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FLIGHT INSTRUCTOR GUIDE

Aeroplane

Canada

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INTRODUCTION

This guide has been prepared by Transport Canada Aviation for the information and guidance of pilots preparing to apply for flight instructor ratings, and for use as a reference by qualified flight instructors.

Some of the material in this guide has been derived from discussions with individual flight instructors and members of Flight Instructor Refresher Courses. The Instrument Flying and Night Flying Instruction exercises have been changed to include the draft revisions that have been in use since 1990 and 1994 respectively.

A brief explanation of the content of the various parts in this guide is as follows:

Part I —

Learning and Learning Factors

The techniques to be used by instructors when conducting ground school training, pre-flight and post-flight briefings, and the air exercises.

Part II —

The Ground and Air Instruction Syllabus

This part outlines the purpose of each exercise, the essential background knowledge a student must possess before air instruction of the exercise commences, advice to instructors, and a step by step procedure for the instructor to follow when carrying out the air instruction.

Part III —

Lesson Plans

This part provides for a step by step progression of learning, with provision for regular review and evaluation at prescribed stages of learning.

Part IV —

Typical Questions

A list of suggested questions has been prepared as a guide to instructors in developing their own questions to suit the temperament and background of individual students.

Attachment —

The form "Instructor's Training Record While Under Direct Supervision" has been included with this guide and may be reproduced as required.

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PART I

Learning and Learning Factors

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PART I

LEARNING AND LEARNING FACTORS

Introduction

1. What is a *trainer*?
2. The Concise Oxford Dictionary definition of the word train is: "Bring to desired state or standard of efficiency by *instruction* or *practice*".
3. Flight instructors are trainers. If you are a flight instructor, your aim is to give students good instruction and sufficient practice so that they can fly aircraft proficiently and safely.
4. Part one of this guide is designed to describe some basic instructional techniques that apply to:
 - (a) ground school training;
 - (b) preparatory ground instruction;
 - (c) pre-flight briefing;
 - (d) in-flight instruction; and,
 - (e) post-flight briefing (debriefing).
5. By using these techniques you will make learning easier for your students as you help them meet the required flight test standards.

Learning

6. No one ever learns except through their own activity and there is, strictly speaking, no such art as teaching, only the art of helping people to learn.

The instructional techniques described in this guide suggest actions that can be performed to stimulate student activity. These activities may be mental or physical and it is through this process of directed activity that students learn the skills and knowledge required to become good, safe pilots.

Learning Factors

7. Listed below are seven learning factors. Read them carefully and determine whether they apply to you as you learn new skills and knowledge. If they apply to you, they will also apply to your students. Attempt to associate a single word that is used to represent the entire learning factor. These words will be used throughout the guide and in test questions on instructional technique.

Learning is made easier when the following factors are used:

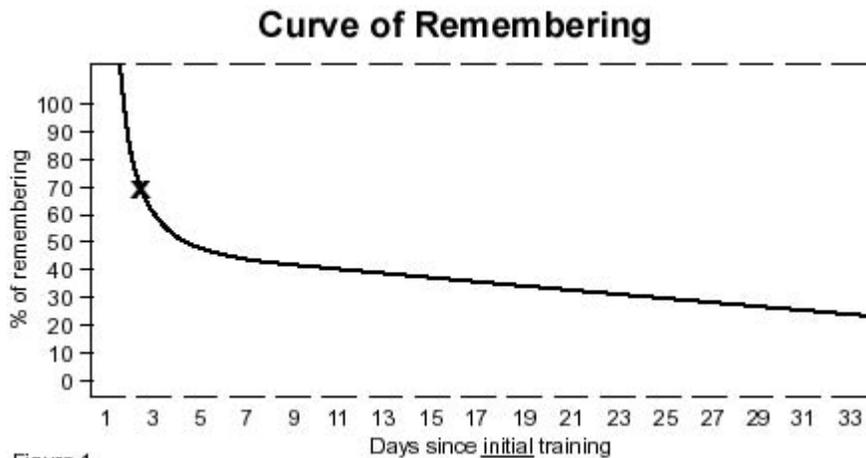
- (a) **READINESS** — Ensure students are mentally, physically and emotionally ready to learn.
- (b) **PRIMACY** — Present new knowledge or skills correctly the first time. (Teach it right the first time.)
- (c) **RELATIONSHIP** — Present lessons in the logical sequence of known to unknown, simple to complex, easy to difficult.

- (d) **EXERCISE** — Ensure students are engaged in meaningful activity.
- (e) **INTENSITY** — Use dramatic, realistic or unexpected things, as they are long remembered.
- (f) **EFFECT** — Ensure students gain a feeling of satisfaction from having taken part in a lesson.
- (g) **RECENCY** — Summarize and practise the important points at the end of each lesson, as last things learned and practised will be remembered longest.

The learning factors listed above are useful "tools" when they are applied correctly. The question of course is how do these learning factors apply to flight instruction? This question will be answered by reviewing and discussing each of the learning factors which offer specific suggestions on what you can do to utilize these "tools" in your instruction.

8. **READINESS** — Ensure students are mentally, physically and emotionally ready to learn.
- (a) To learn, a person must be ready to do so. An effective instructor understands this necessity and does the utmost to provide well conceived motivation. If a student has a strong purpose, a clear objective and a sound reason for learning something, progress will be much better than if motivation were lacking.
 - (b) Under certain circumstances you can do little, if anything, to inspire a student to learn. If outside responsibilities, interests or worries are weighing heavily, if schedules are overcrowded, if personal problems seem insoluble, the student will be unable to develop the interest to learn.
 - (c) Here are some suggestions you can follow to arouse interest and make the student ready to learn:
 - (1) Start lessons with an **ATTENTION GETTING** opening. For examples of opening sentences that are effective, listen carefully to the start of documentary films or interviews on television. Writers spend a great deal of time developing the exact words to tune you in.
 - (2) State **SPECIFICALLY WHAT** is required during the lesson and how you intend to prove that the student has the knowledge or can master the skill at the end of the lesson. Make all your statements student centred — use the terms "you" and "we" when you describe what is to take place.
 - (3) Tell students the **PURPOSE** of the lesson and stress the **BENEFIT** from the new knowledge or skill. Try to give more than one reason for learning, just in case the student doesn't fully accept the first reason.
 - (4) Specify **WHERE** the lesson fits into the overall picture, and relate the lessons to past experiences that the students may have had. This statement provides a link with something students have learned before and allows them to build on that knowledge or skill. As an example, if you were giving instruction on how to taxi a fixed wing aircraft and the student happened to have had experience in driving a tractor, you would point out that there is very little difference in how the brakes are operated. This concept is closely related to the Learning Factor of Relationship.
 - (5) If the new material is dependent on students having mastered previous lessons, confirm that the required level has been attained before proceeding with the new material. Conduct a review and, if necessary, clear up any misunderstandings by briefly re-teaching the major points.
 - (6) Plan for reviews of lesson material. Students start to forget the moment they leave the instructional environment. The greatest rate of forgetting occurs during the first *24-48 hours* after learning the material. Ohio State University has carried out

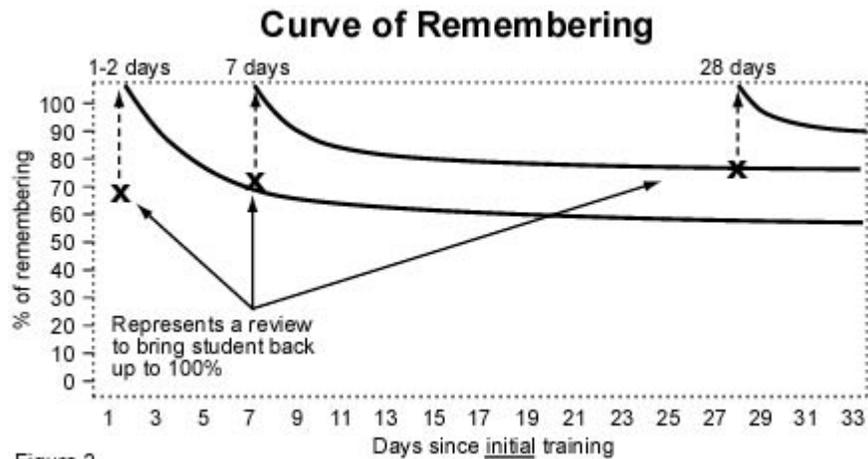
extensive research in this area and has designed a recommended schedule of when reviews should be done. Refer to FIG. 1 & 2 and the notes below each diagram.



- Notes:
- (1) Statistics are based on an average cross-section of students.
 - (2) Curve is very steep initially — within two days students will remember less than 70% of what they learned.
 - (3) At the end of the month without reviews students will only remember approximately 40% of lesson material.
9. **PRIMACY** — Present new knowledge or skills correctly the first time. (Teach it right the first time.)
- (a) When students are presented with new knowledge or skills, the first impression received is almost unshakeable. This means that what you teach must be correct the first time. Students may forget the details of lessons, but will retain an overall image of the skill or knowledge for a long time. Frequently you will be required to perform manoeuvres in the aircraft before a student has had the necessary background training. You must perform those manoeuvres correctly or the student may imitate any errors you make. For example, before the exercise on cross-wind landings, you and your student are required to land in a cross-wind. Any poor example shown at this time would have to be "unlearned" when the exercise came up in a subsequent lesson.

(b) Suggestions:

- (1) Rehearse lessons to become thoroughly proficient at the skill or in answering questions related to the subject.



- Notes:
- (1) To maintain at least a 70% level, a review should be conducted within two days.
 - (2) After learning material a second time the curve flattens out somewhat, but after seven days the student is back down to the 70% level.
 - (3) Another review and the curve really flattens. The student will be above 70% retention until approximately day 28.
 - (4) A review at this time will generally cause long lasting retention of lesson material.
 - (5) The amount of time required for reviews reduces each time a review is conducted.

Example: initial training	— 50 minutes
1st review — at 2 days	— 15 minutes
2nd review — at 7 days	— 10 minutes
3rd review — at 28 days	— 5 minutes

- (2) Attempt to give a perfect demonstration of the manoeuvres to be learned in the next lesson. If students read or study exercise material without experiencing the actual exercise, they may form an incorrect mental image.
- (3) If practicable, start each lesson with a perfect demonstration. Sometimes it may be better to avoid talking during this demonstration to allow maximum concentration on doing the skill perfectly.
- (4) While the student is performing an exercise, supervise the actions very closely. Stop the student as soon as any performance error is noticed and teach the correct method. Close supervision means — **NEVER** allow a student to make an error during the initial stages of training. Think of how you would go about training a student to defuse a live bomb.

10. **RELATIONSHIP** — Present lessons in the logical sequence of known to unknown, simple to complex, easy to difficult.

- (a) This particular learning factor emphasizes the necessity for your student to understand relationships between new and old facts, or between ideas and skills if learning is to take place. During flight training, students must understand not only why they are learning a particular exercise, but how that exercise combines with previous ones and where it fits into the overall syllabus. Giving students the relationship at the start of the lesson provides preparation for learning. Continuing the process throughout the lesson helps to maintain the desire to learn.

Examples: Compare or relate cross-wind take-offs and landings to normal take-offs and landings; show how a forced landing is really a type of circuit procedure.

(b) Suggestions:

- (1) Present lessons in a logical sequence:
 - (a) known to unknown;
 - (b) easy to difficult;
 - (c) concrete to abstract;
 - (d) simple to complex;
 - (e) familiar to unfamiliar.
- (2) Always review basic knowledge before proceeding to the unknown. For example, when teaching students to multiply with a circular slide rule, the first example should be as simple as 2×2 . The reason is that students already know the answer and are able to follow the manipulation of the slide rule. In the next problem or example, a change of one factor (2×4) allows students to build on knowledge already gained. The process is continued until students have mastered all the required knowledge and skill necessary to solve real problems.
- (3) Present new material in stages, confirming that students have mastered one stage before proceeding to the next. The length of time for each stage would depend on the complexity of the material covered.
- (4) Reinforce students' learning of new facts or ideas by frequently summarizing the major points of your lesson.
- (5) Use examples and comparisons to show how the new material being learned is really not much different from that already known by your students. The examples you use may be real or imaginary as the main purpose of an example is to paint a verbal picture so students can visualize relationships between the new material and things that have happened before. This is called using verbal aids for your instruction.

11. **EXERCISE** — Ensure students are engaged in meaningful activity.

- (a) Meaningful mental or physical activity is essential if learning is to occur. During flight training this is achieved through correct practice or repetition. Students learn by applying what they have been told or what has been demonstrated. As learning continues or is strengthened by additional practice, your training syllabus should make provision for this practice time. You must ensure that the practice is directed toward a specific goal. Oral questions, hypothetical problems, dual review, or solo practice are all methods of providing mental or physical activity.
- (b) If students are able to answer questions involving the words "how" and "why", it usually means that they have a good understanding of the subject. As a flight instructor these two words are probably the most important in your vocabulary. Study Table I and note both

the instructor and student activity for each level of learning. Should you attempt to employ the application level of learning without having covered the understanding level, students will encounter much more difficulty than if they had mastered previous levels.

VII	EVALUATION	PROVIDES ITEMS TO BE TESTED	RECORDS AND DRAWS CONCLUSIONS	ALL
VI	SYNTHESIS	PROVIDES EXERCISE SITUATIONS	COMBINES INFORMATION INTO CONCEPTS	ALL
V	ANALYSIS	PROVIDES EXERCISE SITUATIONS	BREAKS ITEMS INTO SMALLER COMPONENTS	ALL
IV	APPLICATION	DEMONSTRATES AND EXPLAINS	IMITATES AND PRACTISES	ALL
III	COMPREHENSION (UNDERSTANDING)	DEVELOPS LESSON BY QUESTIONING	ANSWERS AND ASKS QUESTIONS	WHY? & HOW?
II	KNOWLEDGE (INFORMATION)	PRESENTS LECTURES	LISTENS	WHAT?
I	FAMILIARIZATION	GIVES BRIEFINGS	LISTENS	WHERE? & WHEN?
	LEVELS OF LEARNING	INSTRUCTOR ACTIVITY	STUDENT ACTIVITY	KINDS OF QUESTIONS

Table 1

(c) Suggestions:

- (1) Unless testing to see what students have learned, avoid questions that are prefixed by the word "what". Give students the facts, figures and necessary knowledge, then ask "how" and "why" questions to develop understanding of the new knowledge.
- (2) Once you have told students a fact, avoid repeating yourself. Instead, have them relate the facts back to you. This strengthens learning and confirms their knowledge of the required material.
- (3) Give students challenging problems that fit the level of learning and provide only enough assistance to keep them on track. When students are able to solve the problems alone, they have demonstrated adequate knowledge and ability.
- (4) Test students' knowledge and abilities frequently. This reinforces learning and builds confidence. However, before testing you must be reasonably certain that students can answer the questions or perform the skills, otherwise they may become frustrated. Testing will also identify areas in which students have weaknesses; thus, allowing you to re-teach to the required standard.

12. **INTENSITY** — Use dramatic, realistic or unexpected things, as they are long remembered.

- (a) Students learn more from dramatic or exciting experiences than from boring ones. It is a well-known fact that a student's "lookout" while flying will improve considerably after a first experience with a near miss. There is no suggestion here that you provide your student with a near miss, but you should attempt to make your students' learning experiences exciting by being excited yourself and perhaps using any opportunity you can to introduce unexpected things to your students. Example: After students have learned fuel management and other aspects of cross-country navigation, you notice that they disregard the fuel quantity gauge during a cross-country flight. Allow them to continue until the fuel quantity is in close, but safe, proximity to running dry on one tank before you mention it. Your students will be shocked to be so close to an actual in-flight engine failure and will probably remember the experience for a long time.
- (b) The Learning Factor of Intensity implies that students will learn more from real experiences than from substitutes. You will have to use your imagination to develop vivid experiences for dramatic or realistic effects.
- (c) Suggestions:
 - (1) Show enthusiasm and sincerity for the subject you are teaching.
 - (2) Attempt to employ a wide range of speech variation in rate, volume and pitch to keep students attentive.
 - (3) Use appropriate and effective gestures while explaining major points. The lesson will seem to "come alive" and the points made will make a greater impression on your student.
 - (4) Use a variety of training aids to appeal to as many senses as possible. Each aid must relate directly to the subject matter being taught.

13. **EFFECT** — Ensure students gain a feeling of satisfaction from having taken part in a lesson.

- (a) Learning is strengthened when accompanied by a pleasant or satisfying feeling. Students will learn and remember more under these conditions than when feelings of defeat, frustration, anger or futility are developed. If you were to demonstrate a spin during the first air lesson, students would likely feel some inferiority if not actual fear. The experience would be negative. They might even give up flying at that stage. This example is rather obvious but you need to consider how your actions could produce feelings of frustration or anger. For example, you ask a student to perform a manoeuvre and then you immediately emphasize all the errors the student made. Your identification of each error may be very accurate but how would the student feel about it? If the objective was to make the student feel defeated, it probably succeeded. It is better to point out the positive aspects of a student's performance first, and then discuss the major errors which were committed and finish with suggestions for improvement.
- (b) Whatever the learning situation, it should contain elements that affect your student positively and give feelings of satisfaction. Each learning experience does not have to be entirely successful, nor do students have to master each lesson completely; however, a student's chance of success will be increased with a sense of accomplishment and a pleasant learning experience.
- (c) Suggestions:
 - (1) Involve students in the lesson by developing some of the new material from them. This can be done by asking students questions related to the subject and allowing student contributions of knowledge and ideas.
 - (2) Throughout your lessons, obtain feedback from students by asking questions, observing the performance of a skill and watching for facial expressions that show a

lack of understanding. You must respond to any feedback by answering questions and providing assistance and correction where needed.

- (3) Show students how to improve and offer praise when improvement occurs.
 - (4) Back up all your statements with reasons. Whenever you tell students something give the reason behind it. For example, you say to a student, "This aircraft has two static vents, one on each side of the fuselage." This is a fact but if students do not know the reason for two vents, they will probably pass it off as unimportant and forget. Remember, if a student understands the concept or theory, details may be forgotten but the overall concept will remain and when an aircraft with only one vent is encountered, more attention may be given to instrument readings while in a side-slip for a cross-wind landing.
 - (5) When a student encounters difficulty in mastering an objective, find a means of allowing some degree of success. For example, the lesson is steep turns and rather than have students attempt the entire manoeuvre, try having them practise the entry. When no difficulty is experienced with the entry, add the next stage, then continue until the entire manoeuvre is completed. Should difficulty still occur, back up a step and attempt medium turns rather than cause too much frustration. Sometimes instructors make the mistake of continuing to have students attempt a manoeuvre when performance is deteriorating. It is better to quit at that point and go back to something the student can do well.
 - (6) Avoid ridicule or sarcasm. You may feel that it might take the place of humour; however, students seldom have the same feeling, especially if they are the butt of the remark.
 - (7) Arrange each lesson so that when a student does something correctly, there is a reward. This reward can be in the form of sincere, honest praise. You ask a student to complete a walk-around on a specific aircraft for which you have arranged to have some hydraulic fluid placed on the ground near a wheel. Your student does a very thorough inspection of that particular area of the aircraft and is praised for this. If a thorough inspection is not completed, you have an excellent teaching point to emphasize why careful inspections must be done. In no case should you deliberately sabotage an aircraft, unless that aircraft is one that is not to be flown at any time. The consequences are too dangerous should the tampering go unnoticed and someone fly the aircraft.
14. **REGENCY** — Summarize and practise the important points at the end of each lesson, as last things learned and practised will be remembered longest.
- (a) Other things being equal, the last things learned are best remembered. Conversely, the longer students are removed from a new fact or even an understanding, the more difficulty they will have remembering it. The need for reviews was stated earlier and a full circle has been completed — review — learn new material — review, etc.
 - (b) Suggestions:
 - (1) Plan for a pre-flight briefing immediately prior to the air lesson and review the main points by questioning. This may sound like the Learning Factors of Readiness and Exercise; however, recency deals with the timing of the practice.
 - (2) Ensure that students receive a thorough summary of the important points towards the end of each lesson.
 - (3) After each sequence within an exercise or class presentation, ask questions on the material or summarize the "need-to know" material.
 - (4) Conduct a test as the final part of your lesson.

- (5) At intervals throughout the course, conduct review periods in which no new material is taught, but reinforcement is obtained.
- (6) Attempt to finish lessons with practise of the most important parts of the lesson. This applies to solo lessons as well as dual exercises. Remember, students practise knowledge by answering questions and they practise skills by doing.

15. An important skill as a flight instructor is the ability to ask good oral questions. Good oral questions satisfy all the identified learning factors. The next section of this guide will deal exclusively with oral questions.

ORAL QUESTIONS

General

1. When presenting a lesson, you have many techniques and aids at your disposal. One aid that can be used to stimulate learning and effectively applied to satisfy all seven learning factors is oral questioning .
2. The actual technique of questioning is a difficult one and is normally one of the most neglected areas of instruction. Good oral questioning requires the ability to think quickly and easily while facing a class or individual student, to shift and change as thought progresses and to phrase questions in clear and simple terms. You must always be mindful of the technique to follow when handling student questions and answers.

Purposes of Oral Questions

3.
 - (a) First, questions can be used to **PROMOTE MENTAL ACTIVITY**. You can state a fact and provide visual or verbal support to back it up but the surest way for students to remember is working it out for themselves. Whenever you can use an oral question to make your students think and reason out the fact, you should take advantage of the situation. Example: As students work towards an objective it is often necessary for them to recall pertinent data or knowledge learned previously. A well worded oral question could provide the required information, thus promoting mental activity.
 - (b) A second purpose of oral questions is to **AROUSE AND MAINTAIN STUDENT INTEREST**. Merely making a statement will often result in a "so what" attitude, but asking questions makes students feel they are participating and contributing to the lesson, thereby arousing interest. You can maintain this interest throughout the lesson by the continuous development of facts and ideas. Remember — Telling is **NOT** teaching.
 - (c) Another purpose of oral questions is to **GUIDE THOUGHT**. By using questions you can lead students to think through to a logical solution. Questions can direct students' thinking through a definite sequence or to particular objectives. **During discussions** you can use questions to guide your student's thoughts back to the objective if they seem to be far afield. An experienced instructor can guide students through an entire lesson by asking the right questions at the right time.
 - (d) A final purpose of oral questions is to **EVALUATE LEARNING** for the benefit of both instructor and student. Oral questions may be used after each stage of a lesson to ensure

students are following before you proceed to the next stage. At the end of the lesson, they confirm that students have attained the objectives for that particular lesson.

NOTE: A drawback of using oral questions to evaluate learning is that only random sampling of a class is obtained, since only one student answers each question. This drawback can be overcome by the use of some sort of student response system by the instructor. On a one-to-one basis, as in pre-flight and post-flight briefings, the above is not a problem.

NOTE: Write your answer in the space provided, then compare your answer with the one on the answer sheet on pages 15 and 16.

QUESTION # 1

How can oral questions promote mental activity?

QUESTION # 2

Why will oral questions maintain student interest during a lesson?

QUESTION # 3

What is a drawback in using oral questions to evaluate learning?

Desired Qualities of Good Oral Questions

4. If oral questions are to serve the purposes stated in paragraph 3, you must be mindful of the following desirable qualities of good questions when composing or preparing to use them.
 - (a) **EASILY UNDERSTOOD.** Questions should be stated in simple straightforward language; they should be brief, yet complete enough that students have no doubt as to the meaning of the question.
 - (b) **COMPOSED OF COMMON WORDS.** Questions should be designed to measure knowledge of a subject, not use of language. The use of high sounding words may give you a chance to display your vocabulary, but adds nothing to instruction. Remember, if students do not know the meaning of the words they will not be able to answer the question. Always keep your vocabulary within the grasp of your student.
 - (c) **THOUGHT PROVOKING.** Questions should not be so easy that the answer is obvious to all students. Students should be challenged to apply their knowledge. You should avoid using questions where your student has a 50/50 chance of being correct. Examples of these are the **YES/NO** and **TRUE/FALSE** type, unless these questions immediately are followed by a "why" or "how" type question.
 - (d) **ON MAJOR TEACHING POINTS OF THE LESSON.** Questions must be built around the main teaching points of the lessons. They must be asked at the proper place so that these points are emphasized.

QUESTION # 4

Consider the following questions: For each one decide if it meets all the qualities of a good oral question. If it does not, state what desirable quality of a good question is violated.

- (a) Was John A. MacDonald the first Prime Minister of Canada?
- (b) What goes up the barrel of a rifle?

- (c) In the event of catatonic paralysis induced by chronic anxiety neurosis, what is the most efficacious procedure for prevailing upon the gunner to abandon the aircraft?

5. Your students may be confused if questions are asked in a haphazard fashion. The purpose for which a question is intended may be lost. To ensure mental participation by all students, the following procedure is used:

- (a) **ASK THE QUESTION.** You should state the question, applying the qualities of a good question. To do this you must have the question in mind before asking it. If questions are being used to evaluate learning or to confirm attainment of objectives, you should prepare them beforehand and write them in your lesson plan. It is often a good idea for beginning instructors to write out ALL questions until they are accustomed to thinking on their feet.
- (b) **PAUSE.** After asking the question, you should pause for approximately 1 to 5 seconds (depending on the complexity of the question) to allow all students to think it over and formulate an answer. During the pause you should look over the class, being careful not to "telegraph" who you are going to call upon to provide the answer.
- (c) **NAME THE STUDENT.** A problem you continuously have to face is selecting the student to answer the question. Some effort should be made to fit the question to the individual because students will vary in ability and you have to recognize and provide for these differences. Therefore, you should consider giving the more difficult questions to the most advanced students. You also have to ensure that everyone in the class is called upon to provide answers with reasonable frequency. A number of systems commonly used to ensure this have serious drawbacks. For example, if members of a class are called on according to seating arrangement or alphabetical order, it becomes quite easy for students to determine when they will be named to answer; thus the lazy students will not give serious thought to any question until it is getting close to their turn to answer. Possibly the most practical approach is to call upon students in a random order, then indicate by a check mark on a seating plan card each time a student is asked a question. To get a broader sampling of learning and to maintain interest, you should periodically call upon other class members to confirm the answer made by the first student asked.
- (d) **LISTEN TO THE ANSWER.** Often an instructor, after naming a student to answer a question, will immediately begin to think about phrasing the next question and will not be listening to the answer and may say "Right" to an incorrect answer. This could lead to student confusion. You should always listen to the answer.
- (e) **CONFIRM THE CORRECT RESPONSE.** Student answers must be evaluated carefully so as to leave no doubt as to what is the correct answer.

QUESTION # 5

After asking a question, why pause before naming a student to answer?

QUESTION # 6

Why is it essential that the instructor always confirm answers to questions?

Handling Student Answers

6. Aside from always confirming correct answers, there are certain techniques you must be aware of when handling student answers.

- (a) **DISCOURAGE GROUP ANSWERS.** When students answer as a group, it is difficult to determine who supplied correct or incorrect answers, thereby leading to student confusion. When given a new class, establish early that you do not want group answers but will call upon a student by name to answer. You may, however, want to use group answers at times to increase class enthusiasm.

- (b) DO NOT MAKE A *HABIT* OF REPEATING ANSWERS. This becomes monotonous to students when you always repeat the answer. If the answer provided is not correct or needs clarification, pass the question to another student. If the students do not answer loudly enough for all the class to hear, have them speak more loudly and repeat the answer.
- (c) GIVE CREDIT FOR GOOD ANSWERS. This is especially true for the weak or shy student. When using oral questions to develop points from the class, do not reject answers that pertain to the subject although they may not be exactly what you are after. Give praise and try using a newly phrased question to bring out your point. If you receive a completely incorrect answer, don't embarrass your student by saying "Wrong". Diplomatically state that the answer is not what you wanted and ask a supplemental question or refer the question to another student.

QUESTION # 7

What technique would you use if a student answers a question and all the class cannot hear it?

QUESTION # 8

Why should group answers be discouraged?

Handling Student Questions

7. Never discourage a genuine question pertaining to the lesson. There is an old saying, — "For every student who asks a question there are six others who wanted to ask it". Usually students ask questions because you have not given a clear explanation of the point or fact being queried. Some techniques to follow regarding student questions are:

- (a) ENCOURAGE QUESTIONS. Let the class know early in the lesson that you encourage questions at any time the students are not clear on points being taught. If it will not interfere with the presentation of the lesson, it is usually best to allow questions immediately any point arises rather than waiting for a break in the lesson to solicit questions. If you wait for questions, the point of concern may have slipped their mind.
- (b) PASS QUESTIONS TO OTHER STUDENTS. Occasionally pass a student question to other members of the class — this will create interest and get class participation. Do not over-use this technique as the students may get the impression that you don't know the answer and are fishing for help. Above all, never use this technique for any question to which you do not know the answer.
- (c) REJECT QUESTIONS NOT RELATED TO THE LESSON. Quite often students will ask a question totally unrelated to the lesson. Politely reject the question being careful not to offend the student and say it is a question you would prefer to discuss after class.
- (d) DO NOT BLUFF. No matter how knowledgeable you are of your subject, there will be times you will be asked a legitimate question and not have the answer. If you do not know the answer, say so, do not bluff. Tell the class you will find the answer and ensure you do, then inform the individual who asked as well as the rest of the class.
- (e) ENSURE ALL THE CLASS HEARS THE QUESTION. When a question is asked, check that all the class has heard it. When you answer the question, answer to the class and not only to the individual asking it. If a long detailed answer is necessary, the remainder of the class may lose interest and "tune out" if you get into a conversation with one student.

QUESTION # 9

At what time in a lesson should students be encouraged to ask questions?

QUESTION # 10

How would you handle a student's question if it did not pertain to the lesson?

QUESTION # 11

How would you handle a question for which you were unable to provide the answer?

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ANSWERS FOR QUESTIONS IN THE TEXT

QUESTION # 1

Rather than giving students information, using oral questions can call upon their background knowledge and previous experience to reason out the answer, thus promoting mental activity.

QUESTION # 2

When students are allowed to participate in a lesson and contribute to its success, interest is maintained to a much greater degree than if students only sit and listen to the instructor.

QUESTION # 3

It provides only a random sampling of the class. Use some type of student response system so that one student does not answer all questions.

QUESTION # 4

- (a) It is not "thought provoking", as a yes or no answer is all that is required.
- (b) It is not clearly and easily understood, as answers such as rifling, bullets, pull through, air, etc., could be received.
- (c) It is not "composed of common words". In plain language the question merely asks "When the gunner freezes, — how do you get the gunner out?"

QUESTION # 5

To allow ALL students to mentally formulate an answer before calling on any specific individual to answer.

QUESTION # 6

To ensure no doubt is left in the student's mind as to what is the correct answer.

QUESTION # 7

Ask for the answer to be repeated so all the class can hear.

QUESTION # 8

The instructor cannot determine who provides correct or incorrect answers. Student confusion may result.

QUESTION # 9

Providing it does not interfere with the outcome of the lesson, students should be encouraged to ask questions at any time they are not clear on a point or have some doubt about what the instructor is saying.

QUESTION # 10

Politely reject the question without offending the student and state that you would prefer to discuss it after class.

QUESTION # 11

Don't bluff. Admit you do not know the answer but you will find out and let them know.

TEST QUESTIONS

QUESTION # 1

State four purposes of oral questions.

- (1)
- (2)
- (3)
- (4)

QUESTION # 2

State four desired qualities of good oral questions.

- (1)
- (2)
- (3)
- (4)

QUESTION # 3

State the procedure to follow when asking a question.

QUESTION # 4

State three points to observe in the handling of student answers.

- (1)
- (2)
- (3)

QUESTION # 5

State five points to observe in the handling of student questions.

- (1)
- (2)
- (3)
- (4)
- (5)

NOTE: Confirm your answers by referring to Summary Sheet on the following page. If you have made any errors, re-read the text to determine where you went wrong.

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TEST ANSWERS AND SUMMARY SHEET

1. Oral questions are an aid to instruction and when used effectively can successfully apply the principles of instruction during presentation of a lesson. For ready reference, a summary of the material covered in this presentation follows:

(a) PURPOSE OF ORAL QUESTIONS

- (1) Promote mental activity.
- (2) Arouse and maintain student interest.
- (3) Guide thought.
- (4) Evaluate learning.

(b) QUALITIES OF GOOD ORAL QUESTIONS

- (1) Easily understood.
- (2) Composed of common words.
- (3) Thought provoking.
- (4) On major teaching points of lesson.

(c) PROCEDURE FOR ASKING QUESTIONS

- (1) Ask the question.
- (2) Pause.
- (3) Name the student to answer.
- (4) Listen for the answer.
- (5) Always confirm correct answer.

(d) TECHNIQUE FOR HANDLING STUDENT ANSWERS

- (1) Discourage group answers.
- (2) Do not make a habit of repeating answers.
- (3) Give credit for good answers.

(e) TECHNIQUE FOR HANDLING STUDENT QUESTIONS

- (1) Encourage questions.
- (2) Occasionally pass questions to other class members.
- (3) Reject questions not related to lesson.
- (4) Don't bluff if you do not know the answer.
- (5) Make sure all of the class hears the question.

THE DEMONSTRATION-PERFORMANCE METHOD OF TEACHING

1. GENERAL

- (a) A student-instructor once asked, "If I had time to learn only one method of lesson presentation, which one should I learn?" The answer is the demonstration-performance method. Why? Well, the primary concern of an instructor is training. Training, in large part, is devoted to the development of physical and mental skills, procedures, and techniques. For example, flying aircraft, interpreting blueprints, driving vehicles, welding, building, shooting, repairing, solving problems, using a slide rule, filling out forms — all of these, and many, many more, can be best taught by using the demonstration-performance method.
- (b) The method is not new. It may be one of the oldest known methods of instruction. One can imagine the caveman demonstrating to a son the procedure for making the club, and then have the child make one.
- (c) The demonstration-performance method can be broken down into five basic procedures. These procedures are:
 - (1) explanation;
 - (2) demonstration;
 - (3) student performance;
 - (4) instructor supervision; and
 - (5) evaluation.

2. EXPLANATION AND DEMONSTRATION

- (a) The explanation and demonstration may be done at the same time, or the demonstration given first followed by an explanation, or vice versa. The skill you are required to teach might determine the best approach.
- (b) Consider the following: You are teaching a student how to do a forced landing. Here are your options:
 - (i) Demonstrate a forced landing and simultaneously give an explanation of what you are doing and why you are doing it; or,
 - (ii) Complete the demonstration with no explanation and then give a detailed explanation of what you have done; or,
 - (iii) Give an explanation of what you intend to do and then do it.
- (c) You will find that different instructors will approach the teaching of this skill differently. The following represents a suggested approach that appears to work best for most instructors.
 - (i) On the flight prior to the exercise on forced landings, give a perfect demonstration of a forced landing. It may be better not to talk during this demonstration, since you want it to be as perfect as possible to set the standard for the future performance. There is another advantage of giving a perfect demonstration prior to the forced landing exercise. Your students will be able to form a clearer mental picture when studying the flight manual because they have seen the actual manoeuvre.
 - (ii) The next step would be for you to give a full detailed explanation of a forced landing. During this explanation you would use all the instructional techniques described previously. You must give reasons for what is expected, draw comparisons with things already known and give examples to clarify points. This explanation should be given on the ground using visual aids to assist student learning.

- (iii) When in the air, give a demonstration, but also include important parts of the explanation. Usually asking students questions about what you are doing or should do, will give them an opportunity to prove they know the procedure, although they have not yet flown it.
- (iv) After completing the forced landing approach, while climbing for altitude, clear up any misunderstandings the students may have and ask questions.
- (v) The demonstration and explanation portion of the demonstration-performance method is now complete and you should proceed to the next part, which is the student performance and instructor supervision.

3. STUDENT PERFORMANCE AND INSTRUCTOR SUPERVISION

- (a) Student performance and instructor supervision are always carried out concurrently during the initial stages of training. A student should not be allowed to make a major error at this time. Your supervision must be close enough to detect the start of an error and you must correct the student at that point.
- (b) The student should be allowed to perform the task in small segments with you providing close supervision of each segment.
- (c) Referring to our example of the forced landing consider the following suggestion of how to divide the task into segments:
 - (i) On student's first attempt:
 - (a) You the instructor;
 - (1) select the field, making sure that it is within easy gliding range;
 - (2) perform all in-flight checks including engine clearing and look-out.
 - (b) The student flies the aircraft and concentrates on making the field.
 - (c) If the student makes a major error, you take control and place aircraft in the correct position, then give the student control and continue the approach. (Try to ensure that the student makes the field on the first attempt even if you have to help all the way through.)
 - (ii) On subsequent attempts, depending on the degree of success of the previous attempt, add more items for the student to carry out.
 - (iii) Continue the process until you feel the student can fly the complete manoeuvre alone. You have now completed the student performance and instructor supervision portion of this method and you should now proceed to the evaluation.

4. EVALUATION

- (a) The evaluation portion of the demonstration-performance method is where students get an opportunity to prove that they can do the manoeuvre without assistance.
- (b) For the simulated forced landing you should tell students that you will be simulating an engine failure and that they are to carry out the entire procedure including all checks and look-out.
- (c) While the student is performing this manoeuvre you must refrain from making any comments. Offer no assistance whatsoever, not even grunts or head nods. You must, however, observe the entire manoeuvre very carefully, so that you can analyze any errors that the student may make and de-brief accordingly.

NOTE: You would interrupt the student's performance, of course, if safety became a factor (clearing engine is one factor, look-out another, there may be many more).

- (d) Success or failure during the evaluation stage of the lesson will determine whether you carry on with the next exercise or repeat the lesson.

5. RULES FOR USING THE DEMONSTRATION-PERFORMANCE METHOD

- (a) Give a perfect demonstration or if not practical, show finished product. Example: When teaching map preparation, show a map with a cross-country trip all marked out — students will see the standard expected in preparing their own maps.
- (b) Give a step-by-step explanation of the required task — use reasons, examples and comparisons to make the explanation clear.
- (c) Have students imitate a step of the skill while you provide close supervision. For example, have students practise the entry to a steep turn until correctly done before going on to the next step.
- (d) Continue until the student has imitated each step.
- (e) Provide student practice, with assistance as necessary.
- (f) Ensure that the amount of time allotted for student practice *equals* or *exceeds* the amount of time for the demonstration, explanation, and student performance under very close supervision. Students should take as much time to practise as you take to teach.
- (g) Overall rule — while you are demonstrating and explaining, your student listens and observes; while your student is performing, you listen and observe. **NEVER** ask the student to perform while you are explaining.
- (h) Complete the exercise with an evaluation (final check-up) in which students have the opportunity to prove what they can do.
- (i) **NEVER** *just* explain and demonstrate a skill or procedure for students. **ALWAYS** have students perform the skill to ensure that the skill or procedure is done properly. **STICK WITH THEM UNTIL THE SKILL IS DONE CORRECTLY.** For example, a student is about to proceed on a solo cross-country trip and asks you how to fill in the aircraft journey log. Explaining how to do it, even with a demonstration, is no guarantee of student success. Have students tell you how to do it or better still, have them make a practice log entry before departure.

INSTRUCTIONAL TECHNIQUES SUMMARY AND GUIDE

1. The following techniques, if applied in a conscientious manner, will assist the flight instructor in giving effective instruction. Because most flight instructors also carry out some, if not all of the ground school training, references to classroom type instruction are included in this summary. The techniques of instruction, questioning techniques, lesson planning, etc., are equally applicable for providing large group instruction or on a one-to-one basis for air instruction, individual preparatory ground instruction, or pre-flight briefings.
2. To present a lesson in a professional manner, you must prepare in advance and proceed as follows:
 - (a) **PREPARE A LESSON PLAN**
 - (1) Reason: A lesson plan acts as a guide and keeps you on track during your presentation. It also ensures that important points are covered and not neglected because of poor memory.
 - (2) What to include: Headings of main points — sufficient notes to jog memory on talking points — specific questions and answers to confirm student learning — visual aid instructions (including a chalkboard plan) — a well thought out opening and closing statement — estimates of the amount of time to be spent on each major idea or item — a visual aids plan — any other point that you feel will help to get the lesson across.
 - (3) What to avoid: Writing material out in full detail (this promotes reading the material while in front of the class); using single space format (this does not allow for revising notes next time the lesson is to be given); writing in longhand unless you are able to read your notes at a distance of three feet (this makes you appear not to know your material because of having to look closely at your lesson plan rather than just glance at it to jog your memory).
 - (b) **PREPARE THE CLASSROOM/TEACHING AREA BEFORE THE LESSON**
 - (1) Reason: The class must be arranged for best student learning. If students cannot see all the aids, they may miss a point. Lesson preparation appears more professional if no time is wasted organizing aids or re-arranging seating.
 - (c) **PREPARE/CHECK TRAINING DEVICES/AIDS BEFORE THE LESSON**
 - (1) Reason: It avoids embarrassment should an item not work, or if any chart, slide or graph were to be shown in the wrong order. Always ensure you have extra light bulbs for any projection device.
 - (d) **PREPARE YOUR STUDENTS FOR LEARNING**
 - (1) Reason: If students are to learn, they must be physically, mentally and emotionally ready to do so.
 - (2) How to do it:
 - (a) Tell students specifically what is required of them during the lesson and what they will be able to do at the end of the lesson.

- (b) Tell students why they should take part in the lesson and how the new skill or knowledge will benefit them. Give as many advantages as you possibly can for having students learn, as they may not agree with some of your reasons.
 - (c) Give students an over-all picture of the lesson, and show them how it fits into the entire course. Attempt to relate the new material to some past and/or future experience of your students.
 - (d) The length of time required for preparing students to learn depends primarily on their background knowledge and the complexity of the material. As a general guide, the amount of time needed is approximately ten percent of the lesson.
- (e) **START THE PRESENTATION OF NEW MATERIAL AT THE STUDENTS' LEVEL OF UNDERSTANDING**
- (1) Reason: If you begin your presentation at a level where your students do not understand, there will be confusion and time wasted. Little or no learning will take place.
 - (2) How to determine the students' level of understanding:
 - (a) Before the instruction starts, conduct a Threshold Knowledge Test (T.K.T.) to determine what your students know, or do not know. A Threshold Knowledge Test is simply some form of examination, written or oral, of sufficient length to inform you as to the actual level of knowledge.
 - (b) During the course of instruction have periodic reviews.
 - (c) Conduct a review of previous lessons before starting each lesson. The review should consist of a series of questions. If your students answer correctly, proceed. If they do not, re-teach.
 - (d) Check with other instructors for the strengths and weaknesses of your students, and arrange your material to fit the students' needs.
- (f) **PROCEED AT THE RATE OF STUDENT COMPREHENSION**
- (1) Reason: If you get ahead of your students during the presentation, you are in the same position as if you started above their level.
 - (2) How to ensure that you are proceeding at the required rate:
 - (a) Arrange your material in stages. Stop at the end of each stage and ask specific questions on the material you have just covered. If your students answer correctly, proceed. If they do not, re-teach. The length of time for a stage depends on the complexity of the material being presented, *but a good general rule is 8-12 minutes.*
 - (b) Write out in full a number of well thought out questions. Put these questions on your lesson plan and make sure they are asked during the presentation. The feedback you get from these answers will determine whether or not your students understand.
 - (c) Observe your students closely for facial expressions which could indicate that they do not understand a particular point. If students say they understand, ask them a question to make sure.
 - (d) Encourage students to ask questions on points which they do not fully understand.
 - (e) Provide for lots of practice of basic skills before going on to the more complex parts.

(g) IDENTIFY AND EMPHASIZE MAJOR POINTS FOR THE STUDENTS

- (1) Reason: During any presentation there is a mixture of "need-to-know" material, that is extremely important, and "nice-to-know" material, which may or may not have to be remembered for a long period of time.
- (2) How to identify and emphasize points for your students:
 - (a) Prepare a visual aid of the main points — approximately 75% of learning comes from vision, whereas only about 13% comes from hearing. The visual aid may be a heading on a chalkboard, chart, or projected image.
 - (b) Have students write the main points down in their notebooks, or provide notes which include these main points.
 - (c) Make a verbal statement to the students such as: "This particular point is very important; remember it."
 - (d) Prepare an orientation board (chalkboard or sheet of paper), that identifies the major points for a lesson. Students can refer to this board throughout the lesson, and this helps their thoughts to be guided to a specific area.
 - (e) Raise the volume of your voice and reduce the rate of delivery while stating an important point, to add emphasis .
 - (f) Besides emphasizing main points, you should also emphasize safety and points that are easily forgotten or difficult to remember.
 - (g) Provide emphasis according to relative importance. The most important things get a greater amount of emphasis.
 - (h) Emphasize points by giving verbal examples (real or imaginary) — by comparisons (similarity or difference to known facts) — and perhaps most important, by giving reasons for each point you make. Students tend to remember better if they understand the reasons behind every point they must learn.
 - (i) Repeat the point frequently — by using summaries, or have your students repeat the point by answering your questions.
 - (j) Conduct periodic reviews of the "need-to-know" material.
 - (k) Have the students complete a home assignment of the important points of a lesson.
 - (l) Have students record, in note form, the major ideas or items you feel must be emphasized. By having them write ideas down, you are using another sense and so learning may be reinforced.
 - (m) Use a variety of training aids to appeal to several senses (touch, feel, etc.).
 - (n) Do not emphasize "nice-to-know" material.

(h) GIVE CLEAR EXPLANATIONS AND DEMONSTRATIONS

- (1) Reason: If students do not understand an explanation, you will have to reteach by rephrasing, or by going over the material a second time. The same applies to a sloppy or inaccurate demonstration.
- (2) Suggestions for ensuring that your explanations and demonstrations are clear:
 - (a) Start verbal explanations by referring to something already known by your students. Association of ideas makes it easier to follow your explanation.

- (b) Use words and phrases that are commonly used. Avoid showing off your command of the English language by using such phrases as: "Elaborate on the fundamental ramifications of hylampherism." Instead, ask "What happens when the lever is lifted?"
 - (c) Attempt to reduce complex material and ideas to a simple, easy to understand form. The best way to do this is to start with something your students know about and build on that knowledge in small steps.
 - (d) If you are required to demonstrate something, make sure you can do it correctly before you show the students.
 - (e) Make sure all students can see even the smallest points of a demonstration — if necessary, gather them around you.
 - (f) If you are doing a simultaneous demonstration and explanation, break the demonstration down into small steps and explain each step thoroughly giving reasons, examples and comparisons.
- (i) USE VISUAL AIDS AND USE THEM EFFECTIVELY
- (1) Reason: Approximately 75% of all learning comes through sight.
 - (2) Sources of ideas;
 - (a) graphic artists or personnel associated with the production of visual aids,
 - (b) other instructors can often give the spark to an idea,
 - (c) commercial displays in newspapers, magazines, television and stores,
 - (d) finally, your own imagination, if you give it full rein, is an excellent source of ideas for aids.
 - (3) Types of visual support;
 - (a) actual equipment,
 - (b) mock-ups, charts, diagrams, pictures or models,
 - (c) films, video tape and cassette recordings,
 - (d) sometimes — people.
 - (4) Guidelines:
 - (a) Plan the lesson first, and then select the type of visual support that helps students learn the material. **DO NOT** select a visual aid and then try to build a lesson around it. Just because the aid looks impressive, it does not mean it will fill the need — the need being to help your student learn the "must-know" information.
 - (b) Plan to use a visual display of all major points that are covered during your lesson. Simple wording on the chalkboard is usually better than repeating the main points over and over again.
 - (c) Make your aids simple and clear. Eliminate all unnecessary data. Avoid the tendency to produce ornate, detailed artwork.
 - (d) Manufacture aids that can be seen by all the students. Before you use it, put the aid in the position in which it is to be used. Go to the position of the student farthest away, and ensure that you can see the aid clearly.
 - (e) Use a variety of colour to add interest, but make sure you keep associated parts or ideas or a repeating idea in the same colour. In this way you help your students to follow your presentation more easily.

- (f) When an aid is not in use, cover it up or remove it from sight. It can act as a distraction for your students if it is there but not being used.
 - (g) If the aid includes written words, have someone check for correct spelling and grammar. You would be surprised how many times mis-spelled words are displayed for students.
 - (h) If possible, stand well away from the aid and use a pointer, so that you do not obstruct the view of any student.
 - (i) If using charts, it is sometimes advisable to have two copies, one labelled and one unlabelled. The unlabelled one can be used later to test student knowledge. Alternatively, a duplicate work sheet of the chart can be given to each student to fill in or label.
- (5) Consider: Will the aid help the student learn better, easier, or faster? You should "show them as well as tell them".
- (j) VARY THE RATE, VOLUME AND PITCH OF YOUR VOICE WHEN DELIVERING THE LESSON
- (1) Reason: Any form of variety adds to student interest. Speaking in a dull manner will generally put students to sleep, or at least allow their minds to wander off the subject.
 - (2) Consider:
 - (a) Speak at a fast rate while presenting "nice-to-know" material. This produces the effect of observable enthusiasm, and enthusiasm is contagious.
 - (b) Speak at a slow rate when identifying "must-know" information. This allows students to separate the "need-to-know" from the "nice-to-know" material, and in most cases adds emphasis to the points being made.
 - (c) Adjust the volume of your voice to the conditions under which you are instructing. If there is background noise you must raise the volume of your voice so that all the students can hear what you are saying. In an aircraft, this is a "must".
 - (d) Generally you will have very little control over the pitch of your voice, but adjusting the volume and varying the rate of delivery will often help to vary the pitch to some extent.
- (k) OBTAIN FEEDBACK FROM STUDENTS BY LOOKING AT THEM (EYE CONTACT)
- (1) Reason: It gives students the feeling that you are interested in them and allows you to determine whether or not they understand what you are presenting. This is a little difficult to do in an aircraft.
 - (2) Consider:
 - (a) Look directly at students, but do not stare at any particular individual for too long at a time. If students avert their eyes, look at someone else or out the window, it means you have stared too long and possibly caused some embarrassment.
 - (b) Make your eye contact impartial. Do not favour any individual student or group of students; include them all in your presentations.

- (I) PROVIDE FOR MAXIMUM STUDENT ACTIVITY DURING THE LESSON
- (1) Reason: Students learn more easily if they are actively engaged in the learning situation.
 - (2) Consider:
 - (a) When learning a theory subject, students' practice of that theory is usually in the form of answering questions. Ensure that you ask questions throughout the presentation.
 - (b) Use sound questioning technique as outlined in the section "Oral Questions".
 - (c) Distribute your questions evenly among all the students, to avoid having a few answer all the questions.
 - (d) Make your questions thought-provoking and challenging.
 - (e) Avoid questions that require a simple **YES** or **NO** answer, unless you immediately follow up with a "why" or "how" question.
 - (f) Always have enough information in the stem of your question to guide the students' thoughts towards a particular area. Avoid general or ambiguous questions, such as "What goes up the cylinder of an engine?" You may not get the answer you are looking for.
 - (g) Meaningful activity while learning a skill is normally a combination of answering questions and practising the various steps of the skill. Arrange to have students involved in the practice as soon as possible after the start of the lesson. If possible, build into the first part of the lesson a "hands-on" opportunity for your students. This increases their interest, and in most cases will give them a positive desire to learn more.
 - (h) Always supervise student practice very closely; do not allow them to make mistakes from which they could begin to learn bad habits. If you do, it means you will have to reteach them. The phrase "practice makes perfect" is only true if the person practising receives close guidance and supervision.
REMEMBER, ONLY CORRECT PRACTICE MAKES PERFECT.
 - (i) When students are able to perform a task with a reasonable degree of proficiency, introduce some competition (speed or ability), or introduce a variation of the skill — but after they have almost mastered the basic skill.

DEVELOPMENTAL TEACHING OR TEACHING BY QUESTIONING

1. Developmental teaching is based upon a student centred philosophy of teaching which requires you to reason with students to have them meet predetermined objectives. Using students' background knowledge, you ask questions which lead students to determine the next step in a procedure, the logical application of a principle, or the final solution to a problem. The rate of progress in developing the more complex ideas of the lesson is governed by the students' perception and comprehension. Questions should be asked to review previously learned material. The process of developmental teaching begins when students are required to reason out and make suggestions with respect to new material.
2. Developmental teaching has been used throughout the years by all good teachers. Because of the requirement for every student to participate, developmental teaching is effective with small groups and with individual students. It can be used at any level of student knowledge provided you know or determine the appropriate level and proceed accordingly. Depending upon the subject matter, some lessons can be entirely "developmental". More frequently, however, there will be a combination of teaching by explanation, where it may be more efficient to explain certain material, and developmental teaching where crucial areas of the subject matter can be reasoned with your students. In almost every lesson, some developmental teaching is appropriate and desirable.
3. The main advantage of developmental teaching is that it promotes efficient student learning because it satisfies all the basic aspects of learning. Since students participate in meaningful activity, they are forced to think about the material being learned, as questions are answered verbally. Consequently, interest is maintained, a sense of accomplishment is gained and effective learning takes place. You receive constant feedback and frequent confirmation of a student's progress.
4. Careful planning for developmental teaching is critical because you must formulate appropriate questions which demand reasoning on the part of your students. The standard questioning techniques must be observed, and student responses must be handled with tact and discretion. In addition to being a master of the subject material, you must be flexible in your approach. You must permit adequate discussion, yet exercise sufficient control to move towards the lesson objectives. Frequent summaries are necessary to consolidate the material as the lesson progresses.
5. Novice instructors are frequently apprehensive about trying developmental teaching. Experience has shown that students consistently surprise instructors if given the chance to participate actively in the learning process. The disadvantage of lecturing during preparatory instruction is that students are frequently told material that they already know, or that they reasonably can be expected to deduce on their own. The best teaching occurs when students are led to a point from which they can systematically direct their own reasoning to the solution of a problem. The secret of effective learning is to keep students mentally active in the learning process. With developmental teaching students are forced to think.

STUDENT PROGRESS

1. RATES OF LEARNING

- (a) Although it would be convenient if the rate of learning could be consistent and predictable, it is not always so. Students may progress rapidly for a period, and then suddenly progress more slowly or even regress for a time. Such variations are to be expected. It is your responsibility to detect them as soon as possible, and to try to eliminate their causes by re-directing your instruction to level them out as much as possible.

2. ADVANCES AND PLATEAUS

- (a) Learning proceeds rapidly at first when a new task is introduced, then slows as a reasonable degree of proficiency is achieved. When plotted on a graph, this decrease in the rate of learning is shown as a levelling of the ascending curve which represents progress (FIG. 3). As students achieve the ability to bring together other aspects of training, progress then tends to resume its upward climb at a slower but fairly constant rate.
- (b) The relatively level portion of the learning curve is termed a plateau. It may represent a period of training during which the student is perfecting the application of the new skill. The correlation of the new skill with the other learning tasks may not yet be obvious.
- (c) The rate of progress in learning is affected by so many outside influences that it is not often predictable. The rate of learning is affected by such things as:
 - (1) diversions;
 - (2) lagging motivation;
 - (3) emotional disturbances;
 - (4) upset training schedule;
 - (5) weather;
 - (6) equipment breakdown; and
 - (7) unavoidable absences.
- (d) Slumps or plateaus in the rate of learning are more likely to occur as your student advances to more complicated operations, such as cross-wind take-offs and landings. Often the reason is that a student has failed to master one basic element of the operation, which leads to the appearance of deficiency in the performance of later elements. Improvement usually becomes normal again when this one basic element is mastered. You can accelerate improvement by careful fault analysis and by concentrating instruction on that one phase of the operation concerned.
- (e) Without competent instruction, students will probably not understand why they aren't improving and will become discouraged. This discouragement tends to prolong the plateau. During such periods of discouragement, you should step in to isolate and correct the situation, and to provide special incentives until normal progress is resumed.

Typical Learning Curve

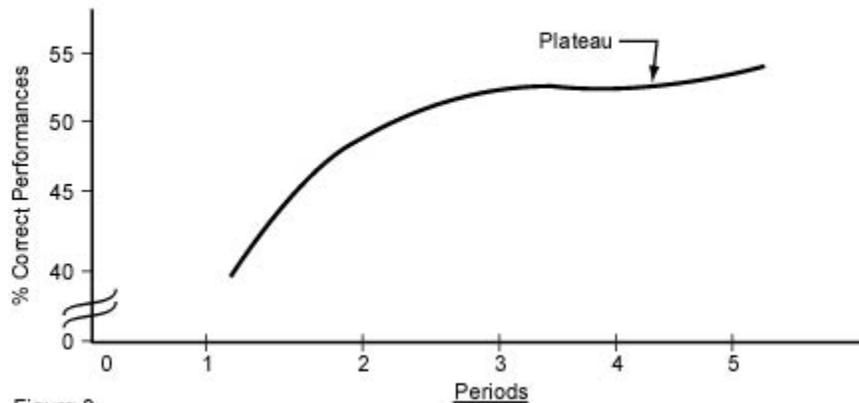


Figure 3

- (f) Reversals sometimes occur, during which a student's performance becomes worse with continued practise. Generally such reversals are due to a faulty habit pattern involving one of the basic elements of the manoeuvre or operation involved. This faulty habit causes your student to practise an erroneous performance repeatedly, until correction becomes very difficult. You must not accept such errors and misunderstandings as normal plateaus in the learning process. They must be corrected before progress can resume.
- (g) During advanced stages of learning, the rate of progress can be very slow. Example: An acrobat who can perform a routine to a level of 9.6 continually practises to improve the performance. Raising the score up to 9.8 or 10 requires extensive training and practise. Students may be nearly ready for a flight test at an early stage and added training will only show slight, slow improvement.
- (h) Reversals in the rate of learning could also take place if you were to place too much emphasis on a single phase, element or manoeuvre.

INDIVIDUAL DIFFERENCES

1. You are likely to be discouraged when you discover that a well-planned lesson does not teach all students with equal effectiveness. Usually, however, you soon see that this is natural. One manifestation of the difference among students is that they seldom learn at the same rate. Differences in rates of learning are based on differences in intelligence, background, experience, interest, desire to learn, and countless psychological, emotional, and physical factors. You must recognize that students are different. You must recognize that this fact dictates how much you can teach, at what rate, and when.

Personality Differences

2. **Attitude:** — Students have their own personal attitudes and methods of thinking. Thinking patterns and reactions to the various philosophies and types of training must be reconciled. The instructor must consider if the attitude is caused by hereditary or environmental factors. The root of attitude problems may sometimes be found in the general attitude of the school staff.
3. **Interest:** — People sense ideas and activities that possess special values, uses or attractions for them. Three general categories of interest are the vocational, educational, and avocational. The interests of students in different aspects of flying will differ. Efforts should be made to take advantage of these, and to channel students into different areas as needed.

Emotions

4. Emotions play an important part in the training of a student. You must know the kinds of emotions and techniques for controlling them. Most of us think of emotion as overpowering feelings such as passion, hatred, or grief. These are not typical of the entire range of emotions. Everything we do, or with which we come in contact, is coloured by some emotional feeling. Emotions vary from mildly pleasant or unpleasant feelings, all the way up to feelings so intense that physical and mental activity is paralyzed. All of us experience a wide variety of emotions every day. Rarely do they bother us or interfere with our ability or willingness to do our job. However, students in flight training are in an abnormal emotional condition. Students are in unfamiliar situations where accelerated pressures are experienced over a long period of time. The learning situation tends to intensify the students' emotional problems more than we would expect in everyday life. You cannot ignore this problem but must learn how to recognize and overcome it.

Degrees of Emotion

For our purposes, we will divide the various levels of emotion into 3 categories:

5. **MILD EMOTION:** — This is the everyday type of emotion such as a small amount of satisfaction or dissatisfaction with our jobs, our personal lives, or with other people. Mild emotions affect motivation.
6. **STRONG EMOTION:** — This degree of emotion is not felt very often in everyday life, but causes most of our emotional problems in flying training. Strong emotions cause a large amount of tension in an individual, and no one can live or work normally with prolonged tension; however, strong emotion can be coped with.
7. **DISRUPTIVE EMOTION:** — These are very severe, deep-rooted emotional tensions which will disrupt logical action and clear thinking. Persons suffering disruptive emotions usually require the assistance of a psychiatrist; however, they occur so rarely that you need only be aware that they exist.

The Effect of Strong Emotional Tension

8. A person cannot tolerate strong emotional tension over any length of time. It causes extreme nervousness, irritability, and an inability to relax. It interferes with normal eating and sleeping habits, and makes the subject generally miserable. Everyone either consciously or subconsciously, tries to relieve prolonged emotional tension.

9. The effect of emotional tension on learning depends on the method chosen by the student for relieving it. If the problem is attacked directly, and solved, then learning is enhanced. For example, students may have strong feelings of frustration or worry due to deficiency in one phase of the flight training program. If they work harder, study more, and receive extra instruction, progress will probably become satisfactory and tension will disappear. On the other hand, if the real problem is avoided, an escape mechanism may be used to reduce tension and learning will suffer.

Use of Emotional Escape Mechanisms

10. Students in flight training will often use the following escape mechanisms. Occasional use of escape mechanisms is normal in everyone, but their over-use indicates strong emotional problems. You, therefore, must learn to identify the symptoms which indicate that a student is using escape mechanisms.

- (a) *Projection* — transferring the blame from oneself to someone or something else.
- (b) *Rationalization* — finding a believable excuse for one's actions or failure; trying to justify unjustifiable behaviour.
- (c) *Resignation* — becoming resigned to the situation; giving up.
- (d) *Flight* — physically or mentally removing oneself from the tension producing situation.
- (e) *Aggression* — taking one's tension out on someone else by becoming belligerent or argumentative.

11. A student's over-use of one or more of the escape mechanisms, along with other symptoms, may indicate an emotional problem. You should not wait until emotional tension becomes extreme before taking corrective action.

Meeting the Differences

12. You must be cognizant of the differences in aptitude, personality, and emotions among your students, and understand the necessity to treat students as individuals. When you have analyzed the situation and determined the differences, seek assistance from more experienced instructors or supervisors when it is necessary. You will attempt to equalize the different levels of understanding, ideally raising the level of some without retarding the progress of others. Coping with differences among students is perhaps the greatest challenge of instructing, and finding the correct approach for each student is essential.

13. Some traits and faults of students are fairly common and can be recognized easily. These are discussed in the following paragraphs, together with suggested corrective actions. (Refer to Table 2)

- (a) **NERVOUS OR UNDERCONFIDENT.** Nervousness or underconfidence in a student is a trait which may or may not disappear. Instruction may be too rapid and material may not be absorbed. Repeating the fundamentals and ensuring mastery will often alleviate this condition. You must ensure that this type of student receives deserved praise whenever

SUGGESTED ACTION	PROBLEM												
	Learns slowly	Know-it-all	Timid	Wastes time	Too aggressive	Antagonistic	Learns rapidly	Finds fault	Immature	Courts favours	Stalls, evades	Dominating	Inattentive
Provide less work	•												
Provide more work		•			•		•			•		•	
Give more individual instruction	•		•								•		
Be patient in correcting mistakes	•		•										
Give no chance to dodge responsibility		•	•	•				•	•	•	•		•
Rigidly check student's work		•		•	•			•	•	•	•	•	•
Let student know what is expected		•		•		•		•	•	•	•	•	•
Determine validity of grievances						•		•					
Give student more responsibility				•	•	•	•	•			•		•
Give more difficult assignments		•			•		•						
Require student to prove ability		•						•		•		•	
Have student work alone				•			•				•	•	
Keep student informed of progress		•		•				•	•		•		•
Tell student why progress is poor			•	•		•		•	•		•		•
Check at first occurrence				•				•	•	•	•	•	
Have a personal talk with student		•	•	•		•		•	•		•	•	•

Table 2

possible. Harsh rebukes should be avoided. Patience is very necessary when dealing with a student of this nature. The student must be aware that you are trying to help. Nervous students may be so apprehensive that they may not be suitable for pilot training. You should avoid manoeuvres involving high G and extreme aircraft attitudes, unless they are essential to the lesson being taught. Take the time to build the student up to exercises involving high G loads or extreme attitudes.

- (b) **OVER-CONFIDENT OR CONCEITED.** You must first ensure that this type of student has the ability to match the confidence and, if so, set more difficult tasks that require greater accuracy. More criticism of imperfections is advisable. If the student has little ability, counselling may be required. Any signs of familiarity must be discouraged.
- (c) **FORGETFUL OF INSTRUCTION.** At the beginning of training, students may forget previous instruction. Students with this problem require a great deal of patience and probably need more review than the average student. Extra time spent in briefing and debriefing, and more study on the student's part should be rewarding for all concerned.
- (d) **INCONSISTENT.** Many students, at one time or another throughout the course, appear to lack consistency in flying proficiency. There are many reasons for this and you must try to find the one that fits a particular student. You must look at yourself and your attitude towards the student. Most of us have good days and bad days, but when a student shows large fluctuations in proficiency the instructor must look closely at the teaching activities. A change in approach or even a change in instructors may be called for.
- (e) **SLOW STARTERS.** Slow starters may be students who find difficulty doing more than one thing at a time. Again, patience is mandatory. Progress may be slow, but encouragement will help.
- (f) **FAST STARTERS.** Fast starters are usually students with previous exposure to flight training who quickly grasp the initial air exercises. You should not omit anything from the briefings. Watch for signs of weakness when new work is introduced. This type of student usually slows down to the level of the others shortly after going solo. A high degree of proficiency throughout the course should not be anticipated unless the student has above average ability.
- (g) **IMMATURE.** You must not be too harsh with students who appear immature. You will find that within a short time in the flying training environment, the students will attain a greater degree of maturity. Your attitude is of prime importance in setting an example. You must encourage and assist these students whenever possible.
- (h) **AIRSICKNESS.** Some students may suffer from airsickness induced by motion, negative G, apprehension, claustrophobia, tensions or excitement. You must attempt to determine what affects the student. When signs of airsickness show up, try methods of prevention such as letting the student fly straight and level, stopping instruction, inducing relaxation, making conversation about something else, or whatever will keep a particular student from becoming airsick.

STUDENT INSTRUCTOR RELATIONSHIP

1. The primary responsibility for establishing a favourable student-instructor relationship rests with you. The successful performance of your job requires that your relationship with students accomplishes three things. It must maintain discipline and respect for you the instructor — these are necessary for any leader. Students must obey your directions, especially in an aircraft. They must follow your example and strive to carry out your instructions and suggestions for improvement.

2. The desire to help your student solve a problem is an important part in student-instructor relations. An obvious willingness to help students with problems will do more than anything else to hold respect, loyalty, and co-operation. This willingness is demonstrated, and often the students' problems are solved by counselling. It is a continual process and informal counselling takes place any time an attempt is made to help students with problems concerning training.

3. You want your teaching to result in good pilots who are able to use the initiative, judgement and skill which you have nurtured in them throughout the course. If students are to respect rather than fear or resent your authority, you must be fair, firm and friendly. Do the following and you will be considered to have some of the qualities of a good instructor.

- (a) Inspire your students to set goals which will stand them in good stead in aviation. Your exemplary conduct and high ideals will help in this goal.
- (b) Be decisive. Weigh all the factors necessary to make decisions and then act with conviction.
- (c) Be interested in your students and let them know by being familiar with their backgrounds, problems and achievements.
- (d) Respect their rights and when correcting mistakes, do so in a straightforward manner, never using sarcasm as a correction method.
- (e) Acknowledge your own mistakes. The admission that "You were right and I was wrong" does much to develop morale.
- (f) If you do not know the answers to relevant questions, say so, find the answers and tell the students later.
- (g) Be enthusiastic. Instructor enthusiasm is reflected in student learning.
- (h) Encourage student initiative, self-reliance, ideas and suggestions. By doing so, you teach your students to reason for themselves instead of driving them to rigid conformity. However, stress that there are certain boundaries which they must not overstep.
- (i) Be impartial and fair — never show favouritism.
- (j) Never bluff — much of your subsequent instruction may be distrusted.
- (k) Use humour. Appropriate humour creates goodwill and can be used to teach difficult subject material. But do not become so humorous that the business at hand becomes secondary.
- (l) If you doubt a student's progress or motivation, arrange for an independent check. Perhaps some modification to your teaching approach may be needed. In extreme cases a change of instructors may be in order, if your school situation will allow.
- (m) Be aware that the use of cockpit intercommunication demands suitable phrasing, speech level, clarity, and discipline.
- (n) Teach your students to have mastery over the aircraft; to fly with verve and spirit to the limit of the aircraft's flight envelope; to know what they can and cannot do; but draw a very definite distinction between intelligent confidence and foolhardiness.
- (o) *Plan all solo lessons.* Give your students thorough pre-flight and post-flight briefings, and make sure that they clearly understand the requirements and aims of the exercises. Thorough debriefings allow you to find out about difficulties which you may not hear about otherwise. To your student, failure to debrief may appear to imply a lack of importance to the exercise or a lack of interest on your part.
- (p) Be present when your students are being debriefed after check rides or tests. You may find out points that you may have missed while flying with your student, and you

will certainly get details in a verbal debriefing that will not be included in a written report.

- (q) Maintain a professional image.

ANALYSIS OF STUDENT PERFORMANCE

1. Analysis of student performance is necessary at all levels of flight training. The ability to debrief effectively does more to separate the successful instructor from the poor one than does above average flying ability. You must realize that the sole purpose of this analysis is to improve future student performance. A valid critique contains three essential elements: (1) strengths, (2) weaknesses, and (3) specific suggestions for improving. Without each of these elements, this analysis is ineffective as it does not accomplish its sole purpose.

2. Strengths are analyzed to give a feeling of satisfaction and to show that you recognize what students can do well. If you are unable to identify strengths, it will be difficult for students to believe that your identification of weaknesses is accurate. Positive reinforcement of a student's strengths will frequently do more for students than any number of remedial suggestions on your part.

3. The necessity of analyzing weaknesses is readily apparent. This leads into the third element — specific suggestions for improvement. Whenever you are critiquing a student consider the following: — if you are unable to suggest a remedy for overcoming the weakness, your student does not have that weakness. Positive suggestions are mandatory for improving future performance; however, you should limit your critique to the identification of a maximum of three weaknesses with suggested remedies. Attempting to correct all the weaknesses that a student may have at one time could result in your student not being able to correct any weaknesses. During actual flight instruction you should attempt to pin-point a single major weakness before considering the next. Improvement in a student's performance takes time — an expert will not appear overnight. More will be learned if a definite improvement in performance is experienced each time the student takes part in a lesson.

4. The recommended format to follow when conducting analysis of student performance:

- (a) When in the air;
- identify major strengths,
 - pin-point a major weakness,
 - suggest a remedy to correct that major weakness.
- (b) On the ground;
- identify major strengths,
 - identify a maximum of three major weaknesses,
 - suggest remedies to correct the major weaknesses.

NOTE: One way to think of a major weakness is: "What item, if corrected now, would result in the correction of the greatest number of other faults?" As student performance improves, the weaknesses that originally were considered minor ones now become the only weaknesses. All weaknesses will be dealt with but in order — the most important ones first.

CHARACTERISTICS OF EFFECTIVE ANALYSIS OF STUDENT PERFORMANCE

1. Effective analysis of student performance always strives for maximum objectivity. You should never allow personal bias to affect the grading or analysis of any particular flight. Objectivity should be considered in both student personality and flying techniques. At times personality conflicts occur but as a professional instructor you will hold these to a minimum. In the area of flight technique, you may become dogmatic and accept only one way to accomplish a manoeuvre.

Always keep in mind that there are many techniques that accomplish the same manoeuvre correctly.

2. You must be consistent in your analysis. Always attach the same importance to an error, provided the circumstances remain the same. Without a consistent set of rules, you will be considered arbitrary or accused of playing favourites.

3. Honesty is the best policy for critiquing. The situation where you may attempt to motivate a weak student by giving better grades than deserved jeopardizes the effectiveness of your instruction. Students must know exactly where they stand and be given specific suggestions for their improvement. This is the sole purpose of analysis of student performance and emphasis must be placed on this function.

GROUND SCHOOL TRAINING

Ground School Definition

1. Classroom type instruction, generally to more than one person, covering items to be taught in the curriculum. This prepares the student for the written examination, although instruction may also be extended to cover the air exercises.

2. This is a list of subjects from the appropriate Study and Reference Guide that the student should have learned or be familiar with before the Preparatory Ground Instruction is given. These points should not form part of the Preparatory Ground Instruction or Pre-flight Briefing.

PREPARATORY GROUND INSTRUCTION

Preparatory Ground Instruction Definition

1. Classroom type instruction, normally on a one-to-one basis, but not excluding group instruction, covering the steps necessary to fly an air exercise. While basic theory of flight, where applicable, would previously have been covered in ground school, some theory may be necessary to explain a point related to the conduct of the air exercise. Essentially Preparatory Ground Instruction should cover the "how to do an air exercise".

2. This is a presentation given by the instructor when introducing a new exercise. Ideally it should be given within 24 hours prior to the related training flight.

PRE-FLIGHT BRIEFING

Pre-flight Briefing Definition

1. Discussion on a one-to-one basis just prior to the conduct of an air exercise to ensure that the student understands exactly what will take place. This is essentially a practical briefing on the Air Instruction in Part II of this guide, avoiding theory but including the important aspects:
 - (a) What are we going to do;
 - (b) How are we going to do it; and,
 - (c) Safety Considerations.

2. This is separate from the ground presentations. It should precede all flights, whether or not there is a new exercise to be covered. It is also particularly important when sending a student solo. Points that should be covered include:
 - (a) Meteorological and aerodrome conditions, and NOTAM;
 - (b) The aeroplane to be used, its fuel state and other relevant information;
 - (c) Where the exercises will be conducted;
 - (d) Take-off time, duration of flight and time when the aeroplane will land back at base;
 - (e) The sequence of exercises to be covered during the flight; and,
 - (f) A review of relevant airmanship points and decision-making situations expected during the flight.

IN-FLIGHT INSTRUCTION

1. The in-flight exercise is the culmination of all ground training and preparation. To achieve maximum effectiveness, it must be flown immediately after the pre-flight briefing, and to avoid confusion it should be flown as briefed. The following is a guide to the conduct of a training flight. Variations may be necessary to suit individual student requirements.

Control of Aircraft

2. There should never be any doubt as to who has control of the aircraft. The procedure for giving and taking control is:
 - (a) When you as pilot-in-command wish to give control to your student, say clearly "You have control". Teach your student to take control only when ready and then to say "I have control". You do not relinquish control until you hear this phrase.
 - (b) When you want to take control, say "I have control" and then take control, ensuring that your student says "You have control" when relinquishing control.
 - (c) As pilot-in-command, you have the final authority. Your request to give or take control should not be questioned but acted on as quickly as possible by your students.
 - (d) When the student has control, you must not "ride" the controls. Your student may feel that you are taking control and this could lead to a dangerous situation. Additionally, you may rob your student of the feeling of accomplishing the manoeuvre independently. This procedure must be adhered to at all times.

In-Flight Teaching

3. For most new exercises you should first review the main points of the manoeuvre and then give a perfect demonstration. The review must be short. Include such items as airspeeds, power settings, altitudes, etc. Usually you can obtain this information from your student. Your demonstration should be a complete manoeuvre and should set the standard you want your student to ultimately achieve.
4. In the case of a complex manoeuvre, after the perfect demonstration, demonstrate a small portion of the manoeuvre giving a brief explanation either before, during or after the demonstration. Have your student attempt this small portion. Watch closely for any major error. If you observe a major error, take control immediately and explain to your student what was done incorrectly, then demonstrate as soon as possible what to do to correct the error. Allow practice of that small portion before proceeding to the next portion. Continue the process of demonstration, explanation and practice with close supervision of each step or portion, until your student has completed the entire manoeuvre. Then, allow continued practice, slowly withdrawing your guidance and assistance.
5. As your student gains proficiency, you may look for minor errors and correct them in the same manner. Remember though, learning to fly well takes time and you should concentrate on the major points first. Many of the minor errors will be corrected as your student corrects the major faults. Also, remember to praise for good performance.
6. If practical, conclude the air exercise with a perfect demonstration of the manoeuvre to be learned on the next lesson. This will help your student fully understand the home study about the next exercise and also provide a positive mental picture about what will be taking place during the next flight. Of course, you would not give a demonstration of new material if the next lesson was to be a review or a repeat of a lesson.

Analysis of Student Performance

7. When discussing a student's performance, always take control so that your student may devote full attention to the instruction. In some cases you may ask the student to analyze the errors in a particular sequence, usually this will happen during latter stages of training. Do not be overly critical of minor faults during early stages. Correct major faults first and then, as improvement is noted, correct the minor errors. If a student indicates problems on a solo flight, it may be possible to analyze the problems from the student's description of actions and the aircraft's response. The correct technique can then be reviewed and practised on the next flight. Sometimes, however, students may not be able to identify or describe a problem clearly enough for a good ground analysis to be made. You should then fly the exercise on the next dual flight where you can analyze the performance and correct any faults.

Planning of Flight Instruction

8. To make efficient use of the time available, you should plan the flight to avoid delays between exercises. Fuel limitations, area restrictions and weather conditions should all be considered. Your flight should be planned so that one exercise is logically and directly followed by another with a minimum time spent losing or gaining altitude or in transit from one area to another.

9. Time spent going to and from the practice area can be utilized to full advantage. Suggested items among other things, that might be included are:

- (a) Airspeed changes;
- (b) Ground speed checks;

- (c) Low level navigation;
- (d) VOR, ADF or GPS introduction;
- (e) Discussions of traffic pattern joining procedures should wind change;
- (f) Emergency procedures;
- (g) D.F. steers;
- (h) Map reading;
- (i) Estimated times of arrival;
- (j) Application of rule of thumb procedures;
- (k) Diversions (navigation).

POST-FLIGHT BRIEFING (DEBRIEFING)

Post-flight Briefing (Debriefing) Definition

1. Review with the student each exercise undertaken during the flight. In the case of a dual flight, the debriefing should include strengths and weaknesses and suggestions to improve performance. An outline of the next training session should be given along with study assignments.
2. This should follow all flights, dual and solo. Points should include:
 - (a) The student's own assessment of the flight and performance.
 - (b) Your assessment of the student's performance. This should include both the strong and weak points, and advice on how to correct any errors.
 - (c) Answering any questions the student may have.
 - (d) Assigning study subjects where appropriate.

FLIGHT SAFETY

1. Flight safety is an important aspect of flight training. Both aircrew and groundcrew must be aware of the need for correct safety practices. You are in a position to reduce incorrect, unsafe and illegal practices. To be successful, a flight safety program requires the correct attitude, proper supervision, rigid enforcement, and proper training. Your student learns by example — you must set this example.
2. An experienced instructor is an effective supporter of the principles of good airmanship and flight discipline. As you gain experience, learn to recognize unsafe practices and do something to correct the situation. Practise flight safety by:
 - (a) being alert to unsafe practices and taking the appropriate action;
 - (b) following-up when you see an unsafe practice by informing the people involved that they have been seen; and
 - (c) promoting the principles of effective flight safety to students and other aircrew and groundcrew.
3. Flight safety consciousness by all personnel must become the fashion. Unsafe procedures must be watched for, identified, and their elimination effected by firm and consistent action. Throughout your instruction, stress the importance of being fuel conscious, the need for proper lookout and the danger of loose articles in the aircraft.

A CHECK LIST FOR GOOD INSTRUCTION

Each Instructor Should:

1. Tell the students specifically what is required of them during the lesson and at the end of the lesson (the "what" of the introduction).
2. Identify the main teaching points for the student by:
 - (a) using visual support (i.e. chalkboard, orientation board, or other visual aids); and
 - (b) verbally referring to the visual aids.
3. Tell the student the purpose of the lesson and stress the advantages of the new knowledge or skill (the "why" of the introduction).
4. Tell students where the lesson fits into the overall picture.
5. Relate the lesson to past and/or future experiences of the student (the "where" of the introduction).
6. Confirm that students are at the required level before having them learn new material.
7. Present the new material in stages (a stage should normally be 8-12 minutes duration).
8. Introduce each stage of the lesson and provide a link or bridge between stages.
9. Obtain student feedback throughout the lesson by:
 - (a) asking questions;
 - (b) observing student performance of a skill;
 - (c) looking at students (watching for facial expressions); and
 - (d) student questions.
10. Respond to feedback by:
 - (a) answering questions;
 - (b) stopping students doing a step of a skill incorrectly;
 - (c) reviewing material or steps;
 - (d) asking questions;
 - (e) correcting the student if an error has been made;
 - (f) explaining why the student's performance is incorrect;
 - (g) using verbal support;
 - (h) re-teaching (if necessary); and
 - (i) praising students for good work.
11. Appear enthusiastic about the subject being taught.
12. Use speech variation in rate, volume and pitch.

13. Have students answer questions related to the objective(s) for the lesson during the presentation of new material.
14. Use correct questioning techniques.
15. Use a variety of training aids to appeal to as many senses as possible whenever these aids contribute to achieving of the objective(s) of the lesson.
16. Provide sufficient meaningful practice of the main points of the lesson so that students confidently achieve the objective.
17. Allot time relative to the importance of the teaching point.
18. Identify and correct errors or mistakes made by the students at the time they occur or as soon thereafter as practicable.
19. Use clearly worded explanations.
20. Deliver the lesson in a logical sequence.
21. Have students carry out speed and/or ability competitions during latter stages of practice, if suited to the objective(s).
22. Conduct periodic reviews of critical areas of the lesson.
23. Summarize the main points of each stage.
24. Confirm student learning at the end of each stage.
25. Test students on the main points of the entire lesson towards the end of the lesson.
26. Provide a final summary that links all stages to the objective(s) of the lesson.
27. Re-motivate students by telling how the new knowledge or skill will benefit them.

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PART II
The Ground and Air
Instruction Syllabus

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PART II

THE GROUND AND AIR INSTRUCTION SYLLABUS

This section has been written with the aim of providing the experienced or trainee flight instructor with direction for the orderly presentation of flight training to a student. As flight instructional techniques must to a large extent depend on the characteristics of the particular type of aircraft and equipment being used, no direct reference is made to any particular type of aircraft or equipment. The material contained within this section is sufficiently comprehensive to cover all aspects of flight training on aircraft varying from very simple, with fixed under-carriage and fixed pitch propeller, to the relatively sophisticated types fitted with retractable undercarriage.

For air instruction to be meaningful, it is essential that the student have a good background knowledge of each exercise before the air instruction commences.

The use of training aids will assist the instructor in presenting this knowledge to the student. In addition to the basic aids such as a chalkboard, aircraft model and flight manuals, there are numerous other teaching aids available which the instructor should seek out and use to advantage. There are good reference manuals on the market which, if used in conjunction with this guide and the Transport Canada Flight Training Manual, can form an effective instructional package.

The methods by which a student acquires background knowledge will vary with the subject and with individual training organizations. In larger schools, a portion of it may be taught by ground school instructors. Where the school is small, the individual flight instructor will generally be responsible for its delivery.

The scope and nature of the ground instruction may also dictate when it is given to the student. In the majority of exercises where the ground lesson plan is short, it can be given just prior to the pre-flight briefing and air instruction. Where it is long and protracted as in pilot navigation, it will often be given as a separate ground school training period, at a date prior to the air exercise. In such cases, the instructor must ensure that the relevant facts are fresh in the student's mind during the pre-flight briefing.

By referring to Part III, Lesson Plans, the instructor will find guidance as to how individual exercises in this Part can be grouped with one or more others to form a complete lesson.

EXERCISE SECTIONS

Objective

Details what new knowledge or skill the student is expected to acquire.

Motivation

This material explains why the student needs to learn particular skills. The instructor must ensure that the student knows why the lesson is important, and where it fits into the overall curriculum of studies.

Essential Background Knowledge

This is the minimum knowledge required for the student to benefit fully from the air instruction. One of your obligations as an instructor is to make sure that students complete all the pertinent ground instruction before beginning air instruction.

Advice to Instructors

Provides information that may help you in presenting or teaching a particular lesson.

Instruction and Student Practice

This includes the steps to follow in presenting the lesson. It also suggests exercises that will help the student to develop the skills needed to meet the objective.

EXERCISE 1

FAMILIARIZATION

Objective

To introduce the student to the physical sensations of flight.

Motivation

As required.

Essential Background Knowledge

- (1) Explain:
 - (a) The purpose of the flight;
 - (b) That there will be no formal instruction, but if the student wishes to handle the controls, an opportunity will be given when a suitable occasion arises;
 - (c) Look-out — that the student should point out any aircraft seen.
- (2) Answer any questions that the student may have about the familiarization flight.

Advice to Instructors

- (1) Avoid going into detail which may confuse the student.
- (2) Emphasize that this is a new experience. Procedures which seem very complicated at this time will become easier with continued exposure and use.
- (3) Although it is not intended that there be any serious instruction at this time, the student should be allowed to handle the controls for some of the simple exercises.
- (4) It is desirable on this flight that turbulent conditions, sudden attitude changes, steep angles of bank, etc., should be avoided as much as possible so as not to upset the student.
- (5) This exercise should be enjoyable and leave the student with a sense of accomplishment.

Instruction and Student Practice

- (1) Carry out a short familiarization flight.
- (2) Point out easily identifiable local landmarks and indications of altitude, airspeed, etc. which may be of interest.

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EXERCISE 2

AIRCRAFT FAMILIARIZATION AND PREPARATION FOR FLIGHT

Objective

To familiarize the student with the purpose of pertinent documents, the aircraft, and how to determine if it is ready for flight.

Motivation

As required.

Essential Background Knowledge

- (1) Using the Pilot Operating Handbook, explain its purpose and layout.
- (2) Identify and explain the use of:
 - (a) Certificate of Airworthiness, Annual Airworthiness Information Report (Annual Report), and Certificate of Registration;
 - (b) Aircraft Journey Log — how to determine that the aircraft is airworthy;
 - (c) Weight and Balance;
 - (d) Radio Licence.
- (3) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) Do not make this a complex exercise. The final level of competency should not be expected in the initial stages, rather the student should demonstrate continuous improvement as the course progresses.

NOTE: The instructor must show by example that this exercise plays a most important part in achieving safe flying practices.

Instruction and Student Practice (Ground)

- (1) Using actual aircraft, identify main components:
 - (a) Wings;
 - (b) Fuselage;
 - (c) Landing gear;
 - (d) Tail surfaces;
 - (e) Ailerons, elevators, rudder;
 - (f) Flaps, trim tabs.

EXERCISE 2

- (2) Explain:
 - (a) Control operation and response;
 - (b) Ancillary control operation;
 - (c) Aircraft instruments;
 - (d) Other aircraft systems;
 - (e) Emergency exits and equipment.
- (3) Demonstrate how to conduct a passenger safety briefing applicable to aeroplane type.
- (4) Explain the procedure to carry out, and the importance of, the external pre-flight inspection, and emphasize:
 - (a) Determination of sufficient fuel and oil for intended flight, security of fuel and oil tank caps;
 - (b) Procedure for inspection of the aircraft for serviceability;
 - (c) Proper positioning of aircraft to prevent damage or nuisance from slipstream when engine is started and during run-up.
- (5) Explain the proper use of check-lists.
- (6) Demonstrate:
 - (a) Geographic check of cockpit;
 - (b) Use of parking brakes;
 - (c) Pre-starting checks;
 - (d) Starting engine and safety considerations;
 - (e) Engine warm-up and clearing;
 - (f) How to determine when the engine is ready for run-up;
 - (g) Run-up;
 - (h) Pre-take-off checks;
 - (i) How to check the ELT, and how to turn it off after inadvertent activation.

NOTE: Refer to the Pilot Operating Handbook for engine starting, post-start, warm-up, run-up, and shut-down procedures.

- (7) Explain the precautions to be followed when:
 - (a) Parking on various surfaces, e.g. ice;
 - (b) Brakes are overheated;
 - (c) Tying down the aircraft.
- (8) Explain the need to wear or have on board the aircraft, proper survival equipment, clothing and footwear for existing and anticipated weather conditions in the event of an unscheduled landing away from home base.

EXERCISE 3

ANCILLARY CONTROLS

Objective

To teach the purpose and operation of carburettor heat, mixture, and other ancillary controls.

Motivation

As required.

Essential Background Knowledge

- (1) Explain:
 - (a) Causes of ice formation in the carburettor. Point out the most critical temperature and humidity conditions;
 - (b) Symptoms of carburettor ice and importance of early detection;
 - (c) Carburettor hot air system and how it is used to remove ice or serve as a source of alternate air;
 - (d) That in some cold weather operations, it is possible to induce ice accumulation by using carburettor heat;
 - (e) Engine symptoms and instrument indications while ice is melting;
 - (f) The need to allow adequate time to enable accumulated ice to be completely removed;
 - (g) Value of a carburettor air temperature gauge, and where the probe is located;
 - (h) How carburettor ice can often be anticipated and prevented by use of carburettor heat (refer to procedures recommended in the Pilot Operating Handbook);
 - (i) Effect of carburettor heat on fuel/air mixture ratio and possible engine symptoms;
 - (j) Importance of correct fuel/air mixture ratio and how this is affected by temperature, density and humidity;
 - (k) Correct use of mixture control to maintain correct mixture at take-off, climb, cruise and descent power settings;
 - (l) How mixture control can be used to re-establish correct fuel/air ratio and obtain optimum engine performance when carburettor heat is used. (Review para. (i));
 - (m) Use of windshield defogging equipment, heater and air vents;
 - (n) The use of other controls (e.g. cowl flaps).

Advice to Instructors

- (1) This exercise is listed separately in order to emphasize the importance of the operation of ancillary controls. In practice, the use of ancillary controls is an integral part of other appropriate exercises.

EXERCISE 3

- (2) The student learns best by doing — let the student operate ancillary controls whenever possible.
- (3) Emphasize that the rate of carburettor ice formation varies widely and that there is a "point of no return" where there will be insufficient heat to remove ice. Therefore, encourage the student to check frequently for presence of ice. A slow rate of ice formation may go undetected while practising exercises involving power changes or when student's attention is concentrated on other matters.
- (4) Refer to the Pilot Operating Handbook for information concerning use of partial carburettor heat in very cold weather and risk of raising carburettor air temperature to critical icing range.
- (5) The student should be encouraged to make qualitative decisions daily before each flight as to whether the right conditions exist for carburettor ice formation, and if so, how severe it may be.

Instruction and Student Practice

Demonstrate:

- (1) During engine run-up:
 - (a) How to choose a suitable area for ground carburettor heat check — dust, sand, etc., avoidance;
 - (b) Use of carburettor heat control — indications to be expected.
- (2) In cruise flight:
 - (a) Effect of carburettor heat on tachometer and/or manifold pressure indications;
 - (b) Correct use of mixture control to maintain smooth engine operation.
- (3) Correct use of carburettor heat:
 - (a) During descent, emphasizing importance of "clearing" engine during prolonged descents at low power settings;
 - (b) When selecting cruise, climb, or take-off power.
- (4) Use of mixture control:
 - (a) At appropriate cruising altitude;
 - (b) During climb;
 - (c) In descent.
- (5) Purpose and operation of other ancillary controls as applicable.

EXERCISE 4

TAXIING

Objective

To teach how to safely manoeuvre the aircraft on the ground.

Motivation

As required.

Essential Background Knowledge

- (1) Explain:
 - (a) Aerodrome layouts, noting aprons, taxiways including identification and markings, runways or surface to be used for take-off, runway numbers and markings;
 - (b) Use of anti-collision lights and navigation lights to increase aircraft conspicuousness;
 - (c) Need for adequate clearance from objects adjacent to the aircraft and ensuring no conflict exists with other traffic prior to taxiing;
 - (d) How to use power to start moving and how to stop;
 - (e) Use of brakes, nose wheel or tail wheel for steering. In the case of a tail wheel aircraft, explain how to anticipate corrective action to maintain directional control;
 - (f) Speed control considerations;
 - (g) How to monitor ATIS and obtain clearance to taxi — use of standard phraseology and radio discipline;
 - (h) How to obtain clearance to enter or cross a runway;
 - (i) Need for keeping the ground controller advised of the aircraft's position when requested;
 - (j) Mandatory readback or acknowledgement, as required, of clearances to enter, exit, cross, hold your position and hold short of active runways and taxiways;
 - (k) Use of the Mandatory Frequency or Aerodrome Traffic Frequency at uncontrolled aerodromes;
 - (l) How flight controls should be used under strong wind conditions to prevent upset;
 - (m) How various flight instruments are checked while taxiing;
 - (n) Parking considerations under various conditions — restricted space, strong winds, slipstream nuisance avoidance, etc.;
 - (o) Use of parking brake/wheel chocks, when brakes are hot and in winter conditions.
- (2) Question the student on the exercise and clarify as necessary.

Advice to Instructors

- (1) Stress that the aircraft must never be taxied at an excessive speed. Emphasize the danger of loss of control.

EXERCISE 4

- (2) Improper use of brakes is the most frequent error while taxiing. Excessive use of power will result in excessive and needless use of brakes.
- (3) Accident reports show many needless taxi accidents due to improper techniques while taxiing in a high wind. Emphasize that constant attention must be paid to the wind direction, particularly while turning from downwind into wind.
- (4) Emphasize that the student must never proceed without assistance if any doubt exists as to the ability to retain control of the aircraft in high winds, ice surface conditions, etc.

Instructor and Student Practice (Ground)

- (1) Demonstrate how to:
 - (a) Place hands and feet on controls;
 - (b) Look for obstacles and conflicting traffic;
 - (c) Start the aircraft moving, test the brakes;
 - (d) Use the taxiways and centre-line markings if applicable;
 - (e) Turn the aircraft. In the case of a tailwheel aircraft, show how to anticipate corrective action to maintain directional control and how turns can be utilized to improve forward visibility;
 - (f) Check flight instruments while taxiing;
 - (g) Hold flight controls while taxiing;
 - (h) Slow down and stop;
 - (i) Park an aircraft without causing a nuisance with the slipstream;
 - (j) Set wheel brakes and use wheel chocks;
 - (k) Select run-up spot so as not to block use of a taxiway.

EXERCISE 5

ATTITUDES AND MOVEMENTS

Objective

To teach:

- (1) The range of attitudes through which the aircraft will normally be operated.
- (2) How the movements necessary to achieve and maintain the desired attitudes of flight are produced and controlled.
- (3) Yaw and how it can be controlled.

Motivation

As required.

Essential Background Knowledge

- (1) Define aircraft attitudes relative to the horizon.
- (2) Define Cruise Attitude (reference datum) and point out:
 - (a) Position of nose and wings relative to the horizon;
 - (b) Power setting used;
 - (c) The airspeed for level flight in this configuration.
- (3)
 - (a) Describe the range of pitch attitudes and limits above (nose-up) and below (nose-down) the reference datum applicable to this exercise. Explain flight instrument indications;
 - (b) Define pitching movements — movement about the lateral axis of the aircraft relative to the pilot;
 - (c) Explain:
 - (i) that the pitching movement is produced and controlled by the elevators;
 - (ii) that this movement is used to achieve pitch attitudes;
 - (iii) how, once achieved, these attitudes are maintained by use of elevators.
- (4)
 - (a) Describe the range of banked attitudes and limits relative to the reference datum applicable to this exercise. Explain flight instrument indications;
 - (b) Define rolling movement — movement about the longitudinal axis of the aircraft relative to the pilot;
 - (c) Explain:
 - (i) that the rolling movement is produced and controlled by the ailerons;
 - (ii) that this movement is used to achieve bank attitudes;
 - (iii) how, once achieved, these attitudes are maintained by use of ailerons.

EXERCISE 5

- (5) Describe combinations of pitch and bank attitudes. Explain how movements are relative to the pilot and the aircraft.
- (6) Explain how forces resulting from bank attitudes, power changes, side-slip, aileron drag, turbulence, etc., may produce yaw. This yawing movement can be controlled by the rudder. Point out that if yaw is not controlled the aircraft may roll.
- (7) Lookout.
 - (a) Explain:
 - (i) collision geometry — head-on, converging, and climbing or descending on the same path;
 - (ii) scanning techniques.
- (8) Question student on the exercise and clarify as necessary.

Advice to Instructors

NOTE: Control of yaw under circumstances such as cross-wind take-offs and landings, slipping turns, etc., will be covered later in this guide.

- (1) As this is to be the student's first flight training exercise, spare no pains to explain everything carefully. Emphasis is necessary since all future flight training exercises are based around the basic principles of this exercise.
- (2) Emphasize that all aircraft attitudes are relative to the horizon, while movements are relative to the pilot and the aircraft.
- (3) Keep all movements slow and attitude changes small, increasing only when it is obvious that this will not distress the student.
- (4) Stress the importance of a complete and continuous look-around.
- (5) Explain to the student that you will often be referring to the nose of the aircraft. The student may not, in fact, be able to see the nose, in which case, indicate some forward part of the aircraft which can be used to judge its attitude relative to the horizon.
- (6) In this and future exercises, it is essential that a routine be followed when control of the aircraft is exchanged between the instructor and student.
- (7) Indicate to the student that co-ordination will be achieved progressively with each successive air exercise.
- (8) The instructor is advised not to attempt to show the effect of aileron drag unless the demonstration is convincing.
- (9) Avoid a tendency to stretch out this exercise. Keep it simple, but meaningful.

EXERCISE 5

Instruction and Student Practice

- (1)
 - (a) Establish a Cruise Attitude and point out reference datum;
 - (b) Demonstrate:
 - (i) range of pitch attitudes;
 - (ii) by use of the elevators, the production and control of the pitching movement;
 - (iii) how to use this movement to achieve and maintain pitch attitudes within the desired range.
 - (c) When the student achieves a reasonable level of competency, point out flight instrument indications.

- (2)
 - (a) Re-establish a Cruise Attitude and point out reference datum;
 - (b) Demonstrate:
 - (i) range of banked attitudes;
 - (ii) by use of the ailerons, the production and control of the rolling movement;
 - (iii) how to use this movement to achieve and maintain bank attitudes within the desired range.
 - (c) When student demonstrates a reasonable level of competency, point out flight instrument indications.

- (3)
 - (a) Demonstrate:
 - (i) combination of pitch and bank attitudes;
 - (ii) pitching while in a banked attitude, and rolling while in various pitch attitudes.
 - (b) Point out flight instrument indications.

- (4) Demonstrate:
 - (a) The yawing movement.
 - (b) How the rudder is used to control yaw — give practical example.
 - (c) Flight instrument indications.

- (5) Have the student practise simple flight manoeuvres by application of the basic principles of this exercise

EXERCISE 6

STRAIGHT AND LEVEL FLIGHT

Objective

To teach the student:

- (1) To fly straight and level (constant heading, selected altitude and airspeed) at various speeds within the full operational speed range of the aircraft.
- (2) The combination of attitude and power to achieve performance.

Motivation

As required.

Essential Background Knowledge

- (1) *Straight Flight*
 - (a) Review:
 - (i) cruise attitude;
 - (ii) need to control yaw;
 - (iii) causes of yaw (bank attitude, slipstream effect, asymmetric thrust, etc.).
- (2) Impress the need for a good look-out, particularly while flying in a nose-up attitude.
- (3) Explain considerations for Straight Flight.
 - (a) Control of Yaw — use of rudder to offset the effect of power changes;
 - (b) Necessity to keep wings laterally level — use of ailerons;
 - (c) Use of trim — if applicable;
 - (d) Instrument indications.
- (4) *Level Flight*

Explain considerations for Level Flight at various airspeeds while maintaining a constant selected altitude:

 - (a) To increase speed (increase power, lower nose);
 - (b) To decrease speed (decrease power, raise nose).
- (5) Explain practical examples of the use of this exercise for flight at other than cruise speed e.g. circuit spacing.
- (6) Instrument indications.
- (7) Look-out — review collision geometry and scanning techniques.
- (8) Question student on the exercise and clarify as necessary.

EXERCISE 6

Advice to Instructors

- (1) Level Flight is defined as flight at a constant altitude and airspeed, and should not be confused with simply keeping the wings level with the horizon.
- (2) Range Flight and Endurance Flight are separate exercises and should be taught as a continuation, as well as practical utilization of this exercise when training progresses to that stage.
- (3) Emphasize the proper use of trim between each attitude change.
- (4) Give the student ample time to practise this exercise. It helps to produce co-ordination and mastery over the aircraft.
- (5) This exercise should not be continued below the speed for maximum endurance.
- (6) Introduction to the magnetic compass and heading indicator in this exercise, and review and practice in subsequent exercises, will ensure proficiency in maintaining accurate headings prior to the cross-country exercises.

Instruction and Student Practice

- (1) Scanning techniques:
 - (a) Demonstrate correct method of searching the sky for other traffic.
- (2) Straight Flight:
 - (a) Establish straight and level flight and point out reference.
 - (b) Point out airspeed and RPM.
 - (c) Show results of not keeping wings level.
 - (d) Show need for control of yaw when increasing or decreasing power.
 - (e) Instrument indications.
- (3) Level Flight — Constant Altitude:
 - (a) Establish straight and level flight and show how to maintain altitude:
 - (i) in normal cruise flight — elevator use and altitude monitoring;
 - (ii) at selected lower speeds — power and attitude relationship;
 - (iii) at selected higher speeds — power and attitude relationship.
 - (b) Monitor directional control.
 - (c) Demonstrate practical examples of the use of this exercise for flight at other than cruise speed, e.g. circuit spacing.
 - (d) Instrument indications.

EXERCISE 6

- (4) Introduce the compass — briefly demonstrate:
 - (a) Problems relating to acceleration, deceleration, turning;
 - (b) Practical use;
 - (c) Technique for setting heading indicator from compass while flying straight:
 - (i) in smooth air;
 - (ii) in rough air.
 - (d) Resetting heading indicator every 15 minutes.

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EXERCISE 7

CLIMBING

Objective

To teach:

- (1) Climbing:
 - (a) At recommended normal climb speed;
 - (b) At various airspeeds — en route climbs;
 - (c) At recommended best rate of climb speed;
 - (d) At recommended best angle of climb speed.
- (2) Levelling off at specified altitude.

Motivation

As required.

Essential Background Knowledge

- (1) Using the Pilot Operating Handbook show where to find recommended climb airspeeds.
- (2) Define and give practical examples in the use of:
 - (a) Normal climb speed;
 - (b) Best rate of climb speed;
 - (c) Best angle of climb speed;
 - (d) Climb at airspeeds above the recommended climb speed — "en route climbs".
- (3) Review:
 - (a) Slipstream effect and control of yaw;
 - (b) How uncontrolled yaw may produce a roll.
- (4) Explain:
 - (a) Safety considerations — cockpit checks;
 - (b) Procedure to enter a climb from level cruise flight: attitude — power — trim;
 - (c) How to return to cruise attitude, i.e., attitude — power — trim;
 - (d) The precautions necessary due to ground effect and those of entering a climb too soon after lift-off at low airspeed;
 - (e) Effect of density altitude on the rate of climb;
 - (f) Need for proper engine cooling during climbs;
 - (g) Effects of flaps and landing gear on climb performance;
 - (h) Effects of application of carburettor heat in a climb;
 - (i) Effect of weight on climb performance;
 - (j) Procedures to enter a climb from a "balked approach", i.e., power — attitude — trim;

EXERCISE 7

(k) Instrument indications.

(5) Question student on the exercise and clarify as necessary.

Advice to Instructor

- (1) This is a progressive exercise, and no attempt should be made to teach all aspects of climbing in one lesson. Demonstrate only where applicable, e.g., best angle of climb, best rate of climb.
- (2) Many accidents can be attributed to poor climb techniques when close to the ground. Monitor the student carefully and correct bad habits before they are entrenched.
- (3) One of the major faults a student can develop in a climb can be keeping the right wing low to prevent a yaw to the left. Use rudder to prevent yaw.
- (4) Entering a climb from a bailed approach should be practised until proficiency is achieved, particularly in the area of sudden attitude change. The correct method of "slowly raising" flaps and loss of performance due to carburettor heat being left on should be demonstrated.
- (5) Emphasize the need to change heading, or lower the nose slightly at regular intervals during a prolonged climb to facilitate effective look-out.

Instruction and Student Practice

- (1) Climbing — normal:
 - (a) Establish cruise attitude;
 - (b) Look out ahead and above;
 - (c) Establish pitch attitude for normal climb and set climb power;
 - (d) Keep straight — visual and instruments;
 - (e) Trim;
 - (f) Adjust attitude if necessary to establish selected climb speed — trim.
- (2) To resume straight and level flight at selected altitude:
 - (a) Lower nose to the cruise attitude, and allow speed to increase (do not exceed red line RPM);
 - (b) Keep straight and maintain altitude;
 - (c) Reduce power to cruise RPM;
 - (d) Trim;
 - (e) Adjust attitude and power if necessary to achieve selected altitude and speed.

EXERCISE 7

- (3) Instrument indications.
- (4) Best rate and angle of climb:
 - (a) Review appropriate airspeeds, and demonstrate:
 - (i) best rate of climb speed;
 - (ii) best angle of climb speed.
 - (b) Resume straight and level flight.
- (5) Instrument indications.
- (6) Repeat, showing:
 - (a) Effects of flaps on climb — how and when to raise flaps;
 - (b) Effects of retractable landing gear where applicable;
 - (c) Reduced climb performance with carburettor heat applied. Compare vertical speeds;
 - (d) How roll may result if yaw is allowed to develop due to slipstream effect.
- (7) Demonstrate entering a straight climb from a bailed approach, (flap, gear, ancillary control management).
- (8) Demonstrate an "en route climb".
- (9) Instrument indications where applicable.

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EXERCISE 8

DESCENDING

Objective

To teach:

- (1) Descending:
 - (a) At the recommended power-off descent speed;
 - (b) At various power settings, airspeeds, and flap/gear configurations to a selected altitude;
 - (c) On constant path of descent towards a specific point of touch-down;
 - (d) At the published airspeeds required for an obstacle clearance approach.

Motivation

As required.

Essential Background Knowledge

- (1) Explain:
 - (a) Use of Pilot Operating Handbook to determine descent airspeeds;
 - (b) The need for a proper look-out ahead and below, before and after commencing descent — cockpit checks;
 - (c) Practical examples in the use of:
 - (i) power-off descent at various airspeeds;
 - (ii) power-on descent at various airspeeds;
 - (iii) power-off descent for range and how to estimate how far the aircraft can glide;
 - (iv) "en route descents";
 - (v) obstacle clearance descents.
 - (d) Procedure to descend from level flight (power — attitude — trim) and how to return to cruise attitude;
 - (e) The use of flaps in a descent:
 - (i) to reduce stall speed;
 - (ii) to steepen angle of descent.
 - (f) How if yaw (due to reduced slipstream effect) is allowed to develop, a roll may result;
 - (g) The effects of wind on gliding distance;
 - (h) How, during a descent at a fixed airspeed, power can be used to adjust the rate of descent;
 - (i) The reasons why and the techniques for warming the engine during a prolonged power-off descent, particularly in cold weather;
 - (j) The use of the carburettor heat in a power-off descent as applicable to various types of training aircraft;

EXERCISE 8

- (k) Speeds for high angle of descent, low speed approaches
- (l) How extension of retractable landing gear can be used to steepen the descent of that type of aircraft;
- (m) Visual indications to detect touch-down point during descents at various speeds and power settings. (See Advice to Instructors);
- (n) Instrument indications where applicable.

(2) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) This is a progressive exercise, and no attempt should be made to teach all aspects of descending in one lesson. Demonstrate only where applicable, e.g., power-on steep angle descents for short field/obstruction clearance approaches.
- (2) Particular attention must be paid to maintaining engine temperature when descending in cold weather conditions.
- (3) Ensure that the student understands the proper use of visual indications which assist in detecting the touch-down point, while descending at various speeds and power settings.
- (4) A sound knowledge of the principles and considerations of power-off descent is a necessary ingredient of successful forced landings. Give the student ample practice at maintaining the correct airspeed/attitude to ensure proficiency is achieved. Use every opportunity (e.g., when proceeding to and from the practice area) to give practice in estimating how far the aircraft can glide under existing conditions.
- (5) The importance of correct use of carburettor heat and mixture controls prior to and during a descent should be emphasized.

Instruction and Student Practice

- (1) To enter power-off descent:
 - (a) Establish Cruise Attitude;
 - (b) Complete cockpit check as necessary;
 - (c) Look out ahead and below;
 - (d) Reduce power to idle — keep straight;
 - (e) Maintain Cruise Attitude until speed approaches recommended power-off descent speed, then place aircraft in appropriate descent attitude;
 - (f) Trim;
 - (g) Explain how to judge the distance the aircraft can glide — how speed affects range;
 - (h) Instrument indications.

EXERCISE 8

- (2) To resume cruise flight at selected altitude and airspeed:
 - (a) Co-ordinate pitch and power changes;
 - (b) Keep straight;
 - (c) Carburettor heat off where applicable;
 - (d) Re-adjust power/attitude, if necessary, to achieve desired performance;
 - (e) Trim;
 - (f) Instrument indications.

- (3) Demonstrate descending:
 - (a) Power-on:
 - (i) en route descent;
 - (ii) power approach;
 - (iii) instrument indications.

- (4) Demonstrate descending with various flap settings:
 - (a) Lower flaps — check correct flap extension speed;
 - (b) Point out:
 - (i) as flaps are extended in stages, the increase in angle of descent if same speed is maintained;
 - (ii) safety consideration when raising flaps on return to Cruise Attitude.
 - (c) If retractable landing gear is fitted, demonstrate its effect on the rate of descent — check correct gear extension speed.

- (5) Power-on descents over an obstacle:
 - (a) Select the appropriate airspeed from the Pilot Operating Handbook;
 - (b) Show how the correct combinations of attitude and power produce the desired flight path (performance);
 - (c) Select proper flap settings for configuration desired.

- (6) Instrument indications.

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EXERCISE 9

TURNS

Objective

To teach:

- (1) Gentle, medium, climbing and descending, and steep turns.
- (2) Turns to selected headings.

Motivation

As required.

Essential Background Knowledge

- (1) Review collision geometry and scanning technique.
- (2) Explain safety considerations (e.g., collision avoidance techniques).
- (3) Define angles of bank as applicable to light training aircraft:
 - (a) Gentle — up to 15°;
 - (b) Medium — 15° to 30°;
 - (c) Steep — beyond 30°.
- (4) Review control of adverse yaw resulting from aileron drag.
- (5) Explain how to:
 - (a) Carry out an effective look-out prior to a turn;
 - (b) Enter a turn maintaining co-ordinated flight;
 - (c) Stay in a turn (i.e.):
 - (i) maintain bank and pitch attitudes by visual reference;
 - (ii) look out during turn.
 - (d) Recover while maintaining co-ordinated flight.
- (6) Climbing and descending turns — reasons for pitch and bank attitude limitations.
- (7) Point out:
 - (a) Proper use of each control in a co-ordinated turn;
 - (b) Precautions to avoid inadvertent entry into a spiral.
- (8) Steep turns.
 - (a) Explain:
 - (i) why additional lift must be produced as angle of bank is increased;

EXERCISE 9

- (ii) how drag increases as lift is increased;
 - (iii) why power must be added if speed is to be maintained;
 - (iv) why there is a tendency to roll toward higher angles of bank;
 - (v) relationship between speed and radius of turn — minimum radius turns — entry speeds — use of power — use of flaps;
 - (vi) use of steep turns for evasive action or collision avoidance — rapid change of direction;
 - (vii) when a steep turn may be inappropriate for collision avoidance — head on, inside a range of approximately 10 seconds to impact;
 - (viii) attitude and speed control during steep power-off descending turns — use of flaps.
- (9) Slipping turns — Refer to Exercise 15, — Side-slipping.
- (10) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) Emphasize the importance of a meaningful look-out prior to and during each turn. Set a good example during the air demonstration.
- (2) It is important that turns be practised in both directions to emphasize the different visual reference in aircraft with side by side seating, and to ensure students do not favour the left turn they learn from the beginning in most circuits.
- (3) One of the most common faults in turning is excessive and incorrect use of the rudder. This should never occur if the student is taught from the beginning not to apply rudder at all unless it is necessary to correct adverse yaw.
- (4) Because of increased stress on accuracy, the student should be shown how to monitor instruments without sacrificing look-out.
- (5) Some steep descending turns should be practised at low altitudes where they are likely to be used in a real emergency.
- (6) During turns, emphasize that the elevators control the attitude of the nose and that any attempt to raise the nose with the rudder will cause a slip.
- (7) A faulty turn may often be traced to inaccurate flying just before entry; therefore, until competency is achieved, insist that the student flies straight and level before commencing any level turn.
- (8) Make sure the student appreciates and counteracts the detrimental forces of gyroscopic and slipstream effect in climbing and descending turns.
- (9) On occasion it is necessary to return to level flight while in a climbing or descending turn. Practice in this area is also a good co-ordination exercise.

EXERCISE 9

- (10) Steep turns as an exercise have a value beyond the practical application. They provide one of the few instances of sustained extra loading, its effect on the pilot and the handling of the aircraft, and excellent practice in co-ordinating the movements of all controls to produce the desired result. Considerable practice is required to ensure the student can perform a precision 45° banked turn, at an airspeed selected by the examiner, and maintain a constant altitude, as required on the flight test.
- (11) Make sure the student appreciates that a steep turn at the last moment to avoid a collision may actually increase the probability of impact. A vertical manoeuvre may be more effective in close range, head on collision situations.

Instruction and Student Practice

- (1) *Safety*
Demonstrate, and insist upon proper look-out before and during manoeuvre.
- (2) *Gentle level turns*
 - (a) Demonstrate:
 - (i) correct entry — yaw control;
 - (ii) co-ordinated flight during turn;
 - (iii) visual reference for control of pitch and bank attitude — instrument indications;
 - (iv) recovery — yaw control while rolling out;
 - (v) instrument indications.
 - (3) Additional considerations for:
 - (a) *Medium level turns*
 - (i) demonstrate increased angle of bank;
 - (ii) instrument indications.
 - (b) *Climbing turns*
 - (i) demonstrate tendency of aircraft to increase angle of bank during turn — stress need for co-ordinated flight;
 - (ii) instrument indications.
 - (c) *Descending turns*
 - (i) demonstrate tendency of aircraft to decrease angle of bank — stress need for co-ordinated flight;
 - (ii) instrument indications.
 - (d) *Steep turns*
Demonstrate:
 - (i) use of power to maintain constant pre-selected airspeed — constant altitude;
 - (ii) consequences of *not* adding power — loss of airspeed;
 - (iii) bank and power limitations;
 - (iv) relationship between speed and radius of turn — minimum radius — entry speed — use of power — use of flaps;
 - (v) co-ordination and technique for evasive action or collision avoidance;

EXERCISE 9

- (vi) attitude and speed control during steep power-off descending turns — use of flaps;
- (vii) instrument indications.

NOTE: Stress attitude control to avoid spiral entry — how to monitor instruments.

EXERCISE 10

FLIGHT FOR RANGE AND ENDURANCE

Objective

To enable the student to:

- (1) Cover the greatest distance per unit of fuel consumed.
- (2) Stay in the air for the longest time per unit of fuel consumed.

Motivation

As required.

Essential Background Knowledge

- (1) Flight for Range:
 - (a) Explain:
 - (i) flight for maximum range — give practical example;
 - (ii) how both by experiment and reference to the tables in the Pilot Operating Handbook the power settings for range flight can be established;
 - (iii) effect of head and tail winds on range;
 - (iv) use of mixture control;
 - (v) effect of altitude.
- (2) Flight for Maximum Endurance:
 - (a) Explain:
 - (i) flight for maximum endurance — minimum power to maintain altitude — give practical examples;
 - (ii) how by experiment, and reference to the tables in the Pilot Operating Handbook, the power settings for endurance flight can be established;
 - (iii) use of mixture control;
 - (iv) use of flaps as applicable to type;
 - (v) effect of altitude.
- (3) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) Ensure the student is able to determine the speed and power settings for flight for maximum range and endurance as specified in the Pilot Operating Handbook. Explain how the wind is an additional factor that must be considered for practical use in flight for range.

EXERCISE 10

- (2) The student should be taught how to establish the power setting for maximum endurance by experimentation. Whenever possible, this exercise should be carried out in smooth air conditions. Proper use of trim is important in this exercise.

Instruction and Student Practice

- (1) Flight for Maximum Range:
 - (a) From cruise flight, adjust power to that determined from Pilot Operating Handbook tables (maintain altitude);
 - (b) Trim;
 - (c) Demonstrate proper use of mixture control;
 - (d) Instrument indications.
- (2) Flight for Maximum Endurance:
 - (a) From cruise flight, adjust power to that determined from Pilot Operating Handbook (maintain altitude);
 - (b) Trim — set mixture;
 - (c) Demonstrate flight endurance by experimentation — from cruise reduce power to lowest setting which will maintain level flight. Resultant speed will be speed for maximum endurance;
 - (d) Note reduced control response;
 - (e) Instrument indications.

SLOW FLIGHT

Objective

- (1) To teach the student the proper flight technique necessary to achieve precise control of the aircraft while operating within the slow flight speed range.
- (2) To teach the student to recognize the symptoms when approaching the slow flight speed range to avoid inadvertent entry.
- (3) To develop co-ordination and instill confidence in handling the aircraft.

Motivation

As required.

Essential Background Knowledge

- (1) Review "Flight for Maximum Endurance".
- (2) Define slow flight and give examples of when it may be encountered, e.g., soft field take-off and recovery from bad landings.
- (3) Describe critical areas where inadvertent entry into slow flight can be hazardous, e.g., attempting a turn immediately after take-off with a high all-up weight on a hot day.
- (4) Point out safety precautions — cockpit checks, minimum altitude, look-out, etc.
- (5) Explain considerations of slow flight:
 - (a) Power and attitude relationship — altitude and heading control;
 - (b) Diminishing response of flight controls;
 - (c) Recognition of minimum controllable airspeed;
 - (d) In straight flight — level, climbing, descending;
 - (e) In level, climbing and descending turns — bank and yaw control — proper use of power — climb and descent control;
 - (f) Effect of flaps and landing gear (when applicable);
 - (g) Return to cruise flight.
- (6) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) Slow flight is defined as flight in the speed range from below the speed for maximum endurance to just above the stall speed. This must not be taught as only a level flight exercise. The student should develop proficiency in climbing and descending in this speed range, as well as turning with an angle of bank of up to 30° while flying level, climbing and descending, if the aircraft is capable.

EXERCISE 11

- (2) In the initial stages of training the student should be given practice controlling the aircraft in the upper limits of the slow flight speed range. As more experience and proficiency is achieved, slow flight at speeds down to and including the minimum controllable airspeed must be practised while in cruising, take-off and landing configurations and in co-ordinated turns. Slow flight practice at minimum controllable airspeed should be performed at an airspeed just slightly above the stall, sufficient to permit manoeuvring, but close enough to the stall to give the student the feel of sloppy controls and diminished response to control movements. Simulate, at altitude, the worst possible conditions, e.g., recovery from a high full flap landing bounce, or commencing a turn when loading and density altitude are critical.
- (3) Direction is an important consideration, and every effort should be made to control adverse yaw with rudder.
- (4) During the initial demonstration of this exercise, a minimum altitude of 2,000 feet above terrain is suggested.
- (5) Emphasis must be placed on the importance of a good look-out at all times.
- (6) Initially it is desirable that this exercise should be carried out in smooth air conditions. As experience is accumulated, less than ideal conditions should be introduced.
- (7) Slow flight is not an exercise to be covered and forgotten. Statistics show that many accidents might have been avoided if the pilot had better appreciation of this exercise i.e. *inadvertent entry into "slow flight" is an almost certain indication of an approaching stall.* Therefore, it is most important that the air exercise include a practical demonstration, at a safe altitude, of the flight manoeuvres which include the operation of the aircraft in the critical lower limits of the slow flight speed range.
- (8) Slow flight is practised so that a student can learn to control an aircraft at low airspeeds. It helps develop a "feel" for flying and enables the pilot to cope with manoeuvres which may be flown at critical speeds. Emphasize the need for co-ordination and smooth handling of the controls to achieve the desired performance.

Instructor and Student Practice

- (1) Straight Flight: — level (constant altitude), climbs and descents:
 - (a) Complete safety precautions, cockpit checks, minimum altitude, look-out;
 - (b) Establish flight for maximum endurance;
 - (c) Review control response — (while in endurance flight);
 - (d) Establish a slow flight attitude;
 - (e) Point out the decrease in airspeed and ensuing loss of altitude;
 - (f) Demonstrate:
 - (i) that an increase in power and an adjustment of attitude is required to maintain altitude and selected airspeed;
 - (ii) control response while in slow flight;
 - (iii) control of yaw to achieve co-ordinated flight;

EXERCISE 11

- (iv) flight characteristics in the slow flight speed range including flight at minimum controllable airspeed;
 - (v) climbs and descents in the slow flight speed range.
- (g) Flight instrument indications.
- (2) Slow Flight Turns — level, climbing, descending:
 - (a) Complete safety precautions;
 - (b) Demonstrate:
 - (i) turns — level, climbing, descending;
 - (ii) use of attitude and power combination for control of altitude and rate of climb and descent.
 - (c) Flight instrument indications.
- (3) Repeat slow flight air exercises (1) and (2) demonstrating effect of flaps and landing gear if applicable.
- (4) Return to cruise flight.

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STALLS

Objective

To teach:

- (1) The recognition of the symptoms of an approaching stall.
- (2) The entry to the stall.
- (3) Recognition of the stall itself.
- (4) The correct recovery for minimum loss of altitude.

Motivation

As required.

Essential Background Knowledge

- (1) Outline safety precautions — cockpit checks, minimum altitude, suitable location, look-out, etc.
- (2) Explain:
 - (a) Basic theory and description of stalls:
 - (i) angle of attack;
 - (ii) stalling angle;
 - (iii) aileron drag;
 - (iv) attitude variations;
 - (v) speed variations.
 - (b) Diminishing control response through endurance speed and slow flight;
 - (c) Symptoms of approaching stall — sight, sound, feel;
 - (d) Action to prevent an approaching stall;
 - (e) Typical entry from normal flight manoeuvres, e.g., climbing and descending turns;
 - (f) Recovery with and without power:
 - (i) control direction with rudder;
 - (ii) unstall aircraft with forward movement of the control column;
 - (iii) level wings with ailerons.
 - (g) Effect of flaps;
 - (h) Effect of thrust;
 - (i) Stall variations (conducted at safe altitude):
 - (i) power on and off — with and without flaps;
 - (ii) from a steep level, climbing or descending turn — with and without flaps;
 - (iii) sudden change of pitch attitude while at low speed;
 - (iv) departure stalls with and without flaps (with slow deceleration under full power);

EXERCISE 12

- (v) acceleration stalls.
- (3) Instrument indications.
- (4) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) This is a progressive exercise and should be practised frequently.
- (2) Avoid the tendency to teach the classical stalls only. At a safe altitude prepare the student to handle the stall and recovery action in all phases of flight that might be encountered, e.g., a steep climbing turn while overshooting in a confined area, or under conditions of reduced aircraft performance due to density altitude.
- (3) Stress that an aircraft can stall at practically any airspeed, in practically any attitude, or at any power setting, and that recovery action initiated when the symptoms are noted will prevent the stall.
- (4) Emphasize on simple stall entries that the nose of the aircraft should not be raised above the horizon any more than necessary to produce the stall. On recovery the nose should be lowered only sufficiently below the horizon to unstall the wings. Use power to prevent excessive loss of altitude.

Instructor and Student Practice

- (1) Complete safety precautions — cockpit checks, minimum altitude, continuous meaningful look-out, avoidance of built-up areas.
- (2) Review diminishing control response through endurance and slow flight speed range.
- (3) Maintain level flight at minimum controllable airspeed (slow flight speed range).
- (4) Review control response, visual indications, sound.
- (5) Raise nose sufficiently to demonstrate stall.
- (6) Demonstrate recovery action.
- (7) Demonstrate stalls and recovery action:
 - (a) Power on and off — with and without flaps;
 - (b) From a steep level, climbing, and descending turn;
 - (c) Due to a sudden change of pitch attitude while at low speed;
 - (d) Departure or overshoot configuration (simulated at an operationally safe altitude);
 - (e) Secondary stall due to abrupt attitude change on recovery.
- (8) Demonstrate conditions which if uncorrected could lead to a high speed stall — applicable to type.

EXERCISE 12

(9) Instrument indications.

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EXERCISE 13

SPINNING

Objective

To teach:

- (1) The recognition and avoidance of the conditions which could lead to a spin.
- (2) The spin entry.
- (3) The correct recovery action to be taken.

Motivation

As required.

Essential Background Knowledge

- (1) Point out the safety precautions — cockpit checks, minimum altitude, suitable area, look-out, etc.
- (2) Explain:
 - (a) Incipient stage:
 - (i) basic theory and description;
 - (ii) causes, prevention, and autorotation;
 - (iii) practice spin entry techniques;
 - (iv) the entry into the incipient stage and when the incipient stage changes to the fully developed stage;
 - (v) recovery action;
 - (vi) effect of varying amount of thrust — use in early stages to conserve altitude — similarity to stall recovery — detrimental effect as development continues;
 - (vii) instrument indications.
 - (b) Fully Developed Stage:
 - (i) basic theory and description;
 - (ii) spin entries — causes and prevention of the fully developed spin — uncorrected incipient stage;
 - (iii) full development of autorotation — the transition into and from the incipient stage;
 - (iv) recovery action — normal and emergency techniques — necessity of using techniques outlined in Pilot Operating Handbook;
 - (v) effect of thrust — spin characteristics — loss of altitude;
 - (vi) instrument indications;
 - (vii) the spin characteristics of light aircraft in current use;
 - (viii) disorientation during the spin and recovery, and its inherent dangers;
 - (ix) dangers of improper loading — effect of spin recovery with various C of G positions.

EXERCISE 13

- (3) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) IT IS ESSENTIAL that the aircraft used for the spin exercise **is certified for this manoeuvre and is properly loaded**. Non-compliance with this requirement has caused fatalities. The Type Certificate, Pilot Operating Handbook, or cockpit placards should be consulted to determine under what conditions, if any, spin practice may be undertaken in a particular aircraft.
- (2) The transition stage between a stall and the incipient stage can be defined as the period between the stall and the commencement of autorotation. If the manufacturer does not provide a recovery technique to "pick-up" a wing drop at the stall, recover as from an aggravated stall. The student's ability to recover from all phases of the incipient stage correctly is one of the most important requirements on the Private Pilot Course. The instructor must ensure a satisfactory standard has been achieved on this exercise.
- (3) The stall/spin accident has led to many fatalities. Recognition of the symptoms of the approaching stall and spin should be impressed upon the student and it should be emphasized that it is not necessary to have an excessively nose high attitude to enter a stall/spin. Insist on correct recovery action.
- (4) All practice spin recoveries should be completed no less than 2,000 feet above ground, or at a height recommended by the Manufacturer, whichever is the greater.
- (5) Emergency spin recovery techniques should be discussed fully. The use of power, elevators and other means of effecting a spin recovery should be discussed.
- (6) The proper handling of flaps and power in the event of an unintentional spin entry should be carefully explained to the student.
- (7) Emphasize that on practice stall/spin entries, the nose of the aircraft should not be raised above the horizon any more than necessary to produce the stall/spin. On recovery from the transition stage and the initial phase of the incipient stage, the nose should be lowered only sufficiently below the horizon to unstall the wings and effect recovery.
- (8) Unless the aircraft is equipped with gyro instruments capable of being caged, or with instruments designed to withstand the effects of the sudden attitude changes in a spin, instrument damage may result if the aircraft is used to demonstrate or practise this exercise.

EXERCISE 13

Instructor and Student Practice

- (1) Spin Recovery:
 - (a) Complete safety precautions — cockpit checks, minimum altitude, suitable area, look-out;
 - (b) From slow flight at the point of stall induce a spin. Allow yaw to continue while aircraft is stalled;
 - (c) Demonstrate recovery action:
 - (i) from the transition stage and the initial phase of the incipient stage — recover as from an aggravated stall;
 - (ii) if the spin entry is allowed to proceed beyond this point:
 - (A) follow the recovery technique recommended in the Pilot Operating Handbook for that particular model and year of aircraft, or
 - (B) in the case where there is no published recovery action:
 - power to idle, neutralize ailerons;
 - apply and hold full opposite rudder;
 - move control column positively forward and hold these control inputs until rotation stops;
 - centralize rudder and level wings;
 - ease out of the ensuing dive with minimum reasonable loss of altitude.
 - apply power as necessary to return to normal flight.

NOTE: If an aircraft enters a spin with the flaps extended, they should be retracted at the first opportunity after initial recovery action has been taken.

- (d) Student practice.
- (2) Spin entries should be demonstrated from:
 - (a) A power-off descent;
 - (b) Climbing manoeuvres;
 - (c) A low speed descending turn when rudder is used incorrectly to increase rate of turn;
 - (d) A steep climbing turn;
 - (e) High "G" flight conditions (simulated at low speed).
 - (3) Demonstrate spin entries with power on — (close throttle on entry).
 - (4) Instrument indications.

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EXERCISE 14

SPIRAL DIVES

Objective

To teach:

- (1) The recognition of the conditions which could lead to a spiral dive.
- (2) The recognition of the spiral dive.
- (3) The correct recovery action.

Motivation

As required.

Essential Background Knowledge

- (1) Point out safety precautions — cockpit checks, minimum altitude, suitable area, look-out, etc.
- (2) Explain:
 - (a) Basic theory and description of spiral dive;
 - (b) Causes and prevention;
 - (c) Correct recovery action — use of throttle and ailerons;
 - (d) Points to be aware of while recovering — excessive speed, "G" loading;
 - (e) Instrument indications.
- (3) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) A spiral dive can be defined as "a steep descending turn with the aircraft in an excessively nose-down attitude and with the airspeed increasing rapidly".
- (2) Aircraft speed limitations can be rapidly exceeded in a spiral dive. Care must be taken to ensure that students fully understand the associated dangers and how to carry out effective recovery action.
- (3) The student must become familiar with the symptoms of the spiral dive, and its difference from the spin.

Instructor and Student Practice

- (1) Complete safety precautions — cockpit checks, minimum altitude, look-out, suitable area.
- (2) Demonstrate how spirals can occur:
 - (a) By allowing the attitude of the nose to become too low due to excessive bank while in a steep turn;

EXERCISE 14

- (b) From an incomplete or poorly executed spin entry or recovery.
- (3) Point out how spirals tighten if an attempt is made to raise the nose and note rapid loss of height and rapid increase in airspeed.
- (4) Demonstrate recovery:
 - (a) Close the throttle;
 - (b) Level the wings — co-ordinated control;
 - (c) Ease out of the dive.
- (5) Instrument indications.

SIDE-SLIPPING

Objective

To teach entry, practical use, and recovery from a side-slip.

Motivation

As required.

Essential Background Knowledge

- (1) Explain:
 - (a) The use of a side-slip:
 - (i) to lose excess height;
 - (ii) in cross-wind landing techniques;
 - (iii) in a slipping turn.
 - (b) Side-slip entry procedure;
 - (c) Attitude of an aircraft while side-slipping;
 - (d) Control of yaw and bank;
 - (e) Control of flight path;
 - (f) Recovery procedure.
 - (g) Consequences of incorrect recovery procedures;
 - (h) Instrument indications.
- (2) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) The side-slip and slipping turn should first be demonstrated and practised at altitude until the student learns how to use the controls. Subsequent demonstrations of the practical applications should be given near the ground.
- (2) In some aircraft, the position of the pitot and static pressure sources cause the airspeed to give unreliable readings depending on the direction of slip. Emphasize the same attitude used in both left and right slips.
- (3) When approaching to land using a side-slip to increase the rate of descent, the side-slip should always be made into the direction of the wind.
- (4) A common fault is the tendency to lose speed during recovery, often resulting in a heavy landing. Emphasize the need to lower the nose slightly to recover in a correct descent attitude at a safe altitude and then continue with a normal approach.

EXERCISE 15

(5) Emphasize the importance of the slipping turn. In most modern aircraft, as it is difficult to maintain direction in a side-slip with a moderate amount of bank, the slipping turn assumes greater importance, particularly in forced landings which are carried out without the use of flaps.

Instructor and Student Practice

- (1) Complete safety precautions — cockpit checks, minimum altitude, look-out, etc.
- (2) From a power-off descent demonstrate entry — apply bank, control yaw, and maintain correct attitude.
- (3) Demonstrate:
 - (a) Ground tracking;
 - (b) Varied rates of descent;
 - (c) Recovery techniques:
 - (i) level wings, control yaw, and adjust attitude for correct airspeed.
- (4) Show how side-slip is used to correct for drift in cross-wind approach and landing.
- (5) Slipping turns.
Demonstrate:
 - (a) Regulation of yaw;
 - (b) Attitude control during entry and recovery;
 - (c) Practical use.
- (6) Show how, depending on the placing of the pitot and static source, the airspeed indicator may be unreliable in a side-slip.
- (7) Instrument indications.

EXERCISE 16

TAKE-OFF

Objective

To teach:

- (1) How to get the aircraft safely airborne under various conditions of surface, wind and runway length.
- (2) The need to make meaningful decisions as to what type of take-off should be used under existing conditions.

Motivation

As required.

Essential Background Knowledge

- (1) Using the Pilot Operating Handbook explain recommended techniques for a normal take-off.
Additional take-off considerations for:
 - (a) Cross-wind. Refer to chart on cross-wind limitations;
 - (b) Minimum Ground Run. Refer to Pilot Operating Handbook;
Examples:
 - (i) short fields without obstacles;
 - (ii) short fields with obstacles;
 - (iii) soft fields;
 - (iv) rough fields;
 - (v) hard surfaces.
 - (c) Wind shear.
- (2) Explain how density altitude may be computed.
- (3) Review take-off data tables in Pilot Operating Handbook. Show how to determine the effect of varying density altitude and aircraft weight on take-off performance.
- (4) Explain the use of the Koch Chart for take-off distance calculation. Discuss selection of decision point to continue or reject the take-off.
- (5) Explain the effects on take-off distance of:
 - (a) Wind — use of head wind and cross-wind component graph;
 - (b) Light shifting wind or tail wind;
 - (c) Up grade or down grade;
 - (d) Surface types, e.g., hard or soft, sand, clay, mud, grass, gravel, snow and ice;
 - (e) Surface conditions, e.g., wet, dry, slush, snow and ice;

EXERCISE 16

- (f) Snow, slush, ice, frost and dirt on aerofoils;
 - (g) Incorrect pilot techniques (example — laminar flow type wings);
 - (h) Rough field;
 - (i) Calm surface wind becoming tail wind just above ground — obstacle clearance considerations;
 - (j) Aeroplane weight.
- (6) For nose wheel and tail wheel aircraft, explain the following as applicable:
- (a) Wheelbarrowing, torque, slipstream, asymmetric thrust in high nose-up attitude take-off, gyroscopic effect during rotation, weathercocking and ground looping tendency.
- (7) Considerations for taking off following large aircraft:
- (a) Wake turbulence — wing tip vortices:
 - (i) time delay;
 - (ii) lift-off point decision;
 - (iii) refusal of take-off clearance.
- (8) Airmanship related to holding clear of active runway, not delaying other aircraft waiting for take-off. Use runway holding position markings, if available.
- (9) Instrument indications:
- (a) Convert CAS to IAS when necessary;
 - (b) Airspeed monitoring during various types of take-off.
- (10) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) Events happen quickly during a take-off; the instructor has to speak clearly and the student may have difficulty in hearing owing to the noise, especially if the instructor's voice is not raised sufficiently. For this reason, adequate preparatory ground instruction is particularly important in this exercise, and a quick summary of the high points just prior to moving on to the runway is necessary.
- (2) The use of brakes during the take-off run should be avoided unless rudder control is insufficient.
- (3) Advise the student to concentrate on keeping straight by some reference at the far end of the runway.
- (4) Impress the student with the importance of the first few metres; if a good straight start to the run is made, keeping straight throughout the take-off run will be easier.

EXERCISE 16

- (5) The instructor must allow the student to make corrections, assisting only as necessary in the interest of control. Encourage the student to relax.
- (6) It should be emphasized that the purpose of short and soft field training is to enable the student to obtain the maximum performance from the aircraft. However, extreme caution must be used and much more experience gained before the student is qualified to operate in and out of fields of marginal length or conditions, or both. Under these circumstances, it may be necessary to walk the take-off area to determine suitability.
- (7) The short field take-off procedure assumes a firm smooth surface for the take-off run. The decision to take off from a short rough field should be made after assessing distance available, obstacles, and the degree of roughness.

NOTE: Minimum run take-offs can be similar to those used for soft/rough field conditions; however, certain aeroplane types, especially those with laminar flow wing characteristics require take-off techniques as specified in the Pilot Operating Handbook for the aeroplane type and model.

- (8) During take-off, "wheelbarrowing" may occur at lower speeds than during landing due to the slipstream increasing the lifting effect of the horizontal stabilizer. The use of excessive forward elevator control pressure during take-off to hold the aircraft on the ground to speeds above normal take-off speed could, if a "yaw" force is introduced, result in serious wheelbarrowing.
- (9) By example, insist that the student use the check-list. Make sure that the check is completed conscientiously and does not become a mere formality.
- (10) The student must be taught to size up the situation before any take-off, taking into consideration the effects of wind, surface conditions, obstacles, turbulence, and vortices from other aircraft, etc. When all pertinent points are taken into account, the student should *then* decide whether or not it is safe to take off. If the decision is to proceed, the student should then select the type of take off to use, rather than correct for problems as they are encountered.

Instruction and Student Practice

- (1) Take-off (ideal conditions):
 - (a) Complete pre-take-off check, check approach, obtain take-off clearance if applicable, and line up with take-off path;
 - (b) Apply take-off power, and keep straight;
 - (c) *Nose Wheel Aircraft* — raise nose to take-off attitude as elevators become effective;
Tail Wheel Aircraft — lower nose to take-off attitude as elevators become effective;
 - (d) Demonstrate attitude control at and after lift-off in order to accelerate to selected climb speed;
 - (e) Demonstrate procedure for retraction of flaps if applicable;
 - (f) Instrument indications — airspeed and heading indications.
- (2) Cross-wind take-off:
 - (a) Complete pre-take-off check;
 - (b) Hold control column fully into wind;

EXERCISE 16

- (c) As ailerons take effect, use only sufficient deflection to counteract cross-wind effect;
 - (d) When safe take-off speed attained — leave ground cleanly — control bank;
 - (e) Avoid re-contacting ground;
 - (f) At suitable height, adjust for drift with appropriate co-ordinated turn into wind;
 - (g) Retract flaps if used;
 - (h) Climb out for normal take-off, tracking along runway centre-line.
- (3) Short field obstacle clearance take-off (hard surface):
- (a) Complete the pre-take-off check, and position the aircraft to ensure maximum take-off distance available;
 - (b) Demonstrate application of power and use of brakes, and *maintain attitude for minimum aerodynamic drag on take-off run* — lift off at recommended speed;
 - (c) Demonstrate flight technique for acceleration to best angle of climb speed after lift-off (if applicable — according to type) and emphasize precautions necessary due to ground effect.
- (4) Soft and/or rough field take-off:
- (a) Complete the pre-take-off check, and position the aircraft to ensure maximum take-off distance available;
 - (b) Demonstrate application of power and use of brakes, and *maintain an attitude which will transfer the aircraft weight from wheels to wings as quickly as possible to minimize rolling drag* and to become airborne as soon as possible. (Avoid dragging aircraft tail on runway);
 - (c) Advise the student about the precautions necessary due to decreased forward visibility;
 - (d) Demonstrate flight technique for acceleration to the desired climb speed after lift-off and emphasize precautions necessary due to ground effect.
- (5) Minimum ground run take-off — no obstacle on climb out.
Demonstrate:
- (a) Similarity to soft/rough field take-off techniques;
 - (b) Flight technique for acceleration to desired climb speed before attempting to climb out of ground effect;
- (6) When suitable conditions exist, demonstrate effect on take-off run of:
- (a) Runway gradient;
 - (b) Tail wind;
 - (c) Maximum all-up weight;
 - (d) High density altitude — (simulate with reduced engine RPM);
 - (e) Wet runways.

EXERCISE 17

THE CIRCUIT

Objective

To teach how to fly a circuit pattern, leave and enter the circuit.

Motivation

As required.

Essential Background Knowledge

- (1) Explain:
 - (a) Circuit pattern including appropriate direction, distances and heights;
 - (b) How to fly a rectangular circuit with emphasis on safety i.e.:
 - (i) other traffic and spacing;
 - (ii) conformity to circuit size;
 - (iii) use of radio;
 - (iv) wake turbulence;
 - (v) acceptance and/or compliance with Air Traffic Control instructions and clearances.
- (2)
 - (a) Consideration for leaving the circuit:
 - (i) departure direction — controlled and uncontrolled airports;
 - (ii) application of Canadian Aviation Regulation 602.96, 602.97 and 602.100 (as well as A.I.P. Canada, RAC);
 - (b) Procedures in control zones.
- (3) Procedure to join the circuit at:
 - (a) Controlled and uncontrolled aerodromes and airports;
 - (b) Safety precautions to avoid other traffic.
- (4) Procedures to operate in or through a Control Zone.
- (5) Requirements to operate in Class A, B, C, D, E, F and G airspace.
- (6) Special VFR circuit considerations.
- (7) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) Insist on increasing aircraft handling accuracy and good airmanship, as circuit training progresses.
- (2) Do not expect the student to be able to immediately memorize all circuit details and handle the radio as well. The instructor should do all radio work until the student has a

EXERCISE 17

reasonable proficiency in flying the circuit. Flight safety should not be compromised in order to quickly acknowledge a radio transmission.

- (3) Because of the dangers associated with wake turbulence, proper circuit spacing is important, and the ability to make a correct decision to overshoot rather than accept a landing clearance should be impressed on the student.
- (4) If the student has difficulty in judging the final turn into wind, insist on a shallow banked turn. The slow rate of turn allows more time for judgement, and bank can be increased or decreased as necessary.
- (5) While circuits are normally to the left, proficiency in right hand circuits should be attained. Make sure the student knows where to find circuit information when planning a flight to an unfamiliar airport.
- (6) When power approaches are normally made, the instructor should periodically insist on a power-off descent to improve the student's proficiency in gliding and judgement on how far the aircraft can glide.
- (7) The procedures to follow when departing or joining the circuit at controlled and uncontrolled airports may differ. Be sure that the student appreciates these differences.
- (8) On occasions when approaching unfamiliar airports, pilots may be asked to report over points which are unknown to them, but are familiar to local pilots, e.g., "report over MacSwains' Marina". The student must be taught to *immediately* advise ATC when unfamiliar with the local area.

Instruction and Student Practice

- (1) Circuit Traffic Pattern:
 - (a) Demonstrate:
 - (i) how to fly an accurate rectangular circuit — drift corrections;
 - (ii) radio procedures — cockpit checks — look-out;
 - (iii) when circumstances permit;
 - (A) circuit spacing — speed and circuit size;
 - (B) pilot decisions with respect to:
 - (i) wake turbulence avoidance;
 - (ii) overshoot;
 - (iii) acceptance and/or compliance with Air Traffic Control instructions and clearances;
 - (iv) instrument monitoring.

EXERCISE 17

- (2) Departing and joining the circuit:
 - (a) Demonstrate:
 - (i) correct procedure;
 - (ii) radio procedures if applicable.
- (3) Demonstrate, when applicable, procedures for flight in or through control zones.
- (4) Special VFR:
 - (a) When conditions permit, demonstrate departure and arrival procedures.

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EXERCISE 18

THE APPROACH AND LANDING

Objective

To teach:

- (1) The techniques necessary to safely land an aircraft under varied conditions.
- (2) The need to make meaningful decisions as to what type of landing should be made under existing conditions.

Motivation

As required.

Essential Background Knowledge

- (1) Using the information in the Pilot Operating Handbook (if specified), at appropriate times explain recommended techniques for normal landings.
Explain additional consideration for:
 - (a) Cross-wind landings;
 - (b) Short field/obstacle clearance approach and landing (spot landing — precision approaches) — use of power;
 - (c) Soft or rough field landings;
 - (d) Landings over an obstacle;
 - (e) "Touch-and-go" or "stop-and-go" landings.
- (2) Explain landing distance tables in the Pilot Operating Handbook. Show how to determine the effect of density altitude and weight on the length of the landing run.
- (3) Explain how and why the length of the landing run is affected by:
 - (a) Wind — use of head wind and cross-wind component graph;
 - (b) Light shifting wind or tail wind;
 - (c) Up grade or down grade;
 - (d) High all-up weight;
 - (e) Surface types, e.g., hard or soft, sand, clay, mud, grass, gravel, snow and ice;
 - (f) Surface conditions, e.g., wet, dry, slush, snow and ice;
 - (g) Wet runways — hydroplaning;
 - (h) Density altitude.
- (4) Explain:
 - (a) Power-off and power-on approach procedures to a touchdown — airspeed surveillance and control.

EXERCISE 18

- (b) By reference to ground visual indications, recognition of undershooting and overshooting.
- (5) For nose wheel equipped aircraft explain:
 - (a) Airmanship precautions for protection of nose gear from damage on landing;
 - (b) "Wheelbarrowing".
- (6) For tail wheel equipped aircraft explain:
 - (a) Ground looping — description, causes, and prevention;
 - (b) Considerations for directional control i.e. tail wheel firmly on ground;
 - (c) Precautions necessary due to decreased forward visibility.
- (7) Explain:
 - (a) Considerations for landing behind large aircraft:
 - (i) spacing;
 - (ii) touchdown point — considerations due to wake turbulence.
 - (b) How and when the pilot may refuse landing clearance;
 - (c) Overshoot techniques with respect to:
 - (i) power — attitude, carburettor heat;
 - (ii) flap retraction;
 - (iii) flight in relation to runway — climb-out path.
 - (d) Effects of flap and wind on final approach path, including wind shear and turbulence;
 - (e) Airmanship relating to:
 - (i) runway turn off point — high speed turns;
 - (ii) clearing active runway;
 - (iii) post-landing checks;
 - (iv) taxi clearance — when applicable.
 - (f) Visual illusions when approaching for a landing on an up or down slope, and on runways which are narrower or wider than those to which the pilot is used to.
- (8) Instrument indications:
 - (a) Airspeed and altitude surveillance during approaches;
 - (b) Conversion of CAS to IAS, when necessary.
- (9) Question student on the exercise and clarify as necessary.

Advice to Instructors

- (1) Accident records show landings contribute immensely to the accident total. Accordingly, it is essential to expose the student to all possible variables that may be encountered in landing conditions and ensure the capability of handling them.
- (2) The student must be taught to size up the situation before any landing, taking into consideration the effects of wind, surface conditions, obstacles, turbulence and vortices from other aircraft, etc. When all pertinent points are taken into account, the student

EXERCISE 18

should then decide whether or not it is safe to land. If the decision is to proceed, the student should then select the type of approach and landing to use, rather than correct for problems as they are encountered.

- (3) A landing is not finished until the landing roll has stopped. Caution the student not to allow attention to be diverted by tower transmissions. Insist that the aircraft be either stopped or taxiing before using the radio.
- (4) Post-landing checks should be carried out well clear of the runway, and where available past the taxiway holding position lines, with the aeroplane fully stopped. Taxiing accidents and the incorrect selection of flap and landing gear levers can be avoided in this manner.
- (5) Landings are a continual challenge. Encourage the student to watch other students landing and learn from their mistakes.
- (6) During the landing, make sure the student looks far enough ahead of the aircraft to properly appreciate both the forward, vertical and possible lateral movement in relation to the runway.
- (7) Allow students to correct their own mistakes. They will never learn if it is all done for them, but be ready to take control — fully or partially, if there is a possibility of loss of control or flight safety could be jeopardized.
- (8) "Touch-and-go" landings should be taught only after the student has achieved a reasonable degree of proficiency in controlling the final stages of the landing roll.
- (9) Should it be necessary to correct a powered approach by altering the power setting, it is always advisable to correct early so that a slight alteration will be sufficient. The student should be taught to strive for an approach that requires minimal power variation.
- (10) When landing on a long runway, you may find that the student is taking advantage of the easy approach and is not being accurate in judgement. Such a habit must not be allowed to develop. Insist that the student land in a predetermined touchdown zone. The touchdown point should not normally be the threshold.
- (11) The student should learn to use the flaps intelligently to steepen the descent path as required, but occasionally, as an exercise in judgement, you should ask the student to land with a predetermined flap setting. The effect of flap on the actual landing is an important consideration.
- (12) The change of attitude of the aircraft to bring about the required round-out and subsequent hold-off to touchdown must be judged by visual reference to the ground rather than by mechanical movements of the control column. This must be demonstrated sufficiently and consistently by the instructor until the student observes the clues which will enable personal decisions to be made.

EXERCISE 18

- (13) Occasionally, while correcting for a bounce during which the nose of the aircraft has risen considerably, the student may open the throttle correctly, but at the same time, due to tension or confusion, may move the control column too far forward. The danger here is obvious, and you should watch for it carefully.
- (14) If, before the first solo, the student has had no trouble in landing the aircraft, you should "assist" by making bad landings to ensure that the proper recovery action is learned.
- (15) Overshoots following a full flap approach should be demonstrated and practised prior to the first solo flight.
- (16) Allow student to rest periodically while you demonstrate a take-off, circuit and landing.
- (17) A number of "wheelbarrowing" accidents have occurred during cross-wind landings made by pilots flying aircraft equipped with nose wheel/rudder steering, and utilizing the "slip" technique for cross-wind correction. On some general aviation aircraft the nose wheel steers when rudder is applied and, for this reason, such landings require careful rudder operation just prior to the nose wheel touching down. The rudder should be centralised just before the nose wheel is allowed to contact the runway. The "slip" method of drift correction is favoured by the majority of pilots (particularly in light aircraft) as it accomplishes the desired results without presenting the need for a last minute directional correction prior to touchdown.

Instruction and Student Practice

FOR NOSE WHEEL AIRCRAFT

- (1) Normal landings — demonstrate:
 - (a) Establishment of landing approach line;
 - (b) Use of flaps/side-slip on desired final descent path;
 - (c) Power-on and power-off approaches;
 - (d) Levelling off — flare;
 - (e) Where to look ahead of the aircraft while landing;
 - (f) Hold-off — diminishing control response;
 - (g) Landing attitude;
 - (h) Touchdown — nose-up attitude to avoid wheelbarrowing;
 - (i) Landing run — lowering nose as elevator control diminishes;
 - (j) Keeping straight.
- (2) Cross-wind landings — demonstrate:
 - (a) Final approach (crab into wind) — use of power;
 - (b) Use of flaps as required or recommended;
 - (c) Lowering into-wind wing to offset drift at approximately 200 feet above ground;
 - (e) Correction of drift on hold-off;
 - (f) Touch down on the upwind main wheel;
 - (g) Attitude and directional control on touchdown — avoid wheelbarrowing;
 - (h) Keeping wings level with aileron during landing roll — directional control.

EXERCISE 18

FOR TAIL WHEEL AIRCRAFT

- (3) Normal landings — demonstrate:
 - (a) As in paragraph (1), (a) through (g);
 - (b) Three-point landing attitude;
 - (c) Keeping straight on touchdown — control column full back — ground loop indications and prevention;
 - (d) Completion of landing — give full attention until the aircraft comes to a stop.

- (4) Cross-wind landings — demonstrate:
 - (a) As in paragraph (2), (a) through (e);
 - (b) Touching down on into-wind main wheel and tail wheel — directional control;
 - (c) As aileron control diminishes, other main wheel will touch runway;
 - (d) Keeping wings level with aileron during landing roll — directional control.

- (5) Wheel landing — demonstrate:
 - (a) Approach at suitable speed — use of power;
 - (b) Levelling out close to ground;
 - (c) Touch down in level attitude on main wheels;
 - (d) As wheels touch — check forward on elevator control;
 - (e) Keeping main wheels firmly on runway;
 - (f) Directional control;
 - (g) As elevator control diminishes, tail wheel will touch runway;
 - (h) Keeping tail wheel firmly on ground.

- (6) Wheel landing — cross-wind — demonstrate:
 - (a) Final approach as in paragraph (2), (a) through (f);
 - (b) As aileron control diminishes, allow other main wheel to touch runway;
 - (c) Keeping straight;
 - (d) As elevator control diminishes, allow tail wheel to touch runway;
 - (e) Keeping tail wheel firmly on ground;
 - (f) Keeping wings level with aileron during landing roll.

EXERCISE 18

FOR BOTH NOSE WHEEL AND TAIL WHEEL EQUIPPED AIRCRAFT

- (7) Approach and landing over obstacle — demonstrate:
 - (a) Approach at recommended airspeed given in the Pilot Operating Handbook, flaps as applicable;
 - (b) Use of attitude/power in maintaining desired airspeed and precision descent path.
 - (c) Control response;
 - (d) Power reduction on completion of flare for landing;
 - (e) Landing to suit existing conditions i.e. cross-wind, soft field, etc.;
 - (f) Precision touchdown point considerations.
- (8) Short field landings — demonstrate:
 - (a) Approach at recommended airspeed — use (7)(a) above;
 - (b) If no obstructions — flight path and use of power;
 - (c) For obstacle approach — see para (7) above;
 - (d) Use of brakes after touchdown;
 - (e) Use of flaps after touchdown — safety considerations.
- (9) Soft field landing — demonstrate special considerations:
 - (a) Touch down at minimal speed;
 - (b) Maintain nose-up attitude as long as possible during landing run — for tail wheel aircraft, fully back on control column;
 - (c) Precautions when using brakes.
- (10) Overshoot — demonstrate:
 - (a) From an approach;
 - (b) From an aborted landing;
 - (i) power, attitude, carburettor heat — cold weather considerations;
 - (ii) flap retraction;
 - (iii) flight in relation to runway — climb path.
- (11) "Touch-and-go"/"stop-and-go" landing considerations:
 - (a) Directional control;
 - (b) Use of ancillary controls;
 - (c) Importance of sufficient runway remaining for take-off.
- (12) Post-landing procedures — demonstrate:
 - (a) Taxiing clear of runway;
 - (b) Completion of post-landing check;
 - (c) Obtaining taxi clearance — if applicable.
- (13) When suitable, and safe conditions exist, demonstrate effect on landing distance of:

EXERCISE 18

- (a) Tail wind;
- (b) Grass surfaces, wet and dry;
- (c) Runway gradient;
- (d) Maximum landing weight.

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EXERCISE 19

THE FIRST SOLO

Objective

To determine that the student is prepared to safely carry out a first solo flight.

Motivation

As required.

Essential Background Knowledge

While no separate ground training in this exercise is required, occasional references to the conditions to be encountered on the first solo flight during ground instruction for other exercises should be meaningful, but in no way conducive towards a feeling of apprehension on the part of the student.

Advice to Instructors

- (1) When the student is ready for solo, the pre-solo briefing should be short, ensuring that the student knows what to do on the flight; keep advice to the bare minimum.
- (2) The dual trip prior to the first solo should leave sufficient fuel for the intended flight. There must be sufficient daylight, suitable weather, reasonable winds and traffic conditions to permit this flight to be carried out with a minimum of distractions.
- (3) The pre-solo flight should not exceed 45 minutes in order to keep fatigue at a minimum.
- (4) The amount of dual instruction required before a student can be sent on a first solo flight need not be a reflection on the ability of an instructor. Everyone varies in their capacity to learn, and very often the student who is a little slow to learn ultimately makes a better pilot. Students who are sent solo too soon and have an unnerving experience may lose confidence, not only in themselves, but, and this is far more important — also in their instructor.
- (5) The first solo is an important step in the student's flying career. It is a never to be forgotten experience — treat it as such. Personal congratulations and subsequent traditional school activities (First Solo certificates, etc.) mean much to the student.
- (6) It is not advisable to tell students that you plan to send them solo until moments before the actual solo flight. The possible apprehension could delay the very flight that you are planning for them.
- (7) Before the first solo flight, ensure the student has received instruction in all exercises specified in Lesson Plans 1 to 10 in Part III of this Guide.
- (8) Your students must be capable of dealing with all routine and emergency situations which are likely to be encountered in the circuit. They shall have demonstrated the ability to consistently:
 - (a) Make safe take-offs while using correct technique for runway surface and wind conditions;

EXERCISE 19

- (b) Acknowledge and comply with ATC clearances or instructions, if applicable;
 - (c) Fly accurate circuits while maintaining safe separation from other aircraft;
 - (d) Fly accurate approaches, recognizing and correcting for any deviations from a proper approach profile;
 - (e) Use the correct overshoot procedures;
 - (f) Land within a predetermined touchdown zone using correct technique for the runway surface and wind conditions;
 - (g) Recover from misjudged landings (e.g., porpoising, ballooning, bouncing);
 - (h) Conduct a forced landing from any point in the circuit in the event of an engine failure.
- (9) The student must be advised to anticipate a change in aircraft performance, such as, a shorter take-off roll and increased rate of climb.
- (10) Normally, the student should have a dual check before the next solo flight.

Instruction and Student Practice

- (1) Carry out several dual circuits until satisfied as to competency of student, and that suitable conditions exist.
- (2) Advise control tower, if applicable.
- (3) Send student on first solo.

EXERCISE 20

ILLUSIONS CREATED BY DRIFT — LOW FLYING

Objective

To teach the student:

- (1) To cope with the illusions created by drift by maintaining co-ordinated flight in turns.
- (2) How to maintain a desired track by compensating for the effects of drift while manoeuvring at low level.

Motivation

As required.

Essential Background Knowledge

- (1) Explain:
 - (a) Illusions and effects of flight at low level in a strong wind:
 - (i) into-wind — reduced ground speed produces an illusion of reduced airspeed;
 - (ii) downwind — increased ground speed produces an illusion of increased airspeed;
 - (iii) when turning from downwind an illusion of a skid outwards results;
 - (iv) when turning from into-wind an illusion of a slip inwards results.
 - (b) Situations where illusions can produce potentially dangerous flight conditions, e.g., low level circuit and approach while operating under conditions of low ceilings, turns at low level associated with high winds, etc.;
 - (c) Precautions:
 - (i) look well ahead;
 - (ii) maintain safe airspeed;
 - (iii) turn accurately in spite of deceptive illusions — maintain co-ordinated flight;
 - (iv) keep a good look-out, and cross-check instruments;
 - (v) maintain safe altitude — observe local regulations;
 - (vi) avoid annoying others and frightening livestock;
 - (vii) do not turn too steeply;
 - (viii) allow sufficient space to manoeuvre when at low altitude.
- (2) Question student on exercise and clarify as necessary.

Advice to Instructors

- (1) The minimum height in this exercise should be governed by local restrictions. Adequate look-out is essential. Use this demonstration to point out inherent dangers of flight at low altitudes.

EXERCISE 20

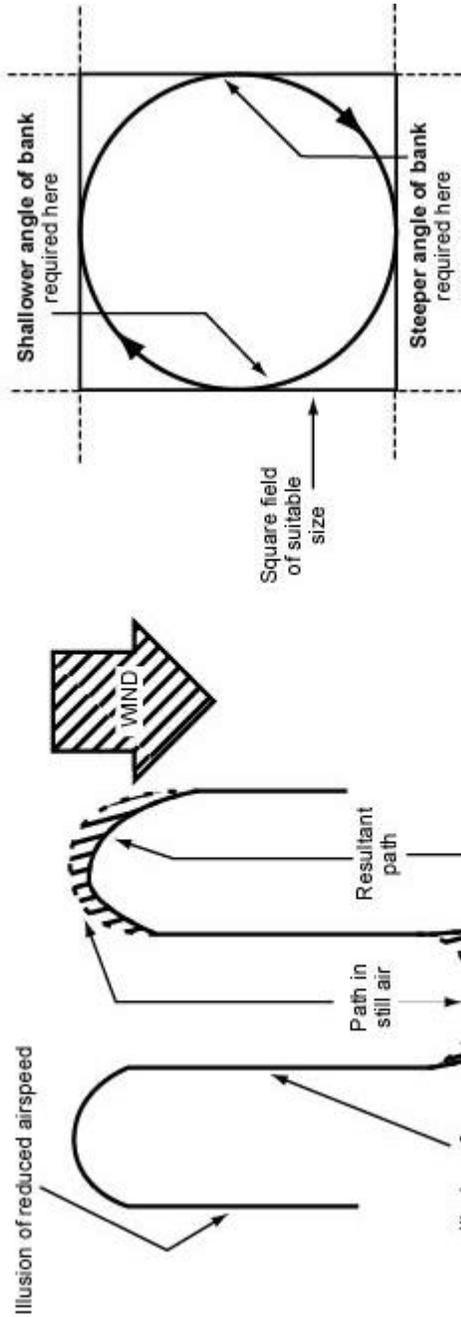
- (2) Choose a day when the wind is strong enough for the effect of drift to be noticeable. An ideal opportunity is when solo flying has been cancelled due to strong winds.
- (3) Since the illusions may lead to inaccurate and potentially dangerous flying, the pupil must thoroughly understand them and adequate practice must be given in flight below normal altitudes.
- (4) Let the pupil try to find the wind direction by judging the drift and adjusting direction until there is no drift. The student will not find it easy, but it is good practice.
- (5) Dangerous situations develop rapidly due to illusions created by drift, when practising forced or precautionary landings in a strong wind. Instructors must not allow the student to attempt to increase the rate of turn with rudder, particularly when turning from base to final approach in these exercises.
- (6) This is a good exercise to acquaint the student with the practical application of the Canadian Aviation Regulations regarding flight over built-up areas.
- (7) Refer to the diagrams on pages 117 and 118 which show suggested in-flight procedures which may be used to effectively demonstrate this exercise.
- (8) When teaching circuits and forced and precautionary landing procedures, take advantage of windy conditions to apply the principles learned in this exercise.

Instruction and Student Practice

- (1) At low level, in a suitable area:
 - (a) Fly into wind and note reduced ground speed;
 - (b) Turn downwind and note increased ground speed;
 - (c) While turning 180° from downwind into-wind, note apparent skid outwards — maintain co-ordinated flight — note the effect of wind drift on the anticipated flight path during the turn;
 - (d) Following this, while turning 180° from into-wind to downwind, note apparent slipping inwards — maintain co-ordinated flight — note the effect of wind drift on the anticipated flight path during the turn;
 - (e) As an additional exercise, note apparent slipping and skidding when performing a 360° turn — the angle of bank needs to be varied to achieve a proper circular path;
 - (f) Refer to Advice to Instructors for suggested demonstrations showing the practical application of this demonstration;
 - (g) Demonstrate a precautionary landing procedure in windy conditions to apply the principles learned in this exercise.
- (2) Repeat the above using flaps as necessary to demonstrate increased visibility — better control.

NOTE: This exercise should be demonstrated with both left and right hand turns.

EXAMPLES OF HOW ILLUSIONS AND EFFECT OF DRIFT IN TURNS DURING HIGH WIND CONDITIONS MAY BE DEMONSTRATED



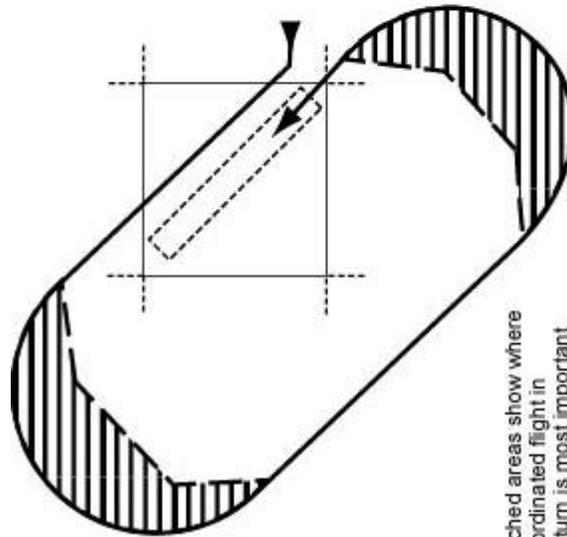
Ground reference manoeuvre

Flying a circle, making allowance for drift by varying angle of bank – constant altitude and airspeed.

Speed and Drift Illusions

Purpose: To demonstrate illusions of increased and decreased airspeeds; illusions while turning; effect on flight path when constant angle of bank maintained.

EXERCISE 20



Hatched areas show where co-ordinated flight in the turn is most important due to drift illusions at low altitude. Drift in turns must be anticipated, particularly when turning from base leg to line up for final approach.



Ground reference manoeuvre:
180° turns crossing a reference line of irregularly spaced points maintaining a constant altitude and airspeed. Bank angles must be varied to obtain radius of turn necessary to cross at each successive point.

Low level circuit:
Practical application of the principles learned in this exercise when low ceiling necessitates low level circuit.

PRECAUTIONARY LANDINGS

Objective

To teach the student the procedures to be followed in preparation for a landing at an aerodrome where the surface condition is unknown, an unfamiliar aerodrome or landing area, or an unprepared surface.

Motivation

As required.

Essential Background Knowledge

- (1) Describe the situations which could lead to a precautionary landing:
 - (a) Aerodrome surface conditions, unfamiliar aerodrome or landing area;
 - (b) Fuel shortage;
 - (c) Deteriorating weather;
 - (d) Lost;
 - (e) Approaching darkness;
 - (f) Other (sickness, mechanical, etc.).

- (2) Discuss points to be considered for selection of best available landing surface:
 - (a) Wind direction and speed;
 - (b) Search procedure for suitable field;
 - (c) Clues indicating surface conditions;
 - (d) Obstacles on approach;
 - (e) Best landing path;
 - (f) Proximity to roads and/or telephone.;
 - (g) Sufficient length for take-off;
 - (h) Overshoot considerations.

- (3) Describe considerations for air inspection of field:
 - (a) Applicable cockpit checks;
 - (b) Flight configuration and speed for circuit and field inspection;
 - (c) Nuisance avoidance regarding persons and property on ground, livestock, etc.;
 - (d) Landing line orientation procedure — use of heading indicator and turning points under reduced visibility conditions;
 - (e) Inspection circuit pattern and altitude according to existing circumstances — terrain, visibility, obstacles, etc.;
 - (f) Considerations relating to drift illusions (see Exercise 20);
 - (g) Radio procedures — where feasible;

 - (h) Approach and landing techniques, landing configuration, airspeed selection and control;

EXERCISE 21

- (i) Final landing check;
 - (j) Removal of power after landing flare;
 - (k) Considerations for overshoot after a practice approach.
- (4) Discuss considerations for landing in trees or water.
- (5) The instructor shall review all pertinent Canadian Aviation Regulations regarding low flying as well as the necessity to conform to applicable circuit procedures when practising at an aerodrome.
- (6) Question student on main elements of the presentation and clarify as necessary.

Advice to Instructors

- (1) Basically, precautionary landings can be divided into two categories: a pre-planned landing where the pilot is unfamiliar with the aerodrome/landing area, or its condition is unknown, or both; and a landing made necessary due to deteriorating weather, darkness, fuel shortage, etc. on an unprepared surface. In the case of a precautionary landing, make the demonstration realistic; paint a picture to the student detailing the weather conditions, cloud base, etc., and having done so, do not change the conditions. When the demonstration is given on the aerodrome, the height and distance from the runway at which the pattern is flown should be consistent with the stated weather conditions, except where flight safety considerations, such as other traffic and built-up areas, may be a limiting factor. As well, on long runways, the portion to be used should be clearly defined. The touchdown point should not normally be the actual threshold of the runway.
- (2) When conducting the inspection and the final approach to a landing, any variation from a normal circuit and approach should be dictated by special existing conditions. The speed used for the field inspection should not be less than that stipulated in the Pilot Operating Handbook, or if this is not given, not less than the normal approach speed. The flight configuration, speed, and altitude selected should require minimum pilot attention to fly the aeroplane safely. This allows more time to be devoted to effective inspection of the intended approach and landing path.
- (3) A most important aspect of a precautionary landing is to make an early decision. The pilot then should have sufficient time to select the best available landing surface.
- (4) Emphasize the importance of speed control during the approach. This can be very usefully practised at altitude.
- (5) Accidents have been caused by the pilot thinking too much of the landing during the approach; teach the student to concentrate on the approach first. This, coupled with the proper use of power and monitoring of airspeed, sound airmanship, etc., should result in a safe touchdown.

EXERCISE 21

- (6) It should be pointed out that in the final stages of a precautionary landing, the pilot may find that the aircraft is sinking too rapidly. This may not be apparent at heights above 50 feet. The pilot should be prepared to give increased throttle before and at the moment of landing in order to cushion the ground contact. This will also help to counteract any effect due to wind shear near the ground.
- (7) Flight instructors must realize that while they, as experienced pilots, may possess the skill to follow the procedure whereby the throttle is closed and the nose lowered significantly when an approach obstacle has been passed, most low time pilots do not possess the judgement necessary to consistently carry out a safe landing flare under conditions of low approach speed and a steep descent path. The inherent dangers of this procedure may be compounded by ground turbulence and wind shear. Once the touchdown point has been selected, the approach path should be set up so as to clear any obstacle, and the final approach power should not be removed until the landing flare has been completed at a satisfactory height. Additional power is also more readily available from a "spooled-up" engine should it be required to cushion a flare or touchdown. If the approach speed has been correct there will be minimum "float" once the throttle has been closed. As the graduate pilot accumulates experience, approach procedures can be varied, but unless the landing surface is minimal, there is little advantage to closing the throttle once the obstacle has been passed.
- (8) Ensure the student is made thoroughly aware of the dangerous situations presented during turns at low altitude caused by the illusions created by drift, while practising precautionary landings. The instinctive desire to increase the rate of turn with rudder will more likely manifest itself in turns from the base leg to final approach, particularly in a strong cross-wind. The hazards of skidding turns at a low airspeed and low altitude, while obvious to the instructor, must be emphasized to the student.

Instruction and Student Practice

- (1) Outline simulated conditions such as:
 - (a) Non-emergency conditions — landing at unfamiliar aerodromes/landing areas or the surface condition is unknown, or both;
 - (b) Emergency conditions — e.g., weather — cloud base and visibility, lost — fuel remaining.
- (2) Determine wind direction and speed — select suitable field, best landing run and overshoot flight path.
- (3) Set up suitable manoeuvring configuration and speed — and demonstrate:
 - (a) Safety precautions;
 - (b) Applicable cockpit checks — passenger briefing;
 - (c) Radio procedures — where feasible;
 - (d) Selection of final approach and landing path;
 - (e) Circuit size and altitude for effective inspection of landing surface (keep field in sight);

EXERCISE 21

- (f) Selection of aids for circuit pattern and line up for final approach — use of heading indicator.
- (4) Carry out field inspection.
 - (5) Overshoot and proceed with circuit for landing if satisfied with field selected and demonstrate:
 - (a) Safety precautions — safe airspeed;
 - (b) Landing checks;
 - (c) Use of orientation aids for circuit and approach.;
 - (d) Final approach procedure, airspeed, and flaps;
 - (e) Landing procedure — touch down on specific point of landing surface (if approved landing surface) — removal of power after landing flare.
 - (6) Student practises principles learned, selecting the field and following approved procedures.

FORCED LANDINGS

Objective

To teach the procedures to follow in the event of a power failure.

Motivation

As required.

Essential Background Knowledge

- (1) Explain:
 - (a) Reasons why a forced landing may be necessary:
 - (i) fuel starvation — plugged fuel tank vents — fuel selector — primer unlocked;
 - (ii) oil starvation;
 - (iii) mechanical failure;
 - (iv) carburettor icing;
 - (v) engine air intake blockage;
 - (vi) other (impending power failure).
- (2) Outline actions to be followed in event of an engine failure:
 - (a) Control of aircraft — correct descending attitude — trim;
 - (b) Use of carburettor heat (simultaneous with (a));
 - (c) Selection of field — wind, altitude and surface conditions;
 - (d) Plan of approach — selection of key points;
 - (e) Power loss check — while heading to key point (fuel, fuel pumps, primer, carburettor heat, mixture, switches, etc.) — distress call — radio and/or transponder;
 - (f) Security check — passenger briefing (loose and hazardous objects, seat belts, exits, fuel, switches, personal objects, etc.);
 - (g) Final approach considerations;
 - (h) Touchdown planning;
 - (i) Use of brakes and other considerations during landing roll — controlled ground loop (if necessary).
- (3) Question student on main elements of the exercise and clarify as necessary.

Advice to Instructors

NOTE: The key can be defined as some physical feature or features on the ground which are chosen to establish a near to normal base leg distance from a field that has been chosen for forced landing purposes. Base leg distance in this case must be well within the into-wind gliding range of the aircraft.

EXERCISE 22

- (1) Key points are selected to assist the pilot to maintain a lateral distance from the landing area until sufficient altitude is lost and the proper approach angle achieved. This will prevent crowding of the field which may result in turns involving excessive angles of bank, and excessively high airspeeds over the boundary of the field.
- (2) The key points should be established on a line that is about the same distance from the landing area as the normal base leg for a glide approach, taking wind conditions into consideration.
- (3) Never allow a practice forced landing to become a real one through poor airmanship and improper engine handling. The student will be expected to demonstrate good airmanship by clearing the engine at appropriate intervals during the descent. The practice of leaving some power on and achieving a normal descent angle and airspeed by using flaps is acceptable.
- (4) Practice should be given at every opportunity — in the circuit, on overshoot, to and from the practice area, etc.
- (5) Normally, once approach flap has been extended, it is rarely necessary to descend below 500 feet on final. However, if a student is consistently under or overshooting, it may be necessary to continue the approach to a lower altitude when conditions permit, to prove that the approach was unsuccessful.
- (6) When traffic conditions permit at an aerodrome, give the student practice at an actual approach to a touchdown by closing the throttle at a suitable position in the circuit. Approach and landing judgement will improve considerably with this type of "for real" practice. The use of other authorized landing surfaces in a similar manner will add variety and interest to this exercise.
- (7) While losing height prior to commencing the final approach, all turns should normally be made in the direction of the field. Using the experience gained in the power-off descending exercises, *teach the student to recognize the visual indications which confirm the point of touchdown.*
- (8) This exercise is an excellent chance to apply the Learning Factors. Do not expect the student to perform all the various stages of a forced landing together at the start. Learning should be progressive as is pointed out in (1), (2) and (3) of the Air Instruction. Making the exercise too complicated precludes proper learning and progress. While the student is learning to fly an approach to a forced landing, the power loss and security checks can be carried out in their proper sequence by the instructor. The student can then progressively incorporate these checks as satisfactory approach proficiency is attained.
- (9) Make good use of the time spent while proceeding to and from flying practice areas to rehearse power loss checks and security checks. Suitable fields can be selected, and the key points located, thus giving better utilization of the time spent actually practising forced landings.

EXERCISE 22

- (10) Simulated engine failures practised during take-off should be cleared with the Air Traffic Control unit in advance to avoid unnecessary concern.
- (11) During preparatory ground instruction draw a field on the chalkboard, give an altitude, and have the student draw and describe the path of flight to be followed in an actual exercise.
- (12) Approaches should be from different positions. The objective is to teach the student to arrive at the correct position, at the correct altitude, by the simplest method, and the method will depend on the circumstances.
- (13) Serious crowding of the field on base leg can be relieved by side-slipping away from the field; however, caution should be exercised if this is done as distance in relation to the field is rapidly increased and altitude is rapidly lost. If the slip is continued too long, an undershoot may result. When certain of getting into the field, use of flaps, side-slip, or slipping turn to lose surplus height and facilitate a touchdown in the first 1/3 of the selected landing surface, should be demonstrated.
- (14) Stress that this approach is not something new — it is a continuation of the descending exercises and of the use of judgement learned when flying the circuit, with respect to distance from the field and HOW FAR THE AIRCRAFT CAN GLIDE. Students training at airports where traffic density dictates continuous power assisted approaches will require more emphasis in this area. Therefore, any opportunity to practise a power-off approach to a landing should be utilized.

Caution

Some aircraft are fitted with combustion heaters which may constitute a fire hazard should the aircraft suffer structural failure on a landing. It is essential that such heater systems be switched off during the security checks.

Instruction and Student Practice

- (1) For the first demonstration approach (from 3,000 feet above ground level approximately) *before the throttle is closed for the descent*, demonstrate and have the student practise power loss checks, security checks, and radio procedure. When the student is reasonably proficient in these areas, then:
 - (a) Indicate wind direction;
 - (b) Point out field and key point to be used — explain reason for selection — wind direction and surface conditions;
 - (c) Simulate power failure;
 - (d) Simultaneously assume correct glide attitude, carburettor heat on and trim;
 - (e) Head for key point;
 - (f) Mention that power loss check, security check, and radio procedures would be conducted at this time;
 - (g) Briefly explain plan of approach and engine clearing/ warming procedures;
- (h) Emphasize:

EXERCISE 22

- (i) constant angle of descent — correct airspeed/attitude;
 - (ii) while losing height at the downwind end of the field, that the key point of the final base leg will be similar to the base leg at the home airport for a glide approach — drift or crab angle — correct distance from field boundary for existing wind velocity;
 - (iii) recognition of visual indications of the point of touchdown while descending at a constant angle of descent;
 - (iv) aiming point of touchdown — in first 1/3 of landing surface;
 - (v) final approach considerations — use of flaps, or side-slip, or slipping turns, to maximize use of the field available;
 - (vi) demonstrate overshoot technique.
- (2) For student practice from approximately 3,000 feet above ground level for several approaches:
- (a) Have student fly approaches, starting from easy situations, progressing to more complicated;
 - (b) Coach when necessary during each practice approach.
- (3) After several successful approaches by student under coaching:
- (a) Simulate power failure without prior warning at various altitudes;
 - (b) Insist on proper selection of field and key point and appropriate checks as approach is being flown;
 - (c) Demand increasing accuracy.
- (4) Simulate power failure on overshoot, take-off, in the circuit, etc.
- (5) Never compromise safety.

PILOT NAVIGATION

Objective

To teach the student to prepare for and be able to conduct safe cross-country flights.

Motivation

As required.

Essential Background Knowledge

- (1) Discuss the procedure to be used to:
 - (a) Obtain weather reports and forecasts and to extract appropriate information for the intended flight and destination aerodrome, including possible cross-wind on the landing runway;
 - (b) Select appropriate track;
 - (c) Determine possible hazards along the proposed track i.e.:
 - (i) towers;
 - (ii) danger areas, etc.
 - (d) Prepare the chart i.e. plotting of track lines, measurement of distances, plotting of 10° lines and distance increments;
 - (e) Select alternate aerodromes for emergency use en route;
 - (f) Calculate heading and time en route;
 - (g) Prepare Navigation Flight Planning Form and Flight Log, and file Transport Canada Flight Plan or Flight Itinerary.

- (2) Outline:
 - (a) Procedure for setting heading: overhead, climb on heading or from known geographic point — precautions to be taken when setting heading indicator to magnetic compass — the need for checking the heading indicator just prior to setting heading and periodic resetting en route — the need for checking visually that the aircraft is heading in the correct direction (visual angle of departure) — chart orientation procedures;
 - (b) Pilot navigation technique to be used for in-flight correction of track error i.e. 10° drift lines, etc. and revision or confirmation of estimated time of arrival (ETA) over the next check-point;
 - (c) Procedure for entering flight progress in flight log;
 - (d) Procedure to divert to alternate aerodrome, return to departure aerodrome or to fly an alternate track;
 - (e) Basic use of radio aids to navigation as appropriate;
 - (f) Considerations for navigation at low level or in conditions of reduced visibility;

EXERCISE23

- (g) Action to be taken if unsure of position or lost — how to request and follow instructions for a DF steer.
- (3) Check aircraft documents for validity and Journey Log to determine that sufficient time remains for the intended flight.

Advice to Instructors

NOTE: *Navigation Terms.* To comply with standard ICAO definitions the words "course" and "route" have been eliminated in this guide. In the past, the terms "set course" "alter course" etc., have been used, and instructors should make every effort to teach the proper terms to their students. "Heading" can be coupled with "true", "magnetic", or "compass" while "intended" or "made good" can be added to "track".

- (1) At some point during navigation training, practice should be given in low level pilot navigation to emphasize the importance of maintaining the planned heading or corrected heading for the time en route.
- (2) During the low level navigation training and flying to and from the training area the student is not expected to use precise plotting techniques in the air; rather, simple useful "rule of thumb" calculations for track and ETA corrections are all that is necessary.
- (3) The Navigation Flight Planning Form and Flight Log used must include at least all the information contained in the form and log on the following pages.
- (4) This exercise affords an excellent opportunity to point out many good airmanship practices and procedures, e.g.:
 - practical weight and balance computation
 - use of Airport Register
 - en route refuelling procedures
 - chart orientation
 - en route weather and airport information
 - usefulness of DR Navigation in establishing "circle of probable location" at all times
 - use of Canada Flight Supplement
 - filing and closing of Flight Plan or Flight Itinerary.
- (5) The solo cross-country exercise involves the application of all skills and experience accumulated by the student throughout the training course. Before authorizing solo, assure yourself and the student that the required competence to complete this exercise successfully has been achieved. Ensure that the student has carried out adequate pre-flight planning and preparation unassisted.
- (6) Extreme care should be taken to ensure the weather is suitable, the aircraft is serviceable, with sufficient fuel for the intended flight, and that the student has been thoroughly briefed on the correct procedure to be followed for any probable event which may occur during the flight.

EXERCISE23

- (7) Prior to being authorized for a solo cross-country flight, students must have demonstrated that they can:
- By application of a systematic pilot navigation technique, make necessary heading corrections to maintain or regain track;
 - Fly a heading with reasonable accuracy;
 - Calculate reasonably accurate and useful time of arrival for the next check-point;
 - Make unscheduled detours from the planned route;
 - Record revised ground speeds, ETAs, new headings and times over check-points, in the Flight Log en route. A sample of the Navigation Flight Planning Form and Flight Log are shown on the following pages. The various columns are set up to enable step by step calculation of the compass heading required to set heading. The example shows a flight involving control zones, position checking, etc. The student shall be instructed to make sufficient in-flight entries to assist with position estimating, ground speed checks, ETAs etc. Many "standard" entries may be made in the Flight Log prior to departure, thereby only requiring pertinent times to be entered while in flight. The flight planning exercise must not be allowed to develop into a complex procedure. Show the student the basic facts necessary to prepare and fly a successful cross-country flight.
- (8) At every opportunity during the student's training, such as when proceeding to and from the training area, progressive introduction to setting heading, maintaining a heading, map reading, establishing tracks and determining ground speed, will make the demonstration and solo practice of this exercise more meaningful and enjoyable.

Instruction and Student Practice

- (1) Teach the student to:
- Establish the aircraft on the required heading over the "set heading point", check heading indicator, enter set heading time in flight log. Check visual angle of departure;
 - Determine ETA for first turning point or first destination.;
 - Appreciate the importance of maintaining an accurate heading;
 - After a suitable period of time and provided a suitable pin-point is located, determine the "track made good" using 10° drift lines;
 - Calculate the heading to regain or maintain required track.;
 - Calculate ground speed for confirmation or revision of ETA at next check-point;
 - Establish aircraft on required heading at turning points and — correction and revisions to ETA, and confirm sufficient fuel;

EXERCISE23

NAVIGATION FLIGHT PLANNING FORM

FROM - TO	ALT	IAS	TAS	TRACK (T)	WV	HDG (T)	DISTANCES/SPEEDS IN-			KT MPH	FUEL ROD	
							VAR	HDG (M)	G/S			DIS-TANCE
Grand Bend - Centralia	3500	105	110	090	210 20	099	7 W	106	119	9	5	
Centralia - Welland	3500	105	110	100	210 20	110	8 W	118	116	98	51	
									Reserve		56 30	
									@ 6 qph		1:26	8.6 gal.

(✓)

WEATHER FORECAST
20010 KT P6SM FEW 060
OVC 100
W/V 3T 210/20
6T 220/25

EN ROUTE RADIO FREQUENCIES
AND NAV AIDS

Centralia ATF 122.8
CYXU TWR 119.4 VOR 117.2
Brantford ATF 123.0
CYHM TWR 125.0

DESTINATION INFORMATION

Forecast cysn 21015 KT P6SM FEW 060
BKN 090
Runway (s) Welland 23 3500' 580 ASL

EN ROUTE STATION REPORTS

EXERCISE23

FLIGHT LOG

FROM - TO	DISTANCES/SPEEDS IN-					KT	(✓)
	IAS	ALT	WV	TRACK (T)	HDG (M)	MPH	DR TIME
Grand Bend - Centralia	105	3500	210 20	090	106	9	5
Centralia - Welland	105	3500	210 20	100	118	98	51

FLIGHT LOG

TIME	HDG (C)	OBSERVATIONS	Actual G/S	ETA
1000		Off Grand Bend		
1004	103	Set heading - Centralia		1009
1009	116	Centralia - set heading Welland		⁵¹ 1100
1020		Tower 3°R track error (22 1/2 NM/11 min)		
	110	Alter heading 6°L - 76 to go	122	³⁷ 1057
1031	113	On track - alter heading 3°R		
1035		Brantford - on track		
1039		YHM TWR 125.0 - for traffic info		
1044		By Caledonia (70NM/35min)	120	¹⁴ 1058
1104		Land - Welland		

EXERCISE23

- (h) Use opening and closing angles, visual alteration method, etc., in addition to the primary double track error method;
 - (i) Establish a heading and how to use physical features (roads, rivers, etc.) to proceed to a suitable alternate aerodrome within the range of fuel remaining including considerations for reserves at some point during the latter stage of the cross-country exercise;
 - (j) Mentally calculate a reciprocal track;
 - (k) Use radio aids to navigation, if practicable, in determining a heading to be flown to a facility or to provide a position line.
- (2) Demonstrate special considerations for navigation at low level or in conditions of reduced visibility with emphasis on the importance of maintaining a compass heading for the planned time en route.
- (3) Demonstrate procedure to follow if unsure of position or lost, including procedure to obtain Air Traffic Control assistance.
- (4) Close Flight Plan or Flight Itinerary, as applicable.

INSTRUMENT FLYING

FULL PANEL

Attitudes and Movements

Objective

To teach, using instrument reference:

- (1) The range of attitudes through which an aircraft will normally be operated.
- (2) How to produce and control the movements necessary to achieve and maintain the desired attitudes.
- (3) How yaw can be controlled.

Motivation

The ability to relate information gained from the instruments to outside references is the cornerstone upon which instrument flying skills are developed.

Essential Background Knowledge

Human Factors

- (1) Before commencing instrument flying instruction, review the effects of the following:
 - (a) Limitation of the senses — visual, vestibular, kinaesthetic.
 - (b) Disorientation — visual illusions, vestibular illusions.
 - (c) Fatigue — acute, chronic, effect on skill.
 - (e) Colds and sinus congestion.
 - (f) Stress, emotional upset.
 - (g) Incorrect dietary habits.
 - (h) Alcohol and the hangover.
 - (i) Medications — prescribed, over-the-counter, anaesthetics.
 - (j) Drugs.
 - (k) Hypoxia and hyperventilation.
 - (l) Carbon monoxide.
 - (m) Blood donations.
 - (n) Cockpit noise, lighting, vibration.
- (2) Explain that illusory sensations are to be expected during instrument flight and how to cope with them.

EXERCISE24

Terminology

- (1) Before commencing instrument flying instruction, review these terms:
 - (a) Pitot Head.
 - (b) Static Pressure .
 - (c) Dynamic Pressure.
 - (d) Position Error.
 - (e) Gyroscopic Precession.
 - (f) Gyroscopic Rigidity.
 - (g) Indicated Airspeed.
 - (h) True Airspeed.
 - (i) Calibrated Airspeed.
 - (j) True Altitude.
 - (k) Indicated Altitude.

- (1) Explain the function and basic mechanical operation of each flight instrument.
- (2) Emphasize the source of operation, limits, errors, and instrument serviceability checks.
- (3) Explain the concepts related to the control and performance instruments. Specifically, explain:
 - (a) The purpose of a scan.
 - (b) Selective radial scan technique.
 - (c) Scanning speed.
 - (d) Detection of instrument malfunctions.
 - (e) Common scanning faults.
- (4) Explain the instrument indications associated with the following attitudes:
 - (a) Cruise;
 - (b) Nose-up;
 - (c) Nose-down;
 - (d) Banked.
- (5) Explain the instrument indications associated with the following movements:
 - (a) Pitching;
 - (b) Rolling;
 - (c) Yawing.
- (6) Explain the following points:
 - (a) The control inputs required to produce a movement or to put the aircraft into a desired attitude are the same as those used in visual flight.

EXERCISE24

- (b) The pilot refers to the control instruments to establish attitude and power, and refers to the performance instruments to verify airspeed, vertical speed, or other desired performance.
- (c) Changes are initiated using the control instruments and the performance instruments are then used to verify airspeed, vertical speed, or other performance information.
- (d) Use smooth control pressures, making small corrections and waiting for the results.
- (e) The pilot must anticipate the need to change power and attitude to arrive at desired airspeeds and altitudes when accelerating, decelerating, climbing, descending, and levelling off.
- (f) Correct use of trim is essential to maintenance of control.

Advice to Instructors

- (1) Maintain a sharp lookout at all times. During flight, with the emphasis on instrument indications, you may be distracted from keeping a vigilant watch for traffic. Have the student ask "ALL CLEAR LEFT (OR RIGHT) ?", and wait for your confirmation before entering a turn. Reassure the student that you are watching for traffic.
- (2) Make every effort to explain all the principles of this lesson carefully. This first instrument training session covers the basics upon which future lessons are developed.
- (3) Give the first few lessons in calm air.
- (4) Present the entire air demonstration of attitudes and movements with the student not using a view-limiting device. Doing so will help the student to concentrate more on the content of the lesson. After the initial demonstration, the student may practise flying while referring only to the instruments.
- (5) While the student is flying with reference to the instruments, initially keep the lessons short. Then gradually lengthen them.
- (6) Emphasize that when in doubt about aircraft control, keep straight with the rudder and level the wings with the ailerons.
- (7) Relate instrument lessons to the equivalent visual lessons. For example, climbs, descents, and turns require the same control inputs whether the pilot is referring to visual or instrument indications.
- (8) Advise the student to view the attitude indicator as though he or she is situated on the tail, looking forward at the wings of the aircraft.
- (9) If the training fleet permits, demonstrate the differences between turn co-ordinators and turn and bank indicators.
- (10) Remember that it is permissible to train for the Private Pilot licence using an aeroplane equipped with partial panel. The student will be required to fly the flight test manoeuvres to the same standard as if the aeroplane were fitted with a full panel.

EXERCISE24

Instruction and Student Practice

Cruise Attitude

- (1) While maintaining outside reference:
 - (a) Establish straight and level flight.
 - (b) Have the student adjust the miniature aircraft on the attitude indicator for level flight at normal cruise.
 - (c) Demonstrate the similarity between the aircraft's attitude relative to the horizon and the display shown on the attitude indicator.
 - (d) Point out the constant indications shown on the performance instruments.

Pitch

- (1) While using outside reference, compare the visual indications of the pitching movement to the instrument indications.

Nose-up attitude

- (a) While the student is following the indications on the attitude indicator, place the aircraft in a nose-up attitude and point out the similarity between the natural horizon and the horizon line on the attitude indicator.
- (b) Compare the nose-up indication on the attitude indicator with the position of the aircraft's nose.
- (c) Point out the pitch scale on the attitude indicator.
- (d) Point out the indications on the performance instruments and compare them with the cruise attitude indications.
- (e) Demonstrate the relationship between the amount of nose-up pitch change and the change indicated by the airspeed indicator, vertical speed indicator and the altimeter.
- (f) Demonstrate the normal range of nose-up attitudes.
- (g) Point out the momentary lag in the vertical speed indicator. Demonstrate the relationship between the abruptness of the pitch change and the lag or reversal.
- (h) Return to the cruise attitude.

Nose-down attitude

- (a) While the student is following the indications on the attitude indicator, place the aircraft in a nose-down attitude and point out the similarity between the natural horizon and the horizon line on the attitude indicator.
- (b) Compare the nose-down indication on the attitude indicator with the position of the aircraft's nose.
- (c) Point out the pitch scale on the attitude indicator.
- (d) Point out the indications on the performance instruments and compare them with the cruise attitude indications.

EXERCISE24

- (e) Demonstrate the relationship between the amount of nose-down pitch change and the changes indicated by the airspeed indicator, vertical speed indicator, and altimeter.
 - (f) Demonstrate the normal range of nose-down attitudes.
 - (g) Point out the momentary lag in the vertical speed indicator. Demonstrate the relationship between the abruptness of the pitch change and the lag or reversal.
 - (h) Return to the cruise attitude.
- (2) Have the student practise by selecting nose-up and nose-down attitudes, as well as the cruise attitude, while referring to the instruments.

Roll

- (1) Compare the outside visual indications of the rolling movement to the instrument indications.

Banked attitude

- (a) Roll the aircraft to a banked attitude. Point out the similarity between the natural horizon and the horizon line on the attitude indicator.
 - (b) Show how the attitude indicator gives a direct indication of bank.
 - (c) Point out the bank scale on the attitude indicator.
 - (d) Demonstrate the range of bank attitudes for gentle and medium turns.
 - (e) Point out the turn indications on the heading indicator and turn co-ordinator or turn and bank indicator.
 - (f) Demonstrate the turn co-ordinator indications while the aircraft is rolling.
 - (g) Point out the relationship between the bank angle and the rate at which the heading changes. Explain how the heading indicator gives an indirect indication of bank.
 - (h) Show that the turn needle reacts to yaw. Point out turn needle indications when the aircraft is yawed with rudder while keeping wings level. Point out turn needle indications when the aircraft is banked and yaw is prevented with rudder.
 - (i) Point out that when the ball is centred, the bank angle and rate of turn are co-ordinated.
 - (j) Point out that when the ball is on one side of centre, it indicates that the corresponding wing is lower than required to produce a co-ordinated turn at that rate.
 - (k) Emphasize that the turn needle can be used as an indirect indication of bank, but only when the ball is in the centre.
- (2) Have the student practise by selecting various banked attitudes to the left and right while referring to the instruments.

EXERCISE24

Yaw

- (1) Compare the visual indications of the yawing movement to the instrument indications.
- (2) Point out that the turn co-ordinator or turn and bank indicator gives a direct indication of yaw.
- (3) Point out that when yaw is desired in order to turn it is produced by selecting the appropriate angle of bank.
- (4) Demonstrate the control of adverse yaw by controlling the movement of the turn needle with rudder. For the purpose of this publication, **adverse yaw** is defined as *any yaw, regardless of origin, having an effect contrary to the interests of the pilot.*
- (5) Using reference to instruments, have the student practise controlling yaw while changing power, while turning, and during climbs and descents.

EXERCISE24

Straight And Level Flight

Objective

To teach, using instrument reference:

- (1) Straight flight;
- (2) Level flight;
- (3) Straight and level flight at various airspeeds.

Motivation

The skills learned in straight and level flight are fundamental to most aspects of instrument flying.

Essential Background Knowledge

Straight Flight

- (1) Review:
 - (a) The wings level indication on the attitude indicator;
 - (b) The yaw indication on the turn co-ordinator or turn and bank indicator;
 - (c) Anticipating yaw, e.g. slipstream effect, asymmetric thrust, aileron drag;
 - (d) The errors related to the magnetic compass and the technique used to accurately read the compass;
 - (e) The correct scan technique for straight flight by:
 - (i) Establishing the wings-level attitude while referring to the attitude indicator;
 - (ii) Referring often to the heading indicator to confirm that the desired heading is being maintained;
 - (iii) Referring occasionally to the turn co-ordinator (or turn and bank indicator) for confirmation that the wings are level, and no yaw is occurring.

Level Flight

- (1) Review:
 - (a) The procedure for setting the attitude indicator for level flight;
 - (b) The importance of detecting small pitch changes on the attitude indicator;
 - (c) How to determine pitch attitude when the wings are not level;
 - (d) The importance of properly trimming the aircraft;
 - (e) The correct scan technique for level flight by:
 - (i) Establishing the cruise attitude while referring to the attitude indicator;

EXERCISE24

- (ii) Referring often to the altimeter to confirm that the assigned altitude is being maintained;
 - (iii) Referring occasionally to the vertical speed indicator to detect any trend toward climbing or descending.
- (f) How to cross-check between the altimeter and the airspeed indicator to identify the need to change pitch or power.

Straight and Level Flight at Various Airspeeds

- (1) Review the following points:
- (a) Altitude can be controlled by pitching the nose up or down;
 - (b) Airspeed can be controlled with power;
 - (c) Both attitude and power must be changed to change airspeed in level flight;
 - (d) Review the correct scan technique for straight and level flight. Explain how to combine the scan techniques for straight flight and level flight. The full selective radial scan should now be used:
 - (i) Using the attitude indicator and tachometer, establish the aircraft in straight and level flight at a desired airspeed;
 - (ii) Refer often to the heading indicator, altimeter and airspeed indicator to confirm that the aircraft is flying straight and level at the desired airspeed;
 - (iii) Use the performance instruments to detect any error in heading, altitude or speed;
 - (iv) Occasionally scan the magnetic compass, tachometer, and engine instruments.
- (2) Explain the control inputs required while accelerating and decelerating.

Advice To Instructors

- (1) SUGGESTED RULES OF THUMB:
- (a) 100 RPM (or one inch of manifold pressure) changes airspeed by about 5 knots.
 - (b) While making small heading corrections, the angle of bank used should not exceed the number of degrees to be turned.
- (2) Allow enough time for a thorough demonstration and student practice in straight and level flight. It is important to master this exercise because the skills learned will be applied to most other aspects of instrument flight.
- (3) Refer to Part Two of the Instrument Procedures Manual (TP 2076E) for information on the magnetic compass.
- (4) When you are teaching straight and level flight while changing airspeeds, it will be helpful to have the student define, first, what information is needed to maintain a constant altitude and, second, how the selective radial scan should be changed to get that information. For example, before accelerating to a high airspeed, determine the power changes required.

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- (5) As power is changed in level flight, a pitch change may occur. Therefore, the student must refer often to the altimeter and attitude indicator to maintain the desired altitude. Then, as the new airspeed is approached, airspeed information becomes increasingly important. At this time, the pilot should make frequent reference to the airspeed indicator until the desired airspeed is established, the power is correctly set, and the aircraft is re-trimmed.

Instruction and Student Practice

- (1) Straight Flight:
- (a) Using outside reference, establish the aircraft in straight and level flight at normal cruise airspeed;
 - (b) Briefly review the scanning technique, then have the student fly straight while referring only to the instruments;
 - (c) Emphasize that the student must keep the wings level and maintain co-ordinated flight while using the rudder to keep straight;
 - (d) Introduce the magnetic compass. Briefly demonstrate:
 - (i) errors related to acceleration, deceleration, turning;
 - (ii) the technique for setting the heading indicator from the magnetic compass while flying in smooth air and rough air;
 - (iii) if the aircraft deviates from the heading, have the student make corrections as necessary to return to the assigned heading.
- (2) Straight and Level Flight:
- (a) Using outside reference, establish the aircraft in straight and level flight at normal cruise airspeed;
 - (b) When the aircraft is stable, have the student adjust the attitude indicator;
 - (c) Assign a heading to be maintained;
 - (d) Review the scanning technique for level flight, then have the student maintain altitude by adjusting the attitude as required, while referring only to the instruments;
 - (e) Demonstrate the use of small changes in pitch attitude for small altitude corrections;
 - (f) Emphasize the importance of trimming the aircraft properly.

Straight and Level Flight at Various Airspeeds

- (1) While the student is using instrument reference, demonstrate how to increase airspeed using the following steps:
- (a) Increase the power to that required for the new airspeed;
 - (b) Control yaw to maintain heading;
 - (c) Adjust the pitch attitude as required to maintain altitude;
 - (d) Adjust trim as required.

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- (2) Demonstrate how to decrease airspeed as follows:
 - (a) Reduce the power to that required for the new airspeed;
 - (b) Control yaw to maintain heading;
 - (c) Adjust the pitch attitude as required to maintain altitude;
 - (d) Adjust trim as required.

- (3) Have the student practise flying straight and level at various airspeeds.

EXERCISE24

Climbing

Objective

To teach, using instrument reference, how to:

- (1) Enter and maintain climbs at specified airspeeds;
- (2) Enter and maintain climbs at specified rates;
- (3) Level off from the climb.

Motivation

The ability to climb at a particular airspeed and a given rate of climb is essential to obtain the best climb performance from the aircraft.

Essential Background Knowledge

- (1) Review:
 - (a) Control of yaw and the effects of asymmetric thrust and slipstream, questioning the student on the anticipated rudder requirement;
 - (b) The climb entry — Attitude, Power, Trim;
 - (c) Levelling off — Attitude, Power, Trim.
- (2) Explain:
 - (a) The nose-up pitch indication for the best rate of climb speed;
 - (b) The correct scanning technique for entering and maintaining the climb using a specific airspeed;
 - (c) The correct scanning technique for climbing at a specific rate;
 - (d) The use of small control inputs to make small corrections to the airspeed and rate of climb;
 - (e) The correct scanning technique for levelling off from the climb;
 - (f) How to estimate the amount of lead for levelling off, based upon the rate of climb.
- (3) Insist that the student continually answer the crucial questions:
 - (a) What Information Do I Need?**
 - (b) Which Instruments Give Me the Needed Information?**
 - (c) Is the Information Reliable?**

Advice to Instructors

- (1) SUGGESTED RULES OF THUMB:
 - (a) One degree of pitch changes airspeed by about 5 knots and the rate of climb by about 100 feet per minute;

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- (b) A change of 100 RPM, or one inch of manifold pressure, changes airspeed by about 5 knots or the rate of climb by about 100 feet per minute;
 - (c) When levelling off from a climb, lead with 10 percent of the vertical speed, e.g., if the rate of climb is 500 feet per minute, begin levelling off 50 feet before reaching desired altitude.
- (2) When climbing at a given airspeed, use small attitude changes to achieve small corrections in airspeed.

Instruction and Student Practice

Constant Airspeed Climbs

- (1) Demonstrate the following while the student is using instrument reference:
- (a) Pitch the nose up to the approximate attitude for the climb;
 - (b) Advance the power to the climb power setting;
 - (c) Cross check the airspeed indicator with the attitude indicator to determine the need for adjusting pitch;
 - (d) adjust the attitude as required while referring to the attitude indicator, then cross check with the airspeed indicator to confirm the correct climb speed has been attained;
 - (e) Trim as required;
 - (f) Emphasize the need to monitor heading throughout the manoeuvre.
- (2) Have the student practice straight climbs at a constant airspeed.

Levelling Off

- (1) Demonstrate the following while the student is using instrument reference:
- (a) Use the attitude indicator to adjust to the cruise attitude;
 - (b) Frequently cross check the altimeter and heading indicator to make sure that the desired altitude and heading are maintained;
 - (c) Set cruise power when the aircraft has reached cruise speed;
 - (d) Trim as required;
 - (e) Point out the need to closely monitor the airspeed as the aircraft accelerates.
- (2) Have the student practise constant airspeed climbs and levelling off.

Constant Rate Climbs at a Specified Airspeed

- (1) Demonstrate the following while the student is using instrument reference:
- (a) Estimate the attitude and power setting required to climb at a predetermined rate and airspeed;
 - (b) Enter the climb by adjusting the attitude and power;

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- (c) Cross check the airspeed indicator with the attitude indicator to determine the need for adjusting pitch;
 - (d) Cross check the vertical speed indicator with the attitude indicator to determine the need for adjusting power;
 - (e) Adjust the attitude and power as required;
 - (f) Trim as required.
- (2) Have the student practise constant rate climbs and levelling off.

EXERCISE24

Descending

Objective

To teach, using instrument reference, how to:

- (1) Enter and maintain descents at specified airspeeds;
- (2) Enter and maintain descents at specified rates;
- (3) Level off from the descent.

Motivation

The ability to descend at a specific airspeed and rate of descent is essential to operating the aircraft safely and efficiently. An instrument approach is usually carried out at a particular airspeed and rate of descent.

Essential Background Knowledge

- (1) Review:
 - (a) Applicable cockpit checks;
 - (b) The descent entry — Power, Attitude, Trim;
 - (c) Control of yaw;
 - (d) Levelling off — Power, Attitude, Trim .
- (2) Explain:
 - (a) The pitch attitude indications for normal descents;
 - (b) The correct scanning technique for descending at a given airspeed;
 - (c) The correct scanning technique for descending at a given rate;
 - (d) The use of suggested rules of thumb to estimate the power setting and pitch attitude for descents at predetermined rates and airspeeds;
 - (e) The use of small control inputs to make small corrections to the airspeed and rate of descent;
 - (f) How to estimate the amount of lead for levelling off, based upon the rate of descent.

Advice To Instructors

- (1) SUGGESTED RULES OF THUMB:
 - (a) One degree of pitch changes airspeed by about 5 knots and the rate of descent by about 100 feet per minute.
 - (b) A change of 100 RPM, or one inch of manifold pressure, changes airspeed by about 5 knots or the rate of descent by about 100 feet per minute.

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- (c) When levelling off from a descent, lead with 10 percent of the vertical speed e.g., if the rate of descent is 500 feet per minute, begin levelling off 50 feet before reaching the desired altitude.

Instruction and Student Practice

Constant Airspeed Descents

- (1) Demonstrate the following while the student is using instrument reference:
 - (a) Complete the applicable cockpit checks;
 - (b) Enter a descent from normal cruise by reducing power to the desired power setting;
 - (c) Maintain the cruise attitude until the airspeed approaches the desired airspeed;
 - (d) Adjust the pitch attitude to maintain the desired airspeed;
 - (e) Trim as required.

Levelling Off

- (1) Demonstrate the following while the student is using instrument reference:
 - (a) Estimate the amount of lead for levelling off;
 - (b) Establish the cruise attitude and set cruise power;
 - (c) Frequently cross check the attitude indicator with the altimeter and heading indicator to make sure that the desired altitude and heading are maintained;
 - (d) Trim as required;
 - (e) Point out the need to closely monitor the airspeed as the aircraft accelerates.
- (2) Have the student practise constant airspeed descents and levelling off.

Constant Rate Descents at a Specified Airspeed

- (1) Demonstrate the following while the student is using instrument reference:
 - (a) Complete the applicable cockpit checks;
 - (b) Estimate the attitude and power setting required to descend at a predetermined rate and airspeed;
 - (c) Enter a descent from normal cruise by reducing power to the desired power setting;
 - (d) Maintain the cruise attitude until the airspeed approaches the desired airspeed;
 - (e) Adjust the pitch attitude to maintain the desired airspeed;
 - (f) Adjust the power to maintain the desired rate of descent;
 - (g) Trim as required;
 - (h) Frequently cross check the attitude indicator with the airspeed indicator and vertical speed indicator to make sure that the aircraft is descending at the desired airspeed and rate of descent.
- (2) Have the student practise constant rate descents and levelling off.

EXERCISE24

TURNS

Objective

To teach, using instrument reference:

- (1) Gentle and medium turns;
- (2) Rate one turns;
- (3) Turns to selected headings;
- (4) Climbing and descending turns;
- (5) Steep turns.

Motivation

The pilot must know how to change the direction of flight using controlled rates of turn while flying on instruments. This skill is necessary to navigate to a destination.

Essential Background Knowledge

- (1) Explain:
 - (a) That whether the student is flying on instruments or using outside reference, control inputs, turn entry and recovery procedures and use of power are the same;
 - (b) How to control adverse yaw resulting from aileron drag;
 - (c) That bank angle is read from the bank scale on the attitude indicator;
 - (d) That in a turn, pitch information displayed on the attitude indicator is shown by the dot that represents the nose of the aircraft;
 - (e) How to estimate the correct lead for recovery from a turn to a specified heading;
 - (f) The rate one turn and its relationship to airspeed and angle of bank;
 - (g) That the student has to anticipate the need to apply back pressure on the control column as the aircraft is rolled into the banked attitude;
 - (h) That after the student has established the angle of bank for the desired rate of turn, fluctuations of the turn needle must be controlled with rudder while using aileron to correct bank.
- (2) Explain the correct scan technique for turning.
 - (a) Entering the Turn:
 - (i) refer to the attitude indicator while rolling to the desired angle of bank;
 - (ii) scan the turn needle to ensure that the correct rate of turn is achieved;
 - (iii) correct bank as necessary.
 - (b) Maintaining the Turn:

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- (i) cross check the attitude indicator with the altimeter and the heading indicator, with occasional reference to the turn needle;
 - (ii) scan the attitude indicator and the turn needle to maintain a given rate of turn;
 - (iii) scan the heading indicator frequently enough to know when to begin recovering from the turn.
- (c) Recovering from the turn:
- (i) as the turn progresses to the desired recovery heading, scan the heading indicator frequently;
 - (ii) applying the correct lead, refer to the attitude indicator while rolling the wings level.

Advice to Instructors

- (1) SUGGESTED RULES OF THUMB:
- (a) To roll out of a turn on a selected heading, lead the heading by half the angle of bank, e.g., if using a 30 degree bank, being the roll-out 15 degrees before reaching the desired heading.
 - (b) Use small angles of bank to make small heading changes. Usually a bank angle equal to half the number of degrees of heading change will suffice.
 - (c) The approximate angle of bank to produce a rate one turn may be calculated by using the following formula: $(\text{KIAS divided by } 10) + 7 = \text{bank angle}$. Add 5 instead of 7 for statute miles per hour.
- (2) Have the student ask "**ALL CLEAR LEFT (OR RIGHT) ?**" and wait for a response before entering the turn.
- (3) Stress smoothness and co-ordination when rolling into and out of turns. Emphasize that it is desirable to use a slower rate of roll than when flying with outside reference.
- (4) Introduce steep turns only after the student is proficient in doing medium turns.
- (5) Common errors that students make during steep turns are as follows:
- (a) Rolling in too quickly, producing a spiral dive;
 - (b) Adding power too late on entry, causing a loss of airspeed;
 - (c) Failure to maintain the correct pitch altitude control while entering, maintaining, and recovering from the turn, causing altitude or airspeed errors;
 - (d) Failure to reset the power as required on recovery, causing the aircraft to climb or increase airspeed after the wings have been levelled.

Instruction and Student Practice

Gentle and Medium Level Turns

- (1) Review scan techniques for entering, maintaining, and recovering from the turn.
- (2) Demonstrate the following while the student is using instrument reference:
- (a) Initiate a gentle or medium turn;
 - (b) Maintain the turn with bank and control adverse yaw with rudder;

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- (c) Point out the instrument indications;
- (d) Show the pitch attitude required for entering, maintaining, and recovering from the turn;
- (e) Show the relationship between angle of bank and the rate of turn;
- (f) Recover to straight flight using the correct lead heading to begin the roll-out;
- (g) Have the student practise gentle and medium turns.

Rate One Turns

- (1) Review scan techniques for entering, maintaining, and recovering from the turn.
- (2) Demonstrate the following while the student is using instrument reference:
 - (a) Apply the rule of thumb to calculate the approximate angle of bank for the rate one turn;
 - (b) Initiate a standard rate turn;
 - (c) After reaching the calculated angle of bank, refer to the turn co-ordinator (or turn and bank indicator) for confirmation of correct rate;
 - (d) Maintain the turn with bank and control adverse yaw with rudder;
 - (e) Recover to straight flight using the correct lead.
- (3) Have the student practise rate one turns.

Turns to Selected Headings

- (1) Review scan techniques for entering, maintaining, and recovering from the turn.
- (2) Demonstrate the following while the student is using instrument reference:
 - (a) Initiate the turn;
 - (b) Maintain the turn with bank and control adverse yaw with rudder;
 - (c) As the desired heading is approached, frequently scan the heading indicator;
 - (d) Recover to straight flight using the correct lead.
- (3) Have the student practise turning to specified headings.

Climbing and Descending Turns

- (1) Review scan techniques for entering the turn, maintaining the turn, and recovering from the turn.
- (2) Demonstrate gentle and medium banked climbing turns while the student is using instrument reference:
 - (a) Initiate the turn;
 - (b) Show the pitch attitude required for entering, maintaining, and recovering from the turn;

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- (c) Maintain the turn with bank and control adverse yaw with rudder;
 - (d) Recover from the turn while maintaining the climb or descent.
- (3) Have the student practise climbing and descending turns.

Steep Turns

- (1) Review scan techniques for entering, maintaining, and recovering from the turn.
- (2) Demonstrate the following while the student is using instrument reference:
- (a) Initiate the steep turn using 45 degrees of bank;
 - (b) Point out variations in pitch and bank indication on the attitude indicator while entering and maintaining the turn, and during roll-out;
 - (c) Maintain the turn with bank and control adverse yaw with rudder
 - (d) Show the attitude and power changes required during entry and roll-out.
- (3) Using instrument reference, have the student practise entering, maintaining, and recovering from 45 degrees banked turns.

EXERCISE24

PARTIAL PANEL

Basic Aircraft Control

Objective

To teach, using partial panel:

- (1) Straight and level flight;
- (2) Climbing;
- (3) Descending;
- (4) Standard rate turns;
- (5) Climbing and descending turns;
- (6) Timed turns.

Motivation

- (1) If a gyroscopic instrument is toppled or becomes unserviceable the pilot must be able to continue the flight using partial panel.
- (2) If one of the power sources for the gyroscopic instruments fails, the pilot will have to continue the flight using partial panel.

Essential Background Knowledge

- (1) Review the basic principles of operation and the correct use of the turn co-ordinator and turn and bank indicator.
- (2) Emphasize the need to resist over controlling.
- (3) Review the lag associated with the vertical speed indicator.
- (4) Explain that time must be allowed for the aircraft to accelerate or decelerate when the attitude or power is changed.
- (5) Explain the scan technique as well as the entry and recovery procedures for the following:
 - (a) Straight and level flight;
 - (b) Climbing;
 - (c) Descending;
 - (d) Standard rate turns.
- (6) Explain that, although the common standard rate turn is a turn at three degrees per second, a slower rate may be used for small heading corrections. Explain that the turn is produced by banking and that any adverse (unwanted) yaw is controlled with rudder.

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- (7) Explain that, to fly an accurate heading or rate of turn in rough air, use the rudder to average the position of the turn needle.
- (8) Explain a procedure for carrying out timed turns:
 - (a) Begin timing;
 - (b) Roll into the turn;
 - (c) Stop timing when appropriate;
 - (d) Roll the wings level using the same control pressures as for entering the turn.
- (9) Review the principles of the magnetic compass outlined in Part Two of the Instrument Procedures Manual (TP 2076E).

Advice to Instructors

- (1) As an error begins to occur, the amount and rate of change will help determine the amount and rate of corrective control input required.
- (2) Ensure the student thoroughly understands the operation and limitations of the turn and bank indicator and the turn co-ordinator.
- (3) Ensure correct control co-ordination, especially while entering and recovering from turns.
- (4) While practising timed turns, initially assign simple heading changes in multiples of 30 degrees.
- (5) If the student is having trouble relating the instrument indications to what is happening to the aircraft, demonstrate the exercise with the student using outside reference. Then repeat it with the student referring to the instruments.
- (6) Common errors in timed turns are:
 - (a) Being too slow in calculating the time needed to turn with the result that the heading wanders while the student is thinking;
 - (b) Not holding a precise rate one turn;
 - (c) Forgetting the starting heading or time;
 - (d) Not keeping the wings level after roll-out;
 - (e) Not allowing the compass to settle down before assessing the accuracy of the turn.
- (7) The student who trains on partial panel only shall, for a private pilot flight test, be able to control and manoeuvre the aeroplane within the full panel tolerances, that is:
 - (a) $\pm 15^\circ$ of the assigned heading;
 - (b) ± 200 feet of the assigned altitude;

 - (c) ± 15 knots of the assigned airspeed;

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- (d) an angle of bank not to exceed 30°.

Instruction and Student Practice

Straight and Level Flight

- (1) Demonstrate the following while the student is using instrument reference:
 - (a) Establish straight and level flight;
 - (b) Keep the wings level (ball centred) with ailerons;
 - (c) Keep straight (turn needle centred) with rudder;
 - (d) Refer to the magnetic compass to confirm that the aircraft is maintaining the required heading.
- (2) Demonstrate how to correct for heading deviations.
- (3) Demonstrate the control inputs and scan technique required to maintain level flight.
- (4) Demonstrate how to correct for altitude deviations.
- (5) Demonstrate and have the student practise straight and level flight at various airspeeds.

Climbing

- (1) Demonstrate a constant airspeed climb as follows while the student is using instrument reference:
 - (a) Gently raise the nose until the airspeed begins to decrease;
 - (b) Apply climb power and keep straight with rudder;
 - (c) Trim as required;
 - (d) Frequently scan the airspeed indicator to confirm that the pitch attitude is correct;
 - (e) Use small pitch adjustments for small airspeed corrections;
 - (f) Frequently scan the turn co-ordinator to check for straight flight and wings level;
 - (g) Refer to the magnetic compass to confirm that the correct heading is being maintained;
 - (h) Refer occasionally to the altimeter and vertical speed indicator to verify climb performance.
- (2) Demonstrate the technique used to level off from a climb:
 - (a) When approaching the desired altitude, frequently scan the altimeter;
 - (b) Using the correct lead, progressively adjust pitch sufficiently to stop the altimeter at the desired altitude;

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- (c) Closely monitor the altimeter and vertical speed indicator for pitch information while accelerating to cruise speed;
 - (d) Monitor the airspeed indicator and set cruise power when the aircraft has accelerated to cruise speed;
 - (e) Trim as required;
 - (f) Refer to the magnetic compass to confirm that the correct heading is being maintained.
- (3) Have the student practise climbing at a constant airspeed and levelling off.
- (4) Demonstrate the technique for entering and maintaining a constant rate climb at a given airspeed:
- (a) While in cruising flight, estimate the power setting required to climb at a predetermined rate and airspeed;
 - (b) Adjust the attitude and power. Allow the aircraft to decelerate to the desired climbing airspeed;
 - (c) Trim as required;
 - (d) Frequently scan the airspeed indicator and adjust the attitude as necessary to maintain the specified climb speed;
 - (e) Frequently scan the vertical speed indicator and adjust the power as necessary to maintain the specified rate of climb;
 - (f) Return to level flight as above.
- (5) Have the student practise climbing and levelling off.

Descending

- (1) Demonstrate the constant airspeed descent as follows while the student is using instrument reference:
- (a) Set the descending power setting and keep straight with rudder;
 - (b) When the airspeed decreases as desired, lower the nose for the descent;
 - (c) Trim as required;
 - (d) Frequently scan the airspeed indicator to determine if the pitch attitude is correct;
 - (e) Use small pitch adjustments for small airspeed corrections;
 - (f) Frequently scan the turn co-ordinator to verify that the aircraft is flying straight;
 - (g) Refer to the magnetic compass to confirm that the correct heading is being maintained;
 - (h) Refer occasionally to the altimeter and vertical speed indicator to confirm descent performance.
- (2) Demonstrate how to level off from a descent as follows:
- (a) When approaching the desired altitude, frequently scan the altimeter;

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- (b) Using the correct lead, apply cruise power and adjust the pitch enough to stop the altimeter at the desired altitude;
 - (c) Closely monitor the altimeter and vertical speed indicator to verify that you are maintaining the desired altitude;
 - (d) Trim as required;
 - (e) Refer to the magnetic compass to confirm that you are maintaining the correct heading.
- (3) Have the student practise descending at a constant airspeed and levelling off.
- (4) Demonstrate the constant rate descent as follows while the student is using instrument reference:
- (a) Estimate the power setting for descending at a given rate;
 - (b) Set the descending power setting and keep straight with rudder;
 - (c) When the airspeed decreases as desired, lower the nose for the descent;
 - (d) Trim as required;
 - (e) Frequently scan the airspeed indicator to determine if the pitch attitude is correct;
 - (f) Use small pitch adjustments for small airspeed corrections;
 - (g) Frequently scan the vertical speed indicator to determine if the power setting is correct;
 - (h) Use small power adjustments for small corrections to the rate of descent;
 - (i) Frequently scan the turn co-ordinator to verify that the aircraft is flying straight;
 - (j) Refer to the magnetic compass to confirm that the correct heading is being maintained;
 - (k) Level off at the desired altitude.
- (5) Have the student practise descending at a constant rate and levelling off.

Standard Rate Turns

- (1) Demonstrate how the turn needle gives a direct indication of change of heading, and an indirect indication of bank.
- (2) Demonstrate the rate one turn as follows while the student is using instrument reference:
- (a) Ensure that the aircraft is correctly trimmed for level flight;
 - (b) Using co-ordinated aileron and rudder, roll the aircraft in the desired direction until the turn needle indicates a rate one turn;
 - (c) Maintain the required angle of bank with ailerons;
 - (d) Keep the turn needle on the rate one indicator by preventing adverse yaw with rudder;
 - (e) Use the ailerons to maintain the ball in the centre;
 - (f) Use co-ordinated aileron and rudder to recover;

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- (g) Refer to the magnetic compass to confirm that the aircraft is maintaining the desired heading.
- (3) Have the student practise rate one turns. Have the student practise other rates of turn, e.g., the rate one-half turn.

Climbing and Descending Turns

- (1) Demonstrate climbing and descending turns as follows while the student is using instrument reference:
- (a) Establish a climb using partial panel;
 - (b) Ensure that the aircraft is correctly trimmed;
 - (c) Demonstrate the rate one turn while climbing;
 - (d) Return to straight flight;
 - (e) Have the student practise climbing turns;
 - (f) Establish a descent using partial panel;
 - (g) Ensure that the aircraft is correctly trimmed;
 - (h) Demonstrate the rate one turn while descending;
 - (i) Return to straight flight;
 - (j) Have the student practise descending turns.

Timed turns

- (1) Demonstrate timed turns as follows while the student is using instrument reference:
- (a) Have the student calculate the number of seconds to turn through 180 degrees;
 - (b) Start timing when control pressure is applied to roll into the turn;
 - (c) Emphasize using the correct scanning technique;
 - (d) Stop the turn by applying control pressure when the calculated time has elapsed;
 - (e) Refer to the magnetic compass to determine if the aircraft is on the correct heading;
 - (f) Make heading corrections if necessary. Use rate one-half turns for small corrections.
- (2) After turning through 180 degrees, have the student repeat the same process while turning through 90 degrees and 30 degrees.
- (3) Have the student practise timed turns in both directions. Practice turns should be made through heading changes of 180 degrees, 90 degrees and 30 degrees. Then assign turns using more difficult calculations.
- (4) After returning to straight flight, have the student maintain straight flight at a constant airspeed before reading the compass. Then confirm the heading by flying straight and taking a second reading of the compass.

EXERCISE24

USING THE MAGNETIC COMPASS

Objective

- (1) To teach:
 - (a) The errors associated with the magnetic compass;
 - (b) How to obtain accurate information from the magnetic compass in spite of those errors.

Motivation

- (1) The pilot must be able to interpret the magnetic compass to set the heading indicator.
- (2) If the heading indicator becomes unreliable, the pilot must be able to fly an accurate heading using the magnetic compass.

Essential Background Knowledge

- (1) Explain Northerly and Southerly Turning Error.
- (2) Explain that steep turns should be avoided since the magnitude of error varies with angle of bank.
- (3) Explain that the magnitude of error is greatest on north and south headings becoming progressively smaller toward east and west headings.
- (4) Explain that the compass error depends on the latitude of the aircraft.
- (5) Explain the compass error caused by acceleration and deceleration.
- (6) Explain that the magnitude of the error depends on the rate of acceleration or deceleration.
- (7) Explain that to read the compass accurately on easterly and westerly headings, the airspeed must be constant.
- (8) Explain that to obtain reliable heading information in turbulence it may be necessary to average several compass readings.

Advice To Instructors

- (1) Initial demonstrations of this exercise are best in calm air.
- (2) When demonstrating turning error set the heading indicator and compare it with the magnetic compass during the turns.

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Instruction and Student Practice

Northerly Turning Error

(1)

- (a) Fly a north heading long enough for the compass to settle down (wings must be level).
- (b) Turn toward the west. The compass immediately indicates a turn in the opposite direction, i.e., toward the east. Return to the north heading.
- (c) Enter a turn toward the east. The compass indicates a turn toward the west. Return to the north heading.
- (d) Enter a very shallow banked turn toward the west. The compass indicates momentarily that a straight course is being maintained. Repeat the demonstration in a shallow turn toward the east.
- (e) Enter a steep turn. The compass may swing completely around in the opposite direction.

Southerly Turn Error

(1)

- (a) Fly a south heading and keep the wings level to let the compass settle down.
- (b) Turn toward the west. The compass indicates a much faster turn in the same direction. Return to the south heading.
- (c) Turn toward the east. The compass indicates a much faster turn in the same direction.
- (d) Repeat the demonstrations of turning error on an east or west heading pointing out that Northerly and Southerly turning errors are not present on east or west headings.

Acceleration and Deceleration Error

(1)

- (a) Fly an east heading.
- (b) Reduce power to reduce airspeed in level flight to show deceleration error indicating a turn toward south.
- (c) Add power to increase airspeed in level flight to show acceleration error indicating a turn toward north.
- (d) Raise the nose at constant power pointing out deceleration error.
- (e) Lower the nose at constant power pointing out acceleration error.
- (f) Repeat the preceding demonstration on a west heading.
- (g) Repeat the preceding demonstrations on a north or south heading to point out that acceleration and deceleration errors are not present on north or south headings.
- (h) Stabilise the aircraft in a constant rate climb at a constant heading and airspeed.

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- (l) Point out that the accuracy of the compass is not affected by climbing at a constant airspeed.
 - (j) Repeat the demonstration in a stable descent.
- (2) Have the student practise reading the magnetic compass:
- (a) Establish the aircraft in straight unaccelerated flight;
 - (b) Read the compass heading;
 - (c) Continue flying straight at a constant airspeed;
 - (d) Read the compass heading again and compare the two readings to confirm that the information is reliable.
- (3) Have the student make turns to magnetic compass headings without the heading indicator by applying estimated compensations for the compass errors noted.

EXERCISE24

UNUSUAL ATTITUDES

Objective

To teach, using instrument reference, how to:

- (1) Recognize unusual attitudes;
- (2) Act promptly and correctly for recovery.

Motivation

Unusual attitudes can lead to dangerous situations from which prompt and correct recovery action is necessary.

Essential Background Knowledge

- (1) Define unusual flight attitudes. Explain that the pilot must assume that an unusual attitude exists if the instrument indications are abnormal in any way.
- (2) Explain that misuse of controls, incorrect scan technique, turbulence, incorrect trim, or inattention may cause the aircraft to fly outside the normal range of flight attitudes.
- (3) Explain that relying on the indications of an unserviceable instrument can lead to an unusual attitude.
- (4) Explain the limitations of the gyroscopic instruments and point out how these limitations may be exceeded during unusual attitudes.
- (5) Explain how the failure or unreliability of the gyroscopic instruments may require the pilot to use partial panel while recovering from an unusual attitude.
- (6) Emphasize the need for the pilot to trust the instrument indications rather than physical sensations.
- (7) Explain the importance of observing the trend of the airspeed indicator and altimeter to determine if the nose is high or low.
- (8) Explain the need to check the turn needle to determine if the aircraft is turning.
- (9) Point out that when the pitch attitude is approximately level the airspeed needle will stop its movement and begin to reverse its movement. The altimeter needle will stop its movement and the vertical speed indicator will reverse its trend at approximately the same time, however the latter two indications are less reliable than the airspeed indicator.
- (10) Explain that, during recovery, the wings will be approximately level when the turn needle is centred.

EXERCISE24

- (11) Explain the need to ensure that the attitude indicator is reliable before using it for attitude reference.
- (12) Ensure that the student knows the following recovery procedures:
 - (a) Nose Low:
 - (i) reduce power to prevent excessive airspeed and loss of altitude;
 - (ii) level the wings by applying co-ordinated aileron and rudder pressures to centre the needle and ball;
 - (iii) apply elevator pressure to correct the pitch attitude to level flight.
 - (b) Nose High:
 - (i) apply power;
 - (ii) apply forward elevator pressure to lower the nose to prevent a stall;
 - (iii) correct the bank by applying co-ordinated aileron and rudder pressure to centre the turn needle and ball.
- (13) Point out that it may be necessary to descend or climb to a safe altitude after the aircraft is again under control.
- (14) Explain that in a spin the turn needle gives a reliable indication of the spin direction but the ball gives no reliable direction information.
- (15) Explain how to recognize and recover from:
 - (a) Nose-high attitudes;
 - (b) Nose-high attitudes while banked;
 - (c) Nose-low attitudes;
 - (d) Nose-low attitudes while banked .
- (16) Apply the above procedures to recognize and recover from:
 - (a) Stalls;
 - (b) Spins;
 - (c) Spiral dives.

Advice To Instructors

- (1) When spins are demonstrated or practised, the instructor must ensure that the aircraft is appropriately certificated and that all published limitations and restrictions are adhered to.
- (2) Because gyroscopic instruments may become inoperative or misleading under extreme conditions, emphasize the need to cross check the instruments to verify the information from the gyroscopic instruments.

EXERCISE24

- (3) Demonstrate how to recover from each unusual attitude visually before having the student use a view-limiting device.
- (4) Begin by having the student recover from small errors in pitch and bank. After the basic techniques are mastered, increase the extent of the unusual attitudes.
- (5) Watch for signs of airsickness. Students often get airsick more easily when using view-limiting devices.
- (6) Recover from spiral dives early enough to avoid high airspeeds. Using a low entry speed will allow the student more time for recognition and recovery and it will allow you more time to determine that your intervention is needed.
- (7) Point out that recovering from stalls, spins, and spiral dives uses the same control inputs under instrument conditions as in visual flight. Have the student practise recovering from the same type of unusual attitude several times before you introduce a new one.
- (8) While the student is practising, watch for the possibility of overstressing the aircraft.
- (9) While the student is practising unusual attitude recoveries using full panel, confirm the serviceability of the attitude indicator and heading indicator before relying upon these instruments.

Instruction and Student Practice

- (1) Demonstrate how to recover using the procedures outlined in *Essential Background Knowledge*.
- (2) Have the student recover, using instrument reference, from unusual attitudes using full panel. Repeat the exercise using partial panel.

EXERCISE24

RADIO AIDS TO NAVIGATION

Objective

To teach, using outside reference:

- (1) How to use VOR, ADF and GPS equipment to determine the position of the aircraft;
- (2) Basic orientation and tracking using VOR, ADF and GPS.

Motivation

- (1) The ability to use radio aids to determine the position of the aircraft will aid visual navigation and is particularly useful over featureless terrain and while flying at night.
- (2) Radio aids can improve the accuracy of cross-country navigation and reduce the pilot's workload.

VOR

Essential Background Knowledge

- (1) Describe VOR stations with respect to:
 - (a) Station and signal characteristics;
 - (b) Range of frequencies;
- (2) Describe the airborne VOR equipment:
 - (a) Receiver;
 - (b) Indicator;
 - (c) Antennae.
- (3) Outline the advantages of VOR:
 - (a) Freedom from interference;
 - (b) Accuracy;
 - (c) Ease of wind drift correction.
- (4) Explain limitations and possible errors:
 - (a) Reception range;
 - (b) Line of sight restrictions.
- (5) Show how to refer to charts and the Canada Flight Supplement for information.
- (6) Explain the purposes of the station identification.
- (7) Explain how to tune frequencies, identify stations and confirm correct equipment operation.
- (8) Explain that the VOR is position sensitive and not heading sensitive.

EXERCISE24

- (9) Explain how to determine what radial the aircraft is on, and how to plot a position fix.
- (10) Explain:
- (a) Tracking a radial to the station;
 - (b) Correcting for wind drift;
 - (c) Indications of station passage;
 - (d) Tracking a radial away from the station.
- (11) Describe the following method to intercept and fly a predetermined radial toward the station:
- (a) Tune and identify the VOR;
 - (b) Determine the inbound track to be used after intercepting the desired radial and set the corresponding number on the omni bearing selector (OBS);
 - (c) Check the TO - FROM indication:
 - (i) if FROM, you cannot readily intercept the desired radial from the present location;
 - (ii) if TO, proceed with the interception;
 - (iii) check the course deviation indicator (CDI);
 - (iv) if CDI left, subtract 90 degrees from the OBS to determine the intercept heading;
 - (v) if CDI right, add 90 degrees to the OBS to determine the intercept heading.
 - (d) Fly the intercept heading until the CDI begins to close;
 - (e) At this point you may want to reduce the intercept angle;
 - (f) Turn to the inbound heading as the CDI centres and track to the station.
- (12) Describe a similar method for intercepting a predetermined radial and flying it away from the station.

Advice to Instructors

- (1) Ensure the VOR equipment is tuned and tested and that the station is identified prior to beginning a VOR exercise.
- (2) Before carrying out a VOR procedure, make sure that the heading indicator is correctly set.
- (3) After determining the aircraft position using VOR, visually confirm using map reference and landmarks.
- (4) When choosing a VOR radial to intercept, select one close enough that the intercept will not be lengthy but far enough away that the demonstration will be effective.

EXERCISE24

- (5) When first demonstrating this exercise use an intercept method that demands as little concentration and calculation as possible. A basic method of VOR interception is included in the Essential Background Knowledge. After mastery of the basic procedure, the intercept angles may be modified to suit specific needs. A method requiring more calculation may be introduced after the basic method has been mastered.
- (6) Thoroughly review VOR procedures before each VOR lesson. Students often forget important information in the interval between the first and second lessons.
- (7) Point out that the course deviation indicator does not necessarily point toward the radial selected on the OBS.
- (8) When intercepting a radial outbound near the station, use a shallow intercept angle.

Instruction and Student Practice

- (1) Demonstrate how to:
 - (a) Tune and test the VOR receiver and how to identify the station;
 - (b) Determine on which radial the aircraft is flying;
 - (c) Use radials from two or more stations to plot a position fix;
 - (d) Track along a radial;
 - (e) Fly directly to the station;
 - (f) Intercept a predetermined radial and fly to the station;
 - (g) Identify station passage by the indications of the course deviation indicator and the ambiguity indicator;
 - (h) Intercept and track outbound along a radial.
- (2) Have the student practise each of these VOR exercises immediately after it has been demonstrated.

ADF

Essential Background Knowledge

- (1) Describe non-directional beacons with respect to:
 - (a) Station and signal characteristics;
 - (b) Range of frequencies.
- (2) Describe the airborne ADF equipment:
 - (a) Receiver;
 - (b) Indicator needle;
 - (c) Antennae.

EXERCISE24

- (3) Outline the advantages of ADF:
 - (a) Reception range at low levels;
 - (b) Reception while not within line-of-sight range of the signal origin.
- (4) Explain limitations and possible errors:
 - (a) Reception range;
 - (b) Bank error;
 - (c) Errors due to thunderstorms or magnetic interference.
- (5) Show how to refer to charts and the Canada Flight Supplement for information.
- (6) Explain the purposes of the station identification.
- (7) Explain how to tune frequencies, identify stations and confirm correct equipment operation.
- (8) Explain that the ADF is heading-sensitive.
- (9) Explain that an increase in heading will result in a decrease in relative bearing, and vice-versa.
- (10) Explain that, while intercepting a track or passing abeam a station, the ADF needle moves toward the tail of the aircraft.
- (11) Review the formula: magnetic heading plus relative bearing equals magnetic bearing to the station.
- (12) Explain:
 - (a) How to plot a line of position on a map;
 - (b) How to plot a position fix on a map.
- (13) Explain:
 - (a) Homing to the station;
 - (b) Tracking directly to the station;
 - (c) Indications of station passage;
 - (d) Tracking away from the station.
- (14) Describe how to intercept a predetermined track inbound to the station:
 - (a) Tune, identify, and test the ADF;
 - (b) Turn parallel to the desired track;
 - (c) From the parallel heading, turn 90 degrees to the direction of the ADF needle;
 - (d) As the needle moves to the wing-tip position (a relative bearing of 090° or 270°), turn inbound on the desired track.
- (15) Describe in a manner similar to the above, how to intercept a predetermined track outbound from the station.

Advice to Instructors

EXERCISE24

- (1) Ensure the ADF equipment is tuned and tested and that the station is identified prior to beginning an ADF exercise. Also test for correct sensing while performing the instrument taxi checks.
- (2) Before carrying out an ADF procedure, make sure that the student sets the heading indicator correctly.
- (3) After the student has determined the aircraft position using ADF, visually confirm by referring to a chart and landmarks.
- (4) When choosing an ADF bearing to intercept, select one close enough that the intercept will not be lengthy but far enough away that the demonstration will be effective.
- (5) The method described in Essential Background Knowledge is one that demands as little concentration and calculation as possible. After mastery of this basic procedure, the intercept angles may be modified to suit specific needs. A method requiring more calculation may be introduced after the basic method as been mastered. NOTE: Point out to the student that changing the intercept angle suggested in the basic procedures produces a different relative bearing upon intercepting the desired track.
- (6) Review ADF procedures before each ADF air lesson. Students often forget important information in the interval between the first and second lessons.
- (7) Tracking on ADF to eliminate wind drift should be compared to flying toward a landmark while compensating for wind drift.
- (9) When intercepting an outbound track while close to a station, use a shallow intercept angle.
- (10) A common error when plotting a position fix on a map is failing to take magnetic variation into account.

Instruction and Student Practice

- (1) Demonstrate the following:
 - (a) How to tune and test the ADF receiver and how to identify the station;
 - (b) How to find the aircraft's magnetic bearing from a station;
 - (c) How to plot a position fix on the map by using bearings from two or more stations;
 - (d) That, when the ADF is tuned to a station and the aircraft heading changes, the ADF needle changes by the same amount;
 - (e) Homing from the present position directly to the station;
 - (f) Tracking to eliminate drift;
 - (g) How to intercept a predetermined track and fly to the station;
 - (h) Indications of the ADF needle as the aircraft approaches the station;
 - (i) Indications of the ADF needle as the aircraft passes the station;
 - (j) Tracking away from the station;
 - (k) How to intercept a predetermined track outbound from the station.

EXERCISE24

- (2) Have the student practice the above immediately after each ADF exercise is demonstrated.

GPS

Essential Background Knowledge

- (1) Describe GPS with respect to:
 - (a) Overview of the system;
 - (b) Number of satellites;
 - (c) Area of coverage.
- (2) Describe the airborne GPS equipment:
 - (a) Receiver;
 - (b) Database;
 - (c) Indicators;
 - (d) Antennae.
- (3) Outline advantages of GPS:
 - (a) Accuracy;
 - (b) Ease in determining ground speed and estimated time of arrivals;
 - (c) Tracking indications.
- (4) Explain limitations and possible errors:
 - (a) Database errors;
 - (b) User input errors;
 - (c) Satellite availability.
- (5) Show how to refer to the AIP for information concerning the terms and conditions of the approval for use of GPS in Canada.
- (6) Explain the function of the various modes of the GPS receiver.
- (7) If the GPS is a fixed installation in the aircraft, explain how the GPS interfaces with other aircraft navigational systems.
- (8) Explain how to turn the GPS receiver on.
- (9) Explain how to complete the receiver initialization with pilot inputs as required.
- (10) Explain how to operate the GPS receiver controls.
- (11) Explain the function of the flight plan mode of the GPS receiver.
- (12) Explain how to create a flight plan in the GPS receiver.
- (13) Explain how to modify the flight plan by deleting or inserting waypoints.
- (14) Explain how to create user-defined waypoints.

EXERCISE24

- (15) Explain airspace advisories, alerts and other receiver generated messages.
- (16) Explain the functions of the navigation mode of the GPS receiver.
- (17) Explain the moving map display screen symbology, if applicable.
- (18) Explain the track bar sensitivity in the navigation mode.
- (19) Explain the “Direct To” function of the GPS receiver.
- (20) Explain how to retrieve information about the nearest suitable airport from the database of the GPS receiver.
- (21) Explain how to execute a diversion by adding an alternate airport to the flight plan in flight.
- (22) Explain the appropriate action for a GPS receiver failure.

Advice To Instructors

- (1) Most GPS manufacturer manuals are good sources of essential background information on the GPS system.
- (2) Remember that students do not have to master all the navigational functions of the GPS receiver in order to operate it competently. Ensure they have a thorough knowledge of the functions required to use the receiver in VMC conditions and encourage them to learn the other functions as need or desire dictate.
- (3) Use a receiver simulator or the simulation mode of the receiver to demonstrate the various modes and functions of the receiver prior to starting instruction in the aircraft if possible. Use the aircraft itself on battery power or GPU, if a simulator or simulation mode is not available.
- (4) For receivers that are permanently installed in the aircraft, be sure to review the Aircraft Flight Manual or Flight Manual Supplement for a description of the installation and/or any pertinent restrictions.
- (5) Take the student to the aircraft and point out the various components of the installation including the receiver, the antenna and inter-related navigation equipment and annunciators.
- (6) Use the Special Aviation Notices in the AIP to explain the terms and conditions of the approval to use GPS in Canada.
- (7) Once the in aircraft training begins, ensure that you and your student do not become so involved in the GPS receiver and its functions that you forget the aircraft. This is important because these systems tend to draw the attention of pilots into the cockpit, especially during the early stages of the learning curve. Heads up!

EXERCISE24

- (8) Ensure that students cross check GPS positions with other navigational equipment. Databases have been known to be wrong.
- (9) After the student is competent in obtaining information from the receiver to divert to the nearest airport, give him/her a simulated emergency requiring a diversion. Ensure the student handles the emergency and then programs the GPS. Do not allow the student to be so concerned with the GPS functions that aircraft safety becomes a secondary consideration.

Instruction and Student Practice

- (1) Demonstrate how to:
 - (a) Turn on and initialize the receiver;
 - (b) Operate the GPS receiver controls;
 - (c) Create a flight plan;
 - (d) Modify a flight plan;
 - (e) Create user defined waypoints;
 - (f) Retrieve airport information from the database;
 - (g) Intercept and track to a waypoint(s);
 - (h) Determine track bar sensitivity;
 - (i) Program a "Direct to" a waypoint;
 - (j) Divert to the nearest suitable airport;
 - (k) Recognize a system malfunction.
- (2) Have the student practice each of these GPS exercises immediately after it has been demonstrated.

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NIGHT FLYING

INTRODUCTION

Organizing the Training

Instructors who do training for the night rating know that their students find it to be a very enjoyable way to enhance their skill and qualifications. Although some polishing may be needed, the students already know how to do everything in daylight, such as taxi, take-off, fly cross-country, and land. But they have to learn to do these things in a new environment — darkness, and in the process what they learn will benefit all of their flying.

Training for the night rating consists of a certain amount of instrument flying combined with dual and solo night flying. The exact requirements are set out in the CARs. The challenge for the instructor is to organize and conduct the training in a manner that respects the principles of good instruction, such as building from simple to complex.

Provided that the licensing requirements are met, instructors have considerable latitude in judging how best to proceed with the training for the night rating. Given the diversity in students and local conditions, this flexibility is needed. Whatever approach is taken, try to organize the training to enrich the experience for your students, taking into account what they are likely to encounter once they have a night rating. For example, breaking a two-hour training session into two trips on different nights might give the student more experience on different runways and in different weather conditions. Be on guard for fatigue; it is likely that the student will already have spent a day at work, and maybe the instructor, too.

Ground Training

Although ground training is not a requirement for the night rating, many of the items listed under "Essential Background Knowledge" in the flight exercises can be presented in a general ground training session for night flying before flying begins. Items to be included:

- (1) Review the training program. Giving an overview of the training for the night rating will not only let the student know what to expect, but what you will expect of the student.
- (2) Explain the airport layout and lighting. Even if the student knows the airport, a review of the layout will be helpful. An understanding of various lighting systems, including taxiway, runway edge, threshold, approach, obstruction, aerodrome beacon, wind direction indicator, and approach slope indicator, is an important requirement.
- (3) Review the aircraft electrical system. The student will already know something of the electrical system, but a review will set the stage for understanding how things can fail and what can be done in the event of a malfunction.
- (4) Explain the aircraft lighting. Success in night flying requires a good working knowledge of the aircraft lighting. That means knowing what lighting is available, and how and when to use it.
- (5) Explain human factors as they apply to night flying. Subjects to talk about include night vision, kinesthetic illusions, visual illusions, autokinesis, black holes, pitch-up and pitch-

EXERCISE 25

down illusions, fatigue, and, if the training is conducted in winter, cold weather operations. Consult **The Pilot's Guide to Medical Human Factors, Human Factors for Aviation — Basic Handbook**, and **Human Factors for Aviation — Instructor's Guide** for some good material on these and other topics.

Instrument Flying

A certain amount of instrument flying is needed for the night rating, because there are some night situations in which instruments are almost the only attitude reference available. Private pilot training now requires five hours of dual instrument flying, so this much can be counted on, unless the candidate completed private pilot training many years ago. Many instructors like to do at least some of this instrument flying at night, although it will not be counted as part of the five hours dual night flight time needed for the rating. In addition, if the equipment is available, it is recommended that they learn more about radio aids to navigation than is required for the Private Pilot Licence. This might include the ability to use VOR, ADF or GPS to determine a position and to home to the facility or waypoint.

Recommending for the Night Rating

There is no flight test required for the night rating, but the instructor is expected to know when the student is competent to exercise the privileges of the rating, which is more than simply acquiring the necessary dual and solo flight time. The student should be able to meet, for those exercises covered in night flying, the same standard set out in the Flight Test Standards, Private and Commercial Pilot Licences — Aeroplane (TP2655E).

EXERCISE 25

Flight Exercises

PRE FLIGHT INSPECTION

Objective

The student will learn how to conduct a thorough pre-flight inspection at night.

Motivation

A thorough pre-flight inspection is always important but it is made more difficult by darkness. Close attention must be given to be sure nothing is missed. There is also more to be checked, such as aircraft lighting.

Essential Background Knowledge

- (1) Review the pre-flight inspection as it is done during the day.
- (2) Review the aircraft electrical system.
- (3) Review the action to be taken if an unsatisfactory item is located during the inspection.
- (4) Explain operation and inspection of aircraft lighting:
 - (a) Cockpit;
 - (b) Landing;
 - (c) Taxi;
 - (d) Beacon;
 - (e) Strobe;
 - (f) Navigation.
- (5) Explain the importance of carrying spare fuses of the right type.
- (6) Explain the need for a serviceable flashlight.
- (7) Explain the need for extra caution when checking for tow bars, chocks, control locks, and pitot covers.

Advice to Instructors

- (1) The initial demonstration of a pre-flight inspection should be done during the day or in a lighted hangar.
- (2) Point out that more caution and attention to detail is needed because darkness can obscure items that would be obvious in daylight.
- (3) Emphasize the importance of having a properly functioning electrical system at night.

Instruction and Student Practice

EXERCISE 25

Demonstrate how to conduct a pre-flight inspection at night.

ENGINE START AND RUN-UP

Objective

The student will learn how to start the aircraft and conduct a run-up at night.

Motivation

The main difference in starting an engine and conducting a run-up at night is in the need to use aircraft lighting correctly and to bring extra caution to the procedures because of darkness.

Essential Background Knowledge

- (1) Review the engine start and run-up procedures.
- (2) Review the emergencies which may be encountered during the engine start.
- (3) Review the passenger safety briefing.
- (4) Explain:
 - (a) Use of cockpit lighting;
 - (b) Use of flashlight;
 - (c) Importance and use of a written check list;
 - (d) Importance of monitoring generator/alternator output.

Advice to Instructors

- (1) Ensure that the student can locate all critical switches by touch.
- (2) Ensure that the student does a thorough look-out for anyone nearby before starting. Turning on the beacon and navigation lights and, if necessary, a "clear" call will warn others that the aircraft is about to be started.
- (3) Start and run-up may take more time at night and the student may be nervous so take care not to rush the student.
- (4) Ensure that brakes are securely applied. It is difficult to detect whether the aircraft is creeping ahead at night.
- (5) Emphasize caution in positioning the aircraft for the run-up as such details as ice, people, and other aircraft are difficult to see at night.

EXERCISE 25

Instruction and Student Practice

- (1) Demonstrate how to start the aircraft at night.
- (2) Demonstrate how to conduct a run-up at night.

TAXIING

Objective

The student will learn how to taxi correctly at night.

Motivation

Darkness, and the absence of normal visual cues, requires that extra attention be given when taxiing at night.

Essential Background Knowledge

- (1) Review taxiing procedures, including instrument checks while turning and placement of flight controls during strong wind conditions.
- (2) Review how to determine which runway is active.
- (3) Explain airport lighting:
 - (a) Aerodrome beacon;
 - (b) Taxiway;
 - (c) Unserviceable area markings;
 - (d) Approach;
 - (e) Runway;
 - (f) Wind direction indicator;
 - (g) Use of taxi lines;
 - (h) Runway exit markings;
 - (i) Retroreflective markers.
- (4) Explain how to judge taxi speed at night.
- (5) Explain the correct operation of the taxi or landing lights on the ground.
- (6) Explain the compulsory use of anti-collision lights and navigation lights.
- (7) Explain that when taxiing in floodlit areas, extra caution will be needed as shadows may make obstructions hard to see.

EXERCISE 25

Advice to Instructors

- (1) Exercise special caution at night. The instructor and the student must avoid becoming so focused on activities in the cockpit that look-out suffers.
- (2) Teach the student to taxi with and without the taxi light. Point out that it is advisable to use the taxi light when turning or manoeuvring in unfamiliar or congested areas.
- (3) Ensure that the student determines and remembers wind direction and applies proper control input to compensate.
- (4) If possible, have the student view the airport from a higher vantage point, such as a control tower.

Instruction and Student Practice

- (1) Review:
 - (a) Brake check;
 - (b) Use of controls while taxiing;
 - (c) Instrument checks while taxiing.
- (2) Demonstrate;
 - (a) Taxiing at night, with and without taxi light;
 - (b) Judging taxi speed;
 - (c) Courteous use of the landing and strobe lights while taxiing;

TAKE-OFF

Objective

The student will learn how to take off at night under varied conditions with and without the use of the landing light.

Motivation

Different visual references during the take-off, and the lack of references during the initial climb, impose special demands on the pilot when taking off at night.

Essential Background Knowledge

- (1) Review normal and cross-wind take-off procedures, including pre-take-off checks.
- (2) Review applicable emergency procedures.
- (3) Explain the use of the landing light for take-off.
- (4) Explain that instrument references may be required after take-off.
- (5) Explain the importance of maintaining a positive rate of climb after take-off.

EXERCISE 25

- (6) Explain illusion of linear acceleration (pitch-up illusion) and black hole illusion.
- (7) Explain that no turns should be made below a safe altitude.

Advice to Instructors

- (1) Conduct the initial take-off with the landing light on.
- (2) Ensure that the student learns the position of the landing light switch.
- (3) Introducing the first night take-off at twilight allows a gradual progression to darkness.
- (4) Emphasize the importance of take-off planning to include consideration of wind, runway surface, obstacles, turbulence, and vortices.
- (5) Ensure that take-offs are done with and without a landing light.
- (6) Ensure that take-offs are done from different runways and, if possible, different airports.
- (7) Ensure that the student confirms a positive rate of climb after take-off using the VSI/altimeter.

Instruction and Student Practice

Demonstrate and practise normal and crosswind take-offs, with and without landing light.

CIRCUIT

Objective

The student will learn how to depart, enter, and fly an accurate circuit at night.

Motivation

Flying an accurate circuit at night requires the use of a combination of visual and instrument references in order to maintain correct position relative to the runway and to other traffic. Achieving this accuracy is necessary and satisfying and it will benefit overall flying skill.

Essential Background Knowledge

- (1) Review circuit procedures:
 - (a) Departure;
 - (b) Entry;
 - (c) Controlled and uncontrolled airports;
 - (d) Radio procedures.
- (2) Review appropriate emergency procedures, including engine failure, forced landing, electrical fire, electrical malfunctions, and radio failure (ARCAL implications).

EXERCISE 25

- (3) Explain the use of the heading indicator to fly an accurate circuit at night.
- (4) Explain the use of runway lights and approach lights as references.
- (5) Explain judgement of distance at night.

Advice to Instructors

- (1) A brief night familiarization flight in the area is recommended before the first night circuit.
- (2) Drift can be harder to determine at night but this assessment is necessary to fly an accurate circuit. Help the student to recognize and correctly compensate for drift in the circuit.
- (3) Long sessions in a night circuit can be very tiring. Keep the trips reasonably short.
- (4) Letting the students leave and re-enter the circuit can give them good experience.

Instruction and Student Practice

- (1) Conduct a brief familiarization flight in the area.
- (2) Demonstrate and have the student practise circuits:
 - (a) With varied approach and runway lighting conditions;
 - (b) At various airports, if possible, including controlled and uncontrolled airports;
 - (c) Emergency procedures, including engine failure, forced landing, electrical malfunctions, communication failure while in the circuit.
- (3) Demonstrate the use of the heading indicator to help fly an accurate circuit.
- (4) Demonstrate, where possible, how to use the ARCAL lighting system.

APPROACH AND LANDING

Objective

The student will learn how to conduct effective approaches and landings at night.

Motivation

The visual references used for an approach at night are different than those experienced during the day. Also, the various illusions that can occur impose special demands on the pilot conducting an approach and landing at night.

EXERCISE 25

Essential Background Knowledge

- (1) Review:
 - (a) Normal and cross-wind approach and landing, including appropriate checks;
 - (b) Overshoot procedure;
 - (c) Approach and runway lighting;
 - (d) **VASIS/PAPI**;
 - (e) Wake turbulence avoidance;
 - (f) **ARCAL** procedures;
 - (g) Use of retroreflective markers.
- (2) Explain illusions as they relate to approach and landing:
 - (a) Runway slope and width;
 - (b) Black holes — approaching over unlighted terrain;
 - (c) Effect of height and brightness of runway lights on judgement of flare.
- (3) Explain the use of runway lights to assess approach angle and drift.
- (4) Explain advantages and disadvantages of using the landing light for landing.
- (5) Explain the use of power during the flare to assist the landing.
- (6) Explain the importance of reducing speed before turning to exit the runway.

Advice to Instructors

- (1) Consider doing the first night approaches and landings at twilight to allow a gradual transition to night flying.
- (2) Emphasize the importance of proper trim and speed control.
- (3) Have the student use the landing light for the first few landings, then introduce some landings with the light off.
- (4) Ensure that the student looks far enough ahead on landing to detect forward, vertical, and lateral movement of the aircraft in relation to the runway.
- (5) The beam of a centre-mounted landing light acts as an extension of the longitudinal axis and may be used to assist in achieving correct alignment with the runway in cross-wind landings.
- (6) Full stop landings are more beneficial during the initial part of night training before attempting stop and go or touch and go landings.

EXERCISE 25

Instruction and Student Practice

- (1) Demonstrate and have the student practise:
 - (a) Approaches and landings at night, gradually introducing variations such as cross-wind, different runways, landing light off, VASIS/PAPI lights off (if available), and different runway light intensities;
 - (b) Straight-in approaches;
 - (c) Simulated system failures, such as loss of cockpit instrument lights, landing light, or radio failure;
 - (d) The use of power on the flare;
 - (e) Overshoots.
- (2) Point out any illusions that may be experienced on approach and landing at night.

PILOT NAVIGATION

Objective

The student will learn techniques for effective pilot navigation at night.

Motivation

Pilot navigation by night, as by day, is a complex but very satisfying task when it is done well. The need to rely on lighted landmarks, the relative lack of detail available for navigational reference, and the difficulty in seeing approaching weather at night impose special demands on the pilot.

Essential Background Knowledge

- (1) Review:
 - (a) Pre-flight planning procedures;
 - (b) Pilot navigation techniques for departure, en route, and arrival;
 - (c) Cockpit lighting;
 - (d) Emergency procedures;
 - (e) Obtaining ATC assistance and DF steer.
- (2) Explain:
 - (a) Why accuracy of heading and time keeping is important;
 - (b) Map reading by night;
 - (c) How to judge distances at night;
 - (d) How to identify precipitation in the beam of the landing light.

Advice to Instructors

- (1) Emphasize the need for a thorough weather briefing.

EXERCISE 25

- (2) Encourage, for flight planning purposes, the use of personal weather limits that are higher than the minimum legal requirements for VFR flight.
- (3) If possible, plan the trip so that the student navigates over populated and unpopulated areas.
- (4) Always have an alternate or an "out" for each leg.
- (5) Ensure that the student understands emergency procedures before the cross-country flight, then use "what-if" scenarios during the trip to develop decision-making skill.
- (6) Short trips out of the circuit and into the local area can be used to build pilot navigation skills before the actual cross-country flight.
- (7) If possible, plan to land at other airports during the cross-country flight.
- (8) Although a solo cross-country is not a requirement, many schools recommend a short solo cross-country at night, perhaps one involving a circuit at another airport.

Instruction and Student Practice

- (1) Demonstrate:
 - (a) Map reading;
 - (b) Judging distance.
- (2) Supervise student practice:
 - (a) Pre-flight planning;
 - (b) Departure;
 - (c) Set heading;
 - (d) En route navigation;
 - (e) Arrival;
 - (f) Emergencies.

INSTRUMENT FLYING

Objective

The student will learn the instrument flying skills needed for night flying. See Exercise 24.

Advice to Instructors

- (1) Consider doing some of the instrument flying at night to develop this skill under the same conditions in which it will be needed — darkness.
- (2) Unusual attitudes are best done during daylight. The risk of disorientation is greater at night for both the student and the instructor.
- (3) All the required instrument flying should be completed before completing the night flying. Ideally, it should even be completed before sending the student solo at night.

EXERCISE 25

EMERGENCY PROCEDURES

Objective

The student will learn how to correctly respond to emergencies at night.

Motivation

All emergencies that can be encountered during the day can and do occur at night, and when they do they bring additional complications. There are also emergencies which are unique to the night environment. The student must understand these emergency situations and be competent in carrying out prompt proper procedures — indecision costs time and time may be crucial.

Essential Background Knowledge

- (1) Review:
 - (a) All emergency procedures as per P.O.H. or F/M;
 - (b) DF steer procedures;
 - (c) The fuel system;
 - (d) The electrical system.
- (2) Explain:
 - (a) How to interpret the ammeter;
 - (b) The implications of overcharging or undercharging;
 - (c) The action in the event of an electrical malfunction;
 - (d) The importance of carrying spare fuses of the right type;
 - (e) How to locate and replace the fuses by touch;
 - (f) The importance of being able to locate essential switches and controls in the cockpit without hesitation or looking;
 - (g) The use of a flashlight in the event of cockpit lighting failure;
 - (h) How to locate and turn on the ELT by touch.
- (3) Explain how to select a forced landing site at night, considering such details as terrain, snow covering, moonlight, and even automobile lighting on highways.
- (4) Explain the use of landing lights on a forced landing.
- (5) Explain ARCAL operation and the implications of transmitter failure.

EXERCISE 25

Advice to Instructors

- (1) Explain why knowledge of the fuel and electrical system is so important in dealing with certain emergencies at night.
- (2) When teaching emergency procedures, do not create situations that add risk to the flight. In other words, do not practise accidents.
- (3) Precede all practice emergencies with the word "simulated".

Instruction and Student Practice

- (1) Demonstrate and have the student practise simulated emergency situations including:
 - (a) Cockpit lighting failure;
 - (b) Electrical system failure;
 - (c) NORDO procedures at night;
 - (d) Forced landing procedure while in the circuit;
 - (e) Choosing a forced landing area;
- (2) Ensure that the student can locate all critical switches by touch.

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EXERCISE 26

SEAPLANES

For the Seaplane Rating, refer to the “Instructor Guide — Seaplane Rating” (TP12668E).

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SKIPLANES

Objective

To familiarize the pilot with skiplane flight operations.

Motivation

As required.

Essential Background Knowledge

- (1) Discuss the different types of skis in common use:
 - (a) Standard skis attached to wheel axle;
 - (b) Wheel-ski combination;
 - (c) Others;
 - (d) Additional items to check during pre-flight visual inspection.
- (2) Review the essential pre-flight inspection items which apply only to skiplanes — cables, shock cords and fastenings, ski pistons, etc.
- (3) Taxiing considerations:
 - (a) Explain:
 - (i) techniques for breaking clear frozen skis;
 - (ii) snow conditions most likely to cause skis to stick;
 - (iii) danger of dirt, soil, ice, etc. adhering to skis, e.g., wheel-ski parking and operations;
 - (iv) lack of braking action on some surfaces;
 - (v) conditions which can lead to engine overheating while taxiing;
 - (vi) the necessity under some snow conditions to first taxi over the proposed take-off path to pack the snow prior to commencing take-off run;
 - (vii) operating in or avoiding slush conditions.
- (4) Take-off:
 - (a) Explain:
 - (i) take-off techniques;
 - (ii) effect of snow conditions on length of take-off run;
 - (iii) similarity to a soft field take-off in a landplane;
 - (iv) considerations where high snow drifts exist;
 - (v) cross-wind techniques.

EXERCISE 27

- (5) Landing:
 - (a) Importance of determining suitability of:
 - (i) proposed landing area surface;
 - (ii) available length for subsequent take-off;
 - (iii) visual reference in white-out conditions, unbroken snow, etc.
 - (b) Approach and touchdown considerations — normal approach and landing — cross-winds;
 - (c) Considerations for landing on unbroken snow, blowing snow conditions, high drifts, etc.;
 - (d) Procedures after landing to prevent freeze-in.
- (6) Parking and tie-down considerations:
 - (a) Use of wood, boughs or plastic to prevent freeze-in;
 - (b) Tie-down techniques.
- (7) General airmanship considerations relative to ski operations:
 - (a) Detection and avoidance of slush areas, fissures, air holes, deep snow, etc.;
 - (b) Avoidance of areas of under-current, e.g., creek or river mouths;
 - (c) Bare ice operations;
 - (d) Effect of cross-winds;
 - (e) Ice conditions during lake operations in fall and spring;
 - (f) Clogged wheels from slush frozen after take-off;
 - (g) A guide to load-bearing of ice quality and thickness.

Advice to Instructors

- (1) The nature of ski operations generates more likelihood of exposure to conditions of hoar frost on wings, refuelling from drums and servicing in the open. For this reason additional care must be exercised.
- (2) The similarity between glassy water seaplane operation and operating a skiplane from white-out or unbroken snow conditions will result in a seaplane rated pilot being able to appreciate the problem more readily than a landplane pilot.
- (3) A skiplane landing on bare ice can become a memorable event if care is not fully exercised. If conditions are favourable, a student should be exposed to this situation. The lack of friction normally experienced has to be seen to be believed.
- (4) For off-base skiplane operations it must be emphasized that except in bare ice operation, the length of the take-off run from a selected landing area is more an operational consideration than solely the distance required for a landing.
- (5) Adequate survival equipment and proper clothing is essential especially for planned or even unplanned overnight stays away from base. Students must appreciate the problems of preparing and starting a cold-soaked engine and understand the responsibilities they have for their passengers.

EXERCISE 27

Instruction and Student Practice

- (1) External line Inspection:
 - (a) Point out the additional considerations for a skiplane;
 - (b) Ensure that the skis are not frozen to the surface.
- (2) Taxiing — demonstrate:
 - (a) The techniques to follow to compensate for the reduced control of aircraft movement as compared to a landplane, e.g., flaps up, stick forward for steering, rope use on tail for restricted area turning, giving wide berth to shoreline snow build-up;
 - (b) How variable ground surface conditions (deep snow — bare ice) result in a large variation of engine power required to move the aircraft and keep it moving;
 - (c) The techniques for preventing freezing-in when the aircraft is brought to a stop.
- (3) Take-off — demonstrate:
 - (a) Before leaving the parking pad:
 - (i) complete normal run-up allowing for possible movement;
 - (ii) complete take-off checks.
 - (b) A normal take-off for the existing conditions;
 - (c) When conditions permit, demonstrate how the take-off surface can be packed down by taxiing over it first;
 - (d) In white-out conditions, or when normal references are not available, demonstrate the techniques for take-off and the need to use instruments for attitude confirmation.
- (4) Landing — demonstrate:
 - (a) Inspection of the landing surface to determine suitability, wind direction, landing path, etc.;
 - (b) Normal approach and landing;
 - (c) In cases of deep snow, post-landing taxi procedures to follow to ensure that sticking does not occur, and that the aircraft can be easily moved again under its own power;
 - (d) How to check for slush before the aircraft is stopped.
- (5) Parking and tie-down:
 - (a) Demonstrate additional considerations as required for a skiplane.

TYPE CONVERSION

Objective

To supplement the existing knowledge and skills of the pilot with those required for the operation of a different or advanced type of aircraft.

Motivation

As required.

Essential Background Knowledge

- (1) Using the Pilot Operating Handbook, explain the various procedures or techniques as applicable to:
 - (a) Weight and balance, loading;
 - (b) Fuel systems and management, consumption, range;
 - (c) Ancillary controls — use and operation;
 - (d) Undercarriage operation, if applicable;
 - (e) Flaps, hydraulic systems, electrical systems;
 - (f) Operational considerations, use of charts, graphs, etc., in the handbook, including approved and unapproved procedures.
 - (g) Emergency procedures.
- (2) Examine the student on essential information and correct any errors as necessary.

Advice to Instructors

- (1) Resist the temptation to "shoot a couple of circuits" and then let the student learn by mistakes made when flying solo. Carefully assess the student's background and ability so as to plan a conversion course to individual needs.
- (2) In some cases, type conversion also includes introducing the students to equipment with which they have had no previous experience, e.g., retractable undercarriage, constant speed propeller, etc. As this equipment is also normally associated with faster equipment, pace the instruction with the student's ability to learn.
- (3) The Pilot Operating Handbook contains information which has been placed there by the manufacturer after considerable research. Encourage students to become familiar with all the information in the handbook, and ensure that they appreciate that aircraft of the same type, but of different years of manufacture, may have airspeed and other operational differences which could cause problems if ignored.

EXERCISE 28

- (4) If the student has had limited or no experience on similar types, spend some time on normal air work before progressing into the more complicated techniques to enable the student to feel at ease with the aircraft.
- (5) A "check-out" is not complete until the student has been exposed to the characteristics of the aircraft in all configurations, including operations at maximum gross weight.

Instruction and Student Practice

- (1) Acquaint the student fully with the essential differences or additional items which must be checked during the external line check of the aircraft.
- (2) Supervise starting, warm-up, run-up and pre-take-off checks.
- (3) After take-off, allow sufficient time in level flight to allow the student to become familiar with the flight characteristics before commencing any serious instruction.
- (4) When the student is at ease with the aircraft in all normal flight manoeuvres, stalls, steep turns, etc., return to the circuit for take-off and landing practice.
- (5) After sufficient competency is demonstrated by the student, assign practice as required.
- (6) Supervise aircraft shut-down and parking as necessary.

EMERGENCY PROCEDURES

Objective

To teach the recognition of an emergency condition or system malfunction and how to complete all procedures in accordance with the Pilot Operating Handbook.

Motivation

When an abnormal or unsafe condition is detected, a pilot must correctly assess the situation, then carry out the proper procedure to resolve the problem. Alternative action must also be considered if the pilot is not able to fully resolve a system malfunction. The alternative may be to divert to an airport nearby.

Essential Background Knowledge

- (1) Review decision making concepts and handling emergencies.
- (2) Explain, for the aeroplane being used, the procedures for:
 - (a) Engine fire on the ground;
 - (b) Engine fire in flight;
 - (c) Low oil pressure;
 - (d) Flaps — failure — split flap condition;
 - (e) Fuel system — gauge/tank selection — boost pump, if applicable;
 - (f) Electrical system malfunction;
 - (g) Electrical smoke or fire;
 - (h) Unlatched hatch, panel or door in-flight;
 - (i) Cabin fire;
 - (j) Ditching;
 - (k) Other systems failures applicable to the aeroplane type.

Advice to Instructors

- (1) Ensure the student is familiar with normal procedures and is handling the aeroplane well before introducing emergencies and system failures.
- (2) It is important that the student be familiar with the Pilot Operating Handbook format, including of all emergency checklists, systems and emergency procedures. Instructors must ensure that the student learns memory items.
- (3) Emergency procedures should be introduced progressively in the training and not left to the later stages of training. Situations involving flap, electrical or fuel problems can be given in the initial training stages.

EXERCISE 29

- (4) Teach emergency procedures by presenting scenarios. This will assist students in analyzing problems, and will prepare them better for actual situations. Always promote the development of sound decision-making skills.
- (5) Be careful not to overload the student with emergencies. Keep the scenarios reasonable and realistic. Avoid multiple emergencies, the student will become frustrated and little knowledge or skill will be gained.
- (6) Ensure that all emergency and system failure procedures have been covered by completion of the training. Any procedure applicable to the aeroplane used for training could be tested by the examiner.

Instruction and Student Practice

- (1) All emergency and systems failure procedures applicable to the aeroplane type are to be taught in accordance with the Pilot Operating Handbook.
- (2) Discuss emergencies with the student, using scenarios to help visualize what can happen.
- (3) With the student in the aeroplane, go through the procedures, calling each item out loud and touching or moving the various controls.
- (4) Question the student on memory items if applicable. The student must know where to locate all other emergency checklist items.

PART III

Lesson Plans

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PART III

LESSON PLANS

PRIVATE PILOT FLIGHT SYLLABUS

Lesson Plans for the Private Pilot Flight Training Syllabus, which follow, provide guidance for the new instructor, and a ready reference for the more experienced instructor. *Flight times are not specified* since it is essential that the required competency in each exercise is achieved, regardless of the flight time involved, before proceeding with the next lesson.

While it is recommended that flight instructors carefully follow these Lesson Plans as outlined, the personal instructional techniques of an individual flight instructor may be cause for modification of this syllabus, in which case, it should be committed to writing and followed with care. In either case, special circumstances such as aircraft availability, geographic location, or weather conditions may necessitate a departure from the written numerical order of the Lesson Plans.

It must be clearly understood that each Lesson Plan does not necessarily constitute a single flight — the number of flights will vary according to Lesson Plan content and student ability. The reference manual for the material contained in the Lesson Plans is Transport Canada's Flight Training Manual. Training aids will vary according to the subject, but the model aircraft, chalkboard, and aircraft flight manual are practically essential in each case.

To ensure that the student understands exactly what will take place during the air exercise, a pre-flight briefing should be carried out. This is essentially a practical briefing using the "Air Instructions" as a guide, *avoiding theory*, but including the important aspects:

- What we are going to do.
- How we are going to do it.
- Safety considerations.

The pre-flight briefing should be conducted just prior to the air exercise. Key points of the proposed flight should be reviewed and the student questioned briefly to determine that there is sufficient understanding to proceed with the air exercise. Part IV of the Flight Instructor Guide contains some suggested typical questions which may be used to determine the student's knowledge of the air exercises.

Each lesson plan outlines the air exercises which should be taught, reviewed, or practised, and also states the expected level of competency at that stage of the student's training. Bearing in mind that perfection is the goal, during each successive flight, the instructor should impose performance standards with that goal in mind.

Following the Learning Factor of Primacy, provision has been made whenever possible, to give a brief demonstration of any new exercise which will be taught during the next training period. It need not necessarily be accompanied by an in-flight explanation and is essentially a familiarization demonstration which will enable the student to more fully understand the written text relating to the exercise in the Flight Training Manual.

A brief discussion (post-flight debriefing) conducted at the conclusion of the training flight is essential to give the student an opportunity to discuss, and obtain clarification of any points involved in the lesson. Study assignments to help the student prepare for the next lesson should be made as part of the post-flight debriefing.

LESSON PLAN NO. 1 (DUAL)

The first lesson consists of an introduction to the aircraft and its major components, the Pilot Operating Handbook and its operational documents. This should be followed by a familiarization flight and some basic instruction. A short out and back cross-country flight to a nearby airport is often effective in stimulating a new student's interest. At the completion of this lesson the student should, under direction, be able to fly the aircraft back to the vicinity of the home base.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Aircraft familiarization <ul style="list-style-type: none"> Aircraft Documents Weight and balance Ancillary controls Pre-flight inspection Cockpit familiarization The Pilot Operating Handbook 					
<ul style="list-style-type: none"> • Ground demonstration and practical use. 					
2. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
3. Air Instruction					
Starting the engine	*				
Radio communications	*				
Taxiing	*				
Pre-take-off check	*				
Take-off, circuit departure and climb-out	*				
Navigation, landmarks, general heading	*				
Area familiarization	*				
Attitudes and movements	*				
Straight and level flight	*				
Turns	*				
Navigation, orientation, general heading	*				
Circuit joining, approach, landing, taxiing and parking	*				
4. Post-flight debriefing <ul style="list-style-type: none"> • Question the student and clarify any problems which may have arisen • Assign study material for next lesson 					
Preview of next lesson <ul style="list-style-type: none"> • Straight and level flight, climbs, descents, turns, circuit departure and joining 					

LESSON PLAN NO. 2 (DUAL)

This Lesson Plan provides for instruction and practice of the basic flight manoeuvres. The student should be able to perform basic climbs, descents, turns and level flight without assistance within suitable tolerances assigned by the instructor, and have a clear understanding of the procedures to be followed when leaving or rejoining the circuit before advancing to the next Lesson Plan.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Aircraft pre-flight inspection	*				
Starting engine		*			
Radio communication procedures	*				
Taxiing		*			
Pre-take-off check		*			
Take-off, circuit departure and climb-out	*				
Navigation: landmarks and general headings to practice area	*				
Attitudes and movements		*			
Straight and level flight		*			
Gentle and medium turns		*			
Climbing and descending		*			
Climbing and descending turns		*			
Magnetic compass	*				
Heading indicator	*				
Navigation: Orientation and general heading for return to airport	*				
Circuit joining, approach, landing, taxiing and parking	*				

3. Post-flight debriefing

- Question the student and clarify any problems which may have arisen
- Assign study material for next lesson

Preview of next lesson

- Line inspection and starting of aircraft — student responsibility
- Straight and level flight at reduced airspeeds
- Climbs and descents to prescribed altitudes
- Climbing and descending turns

LESSON PLAN NO. 3 (DUAL)

This Lesson Plan provides for consolidation of the air exercises covered in the previous lesson. In addition, the time en route to the training area should be calculated for navigational timing practice. Advancement to the next lesson plan can be made when the student is able to maintain height during level flight at selected airspeeds and during level medium turns, with minor variations from assigned performance standards and is able to climb and descend at pre-selected airspeeds, with only momentary deviations from assigned airspeeds. The return flight to the airport and rejoining the circuit should be performed without assistance.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Aircraft pre-flight inspection			*		
Starting engine			*		
Radio communication procedures			*		
Taxiing			*		
Take-off and climb		*			
Departure from Circuit			*		
Navigation — Heading and Timing		*			
Straight and level flight — various airspeeds		*			
Climbing at various airspeeds		*			
Descending at various airspeeds		*			
Climbing and descending turns			*		
Range and endurance	*				
Navigation: Headings and altitude			*		
Circuit joining, and approach			*		
Landing	*				
Taxiing and parking			*		

- 3. Post-flight debriefing**
- Question the student and clarify any problems which may have arisen
 - Assign study material for next lesson

- Preview of next lesson**
- Range and endurance

LESSON PLAN NO. 4 (DUAL)

In this Lesson Plan, the skills attained by the student while developing control of airspeed in the previous lesson plan are used when progressing to climbing at the aircraft's best angle and best rate of climb speed. Accuracy in maintaining altitude and airspeed should be the goal as the student learns to fly for range and endurance. The student should be able to perform this without assistance with only minor variations from the ideal performance before advancing to the next lesson plan. During this lesson, and hereafter, the student should be responsible for the pre-flight inspection, engine starting and shut-down, radio communications, taxiing, parking, and engine run-up without direction from the instructor, except in unusual circumstances or in new, unfamiliar situations.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Aircraft pre-flight inspection, starting, radio communications, taxiing and run-up			*		
Take-off		*			
Circuit departure			*		
Navigation: Map reading to practice area			*		
Climbs and climbing turns			*		
Descents and descending turns			*		
Straight & level flight, medium turns			*		
Climbing at best angle and best rate of climb speeds		*			
Speed changes in level flight		*			
Flight for range		*			
Endurance flight		*			
Slow flight	*				
Power-off stalls	*				
Navigation: Map reading to home base			*		
Airport approach and circuit joining			*		
Landing		*			
Radio communications, taxiing and shut-down			*		

- 3. Post-flight debriefing**
- Question the student and clarify any problems which may have arisen
 - Assign study material for next lesson

Preview of next lesson

- Slow flight
- Stalls

LESSON PLAN NO. 5 (DUAL)

The student should be striving for greater accuracy in attitude, power and airspeed control in this Lesson Plan, and will be introduced to slow flight and stalls. The lower speed range in slow flight, and power-on stalls will follow in Lesson Plan No. 6. While continuing to practise the basic exercises by the end of this Lesson Plan the student should be able to maintain altitude while flying at airspeeds ranging down to mid-point of the slow flight range, and recover from simple power-off stalls, using power-off recovery action, with only minor variations from the ideal in-flight skill and ability.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Take-off and circuit departure			*		
Navigation: Headings and timing			*		
Straight and level flight, turns, climbs and descents			*		
Speed changes in level flight			*		
Flight for range			*		
Endurance flight			*		
Slow flight		*			
Power-off Stalls		*			
Power-on Stalls	*				
Incipient spins	*				
Navigation: Map reading or use of radio aid for return to home base		*			
Airport approach and circuit joining			*		
Landing		*			
Radio communication, taxiing and shut-down			*		

- 3. Post-flight debriefing**
- Question the student and clarify any problems which may have arisen
 - Assign study material for next lesson
- Preview of next lesson**
- Power-on stalls
 - Incipient spins

LESSON PLAN NO. 6 (DUAL)

This Lesson Plan reviews some of the previous exercises while introducing slow flight through the full slow flight speed range, stalls, and incipient spins. By the end of this Lesson Plan the student should be competent to manoeuvre the aircraft in the full slow flight speed range in level, climbing and descending flight while flying straight and while turning. Reasonably large variations from the ideal are acceptable initially while the student is learning the "feel" of slow flight. Also, by the end of this Lesson Plan, the student should be comfortable in the unusual attitudes sometimes encountered in stalls and spin recoveries, and should be competent in recovering from stalls and incipient spins with a minimum loss of height.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Take-off and circuit departure			*		
Navigation: Headings and ETA			*		
Straight and level flight, turns, climbs and descents			*		
Range and endurance			*		
Slow flight		*			
Stalls: Power-off			*		
Stalls: Power-on		*			
Incipient spins		*			
Spiral dive recovery	*				
Side-slipping	*				
Navigation: Low level map reading			*		
Circuit joining			*		
Landing		*			

- 3. Post-flight debriefing**
- Question the student and clarify any problems which may have arisen
 - Assign study material for next lesson
- Preview of next lesson**
- Side-slipping
 - Spiral dive recovery

LESSON PLAN NO. 7 (DUAL)

This Lesson Plan is a review of the flight manoeuvres and procedures previously covered in preparation for take-offs, landings, and traffic circuit operations. Spiral dive recovery will be demonstrated and practised. Acceptable proficiency in all co-ordination and airspeed control manoeuvres should be achieved before take-off and landing practice is initiated.

During this Lesson Plan, the student should achieve the ability to control the aircraft through the full slow flight speed range with only minor variations from the ideal performance and to recognise and recover from power-off and power-on stalls and incipient spins, executing circuit joining and the landing approach without direction from the instructor.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Take-off and circuit departure			*		
Navigation: Headings and altitude control			*		
Steep turns	*				
Slow flight — straight flight and turns		*			
Stalls			*		
Incipient spins			*		
Spiral dive recovery		*			
Turns to headings		*			
Side-slipping		*			
Elementary forced landing	*				
Circuit joining			*		
Landing			*		

- 3. Post-flight debriefing**
- Question the student and clarify any problems which may have arisen
 - Assign study material for next lesson
- Preview of next lesson**
- Take-offs, circuits and landings

LESSON PLAN NO. 8 (DUAL)

This Lesson Plan covers concentrated practice of take-offs and landings. If necessary to relieve boredom and frustration, LESSON PLAN NO. 7 in whole or in part should be repeated and included as part of a flight programme, as well as steep turn instruction.

By the time this Lesson Plan is mastered, the student should be able to carry out take-offs, circuits and landings without assistance. Simulated forced landings in the circuit should be introduced at unannounced points during this lesson and hereafter. Side-slipping should be shown as an alternative to the use of flaps.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction Take-offs, circuits and landings			*		
Lesson Plan No. 7 and steep turns			*		
Side-slipping		*			

- 3. Post-flight debriefing**
- Question the student and clarify any problems which may have arisen
 - Assign study material for next lesson
- Preview of next lesson**
- Loss of communication procedures
 - Runway change flight procedures
 - Bounce recovery techniques
 - Missed approach

LESSON PLAN NO. 9 (DUAL)

This Lesson Plan differs from Lesson Plan No. 8 in that advanced proficiency is expected of the student. Runway changes, loss of communication procedures and bounce recovery techniques should be covered. Upon completion of this Lesson Plan, the student should be ready for the first solo check-flight.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Take-offs, circuits and landings			*		
Side-slipping			*		
Loss of communication procedures		*			
Runway change procedures		*			
Bounce recovery				*	
Missed approach		*			

- 3. Post-flight debriefing**
- Question the student and clarify any problems which may have arisen
 - Assign study material for next lesson
- Preview of next lesson**
- First solo competency check

LESSON PLAN NO. 10 (DUAL)

At the completion of this Lesson Plan, the student should display sufficient competency to warrant being sent on the first solo flight. Before authorizing the first solo, the instructor should determine that the student understands the actions that must be followed for runway changes, loss of communication, traffic spacing, overshoot procedures, wake turbulence avoidance, etc., as the student must now make all the decisions.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Take-offs, circuits and landings			*		
Pre-solo contingencies			*		

- 3. Post-flight debriefing**
- Brief student for the first solo flight.

LESSON PLAN NO. 11 (SOLO)

Upon being suitably briefed, the student should be authorized for the first solo flight. As this is a memorable occasion, pre-flight discussion should be kept brief, but adequate.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What you are expected to do. Safety considerations”.					
2. Air Exercises First solo flight					*
3. Post-flight debriefing <ul style="list-style-type: none"> • Congratulate student and clarify any problems which may have arisen 					
Preview of next lesson <ul style="list-style-type: none"> • Take-off, circuit and landing practice 					

LESSON PLAN NO. 12 (DUAL)

This Lesson Plan will normally be followed immediately by Lesson Plan No. 13, solo take-offs, circuits and landings. The instructor should determine that the student is competent to handle the aircraft under current and anticipated traffic and weather conditions before authorizing additional solo circuits. Lesson Plan No. 12 should be repeated as often as necessary until the student is competent to be sent out for solo circuits without a check-flight. Precision point landings should be emphasized and a familiarization demonstration of minimum run take-offs and short and soft field landings should be given during one of the circuit progress checks.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction Solo circuits competency check				*	
Precision point landings				*	
Minimum run take-offs	*				
Short and soft field landings	*				
3. Post-flight debriefing <ul style="list-style-type: none"> • Brief the student on upcoming solo circuit practice 					

LESSON PLAN NO. 13 (SOLO)

This Lesson Plan should be repeated as often as necessary until the student accumulates sufficient take-off, circuit and landing experience to warrant moving on to the more advanced exercises, or take-offs and landings requiring a higher degree of skill than into-wind take-offs and landings. These solo practice flights should be alternated with dual competency progress checks as required. Continuing progress towards greater competency should be emphasized by the supervising instructor.

1. Pre-flight briefing Clarify with the student: — “What is to be done. What to do if problems develop. Safety considerations”.	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
2. Air Exercise practice Take-off, circuits and landings					*
3. Post-flight debriefing <ul style="list-style-type: none"> • Question the student and clarify any problems encountered 					

LESSON PLAN NO. 14 (DUAL)

Due to the possibility of confusion of techniques, it is not recommended that this Lesson Plan and Lesson Plan No. 16 be combined. Advancement to Lesson Plan No. 15 can be made when, under existing conditions, the student demonstrates ability to safely fly the aircraft at the airspeeds required in the exercise.

1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
2. Air Instruction Minimum run take-offs (a) short field (b) obstacle clearance Short field landings (a) no obstacle (b) obstacle clearance		*			
3. Post-flight debriefing <ul style="list-style-type: none"> • Brief student on upcoming solo practice of these exercises 		*			

LESSON PLAN NO. 15 (SOLO)

After sufficient dual instruction on Lesson Plan No. 14 the student may be authorized for solo practice.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What you are expected to do. Safety considerations”.					
2. Air Exercise					
Minimum run take-offs					
(a) short field					*
(b) obstacle clearance					*
Short field landings					
(a) no obstacle					*
(b) obstacle clearance					*
3. Post-flight debriefing <ul style="list-style-type: none"> • Question the student and clarify any problems which may have arisen • Assign study material for next lesson 					
Preview of next lesson					

LESSON PLAN NO. 16 (DUAL)

To avoid confusion of techniques, it is not recommended that this Lesson Plan and Lesson Plan No. 14 be combined. Advancement to solo practice in Lesson Plan No. 17 may be made when, under existing conditions, the student demonstrates ability to safely fly the aircraft at the airspeeds required in this exercise.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Minimum run take-offs					
(a) soft/rough field — no obstacle		*			
(b) soft/rough field — obstacle clearance		*			
Soft/rough field landings					
(a) no obstacle		*			
(b) obstacle clearance		*			
3. Post-flight debriefing <ul style="list-style-type: none"> • Brief student on upcoming solo practice of these exercises 					

LESSON PLAN NO. 17 (SOLO)

After sufficient dual instruction on Lesson Plan No. 16 the student may authorized for solo practice.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What you are expected to do. Safety considerations”.					
2. Air Exercise Minimum run take-offs (a) soft/rough field — no obstacle					*
(b) soft/rough field — obstacle clearance					*
Soft/rough field landings (a) no obstacle					*
(b) obstacle clearance					*
3. Post-flight debriefing					
<ul style="list-style-type: none"> • Question the student and clarify any problems which may have arisen 					
Preview of next lesson					
<ul style="list-style-type: none"> • Cross-wind take-offs and landings 					

LESSON PLAN NO. 18 (DUAL)

During the student's pre-solo circuit training, there will normally be an opportunity to introduce this Lesson Plan in conjunction with others, such as Lesson Plan No. 9. When conditions permit, cross-wind take-offs and landings should be taught and authorized for solo practice when a continuing degree of competency is demonstrated by the student. Safety aspects relating to using runways other than those being used by other traffic landing into wind (if applicable) should be stressed. In future dual exercises, this Lesson Plan may be included with other Lesson Plans.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction Cross-wind take-offs and landings		*			
3. Post-flight debriefing					
<ul style="list-style-type: none"> • Brief the student on upcoming solo practice 					

LESSON PLAN NO. 19 (SOLO)

This Lesson Plan should normally follow Lesson Plan No. 18 which provides for dual instruction on cross-wind take-offs and landings to a level of competency where solo practise of the exercise may be authorized. Whenever conditions permit in the future, cross-wind take-offs and landings should be added to other Lesson Plans.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What you are expected to do. Safety considerations”.					
2. Air Exercise Cross-wind take-offs and landings					*
3. Post-flight debriefing <ul style="list-style-type: none"> • Question the student and clarify any problems which may have arisen 					
Preview of next lesson <ul style="list-style-type: none"> • Exercise review for solo practice 					

LESSON PLAN NO. 20 (DUAL)

This Lesson Plan provides for refamiliarization of the local practice areas and a review of pre-solo flight manoeuvres in preparation for local solo practice flights. Navigation practice of heading calculation, ETA's and map reading should be incorporated into the flight to and from and while in the practice area. At the completion of the Lesson Plan, the student should display a level of competency to warrant authorization for local solo and practice flights in assigned practice areas.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Minimum run take-offs			*		
Navigation: Headings and ETA to practice area			*		
Review of pre-solo exercises: Level Flight: At various airspeeds				*	
Climbs: Normal, best rate, best angle				*	
Descents: With and without power; obstacle clearance techniques				*	
Turns: Gentle, medium, steep				*	
Range, endurance, slow flight, stalls				*	
Spin entry and recoveries				*	
Spiral dive recoveries				*	
Map reading and orientation			*		
Forced landings		*			
Navigation: Headings and ETA's			*		
Circuit joining			*		
Short field landing			*		

- 3. Post-flight debriefing**
- Brief the student for the upcoming solo practice of these exercises

LESSON PLAN NO. 21 (SOLO)

This Lesson Plan may be repeated as necessary, according to the needs of the student. All the exercises covered in Lesson Plan No. 20 should be authorized as applicable, and the student should be encouraged to strive for accuracy and co-ordination. As this is the first solo flight away from home base, flight safety, adequate look-out and weather conditions which would dictate an early return to base (if applicable) should be discussed. Map reading practise should be encouraged as a diversion from routine exercise practice. At the completion of this Lesson Plan, the student should have confidence and a sense of ease in flight which will instill receptiveness to new areas of instruction.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What you are expected to do. Safety considerations”.					
2. Air Exercises					
Minimum run take-off					*
Navigation: Map reading to practice area					*
Review of exercises: Level flight: At various airspeeds					*
Climbs: Normal, best rate, best angle					*
Descents: With and without power, and obstacle clearance					*
Turns: Gentle, medium, steep					*
Slow flight, stalls					*
**Incipient spin recovery					*
Map reading and orientation					*
Circuit joining					*
Soft field landing					*

- 3. Post-flight debriefing**
- Question the student and clarify any problems which may have arisen
- Preview of next lesson**
- Review and advanced dual on previous exercises
 - Forced landings

***Reference GAAC 2004-02*

LESSON PLAN NO. 22 (DUAL)

With cross-country flight training approaching, this lesson prepares the student to deal with possible emergencies which may be encountered on such a flight. Advanced dual on previous exercises such as slow flight, stalls off a steep climbing turn, etc. should be covered and practised. Simple forced landings may be introduced to lead up to Lesson Plan No. 24. The requirements of the Flight Test Standards should be consulted for the purpose of setting final goals on this and subsequent flights.

1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
2. Air Instruction					
Minimum run take-off			*		
Navigation: Headings and ETA to practice area			*		
Slow flight — advanced manoeuvres		*			
Stalls from critical flight situations		*			
Steep turns			*		
Spins from practical causes		*			
Spiral dive recovery			*		
Forced landings		*			
Illusions created by drift (if applicable)	*				
Precautionary landings	*				
Navigation: Map reading divert to home base			*		
Soft field landing			*		

- 3. Post-flight debriefing**
- Question the student on essential points of exercises to be practised solo next flight.

LESSON PLAN NO. 23 (SOLO)

This Lesson Plan is a logical progression from Lesson Plans 21 and 22 where increasing accuracy and co-ordination should be the objective.

The student's own copy of the Private Pilot Flight Test Standards should be issued, and the limits therein should be marked and assigned as goals in solo practice.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What you are expected to do. Safety considerations”.					
2. Air Exercises					
Short or soft field take-off					*
Navigation: Map reading to practice area					*
Review of exercises: Steep turns					*
Range and endurance					*
Slow flight and stalls					*
**Incipient spin and spiral dive — recoveries					*
Side-slipping and slipping turns at altitude					*
Navigation: Map reading to home base					*
Soft field landing					*

- 3. Post-flight debriefing**
- Question the student and clarify any problems which may have arisen
 - Assign study material for next lesson
- Preview of next lesson**
- Precautionary landings

***Reference GAAC 2004-02*

LESSON PLAN NO. 24 (DUAL)

This Lesson Plan will be much more meaningful if approved landing areas are available to permit actual touch-down landings which will contribute greatly to the "for real" atmosphere which is needed. However, the student should be given ample opportunity to practise, under supervision, selecting and flying approaches to other acceptable fields. On return to base, the use of DF steers and emergency radar assistance should be demonstrated if such services are available. This may also be simulated by the instructor acting as controller.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What we are going to do. How we are going to do it. Safety considerations”.					
2. Air Instruction					
Minimum run/cross-wind take-off			*		
Navigation: Map reading and ETA to training area			*		
Steep turns				*	
Forced landings			*		
Illusions created by drift		*			
Precautionary landing		*			
DF Steer and radar assistance		*			
Short/soft/cross-wind landing			*		

- 3. Post-flight debriefing**
- Brief the student for the upcoming solo practice of these exercises

LESSON PLAN NO. 25 (SOLO)

This Lesson Plan provides for the reinforcement of the exercises to which the student must have adequate exposure prior to attempting a solo cross-country flight. Performance of steep turns within flight test limits should also be a goal. The minimum descent height for forced or precautionary landing overshoot should be established and understood clearly by the student. At completion of this Lesson Plan, the student should be competent to cope with most navigational and weather emergencies which may be encountered on solo cross-country flights.

NOTE: Authorization for solo precautionary landing practice is subject to school policy.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Clarify with the student: — “What you are expected to do. Safety considerations”.					
2. Air Exercises					
Minimum run cross-wind take-off					*
Navigation: heading and altitude control					*
Steep turns					*
Forced landing approaches					*
Precautionary landings					*
Navigation: Heading and altitude control					*
Short/soft/cross-wind landing					*
3. Post-flight debriefing <ul style="list-style-type: none"> • Question the student and clarify any problems which may have arisen • Assign study material for next lesson plan 					
Preview of next lesson <ul style="list-style-type: none"> • Dual cross-country flight 					

LESSON PLAN NO. 26 (DUAL)

This is a cross-country flight over a triangular track requiring approximately 2-3 hours of flight time, using pilotage, dead reckoning, and radio navigation aids where applicable. At the completion of this lesson, the student should be prepared for solo VFR navigation over unfamiliar terrain, and have the ability to cope with common cross-country situations.

1. Pre-flight briefing Flight planning and preparation	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
2. Air Instruction					
Practical weight and balance			*		
VFR Navigation:		*			
Pilotage		*			
Dead reckoning		*			
Use of radio aids	*				
Lost procedures		*			
Simulated inadvertent encounter with adverse weather conditions (Divert)		*			
Unfamiliar airport procedures		*			
Use of radio for en route communications		*			
Cross-country emergencies		*			

- 3. Post-flight debriefing**
- Carefully cover all aspects of the flight, clarifying vague points as necessary
- Preview of next lesson**
- Solo cross-country flight
 - Assignment
 - Prepare materials
 - Prepare navigation log
 - Prepare flight log

LESSON PLAN NO. 27 (SOLO)

This Lesson Plan should be structured to meet the private pilot licensing requirement of a triangular flight of at least 120 nautical miles for 2 landings at airports other than the point of departure. At the completion of this Lesson Plan, students should be competent to make VFR cross-country flights on their own responsibility.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Instructor's approval of flight log and weather analysis					
2. Air Exercises					
Filing and closing of flight plans					*
VFR Navigation					*
En route radio communications					*
Unfamiliar airport procedures					*
Supervision of aircraft servicing					*
3. Post-flight debriefing					
Preview of next lesson					

- Discuss and clarify any unanticipated incidents
- Review of flight manoeuvres
- Emphasis of precision on all manoeuvres

LESSON PLAN NO. 28 (DUAL)

This Lesson Plan consists of the instructor's first evaluation of the student's performance during a simulated complete private pilot flight test. Any deficiencies should be carefully noted for discussion at the end of the lesson and correction in the next lesson.

	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
1. Pre-flight briefing Review as required.					
2. Air Exercises					
Private pilot flight test items				*	
3. Post-flight debriefing					
Preview of next lesson					

- A thorough review of any deficiencies and a full explanation of the appropriate corrections
- Solo practice on deficiencies

LESSON PLAN NO. 29 (SOLO)

All exercises other than cross-country flight as required for the private pilot flight test should be practised on this flight, with emphasis being given to known deficiencies. This Lesson Plan may be repeated in whole or in part after Lesson Plan No. 30 has been completed.

1. Pre-flight briefing Clarify with the student: — “What you are expected to do. Safety considerations”.	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
2. Air Exercises All exercises authorized by the instructor					*

- 3. Post-flight discussion**
- Carefully discuss each exercise and determine that the student has a full understanding of flight test limitations and requirements. Clarify any problem areas.
- Preview of next lesson**
- Flight instructor’s check for recommendation of the student for the private pilot flight test

LESSON PLAN NO. 30 (DUAL)

This Lesson Plan consists of the private pilot flight test conducted by the instructor exactly as such tests are conducted by Inspectors or Designated Flight Test Examiners. The student should be able to perform all required private pilot flight test procedures and manoeuvres in an acceptable manner in accordance with the Flight Test Standards, Private and Commercial Pilot Licences — Aeroplane (TP2655E).

1. Pre-flight briefing Phase I of the private pilot flight test	FAMILIARIZATION DEMONSTRATION	DEMONSTRATION & PRACTICE	SUPERVISED PRACTICE	REVIEW	SOLO PRACTICE
2. Air Exercises Private pilot flight test				*	

- 3. Post-flight discussion**
- Critique of overall performance
- Preview of next lesson**
- Private pilot flight test

NOTE: Before signing a flight test recommendation, it is the flight instructor’s responsibility to determine that the student meets all of the flight experience requirements for a private pilot licence.

LESSON PLAN NO. 31 (DUAL)

Flight Test for Private Pilot Licence

Prior to the start of the private pilot flight test, the student should be put at ease as much as possible. Following the test, it is the responsibility of the flight instructor to be present during the debriefing to assist the student and receive any comments from the Examiner.

Typical Questions

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PART IV

TYPICAL QUESTIONS

Prior to commencing and after completing any preparatory ground instruction, dual instructional flight, or when briefing a student prior to authorizing solo practice, it is essential that the instructor determines that the student has sufficient understanding of the objective and procedure to be used in the exercise to allow productive instruction or practice to be achieved. This may be determined by questioning the student on the essential elements of the exercise and by establishing the degree of retention of any related exercise already covered .

This is particularly important in the pre-solo stages where the work covered is so closely linked that, in many instances, it is impossible to introduce new work if the student has not absorbed the previous lesson. In many cases, constant repetition is desirable in the pre-solo stage. The student is receiving not only flight line instruction, but academic instruction as well, and can easily forget what has been taught in a previous lesson. The extent to which previous lessons are reviewed is a result of the student's response to questions. The following suggestions may help an instructor in planning these questions:

- (a) Each question should be either thought-provoking or should require a quick, factual answer. Questions requiring a "yes" or "no" answer prove very little. Questions on "nice to know" but non-essential information should be avoided.

It is more effective to guide the student's thoughts towards the area to be questioned, then ask the question. In this way the student can visualize the situation and then think about the answer to the specific question. In many cases, a follow up "how" and "why" question really gets the student involved. *Generally speaking, knowing that something happens is not as important as understanding why it happens.*

- (b) The student must understand the question. Terms which are familiar must be used. The situation and conditions should be clear so that the student knows exactly what type of answer is required. Using the exact wording of the written references is not advisable.
- (c) Each question should centre on one idea only. An instructor can solicit an answer to a question on a complex procedure by skillfully injecting "who — what — when — where — why". The answers given may be an indication that the previous instruction was not as well absorbed as the instructor believed.
- (d) Tricky or irrelevant questions must be avoided. An instructor should ensure that they are challenging, and that the student has had all the material for the questions asked.

The student's answers to questions will determine the next step. If the student has proved to the instructor's satisfaction that the previous instruction is understood, the lesson may continue as planned. Should the student give wrong answers, but, in the main, knows most of the previous work, then the instructor must stop and correct any misconceptions the student may have before proceeding with the lesson. Should the student show lack of comprehension during this review, there is little to be gained from proceeding with a planned lesson, and the instructor must consider changing the lesson into a complete review. Meaningful instruction and learning is much less likely to take place if an instructor attempts any form of instruction before the student has sufficient grasp of preceding relevant lessons.

Typical questions which may be used by the instructor, *or used as a basis for developing questions*, to suit individual students follow.

Ex. 1 Familiarization

Ex. 2 Aircraft Familiarization and Preparation for Flight

These two exercises are basically "demonstration" type exercises, and caution should be exercised to ensure that the apparent complexity of what the student sees on the first flights be not turned into a discouraging experience by expecting the student to answer anything but very elementary questions at this stage.

Ex.3 Ancillary Controls

- (1) When carburettor heat is applied:
 - (a) What will be the effect on the tachometer reading?
 - (b) Why does this effect occur?
 - (c) What change can you expect in the sound of the engine?
- (2) Within what range of outside air temperature can carburettor ice form, if the proper conditions exist?
- (3) During practice exercises, what is the position for the mixture control?
- (4) What is the purpose of the external line check on the aircraft?

Ex. 4 Taxiing

- (1) When taxiing in strong winds, the flight controls should be held in certain positions. Describe the positions for a wind coming from:
 - (a) Rear right;
 - (b) Front left.
- (2) Why must the controls be held in these positions?
- (3) To demonstrate good airmanship, what precautions must be observed *before* commencing an engine run-up?

Ex. 5 Attitudes and Movements

- (1) When at cruise RPM, what indicated airspeed can we expect in the aircraft we are going to use on this flight?
- (2) When placing the aircraft in a banked attitude, what movements do we use?
- (3) If during a substantial power change, an aircraft is allowed to yaw, a roll may result.
 - (a) Why?
 - (b) How is yaw prevented?

Ex. 6 Straight and Level Flight

- (1) When reducing power in level flight, what control movements will be necessary to maintain straight and level flight?
- (2) We must keep the wings level in order to fly straight. Why?
- (3) Learning to fly at a constant altitude and airspeed has many practical applications. Can you give an example when level flight at a reduced speed may be used?
- (4) The aircraft must be held in straight, unaccelerated flight when setting the heading indicator. Why?

Ex. 7 Climbing

- (1) There are various fixed speeds for the various applications of climbing. Can you give the speed you will use for:
 - (a) Normal climb?
 - (b) Best rate of climb?
 - (c) Best angle of climb?
- (2) We use best angle of climb to clear an obstacle during a short field obstacle clearance take-off. Why would we not use best rate of climb?
- (3) During a climb in this aircraft, we use right rudder pressure to keep straight. What makes this necessary?
- (4) When returning to straight and level flight from a climb, we initially continue to use climb power setting. Why is this procedure followed?

Ex. 8 Descending

- (1) If, when descending at a constant airspeed we extend the flaps, the rate of descent increases. Why?
- (2) The Pilot Operating Handbook is used to obtain the final approach speed during an obstacle approach. What *indicated* airspeed will we use while descending in the aircraft you are using for your flight training?
- (3) During a power-off descent, we must periodically increase the power to near full power. What is the purpose of this?
- (4) During a power-off descent into a direct head wind, we can increase the range by increasing the speed. Why does this happen?

Ex. 9 Turns

- (1) When carrying out an effective look-out prior to a turn, we must scan the look-out area in sectors, rather than a sweeping scan from one side to the other. Why?
- (2) As we roll into, or recover from a turn, rudder control is used. What is the reason for this?
- (3) Power must be added to maintain a selected entry speed during a constant altitude steep turn. Why is additional power necessary?
- (4) During a steep power-off descending turn, if the nose is allowed to sink below an acceptable level, the speed builds up rapidly. Why must corrective action be taken immediately?

Ex. 10 Flight for Range and Endurance

- (1) What effect will increased weight have on endurance flying?
- (2) Why?
- (3) What effect does wind have on endurance flying?
- (4) Why?
- (5) At what altitude is best endurance obtained?
- (6) What effect does wind have on flying for range? Explain.

Ex. 11 Slow Flight

- (1) Situation: You are set up in the slow flight configuration, maintaining your heading and altitude.
Question: What action must you take to maintain altitude, if you notice airspeed is decreasing?
- (2) When the aircraft is set up for slow flight, a higher power setting is required than for endurance. Why?
- (3) When changing from the slow flight configuration back to normal cruise, why is it mandatory to apply necessary power and check that your airspeed is above the 0° flap stall speed before raising the flaps?
- (4) Why is it recommended that you raise your flaps in stages?
- (5) Situation: You are practising slow flight with 20° of flap and you inadvertently stall the aircraft.
Question: At what point in the stall recovery would you raise the flaps?
- (6) When slow flying, why should you be particularly alert when checking engine temperatures and pressures?

Ex. 12 Stalls

- (1) Describe how you would recover from a stall. ("How — what — when — where — why" questions.)
- (2) When recovering from a stall during which a roll has developed, why must you not use only aileron to recover?
- (3) When performing a power-on stall, why is the indicated stalling airspeed lower than for a power-off stall?
- (4) When setting up for a stall entry, why is it necessary to maintain the wings level and the ball centred?
- (5) During recovery from a stall, to what attitude should the nose be raised and maintained to stop the rate of descent as soon as possible?
- (6) During recovery from a high speed dive, it is possible to induce a stall during recovery, even if the aircraft is in normal cruise attitude. Why is this possible?

Ex. 13 Incipient Spins and Full Spins

- (1) Describe how you would recover from an incipient spin. ("How — what — when — where — why" questions.)
- (2) At the point of a stall, a yaw is allowed to develop. Recovery is made by simultaneously preventing further yaw, lowering the nose and applying power as necessary. Why is it important to prevent further yaw?
- (3) Except where the Pilot Operating Handbook dictates otherwise, the action to recover from a spin is "full opposite rudder, elevator control forward until the spin stops, centralize the rudder, and ease out of the dive". Why is it important to move the elevator control progressively forward until spinning stops?
- (4) When an aircraft is entering a full spin, the down going wing cannot be raised by the use of aileron alone. Why?

Ex. 14 Spiral Dives

- (1) Describe how you would recover from a spiral dive. ("How — what — when — where — why" questions.)
- (2) During a spiral dive, it is imperative that an immediate recovery be made. Why?
- (3) A spiral dive differs from a spin because the speed builds up rapidly; while in a spin, the speed is not increasing. Why?

Ex. 15 Side-slipping

- (1) Situation: An aircraft is being side-slipped in an excessively nose-up attitude. Why may the aircraft be expected to stall, if the nose is not lowered during the recovery?
- (2) During a side-slip at an excessively steep angle of bank, it may not be possible to control yaw. Why?

Ex. 16 Take-off

- (1) Describe the steps to be followed on:
 - (a) A cross-wind take-off.
 - (b) A soft field take-off.
 - (c) A short field take-off. ("How — what — when — where — why" questions).
- (2) During a soft field take-off, once the aircraft is airborne, it must be levelled off as soon as possible at a safe altitude. What is the reason for this?
- (3) What effect will high ambient temperatures have on the take-off distance of an aircraft?
- (4) Why?
- (5) As soon as the aircraft is safely clear of the ground on a cross-wind take-off, the nose must be turned slightly in the direction of the wind. What is the purpose of the turn?
- (6) When turning "into the wind" on a cross-wind take-off, why is it important to do a balanced turn?
- (7) During a take-off following the landing of a large aircraft, the lift-off of a light aircraft is delayed until after passing the point where the large aircraft touched down. Why?
- (8) During a take-off from a rough field, we use the same basic technique as for a soft field take-off. Why?

- (9) Describe why care must be exercised when taking off following the take-off of a large aircraft. ("How — what — when — where — why" questions.)
- (10) If excessive forward elevator pressure is exerted in a nose wheel equipped aircraft during a cross-wind take-off, the aircraft may suddenly take an uncontrollable change in direction toward the side of the runway. What would cause it to do this?

Ex. 17 The Circuit

- (1) While flying the downwind leg of the circuit, the tower clears you to land. Is it mandatory for you to land on completing the circuit?
- (2) When joining the downwind leg of the circuit from the upwind side, you are required to cross the active runway at approximate mid-point at circuit height. Why must you be at circuit height?

Ex. 18 The Approach and Landing

- (1) During a cross-wind landing in a light aircraft, the into-wind wing is lowered. Why?
- (2) When there is a strong cross-wind across a landing runway, we must consult the "cross-wind limitations" chart before electing to use that runway. Why?
- (3) When excessive forward elevator pressure is exerted during touchdown in a nose wheel equipped aircraft in cross-wind conditions, "wheelbarrowing" may result. How can we prevent the possibility of wheelbarrowing?
- (4) What is likely to result from wheelbarrowing?
- (5) During an approach over an obstacle into a short field, good airmanship requires that the power not be reduced fully until after the landing flare. Why?
- (6) It is essential to monitor the airspeed during an obstacle approach. Why?

Ex. 19 The First Solo

- (1) Questions as applicable to the existing conditions.

Ex. 20 Illusions Created by Drift

- (1) During a turn from into-wind to downwind during flight at low level in high wind conditions, a dangerous illusion may affect your flying.
 - (a) What is that illusion?
 - (b) Why is it dangerous?
- (2) When flying downwind at low level in a strong wind:
 - (a) What illusion may be experienced?
 - (b) Name a condition where this could be dangerous?
- (3) When turning from downwind to into-wind, the actual path of flight will not necessarily follow the still air flight path. Why?

Ex. 21 Precautionary Landing

- (1) During the inspection of a selected landing area for a precautionary landing, the surface conditions, wind speed, obstacles, etc., are all taken into account. During this inspection run:
 - (a) What is the minimum airspeed we should use?
 - (b) What height above ground will we fly?
 - (c) Why is it important to monitor airspeeds while manoeuvring close to the ground?
 - (d) What size circuit should we fly under good visibility conditions?
- (2) We have discussed the use of precautionary landings under emergency conditions. What other practical use does this manoeuvre have?

Ex. 22 Forced Landings

- (1) In the event of engine failure, why is the power-loss check normally completed before a pilot makes a "Mayday" distress call?
- (2) During a forced landing approach, why must a pilot be *absolutely* certain that the point of intended touchdown will be reached, before electing to lower flaps?
- (3) Why is it so important to maintain the ideal glide speed during a forced approach?
- (4) During a forced approach, it is recommended that you not exceed gentle to medium bank turns. What actions must you take with regard to the pitch attitude if you increase your bank to a steep angle?
- (5) Why?

Ex. 23 Pilot Navigation

- (1) Canadian Aviation Regulations (CARs) indicate: The pilot-in-command of an aircraft shall, before commencing a flight, be familiar with the available information that is appropriate to the intended flight. With respect to a cross-country flight, how would you meet this requirement?
- (2) The use of 10° drift lines permits you to regain track in a prescribed manner when there is drift other than that allowed for in your pre-flight calculations. Why is accurate heading control necessary when using the "10° drift method"?
- (3) Ground speed checks are essential during cross-country flight. What are the problems associated with attempting to obtain a ground speed check within a few minutes after setting heading?
- (4) Using the Double Track Error method, a reasonable distance should be covered before the actual drift error is determined and corrected. Why is this necessary?
- (5) Assuming you were planning to use your VOR receiver to locate yourself in relationship to a VOR station, a "FROM" reading on the Omni Bearing Selector is necessary to determine the radial you are on. If you were to fly that radial "TO" the station what steps must you take to determine and fly the correct magnetic track?

Ex. 24 Instrument Flying

- (1) Instruments which indicate pitch in one manner or another are the attitude indicator, the airspeed indicator, the sensitive pressure altimeter and the vertical speed indicator. In straight flight, if there is a sudden change of attitude, which instrument will indicate this change first?
- (2) Why do the other instruments not indicate the attitude change immediately?
- (3) It is imperative that when outside visual reference is lost, the body sensations be ignored and complete trust placed in the instruments. Other than "the seat of the pants" sensations, which organs are most likely to produce these false body sensations?
- (4) It is necessary to synchronize the heading indicator with the magnetic compass at least every fifteen minutes. Why?

Ex. 25 Night Flying

- (1) During a night take-off, a positive climb is imperative after lift-off. The vertical speed indicator will confirm that there is, in fact, a definite climb taking place. Why can we not rely entirely on the attitude indicator during this period of the take-off climb?
- (2) During the "hold-off" prior to a touchdown when landing at night, power is used to reduce the flight path angle with the landing surface. What outside reference can be used to determine the approximate height above the landing surface?
- (3) If cloud is encountered at night while VFR, a 180° turn is necessary to regain visual contact. What rate turn should be used during this turn?

Ex 29 Emergency Procedures

- (1) What countermeasures can a pilot use to reduce the likelihood of an emergency?
- (2) What is the best technique for remembering the correct emergency procedure?
- (3) Why is it important to advise ATC when you are dealing with an emergency?

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**INSTRUCTOR'S TRAINING RECORD
WHILE UNDER DIRECT SUPERVISION**

Name: _____ 5802 - _____

Address: _____

Telephone Number: _____ Licence Number: _____

Instructor Rating Held: Aircraft Category _____ Class _____

I have conducted 50% or more of the last 10 hours of the dual flight instruction for the following applicants, each of whom, upon my recommendation, demonstrated the required standard of skill and knowledge for first solo flight and for the flight test for issue of a licence.

Section 1 FIRST SOLO FLIGHT - DAY VFR

Date	Students Name and Licence/Permit Number	Name of School or Club	Supervising Instructor's Signature & Licence Number
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____

**Section 2 STUDENTS RECOMMENDED TO UNDERTAKE THE FLIGHT TEST FOR
ISSUE OF A LICENCE**

Date	Students Name and Licence/Permit Number	Name of School or Club	Supervising Instructor's Signature & Licence Number
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____

This record is in support of my application for the issue of a Class 3 Instructor Rating -
_____ Category.
(aeroplane, helicopter, etc.)

Signature of Applicant _____ Date: _____

This is to certify that _____ has conducted 100:00 hours dual
flight instruction and it is recommended that a Class 3 _____ Flight
Instructor Rating be issued. (aeroplane/helicopter)

Name: _____ Licence no: _____ Date: _____

Checked and Recommended Issue
Date: _____ For RMAL: _____