SESAR Innovation Days

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Dynamic Aircraft Energy and Configuration Management with DYNCAT

Tobias BAUER &
Fethi ABDELMOULA
DLR

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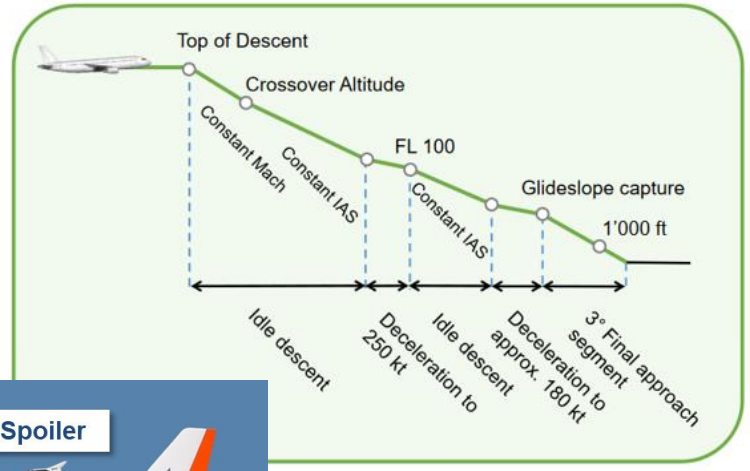
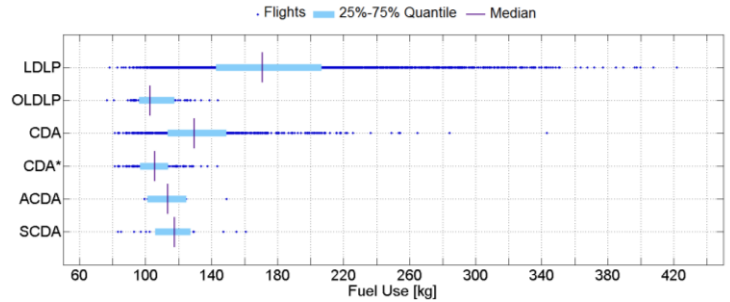
The challenge of aircraft energy management

- descent and landing approach:
  reduce potential and kinetic energy from cruise (high and fast)
  to touchdown (low and slow)
- *configure* flaps and landing gear
- the theory: Continuous Descent Operation (CDO)
  in idle from top of descent to stabilisation
  altitude (typically 1000 ft above threshold)
- the practice: wide variation of fuel
  consumption and noise for nominally
  identical transitions

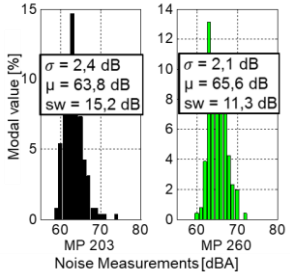
what are the reasons for these differences?



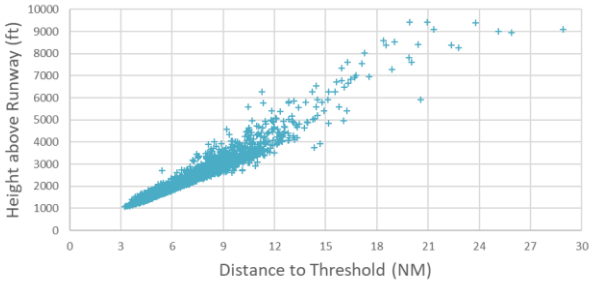
example: fuel use for different approach types



example: noise monitoring data for nominally identical trajectories

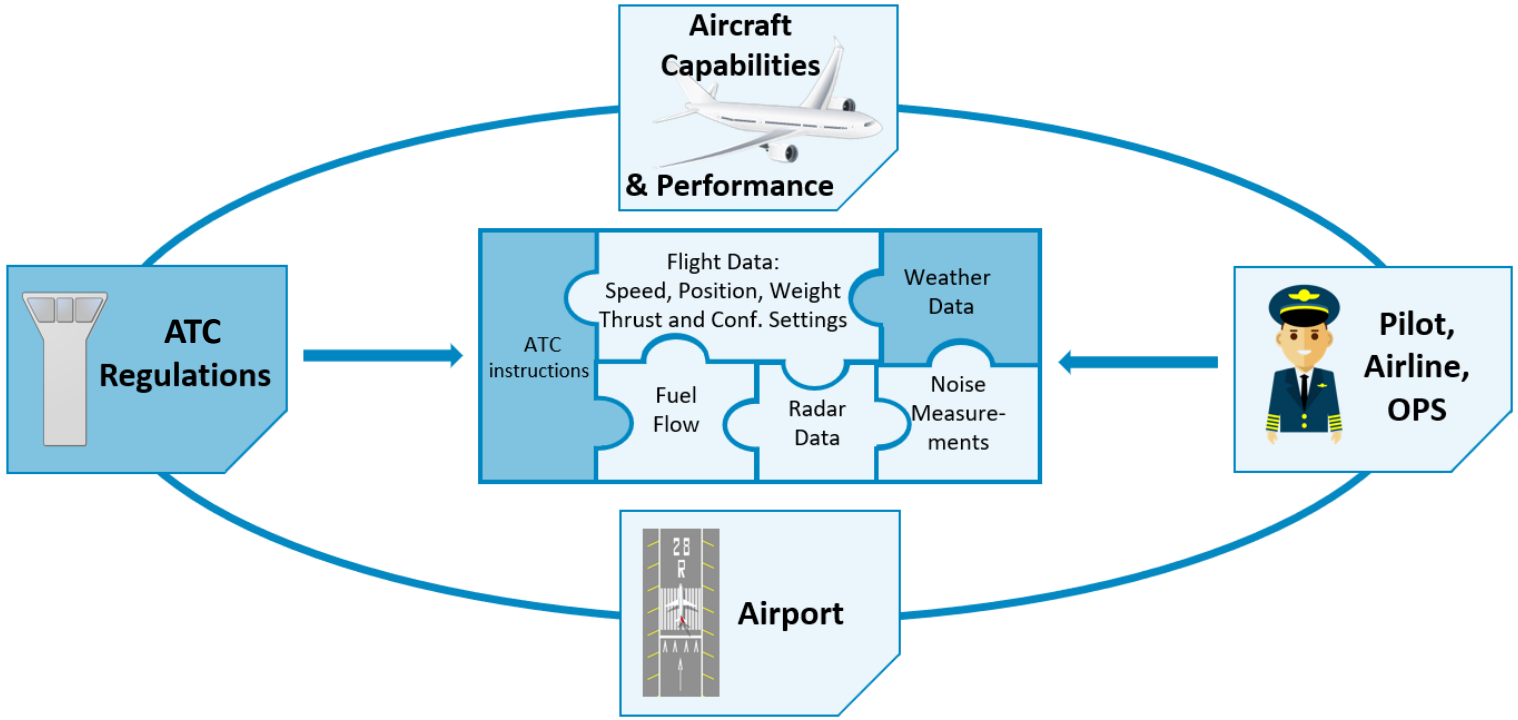


example: height/airspeed of landing gear extension



DYNCAT project approach

exemplary approach: LSZH (ZRH) runway 14, A320-214



with input from practitioners (pilots, ATCos) and authorities throughout the project

Analysis of combined real-world data from all relevant sources

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Definition of **operational concept**

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Prototyping of DYNCAT algorithms into FMS and CDS demonstrator on an industrial test bench

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Evaluation / quantification

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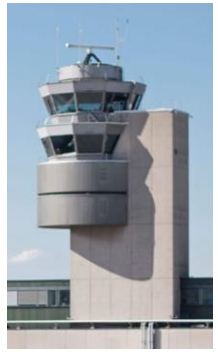
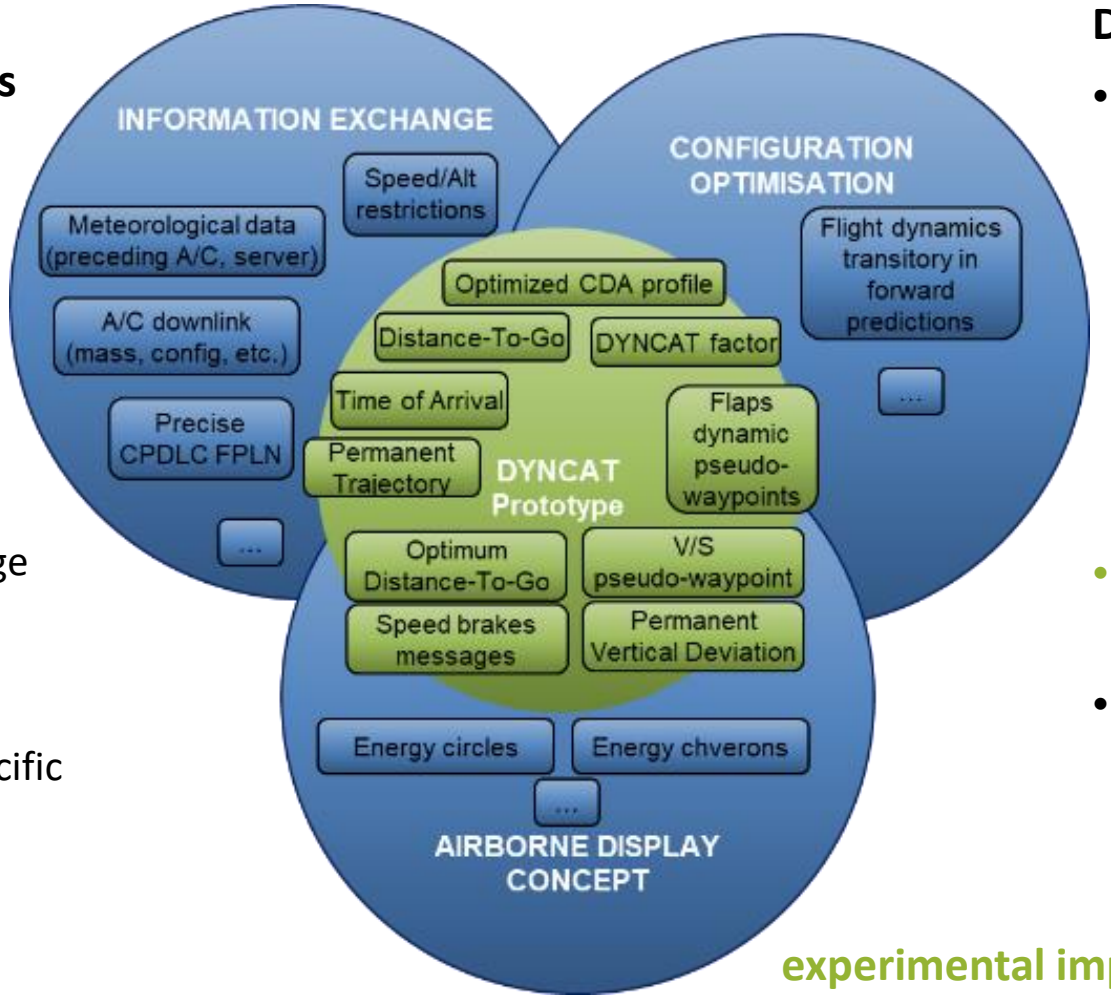
Recommendations



Data analysis and operational concept

identified points for improvements

- missing information about the expected route to the runway
- missing information about the expectable speed / altitude instructions
- changing / unknown wind conditions
- compromise of efficiency vs. reserves
- experience / skills and pilot knowledge about the approaching airport
- unnecessarily rigid instructions from ATC
- ATC lack of knowledge about the specific aircraft performance characteristics

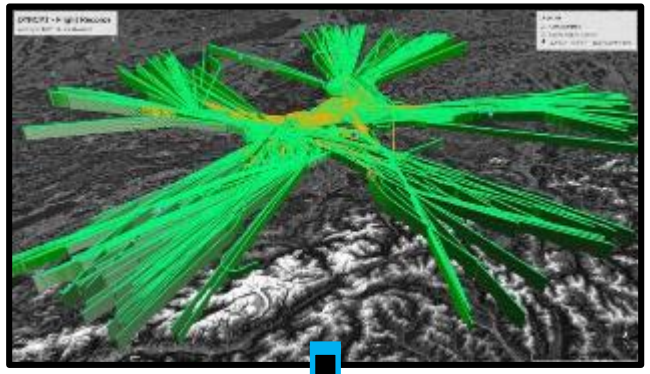


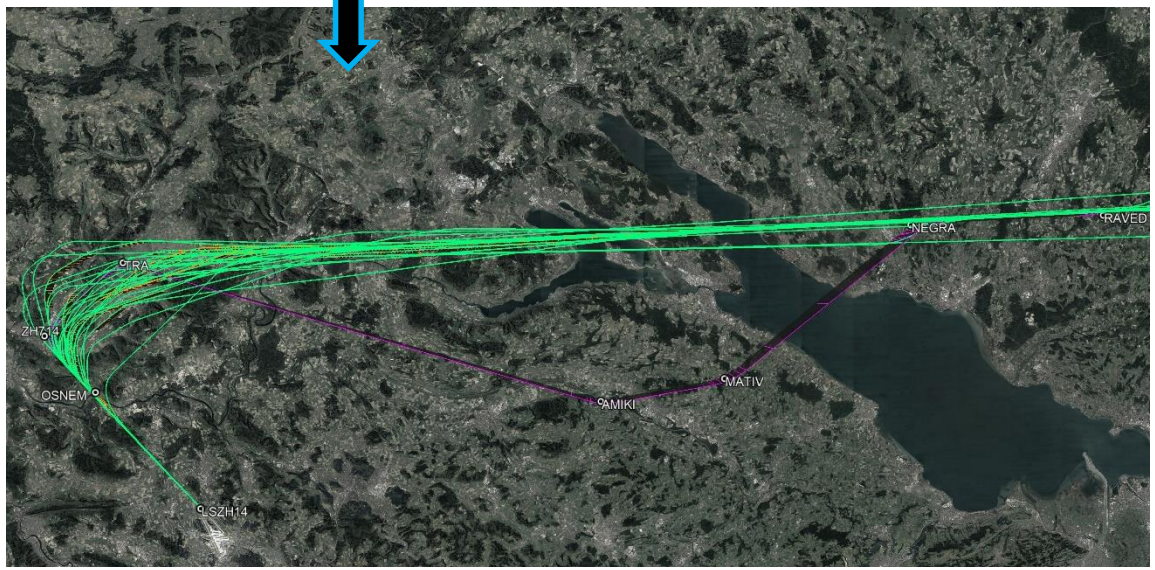
DYNCAT operational concept

- *improved communication / information exchange:*
  - meteo data
  - ATC restrictions
  - aircraft capabilities and precise flight plan downlink
  - distance-to-go / time of arrival
- *aircraft configuration and speed schedule optimisation*
- *improved display concept*
  - energy awareness
  - pseudo waypoints for optimal changes

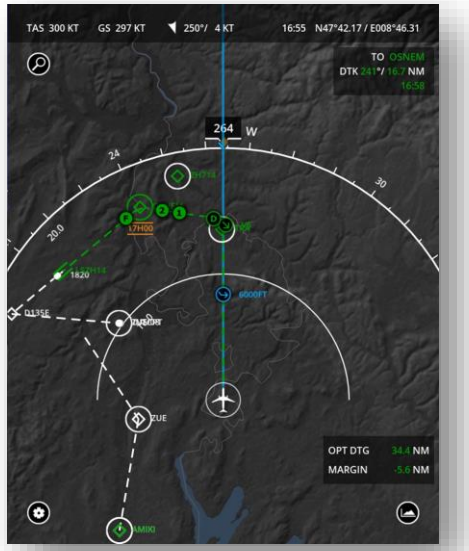
experimental implementation of selected components

FMS prototype testing in RTS on test bench

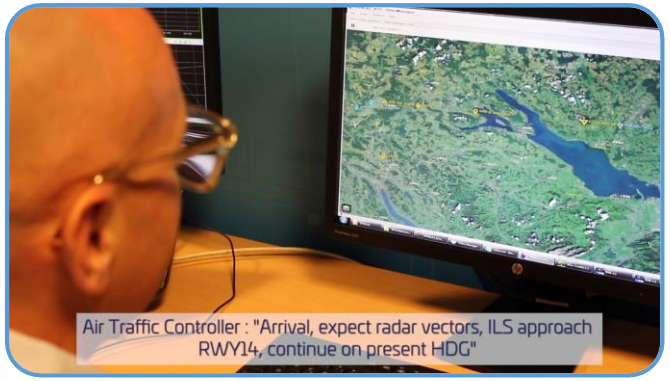




- scenario: typical over-energy situation caused by shortcut



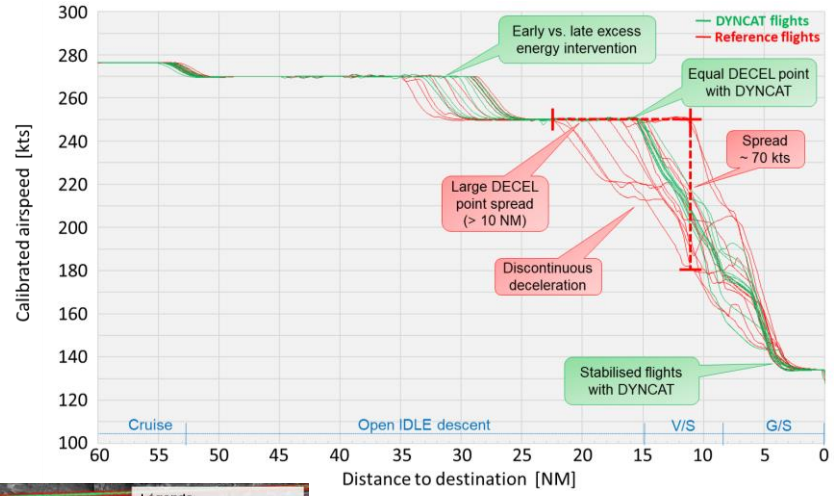
- experimental cockpit display system

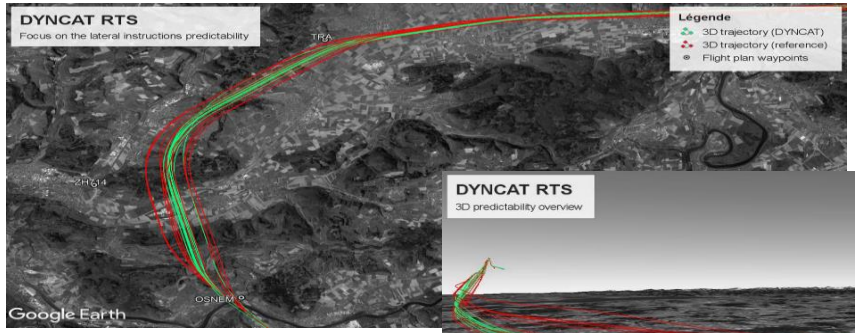


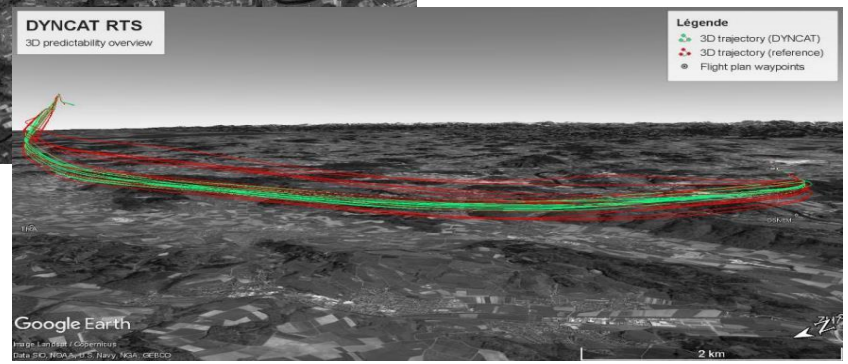
- piloted simulation trials, 1 ATCo + 10 airline pilots

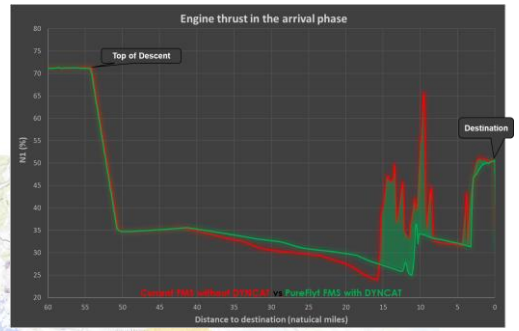
Quantified benefits of DYNCAT FMS function

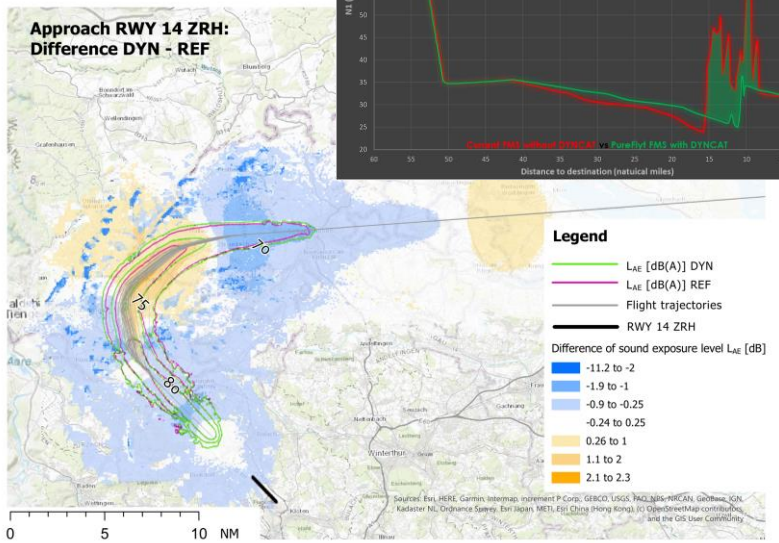
- better stabilisation
- higher predictability of trajectory (in 4D)

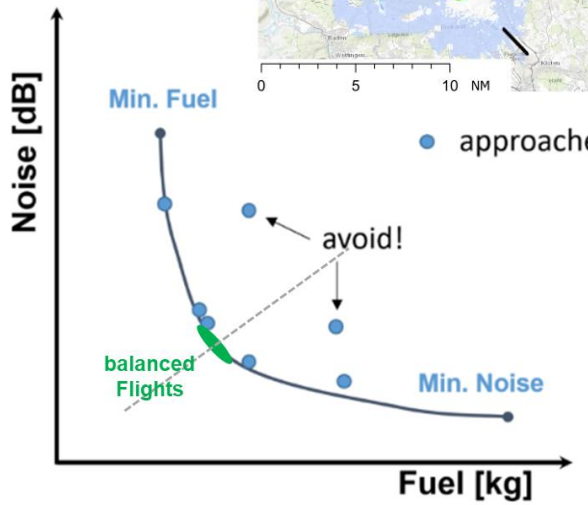












- fuel use & noise reduction
- optimal trade-off

Thank you

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