

#### Ultra's Experience with A-CDM Simon Wilkins – Chief Technology Officer

ICAO A-CDM Workshop 20 October 2016





🛛 RESPONSE 🕂

ANALYSIS 🕂

EVOLUTION =

HEIGHTENED EFFICIENCY



- Improve predictability of operations
- Improve on-time performance
- Optimise utilisation of ground handling resources
- Optimise utilisation of airport infrastructure
- Reduce slot wastage
- Flexible pre-departure planning
- Reduce Apron and Taxiway congestion





#### A-CDM Core Elements OBSERVATION + RESPONSE EVOLUTION = EuroControl A-CDM consists of 16 Milestones which map the inbound – turnaround and outbound process of a flight. Using the milestone approach it becomes possible **Milestone Approach** 1 to monitor the whole process and influence where need. From the milestone approach the Target Off-Block Time (TOBT) is derived. Variable Taxi Time replaces the standard taxi time and is used for inbound and outbound flights. It reflects the individual taxi time from parking position to the Variable Taxi Time 2 runway in use and vice versa, including contributing factors such as aircraft type, pushback time, local weather conditions and operational restrictions Pre-departure Sequencing moves the operational concept from first come – first **Pre-Departure** served to best planned - best served. Pre-departure sequencing generates an optimised off-block sequence that takes into account operational considerations and Sequencing limitations. CDM in Adverse Conditions enables efficient management of the operation during **CDM in Adverse** time where airport capacity is limited. Such adverse conditions would cover local weather conditions such as fog through to on airport situations such as a runway **Conditions** closure Collaborative Collaborative management of flight updates enables the exchanges of arrival and departure information with central flow management organisations such as NMOC, **Management of Flight** 5 DGAC, ANAC, etc. **Updates**

#### THE ULTRA EQUATION 1. Milestone Approach OBSERVATION + RESPONSE HEIGHTENED EFFICIENCY EVOLUTION = man-dev-uasrv-4 (GVA 1.9) 14 🔾 • 💭 • 📕 Edit 🔨 Milestone Dashboard The Milestone Ground Flight Plan Take Off TOBT Final Boarding Aircraft Start Startup FORT -Bes Handling Off Blocks Take Off-Local Rada Innded In Blocks SAT Issue Activated Outstation Approach Confirm-Started -Ready-Request-Approval BestTime Start-FLT IN -BestTime BestTime -BestTime BestTime BestTime FLT OUT Dashboard displays Best Time BestTime BestTime BestTime BestTime BestTime BestTime BestTime BestTime the predicted and actual status for each ETD053 ETD054 09:35 of the 16 EuroControl AFR1242 AFR1243 03:35 pre-defined Turn-Round milestones. LGL83Q 05:00 LGL62Q WZZ3088 WZZ3087 Associated with these milestones are 14 A-EZY1378 EZY1377 CDM alerts. GW17740 GW17741 GW19742 **TAP947** 09:16 $\checkmark$ View the turnaround performance of each aircraft Off Blocks-Actual: 22/12/2015 09:13:00 as a series of 16 pre-defined EuroControl Off Blocks-Estimated: 22/12/2015 09:10:00 Off Blocks-Scheduled: 22/12/2015 09:10:00 milestones ✓ Gives early visibility of developing problems and Ultra highlights areas where pre-emptive action can ELECTRONICS reduce delays and improve turnaround times

# 2. Variable Taxi Time

OBSERVATION + RESPONSE +

ANALYSIS 🕂

s 🕂 EVOLUTION 😑

CDM09	Boarding	Not Started																/ Ed	it 🔽
Pre-depart	ure Sequence	er × Taxi Time Ex	tension × Ta	ixi Time Configuratio	on ×														
○ De	fault Tax		Taxi In	Times							(Loc	(Local)							
Airport [ Taxi-In		axi-Out			FLT	ADEP	3	Stand	RWY	ТҮР	ELDT	ALDT	EXIT	4	AIBT	Ti 着			
10	minutes	10 🗧 minutes S		V		7	V	7	7	Enti 🔳 🏹	Enti 🔳 🍸		V	Enti 🔳 🏹	Ľ				
Taxi Time Extension Configuration									EDDP		01	05	B773	0504	0501	10		0510	
Thresholds Max Window Mins Mins In Advance Limit									LSZA OMAA KEWR		03A 01 03A	05 05 05	PA34 B773 B737	0608 0610 0647	0611 0606 0648	10 10 10	c	0614 0610 0655	
	minutes	30 🗙 minutes	Save Changes					UAL956 SWR1339	UUDD		03	05	PC12	0651	0653	10		0654	
Stand-	Runway	Taxi Times		Aircraft Type	e Taxi Times			<b>.</b>											۶.
Batch Updates Taxi-In (minutes) 0								B2 of B2	ADES		Stand	RWY	TYP		AOBT	EXOT		(Loc ATOT Ent III 🕎	cal)
Stand V		Taxi-In (Offset) 🟹	Taxi-Out (0 *	Description	7 Taxi-In (%)	Taxi-Out (%) 🛐	7 🔺	SWR2801	LSZH		01	05	C501	0510	0458	10		0505	
01	05	0	0	* 141	100	100	-	SWR1304	ULLI		01	05	CL30	0530	0533	10			
01	23	0	0	<ul> <li>142</li> </ul>	100	100		EZS1533	EBBR		02	05	GLF4	0535	0538	8			
02	05	0	-2	143	100	100		EZS1425 EZS1371	LEAL LFBD		02	05	GLEX	0535	0538 0538	8			
02	23	0	0 -	<ul> <li>310 series</li> </ul>	100	100		4	LFBD		03	05	GLF5	0535	0536	8			•
				+ 318	100	100	-	126 of 126											

Support for default taxi times which can be finetuned for particular configurations.

- ✓ Taxi Times configured for a Stand/Runway pairing and aircraft type
- ✓ Information is used to configure Taxi In (EXIT) and Taxi Out (EXOT) times for flights
- Variable taxi times improves quality of Target Take Off Times and reduce delays at the runway



THE ULTRA EQUATION

### 3. Pre-departure Sequencer

OBSERVATION +

RESPONSE + ANALYSIS +

HEIGHTENED EFFICIENCY

THE ULTRA

The Pre-Departure Sequencer calculates a *Target Startup Approval Time (TSAT)* which is used to calculate a *Target Take Off Time (TTOT) whilst* ensuring adherence to calculated take off times (CTOT) and hence the optimised use of take off slots.

Pre-D	eparture Sequencer		Pre-dep	arture S	equence	r Flight Vi	ew						
	10 Friday												
	Active Sequence	•	Drag a colur	mn header and	drop it here	to group by tha	t column						
10:00			FLT	CSG	ADES	TYP	RWY	STAND	EXOT	TSAT	ASAT	SOBT	EOBT _
			8	8	8	7		7 7		Ent 🔳 🍸	Ent 🔳 🍸	Enti 🔳 🍸	Enti 🔳 🍾
			SWR2801	SWR40KX	LSZH		23		10	0506		0500	
10:05			SWR442	SWR44U	EGLC				10	0546		0540	
			NJE213H	NJE213H	EGCC		23	01	10	0634		0547	0547
			SWR1472	SWR1472	LKPR				10	0606		0600	
10:10	● N525RZ		SWR1940	SWR194A	LEBL				10	0606		0600	
			SWR352	SWR352	EGLL				10	0636		0630	
	• PAJ422 • TOBT: 10:00 TSAT: 10:02 TTOT: 10:12 CTOT: 10:15		MBIGG	MBIGG	EGCC		23	01	10	0630		0630	0630
10:15			SWR2805	SWR805G	LSZH		23		10	0646		0640	0640
			LXJFQ	LXJFQ	EGCC	PC12	23	01	10	0746		0745	0745
			SWR1336	SWR1336	UUDD		23		10	0806		0800	0836
10:20	SWR2809 SWR2809 TOBT: 10:10 TSAT: 10:10 TTOT: 10:20 CTOT: 10:20		SWR1304	SWR1304	ULLI				10	0820		0815	
10.20	• SHR205 • 1001.1010 ISAN 1010 1101.1020 CION 1020		HBPRJ	HBPRJ	EGCC			01	10			0815	
			N79CN	N79CN	EGCC		23	01	10	0844		0830	0830
10:25			SSBDG	SSBDG	EGCC			01	10			0900	
10:25	SWR434 STOBT: 10:15 TSAT: 10:16 TTOT: 10:26 CTOT: 10:25		SWR2807	SWR80TL	LSZH		23		10	0916		0910	0910
			SWR1822	SWR182H	LGAV				10	0926		0920	
10:30			PAJ422	PA3422	EGCC			01	10	1002		1000	1000
10:30			N525RZ	N525RZ	EGCC			01	10	1000		1000	1000
			SWR2809	SWR280J	LSZH				10	1010		1005	
			SWR434	SWR34P	EGLC				10	1016		1010	
10:35			SWR2200	SWR2200	GMMX				10			1025	
			GAC459T	GAC459T	EGCC			01	10			1030	1030
			TIE463S	TIE463S	EGCC			01	10			1030	1030
10:40			MLM007	MLM007	EGCC			01	10			1100	1100
			N925JS	N9253S	EGCC			01	10			1100	1100
			SWR022	SWR22B	KJFK				10			1115	1115
10:45			4 77 of 77										•
_		Ľ	77 of 77										

EVOLUTION =

✓ Enhance predictability

- Reduce taxi and hold times
- Colour coding to highlight important points

- ✓ Increase punctuality
- ✓ Improved slot adherence



### 3. Pre-departure Sequencer

OBSERVATION + RESPONSE +

🕨 🗛 ANALYSIS 🕂

EVOLUTION = HEIGHTENED EFFICIENC

Pre-departure Sequencer Flight View

THE ULTRA

#### Sequence Reorganisation

Users need to be able to manually lock or unlock flights in the sequence.

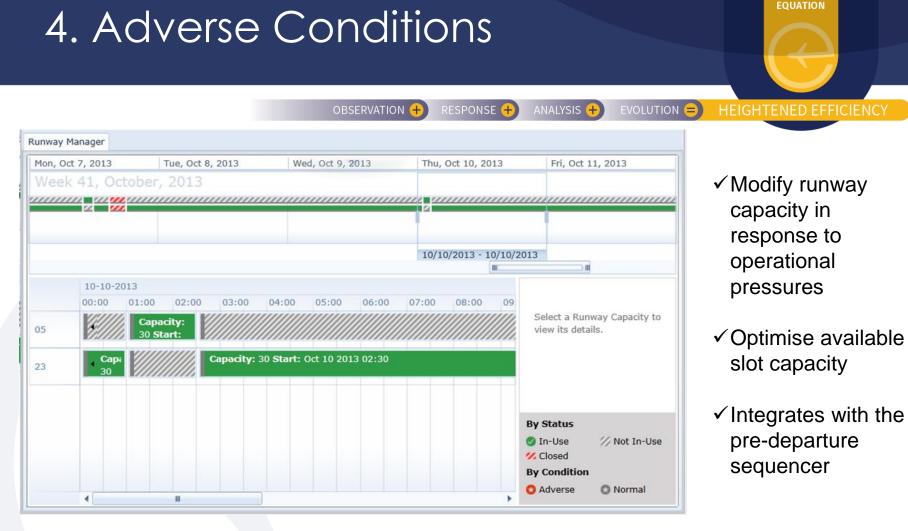
Flight sequences should be easily swapped with a right click command on the two selected sequences.

Airlines may be allowed to move slots between their own flights.

Pre-depar	ture Sequencer	
Pre-D	eparture Se	equencer
	06 Wednesday	
	Active Sequence	e
16:40		
16:45		
16:50	AFR1143	• TOBT: 16:40 TSAT: 16:41 TTOT: 16:50 (
16:55	. • BAW733	<b>CODE:</b> 16:45 TSAT: 16:45 TTOT: 16:54 (
10.55	• EZY1327	CONTRACT 16:45 TSAT: 16:47 TTOT: 16:56 (
		Lock/Unlock
17.00	F7V200K	Swap Flight
17:00	EZY389K	Clear Errors

The dep		lqueneer	i ligite vi	c m
FLT	CSG	ТҮР	RWY	ST
7	7	7	7	
EZS1535	EZS725N	C525	05	19
SWR528	SWR528	B733	05	19
EZS1307	EZS877K	A320	05	19
EZS8475	EZS8475	BE20	05	21
SWR348	SWR34X	B744	05	22
BEE1831	BEE1831	FA20	05	28
DWT026	DWT026	A320	05	23
UAE090	UAE90	A320	05	19
SVA236	SVA236	A319	05	32
SWR2148	SWR214Z	B712	05	24
EZS1395	EZS771F	C680	05	25
EZS1471	EZS1471	MD81	05	26
EZY7370	EZY690J	B738	05	19/
F7Y8477	FZY901R	E145	05	19





✓ View runway status received from integration with ATC systems.

Runway information can be input manually and / or supplied by external systems.



THE ULTRA



Taxi time extensions can be applied to all flights for a period of time in response to operational delays such as those caused by adverse weather.

CDM09	- Board	ing Not S	Started																	/E
Pre-depa	rture Sequ	encer ×	Taxi Tim	e Extensio	n × Tax	ci Time Cor	figuration	×												
Friday, September 16, 2016     Saturday, September 17, 2016     Sunday, September 18, 2016     Monday, September 19, 2016     Tuesday, September 19, 2016									ptember 20, 2016											
														Week	38, Sej	otembe	er, 201	5		
														19/09/20	16 - 19/09	/2016				
19-09-2	2016																			Insert New
00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00 Ex	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	Time Range Sep 19 2016 11:25 - Sep 19 2016 12:54 Extension 10

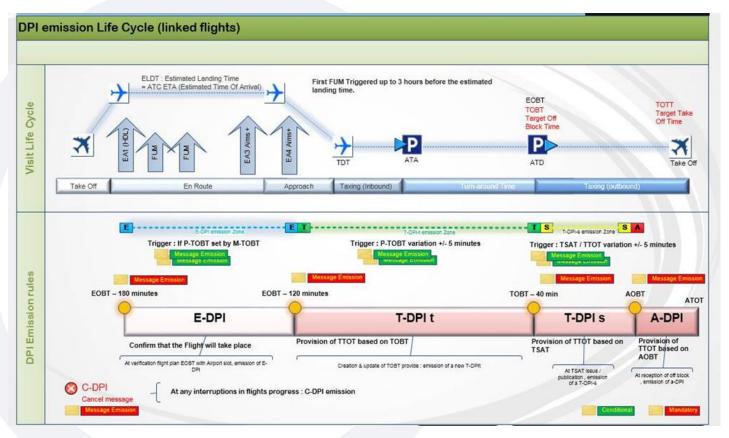
✓ Improves accuracy of TSAT and TTOT times

- Ensures resource planning is considering local operating conditions
- ✓ Reduces delays at the runway





The diagram shows an example DPI lifecycle and the points along the turn-round process at which DPI messages are generated.



The rules to generate DPI messages need to be configurable so they can be modified to satisfy an airport's local requirements which may change over time.



### 5. Intra Airport Communication

OBSERVATION +

RESPONSE + ANALYSIS +

EVOLUTION = HEIGHTENED EFFICIENC

THE ULTRA

Local DPI Generation Rules

Rules can be configured to create DPI messages at different stages of the turn-round process for different types of flights.

	-	<b>d flight = (ATC) slotted flight</b> s CTOT set)	Un-regulated flight = (ATC) non-slotted flight (flight has NO CTOT )						
North Zone	T-DPI-t	Send a T-DPI-t <u>until</u> <b>SUT</b> is set	T-DPI-t	Send T-DPI-t until TOBT-40					
(general parking area)	T-DPI-s	Send a T-DPI-s when SUT is set (t) at TOBT-40 mins)	T-DPI-s	Send a T-DPI-s when TSAT set (typically at TOBT-40 mins)					
	A-DPI	Send a A-DPI when <b>SUT</b> is set		A-DPI	Send a A-DPI as soon when <b>SUT</b> is set				
South Zone	T-DPI-t	Send a T-DPI-t <u>until</u> <b>HAP</b> is set		T-DPI-t	Send T-DPI-t until TOBT-40				
(airport terminals)	T-DPI-s	Send a T-DPI-s when <b>HAP</b> is set		T-DPI-s					
	A-DPI	Send a $\mathtt{A-DPI}$ when $TAD$ is set		A-DPI	(typically at TOBT-40 mins) Send a A-DPI at soon when TAD is set				

 ✓ DPI message generation rules are fully configurable to satisfy local operations



### 5. Intra Airport Communication

TION 🕂 🛛 RESPO

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DPI Flig	ht View																		(Local)
FLT	CSG	ADES	SID	ARCTYP	REG	FPL	EOBT-2	TSAT Issue	TSAT	EOBT	товт	AOBT	EXOT	стот	ттот	ATOT	DEI	CE	1
V	V	· 5	7	V	V	Enti 🖩 🏹	Enti 🔳 🏹	Enti 🖩 🏹	Enti 🔳	T Enti 🖩 🟹	Ent	Ent 🖩 🏹	7	Enti 🖩 🏹	Enti 🔳 🏹	Enti 🖩 🏹	7	V	
AFR1143	AFR1143	LFPG	DEP	A320	EIDVK	1200				1600	1600		10		1610				
THY1922	THY1922	LTBA		B737	PHBGM		0405	0525	0602	0605	0600	0603	8	0604	0611				
DLH1229	DLH1K	EDDF	L3N1234	E195	DAEBI	0150	0350	0515	0626	0550	0640	0549	10	0642	0559	0556			
BAW723	BAW723	EGLL	T5N	F2TH	N132DA	0235	0435	0559	0638	0635	0720	0639	8	0651	0647	0650			
TAP949	TAP949G	LPPT	W2T	B772	N37018	0130	0330	0454	0606	0530	0605	0539	8	0540	0547	0545			
AUA578	AUA578G	LOWW	S4N	B733	нвјјв	0207	0425	0548	0626	0625	0625	0628	8	0629	0636	0642			
37 of 137																			
DPI Viev	wer																М	essage	Info
Drag a colun	nn header and	l drop it here t	to group by that	olumn														Message D	ata
Queued On	7	Sent On 🍸	Message Type	Flight S	Errors	Aircraft Id	entifier 🍸	товт	7	TSAT	7	ттот	🝸 Estim	iated Taxi Tin	ne 🏹	4	۰ -	DPISTATUS ARCID EZY	
19/09/2016	11:16:18		T-DPI-t	EZY615	4 0	EZY874L		19/09/2016 1	12:05:00			19/09/2016 12:14	:00 00:0	9:00		٦		ADEP LSG	3
19/09/2016	11:16:03		E-DPI	DWT026	5 0	DWT026		19/09/2016 1	4:15:00			19/09/2016 14:2	5:00 00:1	0:00				ADES EGG EOBT 1155	
19/09/2016	11:15:28		T-DPI-t	EZS145	5 0	EZS853P		19/09/2016 1	1:45:00	19/09/2016 11	:45:00	19/09/2016 12:04	:00 00:1	9:00				EOBD 1609 TOBT 1205	
19/09/2016	11:15:01		T-DPI-t	UAE090	0	UAE90		19/09/2016 1	13:15:00			19/09/2016 13:2	5:00 00:1	0:00				TAXITIME TTOT 1214	
19/09/2016	11:12:09		T-DPI-t	KLM193	0 0	KLM1930		19/09/2016 1	12:28:00			19/09/2016 12:4	:00 00:1	7:00				ARCTYP B7 REG N66ZE	

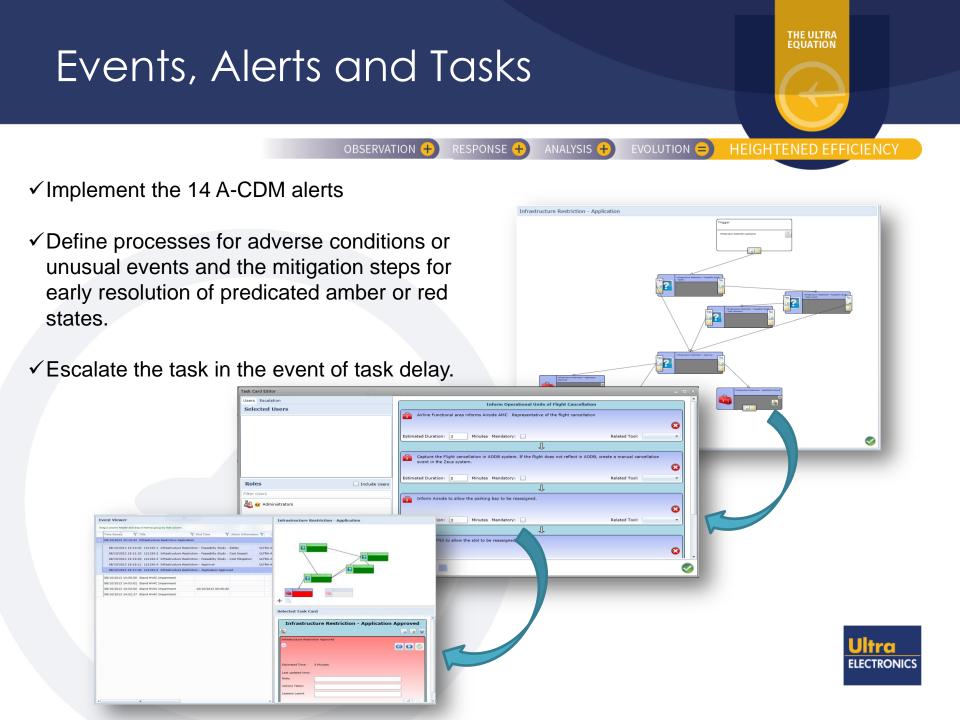
EVOLUTION =

✓ Process Flight Update (FUM) messages.

- ✓ Details of the FUM messages received can be viewed
- ✓ Generate standard Departure Planning Information (DPI) messages.
- DPI messages generated for a particular flight or for all flights over a period of time can be viewed in the "DPI Viewer"

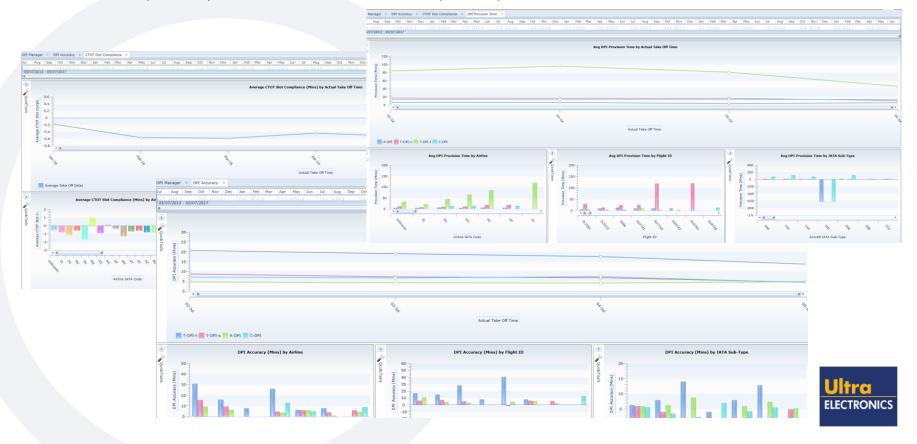
Provides an audit trail of information sent to central flow management unit



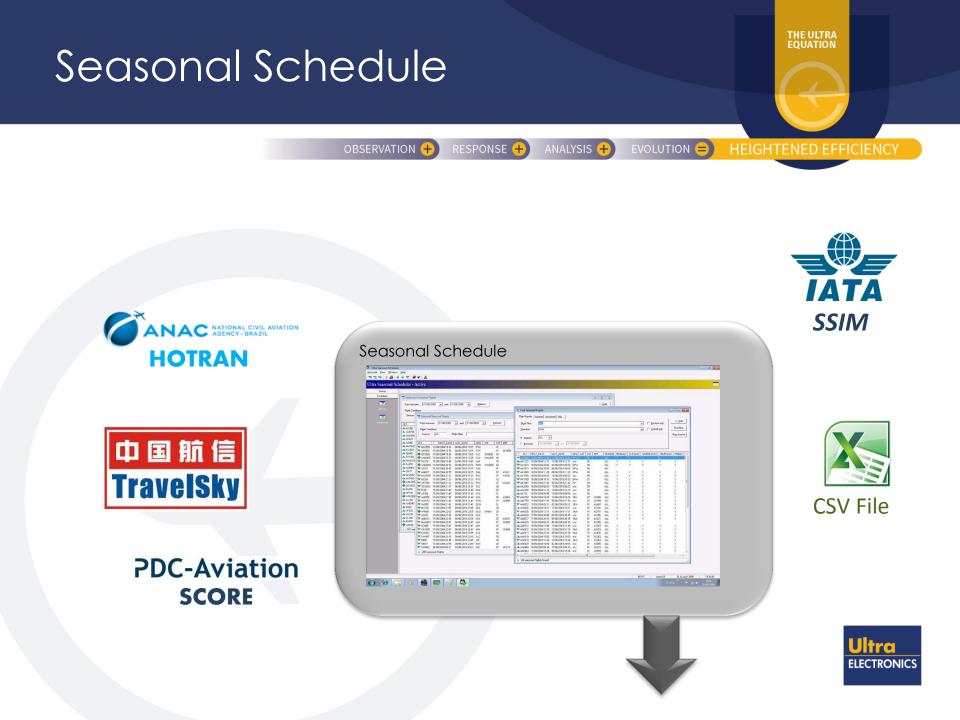


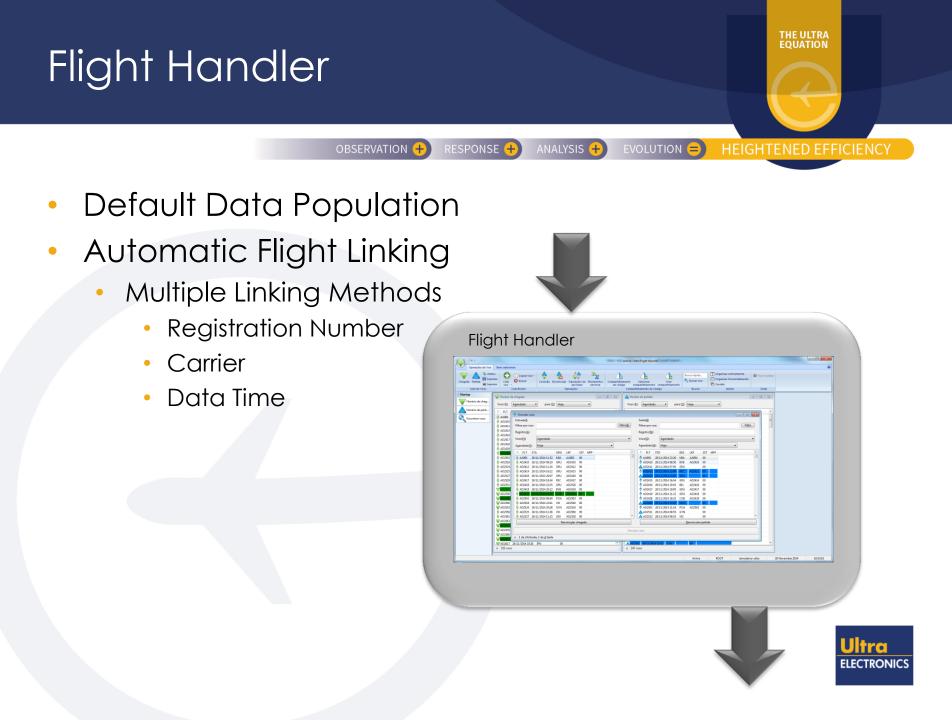


Timely provision of accurate information is central to achieving the A-CDM objectives. Such performance monitoring needs frequent review to ensure data accuracy such as Calculated take-off time (CTOT) vs Actual take-off time (ATOT).









### Resource Planners

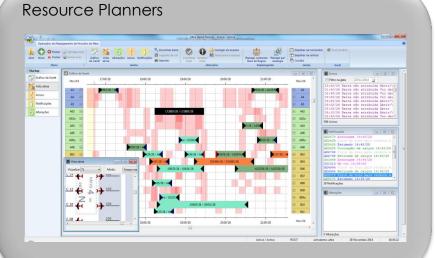
Airport Wide Resource Optimization

OBSERVATION +

RESPONSE

- Fixed
- Mobile
- Intelligent Rulebase
- Template Capability
- What If? Scenarios
- Sandbox Capability

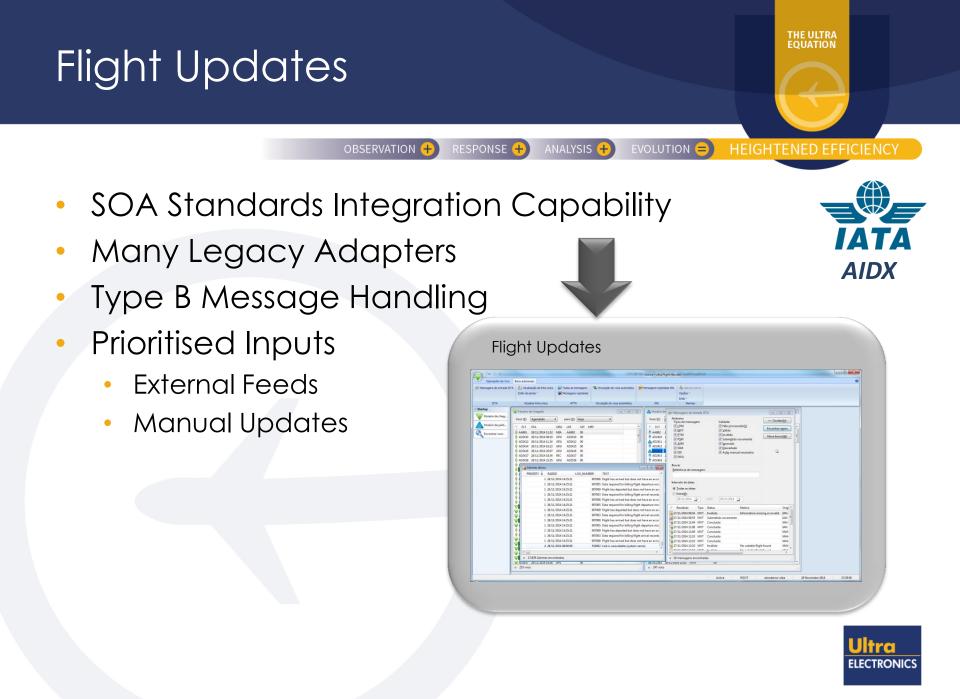


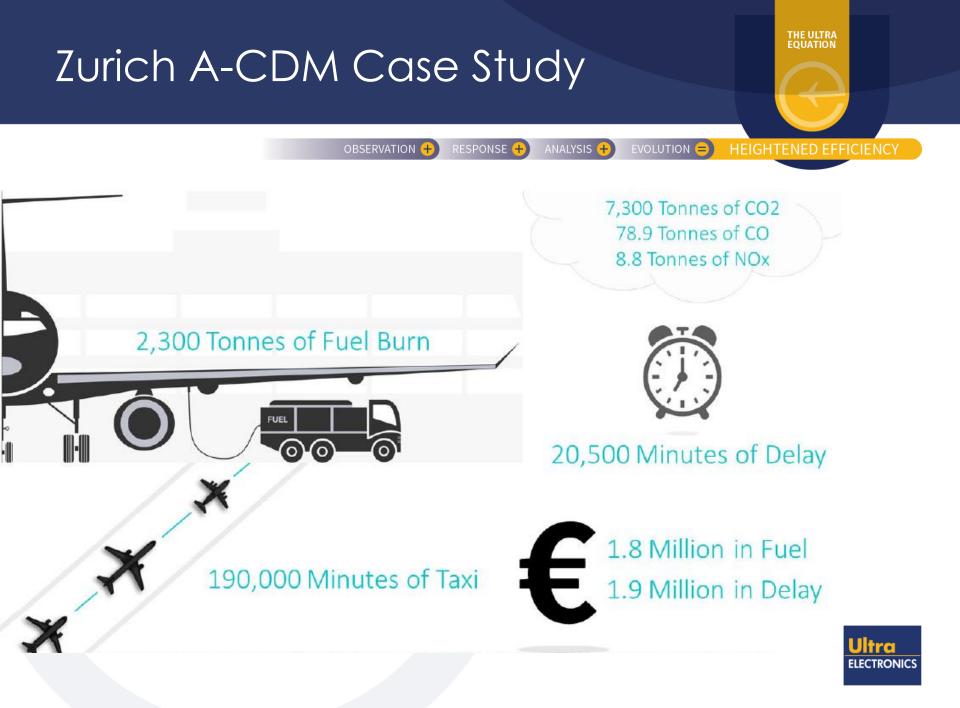


EVOLUTION =



THE ULTRA









EVOLUTION =

• <u>http://www.eurocontrol.int/sites/default/files/publication/files/2</u> 012-airport-cdm-manual-v4.pdf

RESPONSE +

ANALYSIS 🕂

OBSERVATION +

- <u>http://www.eurocontrol.int/sites/default/files/publication/files/a</u>
   <u>-cdm-impact-assessment-2016.pdf</u>
- <u>https://www.zurich-airport.com/business-and-partners/flight-operations/a-cdm-en</u>
- https://www.zurichairport.com/~/media/flughafenzh/dokumente/business\_und\_p artner/flugbetrieb/acdmopsmanualv1220151214en.pdf https://www.zurichairport.com/~/media/flughafenzh/dokumente/business\_und\_p artner/flugbetrieb/acdmzrhdocumentationv1020151214en.pdf
- <u>http://www.ultra-as.com/ultraapex</u>



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#### BEST AIRPORTS BY REGION



BEST DOMESTIC AIRPORT: CHINA Shanghai Hongqiao BEST AIRPORT: RUSSIA/CIS

WORLD

AIRPORT AWARDS

- Moscow Domodedovo
- BEST AIRPORT: NORTH AMERICA
- BEST AIRPORT: C AMERICA/CARIBBEAN
- BEST AIRPORT: MIDDLE EAST
- Doha Hamad
  - BEST INT'L TRANSIT AIRPORT
- Seoul Incheon

#### WORLD'S TOP 10 BEST AIRPORTS

THE ULTRA

- Ultrans 1 Singapore Changi
  - 🔜 2 Incheon, S Korea
    - 3 Munich
    - 4 Tokyo Haneda
    - 5 Hong Kong
      - 6 Centrair Nagoya, Japan
  - 🔙 7 🛛 Zurich

Ultra ELECTRONIC

- 🐭 8 London Heathrow
  - 9 Kansai, Japan

🔚 10 Doha Hamad



