



SUPPORTING  
EUROPEAN  
AVIATION

# Forecast of ATFM delay evolution – FADE

## How an NM operational AI tool transforms operations

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# FADE – Forecast of ATFM (Air Traffic Flow Management) Delay Evolution

## CONTEXT

### Operations pain points:

- Airspace users only know the current ATFM delay
- The ATFM delay assigned to a flight may change with time
- This uncertainty has operational and economic consequences

### Scope:

Predict the evolution of ATFM delay for regulated flights



PROBABILITY  
TO DECREASE



PREDICTED  
DELAY

ARCID: RYR4FU

Time before EOBT	DELAY	TRD wv	P.DLY
	22	84%	9
	16	68%	8
	11	56%	6
	11	60%	5
	11	38%	7
	5	13%	3
	5	13%	3

## PARTNERS



# FADE – Forecast of ATFM (Air Traffic Flow Management) Delay Evolution

## MODEL

### Inputs:

- EFDs: city-pair, time to EOBT, airline, day of the week...
- Regulation(s) affecting the flight: reference location, reason...

### Training:

- Training dataset cleaned from obvious human actions → FADE predicts what is going to happen if the dispatcher does not act

Flight Delay History @ 18:00:00

Sat 27 Jul | ARCID: SWR184H | ADEP: LGAV | ADES: LSZH | EOBT: 03:25 | Auto Refresh: never | GO

TIME	(REL)	EVENT	STATE	EOBT	COBT	AOBT	TOBT	TSAT	TAXI	DELAY	TRD vv	P.DLY	MPR	OTHER REGS
01:25:01	-01h59	SIT	SI	03:25	03:53				12	28	74%	13	LOWB1227	KLK27, LSZHA27E
02:15:24	-01h09	ICH	SI	03:25	03:46				12	21	31%	18	LSZHA27E	
03:36:15	+00h11	REA	SI	03:25	03:46				12	21	2%	24	LSZHA27E	
03:42:33	+00h17	CAL	SI	03:25	03:46				12	21	1%	23	LSZHA27E	
03:58:42	+00h33	TDE	TA	03:25		03:46			12	21			LSZHA27E	

- 1st version-model too optimistic with high delays → Increased the weight for these cases

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## DEPLOYMENT

Model deployed on NM Cloud platform (Cloudera)

Monitoring of performance by NM

- Daily monitoring of performance

Name	ID	Status	Project
Smoke test	166	Success	FADE - MLOPS
Evaluate and retrain	164	Success	FADE - MLOPS
Fit model	163	Success	FADE - MLOPS



- Automatic retraining once the performance reaches the threshold

```
mae_retrain_coeff is 0.5, MAE score is 5.65 while CASA MAE is 8.6, retraining
```

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## DEPLOYMENT

### NMP / NMUI Flight – May 2023

MP							AIRSPACE	RAD	FLIGHT	FLOW	CRISIS
Flight Query											
Saved Flight Lists											
e-Helpdesk Information Hub Free Text Editor IFPS Flight Q											
Flight list											
Enter a name 262 flights											
High 0 Medium 0 Low 0											
	ARCID	REG	ADEP	ADES	EOBT	E/CTOT	FADE DELAY				
							Delay	Trend			
>	SAS2821	SEROB	EKCH C	LTFG	16-12:05	13:01C					
>	SAS1697	OYJZP	EKCH C	LICC	16-14:15	14:25E					
>	SAS81L	SEROM	EKCH C	LIRN	16-15:05	15:15E	*33*	↘ 6			
>	SAS4773	SEROJ	ENGM C	LTFG	16-12:00	12:42C	33	↘ 14			
>	SAS697	SERSI	EKCH C	LIRP	16-14:20	14:30E	*22*	↘ 6			
>	SAS59J	EIFPT	EKCH C	EDDL	16-15:00	15:10E	*16*	↘ 6			
>	SAS823	OYKBP	ENGM C	EHAM	16-09:05	09:27C	12				
>	SAS2518	SERSK	LIBD S	EKCH	16-09:55	10:13C	10a				
>	SAS2777	SEROS	EKCH C	LGAV	16-14:25	14:35E	*8*	↘ 5			

+80 airspace users

## API

API for AI application from NM

contoso			Home	APIs	Products	Reports	Profile	Sign out
APIs								
Search APIs								
Group by tag								
Name	Description	Type						
FADE		REST						
FADE Dev		REST						

# FADE – Forecast of ATFM (Air Traffic Flow Management) Delay Evolution

## SATISFACTION SURVEY

- Satisfaction survey launched in October 2024 and sent to the PoC
- 41 AUs answered out of 65 PoC
- 63% response rate

### Very positive feedback:

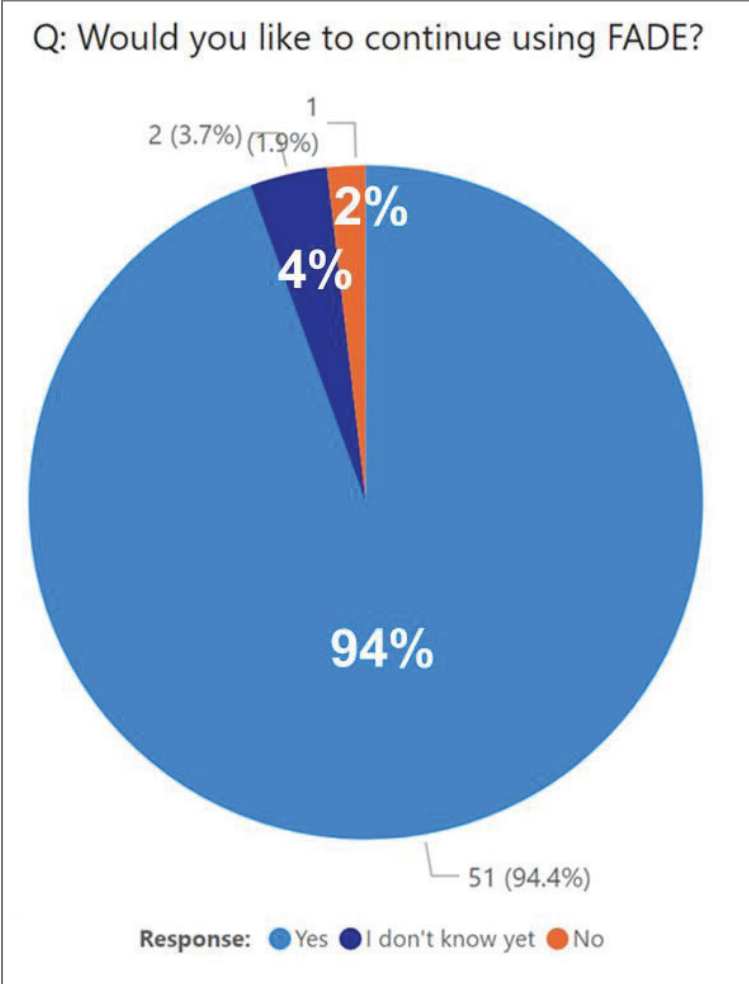
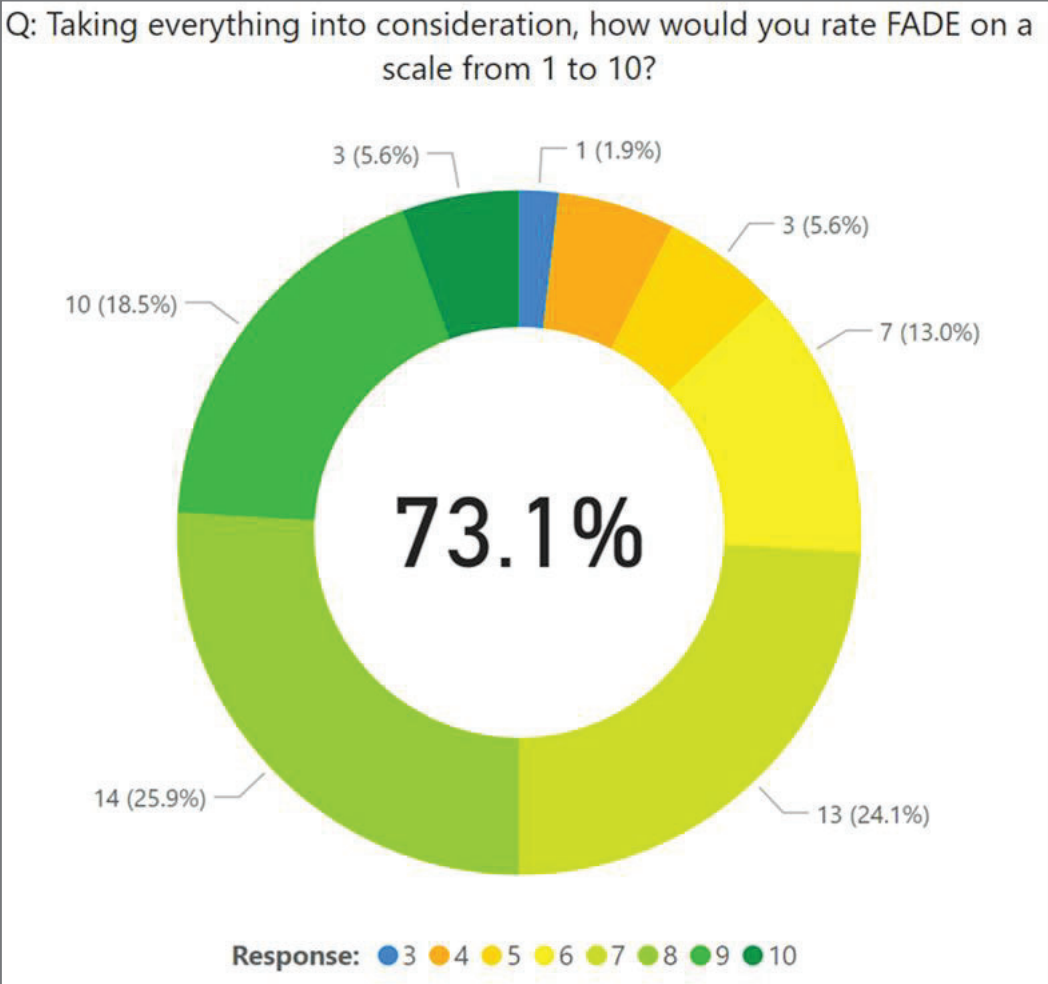
- Useful tool with great potential
- Well-appreciated and regularly used
- Big improvement compared to before (no information on delay evolution)
- Very good predictions, generally accurate during Summer operations

### Some improvements to make:

- Reliability and accuracy
- Further information on FADE:
  - Reports on FADE performance
  - Limitations of the models: adverse weather, ATC-industrial actions
  - Usage of the models: timeframe, probability thresholds, models complementarity

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## SATISFACTION SURVEY



# FADE – Forecast of ATFM (Air Traffic Flow Management) Delay Evolution

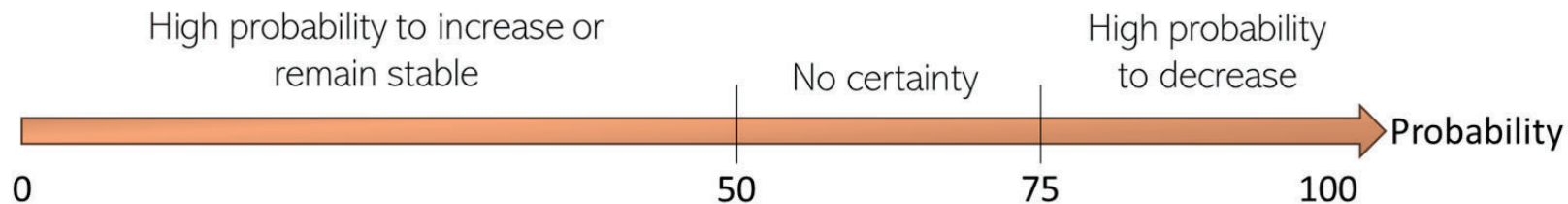
## NEXT STEPS

### Improve accuracy

- Review of the training process of the model: time binning strategy, pinball loss instead of MAE
- Consideration of new metrics for performance monitoring

### Improve communication on FADE

- Limitations of the model
- Usage of the models: probability thresholds, models complementarity



- Performance reporting directly in NMUI Flight



# FADE – Forecast of ATFM (Air Traffic Flow Management) Delay Evolution

USERS' JOURNEY

**Austrian** 

## Building up confidence...



## ... becoming the prio list for our dispatch

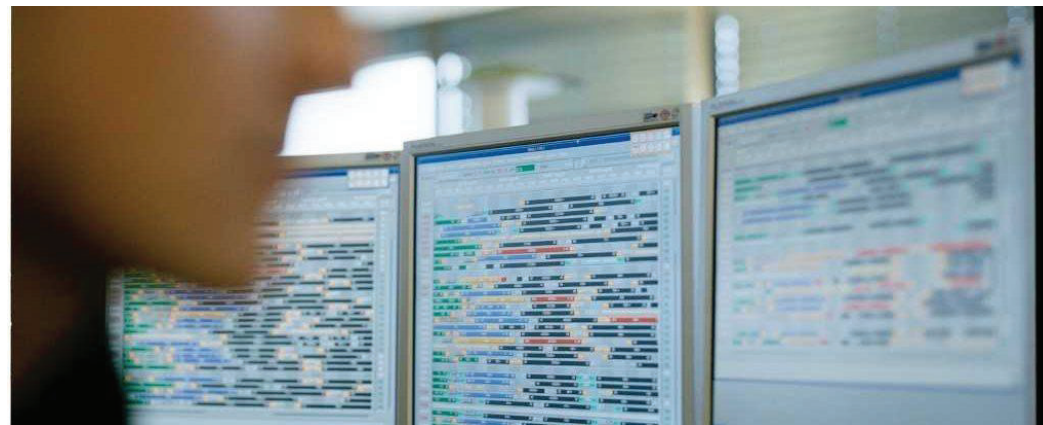
✂	★	AUA078Y	OELWG	LDZA S	LOWW	10-10:30	17:01E		
>	★	AUA429L	YLABO	LOWW C	LFMN	10-16:55	17:01E	*51* ✓	LFMNA10M
>	★	AUA505K	OELBD	LOWW C	LIRF	10-17:05	18:19E		*51* ✓ 20

Supports tactical planning and steering

Prediction generates expectation

Prioritizing regulated flights

Shifting resources to where it matters



**Slot Coordinator**



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# Thank you!

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**Austrian** 

