

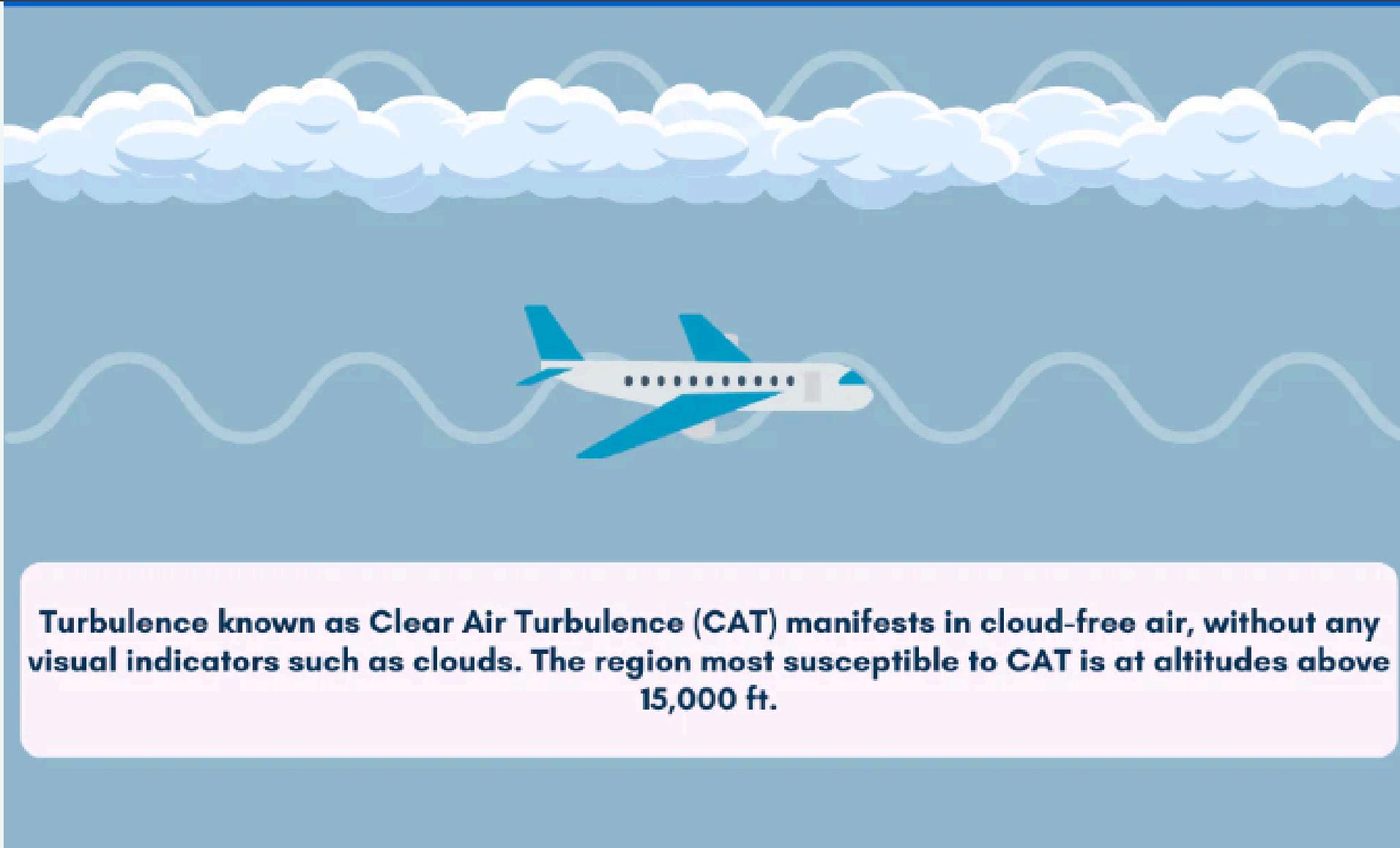
REAL-TIME CAT PREDICTION VIA CABIN SENSOR AND GROUND SYSTEM

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8 years of experience as a Aviation Solution Manager

WHAT IS THE CAT?



Turbulence known as Clear Air Turbulence (CAT) manifests in cloud-free air, without any visual indicators such as clouds. The region most susceptible to CAT is at altitudes above 15,000 ft.

CHALLENGE

1

Difficulty in Predicting

CAT occurs in cloudless skies, making it difficult to detect visually.

2

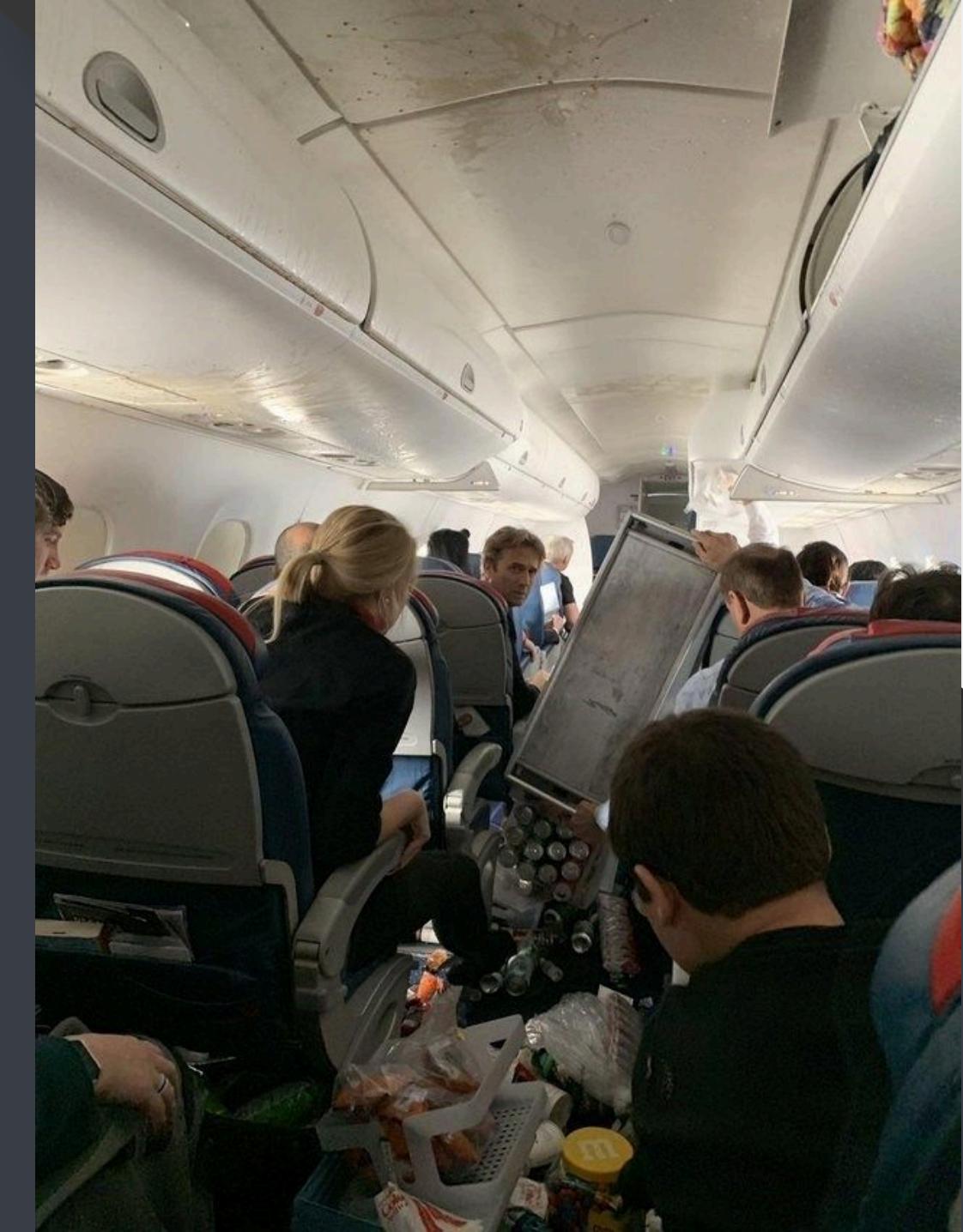
Safety Risk

Sudden turbulence can cause injuries and anxiety among passengers and crew.

3

Increased Cost

CAT disrupts flight paths, increases fuel consumption, and impacts schedules.



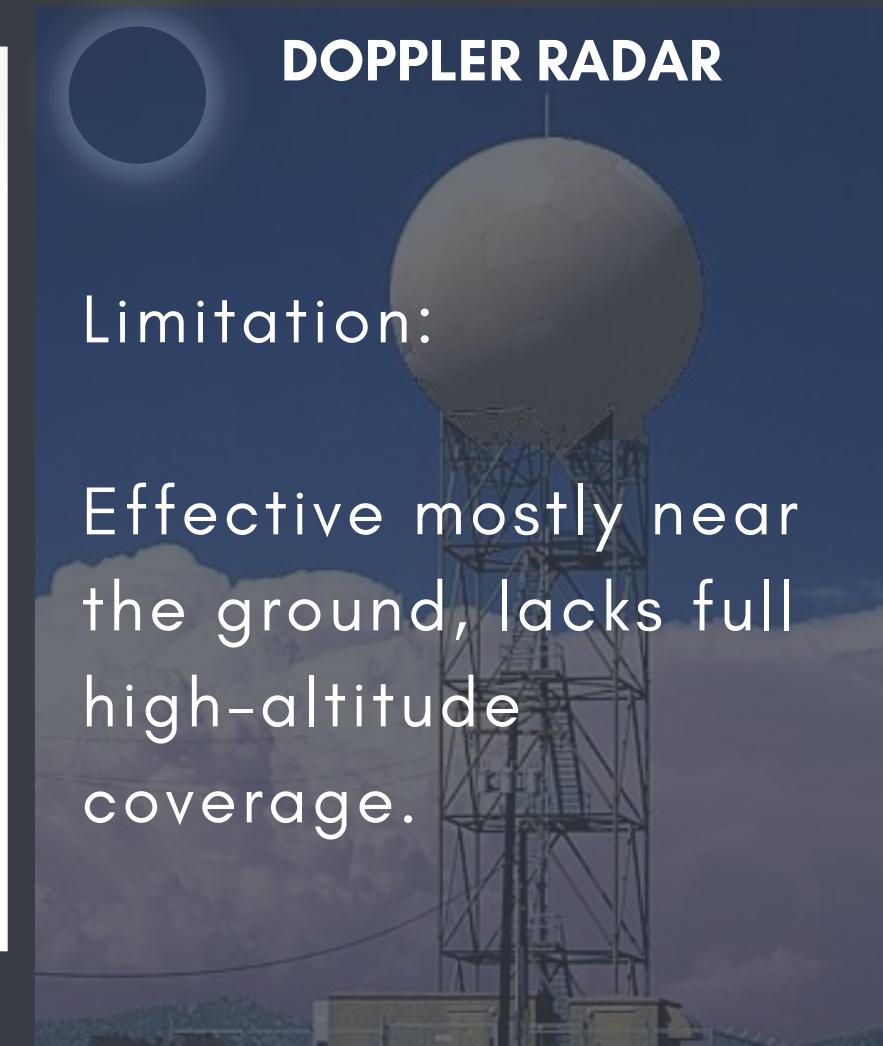
LIMITATIONS OF CURRENT DETECTION SYSTEMS



WIND PROFILER RADAR

Limitation:

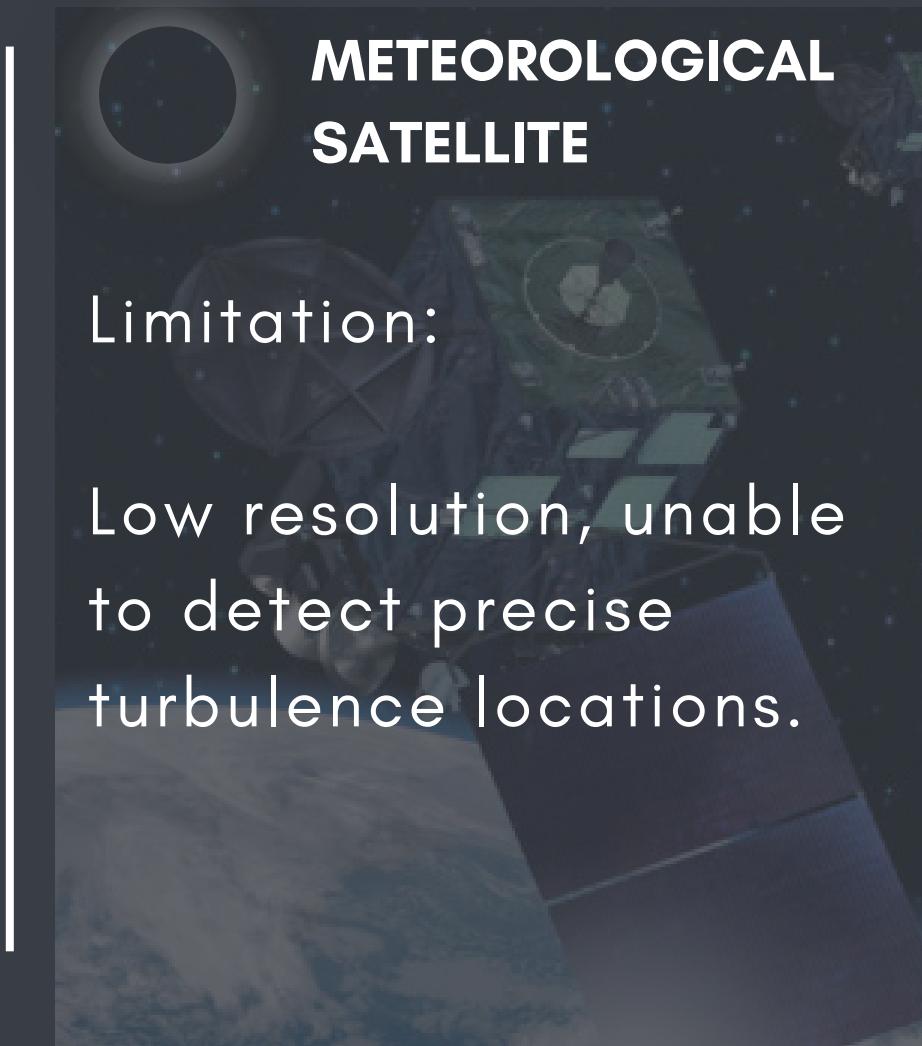
Limited coverage, only detects winds near the ground.



DOPPLER RADAR

Limitation:

Effective mostly near the ground, lacks full high-altitude coverage.



METEOROLOGICAL SATELLITE

Limitation:

Low resolution, unable to detect precise turbulence locations.



COMBINING CABIN SENSOR DATA WITH GROUND-BASED SYSTEMS

- 1 Real-time Data Collection
- 2 Data Transmission
- 3 Data Fusion
- 4 Predicting

DATA COLLECTION FROM PAD DEVICES

ACCELEROMETER

ACCELERATION DATA IN EACH DIRECTION

GYROSCOPE

ANGULAR VELOCITY DATA

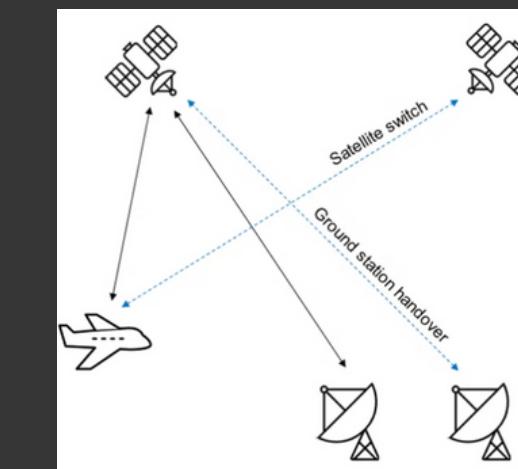


DATA TRANSMISSION



SATELLITE COMMUNICATION

HIGH-BANDWIDTH SATELLITE COMMUNICATION
FOR GLOBAL COVERAGE



ATG NETWORKS

USE GROUND BASE STATIONS TO ACHIEVE
GROUND TO AIR NETWORK INTERCONNECTION

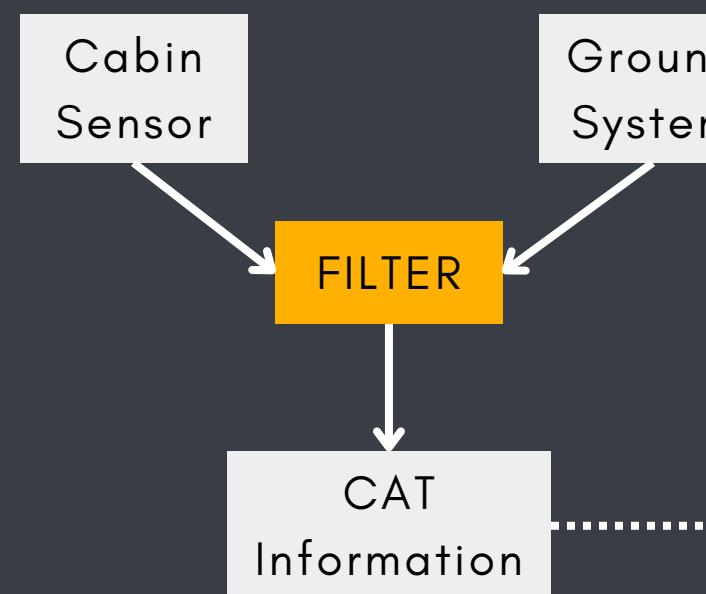


DATA FUSION



KALMAN FILTER

Used to filter and integrate real-time PAD sensor data with ground data, providing continuous estimates of CAT severity.



MACHINE LEARNING MODELS

Algorithms like Support Vector Machines (SVM) or Neural Networks analyze historical and real-time data to identify patterns, improving CAT prediction accuracy.



DETECTION AND PREDICTION IN REAL-TIME



DATA ANALYSIS

AI algorithms process fused data to identify potential turbulence zones.

RISK ASSESSMENT

Predictive models calculate turbulence probability and severity.

ALERT GENERATION

System issues timely warnings to pilots and air traffic control.

AUTOMATED RESPONSE

Aircraft systems adjust flight parameters to mitigate turbulence effects.

DETECTION AND PREDICTION IN REAL-TIME



ENHANCED SAFETY

Proactive turbulence avoidance reduces passenger injuries and anxiety.



OPERATIONAL EFFICIENCY

Optimized flight paths lead to significant fuel savings and reduced emissions.



PREDICTIVE IMPROVEMENTS

Long-term data collection enhances turbulence models and forecasting accuracy.

CONCLUSION

We explored how PAD sensor data, combined with ground-based weather systems, can improve CAT prediction accuracy, providing benefits in safety, comfort, and operational efficiency.

THANK YOU