ICAO GANP PORTAL

PERFORMANCE OBJECTIVE CATALOGUE

- Efficiency
  - Flight time & distance
    - Taxi-out time
      - Reduce taxi-out time
        - Reduce unimpeded taxi-out time
          - Reduce push-back time
          - Reduce distance between gate/stand and departure RWY
            - Improve geometric layout of airport
            - Assign best departure RWY where there is a choice
            - Apply intersection take-offs where safely possible
            - Optimise gate/stand assignment
          - Increase taxi speed
        - Reduce taxi-out additional time KPI02
          - Avoid taxi-out additional time resulting from poor push-back timing
            - Avoid penalties caused by planning for early pushback
              - Plan pushback using accurate taxi-time prediction (apply variable taxi-time)
              - Avoid early pushback resulting from need to free up the gate/stand
            - Avoid penalties caused by late push-back
              - Adhere to target start-up time
              - Avoid ground handling problems leading to long push-back
          - Avoid taxi-out additional time resulting from adverse conditions
            - Avoid slow taxi-out
              - Avoid slow taxi-out due to taxiway congestion
              - Avoid slow taxi-out due to weather conditions
              - Avoid slow taxi-out due to ATC and/or pilot
            - Avoid longer taxi-out routes
              - Avoid longer taxi-out routes due to unavailability of taxiways
              - Avoid longer taxi-out routes due to taxi errors

- Reduce taxi-out stops before reaching the departure RWY
  - Reduce holding time on apron after push-back
    - Reduce time for engine start-up
    - Avoid holding due to other inbound or outbound traffic on the apron
  - Reduce time on de-icing pads
    - Avoid queueing at the de-icing pad
    - Speed up de-icing
    - Do de-icing at the gate
  - Reduce taxi-out stops due to conflicting traffic
    - Reduce need to cross active RWYs during taxi-out
    - Reduce conflict points of taxi-out flows
      - Introduce 4D planning of taxi-out surface movements
      - Build additional taxiways
    - Reduce ATC constraints during low visibility taxi-out
- Reduce taxi-out stops after reaching the departure RWY
  - Reduce queueing at the departure RWY (departure holding time)
    - Limit the length of the departure queue
      - Optimise the delivery of aircraft to the departure queue
    - Avoid additional holding delay caused by departure metering not factored in during push-back planning
      - Improve the delivery of departing traffic into the overhead stream
  - Avoid time lost on the departure RWY
    - Avoid slow line up
    - Avoid additional holding time after line up caused by departure metering not factored in during pushback planning
    - Avoid need to back-track on the departure RWY
- Taxi-in time
  - Reduce unimpeded taxi-in time
    - Reduce distance between arrival RWY and gate/stand
      - Improve geometric layout of airport
      - Assign best arrival RWY where there is a choice
      - Optimise gate/stand assignment
    - Increase taxi-in speed
  - Reduce taxi-in additional time KPI13
    - Avoid taxi-in additional time resulting from adverse conditions

- Avoid slow taxi
  - Avoid slow taxi-in due to taxiway congestion
  - Avoid slow taxi-in due to weather conditions
  - Avoid slow taxi-in due to ATC and/or pilot
- Avoid longer taxi-in routes
  - Avoid longer taxi-in due to unavailability of taxiways
  - Avoid longer taxi-in due to taxi errors
- Reduce taxi-in stops before reaching the gate/stand
  - Reduce taxi-in stops due to conflicting traffic
    - Reduce need to cross active RWYs during taxi-in
    - Reduce conflict points of taxi flows
      - Introduce 4D planning of taxi-in surface movements
      - Build additional taxiways
    - Reduce ATC constraints during low visibility taxi-in
  - Reduce taxi-in holding due to unavailability of gate/stand
    - Reduce gate/stand unavailability
      - Increase buffer time between gate/stand allocations
      - Reduce delays of aircraft occupying the stand
      - Reduce occurrence of technical problems with gates/stands
      - Avoid assignment of gates/stands incompatible with the aircraft
    - Reallocate flights to alternative gates/stands

- En-route distance (horizontal flight efficiency)
  - Optimise horizontal flight efficiency in the en-route phase
    - Improve route selection at the flight planning stage KPI04
      - Overcome route selection inefficiencies attributable to individual airspace user constraints
        - Choice of longer route due to lack of overflight permit(s)
        - Choice of longer route due to aircraft equipage and operating limitations
          - Not equipped (CNS) to access certain airspace
          - Not equipped for the shorter route (e.g. overwater operations, polar operations etc.)
          - Aircraft performance limitations (range, ceiling, climb rate etc.)
        - Choice of longer route due to less capable internal flight planning process
          - AU unable to find/choose optimum route
          - AU uses city-pair standard route in flight plans instead of adapting each individual FPL to day of week, latest conditions etc.

- Overcome route selection inefficiencies caused by airspace user performance optimisation
  - Safety considerations
    - Choice of longer route to avoid conflict zone(s)
    - Choice of longer route to avoid forecasted weather
  - Cost optimisation (trade-off between distance and other criteria)
    - Choice of longer route due to preference for airspace with lower route charges
    - Choice of longer route to avoid predicted ATFM delay
    - Choice of longer route to optimise for wind
- Overcome route selection inefficiencies associated with ATM induced constraints
  - Overcome route selection inefficiencies resulting from Traffic Orientation Schemes
    - Reduce need for ATM or CDM to reroute entire traffic flows for load balancing
  - Overcome route selection inefficiencies associated with route & airspace availability as known at the flight planning stage
    - Reduce need to avoid airspace because of lack of confirmation that it will be open
    - Reduce need to avoid routes because of lack of confirmation that they will be open
  - Overcome route selection inefficiencies associated with route network design
    - Reduce inefficiency induced by FIR border crossing constraints (number and positioning of possible entry and exit points)
    - Reduce inefficiency induced by internal FIR route network design constraints (inability to flight plan direct within the FIR)
- Improve route selection after the flight planning stage KPI05
  - Prevent tactical decisions leading to a longer actual route than in the initial FPL
    - Reduce need for tactical ATFM rerouting
      - Reduce need for tactical ATFM rerouting for safety reasons
        - Reduce need for tactical ATFM rerouting to avoid weather
      - Reduce need for tactical ATFM rerouting for capacity reasons
        - Reduce need for tactical ATFM rerouting to circumnavigate airspace closed at short notice
        - Reduce need for tactical ATFM rerouting to avoid demand/capacity imbalance leading to ATFM delay (trade-off)
    - Reduce extra distance flown en-route due to the need to loose time
      - Reduce need for en-route holding
      - Reduce need for en-route vectoring
    - Reduce effect of en-route / terminal airspace interface
      - Reduce need for unfavourable exit from or entry into terminal airspace which adds distance to the en-route phase
  - Facilitate tactical decisions leading to a shorter actual route than in the FPL
    - Facilitate direct routing of portions of the flight (if this does not cause network problems)

- Take advantage of airspace made available at short notice
- Take advantage of routes made available at short notice
- Take advantage of reroute cancellation

- Terminal airspace transit time (upon arrival)
  - Reduce terminal airspace transit time
    - Reduce unimpeded terminal airspace transit time
      - Reduce distance of arrival paths
        - Reduce distance of IFR arrival paths
          - Provide more IFR arrival options
            - Provide IFR approaches to more RWY ends
          - Improve geometric layout of IFR approach procedures
        - Use VFR arrivals
      - Increase arrival ground speed
        - Tailwinds increase ground speed
        - Use higher airspeed
    - Reduce additional time in terminal airspace KPI08
      - Reduce excessive queueing in terminal airspace
        - Reduce arrival holding (total time in holding stacks)
          - Increase/restore arrival capacity as quickly as possible
          - Reduce arrival demand if holding time is predicted to be unacceptable
            - Divert flights to other airports if already airborne
            - Prevent take-off if flights are not yet airborne
              - Taxi-back if already off-blocks
              - Cancel flights if still at the gate/stand
          - Absorb holding time before arriving at the destination airport
            - Improve arrival time at the destination airport
              - Apply TTA and en-route speed reduction if traffic is already airborne
              - Delay take-off if traffic is not yet airborne
                - Absorb time at the departure runway if already off-blocks
                - Hold traffic at the gate/stand if not yet off-blocks
              - Apply a longer time horizon to arrival
                - Extend arrival management to a greater radius around the destination airport
      - Reduce need to fine-tune traffic spacing in terminal airspace (arrival)
        - Reduce need for path stretching (arrival)

- Apply TTA and en-route speed reduction

- Reduce need for vectoring (arrival)
  - Apply TTA and en-route speed reduction

- Vertical flight efficiency
  - Vertical flight efficiency during the climb phase
    - Reduce vertical flight inefficiency during the climb phase KPI17
      - Reduce climb inefficiency attributable to aircraft operator choices (operating practice)
      - Reduce climb inefficiency attributable to altitude constraints imposed by ATM
        - Reduce permanent (airspace and departure procedure design) and semi-permanent (ATFCM measures) altitude constraints (level capping) along the climb portion of traffic flows, in terminal and en-route airspace
          - Reduce altitude restrictions during climb introduced to avoid airspace above
            - Reduce altitude restrictions during climb for load balancing (capacity management)
            - Reduce altitude restrictions during climb to avoid Special Use Airspace
          - Reduce altitude restrictions (climb) introduced to ensure vertical separation of conflicting traffic flows in same airspace (eg arriving vs departing or deconflicting flows to/from adjacent airports)
          - Reduce altitude restrictions during climb introduced for dealing with aircraft capability limitations (e.g. navigation capabilities)
        - Reduce tactical altitude constraints during climb imposed by ATM
          - Reduce level-off instructions during climb issued by ATCOs for conflict resolution purposes
  - Vertical flight efficiency during the cruise phase
    - Reduce vertical flight inefficiency during the cruise phase KPI18
      - Reduce cruise level inefficiency attributable to aircraft operator choices/needs
        - Reduce occurrence of lower level cruising due to weather
        - Reduce occurrence of lower level cruising due to flight planning practice (in cases where there are no [or no longer any] ATM constraints)
      - Reduce cruise level inefficiency attributable to altitude constraints imposed by ATM
        - Reduce permanent (airspace and route network design) and semi-permanent (ATFCM measures) altitude constraints (level capping) on city-pairs
          - Reduce altitude restrictions during cruise introduced to avoid airspace above
            - Reduce altitude restrictions during cruise for load balancing (capacity management)
            - Reduce altitude restrictions during cruise to avoid Special Use Airspace
          - Reduce altitude restrictions during cruise introduced to ensure vertical separation of conflicting traffic flows in the same airspace
          - Reduce altitude restrictions during cruise introduced for dealing with aircraft capability limitations (e.g. navigation capabilities)
        - Reduce tactical altitude constraints during cruise imposed by ATM
          - Reduce level restrictions during cruise issued by ATCOs for conflict resolution purposes

- Increase acceptance of pilot requests for higher cruise level

- Vertical flight efficiency during the descent phase
  - Reduce vertical flight inefficiency during the descent phase KPI19
    - Reduce descent inefficiency attributable to aircraft operator choices (operating practice)
    - Reduce descent inefficiency associated with inability to land at first attempt
      - Reduce vertical flight inefficiency attributable to missed approach
      - Reduce vertical flight inefficiency attributable to go-around instructions from ATC
    - Reduce descent inefficiency attributable to altitude constraints imposed by ATM
      - Reduce permanent (airspace and approach procedure design) and semi-permanent (ATFCM measures) altitude constraints along the descent portion of traffic flows, in en-route and terminal airspace
        - Reduce altitude restrictions introduced to avoid airspace above or below
          - Reduce altitude restrictions during descent for load balancing (capacity management)
          - Reduce altitude restrictions during descent to avoid Special Use Airspace
          - Reduce altitude restrictions during descent to avoid uncontrolled airspace (with VFR traffic)
          - Reduce altitude restrictions during descent to ensure terrain and obstacle clearance
        - Reduce altitude restrictions (descent) introduced to ensure vertical separation of conflicting traffic flows in the same airspace (e.g. arriving vs departing or deconflicting flows to/from different adjacent airports)
        - Reduce altitude restrictions during descent introduced for noise management reasons
        - Reduce altitude restrictions during descent introduced to facilitate merging of traffic flows in the vertical plane
        - Reduce altitude restrictions during descent introduced for sequencing and metering (including holding in arrival stacks)
        - Reduce altitude restrictions during descent introduced for dealing with aircraft capability limitations (e.g. navigation capabilities)
      - Reduce tactical altitude constraints during descent imposed by ATM
        - Reduce level-off instructions during descent issued by ATCOs for conflict resolution purposes
    - Optimise choice of Top of Descent (ToD)
      - Reduce uncertainty about the optimum ToD point
        - Reduce ToD uncertainty by early assignment of landing RWY and approach procedure
        - Reduce ToD uncertainty by early knowledge of arrival restrictions (queueing and path extension including holding)
          - Reduce ToD uncertainty due to other traffic
          - Reduce ToD uncertainty due to weather
          - Reduce ToD uncertainty due to special conditions at the airport (including RWY configuration change)
      - Avoid efficiency penalties attributable to non-optimum ToD (descent starts before or after the optimum ToD)
        - Choose ToD closest to optimum taking into account a variety of factors

- Choose ToD closest to optimum taking into account cruise altitude
- Choose ToD closest to optimum taking into account target landing time and route to be flown (gives remaining distance till RWY threshold)
- Choose ToD closest to optimum taking into account speed restrictions (airspace related and sequencing/metering related)
- Choose ToD closest to optimum taking into account wind direction and strength at all altitudes
- Choose ToD closest to optimum taking into account aircraft performance characteristics (optimum speeds, descent angle, deceleration needs)
- Choose ToD closest to optimum taking into account aircraft navigation capability in each of the 4D dimensions
- Choose ToD closest to optimum taking into account all permanent and semi-permanent altitude constraints after ToD
- Choose ToD closest to optimum taking into account predicted traffic conflicts
- Choose ToD closest to optimum taking into account a margin for unexpected events

▼ Optimise descent after ToD has been chosen and executed

▼ Optimise descent in case of early start of descent (which implies that there will be level segments)

- Fly level segments as high as possible
- In case of holding: hold at optimum altitude (with lowest fuel flow)
- Shorten length of arrival path if possible to reduce amount of level flight

▼ Optimise descent in case of late start of descent

- Increase drag for a steeper descent (wastes energy)
- Do not increase drag, which increases length of arrival path (does not consume extra energy) if this leads to benefits elsewhere

▼ Optimise descent in case of optimum start of descent

- Avoid tactical lengthening of arrival path (eg vectoring, holding, trombone extension) because this leads to level flight

▼ Fuel burn

▼ Fuel burn

▼ Reduce total fuel burn of aviation

- Reduce number of flights

▼ Reduce fuel burn per flight

▼ Reduce fuel burn per flight under unimpeded conditions

- Reduce average city-pair distance per flight

▼ Reduce average fuel flow per flight

▼ Improve fuel efficiency of airborne fleet

- Use smaller aircraft which consume less fuel

▼ Replace fleet by more fuel efficient aircraft

- Use aircraft with better aerodynamic characteristics

- Use aircraft with lower empty weight (e.g. lighter materials and design)
- Use aircraft with more efficient engines
- Retrofit aircraft with fuel saving options (e.g. winglets)
- Keep aircraft in good operating condition (e.g. clean, correct rigging)
- Use more aircraft flying on alternative energy sources (e.g. biofuel, electric, hybrid)

Reduce take-off mass

Reduce fuel reserve

- Avoid unnecessary fuel reserve
- Reduce weight of equipment and supplies (e.g. potable water)
- Reduce payload

Apply more fuel efficient aircraft operating procedures in each flight phase

- Reduce or eliminate APU fuel consumption during turn-around (e.g. use ground power supply)
- Reduce or eliminate fuel flow during taxi-out (e.g. single engine taxi, electric taxi, TaxiBot, engine shutdown during long holds)
- Use more fuel-efficient cost index during flight
- Reduce or eliminate fuel flow during taxi-in (e.g. single engine taxi, electric taxi, TaxiBot)

Reduce fuel burn impact of impeded conditions KPI16

Reduce additional fuel burn during taxi-out

- Improve taxi-out additional time KPI02

Reduce additional fuel burn during climb phase

- Improve level-off during climb KPI17

Reduce additional fuel burn during en-route

- Improve actual en-route extension KPI05
- Improve level capping during cruise KPI18

Reduce additional fuel burn during descent phase

- Improve level-off during descent KPI19

Reduce additional fuel burn during taxi-in

- Improve taxi-in additional time KPI13

Reduce additional fuel burn attributable to extra weight of contingency fuel

- Improve flight time variability KPI16

Capacity

Capacity, throughput & utilization

Airport/terminal airspace throughput and capacity

- Increase airport throughput (departures+arrivals) KPI10
  - Increase airport arrival rate
    - Increase demand if capacity constraints are not the issue
      - Accept traffic growth if airport is not congested
    - Relax scheduling constraints if these are capping the demand unnecessarily
      - Discontinue slot coordination if not needed any more
      - Increase capacity declaration
        - Bring capacity declaration in line with real capacity if there is a mismatch
          - Increase airport peak arrival capacity KPI09
        - Declare higher capacity than real capacity and accept more ATFM delay if economic value of airport slots is high and stakeholders agree
          - Increase airport peak arrival capacity KPI09
    - Increase real capacity if this is the constraining factor
      - Mitigate landside capacity constraints if this is the problem
      - Mitigate parking/gate capacity constraints if this is the problem
      - Mitigate taxiway network constraints if this is the problem
      - Mitigate local airspace capacity constraints if this is the problem
      - Mitigate environmental constraints if this is the problem
        - Mitigate noise constraints if this is the problem
      - Mitigate ATM service provision constraints if this is the problem
        - Resolve ATC staffing, workload, frequency congestion problems
      - Mitigate landing constraints if this is the problem
        - Reduce arrival bunching if this causes unused landing slots
          - Control and smooth arrival rate
            - Apply airport scheduling (airport slots)
            - Apply ATFM measures (ATFM slots)
            - Apply arrival management
              - Apply merging & synchronisation of arrival flows
              - Apply buffering of arrival flows
                - Apply upstream time absorption
                  - Apply speed reduction
                - Apply arrival holding
                - Apply path extension
        - Use other RWY(s) if one is saturated

- Apply arrival balancing
- Use more arrival runways simultaneously
  - Use other RWY configuration if available
  - Equip additional RWY ends with instrument approaches
  - Construct additional RWY(s)
- Make better use of RWY during low visibility conditions
  - Reduce approach minima (ceiling & visibility)
- Make more RWY occupancy time available for arrivals
  - Reduce RWY unavailability
    - Reduce unavailability due to active RWY crossings by taxiing aircraft
    - Reduce unavailability due to FOD detection and removal
    - Reduce unavailability due to snow removal
  - Reduce departure rate in case of mixed operations
    - Give priority to arrivals
- Make better use of RWY occupancy time which is available for arrivals if this is the constraint
  - Reduce ROT of landing aircraft if this is the constraint
    - Avoid long taxi times after roll-out
      - Avoid need to backtrack after landing
        - Construct parallel taxiway
      - Construct more RWY exits
      - Extend roll-out till next RWY exit
    - Shorten roll-out
      - Land with lower ground speed
        - Use headwind
      - Use high-speed RWY exit
        - Construct high-speed RWY exits
      - Apply stronger breaking
- Mitigate final approach occupancy constraints if this is the problem
  - Mitigate NAV constraints
    - Solve problem of ILS signal interference
  - Mitigate SUR constraints
    - Apply visual approaches
    - Apply better surveillance (more accurate, higher update rate)
- Maintain or improve arrival rate at the RWY threshold

- Prevent missed approaches
- Prevent reduction of arrival rate during headwind conditions
  - Apply time-based separation instead of distance-based (arrival)
- Compress the arrival flow (reduce time/distance separation on final approach)
  - Reduce uncertainty of the ROT of the aircraft ahead (arrival)
    - Improve prediction of the ROT of the aircraft ahead (arrival)
  - Reduce penalty caused by parallel dependent RWYs (arrival)
    - Reduce wake turbulence impact from parallel RWY during crosswind (arrival)
    - Reduce impact of other constraints from parallel RWY (arrival)
  - Harmonise final approach speeds
    - Apply smart sequencing to harmonise final approach speeds (arrival)
    - Apply speed instructions to harmonise final approach speeds (arrival)
  - Avoid wake vortices (arrival)
    - Use displaced touch-down points (aircraft behind uses approach path above wake vortex of preceding aircraft)
  - Reduce the percentage of large wake vortex separations between aircraft pairs (arrival)
    - Apply smart sequencing to optimise wake vortex separations (arrival)
  - Reduce wake vortex separation minima (arrival)
    - Base minima on more accurate wake vortex characteristics of aircraft pairs (static) (arrival)
      - Improved categorisation of aircraft (arrival)
    - Apply dynamic separation minima (arrival)
      - Adapt minima to WX conditions (reduce during X-wind) (arrival)
      - Base minima on real-time wake-vortex measurement (arrival)

- Increase airport departure rate
  - Mitigate departure constraints if this is the problem
    - Use other departure RWY(s) if one is saturated
    - Use more departure runways simultaneously
      - Use other RWY configuration if available
      - Construct additional RWY(s)
    - Make more RWY occupancy time available for departures
      - Reduce RWY unavailability
      - Reduce arrival rate in case of mixed operations
    - Maintain or improve departure rate of the RWY
      - Compress the departure flow of the RWY (reduce time/distance separation on take-off)

- Reduce wake vortex separation penalty from other traffic using the departure RWY
- Reduce penalty caused by parallel dependent RWYs (departures)
  - Reduce wake turbulence impact from parallel RWY during crosswind (departures)
- Improve multi-airport terminal airspace throughput (departures+arrivals) KPI10
  - Increase multi-airport terminal airspace arrival rate
  - Increase multi-airport terminal airspace departure rate
- Airport capacity utilisation
  - Improve airport capacity utilization (throughput efficiency) KPI11
    - Increase airport arrival capacity utilization
      - Increase airport arrival capacity utilization when demand is less than capacity
        - Improve the prediction of demand (number of expected arrivals)
          - Improve the accuracy of ELDT estimates provided by airspace users
        - Increase the number of arrivals to match the number of expected arrivals (according to FPL)
          - Reduce the number of flights that do not arrive
            - Reduce the number of diversions
            - Reduce the number of cancellations
          - Reduce the number of flights that have an arrival delay
            - Resolve upstream en-route and/or departure bottlenecks if these affect the inbound traffic stream to the airport
              - Reduce departure delays
              - Reduce flight time increases
                - Reduce reroutes
            - Resolve destination airport bottlenecks if these constrain the inbound traffic stream
              - Increase airport arrival rate
      - Increase airport arrival capacity utilization when demand exceeds capacity
        - Improve the quality of the capacity declaration
          - Reduce declared arrival capacity if the utilisation is consistently low
        - Increase momentary arrival capacity to match declared capacity
          - Mitigate the need to reduce momentary arrival capacity
        - Increase the number of arrivals to match the momentary arrival capacity
          - Make better use of the arrival demand to fill all arrival slots
            - Improve ATFM slot allocation to fill all arrival slots
            - Improve arrival sequencing and metering to fill all arrival slots
    - Increase airport departure capacity utilization

- Introduce integrated arrival and departure sequencing for a single runway or dependent runways of the same airport

- En-route airspace capacity
  - Optimise en-route airspace capacity
    - Introduce or improve capabilities that allow temporary capacity reduction (with associated reduction of cost) during times that little capacity is needed
      - Apply flexible capacity management at facility level
        - Improve flexibility of sector configuration management
      - Apply flexible capacity management at multi-facility level
        - Develop capability to temporarily (e.g. at night) reduce the number of facilities serving a given airspace (facilities taking over the airspace of other facilities, e.g. virtual center)
    - Introduce or improve capabilities that improve resilience against loss of capacity during scheduled or unscheduled loss of ATC service provision capability
    - Introduce or improve capabilities that improve resilience against unnecessary or excessive closure of airspace for safety reasons (e.g. due to ash cloud, weather, conflict zones etc.)
    - Increase en-route airspace capacity when needed
      - Increase planned capacity (the maximum configuration capacity established as part of [multi-year] ATM planning) KPI06
        - Establish/improve capability to develop a capacity planning scenario with assumptions for future traffic levels, based on traffic forecast
        - Solve issues preventing the implementation of capacity planning scenarios
          - Overcome traffic density limitations if these are the blocking factor
            - Solve issues preventing shared use of airspace by different categories of airspace users
            - Reduce ‘space needed’ by traffic
              - Take advantage of increased navigation precision (airspace with PBN operations) to implement route networks and airspace structures with smaller lateral and vertical safety buffers
            - Reduce separation minima if these are constraining the throughput
              - Improve what’s needed to reduce longitudinal separation minima
              - Improve what’s needed to reduce lateral separation minima
              - Improve what’s needed to reduce vertical separation minima
                - Reduce vertical separation minima in level flight
                - Reduce vertical separation minima when climbing/descending traffic is involved
          - Overcome CNS and information management limitations if these are the blocking factor
            - Resolve technical blocking factors such as: limited bandwidth, frequency congestion (data and voice), insufficient response time, shortage of channels, code shortage, signal and data processing limitations (max no of flights that can be processed), etc.
          - Overcome airspace organisation limitations if these are the blocking factor
            - Overcome capacity limitations attributable to airspace design
            - Overcome capacity limitations attributable to route network design

- Overcome operational ATC service delivery limitations if these are the blocking factor
  - Increase planned capacity of facilities based on sector concept
    - Increase maximum sector configuration
      - Apply horizontal sector splitting
      - Apply vertical sector splitting
    - Increase individual sector capacity
      - Reduce ATCO workload (en-route)
  - Increase planned capacity through sector-less concept
  - Reduce the need for an extra capacity reserve above the planned capacity
    - Improve capability of ATFM to protect against overdelivery
  - Use the most appropriate capacity monitoring parameters
    - Switch from entry rates to occupancy counts if this provides a more reliable indication of capacity
- Optimise declared capacity (capacity monitoring values and sector configurations to be used on the day of operation, available during the strategic and pre-tactical process, called expected capacity)
  - Determine capacity up to the time horizon of the strategic process
    - Establish/refine expected demand
      - Establish/refine the traffic scenario at city-pair level
        - Establish/refine the traffic scenario at city-pair level, taking into account airline schedules and known future events
      - Establish/refine the traffic scenario at airspace level
        - Establish/refine the traffic scenario at city-pair level, taking into account the city-pair traffic scenario, known future airspace events (airspace changes and events driving the need for rerouting or capping of flows), and the routing scenario
    - Identify capacity delivery constraints
      - Derive the constraint baseline from the planned capacity (the maximum configuration capacity established as part of [multi-year] ATM planning)
      - Modulate this baseline by taking into account known future ANS events and resource planning
    - Establish declared capacity to be used as input for the pre-tactical process
      - Establish declared capacity to be used as input for the pre-tactical process, taking into account the traffic scenario at airspace level
      - Establish declared capacity to be used as input for the pre-tactical process, taking into account capacity delivery constraints
      - Establish declared capacity to be used as input for the pre-tactical process, taking into account strategic DCB measures
  - Determine capacity for the time frame covered by the pre-tactical process (ending the day before the day of operation)
    - Establish pre-tactical traffic scenario
    - Identify pre-tactical capacity delivery constraints
    - Establish declared & expected capacity to be used on the day of operation

- Decide on capacity monitoring values to be used on the day of operation
- Decide on sector configurations to be used on the day of operation

Optimise actual capacity (capacity monitoring values and sector configurations actually used on the day of operation)

Cope with traffic variations resulting in hotspots with higher than anticipated demand

Increase capacity where possible

- Improve flexibility to open more sectors at short notice
- Improve flexibility to modify sector configuration at short notice to cope with traffic pattern variations

Protect against overload where needed

- Take tactical ATFM measures

Cope with unexpected conditions/events causing a capacity reduction or even a closure of airspace

Reduce capacity monitoring values

- Take tactical ATFM measures

Capacity shortfall & associated delay

Demand/capacity imbalance at airports and/or associated terminal airspace

Mitigate demand/capacity imbalance at airports and/or associated terminal airspace

Mitigate chronic demand/capacity imbalance

Increase capacity if feasible

- Increase airport throughput

Constrain traffic demand if it is consistently too high and capacity increase is not feasible

- Introduce reservation and slot coordination at the airport

Mitigate minor, occasional and/or temporary demand/capacity imbalance

- Mitigate demand/capacity imbalance for departure flows

Mitigate demand/capacity imbalance for arrival flows

Temporarily increase arrival capacity if feasible

- Increase airport throughput

- Advance inbound traffic to use spare capacity available before the start of the imbalance

Temporarily constrain inbound traffic demand

- Cancel inbound traffic if not yet departed
- Divert inbound traffic if it’s already airborne

Accept inbound traffic with arrival delay

Use ATC oriented flow management: absorb (all or part of the) arrival delay after push-back

- Delay take-off of inbound traffic (sequencing & metering measures)
- Slow down inbound traffic during en-route

- Apply (unplanned) airborne holding to inbound traffic
- Apply path extension to inbound traffic during arrival

Use ATFM oriented flow management: delay push-back of inbound traffic

Redistribute the impact of ATFM measures

- ATFM approach: many flights receive a small delay
- ATFM approach: few flights receive a significant delay

Reduce impact of ATFM measures KPI12

- Focus improvements on event types (delay reasons) generating the highest amount of delay

Improve the handling of specific delay generating event types

- Mitigate the occurrence of specific delay generating event types (frequency of occurrence, duration, severity)

Improve the response to specific delay generating event types

- Apply least restrictive ATFM measures
- Reduce the duration of the ATFM measures

Demand/capacity imbalance in en-route airspace

Mitigate demand/capacity imbalance in en-route airspace

Address demand/capacity imbalance risks identified at the strategic [multi-year] ATM planning stage

- Establish/improve planning processes resulting in adequate capacity enhancement plans
- Overcome issues preventing timely implementation of capacity enhancement plans

Address demand/capacity imbalance risks identified at the strategic [seasonal] ATFM stage

- Optimise airspace, route network and traffic orientation scheme for the coming season in function of forecasted traffic patterns under normal conditions (the baseline plan)
- Prepare and publish strategic ATFM measures and airspace organisation to cope with planned/known significant events (events of limited duration known months ahead)
- Establish/update/publish the catalogue of strategic ATFM measures designed to respond to a variety of possible/typical/recurring events degrading the airspace system (e.g. predefined action plans)

Establish/update the crisis management capabilities and plans (to cope with the risk of large scale disruptions)

Establish/update massive aircraft diversion plans

- Establish/update aircraft diversion plans for each major airport (or set of airports)
- Establish/update the default preferences for the Airspace Users
- Establish/update scenarios anticipating the best network management measures for dealing with disruption

Address demand/capacity imbalance risks identified at the pre-tactical ATFM stage

- Establish/improve capabilities to refine the strategic [seasonal] airspace and ATFM plan into a draft ATFM Daily Plan (ADP) and Airspace Use Plan (AUP) at network level, based on the latest available information known one (or more) day(s) ahead
- Establish/improve capabilities to finalise the ADP & AUP through collaborative analysis and discussion amongst the ATFM stakeholders

- Establish/improve capabilities of ATFM stakeholders to adapt their own local daily plans to the finalised network ADP & AUP

- Address demand/capacity imbalance handled at the tactical ATFM stage (on the day of operations)
  - Establish/improve the capability to continuously assess the impact of ATFM measures and to adjust them, in a collaborative manner, using the information received from the various stakeholders
    - Ensure that the measures taken during the strategic and pre-tactical phases actually address the demand/capacity imbalances
    - Ensure that the measures applied are absolutely necessary and that unnecessary measures are avoided
    - Ensure that the measures are applied taking due account of equity and overall system optimization
  - Establish/improve the capability to use opportunities to mitigate disturbances
    - Establish/improve the capability to use opportunities to mitigate disturbances, originating from: Staffing problems
    - Establish/improve the capability to use opportunities to mitigate disturbances, originating from: Significant meteorological phenomena
    - Establish/improve the capability to use opportunities to mitigate disturbances, originating from: Crises and special events
    - Establish/improve the capability to use opportunities to mitigate disturbances, originating from: Unexpected opportunities or limitations related to ground or air infrastructure
    - Establish/improve the capability to use opportunities to mitigate disturbances, originating from: More precise flight plan data
    - Establish/improve the capability to use opportunities to mitigate disturbances, originating from: More precise surveillance data
    - Establish/improve the capability to use opportunities to mitigate disturbances, originating from: The revision of capacity values
  - Establish/improve the capability to tactically manage demand in response to unforeseen weather, closed airspace and capacity shortage (enhance the toolbox of TMIs – Traffic Management Initiatives)
    - Implement ATFM capabilities
      - Implement mandatory ATFM TMIs
        - Implement TMIs that keep traffic at the gate to keep them out of the airspace
          - Implement TMIs to cancel flights
          - Implement TMIs to suspend flights (with an undetermined delay)
        - Implement TMIs that manage airspace entry times (translated into take-off times or ATFM slots) to control airspace occupancy (longitudinal TMIs)
          - Implement TMIs to advance take-off times KPI07
          - Implement TMIs to delay take-off times KPI07
        - Implement TMIs that off-load traffic into other airspace to control airspace occupancy (for load balancing) KPI07
          - Implement rerouting TMIs (lateral TMIs) KPI04 KPI05
          - Implement level capping TMIs (vertical TMIs) KPI18
      - Implement collaborative ATFM techniques

- Implement collaborative ATFM techniques to balance delay and flight efficiency KPI04 KPI07 KPI18
  - Network Management informs airspace users of an anticipated demand/capacity imbalance, followed by a time window during which voluntary refiling can reduce demand (ICR – Integrated Collaborative Rerouting)
  - For a given flight: at flight plan filing time airspace users provide network management with a range of trajectory options and associated trade-off criteria, from which one solution is chosen (CTOP – Collaborative Trajectory Options Program)
- Implement collaborative ATFM techniques to reduce the cost of delay
  - For a given airspace entry slot: let airspace users swap the slot to another flight (slot substitution or UDPP – User Driven Prioritisation Process)

- Implement ATC flow management capabilities (to control longitudinal spacing of traffic in a flow, and flow rates over constraint satisfaction points)
  - Prior to take-off: optimise take-off clearance to fit departing traffic into the overhead stream (while respecting departure and arrival flow constraints)
    - TMI-based optimisation (only impacts traffic when a TMI or restriction is manually activated for one or more constraint satisfaction points)
    - Continuous parameter-driven optimization
  - Flow management after take-off (en-route)
    - Fine-tune flows without modifying trajectory
      - Implement Speed Advisory / Speed Control
    - Adjust flows by modifying trajectories
      - En-route vectoring
      - Airborne holding in en-route airspace
        - Planned holding to absorb brief delays and capacity dips
        - Unplanned holding in response to a situation
      - Diversion of traffic

- Predictability
  - Punctuality
    - Departure punctuality at the gate/stand
      - Increase the number (%) of scheduled flights adhering to the scheduled off-block time KPI01
        - Optimize the number of scheduled flights adhering to the push-back tolerance window
          - Reduce the number of scheduled flights with push-back before the tolerance window
          - Reduce the number of scheduled flights with push-back after the tolerance window
            - Reduce the number of delayed push-back events attributable to non-ATM causes
              - Reduce the number of delayed push-back events attributable to air carrier and/or local turnaround problems
              - Reduce the number of delayed push-back events attributable to extreme weather
              - Reduce the number of delayed push-back events attributable to security problems

- Reduce the number of delayed push-back events attributable to ATM causes
  - Reduce the number of delayed push-back events attributable to ATFM measures calling for a delayed take-off time (ATFM slot)
    - Reduce ATFM delay
    - Redistribute given ATFM delay
      - Distribute given ATFM delay over more flights with a small delay per flight (which are still counted as on-time)
      - Concentrate given ATFM delay into less (severely delayed) flights if this results in significantly more on-time departures
  - Avoid local ATC inefficiencies (poor trade-offs between push-back time and taxi-out time) caused by improper surface movement management
    - Avoid pushing back earlier than needed
    - Avoid pushing back later than needed
  - Reduce the number of delayed push-back events due to reactionary delay
    - Reduce the number of delayed push-back events due to late-arriving aircraft
      - Reduce the number of late-arriving aircraft
        - Improve arrival punctuality at the gate/stand
      - Schedule an increased turn-around time to absorb (some of) the reactionary delay
      - Use a different (spare) aircraft
- Arrival punctuality at the gate/stand
  - Increase the number (%) of scheduled flights adhering to the scheduled on-block time KPI14
    - Optimize the number of scheduled flights adhering to the on-blocks tolerance window
      - Reduce the number of scheduled flights with on-blocks before the tolerance window
        - Reduce the scheduling buffer
      - Reduce the number of scheduled flights with on-blocks after the tolerance window
        - Increase the scheduling buffer
        - Reduce departure (off-block) delay
        - Reduce gate-to-gate time
          - Reduce taxi-out time
          - Reduce airborne time
            - Reduce terminal airspace transit time upon departure
            - Reduce en-route time
              - Improve actual enroute extension KPI05
              - Fly faster (ground speed)
            - Reduce terminal airspace transit time upon arrival
          - Reduce taxi-in time

- Adherence to the planned take-off time
  - Increase the number (%) of flights adhering to the planned take-off time
    - Increase the number of flights adhering to the Departure Tolerance Window (DTW)
      - Improve departure management of flights not delayed by ATFM or at locations where ATFM does not exist
    - Increase the number of flights adhering to the Slot Tolerance Window (STW) / EDCT Window KPI03
      - Improve departure management of ATFM delayed flights
        - Reduce number of flights taking off before the ATFM slot
          - Prevent early take-offs
            - Delay take-off clearance for flights arriving too early at the departure RWY KPI02
            - Delay pushback of flights ready at the gate/stand KPI01
        - Reduce number of flights taking off after the ATFM slot
          - Prevent late take-offs
            - Reduce the number of flights which leave the gate/stand too late to reach the RWY in time
              - Mitigate problem of aircraft not being ready in time
                - Improve ground handling / turn-around
              - Mitigate problem of aircraft leaving the gate/stand too late because taxi-out time was underestimated
                - Use more accurate prediction of taxi-out time
                  - Improve assumption/prediction of ground movement time (from gate to end of departure RWY queue)
                  - Improve assumption/prediction of queueing time at departure RWY
                  - Fine tune the extra buffer time included to cope with uncertainty
            - Reduce the number of flights which push-back in time but loose too much time during taxi-out to reach the RWY in time
              - Reduce taxi-out additional time KPI02
- Variability
  - Flight time variability
    - Reduce the variability of actual block times of scheduled flights on airport-pairs
      - Reduce gate-to-gate flight time variability of infrequent scheduled flights (not meeting the minimum monthly frequency requirement)
      - Reduce gate-to-gate flight time variability of frequent scheduled flights (meeting the minimum monthly frequency requirement) KPI15
        - Reduce the variability of taxi-out times KPI15
          - Decrease the number of flights with an exceptionally short taxi-out time
          - Decrease the number of flights with an exceptionally long taxi-out time

- Reduce exceptionally long taxi-out time

- Reduce the variability of airborne flight time KPI15
  - Decrease the number of flights with an exceptionally short airborne flight time
  - Decrease the number of flights with an exceptionally long airborne flight time
    - Reduce exceptionally long terminal airspace transit time upon departure
    - Reduce exceptionally long en-route time
    - Reduce exceptionally long terminal airspace transit time upon arrival
- Reduce the variability of taxi-in times KPI15
  - Decrease the number of flights with an exceptionally short taxi-in time
  - Decrease the number of flights with an exceptionally long taxi-in time
    - Reduce exceptionally long taxi-in time

- Safety
  - Maintain or improve safety
    - Maintain or improve safety in the air
      - Improve mid-air collision avoidance (safety net)
      - Reduce number of vertical & lateral navigation errors during flight (cases of non-conformance with clearance)
      - Improve separation provision (at a planning horizon > 2 minutes)
      - Improve early detection of conflicting ATC Clearances (CATC) (en-route / departure / approach)
      - Reduce unauthorized penetration of airspace risk
      - Reduce controlled flight into terrain (CFIT) and obstacle collision risk
      - Avoid flight encounters with hazardous conditions
        - Avoid hazardous weather
        - Avoid volcanic ash
        - Avoid en-route wake vortex encounters
        - Avoid exposure to hazardous space weather
    - Maintain or improve safety on the runway
      - Improve runway collision avoidance (safety net)
      - Reduce number of runway incursions
        - Avoid incorrect entries of aircraft or vehicles onto the runway protected area (without or contrary to ATC clearance or due to incorrect ATC clearance)
        - Avoid incorrect presence of vacating aircraft or vehicles onto the runway protected area)
        - Avoid incorrect runway crossings by aircraft or vehicles (without or contrary to ATC clearance or due to incorrect ATC clearance)
        - Avoid incorrect spacing between successive arriving or arriving and departing or departing and arriving aircraft

- Avoid landings without ATC clearance
- Avoid landings on wrong runway at right airport
- Avoid landings at wrong airport
- Avoid take-offs without ATC clearance)
- Improve early detection of conflicting ATC Clearances (CATC) related to runway usage
- Reduce number of runway excursions

Maintain or improve safety during surface movement

- Improve collision avoidance during taxi operations (safety net)
- Reduce number of taxi errors (cases of non-conformance with clearance)
- Reduce number of flights attempting to land/takeoff on/from taxiways
- Improve early detection of conflicting ATC Clearances (CATC) related to taxi operations

- Maintain or improve safety of very low level operations (<500ft)
- Maintain or improve safety of high altitude operations (>FL600)

Security

- Maintain or improve security

Environment

- Maintain or improve environmental sustainability of aviation

Cost effectiveness

Improve cost effectiveness of ANS

- Reduce costs in the Air Navigation System

Interoperability

- Improve interoperability

Access and equity

Improve access and equity

Improve access

- Improve airspace reservation management

- Improve equity

Participation by the ATM community

- Improve participation by the ATM community

Flexibility

- Improve flexibility of the Air Navigation System