	**HoliDes** **Holi**stic Human Factors **Des**ign of Adaptive Cooperative Human-Machine Systems	

Deliverable 7.1: WP7 Requirements

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Authors:	Zdenek Moravek, HON Maros Raucina, HON Frank Rister, TRS

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1 Overview

This document is the result of the analysis made by the WP7 group for the definition of methods in the assessment of target scenarios, use cases and requirements in the aeronautical domain. The document is an overview of data gathered in other documents

- Use-case descriptions
  - HoliDes-WP7-D7_1-AppendixB-HON_use-case
  - HoliDes-WP7-D7_1-AppendixD-TRS_use-case
- Requirements description
  - HoliDes-WP7-D7_1-AppendixA-HON_requirements
  - HoliDes-WP7-D7_1-AppendixC-TRS_requirements

2 Use case description

WP7 concerns two main AdCoS applications:

(1) Automated planning of diversion airport in case of emergency (HON)
(2) Adaptive flight simulator transition training (TRS).

The applications are electronic flight bag based tools. Electronic Flight Bag (EFB) is an electronic device (aircraft mounted or a tablet) used for information management with ultimate goal to remove paper from the cockpit. Paper charts, reports and various calculators used by pilots to plan their flight are being continuously replaced by software EFB applications.

The EFBs are divided into several hardware classes differing in the criticality of applications which can be hosted by them (EASA TLG-36). The most frequently used EFBs are hardware classes 1 and 2, which do not require certification and the applications which are hosted by these hardware classes are of low safety criticality. In spite of these requirements EFBs may still host safety beneficial features, which can be understood as any type of functions or application which decrease the probability of occurrence of a hazardous situation. These EFB platforms, even those using hardware originating in consumer electronic (e.g. iPads) are becoming a popular target for software developers and who are introducing even applications which are unrelated to the original intent to remove paperwork from the flight deck.

The ecosystem of applications is variable with respect to the quality of performance and user interface. There are no accepted standards and no

common practices to apply reasonable human factors approach. HoliDes project is a standpoint that may change the situation. By selecting a substantially complex use-case with appropriate and numerous human factors touch points, a set of good practices can be defined.

2.1 Use-case 1: Airport diversion assistant (HON)

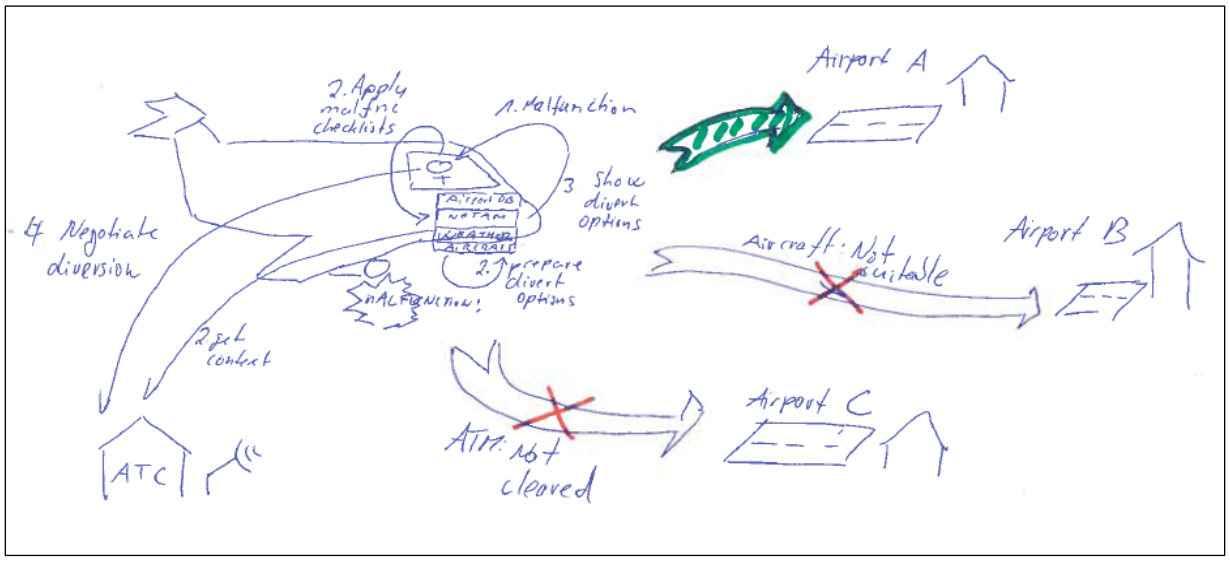


Figure 1: Airport diversion use-case

Such a use-case can be the automated planning of diversion in case of emergency. The use-case is triggered by a malfunction emerging in an acraft and takes the following steps (also see Figure 1):

1. On-board system (AOS) detects a malfunction and alerts the crew. It dispatches the information to MAV AdCoS (MAdCoS).

2. Pilots follow malfunction checklists. At the same time, MAdCoS decides whether it should take over the task 'look-up a diversion airport' and if yes, it evaluates diversion options.

2a. NOTAM module updates information about airports within range.
2b. Weather module determines obstacles and weather related issues.
2c. AOS determines ability of aircraft to reach and land on available destinations.

2d. Optimization module combines all pieces of information and sorts applicable destinations with respect to priority.

3. MAdCoS displays diversion options.

4. Pilots communicate diversion options to ATC and ATC issues clearance for the selected diversion airport.

2.2 Use Case 2: adaptive flight simulator transition training (TRS)

Transition training in a flight simulator is used to train pilots, who have previously qualified for a different aircraft type, onto a new aircraft type. Nowadays, such training courses do not account for the previous experience a pilot might have gathered on other aircraft types. Instead, all pilots, regardless whether they train for their first complex aircraft type or whether they have flown ten-thousands of hours on similar aircraft, undergo the same amount of training with the same contents. The respective FAA and/or EU-regulations determine the latter.

In HoliDes, pure regulation-based training will be modified by the application of tools provided from WPs 1-5 and the resultant RTP. As a result, a model-based, adaptive training model and training tool is projected to be the outcome. Such a model and tool will enable to adapt training programs according to the trainee's experience and skills. The improvement of the quality of such a training, as well as time-saving is the expected perceptive. In order to comply with the vast array of regulations for flight crew licensing, our requirements for WP7 were in great parts driven by such regulations. Those are referenced in the requirements tables.

As outlined in the introduction, we focus on a pilot (trainee), or crew of two pilots (trainees), who are experienced and qualified to operate a certain aircraft type and require raining to qualify for the operation of a different aircraft type.

Figure 2 shows how the user experience (e.g. commonalities between the 2 aircrafts), regulations and in the end the trainee's progress during the training are addressed by a tool which is founded on the above plus the available tools from the RTP to focus a qualitatively better training by an adaptive training tool and program modelling tool.

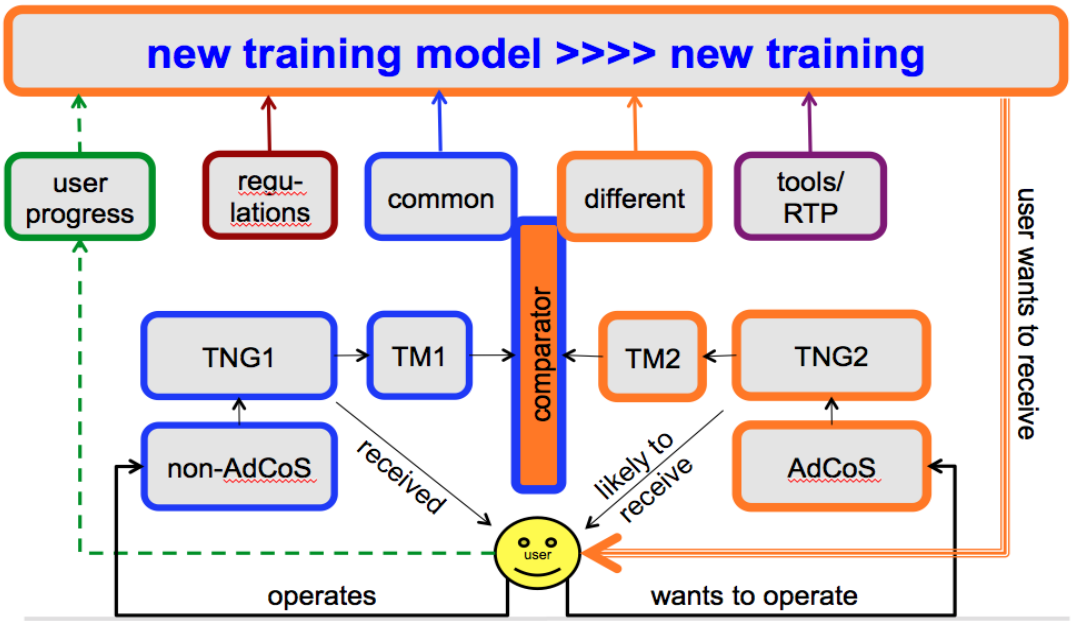


Figure 2: Scheme of the use-case for adaptive flight simulator transition training

3 Requirements

The structure of WP7 group allows for approaching the use-cases from diverse points of view such as

- physiological state inference of pilot's workload
- physiological aspects of usability
- procedure modeling
- certification aspects
- validation strategies
- large data processing

These technologies extend the main use-cases and create a tree of derived use-cases that will be fully specified during the first cycle of the project.

Initial set of requirements has been collected during the first three months of the project and these requirements are in detail described in the Appendixes:

- HoliDes-WP7-D7_1-AppendixA-HON_requirements
  - for airport diversion assistant
- HoliDes-WP7-D7_1-AppendixC-TRS_requirements
  - for adaptive flight simulator transition training

AdCoS Specific (AdCoS) / RTP General (RTP)	ID	Name	Definition	Rationale	Workpackage relevance	Relevance	Development Process Step	Classification	Type	Proof	Responsibility	Author
AdCoS	WP7_HON_AERO_REQ1_v0.1	System hardware classification	The system will use a hardware which can be operationally approved as Electronic Flight Bag Class 2	The system is supposed to represent a portable flight crew information management system (decision support tool); the Electronic Flight Bag is an ideal candidate as it does not required certification, only operational approval.	WP7	H	AD	HW	N	Inspection	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ2_v0.1	System hardware control type	The system will use a touch screen tablet hardware	The system will use a common tablet solution which is used in the aerospace market as Electronic Flight Bag of Class 2 (e.g. iPad)	WP7	M	AD	HW	N	Inspection	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ3_v0.1	Aircraft connectivity	The system requires connectivity to the aircraft systems via certified aircraft connection device	The system requires connectivity to obtain relevant data to ensure intended functionality; this component is a pre-requisite and not part of the AdCoS (for purposes of the project a non-certified aircraft connection device will be used).	WP7	H	AD	HW, SW	F	Inspection	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ4_v0.1	Ground data connectivity	The system requires connectivity to the ground aerospace data services for continuous data uplink	The system requires ground services data connectivity to ensure the intended functionality; development of the communication device between ground and aircraft will not be part of the AdCoS (standard communication hardware and protocols will be used in AdCoS development).	WP7	H	AD	HW, SW	F	Inspection	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ5_v0.1	Operative flight phase	The system should be operative in climb, cruise, descent, and approach flight phases.	The system is supposed to aid the pilot in selection of optimal deviation airport in all flight phases except for taxi, take-off, and landing.	WP7	M	AD	SW	O	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ6_v0.1	Access to FMS flight plan	The system should have access to FMS flight plan.	The FMS flight plan is required to continual assessment of available deviation options and generation of pre-prepared solutions.	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ7_v0.1	Access to current aircraft position	The system should have access to current aircraft position.	The current aircraft position is required for identification of airports in the vicinity.	WP7	H	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ8_v0.1	Access to active flight leg	The system should have access to active flight leg.	The active leg is required due to the limitations of the display (cannot display ownship position in-flight) and provision of feedback that the system operates with currect values.	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ9_v0.1	Access to gross aircraft weight	The system should have access to gross aircraft weight.	Gross weight is required for determination of the current aircraft perfomance parameters with help of the aircraft performance tables.	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ10_v0.1	Access to the current flying range	The system should have access to current flying range.	The flying range is required for evaluation of the convenient deviation airport which depends on the flying range of the aircraft.	WP7	H	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ11_v0.1	Access to the Crew Alerting System messages	The system should have access to Crew Alerting System messages.	The access to the crew alerting system is required to identify the current context by the system (e.g. Engine failure, loss of hydraulics, etc.).	WP7	H	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ12_v0.1	Access to navigation database	The system should have access to navigation database.	The navigation database is required for proper re-routing and generation of the route based on the charts.	WP7	H	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ13_v0.1	Access to standard operating procedures	The system should have access to standard operating procedures.	Standard operating procedures are required for understanding the current context of the flight.	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ14_v0.1	Access to emergency procedures	The system should have access to emergency procedures.	The emergency procedures are required for displaying and optional verification of the flight crew actions taken in case of emergency.	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ15_v0.1	Access to aircraft performance model	The system should have access to aircraft performance model	The access to aircraft performance model is required for matching the current aircraft status with the aircraft performance to determine the correct flight model.	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ16_v0.1	Access to pilot task model	The system should have access to pilot task model	The pilot tas model should be available to evaluate the context and convience of decision aid presentation	WP2	L	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ17_v0.1	Access to AIS/MET information	The system should have access to AIS/MET information.	AIS/MET information is required for evaluation of the deviation airport options; this includes for example: visibility conditions at the airport or runway contamination, runway shortage or obstacles.	WP7	H	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ18_v0.1	Access to electronic approach charts	The system should have access to electronic approach charts.	The electronic charts are required to properly plan the route according to the standard routes and proper identification of flight procedures; for example minimum sector altitude, etc..	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ20_v0.1	Access to electronic airport diagrams	The system should have access to electronic airport diagrams.	The airport diagrams are required for proper identification of airport conditions and facilities; for example runway lenght.	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ21_v0.1	Data exchange between applications	The system should provide infrastructure for data sharing between applications on the platform	b	WP1	H				Validation		

AdCoS Specific (AdCoS) / RTP General (RTP)	ID	Name	Definition	Rationale	Workpackage relevance	Relevance	Development Process Step	Classification	Type	Proof	Responsibility	Author
AdCoS	WP7_HON_AERO_REQ21_v0.1	Displaying lateral map	The system should display lateral map.	The lateral map is required to provide georeferenced navigational cues; the map type is yet to be identified (geopolitical, terrain elevation, etc.).	WP7	H	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ22_v0.1	Displaying vertical profile	The system should be capable of displaying vertical profile.	The system displays the vertical profile to provide feedback to the user and optiona re-evaluation of the solution; pre-requisite of displaying of the vertical profile is existence of the flight plan in the system.	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ23_v0.1	Displaying navigation points	The system should display navigation points including airports.	The navigation points and airports are optionally displayed to provide the user with sufficient situation awareness.	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ24_v0.1	Displaying flight plan	The system should display flight plan.	The flight plan is displayed to provide the user with comfortable view on the flight and georeferenced possible deviation airports in the vicinity.	WP7	H	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ25_v0.1	Displaying active leg	The system should display the current active leg.	The active leg is displayed for provide feedback to the user about the functionality of the system.	WP7	M	AD	SW	F	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ26_v0.1	Displaying AIS/MET information	The system should display AIS/MET information.	The system displays AIS/MET information to provide the pilot with sufficient information to re-evaluate the solution and to keep the user in the loop.	WP7	H	AD	SW	F	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ27_v0.1	Displaying advisories	The system should display list of recommended actions to be taken by the pilot.	The system will display advisories to decrease workload and increase efficiency of the decision and pilot comfort in emergency situations.	WP1	H	AD	SW	F	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ28_v0.1	Displaying reasons for given advisory	The system should accompany the provided solution with explanation on why it was selected.	The system will display explanation of the provided decision aid to keep the user in the loop and optional re-evaluation of the solution.	WP1	M	AD	SW	F	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ29_v0.1	Optimal advisory	The system should provide optimal solution in no less than 95% cases.	The minimal system performance is yet to be defined, but the starting reliability will be at 95% cases.	WP4, WP5	M	AD/V	SW	O	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ30_v0.1	Human machine interface consistency	The system should provide a consistent and intuitive user interface, within and across the various hosted applications; including, but not be limited to, data entry methods, colour-coding philosophies, and symbology.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2	H	AD/V	SW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ31_v0.1	Legibility of text	Text displayed on the EFB should be legible to the typical user at the intended viewing distance(s) and under the full range of lighting conditions expected on a flight crew compartment, including use in direct sunlight.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2, WP3, WP4	H	AD/V	SW, HW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ32_v0.1	Adjustability of brightness	Users should be able to adjust the screen brightness of an EFB independently of the brightness of other displays on the flight crew compartment. In addition, when automatic brightness adjustment is incorporated, it should operate independently for each EFB in the flight crew compartment.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2, WP3, WP4	H	AD	SW, HW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ33_v0.1	Control components illumination	Buttons and labels should be adequately illuminated for night use.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2, WP3, WP4	H	AD/V	SW, HW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ34_v0.1	Controls components labeling	All controls should be properly labelled for their intended function; consideration should be given to the long-term display degradation as a result of abrasion and ageing.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2, WP3, WP4	H	AD	SW	N	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ35_v0.1	Input devices	Applicants should consider the type of entry to be made and flight crew compartment environmental factors, such as turbulence, that could affect the usability of that input device. Typically, the performance parameters of cursor control devices should be tailored for the intended application function as well as for the flight crew compartment environment.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP7	H	AD/V	SW	N	Validation	HON	Jiri Vasek

AdCoS Specific (AdCoS) / RTP General (RTP)	ID	Name	Definition	Rationale	Workpackage relevance	Relevance	Development Process Step	Classification	Type	Proof	Responsibility	Author
AdCoS	WP7_HON_AERO_REQ36_v0.1	Consistency with flight deck applications	Whenever possible and without compromising innovation in design/use, EFB user interfaces should be consistent with the other flight deck avionics applications with regard to design philosophy, look and feel, interaction logics and workflows.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP7	H	AD	SW	N	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ37_v0.1	General use of colours	If warning, caution, or advisory lights are installed in the cockpit, they must, unless otherwise approved by the Administrator, be: (a) Red, for warning lights (lights indicating a hazard which may require immediate corrective action); (b) Amber, for caution lights (lights indicating the possible need for future corrective action); (c) Green, for safe operation lights; and (d) Any other color, including white, for lights not described in paragraphs (a) through (c) of this section, provided the color differs sufficiently from the colors prescribed in paragraphs (a) through (c) of this section to avoid possible confusion. (e) Effective under all probable cockpit lighting conditions.	Required by 14 CFR 23.1322 - Warning, caution, and advisory lights.	WP7	H	AD	SW	N	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ38_v0.1	EFB specific use of colours	Colour 'red' is to be used only to indicate a warning level condition. 'Amber' is to be used to indicate a caution level condition. Red and amber colours should be limited and considerate. Any other colour may be used for items other than warnings or cautions, providing that the colours used, differ sufficiently from the colours prescribed to avoid possible confusion.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP7	H	DD	SW	N	Validation	HON	Jiri Vasek
AdCoS	WP7_HON_AERO_REQ39_v0.1	Messages displaying	EFB messages and reminders should be integrated with (or compatible with) presentation of other flight crew compartment system alerts. EFB messages, both visual and auditory, should be inhibited during critical phases of the flight. Flashing text or symbols should be avoided in any EFB application.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP7	H	AD	SW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ40_v0.1	Messages prioritization	Messages should be prioritised and the message prioritisation scheme evaluated and documented. Additionally, during critical phases of the flight, required flight information should be continuously presented without un-commanded overlays, pop-ups, or pre-emptive messages, excepting those indicating the failure or degradation of the current EFB application.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2	H	AD	SW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ41_v0.1	System error messages displaying	If an application is fully or partially disabled, or is not visible or accessible to the user, it may be desirable to have a positive indication of its status available to the user upon request. Certain non-essential applications such as e-mail connectivity and administrative reports may require an error message when the user actually attempts to access the function rather than an immediate status annunciation when a failure occurs.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2, WP3	H	AD	SW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ42_v0.1	System status messages prioritization	EFB status and fault messages should be prioritised and the message prioritisation scheme evaluated and documented.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2, WP3	H	AD	SW	N	Validation	HON	Jiri Vasek

AdCoS Specific (AdCoS) / RTP General (RTP)	ID	Name	Definition	Rationale	Workpackage relevance	Relevance	Development Process Step	Classification	Type	Proof	Responsibility	Author
RTP	WP7_HON_AERO_REQ43_v0.1	Data entry screening and error messages	If user-entered data is not of the correct format or type needed by the application, the EFB should not accept the data. An error message should be provided that communicates which entry is suspect and specifies what type of data is expected. The EFB system should incorporate input error checking that detects input errors at the earliest possible point during entry, rather than on completion of a possibly lengthy invalid entry.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP1	H	AD	SW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ44_v0.1	Flight crew error	The system should be designed to minimise the occurrence and effects of flight crew error and maximise the identification and resolution of errors; for example, terms for specific types of data or the format in which latitude/longitude is entered should be the same across systems. Data entry methods, colour-coding philosophies, and symbology should be as consistent as possible across the various hosted EFB applications. These applications should also be compatible with other flight crew compartment systems.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP1	H	AD/V	SW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ45_v0.1	Identifying failure modes	The EFB system should be capable of alerting the flight crew of probable EFB system failures.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2	H	AD	SW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ46_v0.1	Responsiveness of application	The system should provide feedback to the user when user input is accepted. If the system is busy with internal tasks that preclude immediate processing of user input (e.g. calculations, self-test, or data refresh), the EFB should display a 'system busy' indicator (e.g. clock icon) to inform the user that the system is occupied and cannot process inputs immediately. The timeliness of system response to user input should be consistent with an application's intended function. The feedback and system response times should be predictable to avoid flight crew distractions and/or uncertainty.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP1	H	AD	SW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ47_v0.1	Off-screen text and content	If the document segment is not visible in its entirety in the available display area, such as during 'zoom' or 'pan' operations, the existence of off-screen content should be clearly indicated in a consistent way. For some intended functions it may be unacceptable if certain portions of documents are not visible. This should be evaluated based on the application and intended operational function.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP4	H	AD/V	SW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ48_v0.1	Active regions	Active regions are regions to which special user commands apply. The active region can be text, a graphic image, a window, frame, or other document object. These regions should be clearly indicated.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2, WP3	H	AD	SW	N	Validation	HON	Jiri Vasek
RTP	WP7_HON_AERO_REQ49_v0.1	Flight crew workload	The positioning and procedures associated with the use of the EFB should not result in unacceptable flight crew workload. Complex, multi-step data entry tasks should be avoided during take-off, landing, and other critical phases of the flight. An evaluation of the EFB intended functions should include a qualitative assessment of incremental pilot workload, as well as pilot system interfaces and their safety implications.	Required by draft proposal Acceptable Means of Compliance (AMC) 20-25 Airworthiness and operational criteria for the approval of Electronic Flight Bags (EFBs); Appendix D - HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS	WP2, WP3	H	AD	SW	N	Validation	HON	Jiri Vasek

AdCoS Specific (AdCoS) / RTP General (RTP)	ID	Name	Definition	Rationale	Workpackage relevance	Relevance	Development Process Step	Classification	Type	Proof	Responsibility	Author
AdCoS	WP7_HON_AERO_REQ50_v0.1	Multiple devices support	The EFB system has to allow connection at least two devices (tablets) for CPT and FO sides.	Multiple devices is necessary as one display is for CPT and one for FO side. It is even suitable (at least for some HF experiments) to utilize another one mountable in between. It is useful to have standalone device as a monitor or control station for a person running an experiment	WP7	H	AD	SW/HW	F	Inspection	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ51_v0.1	Multiple devices consistency	The EFB system has to present consistent information on connected devices (tablets)	Information presented to pilots have to be consistent on all devices. An actions (inputs) done by CPT has to be immediatelly propagated to FO and vice versa.	WP1	H	DD	SW	F	Validation	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ52_v0.1	Multiple devices cooperation	The EFB system has to allow cooperative tasks distributed between connected devices	An application may differ in outputs/inputs for pilot flying and pilot monitoring to support their cooperative tasks	WP1	H	DD	SW	F	Validation	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ53_v0.1	Client - Server architecture	The EFB system has to have one server application processes and external data I/O	The client - server architecture is well known proved concept to keep applications consistency in multidevices environment. It is not acceptable to get wired all devices directly to avionic. Instead it seems suitable to have one connected embeded device as a server terminating all data access (both to avionics and ground). The devices shall be connected to the server to provide GUI.	WP1	H	AD	SW/HW	F	Inspection	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ54_v0.1	Data logging	It has to be possible to save received and computed data for offline debug and operational analyzes	It is suitable to have an efficient system for storing data received and generated by the applications. The data are useful for offline analyses, evaluation or even replaying of applications behaviour. The data shall be stored on server filesystem or send via TCP/IP to a remote machine	WP4	M	SI/V	SW/HW	O	Validation	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ55_v0.1	Tracing	SW runtime traces have to be saved in error, warning, info and detail level for debug and testing purposes. The levels has to be switchable during runtime	The applications behaviour is traced to files. Trace points are inherent in source code. The error messages are emited in unsolvable situation, warnings are use for unexpected but solvable situations. The info messages are for key events and detail level is the most verbose used for tiny details of running application. The trace files are used for debug purposes. In normal operation the only error level is switched on	WP4	M	LLT/LLI	SW/HW	O	Validation	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ56_v0.1	Authentication/authorization	User authentication and authorization has to be supported	An access to the system has to be authenticated (verification of a user's identity) and authorized (the user has granted access to a particular functionality). For example the only CPT has access to write something.	WP1	M	DD	SW	F	Inspection	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ57_v0.1	SW portability	SW has to be portable between main device platforms on the market	It is too risky to develop SW runable only on one platform. The SW shall be portable to Windows, Android, Linux and iOS devices	WP1	H	DD	SW/HW	NF	Inspection	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ58_v0.1	Screen adaptability	Applications shall adapt to different screen resolution and screen size	There is a lot of platforms on the market, so the GUI shall not be bound to a definite resolution. Instead it shall be adaptable dynamically to host platform	WP3	M	AD	SW/HW	F	Inspection	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ59_v0.1	System scalability	A versatile plug-in system have to be developed to host miscellaneous components enabled/disabled during flight phases	The world of EFB is evolving rapidly so we have to avoid rigid solutions. The EFB system shall allow fast deployment of loosely coupled components with high level of reusability. The components shall be easily replaceable by another version or even implementation without significant impact on rest of the system	WP1	H	AD	SW	F	Inspection	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ60_v0.1	Data encryption	Data sent wireless has to be encrypted	The data sent wireless may contain sensitive data. It seems suitable to encrypt the communication to prohibit an eavesdropping	WP1	L	DD	SW	O	Inspection	HON	Frantisek Mikulu
RTP	WP7_HON_AERO_REQ61_v0.1		Users should be able to identify the currently active application	Required by Human Factors Design Considerations in the Design and Evaluation of Electronic Flight Bags	WP2, WP3	H		SW		Validation	HON	Martin Dostal
RTP	WP7_HON_AERO_REQ62_v0.1		User should be informed when exiting application that has pending activities	Required by Human Factors Design Considerations in the Design and Evaluation of Electronic Flight Bags	WP2, WP3	H		SW		Validation	HON	Martin Dostal
RTP	WP7_HON_AERO_REQ63_v0.1		User activities not directly related to the flight tasks should be minimzed	Required by Human Factors Design Considerations in the Design and Evaluation of Electronic Flight Bags	WP2, WP3	H		SW		Validation	HON	Martin Dostal
RTP	WP7_HON_AERO_REQ64_v0.1	Flight crew workload	Required flight information should be presented continuously without unintended dialogs, pop-ups or overlays	Required by Human Factors Design Considerations in the Design and Evaluation of Electronic Flight Bags	WP3	H		SW		Validation	HON	Martin Dostal

AdCoS Specific (AdCoS) / RTP General (RTP)	ID	Name	Definition	Rationale	Workpackage relevance	Relevance	Development Process Step	Classification	Type	Proof	Responsibility	Author
RTP	WP7_HON_RTP_REQ65_v0.1	Requirement versioning and tracking	RTP shall provide mechanisms for tracking requirements to CASE tools and for reviewing so that a process of requirement, specification and review is unified.	Review of requirements may become an iterative process, in which several persons in different locations discuss a problem. It is advantageous to keep track of the discussions as it describe the proces sof evolution of a requirement. At the same time, it is needed to see how a requirement is considered in phase of specification and implementation to easily see whether and how it was fulfilled.n item	WP1	M	AD	COM	NF	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ66_v0.1	Complex visualization	Create a common GUI that will allow to show dynamics logs, physiology recordings, event lists etc. at one time and that will allow for annotations of a situation.	Analysis of experiments takes many different data channels to be evaluated at a time. A possibility to see them at one common GUI will decrease time and frustration.	WP4, WP5	L	V	SW	NF	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ67_v0.1	Generic questionnaires	Create/adopt tools that will process questionnaires to create the defined statistics on the data (demongraphics aspects, subjective evaluations, NASA TLX etc.)	Evaluation of experiments consists of many steps made of large amount of routine work. One example is the analysis of questionnaires, which can be defined were genericly and thus be assessed by a software tool. Such tool should create statistics, whose form is very often standardized.	WP4, WP5	H	V	SW	NF	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ68_v0.1	Scenario modeling	Create/adopt tools that allow to graphically create a scenario. Such tools should support specification of positions, parameters, actors and events. It should be possible to use maps as background image.	In general a scenario consists of predefined acitivities (fly a path, do a set of tasks) and interruptive event, to which a person/machine reacts. The activities happen in connection to a plan (map, work order) and automated scenario creation ccould show such a plan and allow for adding actors and events to create the whole scenario and possible allow to test its consistence.	WP4, WP5	M	V	SW	NF	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ69_v0.1	Certification checklists	Create a methodology for certification of an application. The methodology shall specify checklists of activities that are required as well as artifacts and their acceptable quality	Certification is made of a set of prescribed steps that must be followed and each step has prescribed artifacts to be delivered. A method that summarizes the steps and artifacts in form of checklists and acceptable quality would be welcome.	WP5	H	SI	Other	O	Inspection, validation by an agency	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ70_v0.1	Certification of complex systems	Create best practices how to certificate a complex system that may consist of various elements each applying for a different safety level.	AdCoS can be a complicated system that is made of parts and each part may require a different level of safety. Therefore the process of preparation for certification is different and a method to deal with various levels needs to be defined.	WP5	M	SI	Other	O	Inspection, validation by an agency	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ71_v0.1	Verification of artifacts for certification	Create a tool that is able to automatically evaluate a quality of an artifact according to general rules. The artifact may be defined as a screenshot or element description etc.	Some certification requirements can be quatified and automatically calacualted from a prototype. Automation would spare a lot of effort. As example a level of contract on a graphical element can be evaluated and compared to restrictions. Other examples will follow in detailed analysis of the requirement.	WP5	L	SI	SW	NF/O	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ72_v0.1	Certificatication requirements for adaptive systems	Create list of requirements related to the adaptive systems as defined by certification agencies.	In aviation domain, the adaptive systems are very rare and general knowledge of certification restriction on adaptability is low. It may be helpful to work with certification agencies to find out 'precendence' cases and ideas of what is required when adaptability is addressed (predictivity, determinism etc)	WP5	H	SI	Other	O	Inspection, validation by an agency	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ73_v0.1	Precendents in certification of adaptive systems	Create list of examples of adaptive systems that have already undergone certification. Use the examples to create best practices with respect to methods of testing and implementation of requirements identified in WP7_HON_RTP_REQ72_v0.1.	Learning from previous experience is the most efficient way of learning.	WP5	M	SI	Other	O	Inspection	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ74_v0.1	Synchronization of systems during experiment	Develop a method for synchronization various independent evaluation systems during experiment. The systems should provide data with equal time offset.	Time consistency is crucial for evaluation of measured data. Post-experiment synchronization is unrelieable and very costly process that harm quality of the data and result interpretation.	WP4, WP5	H	V	SW/HW	O	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ75_v0.1	Standard format for task modeling	The format shall support easy portability to proprietary formats. It shall support hierarchy of information and item parametrization. A good candidate may be adoption of XML.	Task models can be used for various puproses - modeling, documentation etc. A model may need to be easily transformed into a different format and therefore a standard and easy format of a task model should be used apart of what tool produces it.	WP2	M	AD	COM	F	Inspection	HON	Zdenek Moravek

AdCoS Specific (AdCoS) / RTP General (RTP)	ID	Name	Definition	Rationale	Workpackage relevance	Relevance	Development Process Step	Classification	Type	Proof	Responsibility	Author
RTP	WP7_HON_RTP_REQ76_v0.1	Formal task modeling	Create a tool that is able to describe task models and procedure models. The tool shall support GUI, it shall provide methods for verification of formal logic and for testing various external inputs. It shall estimate a workload related to any part of the model. Task shall have detailed description and the tool shall suppport export to standard format.	When building task models, it is needed to be able to graphically inspect a model, to control is logic consistency and evaluate its level of difficulty. All that for various states of the external environment.	WP2	M	AD	SW	NF	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ77_v0.1	Accessability of experimental data	Define method to efficiently format and store experimental data (such flight logs, flight annotations etc.) in a database. The method shall suppport easy and flexible access to data and ability to share the database with partners, clients etc.	Large amount of experimental data requires further processing. Efficient filtering and storage in form of a database accompanied with domain specific interface will spare effort and reduce amount of errors. The database can also be accessiblet to remote users reducing the need to distribute data files (with risk of errors due to version inconsistency etc.)	WP4, WP5	H	V	SW	O	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ78_v0.1	Evaluation of agent action	Create a tool/methodology that is able to classify an action of agent (human, machine) being either appropriate or erroneous. It is assumed that the tool has a task/procedure model with all supported alternate actions for a given situation.	At a given situation an agent may apply a number of actions. Some are correct, some may be erroneous. A generic classification against a defined procedure and accepted behavior is needed.	WP2, WP3	H	LLI	SW	F	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ79_v0.1	Transactive cooperation	Define methodology that supports interaction among agents in form of transation - so that each party is assured of information being delivered to other parties.	Information sharing in a system of two or more agents requires a consistency of information that all participats have. Whenever an information is sent out, the exchange should have a form of transaction so that all recipients have the update in the end.	WP2	H	LLI	SW	F	Inspection	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ80_v0.1	user interface design	Create a tool for GUI mock-ups prototyping	There are many tools for mock-up prototyping. A survey and prioritization according to HoliDes objectives is needed.	WP1	M	AD	SW	NF	Validation	HON	Martin Dostal
RTP	WP7_HON_RTP_REQ81_v0.1	adaptive user interface design	Create a tool for developing interactive prototypes or mock-ups	Evaluate existing tools or extend them with respect to interactivity and adaptability.	WP1	M	AD	SW	NF	Validation	HON	Martin Dostal
RTP	WP7_HON_RTP_REQ82_v0.1	Eye-tracker strategy	Compare benefits and disadvantages of using either head-mounted or cockpit mounted eye-tracker in highly unstable environment (cockpit, car). Define best practices/constraint when either of the two is more relevant.	Two classes of devices are available. To apply them in real operations, it is necessary to evaluate how appropriate each of them is to the purposes we have.	WP3	M	SI	HW	F	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ83_v0.1	Eye-tracker operability	Investigate strategies of using eye-tracker when the subject needs to - turn head in wide range of angles - may wear sunglasses or headsets - undergoes sudden changes in illumination - may need to change seat - needs to be monitored for a long period of time	We need to be aware of all operational constraints the eye-tracker technology brings before applying it in the AdCoS. Experience and algorithms that push the boundaries are needed.	WP3	M	SI	HW	F	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ84_v0.1	Pupilomentry	Analyse and develop strategies for using the pupil information measured by eye-tracker in environment with - unstable level of illumination that can change rapidly - person changing often direction of view and focus	The parameters of the pupil are well related to the mental state, but are sensitive to eye accomodation and illumination. We need to know under which conditions pupil can be safey used or what algorithms and methods can be applied to filter out the workload relevant information.	WP3	M	SI	HW	F	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ85_v0.1	Transferable sensors	Create market analysis for available sensors of various biosignals with respect to least amount of intrusivness. Define strategies how such sensors can be used for long time monitoring without iritating the subjects.	The intrusivness is the key parameter when the state assessment is supposed to be done for long and in the real environment. The technology evolves fast and current status-quo is needed to decide about applicability.	WP3	M	SI	HW	F	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ86_v0.1	Applicability of biosignals	Compare performance of various biosignals with respect the conditions in the variable environment: - high amplitude fluctuations in noise, light - vibrations, turbulences - need for operating with hands and feet - subject movements and comfort Create and overview and options. Address the possibility of using several biosignals together	There are many biosignals with different aspects. This requirement should give overview and applicability to the specific field of industrial application.	WP3	M	SI	HW	F	Validation	HON	Zdenek Moravek
RTP	WP7_HON_RTP_REQ87_v0.1	Classification of physiological output	Define methods and tools for classification of measured physiological signal and related level of stress/workload. Do it in real time.	Real time classification of physiological inference of the pilot state is a prerequisity for any adaptivity based on the physiological measures.	WP3	M	SI	SW	F	Validation	HON	Zdenek Moravek

Characteristics and Information about the Use-case	
Name	Adaptive diversion airport advisory
Category	Handling emergency situations, diversion airport, context aware decision aid, workload mitigation
Description	the system detects the current aircraft state (e.g. aircraft position, performance, flight plan, etc.) and by comparing it with relevant pieces of relevant static information (e.g. navigation database, charts, etc.) and dynamic information (e.g. strategic weather, DNOTAM, etc.), it presents the flight crew a prioritized list of potential deviation airport encompassing appropriate information in selected catagories (e.g. distance of the airport from the current position, weather at the airport, runway lenght, approach type, etc.)
Pre-condition	System connected to aircraft data buses and receiving relevant data, aircraft in-flight
Success-end condition	Correct prioritized list of potential deviation airports generated and presented to the flight crew
Trigger event	Two options of triggering the deviation airport decision support possible (to be decided yet): (1) user activated, (2) automatically triggered by adverse event resulting in potential diversion
Minimal guarantee	Diversion airport will be determined and clearence obtained from ATC
Author - Date	HON (Jiri Vasek) - 07/01/2014

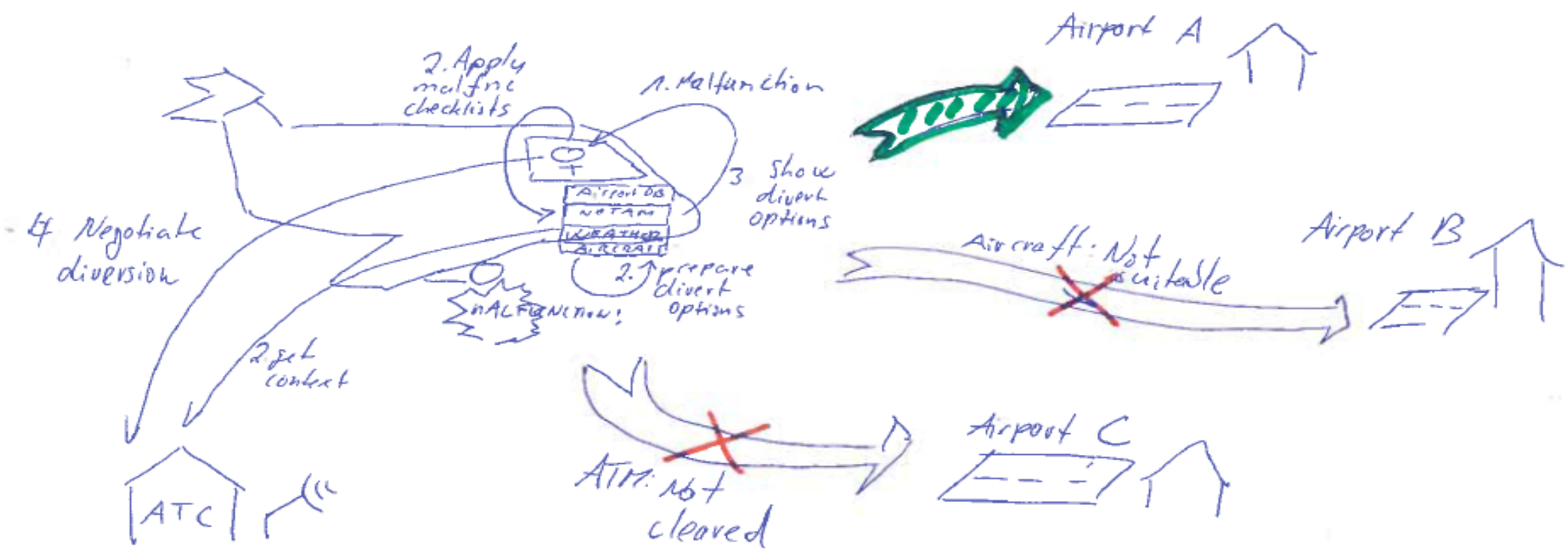
Scenario Description Attributes

	Steps	Actor	Action
Main Success Scenario	*Trigger event:*	Aicraft	Malfunction emerges
	1	Aircraft on-board system (AOS)	AOS detects a malfunction and alerts the crew. It dispatches the information to MAV AdCoS (MAdCoS)
	2	Pilot flying, pilot monitoring, MAdCoS	Pilots follow malfunction checklists. At the same time, MAdCoS decides whether it should take over the task 'look-up a diversion airport' and if yes, it evaluates diversion options.
	2a	NOTAM module	NOTAM module updates information about airports within range.
	2b	Weather module	Weather module determines obstacles and weather related issues.
	2c	AOS	AOS determines ability of aircraft to reach and land on available destinations.
	2d	Optimization module	Optimization module combines all pieces of information and sorts applicable destinations with respect to priority.
	3	MAdCoS	MAdCoS displays diversion options.
	4	Pilot flying, pilot monitoring, ATC	Pilots communicate diversion options to ATC and ATC issues clearance for the selected diversion airport.
Features	***Type***	All flight phases, expected use mostly in cruise phase	
	Situations	Any situation requiring diversion to a different airport	
Environmental conditions	***Weather***	All weather conditions	
	Visibility	All visibility conditions	
	Lighting conditions	all ambient light conditions	

	Steps	Conditions	Action
Scenario extension	E2	MAdCoS cannot handle the malfunction	MAdCoS informs pilots about inability to help.
	E3	Pilots decide to handle the malfunction themselves	Pilots find diversion options and communicate with ATC to get clearance.

Scenario Graphical Description

Scenario pictogram / sketch



	Steps	Variables	Variations
Alternative scenario 1 -n			

Use-case Description

Agents	2 Users (Pilots) acting as pilot-flying (PF) and pilot-non-flying (PNF), ATC, MAdCoS (NOTAM module, Weather module, Optimization module), Aircraft on-board systems
Task	Divert to an airport
Resources	aircraft systems, aircraft operating manuals, aircraft performance data, SOPs, flight simulator data, external sources as AIS/MET data, NOTAMs
ID **: WP7_AER_UC1_HON_v01**	Situation in which the pilot requires deviation to an airport because of loss of engine power

ID	Name	Definition	Rationale	Relevance	Development Process Step	Classification	Type	Proof	UC Reference	Regulatory Reference	REQ Class	Respons ibility	Author
WP7_TRS_AER_REQ_01	Consistent user interface through the whole system	simple way. To achieve this requirement for simplicity it is necessary apply the following:	This asset will foster the accepatbility and interactivity of the system by the instructor pilot	L	DD, V	SW, COM	F	Feedback by Instructor Pilots using the system	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_02	Legibility	The instructor's interface should allow for interaction in difficult conditions, such as: 1. High workload 2. In movement/acceleration 3. all lighting conditions	The instructor needs to make use of the training tool in a full flight simulator in motion and under high workload.	M	DD, V	SW, COM	F	Feedback by Instructor Pilots using the system	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_03	Use of colours – general	Colour coding should be consistent with other interfaces in the simulator and should also allow for easy access for the modeller to identify tasks or task-sets.	This is required to ease the modelling work and provide the possibility for experts to understand and/or adjust the training model.	H	AD, DD, SI, V	SW, PER	F	Feedback by Instructor Pilots and Modellers working on/using the system	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_04	Graphical icons	The use of graphical icons should be reduced to a level comprehensive to the user and consistent with known icons to avoid confusion.	This is required to ease the modelling work and provide the possibility for experts to understand and/or adjust the training model.	H	AD, DD, SI, V	SW, PER	F	Feedback by Instructor Pilots and Modellers working on/using the system	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_05	Responsiveness	The interface shall be quick in response in order to allow the instructor to follow through the dynamic changes during the trainees' flight tasks and shall not distract the instructor i.e. by being slow in response and thus hinder observation/assessment of the crew.	The instructor needs to make use of the training tool in a full flight simulator in motion and under high workload.	H	AD, DD, V	SW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_06	Alerts and reminders	To foster a flawless grading/arrangement of training tasks, alert and follow-up reminder messages shall be enabled.	This is required to allow the IP to understand the tool and share a common picture with the machine agent.	H	AD, DD	SW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_07	Context awareness	The interface shall enable an easy way to allocate tasks and flight-phases/exercises through the whole program.	This is required to allow the IP to understand the tool and share a common picture with the machine agent. Task sets need to be quickly accessible.	H	AD, DD	SW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_08	System failure indication,	The interface shall place simple alert messages which allow the instructor to revert to contingency procedures regarding placement of training tasks without (artificial) intervention with the trained crew.	This is necessary to not infringe training while using the tool	H	AD, DD, SI, V	SW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_09	Notes, highlighting	The interface should allow to quickly access/take notes to be used for debriefing and understand training adjustment after each session.	This will cease the need for the IP to work on different sets of tools/papers.	L	DD, V	SW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_10	Task reminders	The interface should facilitate navigation and highlight open training tasks.	Enables the IP to identify and not to miss open items to be trained.	L	DD, V	SW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_11	Links to relevant information/bookmarks	The interface should provide links to task-relevant documentation and allow for setting of bookmarks for debriefing purposes.	This allows the IP to provide background information to the trainees	L	DD, V	SW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_12	Default values	The interface shall provide pre-set default values, e.g for grades of (sub-) tasks to enable quick grading and IOS setup changes.	This eases situation in which a grading of standard, low-demand task is rarely deviating from the standard grade	M	DD, V	SW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_13	Data entry, error checking	Data entry should be augmented by highlighting missing entries and/or unchanged pre-set default values in each grading section.	Enables the IP to identify and not to miss open items to be trained.	L	DD	SW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	N/A	RUI	TBD	Frank Rister
WP7_TRS_AER_REQ_14	Commonality of Definitions and Abbreviations	Definitions and common terms shall be consistent with above regulations throughout the whole system.	This is required to assure validation and certification of such a tool and ist output (training program)	H	AD, DD, SI, V	SW	F	Inspection, Feedback from Instructors, EEAG, EASA	WP7_AER_UC1_TRS_v01	EC 216/2008 EC 1178/2011_PART-FCL.010	RTT	TBD	Frank Rister

ID	Name	Definition	Rationale	Relevance	Development Process Step	Classification	Type	Proof	UC Reference	Regulatory Reference	REQ Class	Respons ibility	Author
WP7_TRS_AER_REQ_15	Creditibility of Trainee Experience and Knowledge	The training tool shall account for trainee experience and shall adapt the training program accordingly.	This is a core requirement to enable the tool to improve training program efficiency and effectiveness.	H	AD, DD, SI, V	SW	F	Inspection	WP7_AER_UC1_TRS_v01	EC 1178/2011_PART-FCL.035 & .720A	RTT	TBD	Frank Rister
WP7_TRS_AER_REQ_16	Applicability to FSTDs fulfilling ZFTT Criteria	The training tool shall be usable on flight simulators of the highest fidelity class.	The tool will be taylored (initially) to especially serve this area of flight training.	H	AD, DD, SI, V	SW, HW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	EC 1178/2011_PART-FCL.730(a)1+2	RTT	TBD	Frank Rister
WP7_TRS_AER_REQ_17	Training Syllabi Contents	The training tool shall at least reference and address the training contents regulated in above regulations.	Necessity to define/limit the scope of the application/tool within the project for covering all legally defined training items.	H	AD, DD, V	SW	F	Inspection	WP7_AER_UC1_TRS_v01	EC 1178/2011 APPENDICES 9A & 9B 1-4,6 ED 2012/007R AMC1.ORA.ATO.125/2(j)	RTT	TBD	Frank Rister
WP7_TRS_AER_REQ_18	Rating Scale	The tool shall provide a grading/rating scale that is consistent with regulated deviation allowances (i.e. flying skills) but shall also account for FCTM/FCOM definitions if more restrictive than the former.	The rating scale is important from the beginning/1st version as it is one proof of measurement regarding the tool's predicted performance.	H	AD, DD, V	SW	F	Inspection, Feedback from Instructors	WP7_AER_UC1_TRS_v01	EC 1178/2011 APPENDIX 9B 1-4,6	RTT	TBD	Frank Rister
WP7_TRS_AER_REQ_19	ATO Facility Integrity	The tool shall be consistent with the ATO's structure of training documentation as far as regulations are concerned.	Required to assure minimum impact of the integration of such a tool into an ATO's documentation and training program portfolio.	H	AD, DD, V	SW	F	Feedback from ATO and EASA	WP7_AER_UC1_TRS_v01	ED 2012/007R AMC1.ORA.ATO.125/2(j)	RTT	TBD	Frank Rister
WP7_TRS_AER_REQ_20	Program Syllabus	The tool shall be consistent with the ATO's approved program syllabi to the extent required by above regulation.	Required to assure minimum impact of the integration of such a tool into an ATO's documentation and training program portfolio.	H	AD, DD, V	SW	F	Feedback from ATO and EASA	WP7_AER_UC1_TRS_v01	ED 2012/007R AMC1.ORA.ATO.125/2(j)	RTT	TBD	Frank Rister
WP7_TRS_AER_REQ_21	Adaptiveness	The tool shall enable the ATO to quickly adapt to the trainees requirements.	Required as this is one core asset of the new tool.	H	AD, DD, SI, V	SW	F	Feedback from Instructors, Examiners and Trainees.	WP7_AER_UC1_TRS_v01	N/A	RTT	TBD	Frank Rister
WP7_TRS_AER_REQ_22	Syllabus Catalogue Accessibility	The tool shall allow for quick access to the catalogue of training items/task for easy adaption/orientation of the training progress.	Required as this is one core asset of the new tool.	H	DD, V	SW	F	Feedback from Instructors, Examiners and Trainees.	WP7_AER_UC1_TRS_v01	N/A	RTT	TBD	Frank Rister
WP7_TRS_AER_REQ_23	data sharing and connectivity	The modelling tool shall enable sharing of data between different levels of model granularities and between the model and the training tool/device/program.	Required as this is one core asset of the new tool.	H	AD, DD, SI, V	SW	F	Feedback from ATO and Modellers	WP7_AER_UC1_TRS_v01	N/A	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_24	automated data delivery	The modelling tool should provide an automated update delivery to the training tool, see also RTM_25_TRS.	Required for an operational state to allow regulatory and/or customer updates.	L	AD, DD, V	SW	O	Feedback from ATO	WP7_AER_UC1_TRS_v01	N/A	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_25	Automated database updating (SOP/Task-Models)	The modelling tool shall provide easy alterations of the task model according to SOP changes.	see above	H	AD, DD, V	SW	O	Feedback from ATO and Modellers	WP7_AER_UC1_TRS_v01	N/A	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_26	Graphical icons	Graphical icons should be easy to understand for both, the modeller and the expert/trainer/ATO in order to foster common understandings of e.g. update processes.	self-explanatory	L	DD, V	SW	F	Feedback by Instructor Pilots and Modellers working on/using the system	WP7_AER_UC1_TRS_v01	N/A	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_27	Alerts and reminders	The modelling tool shall account for alerts/reminders when ambiguities and/or errors exist and are detected by the software.	required to assure a safe modelling process with complex task models.	H	AD, DD, SI, V	SW	F	Feedback from Modellers	WP7_AER_UC1_TRS_v01	N/A	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_28	Default values	Default values, such as workload types and values, shall be retainable and automatically reused in matching procedures/sub-tasks.	required to assure a safe modelling process with complex task models.	H	AD, DD, SI, V	SW	O	Feedback from Modellers	WP7_AER_UC1_TRS_v01	EC 1178/2011_APPENDIX 9B 1-4	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_29	Data entry, error checking	As outlined in RTM_27_TRS, the modelling tool shall be able to detect entry errors.	see REQ_27	H	AD, DD, SI, V	SW	F	Feedback from Modellers	WP7_AER_UC1_TRS_v01	N/A	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_30	Support information on data entry	The modeller should be supported by the modelling tool in e.g. setting rules/conditions.	self-explanatory	L	DD, V	SW	F	Feedback from Modellers	WP7_AER_UC1_TRS_v01	N/A	RTM	TBD	Frank Rister

ID	Name	Definition	Rationale	Relevance	Development Process Step	Classification	Type	Proof	UC Reference	Regulatory Reference	REQ Class	Respons ibility	Author
WP7_TRS_AER_REQ_31	Commonality of Definitions and Abbreviations	Definitions and Abbreviations shall be in accordance with the relevant regulations and reflect a training syllabus nomenclature understandable to all involved users.	self-explanatory	H	AD, DD, SI, V	SW, COM	O	Feedback from ATO and Modellers	WP7_AER_UC1_TRS_v01	EC 216/2008 EC1178/2011 PART-FCL.010	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_32	Program Syllabus Transfer	The modelling tool shall provide roof procedures that enable easy transfer of the models into a training syllabus of the training tool.	this is to enable the modelling of complex task-tree sets which are interchangeable and extendable.	H	AD, DD, SI, V	SW	O	Feedback from Modellers	WP7_AER_UC1_TRS_v01	EC 1178/2011 APPENDIX 9A & B 1-4,6 ED 2012/007R AMC1.ORA.ATO.125/2(j)	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_33	Adaptiveness	The modelling tool shall account for an easy way to adapt procedures, syllabi and changing variables therein, such as changes in crew composition, SOPs, aircraft type, etc.	This will alleviate the workload of both, modeller and instructor and foster a common understanding of the program's rationale.	H	AD, DD, SI, V	SW	O	Feedback by Instructor Pilots and Modellers working on/using the system	WP7_AER_UC1_TRS_v01	EC1178/2011_PART-FCL.035	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_34	SOP Comparator	The modelling tool is required to have a comparator installed which allows to compare SOPs of different aircraft types and / or operator specific SOPs (e.g. for OCC training).	core-asset of the new tool, self-explanatory.	H	AD, DD, SI, V	SW	O	Feedback from Modellers	WP7_AER_UC1_TRS_v01	EC 1178/2011 APPENDIX 9A & B 1-4,6 ED 2012/007R AMC1.ORA.ATO.125/2(j)	RTM	TBD	Frank Rister
WP7_TRS_AER_REQ_35	Workload Comparator	A workload comparator shall be provided in order to identify workload commonalities and/or peak differences within comparable SOPs as identified/compared like RTM_34_TRS describes.	see REQ 34	H	AD, DD, SI, V	SW	O	Feedback by Instructor Pilots and Modellers working on/using the system	WP7_AER_UC1_TRS_v01	N/A	RTM	TBD	Frank Rister

Characteristics and Information about the Use-case

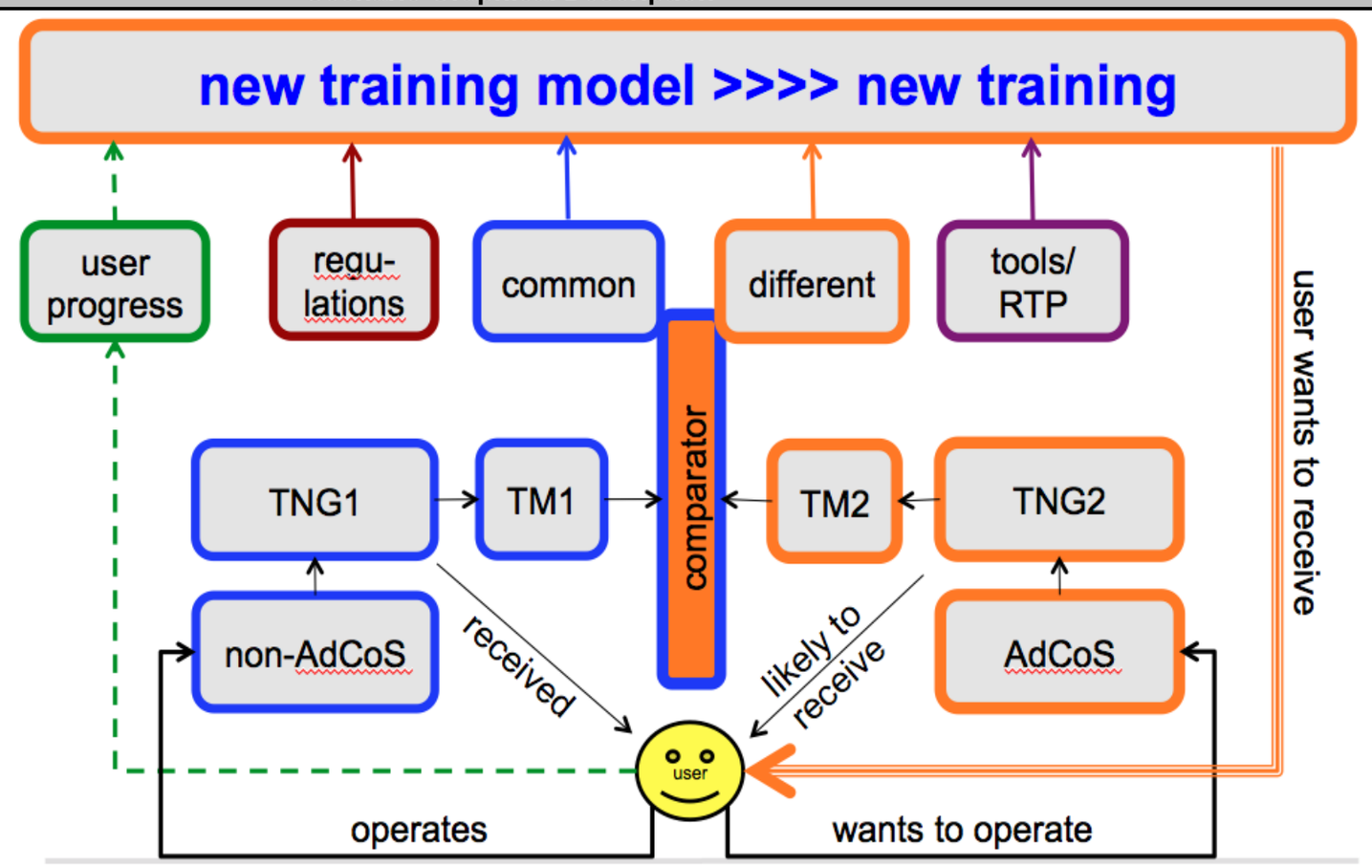
Name	Adaptive Flight Crew Simulator Transition Training
Category	Type Rating, Conversion Training, User-Background Centered Training Tools
Description	A pilot rated to fly aircraft A requires transition training to fly aircraft B. The adaptive training tool acquires data of pilot's experience ("proceduralized knowledge") and subsequently compares the training models of aircraft A type rating training with aircraft B type rating training. In a next step, the new training for aircraft B is adapted to the pilot's previous experience according to the aforementioned comparison. As an output, the training syllabus will be adapted by the new training tool to optimize the training program in terms of quality and efficiency.
Pre-condition	Pilot rated for aircraft A, requiring trainsition training in full flight simulator for aircraft B
Success-end condition	Pilot successfully passes skill test after completion of adaptive trainsition simulator training and will receive new licence entry to fly aircraft B
Trigger event	
Minimal guarantee	
Author - Date	TRS (F.Rister, December 2013)

Scenario Description Attributes

Main Success Scenario	**Steps**	**Actor**	**Action**
Features	***Type***	entire operational envelope as required by Part-FCL	
	Situations	all normal and non-normal situations as outlined in approved training syllabi and as required by Part-FCL	
Environmental conditions	***Weather***	any	
	Visibility	any	
	Lighting conditions	any	
Scenario extension	**Steps**	**Conditions**	**Action**

Scenario Graphical Description

Scenario pictogram / sketch



Alternative scenario 1 -n	**Steps**	**Variables**	**Variations**

Use-case Description

Agents	2 Users (Pilots) acting as pilot-flying (PF) and pilot-non-flying (PNF)
Task	obtain a new aircraft type rating with optimum performance in minimum time
Resources	aircraft systems, aircraft operating manuals, SOPs, flight simulator data, instructor grading scheme, pilot CV data
***ID* : WP7_AER_UC1_TRS_v01**	Situation as described above, with given variations. Adaptive training tool delivers the entire training syllabus and adapts it to the pilots' training needs.