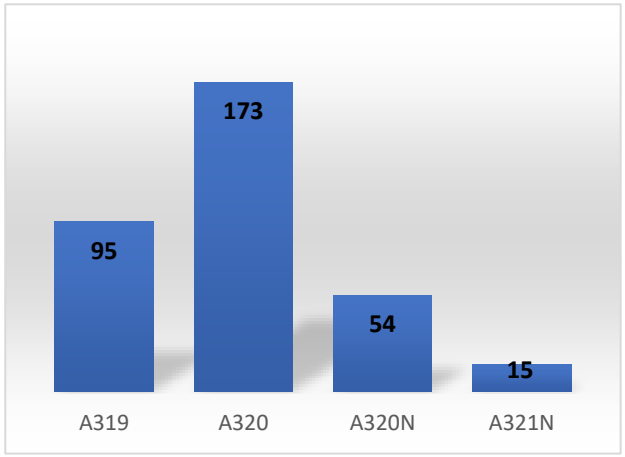
Enhancing Easyjet's digital journey

SWARAN SIDHU – HEAD OF FLEET TECHNICAL MANAGEMENT, EASYJET

Who are we?

- 300+ A320 family aircraft. 3rd largest A320 fleet in the world.
- 154 airports, 35 countries, 981 routes
- 13000 people
- Aiming to become tHE world's most data driven airline
- First airline to announce A credible sustainability roadmap



- Average age: 9.3 years
- 12m+ hours flown with Airbus
- 7m+ cycles flown with Airbus

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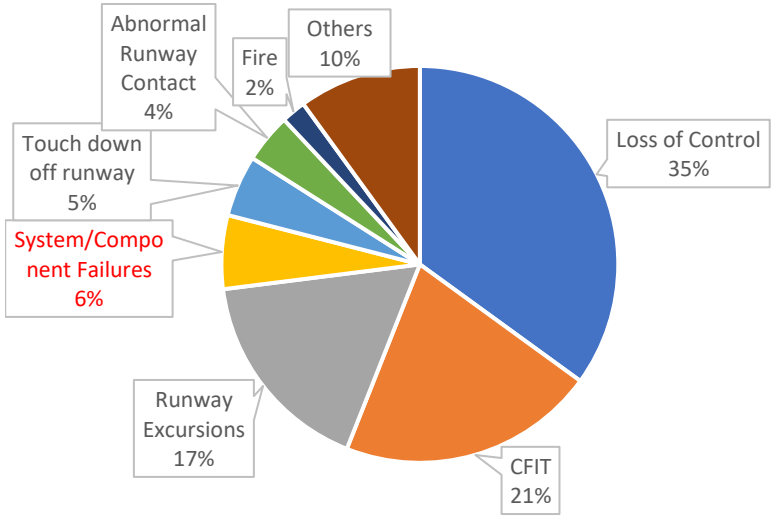
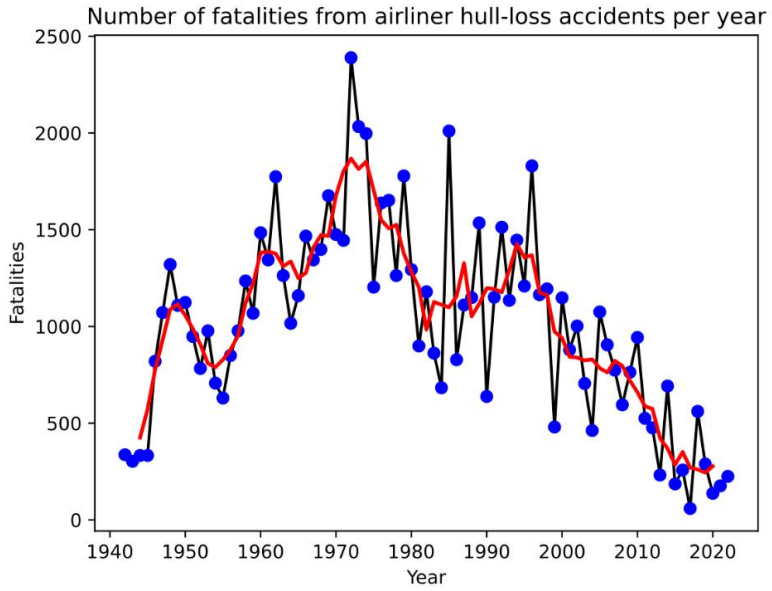
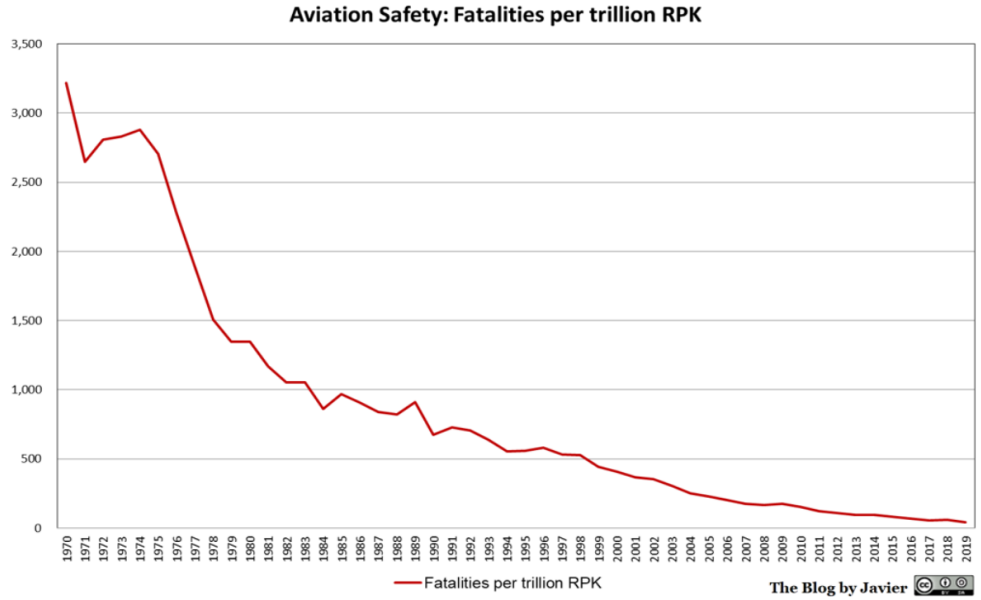
Evolution of safety

Year	Total Fatal Crashes	Comments
1926/27	24	
1928	16	
1929	51	
Total	91	In todays flying this is equivalent to 7000 fatal crashes per year







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Evolution of maintenance philosophy

1978 study of Reliability Centred Maintenance showed 90% components did not benefit from overhaul

Perception of HT Components giving better reliability

No correlation with age & failure

1960s Manufacturer responsible for MPD-Promoted Hard Time Life Of Components

On-Condition (OC) maintenance, where it was acceptable to continue with a known deterioration, degradation or wear, and defer the required maintenance action until a future opportunity

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Evolution of LCC’s

- Post MSG 3, carriers benefitted from the MPD (lower DMC).
- Reliability Centred Maintenance provided better aircraft reliability
- However this was still reactive, in other words it meant fixing a failure post the event instead of avoiding one.
- LCCs modelled themselves on short turnrounds, demanding highly reliable aircraft, high utilisation and cutting edge digitalisation.
- easyJet embarked on an operational resilience programme, entered into an era of digitalisation and embracing PDM was part of that journey.
- Teamed up with Airbus to create PDM, through Airbus’s Skywise platform.
- Start of our journey into various innovations with digitalisation being the centre of it.

Our digital journey to date

2009/2010

- Insourced Part M
- Introduced AMOS
- Introduction of a document scanning Bureau (Waviatech)

2011/2012

- Fan Blade Balancing
- Digital document management (AerData)
- Flight Deck ToughPad

2013/2014

- 3D Digital Damage Chart mapping on a web based platform within AMOS
- Introduction of Drone Inspections concept utilising digital images from aircraft

2015/2016

- Introduction of E-Sign
- Major AMOS upgrade
- Introduction of Aerogility Planning Software
- Airbus Data-bird trials

2017/2018

- Skywise Core
- FOMAX

2019/2020

- Introduction to SHM
- FlyDoc's Digital Documentation Management

2021/2022

- Skywise Core Development e.g. Parking Tool, Automated Reliability Reports, HBM Reporting, Enhancing Aerogility

2023 to date

- IRIS Trial
- Change to iPad EFB
- E-Tech Log

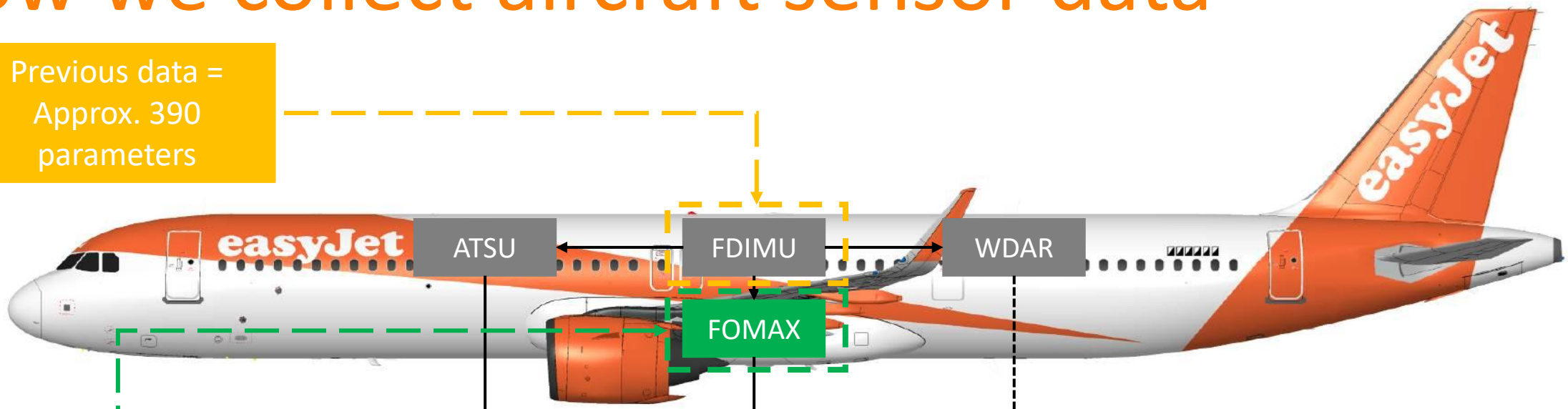
FOMAX

Flight Operations and Maintenance EXchanger

- easyJet recently completed a full fleet retrofit of Airbus' FOMAX system.
- FOMAX is a compact connectivity unit which collects aircraft system and performance data.
- easyJet chose to install it primarily for predictive maintenance. The data collected by FOMAX is sent to an Airbus service known as SkyWise where calibrated models use this data to predict impending failures on the aircraft
- Whilst the primary reason for easyJet installing FOMAX was predictive maintenance, it has a number of optional features which could act as an enabler to a fully connected aircraft

How we collect aircraft sensor data

Previous data = Approx. 390 parameters



Report 38 via ACARS

FOMAX data via 4G network

DAR data (for development)

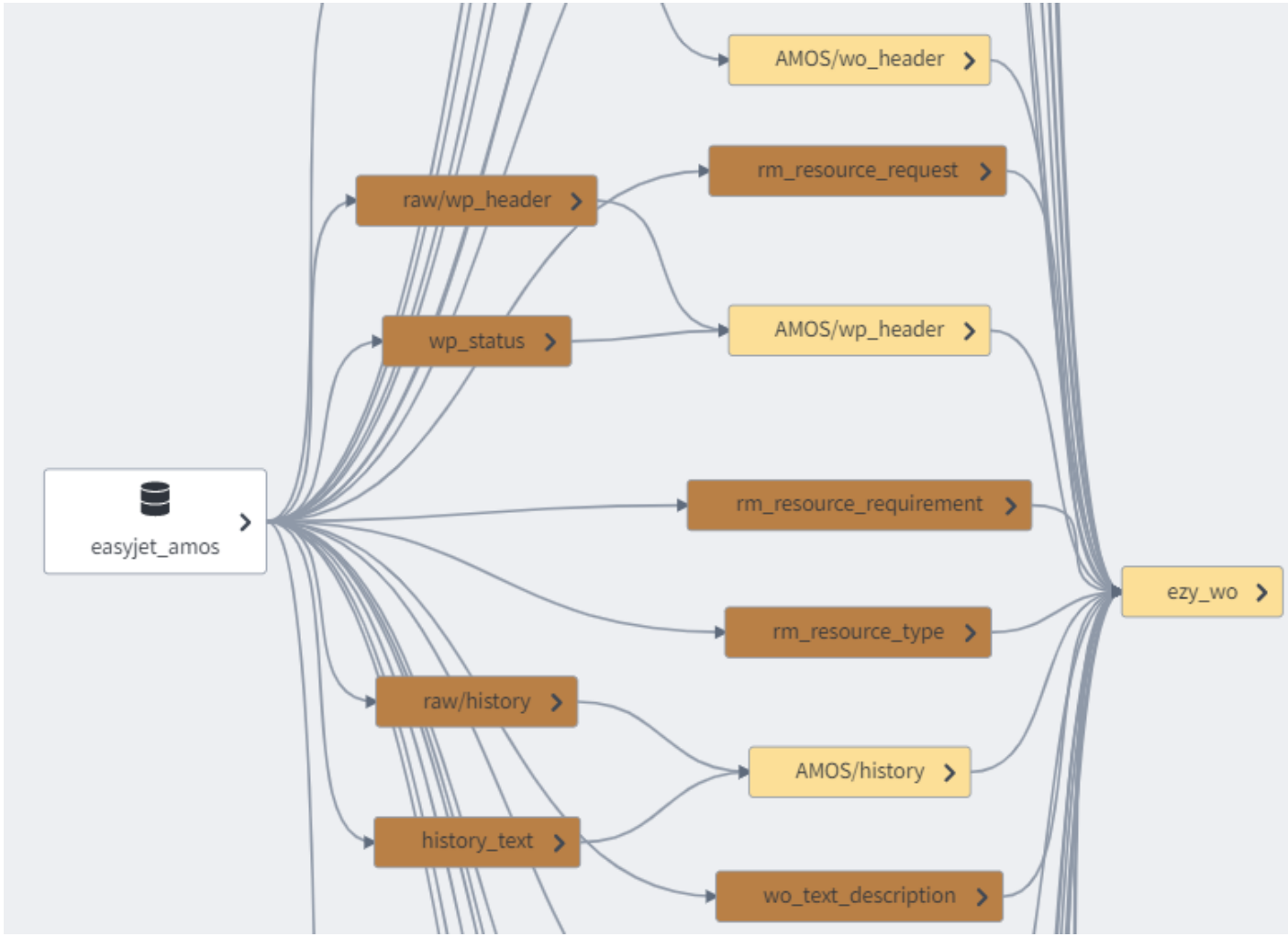
FOMAX data = Up to 10,000 + parameters

skywise. core

skywise. spm

Data clean-up and transformation

- Once the raw tables are in Skywise, they need to converted into a meaningful data dictionary.
- They go though a cleaning and joining process until all the details required are available.
- This example shows workorder. Various sources of information need to be combined to get the full details of an actual workorder.



Our enhanced digital services

ACARS

Lufthansa Systems
LIDO

AIRBUS

Skywise Core is the “data warehouse” platform with advanced analytic tools.

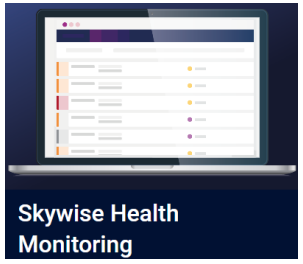
Skywise Core

Analyse and Develop Airline Specific Reports

- > Fleet Reliability Report
- > Component Reliability Analysis
- > Task Findings Analysis and Optimisation
- > Base Maintenance Performance
- > AOG Management - SCRUM
- > Logistics Optimisation – Inventory modelling
- > Sensor Data Alerts – Build our own alerts

Skywise Predictive Maintenance

SPM is the tool which provides early alerts of upcoming system degradation.(Fomax, ACARS Data)



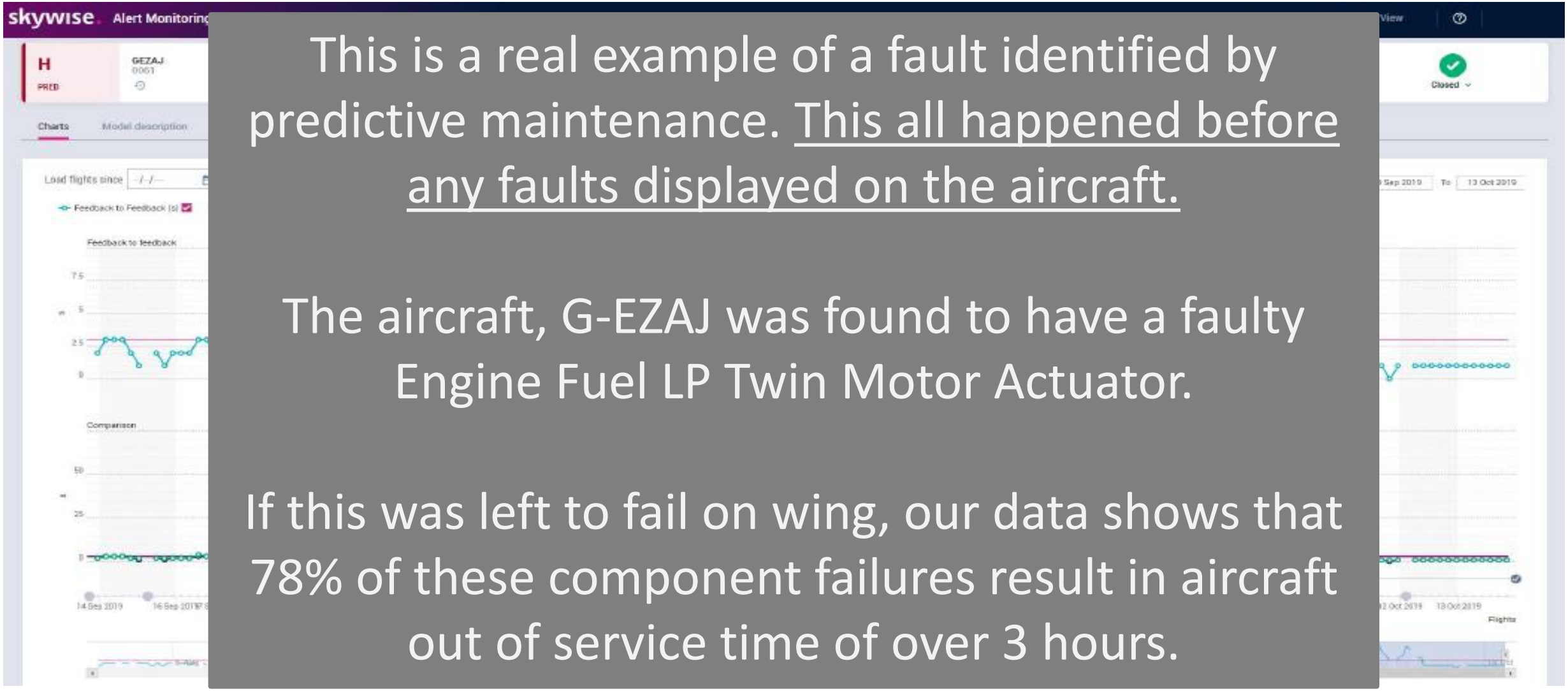
Skywise Health Monitoring

SHM (replacement of Airman) allows real-time tracking of aircraft fault messages with associated troubleshooting documentation.(ACARS, AMOS Data

Skywise Reliability Premium

SRS provides statistical review of the fleet with benchmarking. Complements our own analysis and dashboards we produce. (AMOS, ACARS Data

Predictive maintenance in action



This is a real example of a fault identified by predictive maintenance. <u>This all happened before any faults displayed on the aircraft.</u>

The aircraft, G-EZAJ was found to have a faulty Engine Fuel LP Twin Motor Actuator.

If this was left to fail on wing, our data shows that 78% of these component failures result in aircraft out of service time of over 3 hours.

Predictive maintenance in action

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Predictive maintenance in action

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Predictive maintenance in action

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Digitalisation efficiency

AMOS Data

- Aircraft Data
- Utilization Data
- Workorder Data
- Delay Data
- Component Removal Data

Code workbook
Contour
Code repositories

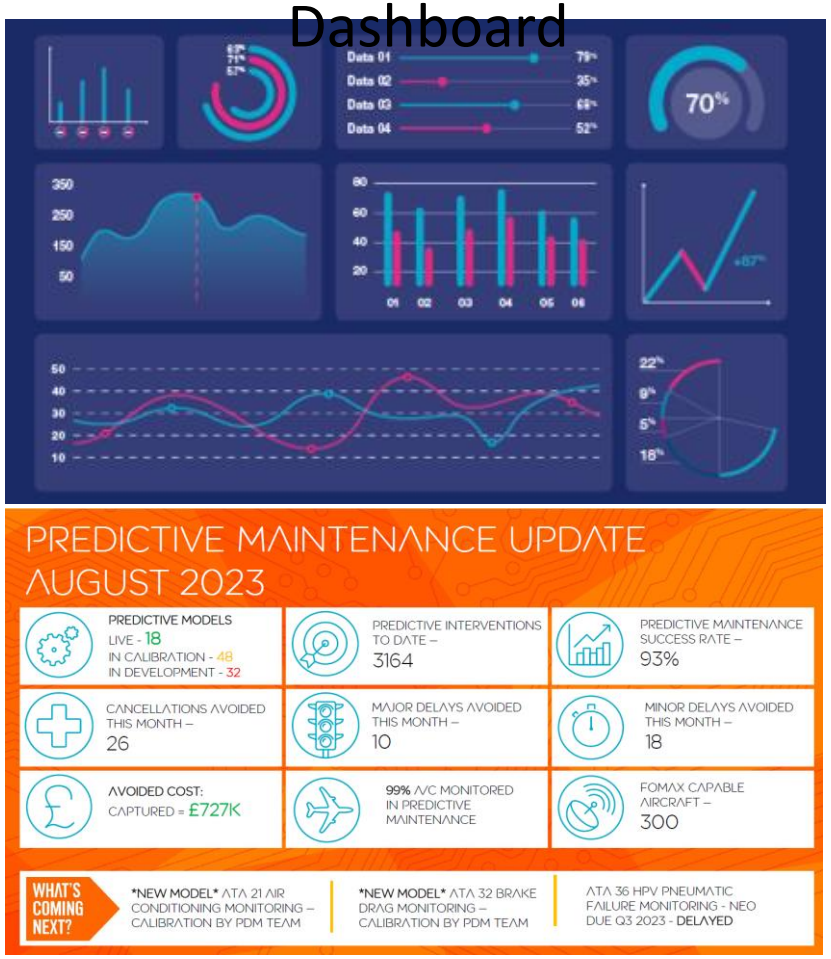
Traditional reliability reports can take up to two weeks to produce with limited scope of analysis.

Skywise Analysis (estimated 2 hours max)

- Fleet and Utilization Summary
- Defect Trends
- TDR Statistics and Drivers
- Availability Statistics and Drivers
- ATA Pireps and Delays Trends
- Component Reliability
- Scheduled Tasks Reliability

Object explorer

Reliability Dashboard



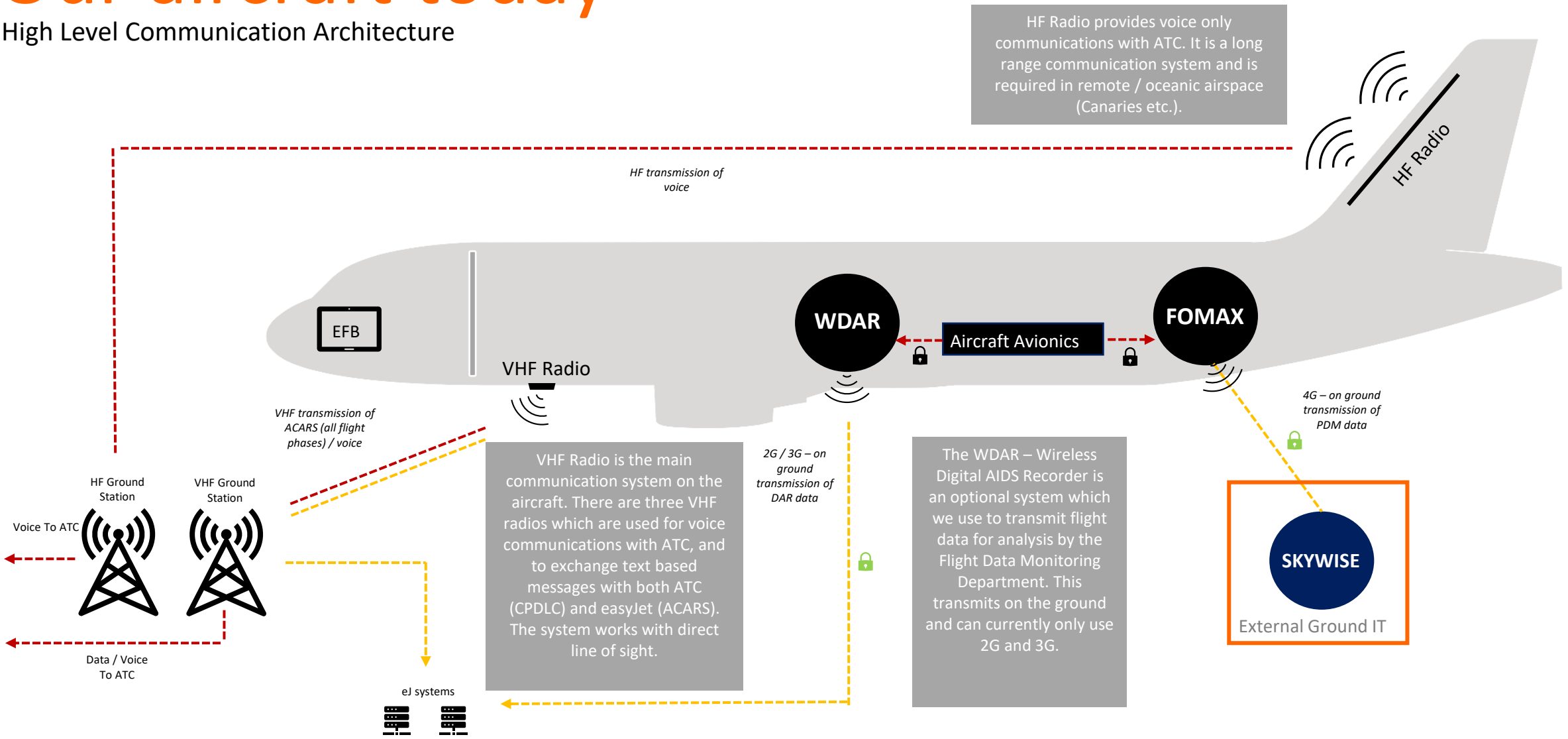
- Using the Skywise analytical tools, huge time savings can be achieved when analysing data whilst also enabling more complex analysis.
- Skywise offers a unique enrichment of data compared to other data warehouse applications, where data can be updated and supplemented with other source (Airbus data, Aircraft Sensor, etc).

Looking to the future…

Using greater connectivity to reduce cost

Our aircraft today

High Level Communication Architecture



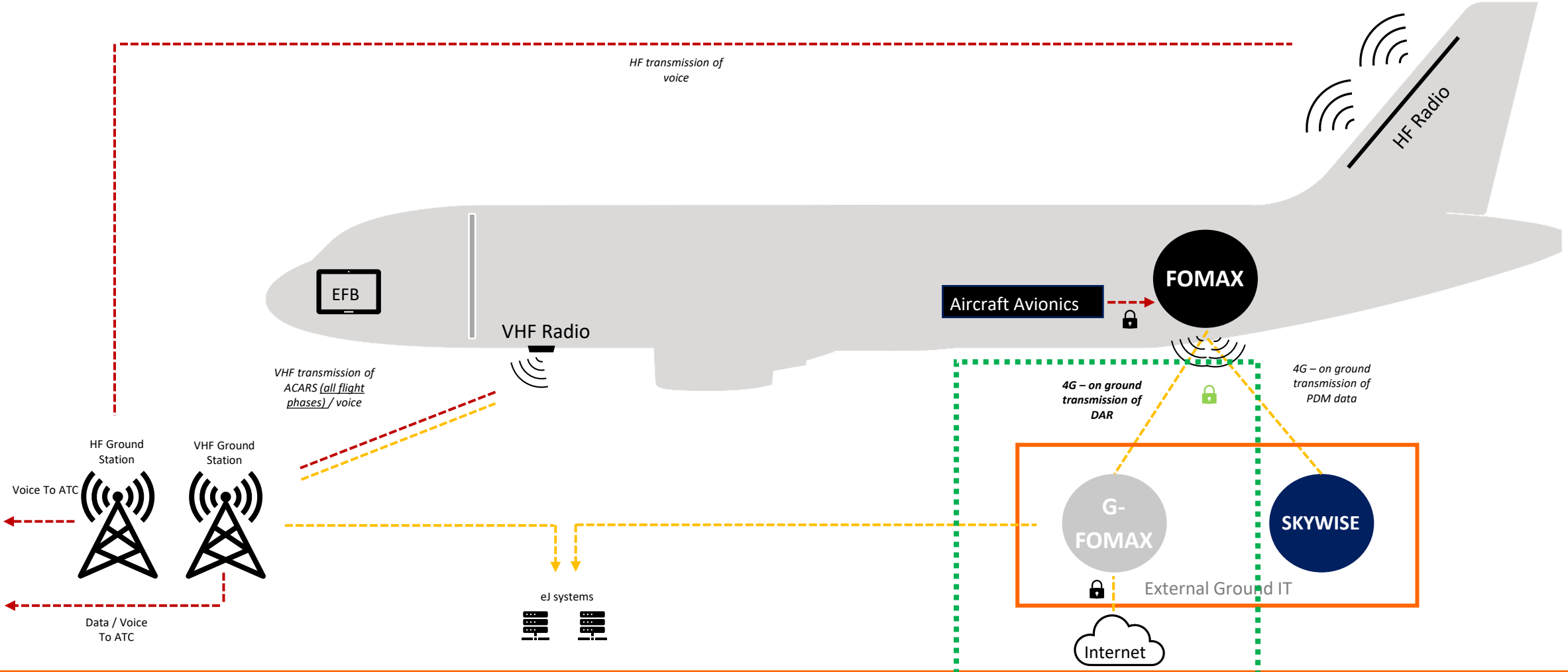
Across Europe 2G and 3G cellular networks are being shut down due to the increased availability of 4G and 5G.

easyJet, like many airlines, are exposed to this due to reliance on 2G and 3G for transmission of FDM data.

Whilst this requires an initial investment to mitigate the risk, it also presents opportunities to modernise and reduce cost.

Mitigating the 2G/3G sunset

FOMAX Cellular Gatelink and Ground(G)-FOMAX



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Mitigating the 2G/3G sunset

FOMAX Cellular Gatelink and Ground(G)-FOMAX

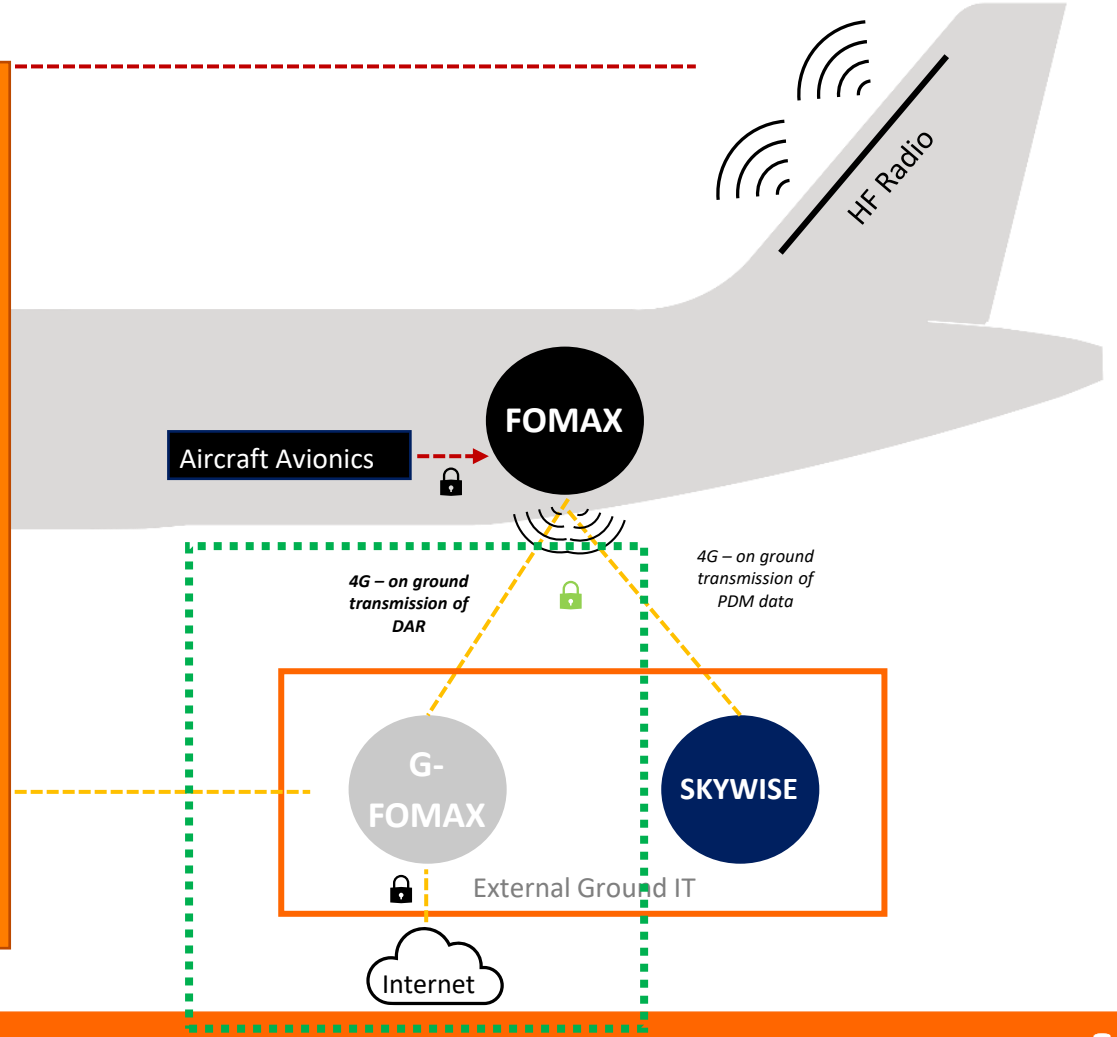
How does this help reduce cost?

> Use FOMAX on the aircraft – no hardware upgrades(Wiggles) or shop visits

> Opportunity to leverage additional FOMAX options that require cellular gatelink

> Increase in data availability

> Opportunity to remove weight from the aircraft



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Additional fomax options

Option 1 – Cellular Gatelink

4G cellular connection on ground

Option 2 – WiFi in the cockpit

Activates FOMAX's WiFi hotspot allowing connection of EFB to FOMAX

Option 3 – ACARS for EFB

Provides an ACARS interface for pilots on their EFBs

* Requires option 2

Option 4 – cabin satcom connection

Provides internet connectivity to FOMAX via cabin connectivity systems

*Requires option 2 to provide connectivity to EFB

**Requires Airbus ACM / ALNA

Option 5 – ACARS over ip

Routes AOC ACARS messages over IP channels rather than VHF/HF

* Options 1 or 4 or 8 are prerequisites

Option 6 – wireless load transmission

Wirelessly stage field loadable software to the aircraft via FOMAX

*Requires compatible data loading system on the aircraft

Option 7 – bi-directional efb-fms link

Update FMS flight plans through the EFB

*Requires option 2

Option 8 – cockpit satcom connection

Provides internet connectivity to FOMAX via cockpit connectivity systems such as SBS

*Requires option 2 to provide connectivity to EFB

Additional fomax options

Option 1 – Cellular Gatelink

4G cellular connection on ground

Option 2 – WiFi in the cockpit

Activates FOMAX's WiFi hotspot allowing connection of EFB to FOMAX

Option 4 – cabin satcom connection

Provides internet connectivity to FOMAX via cabin connectivity systems

*Requires option 2 to provide connectivity to EFB

**Requires Airbus ACM / ALNA

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aft via

fms

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Provides internet connectivity to FOMAX via cockpit connectivity systems such as SBS

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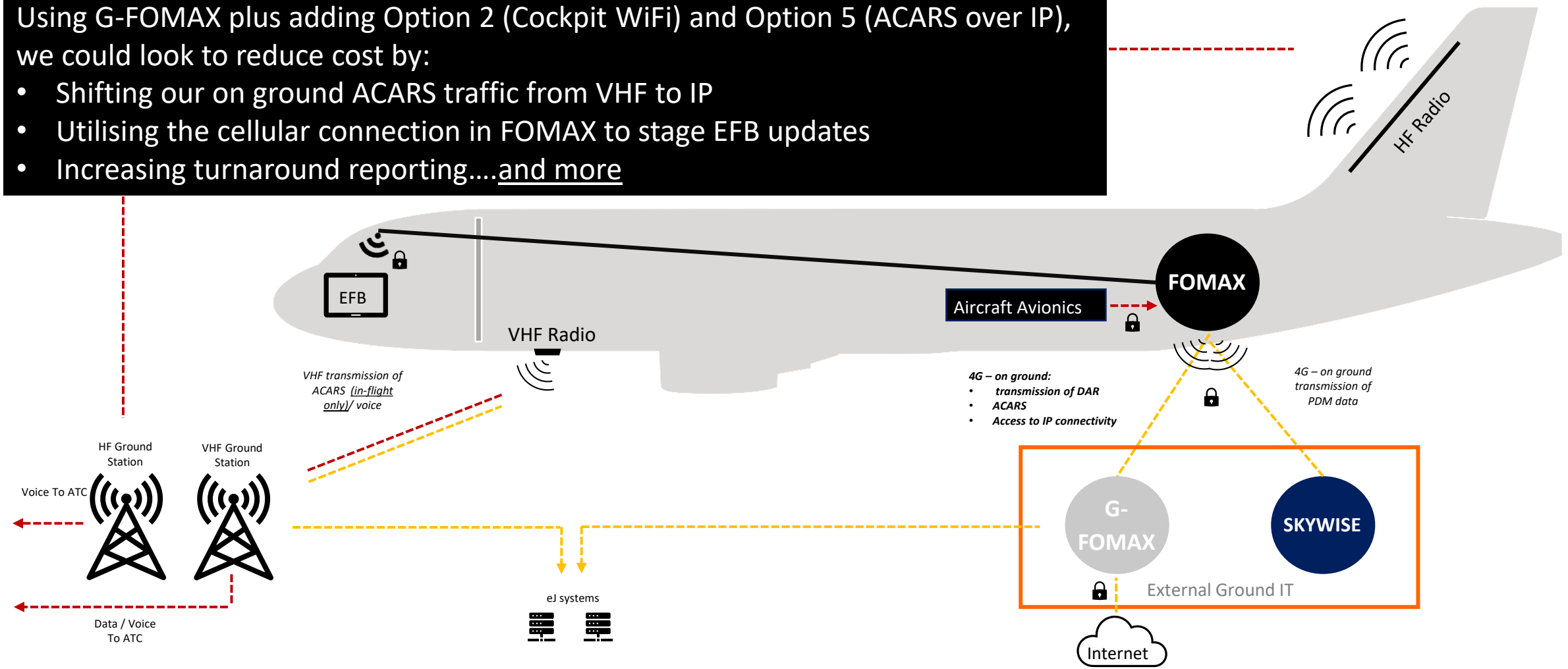
All of the highlighted options require G-FOMAX – an investment already made as part of 2G/3G sunset remediation

Mitigating the 2G/3G sunset

FOMAX Cellular Gatelink plus Option 2 and Option 5

Using G-FOMAX plus adding Option 2 (Cockpit WiFi) and Option 5 (ACARS over IP), we could look to reduce cost by:

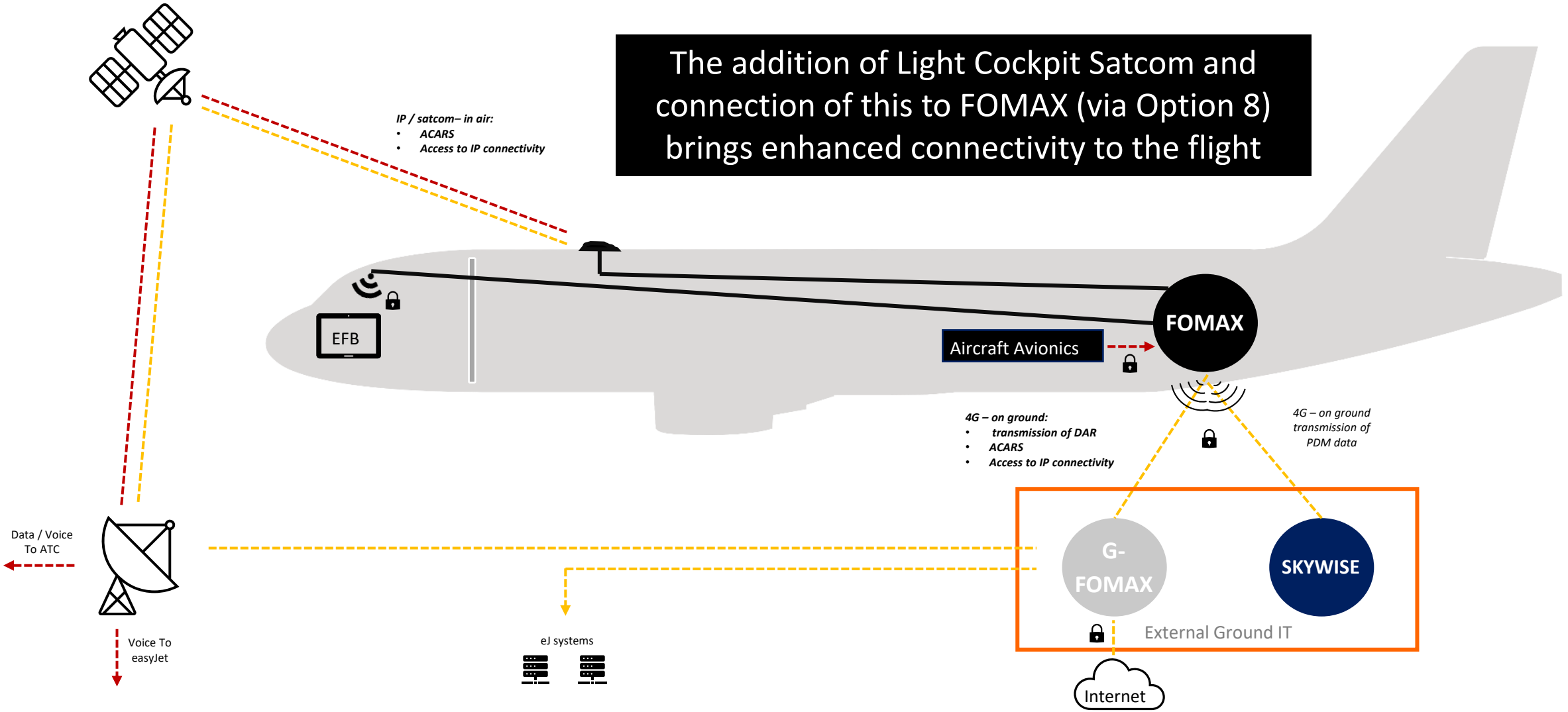
- Shifting our on ground ACARS traffic from VHF to IP
- Utilising the cellular connection in FOMAX to stage EFB updates
- Increasing turnaround reporting….and more



But the real opportunities come once the aircraft is in the air…..

The connected aircraft for cockpit operations

The addition of Light Cockpit Satcom and connection of this to FOMAX (via Option 8) brings enhanced connectivity to the flight



ACD, AISD, PIESD

VHF / HF radios are still equipped but omitted from the diagram

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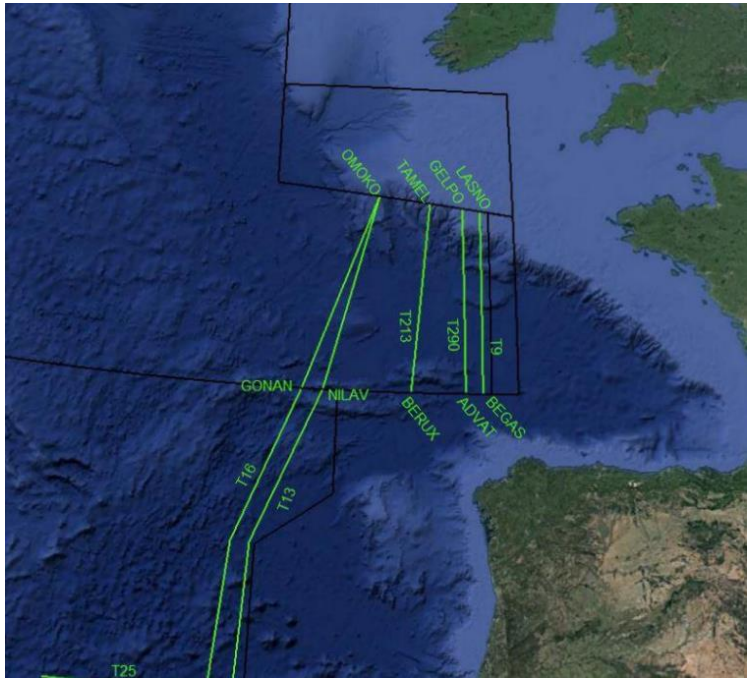
New flight plan opportunities

Usage of routes that require enhanced connectivity, reducing fuel usage and navigation charges



Real-time in flight weather

Live weather information, reducing lighting strikes, turbulence etc. and providing pilots with greater data for tactical planning.

Flight profile optimisation

Constant monitoring of improved route opportunities to reduce fuel

Full acars over ip, access to operational apps in flight, enhanced voice communications with airline OCC, datalink connectivity everywhere, in-flight medical services, live credit card authorisations

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THANKS!

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