IATA
GLOBAL
MEDIA DAYS

Turbulence Aware Update

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**"Facilitating industry shift
to data-driven turbulence mitigation"**

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IATA

Turbulence is

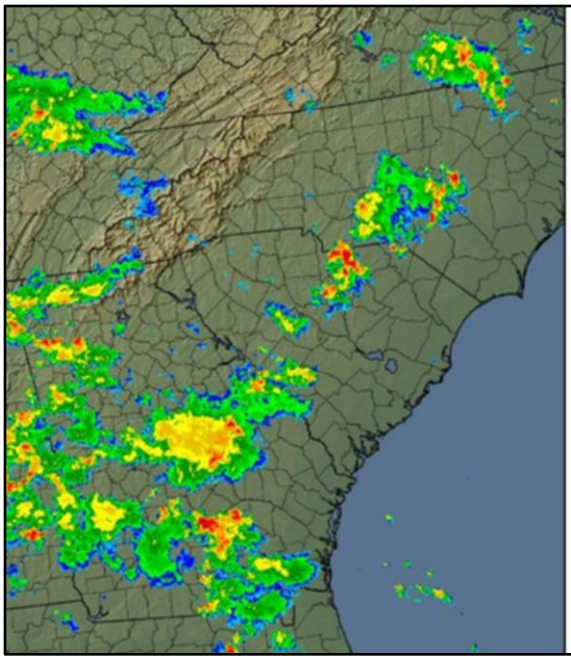
The leading cause of injuries to cabin crew and passengers in non-fatal accidents (FAA)

Contributing to the fear of flying

Significant economic impact

Just to start, let's talk a little bit about turbulence and how if affects the industry globally. As we know, turbulence is a major safety concern for airlines as it is one of the main causes of injuries in-flight and is the leading cause of injuries in non-fatal accidents according to FAA.

Turbulence related events have an economic impact on airlines. There is a study from Airbus saying turbulence costs the industry US $2bn per year; costs coming from potential inflight diversions due to injuries, damage to aircraft interiors, excessive fuel burn resulting in increased CO2 emissions as pilots search for smooth air which may deviate from their optimal flight level, unnecessary maintenance inspections, labor related costs because of crew injury, customer satisfaction, brand image damage and so on.



Existing tools for managing turbulence have limitations

PIREPs are subjective

Forecasts may be inaccurate and hours old

Weather radar cannot detect clear air turbulence

Current aviation meteorological tools do not provide pilots and dispatchers with accurate enough information regarding the location and severity of turbulence. Pilot reports are subjective and can depend on aircraft size and pilot experience. Forecasts can be many hours old and potentially inaccurate. Weather radar is used for turbulence avoidance related to thunderstorms but cannot yet detect CAT (clear air turbulence).

Consequently, many turbulence encounters are unforeseen resulting in passenger and crew injuries.

More effective approaches are being sought after by airlines
to manage turbulence and meet both safety and efficiency demands of operations globally.

Industry shift from subjective pilot tools in the previous slide to objective, aircraft generated, in-situ, real time turbulence data.

Turbulence – sea state of the atmosphere

EDR (Eddy dissipation rate)

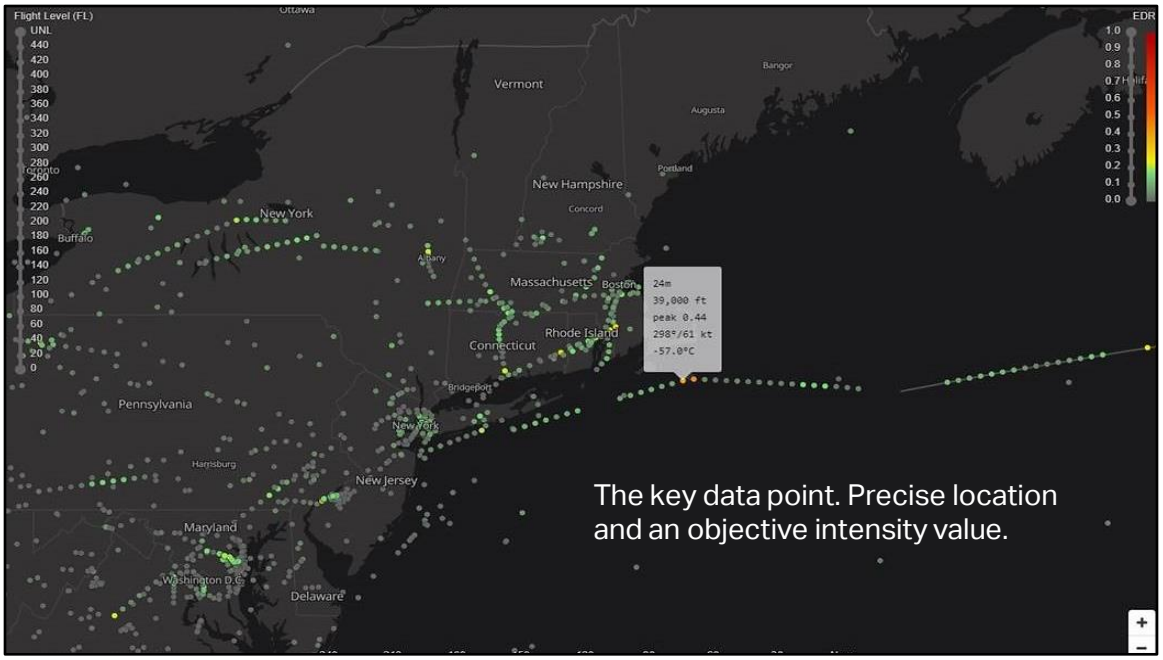
=

Height of the wave

How is an objective turbulence report generated?

Let's imagine an aircraft flying in clear air conditions when suddenly it enters an area of turbulence. During the turbulence encounter, existing sensor data such as TAS (true airspeed), AOA (angle of attack) are sent to an algorithm within the avionics bus. This algorithm is calculating EDR (eddy dissipation rate) turbulence intensity values indicating the state of the atmosphere around that aircraft, so it is an aircraft independent, absolute value. (Aircraft of differing sizes in the same atmospheric location will theoretically calculate the same EDR value). The impact of turbulence on aircraft of different sizes will vary for the same EDR value. For example, EDR of 0.24 will be moderate turbulence for an A320 but light turbulence for a B777.

The EDR report is compiled and sent via ACARS (Aircraft Communication Addressing and Reporting System) or wifi to the ground. It is important to know that the process I just showed you is based on a free and open source EDR calculation and reporting software developed by NCAR (U.S. National Center for Atmospheric Research) and is available to anyone who wants to implement it. It's called NCAR version 2 vertical wind algorithm.



So here is an example of these data points as displayed in IATA's Turbulence Aware viewer tool. When we talk about these objective reports, this is what it looks like. Each dot (report) contains specific operational information. Similar to the WAZE car navigation app indicating potholes in the road ahead of you but in this case "bumps" in the sky ahead.

More detail in a minute during the demo.

IATA Turbulence Aware

A global platform for sharing automated EDR* turbulence reports in real time

*EDR (Eddy Dissipation Rate)

Real-time turbulence data is collected from airlines, business aviation or third party ground servers

Data is consolidated, quality controlled and de-identified

Data is currently processed through the platform within 1 second

Turbulence data points are made available for immediate operational use via a range of airline/vendor applications and/or ITA Viewer

The IATA platform not only processes and hosts the turbulence data from various airlines but also makes it available for them to consume and integrate it into their existing flight planning and inflight tools used by your dispatch personnel and pilots. Airlines have complete operational flexibility on how to operationalize the raw data turbulence reports.

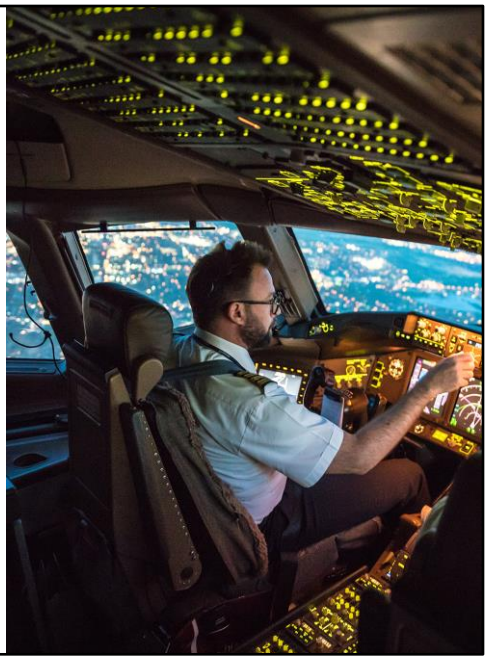
The global data is also graphically displayed on the IATA Turbulence Aware web-based viewer which will be demonstrated shortly.

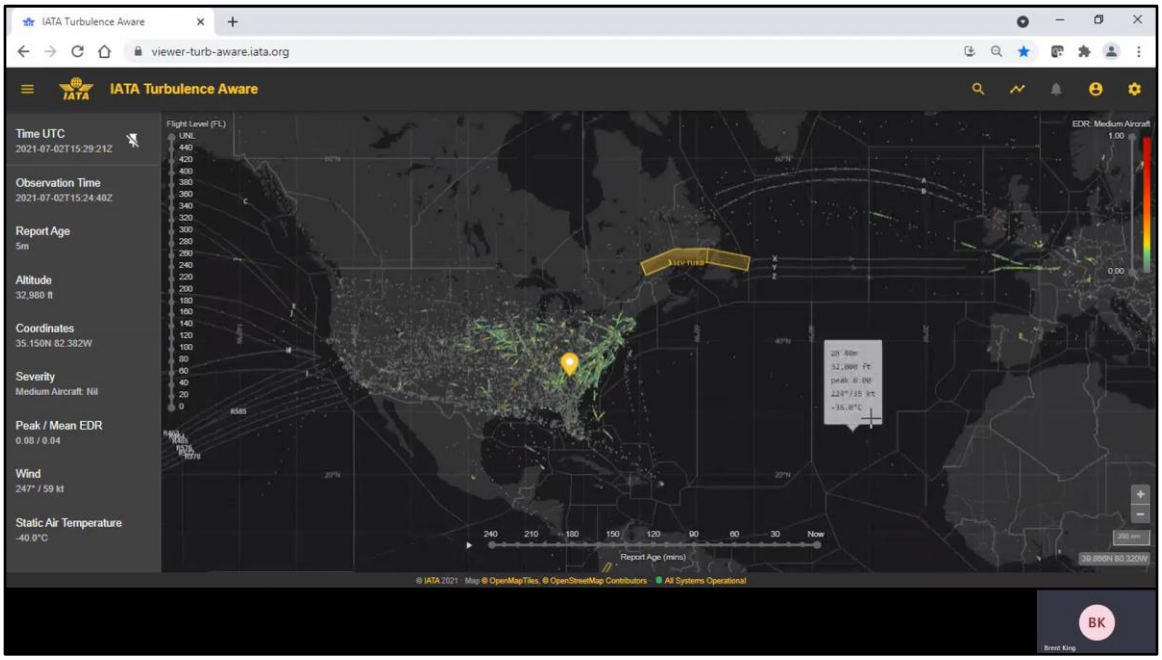
Practical Use of EDR Data

Secure the cabin and coordinate service

Change altitude to avoid turbulence for a safer, more fuel-efficient flight based on:

- Real-time, precise information about the location, altitude and intensity of turbulence
- Heartbeat reports identifying areas of smooth air





- All reports are color coded
- Grey dots represent areas of no turbulence and colored dots represent different intensity of turbulence as per the scale on the right
- Flight Level (altitude) filter on the left can be used to assess the intensity of turbulence at different flight levels
- Time slider at the bottom allows users to see turbulence reports between now and up to four hours prior
- The user can click on the dot and see a detailed report as shown on the left, including time, altitude, aircraft position, mean and peak turbulence values as well as wind and temperature data
- Operationally, pilots and dispatchers can display their flight planned route and buffer the turbulence data around their flight path.
- Access to historical data is available for post flight investigation and analysis.

QATAR AIRWAYS القطرية

Most recent IATA member airline to officially join the operational program

Significant data contribution (currently 120 aircraft and increasing)

Extensive route network

Greatly helping to increase coverage in data sparse areas

First Middle Eastern airline to contribute data and sign an operational contract

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Benefits of IATA's Turbulence Aware

Improved safety outcomes

Enhanced customer experience and brand image

Efficient fuel planning and optimum fuel burn in-flight (reduced CO2)

Fewer engineering inspections

Lower insurance premiums

Significant risk mitigation tool