

SAFELAND Final Dissemination Event Real Time Simulation

Barcelona 19 October, 2022 Joonas Lieb, DLR



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The **focus** of the RTS was on:

- Emergency Operating Procedure for pilot incapacitation (normal operations are out of scope)
- Roles and responsibilities of the different participants
- Task allocation (including between human and automation)
- Communication and Coordination between participants

General schedule



Slot	Description	Duration	
09:00- 09:45	Welcome and Brief	0:45	
09:45 - 10:30	Training	0:45	
10:30 - 10:45	BREAK		0:15
10:45 - 11:30	Simulation	Run 1 (incl. Post run questionnaire + Debriefing)	0:45
11:30 - 11:45		BREAK	0:15
11:45 -12:30		Run 2 (incl. Post run questionnaire + Debriefing)	0:45
12:30 - 13:30	Lunch		1:00
13:30 - 15:30	Debriefing (incl. Po	2:00	



RTS participants

- 1. Pilots from SWISS-> GSO
- 2. ATCOs from LFV -> ATCOs
 - > 1 pilot + 1 ATCO each day (5 days)

Other roles

- Single Pilot
- Cruise GSO
- Other ATS units
- NOC

-> SAFELAND Consortium



Simulation scenarios



Scenario 1: TMA

- Aircraft type: A321
- Departure Arrival: Zurich (LSZH) – Düsseldorf (EDDL)
- Flight Phase: About to enter TMA (FL120)
- Surrounding traffic:
 - Air traffic constructed based on recorded traffic at EDDL from 2019
 - 35 arrivals per hour

Scenario 2: En-route

- Aircraft type: A321
- Departure Arrival: Zurich (LSZH) – Kiev (UKKB)
- Flight Phase: About to enter a new sector in Hungarian airspace (FL330)
- Surrounding traffic:
 - Air traffic extracted from EUROCONTROL's DDR2 traffic data
 - Air traffic day recorded on 29.06.2019

Roles in RTS – TMA (Run 1)



Controller Working Position

- APP ATCO
- Other ATS units





GSO

(U-FLY)

U-FLY SW

Approach GSO

Ground Station Position





X-plane

Cockpit simulator

On-board Single Pilot



SAFELAND RTS

Roles in RTS – En-route (Run 2)



Skynet SW

Controller Working Position

- ACC ATCO
- Other ATS units





- Cruise GSO
- Stand-by GSO









19-10-22

Cockpit Simulator iSim



Touch-enabled fully functional A321 Cockpit Simulator

- Dual-Seat Simulation based on X-Plane 11
- Primary flight control hardware (Sidesticks, Padels, Flight Control Unit)
- 5 Displays with touchscreen for Overhead, Main Instrument and Pedestal Panel
- Touch enabled interactive Buttons, Lights, Knobs and Levers
- Normal and non-normal procedures possible with realistic failure modes
- Fully integrated into DLR-FL Simulation Infrastructure



Ground Control Station U-FLY



Generic Ground Control Station - U-FLY

- Human-machine interface (HMI) for the simultaneous supervision and guidance of multiple aircraft operated in controlled airspace with the following functions
 - 3D map view
 - Flight plan waypoint list
 - Attitude display and control
 - System pages for indication and control (incl. e.g. adapted Primary Flight Display, ECAM pages)
 - Remote access to AP functions and A/C configuration
 - Communication Display
 - Permanent ground-air intercom (during remote support)
 - PTT activated ground-ATC intercom



Controller Working Position CWP



Generic Controller Working Position

 CWP consists of a generic radar screen environment from the DLR tool platform *Skynet*

The main functionalities of the CWP:

- Display and monitor surrounding air traffic
- Overview of air traffic situation in the relevant sector
- Visualisation of actual position of each aircraft in the relevant sector
- Aircraft control (i.e. altitude, heading, speed changes) via datalink (if required)
- Voice communication with pilots via head-set





Assumptions



- All systems operating as expected
- **No delay** (in C2 link or communication)
- Onboard pilot health monitoring system capable of detecting incapacitation and automatically alerting the GSO and ATCO
- Surrounding traffic is datalink-equipped (no pseudo-pilots or read backs)
- ATC provides clearances via voice only to EMERG A/C
- After incapacitation, **autopilot engaged** automatically (i.e. a/c flies according to last FMS entry)
- Manual control from ground not foreseen (i.e. only high-level commands from ground to a/c, such as HDG, SPEED, ALT)
- Advanced Landing System is engaged during arrival (TMA run)
 - If not given any further inputs, a/c lands according to the last FMS entry
 - Secondary flight controls and the landing gear are operated automatically

Supporting material



SAFELAND RTS – GSO Checklist

Run 2 – En-route

CHECKLIST – Cruise GSO

PILOT INCAPACITATION

	TRY TO CONTACT SINGLE PILOT	DONE	
	CONFIRM PILOT INCAPACITATION	DONE	
	TAKEOVER A/C CONTROL	DONE	
	(4) Go to Flight Plan widget		
	(5) Click on "Control"		Īr
	(6) Wait until the system gives you control		-
	A/C STATE (ALT, SPD, HDG)	CHECK	
	FLIGHT PLAN/ NEXT WAYPOINT	CHECK	S
	DECLARE MAYDAY	DONE	D
	COMMUNICATE CONTROL FROM GROUND	DONE	(6
	COMMUNICATE START OF HANDOVER PROCESS TO ATC	DONE	ai
	REPORT READY FOR HANDOVER BRIEFING TO STBY GSO	DONE	d
	REPORT POSITION OF A/C	DONE	D
	REPORT FLIGHT LEVEL	DONE	h
	REPORT HEADING	DONE	٢
ing	ACKNOWLEDGE HANDOVER TO STBY GS	DONE	Т
	(1) Click on "OK" for handover on the pop-up window		co
	STATE "YOU HAVE CONTROL OF SWR1026"	DONE	

ig. Checklist GSO

SAFELANE ■ SAFELANE

Storyline

Please imagine you are an approach Air Traffic Controller (ATCO) in a future air traffic scenario (e.g. year 2030+) for Düsseldorf airport (EDDL). In this scenario some aircraft are single piloted aircraft, some are two piloted aircraft but none are unmanned aircraft vehicles. You monitor, control and handle all aircraft the same way and you control your approach sector as you would do it in today's operations (cf. Your tasks below). Approximately 35 flights per hour will land at Düsseldorf airport (EDDL) in the developed scenario.

Objective

he objective of this real-time simulation exercise is for you to experience the SAFELAND oncept for handling pilot incapacitation in future single pilot operations.

Your tasks

- Monitor, control and handle all aircraft on your radar screen
- Manage your sector as you would do it in today's operation
- Coordinate and communicate your actions with the PIC (as today)
- React to the simulated situation as you would react in today's operations

The scenario will take about 15-20min. Afterwards you will be asked to fill in a questionnaire and participate in debriefings and discussions.

Thank you for your participation!



- Training session for GSO and ATCO
- Simplified Checklist for all participants
- Instruction for all participants
- Script for roles simulated by SAFELAND participants

Run 2 - Pilot Incapacit. during CRUISE			g CRUISE				REPORT READY FOR H
				grey cell means: not listening to the communication/exchange taking place			REPORT POSITION OF REPORT FLIGHT LEVEI
No	Phase	SP (iSIM) Thomas/Matthias (DLR)	Cruise GSO (U-FLY1) Andreas Triska (SWISS)	Stand-by GSO (U-FLY2) Participant No 1 (SWISS)	ACC ATCO (CWP) Participant No 2 (LVF)	NOC Joonas (DLF	REPORT HEADING
	In Cruise	FL320; heading West -> East; before entering Hungarian Airspace {1-2 min}	Monitoring 4 a/c simultaneously, all sharing the same ATC frequency	On stand-by to support other GSO, including receiving an a/c in case of emergency.	Responsible for Hungarian airspace	Supporting	ACKNOWLEDGE HAND (1) Click on "OK
	1 scenario starts with a/c approaching Hungarian airspace and contacting ATC	Budapest Center, SWISS 1026, FL320 inbound PESAT, hello!	(listens in to exchange between SP and ATC)				Fig. Chec
	2				SWISS 1026, identified. Good day!		Ū
	3	INCAPACITATION TAKES PLACE Squawk 7700 Automation disables onboard controls and continues approach.	Cruise GSO receives the alert and the squawk 7700	receives squawk 7700, starts listening to comms between cruise GSO and SWISS 1026 in order to build up SA.	receives squawk 7700	receives sq	uawk 7700 (not implemented in RTS)
	4		(selects a separate line to talk exclusively to SWISS 1026 - other a/c and ATC not listening) SWISS 1026, this is your cruise ground station operator speaking: Please report your status				
	SAFE	LAND RTS	19-10-22			Fig. So	cript Run 2



Onboard Single Pilot

Responsibilities: Pilot in Command (PIC), responsible for flight safety and thus main decision-maker.

ATCO

Responsibilities: Ensures air traffic operation and management. Responsibilities are not expected to change compared to current operations.

Approach GSO – Run 1

Responsibilities: Support the PIC, contributing to a safe and efficient flight. Act as PIC after SP becomes incapacitated.

Cruise GSO – Run 2

Responsibilities: Support several single pilots, contributing to a safe and efficient flight. Act as PIC after SP becomes incapacitated until a/c is transferred to stand-by GSO.

Stand-by GSO – Run 2

Responsibilities: Become PIC after pilot incapacitation, responsible for flight safety and thus decision maker.



Approach GSO – Run 1

Responsibilities: Support the PIC, contributing to a safe and efficient flight. Act as PIC after SP becomes incapacitated.

Tasks before incapacitation

- Monitor aircraft systems and flight
- Monitor pilot's health
- Support the PIC upon request
- Cross-check and monitor SP actions
- Listen to communication between SP and ATC

Tasks after incapacitation detection

- Confirm pilot incapacitation
- Take over control of the aircraft
- Declare MAYDAY and communicate control from ground
- Communications with ATC
- Manage flight via high-level commands (HEAD, ALT, SPEED) until landing



ATCO

Responsibilities: Ensures air traffic operation and management. Responsibilities are not expected to change compared to current operations.

Tasks before incapacitation

- Issue clearances and instructions (if needed)
- Provide separation between controlled aircraft
- Communication/Coordination with SP

Tasks after incapacitation

- Same as before incapacitation
- Communication/Coordination with GSO
- Support GSO as needed
- Coordinate with ground services

Impressions







THANK YOU FOR YOUR ATTENTION

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Stand-by GSO – Run 2

Responsibilities: Become PIC after pilot incapacitation, responsible for flight safety and thus decision maker.

Tasks before incapacitation

Monitor several A/C

Tasks after incapacitation

- Receive control of aircraft from Cruise GSO
- Build Situation Awareness
- Decide for suitable alternate airport with NOC support
- Manage flight via high-level commands (HEAD, ALT, SPEED) or FPL changes
- Communications with ATC



Onboard Single Pilot

Responsibilities: Pilot in Command (PIC), responsible for flight safety and thus main decision-maker.

Tasks before incapacitation

- Manage flight until incapacitation
- Communication and coordination with ATC and GSO, as needed

Tasks after incapacitation

• N/A



ATCO

Responsibilities: Ensures air traffic operation and management. Responsibilities are not expected to change compared to current operations.

Tasks before incapacitation

- Issue clearances and instructions (if needed)
- Provide separation between controlled aircraft
- Communication/Coordination with SP

Tasks after incapacitation

- Same as before incapacitation
- Communication/Coordination with GSO
- Support GSO as needed
- Coordinate with ground services



Cruise GSO (not a participant) – Run 2

Responsibilities: Support several single pilots, contributing to a safe and efficient flight. Act as PIC after SP becomes incapacitated until a/c is transferred to stand-by GSO.

Tasks before incapacitation

- Monitor several aircraft systems and flights
- Monitor pilots' health
- Support the PICs upon request
- Cross-check and monitor SP actions
- Listen to communication between SP and ATC

Tasks after incapacitation detection

- Confirm pilot incapacitation
- Takeover control of the aircraft
- Declare MAYDAY and communicate control from ground
- Manage flight via high-level commands (HEAD, ALT, SPEED) or FPL changes (if needed)
- Hand over control to stand-by GSO
- <u>Communications with ATC and stand-by GSO</u>



- Explain role of the NOC and what NOC did in RTS -> info about weather conditions, RWY, etc
- Explain role of all other ATC Units
- This presentation should be coordinated with DBL (Results), so that attendees understand the comments made by the participants (e.g., issues with GS)