

ATM SG/9 meeting

Sharm El Sheikh ,Egypt

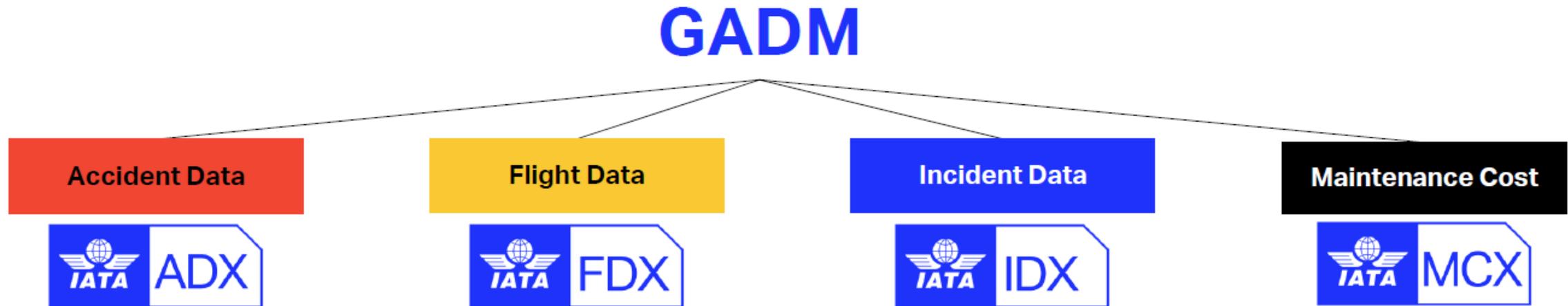
14-16 November 2023

GNSS/GPS Interference

MENA Region 2022-2023 (Jan-Aug)

Global Aviation Data Management

- IATA's Operations, Safety & Security Division
 - Safety & Operational Data and Analytics Programs
- GADM is a unique global aviation safety database with IATA serving as a custodian trusted by the industry to do this.



GADM Statistics Overview 2023

as at 06/06/2023

GADM Members

271 Participants

IDX Participants

253 Participants

FDX Participants

194 Participants

Yearly Flights (FDX)

5 million flights +

Total Number of Aircraft (FDX)

6500+ Aircraft

The members are keep **growing**

Background

- The GPS signal is a low power signal. It is comparable to the **power emitted by a 60W light-bulb** located more than **20,000 km away** from the surface of the earth.
- GPS L1 frequency band (**1575.42 MHz +/- 10 MHz**),

- **GNSS spoofing**

Some of the known RFI sources are reportedly capable of emitting signals that **mimic GNSS signals**

Analysis Scope – Event Definition

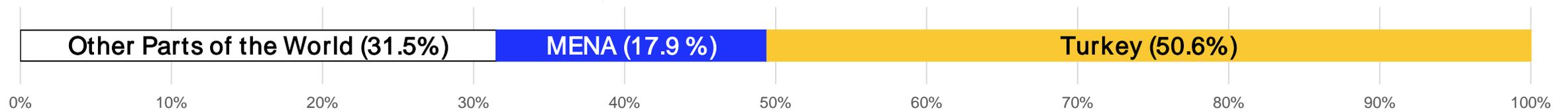
The analysis utilized three datasets: Incident Data Exchange (IDX), Flight Data Exchange (FDX), and NOTAM information held by the IATA. The analysis covers the time period of January 2022 to December 2022.

Incident Data Exchange (IDX)

The analysis revealed 524 GNSS/GPS jamming or suspected interference reports from 12 operators in the MENA region and adjacent states gathered through the Incident Data Exchange (IDX) from January 2022 to December 2022. A total of 462 reports of GNSS interference were excluded from the analysis because the exact location of the incident could not be determined for flights that departed from or arrived in the MENA region.

Flight Data Exchange (FDX)

The analysis also utilized data from the Flight Data Exchange (FDX) to extract a total of 162,654 'GPS signal loss' events from 54 operators in the MENA region and adjacent states from January 2022 to December 2022. This is 68.5% of all GPS Signal Loss Events in FDX database in 2022. The Total Event Count around the world was 237,489.

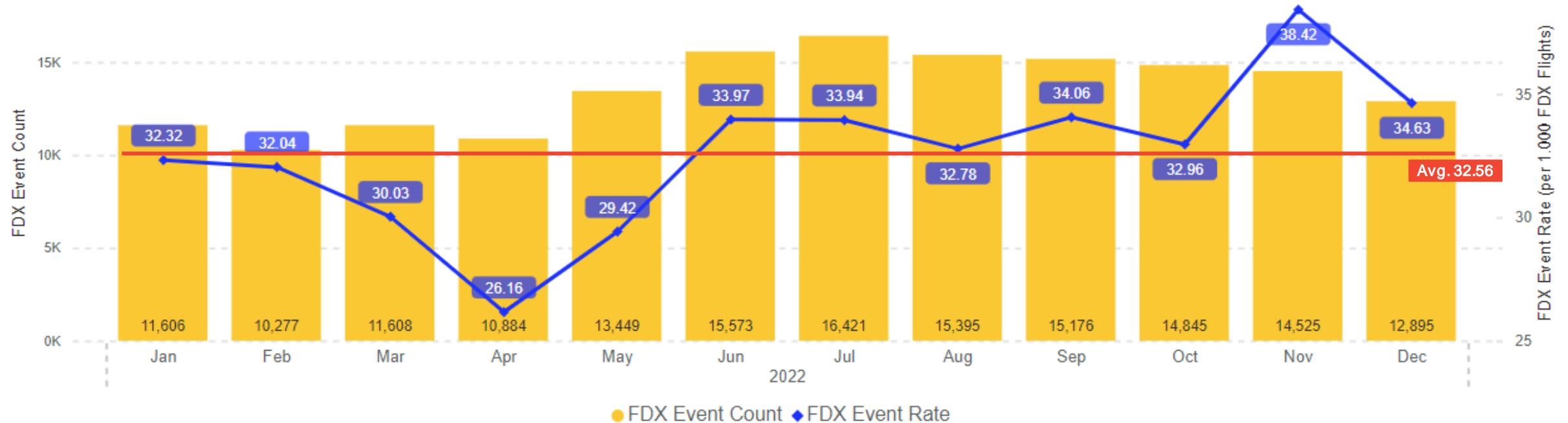


NOTAM (FAA SWIFT Portal)

In addition to the above datasets, 66 GNSS interference NOTAMs were extracted from the NOTAM archive issued over MENA States from January 2022 to December 2022, sourced from the FAA SWIFT Portal.

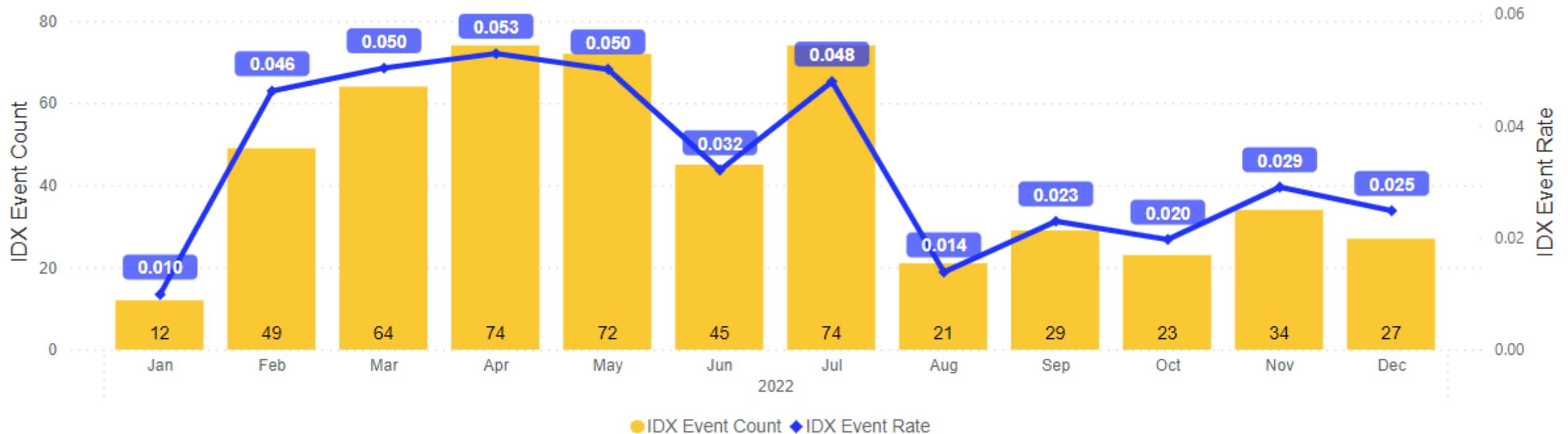
GNSS/GPS Interference Trend 2022

Monthly rate trends for the FDX 'GPS Signal Loss' event and Event Count



GNSS/GPS Interference Trend 2022

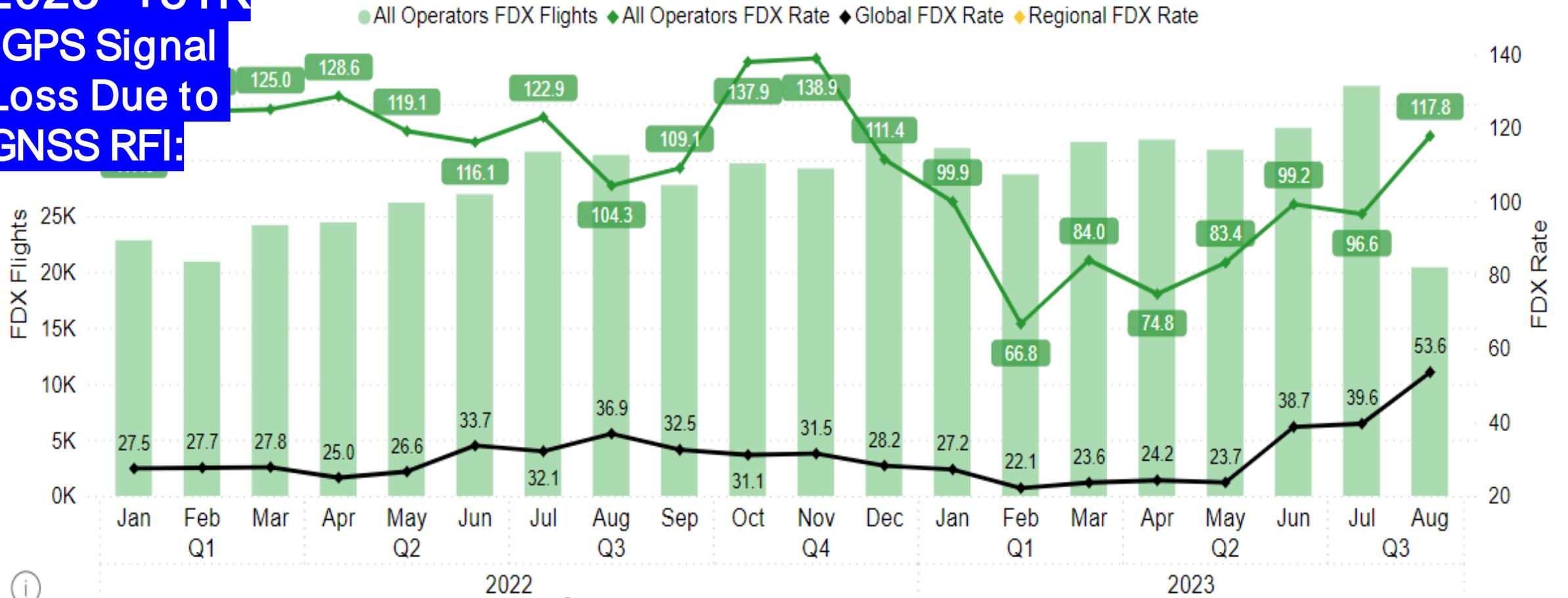
Monthly rate trends for the IDX GNSS Interference event and Event Count



- The number of reported GPS Signal Loss events in the IDX data is significantly lower than in the FDX data.
- This may be due to the fact that these events are not mandatory to report, and they have become so common that they are no longer considered abnormal or worthy of reporting.
- Additionally, many reports that mentioned GNSS interference were not included in the analysis because the exact incident location could not be determined with the information provided in the report. As a result, the actual number of GPS Signal Loss events may be even higher than reported in the data.

GNSS/GPS Interference Trend (Jan22-Aug.23)

2023 --+81K
"GPS Signal
Loss Due to
GNSS RFI:



MENA rate 107.57 Global 30.34



GNSS/GPS Interference Trend

FDX Event Rate per Departure – Arrival Region Combination

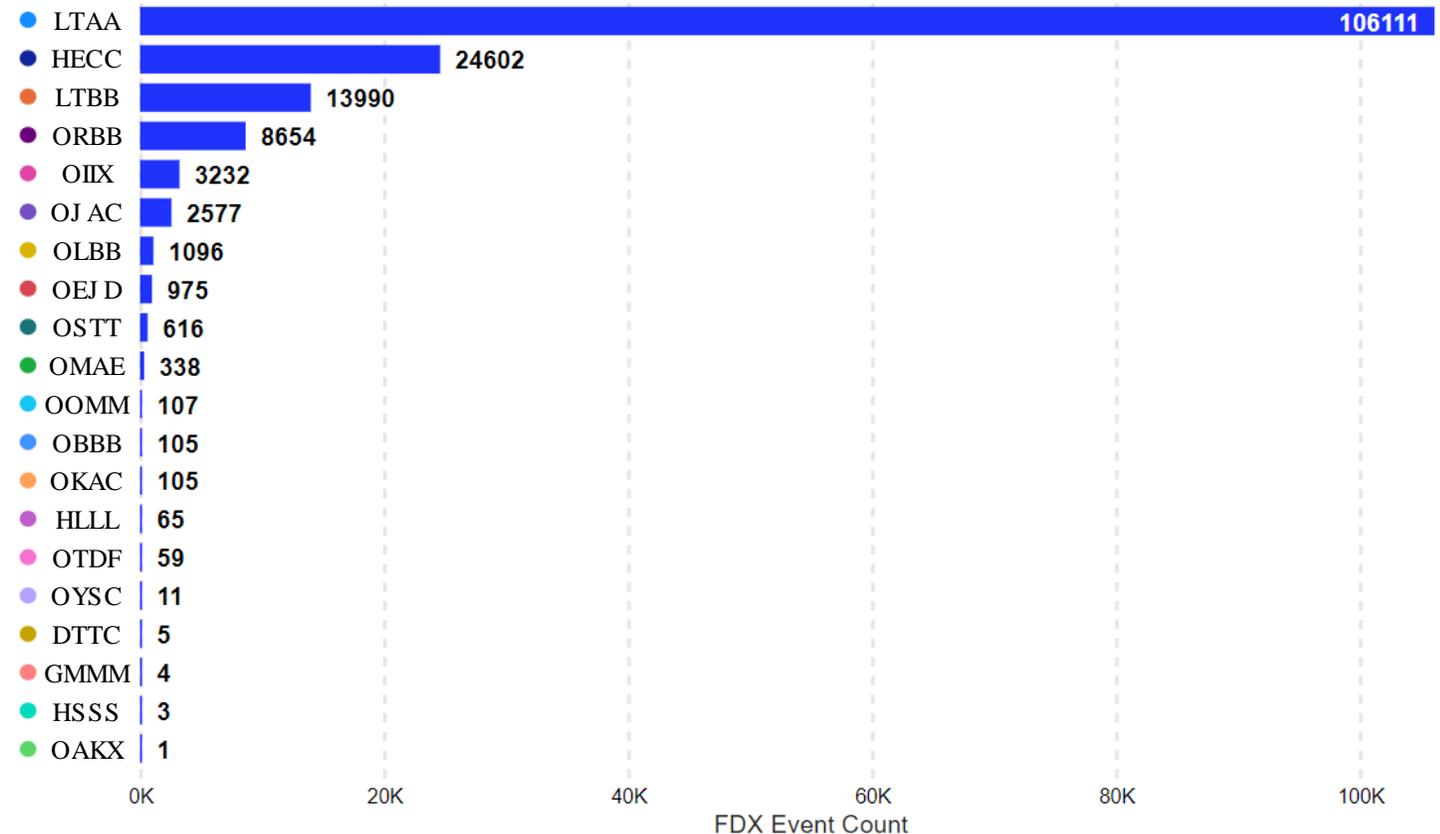
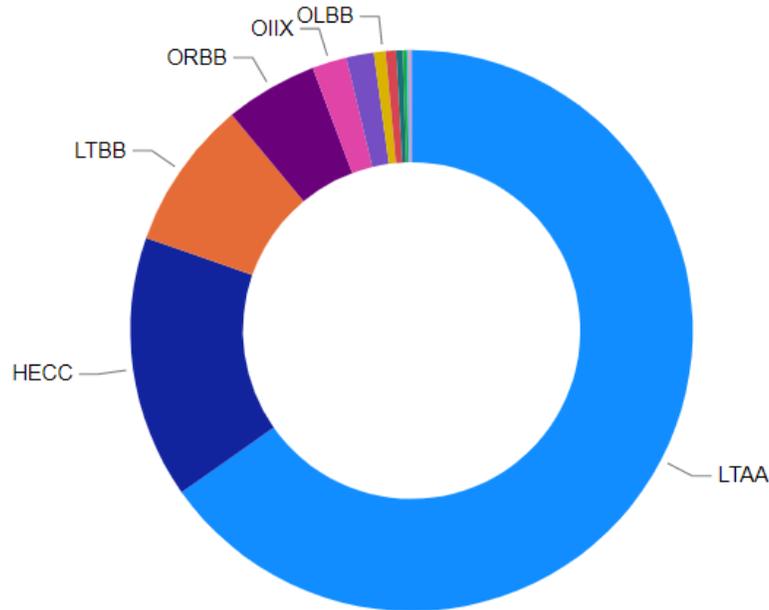
Departure	Arrival						
	AFI	ASPAC	CIS	EUR	MENA	NAM	NASIA
AFI					152.5		
ASPAC			13.1	176.2	4.2		
CIS		12.2	0.1	271.2	147.9		
EUR	0.2	185.4	215.9	73.7	430.2		93.4
MENA	114.9	2.5	135.9	376.5	169.1	80.6	5.6
NAM		8.9			103.2		
NASIA				72.5	0.4		

- EUR – MENA routes exhibit significantly higher rates of ‘GPS Signal Loss’ events compared to other regions.
- The event rate is approximately 400 per 1,000 flights, indicating 40% of FDX flights experienced ‘GPS Signal Loss’ events on these routes

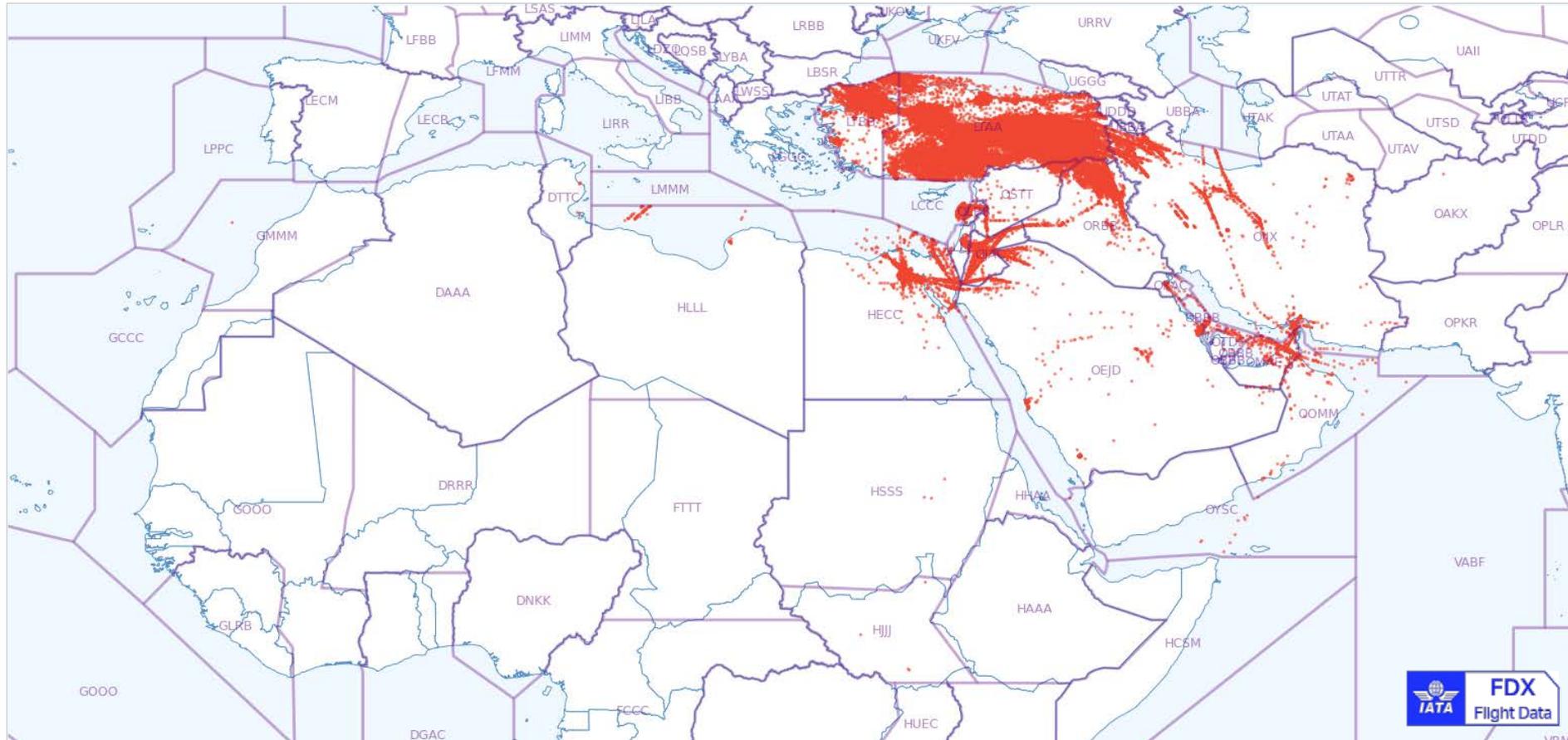
Distribution of GPS Signal Loss by FIR

FDX GPS Signal Loss Event Count Per FIR

FDX GPS Signal Loss Event Count By FIR



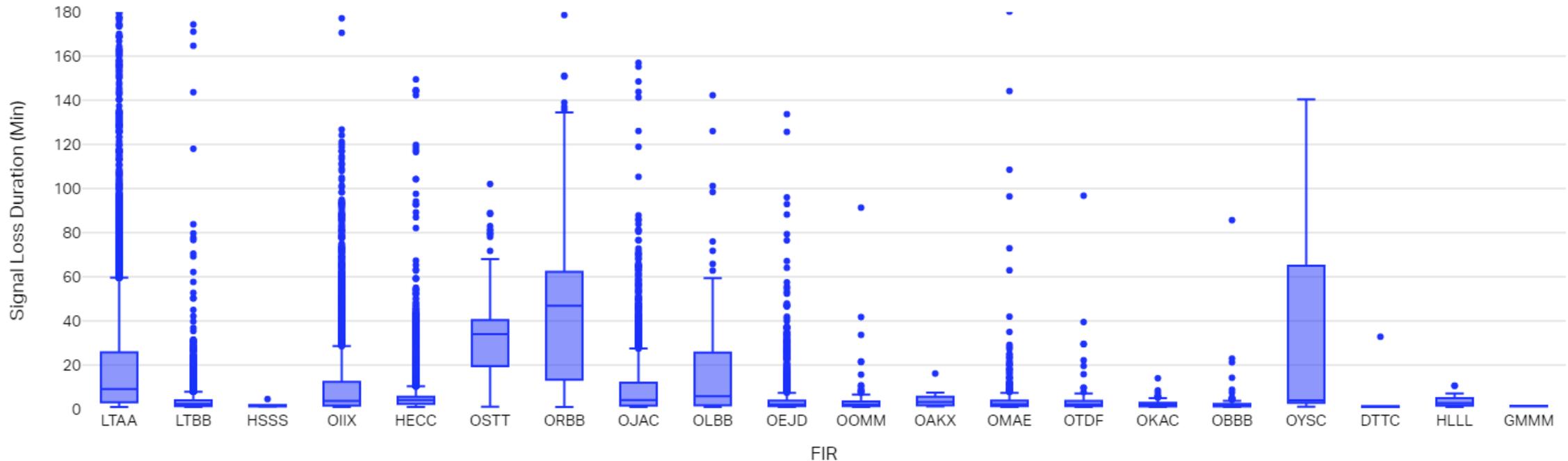
GPS Signal Loss Hot-Spots



- The chart displays **164,577** red dots, each representing a single 'GPS Signal Loss' event in the MENA region.
- This highlights the need for increased awareness and proactive measures to address GPS Signal Loss issues in the region.

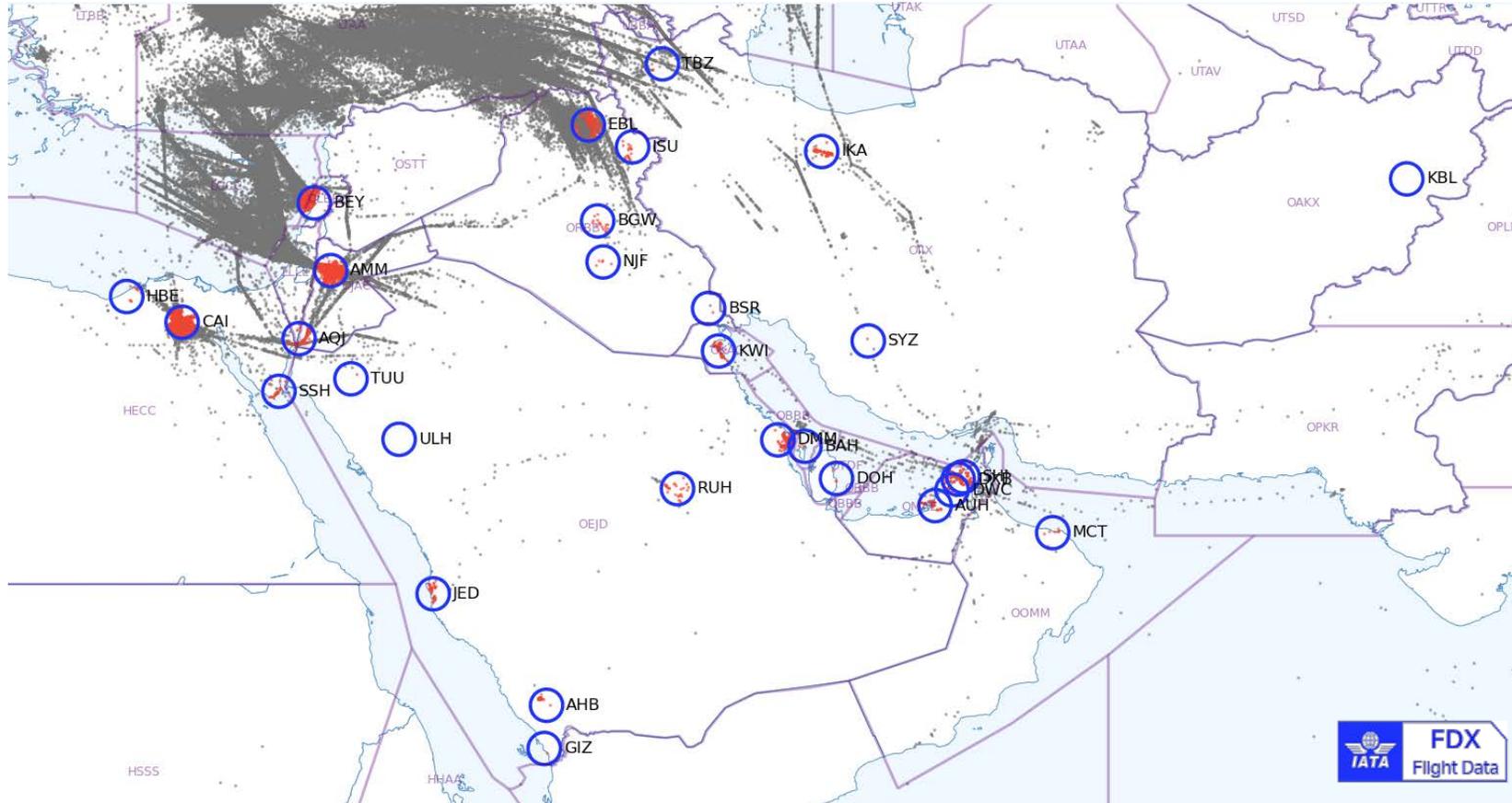
GPS Signal Loss Duration

GPS Signal Loss Duration (in Minutes) Distribution



- This box plot visualizes the distribution of 'GPS Signal Loss' event durations across the FIRs in the MENA region
- To better display the central tendency and spread of the data, any outliers with abnormally high values were removed.
- On average, the duration of GPS Signal Loss events is **14.5 minutes**. The lower 25% of events have a duration of **2.5 minutes or less**, while the upper 25% of events have a duration of **21.2 minutes or more**. The median duration of GPS Signal Loss events is **6.0 minutes**, indicating that half of the events lasted shorter than 6.0 minutes, and half lasted longer.

GPS Signal Loss Near Airports



- This chart depicts flights in the MENA region that have experienced 'GPS Signal Loss' during departure or arrival near airports.
- The 30 NM radius circle around the airport was used to determine the vicinity.
- Red dots within the airport area indicate where the interference occurred, while grey dots represent events that occurred outside the airport area or during the cruise phase.
- The intensity of the red color reflects the frequency of the events.
- Cairo International Airport has the highest number of events near the airport.

GPS Signal Loss Near Airports

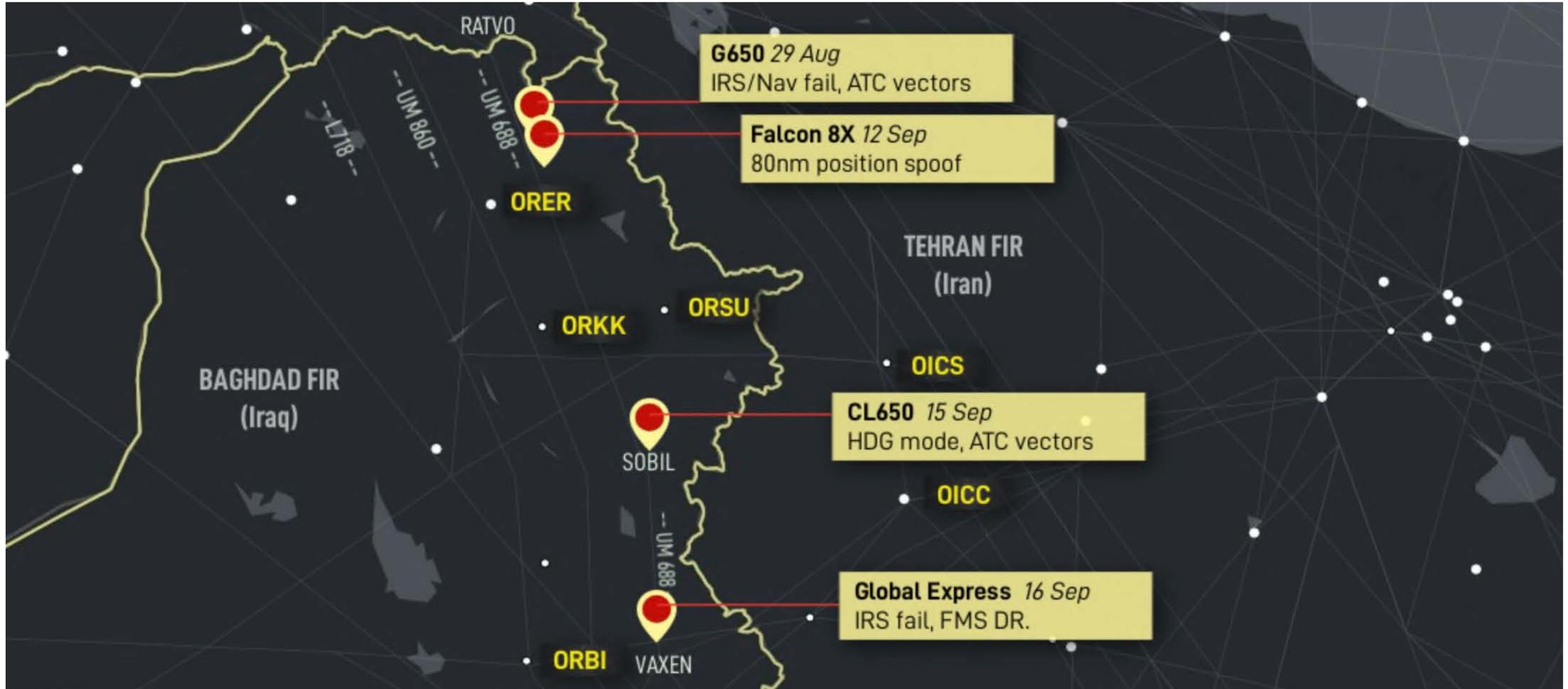
Number of GPS Signal Lost Events Near Airports (30NM)



- The bar chart and table display the frequency of 'GPS Signal Loss' events during departure or arrival at airports in the MENA region.
- Cairo International Airport stands out as having a significantly higher frequency of events compared to other airports.
- This difference is clearly shown in both the bar chart and table.

	CAI	BEY	AMM	EBL	AQJ	DMM	AHB	IKA	KWI	DXB	SHJ	JED	SSH	DWC	AUH	BAH	RUH	ISU	BGW	HBE	TBZ	MCT	NJF	DOH	BSR	GIZ	SYZ	TUU
Arrival	13803	439	498	262	30	95	151	132	60	66	74	18	44	31	16	29	16	9	10	4	1	6	4	3	1	1	0	1
Departure	9295	1119	789	866	140	64	0	19	30	23	13	34	7	19	25	8	13	11	8	7	10	2	3	0	0	0	1	0

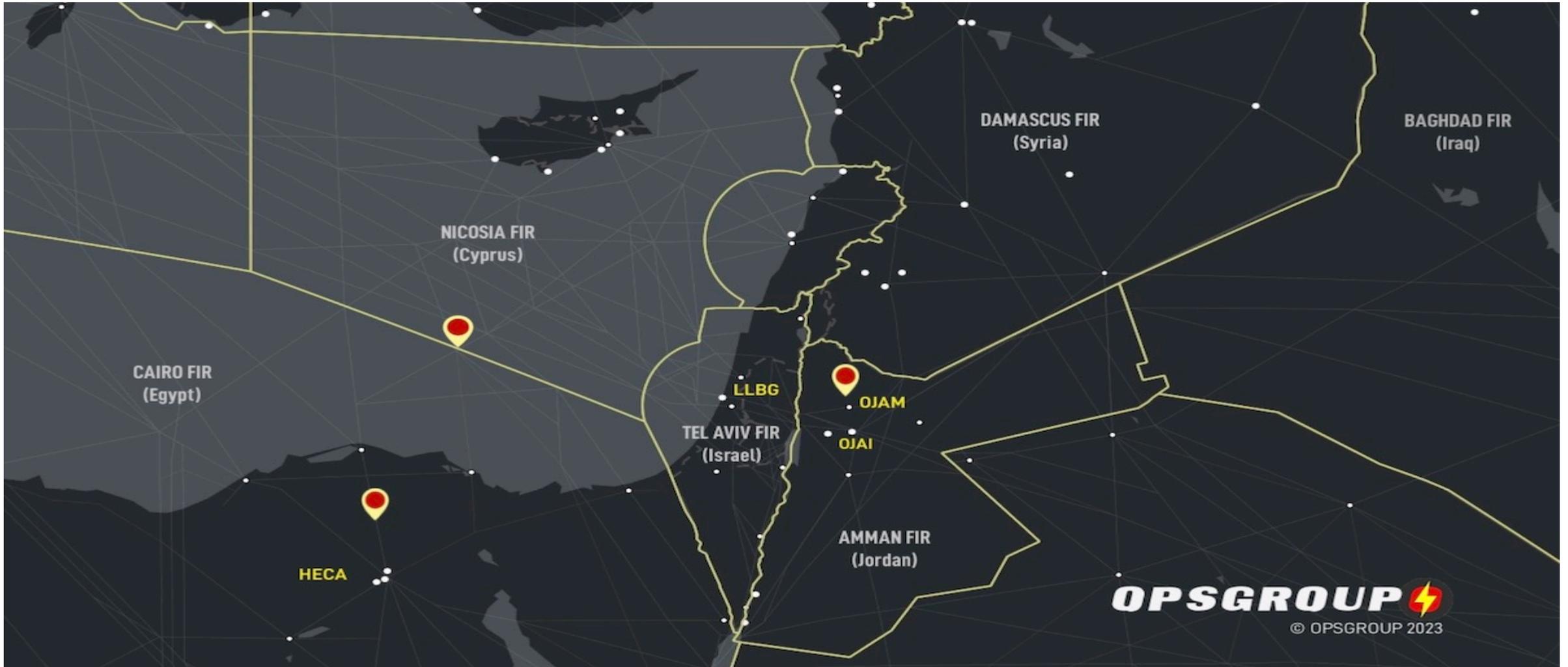
GNSS Spoofing Baghdad FIR / New Threat is



GNSS Spoofing /Location



New variety of GPS spoofing (LLBG)



GNSS Spoofing

- Fake GPS signal (spoofed) gives the FMS the **indication it is 60nm off track**
- IRS failure follows rapidly
- No reliable on-board navigation – ATC vectors required

Aircraft types affected so far:

- Gulfstream G650
- Boeing 777, 747, 737
- Bombardier Global Express
- Bombardier Challenger 604, 650
- Embraer E190
- Embraer Praetor 600, Embraer Legacy 650
- Dassault Falcon 8X

GNSS Spoofing

The spoofing reports are as alarming for two reasons:

- the sophistication of the methodology, and
- the unexpected “infection” of the IRS. (May update the IRS with bad data)
 - FMS and IRS have only been designed to cope with a loss of GPS signal, and not an intentional spoofed signal.

Recommended Procedure – entering risk area

1. Check enroute FIR NOTAMs for any GPS spoofing advice (in time this will likely be published)
2. Cockpit Preparation: Perform full IRS alignment if entering known area with GPS spoofing risk
3. Be aware of typical sensor hierarchy for FMS position: GPS, then IRS, DME/DME, VOR/DME, DR.
4. Consider de-selecting GPS sensor input if option available.
5. Review differences between GPS Jamming and GPS Spoofing.
6. Perform time check and set correct time on personal device or watch.

Thank you.

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