Sector Capacity Assessment Methodology

ATFM

- 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 analyzing 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.

ATFM

- 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 analyse 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.
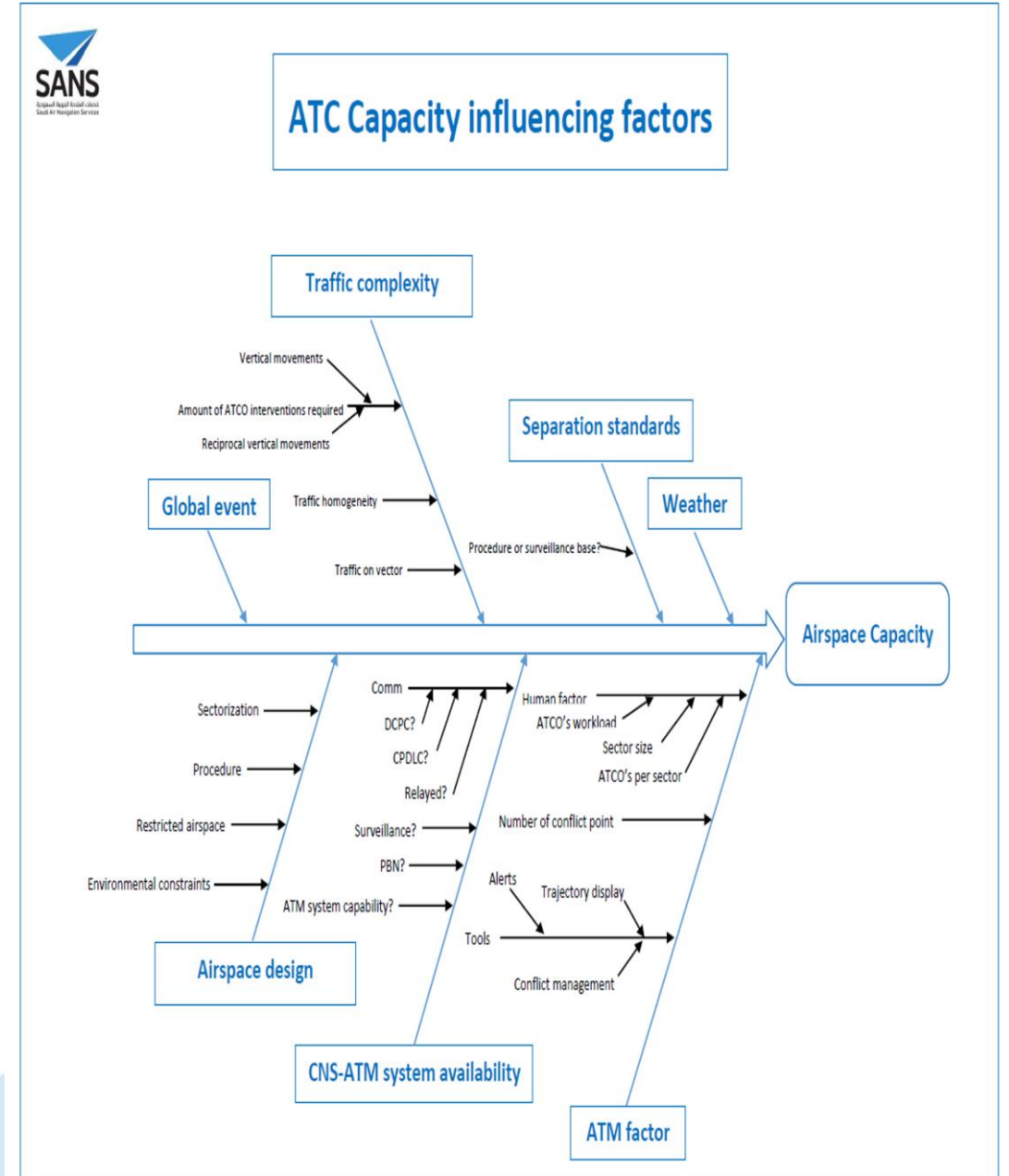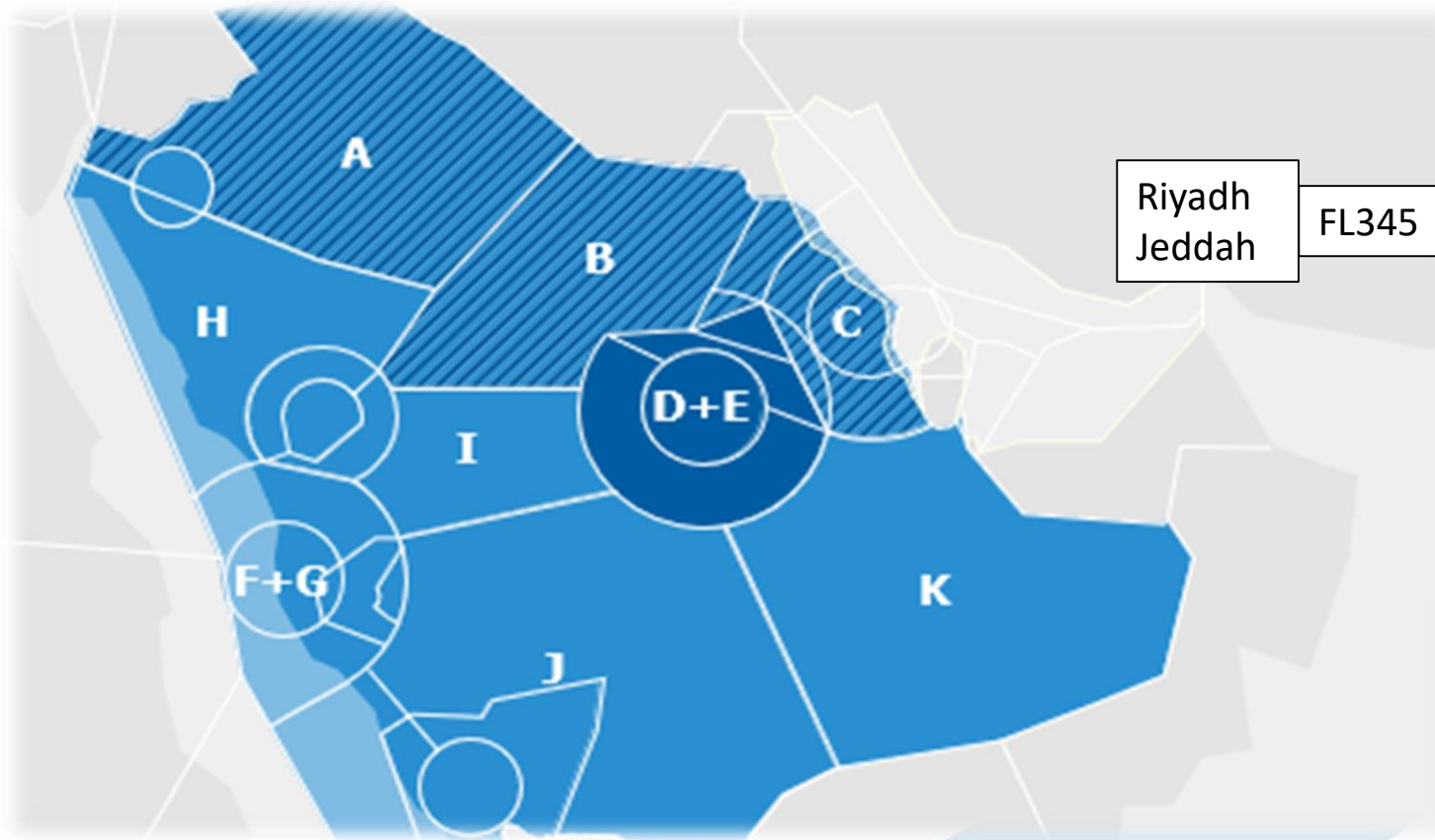
ATC

- ACC Sectors

Jeddah

ACC Sectors

1. North L
2. East L
3. North East L
4. CTA West
5. CTA East
6. West
7. Central
8. South
9. South East

Riyadh
Jeddah

FL345

Riyadh

ACC Sectors

1. North U
2. East U
3. North East U
4. CTA Upper
5. CTA Lower

Capacity

- Sector Capacity Equation And Methodology

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

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)

Note: All the above figures based on field assessments.
(T) is based on fast time simulation.

Capacity

- Field assessment figures based on sector operation - Riyadh

Riyadh Center				
ACC Sector	Number of transmit	Average duration per transmit	Controller Availability	
			ATCO	ATCO+PLNR
ACC-N	6	6	50%	70%
ACC-E	5	5	50%	70%
ACC-NE	5	5	50%	70%
APU	5	6	50%	70%

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.

Equation and Methodology

- availability factor (φ)

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. (Previous slid)

The percentage accounted for by this φ factor could increase if the "Human Machine Interface –HMI" is enhanced; that is, when increasing the level of automation in some tasks.

Studies conducted by experts, who analyzed 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 minimize 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).

ATFCM

- Current Measures and Future Plan

Current

- Activate the flow management if agreed with adjacent centers.
- Coordinate departure with ATS units.
- Activate the planner position.
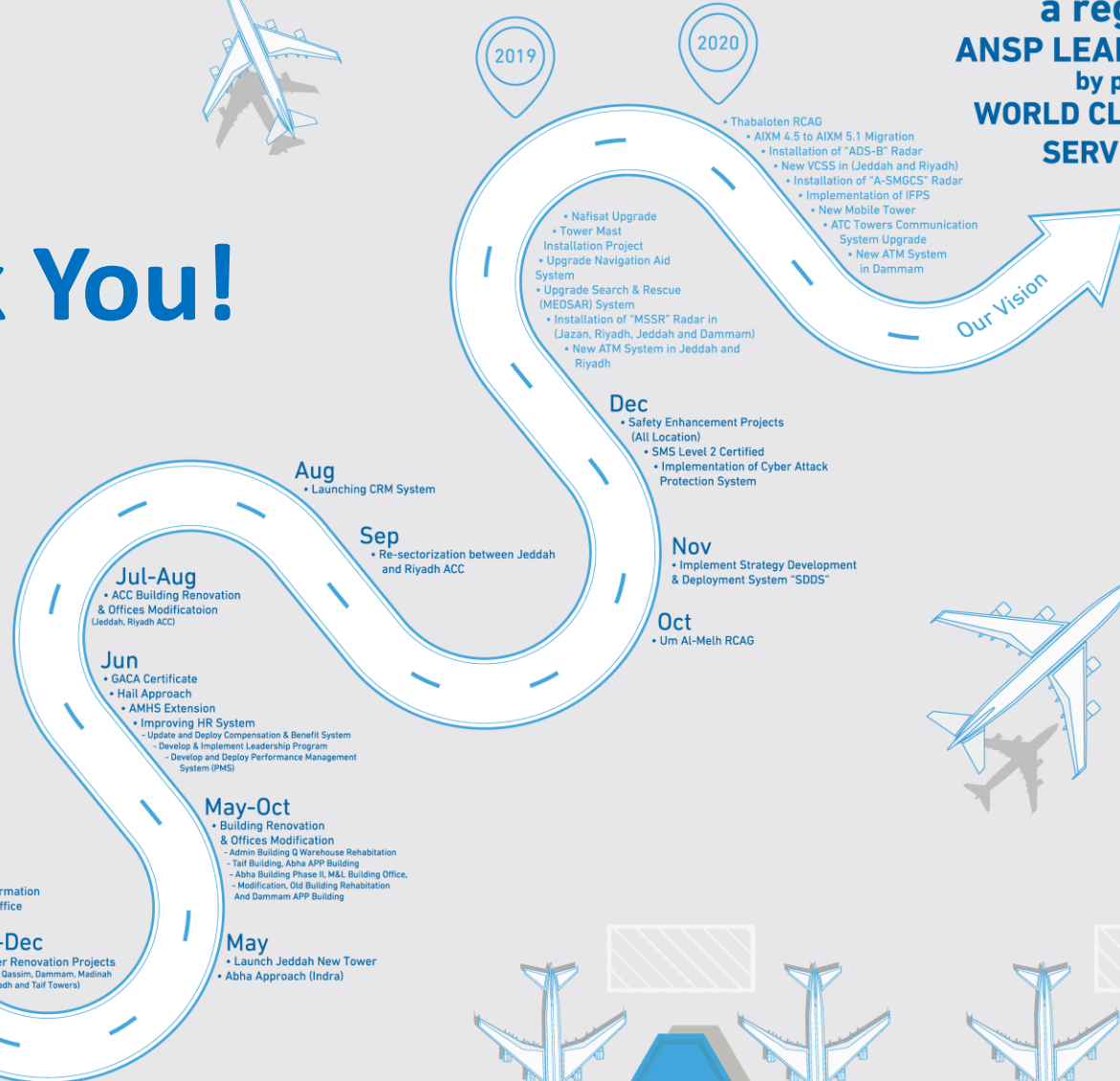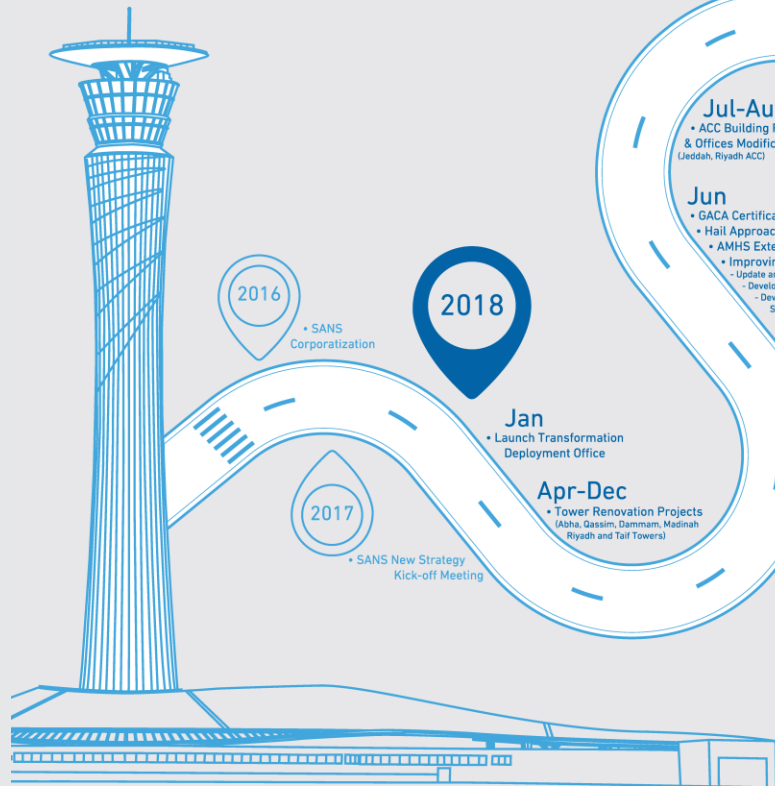- Airspace Changes.
- Active the maestro position (Hajj)

Future

- CMC – FUA (End 2019)
- CNS|ATM Infrastructure Plan
- Airspace Restructure
- Re-sectorization (Dynamic Sectors)
- ATFCM
  - Sector Capacity (ACCs-TMAs)
  - Runway Capacity
  - AD Capacity
  - IFPS (Q1 2020)
  - ATFM System