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# MULTI-CREW COOPERATION TRAINING MANUAL FOR AIR TRAINING AND EDUCATION CENTRE

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## Abstract

*The main goal of the training manual is to create a study material for the theoretical and practical part of the multi-crew cooperation training course, which is provided by the Air Training and Education Centre of the University of Žilina since 2007. At the same time, the purpose of the training manual will be to contribute to the quality of education, streamlining the multi-crew cooperation training course and to provide a comprehensive study material for pilots in training that reflects on the changes made from 2007 to the present. The reason which stimulated the elaboration of the training manual is mainly the already existing study material which has now proved to be outdated and insufficient for the needs of the training course. The training manual will reflect the legislative changes made, the modifications to the flight and navigation procedures trainer and some training elements, which are currently emphasized in the training process and will meet all the currently required criteria. The content of training manual which is based on valid and effective regulations, on the airplane flight manual of Beechcraft Super King Air B200 / B200C, inspired by internal operation manuals of the airline operators, internal manuals of the Air Training and Education Centre and is also based on the already existing study material. At the same time, it will be possible to implement some parts of the training manual into the internal manuals of the Air Training and Education Centre. Expected date of issue of training manual is May 2022.*

## Keywords

*Multi-crew cooperation, Training, Manual, Air Training and Education Centre*

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## 1. Introduction

Flying in a multi-member crew has undergone considerable development, especially by reducing the number of flight crew members in the cockpit. The main reason was the technological development of airplanes. Automation and instrumentation of airplanes literally replaced some members of the flight crew. Despite the reduction in the number of flight crew members in the cockpit, safety requirements are still increasing. The main priority in the aviation is undoubtedly the safety that can be achieved not only by the multi-crew cooperation training course itself, operations manuals, but also on the basis of training and applying of the principles of crew resource management. The 1980s of the last century were significant for the development of crew resource management which has proven to be another factor playing a role in air accidents.

Training manual will describe the historical development of the multi-crew cooperation, crew resource management and will contain a basic skills of CRM that will be applicable to the flight crew members during the training. The main objective of the training manual is to develop a new, current study material for multi-crew cooperation training course provided by the Air Training and Education Center of the University of Žilina. The Training manual will be applicable solely on the flight and navigation procedures trainer of Mechtronix Ascent FNPT II MCC with the FSTD SK.002.A qualification certificate in the Beechcraft King Air B200 (generic) configuration.

MCC training manual will be based on the Air B200 / B200C aircraft flight manual and on the internal operations manuals of

the Air Training and Education Centre. Furthermore, it will be inspired by internal operations manuals of air operators and corrects already existing study material, but mainly amends its absent elements that are currently necessary part of a multi-crew cooperation training course.

The basis for creation of training manual is also knowledge and experience I have gained within an integrated flight training course in the Air Training and Education Centre of the University of Žilina.

The training manual will bring a comprehensive study that will contain a detailed manual for a modified flight simulator, defining new normal and emergency checklists, memory items, standard operating procedures and will be supplemented by theoretical preparation for the multi-crew cooperation training course.

## 2. Current status analysis

Flight and Navigation Procedures Trainer Mechtronix ASCENT FNPT II MCC is a flight simulation training device (FSTD) which was installed in the Air Training and Education Center of the University of Žilina in 2005. Since 2007 multi-crew cooperation training course is provided on this flight simulator. In the same year a study material entitled *Metodika pilotného výcviku na letovom simulátore* was published. This methodology, and especially the part focused on the MCC training course was created in accordance of previous valid regulation JAR-FCL. As well as the flight simulation training device was certified in

accordance of JAR-STD 3A regulation. Both of these regulations are not actual anymore.

Since 2005, a few significant changes have been made that prompted this proposal of training manual and has also stimulated the need for new study material.

The first significant change occurred in legislation. In particular, the change concerns the legislative, according to which the flight simulation training devices are certified nowadays and which regulates the multi-crew cooperation training courses.

The Civil Aviation Authority certify flight simulation training devices according to CS-FSTD (A) and Subpart FSTD, Part ORA of Commission Regulation (EU) No 1178/2011.

MCC training course is currently undertaken by FCL.735.A.

Significant changes for MCC training:

- Definition of performance-based navigation (PBN) instrument rating privileges,
- Replacement in terminology for 2D and 3D instrument approach operation,
- Change of the flight crew member label from pilot not-flying (PNF) to pilot monitoring (PM). (European Commission 2016 & ED Decision 2017)

The second change is the transition from FTO to ATO in 2013.

The third change is the modification of the Mechtronix ASCENT FNPT II MCC simulator that has been performed in 2019. The content of the modification was the installation of the Garmin GTN 650 device (Skvarekova et al., 2020), which replaced the Bendix / King 165 and (COMM / NAV), installing a new instrument panel backlight (Brezonakova et al., 2019) and new control switch for warning transparent.

### 3. Introduction to the CRM and MCC

#### 3.1. Historical development

Human factor belongs to the main causes of air incidents and accidents in aviation. Represents more than 70% of air accidents. Air accident investigators have already knew about the possibility of errors caused by human factor. In the framework of prevention, emphasis was primarily on improving operation manuals, pilots training, pilot space ergonomics, reducing cabin noise and others. However, it has absented one important factor that has not been emphasized and whose existence has not been discussed thoroughly, although it was always present when flying in a multi-member crew. It was a factor that concerns the activities and relationships of the flight crew itself. The breakthrough was a year 1979, since we date the emergence of a new area called crew resource management (CRM) as we know it today. In particular, the creation of this area was caused by air accidents where the main cause was especially a human factor (Pružina, 2009).

Table 1: Air accidents related to crew resource management Source: Munk (2010); NTSB (1973, 1979); ALPA (1978).

Date of accident	Place of accident	Flight number	Air operator	Type of aircraft
29. 12. 1972	Miami	401	Eastern Air Lines	Lockeed L-1011-1 TriStar
27. 3. 1977	Tenerife	4805	KLM	Boeing 747-206B
		1736	Pan Am	Boeing 747-121
28. 12. 1978	Portland	173	United Airlines	DC-8-61

Air accident of DC-8 can be considered key to the creation of CRM. The first airline that was interested in implementing CRM to the syllabus of flight training was United Airlines. United Airlines with cooperation of NASA and NTSB proposed the possible scheme of CRM to the flight training to optimize crew cooperation in the cockpit. The original CRM name was Cockpit Resource Management. At the birth of CRM was NASA psychologist, John Lauber, who dealt with communication processes in cockpit. CRM, which emphasizes the role of the human factor, passed in the 1980s and in the 1990s of a few phases of development. In the 1986, CRM was renamed to the Crew Resource Management. (Pružina, 2009 & Munk, 2010)

In particular, the reason for renaming was found that the flight crew is only one part of the team involved in the process during the flight. Based on this findings, the CRM was introduced in to the training for cabin crew members. In the 1990s, CRM training has been fully used in many airlines. Some airlines have implemented joint CRM training for flight crew and cabin crew, referred to as Joint CRM training.

CRM does not only concern flight crew and cabin crew, but also other company workers such as ground personnel, airline company management and others. For this reason, we can also meet the so-called Total Company Resource Management (TCRM), which also includes other company employees. Another development of CRM is EM - Error Management. EM deals with managing of unprepared situation and errors. The aim is to detect error and subsequent response of the crew. (Pružina, 2009)

The next step that includes EM is Loft - Line Oriented Flight Training. Loft is a type of training that contains realistic simulations of full flight focusing on communication and leadership. The last degree is TEM model - Threat and Error Management. The TEM model describes the possible external risks in service and consists of internal and external threats and errors. (Pružina, 2009)

#### 4. Flight Simulator Mechtronix Ascent FNPT II MCC

Flight Simulator Mechtronix Ascent FNPT II MCC with SK.002 approval number and SN-FFT-2068 identification number from the Canadian manufacturer Mechtronix Systems is a device designed for training of flight and navigation procedures. Flight simulation training device (FSTD) is certified in accordance with Commission Regulation (EU) No 1178/2011, complies with requirements set by Part ORA, Subpart FSTD and meets the certification specification CS-FSTD (A). Air Training and Education Centre (LVVC) has been using this device since 2005 to train pilots who are applying for IR(A) instrument

qualifications and since 2007 also provides training focused on multi-crew cooperation. The flight simulator is of almost 100% identical to the aircraft Beechcraft King Air B200 regarding dimensions, ergonomics and even an instrumentation. It can be reconfigured into the following types of airplane:

- Beechcraft King Air B200 (generic) – Multi-engine turboprop,
- Piper Seneca V (generic) – Multi-engine piston.

The visualization system of flight simulator offers visual display at 180° horizontally and 37.5° vertically. On the equipment it is possible to make simulations of the day, night, dusk, but also meteorological conditions in various flight levels. The simulator also allows you to perform the CAT Category I approach to the decision height of 200 feet, including a possibility to use autopilot for approach.

Table 2: Instrumentation of flight simulator device. Source: Author.

Number of devices	Equipment
2	Mechtronix Synthetic Instrument Display (SID) panel
1	Bendix/King KDI 572 Digital DME Indicator
1	Bendix/King KT 79 Transponder
1	Bendix/King 165 A (COMM/NAV 2)
2	Bendix/King KR 87 ADF
1	Bendix/King KAS 297 Altitude Pre-Selector
1	Bendix/King KFC 200 Flight Director/Autopilot System
1	Bendix/King KMA 24H Audio Control Panel
1	Garmin GTN G650 (COMM/NAV 1)

The instructor has two monitors available through which can create normal or emergency situations, changes in meteorological conditions, affect the technical condition of the airplane, monitor the operation and response of pilots and others. The instructor also has information about the vertical and horizontal airplane position in real-time. The Flight Simulator Mechtronix Ascent has also a two-sided radio connection between the crew and the instructor.

## 5. Cockpit ergonomics of the flight simulator in Beechcraft King Air B200 (Generic)

This chapter will include explanation and detailed photos of all flight simulator controls, switches and instruments along with a description. It is necessary for the pilots to be familiarized with the cockpit environment for successful achievement of tasks.



Figure 1: Cockpit ergonomics of the flight simulator in Beechcraft King Air B200 (Generic). Source: Autor.

## 6. Theoretical preparation for MCC training

The theoretical preparation will consist of theoretical knowledge for individual phases of flight in chronological order as well as standard operating procedures for normal, abnormal and emergency situations. Theoretical preparation for MCC training consists of:

### 6.1. Normal procedures

- General normal procedures
- Preliminary cockpit preparation,
- Pushback / towing,
- Engine start-up,
- Taxi,
- Take-off,
- Climb,
- Cruise,
- Descent,
- 3D approaches,
- 2D approaches,
- Go-around, missed approach procedures,
- Landing.

### 6.2. Abnormal and emergency procedures

- General abnormal and emergency procedures,
- Engine shut-down procedures,
- Rejected take-off to the V1,
- Emergency engine shut-down / engine fire after V1,
- Emergency engine shut-down during the flight,

- Engine fire during the flight,
- Emergency descent,
- Evacuation.

## 7. Conclusion

The training manual will provide a comprehensive field of study for the theoretical and practical part of the multi-crew cooperation training course, which meets the current criteria. Training manual will contain a historical development of the multi-crew cooperation and the crew resource management. The chapter of CRM will be extended and will involve detailed description of each skills which are applicable to the fight training.

New memory items and checklists for normal and emergency situation will be created, based on the Beechcraft Super King Air B200 / B200C aircraft flight manual and will be adapted to be fully executable on a given flight simulator type. Checklists can be later implemented as a new revision.

The training manual will includes corrected and amended new standard operating procedures that are the basis for the successful execution of a multi-crew cooperation training course. The aim of the course is to get a knowledge, habits and understand basic philosophy which is required in a multi-crew aircrafts but it is also a part of the internal operations manuals of each air operators.

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