



الهيئة العامة للطيران المدني
General Authority of Civil Aviation

AIR TRAFFIC FLOW AND CAPACITY MANAGEMENT

- ☑ ATFM Introduction
- ☑ ATFM Future Structure Proposal
- ☑ Capacity Influencing Factors
- ☑ Airspace Definition
- ☑ Assessment Methodology
- ☑ Data Sampling Processes
- ☑ Flow Management Solutions
- ☑ COVID-19 Traffic Trend



SANS

خدمات الملاحة الجوية السعودية
Saudi Air Navigation Services

Air Traffic Flow Management

The purpose of ATFM is to achieve a balance between air traffic demand and airspace capacity to ensure an optimum safe and efficient use of airspace.

In order to manage this demand-capacity balance, it is necessary to know the current and expected demand, to establish a capacity baseline using an analytical calculation, to analyze the impact that expected demand will have on existing capacity, to identify the limitations of, and possible improvements to, the current system based on a cost/benefit analysis thereof, to set priorities, and to develop a capacity improvement plan.

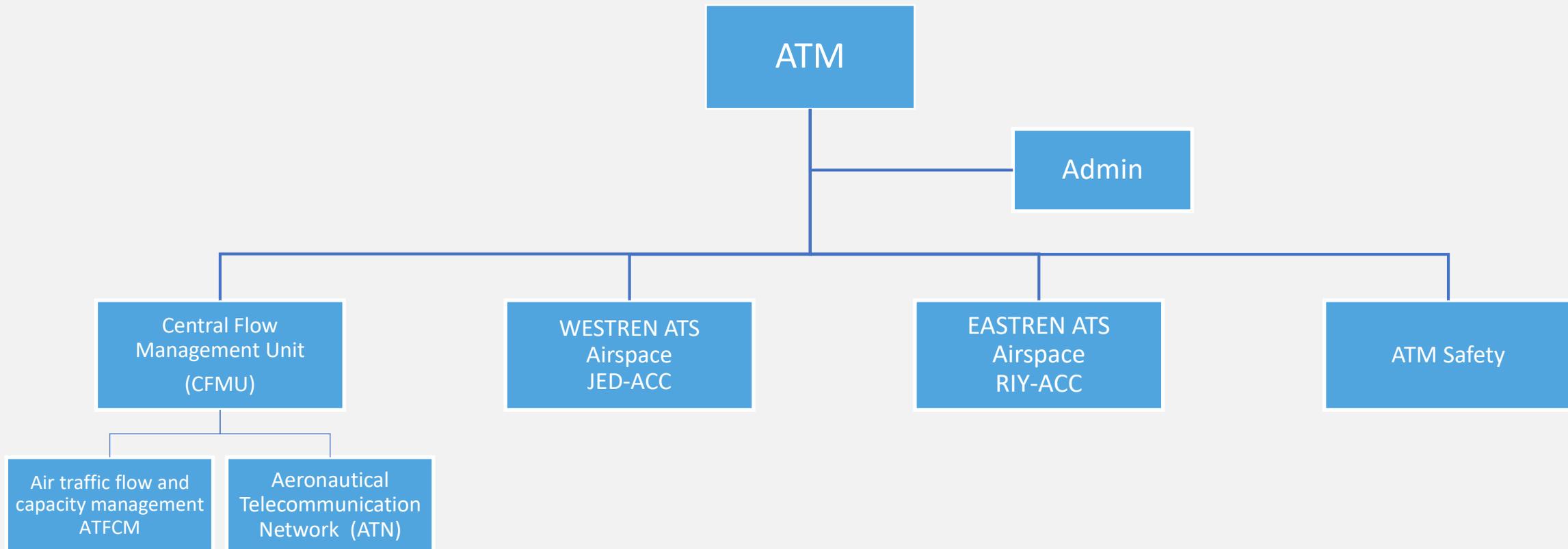
ATFM Aim

Air Traffic Flow and Capacity Management aims to provide a smoothing mechanism to avoid the overloads and maximize the use of airspace

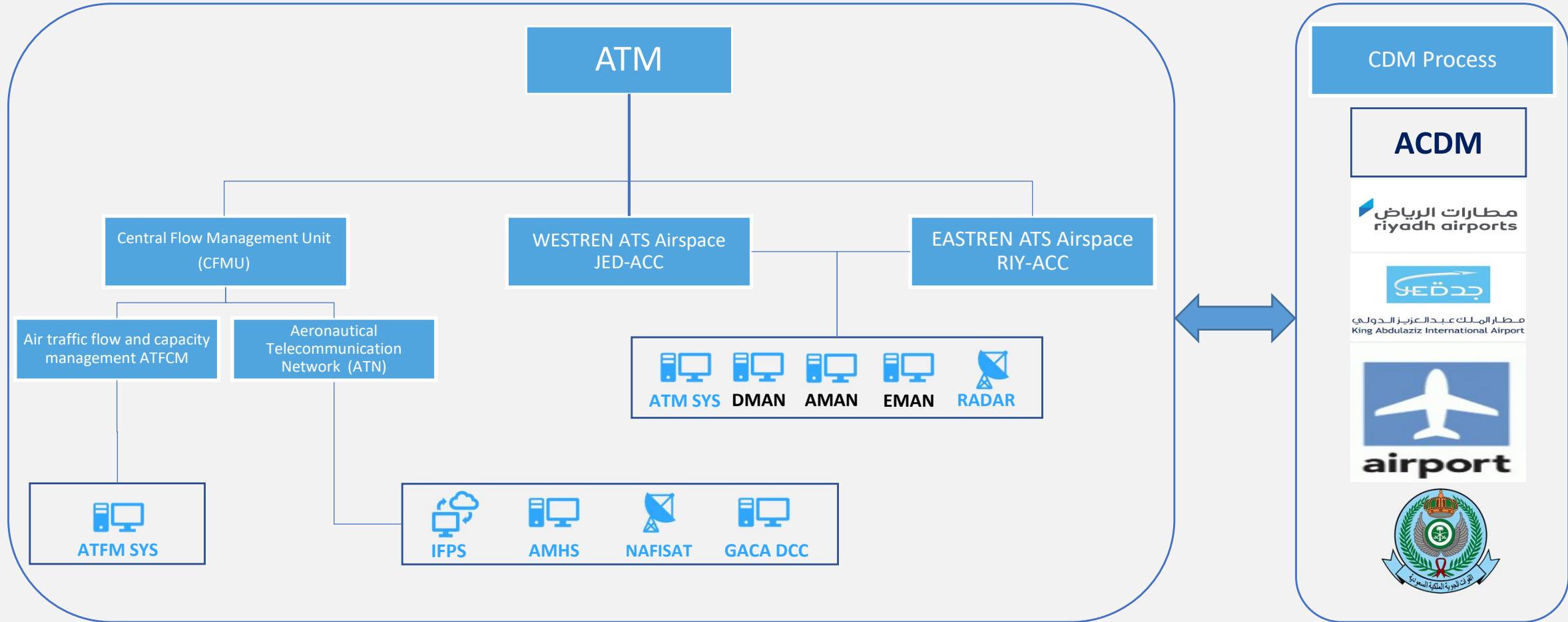
ATFM Objectives

- Enhanced ATM system safety.
- Increased system operational efficiency and predictability.
- Effective management of capacity and demand through data analysis and planning.
- Reduced fuel burn and operating costs.
- Improved quality of air travel; increased economic development through efficient cost-effective services to the projected increased levels of air traffic.

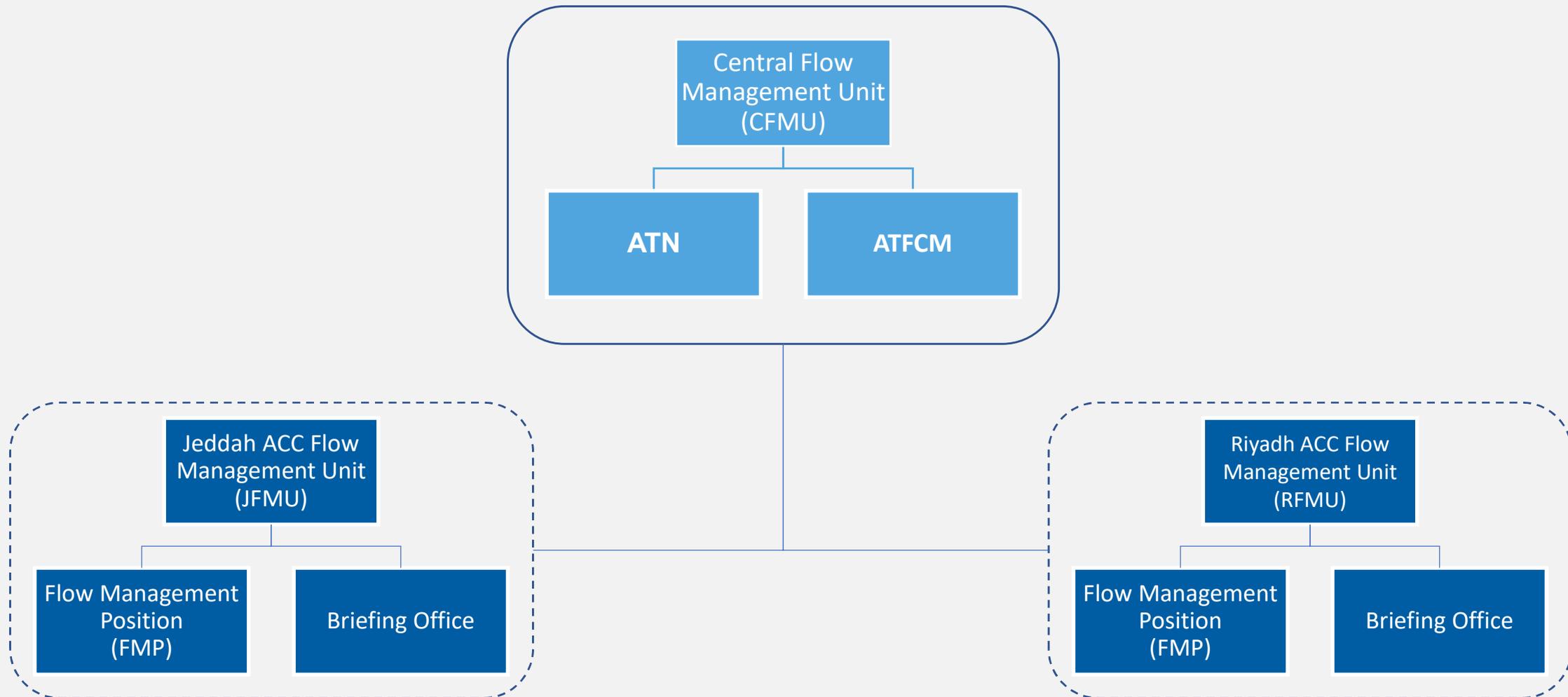
Proposed Future State Structure

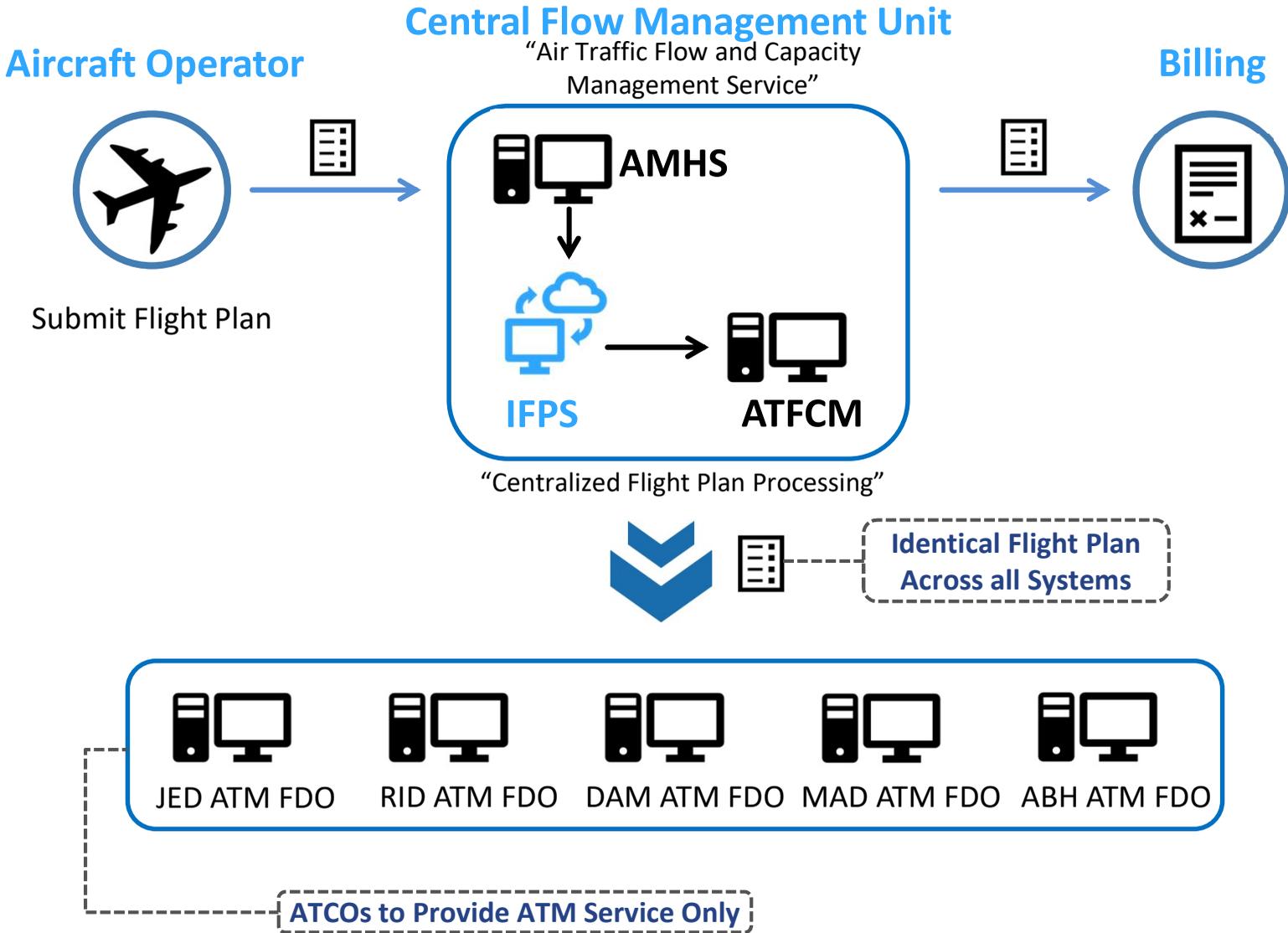


Proposed Future State Tools



Proposed Future State Structure



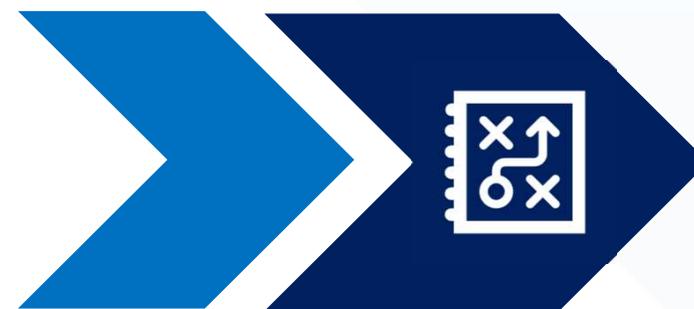


Advantages

- Centralized Flight Plan Distribution
- Identical Flight Plan in All Systems
- Correct Reference to Finance
- Correct Reference in Investigation
- Ensure all System are Up to Date Cross the Environment "DATA SET"
- Reduce ATCOs Workload and Miss Availability of Flight Plans
- Enhance ATN Operation Behavior



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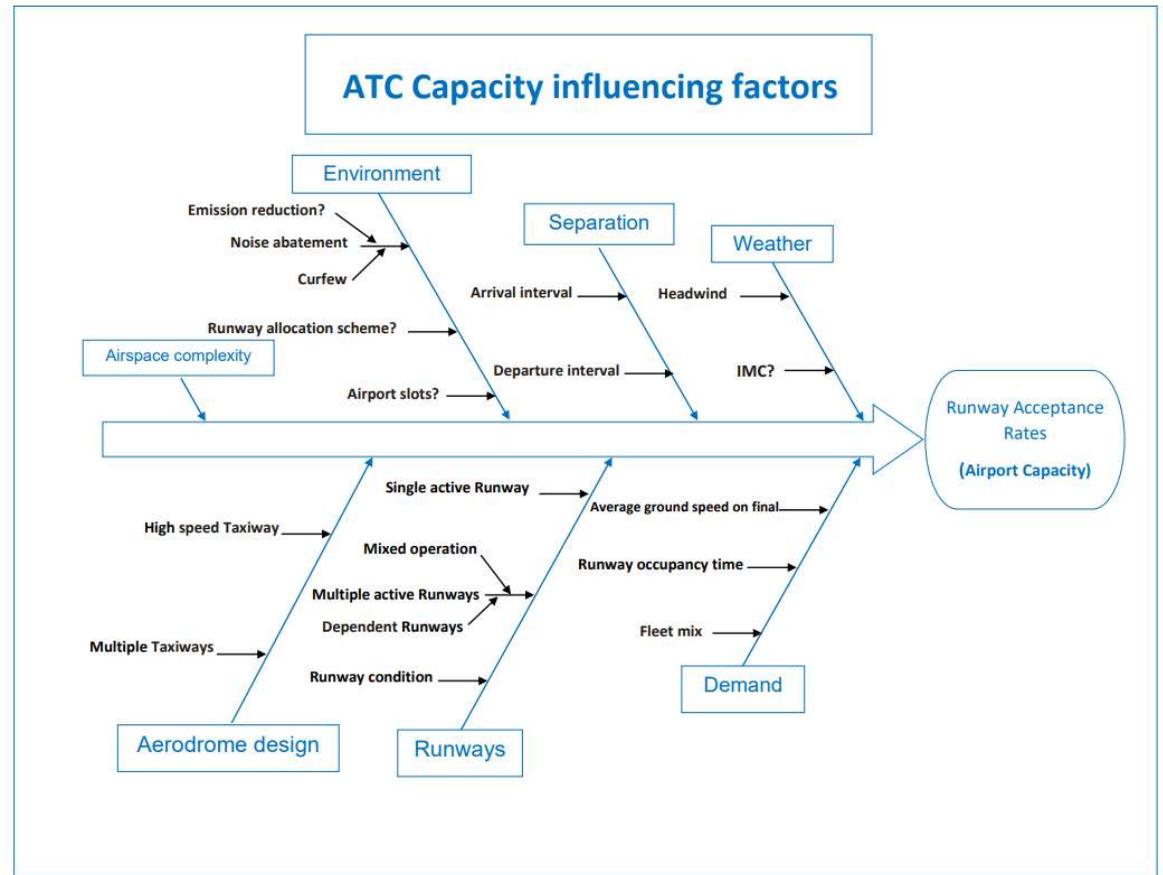
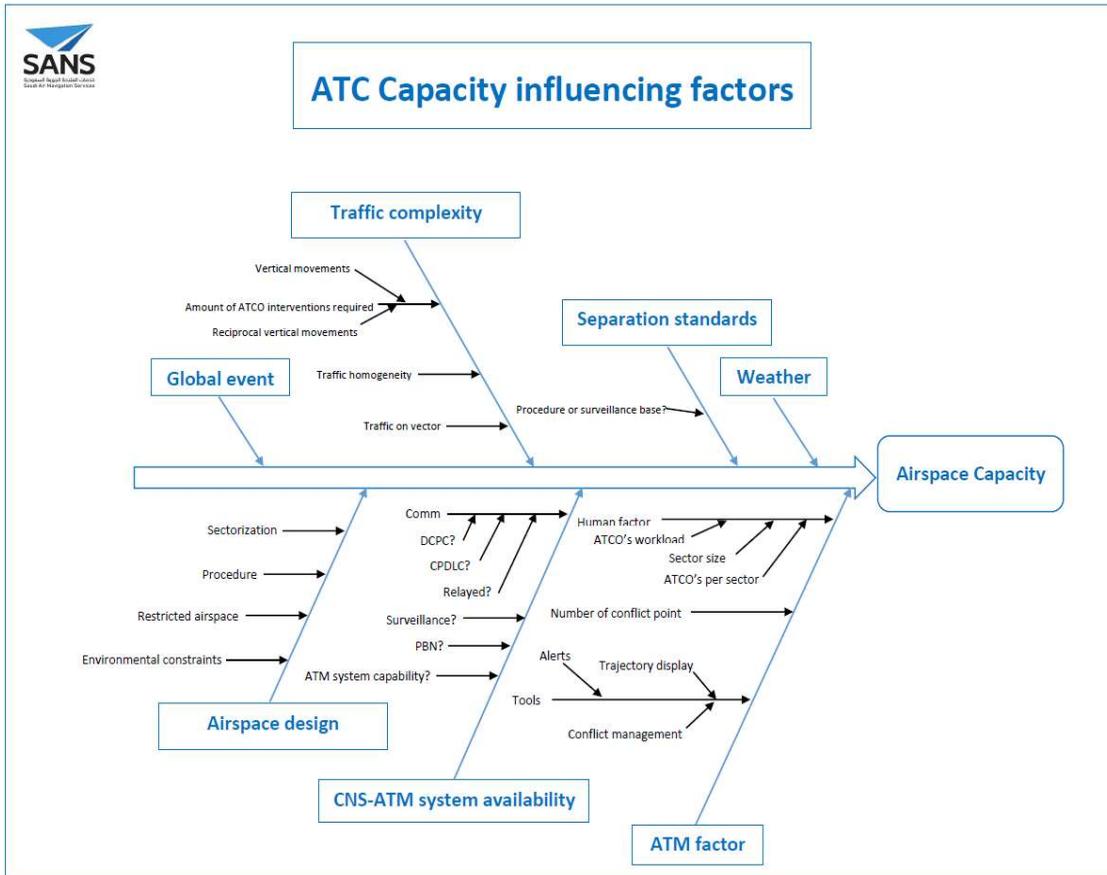
CAPACITY MANAGEMENT

Airspace Capacity

Airspace capacity is not unlimited, but it can be more or less optimized depending on many factors, such as:

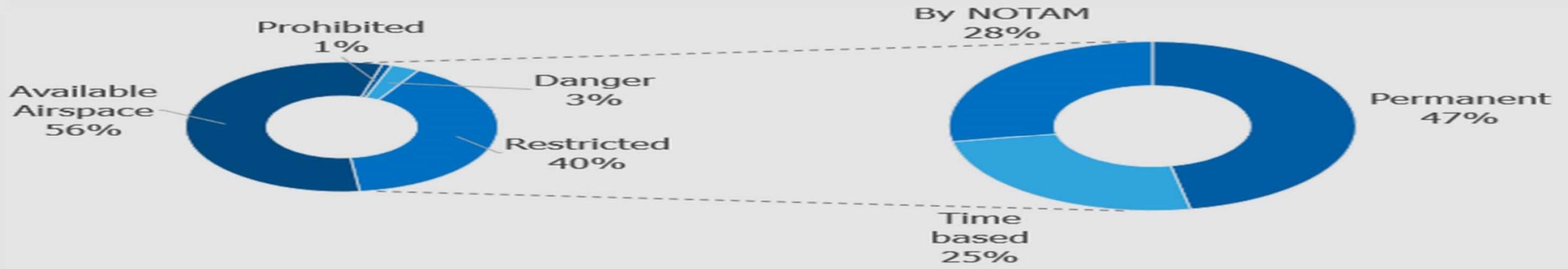
- Airspace design and flexibility.
- ATC system capacity.
- Number of sectors and their complexity.
- Segregated airspace.
- Availability, training, and response capability of personnel.
- Available CNS infrastructure.
- Degree of automation.
- The equipage and type of aircraft in the fleet.

When analysing airspace capacity, we are interested in focusing on ATC system capacity and, in this sense, we have highlighted some concepts that must be taken into account as indicators to calculate the ATC sector capacity, such as: workload, the importance of observable and non-observable tasks performed by air traffic controllers.

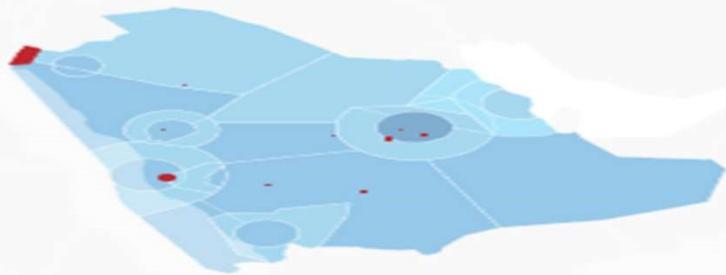


Only 56% of our
airspace is freely
utilized

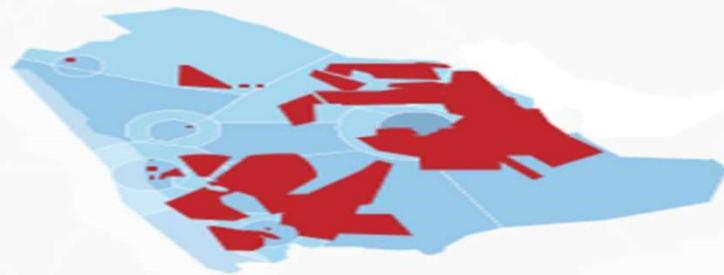
12 Prohibited	60 Restricted	55 Danger
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Prohibited



Restricted



Danger



Runway Acceptance Rate Calculator

Aerodrome Theoretical capacity calculation model Print Result

Input your assumptions in columns with blue color headings; black colored cells are automatically calculated

Select Aerodrome: OEMA

APC (ACFT/hr)	71	APC constraint (ACFT/hr)	22
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Reference / Guide for the application of a common methodology to estimate Airport and ATC sector capacity for SAM region 2009

Runways	OPS mode	UP%	FAS (nm)	MROT	PCR (ACFT/hr)	MV (KT)	SS (nm)	TS (nm)	MTTS	ACFT landing	ACFT takeoff	TRC
17	Multi	38%	6	00:00:50	72	125.874126	2	10	00:04:46	13	12	24
35	Multi	42%	6	00:00:52	69	125.874126	2	10	00:04:46	13	12	24
18	Takeoff	9%	6	00:00:50	72	125.874126	2	10	00:04:46	13	12	12
36	Landing	11%	6	00:00:52	69	125.874126	2	10	00:04:46	13	12	13
	Multi	0%										
	Landing	0%										
		100%										

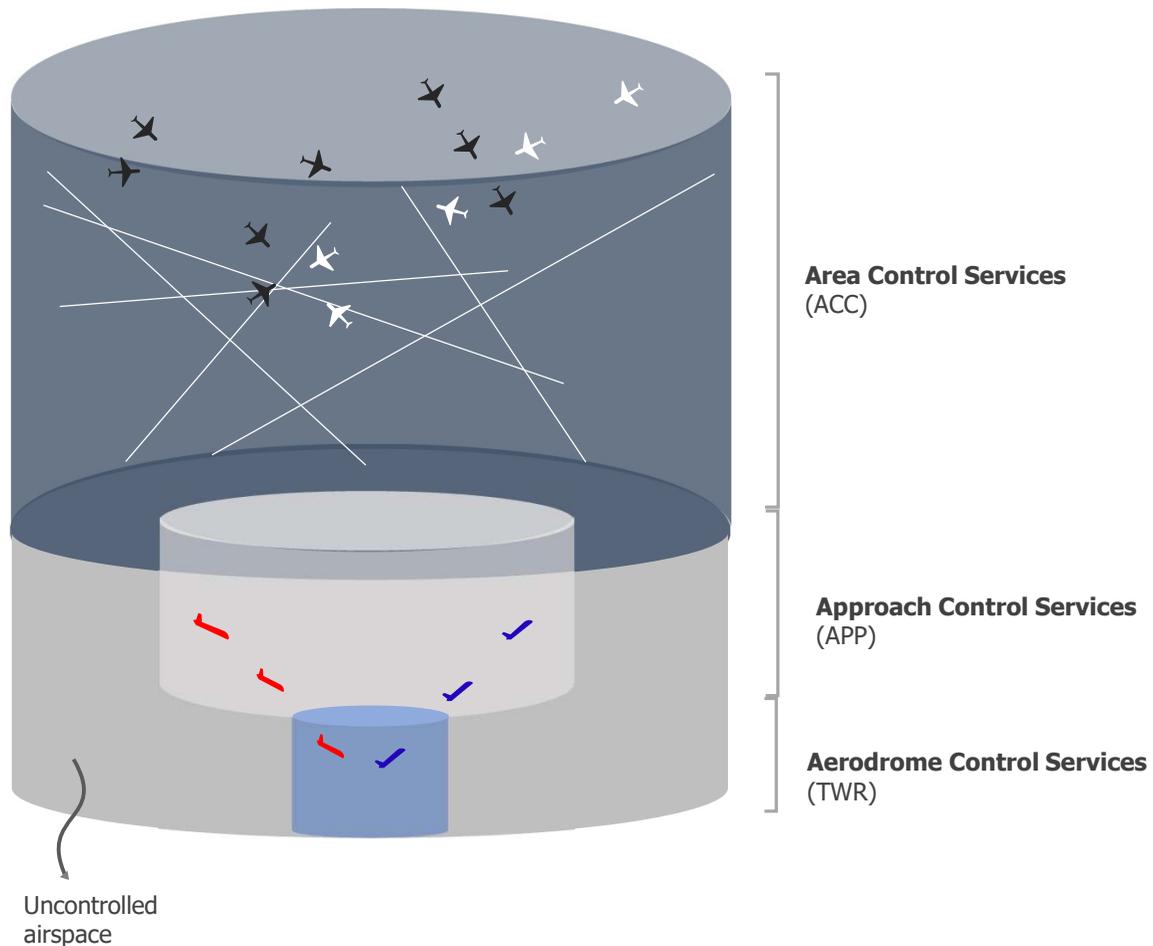
ACFT Class	UP%
G	100%

Detailed runway occupancy time and final approach segment speed assumptions

DO NOT COPY PASTE ENTRIES AT MROTT AND MROTL COLUMNS OR IT WILL BREAK THE VALIDATION PLACED IN THE CELLS

Runway	ACFT Class	MROTT	MROTL	AMROT	FAS MT	FAS AV (KT)
17	G	00:00:50		00:00:50	00:02:23	125.874126
35	G		00:00:52	00:00:52	00:02:23	125.874126
18	G	00:00:50		00:00:50	00:02:23	125.874126
36	G		00:00:52	00:00:52	00:02:23	125.874126
		00:00:50			00:02:23	
		00:00:52			00:02:23	

- Runway Acceptance rate calculator is built based on the equations defined in the manual to reflect the theoretical number, further validation to be done by the ATS unit forming a group of expert to validate the capacity and consider all possible factor which may have an impact on capacity.
- For further planning the validated capacity shall be communicated to airport authority to ensure proper balance and planning of demand vs capacity.



$$N = \frac{\varphi \cdot T}{\eta \cdot \tau m}$$

Field assessment figures based on sector operation

- (η)
- (τm)
- (φ)

Fast time simulation per sector

- T

N	The number of aircraft that can be controlled simultaneously by a single ATCO
φ	The ATCO availability factor (expressed as a %), defined as the percentage of time available for planning aircraft separation procedures (more information about this parameter is provided in the Airspace and Capacity Management Manual, p. 63-64)
T	Average flight time of the aircraft in the sector (the unit of time needs to be the same as for τm below - the conversion is done automatically in this tool)
η	Number of communications for each aircraft in the sector, which must be limited to the least possible number required for an understanding between the pilot and the ATCO
τm	Mean duration of each message (the unit of time needs to be the same as for T above - the conversion is done automatically in this tool)

Data sampling for estimating ATC sector capacity

It is important for data collection to be significant so as to dilute temporary stochastic deviations and to represent reliable values for the ATC unit.

According to the current model, controller workload is the summation of times spent on:

1. Communication (transmission/reception);
2. Manual activities (updating out flight progress strips) and coordination
3. Traffic planning and distribution.

“availability factor” (ϕ) concept, which is defined as the percentage of time available for the ATCO to plan aircraft separation procedures.

This availability factor normally falls between a minimum value of 40% of ATCO time for non-radar control, and 60% for radar control. It is thus clear that efforts need to focus on increasing the “availability factor” ϕ .

- The latter can only be achieved by applying measures to reduce the level of controller intervention in the activities mentioned in 1 and 2.
- The percentage accounted for by this ϕ factor could increase if the “Man/Machine Interface –MMI” is enhanced; that is, when increasing the level of automation in some tasks.
- Studies conducted by experts, who analysed the sampling techniques, show that it is advisable to make at least 25 observations of each parameter for average controller, during peak traffic, respecting the minimum number of controllers specified by the sampling technique used.
- It is essential to collect as many observations and controllers as possible in the unit being assessed in order to eliminate extreme values and to minimise any type of trend (*e.g.*, cases of controllers or pilots who are either too slow or too quick in their communications, affecting the arithmetical mean).

ATC Sector Capacity Calculator

Airspace Capacity result:

17

Inputs

Average time in sector (per aircraft)

From list:
Time in sector:
 (min)
 Custom: (min)

Number of controller communications (per aircraft)

From list:
No of communications:

 Custom:

Average duration of a communication

From list:
Communication duration:
 (s)
 Custom: (s)

Controller availability

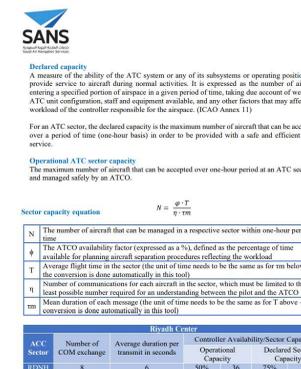
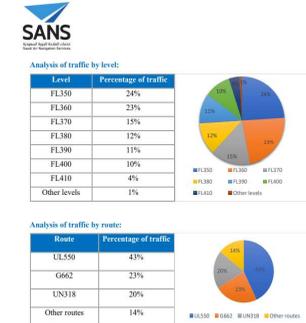
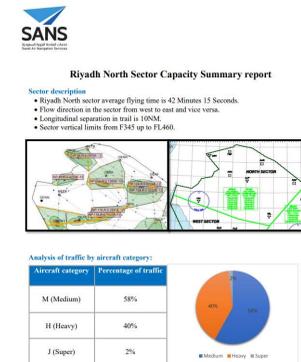
From list:
Controller availability:

 Custom:

Sector Name	Airspace Capacity	Average flight duration (min)	Number of communications	Message duration (s)	Availability percentage	Average flight duration (sec)	Sector Capacity
Jeddah Central	23	27:53	6	6	50.00%	1673	73
Jeddah East Lower	15	24:01	8	6	50.00%	1441	54
Riyadh East Upper	22	26:58	6	6	50.00%	1600	73
Jeddah North-East Lower	12	12:38	6	5	50.00%	758	85
Riyadh North-East Upper	15	15:37	6	6	50.00%	917	88
Jeddah North Lower	28	38:22	8	5	50.00%	2302	67
Riyadh North Upper	26	42:10	6	6	50.00%	2535	55
Jeddah South	25	40:53	8	6	50.00%	2453	55
Jeddah South-East	38	45:55	6	6	50.00%	2755	74
Jeddah West	24	28:52	6	6	50.00%	1732	74
Jeddah CTA East	7	09:20	6	6	50.00%	560	70
Jeddah CTA West	9	11:22	6	6	50.00%	682	73
Riyadh CTA Upper	13	15:36	6	6	50.00%	930	73
Riyadh CTA Lower	11	11:36	6	6	50.00%	699	87

- ATC sector capacity calculator is built based on the equations defined in the manual to reflect the theoretical number of aircraft can be managed and handled by ATCO, further validation to be done by the ATS unit forming a group of expert to validate the capacity and consider all possible factor which may have an impact on capacity.
- For further planning the validated capacity shall be communicated to airport authority to ensure proper balance and planning of demand vs capacity.

- ATS unit shall validate the result assessed in the calculator to ensure the proper workload and considering all possible factor may have an impact over the declared capacity.
- Each ATC sector shall have a report including sector description, solutions to increase sector capacity on tactical and strategic level.
- Training and awareness to concerned staff about capacity management and enhancement.
- Flow management planner shall maintain monitoring over all ATC sectors where demand exceeds capacity to ensure proper ATFM measures implementations.
- ATS unit is responsible to maintain periodic reviews over ATC sector capacity to ensure proper capacity management and enhancement.



- Increase sector capacity**
- Sector capacity is subject of change based on any factor that may cause an impact the provision of ATC services such as but not limited to, enhancement of COM and SUR facilities, ATCO workload, weather, FIR closer, military exercise etc. The sector capacity may be increased by:
- Strategic measures such as but not limited to:
 - Flow management in time to be agreed with adjacent FIRs or ATS Units.
 - Implementation of new airways to enhance the flow.
 - Dynamic sector split.
 - Route optimization.
 - Separation optimization.
 - Tactical measures such as but not limited to:
 - Activate as required minutes, miles in trail flow if agreed with adjacent sector.
 - Coordinate departure with ATS units which has immediate impact over the capacity in the concerned sector.
 - Coordinate with other sector if possible, to avoid exceeding the operational declared capacity by holding, level capping, speed control.
 - Activate planner position.
 - Sector split.
 - Apply delay action such as Holding or speed control.
 - Remove traffic.

Flow management measures to assist when capacity trigger up

Tactical ATFM measures such as but not limited to:

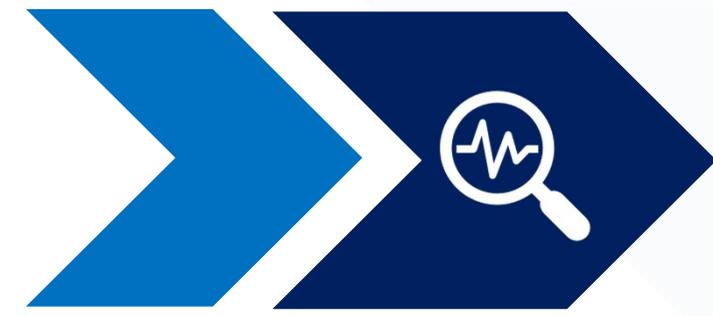
- Activate as required the flow by time if agreed with adjacent sector.
- Coordinate departure with ATS units which has immediate impact over the capacity in the sector.
- Coordinate with other sector if possible, to avoid exceeding in the capacity.
- Activate the planner position.

Strategic ATFM measures such as but not limited to:

- Flow management in time to be agreed and signed with adjacent FIRs or ATS Units.
- Implementation of new airways to enhance the flow.
- Dynamic sector split.
- Altering traffic movement and flow as required route.



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COVID-19 TRAFFIC TREND



Overall 2020 Trend commentary to date

Show for domestic



Show for Int.



Show for Ovf.



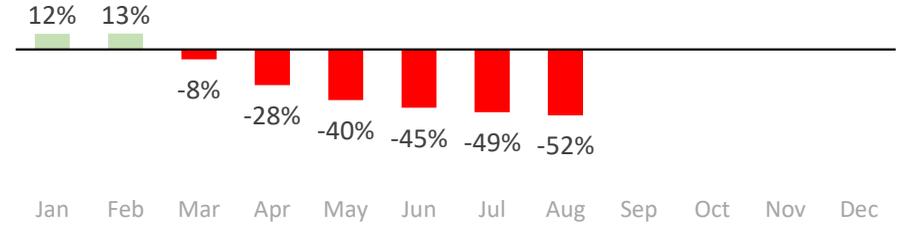
Show for Int. source of flow



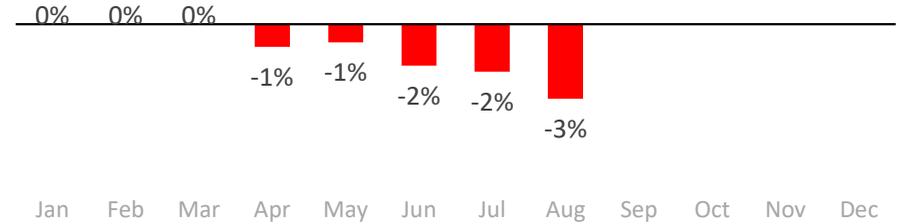
Actuals vs. LY vs. COVID refreshed scenarios



YTD VS. LYTD

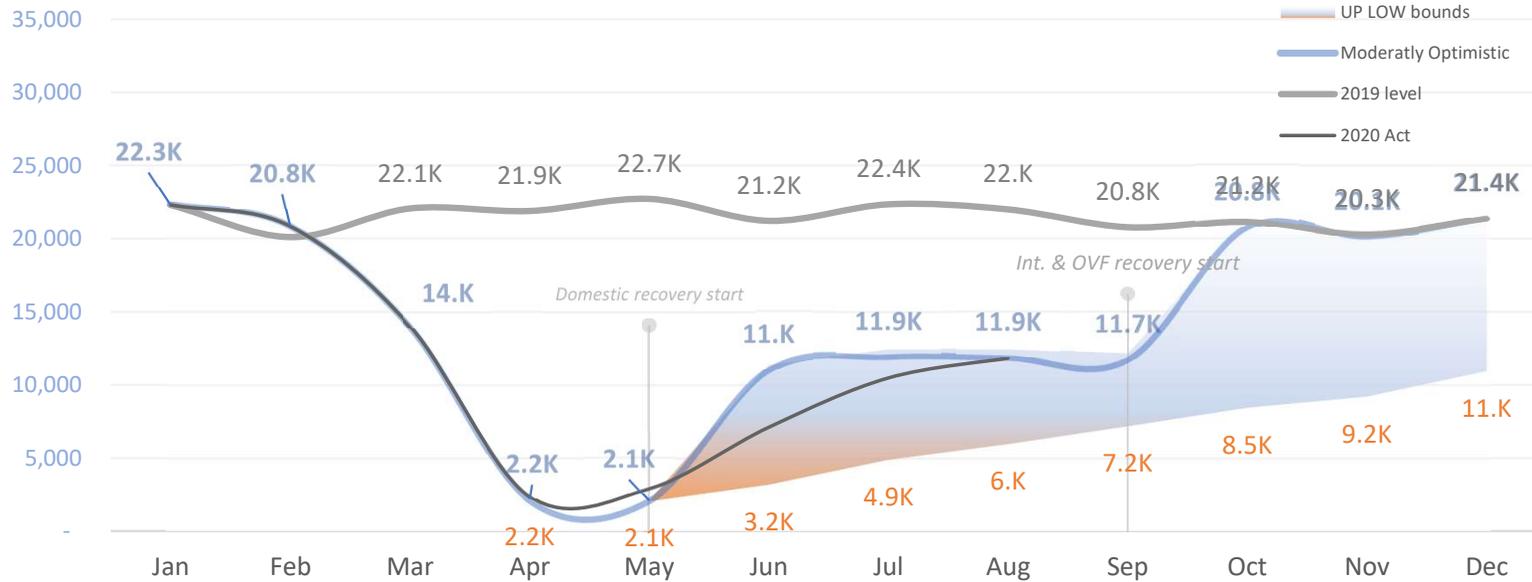


YTD VS. COVID FCST YTD

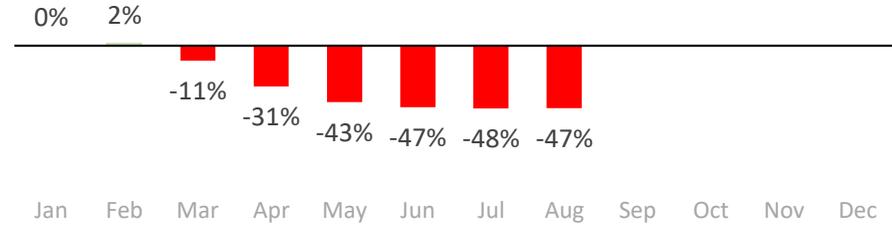


- As of August actual YTD flows have shown minimal deviation against revised forecasts. However AUG recovery rates have remained flat compared to JUL (< than moderate optimistic forecast YTD by - 3%, ~ - 7,500 flights)
- International flights are still suspended; SAUDIA have permitted inbound flights from 25 international location but under very restricted conditions

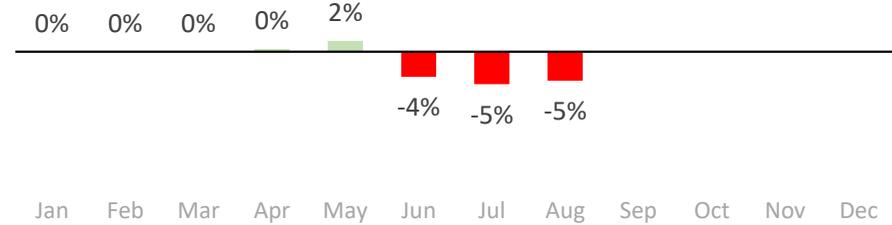
Actuals vs. LY vs. COVID refreshed scenarios



YTD VS. LYTD

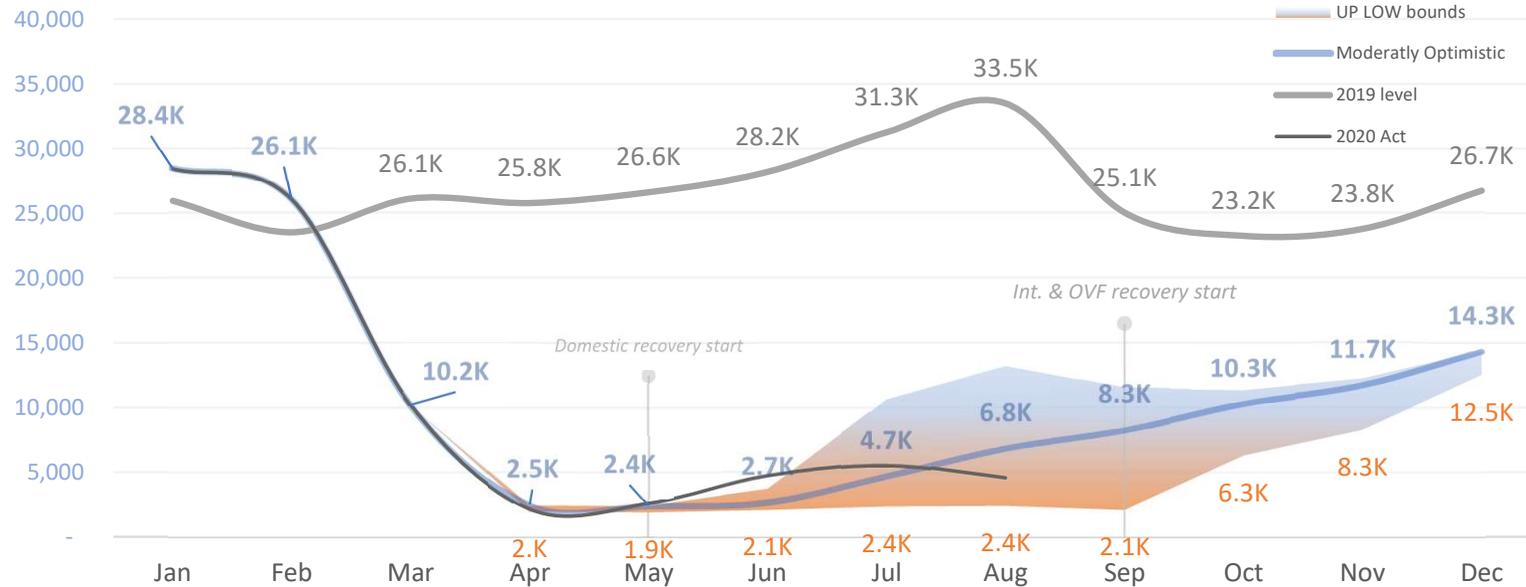


YTD VS. COVID FCST YTD

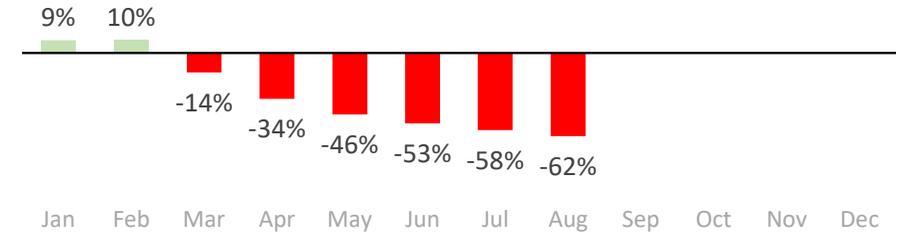


- YTD domestic flows are below their revised forecast figures; however that deviation was minimized in AUG. (< than moderate optimistic forecast YTD by - 5%, ~ -6 Million SAR, ~ - 4,000 flights)
- SAUDIA, FLYNAS and FLYADEAL flows have doubled in August compared to June in line with expanding capacities on additional routes/city pairs. No major city pairs were added in AUG compared to JUL; An increase in frequencies notable on OERK, OEJN, OEDF, OEAB and OEGN routes.

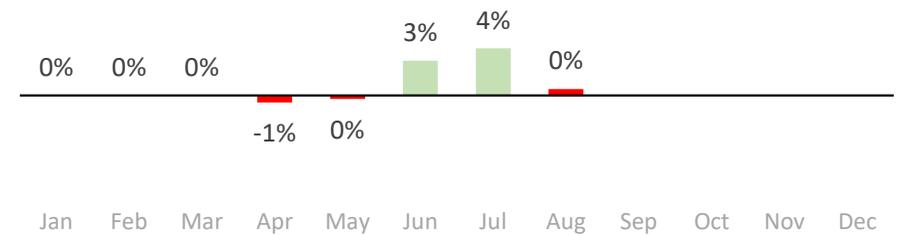
Actuals vs. LY vs. COVID refreshed scenarios



YTD VS. LYTD

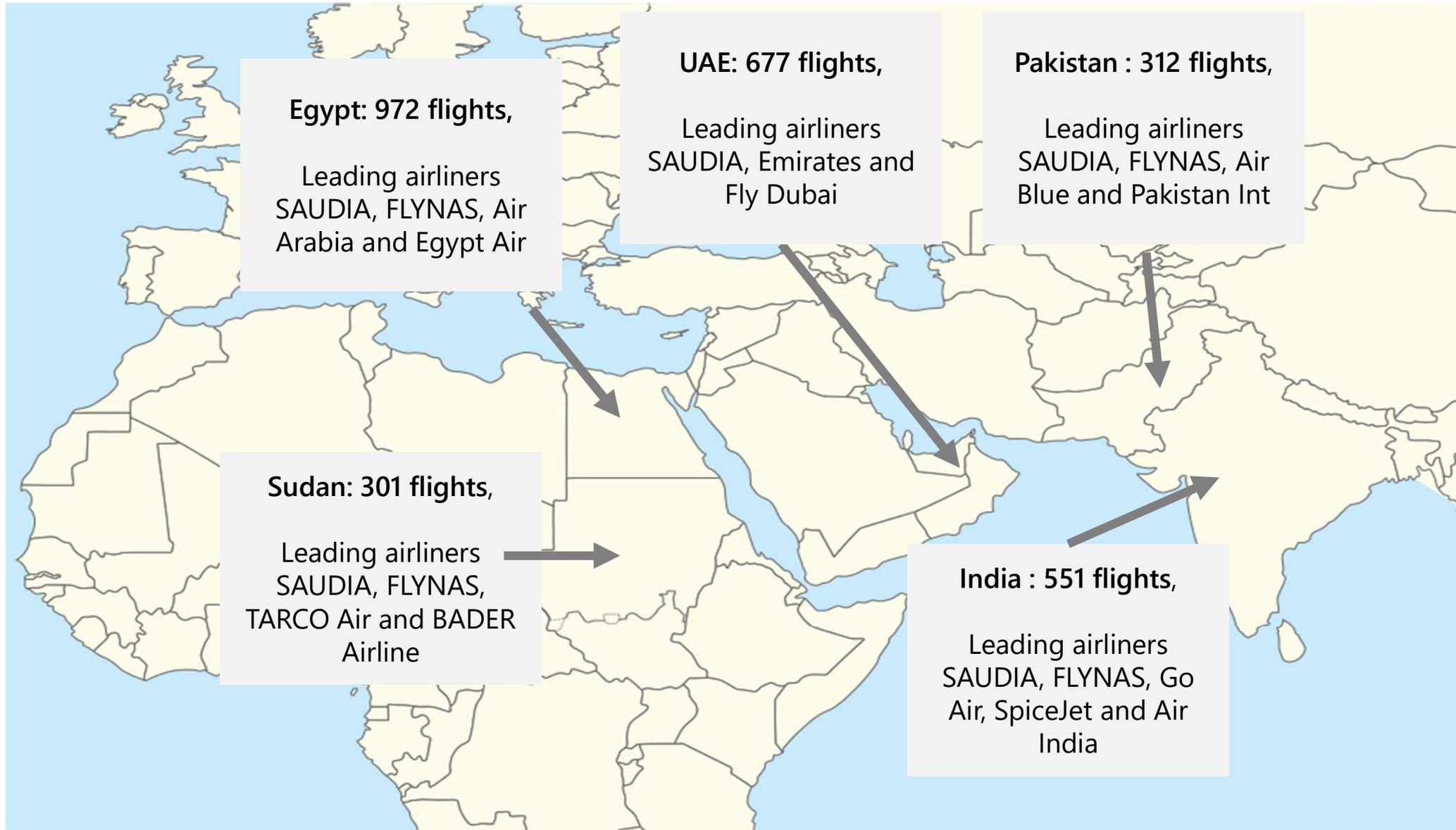


YTD VS. COVID FCST YTD

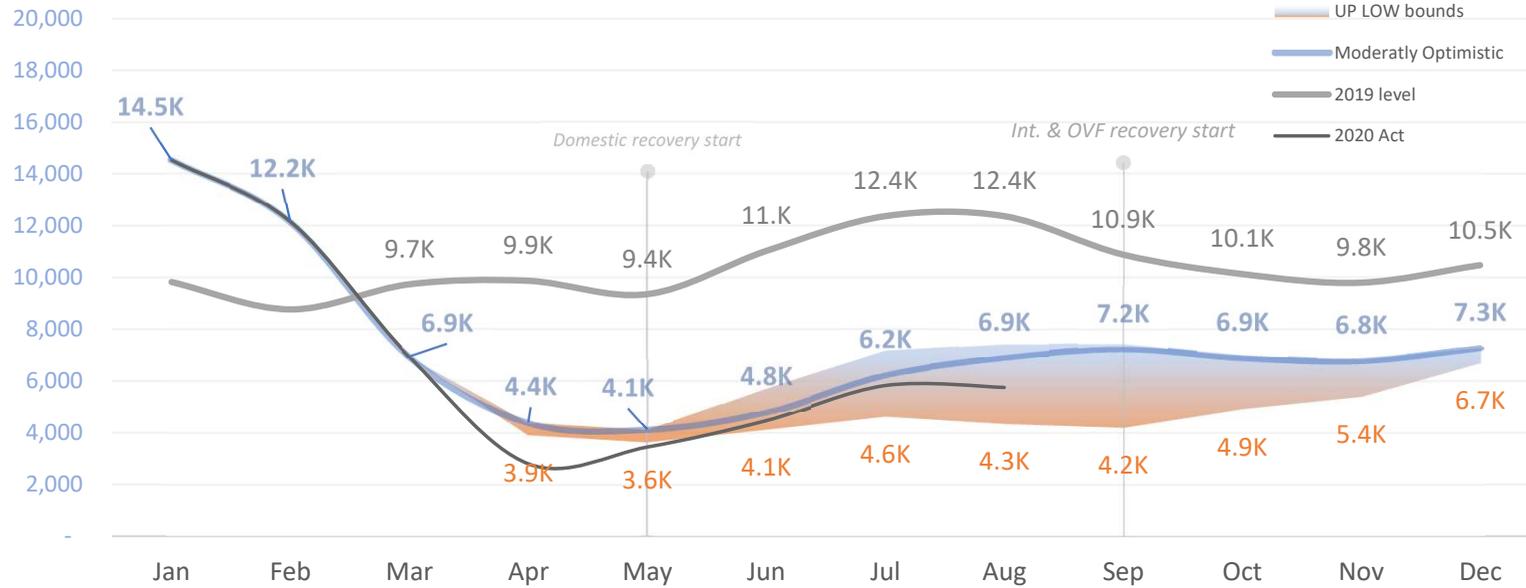


- As of August, only 14% of international capacities are in operation on YoY basis, still mostly repatriation flights. Dates for lifting the inbound/outbound travel curfew still uncertain, might be pushed forward to October ~ Q4
- Repatriation flights operated by SAUDIA have exhibited slight reduction in August.

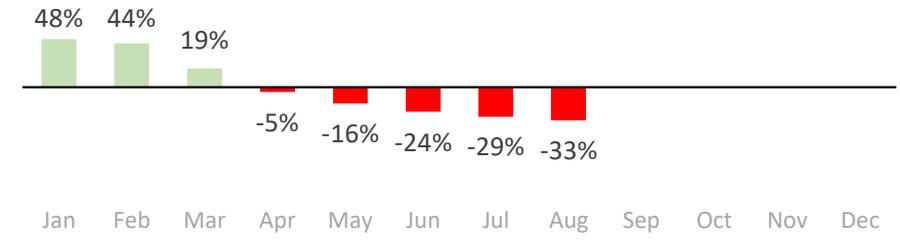
Major sources for international flows in August 2020



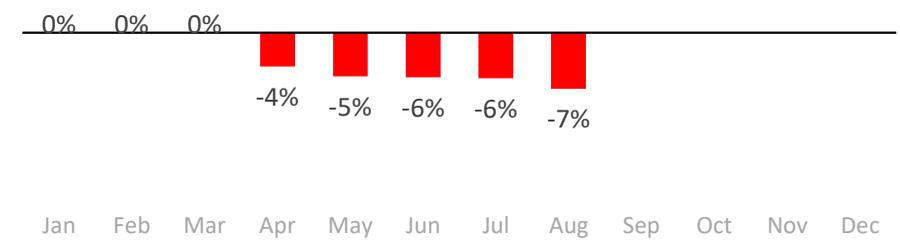
Actuals vs. LY vs. COVID refreshed scenarios



YTD VS. LYTD



YTD VS. COVID FCST YTD



- While Q2 and Q3 Overflights recovery rate are still at ~ 47%, YTD flows are at ~ 70% compared to LY due to the historical uptick experienced in JAN and FEB during the Iraqi/Iran Airspace restriction incident. (< than moderate optimistic forecast YTD by - 7%, ~ -6 Million SAR, ~ - 4,000 flights)
- AUG flows have not experienced any notable uptick compared to JUL.
- Ethiopian Airlines continue to exhibit increasing traffic exceeding last year levels by 35% YoY mainly on European routes
- Egyptian and UAE flag carriers, ACMI operators, and private jet fleets operators' flows have increase by 66% in August on YoY basis mainly on UAE, Egyptian, Kuwaiti, Jordanian and European routes.

Thank you for your time
Feel free to ask any questions