Airport capacity imbalance concept

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Airport capacity planning process is a complex issue which requires to be performed and tune in a permanent feedback with **performance results**.

It requires the consideration and correlation of several factors:

-airport location, design and construction

-a/c fleet types and mix

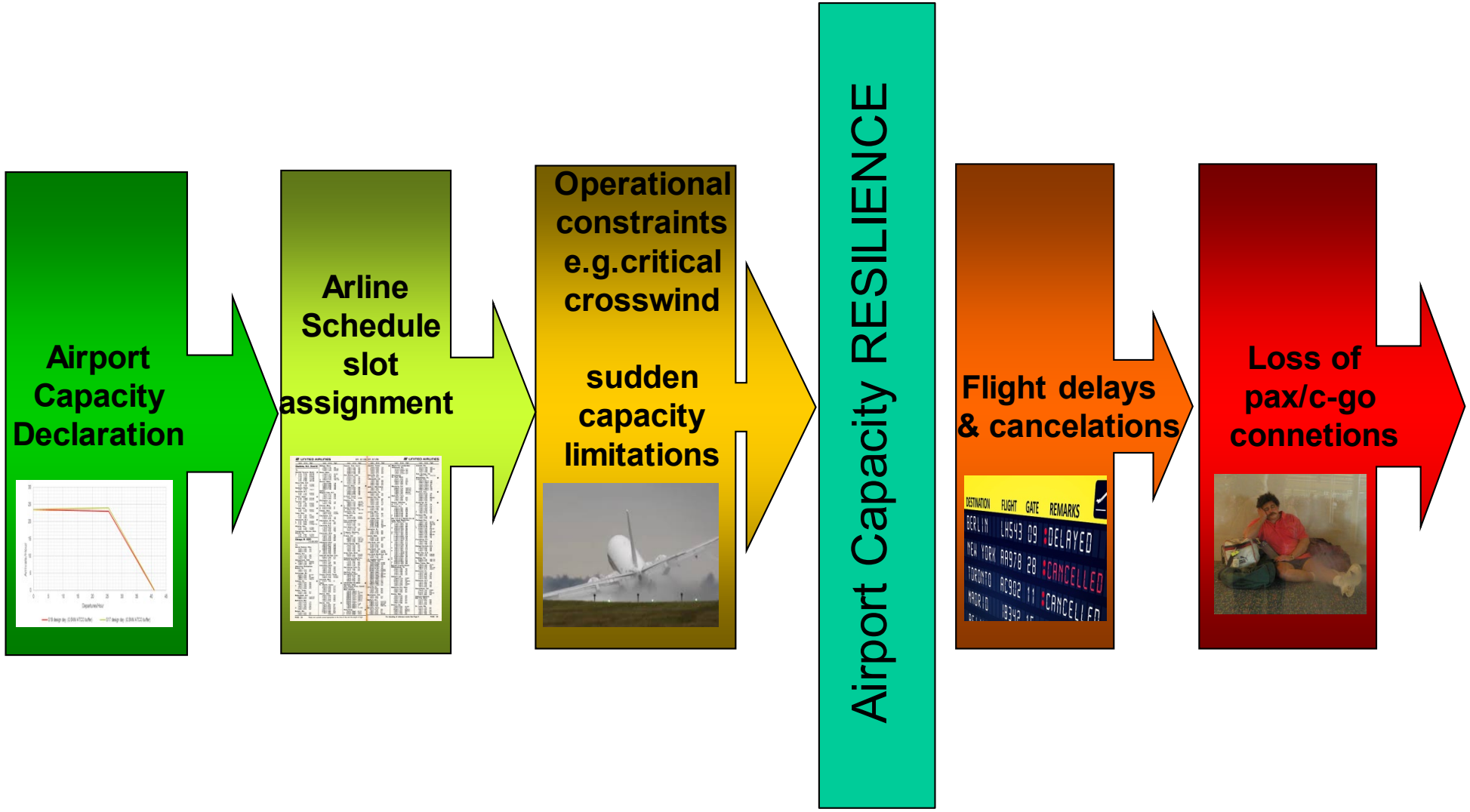
-weather (e. g. **wind rouse,** visibility, rain/snow, temp, etc)

-regulations (inlc environment), procedures and organization

-automation, technology and support

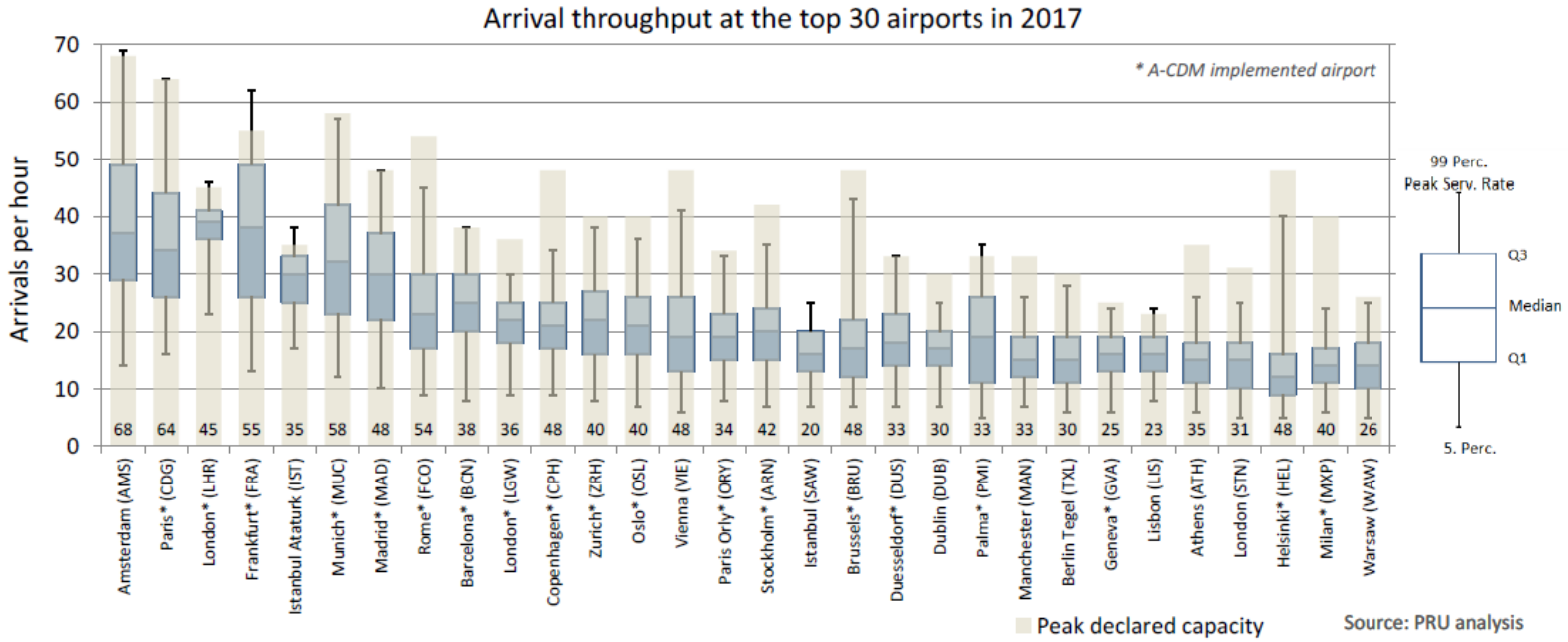
It is multi stakeholder's (ATC, Airport Operator, Airport Users, Ground Handling, etc.) influenced process.

Airport operations disruption sequence



RWY system capacity is a primary issue of airport capacity. **Lack of capacity symmetry (same value for all RWY in use configurations) may lead to substantial throughput imbalance.** As a consequence it has a crucial influence on punctuality and regularity of operations, which propagates into the overall operating network.

PRR compares the declared peak arrival capacities in ideal conditions (brown bars) to actual throughput dispersion degree



Critical Crosswind RWY System Resilience

With the introduction of the following metrics:

$$C_{imb}(Prob) = (C_{decl} - C_{min})/C_{decl}$$

where

Prob – Probability of the occurrence of unfavorable wind conditions which prevent takeoffs and landings (due to crosswind limitations) on RWY in use corresponding to declared capacity configuration

C_{decl} – Declared capacity with favorable wind conditions

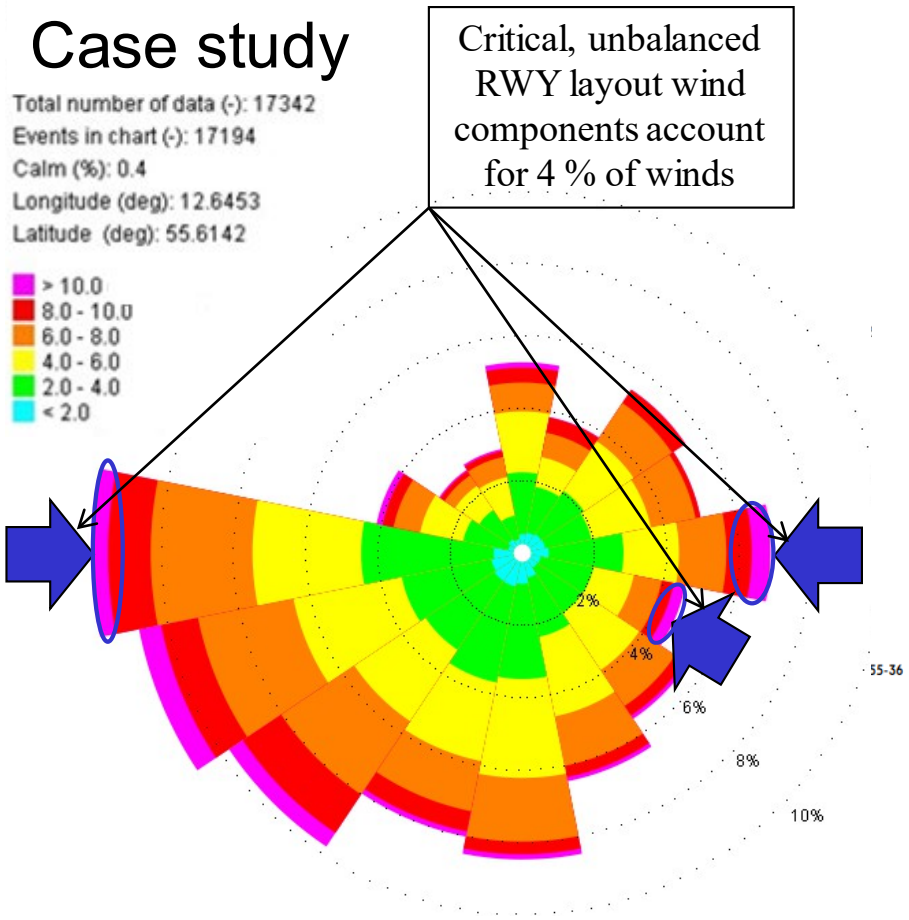
C_{min} – Minimum capacity with unfavorable wind conditions

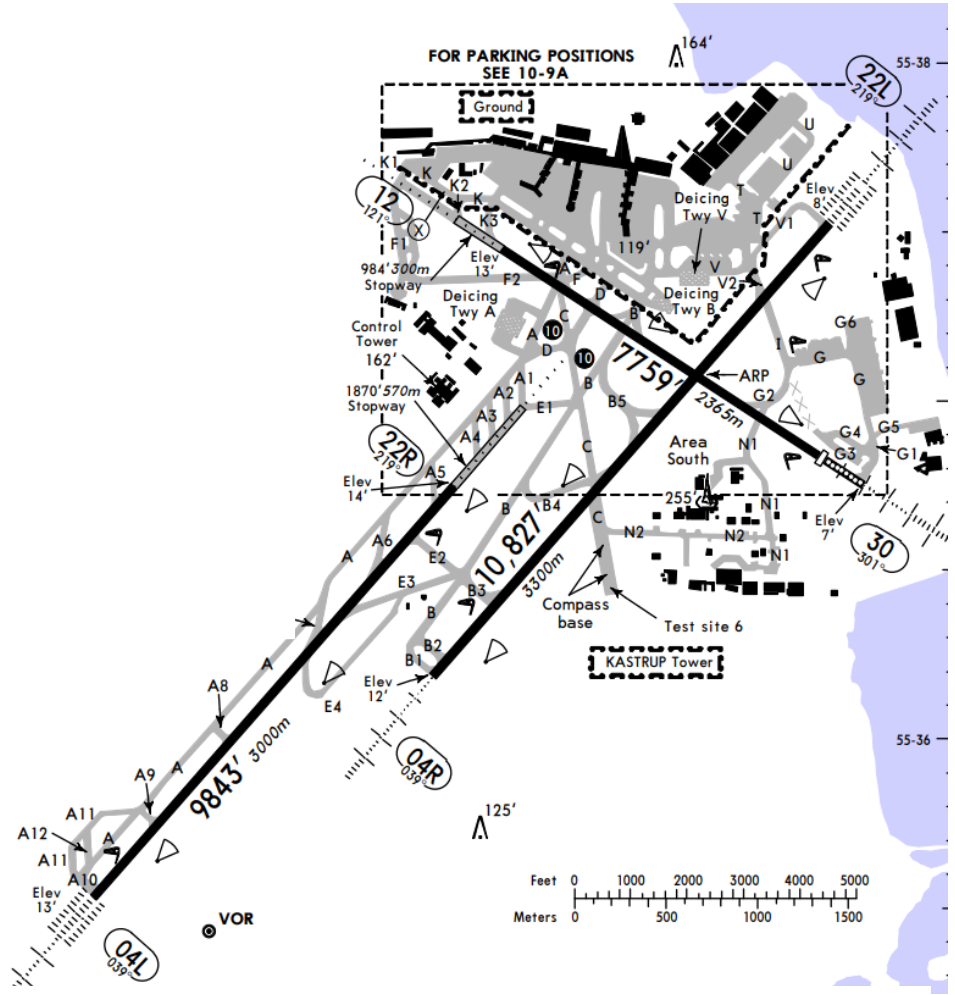
$C_{imb}(Prob)[\%]$ - Capacity imbalance as a percentage of lack of capacity in reference to declared capacity, associated with the probability *Prob* of this occurrence

Capacity Resilience [%] = 100 − (*Prob*∗ C_{imb})

Case study

Critical, unbalanced RWY layout wind components account for 4 % of winds





Capacities for different runway configurations

Runway Configuration	Max Arrivals (movements/hour)	Max Departures (movements/hour)	Global (movements/hour)	Optimum
22L/R	48	48	83	Yes
04L/R	48	48	83	Yes
12/30 + 22R/04L	48	48	83	No
12/30	20	20	36	No

$$C_{imb}(4)=(83 - 36)/83 = 0,57$$

$$\text{Capacity Resilience} = 100 - 4 * 0,57 = 97,72\ \%$$

Conclusions

1/ Airport capacity imbalance metrics as a delay/cancelation risk assessment input have significant potential for wide group of stakeholders:

- Slot coordinators
- ATCs
- Airports (APOC)
- Airlines
- Airport Development Planners

specially for airport operations monitoring & optimization process.

2/ This novel approach value consists of simultaneous expression of performance metric related to the probability of its occurrence

3/ Presented methodology can be expanded to other airport variable performance issues like night curfew limitations , low visibility constrain limitations and others.

References:

- Wind roses – www.enviroware.com
- Airport map – AIP
- Airport capacity data – https://ext.eurocontrol.int/airport_corner_public

Many thanks for your attention