

# POTENTIAL USES OF SYNTHETIC TRAINING DEVICES FOR FLIGHT PREPARATION SUBJECTS

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This thesis discusses the synthetic training devices, their individual models, which have a great contribution to the enhancement and motivation of learning pilots and air traffic controllers. After individual characterization and analysing properties of these sophisticated devices, it addresses the possibility of using training devices in a particular education of students. It contributes to enriching the teaching of subjects of flight preparation and it is a mean of simplifying the understanding of the issue and the possibility of direct presentation of discussed issue.

**K e y w o r d s:** synthetic training devices, sophisticated equipment

## 1 INTRODUCTION

This thesis deals with the topic of the use of synthetic training devices in teaching subjects of flight preparation. It is based on my own experience with the learning process of these subjects. As the aviation and technology are constantly advancing, I think the process of education should constantly progress, too. This work is dedicated to the division of basic types of synthetic devices and requirements on them, and further expands the possibilities of introducing these devices into the education process at the Faculty of Aeronautics of the Technical University of Košice. Due to the content of this work, the way of preparation new students for their future profession of professional pilots and air traffic controllers could be innovated.

## 2 GENERAL INFORMATION

**Synthetic Training Device (STD).** A training device which is either a Flight Simulator (FS), a Flight Training Device (FTD), a Flight & Navigation Procedures Trainer (FNPT), or a Basic Instrument Training Device (BITD).

**Flight Simulator (FS).** A full size replica of a specific type or make, model and series aeroplane flight deck, including the assemblage of all equipment and computer programmes necessary to represent the aeroplane in ground and flight operations, a visual system providing an out of the flight deck view, and a force cueing motion system. It complies with the minimum standards for Flight Simulator Qualification.

**Flight Training Device (FTD).** A full size replica of an aeroplane's instruments, equipment, panels and controls in an open flight deck area or an enclosed aeroplane flight deck, including the assemblage of equipment and computer software programmes necessary to represent the aeroplane in ground and flight conditions to the

extent of the systems installed in the device. It does not require a force cueing motion or visual system. It complies with the minimum standards for a specific FTD Level of Qualification.

**Flight and Navigation Procedures Trainer - (FNPT).** A training device that represents the flight deck/cockpit environment including the assemblage of equipment and computer programmes necessary to represent the aeroplane in flight operations to the extent that the systems appear to function as in an aeroplane. It complies with the minimum standards for a specific FNPT Type of Qualification.]

**(Basic Instrument Training Device (BITD) –** A ground based training device which represents the student pilot's station of a class of aeroplanes. It may use screen-based instrument panels and spring-loaded flight controls, providing a training platform for at least the procedural aspects of instrument flight.

## 3 CONTENTS

### 3.1 Synthetic Training Device Approval (STD Approval).

**Synthetic Training Device Approval (STD Approval).** The extent to which an STD of a specified Qualification Level may be used by persons, organisations or enterprises as approved by the Authority. It takes account of aeroplane to STD differences and the operating and training ability of the organisation.

**Synthetic Training Device Qualification (STD Qualification).** The level of technical ability of an STD as defined in the compliance document. An STD

qualification is valid for 12 months unless otherwise specified by the Authority.

Any [flight simulator] submitted for initial evaluation on or after 1 April 1998, will be evaluated against [applicable] JAR-STD 1A criteria for Qualification Levels A, B, C or D. [Reccurent evaluations of a flight simulator will be based on the same version of JAR-STD 1A, which was applicable for its initial evaluation. An upgrade will be based on the currently applicable version of JAR-STD 1A.]

A flight simulator shall be assessed in those areas that are essential to completing the flight crew member training and checking process, including:

- (1) Longitudinal, lateral and directional handling qualities.
- (2) Performance on the surface and in the air.
- (3) Specific operations where applicable.
- (4) Flight deck configuration.
- (5) Functioning during normal, abnormal, emergency and, where applicable, non-normal operation.
- (6) Instructor station function and simulator control; and
- (7) Certain additional requirements depending on the

Qualification Level and the installed equipment.

In the case of a flight simulators upgrade, an STD operator shall run all validation tests for the requested Qualification Level. Validation test results offered in a test guide for previous initial or upgrade evaluation shall not be used to validate simulator performance in a test guide offered for a current upgrade.

### 3.2 Study programs of the Department of flight training

**Professional pilot** - this study is specialized in gaining knowledge of the role of professional pilot in aviation, or of other types of aerial works. The main aim is to provide students with the required theoretical training so that they could simultaneously carry out practical flight training in a selected flight training organisation (FTO). Acquired necessary level of competence allows them to function as the co-pilot in commercial air transport, and thus obtain a commercial pilot license (CPL) with a clause for instrument flying (IR). After completion of the relevant training on the appropriate type of the aircraft, the student must pass a theoretical and practical examination in accordance with JAR - FCL.

Graduates of the course Professional pilot are ready for the profession in accordance with European regulations. After passing an examination in accordance with JAR - FCL they are qualified as professional pilots in any country of the European Union. They also have required theoretical and practical knowledge and experience to perform the role of a military pilot of Air Force of the Armed Forces.

**Air traffic controller** - this study program is specialized in training university educated air traffic controllers for air traffic management in the Slovak Republic, which require the education. A study is based on the qualifications required for the newly created states of the European Union embodied in the regulations of competence of the air traffic management EATMP. Specific subjects defined by European regulations of ECAC for obtaining knowledge of air traffic control officer ATCO are taught in this subject of study. This study prepares the students to carry out theoretical examinations ATCO. Successful management of these examinations is essential for granting a license ATCO by Aviation Authority of the Slovak Republic. The theoretical study includes the possibility of attending practical training on synthetic device for air traffic management.

Graduates are prepared, based on the passing of specific examinations, to perform the role of air traffic controllers in accordance with aerial European regulations, enabling them to operate in any country of the European Union. They also have required theoretical and practical knowledge and experience to perform the role of a military air traffic controller of Air Force of the Armed Forces.

### 3.3 Synthetic training devices of the Faculty of Aeronautics of TUKE

**"Simulator LETVIS"** - the synthetic training device is used for practical training in the study program of the Department of flight training - air traffic controller. It simulates the direct control of air traffic in the field of radar control. Its basis is to deepen and test the knowledge on air communication and application of the knowledge in solving specific situation of management of landings and departures in compliance with safety rules and organized flow of air traffic. It helps students to improve their knowledge and skills in preparation for their future profession. Thanks to this system is their preparation more efficient and more easily accessible about as if contained only theoretical knowledge. Teaching educators may practically

demonstrate how the system operates in a real operation, and thanks to this device, they are able to better evaluate students. LETVIS SIM system simulates a wide range of military and civilian movements in the airspace. This system can fully replace and simulate real system for processing and management of air traffic. Pseudo pilots simulate the operation of pilots based on commands issued by students. The whole situation is displayed on monitors that students and pseudo pilots have. Teaching educators represent pseudo pilots. LETVIS classroom of the Department of flight training is equipped with the two versions of the simulator. One version consists of the two workplaces of pseudo pilots and two workplaces of students. They are configurable separately or in a single unit, which allows complex management at several workplaces at the same time. Designation of this version is LETVIS RDP/RC 8.5 NX for pseudo pilots and LETVIS RDP / SIM 8.5 NX for air traffic management workers. The second and more recent version consists of the two workplaces Instructor/pseudo pilot and a student on ordinary office devices labelled LETVIS RDD 9.2A for instructor/pseudo pilot and LETVIS RDD 9.2N for a student. The first version includes an operating system OPENSTEP 4.2 and the second version operating system SOLARIS 10, its design does not allow linkage with the previous older version.

**"Cessna 172 Simulator"** is a synthetic training device of a TRD40 type. This device, along with the following synthetic device is the latest addition to the Faculty of Aeronautics. A view of the flight and navigation data can be changed in a simple way into analogue view or into glasscockpit Garmin 1000 view. The device is primarily intended to acquire new knowledge in the field of exploration the effects of view changes of the flight and navigation data on the pilot's performance. It would be very good to include this synthetic training device into the curriculum of the subjects of the Department of flight training. Furthermore, we describe the possible use of this and the following synthetic training device in the teaching of the subjects of the Department of flight training.

**"Simulator Beechcraft B58"** is also the latest addition to the Faculty of Aeronautics. Synthetic training device is a copy of the aircraft Beechcraft Baron 58, it is a twin-engined aircraft. The aim of using this equipment will be a research on navigation procedures at different stages of flight, GIS modelling, integrated processing of GNSS measurements and a research on the

performance of pilot and aviation safety. The synthetic training device is fully functioning, but it is used only for research purposes and projects. It would be very practical to involve this synthetic training device into the curriculum of the subjects of the Department of flight training.

### 3.4 The use of synthetic training devices in the study program Professional pilot

In the teaching of the study program Professional pilot is not currently used any synthetic training device. However the Department of flight training is equipped with appropriate devices, which could be involved in teaching and thereby contribute to the improvement of the learning process in this program.

Based on my own experience with this study program, I conclude that this modernization of teaching would certainly contribute to the improvement of teaching and help to train new professional pilots.

The following sections will therefore focus just on this study program, and we will specify the possibility of using synthetic training devices in specific subjects.

Specific subjects:

Fundamentals of Cartography

Air Navigation

Air navigation I.

Air Navigation II.

Aviation Regulation II.

Flight planning and monitoring

Operational Procedures

### 3.5 Examples of using synthetic training devices in the subject Air Navigation II.

We will focus specifically on the navigation system VOR, its characteristics and use.

VOR is a omnidirectional non-autonomous navigation system, which is used when navigating over short distances. Maximum distance from a ground equipment is 300 - 400 km; the device operates in the zone of VHF from 108 to 117.975 MHz with the channel spacing of 50 kHz.

Types of ground beacons:

**VOR** is used for the setting of track points and axes of flight routes or sections of flight routes, for the setting of points and help in the implementation of the published procedures at the airports, as a source of

position lines while flying down the track and for the determination of the holding patterns.

**BVOR** is used to transmit information of automatic information service ATIS in the terminal control area.

**DVOR** is actually VOR, which uses the Doppler principle to achieve greater accuracy.

**TVOR** is VOR with low power used at the airports terminal area.

**VORTAC** is a combination of military navigation system with VOR.

**VOT** is the so-called testing VOR with a fixed directional signal 000° and with a permanent identification "FROM".

We will use "Cessna 172 Simulator" for the training with the preview of navigation system VOR.

We can use VOR navigation system for:

- simulation of the setting of line points and track axes of traffic services
- simulation of the setting of navigating points and help in carrying out procedures SID, STAR in terminal area
- simulation of the procedure of not-precise approach (with DME)
- simulation of the determination the points of waiting and position in holding patterns
- simulation of the indication of right and left deflection
- simulation of the indication TO - FROM
- simulation of the source of position lines while flying down the track

## 4 CONCLUSION

This thesis describes the basic types of synthetic training devices and equipment of the Faculty of Aeronautics of the Technical University of Košice. Based on the equipment with the synthetic training devices and information sheets that describe the teaching of subjects of the flight preparation in the future, this work suggests the possibility of their use. The description is focused on the core subjects of the flight training that, thanks to the contribution of the synthetic training devices, will receive new dimension and thereby help to better preparation of new students of the Faculty of Aeronautics.

Introducing exercises using the synthetic training devices in the following subjects will result in the improvement of the learning process. I think it would increase interest in these subjects, as well as in the study program Professional Pilot.

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