International Civil Aviation Organization

MIDANPIRG/22 & RASG-MID/12 Meetings

(Doha, Qatar, 4 – 8 May 2025)

Agenda Item 5.3: ANS (AIM, PBN, AGA-AOP, ATM-SAR, CNS and MET)

DEVELOPMENT OF ADVANCED SURVEILLANCE SYSTEM (ASUR)

(Presented by I.R.of Iran)

SUMMARY

This paper introduces a domestically-developed alternative surveillance system designed to enhance and strengthen air traffic control surveillance services within the Tehran FIR in line with ANS requirements. The system architecture permits future integration as a **hybrid surveillance solution**.

Action by the meeting is at Paragraph 4.

REFERENCE

- Doc 4444, PANS-ATM
- Doc 9854, Global Air Traffic Management Operational Concept
- Doc 9750, Global Air Navigation Plan
- ICAO Annexes 10
- ICAO Annexes 11
- ICAO Annexes 15

1. INTRODUCTION

1.1 The main challenge we face in purchasing an integrated ATM automation system is the existing sanctions, which prevent us from acquiring a comprehensive system. To ensure safe air traffic services and prevent disruptions, a domestically developed software called **Advanced Surveillance System (ASUR)** has been created in line with ANS requirements.

1.2 In airports without radar systems, those located below radar coverage, or border areas where deploying surveillance radars is neither practical nor cost-effective, alternative and low-cost surveillance systems like ADS-B offer the best solution. These systems enhance air traffic monitoring and provide better situational awareness for air traffic controllers (ATC), search and rescue centers, security agencies, and other stakeholders involved in aviation operations. Moreover, ADS-B has been identified, under ICAO GANP, as ICAO ABSU ASUR B0-1 element that supports the provision of Air Traffic Services and operational applications at reduced cost and increased surveillance coverage.

1.3 The ASUR alternative surveillance system is a GIS-based software infrastructure and the first system introduced by the Iran Airports and Air Navigation Company that utilizes ADS-B data for surveillance operations. In addition to leveraging the advantages of ADS-B-based systems—such as cost-effectiveness, accessibility, and high scalability—ASUR can also integrate and process data

from installed radar systems across the country. This capability enables the development of a hybrid, domestically-built surveillance system, contributing to the accumulation of expertise in aviation surveillance system development.

2. DISCUSSION

2.1 The development of the ASUR project has been structured into at least three phases, with the first phase and part of the second phase already completed. The system is currently operational in various air traffic control units across the country.

2.2 In line with the objectives of the first phase—ensuring coverage above 20,000 feet across the entire national airspace—19 ADS-B sensors have been installed nationwide, with site selection carried out based on this strategy.

2.3 The implementation process of the ASUR project has followed these steps:

- Design and development of the project architecture
- Site selection for antenna and receiver installation in alignment with the objectives of the first project phase
- Installation and deployment of ADS-B antennas and receivers at designated locations
- Establishing connectivity with the AFTN network and integration with other systems
- Design and implementation of data models
- Separation of services, databases, and core software components
- Deployment of the above components on virtualized servers
- Implementation of the project as a web-based application

2.4 As shown in the figure Attachment A, ADS-B data is collected from sensors installed across the country through the data network, based on two criteria:

1) The sensor must be approved for data reception.

2) The network communication bandwidth and data transfer speed must meet requirements.

2.5 Accordingly, ADS-B data is received and processed in JSON and ASTERIX CAT 021 formats via TCP and UDP protocols:

- Flight data in JSON format is obtained through API requests.
- ASTERIX data is transmitted via UDP on a designated port.

2.6 Incomplete data (e.g., missing flight ID, corrupted flight ID, or no geographic coordinates) is filtered out. Duplicate data from overlapping sensor coverage areas is also removed. The processed data is stored in the database and distributed as static files for use by other subsystems and for display on the CWP (Controller Working Position). ADS-B data is updated every 4 seconds, in compliance with the specified criteria.

2.7 The services currently provided by ASUR can be summarized as follows:

- Flight monitoring on various offline maps
- Displaying detailed flight information upon selection
- Visualization of actual flight paths and FPL-based routes
- Processing flight trajectories according to flight plans and displaying actual and

processed routes on various maps

- Estimating arrival times at route waypoints
- Real-time flight display in a matrix format, showing time and altitude details for each waypoint crossing
- Traffic flow estimation charts and statistical traffic flow reports
- Filtering flights based on flight altitude and Mode-S code
- Drawing Graphic Cursor Lines (GCL) between flights, waypoints, and custom points in the airspace
- Displaying velocity vectors for flights
- Exporting statistical air traffic data in .xls format
- Providing standard datasets for the four designated areas (OICs, OIDs, OIPs, OIRs)
- Supplying datasets for flight routes, waypoints, and NAVAIDs
- Providing datasets for TMA and CTR regions
- Processing various meteorological data (METAR, SPECI, TAFOR, AIRMET CLD, SIGMET) and displaying them on different maps
- Processing NOTAMs, including listing active and archived NOTAMs by airport, sector, etc.
- Processing and displaying Gun-Firing activities, RPA/PJE operations, GNSS-Failure NOTAMs, and the activation of designated areas on maps
- Drawing and saving local (LCA) and temporary (TRA) areas on maps
- Displaying Obstacle Limitation Surfaces (OLS)
- Record & Playback functionality
- Sending messages and notifications to users with different access levels
- Customization options for flights, labels, and maps
- Automatic View mode for periodic display of different map layers
- Providing an API for interaction with other services and systems
- Processing and positioning COSPAS-SARSAT data for search and rescue operations
- Generating virtual tracks for flights lacking ADS-B data
- Implementing a Digital Elevation Model (DEM) to determine terrain elevations across the country and generate Digital Terrain datasets.

3. CHALLENGES AND LIMITATIONS

3.1 The ASUR system utilizes data transmitted by ADS-B systems installed on aircraft to determine flight positions. Consequently, aircraft lacking this equipment will not be visible within the system. However, ASUR system has the capability to estimate the positions of these flights using certain flight information, such as Flight Plans (FPL) and DEP messages. Nevertheless, precise position determination requires the aforementioned onboard equipment. In this regard, at least the following two

fundamental actions are necessary:

1. Establishing the necessary regulatory instructions by the Civil Aviation Authority to mandate airlines to equip their aircraft with ADS-B devices for flights over the country.

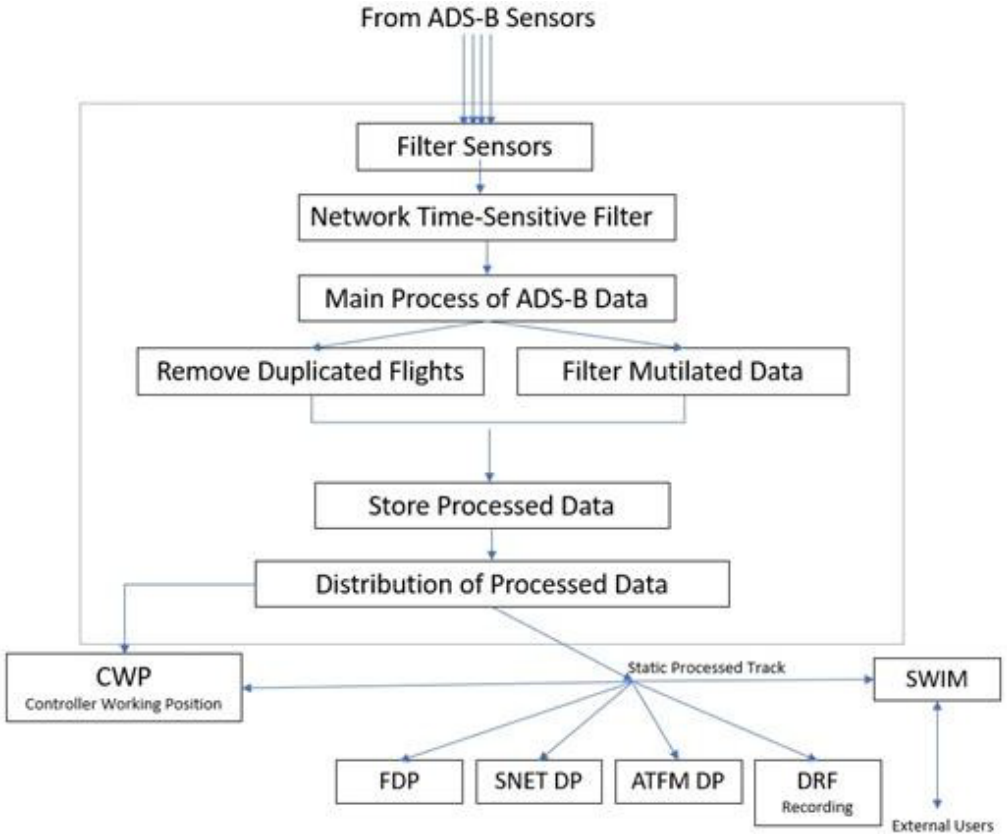
2. Providing and transmitting radar information to the ASUR system.

3.2 Another limitation of the project is the limited number of ADS-B sensors and receivers procured in the first phase. To ensure full coverage from ground level to the required altitude within the country's airspace, these receivers must be installed at most airports nationwide. In this regard, Iranian companies are also capable of manufacturing these receivers. However, for their use in the civil aviation sector, compliance with certain requirements and standards specified in regulatory documents is essential.

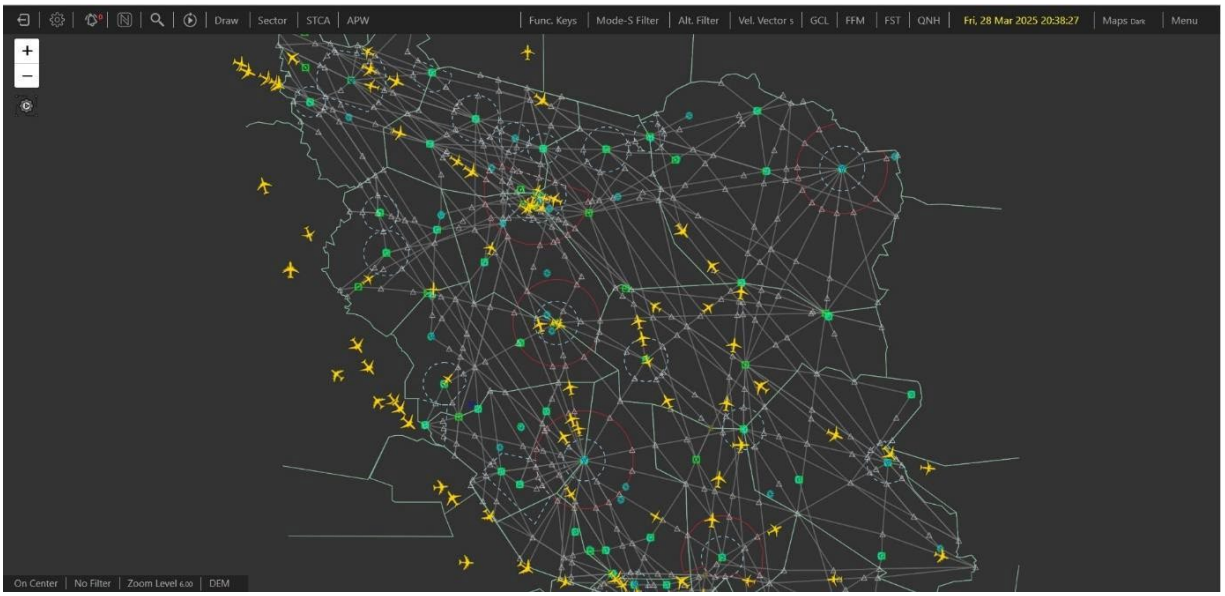
4. ACTION BY THE MEETING

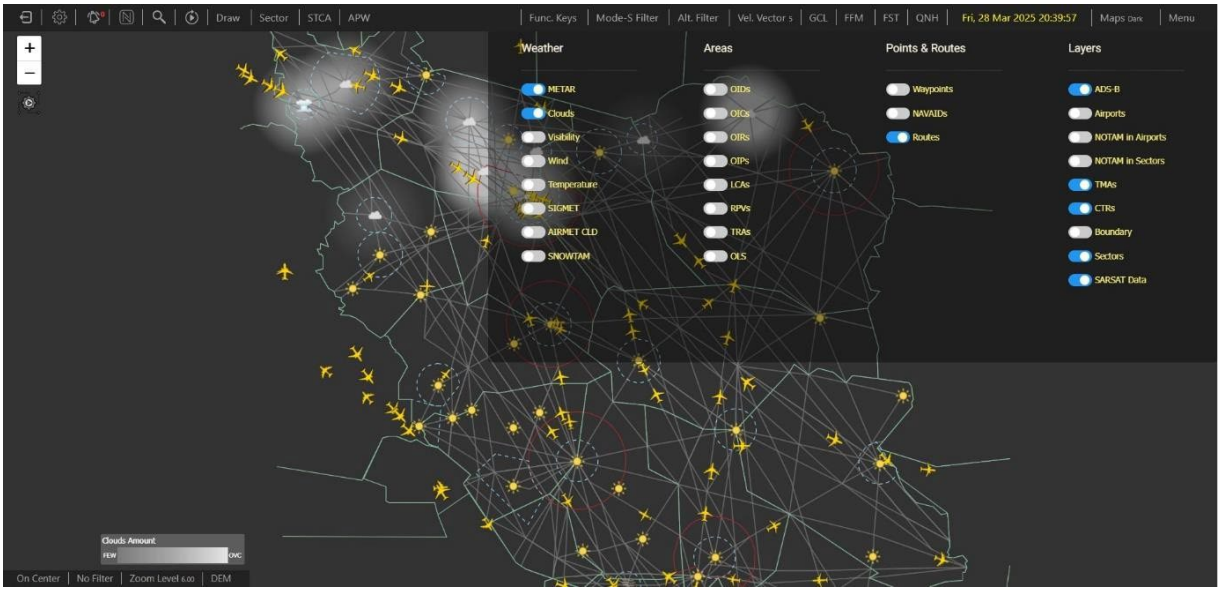
4.1 The meeting is invited to take note of I.R. of Iran experience.

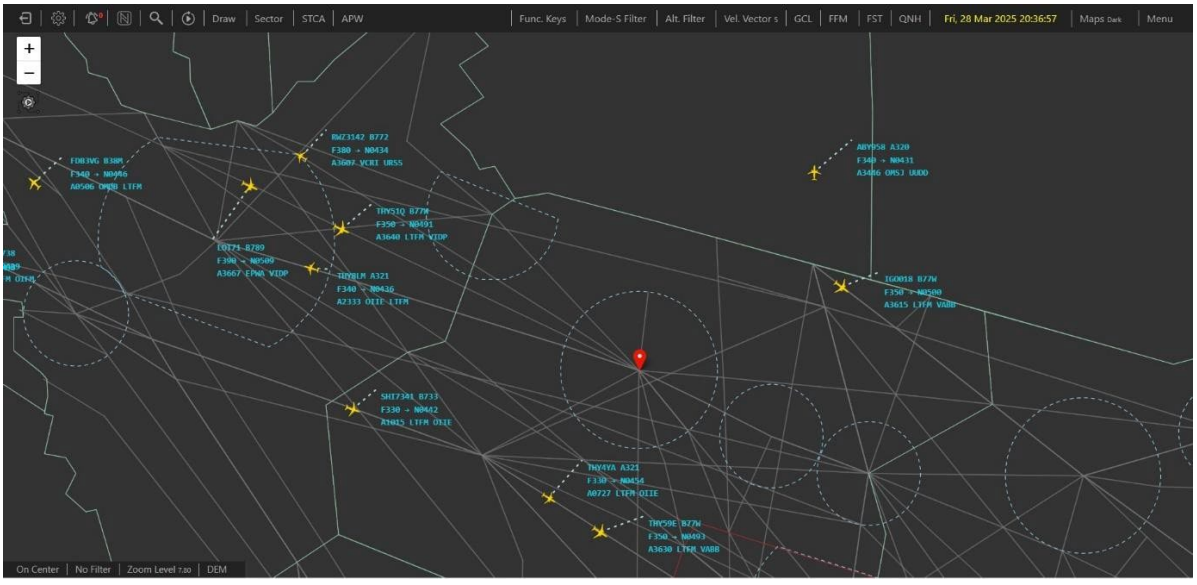
Attachment A – ASUR System ADS-B DP functional architecture and processed data flow

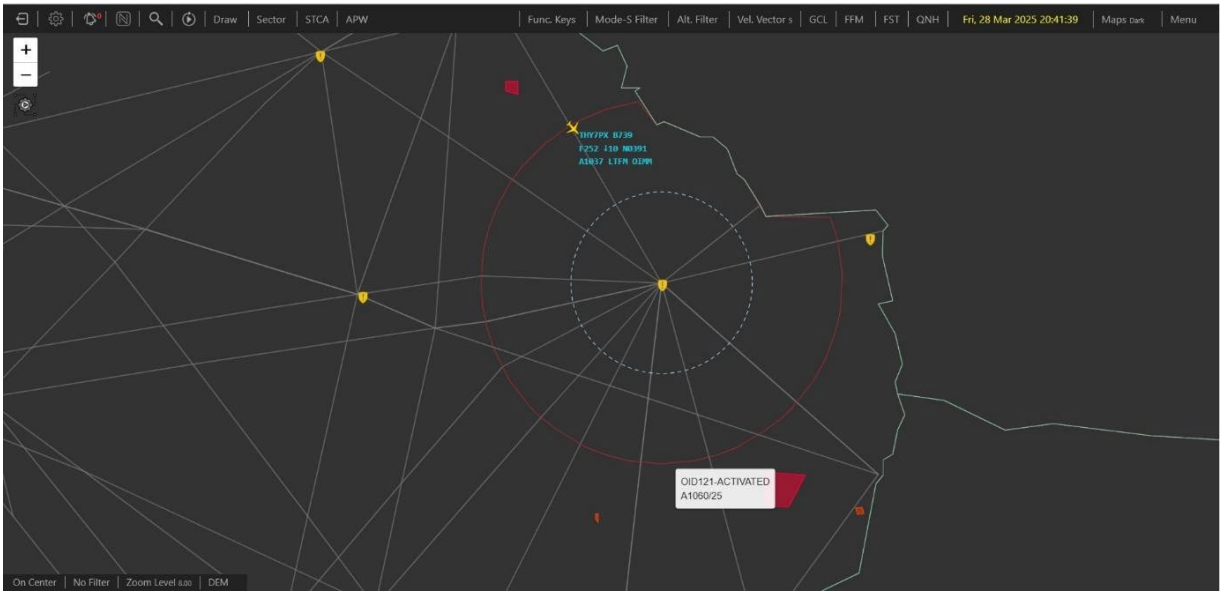


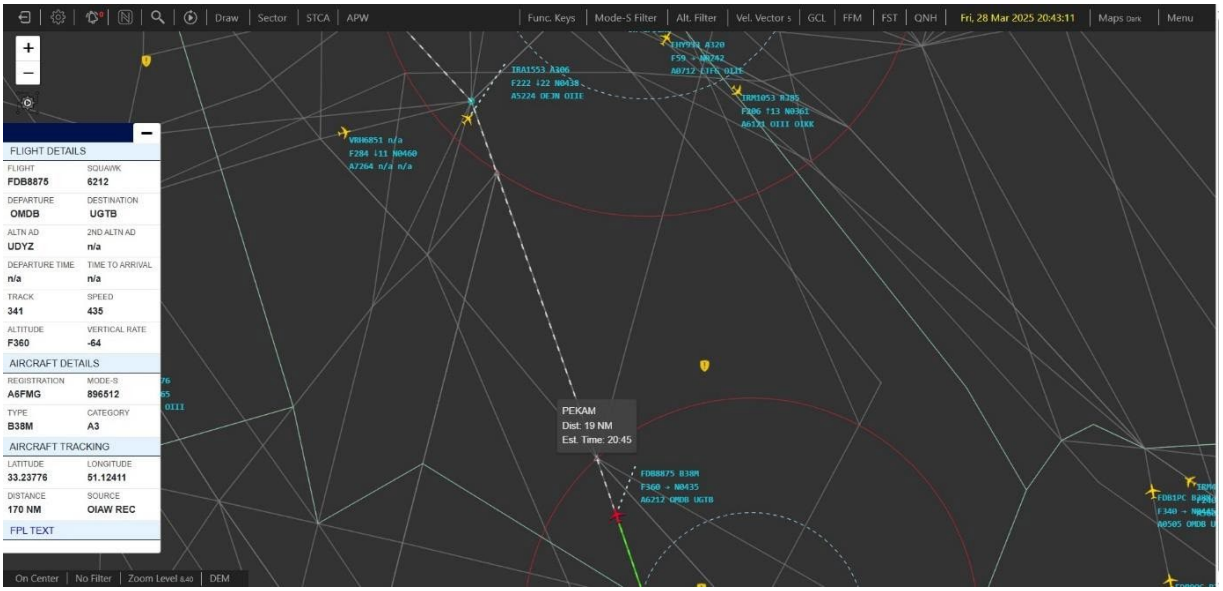
Attachment B – ASUR System Snapshots

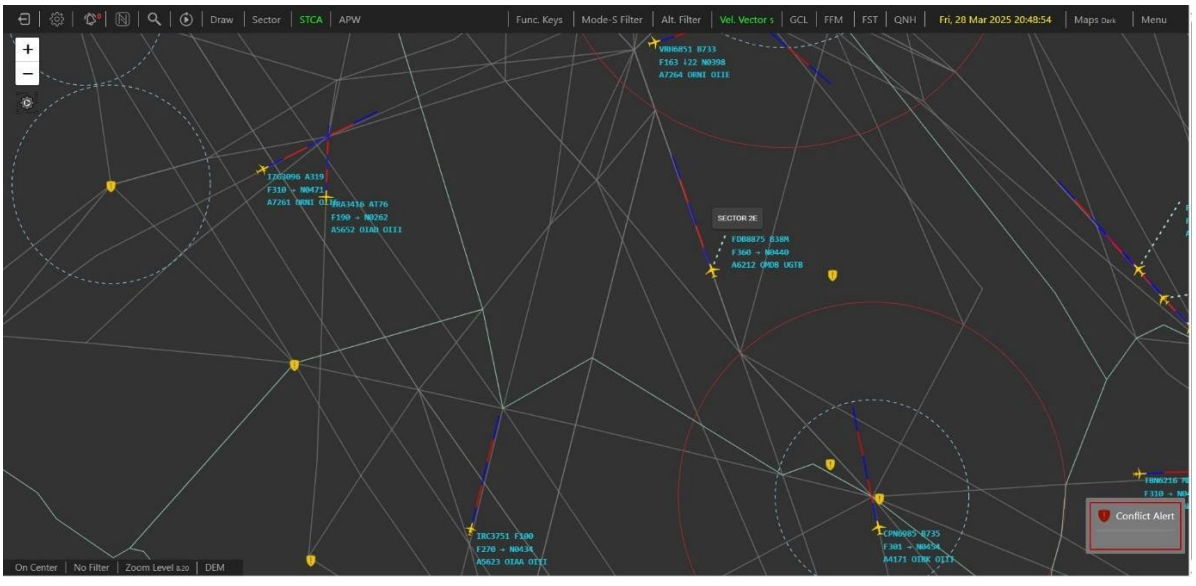


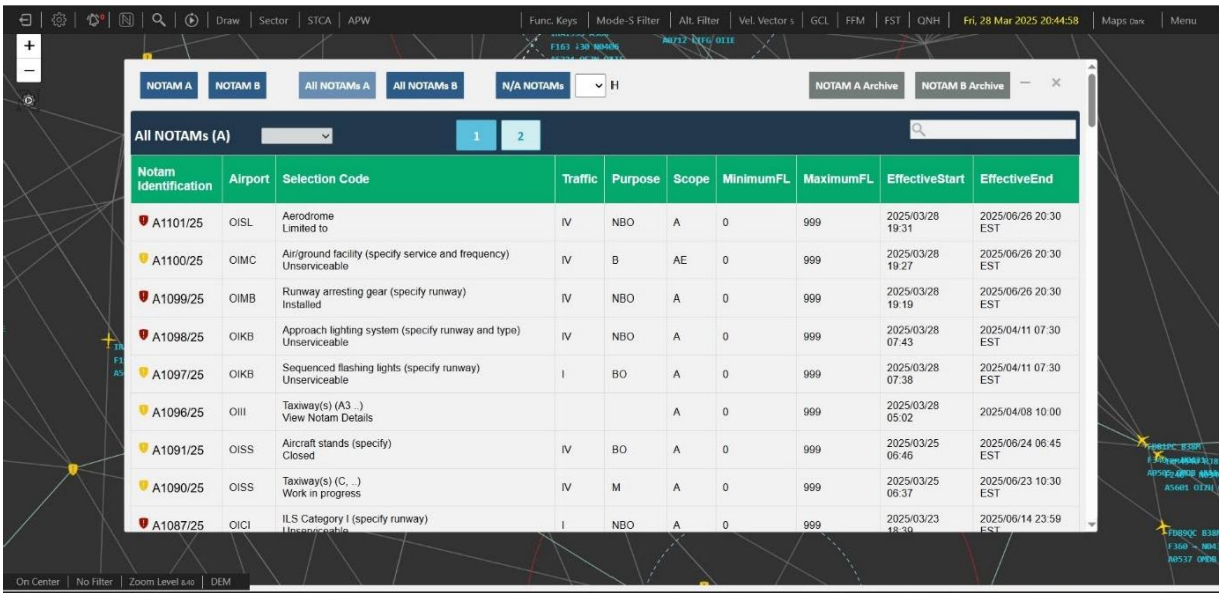


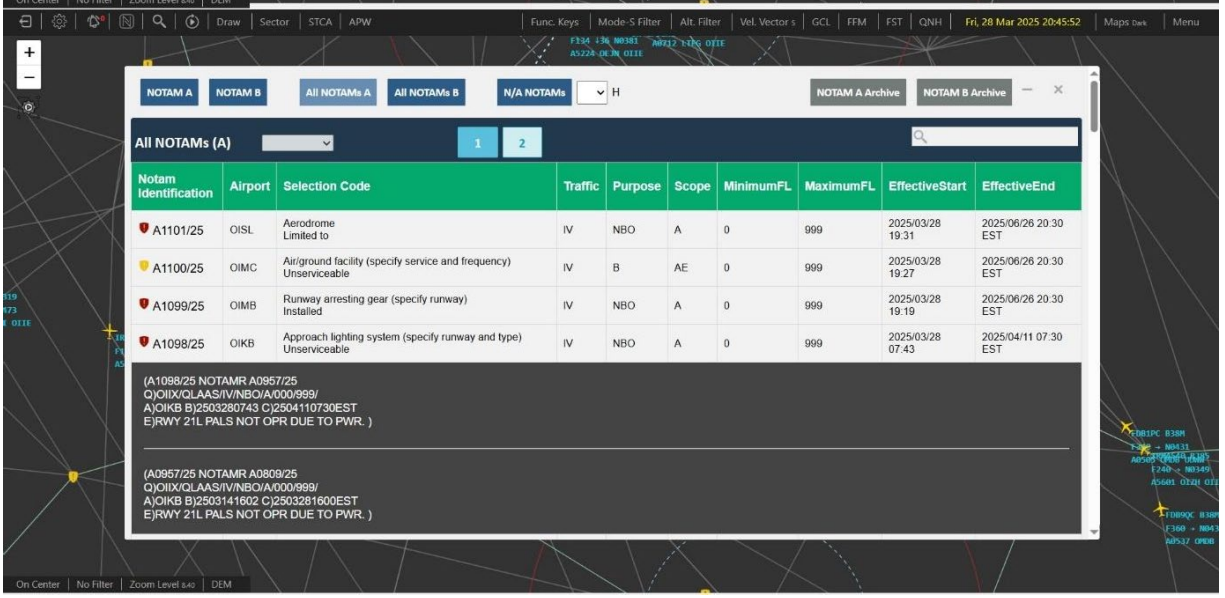


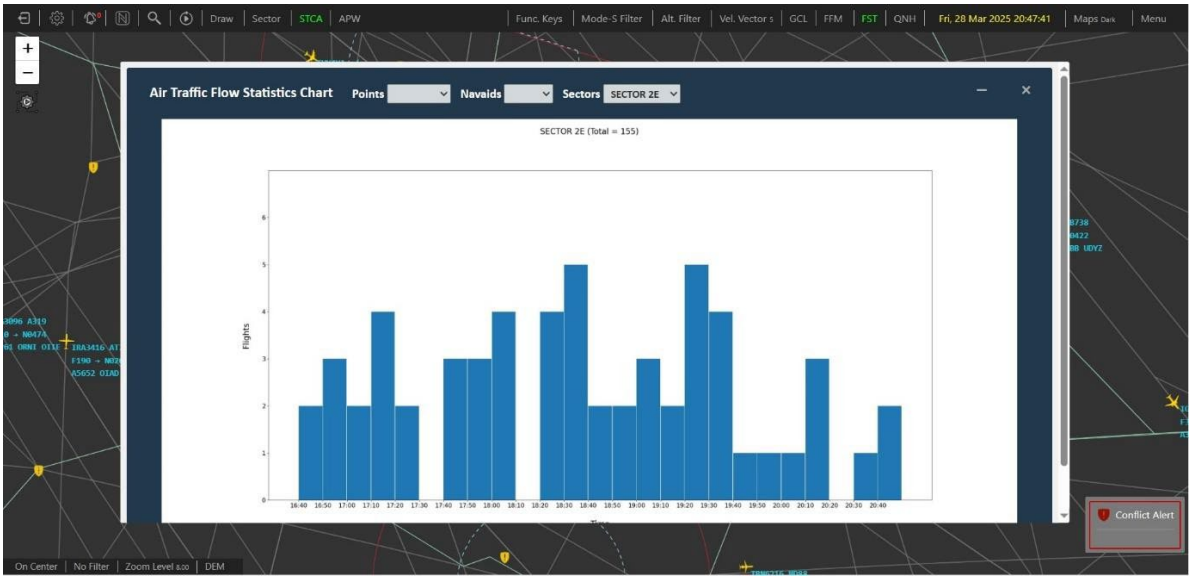

Draw | Sector | STCA | APW | Func. Keys | Mode-S Filter | Alt. Filter | Vel. Vector 5 | GCL | FFM | FST | QNH | Fri, 28 Mar 2025 20:41:39 | Maps Dark | Menu
OID121-ACTIVATED
A1060/25
On Center | No Filter | Zoom Level 8.00 | DEM

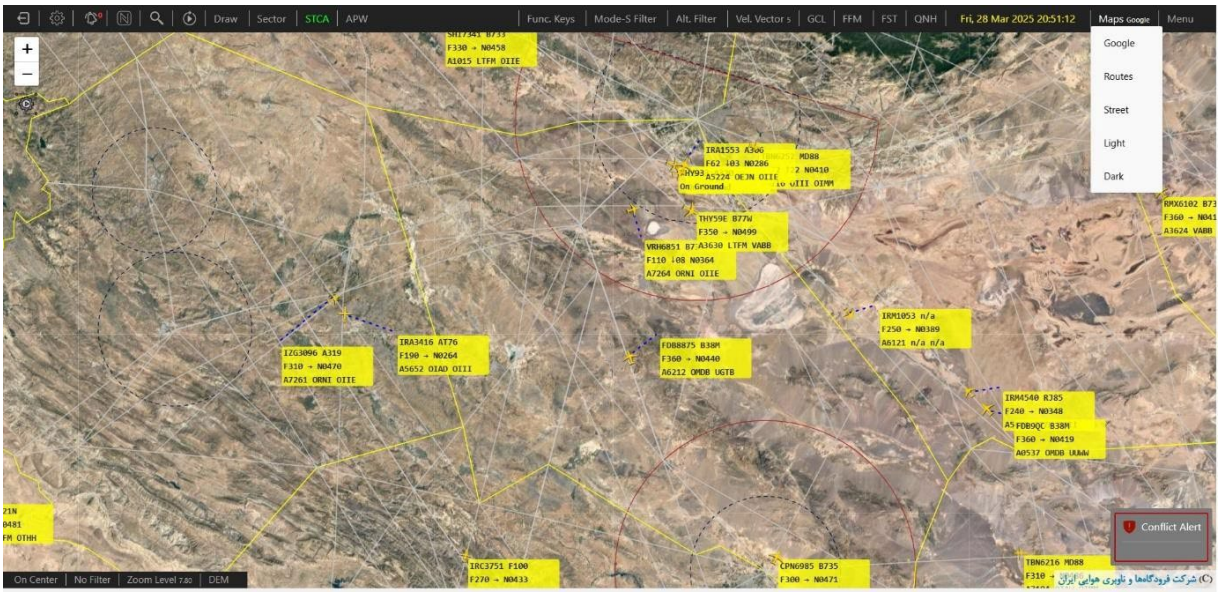

Draw | Sector | STCA | APW | Func. Keys | Mode-S Filter | Alt. Filter | Vel. Vector 5 | GCL | FFM | FST | QNH | Fri, 28 Mar 2025 20:43:11 | Maps Dark | Menu
FLIGHT DETAILS
FLIGHT FDB8875
SQUAWK 6212
DEPARTURE OMDB
DESTINATION UGTB
ALTN AD UDYZ
2ND ALTN AD n/a
DEPARTURE TIME n/a
TIME TO ARRIVAL n/a
TRACK 341
SPEED 435
ALTITUDE F360
VERTICAL RATE -64
AIRCRAFT DETAILS
REGISTRATION A6FMG
MODE-S 896512
TYPE B38M
CATEGORY A3
AIRCRAFT TRACKING
LATITUDE 33.23776
LONGITUDE 51.12411
DISTANCE 170 NM
SOURCE OIAW REC
FPL TEXT
PEKAM
Dist: 19 NM
Est. Time: 20:45
On Center | No Filter | Zoom Level 8.40 | DEM

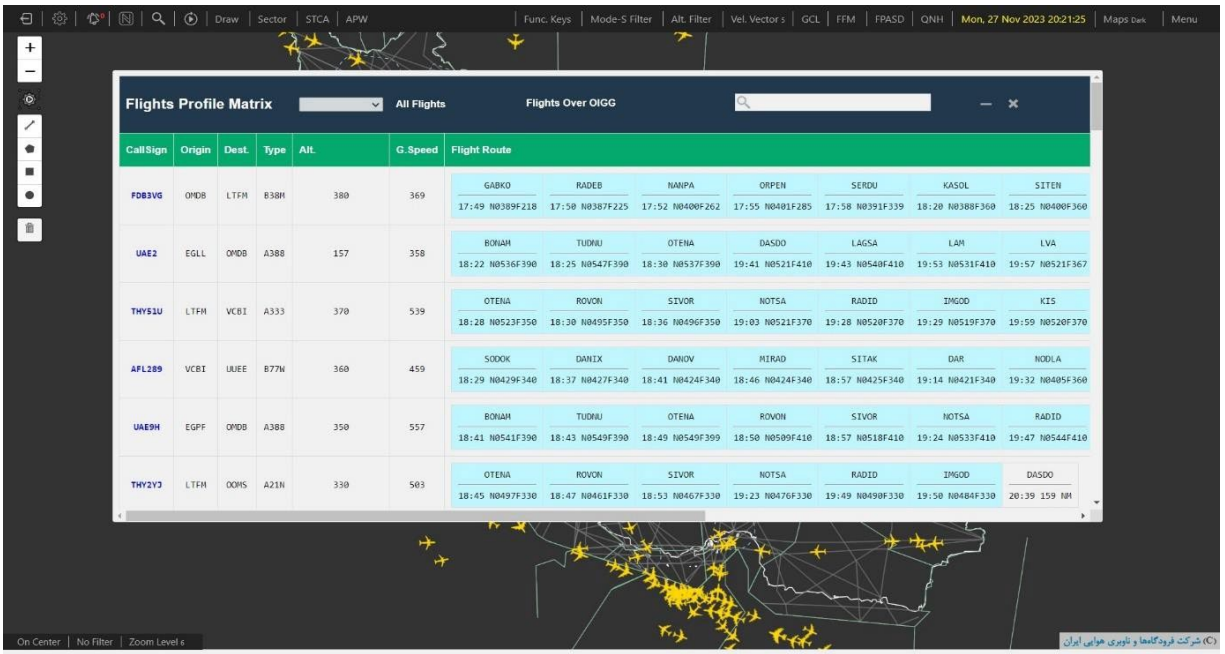

Draw | Sector | STCA | APW | Func. Keys | Mode-S Filter | Alt. Filter | Vel. Vector 5 | GCL | FFM | FST | QNH | Fri, 28 Mar 2025 20:48:54 | Maps Dark | Menu
SECTOR 2E
Conflict Alert
On Center | No Filter | Zoom Level 8.20 | DEM


NOTAM A
NOTAM B
All NOTAMs A
All NOTAMs B
N/A NOTAMs
NOTAM A Archive
NOTAM B Archive
All NOTAMs (A)
Notam Identification
Airport
Selection Code
Traffic
Purpose
Scope
MinimumFL
MaximumFL
EffectiveStart
EffectiveEnd
A1101/25 OISL Aerodrome Limited to IV NBO A 0 999 2025/03/28 19:31 2025/06/26 20:30 EST
A1100/25 OIMC Air/ground facility (specify service and frequency) Unserviceable IV B AE 0 999 2025/03/28 19:27 2025/06/26 20:30 EST
A1099/25 OIMB Runway arresting gear (specify runway) Installed IV NBO A 0 999 2025/03/28 19:19 2025/06/26 20:30 EST
A1098/25 OIKB Approach lighting system (specify runway and type) Unserviceable IV NBO A 0 999 2025/03/28 07:43 2025/04/11 07:30 EST
A1097/25 OIKB Sequenced flashing lights (specify runway) Unserviceable I BO A 0 999 2025/03/28 07:38 2025/04/11 07:30 EST
A1096/25 OIII Taxiway(s) (A3 ...) View Notam Details A 0 999 2025/03/28 05:02 2025/04/08 10:00
A1091/25 OISS Aircraft stands (specify) Closed IV BO A 0 999 2025/03/25 06:46 2025/06/24 06:45 EST
A1090/25 OISS Taxiway(s) (C, ...) Work in progress IV M A 0 999 2025/03/25 06:37 2025/06/23 10:30 EST
A1087/25 OICI ILS Category I (specify runway) I NBO A 0 999 2025/03/23 2025/06/14 23:59 EST


NOTAM A
NOTAM B
All NOTAMs A
All NOTAMs B
N/A NOTAMs
NOTAM A Archive
NOTAM B Archive
All NOTAMs (A)
Notam Identification
Airport
Selection Code
Traffic
Purpose
Scope
MinimumFL
MaximumFL
EffectiveStart
EffectiveEnd
A1101/25 OISL Aerodrome Limited to IV NBO A 0 999 2025/03/28 19:31 2025/06/26 20:30 EST
A1100/25 OIMC Air/ground facility (specify service and frequency) Unserviceable IV B AE 0 999 2025/03/28 19:27 2025/06/26 20:30 EST
A1099/25 OIMB Runway arresting gear (specify runway) Installed IV NBO A 0 999 2025/03/28 19:19 2025/06/26 20:30 EST
A1098/25 OIKB Approach lighting system (specify runway and type) Unserviceable IV NBO A 0 999 2025/03/28 07:43 2025/04/11 07:30 EST
(A1098/25 NOTAMR A0957/25
Q)OIIX/QLAAS/IV/NBO/A/000/999/
A)OIKB B)2503280743 C)2504110730EST
E)RWY 21L PALS NOT OPR DUE TO PWR.)
(A0957/25 NOTAMR A0809/25
Q)OIIX/QLAAS/IV/NBO/A/000/999/
A)OIKB B)2503141602 C)2503281600EST
E)RWY 21L PALS NOT OPR DUE TO PWR.)


Air Traffic Flow Statistics Chart
Points
Navaids
Sectors
SECTOR 2E
SECTOR 2E (Total = 155)
Flights
Conflict Alert





CallSign	Origin	Dest.	Type	Alt.	G.Speed	Flight Route						
FDB3VG	OMDB	LTFM	B38M	380	369	GABKO 17:49 N0389F218	RADEB 17:50 N0387F225	NANPA 17:52 N0400F262	ORPEN 17:55 N0401F285	SERDU 17:58 N0391F339	KASOL 18:20 N0388F360	SITEN 18:25 N0400F360
UAE2	EGLL	OMDB	A388	157	358	BONAM 18:22 N0536F390	TUDNU 18:25 N0547F390	OTENA 18:30 N0537F390	DASDO 19:41 N0521F410	LAGSA 19:43 N0540F410	LAM 19:53 N0531F410	LVA 19:57 N0521F367
THY51U	LTFM	VCBI	A333	370	539	OTENA 18:28 N0523F350	ROVON 18:30 N0495F350	SIVOR 18:36 N0496F350	NOTSA 19:03 N0521F370	RADID 19:28 N0520F370	IMGOD 19:29 N0519F370	KIS 19:59 N0520F370
AFL289	VCBI	UUEE	B77W	360	459	SODOK 18:29 N0429F340	DANIX 18:37 N0427F340	DANOV 18:41 N0424F340	MIRAD 18:46 N0424F340	SITAK 18:57 N0425F340	DAR 19:14 N0421F340	NODLA 19:32 N0405F360
UAE9H	EGPF	OMDB	A388	350	557	BONAM 18:41 N0541F390	TUDNU 18:43 N0549F390	OTENA 18:49 N0549F399	ROVON 18:50 N0509F410	SIVOR 18:57 N0518F410	NOTSA 19:24 N0533F410	RADID 19:47 N0544F410
THY2YJ	LTFM	OOMS	A21N	330	503	OTENA 18:45 N0497F330	ROVON 18:47 N0461F330	SIVOR 18:53 N0467F330	NOTSA 19:23 N0476F330	RADID 19:49 N0490F330	IMGOD 19:50 N0484F330	DASDO 20:39 159 NM