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Aviation in Europe – Innovating for Growth

The 7th European Aeronautics Days

L O N D O N

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Minisimising Noise at Airports P06.08.08 21st October 2015

Summary

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  - Adaptive Increased Glide Slope
  - Double Slope Approach
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  - V2 Cycle: Adaptive Increased Glide Slope
  - V2 Cycle: Double Slope Approach
  - V2 Cycle: Multiple Runway Aiming Points
  - V2 Cycle: Curved RNP to GLS Precision Approach
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Project overview and scope

SESAR Project 06.08.08

developing and validating advanced approach procedures enabled by Ground Based Augmentation System (GBAS) to reduce noise impact, improve fuel efficiency, increase runway capacity (thanks to wake turbulence separations' reduction and potential increase of capacity in noise restricted periods)

Why GBAS: with one GBAS station multiple approaches per multiple runways and runway thresholds can be provided

Main Objectives:

Assess feasibility of enhanced approach procedures based on GBAS (HP/SAF/Systems)

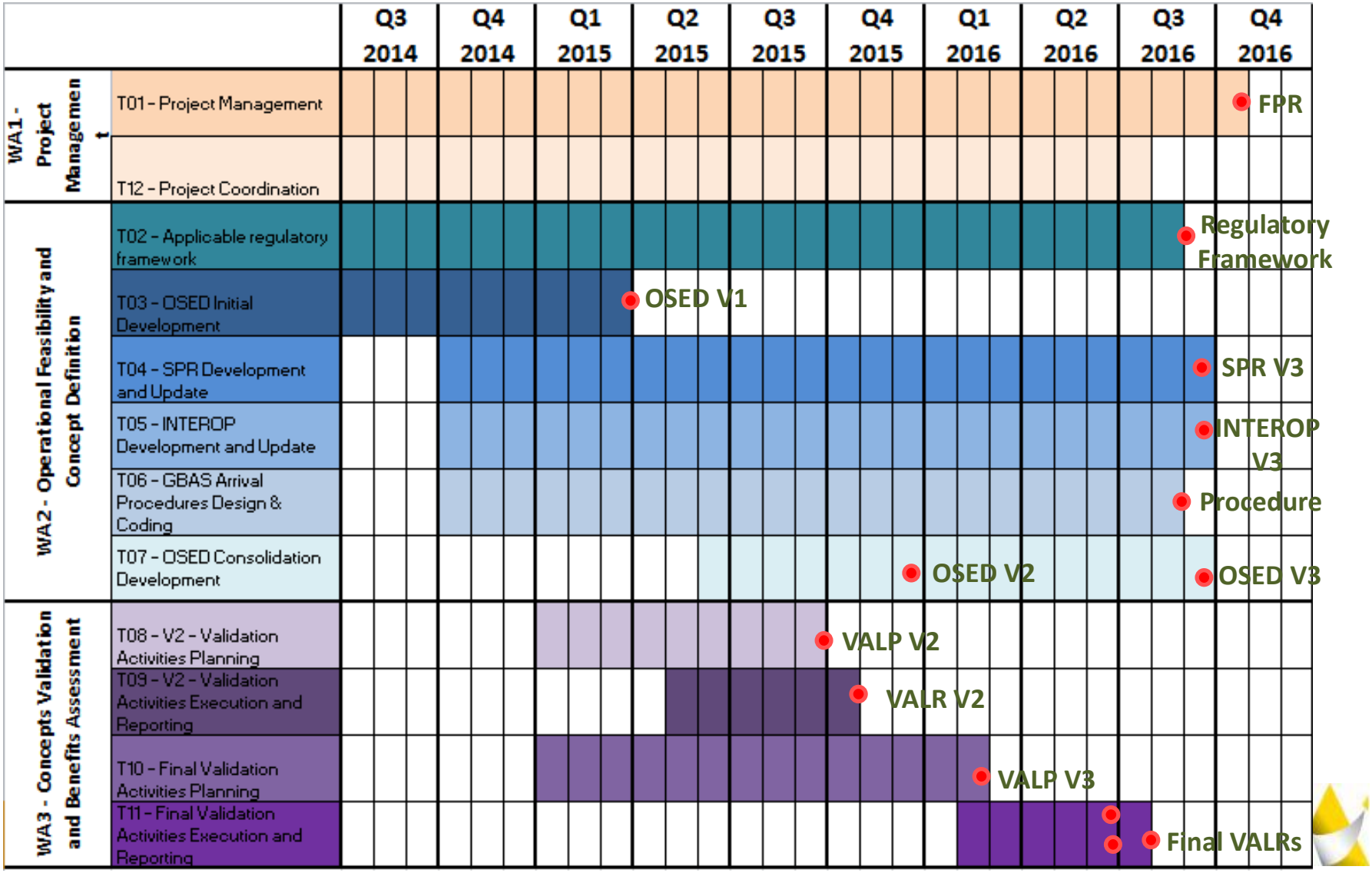
Evaluate potential environmental gains (noise/emissions/distance flown)

Evaluate potential gain in airport capacity and predictability

(runway throughput, taxi-in time, runway occupancy time)

ENAV NATS THALES DFS Deutsche Flugsicherung noracon AleniaAeronautica Honeywell AIRBUS SEAC EUROCONTROL SESAR JOINT UNDERTAKING

Project overview and scope

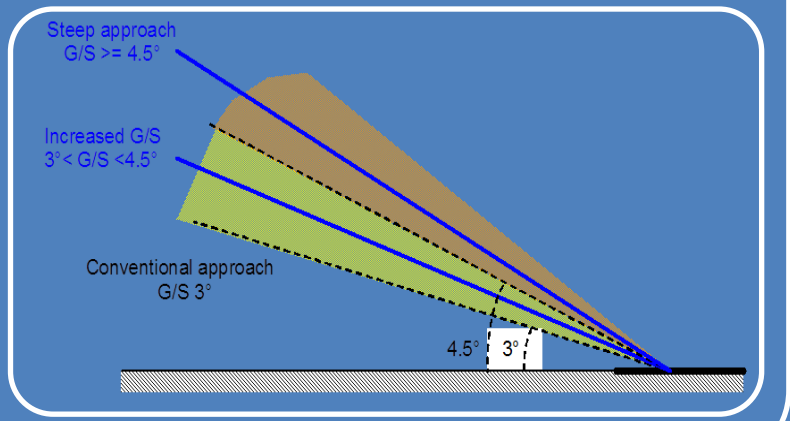


Increased Glide Slope

OFA01.03.01 Enhanced Runway Throughput

AO-0320 Enhanced Arrival procedures using Increased Glide Slope

Increased Glide Slope IGS



- Reduction of noise under the final approach path
- Flexibility of approach procedure design
- Improved airport access in environment with orographic constraints

IGS

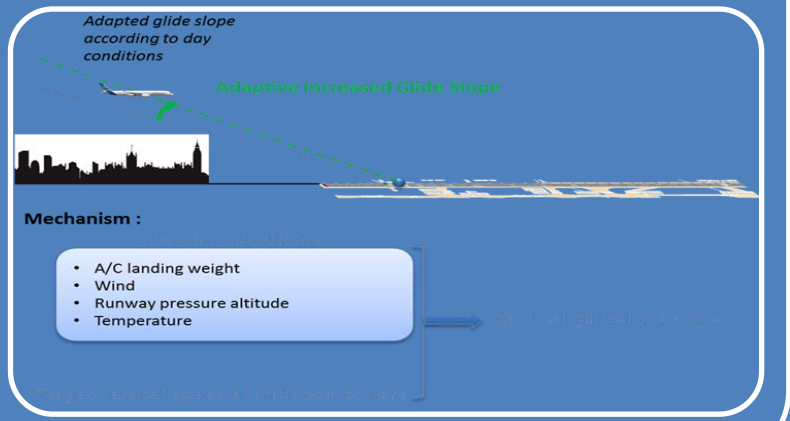
- a glide path with a glide slope increased with respect to the conventional one (e.g. 3°), up to 4.5° (regulatory limit before steep approach domain)

Adaptive Increased Glide Slope

OFA01.03.01 Enhanced Runway Throughput

AO-0321 Enhanced Arrival procedures using Adaptive Increased Glide Slope

Adaptive Increased Glide Slope A-IGS



Optimization of final approach procedure to reduce noise & fuel consumption

Airborne flexibility of approach procedure

Flying glide path the aircraft is more able to fly with respect to the aircraft status

A-IGS

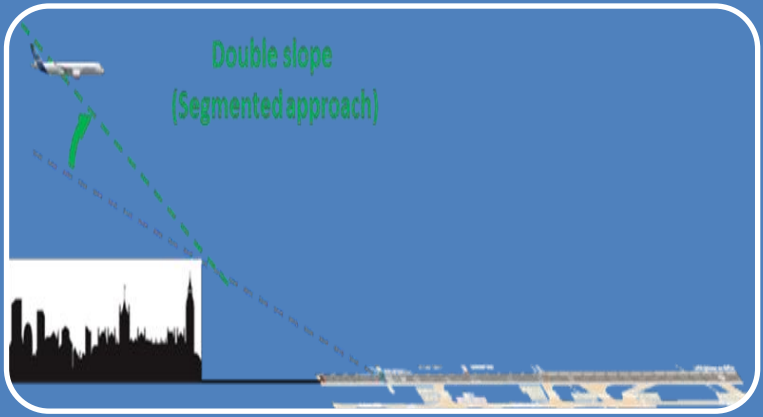
- an on-board functionality that calculates the best increased glide slope in accordance to the local conditions (e.g. wind, aircraft mass etc.) based on the conventional published glide slope

Double Slope Approach

OFA01.03.01 Enhanced Runway Throughput

AO-0322 Enhanced Arrival procedures using double slope approach

Double Slope Approach DS



- Reduction of noise under the final approach path
- Flexibility of approach procedure design
- Improved airport access in environment with orographic constraints

DS

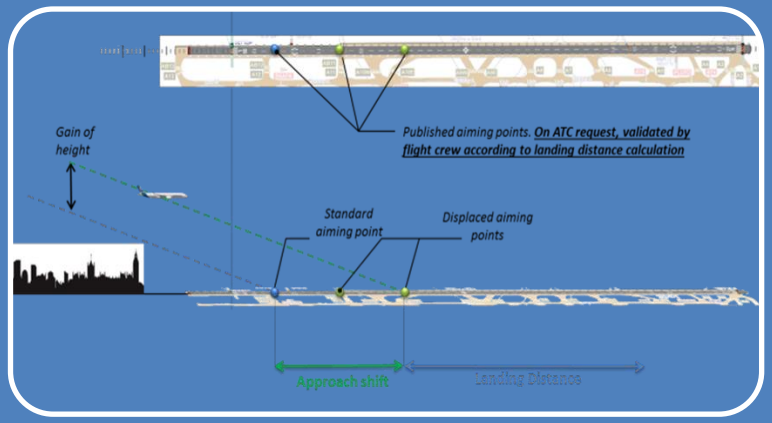
- a glide path split in two different segments, a first segment with an increased glide followed by a standard one

Multiple runway aiming points

OFA01.03.01 Enhanced Runway Throughput

AO-0319 Enhanced Arrival procedures using Multiple runway aiming points

Multiple runway aiming points MRAP



Reduction of noise under the final approach path

Potential reduction or runway occupancy time and taxi-in time

Potential reduction of the wake turbulence separations and the wake vortex encounter risk

MRAP

- glide path anchored to shifted touch down points with respect to the standard threshold

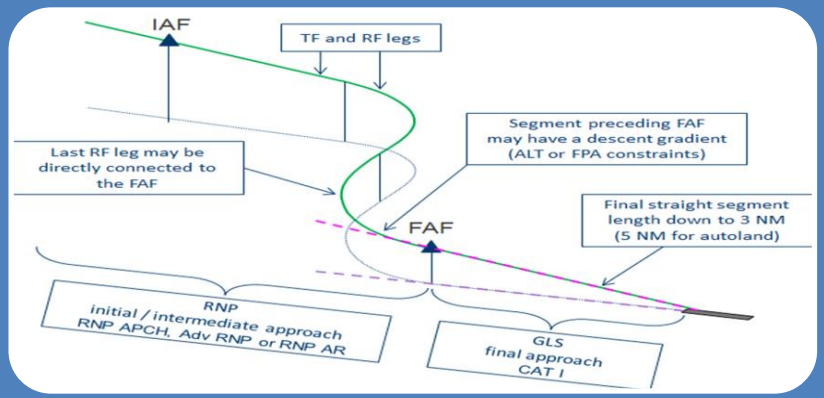
Curved RNP transition to GLS precision approach

OFA02.01.01 Optimised 2D/3D Routes

AOM-0605

Enhanced terminal operations with automatic RNP transition to XLS/LPV

Curved RNP transition to GLS precision approach



RNP: RF leg and predictability, reliability and repeatability of approach path

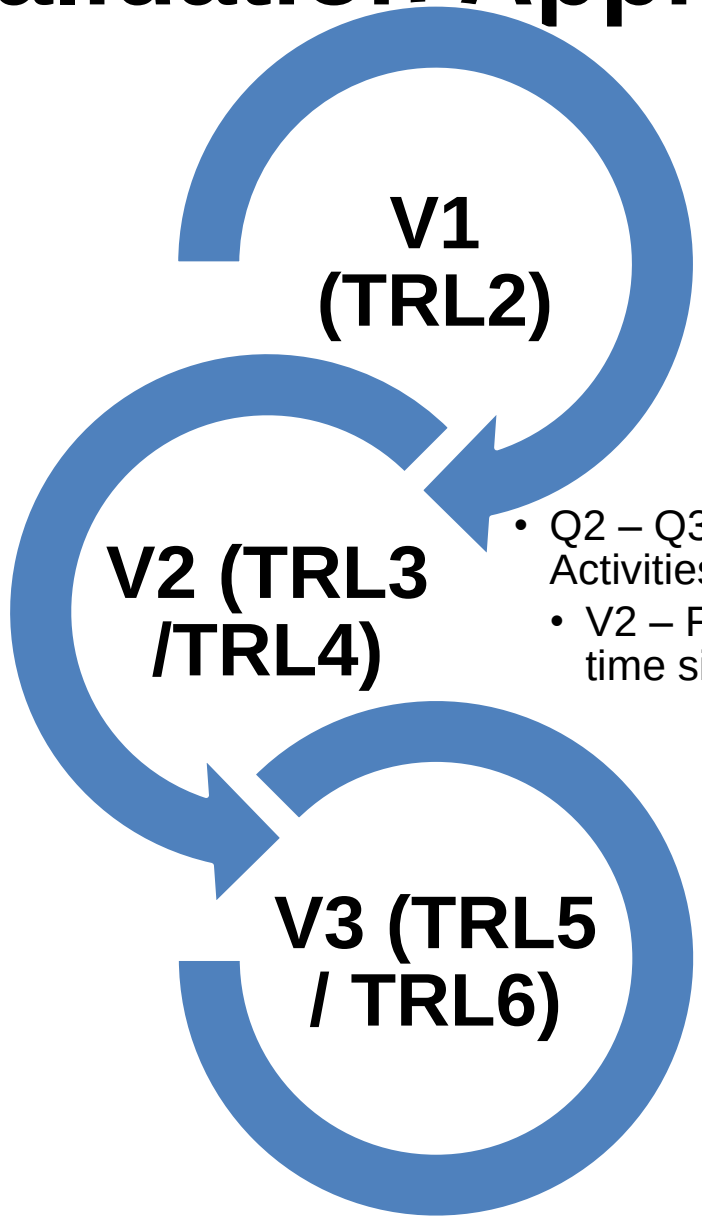
Flexibility of approach procedure design

Potential reduction of distance flown/CO_2 emission, avoidance of orographic constraints and noise-sensitive areas

RNP to GLS

- curved RNP initial and intermediate segments with a transition to final approach segment provided by GBAS landing system

Validation Approach



- Concept, Operational Services and environment definition
- Operational, safety, performance and interoperability requirements definition

- Q2 – Q3 - Q4 2015 Validation Activities:
  - V2 – Fast time Simulations / Real time simulations

Refinement

Refinement

- Q1 – Q2 – Q3 2016
  - Validation Activities: V3 – Flight trials / Real time simulation

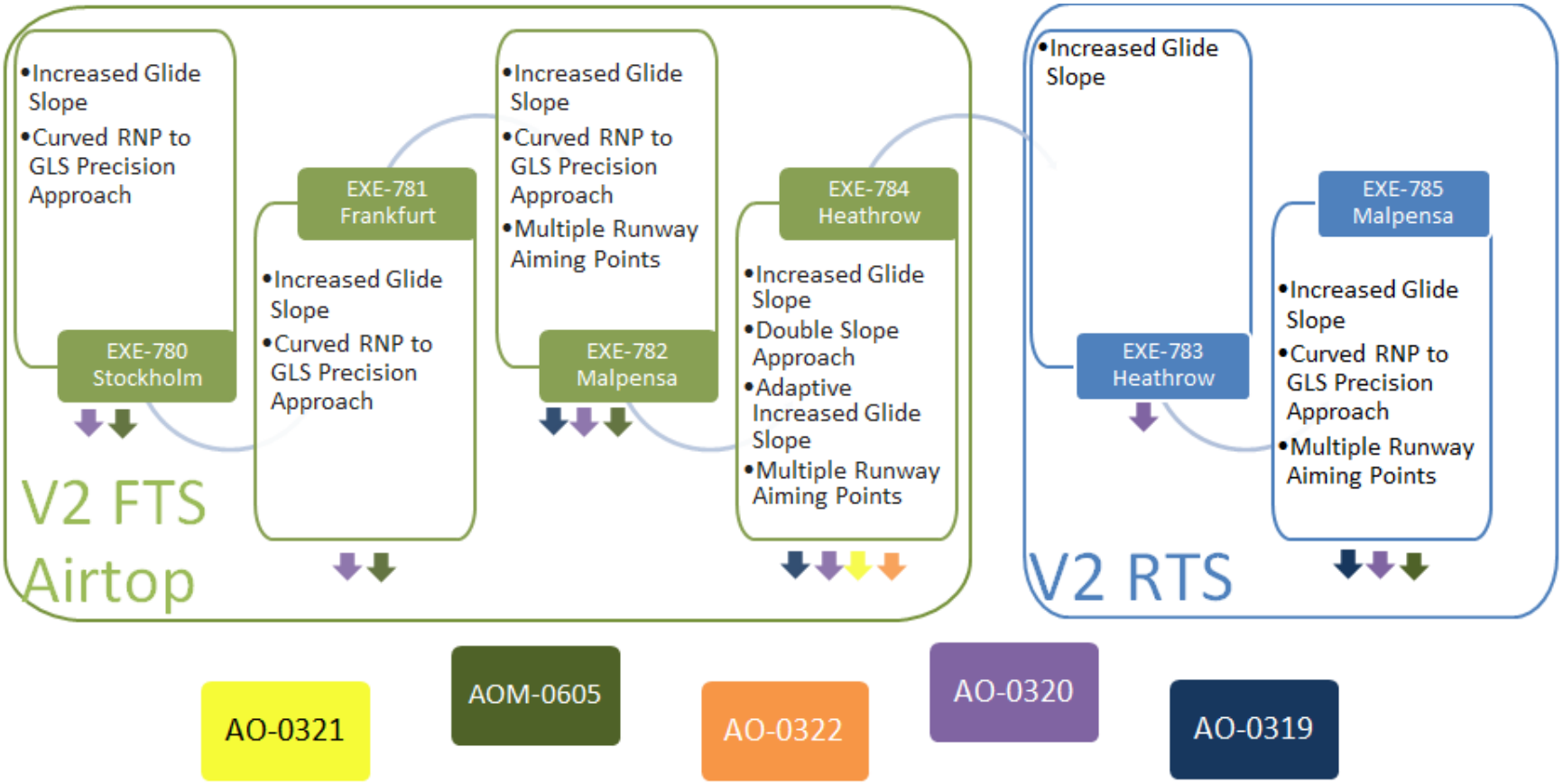
Validation Approach

Assessments

- **ENVIRONMENTAL SUISTAINABILTY AND FUEL EFFICIENCY**
- **CAPACITY**
- **PREDICTABILITY**
- **HUMAN PERFORMANCE**
- **SAFETY**

PRELIMINARY DRAFT RESULTS

V2 PRELIMINARY DRAFT RESULTS



V2 Cycle: Increased Glide Slope

Environmental Sustainability and Fuel efficiency

Noise impact

- Reduction in the number of people affected by noise levels was assessed when solution scenarios are used. Reductions in impacted area within noise levels were also observed if comparing solution scenarios with the reference scenarios. Benefits are even more evident as the glide slope increases. Assessment done for both L_{den} and L_{max} and making use of predictive tools.

Fuel Efficiency

- No major impact on Fuel Burn/CO2 (+1.70% CO2 in unconstrained environment, worst case) as well as on flown distance

Capacity

No major impact on runway throughput when comparing solution scenarios with reference scenario results (-1 mov/h in unconstrained environment worst case)

V2: Adaptive Increased Glide Slope

Environmental Sustainability and Fuel efficiency

Noise impact

- Reduction in the number of people affected by noise levels was assessed when solution scenarios are used. Reductions in impacted area within noise levels were also observed if comparing solution scenarios with the reference scenarios. Benefits are even more evident as the glide slope increases. Assessment done for both L_{den} and L_{max} and making use of predictive tools.

Fuel Efficiency

- No major impact on Fuel Burn/CO2 as well as on flown distance

Capacity

No major impact on runway throughput when comparing solution scenarios with reference scenario results

V2 Cycle: Double Slope Approach

Environmental Sustainability and Fuel efficiency

~ <u>Noise Impact</u>

- Available results under consolidation: noise impact can be slightly positive or negative depending on the observed contour level. Further analysis could be required. The concept could be further developed adapting the speed profile and/or the procedure geometry and to couple DS with RNP to GLS capability (so as to enable curved path during the first steeper slope)

<u>Fuel Efficiency</u>

- Negative impact on Fuel Burn/CO2 as well as on distance flown (as straight-in Double Slope approaches considered only so far)

Capacity

~ No major impact on runway throughput when comparing solution scenarios with reference scenario results

V2 Cycle: Multiple Runway Aiming Points

Environmental Sustainability and Fuel efficiency

Noise Impact

- Available results show that the concept can have positive or negative effect on noise depending on the operational environment. Impact on noise is positive in unconstrained environment where the noise contour shifted towards the airport as the descent started later with evident decrease in areas and people within noise contours, or is slight negative in constrained environment

Fuel Efficiency

- No major impact on Fuel Burn/CO2 (+0,9% in unconstrained environment worst case) as well as on distance flown

Capacity/Predictability

No major impact on runway throughput when comparing solution scenarios with reference scenario results (-1 mov/h in unconstrained environment worst case)

ROT/Taxi-in time: Reduction alternatively in arrival runway occupancy time or in taxi-in time depending on the local implementation

V2 Cycle : Curved RNP to GLS precision approach

Environmental Sustainability and Fuel efficiency

Noise Impact

- Reduction in the number of people affected by noise levels was assessed when solutions scenario are used. Reductions in impacted area within noise levels were also observed if combined with IGS. Assessment done for both L_{den} and L_{max} and making use of predictive tools.

Fuel Efficiency

- Decrease in Fuel Burn/CO2 was measured in unconstrained environment as well as distance flown. It can be used to significantly decrease the distance flown or to avoid sensitive areas with a consequent longer path

Capacity

No major impact on runway throughput when comparing solution scenarios with reference scenario results(-1 mov/h in unconstrained environment worst case)

V3 Cycle – Next steps

V3 Milano Malpensa Airport and TMA Real Time Simulation

- R5 - Curved RNP to GLS precision approach
- Increased Glide Slope
- Double Slope Approach

V3 Flight trial at Milano Malpensa Airport

- R5 - Curved RNP to GLS precision approach
- Increased Glide Slope
- Double Slope Approach
- Multiple Runway Aiming Points

V3 Flight trial at London Heathrow Airport

- Increased Glide Slope

Environmental Sustainability and Fuel Efficiency

- Noise further analysis
- CO2/Fuel Burnt further analysis

Human Performances

- V2 recommendations and open issues

Safety

- V2 recommendations and open issues

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