PJ18-W2 SOL53 B DFS TP improvements (ADS-C & ENH GRIB)

Thomas Pütz, DFS

DISSEMINATION EVENT, EUROCONTROL, 21 MARCH 2023

These projects have received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreements No 101017626 and 872320

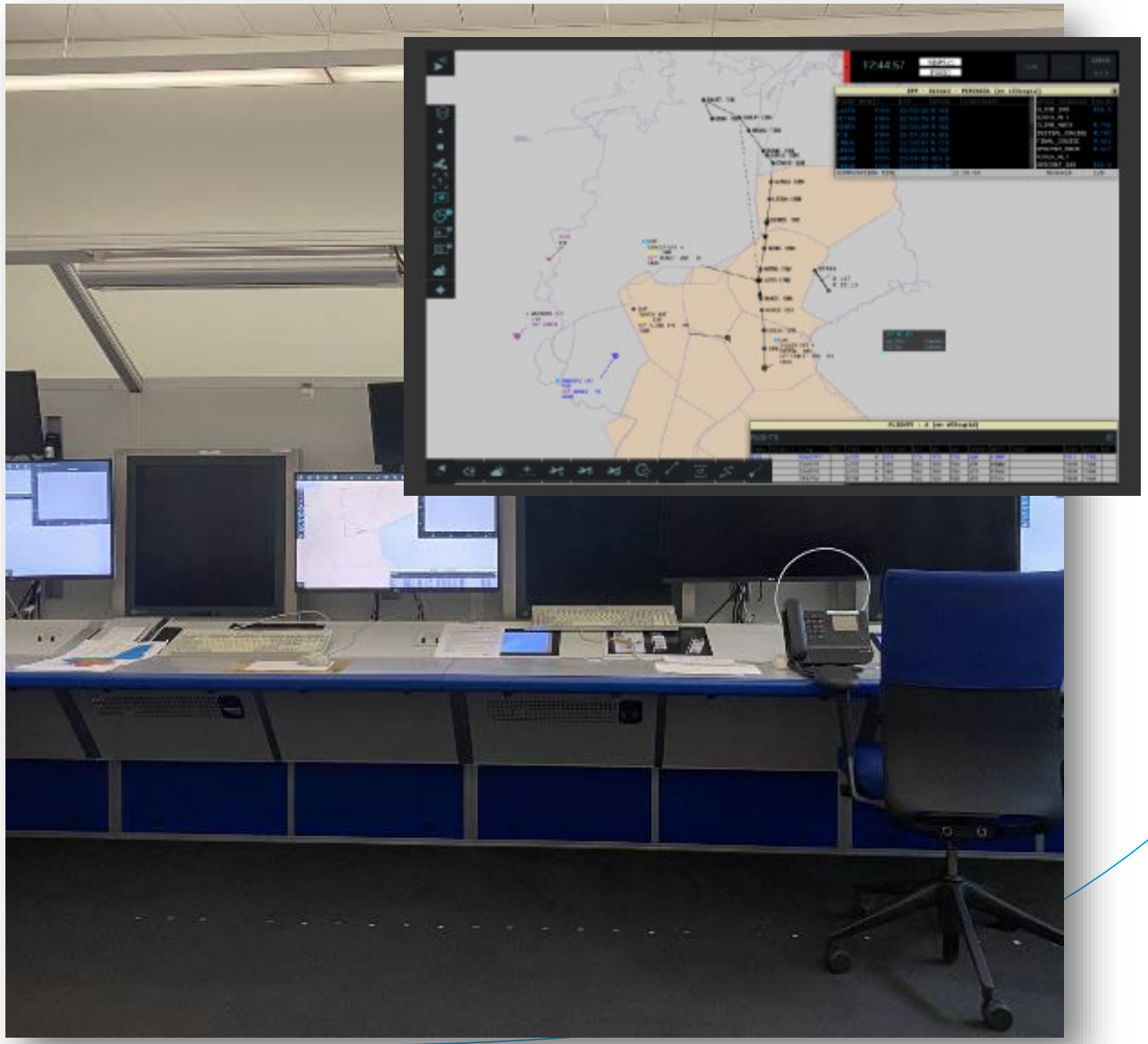
EUROPEAN PARTNERSHIP

Co-funded by the European Union

TP Improvement with ADS-C EPP and new MET WTQ data

Scope

- PJ.18-W2-53B-V3-EXE-009 was conducted by **DFS** and **Indra** with **Airbus** support (PAS@ATM simulator)
- and focused on the development of additional TP (**Trajectory Prediction) improvements** using
  - further elements of Automatic Dependent Surveillance – Contract Extended Projected Profile (**ADS-C EPP**) and
  - more recent weather information (**enhanced GRIB*** of WTQ** data with higher resolution and update rate -> WTQ2)
- and adverse weather areas (**AWA**s),
- assessing also the impact on conflict tools and separation management (**CD&R**).



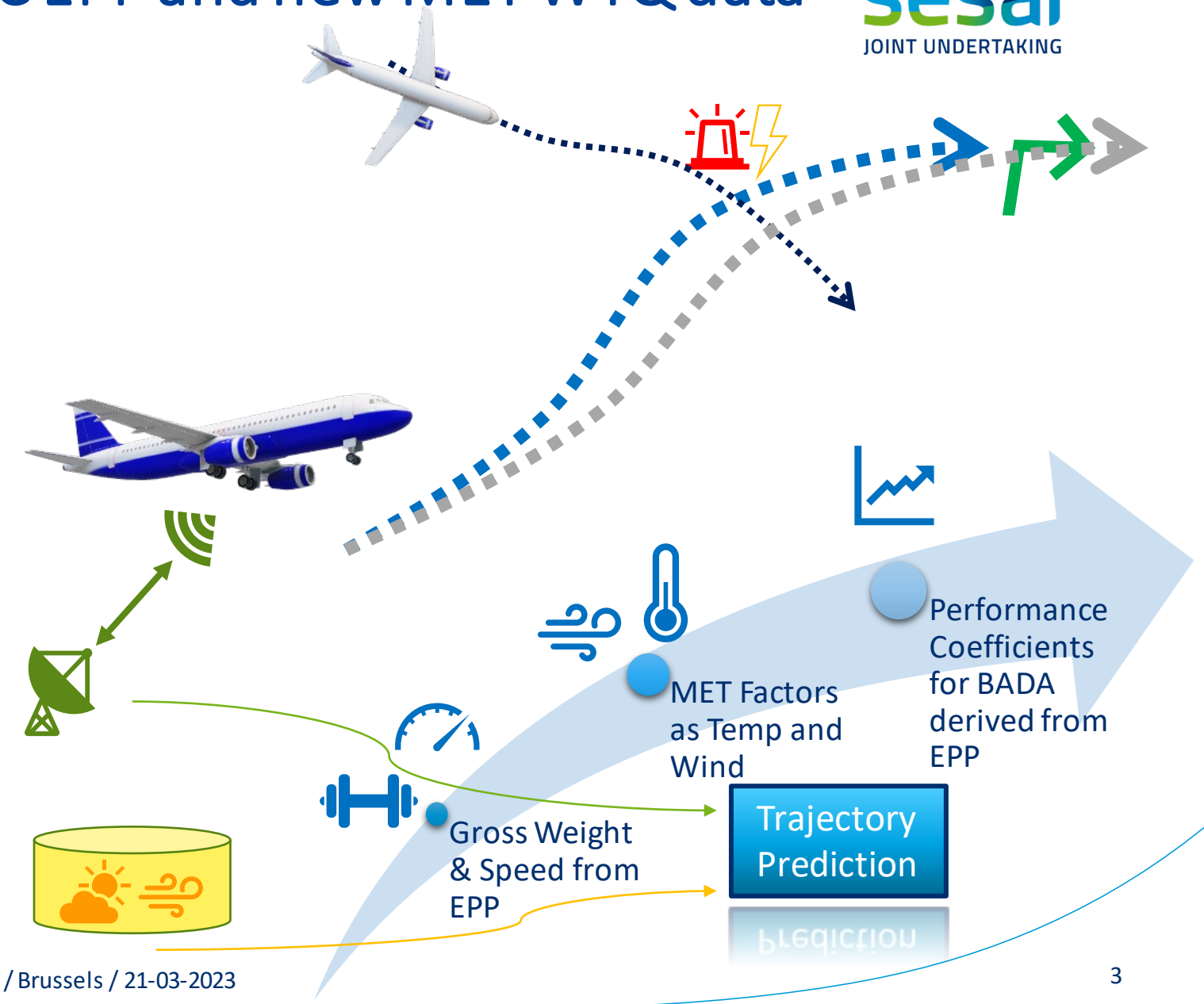
* GRIB = Gridded Binary

**WTQ = Wind Temperature & QNH

TP Improvement with ADS-C EPP and new MET WTQ data

Objectives

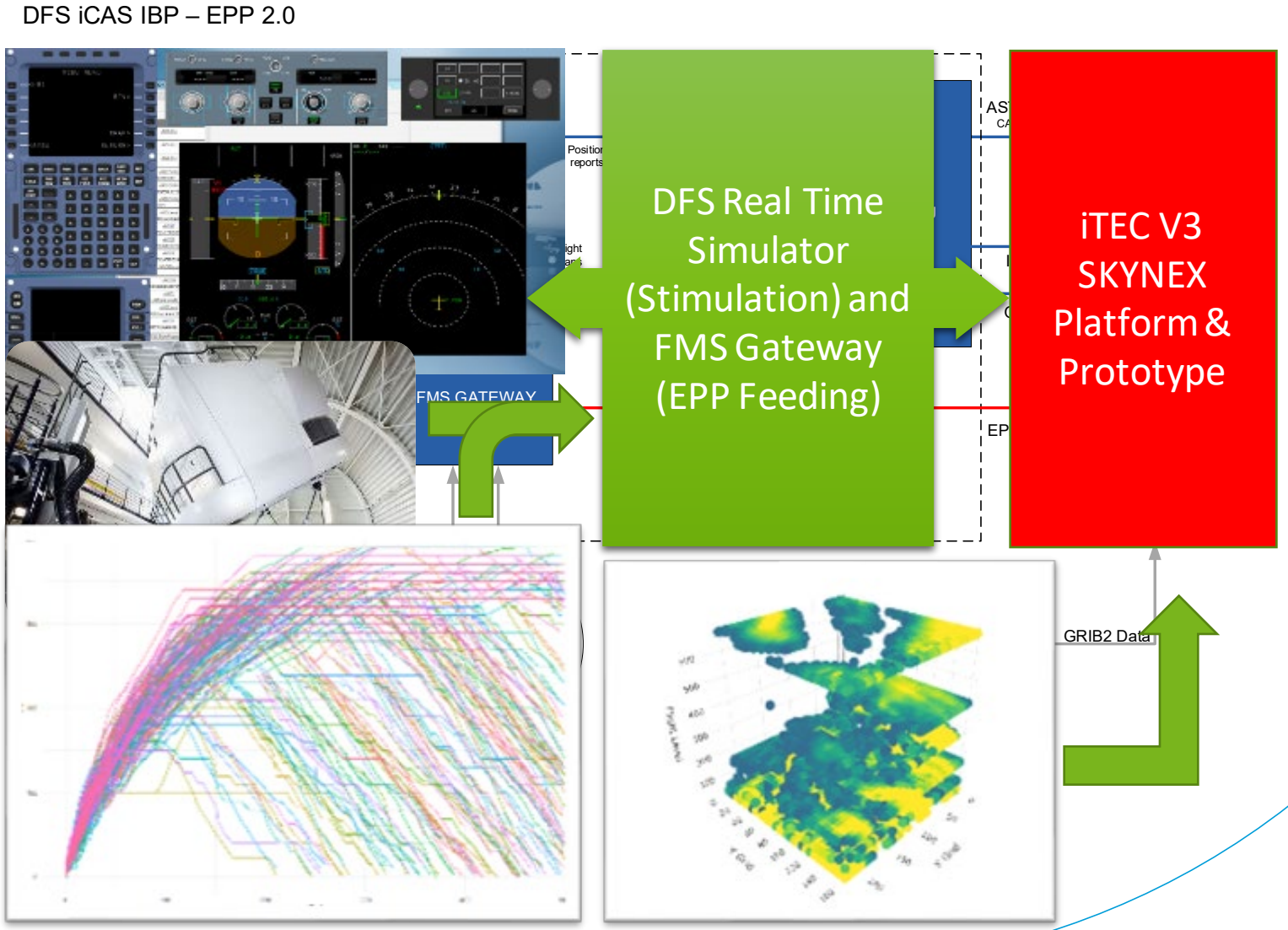
- The following features were validated in the exercise:
  - Improved TP by ADS-C EPP
    - GW and SPD
    - corrective BADA coefficients,
    - ToC and ToD positions
  - Improved TP by more accurate MET data
    - higher resolution in time,
    - high granular data in lateral and vertical dimension
    - of WTQ2 data grid in GRIB2 format
  - ATCO (Air Traffic Controller) tools enhancements enabled by TP improvements
    - assessing the impact on the level of CD&R (medium term conflict detection, MTCD)



TP Improvement with ADS-C EPP and new MET WTQ data

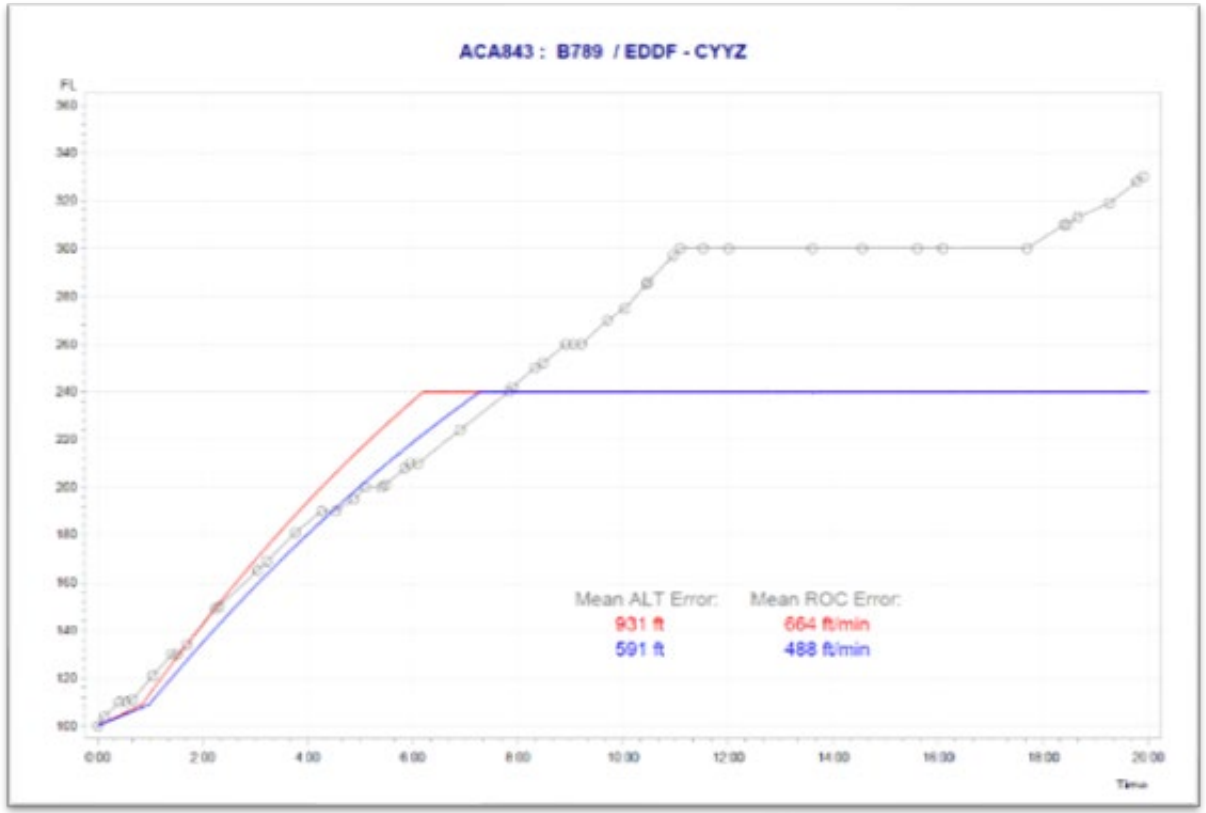
Validation Set-Up

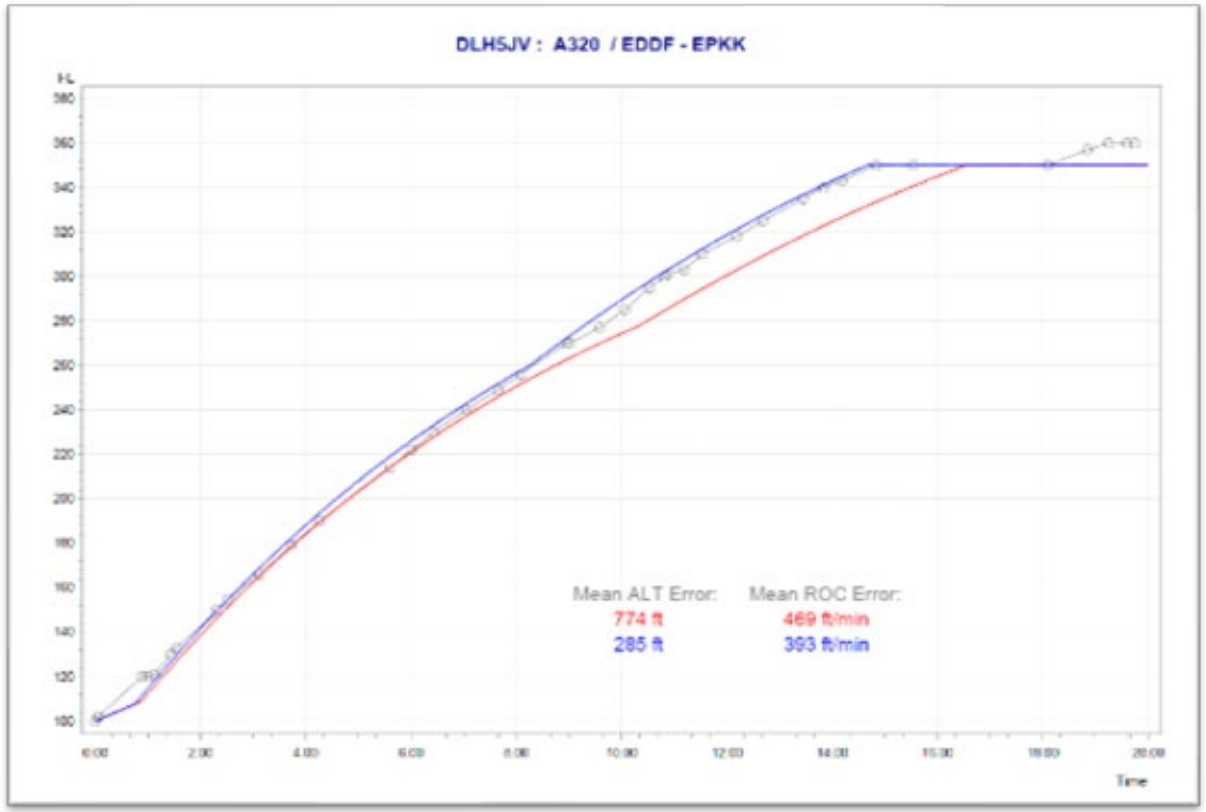
- Scenarios prepared for Karlsruhe Airspace with todays traffic (high density) with high equipage rate
- Flights with ADS-C were assessed by using 3 different sources.
  - Single simulated flights:
    - Replay of recorded Airbus emulator PAS@ATM flights (A/C type A330) with EPP
    - Replay of recorded Full Flight Simulator Flights (different A/C types were used) with Pseudo-EPP generated
  - Multiple flights:
    - Interactive simulation with the RTS using multiple replayed real flights (non-EPP but post flight info).
- High resolution WTQ2 data (17 vertical layers) for the solution were provided by the weather service DWD (WAWFOR ICON-EU data set)
- In addition, parallel TP calculations were performed with a mathematical model.



TP Improvement with ADS-C EPP and new MET WTQ data

Offline Analysis: Replay of real flights with pseudo-EPP (improvement by GW and SPD only)



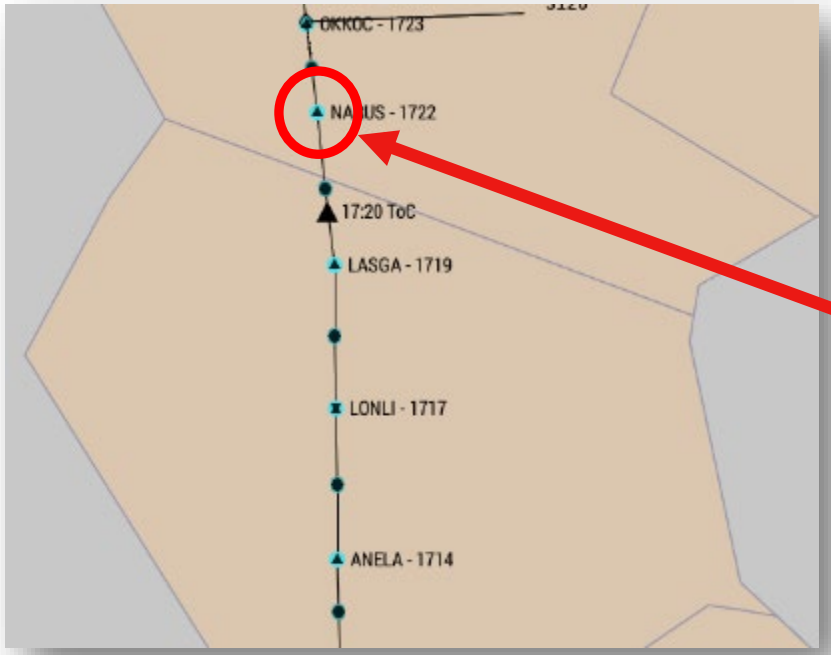


REF BADA EPP

TP Improvement with ADS-C EPP and new MET WTQ data

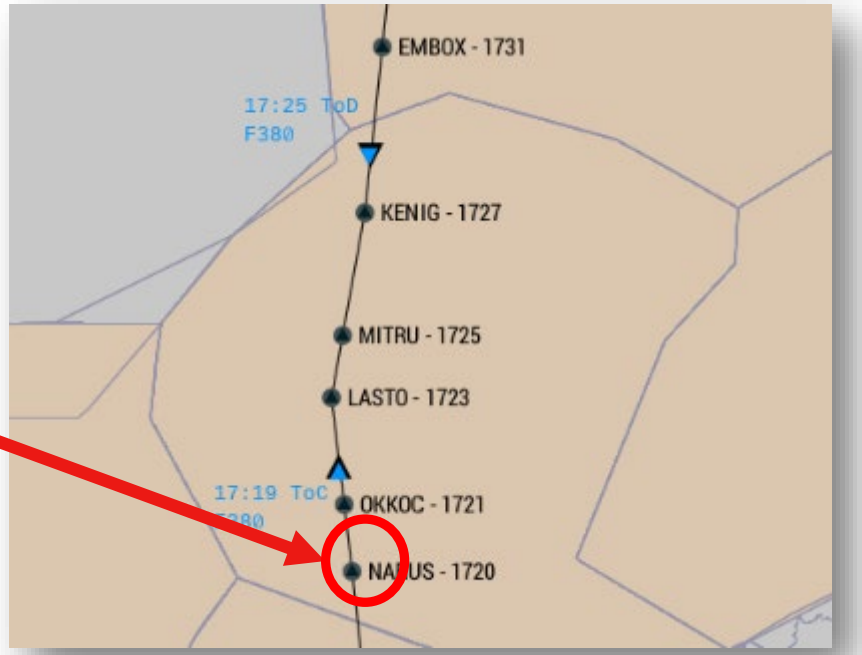
CWP view of ATCO – BADA coefficients applied – Effect on Top of Climb (ToC)

Without Improvement



WPT NARUS as reference

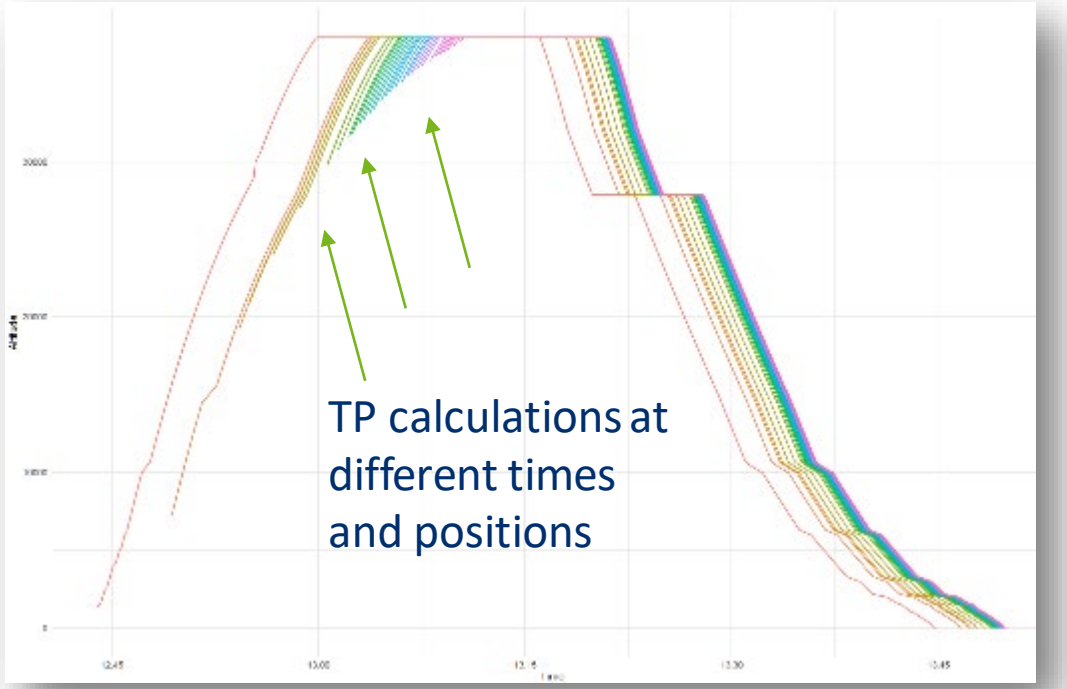
With ADS-C EPP / MET WTQ



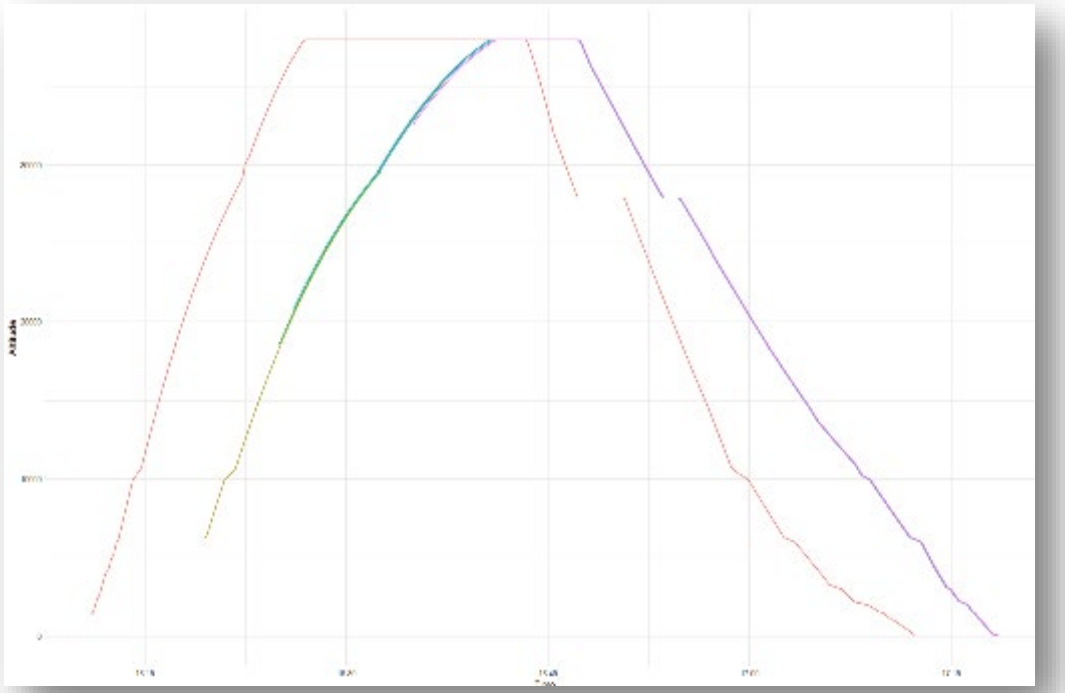
TP Improvement with ADS-C EPP and new MET WTQ data

Data Viewer – ATM System calculations - BADA coefficients applied plus enh. GRIB

Without Improvement



With ADS-C EPP / MET WTQ

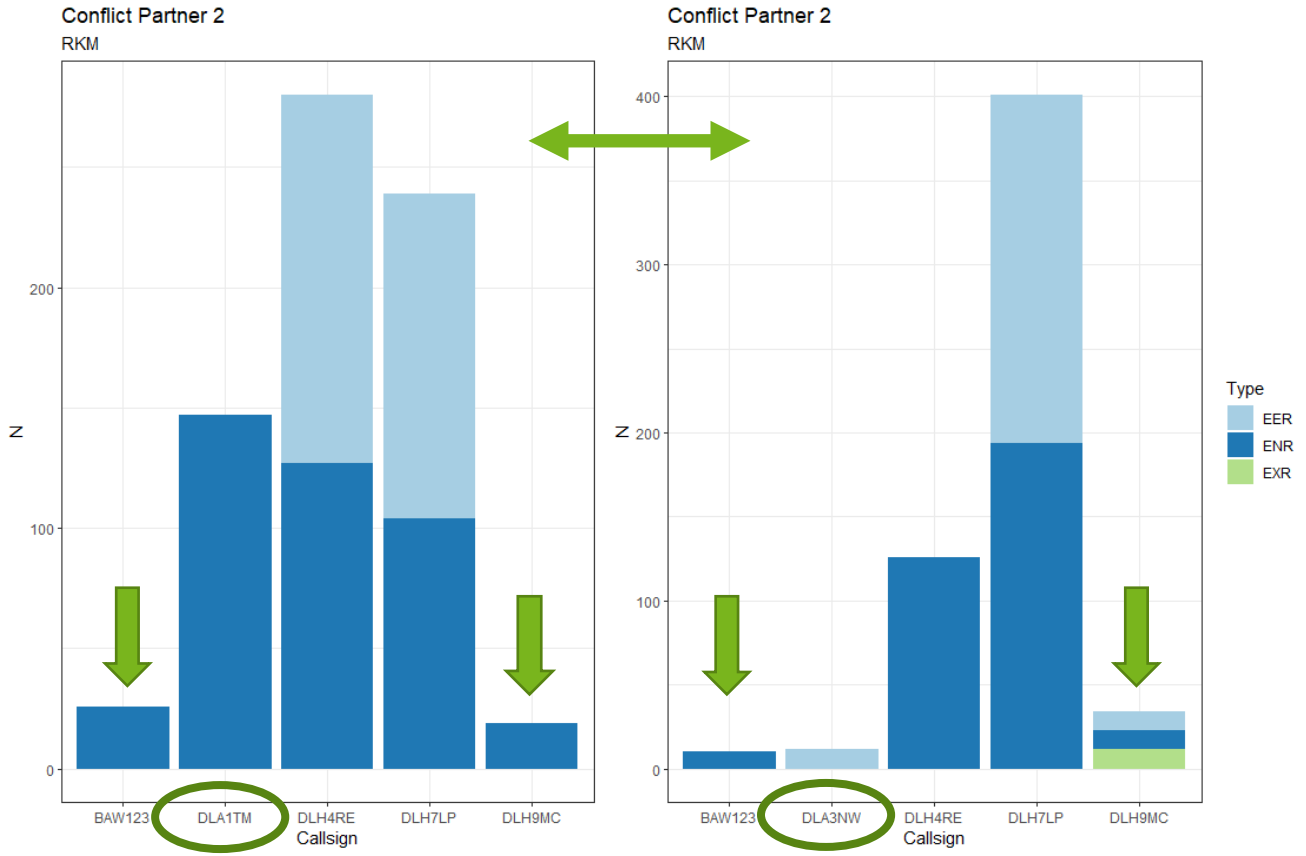


TP Improvement with ADS-C EPP and new MET WTQ data

Impact on CD/R – Medium Term Conflict Detection (MTCD) – Risk Module (RKM)

Looking at the results, it can be concluded that

- ❑ improved TP has notable effect on the CD/R detection
- ❑ additional conflict partners (undetected conflicts) were identified, and
- ❑ different conflict types were detected by the improvement
- ❑ same conflicts but with different conflict lengths were identified (number of conflicts could rise)
- ❑ TP improvement leads to a more accurate conflict detection
- ❑ Potentially more false alerts could be suppressed.



N = Number of Events (Risks)
EER = Entry-Exit Risk
ENR = Entry Risk
EXR = Exit Risk

TP Improvement with ADS-C EPP and new MET WTQ data

Conclusions and Recommendations

The following **conclusions** can be made:

- It can be concluded that undisturbed climb procedures can be more accurately predicted when using ADS-C EPP information and enhanced weather information.
- The coefficient approach (further adjustment of the aircraft performance by calculating corrective coefficients) brings additional improvement.
- Ground predicted ToC and ToD are more accurate and reflect a more realistic A/C performance
- Enhanced weather is relevant for the improved TP
- TP improvements enable more accurate conflict detection.
- The improved TP has notable effect on the CD/R detection.
- Additional conflict partners were identified, or different conflict types were detected by the improvement.
- It is expected that practically the number of false alerts would drop.

Recommendations:

- Potentially, the adjustment of the conflict tolerances might be necessary to bring the full benefit. The optimum settings for conflict parameter tuning need to be investigated.

THANK YOU FOR YOUR ATTENTION

These projects have received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreements No 101017626 and 872320

EUROPEAN PARTNERSHIP

Co-funded by the European Union