



Performance
through
innovation



AF6/CP1 INITIAL TRAJECTORY SHARING MUAC ADS-C IMPLEMENTATION BENEFITS AIRSPACE WORLD 2023, GENEVA

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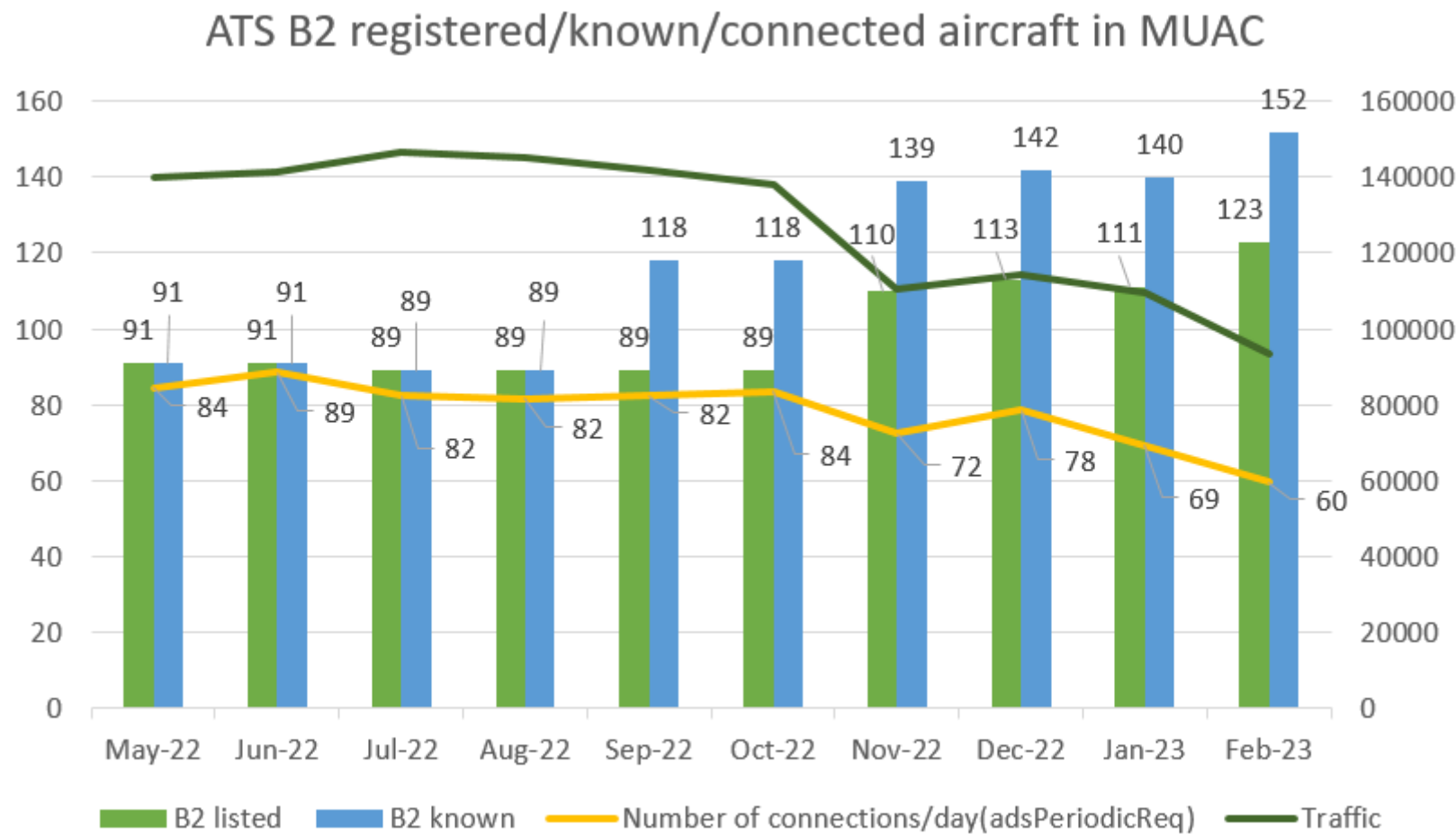
10 March 2023

Maastricht Upper Area Control Centre





Statistics – current equipage and known capabilities



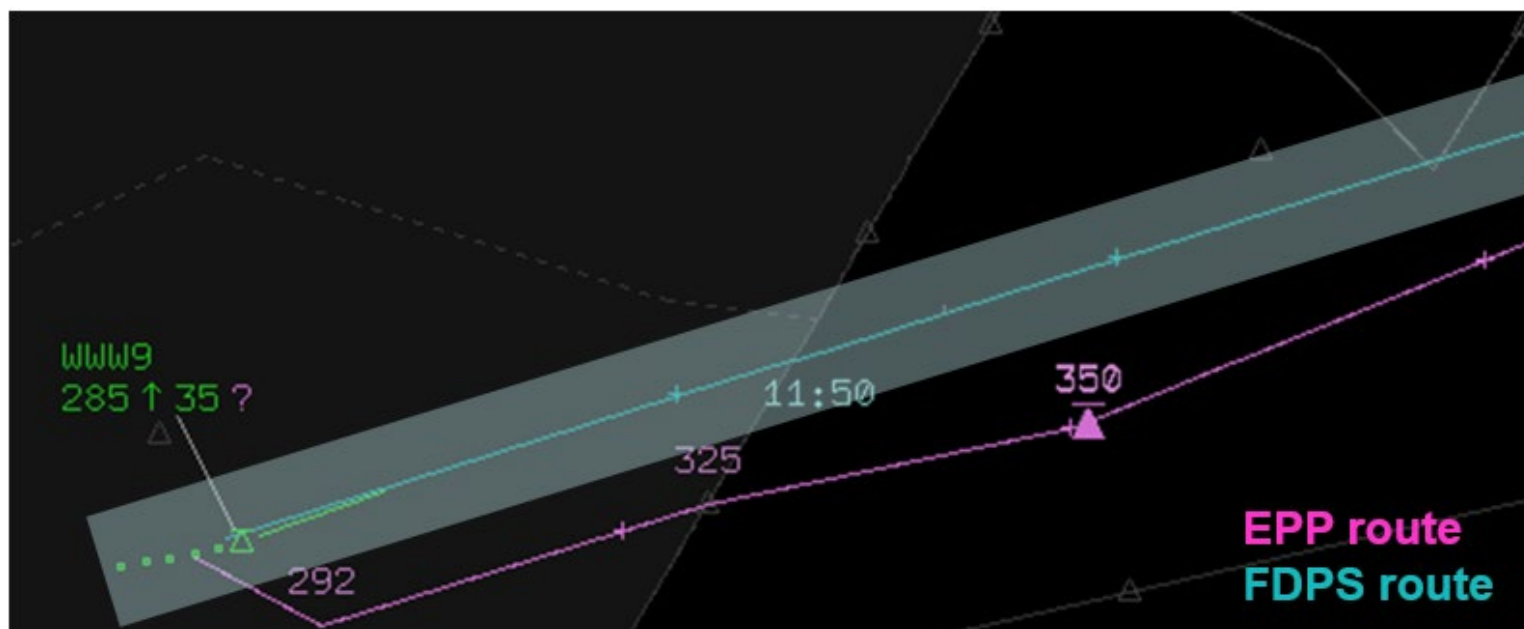
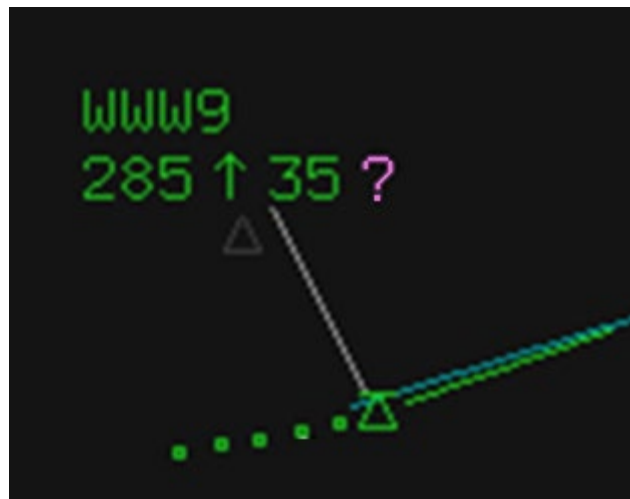
CPDLC Logon becomes even more important

Airlines which do not confirm that they have trained their crews for the CPDLC v2 message set, can't use B2 services with their equipped aircraft at MUAC



AF6/CP1 mandate features

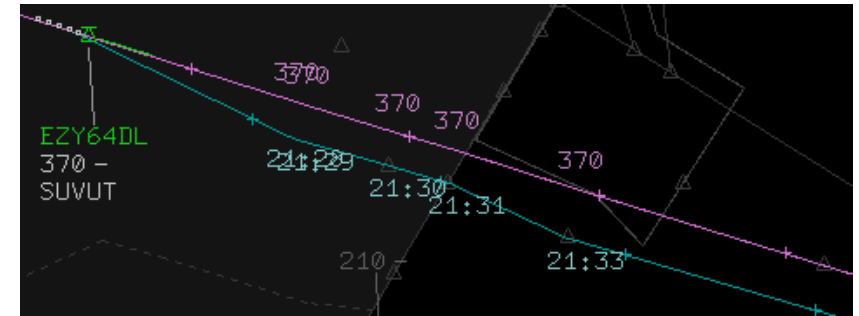
- MUAC FDPS continuously compares the FDPS-trajectory (based on ATCO inputs/OLDI messages) with the EPP downlinked trajectory
- An automated alert is generated when air-/ground trajectories are not aligned (?)



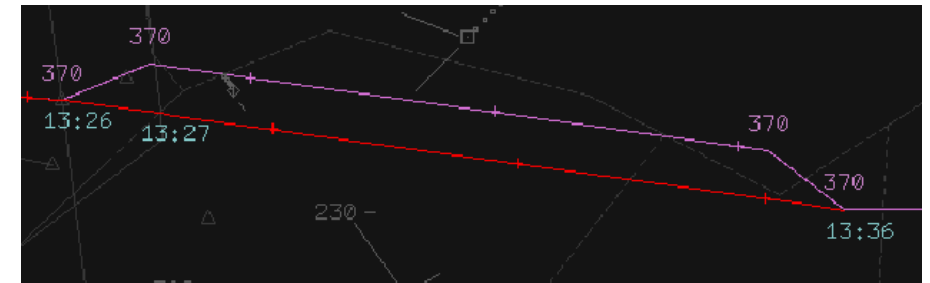
- Grace period of 30 s(CPDLC) or 60 s(verbal) after the instruction to execute
1 recorded occasion when it helped spotting a wrong external sector sequence since implementation

ADS-C benefits

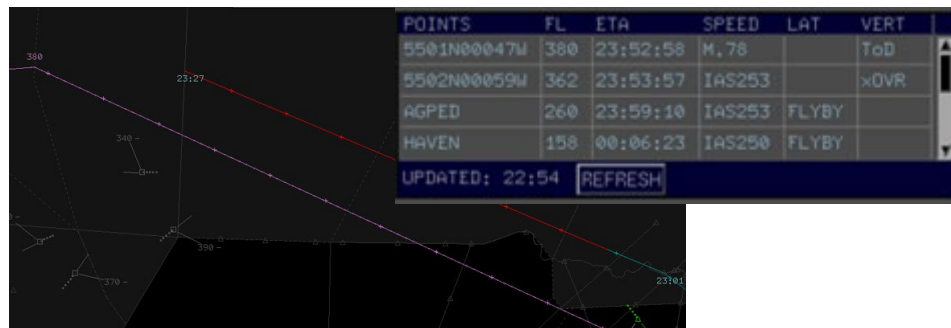
- FMS trajectory can be checked anytime, discrepancy warnings reduce the need for monitoring → **workload reduction**



- Reduced need for monitoring the vertical profile (ToC/ToD display) → **workload reduction**



- EPP can clearly show offset procedures during weather-deviation, reducing the need of keeping aircraft on radar headings → **workload reduction**



- Better ATCO awareness of the lateral trajectory enables coordination for better routings beyond the limits of the ground trajectory → **improved service**



A320 Descent statistics

CPDLC WHEN READY + ADS-C EPP

A320 family aircraft savings/flight by maintaining cruising level from clearance to ToD (DESCEND WHEN READY) in MUAC airspace
15 November 2022 - 31 January 2023 (fuel data from Airbus)

Total saved 15/11-31/01

5.190 nm maintaining

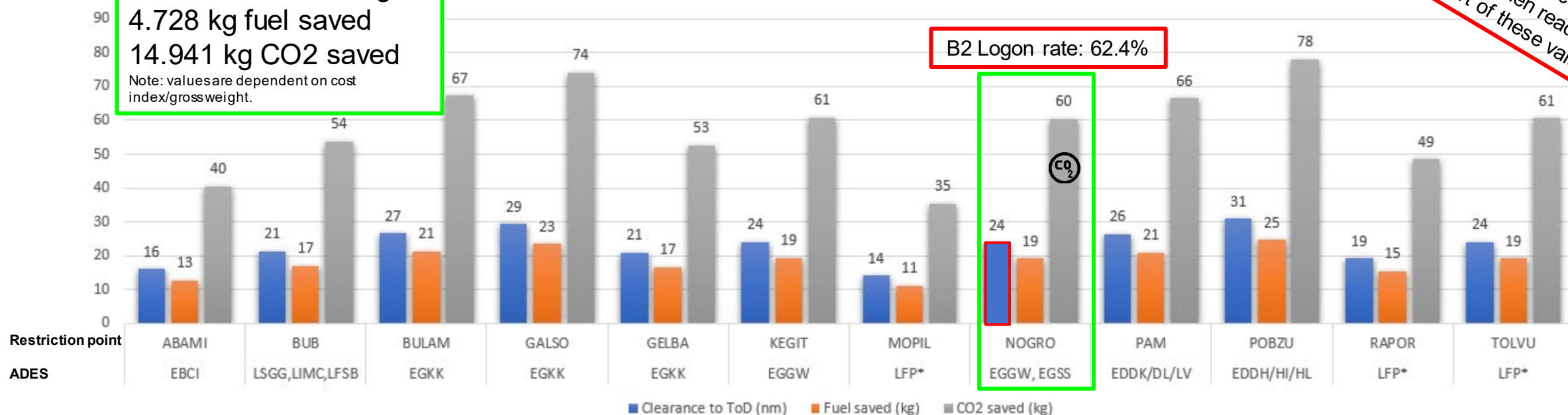
4.728 kg fuel saved

14.941 kg CO2 saved

Note: values are dependent on cost index/gross weight.

Voice clearances to descend when ready are not part of these values

B2 Logon rate: 62.4%



Data sources:

- aircraft position upon receipt of CPDLC uplink
- Descend + When ready
- EPP ToD position in the next downlink
- recorded radar data (distance to ToD: average)
- Airbus official data for fuel consumption/CO2

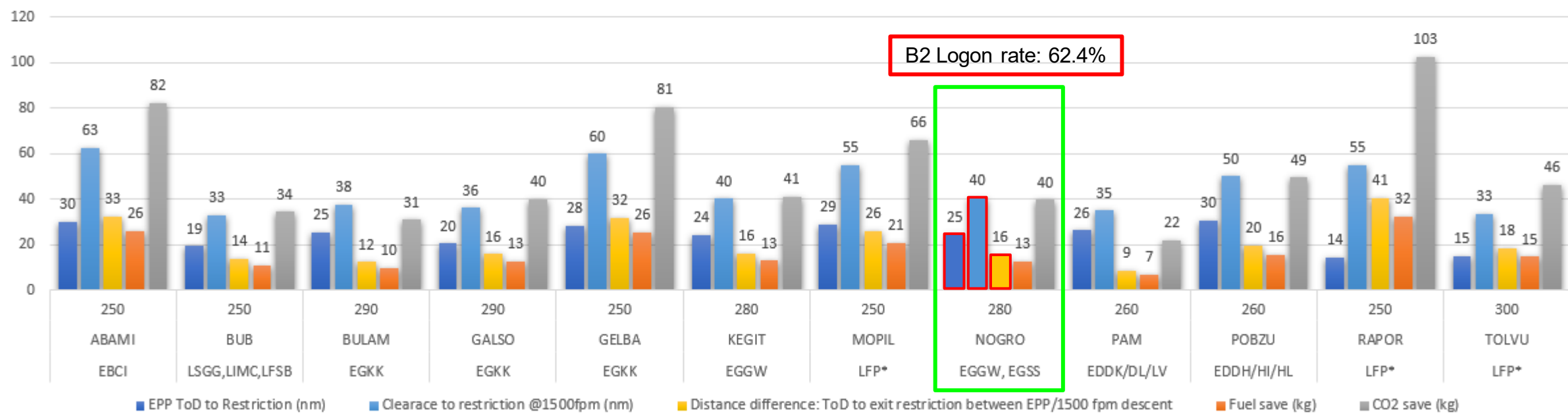


A320 Descent statistics

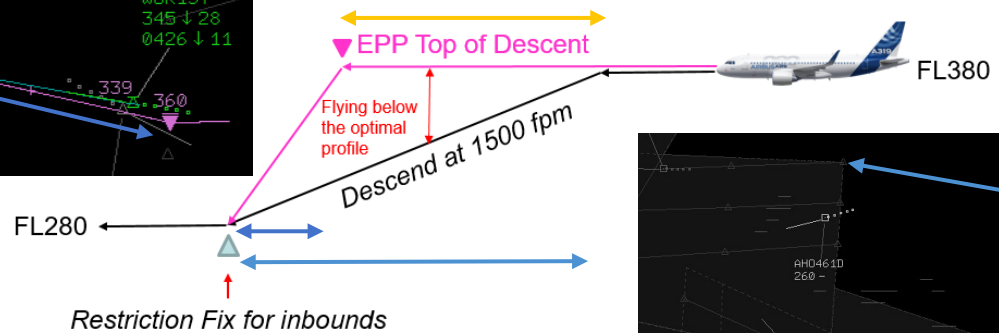
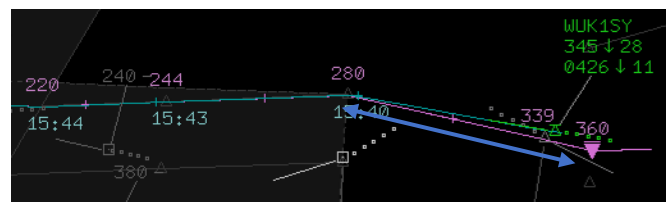
CPDLC WHEN READY + ADS-C EPP vs descend at 1500 fpm

Calculated A320 family aircraft savings/flight between descending at EPP ToD with own vertical rate vs. descending at 1500 fpm standard RoD and starting earlier [eg. B1/B2 aircraft difference]

15 November 2022 - 31 January 2023 (fuel data from Airbus)



B2 Logon rate: 62.4%

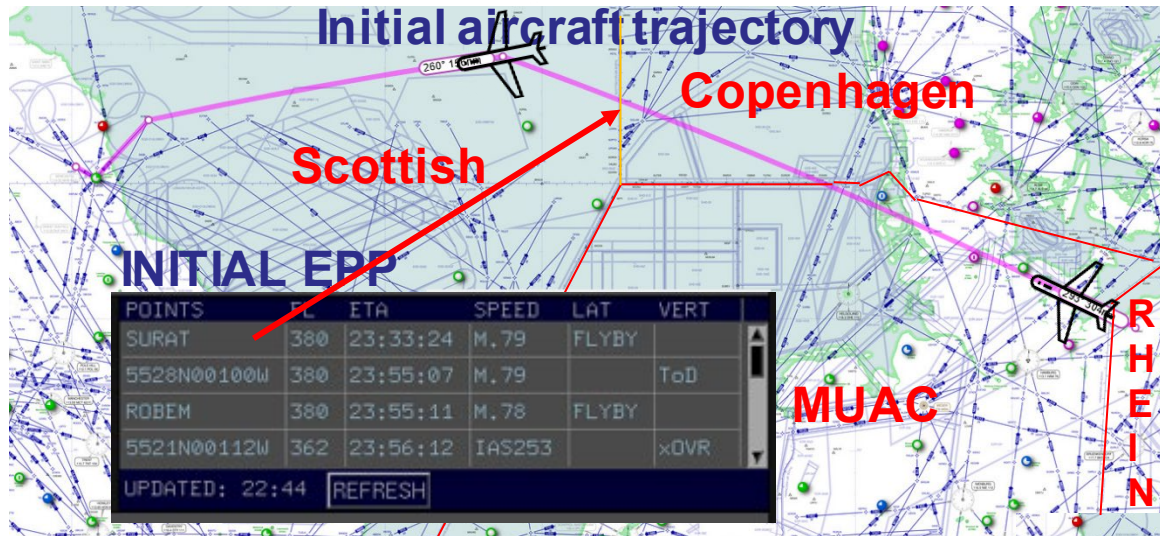


Totals 15/11-31/01
Descend at ToD vs. 1500 fpm profile
6.517 nm maintaining
5.218 kg fuel saved
16.475 kg CO2 saved
Note: values are dependent on cost index/gross weight.



Benefits in numbers

Looking beyond the FIR boundaries with EPP



- October 2022: 3 flights in a trail with the same ADES
- All 3 got the same direct [AGPED – well beyond MUAC ground trajectory] based on EPP downlink
- Track shortening: 503.9 vs. 477 nm = **26 nm/flight**
- A20N@FL380: ~110 kg fuel saved, ~350 kg CO2

Fuel/CO2 savings

Shortcut 5 nm @ FL380

A320: ~25 kg / 79 kg CO2

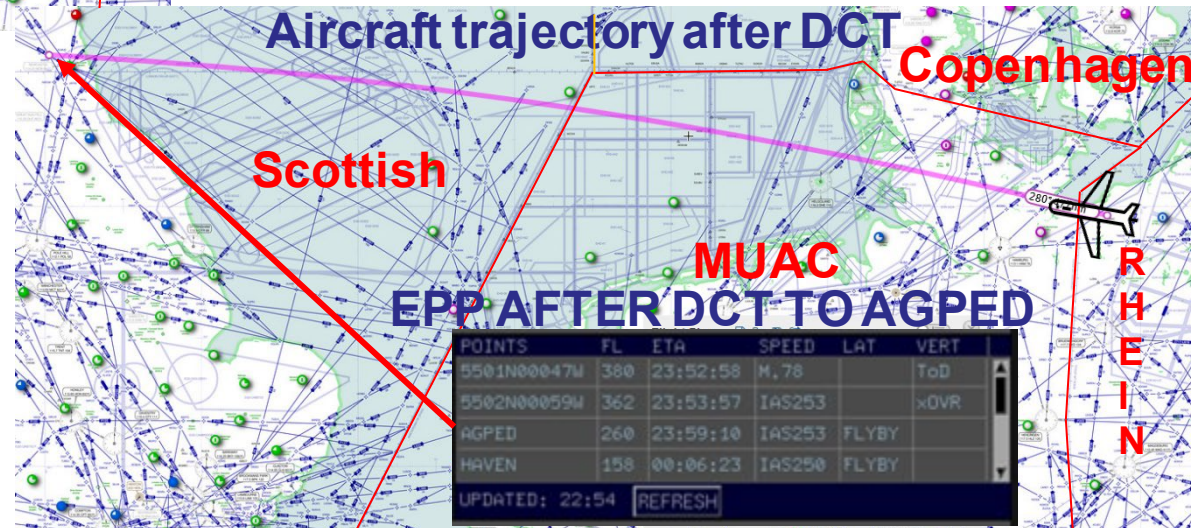
A330: ~55 kg / 173 kg CO2

Shortcut 20 nm @ FL380

A320: ~100 kg / 316 kg CO2

A330: ~220 kg / 695 kg CO2

Note: values are dependent on cost index/grossweight.



EPP use cases for increased safety (with CPDLC v2+)

Controllers can more easily check if route clearances were implemented correctly. Pilots have the option to push-load the clearances.

AAA6 [ATFCM] [FDM] [EPP] [COORD] [CPDLC] [MSG] [FPL] [X]

A320 /M N0465 LFPG EFHK|ECL390|YXCCD 1245 390|127.865

134.705|AAA6 F390 H042°|M0.78 IAS241|GS0430 - |T046°

RMK TCAS

NO MESSAGES

LVL

RTE WCO/RTE EVADI VIA ALASA ← CPDLC clearance

FRQ WCO/CONTACT MAASTRIC 134.705

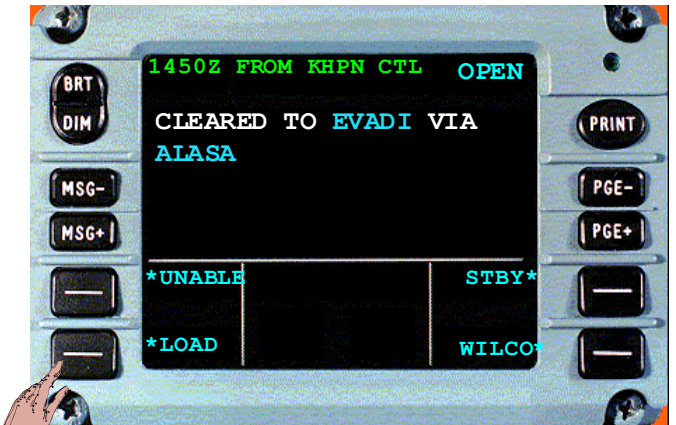
ADSC

YXCCD 1245 /45 390 N5617 CPH OK 127.865

EPP downlinked from FMS

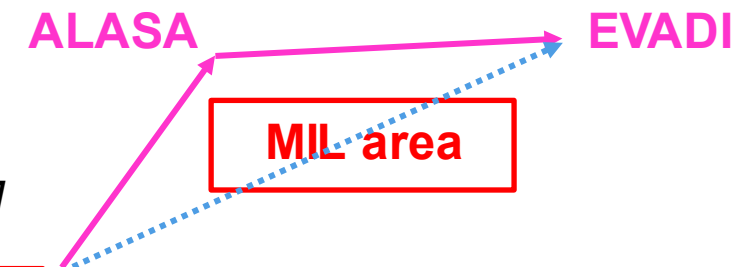
POINTS	FL	ETA	SPEED	LAT	VERT
ALASA	390	12:47:17	M.77	FLYBY	
EVADI	390	13:56:11	M.77	FLYBY	
5927N02215E	390	13:58:08	M.76		ToD
RUMEP	370	13:59:02	M.77	FLYBY	

AGE: 12:34 [REFRESH]



ATN B2: lateral clearances are loadable

Common mistake upon receipt of UM79:



Regular misinterpretations of UM79 *CLEARED TO [POINT 2] VIA [POINT 1]*

8 recorded occasions of misinterpretations in MUAC airspace during 2022

ATS-B2 benefits

Airborne side - ADS-C + CPDLC

Airlines



- Optimized climb and descend profiles
- Optimized routes, less miles flown
- Fuel saving & Less CO₂ emissions → greener flights
- Future: less regulations through a more optimized network (use of EPP ETA, runway occupancy parameter iso. FPL times)

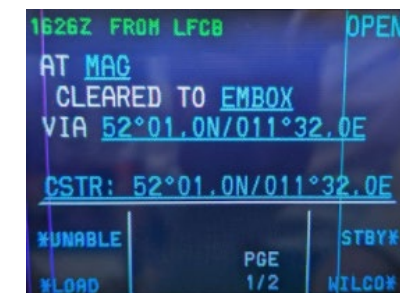
Pilots



- Link of the ATSU to FMS for easier handling of messages (CPDLCv2)
- Less radio usage for routine information requested by controllers
- Reduced Flight crew workload

	ATN STD	UM	AVG(s)	PC50(s)	PC70(s)	PC95(s)	COUNT
PROCEED DIRECT TO X	B1	74	12,401	10	13	26	519548
PROCEED DIRECT TO X	B2	74R	10,5784	9	11	22	20206
CLEARED TO X VIA Y	B1	79	21,7196	16	23	55	5128
CLEARED TO X VIA Y	B2	79R	18,25	14	19	41	188

Response times to PROCEED DCT and CLEARED TO CPDLC uplinks in B1/B2 airframes in 2022 at MUAC.
Note: Measured as time between uplink and receipt of WILCO, there are more contributing factors.



ANSP side - CPDLC v2 benefits

Controllers

- **Safety enhancement** through push-to-load capability. *MUAC recorded 8 instances in 2022 where pilots entered the received route-clearance wrongly (UM79 CLEARED TO [FIX2] VIA [FIX1])*
- Lat-Long coordinate uplinks: track shortening → less time in the airspace → **ATCO workload reduction**
- Lat-Long coordinate uplinks: closed trajectories – aircraft will cater for the wind effect itself, resulting in a much more predictable profile and conflict detection → **ATCO workload reduction**
- Higher expected logon rate due higher pilot acceptance → **ATCO workload reduction**



ATS B2 Future: Revision B – ADS-C V3

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- **Enhanced features**

- Active VHF frequency downlink
- Runway occupancy data
- Holding data
- Enhanced speed schedule profile, including planned final approach speed
- Enhanced EPP to contain the destination airport
- Introduction of the ADS-C Common Service (ACS)

- **New events**

- EPP multiple points tolerance events [TBO requirement]
- Hold status / entry change event
- Runway occupancy status change event

ATS B2 Future: Revision B – CPDLC V4

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- **Safety benefits**
 - Clarified wording of certain CPDLC messages (ie. UM321 CONFIRM → REPORT VIA VOICE)
 - Adopted performance/availability metrics
- **Higher pilot acceptance**
 - UM271 CURRENT ATC UNIT becomes a system-management message (no alert attribute)
 - Reduced number of nuisance messages (ie. CPDLC BACK IN USE, CURRENT ATC UNIT)
 - CONTACT [unit] [frequency] CALLSIGN ONLY message
- **New messages (excerpt)**
 - **UM382** DESCEND VIA STAR TO [*level single*]
 - **UM383** AFTER PASSING [*positionR*] DESCEND VIA STAR TO [*level single*]
 - **UM384** CLIMB VIA SID TO [*level single*]
 - **DM166** REQUEST DESCEND DUE TO TOP OF DESCENT

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