

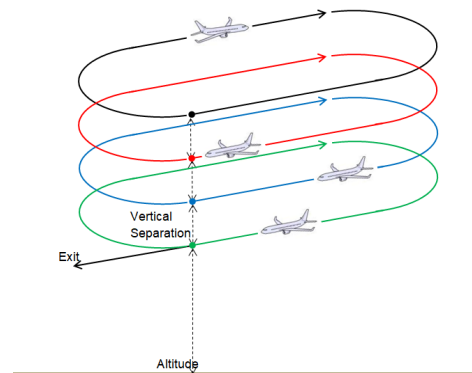


PJ25 Zurich arrivals streaming



Zurich-LSZH Context

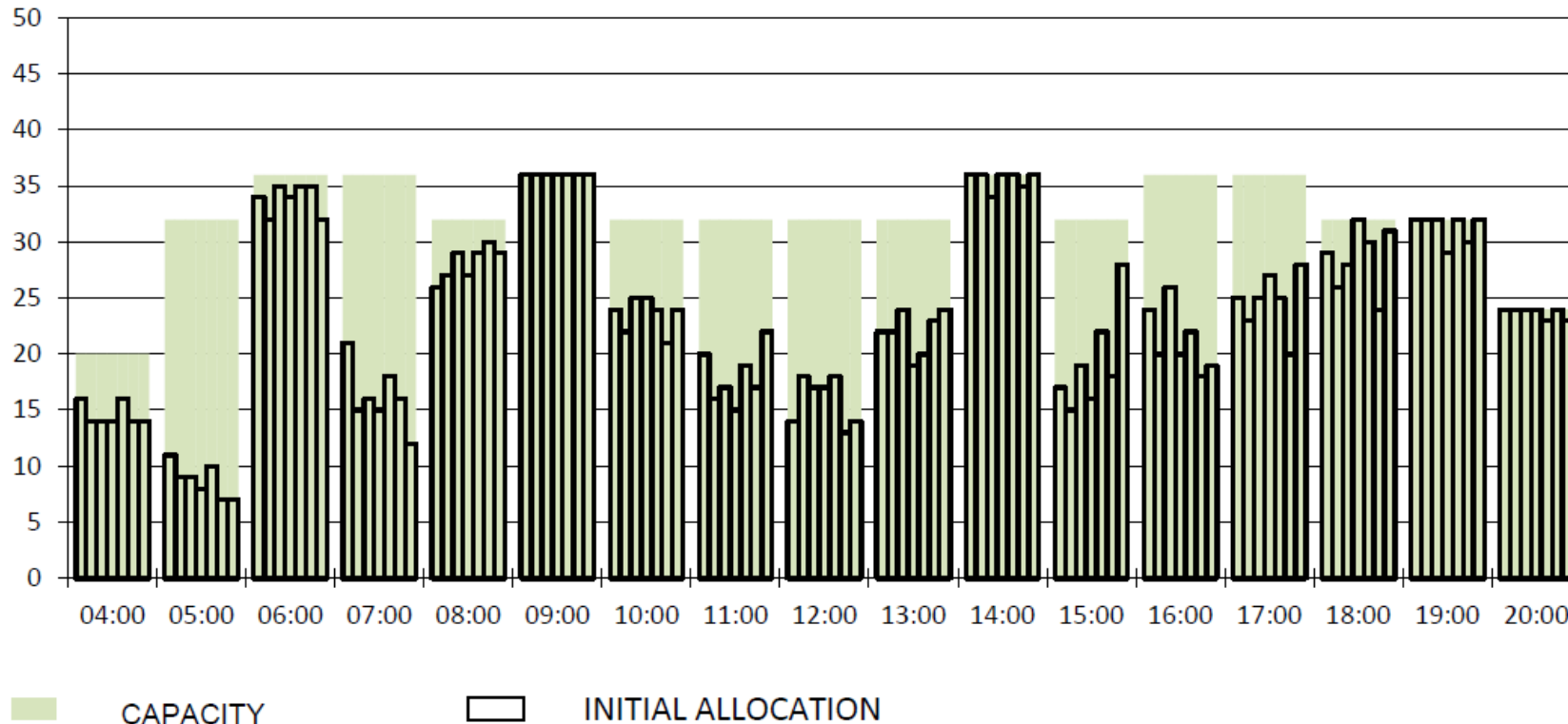
- Opening of the airport: no capacity-constrained situation, but inefficient paths!
- LSZH Early Wave 06.00-07:00 LT
 - Majority of long-hauls
 - Lots of connecting PAX
- Everyone wants to be 1st
 - Holding
 - Vectoring



Airport traffic demand

RUNWAY MOVEMENT INITIAL COORDINATION - ARRIVALS

Reference week, movements per hour - all times UTC



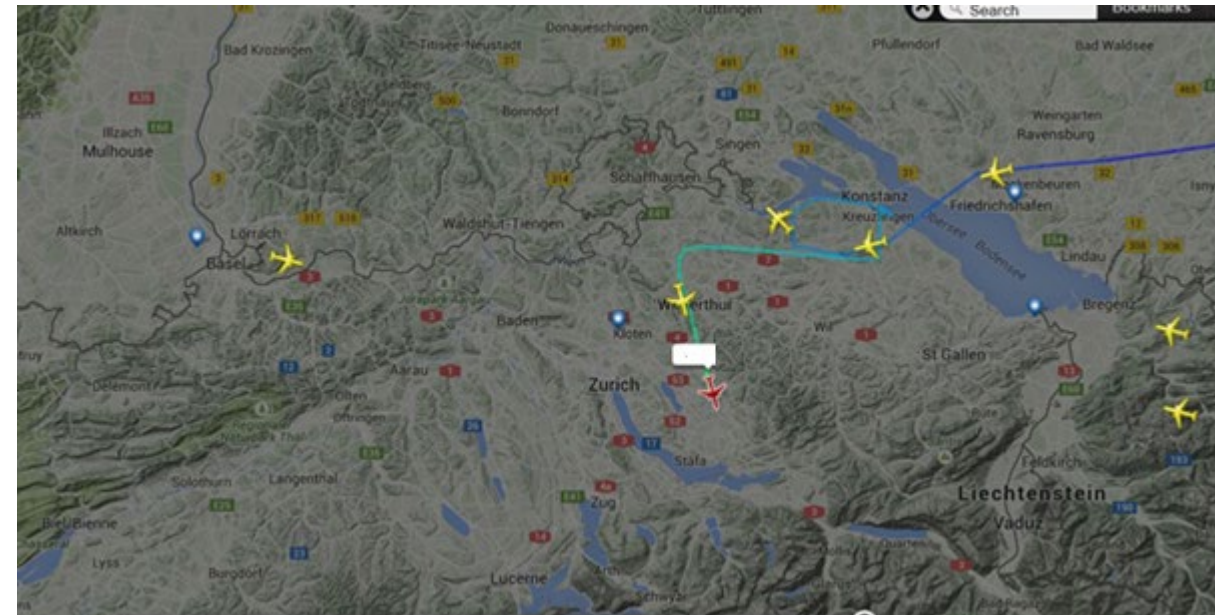
- Hub airport with important variations in the traffic demand flows during the day
- Wave of inbound flights followed by outbound wave creating a cycle of peaks and troughs in arrival demand
- To accommodate these traffic peaks → focus on smoothing the arrival wave considering the impacted departures



Examples of situations to be improved



June 8th 2015, 06:04 - not planned in the sequence and had to fly a 360 to get in



June 6th 2015, 05:56 LT Coming too early : had to fly a holding and caused following flights to be vectored



Historic

- Cooperation between SWISS, Zurich Airport and Skyguide to streamline the early arrivals
- 2014: Creation of the LSZH Early Wave procedure (“**Green wave**”) for Swiss long-haul inbound flights between 06.00-06.30 LT
 - Very good adherence to the TT at IAF
 - Flights arrive in LSZH lower airspace already sequenced, able to perform continuous descent
- 2015: **iStream**: extension to 06:00 – 07:00 LT + involvement of all airlines + strategic phase
- 2018: **PJ25** enhancement of iStream: involvement of NM and integration of short-hauls with API



iStream

- **Objective:**
 - Prevent holding/ATC-delay - contribute to smoother arrival sequencing
 - Reduction of CO2 and noise emissions of early-morning Zurich arrivals
 - Provide flexibility for Airlines' operations
- **How:**
 - Assign tactical time of arrival (TTA) to long haul flights
 - Aircraft operator able to exchange Target Times between its aircraft at arrival for more flexibility in operations
- **To achieve:**
 - Flight efficiency
 - 75% decrease in the time spent in holdings
 - Savings in CO2 emissions amount to 1 800 tonnes a year



iStream: a new process



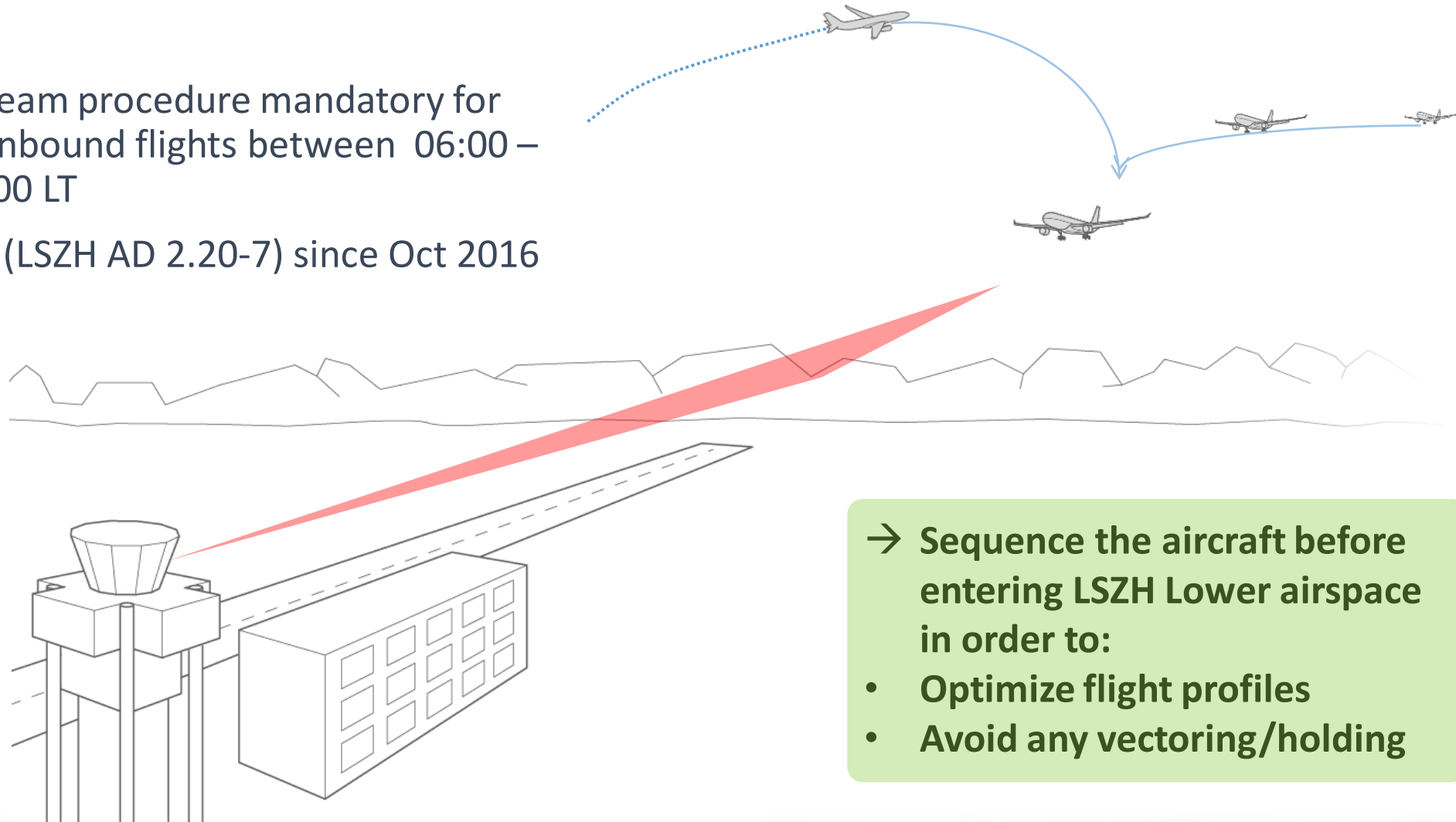
- ➔ **Collaboration with Airlines:** coordination for their Planned TOT
- ➔ **Strategic phase**
 - ➔ Provision of the Strategic arrival sequence on D-1
 - ➔ Sequence based on STA at ZRH: OCC to take into account the provided Target Times over the STAR entry to fill Operational Flight Plans
- ➔ **Tactical phase**
 - ➔ Provision of the updated arrival sequence 5 hours prior landing
- ➔ Procedures for Air Traffic Controllers do not change - ATC principle "**first come, first served**" prevails



iStream at LSZH

iStream procedure mandatory for all inbound flights between 06:00 – 07:00 LT

AIP (LSZH AD 2.20-7) since Oct 2016



- Sequence the aircraft before entering LSZH Lower airspace in order to:
- Optimize flight profiles
 - Avoid any vectoring/holding

Strategic Phase (D-1)

→ Support the process at an early stage: target Flight Planning and enable lower Cost Index flights, allowing greater range for in-flight adaptations

→ Sent out each day at 11:00 LT

skyguide Phases Documentations Administration Lacroix Anaïs

Destination LSZH / ZRH - Strategic Phase

Date 22.10.2016 Search by date Strategic sending is: On Sequence sent 21.10.2016 09:00

Calculated Sequence

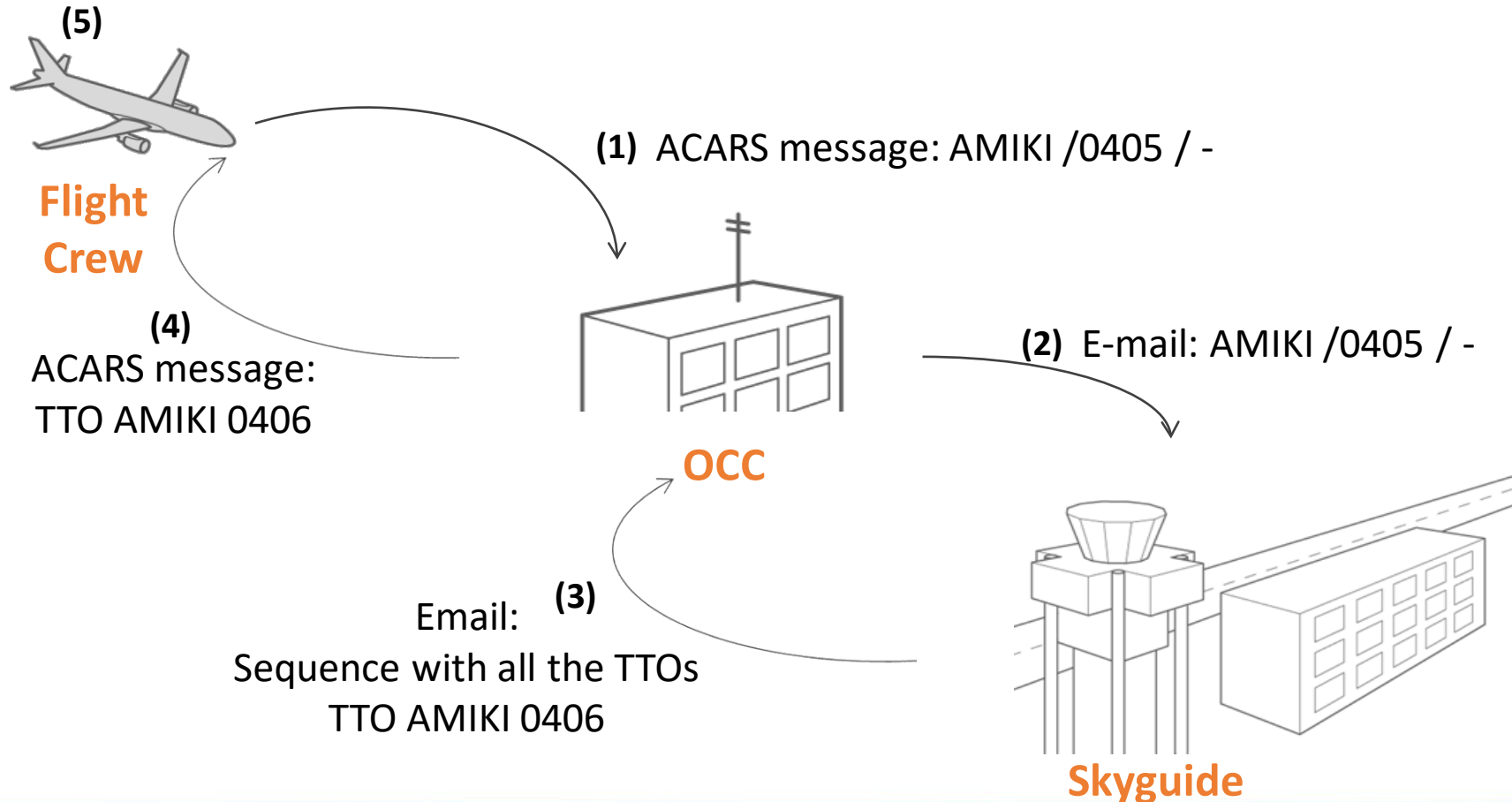
Order	Flight	Strategic Landing Time	Schedule Time of Arrival	Planning Time Frame
1	LX139	04:04	04:10	04:04 - 04:12
2	LX179	04:06	04:10	04:04 - 04:12
3	LX289	04:08	04:10	04:04 - 04:12
4	WK085	04:10	04:10	04:04 - 04:12
5	LX155	04:12	04:15	04:08 - 04:18
6	LX294	04:14	04:15	04:08 - 04:18
7	LX087	04:16	04:20	04:12 - 04:22
8	LX147	04:18	04:20	04:12 - 04:22
9	LX1179	04:20	04:25	04:16 - 04:26
10	LX243	04:22	04:25	04:16 - 04:26
11	CX383	04:25	04:30	04:22 - 04:32
12	LX2087	04:27	04:30	04:22 - 04:32
13	HBJGI	04:29	04:30	04:22 - 04:32
14	LX2801	04:40	04:45	04:35 - 04:45
15	EY073	04:45	04:50	04:40 - 04:50



Tactical Phase

Adaptation of the arrival slots when flights are getting airborne → reactivity of the arrival slot management depending on network/ops events

Consideration of the TTO and speed adjustments





Tactical Phase

- Update the arrival sequence based on the Estimates received by the Airspace Users
- Sent out each day at 1:40 LT

Destination LSZH / ZRH - Tactical Phase

Date22.10.2016



 Search by date

A synchronization with Network manager has been performed.

Sequence manually validated on 21.10.2016 23:33

Calculated Sequence

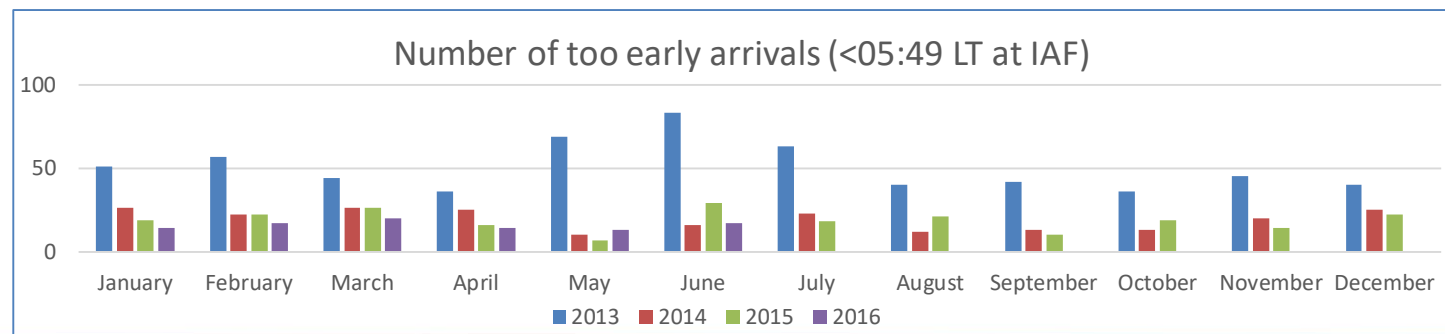
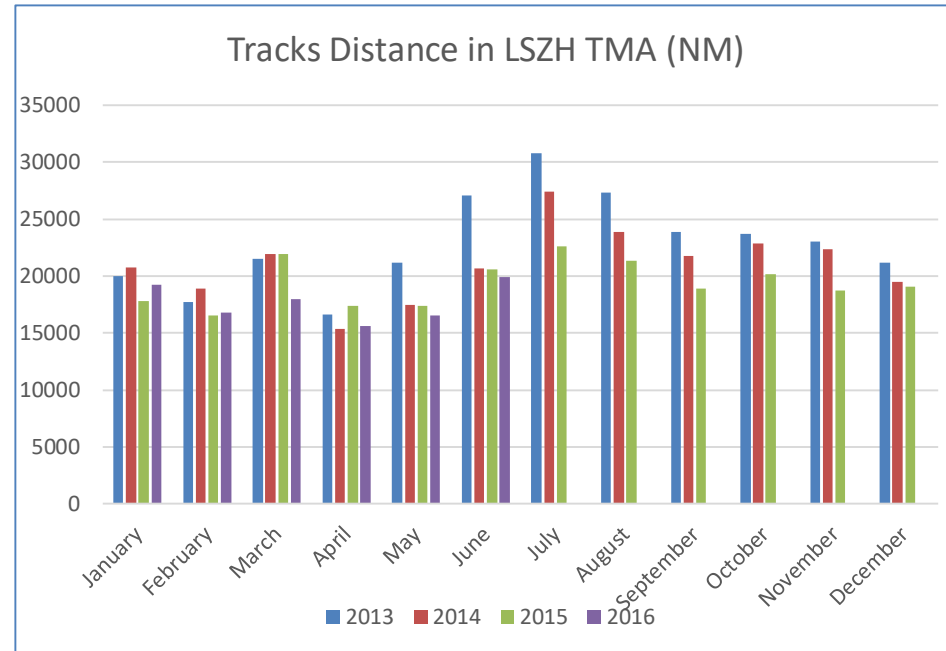
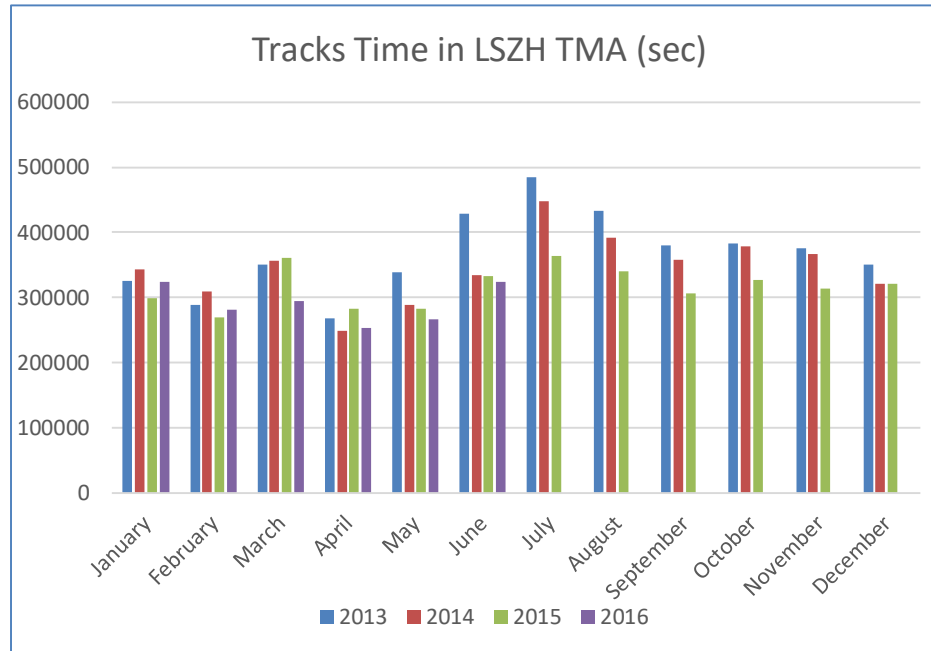
Sequence Number	Original Sequence Number	Estimated Landing Time	Flight	Initial Approach Fix	Crew preference	Target Time Over	Estimated Time Over
1	1	04:04	SWR179	AMIKI	-	03:53	03:53
2	2	04:06	SWR289	KELIP	-	03:52	03:52
3	3	04:08	SWR294	AMIKI	-	03:57	03:59
4	4	04:12	SWR155	AMIKI	-	04:01	04:05
5	5	04:14	EDW85	DOFIL	-	03:59	03:51
6	6	04:22	HBJGI	KELIP	-	04:08	04:02
7	7	04:25	SWR117R	RILAX	-	04:10	04:12
8	8	04:27	SWR2087	DOFIL	-	04:12	04:12
9	9	04:29	SWR243	AMIKI	-	04:18	04:19
10	10	04:39	ETD88V	AMIKI	-	04:28	04:28
11	11	04:46	SWR147	AMIKI	-	04:35	04:35
12	12	04:49	SWR44KX	GIPOL	-	04:39	04:39

Out of Window

Sequence Number	Estimated Landing Time	Flight	Initial Approach Fix	Crew preference	Estimated Time Over
#	05:24	ACA878	GIPOL	-	05:14



Tracks Time/Distance in TMA



iStream recommendations

- NM estimates for long-hauls not accurate → TTOs not achievable
- Necessity to integrate short-haul flights
- Involve NM in the process



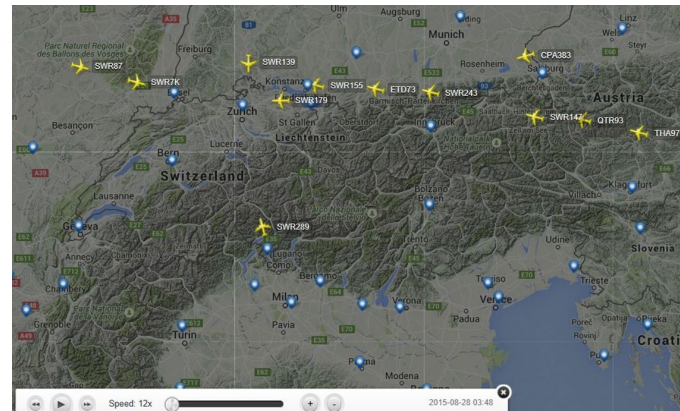
PJ25 XSTREAM

[Crossborder SESAR Trials for Enhanced Arrival Management]

Very Large Scale Demonstration - 2019



Objective	<ul style="list-style-type: none">• Follow-up of the iStream project, allowing for early sequencing of inbound traffic flows in accordance with specific Operational needs• Consideration of the ATM operations beyond the ATM world. Coordination with AO for the provision of specific Target times for sequencing purposes• Involvement of the Network Manager• EXE-VLD-08-003: Improved Arrival Planning Management & NM integration (iStream enhancement thanks to API)
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PJ25 scope

- **Objective:**
 - Provide efficient & sustainable early-wave arrival at Zurich airport
- **How:**
 - Full involvement of airlines
 - Aircraft operator able to exchange Target Times between its aircraft at arrival
 - Use NM B2B API service
- **To achieve:**
 - Benefit of Target Time for complete traffic flows, with comprehensive collaborative processes
 - Arrival Flexibility for Airspace Users

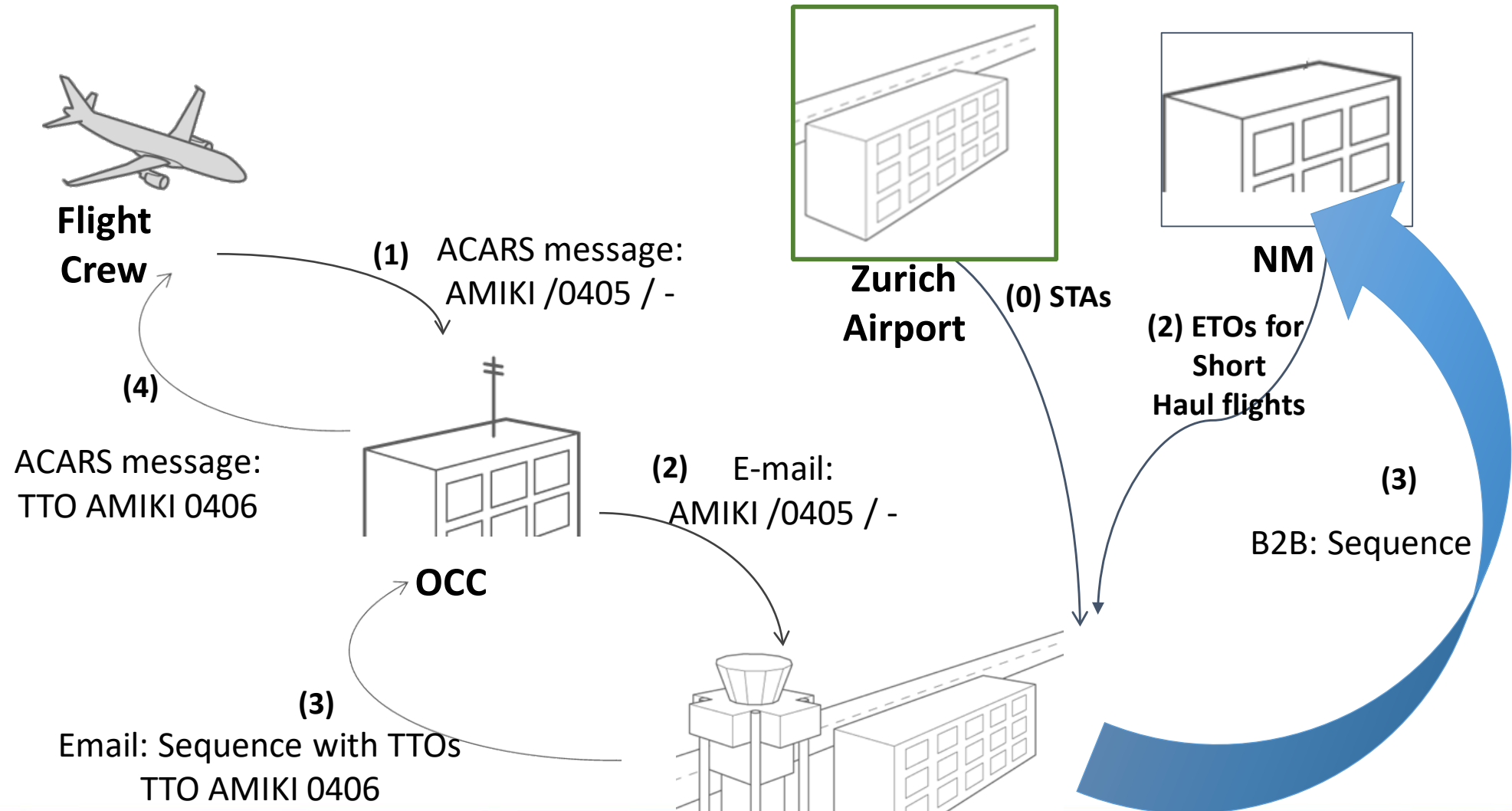


PJ25 Live Trials

- **Involvement of all – long & short hauls** flights within iStream timeframe
- **Involvement of NM:**
 - Arrival sequence sent to Network Manager using API B2B service:
 - API Target Time Over for long-hauls → update the ETFMS profiles (improve accuracy of long-haul flight profiles)
 - API Target Take Off for short-hauls + introduction of the MCP regulation. Flights assigned a CTOT slot compatible with their TTO at ZRH → optimize short haul's adherence
- The regulation of the short-haul flights to avoid these flights popping up in the established sequence. The arrival flow is expected to be smoother at the entrance of the APP sector
- AIP publication + Information to impacted AUs by e-mail
- API transparent to ATCOs



PJ25 updated process: involvement of NM

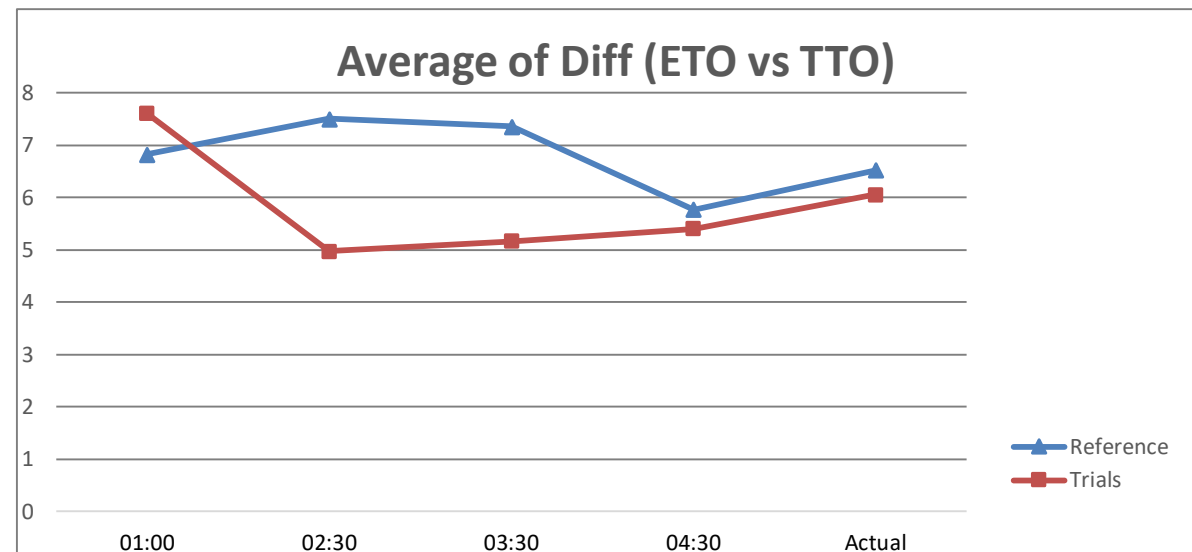


PJ25 – Results

Total ATFCM delay for Trial period due to MCP	66'	
Flights MCP-regulated	50	
Flights regulated/delay = 0	36	72%
Flights reg/delay > 0	14	28%
Flights delay > 15	0	

- Majority of flights had 0-minute delay

Total ATFCM delay for Trial period non-related to MCP	85
Flights regulated	7
Flights regulated/delay = 0	2
Flights reg/delay > 0	5
Flights delay > 15	3



- Accuracy of ETFMS profiles for long-haul flights outside ECAC area



Achievement



→ Early established sequence

→ Optimised flight profiles and landing spacing



PJ25 conclusions

- Optimised operations due to improved gate-to-gate planning → optimisation of fuel-burn and therefore of CO2 emissions per flight
- Optimised landing sequence: more efficient use of the available capacity
- Optimized Airspace Users operations → improved hub operations and passenger connections
- Automation necessary to ensure resilient and adaptable air traffic management procedures
- No added ATC workload: procedure transparent to ATCOs
- Generated delay supported the predictability of the short-hauls
- ATFM regulation's aspect which does not only provide a smoothing effect for air traffic control but also for the airline by pushing the flight closer to the scheduled arrival time



Going towards performant & sustainable environmental operations

- Improvement of Flight Predictability & Punctuality
- Facilitate ATC
 - Better usage of available capacity
 - Reduce tactical interventions
 - Green ATC delay
- Environment & Cost Efficiency
- Increase smooth arrivals
 - Avoid holdings/vectorings
 - Reduce fuel consumption
 - Reduce CO2 and noise emissions
 - Contribute to Continuous Descent Operations
- Flexibility for Airlines Operations





Thank you 😊
Questions ?



References

- [iStream Youtube video](#)
- [iStream Demonstration Report](#)
- [PJ25 Final Report](#)
- [SJU Communication about iStream](#)