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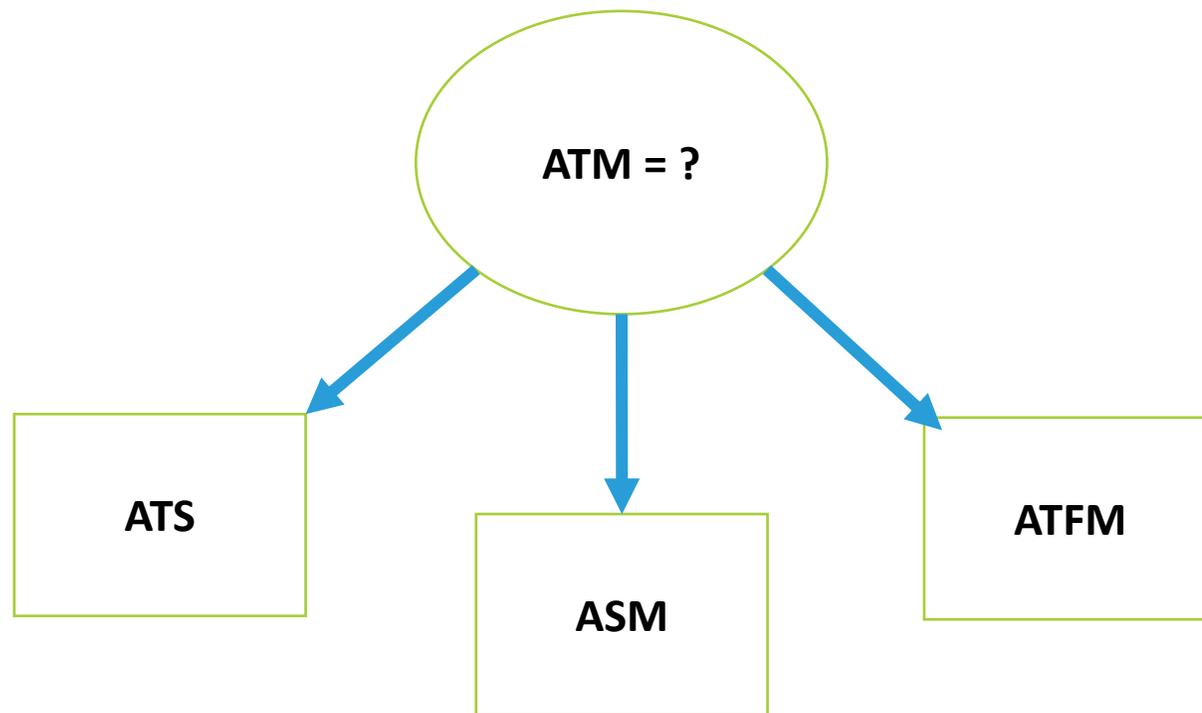
**ATC SECTOR AND AIRPORT
CAPACITY ASSESSMENT
METHODOLOGY**

REGULATORY FRAMEWORK

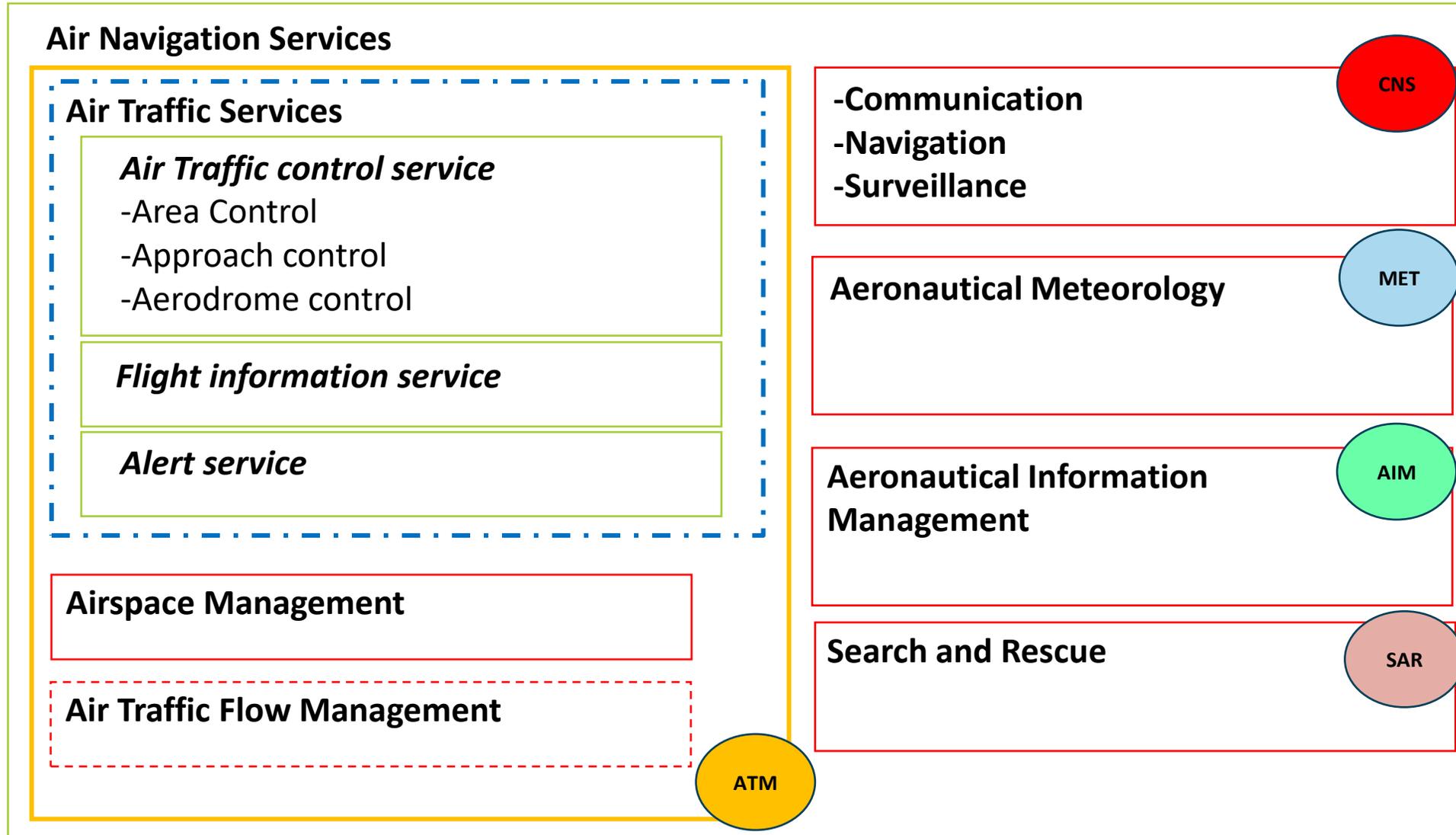
Abuja, 8-12 July 2024

- Structure of ATM
- Standards and recommended practices
- Procedures
- Guidance
- Regional requirements
- ATC capacity in the ASBU

SUMMARY



STRUCTURE OF AIR TRAFFIC MANAGEMENT



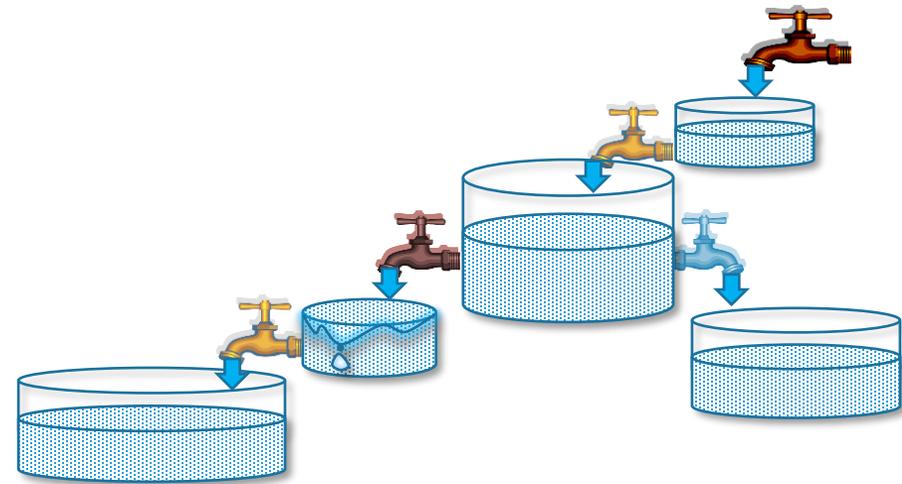
DEFINITIONS

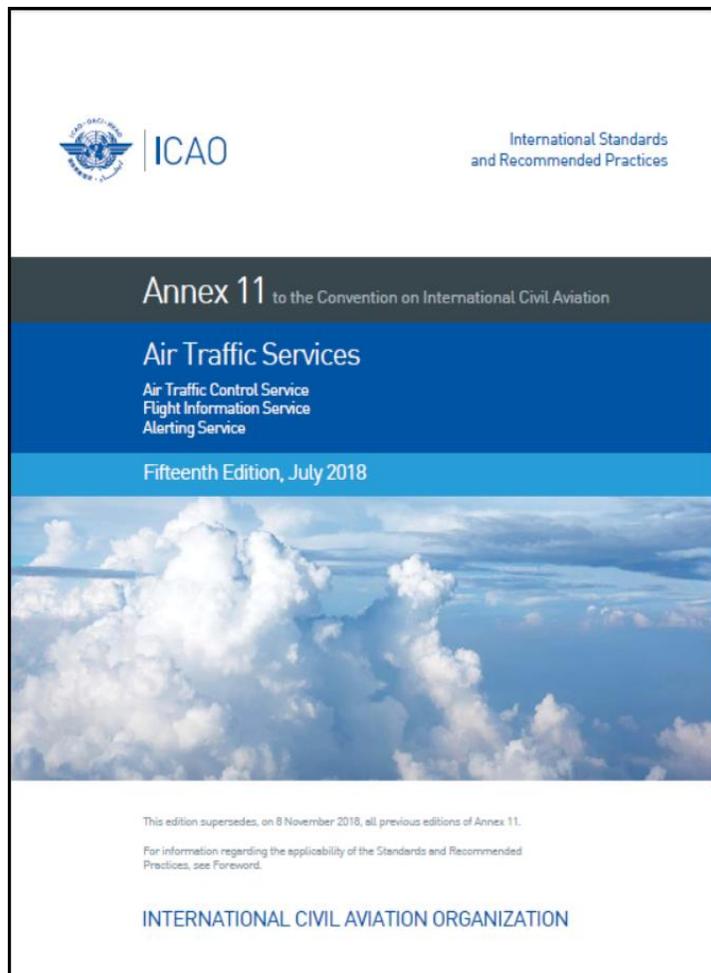
- **DEFINITIONS**

- ✓ **Capacity:** The maximum number of aircraft that can be accommodated in a given time period by the system or one of its components (throughput).
- ✓ **ATC capacity:** is the maximum number of aircraft which can be accepted over a given period of time within the airspace or at the aerodrome concerned
- ✓ **Operational capacity (available capacity):** The expected capacity associated with the tactical situation at the airport or airspace.
- ✓ **Demand:** The number of aircraft requesting to use the ATM system in a given period of time.
- ✓ **Air Traffic Flow Management (ATFM):** A service established with the objective of contributing to a safe, orderly and expeditious flow of air traffic by ensuring that ATC capacity is utilized to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate ATS authority.

Why is knowledge of ATC capacity important?

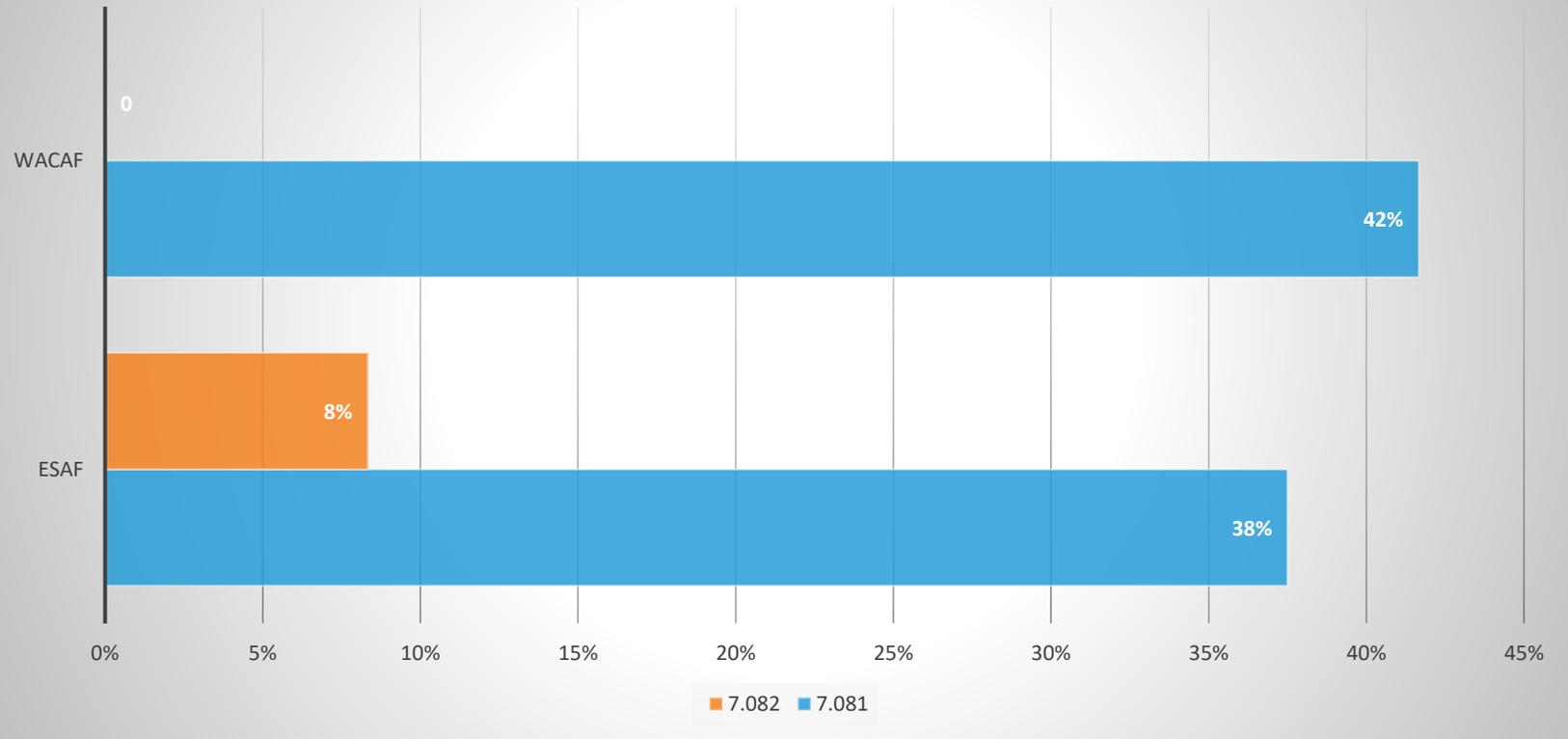
The number of aircraft provided with ATC service should not exceed that which can be safely handled by the ATS unit concerned. In order to define the maximum number of flights that can be safely managed in compliance with ICAO provisions, the appropriate ATS authority should assess and declare the capacity for control sectors (en-route and terminal control area) and for airports.





- 3.7.5.1 Air traffic flow management (ATFM) **shall** be implemented for airspace where air traffic demand at times exceeds, or is expected to exceed, the declared capacity of the air traffic control services concerned.
- Note.— The capacity of the air traffic control services concerned will normally be declared by the appropriate ATS authority.
- 3.7.5.2 Recommendation.— ATFM should be implemented on the basis of regional air navigation agreements or, if appropriate, through multilateral agreements. *Such agreements should make provision for common procedures and common methods of capacity determination.*

ATC capacity/ATFM implementation in AFI



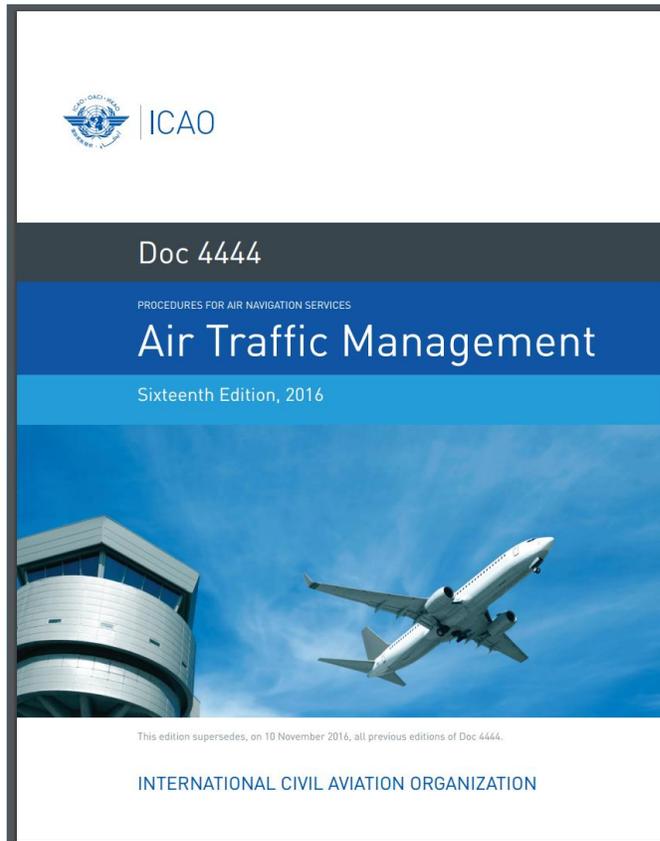
PQ 7.081

Does the State ensure that the ATS provider assesses and declares the ATC capacity?

PQ 7.082

Does the State ensure that air traffic flow management (ATFM) is implemented when air traffic demand at times exceeds, or is expected to exceed, the declared ATC capacity?

Procedures



Safety consideration

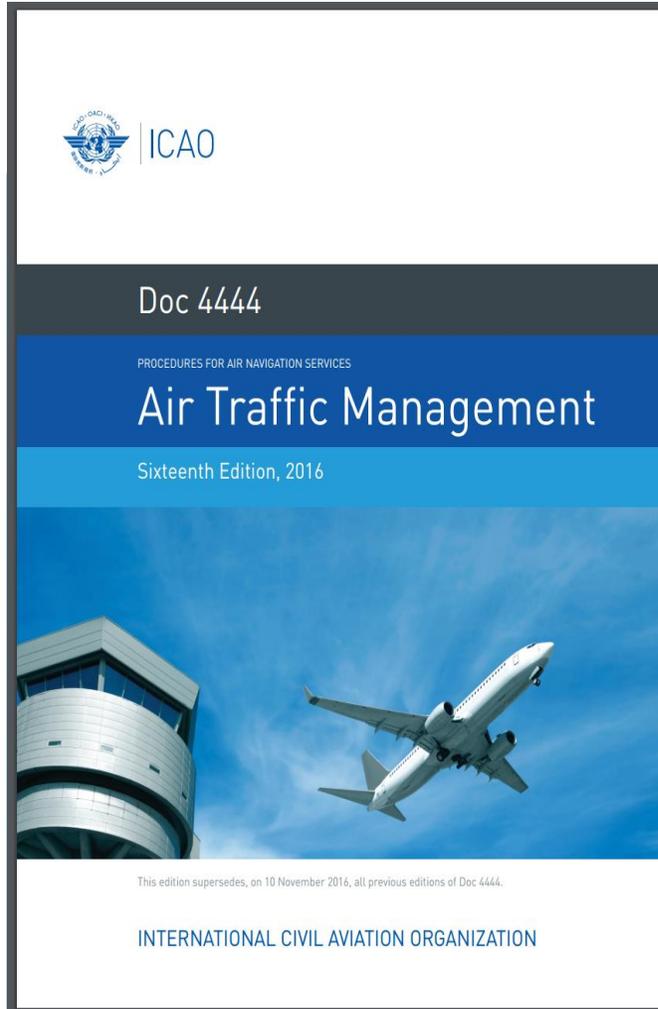
- Para.3.1.1.1 PANS-ATM

ATS authority shall ensure that safety risk assessment is conducted prior to the implementation of any measures to increase capacity.

State's responsibility for capacity assessment

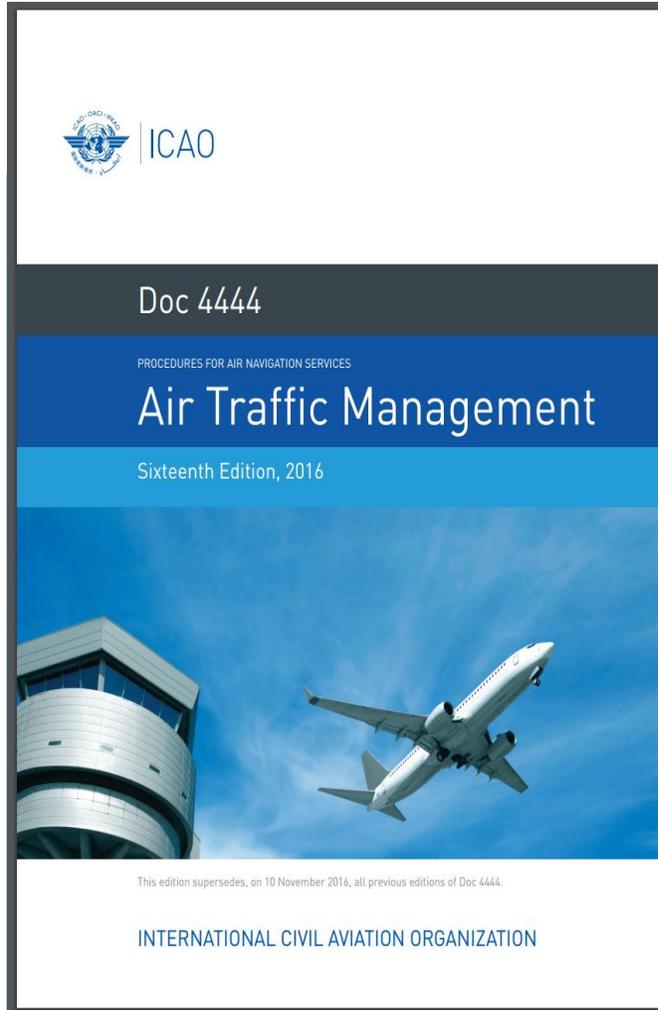
- Para.3.1.1.2 PANS-ATM

In order to define the maximum number of flights which can be safely accommodated, the appropriate ATS authority should assess and declare the ATC capacity for control areas, for control sectors within a control area and for aerodromes.



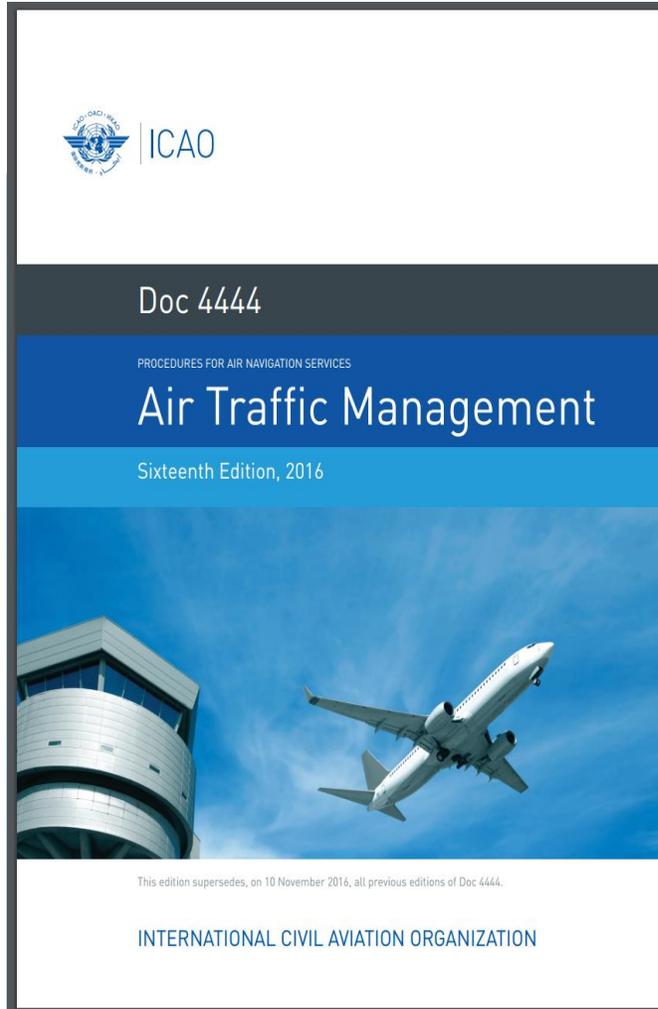
Minimum factors to consider in assessing capacity

- Para.3.1.2 PANS-ATM
 - a) the level and type of ATS provided [*aerodrome/Approach/En-Route # ATC/advisory/Flight information/Alert service...*]
 - b) the structural complexity of the control area, the control sector or the aerodrome concerned [*Lower/Upper airspace # ATS routes and hotspots # existing SUAs # number of sectors # runway exits number and layout*]
 - c) controller workload, including
 - background tasks (*Planning tasks*)
 - transition tasks (*entry/exit/clearance RT*),
 - recurrent tasks (*coordinations*) and
 - ATC conflict management tasks (*detection/resolution*).



Minimum factors to consider in assessing capacity

- d) the types of communications, navigation and surveillance systems in use, their degree of technical reliability and availability as well as the availability of backup systems and/or procedures *[Voice/datalink # conventional/GNSS # PSR/SSR/ADS-B/ADS-C/MLAT]*
- e) availability of ATC systems providing controller support and alert functions *[automated FPL processing System # STCA/MTCA/APW/MSAW etc.]*
- f) any other factor or element deemed relevant to controller workload. *[Weather/Military activities/ATC contingencies etc.]*



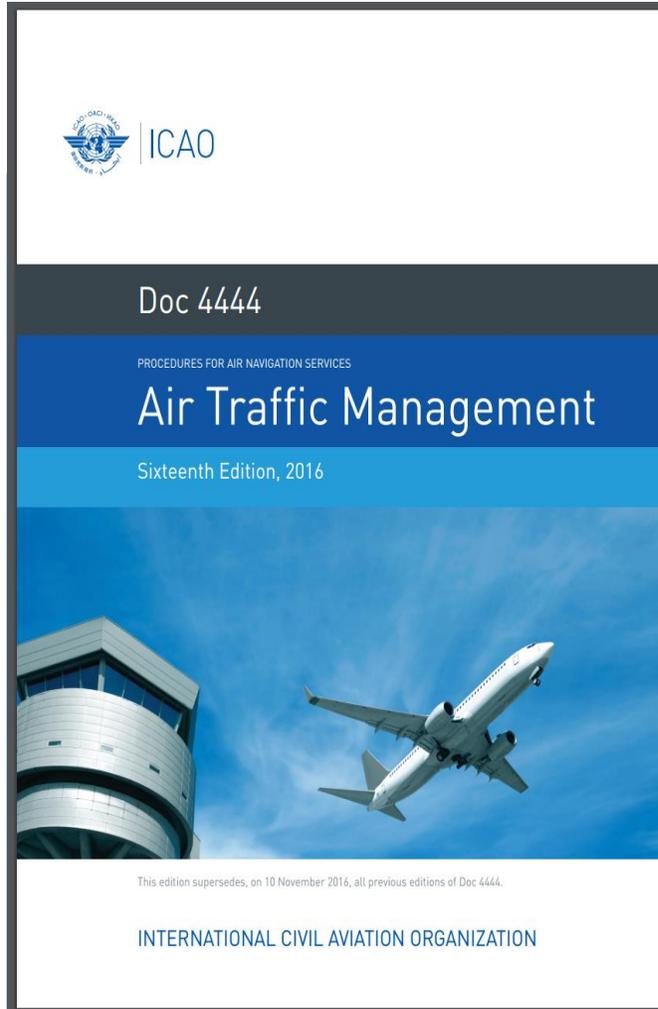
Demand/capacity management

- Para.3.1.3.1 PANS-ATM

Where traffic demand varies significantly on a daily or periodic basis, facilities and procedures should be implemented to vary the number of operational sectors or working positions to meet the prevailing and anticipated demand. *[Ensure adequate numbers of sectors/positions are available # Defined period for opening/closure of additional sectors based on traffic variability]*

- Para.3.1.3.2 PANS-ATM

Whenever possible, the capacity pertaining to events which have negative impact on the declared capacity of an airspace or aerodrome, the capacity of the airspace or aerodrome concerned should be predetermined. *[Operational capacity # Declared capacity]*



Capacity enhancement

- Para.3.1.4.1 PANS-ATM

The appropriate ATS authority should:

- a) periodically review ATS capacities in relation to traffic demand;
[Set operational multi-disciplinary team # hold periodic meetings]
and
- b) provide for flexible use of airspace in order to improve the efficiency of operations and increase capacity. *[Establish civil/military airspace management cells # sign civil/military or cross-border agreement or MoU]*

Guidance material-capacity assessment

Doc 9426-Air Traffic Services planning Manual Part II – Section 1

- **Appendix C-Techniques for ATC sector/position capacity estimation**
Two techniques indicated
 - ✓ **DORATASK technique**
 - Main criteria: ATC workload based on
 - Observable tasks *[ATC transmit on RT, Strip markings, coordination etc.]*
 - Non-observable tasks *[Conflict detection, resolution planning and monitoring]*
 - Recuperation time *[time with no task performed]*

**Doc 9426-Air Traffic Services
planning Manual
Part II – Section 1**

- **Appendix C-Techniques for ATC sector/position capacity estimation**

Two techniques indicated

- ✓ **MBB technique**

Main criteria: ATC workload based on

- Categorization of observed working actions

[RTF conversation, Strip processing, flight information sharing etc.]

- Time measuring of all observed categories

- Sector structure and traffic characteristics

[Number of hotspots, mix traffic IFR/VFR, aircraft performance etc.]

- **Limit of applicability:**

cannot readily be used to assess capacity under a future airspace organization, with different equipment or procedures, under different traffic loadings, or with different manning.

Guidance material-capacity enhancement

**Doc 9426-Air Traffic Services
planning Manual
Part II – Section 1**

- **Para 1.2.5-Measures to increase ATC capacity**

- ✓ ***ATC saturation can be noticed through:***

- Prevailing high density traffic
- Continuing and more frequent delays
- Disruption of services with slow recovery

HOW TO RESPOND TO ATC SATURATION?



Guidance material-capacity enhancement

Doc 9426-Air Traffic Services planning Manual Part II – Section 1

- **Para 1.2.5-Measures to increase ATC capacity**
 - ✓ Possible solutions:
 - Full exploitation of the existing capacity of the air navigation system (*unlock latent capacity*)
 - Development of plans to increase capacity considering: improved TMA operations (*effective SID/STAR, segregation of traffic DEP/ARR IFR/VFR etc., effective procedures for emergency situations*)
 - Effective LOA between adjacent States to enhance coordination and transfer of control (*possible cross boundary resectorization*)
 - Development of inter units procedures to improve flow management (*maximize the use of existing ATC capacity*)

Guidance material-capacity enhancement

Doc 9426-Air Traffic Services planning Manual Part II – Section 1

- **Para 1.2.5-Measures to increase ATC capacity**
 - ✓ Possible solutions:
 - Coordinated and preferably simultaneous introduction of new procedures between adjacent ATS units (*ensuring early benefit*)
 - Best exploitation of runways and landing capacity through effective ATC procedure design (*incorporating CDO & DRO*)
 - Improvement in runway/taxiway design to achieve efficiency in arrival/departure operations (*Parallel taxiways & rapid exit*)
 - Determination of traffic forecast in the targeted airspace or airport on at least five years (*enabler for long-term planning of airspace and airport improvement to accomodate future traffic demand*)

Guidance material

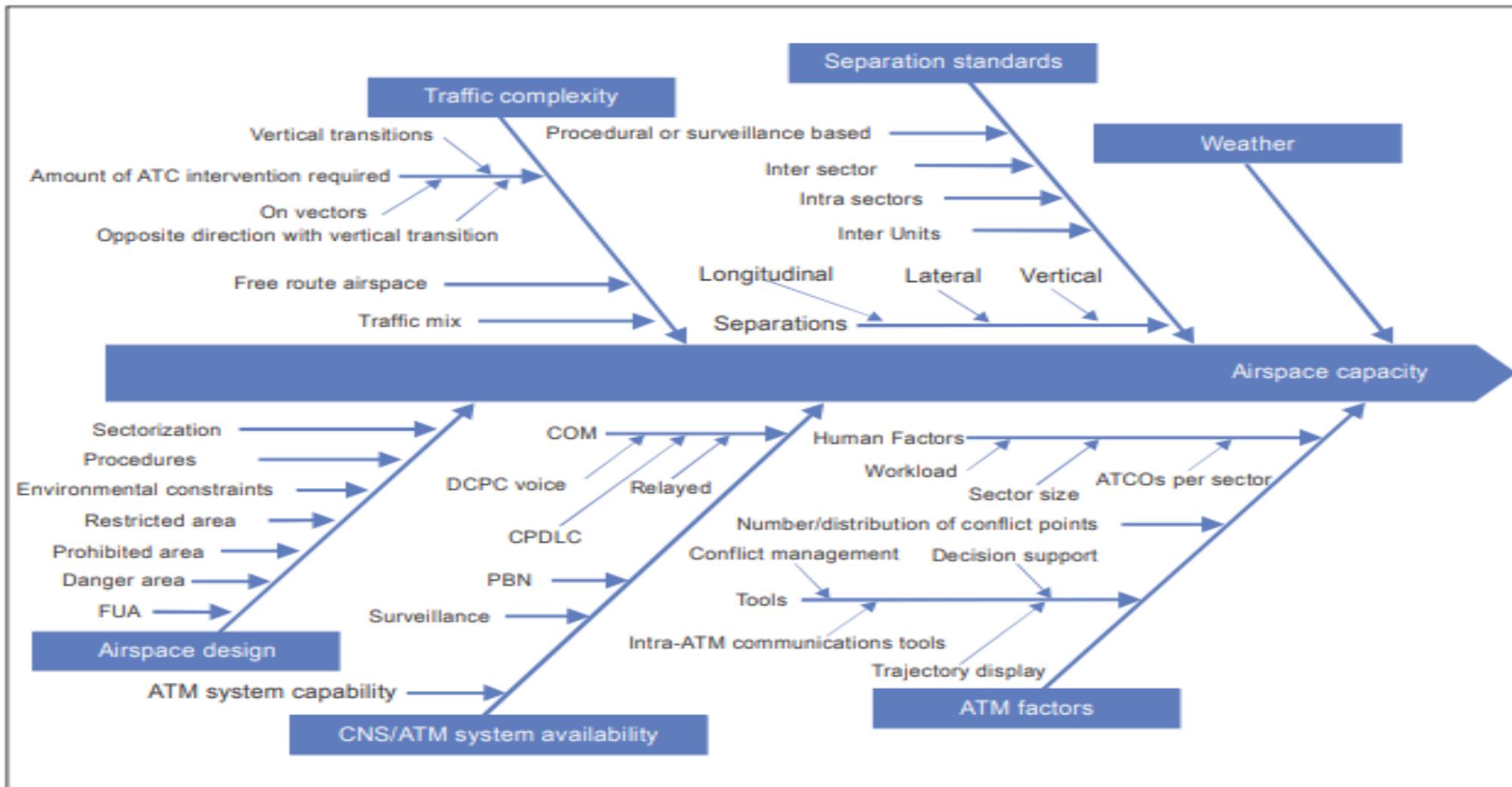
Doc 9971-Air Traffic Flow Management Manual

Capacity determination

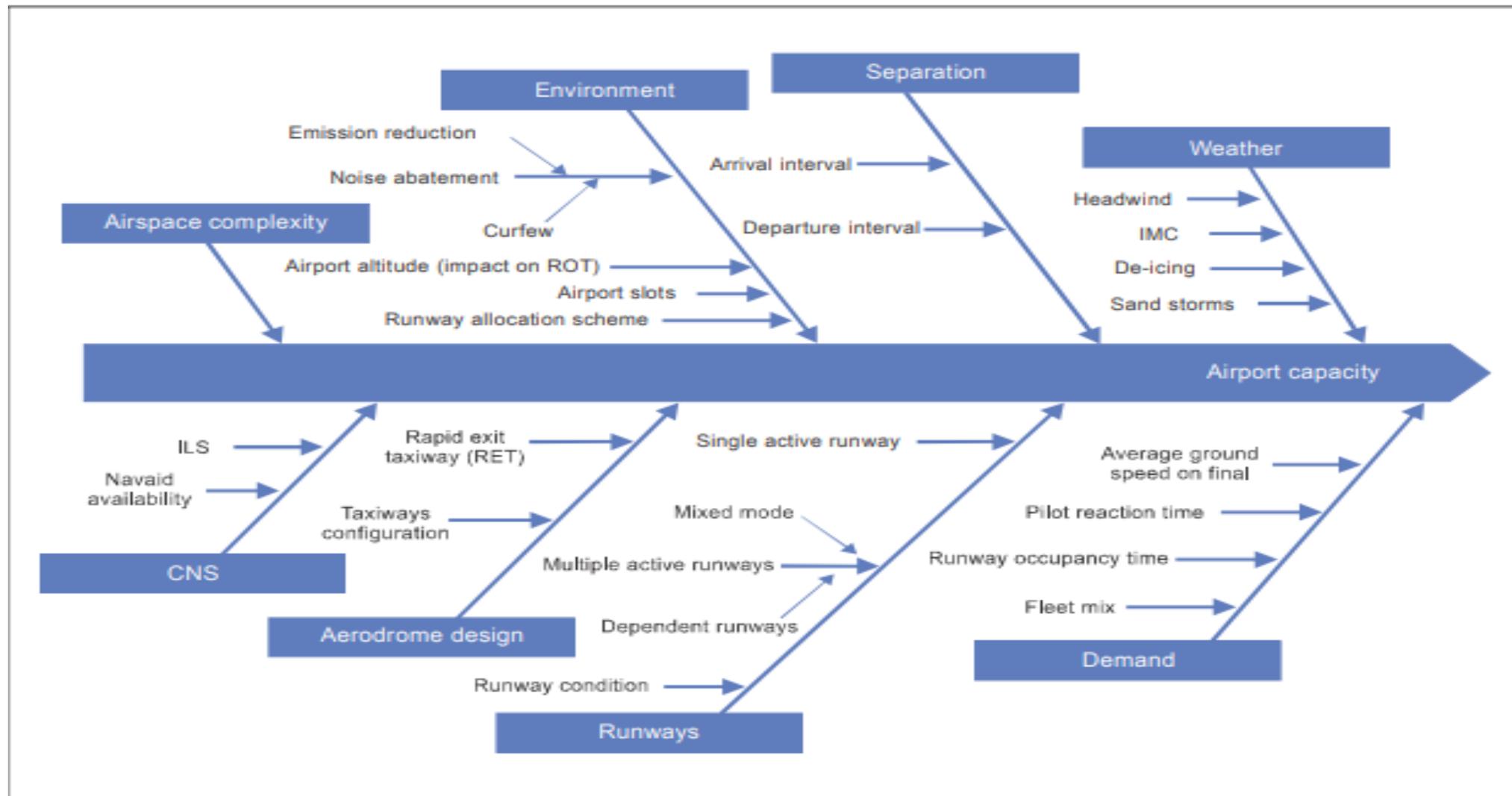
3.1.7.4 Capacity measurement and calculation methodologies should be developed according to the requirements and conditions of their operational environment.

3.1.7.5 Each State is responsible for determining capacity, while using the methodology of its choice. Due consideration should, however, be given to the methods employed by neighbouring States, so as to ensure as much consistency as possible in the methods used to determine capacity for sectors or airports used by the same traffic flows. When regional agreements are established, this specific provision should be addressed.

Factors affecting airspace capacity



Factors affecting airport capacity



Capacity/ATFM in ASBU

- ASBU thread elements applicable in the AFI Region

<p>Doc9750-GANP 7th & AFI eANP Vol III</p>	<p>NOPS</p>	<p>Network Operations</p>	NOPS – B0/1	Initial integration of collaborative airspace management with air traffic flow management
			NOPS – B0/2	Collaborative Network Flight Updates
			NOPS – B0/3	Network Operation Planning basic features
			NOPS – B0/4	Initial Airport/ATFM slots and A-CDM Network Interface
			NOPS – B0/5	Dynamic ATFM slot allocation
			NOPS – B1/1	Short Term ATFM measures
			NOPS – B1/2	Enhanced Network Operations Planning
			NOPS – B1/3	Enhanced integration of Airport operations planning with network operations planning
			NOPS – B1/4	Dynamic Traffic Complexity Management
			NOPS – B1/5	Full integration of airspace management with air traffic flow management
			NOPS – B1/6	Initial Dynamic Airspace configurations
			NOPS – B1/7	Enhanced ATFM slot swapping
			NOPS – B1/8	Extended Arrival Management supported by the ATM Network function
NOPS – B1/9	Target Times for ATFM purposes			
NOPS – B1/10	Collaborative Trajectory Options Program (CTOP)			

Conclusion

- **Capacity assessment is mandatory for all airspace and airport used for international air navigation**
- **Responsibility for determining airport/airspace capacity rests with the State**
- **Effective capacity assessment and management can be achieved through regional agreement and inter State's collaboration and coordinations**
- **Safety must always be considered first when assessing the capacity of a system or its component.**
- **Capacity determination is one enabler for ATFM implementation**



Thank You!