METHODOLOGY OF PS-28 CRUISER FLIGHT TRAINING

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The objective of this final diploma thesis is the elaboration of a methodology of PS-28 pilot training. The beginning of the thesis is aimed on the PS-28 characteristics. The characteristics consist of the airplane description and technical and performance specifications processed in arranged tables. Next part of the thesis is dedicated to analysis of the airplane use in various stages of a pilot training, based on the previously mentioned characteristics. However substantial part of the thesis is referred to the methodology of PS-28. The methodology is divided to five parts, so its structure corresponds to training lectures within private pilot training. It has text, combined with figurative images.

K e y w o r d s: methodology, handbook, training figures

1 INTRODUCTION

In the present days there is wide choice of the airplanes, used for pilot training. Every airplane has specific technical and performance characteristics. It is a challenge for training organisations to choose the most suitable airplane for their training purposes. Ideal airplane should have low operational and maintenance costs, satisfying flight characteristics and everything that for low purchase cost. It seems, PS-28 Cruiser is the ideal choice, fulfilling these requirements. One of the objectives of the thesis is to analyse potential use of the airplane in various stages of pilot training. Analysis is based on the technical and performance characteristics and also according to the different methodologies of the pilot training. Mentioned methodology is also the main theme of the second part of the thesis. More exactly elaboration of the methodology and adjust is content directly for PS-28 Cruiser.

2 CHARACTERISTIC OF THE PS-28 CRUISER

The PS-28 Cruiser is Type Certified for VFR Day operations according to EASA LSA regulations and can be fully commercially operated in all EASA countries or in countries where the PS-28 Cruiser obtained local CAA Type Certification. In April 2012, the PS-28 Cruiser was the very first aircraft to receive certification in the brand new category of Light Sport Aircraft with European General Aviation.

The PS-28 Cruiser is used extensively for flight training in Europe. Current statistics show that around 30% of aircraft delivered by Czech Sport Aircraft are used by flight schools in a basic and advanced training role as well as for time building. The excellent flight characteristics of the aircraft and robust construction of the airframe are perfectly suited to entry-level students and this makes the PS-28 Cruiser the ideal platform for training purposes. Due to the highest standards of safety, superior performance, ease of maintenance and low through-life operating costs the PS-28 Cruiser has quickly established itself as the new benchmark for flight training.

The facts on the market today clearly confirm the leadership of the PS-28 Cruiser within the flight training segment of the Light Sport Aircraft market. As of December 2012, the PS-28 Cruiser was being used by more than 10 flight schools in Europe. When evaluating the success of the PS-28 Cruiser within Europe, it is important to consider that the aircraft only received EASA type certification in April 2012.

Basic Design

The PS-28 Cruiser is a double-seat aircraft of full metal construction. The aircraft is arranged as a low wing mono-plane with cantilevered wings and a conventional empennage.

Wing

The wing is a cantilever wing designed in two pieces. Each wing is attached by 6 shear bolts to the wing centre section. A fuel tank is located in each wing with a capacity of 57 litres. A unique storage compartment is also located in each wing with a capacity of 10kg per compartment. The wing tip is constructed from carbon-glass laminate. The wing is equipped with slotted flaps and ailerons. The right aileron is fitted with electrical trim.

Tailplane

The tailplane is formed by a stabilizer and elevator. The elevator is full balanced by horn balance and is equipped with a trim tab controlled by electrical servo.

Fuselage

The fuselage is designed as a conventional metal semi-monocoque structure. The cockpit frame and cover frame are made from a carbon glass fibre construction. The undercarriage is attached directly to the channel on the fuselage base.

Cockpit

The PS-28 Cruiser boasts the most spacious and ergonomic cockpit in the Light Sport Aircraft category. The cockpit has front-up-opened cover and two side sliding windows. All windows are made from Plexiglass. Located to the rear of the pilot seats is a spacious baggage compartment. The cockpit is equipped with an instrument panel holding all instruments in 3 separate panels. Individual control sticks and pedals provide the flight controls for both seats. The throttle is positioned on the centre console and the wheel brakes are located on the pedals.

2.1 Airplane specifications

Table 1 Technical specifications

Wingspan	8,6 m
Lenght	6,6 2m
Height	2,315 m
Wing surface	12,30 m^2
Wing loading	49 kg/m^2
Cockpit width	1,170 m
Max. take off weight	600 kg
Max. weight of fuel	82 kg
Max. baggage weight	38kg
Empty weight	374 kg
Engine	Rotax 912 ULS
Propeller	Klassic 170/3/R

Table 2 Performance specifications

Max. engine performance	73,5 kW, at 5800 rpm
Max. usable fuel	113l
Fuel consumption, cruise	19l/h
Endurance	5h 26min
Range	948 km
Service ceiling	15 090ft
Best rate of climb	825ft/min
Cruise speed, 3000ft	93kt IAS
Max. airspeed	138kt IAS
Glide speed	60kt IAS
Stall speed, clear conf.	37kt IAS
Stall speed, flaps extended	31kt IAS
Max. G loads	+4/-2 G

Figure 1 PS-28 Cruiser Opera Jet ATO

3 METHODOLOGY OF FLIGHT TRAINING

The methodology of the flight training is designed as a technical manual to introduce basic pilot skills and knowledge that are essential for piloting airplanes.. The methodology is developed to assist student pilots learning to fly airplanes. It is also beneficial to pilots who wish to improve their flying proficiency and aeronautical knowledge, those pilots preparing for additional certificates or ratings, and flight instructors engaged in the instruction of both student and certificated pilots. It introduces the future pilot to the realm of flight and provides information and guidance in the performance of procedures and maneuvers required for pilot certification. The methodology is divided into the following parts:

3.1 Ground operations

In the interest of safety and good habit pattern formation, there are certain basic flight safety practices and procedures that must be emphasized by the flight instructor, and adhered to by both instructor and student, beginning with the very first dual instruction flight. These include, but are not limited to, collision avoidance procedures including proper scanning techniques and clearing procedures, runway incursion avoidance, stall awareness, positive transfer of controls, and cockpit workload management. After acquiring these theoretical topics, ground operations continue with visual inspection training. The accomplishment of a safe flight begins with a careful visual inspection of the airplane. The purpose of the preflight visual inspection is twofold: to determine that the airplane is legally airworthy, and that it is in condition for safe flight. The airworthiness of the airplane is determined, in part, by the following certificates and documents, which must be on board the airplane when operated.

3.2 Pilotage techniques

There are four fundamental basic flight maneuvers upon which all flying tasks are based: straight-and level flight, turns, climbs, and descents. All controlled flight consists of either one, or a combination or more than one, of these basic maneuvers. If a student pilot is able to perform these maneuvers well, and the student's proficiency is based on accurate "feel" and control analysis rather than mechanical movements, the ability to perform any assigned maneuver will only be a matter of obtaining a clear visual and mental conception of it. The flight instructor must impart a good knowledge of these basic elements to the student, and must combine them and plan their practice so that perfect performance of each is instinctive without conscious effort. The importance of this to the success of flight training cannot be overemphasized. As the student progresses to more complex maneuvers, discounting any difficulties in visualizing the maneuvers, most student difficulties will be caused by a lack of training, practice, or understanding of the principles of one or more of these fundamentals.

Straight and level flight

Many flight instructors and students are prone to believe that perfection in straight-and-level flight will come of itself, but such is not the case. It is not uncommon to find pilot whose basic flying ability consistently falls just short of minimum expected standards, and upon analyzing the reasons for the shortcomings to discover that the cause is the inability to fly straight and level properly. Straight-and-level flight is flight in which a constant heading and altitude are maintained. It is accomplished by making immediate and measured corrections for deviations in direction and altitude from unintentional slight turns, descents, and climbs. Level flight, at first, is a mater of consciously fixing the relationship of the position of some portion of the airplane, used as a reference point, with the horizon.

Turns

Student pilots are first taught the basics of straight and level flight. After practice the basics of aircraft control in keeping the shiny side up is mastered with relative ease. The newfound confidence is easily destroyed when the first turn is attempted. An airplane does not turn in the same way as does a car or boat. There is negative learning transfer from a car where the steering wheel remains deflected until the turn is completed. Oddly, in an aircraft the control wheel is returned to neutral after the desired bank is established. Rudders don't turn the aircraft, they coordinate the turn. Then there is the need for increased elevator backpressure to keep the flight path level, and if this were not enough, if a constant airspeed is desired the thrust must also be increased. So in a level, coordinated turn at a constant airspeed the pilot must adjust every flight control, ailerons, rudder, elevator and thrust. Then add the task of rolling out at a rate that is appropriate to complete the turn on an assigned heading while again adjusting the ailerons, elevator, rudder, and power, the task involves a lot of coordination, planning, and understanding of aerodynamic concepts.

Climbs

Climbs and climbing turns are basic flight maneuvers in which the pitch attitude and power result in a gain in altitude. A straight climb is one in which the airplane gains altitude while traveling straight ahead. Climbing turns are those in which the airplane gains altitude while turning.

Descents

A descent, or glide, is a basic maneuver in which the airplane is losing altitude in a controlled descent with little or no engine power; forward motion is maintained by gravity pulling the airplane along an inclined path, and the descent rate is controlled by the pilot balancing the forces of gravity and lift. Although power off descents (glides) are directly related to the practice of power off accuracy landings. Therefore, it is necessary that they be performed more subconsciously than other maneuvers because most of the time during their execution, the pilot will be giving full attention to details other than the mechanics of performing the maneuvers. Since glides are usually performed relatively close to the ground, accuracy of their execution and the formation of proper technique and habits are of special importance.

Slow flight, stalls and spins

The maintenance of lift and control of an airplane in flight requires a certain minimum airspeed. This critical airspeed depends on certain factors, such as gross weight, load factors, and existing density altitude. The minimum speed below which further controlled flight is impossible is called the stalling speed. An important feature of pilot training is the development of the ability to estimate the margin of safety above the stalling speed. Also, the ability to determine the characteristic responses of any airplane at different airspeeds is of great importance to the pilot. The student pilot, therefore, must develop this awareness in order to safely avoid stalls and to operate an airplane correctly and safely at slow airspeeds.

3.3 Phases of flight

Take offs and departure climbs

This chapter discusses takeoffs and departure climbs in tricycle landing gear (nosewheel-type) airplanes under normal conditions, and under conditions which require maximum performance. A thorough knowledge of takeoff principles, both in theory and practice, will often prove of extreme value throughout a pilot's career. It will often prevent an attempted takeoff that would result in an accident, or during an emergency, make possible a takeoff

under critical conditions when a pilot with a less well rounded knowledge and technique would fail.

Landings

This chapter discusses the factors that affect an airplane during the landing approach and the landing under normal and critical circumstances, and the pilot's techniques for positively controlling those factors. The pilot must be able to make the transition from in-flight control with accuracy, smoothness, and positiveness. So that the pilot may better understand the factors that will influence judgment and technique, the last part of the approach pattern and the actual landing will be divided into five phases - the base leg, the final approach, the roundout, the touchdown, and the after landing roll. Also in spite of the remarkable reliability of present day airplane engines, the pilot should always be prepared to cope with emergencies which may involve a forced landing caused by partial or complete engine failure.

Airport traffic patterns

To assure that air traffic flows into and out of an airport in an orderly manner, an airport traffic pattern is established appropriate to the local conditions, including the direction and placement of the pattern, the altitude at which it is to be flown, and the procedures for entering and leaving the pattern. The pilot is not expected to have intimate knowledge of all traffic patterns at all airports, but if familiar with the basic rectangular pattern, it will be easy to make proper approaches and departures from most airports, regardless of whether they have control towers.

3.4 Cross-country flying

This chapter discusses the basic elements of cross-country flying, including various methods of air navigation - the art of flying the airplane from one point to another and determining its position along the route. It is not intended to explain in detail the intricacies of air navigation. For that information, the learning pilot is directed to the theoretical aviation publications, ,published by the CERN Brno, or to suitable commercially published navigation books. Air navigation is not limited to the actual guiding of an airplane from one place to another - it begins and ends on the ground. Before starting a cross-country flight, the pilot should plan the flight thoroughly. This includes obtaining pertinent weather information, plotting the course on an aeronautical chart, selecting checkpoints, measuring distances, and computing flight time, headings, and fuel requirements.

3.5 Instrument flying

Proper interpretation of flight instruments yields essentially the same information about the aircraft's spatial orientation as outside visual references. Safe, precise, proficient performance of any instrument flight maneuver depends fundamentally on mastery of basic flight maneuvers. Competence in basic instrument flight maneuvers flying not only makes possible safe, precise flight in IMC, but also enhances the safety and accuracy of VFR flight. Thorough understanding of the operation and use of all the flight instruments plus regular practice leads to prompt recognition of instrument failure and transition to safe partial panel attitude instrument flight.

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