



United Arab Emirates



الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY

Air Accident Investigation Sector



United Arab Emirates



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Unreliable Airspeed Indication

Airbus A340-600, UAE Operator, 3 Feb 2013 at 0049 UTC

رؤيتنا: منظومة طيران مدني آمنة ورائدة ومستدامة
OUR VISION: A LEADING, SAFE, SECURE AND SUSTAINABLE CIVIL AVIATION SYSTEM

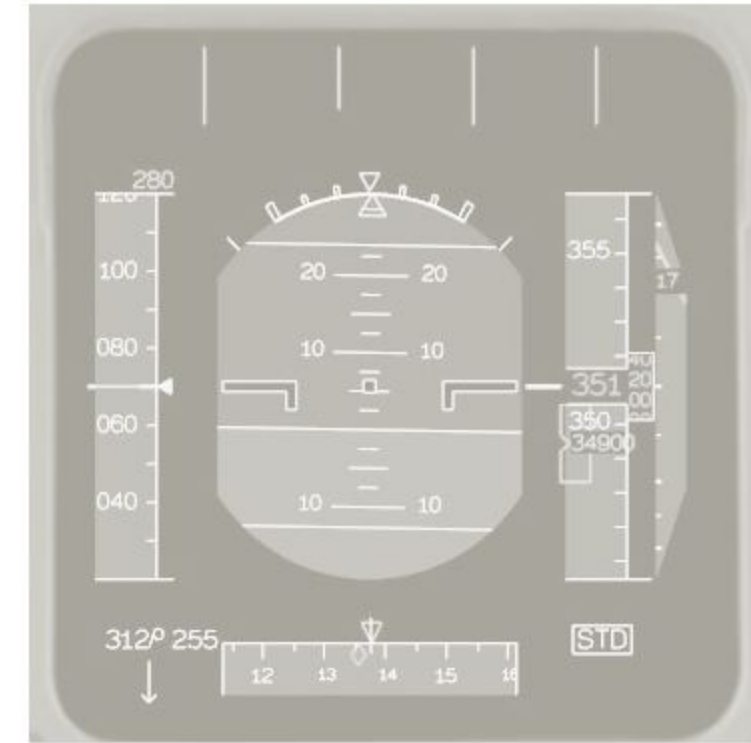
Unreliable Airspeed Indication

Notification to GCAA

FDR preservation

Notification to ICAO & BEA (State of Design & Manufacture)

Accredited Representative



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Almost no or few green returns

Gain: AUTO

Radalt Tilt Angle: -0.8

Returns became stronger from mainly black to 80% green, then from green to 80% yellow

Suddenly, the displayed radar returns depicted 2-3 millimeters of solid red around the aircraft symbol

ISSUED BY WAFC LONDON
 FIXED TIME PROGNOSTIC CHART
 (ENT) EY0460: AUH -> MEL
 FL 250-630
 VALID 00 UTC 03 Feb 2013

CB IMPLIES TS, GR, MOD OR SEV
 TURB AND ICE

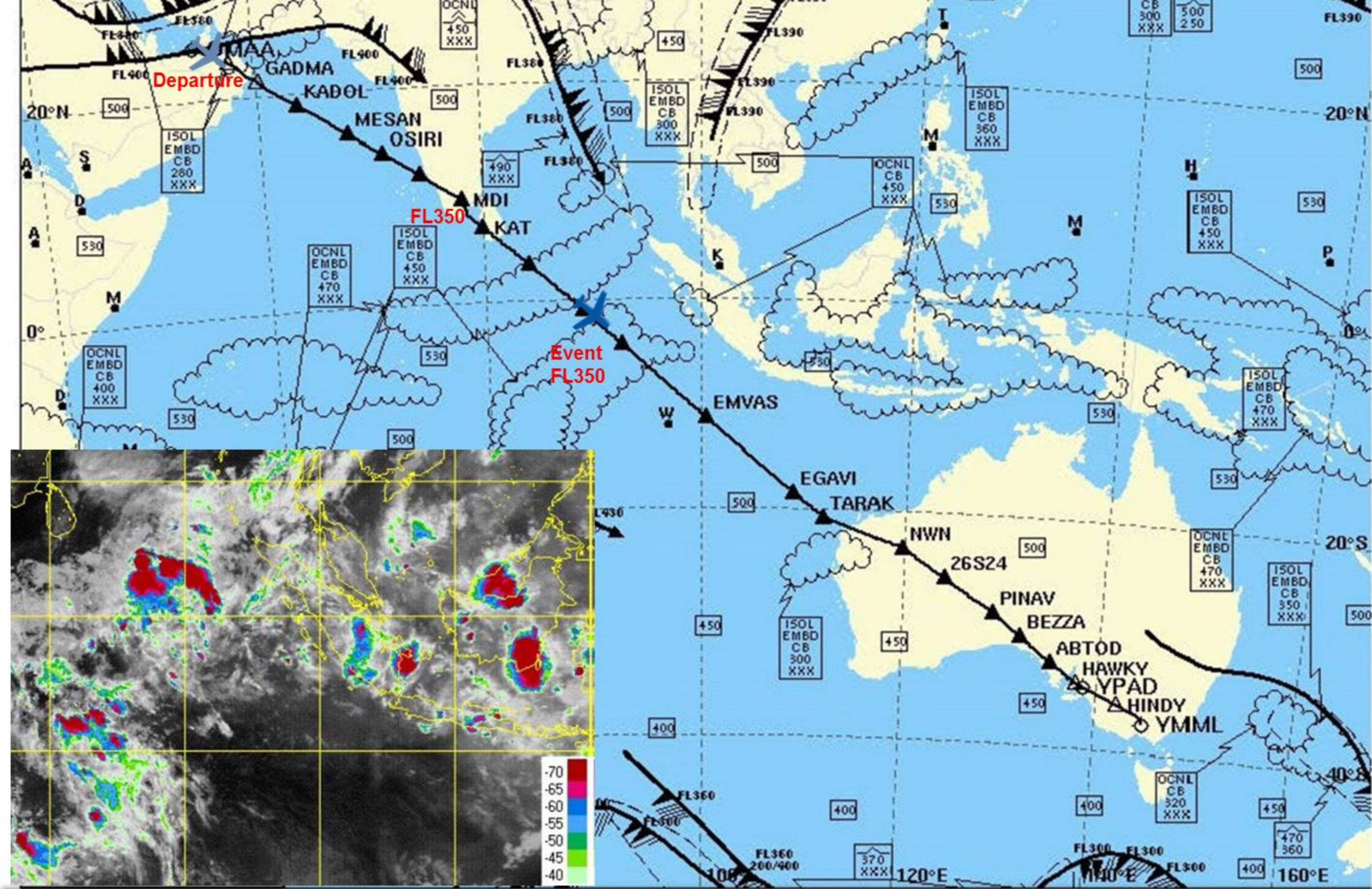
UNITS USED: HEIGHTS IN FLIGHT LEVELS
 CHECK SIGMET, ADVISORIES, ASHTAM
 AND NOTAM FOR VOLCANIC ASH



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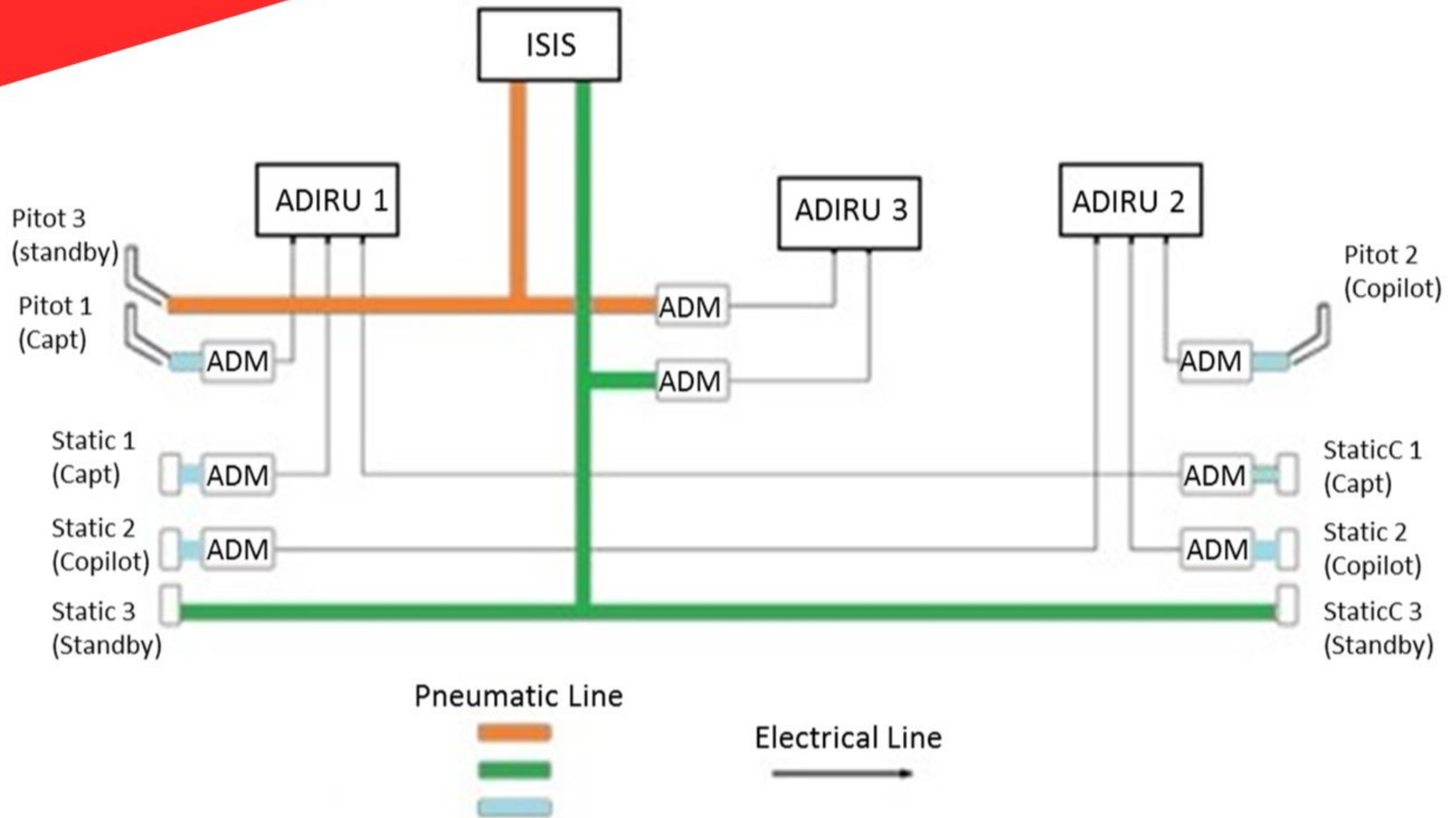


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Airspeed Measuring System

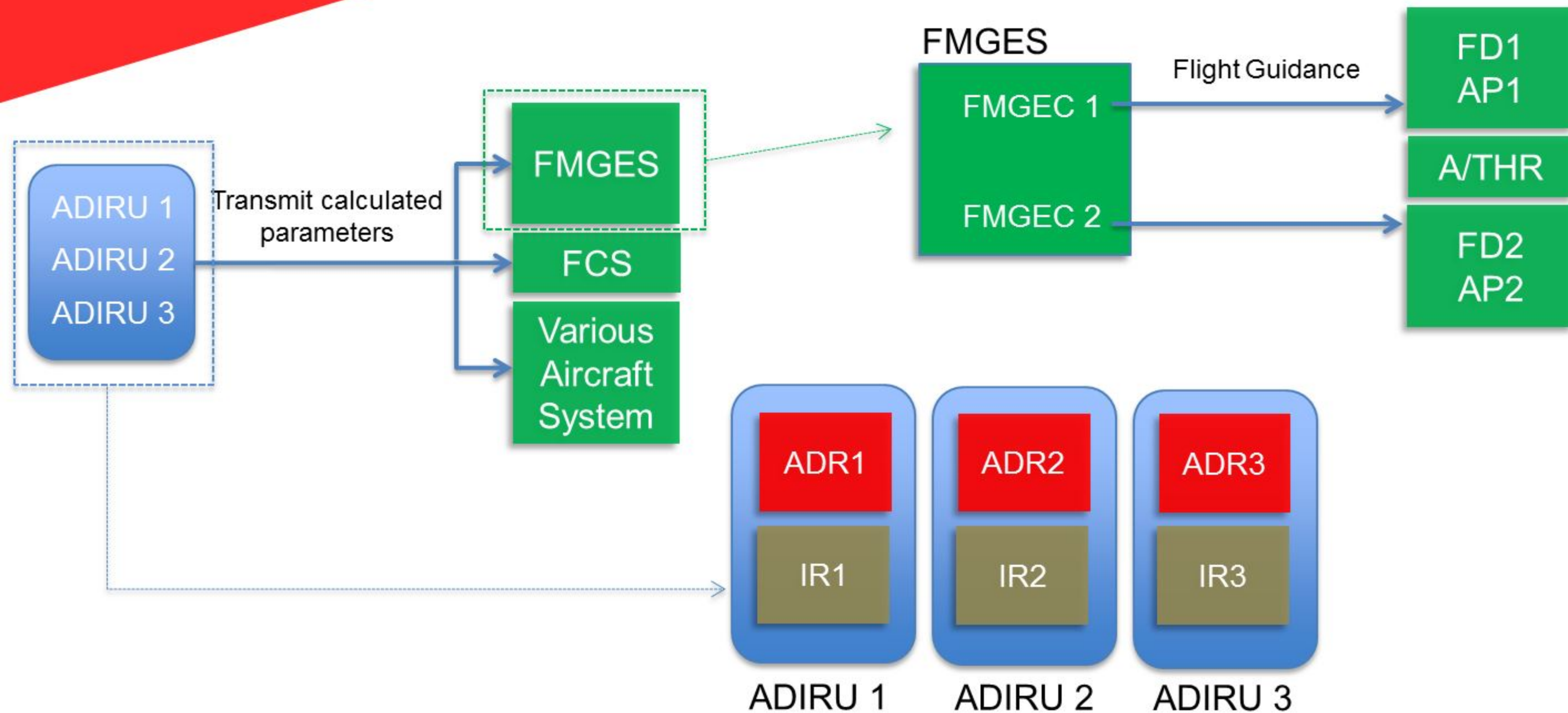


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Flight Guidance System



Flight Guidance System

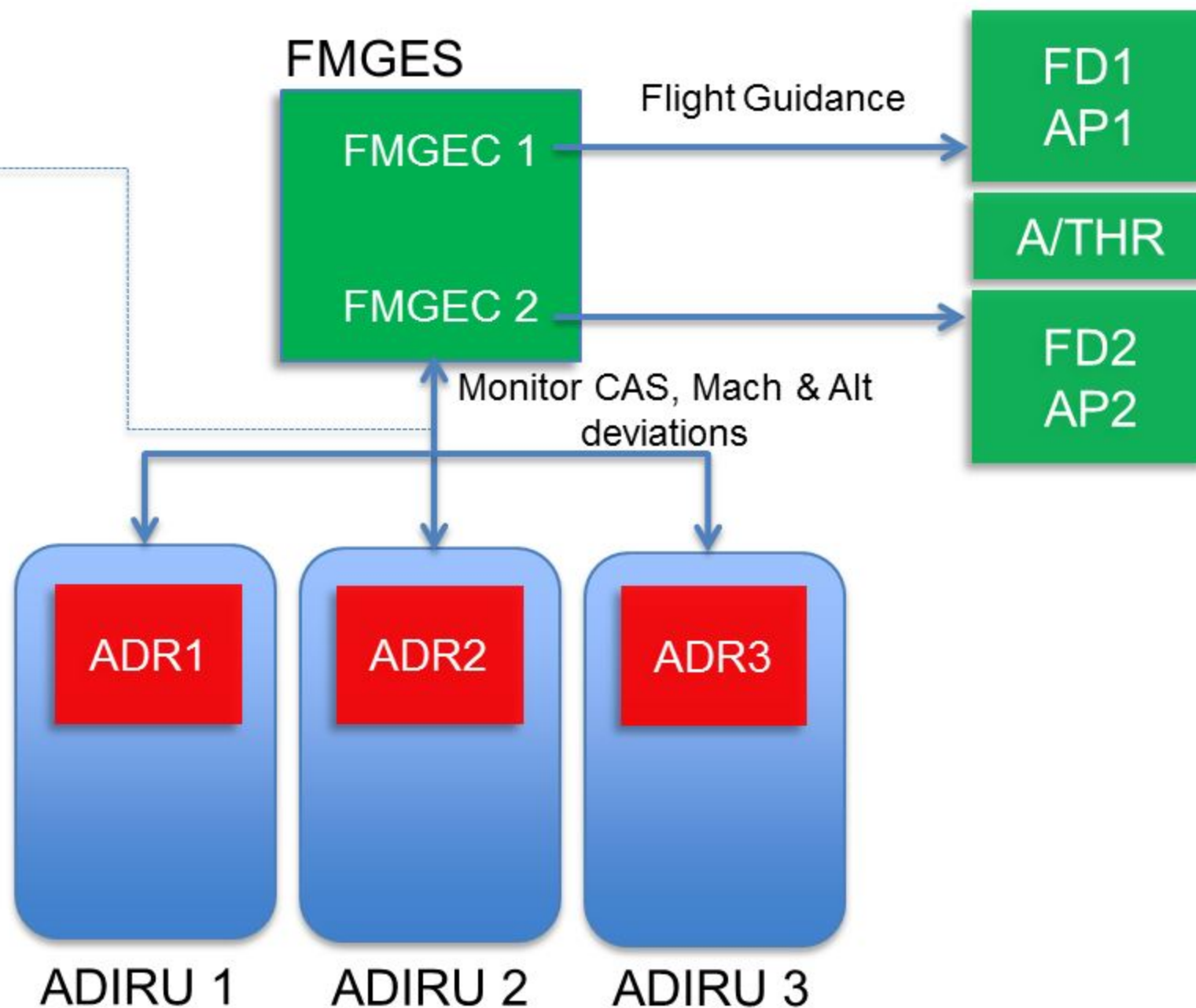
FMGEC – ADR Monitoring (AF Disconnection Logic)

If one ADR output is out of tolerance, then FMGECs reject this ADR output

If one of the two remaining ADR outputs is out of tolerance, then FMGECs disconnect AP, A/THR & FD automatically

At least two valid ADRs return to within tolerance, the re-engagement of FDs becomes possible

When three ADRs return to within tolerance, the associated AP and A/THR become available again, and the flight crew may re-engage them manually



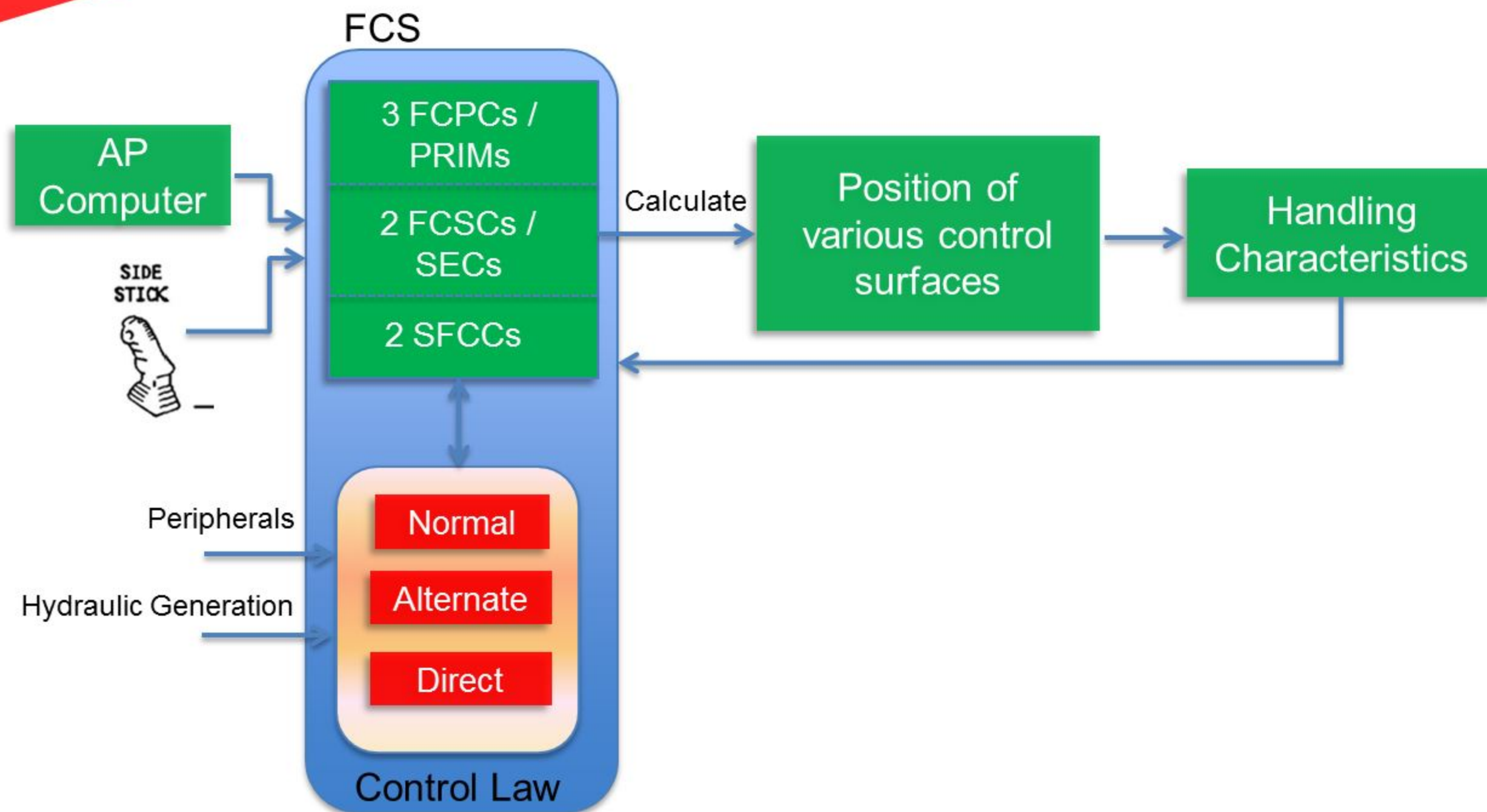
FD, A/THR & AP logics are in the FMGECs



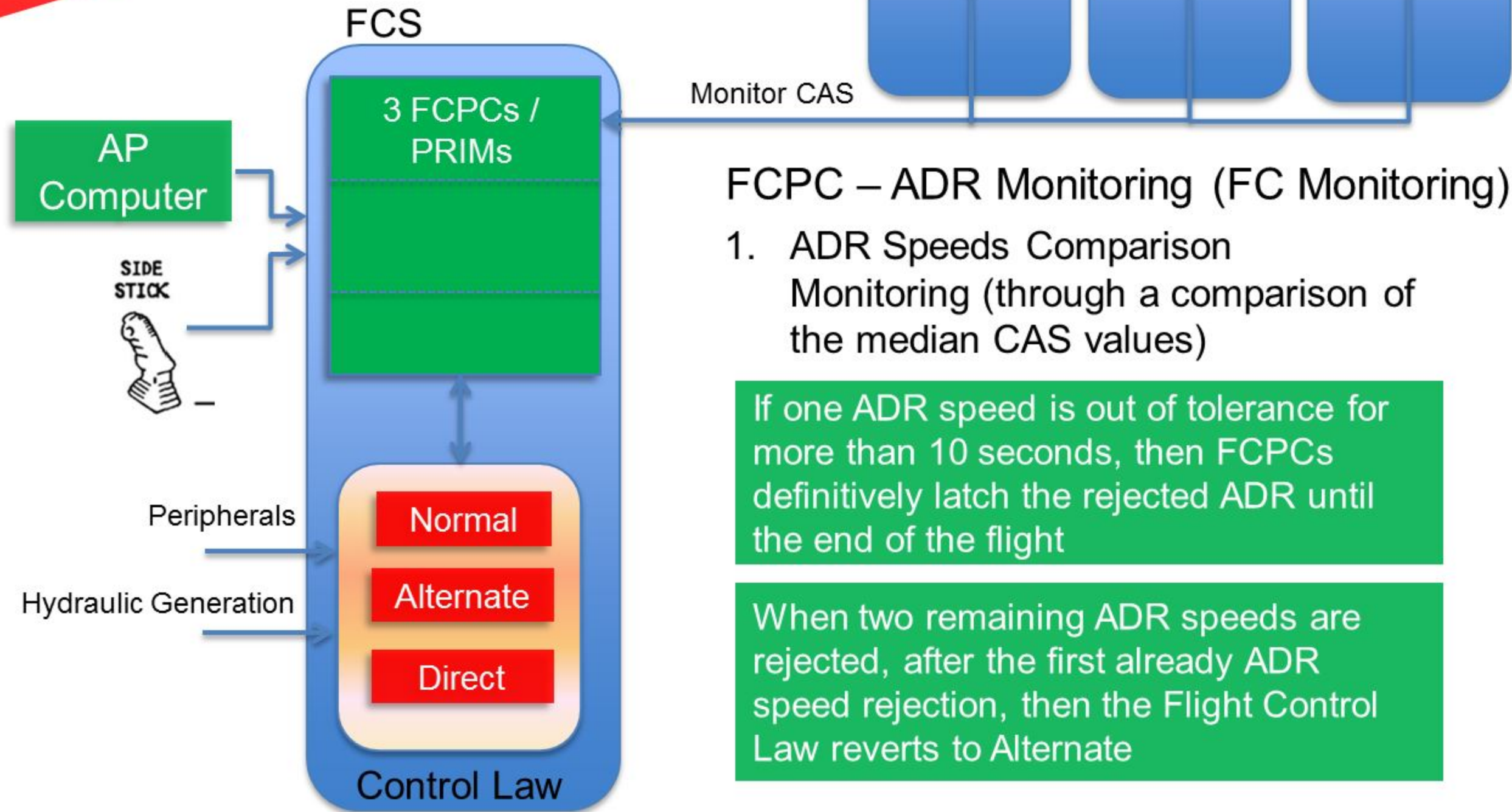
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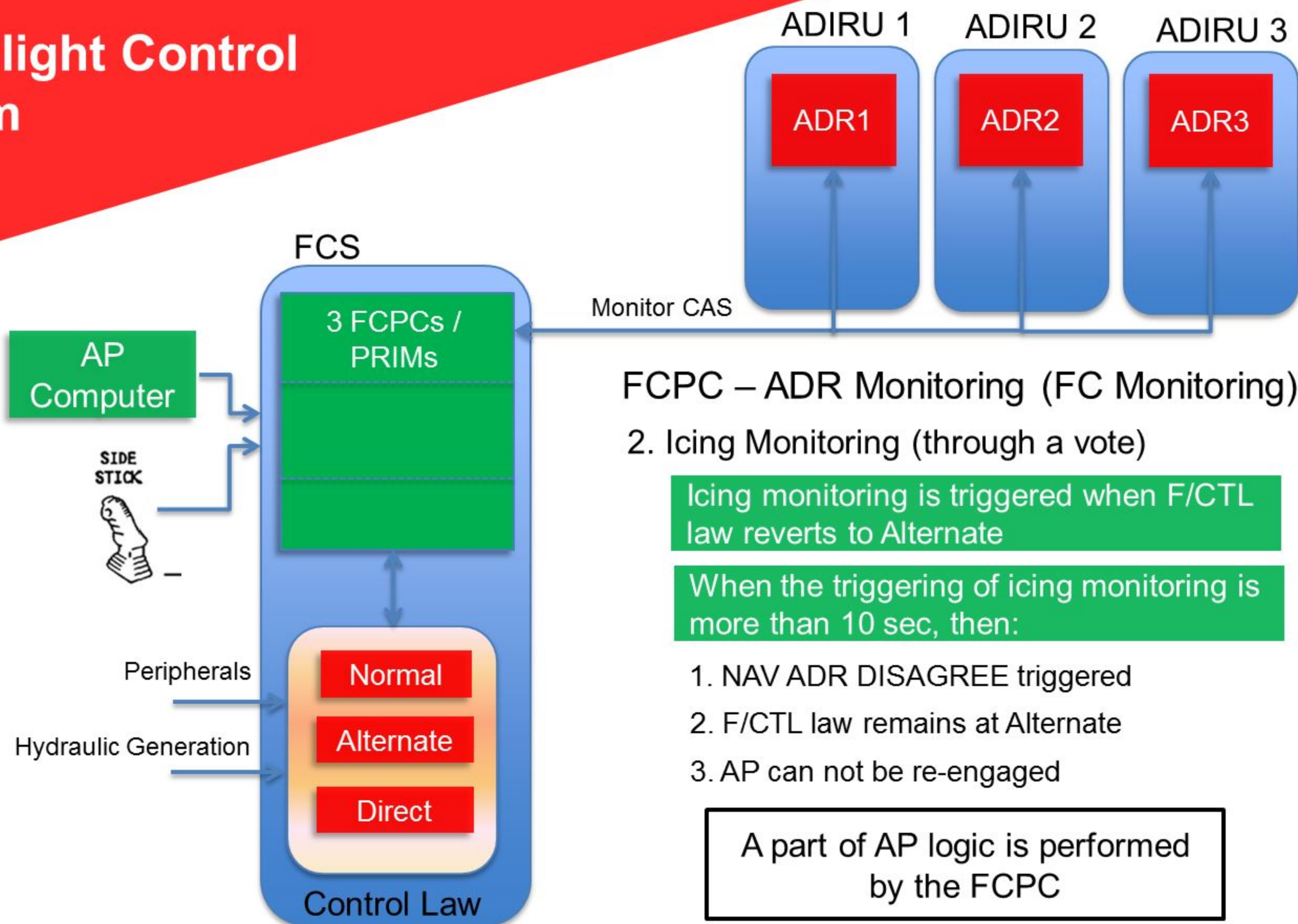
FBW Flight Control System



FBW Flight Control System



FBW Flight Control System



FCPC – ADR Monitoring (FC Monitoring)

2. Icing Monitoring (through a vote)

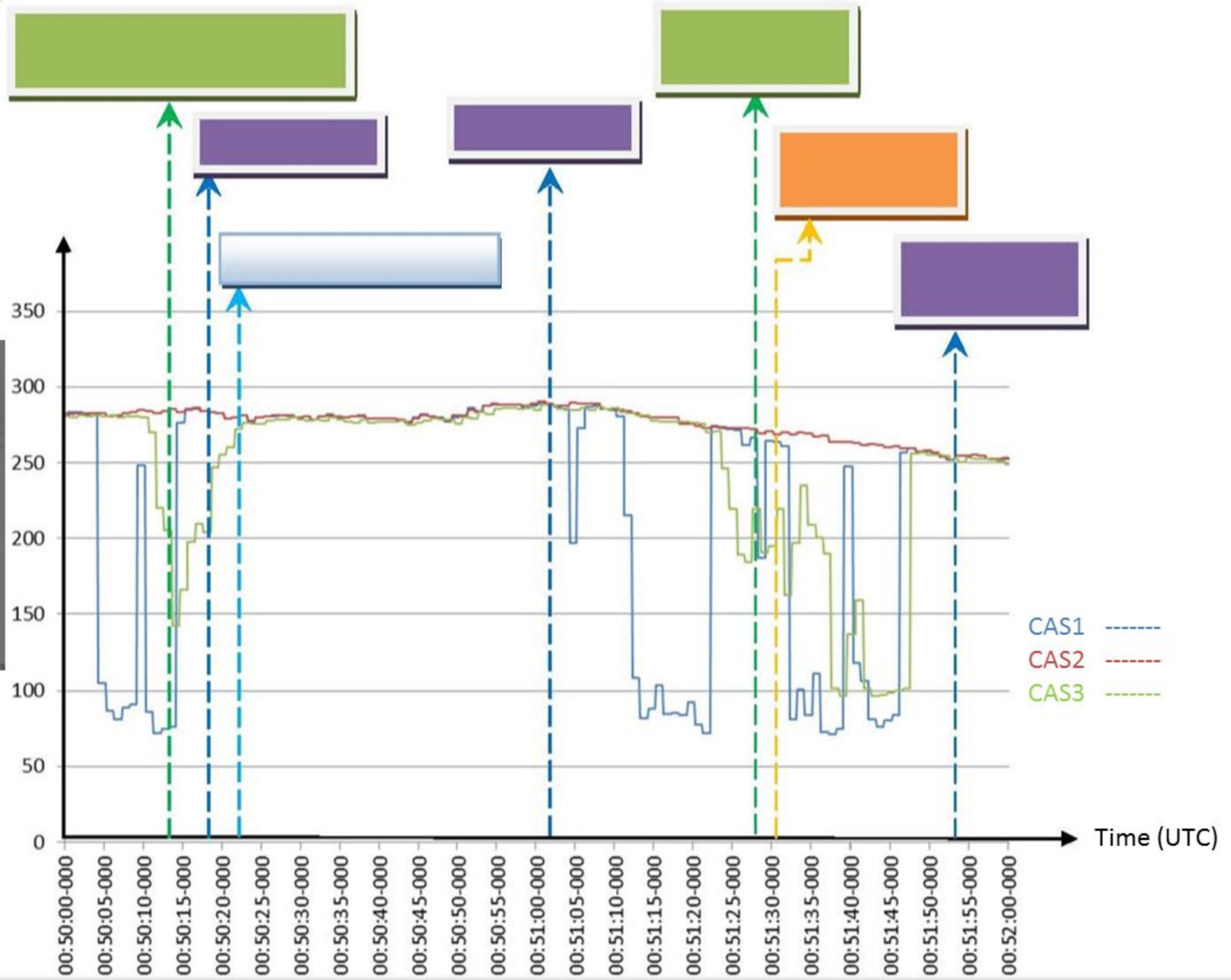
Icing monitoring is triggered when F/CTL law reverts to Alternate

When the triggering of icing monitoring is more than 10 sec, then:

1. NAV ADR DISAGREE triggered
2. F/CTL law remains at Alternate
3. AP can not be re-engaged

A part of AP logic is performed by the FCPC

Airspeeds

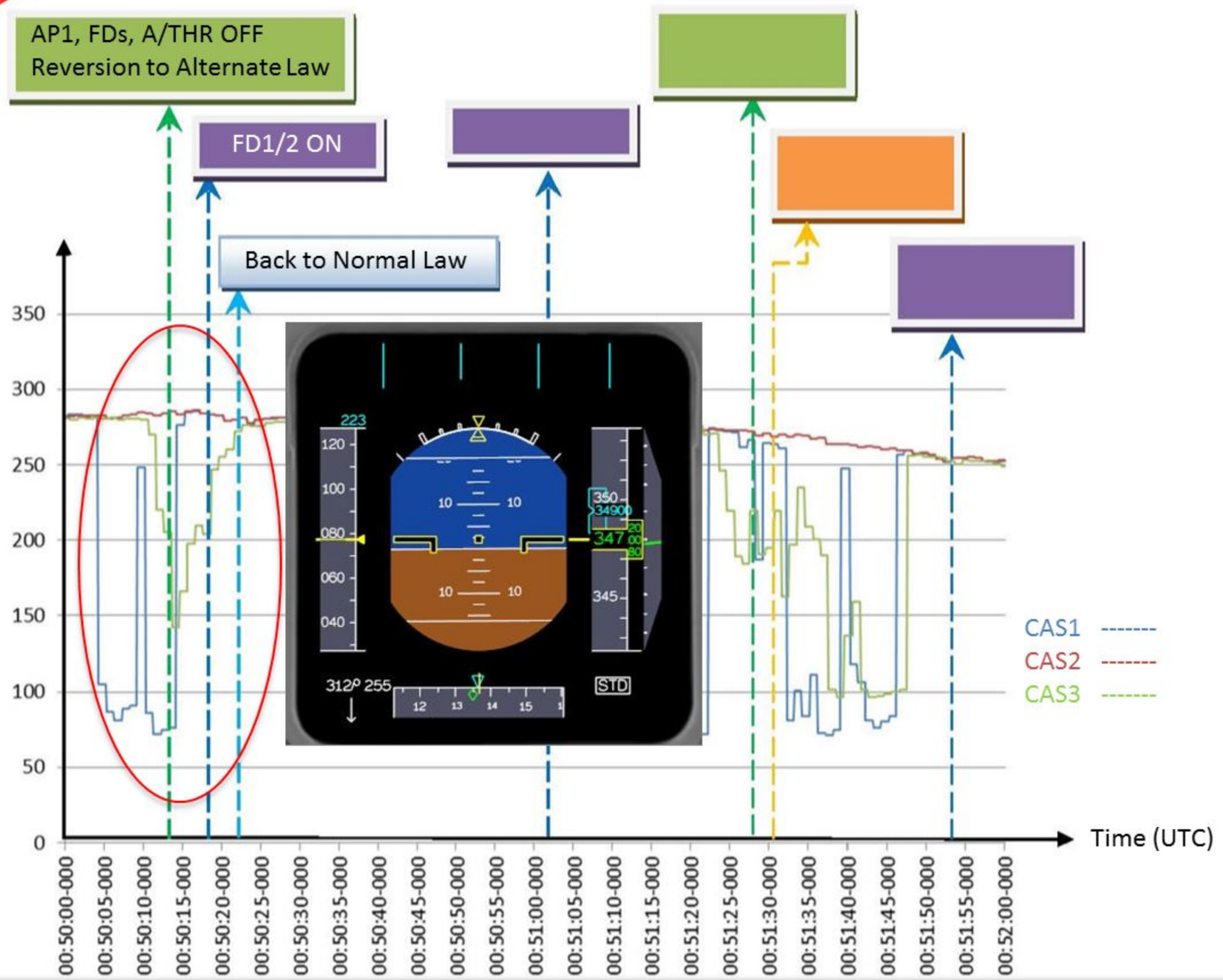


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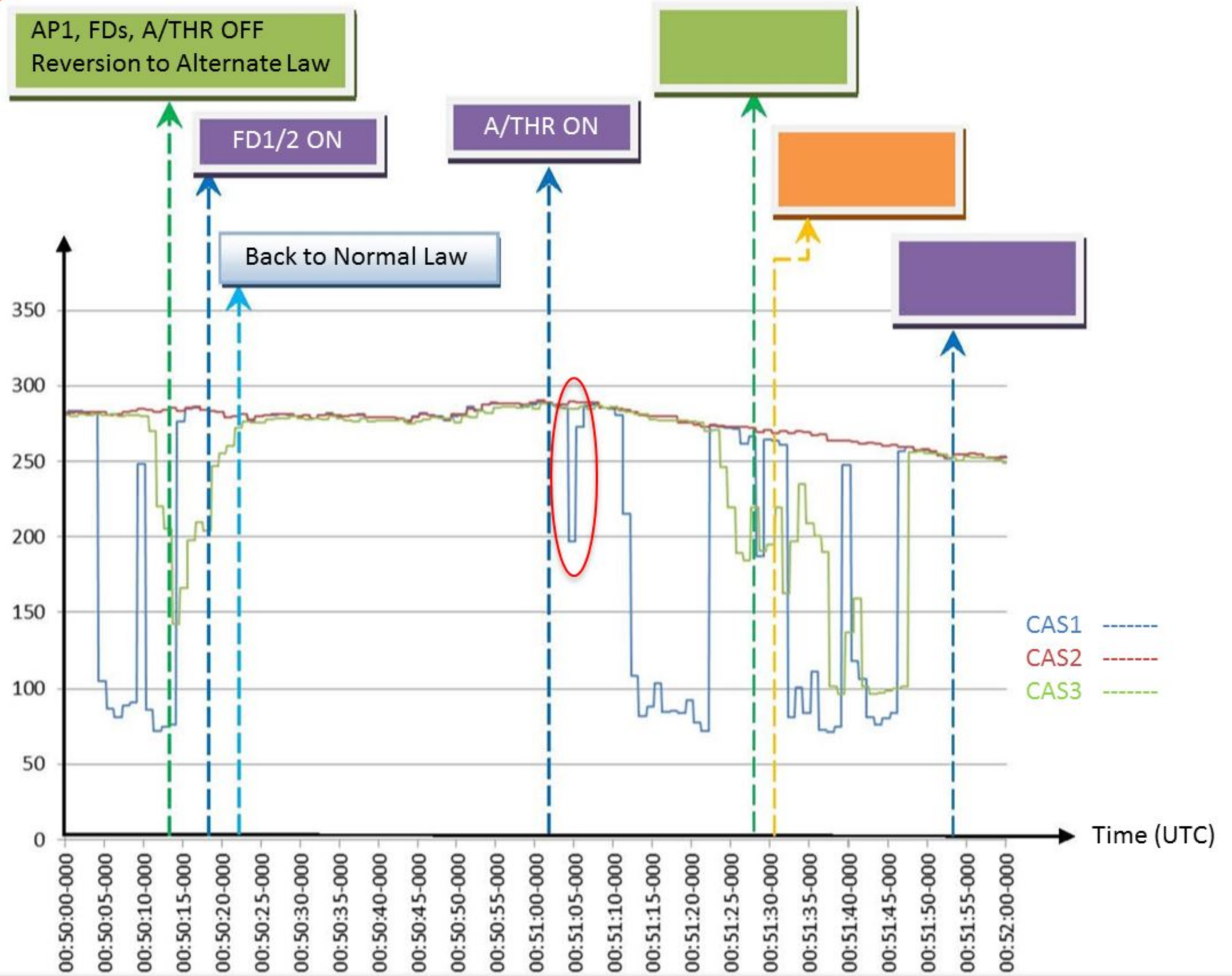
Airspeeds



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Airspeeds

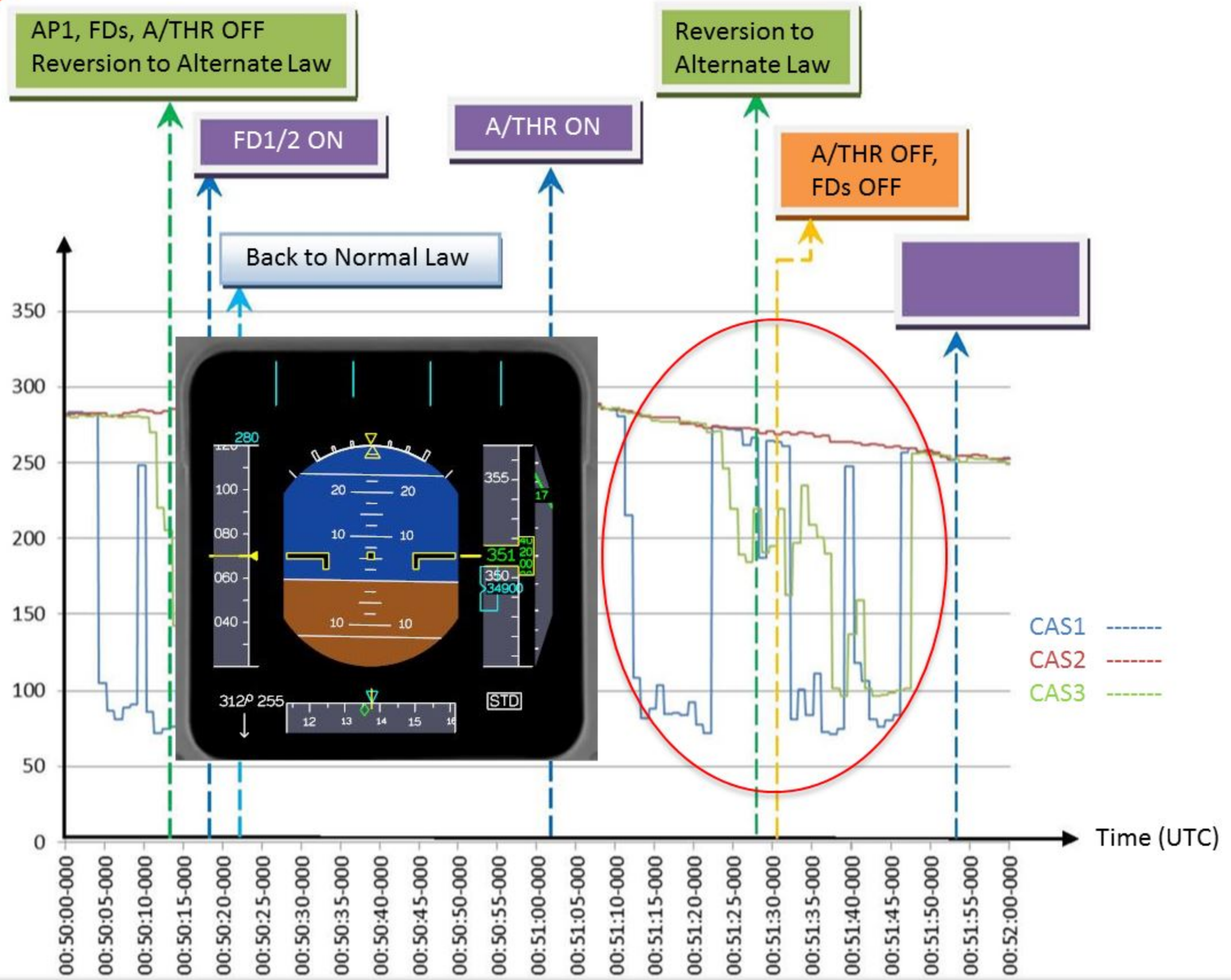


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Airspeeds

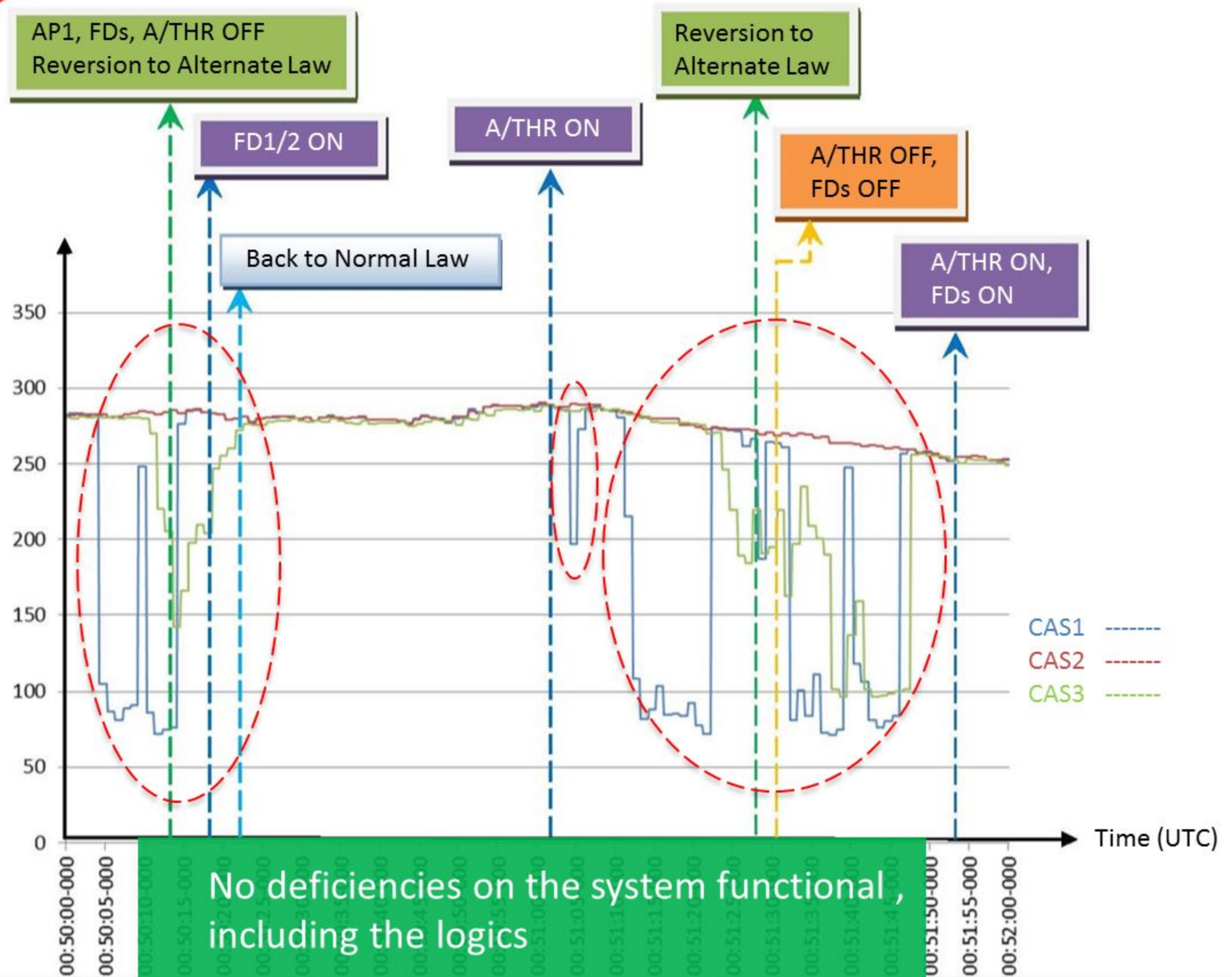


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Airspeeds



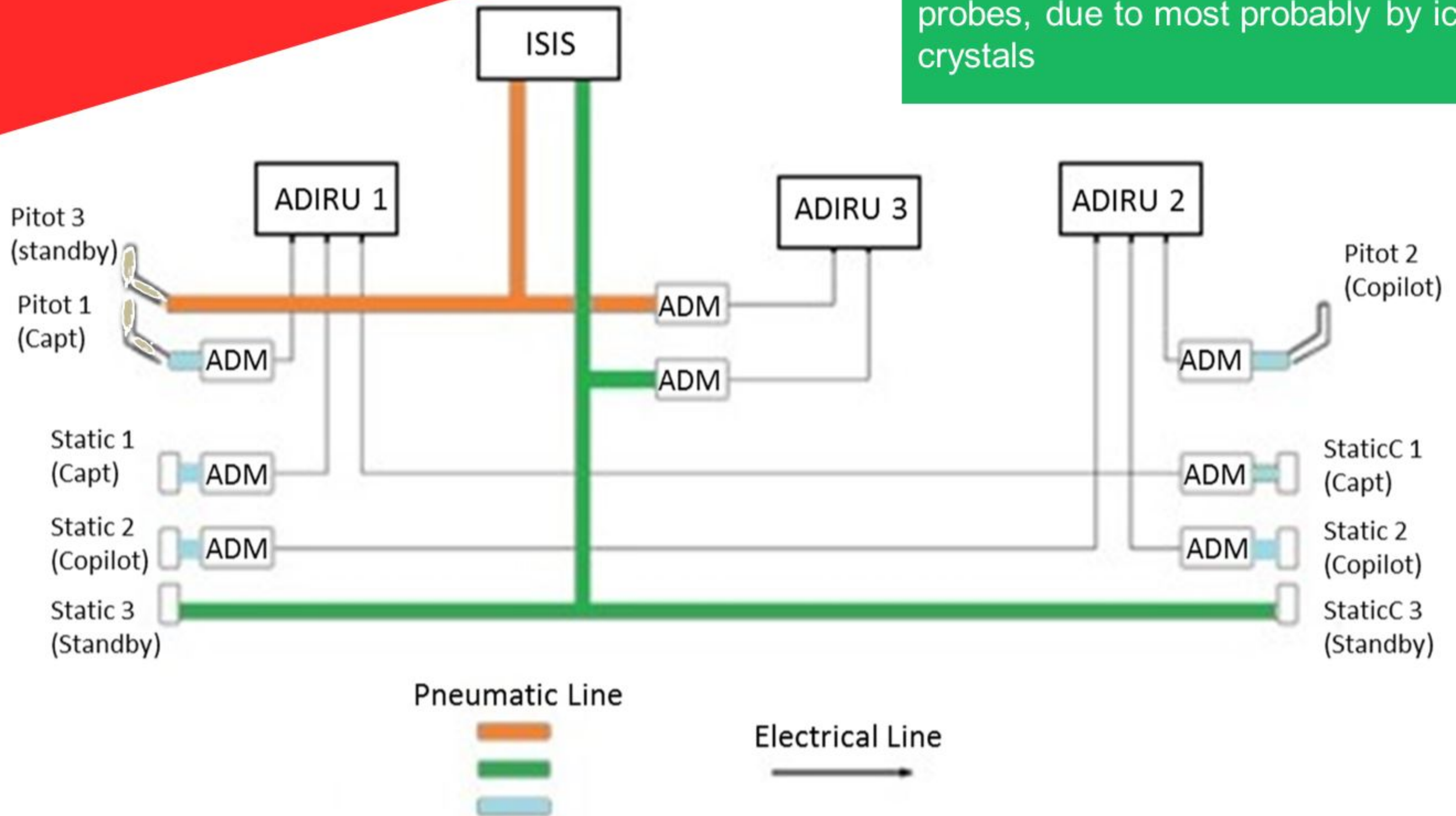
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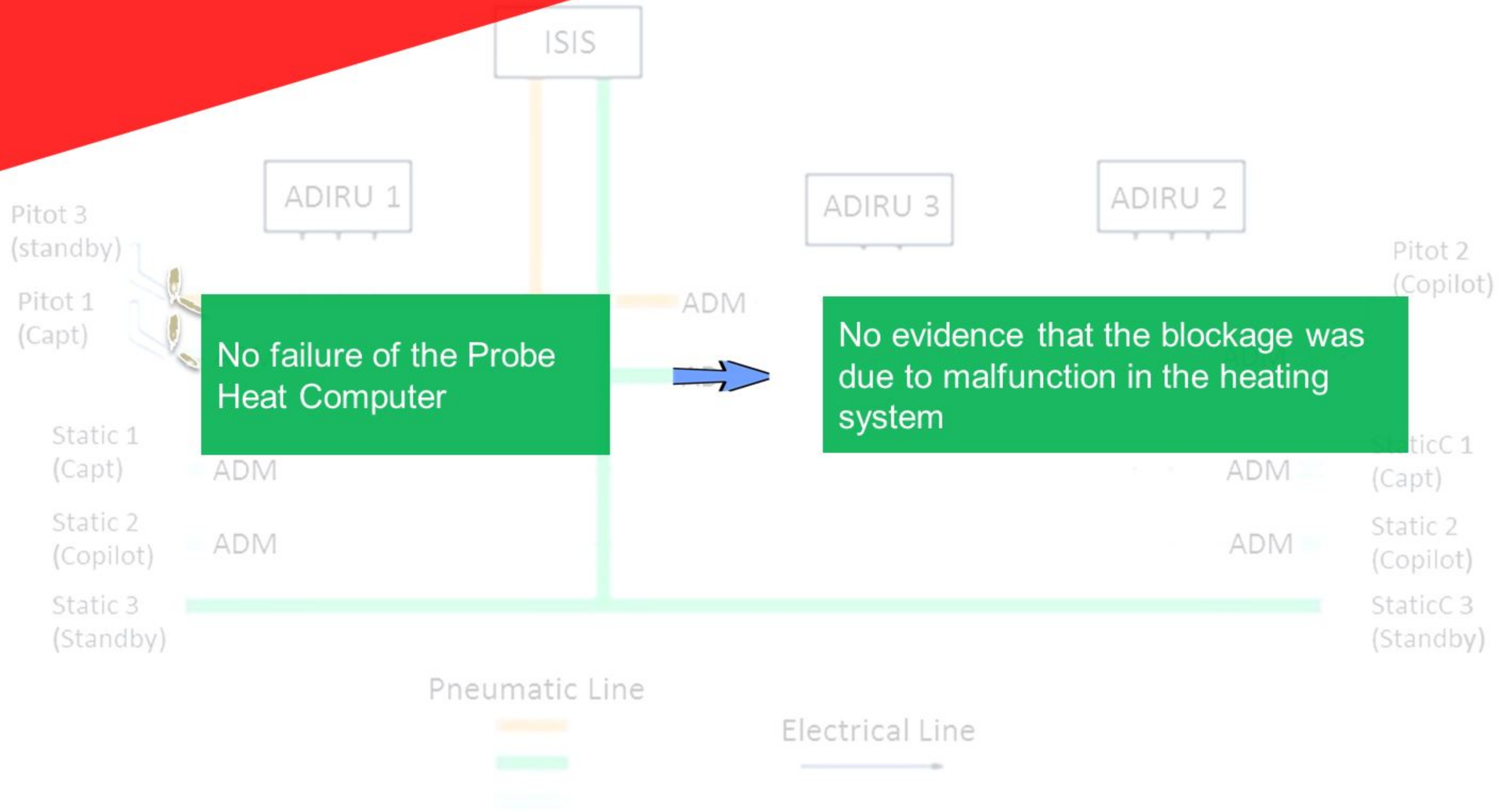
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Pitots Blockage

The fluctuations were caused by intermittent blockage of the left pitot probes, due to most probably by ice crystals



Pitots Blockage



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Weather Radar

Wx Radar not equipped with auto-tilt function

requires

Finding a proper tilt angle setting manually, along with an adequate selection of ND range

how

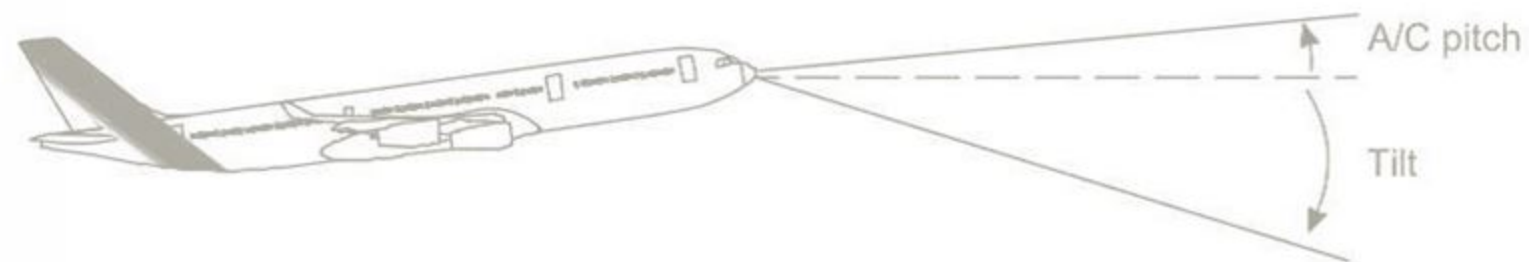
Optimizes observation of the most reflective part of the cloud and reduces ground clutter returns



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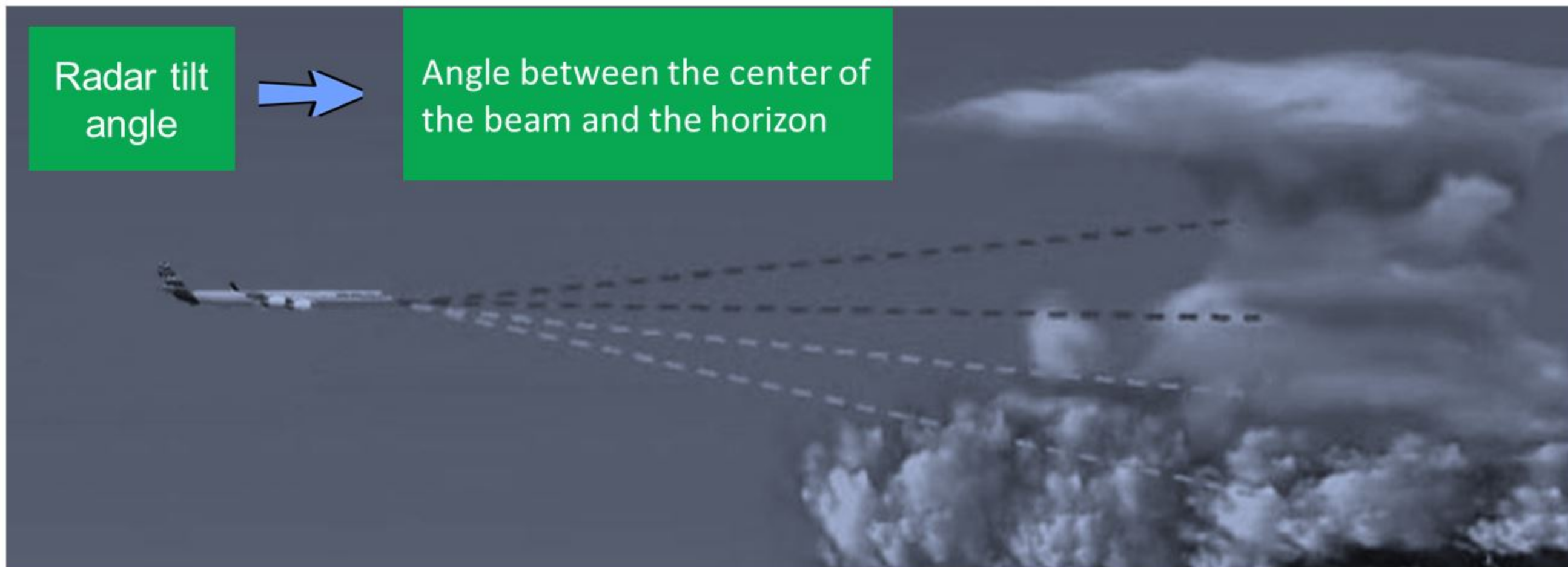
Weather Radar (Cont.)



Radar tilt
angle



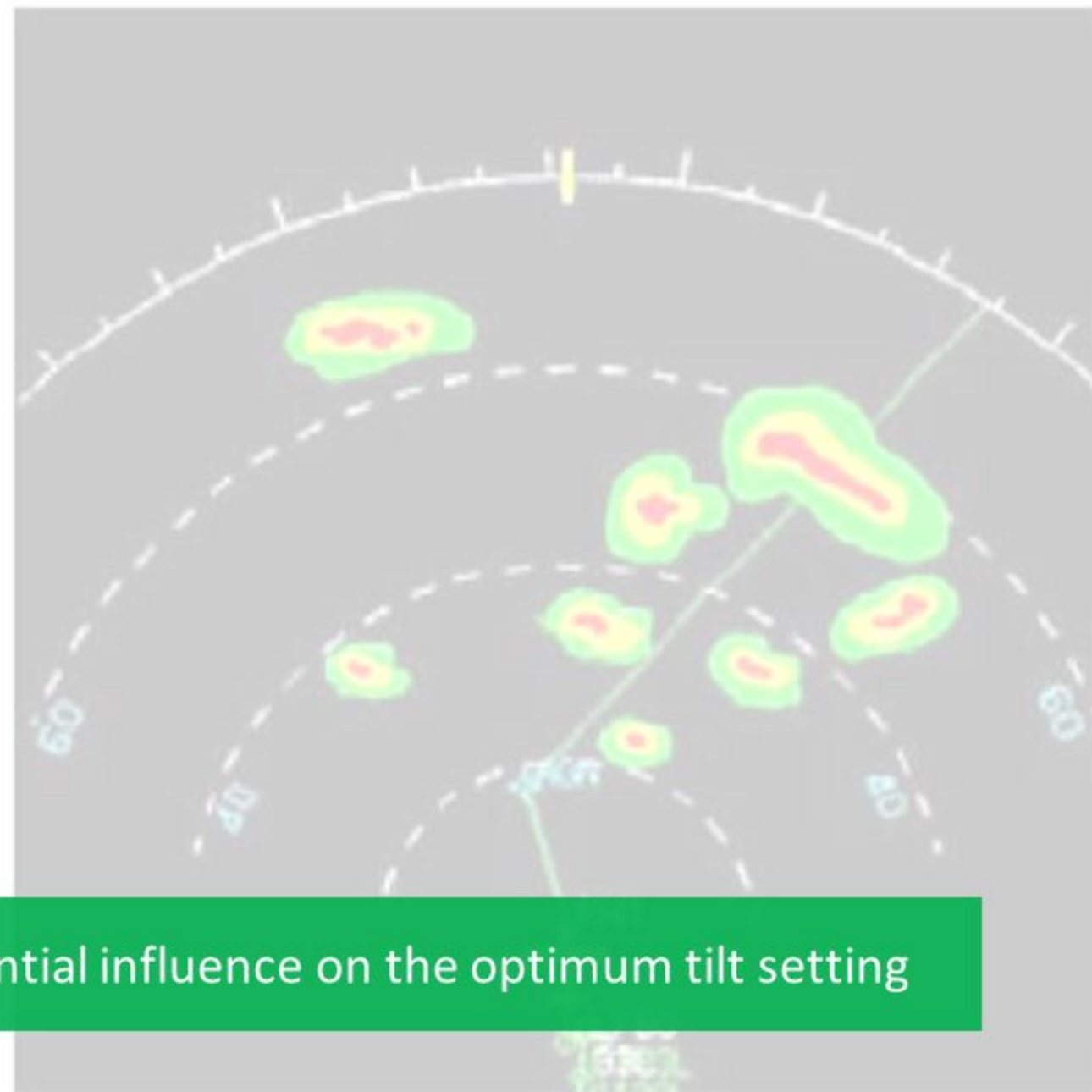
Angle between the center of
the beam and the horizon



Weather Radar (Cont.)



ND Range = 40 NM



ND Range = 80 NM

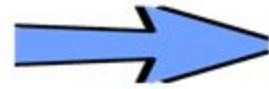


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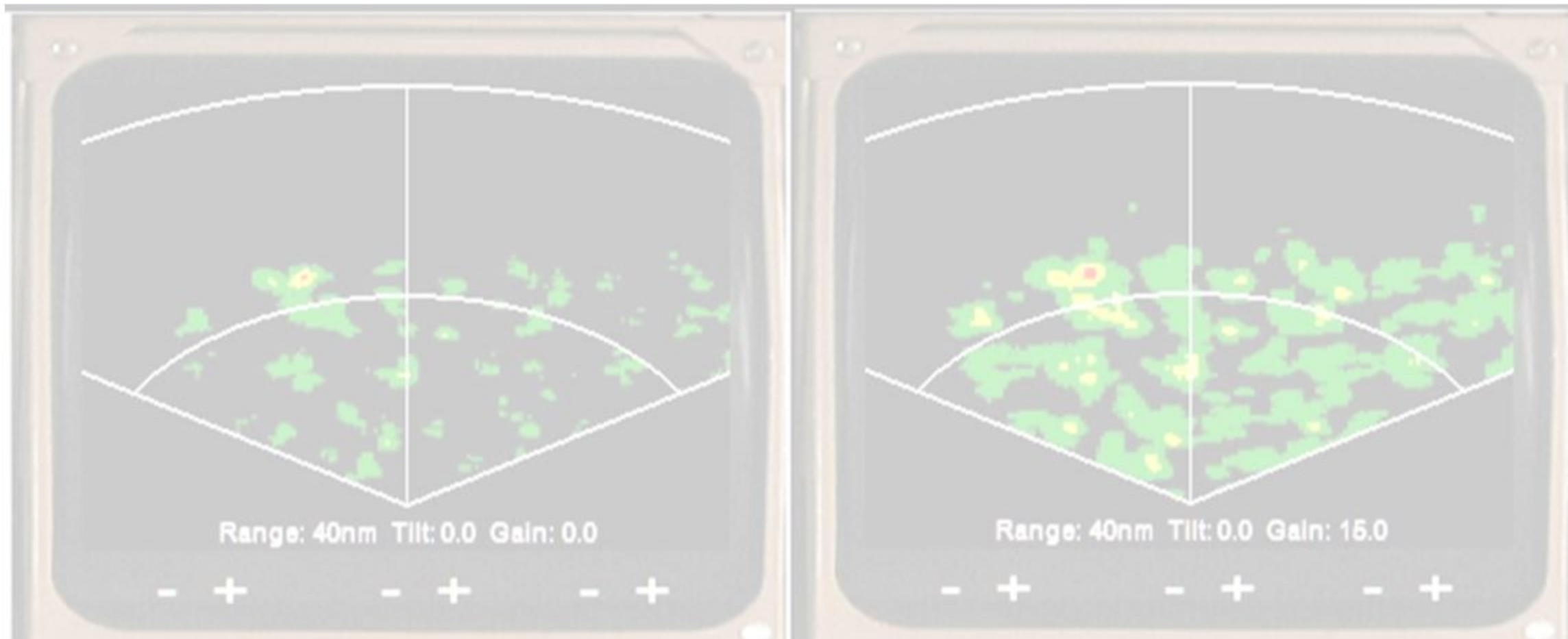


Weather Radar (Cont.)

Gain



Adjusts the sensitivity of the receiver



Weather Radar (Cont.)

Antenna
Tilt

Range

Gain

- Use the Wx radar to detect/analyze/avoid significant weather
- Periodically scan Vertically, using the tilt function
- Periodically scan Horizontally, using range change
- The shape/colour/size of returns are factors to interpret the weather
- Effective management of the antenna tilt along with an appropriate ND range selection
- Use Gain in AUTO mode for detection and initial evaluation of the displayed weather
- Use Manual Gain control to analyze the weather

ND Range = 40 NM

ND Range = 80 NM



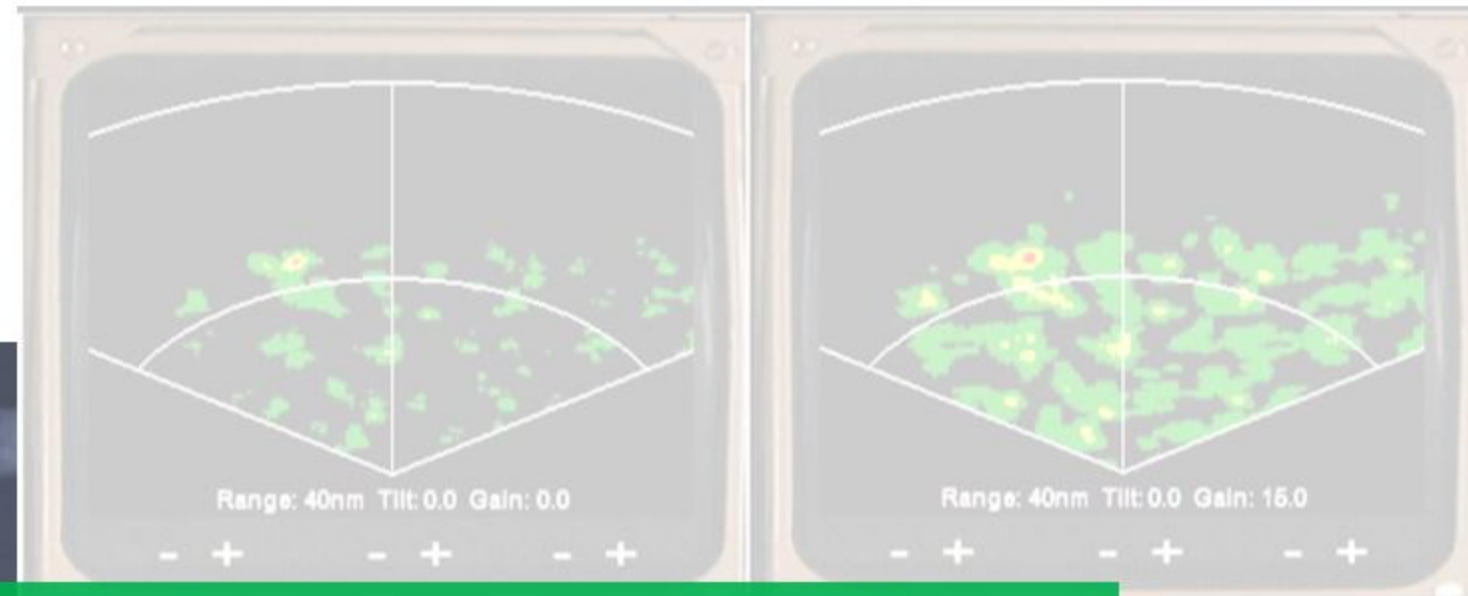
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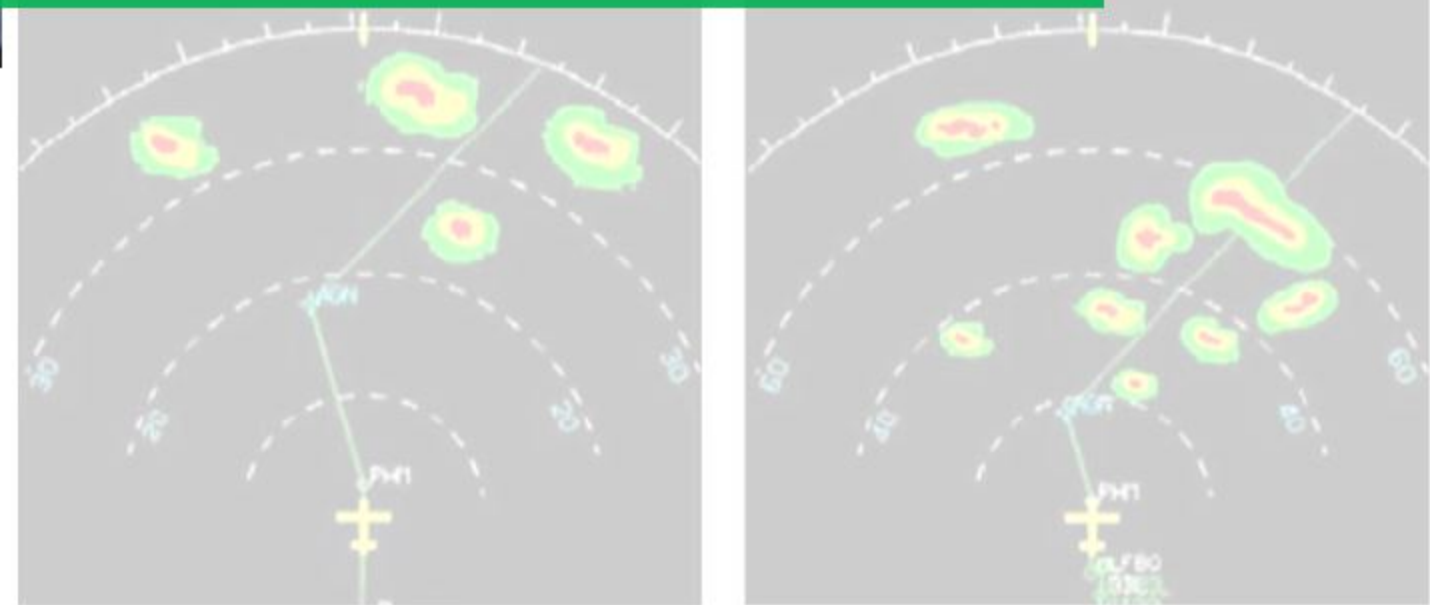


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Weather Radar (Cont.)



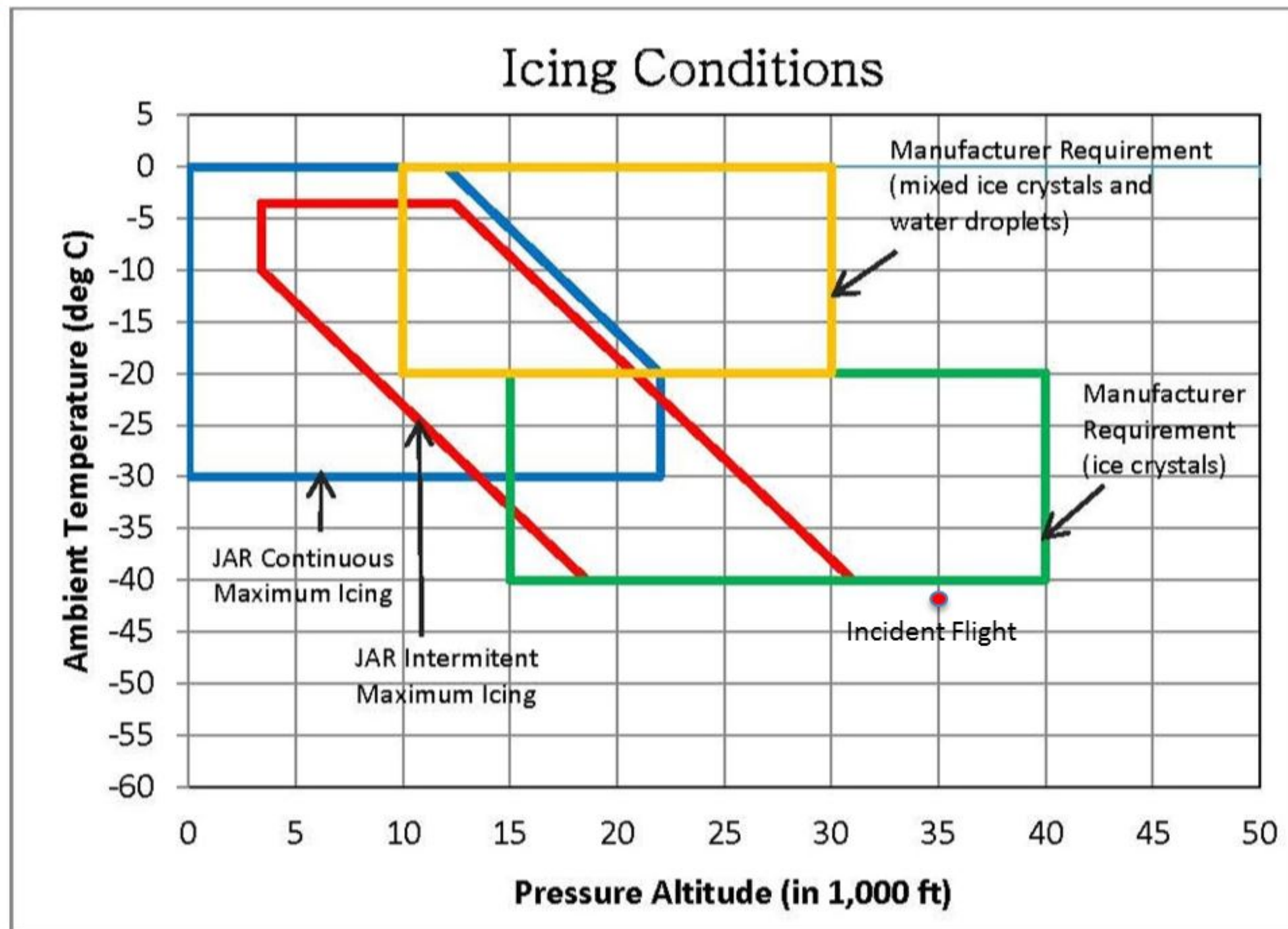
The weather radar was not used efficiently, such that the incorrect high tilt setting caused the radar to scan only the upper (less reflective) part of the cell.



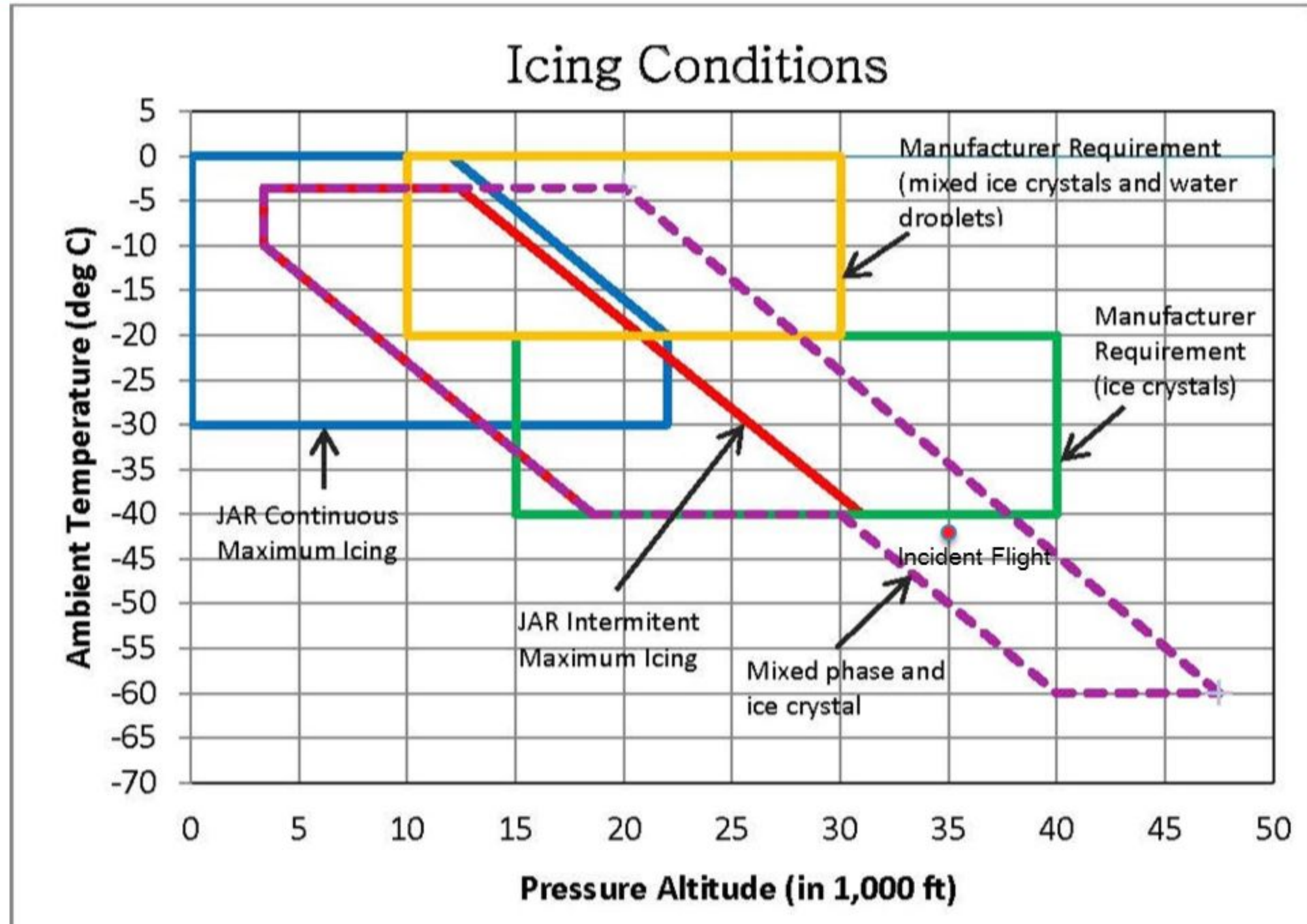
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JAR25 & Manufacturer Requirement



New CS-25 / Amdt 16

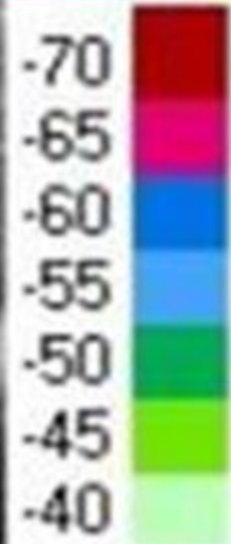


Cause of the Incident

Accumulation of ice crystals



Intermittent obstruction of left side Pitot probes



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Contributing Factors

An incorrect radar tilt angle setting



no timely detection of the CB that could have triggered the crew to take the necessary avoidance maneuvers



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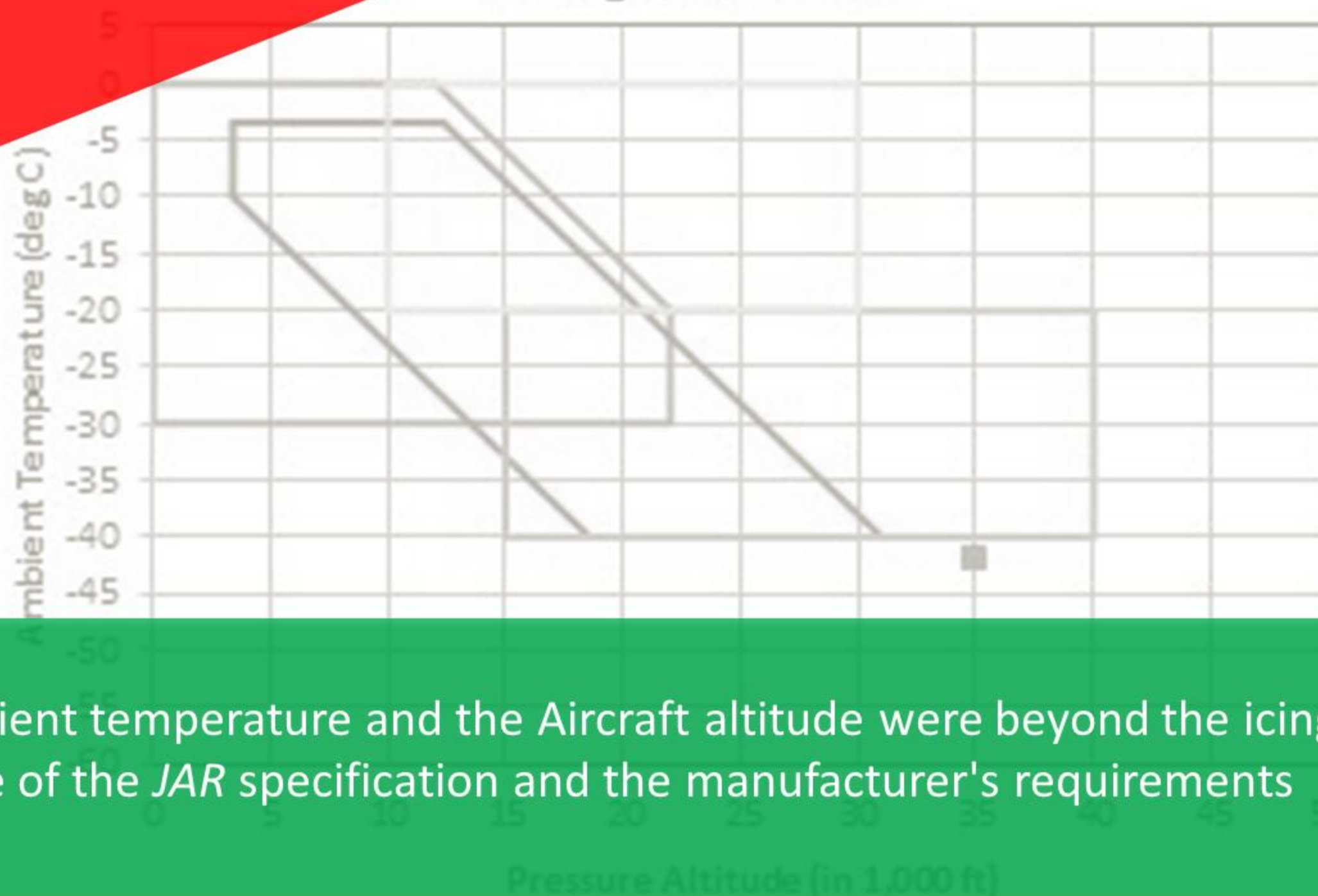
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Contributing Factors

Icing Conditions



The ambient temperature and the Aircraft altitude were beyond the icing envelope of the *JAR* specification and the manufacturer's requirements



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Safety Recommendations

Four (draft) Safety Recommendations



Operator

EASA

GCAA



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Safety Recommendations

to Operator

One Safety Recommendation



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Safety Recommendations

to Operator



Add to the existing initial and refresher type training syllabi optimum technique using the manual weather radar



maximize the weather survey and detection functions



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Safety Recommendations

to EASA

One Safety Recommendation



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Safety Recommendations

to EASA



Certification Specifications

and

Acceptable Means of Compliance

for

Large Aeroplanes

CS-25

Amendment 16
12 March 2015¹

Consider mandating the qualification aspects of the Pitot probes in icing conditions to the new requirements of CS-25, Amendment 16



forward fitting the aircraft in production and for retrofitting to aircraft in-service



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Safety Recommendations

to GCAA

Two (2) Safety Recommendations



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Safety Recommendations

to GCAA

1st Recommendation

Establish communication with the type certification authorities



Examine the 'ice protection CS' regarding aircraft operating outside the older applicable certification specification, *JAR 25*, and the new *EASA CS-25, Amendment*



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Safety Recommendations

to GCAA

2nd Recommendation

Take the necessary action in requiring operators in the United Arab Emirates



Include optimum techniques of using manual weather radars in initial and refresher type training syllabi



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Thank you

Questions ?

<https://www.gcaa.gov.ae/en/ePublication/Pages/InvestigationReport.aspx>

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