**
- **Enables comparison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



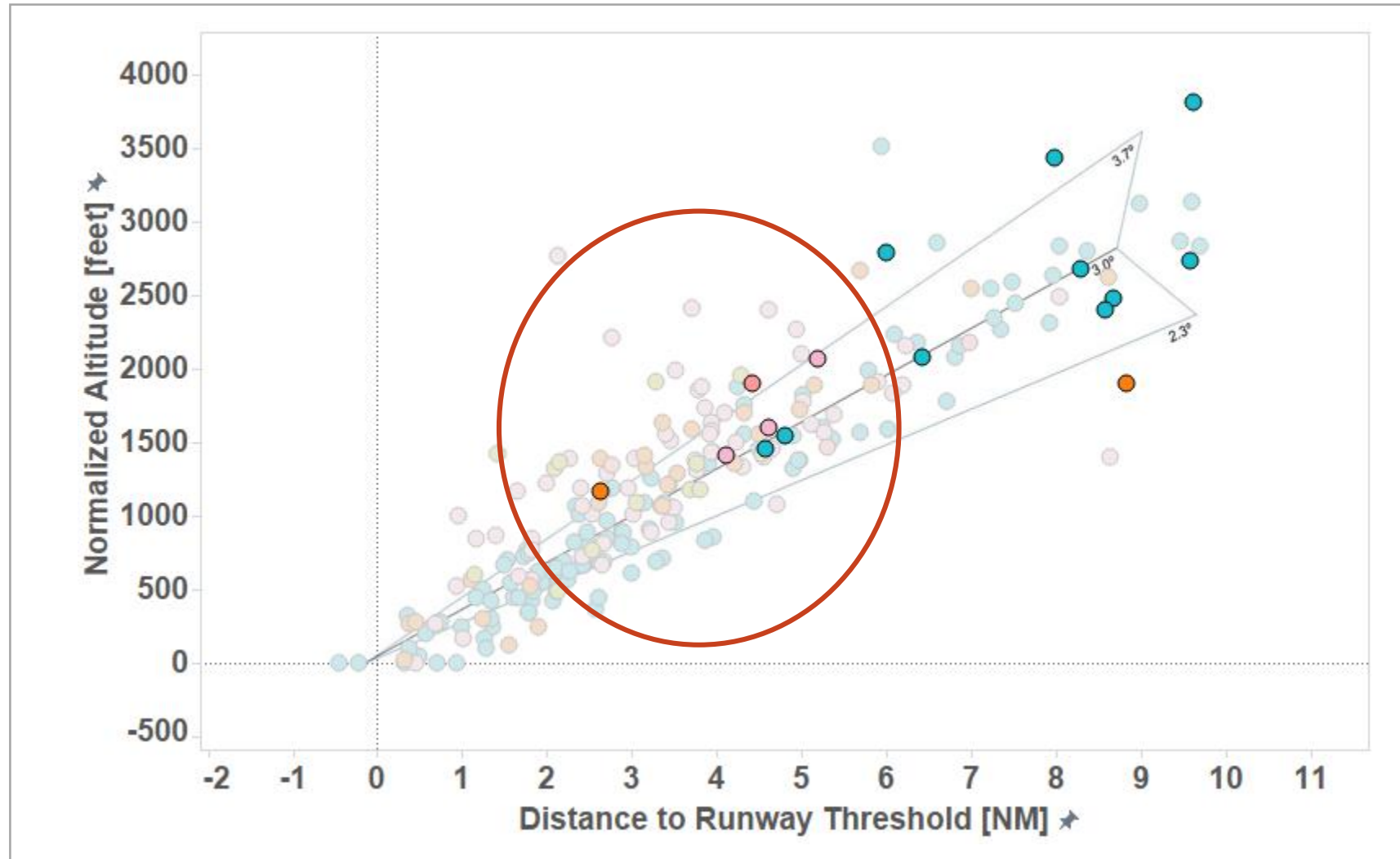
# Missed Approach Initiation Points for Airport X



# Ground Speed at Initiation of Missed Approach for Airport X

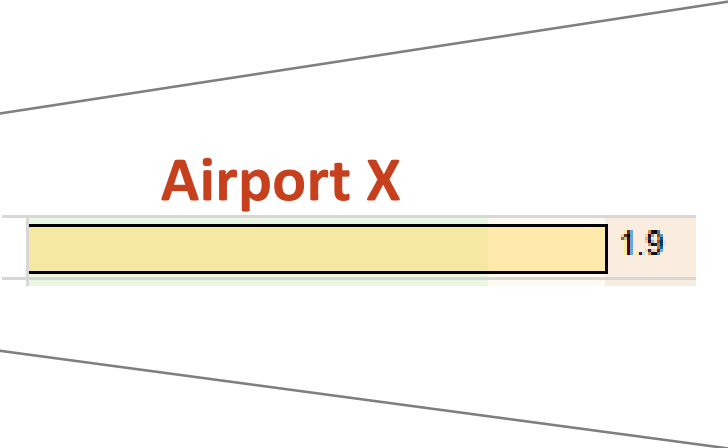
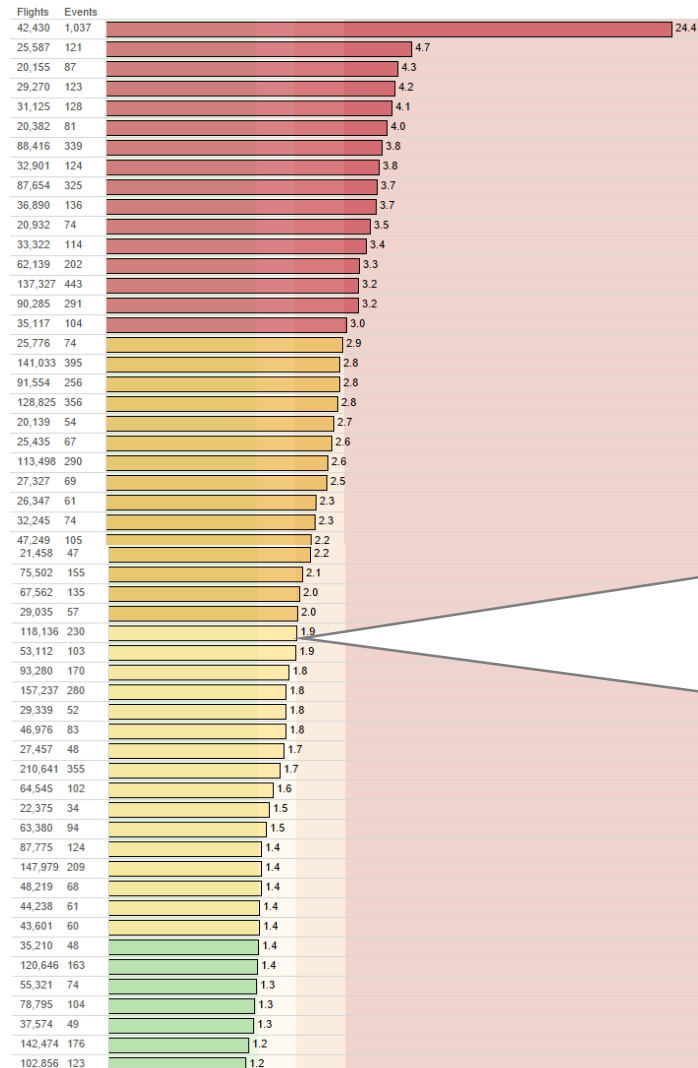


# Missed Approach Initiation Points with Ground Speed > 200 knots at Airport X



- Runway 1
- Runway 2
- Runway 3
- Runway 4

# Comparing Missed Approach Rates Across All APAC Airports



# Moving Forward

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- **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**