FOR HELICOPTER FLIGHT INSTRUCTORS

TRAINING MANUAL

HELICOPTER FLIGHT INSTRUCTOR MANUAL

ISSUE 1:JUNE 2015

EHEST
Component of ESSI

European Helicopter Safety Team

FOREWORD

One of the important ingredients for a safe and viable aviation industry is a properly resourced flying training sector.

Some of those resources can be quite fundamental. For example, an important contribution to training is for flying instructors to have available to them a basic guide to elementary flying training.

In response to this need, the European Helicopter Safety Team contacted the Australian Government Civil Aviation Safety Authority (CASA) which was known to have developed a flying instructors' manual based on extensive feedback from the helicopter training industry. CASA has kindly made this manual freely available to the EHEST team for dissemination. Some changes have been incorporated to reflect European terminology and syllabus content.

Readers are encouraged to provide feedback to ensure that any further versions meet industry needs.

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This manual is for general information only.

Where the helicopter manufacturer's flight manual or pilot operating handbook, or similar document describes techniques different from in this manual, the manufacturer's techniques must take precedence.

All EASA Approved Training Organisations (ATO) are required to maintain operations manual, the procedures and techniques as laid out in the ATO's operations manual must take precedence over the techniques referred to in this manual.

You should also refer to current rules and the relevant Aeronautical Information Publication (AIP) for full details of operational requirements.

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EHEST version produced by ODEE Consulting Ltd

Additional contributions from Sloane Helicopters S.L. Bournemouth Helicopters Ltd, Heli Air, Helicentre Aviation Ltd and Vantage Aviation Ltd

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The EASA syllabus for teaching and learning includes at least 125 hours of theoretical knowledge instruction. Of this at least 25 hours are devoted to the Principles and Methods of instruction. Part 1 of this guide covers the laid down syllabus but the individual topics are dealt with in a different order.

The EASA syllabus is set out on pages 301 and 302 of Annex to ED Decision 2011/016/R a copy of which is overleaf. This is cross referenced to the page in this guide

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CONTENT OF THE EASA PART FCL TEACHING AND LEARNING INSTRUCTION (INSTRUCTIONAL TECHNIQUES) SYLLABUS

(b) The learning process:
- (1) motivation;
- (2) perception and understanding;
- (3) memory and its application;
- (4) habits and transfer;
- (5) obstacles to learning;
- (6) incentives to learning;
- (7) learning methods;
- (8) rates of learning.

(c) The teaching process:
- (1) elements of effective teaching;
- (2) planning of instructional activity;
- (3) teaching methods;
- (4) teaching from the 'known' to the 'unknown';
- (5) use of 'lesson plans'.

(d) Training philosophies:
- (1) value of a structured (approved) course of training;
- (2) importance of a planned syllabus;
- (3) integration of theoretical knowledge and flight instruction;

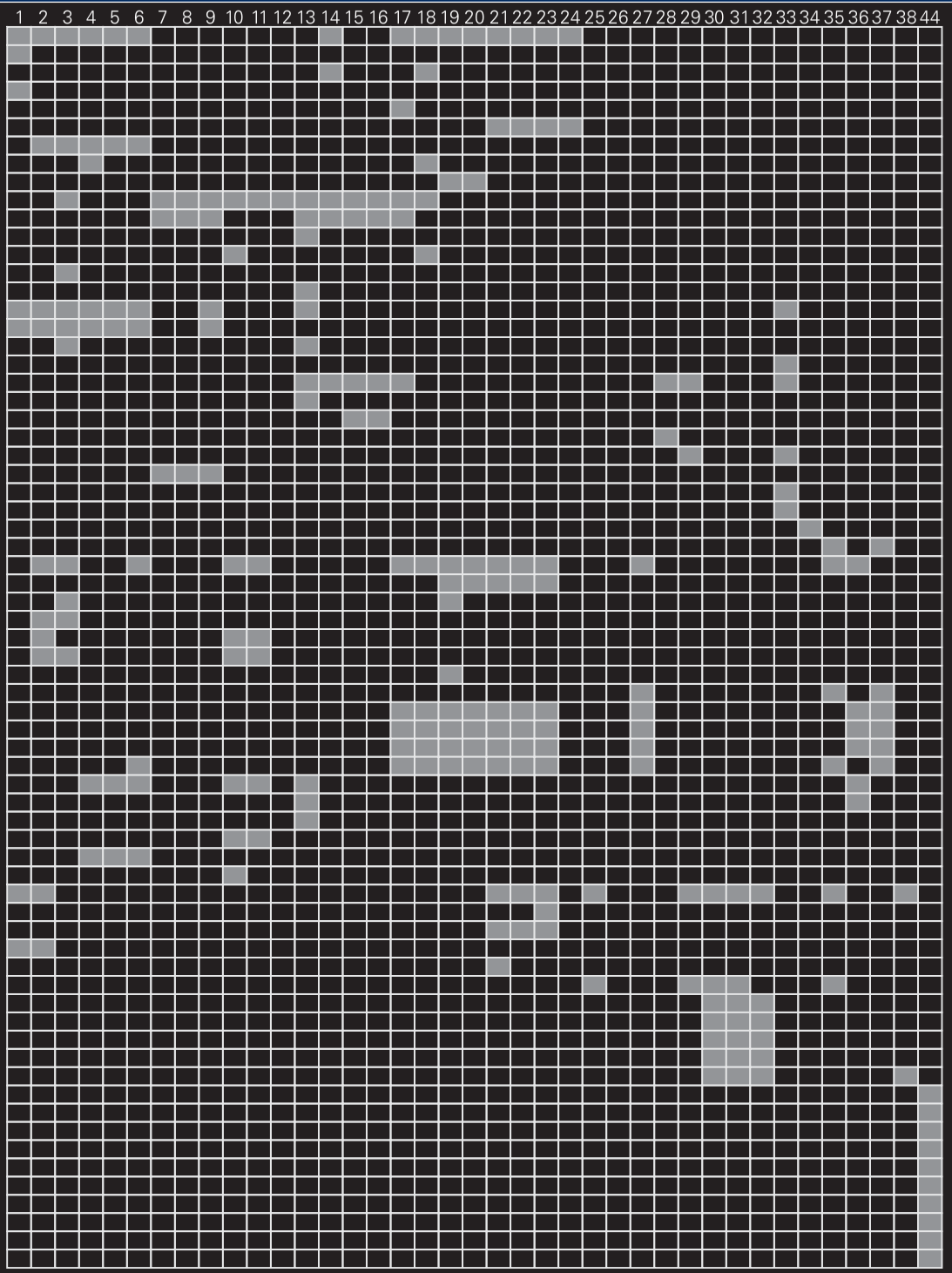
(e) Techniques of applied instruction
- (1) theoretical knowledge: classroom instruction techniques:
  - (i) use of training aids;
  - (ii) group lectures;
  - (iii) individual briefings;
  - (iv) student participation or discussion.
- (2) flight: airborne instruction techniques:
  - (i) the flight or cockpit environment;
  - (ii) techniques of applied instruction;
  - (iii) post-flight and in-flight judgement and decision making.

(f) Student evaluation and testing
- (1) assessment of student performance:
  - (i) the function of progress tests;
  - (ii) recall of knowledge;
  - (iii) translation of knowledge into understanding;
  - (iv) development of understanding into actions;
  - (v) the need to evaluate rate of progress.
- (2) analysis of student errors:
  - (i) establish the reason for errors;
  - (ii) tackle major faults first, minor faults second;
  - (iii) avoidance of over criticism;
  - (iv) the need for clear concise communication.

(g) Training programme development
- (1) lesson planning;
- (2) preparation;
- (3) explanation and demonstration;
- (4) student participation and practice;
- (5) evaluation.

(h) Human performance and limitations relevant to flight instruction
- (1) physiological factors:
  - (i) psychological factors;
  - (ii) human information processing;
  - (iii) behavioural attitudes;
  - (iv) development of judgement and decision making.
- (2) threat and error management.
  - (i) Specific hazards involved in simulating systems failures and malfunctions in the aircraft during flight:
  - (i) importance of 'touch drills';
  - (ii) situational awareness;
  - (iii) adherence to correct procedures.

(j) Training administration:
- (1) flight or theoretical knowledge instruction records;
- (2) pilot's personal flying logbook;
- (3) the flight or ground curriculum;
- (4) study material;
- (5) official forms;
- (6) flight manual or equivalent document (for example owner's manual or pilot's operating handbook);
- (7) flight authorisation papers;
- (8) aircraft documents;
- (9) the private pilot's licence regulations.



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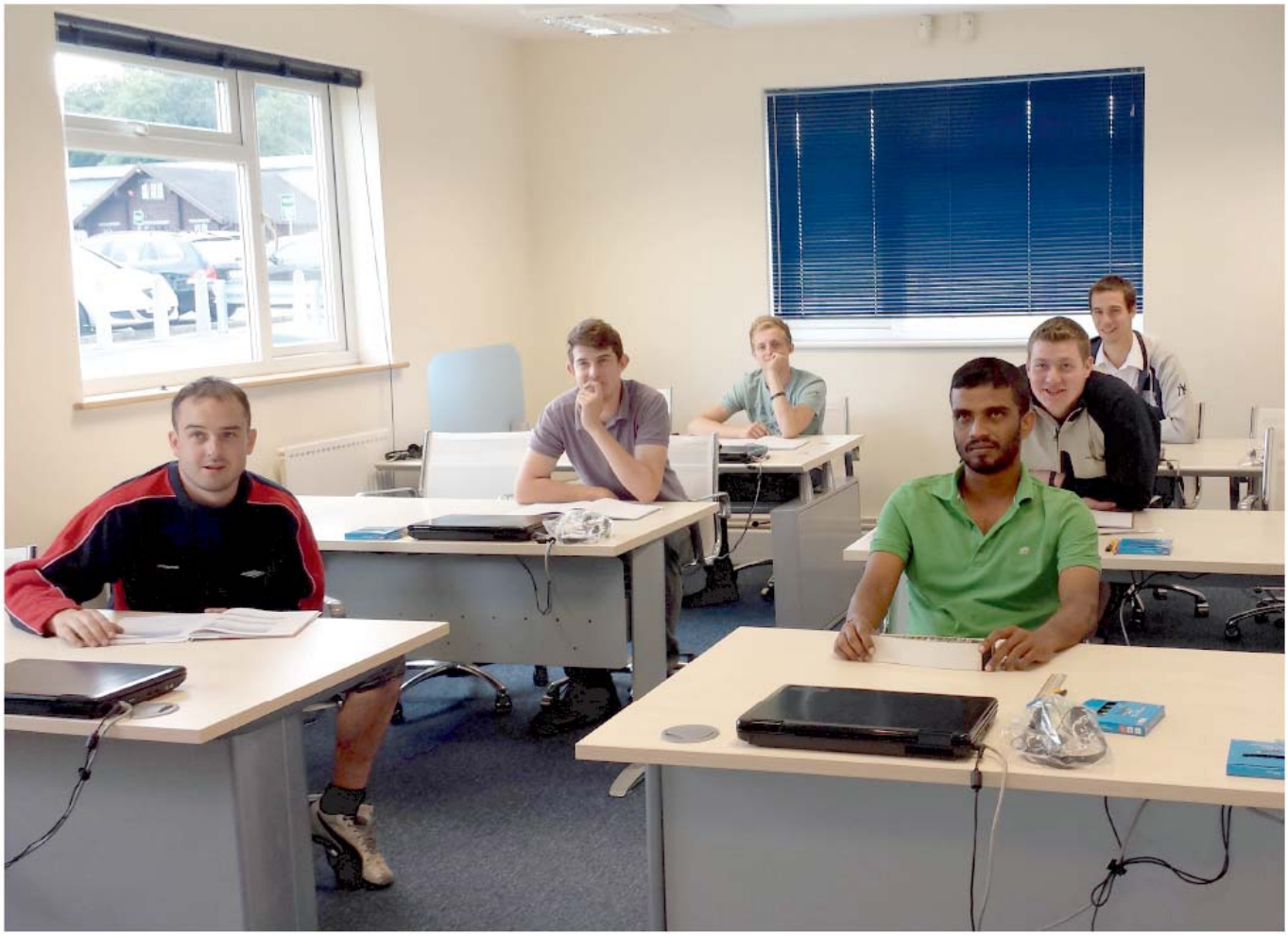
PART 1

PRINCIPLES AND METHODS OF INSTRUCTION

This part outlines and discusses the various methods and techniques that have proved to be effective for use in the flying training environment.



INTRODUCTION

THE TRAINER

What is a trainer?

The Oxford Dictionary of English definition of the word train is: 'to teach a particular skill or type of behaviour through sustained practice and instruction'.

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 the helicopter proficiently and safely.

Part One of this guide describes some basic instructional techniques that apply to:

- Ground school training
- Preparatory ground instruction
- Pre flight briefing
- In flight instruction
- Post flight briefing (debriefing).

By using these techniques you will make learning easier for your students as you help them to meet the required flight test standards.

THE LEARNING PROCESS

No one ever learns except through their own activity, and, strictly speaking, there is 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 proficient, safe pilots.

MOTIVATION

Listed on the next page 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:

READINESS: Ensure students are mentally, physically and emotionally ready to learn.

PRIMACY: Present new knowledge or skills correctly the first time. (Teach it right the first time.)

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

EXERCISE: Ensure students are engaged in meaningful activity.

INTENSITY: Use dramatic, realistic or unexpected things, as they are best remembered.

EFFECT: Ensure students gain a feeling of satisfaction from having taken part in a lesson.

RECENCY: Summarise and practise the important points at the end of each lesson, as the last things learned and practised will be remembered the 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 that offer specific suggestions on what you can do to utilise these 'tools' in your instruction.

READINESS: Ensure students are mentally, physically and emotionally ready to learn.

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.

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, or if personal problems seem insoluble, then the student will be unable to develop the interest to learn.

Here are some suggestions you can follow to arouse interest and make the student ready to learn:

- 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.
- 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.
- 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.
- 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 level out from the climb to a student with an aeroplane pilot licence, you could point out that the sequence of control movements is the same as in an aeroplane. This concept is closely related to the RELATIONSHIP learning factor.
- 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.
- 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 to 48 hours after the material has been learned. 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 FIGS 1 & 2 and the notes below each diagram.

Figure 1: Curve of remembering

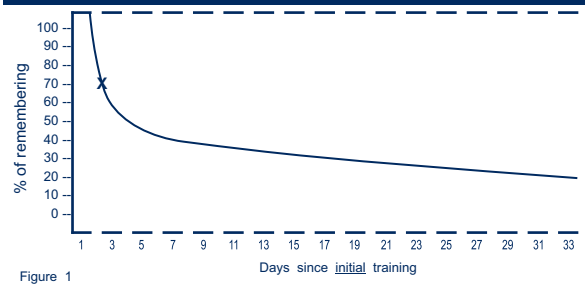


Figure 1

Notes: Statistics are based on an average cross section of students.

The curve is very steep initially: within 2 days students will remember less than 70% of what they learned.

At the end of the month, without reviews, students will remember only approximately 40% of the lesson material.

Figure 2: Curve of remembering

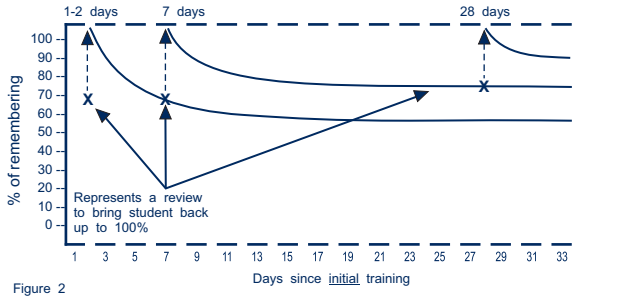


Figure 2

Notes:

- To maintain at least a70%level, a review should be conducted within 2 days.
- After the material is learned a second time the curve flattens out somewhat, but after 7 days the student is back down to the 70% level.
- Another review at 7 days and the curve really flattens. The student will be above 70% retention until approximately day 28.
- A review at this time will generally cause long-lasting retention of lesson material.
- 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

PRIMACY: Present new knowledge or skills correctly the first time. (Teach it right the first time.)

When students are presented with new knowledge or skills, the first impression they receive is almost unshakeable. This means that what you teach must be correct the first time. Students may forget the details of lessons, but they will retain an overall image of the skill or knowledge for a long time. Frequently you will be required to perform manoeuvres in the helicopter 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 Confined Areas, you and your student may be required to land in a Confined area. Any poor example shown at this time would have to be 'unlearned' when the exercise came up in a subsequent lesson.

Suggestions:

- Rehearse lessons to become thoroughly proficient at the skill or in answering questions related to the subject.
- 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.
- 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.
- 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 that you 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.

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

This particular learning factor emphasises 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.

Example: Compare or relate advanced take-offs and landings with normal take-offs and landings; show how a steep approach uses the same techniques.

Suggestions:

- Present lessons in a logical sequence:
  - known to unknown
  - easy to difficult
  - concrete to abstract
  - simple to complex
  - familiar to unfamiliar.
- 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 skills necessary to solve real problems.
- 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.
- Reinforce students' learning of new facts or ideas by frequently summarising the major points of your lesson.
- 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 visualise relationships between the new material and things that have happened before. This is called using 'verbal aids' for your instruction.

EXERCISE: Ensure students are engaged in meaningful activity.

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 towards a specific goal. Oral questions, hypothetical problems, dual review, or solo practice are all methods of providing mental or physical activity.

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. For you as a flight instructor, these two words are probably the most important in your vocabulary. Study Table 1 opposite and note both the instructor and student activities for each level of learning. Should you attempt to employ the application level of learning without having covered the understanding level, students will probably encounter much more difficulty than if they had mastered previous levels.

Suggestions:

- Unless you are 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 their understanding of the new knowledge.
- Once you have told students a fact, avoid repeating yourself. Instead, have them relate the facts back to you. This strengthens their learning and confirms their knowledge of the required material.
- 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.

Table 1: Instructor and student activities for each level of learning

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

- 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 identifly areas in which students have weaknesses, thus allowing you to re teach these subjects to the required standard.

INTENSITY: Use dramatic, realistic or unexpected things, as they are best remembered.

Students learn more from dramatic or exciting experiences than from boring ones. It is a well known fact that a student's 'look out' 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 appropriate opportunities you can to introduce unexpected things to your students.

The INTENSITY learning factor 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.

Suggestions:

- Show enthusiasm and sincerity for the subject you are teaching.
- Attempt to employ a wide range of speech variation in rate, volume and pitch to keep students attentive.
- 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.
- 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.

EFFECT: Ensure that students gain a feeling of satisfaction from having taken part in the lesson.

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 'wingover' type manoeuvre during the first air exercise, 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 emphasise 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 were to make the student feel defeated, then you would probably succeed. It is better to point out the positive aspects of a student's performance first and then discuss the major errors that were committed and finish with suggestions for improvement.

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.

Suggestions:

- Involve students in the lesson by developing some of the new material with them. This can be done by asking students questions related to the subject and allowing students to contribute knowledge and ideas.
- 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 help and correction where needed.
- Show students how to improve, and offer praise when improvement occurs.
- Backup all your statements with reasons. Whenever you tell students something, give the reason behind it. For example, you say to a student, 'This helicopter has two static vents, one on each side of the fuselage.' This is a fact, but if students do not know the reason for the 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 a helicopter with only one vent is encountered more attention may be given to instrument readings while making a cross-wind approach.
- 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. Rather than having 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 causing 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.
- 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.
- 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 pre-flight inspection on a specific helicopter for which you have a component such as a nut placed on the ground under the engine. Your student notices the offending part and brings this to your attention and is praised for this. If a thorough inspection is not completed, you have an excellent teaching point to emphasise why careful inspections must be done.

RECENCY: Summarise and practise the important points at the end of each lesson, as things learned and practised last will be remembered longest.

All things being equal, the things learned last 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.

Suggestions:

- Plan for a pre-flight briefing immediately before the air exercise, and review the main points by questioning. This may sound like the READINESS and EXERCISE learning factors. However, recency deals with the timing of the practice.
- Ensure that students receive a thorough summary of the important points towards the end of each lesson.
- After each sequence within an exercise or class presentation, ask questions on the material or summarise the 'need to know' material.
- Conduct a test as the final part of your lesson.
- At intervals throughout the course, conduct review sessions in which no new material is taught, but reinforcement of previously learned material is obtained.
- Attempt to finish each lesson with a practice 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.

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

ORAL QUESTIONS

GENERAL

When you present a lesson you have many techniques and aids at your disposal. One aid that can be used to stimulate learning and can be effectively applied to satisfy all seven learning factors is oral questioning.

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 thoughts progress, 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

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 to work 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.

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 and thereby arouses interest. You can maintain this interest throughout the lesson by the continuous development of facts and ideas. Remember: Telling is NOT teaching.

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 students' 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.

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 that students are following before you proceed to the next stage. At the end of the lesson, such questions 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 issue mentioned above is not a problem.

DESIRED QUALITIES OF GOOD ORAL QUESTIONS

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.

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.

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.

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.

ABOUT THE 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 time so that these points are emphasised. 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:

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.

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.

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 recognise 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.

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; the instructor may say 'Right' to an incorrect answer. This could lead to student confusion. You should always listen to the answer.

CONFIRM THE CORRECT RESPONSE. Student answers must be evaluated carefully so as to leave no doubt as to what is the correct answer.

HANDLING STUDENT ANSWERS

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

DISCOURAGE GROUP ANSWERS. When students answer as a group it is difficult to determine who supplied correct or incorrect answers. This may lead to student confusion. When you are 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.

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 on 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.

GIVE CREDIT FOR GOOD ANSWERS. This is especially true for the weak or shy student. When you are 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, comment on the degree of correctness and ask a supplemental question or refer the question to another student.

HANDLING STUDENT QUESTIONS

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:

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 minds.

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.

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 then say that it is a question you would prefer to discuss after class.

DO NOT BLUFF. No matter how knowledgeable you are of your subject, there will be times when you will be asked a legitimate question and will not have an answer. If you do not know the answer, say so—don't bluff. Tell the class you will find the answer. Ensure you do, and then inform the individual who asked, as well as the rest of the class.

ENSURE THAT ALL THE CLASS HEARS THE QUESTION. When a question is asked, check that all members of the class have 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.

THE DEMONSTRATION–PERFORMANCE METHOD OF TEACHING

GENERAL

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 helicopters, interpreting blueprints, driving vehicles, welding, building, shooting, repairing, solving problems, filling out forms—all of these, and many more, can be best taught by using the demonstration–performance method.

The demonstration–performance method can be broken down into five basic procedures:

- explanation
- demonstration
- student performance
- instructor supervision
- evaluation.

EXPLANATION AND DEMONSTRATION

The explanation and demonstration may be done at the same time, or the demonstration given first followed by an explanation, or vice versa. The type of skill you are required to teach might determine the best approach.

Consider the following. You are teaching a student how to do a forced landing. Here are your options:

- Demonstrate a forced approach and simultaneously give an explanation of what you are doing and why you are doing it.
- Complete the demonstration with no explanation and then give a detailed explanation of what you have done.
- Give an explanation of what you intend to do and then do it.

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.

- On the flight before the exercise on 'practice forced landings' (PFL's) give a perfect demonstration of a PFL. 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 before 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.
- The next step would be for you to give a full detailed explanation of a practice 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; use visual aids to assist student learning.
- 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 that they know the procedure, although they have not yet flown it.
- After completing the practice forced landing approach, and while climbing for altitude, clear up any misunderstandings the students may have and ask questions.
- 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.

STUDENT PERFORMANCE AND INSTRUCTOR SUPERVISION

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.

The student should be allowed to perform the task in small segments, with you providing close supervision of each segment.

Referring to our example of the practise forced landing, consider the following suggestion of how to divide the task into segments:

On the student's first attempt:

You, the instructor:

- select the field, making sure that it is within easy autorotational range
- perform all in-flight checks, including LOOKOUT.

The student flies the helicopter and concentrates on making the field.

If the student makes a major error, you take control and place the helicopter 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.)

On subsequent attempts, depending on the degree of success of the previous attempt, add more items for the student to carry out.

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.

EVALUATION

The evaluation portion of the demonstration–performance method is where students get an opportunity to prove that they can do the manoeuvre without assistance.

For the practise 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 lookout.

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 analyse any errors that the student may make and debrief accordingly.

NOTE: Of course, you would interrupt the student's performance if safety were to become a factor.

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

RULES FOR USING THE DEMONSTRATION PERFORMANCE METHOD

Give a perfect demonstration or, if this is not practicable, show the 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.

Give a step by step explanation of the required task. Use reasons, examples and comparisons to make the explanation clear.

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 it is correctly done, before you go on to the next step.

Continue until the student has imitated each step.

Provide student practice, with assistance as necessary.

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.

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.

Complete the exercise with an evaluation (final check up) in which students have the opportunity to prove what they can do.

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 navigation 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

The following techniques, if applied in a conscientious manner, will help the flight instructor to give 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 for air instruction on a one to one basis, individual preparatory ground instruction, or pre flight briefings.

To present a lesson in a professional manner, you must prepare in advance and proceed as follows:

PREPARE A LESSON PLAN

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.

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.

What to avoid: Writing material out in full detail (this promotes reading of the material while you are in front of the class); using single space format (this does not allow for revision of the notes the next time the lesson is to be given); writing in longhand, unless you are able to read your notes at a distance of 1 metre. (This makes you appear not to know your material because you have to look closely at your lesson plan rather than just glance at it to jog your memory.)

PREPARE THE CLASSROOM/TEACHING AREA BEFORE THE LESSON

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 organising aids or rearranging seating.

PREPARE/CHECK TRAINING DEVICES/AIDS BEFORE THE LESSON

Reason: This avoids embarrassment should an item not work, or should any chart, slide or graph be shown in the wrong order.

PREPARE YOUR STUDENTS FOR LEARNING

Reason: If students are to learn, they must be physically, mentally and emotionally ready to do so.

How to do it:

- 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.
- 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.
- Give students an overall 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.
- The length of time required to prepare students for learning depends primarily on their background knowledge and the complexity of the material. As a general guide, the amount of time needed is approximately 10% of the lesson.

START THE PRESENTATION OF NEW MATERIAL AT THE STUDENTS' LEVEL OF UNDERSTANDING

Reason: If you begin your presentation at a level your students do not understand, there will be confusion and time wasted. Little or no learning will take place.

How to determine the students' level of understanding:

- Before the instruction starts, conduct a Threshold Knowledge Test to determine what your student knows or doesn't 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.
- During the course of instruction have periodic reviews.
- Conduct a review of previous lessons before you start each lesson. The review should consist of a series of questions. If your students answer correctly, proceed. If they do not, re-teach.
- Check with other instructors for the strengths and weaknesses of your students, and arrange your material to fit the students' needs.

PROCEED AT THE RATE OF STUDENT COMPREHENSION

Reason: If you get ahead of your students during the presentation, you are in the same position as if you started above their level.

How to ensure that you are proceeding at the required rate:

- 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 to 12 minutes.
- 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.
- Observe your students closely for facial expressions that could indicate that they do not understand a particular point. If students say they understand, ask them a question to make sure.
- Encourage students to ask questions on points that they do not fully understand.
- Provide for lots of practice of basic skills before you go on to the more complex parts.

IDENTIFY AND EMPHASISE MAJOR POINTS FOR THE STUDENTS

Reason: During any presentation there is a mixture of 'need to know' material, which is extremely important, and 'nice to know' material, which may or may not have to be remembered for a long period of time.

How to identify and emphasise points for your students:

- 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.
- Have students write the main points down in their note books, or provide notes that include these main points.
- Make a verbal statement to the students, such as: 'This particular point is very important: remember it.'
- Prepare an orientation board (chalk board 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.
- Raise the volume of your voice and reduce the rate of delivery while stating an important point, to add emphasis.
- Besides emphasising the main points, you should also emphasise safety and the points that are easily forgotten or difficult to remember.
- Provide emphasis according to relative importance. The most important things get a greater amount of emphasis.
- Emphasise points by giving verbal examples (real or imaginary); by comparisons (similarity to, or difference from, known facts); and, perhaps most importantly, by giving reasons for each point you make. Students tend to remember better if they understand the reasons behind every point they must learn.
- Repeat the point frequently by using summaries, or have your students repeat the point by answering your questions.
- Conduct periodic reviews of the 'need-to-know' material.
- Have the students complete a home assignment of the important points of a lesson.
- Have students record, in note form, the major ideas or items that you feel must be emphasised. By having them write ideas down you are using another sense, so learning may be reinforced.
- Use a variety of training aids to appeal to several senses (touch, feel, etc.).
- Do not emphasise 'nice-to-know' material.

GIVE CLEAR EXPLANATIONS AND DEMONSTRATIONS

Reason: If students do not understand an explanation, you will have to re-teach by rephrasing or by going over the material a second time. The same applies to a sloppy or inaccurate demonstration.

Suggestions for ensuring that your explanations and demonstrations are clear:

- Start verbal explanations by referring to something already known by your students. Association of ideas makes it easier to follow your explanation.
- 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?')
- 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.
- If you are required to demonstrate something, make sure you can do it correctly before you show the students.
- Make sure all students can see even the smallest points of a demonstration; if necessary, gather them around you.
- 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.

USE VISUAL AIDS AND USE THEM EFFECTIVELY

Reason: Approximately 75% of all learning comes through sight.

Sources of ideas:

- graphic artists or personnel associated with the production of visual aids
- other instructors, who can often give spark to an idea
- commercial displays in newspapers, magazines, television and stores
- finally, your own imagination, which (if you give it full rein) is an excellent source of ideas for aids.

Types of visual support:

- actual equipment
- mock-ups, charts, diagrams, pictures or models
- DVDs, films, video tape and cassette recordings
- sometimes, people.

Guidelines:

- 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 students learn the 'must-know' information.
- Plan to use a visual display of all major points that are covered during your lesson. Simple wording on the whiteboard is usually better than repeating the main points over and over again.
- Make your aids simple and clear. Eliminate all unnecessary data. Avoid the tendency to produce ornate, detailed artwork.
- 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.
- Use a variety of colours 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.

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.

- If the aid includes written words, have someone check for correct spelling and grammar. You would be surprised how many times misspelled words are displayed for students.
- If possible, stand well away from the aid and use a pointer, so that you do not obstruct the view of any student.
- If you are 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.

Consider: Will the aid help the student learn better, easier, or faster? You should 'show them as well as tell them'.

VARY THE RATE, VOLUME AND PITCH OF YOUR VOICE WHEN DELIVERING THE LESSON

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.

Consider:

- Speak at a fast rate while presenting 'nice to know' material. This produces the effect of observable enthusiasm, and enthusiasm is contagious.
- 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.
- 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.
- 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.

OBTAIN FEED BACK FROM STUDENTS BY LOOKING AT THEM (EYE CONTACT)

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.

Consider:

- Look directly at the students, but do not stare at any particular individual for too long at a time. If students avert their eyes it means you have stared too long and possibly caused some embarrassment—look elsewhere.
- Make your eye contact impartial. Do not favour any individual student or group of students; include them all in your presentations.

PROVIDE FOR MAXIMUM STUDENT ACTIVITY DURING THE LESSON

Reason: Students learn more easily if they are actively engaged in the learning situation.

Consider:

- 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.
- Use sound questioning technique, as outlined in the section 'Oral Questions'.
- Distribute your questions evenly among all the students, to avoid having a few answer all the questions.
- Make your questions thought provoking and challenging.
- Avoid questions that require a simple YES or NO answer, unless you immediately follow up with a 'why' or 'how' question.
- 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.
- 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.
- 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, 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.
- When students are able to perform a task with a reasonable degree of proficiency, introduce some competition (speed or ability) or a variation of the skill—but only when they have almost mastered the basic skill.

DEVELOPMENTAL TEACHING OR TEACHING BY QUESTIONING

Developmental teaching is based upon a student-centred philosophy of teaching that requires you to reason with students to have them meet predetermined objectives. By using the students' background knowledge, you ask questions that lead the 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.

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 that 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.

The main advantage of developmental teaching is that it promotes efficient student learning because it satisfied 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 the students' progress.

Careful planning for developmental teaching is critical because you must formulate appropriate questions that 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.

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

RATES OF LEARNING

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 retrogress 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 redirecting your instruction to level them out as much as possible.

ADVANCES AND PLATEAUS

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 that represents progress (FIG. 3). As of training, progress then tends to resume its upward climb at a slower but fairly constant rate.

Figure 1: Curve of remembering

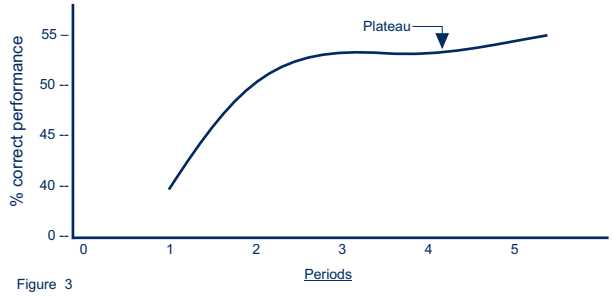


Figure 3

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.

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:

- diversions
- lagging or lacking motivation
- emotional disturbances
- upset training schedule
- weather
- equipment breakdown
- unavoidable absences.

Slumps or plateaus in the rate of learning are more likely to occur as your student advances to more complicated operations, such as hovering or transitions. Often the reason is that a student has failed to master one basic element of the operation, and this 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.

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.

Reversals sometimes occur, during which a student's performance becomes worse with continued practice. 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.

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 practice. Students may be nearly ready for a flight test at an early stage, and added training will only show slight, slow improvement.

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, particularly to the detriment of other evolutions.

INDIVIDUAL DIFFERENCES

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 recognise that students are different. You must recognise that this fact dictates how much you can teach, at what rate, and when.

PERSONALITY DIFFERENCES

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 whether 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.

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

Emotions play an important part in the training of a student. You must know the kinds of emotions and the techniques needed to control 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 paralysed. 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 recognise and overcome it.

DEGREES OF EMOTION

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

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.

STRONG EMOTION: This degree of emotion is not felt very often in everyday life, but it 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.

DISRUPTIVE EMOTION: These are very severe, deep rooted emotional tensions that disrupt logical action and clear thinking. Persons suffering disruptive emotions usually require the assistance of a psychiatrist. However, these problems occur so rarely that you need only be aware that they exist.

THE EFFECT OF STRONG EMOTIONAL TENSION

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.

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

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 that indicate that a student is using escape mechanisms.

- PROJECTION: transferring the blame from oneself to someone or something else.
- RATIONALISATION: finding a believable excuse for one's actions or failure; trying to justify unjustifiable behaviour
- RESIGNATION: becoming resigned to the situation; giving up
- FLIGHT: physically or mentally removing oneself from the tension-producing situation.
- AGGRESSION: taking one's tension out on someone else by becoming belligerent or argumentative.

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.

MEETINGTHE DIFFERENCES

You must be aware of the differences in aptitude, personality, and emotions among your students and understand the necessity to treat students as individuals. When you have analysed the situation and determined the differences, seek help from more experienced instructors or supervisors when necessary. You will attempt to equalise 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.

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

NERVOUS OR UNDER CONFIDENT. Nervousness or under confidence in a student is a trait that 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 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 extreme helicopter attitudes, unless they are essential to the lesson being taught. Take the time to build the student up to exercises involving extreme helicopter attitudes.

OVERCONFIDENT 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.

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.

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.

SLOW STARTERS. Slow starters are students who find difficulty doing more than one thing at a time. Again, patience is mandatory. Progress may be slow, but encouragement will help.

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 briefing. 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.

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 more than likely attain a greater degree of maturity. Your attitude is of prime importance in setting an example. You must encourage and help these students mature into the role of a responsible pilot whenever possible.

AIRSICKNESS. Some students may suffer from airsickness induced by motion, negative G, apprehension, claustrophobia, tension 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.

Table 2: Student traits and how to address them.

	Learns slowly	Know-it-all	Timid	Wastes time	Too aggressive	Antagonistic	Learns rapidly	Finds fault	Immature	Courts favours	Stalls, evades	Dominating	Inattentive
Provides less work	•												
Provide more work		•			•		•			•		•	
Give more individual instruction	•		•								•		
Be patient in correcting mistakes	•		•										
Give no chance to dodge responsibility		•	•	•				•	•	•	•		•
Rigidly check students 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		•	•	•		•		•	•		•	•	•

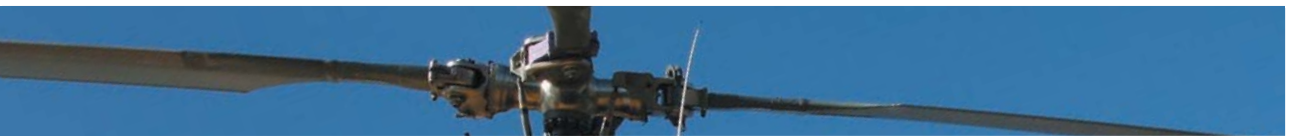
THE STUDENT–INSTRUCTOR RELATIONSHIP

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 a helicopter. They must follow your example and strive to carry out your instructions and suggestions for improvement.

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 cooperation. 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.

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

- Inspire your students to set goals that will stand them in good stead in aviation. Your exemplary conduct and high ideals will help in this goal.
- Be decisive. Weigh all the factors necessary to make decisions and then act with conviction.
- Be interested in your students and let them know by being familiar with their backgrounds, problems and achievements.
- Respect their rights and, when correcting mistakes, do so in a straight forward manner, never using sarcasm as a correction method.
- Acknowledge your own mistakes. The admission that 'You were right and I was wrong' does much to develop morale.
- If you do not know the answers to relevant questions, say so, find the answers, and tell the students later.
- Be enthusiastic. Instructor enthusiasm is reflected in student learning.
- 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 that they must not overstep.
- Be impartial and fair: never show favouritism.
- Never bluff: much of your subsequent instruction may be distrusted.
- Use humour. Appropriate humour creates good will and can be used to teach difficult subject material—but don't become so humorous that the business at hand becomes secondary.
- 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.
- Be aware that the use of cockpit intercommunication demands suitable phrasing, speech level, clarity, and discipline.
- Teach your students to have mastery over the helicopter, to fly with verve and spirit to the limit of the helicopter's flight envelope, and to know what they can and cannot do, but draw a very definite distinction between intelligent confidence and foolhardiness.
- 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 that you may not hear about otherwise. To your student, failure to debrief may appear to imply a lack of importance of the exercise or a lack of interest on your part.
- 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 almost certainly be given details in a verbal debriefing that may not be included in a written report.
- Maintain a professional image.



FAULT ANALYSIS

Fault analysis 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 realise that the sole purpose of fault analysis is to improve future student performance. A valid critique contains three essential elements:

1. Strengths
2. Weaknesses
3. Specific suggestions for improvement.

Without each of these elements, fault analysis is ineffective.

Strengths are analysed to give a feeling of satisfaction and to show that you recognise 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 the student than any number of remedial suggestions on your part.

The necessity for analysing 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 pinpoint 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.

The recommended format to follow when conducting fault analysis is:

When in the air:

- identify major strengths
- pinpoint a major weakness
- suggest a remedy to correct that major weakness.

On the ground:

- identify major strengths
- identify a maximum of three major weaknesses
- suggest remedies to correct the major weaknesses.

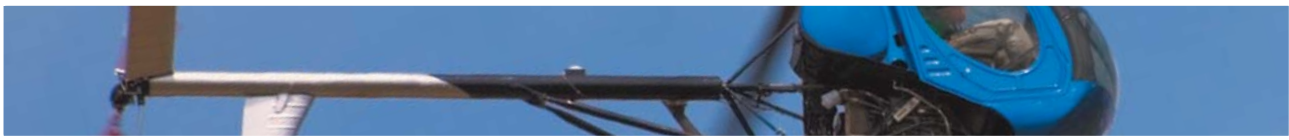
NOTE: One way to think of a major weakness is: 'What item, if corrected now, would result in the correction of the greatest number of other faults?' As student performance improves, the weaknesses that originally were considered minor ones now become the only weaknesses. All weaknesses will be dealt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

CHARACTERISTICS OF EFFECTIVE FAULT ANALYSIS

Effective fault analysis 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.

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.

Honesty is the best policy for critiquing. The situation where you may attempt to motivate a weak student by giving better grades than deserved jeopardises 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 fault analysis, and emphasis must be placed on this function.



GROUND SCHOOL TRAINING

GROUND SCHOOL DEFINITION

Classroom-type instruction, which may be 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.

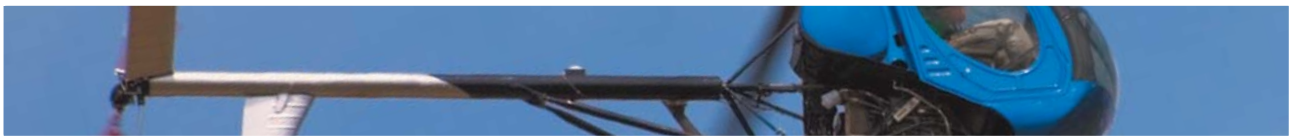
This is a list of subjects from the appropriate Study and Reference Guide that the student should have learned or have become familiar with before the preparatory ground instruction is given. These points should not form part of the preparatory ground instruction or pre flight-briefing.

PREPARATORY GROUND INSTRUCTION

PREPARATORY GROUND INSTRUCTION DEFINITION

Classroom-type instruction, normally on a one to one basis, but not excluding group instruction, covering the steps necessary to fly an air exercise. Whereas the 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 'how to do an air exercise'.

This is a presentation given by the instructor when introducing a new exercise. Ideally it could be given no more than 24 hours before the related training flight and could be given in the form of a mass briefing where there is a number of students at the same stage of training.



THREAT AND ERROR MANAGEMENT

THREAT AND ERROR MANAGEMENT (TEM) DEFINITIONS

TEM is an operational concept applied to the conduct of a flight that is more than the traditional role of airmanship, as it provides for a structured and pro-active approach for pilots to use in identifying and managing threats and errors that may affect the safety of the flight. The International Civil Aviation Organization (ICAO) and EASA Part FCL require that Human Factors and Threat and Error Management (TEM) be introduced into all pilot training.

There are three basic components in the TEM model, from the perspective of flight crews:

THREATS. Threats are defined as events or errors that occur beyond the influence of the flight crew, increase operational complexity and which must be managed to maintain the margins of safety. During typical flight operations, flight crews have to manage various contextual complexities. The TEM model considers 3 types of threats, anticipated, unanticipated and latent which all have the potential to negatively affect flight operations by reducing margins of safety.

- **Anticipated:** Some threats can be anticipated, since they are expected or known to the flight crew:

  Thunderstorms / wind shear and other forecast inclement weather;

  Congested airport / heliport;

  Obstacles/Wires;

  Complex ATC clearances;

  Out of wind approaches/landings;

  Air temperature/DA extremes;

  Mass and balance;

- **Unanticipated:** Some threats can occur unexpectedly, suddenly and without warning. In this case, flight crews must apply skills and knowledge acquired through training and experience:

  In-flight aircraft malfunction;

  Automation - anomalies /over reliance;

  Un-forecast weather:

  ATC re-routing / error / non-standard phraseology navigation aid un-serviceability;

  Ground handling errors;

  Wires;

  ACAS RA/TA;

  Un-forecast bird activity;

  Laser attacks;

  Sloping landing areas;

- **Latent:** Lastly, some threats may not be directly obvious to, or observable by, flight crews immersed in flight operations, and may need to be uncovered by safety analysis. These are considered latent threats and may include organisational weaknesses and the psychological state of the pilot:

  Organisational culture/changes;

  Documentation error;

  Equipment design issues;

  Operational pressures/ delays;

  Optical illusions;

  Fatigue / rostering;

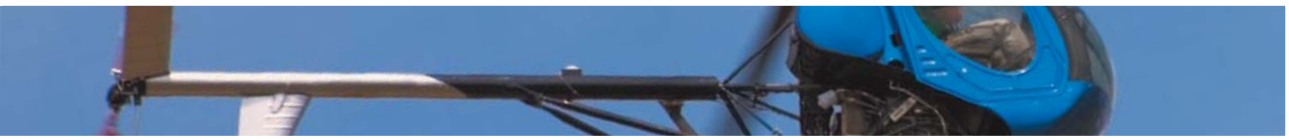
  Complacency;

  Over or under confidence;

  Lack of recency/ proficiency

ERRORS. Errors are defined actions or inactions by the flight crew that lead to deviations from organisational or flight crew intentions or expectations. Unmanaged or mismanaged errors frequently lead to undesired aircraft states. Errors in the operational context thus tend to reduce the margins of safety and increase the probability of adverse events.

UNDESIRED AIRCRAFT STATES (UAS). Undesired aircraft states are flight crew-induced aircraft position or speed deviations, misapplication of flight controls, or incorrect systems configuration, associated with a reduction in margins of safety. Undesired aircraft states that result from ineffective threat or error management may lead to compromising situations and reduce margins of safety in flight operations. Often considered at the cusp of becoming an incident or accident, undesired aircraft states must be managed by flight crews.



TEACHING THREAT AND ERROR MANAGEMENT

TEACHING THREAT MANAGEMENT

Instructors should stress that threats (and errors) are a part of everyday aviation operations that must be managed through all the phases of flight:

- **Pre flight:** As part of the airmanship element of the briefing, time should be spent identifying possible threats and errors associated with the flight in order to plan and develop countermeasures. For example a possible threat in the circuit is other aircraft which could lead to a mid air collision. Possible errors that could lead to this UAS are: spending too much time with 'head in' not looking out, looking out in the wrong area, not scanning properly, not listening out on the radio. Counter-measures could be to develop a crew strategy for lookout, adopting a scan technique taking into account climbing/descending/turning, listening out on the RT for other traffic calling ATC for traffic information etc).
- **In flight:** Brief on the planned procedures before take-off and prior to commencing each significant flight sequence including anticipated threats and counter-measures in briefings. Prioritise tasks and manage workload to avoid being overloaded (e.g. use checklists); Identify any UAS to the student and manage accordingly. Recover aircraft to safe flight configuration safety margins before dealing with other problems.

  Unanticipated threats are most likely in flight. These threats are generally managed by applying skills and knowledge acquired through training and flight experience. Typically, a practice engine failure or simulated system failure are methods of training a pilot to manage unexpected threats. Knowledge and repetition prepare a trainee to manage such events should they occur for real in flight.

  Instructors should develop training scenarios, 'what if' questions or examples that will address the different categories of threats and thereby develop the trainee's ability to detect and respond appropriately to threats .

  During flight training the instructor must identify unanticipated threats such as incorrect ATC instructions, traffic hazards or adverse weather and point them out to the trainee should they fail to identify them. Then it is important to question the trainee to see what steps they could take to mitigate the threats, ensuring that the action is completed in the time available.

  A good technique to teach the student to recognise these threats is to:

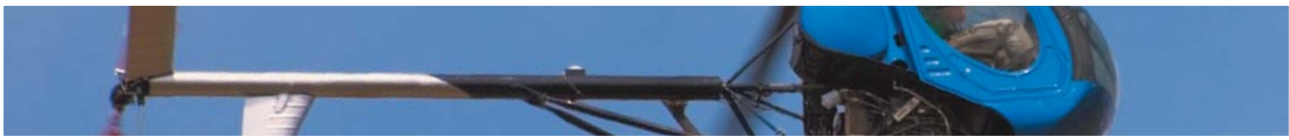
  - Prompt (what is the threat)
  - Question (how could it be mitigated)?
  - Direct (do this)
  - Physical intervention if necessary (take control)
- **Post flight:** Reconsider what threats, errors and/or UAS were encountered during the flight. Ask the student how well they were managed and what could be done differently to improve the management of similar threats and errors on future flights to assist with the development of improved TEM strategies.

TEACHING ERROR MANAGEMENT

The acknowledgement that errors will occur has changed the emphasis in aviation operations to error recognition and management rather than just error prevention. Rather than just pointing out errors to the student as they occur, instructors should show how to minimise the chances of errors happening, and then if they do happen, recognise the fact and implement strategies to manage them.

Instructors must afford the student the opportunity to recognise a committed error rather than intervening as soon as they see an error committed, they must wait (if time allows) to see if the error is identified by the trainee. If it is not, the instructor should then analyse why the error happened, why it was not recognised and how to prevent future occurrences.

Mitigators that are in place such as checklists, SOPs and aviation rules must be applied and complied with. Whether a checklist is used from memory or read, they are provided to enhance safety (by helping reduce errors) and instructors must continually stress their importance and accept no deviations to its application and terminology.



TEACHING UNDESIRED AIRCRAFT STATE MANAGEMENT

Unmanaged or mismanaged threats or errors may result in a UAS. Ideally, students should be taught to manage threats and errors before a UAS develops. During flight training, instructors will be dealing with many undesired aircraft states as trainees develop their flying skills.

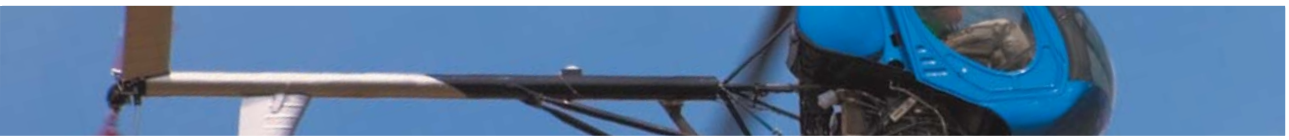
In this context, instructors have the dual role of practising TEM by ensuring that undesired aircraft states are managed and then teaching trainees how to do the same. Because students may not have the manipulative and cognitive skills of a qualified pilot, they will often not meet specified flight tolerances or procedures.

Some typical examples would be:

- hover taxiing too fast;
- too fast or slow on final approach; or
- inability to maintain altitude or heading during straight and level flight.

Although such examples would be classified as UAS when committed by a qualified pilot, they are not unusual events during flight training. The difference is that the instructor should be aware of the threats and errors and should not let an undesired aircraft state develop into an undesired outcome (i.e. an accident or incident).

A critical aspect that instructors must teach is the switch from error management to UAS management. During the error management phase, a pilot can become fixated on determining the cause of an error and forget the old adage 'aviate, navigate, communicate'.



PRE-FLIGHT BRIEFING

PRE-FLIGHT BRIEFING DEFINITION

Discussion on a one to one basis just before 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, which should have been covered in the mass briefing, but including these important aspects:

- What are we going to do?
- How are we going to do it?
- Safety considerations including Threat and Error Management.

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:

- meteorological and aerodrome conditions, and NOTAMs
- the helicopter to be used, its fuel state and other relevant information
- where the exercises will be conducted
- take off time, duration of flight, and time when the helicopter is due to land back at base
- the sequence of exercises to be covered during the flight
- a review of relevant airmanship points.

IN FLIGHT INSTRUCTION

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 HELICOPTER

There should never be any doubt as to who has control of the helicopter. The procedure for giving and taking control is:

- When you, as pilot in command, wish to give control to your student, say clearly 'Follow me'. Teach your student to take control only when ready and to always say 'I have control'. You do not relinquish control until you hear this phrase. Formalise this portion of the evolution by saying 'You Have Control'.
- When you want to take control, say 'Taking over' and then take control, ensuring that your student says 'Handing over' when relinquishing control. Formalise this portion by saying 'I Have Control'.
- 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.
- 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 is particularly difficult during critical manoeuvres, such as touch down autorotations, when there is little time available to the instructor to correct errors. This procedure should be adhered to at all times.

IN FLIGHT TEACHING

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.

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.

As your student gains proficiency, you may look for minor errors and correct them in the same manner. Remember, though, that learning to fly proficiently 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 acknowledge- good performance.

If practicable, conclude the air exercise with a perfect demonstration of the manoeuvre to be learned on the next lesson. This will help your student to fully understand the home study for the next exercise and will 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 were to be a review or a repeat of a lesson.

FAULT ANALYSIS

When discussing a student's faults, always take control so that your student may devote full attention to the instruction. In some cases you may ask the student to analyse the errors in a particular sequence; usually this will happen during the later 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 analyse the problems from the student's description of actions and the helicopter'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 analyse the performance and correct any faults.

The process of fault analysis can be summarised as follows:

- Recognise the fault
- Correct the fault
- Prevent reoccurance

PLANNING OF FLIGHT INSTRUCTION

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 of time spent losing or gaining altitude or in transit from one area to another.

POST FLIGHT BRIEFING (DEBRIEFING)

POST FLIGHT BRIEFING (DEBRIEFING) DEFINITION

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.

This should follow all flights, dual and solo. Points should include:

- the student's own assessment of the flight and performance
- your assessment of the student's performance. This should include both the strong and weak points, and advice on how to correct any errors.
- answering any questions the student may have
- assigning study subjects where appropriate.

Note: Debriefings should always be conducted in private and in a manner mindful of the sensitivities of the student.

STUDENT RECORDS

When the debriefing is complete a record of the flight should be made in the form set out in the Approved Training Organisation's Manual and the taxonomy completed. Such records form an essential record of student progress and must be completed accurately and in sufficient detail.

FLIGHT SAFETY

Flight safety is a vital aspect of flight training. Both aircrew and ground crew must be aware of the need for correct safety practices. You are in a position to reduce incorrect, unsafe and illegal practices. You are also in a position to influence the attitudes and disciplines of future pilots in this industry. 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 SETTHIS EXAMPLE!

An experienced instructor is an effective supporter of the principles of good airmanship and flight discipline. As you gain experience, learn to recognise unsafe practices and do something to correct the situation. Practise flight safety by:

- being alert to unsafe practices and taking the appropriate action
- following up when you see an unsafe practice by informing the people involved that they have been seen
- promoting the principles of effective flight safety to students and other aircrew and groundcrew.

Flight safety consciousness by all personnel must become the fashion. Unsafe procedures must be watched for, identified, and eliminated by firm and consistent action. Throughout your instruction, stress the importance of being fuel conscious, the need for proper lookout and the danger of having loose articles in the helicopter.

A CHECKLIST 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. whiteboard, orientation board, or other visual aids)
   (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 the student's past and/or future experiences (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.
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)
   (d) taking student questions.
10. Respond to feedback by:
   (a) answering questions
   (b) stopping students from 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)
   (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 help to achieve 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. Conduct periodic reviews of critical areas of the lesson.
22. Summarise the main points of each stage.
23. Evaluate level of student learning at the end of each stage.
24. Test students on the main points of the entire lesson towards the end of the lesson.
25. Provide a final summary that links all stages to the objective(s) of the lesson.
26. Re-motivate students by telling them how the new knowledge or skill will benefit them.
27. Ensure they are well prepared for the programmed lesson prior to meeting with student.

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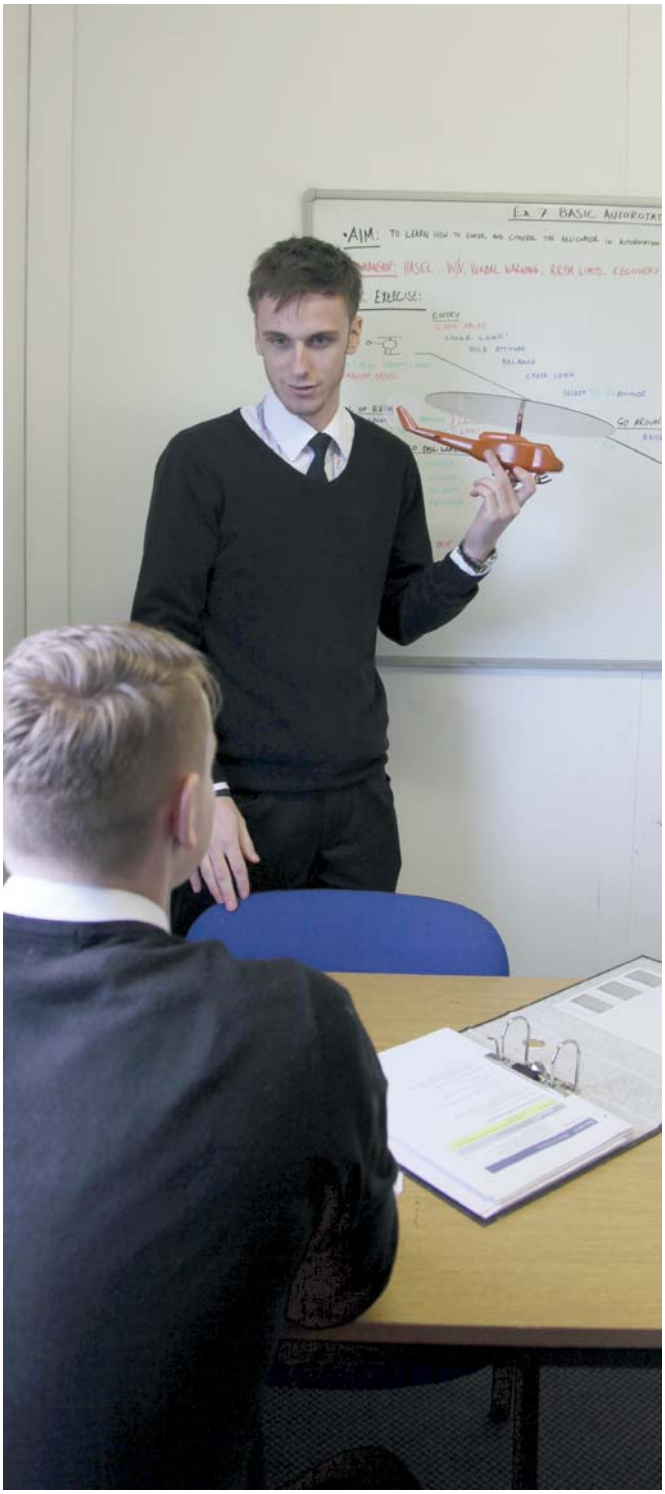
PART 2

GROUND AND AIR INSTRUCTION EXERCISES

This part outlines the purpose of each exercise, the essential background knowledge a student must possess before commencing the air exercise, advice to the instructor and a simple outline for each air exercise.



INTRODUCTION

GROUND AND AIR INSTRUCTION EXERCISES

This part is presented as a series of exercises. These are specific skills that either singly or in a group form a convenient unit for the student to learn.

In most cases, when presenting a new exercise to a student, you should be able to follow the sequence shown. However the numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide. Therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the helicopter.

Ground instruction in weather interpretation, planning and route assessment, decision making on encountering a degraded visual environment (DVE) including reversing course or conducting a precautionary landing should be incorporated throughout the course. Wherever possible, flight simulation should be used to demonstrate to student pilots the effects of flight into DVE and to enhance their understanding and need for avoidance of this potentially fatal flight regime.

Each exercise is presented in the following manner:

GROUND SCHOOL

This is a list of subjects that the student should have learned or should be familiar with before the preparatory instruction is given. These points should not form part of the preparatory instruction or the pre-flight briefing.

PREPARATORY INSTRUCTION

This is the presentation given by the flight instructor when introducing a new exercise. Ideally you should give it in the form of a mass briefing and no more than 24 hours before the related training flight.

Preparatory instruction is presented as follows:

Aim

State the aim in terms of not so much what you, the instructor, are about to teach, but what your student is about to learn.

Review

Review previously learned facts. This will generally help students to understand and assimilate the new skills and knowledge they are about to acquire. This is a good time to discuss any related problems they may have.

Motivation

Give students a good reason why they should learn this skill. Use specific terms to suit the individual student and training situation.

Airmanship / TEM

Airmanship points will vary with the type of training helicopter and local conditions. Always stress the safety and TEM aspects of any training.

Teaching Points

These are self-explanatory. They are sometimes listed in broad terms, so as to cover all training helicopter and conditions. Occasionally you will need to amend them to your specific needs.

Confirmation

This is a reminder to you to ask the student appropriate questions to confirm that learning has taken place and that the air exercise is likely to be effective. Give students ample opportunity to ask you questions so as to remove any doubts or problems they might have.

PRE-FLIGHT BRIEFING

This is a separate part of the ground presentation. It should precede all flights, whether there is a new exercise to be covered or not. It is also particularly important when sending a student solo.

Points to be covered include:

- local weather and meteorological conditions
- the helicopter to be used, its fuel state, C of G, servicing schedule, aircraft documentation and any other relevant information
- where the exercises will be conducted including any airspace , communication, NOTAM considerations
- take-off time, duration of flight, and estimated landing time back at base
- the sequence of exercises to be covered during this flight
- a review of relevant airmanship CRM andTEM points
- Threat and Error Management

AIR EXERCISE

This is the recommended sequence of introducing an exercise to a student. The sequence of further demonstration, practice and fault analysis will vary from one student to another.

POST-FLIGHT DE-BRIEFING

This follows all flights, dual and solo. Points should include:

- the student's assessment of the flight and performance.
- your assessment of the student's performance. This includes both strong and weak points, and advice on how to correct any repeated errors.
- answering any student questions.
- assigning study subjects where appropriate.
- completion of student training records and taxonomy.

Note: Full and accurate training records are essential to effective training. It is important that training records should be completed by the instructor as soon as possible after completion of the training session. Records for each individual training session should ideally include a comprehensive narrative report recording the training provided, the training medium, weather (if applicable), as well as the trainee's performance, progress, any weaknesses and should be signed by the instructor and the student.

TIPS FOR INSTRUCTORS

These are aimed at helping you in your role as an instructor. The points mentioned should not be included in your ground or air presentations.

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1a & 1b
FAMILIARISATION WITH THE HELICOPTER AND EMERGENCY PROCEDURES

GROUND SCHOOL POINTS

Familiarise the student with the layout of the school, including briefing rooms, crew rooms, etc., introduce him or her to the members of the staff who are associated with the flight training.

Explain the course syllabus and how it will be applied, including details of how, when and where ground school, preparatory instruction, pre-flight briefings and post-flight debriefings are carried out; how dual and solo flights are authorised; how progress is monitored; and any other information necessary to the student in his or her day-to-day attendance at the Approved Training Organisation (ATO).

PREPARATORY INSTRUCTION

Aim:

Exercise 1a: To familiarise the student with:

- the characteristics of the helicopter, its external features, cockpit layout, systems, and controls drills, checklists and procedures

Exercise 1b - Emergency Procedures: To learn the action to be taken in the event of:

- fire on the ground and in the air,
- engine, cabin and electrical system fire,
- system failures (where appropriate),
- escape drills including the location and use of emergency equipment and exits.

Motivation:

The knowledge gained in this exercise underpins the whole of the course. Understanding how the helicopter works will make subsequent lessons easier to understand and save valuable training time both in the air and on the ground.

Airmanship / TEM:

- the use of Checklists,
- Approaching and leaving a helicopter and procedures to be observed when 'airside' e.g. No Smoking, switch off mobile phones,
- thorough pre-flight inspection,
- knowledge of emergency drills, the helicopter's emergency equipment and fire extinguisher types

Explain:

- the cockpit layout and the control system. In the case of students with fixed wing experience, with particular reference to those controls that are new to the student.
- the various aircraft systems:
  - the main and tail rotor systems
  - the fuel and oil systems
  - the electrical system and avionics equipment
  - the hydraulic system (if applicable)
- weight and balance.
- the use of the check lists, drills for normal flight and emergency drills.
- Emergency procedures escape drills and emergency fire drills.
- the Rotorcraft Flight Manual (or Pilot's Operating Handbook).
- any course material provided by the ATO together with recommended publications for study during the course.

Teaching Points:

Cover all the learning points in a logical sequence using the aircraft as a training aid getting the student to identify the main components and systems of the helicopter while explaining their purpose.

There is a great deal to cover in these two lessons so it is advisable to have the lesson plan readily to hand and work through each learning point to avoid going into too much detail at the same time ensuring that all the necessary items have been covered. Whilst too much detail should be avoided bear in mind that the student will usually be fresh and eager for knowledge so full advantage should be taken of this desire to learn. Explanations may be simplified if necessary but care must be taken to avoid the student forming a false impression of how a system or control works which may be difficult to correct later.

Cover the drills for Engine Fire on Start Up, Engine Fire in Flight and Electrical Fire in Flight in detail and get the student to practise aircraft escape drills physically rather than just talk about them. Discuss other systems failures and avoid creating a negative impression of helicopter flying by explaining that these are rare occurrences. However a pilot must be able to deal with all potential emergencies.

TIPS FOR INSTRUCTORS

Show the student a thorough external check on the aircraft, with particular reference to items that are probably completely new to him or her (e.g. main rotor, tail rotor, transmission etc) Reinforce the classroom instruction with practical exercises, e.g. reading the checklist; practical escape drills; dry use of fire flighting equipment and physical identification of components on the helicopter.

Avoid confusing the student by presenting too much detailed information at this initial stage. The use of models and training aids is helpful when explaining aircraft systems especially where it is not easy to visualise how a component works by looking at its exterior.

Relate this exercise to the student's flying background, level of experience and general aviation knowledge.

Discuss ground school requirements and how these will be integrated with flight instruction as a precursor to each air exercise.

This lesson is often combined with Exercise 2: Preparation for and Action after Flight.

2
PREPARATION FOR AND ACTION AFTER FLIGHT

PREPARATORY INSTRUCTION

Aim

To introduce the student to the preparation necessary before commencing a flight.

Review

Exercise 1a & 1b

Motivation

Stress the fundamental part that proper preparation for flight plays in flight safety. Explain that a high percentage of helicopter accidents and incidents are due to poor preparation and inadequate planning.

Airmanship / TEM

- Equipment required
- Maps

Teaching Points

Explain that the sequence of events leading up to the take-off and departure can be conveniently considered in three phases:

- flight planning
- checking of helicopter documents
- inspection of the helicopter and completion of checks and procedures.

Point out that during the initial stages of training, the flight-planning phase will be covered by the instructor during Pre-Flight Briefings. As the course progresses, the student will be required to take part increasingly in all the aspects of preparation for flight.

Explain that it is the pilot-in-command's responsibility to ensure that the helicopter is safe and fit in all respects for the intended flight.

Explain the need to wear, or have on board the helicopter, proper survival equipment, clothing and footwear for existing or anticipated weather conditions in case of an unscheduled landing away from base.

Explain the procedures for the student to follow, should he or she discover a defect or unserviceability in the training helicopter during the inspection or pre-take-off phase. Stress that students should not fly the helicopter if they have any doubts about its airworthiness.

Documents: Show the student all the documents required by legislation to be on board the helicopter in flight. Explain the significance of each and its bearing on airworthiness.

Inspections and checks

While walking to the helicopter, point out that the student should always note:

- wind velocity.
- the presence of any helicopter or obstacle that might affect the starting of the rotors or the departure procedure.
- the location of any external fire flighting equipment.

Demonstrate the external inspection and the internal checks and procedures to be carried out before take-off, as appropriate to type.

Demonstrate seat position, the operation of the harness and emergency exits together with the brace position.

Demonstrate starting and warm-up checks, clutch engagement and starting rotors. Once completed the start up demonstrate the power checks used, appropriate to type. Upon completion of flight demonstrate shut-down checks and procedures appropriate to type.

Discuss the procedures for parking and security of the helicopter, and completion of the necessary documentation.

TIPS FOR INSTRUCTORS

Although treated here as a separate exercise, it may be more convenient to combine the introduction to Preparation for Flight with Exercise 3.

Student practice of the external inspection, and pre-take-off procedures, should be carefully monitored until reliable proficiency is attained, and should be checked at regular intervals thereafter.

Explain the importance of the student becoming familiar with the helicopter and its components when all is normal and serviceable so that any abnormality becomes readily and easily apparent when conducting the pre flight inspection.

G-ORBK

3
AIR EXPERIENCE

GROUND SCHOOL POINTS

Review Exercise 1- Familiarisation with the Helicopter and Exercise 2 - Preparation for and action after flight

PREPARATORY INSTRUCTION

Aim

To introduce the student to rotary wing flight

Review

Exercise 1 & 2

Motivation

By the end of this lesson the student will be able to make a judgement to continue to learn to fly or not.

Airmanship / TEM

- Lookout
- Use of Checklists
- Handing Over/Taking Over Control
- Aircraft Limitations

Explain

- how to enter and leave the helicopter with the rotors turning
- that seat belts or harnesses should be done up at all times during flight
- the necessity for positive hand-over and take-over of the controls as discussed in Part 1.
- the need for a constant and thorough lookout for other aircraft. Describe the clock method of reporting aircraft to the other crew member.
- the need for flight clothing commensurate with the weather, area of operation and role being performed.

Teaching Points

It is not intended that the flying instruction given in this period should be formal in nature but students should be allowed to get accustomed to the sensations of rotary-wing flight, the attitudes of the aircraft when climbing and descending and, particularly, the ability to reduce speed to zero (i.e. hover) in the air. They may be given the feel of the controls without any attempt to explain their effects in detail but emphasising their sensitivity and the need not to let go of them.

The student should be encouraged to relax and pay particular attention to the need for fresh air and the action to be taken in the event of feeling unwell. The student should assist in lookout throughout the sortie stressing the need to keep the eyes out of the cockpit as much as possible and to develop a basic scan pattern.

Talk about communications in the cockpit environment avoiding the natural instinct to make eye contact with the other person in order to maintain external lookout.

This period can also be used to show the student the immediate vicinity of the airfield pointing out the local landmarks and providing a general impression of the circuit area with particular reference to any other flying that may be taking place.

COMMON ERRORS

- *Student will be nervous and tense -encourage the student to relax and enjoy the flight*

AIR EXERCISE

Identify the main components of the helicopter. This can be done during the instructor's external check, but care should be taken not to confuse the student with too many details.

Seat the student in the pilot's position in the helicopter and give a full passenger and crew briefing. Explain the general function of the controls and instruments. Demonstrate adjustment of the controls for comfort and safety, as applicable to type.

Carry out a short familiarisation flight, pointing out prominent landmarks and giving the student an opportunity to handle the controls in cruising flight. Student performance should not be criticised or corrected at this stage and ensure all checks are completed by using a checklist.

TIPS FOR INSTRUCTION

As this is to be the student's first flight training exercise, ensure that everything is explained painstakingly. Emphasise this as necessary, since all future flight training exercises are based around the basic principles learned in this exercise.

This exercise should be tailored to the student's previous flying experience if applicable. It is important that the student has an enjoyable and pleasant experience. The instructor must set the highest standard of airmanship and procedures throughout.

Students will often get very tense in the earlier air exercises. The instructor should make every effort to ensure that the student is comfortable and relaxed as much as possible. Stress the need for correct, comfortable posture in these early stages. Introducing short in-flight relaxation exercises from time to time to prevent the student from tensing muscles may be helpful during earlier flights.

Ensure that the helicopter is reasonably stable before handing over control to the student.

Emphasise the use of verbal confirmation before commencing any turns.

The use of a model helicopter will make preparatory instruction much more effective.

4
EFFECTS OF CONTROLS

GROUND SCHOOL POINTS

Theory of flight:

- definitions
- helicopter controls

Function of flight and engine instruments

Function of ancillary controls

PREPARATORY INSTRUCTION

Aim

For the student to learn:

- the primary and secondary effects of flight controls in flight
- the effects of:
  (a) air speed;
  (b) power changes (torque);
  (c) yaw (sideslip);
  (d) disc loading (bank and flare);
  (e) controls of selecting hydraulics on/off;
  (f) control friction.
  (g) instruments;
  (h) use of carburettor heat or anti-icing control.
- the use of ancillary controls.

Review

Exercise 2: Preparation for Flight

Exercise 3: Air Experience

Motivation

This exercise introduces the helicopter controls and their functions with the associated indications and use of the instruments.

Airmanship / TEM

- Lookout
- Handing Over/Taking Over
- Aircraft Limitations

Teaching Points

- **Cyclic pitch control**

  Moving the cyclic causes the rotor disc to tilt. As a result of this, the helicopter will either pitch or roll, or a combination of the two, depending on the direction in which the cyclic is moved. Explain that there are secondary effects comprising changes in altitude, airspeed and RPM.

  Describe the visual and instrument indications resulting from various cyclic control movements.

  Explain that the cyclic a sensitive control and that the disc responds rapidly to the rate of movement of the cyclic so smooth controlled movements should be made. Also emphasise to the student that the cyclic is not self centering and will need continual adjustments to maintain attitude.

- **Collective pitch control**

  Moving the collective causes an equal change of pitch to all main rotor blades. The primary effect of moving the collective alone, in cruising flight, is a change in height.

  Explain that there are secondary effects comprising changes of attitude, heading and RPM. For this reason, the collective is seldom moved without coordinating movements of the cyclic, pedals and throttle. This aspect will be covered in the following exercise.

- **Throttle**

  Move the twist grip to open and close the throttle.

  Explain the function of the throttle as appropriate to the type. The primary effect is RPM control (engine and rotor RPM). Explain that there are secondary effects comprising YAW and MAP changes.

- **Tail rotor pedals**

  Movement of the pedals causes a change in pitch of the tail rotor blades. The result of this is a yaw. Stress that, in the cruise, this yaw is a large skidding motion. Explain that there are secondary effects comprising roll, RPM changes and IAS errors. The pedals should not be used to change the helicopter's direction of flight.

- **Ancillary controls**

  Describe the use of the ancillary controls (e.g. carburettor heat, mixture, trim, rotor brake, anti-ice, windscreen, de-fogging, heater, etc.) as appropriate to type.

COMMON ERRORS

- *Particular care must be taken when demonstrating the effect of the throttle and collective pitch lever to avoid confusing the student in the air. A thorough explanation is necessary before flight.*
- *Emphasis must be made on using the horizon and attitude, not on the instruments*

AIR EXERCISE

Before take-off:

- make sure the student is seated comfortably and ensure all checks are completed by using a check list
- demonstrate the correct use of frictions, trims and control adjustments, as appropriate to type
- demonstrate the effect of cyclic control movements on the rotor disc, including how the horizon is used as a reference to interpret the helicopter's attitude
- demonstrate the effect of collective lever on the pitch of both blades when raising and lowering the control
- demonstrate opening and closing the throttle
- demonstrate the effect of pedals on the pitch of the tail rotor

In Flight:

- **Cyclic Control**

  Establish a straight and level cruise at a safe altitude.

  Demonstrate pitching movement in the normal range. Point out the sensitivity or lag, as appropriate to type.

  Student practice

  When the student demonstrates reasonable competency, point out the flight instrument indications.

  Re-establish a straight and level cruise.

  Demonstrate rolling movement (gentle and medium turns)

  Student practice

  Point out flight instrument indications

  Re-establish a straight and level cruise.

  Demonstrate a combination of pitching and rolling movements.

  Student practice

  Point out flight instrument indications.

- **Collective Control**

  Re-establish a straight and level cruise.

  Demonstrate the effects of raising and lowering the collective, pointing out the visual and flight instrument indications.

  Student practice.

- **Throttle**

  Where appropriate to type, re-establish a straight and level cruise.

  Demonstrate the effects of opening and closing the throttle, pointing out the visual and flight instrument indications.

  Student practice

- **Tail Rotor Pedals**

  Re-establish a straight and level cruise.

  Demonstrate the effects of right and left pedal movement, pointing out the visual and flight instrument indications.

  Student practice

- **Ancillary Controls**

  As appropriate to type:

  Demonstrate the use of ancillary controls.

  Student practice

  All Controls

  Have the student practise simple flight manoeuvres by application of the basic principles of this exercise. Stress the need for smooth operation. Rather than demand accuracy at this stage, monitor the controls to avoid excessive control movements by following through as necessary.

TIPS FOR INSTRUCTORS

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 learned in this exercise.

This exercise should be tailored to the student's previous flying experience if applicable.

Students will often get very tense in the earlier air exercises. The instructor should make every effort to ensure that the student is comfortable and relaxed as much as possible.

Ensure that the helicopter is reasonably stable before handing over control to the student.

Emphasise the use of verbal confirmation before commencing any turns.

The use of a model helicopter will make preparatory instruction much more effective.

Stress the need for correct, comfortable posture in these early stages.

5
POWER AND ATTITUDE CHANGES

GROUND SCHOOL POINTS

Flight manual: engine, transmission and airspeed limitations

Flapback

Power required diagram

PREPARATORY INSTRUCTION

Aim

Is for the student to learn how to maintain a specified airspeed, how to change that airspeed by changing the fuselage attitude and the relationship of the cyclic position to the airspeed and how to make power changes.

Review

Exercise 4: Effects of Controls

Motivation

This exercise will enable the student to maintain and change the aircraft airspeed.

Airmanship / TEM

- Positive hand over of controls
- Lookout
- W/V
- Monitor /scan of engine temperatures and pressures
- Helicopter limitations

Teaching Points

Describe how to conduct attitude and power changes as follows:

Speed Increase

Explain that to increase the speed from balanced cruise flight it is necessary to tilt the rotor disc further forward with the cyclic which will result in the nose dropping to a new attitude. As the aircraft accelerates the rotor disc will tend to 'flapback' so to maintain the acceleration it is necessary to move the cyclic progressively forward and reselect the attitude for the required speed. In light helicopters with an effective horizontal stabiliser the increase in down wash force tends to maintain the fuselage attitude relatively constant over a large part of the speed range.

Speed Decrease

Explain to decrease the speed the disc is tilted back with the cyclic, the nose rises to a more nose up attitude and the aircraft slows down. As the speed decreases, the disc 'flaps' forward and the cyclic must be moved further back to maintain the deceleration. When the speed is close to the desired speed the nose attitude is reselected to the attitude for the required speed.

Power changes

Explain how the height of the aircraft is controlled by collective lever. When the lever is raised the power increases because of the correlater linkage and the aircraft nose will yaw. The reverse is true when the lever is lowered and consequently to maintain the heading the use of pedal is required when changing power. Increases and decreases in collective pitch will result in attitude changes which should be anticipated.

AIR EXERCISE

Demonstrate airspeed changes.

Student practice

Demonstrate power changes.

Student practice

TIPS FOR INSTRUCTORS

If the student is able to cope, this exercise can be combined with Exercise 6.

Students will often tend to pay excessive attention to the flight instruments in this exercise. Care must be taken to ensure that a proper scan between the instruments and external references is established and that a good lookout is maintained.

It should be explained that it takes a certain time for speed changes to occur and attempts to hurry the process can lead to over controlling. Therefore the student should be encouraged to SELECT, HOLD and ADJUST. It is recommended that initially speed changes only between 40-80kts is practised.

COMMON ERRORS

- *Over controlling on the cyclic, usually caused by failure to appreciate the lag in control response.*
- *Failure to maintain selected attitude.*
- *Incorrect Throttle movement.*
- *Failure to appreciate and correct for yaw.*

Changes of airspeed during the early stages of this air exercise will result in changes of altitude. It is important therefore, to conduct this lesson at 1000 feet AGL or more, in good weather conditions with a defined horizon.

Where appropriate to the aircraft type, demonstrate the methods of changing manifold pressure at constant rotor RPM and changing rotor RPM at constant manifold pressure.

6
STRAIGHT AND LEVEL

GROUND SCHOOL POINTS

Flight manual: engine, transmission and airspeed limitations

Flapback

Power required diagram

PREPARATORY INSTRUCTION

Aim

The aim is for the student to learn how to utilise speed control and power changes to achieve level balance flight at specified airspeeds. (Note: straight and level flight means at constant altitude and heading)

Review

Exercise 4: Effects of Controls

Exercise 5: Power and Attitude Changes

Motivation

This exercise will utilise speed control and power changing techniques learned in last exercise to achieve a level balanced flight at specified airspeeds.

Airmanship / TEM

- Positive hand over of controls
- Lookout
- W/V
- Monitor /scan of engine temperatures and pressures
- Helicopter limitations

Teaching Points

Describe how to maintain straight and level flight as follows:

Explain that the basic rules to remember from previous exercises are that the collective lever controls height and the cyclic controls the attitude therefore the airspeed.

Describe the power and airspeed settings used for straight and level cruise flight as appropriate to type.

Describe how to maintain airspeed at a constant altitude and airspeed by the use of visual and instrument cues, such as the relationship between the disc and the horizon, cross checking with the airspeed indicator, altimeter, VSI etc.

Describe how to conduct speed changes between 40-80kt in level balanced flight as follows:

Select the attitude to accelerate or decelerate, using trim or control friction if appropriate, to the desired speed and check with the altimeter and VSI to see whether climbing or

Make appropriate movement to the collective lever to correct climb or descent back to level flight at the same time preventing/correcting yaw with pedals.

Adjust attitude, power and yaw pedals as required to settle accurately in level flight at the nominated airspeed ensuring balance ball and/or string is in the middle. Note that attitude of the aircraft is not significantly different between 40-80kts.

AIR EXERCISE

Demonstrate straight and level balance flight at cruise power

Student practice

Demonstrate airspeed changes whilst maintaining altitude

Student practice

TIPS FOR INSTRUCTORS

If the student is able to cope, this exercise can be combined with Exercise 5.

Students will often tend to pay excessive attention to the flight instruments in this exercise. Care must be taken to ensure that a proper scan between the instruments and external references is established and that a good lookout is maintained.

It should be explained that it takes a certain time for speed changes to occur and attempts to hurry the process can lead to over controlling. Therefore the student should be encouraged to SELECT, HOLD and ADJUST. It is recommended that initially speed changes only between 40-80kts are practised.

Where appropriate to the aircraft type, demonstrate the methods of changing manifold pressure at constant rotor RPM and changing rotor RPM at constant manifold pressure.

COMMON ERRORS

- *Failure to hold attitude long enough to allow the speed to stabilise resulting in over controlling on the cyclic.*
- *Poor rotor RPM control usually caused by the lack of anticipation of the effect of changing airspeed.*
- *Failure to correct yaw during power changes.*
- *When flying straight and level controlling height with cyclic and speed with power.*

DANGER

7
CLIMBING

GROUND SCHOOL POINTS

Flight manual, Power Limitations & Performance Data

Optimum Climb Speed, Best Rate of Climb, Best Angle of Climb

Power Required Diagram

PREPARATORY INSTRUCTION

Aim

For the student to learn how to climb at given speeds, reommended airspeed and power settings.

Review

Exercise 5: Power and attitude changes.

Exercise 6: Straight and Level Flight.

Motivation

When learning to fly helicopters being able to climb with precision is an integral part of the basic handling of the aircraft.

Airmanship / TEM

- Lookout
- Helicopter limitations
- Control Handover

Teaching points

Explain using the Power Required Diagram and the POH: the different speeds for optimum climb best rate of climb and best angle of climb, that are achievable when altering power and airspeed. Give examples when and why the different techniques may be used.

Explain the importance of initially adopting straight and level attitude, before commencing a climb and performing a lookout, including above the aircraft altitude, emphasising the difficulty in seeing aircraft.

A mnemonic commonly used for climbing is APT:

ATTITUDE: Move the cyclic aft to adopt the helicopter climb attitude for the desired climbing airspeed

POWER: Raise collective to recommended climb power

TRIM: Apply the necessary pedal to maintain balanced flight

Describe how the climb attitude is performed visually using the helicopter attitude and the horizon.

Once the aircraft is assessed to be established in the climb the student should then check the airspeed, VSI, Altimeter, Compass, Power and make the necessary adjustments to the appropriate control .

Explain that before reaching the required altitude that it is necessary to anticipate the 'level off' and the same mnemonic can be applied:

ATTITUDE: Move the cyclic forward to adopt the helicopter in a straight and level attitude

POWER: Lower collective to required power to maintain straight and level flight

TRIM: Apply the necessary pedal to maintain balance flight

Describe how the level off is performed visually using the helicopter attitude and the horizon. Once the aircraft is assessed to be established in straight and level flight the student should then check the airspeed, VSI, Altimeter, compass, power and make the necessary adjustments to the appropriate control .

AIR EXERCISE

Demonstrate descending and level off at various speeds and power settings.

Student practice

TIPS FOR INSTRUCTORS

Emphasise the need for lookout, before and during the manoeuvre, especially above the aircraft, - LOOK OUT and CHECK IN!

Describe how cyclic is used for airspeed corrections, collective for altitude corrections and pedals used to maintain balanced flight and although the cyclic is used to initiate the climb after practice the procedure should be a co-ordination exercise among all three controls.

It may be possible to combine Exercises 7, 8 & 9 to make efficient use of time and airspace

COMMON ERRORS

- *On levelling out from the climb, reducing power before speed increases.*

8
DESCENDING

GROUND SCHOOL POINTS

Flight manual, Power Limitations & Performance Data

Optimum Descent Speed, Best Rate of Descent, Best Angle of Descent, Carburettor Icing

Power Required Diagram

PREPARATORY INSTRUCTION

Aim

For the student to learn how to descend at given speeds

Review

Exercise 5: Power and attitude changes.

Exercise 6: Straight and Level Flight.

Motivation

When learning to fly helicopters being able to descend with precision is an integral part of the basic handling of the aircraft.

Airmanship / TEM

- Lookout
- Carburettor Heat, if applicable
- Helicopter limitations
- Control Handover

Teaching points

Explain using the Power Required Diagram and the POH, the optimum descent speed, best rate of descent speed, best angle of descent, and the different rates of descent (ROD) achievable when altering power and airspeed, giving examples when and why the different techniques may be used.

Explain the importance of initially adopting a straight and level attitude, before commencing a descent and performing a lookout, including below the aircraft altitude, emphasising the difficulty in seeing aircraft below the horizon.

If the helicopter requires the application of carburettor heating emphasise the dangers of carburettor icing when reducing power to descend.

A mnemonic commonly used for descending is PAT:

POWER: Lower the collective to the required power setting for the descent

ATTITUDE: Move the cyclic aft to prevent nose down pitch, and select the helicopter attitude for the desired descent speed

TRIM: Apply the necessary pedal to maintain balanced flight

Describe how the descent attitude is performed visually using the helicopter attitude and the horizon. Once the aircraft is assessed to be established in the descent the student should then check the airspeed, VSI, Altimeter, Compass, Power and make the necessary adjustments to the appropriate control.

Explain that before reaching the required altitude that it is necessary to anticipate the 'level off' and the same mnemonic can be applied:

POWER: Raise the collective to the required power setting for the desired level flight speed

ATTITUDE: Move the cyclic forward to prevent nose up pitch, and select the helicopter attitude for the desired level flight speed

TRIM: Apply the necessary pedal to maintain balanced flight

Describe how the level off is performed visually using the helicopter attitude and the horizon. Once the aircraft is assessed to be established in straight and level flight the student should then check the airspeed, VSI, Altimeter, compass, power and make the necessary adjustments to the appropriate control.

AIR EXERCISE

Demonstrate descending and level off at various speeds and power settings.

Student practice

TIPS FOR INSTRUCTORS

Emphasise the need for lookout, before and during the manoeuvre, especially below the aircraft, - LOOK OUT; ATTITUDE; INSTRUMENTS

Describe how cyclic is used for airspeed corrections, collective for altitude corrections and pedals used to maintain balanced flight and although the cyclic is used to initiate the descent after practice the procedure should be a co-ordination exercise among all three controls.

If the helicopter is equipped with a carburettor - explain the formation and dangers of carburettor icing, and explain the carburettor heating system and its operation.

It may be possible to combine Exercises 7, 8 & 9 to make efficient use of time and airspace

COMMON ERRORS

- *Failure to maintain attitude caused by chasing the aircraft instruments.*

9
TURNING

GROUND SCHOOL POINTS

POH Optimum Angle of Bank, for Rate 1 & Medium Turns

PREPARATORY INSTRUCTION

Aim

For the student to learn how to turn the helicopter on a new heading in level flight and whilst climbing and descending.

Review

Exercise 6: Straight and Level Flight

Exercise 7: Climbing

Exercise 8: Descending

Motivation

When learning to fly helicopters it is necessary to be able to alter the direction of the helicopter in a controlled and accurate manner.

Airmanship / TEM

- Lookout
- Helicopter limitations
- Control Handover

Teaching points

Level Medium Turns

Explain that before any turn is attempted it is necessary to perform an effective lookout, especially in the direction of turn.

Describe how lateral cyclic is used to roll to the desired angle of bank, noting that the cyclic is affected by rate of displacement so should be a smooth controlled movement. The bank angle should be selected by reference to the horizon.

Explain once in the turn the ASI, VSI, Altimeter, Power, balance all should be checked and the student should return to looking outside and referencing the horizon and bank angle. Describe how cyclic is used for airspeed corrections, collective for altitude corrections and pedals used to maintain balanced flight and how it will be necessary to repeat the check during the turn.

Explain that the student should anticipate when the new desired direction is reached and begin to roll level before the direction is obtained. To roll level use lateral cyclic to place the helicopter in a level attitude. Once level, the instruments should be checked for precision and necessary adjustments made for straight and level flight.

Climbing and Descending Turns

Describe how to perform turning in the climb and in the descent as follows:

Perform a lookout, including above, and then initiate a climb. Once the climb has been established use lateral cyclic to turn, noting the reduced rate of climb during the turn and control/correct with collective application. Note that returning to level attitude during the climb will restore the original rate of climb.

Perform a Lookout, including below, and then initiate a descent. Once the descent has been established use lateral cyclic to turn. Note the increased rate of descent during the turn and control with collective application. Note that returning to level attitude during the descent will restore the original rate of descent.

AIR EXERCISE

Demonstrate medium level turns left and right on to nominated headings using the gyro heading indicator and compass.

Student practice

Demonstrate medium climbing and descending turns left and right on to nominated headings using the gyro heading indicator and compass.

Student practice

Demonstrate medium level turns left and right on to nominated headings using the gyro heading indicator and compass.

Student practice

COMMON ERRORS

- *When turning, using the pedals to assist in the turn, causing out of trim flight.*

TIPS FOR INSTRUCTORS

Emphasise the need for lookout, before and during the manoeuvre, especially in the direction of turn and above and below when descending and climbing.

It should be noted that in a helicopter with side-by-side seat configuration, there may be an offset seating visual error. This is due to the fact that the helicopter is turning through the longitudinal axis, from which the student position is offset. This can lead to incorrect fore and aft attitude selection and should be corrected in the turn. It is important that turns be practised in both directions to show the different visual references in the helicopter.

It is usual for the student to spend too much time looking in at the instruments during the turn/climb/descent and over control the helicopter, especially with instruments that lag. An effective scan and lookout should be used to climb/descend accurately. Because of the need for safety and accuracy the student should be taught how to LOOK OUT and CHECK IN!

Students also have a tendency to assist the turn using the pedals, (especially fixed wing pilots). This needs to be monitored and corrected if it occurs.

Once the student is comfortable with the basic handling during a turn the instructor can introduce turning on to headings using the Compass and demonstrate the changes of compass when rolling level on to a Magnetic Heading of North and South. The student can also learn how to turn on to heading using the Directional Gyro, and emphasise the need to check the Directional Gyro before turning, and Gyroscopic Errors. However the Directional Gyro removes the Compass turning errors.

Note that any errors should be correctly identified before any corrections made (e.g. it is possible for the student to note a rate of climb and adjust the collective, when the rate of climb was caused by the helicopter attitude. Therefore requiring a cyclic correction).

Explain that the student should anticipate when the new desired direction is reached and begin to roll level before the direction is obtained. To roll level use lateral cyclic to place the helicopter in a level attitude. Once level, the instruments should be checked for precision and if necessary adjustments made for straight and level flight.

It may be possible to combine Exercises 7, 8 & 9 to make efficient use of time and airspace

10
BASIC AUTOROTATION

GROUND SCHOOL POINTS

- H. V. Diagram
- Flight Manual
- Aerodynamics of Autorotations

PREPARATORY INSTRUCTION

Aim

For the student to learn autorotation

(A) safety checks, verbal warning and look-out;

(B) entry, development and characteristics;

(C) control of air speed and RRPM, rotor and engine limitations;

(D) effect of AUM, IAS, disc loading, G forces and density altitude;

re-engagement and go-around procedures (throttle over-ride or ERPM control);

(F) danger of vortex condition during recovery;

(G) gentle and medium turns in autorotation techniques;

(H) demonstration of variable flare simulated engine off landing.

Review

Climbs, descents and turns

Motivation

In powered flight the rotor drag is overcome by engine power but when the engine fails or is deliberately disengaged some other means is required to maintain the RPM. This is achieved by allowing the helicopter to descend and lowering the collective lever so that the resultant airflow provides the driving force to turn the blades.

Airmanship / TEM

Pre-entry checks, to include:

Pre-landing check.

Lookout, particularly below in the descent and above in the go-around.

Select suitable precautionary landing area.

Verbal warning.

Post-entry checks as appropriate to type.

Aircraft performance limitations, specifically RPM.

Teaching Points

Explain that the helicopter is fully manoeuvrable in autorotation.

State the manufacturer's Indicated Airspeed and RPM for minimum rate of descent in autorotation.

Describe the entry, as follows:

At a safe altitude, straight and level cruise, into wind, over a suitable area, complete airmanship checks.

Lower collective.

Use throttle to prevent overspeed, as appropriate to type.

When collective is fully down, split needles and select recommended engine RPM.

Prevent yaw.

Explain that:

Heading and airspeed are controlled with cyclic, as in powered flight.

Changes in speed will cause the RRPM to increase and decrease.

RPM is controlled by collective.

Point out that turns in autorotation increase the rate of descent and RPM.

COMMON ERRORS

- *Allowing the nose to drop during entry.*
- *Allowing aircraft to yaw during entry and re engagement.*
- *Over controlling on cyclic on entry.*
- *Closing throttle before collective lever is fully down.*
- *Over speeding the engine by not closing the throttle as collective lever is lowered.*
- *Harsh re-engagement with a tendency to over pitch on go-around with low RPM.*
- *Rapid throttle engagement and raising collective lever on go-around causing Overspeed.*
- *Ensuring safe airspeed, before initiating go-around, to prevent Vortex Ring state.*

Describe the go-around as follows:

At a safe altitude, rejoin the needles, using the throttle as appropriate to type.

Apply climb power.

Select or maintain climb airspeed.

Explain that whereas the reaction has to be quick in the event of an actual engine failure, the accent during this introduction will be on smoothness and accuracy.

11a
HOVERING

GROUND SCHOOL POINTS

Ground Effect

Tail Rotor Drift/Roll

Flight manual performance charts:

- Hover in-ground effect
- Hover out-of-ground effect
- HV Graph - Risks Associated
- Over-pitching - Rotor Stall

PREPARATORY INSTRUCTION

Aim

For the student to learn how to hover IGE.

Review

Exercise 4 - Effects of Controls

Motivation

It is essential to helicopter operations to be able to hover a helicopter holding a given position relative to the ground, maintaining a constant height and heading as a prerequisite to a safe landing.

Airmanship / TEM

- Lookout
- Engine limitations
- Wind speed and direction
- Downwash
- Tail rotor clearance

Teaching Points

The hover

Define hovering as maintaining a constant height and heading over a given ground position.

State the hover height, as appropriate to type.

Explain that facing into the wind results in the helicopter being easier to control and uses less power.

Explain the effects of controls at the hover.

Cyclic

Point out the following:

The cyclic controls the disc attitude which in turn controls the helicopter's position over the ground. A change of disc attitude is followed by a change in fuselage attitude. This results in the helicopter moving over the ground. In some types of helicopter there is an appreciable lag in this chain of events.

Regaining the hover from movement in any direction requires two attitude changes: one to stop the movement, and a second to stabilise the helicopter.

All cyclic movements should be small. Cyclic trim should be employed, if applicable.

Collective

Point out the following:

The collective controls the height above ground.

Changes in collective pitch will produce yaw and RPM changes unless prevented.

Throttle

Where appropriate to type, describe the use of the throttle to maintain RPM.

When an in-flight low RPM condition exists, explain that if the condition is allowed to deteriorate to a dangerously low RPM, Rotor Stall can occur with severe or fatal consequences. Explain that immediately the throttle must be increased and simultaneously the collective lowered, as appropriate, to recover from the low RPM condition. Emphasize the importance of avoidance and early recognition (via: engine noise, warning horn or light) of a low RPM condition.

Pedals

Point out that the pedals control heading.

Describe the effects of pedal control movements on heading and RPM.

Describe the visual cues used to maintain the hover, and stress the importance of looking well ahead of the helicopter.

COMMON ERRORS

- *Tenseness on the controls, particularly the pedals.*

AIR EXERCISE

Demonstrate the use of the cyclic at the hover into wind.

Student practice with the cyclic only, until a hover can be maintained without excessive effort.

Demonstrate the use of the collective.

Student practice.

Demonstrate the use of the pedals.

Student practice.

Student practice using all controls.

Demonstrate the differences in power required to hover in and out of the wind, with the ground effect, and over different types of surface (e.g. tarmac, long grass).

Demonstrate gentle forward running touchdown.

Demonstrate down wash and explain specific hazards for example snow, dust and litter.

TIPS FOR INSTRUCTORS

This exercise demands a high degree of coordination and should not be taught until the student has acquired a reasonable state of competence in Exercises 1 to 6. Introducing it earlier than this could lead to frustration and undue fatigue for both student and instructor.

An alternative technique is to use slow flight to introduce hovering. This procedure takes the form of low, slow flight into the wind across a suitable clear area. Speed and height are progressively reduced in successive passes until the helicopter is creeping forward at a walking pace in ground effect and is then momentarily halted before transitioning into forward flight again. These momentary pauses are in fact periods of hovering, however brief, and are gradually extended as competency improves, until prolonged periods of hovering are achieved. This procedure is outlined in Exercise 13.

Whichever technique for teaching the hover is used, the student will generally tend to tire quickly. Air exercises should be kept short and terminated as soon as the first signs of fatigue appear.

Initially the student may not be able to use more than one control at a time, and it may even be necessary to limit the travel of that control.

Allow frequent rest periods to enable the student to relax, and try to practise other exercises or perform other demonstrations to give the student a break from hovering.

Keep a close watch on the temperatures, pressures and wind velocity during prolonged hovering.

11b
HOVER TAXIING AND SPOT TURNS

GROUND SCHOOL POINTS

Flight manual: Performance charts

PREPARATORY INSTRUCTION

Aim

For the student to learn how to:

- turn at the hover
- hover-taxi.
- perform a gentle forward running landing.
- maintaining height and heading.

Review

Exercise 11a: Hovering

Motivation

Manoeuvring close to the ground and obstacles is necessary to position the helicopter on the airfield ready to transition and to return to the parking area after landing. It is also necessary to complete a lookout turn before take off and moving off in any direction.

Airmanship / TEM

- Lookout: obstacles
- Helicopter limitations

Teaching Points

Turn at the hover

Describe the techniques for making hovering turns, and stress the following points:

The effects of weathercocking must be taken into account.

There can be problems with yaw control and a need for increased power when the helicopter is downwind, or crosswind, in strong wind conditions.

Lookout is important during all hovering manoeuvres and, in particular, for low obstacles that are hard to see and that can snag the landing gear or tail rotor.

In strong or gusty wind conditions, a turn away from into the wind should be in the opposite direction to the torque reaction (i.e. to the left in a helicopter with a counter-clock turning rotor). In this way it is possible to ensure that there is sufficient tail rotor control available. If control limits are reached at this stage, a safe return to into-wind is easily accomplished.

No turns or any movements from the hover should be initiated until the helicopter is settled in an accurate hover at the required RPM and power setting.

The continuous use of high power in this exercise means that a careful watch should be kept on engine temperatures and pressures. Prolonged hovering out of the wind should be avoided on some types of helicopter because of the dangers from carbon monoxide in the cockpit.

In some helicopters at certain C of G configurations (i.e. high cabin loading) it is possible to reach the aft cyclic limits when hovering downwind. Warn the student of this possibility and describe the safe recovery actions when:

- turning into the wind
- landing straight ahead
- Hover-taxiing

State the height and ground speed to be used, and relate them to the safety considerations.

Describe the effects of the controls.

Describe technique for gentle forward running landing.

AIR EXERCISE

Hovering turns

Demonstrate 360° hovering turns in each direction, commencing into the wind and pausing at each 90° point.

Student practice

Hover-taxi

Demonstrate hover-taxiing into the wind.

Student practice

Demonstrate hover-taxiing out of the wind.

Student practice

Running Landing

Demonstrate gentle running landing.

Student practice.

COMMON ERRORS

- *Inability to recognise attitude changes until the aircraft moves.*

TIPS FOR INSTRUCTORS

Dual instruction in this exercise should be carried out in a wide range of wind conditions. This will prevent the situation arising where the dual instruction is given on a calm day and the student meets the problems of strong winds when solo on another.

Pausing at each cardinal point enables the instructor to point out the different cyclic positions into the wind. When the student is competent, complete the 360° turn without pause.

Whenever possible, when hover-taxiing, keep the skids parallel to the helicopter movement in case of engine failure or the need to run the helicopter on to the ground in an aft C of G condition.

Turns around the tail are covered separately in Exercise 17.

Sometimes the student will use cyclic instead of pedal to help turn the helicopter, particularly in strong winds. This should be avoided.

When the student is proficient at the basics, introduce some hover patterns requiring taxiing and pedal turns.

11c
HOVERING AND TAXIING EMERGENCIES

GROUND SCHOOL POINTS

Flight manual: Height velocity chart, overpitching, emergency procedures.

PREPARATORY INSTRUCTION

Aim

For the student to learn how to land safely following an engine failure/hydraulic failure (where appropriate) at the hover or hover-taxi and recognise over-pitching in order to take the corrective action.

Review

Exercise 11a & 11b: Hovering/Hover taxi and spot turns

Exercise 12: Take-off and landing (when covered)

Motivation

Malfunctions, whilst very rare can happen in the hover/hover taxi and because of the proximity to the ground, swift corrective action is required to minimise damage.

Airmanship / TEM

- Selection of a suitable area for practice
- Wind speed and direction

Teaching Points

Point out that at normal hover or hover-taxi heights, it will not be possible for the pilot to enter autorotation. In fact, lowering the collective following an engine failure will result in a heavy landing. This manoeuvre should not be considered an autorotation; the pilot relies on the inertia in the rotor system to land safely.

Describe the reaction of the helicopter when the engine fails:

- yaw
- drift
- sink.

Explain that the yaw and drift must be corrected before touchdown. Sink should be controlled by use of the collective, as appropriate to the type of helicopter and the height above ground, to cushion the landing.

Explain that should engine failure occur at the hover-taxi, the pilot should avoid any rearward movement of the cyclic and accept a run-on landing.

AIR EXERCISE

Engine failure in the hover

Demonstrate into wind as follows:

Give a verbal warning.

Close the throttle.

Counteract yaw and drift.

Cushion the landing.

Student practice

Engine failure at the hover taxi

Demonstrate into the wind.

Student practice.

Hydraulic failure in the hover/hover taxi

Demonstrate into wind as follows:

Give verbal warning

Turn off hydraulics

Carry out landing in accordance with flight manual

Student practice as appropriate

Over-pitching

Use technique as appropriate to aircraft type

Student practice.

COMMON ERRORS

- *Failure to distinguish between drift and yaw.*
- *Visual reference on the ground immediately in front of the aircraft.*
- *Yawing out of wind.*
- *Over controlling of the controls causing Pilot Induced Oscillations.*
- *Never allow the student to remove hands from controls in the hover without positive change over of control.*
- *The Student will, initially, find hovering extremely fatiguing and will need regular rest to prevent loss in ability.*

TIPS FOR INSTRUCTORS

This exercise should be introduced by providing the student with plenty of warning before each practice. The manoeuvre can then be speeded-up to flight test standards where the student is given minimal warning of the practice engine failure.

Closing the throttle and cushioning the landing with the collective takes a good deal of manual dexterity in most helicopters. Since the aim of this exercise is for students to react to an engine failure, there is little point in their learning throttle control. In other words, the instructor should control the throttle.

Tail-rotor failure at the hover or hover-taxi, which does require coordinated use of the throttle and collective by the student, should be practised at a later stage in training.

Always ensure that the surface is suitable for this exercise,

This is a good exercise to demonstrate to the student the landing stage of an autorotation. It is a good skill to practise just before starting a full-on autorotation exercise.

Exercise caution, as the student may react to the simulated engine failure by rapidly lowering the collective. Be sure to give a verbal warning before closing the throttle.

Over-pitching can best be demonstrated at maximum all up mass.

Hydraulic failures/de-selection at low speeds can result in strong and rapid feedback forces especially in helicopters without hydraulic accumulators. Often the hydraulic switch is located only on the pilot's side and therefore consideration needs to be given as to how the instructor covers the controls while the hydraulics are de-selected.

12
TAKE-OFF AND LANDING

GROUND SCHOOL POINTS

Dynamic rollover

Ground resonance

Flight manual: checks

Over-pitching - Rotor Stall

PREPARATORY INSTRUCTION

Aim

For the student to learn how to take off to, and land from, the hover into wind, cross wind and down wind.

Review

Exercise 11a Hovering

Exercise 11b Hover Taxiing and Spot Turns

Exercise 11c Hovering and Taxiing Emergencies

Motivation

Full and accurate control of the helicopter in the take-off and landing phase is vital to flight safety.

Airmanship / TEM

- Lookout
- Engine consideration
- Pre-takeoff /after take off/pre-landing checks
- Wind speed and direction

Teaching Points

Take-off

Describe the procedures for take-off to the hover into wind, as appropriate to type, and including:

pre-take-off checks

effects of controls during take-off:

cyclic to maintain position over the ground

collective to gain height

pedals to prevent yaw.

Hover check as appropriate to type, but including:

centre-of-gravity check

power required to hover

control response normal.

Point out the dangers of over-pitching- leading to low Rotor RPM and Rotor Stall. As appropriate to the type, describe the avoidance and recovery actions, including:

- Knowledge of the preconditions of over-pitching and low RPM
- Recognition of the symptoms for low RPM
- Skill in applying the appropriate recovery technique

Describe the symptoms of incipient dynamic rollover, avoidance and recovery action:

- Landing

Describe the procedure for landing from the hover into wind, as appropriate to type and including:

the need to start the manoeuvre from a stable and accurate hover

the effects of controls during landing from the hover:

- use the cyclic to maintain position. Stress the need to avoid sideways or rearwards drift.
- use the collective to control the rate of descent
- use the pedals to prevent yaw.

Point out the need to anticipate the increase in ground effect during a landing in light or nil wind conditions.

Point out the need to anticipate ground resonance, if applicable to type.

COMMON ERRORS

LANDING:

- *Over controlling on cyclic and collective lever during latter stages of descent.*
- *Failure to appreciate attitude changes, looking downwards.*
- *Pulling back or pushing forward on cyclic after touchdown.*
- *Failure to lower collective lever fully after touchdown.*
- *Attempting to land with an unstable hover.*

TAKE-OFF:

- *Failure to appreciate attitude changes and the need for corrections.*
- *Slowness in correcting yaw.*
- *Incorrect use of the collective lever and throttle resulting in a rapid climb out of the ground cushion, over speeding and over pitching.*
- *Failure to ensure correct control position before initiating take-off.*

AIR EXERCISE

Demonstrate the take-off to the hover into wind.

Demonstrate hover into wind check.

Student practice

Demonstrate landing from the hover into wind.

Demonstrate take off and landings cross wind and down wind

Student practice

TIPS FOR INSTRUCTORS

Do not teach this exercise unless the student can consistently maintain a steady hover.

It is essential that horizontal and yawing movements are corrected before a landing is made. Should movement in either plane exist whilst descending to land the student should be made to immediately abandon the landing and return to hover by raising the collective smoothly enough to return to safe hover height. Once in the hover a conscious effort to relax the student should be made before a further attempt.

Ensure students keep looking at their reference points in front of the helicopter and not down at the ground.

Monitor the collective closely on the initial attempts to land so as to guard against sudden and excessive movements. Ensure once landing is achieved, the collective is smoothly lowered full-down.

It is generally an advantage to strive for smoothness and accuracy before speed during these manoeuvres.

Student technique should nonetheless be developed to the point where contact with the ground is made and broken cleanly, particularly in helicopters prone to ground resonance.

When the student is working smoothly and accurately, introduce lifting from the 'skids light' condition to a low hover before going to normal hover height to preclude dynamic rollover.

Be aware that, when getting close to the surface, some students try to 'feel' the ground by rocking the cyclic laterally.

As with hovering, this exercise is very tiring; break it up by practising other exercises when necessary.

13
TRANSITIONS FROM HOVER TO CLIMB AND APPROACH TO HOVER

GROUND SCHOOL POINTS

Note: Transitions can be taught in conjunction with the lesson on circuits unless a student displays problems with the concepts associated with the transition.

Ground effect

Translational lift

Dissymmetry of lift and flap back

Tail rotor drift

Vortex ring

Flight manual:

- Height velocity chart
- Climb and descent power
- Airspeed settings

PREPARATION INSTRUCTION

Aim

The aim is for the student to learn how to:

- conduct a look out turn
- transition from the hover to the climb
- transition to the hover from the descent
- demonstrate a variable flare simulated engine off landing.

Review

Straight and level flight, climbs and descents, hovering and autorotations.

Motivation

The term transition covers all flight to and from the hover. The constant angle approach is particularly important as it is used in circuits and future advanced exercises.

Airmanship / TEM

- Lookout including the lookout turn
- Wind velocity
- Checks

Teaching Points

Transition to the climb

Describe the transition from the hover to the climb as follows:

Complete pre-take off checks

Establish a steady hover into wind

Complete after take off checks

Establish a steady hover into wind.

Make a lookout turn and check that the area is clear.

Select an outside reference to help in directional control, and ease the cyclic forward slightly to initiate movement.

Apply lateral cyclic to overcome inflow roll effect.

At the same time, if required, adjust power sufficiently to maintain height as ground effect is lost and translational lift is acquired.

Apply enough forward cyclic to overcome flap-back.

Select the climb attitude and power.

Prevent yaw throughout and adjust the attitude as required to maintain the climb attitude.

Transition from forward flight to the hover (standard approach)

Explain that the transition to the hover involves two separate requirements that have to be combined into one coordinated manoeuvre:

Height reduction

Height must be reduced from the approach altitude to the hover height above ground. Explain the constant angle approach, describing the visual indications.

COMMON ERRORS

- *Failure to correct yaw with power changes.*
- *Applying too much power during transition to climb, over pitching.*
- *Failure to anticipate loss of Translational Lift when approaching hover.*
- *Incorrect judgement of apparent groundspeed and closing angle.*
- *Incorrect use of cyclic and collective lever during approach to hover.*

Speed reduction: Speed must be progressively reduced from the approach airspeed to a zero groundspeed at the hover. Varying approach angles and/or wind conditions will cause the airspeed to vary a great deal from one approach to another. It is vital, therefore, that the student learns to refer to groundspeed only.

Describe the procedure as follows:

Approach the landing spot into the wind at a specific altitude and airspeed.

Select a constant approach angle (sight picture).

Initiate the approach by reducing power and commencing a progressive decrease in airspeed.

Maintain the constant approach angle with the collective.

Establish the constant ground/closing speed (a fast walking pace), and maintain it with the cyclic.

Anticipate the loss of translational lift.

Establish a hover over the selected spot.

Prevent yaw or sideways drift.

Describe the go-around (missed approach) procedures as appropriate to type and local conditions.

Explain that wind velocity will significantly affect helicopter performance and handling characteristics, as appropriate to type.

AIR EXERCISE

Demonstrate inflow roll, flap-back and a transition from the hover to the climb.

Student practice

Demonstrate a transition to the hover, showing the visual cues of overshooting/undershooting the constant angle approach and the actions required to re-establish the constant approach angle and the correct rate of closure.

Student practice

Demonstrate the go-around procedures.

Student practice

TIPS FOR INSTRUCTORS

The concept of making an approach at a constant angle and at a progressively decreasing ground speed can be a difficult one for the student pilot to grasp. The use of perspective diagrams in pre-flight briefing is essential.

The instructor should be prepared for the fact that, in the early stages, the student will almost certainly fail to anticipate the amount of power required when translational lift is lost coming to the hover. This will often lead to undershooting.

Another problem resulting from this is underestimation of the pedal requirements. Explain that the greater the power required to establish the hover, the greater the pedal movement required to keep the helicopter straight, and this can be corrected only by using an outside reference.

Emphasise the need to assess the approach in relation to the groundspeed and sight picture. This can be accomplished only by looking outside the helicopter, with an occasional cross-check of the instruments.

Ensure that the pedals are used to make the helicopter move straight with the direction of travel when close to the ground.

Students should be encouraged to go-around if the rate of descent is high and the airspeed is low.

R44 Clipper II
LOW-G PUSHOVERS PROHIBITED
START
HYD
CH SEL
FREQ

14a
CIRCUIT, APPROACH AND LANDING

GROUND SCHOOL POINTS

Local aerodrome procedures.

PREPARATORY INSTRUCTION

Aim

For the student to learn how to fly an accurate circuit

Review

All previous exercises as required.

Motivation

Circuits remain an excellent way of consolidating all the previous air exercises in one convenient sequence.

Airmanship / TEM

Circuit patterns are used at aerodromes and field sites to ensure a safe separation of aircraft operating at an aerodrome and as an exercise circuits remain an excellent way of consolidating all the previous air exercises in one convenient sequence.

- Lookout
- Checks
- RT procedures
- Wind velocity
- Spacial awareness and spacing with other traffic
- Local noise abatement procedures

Teaching Points

With the aid of suitable visual aids, describe the circuit pattern to be used, specifying directions, speeds, distances, heights, etc.

Where applicable, explain the use of the radio and the significance of Air Traffic Service instructions and clearances.

Where applicable, describe local procedures for joining and leaving the circuit including noise abatement considerations.

AIR EXERCISE

Demonstrate a circuit.

Student practice

When circumstances permit, demonstrate:

circuit spacing: speed and circuit size variations, and

acceptance and/or compliance with Air Traffic Service instructions and clearances.

Student practice

When a reasonable standard has been reached in normal circuits;

describe the application of Exercise 14c (Emergency Procedures) to the various segments of the circuit, as applicable to type and local conditions; and

Demonstrate go rounds

Student practice

Demonstrate emergencies in the circuit.

Student practice

TIPS FOR INSTRUCTOR

This exercise should be introduced when a reasonable level of competence at transitions and the preceding exercises has been reached. Otherwise the result will be time-wasting and hard on the student's morale.

When flying in the circuit encourage the student to strive for perfection, but not to the detriment of look-out by concentrating too much on the instruments.

Impress upon your student to 'go around' rather than trying to make a good approach from a poor one.

Correct any persistent errors, but by this stage, students should be self critical enough to recognise and remedy most faults themselves.

COMMON ERRORS

- *Failure to look out in turns.*

14b
STEEP AND LIMITED POWER APPROACHES AND LANDINGS

GROUND SCHOOL POINTS

Flight manual:

Limitations

Load and density altitude performance charts

Vortex ring

Over-pitching - Rotor Stall

PREPARATORY INSTRUCTION

Aim

For the student to learn additional approach and landing techniques for use under varying conditions

Review

Exercise 12:Take-off and Landing

Exercise 13: Transitions from Hover to Climb and Approach to Hover

Motivation

Although the techniques learned in Exercises 7 and 11 are those that should continue to be used under optimum conditions, situations such as high all-up weight, high density altitude, unfavourable wind conditions, limited power or obstacles close to the flight path may dictate the use of advanced techniques.

Airmanship / TEM

- Lookout: obstacles
- Helicopter limitations
- Checks
- Wind Velocity
- Vortex Ring
- Ground Effect

Teaching Points

Zero speed landing

Explain that this type of landing is useful in conditions where it is not desirable to approach or hover, such as in dust, powdery snow or turbulence. It requires less power than a normal approach to a hover.

Describe the technique for carrying out a zero speedlanding, as follows:

Approach the selected landing spot as required.

When the approach is almost completed, and groundspeed is close to zero, anticipate loss of translational lift by applying sufficient power to minimise the rate of descent.

Let the helicopter sink gently through the cushion on to the ground.

Point out that this type of landing requires recce prior confirmation that the selected spot is suitable for landing.

Running landing

Explain that this type of landing can be used in similar conditions as the zero speed landing. Although it is easier to maintain directional stability and requires less power to perform because translation lift is maintained until landing on a large, flat, smooth surface such as a runway is essential.

Describe the technique for carrying out a running landing, as follows:

Approach the selected landing area as required.

As the approach is completed, run on at slow walking pace.

Apply sufficient power to cushion the landing.

After landing, maintain the cyclic and collective positions until forward movement stops.

Approaches

Explain that in operational conditions it is sometimes necessary to approach to land at an angle other than standard, as follows:

COMMON ERRORS

- *Failure to anticipate height to level off.*

Steep approach

This approach is for avoiding obstacles on the final approach path. Point out that airspeed will be lower than normal and that more power will be required.

Always prepare for a zero speed landing.

Stress the need to maintain reasonable airspeed for as long as possible owing to the danger of a vortex ring state occurring or of insufficient power to prevent a high sink rate and a hard landing.

Shallow approach

Explain to the student that a shallow approach requires less power than a standard or steep approach. It should be employed when the approach path is free from obstacles and where conditions limit the power available, or where maximum power is available but inadequate for the use of standard techniques.

Stress that care should be taken to avoid making the approach angle too shallow, i.e. flat. This requires more power and can lead to problems in decelerating to a hover because of the possibility of the tail striking the ground.

AIR EXERCISE

Review the standard approach to the hover into wind pointing out changes in power required due to ground effect in the latter stages. Note and compare the power required, after demonstrating with the following techniques:

standard approach to a zero speed landing

standard approach to a run-on landing

steep approach to a zero speed landing

shallow approach to the hover

shallow approach to a zero speed landing.

Student practice

Demonstrate a flat approach (i.e. too shallow) and point out the difference in power required.

Demonstrate a variable flare simulated EOL.

TIPS FOR INSTRUCTORS

Introduce these techniques in a flat, clear training area ideally. This exercise should be flown in light wind conditions.

Limited power situations can be achieved by loading the helicopter or by limiting the amount of power the student is allowed to use, as appropriate to type.

Zero speed landings can, and should, be practised from any type of approach.

Point out the similarities of the running landing to an engine failure in the hover with regard to groundspeed and pedal control.

Initially, when you are demonstrating steep approaches use an open area, preferably with a line of trees or bushes over which you can shoot the approach. Ensure that the student can see the intended landing spot over the trees.

14c
EMERGENCY PROCEDURES

GROUND SCHOOL POINTS

Flight manual

PREPARATORY INSTRUCTION

Aim

For the student to learn how to conduct:

- an abandoned take-off;
- a missed approach and go-around;
- a hydraulic off landing (if applicable);
- a tail rotor control or tail rotor drive failure (briefing only)
- simulated emergencies in the circuit to include:
  - (a) hydraulics failure;
  - (b) simulated engine failure on take-off, crosswind, downwind and base leg;
  - (c) governor failure.

Review

Exercise 10; Basic Autorotation

Exercise11c; Hovering and Taxiing Emergencies

Exercise13; Transitions from Hover to Climb and Approach to Hover

Exercise14a; Circuit approach and Landing

Motivation

The ability to detect and manage a malfunction or emergency safely is essential before the student is permitted to conduct his first solo flight.

Airmanship / TEM

- Lookout
- Wind W/V
- ATC calls
- Vortex Ring
- Checks
- Touch drills

Teaching Points

Abandoned Take Off

The importance of conducting after take-off checks before transitioning from the hover should be stressed including the necessity to immediately land back on the ground if an abnormality is detected.

During the transition from the hover, if a malfunction or emergency is detected, then if safe to do so, the climb should be stopped and a controlled descent, back to the ground, into wind should be conducted. During practice/ demonstrations possible precautionary/emergency landing sites should be identified on the climb out path.

Missed Approach and Go Around

The student will have had demonstrated the go-around technique in Exercise 14a. However, it is important that the student should be able to recognise the necessity for, and procedure to be used for a missed approach, go around, and climb back into the circuit, without prompting and un-assisted. The Instructor should ensure that the student is monitoring the rate of descent, speed and power available throughout the descent in order to identify a possible requirement for a go around at all stages of the approach. Student practice of a go around with a Vy climb back into the circuit including the completion of the appropriate checks and radio calls, should be undertaken prior to solo flight.

Simulated Emergencies in the Circuit / Hydraulic Landing

If safe to do, the hydraulic failure demonstration should take place initially in flight at altitude, demonstrating how to recover the aircraft to an appropriate safe flight condition before conducting the relevant flight manual procedures. This can then be progressed to conduct the approach and appropriate landing technique in accordance with the flight manual recommendations.

Simulated Engine Failure on crosswind, downwind, base and finals

The techniques taught in Exercise 10 Basic Autorotation, should now be developed to demonstrate how to conduct simulated engine failures during the various stages of the circuit. It would be appropriate to also introduce the students to elements of practice forced landings from Ex 21. The student should also have had demonstrated and practised basic EOLs from Ex 19 prior to going solo. During the practice circuits the landing sites to be used in the case of an engine failure should be identified and PFLs practised to those sites.

COMMON ERRORS

- *Incorrect technique when levelling off from climb.*
- *Failure to appreciate drift when across wind.*
- *Failure to select the correct approach angle and failing to commence the descent immediately the correct approach angle is reached.*
- *Excessive rates of descent with low airspeed.*
- *Undershooting the landing point.*
- *Incorrect hover height.*
- *Harsh use of controls and poor control.*

Governor Failure

As appropriate to the aircraft type the student would in Exercise 4 have had demonstrated the effects of the governor. If safe to do, the governor failure demonstration should take place initially in flight at altitude, demonstrating how to recover the aircraft to an appropriate safe flight condition before conducting the relevant flight manual procedures.

This can then be progressed to conduct an approach and appropriate landing technique in accordance with the flight manual recommendations. As part of the training the recognition of and recovery from low and high rotor rpm conditions should be demonstrated and practised.

Tail Rotor Failure

Tail rotor failures at this stage are normally only a discussion with the instructor using the relevant flight manual to explain the various tail rotor malfunctions and the appropriate techniques to be employed. Later in the syllabus, when the student handling skills have been developed, it may be possible to fly the appropriate tail rotor failure/malfunction recovery techniques.

AIR EXERCISE

Demonstrate abandoned take-off.

Student practice

Demonstrate missed approach and go-around.

Student practice

Demonstrate simulated emergencies in the circuit.

Student practice

TIPS FOR INSTRUCTORS

Prior to teaching aircraft malfunctions and emergency procedures to students it is important that they understand how the principles of Threat and Error Management can assist them in such situations.

Before the flight it is important that the procedures in the aircraft flight manual (FM) or Pilot Operating Handbook (POH) are fully briefed and understood including, where appropriate, the manufacturer's definitions for Land Immediately, Land as soon as Possible and Land as soon as Practicable.

A sound technical knowledge of the helicopter systems will assist the pilot in making an informed decision when faced with an unusual situation. It is important during the aircraft technical knowledge training that the pilot understands how and where the cockpit indications are taken from, any common faults or indications and how to differentiate between a system fault and a gauge/warning light malfunction.

When training the student for aircraft malfunctions it is important to initially build confidence by demonstrating careful, safe de-selection of the appropriate systems to show the relevant indications, handling effects and how to rectify/mitigate in a safe timely manner.

Once this is satisfactorily achieved pilots must then learn how to identify a malfunction, diagnose and carry out the appropriate actions in accordance with the FM/POH. A useful procedure to follow using an adaptation of the DODAR decision making cycle is:

Detect - a malfunction can be detected by any, or all of the senses, not only visually by a warning light or gauge indication. It could be aurally by a warning horn or noticing unusual noises, it could be the smell of burning or feeling of a vibration through the controls.

Obtain Information – once a possible malfunction is detected then the pilot must use their CRM skills to gain all relevant information by cross checking for other aircraft indications, using crew members, passengers, ground observers, ATC, etc to gain as much information as possible before continuing on to the next stage.

Decide – once all the information is collated and the diagnosis is complete, a decision can then be made as to the most appropriate course of action.

Act – take the appropriate action in accordance with the FM/POH/flight reference cards emergency procedures.

Review – if time permits review the above stages and adapt/modify as necessary to ensure a safe outcome.

The time taken to complete the above sequence will be dictated by the degree of urgency of the malfunction i.e. an engine failure in a single engine helicopter will require it to be completed in seconds, whereas a non critical malfunction such as a generator failure could be reasonably dealt with in minutes.

When experiencing a malfunction the pilot must still follow the old adage of:

Aviate – establish an appropriate safe flight condition e.g. straight and level flight, autorotation, orbit, land etc.

Navigate – it may be appropriate to turn away from high ground, not enter controlled airspace, avoid DVE, select a landing site to conduct a precautionary landing or divert to an airfield.

Communicate – a radio call to an appropriate agency to inform them of the situation, the degree of urgency, any proposed actions and request assistance if required. Crew and passengers should be briefed, which may be an explanation of the malfunction and what actions you are taking, (especially if diverting or conducting a precautionary landing)! In the case of an emergency landing a warning to adopt the pre-briefed 'Brace Position' would be included.

During progressive training for non critical malfunctions the instructor should introduce the fault in a realistic, unannounced manner which will allow the student the ability to practise the full 'DODAR' process of detection, diagnosis and corrective actions. An example of this could be the failure of a hydraulic, governor or electrical system. During cruise flight the instructor could distract the student momentarily while de-selecting the system. Once the student has conducted the above actions the exercise should be completed to its conclusion as much as is safely possible. Where a particular malfunction requires that the pilot conducts a precautionary landing, the instructor should ensure that the student is taught to fly the aircraft safely to that site, while carrying out all necessary actions, radio calls and landing site assessments.

When teaching critical malfunctions such as engine, tail rotor failure etc in single engine helicopters it is important to pre warn the student. Notwithstanding that, the student must also be taught to recognise the symptoms of unexpected engine/ tail rotor failures.

It is worth mentioning that emergencies may not be confined to mechanical or electrical faults, for example, doors opening in flight, passenger illness or behaviour and bad weather.

A useful technique, to introduce at this point is the pre-take off/departure 'eventualities' brief. This short self brief, said out loud, might cover what action to take in the event of an engine failure at various heights, where to land and the action to be taken in the event of a door coming open. It can be adapted to suit the aircraft type, airfield and student's ability.

15
FIRST SOLO

GROUND SCHOOL POINTS

All necessary examinations completed.

Medical held and current.

Meteorological and air traffic conditions are suitable, the Helicopter is fully serviceable with sufficient fuel, etc.

Ensure that the student can operate the required systems and equipment and use R/T communication.

The instructor is qualified to send the student first solo.

Advise control tower where applicable.

PREPARATORY INSTRUCTION

Aim

For the student to conduct a minimum of one circuit without an instructor on board.

Review

Exercises 11a - Circuit, Approach and Landing
Local Operating Procedures

Motivation

The first solo is a very important and never-to-be-forgotten experience in a pilot's career.

Airmanship / TEM

Brief student for first solo. This should be a short briefing, to inform the student of the following;

(I) the change of attitude from reduced and laterally displaced weight;

(ii) the danger of low tail, low skid or wheel during hover, landing;

(iii) dangers/recovery from of loss of RRPM and overpitching;

(iv) pre take-off checks;

(v) into wind take-off;

(vi) procedures during and after take-off;

(vii) normal circuit, approaches and landings;

(viii) action if an emergency.

Student Solo

A student's first solo can be considered when the following requirements have been met:

A safe standard has been reached in Air Exercises 1 - 14

A safe and acceptable standard has been reached in circuits.

Teaching Points

Instructor's observation of flight and debriefing

AIR EXERCISE

Take-off and Landing

Lift offs and landings should be reasonably smooth and consistently vertical. They should be with no yaw, sideways or rearward drift. Hovering should be well controlled.

Transition and Climb

A clearing turn should precede the transition as a normal airmanship manoeuvre. The transition to the Upwind Leg should be smooth and well controlled as regards airspeed and power settings.

Crosswind, Downwind and Base Legs

The circuit should be consistently safe. The student should be aware of any inaccuracies and able to correct them without assistance from the instructor.

Final Approach

The student should be able to fly a safe approach and able to correct large deviations from the selected approach angle. Reduction of forward speed should be smooth and progressive. The approach should consistently terminate with a hover over the selected spot at the recommended height.

Emergencies

The student must be able to recognise and take corrective action for any emergency during the first solo trip, including an engine failure from any point in the circuit.

COMMON ERRORS

- *Ensuring student is prepared for change in Centre of Gravity and cyclic position.*

TIPS FOR INSTRUCTORS

The first solo is a very important and never-to-be-forgotten experience in a pilot's career. It gains even more importance in a multi student course environment, particularly with a student who is a slow learner. In this case it is generally necessary to play down the significance of the first solo to prevent low morale and an even slower rate of learning. Avoid referring to "average hours to first solo" or condoning a spirit of competition between students who are at the same phase of the training curriculum.

The pre-solo flight should not exceed 45 minutes in order to keep fatigue to a minimum.

It is not advisable to tell students that they are about to fly solo until just before the actual flight. The possible apprehension could delay the very flight that you are planning for them.

Before sending the student on the first solo, carry out sufficient dual circuits to confirm consistency and competency, and that suitable conditions exist.

Observe the flight and debrief the student afterwards encourage the student to critique the flight too as this will form an important part of future learning.

16
SIDEWAYS & BACKWARDS HOVER MANOEUVRING

GROUND SCHOOL POINTS

Flight manual - Limitations

Centre of Gravity

Wind Direction

PREPARATORY INSTRUCTION

Aim

For the student to learn sideways and backwards hover manoeuvring into and out of the wind.

Review

Exercises 11a, 11b and 11c - Hovering

Motivation

The ability to fly sideways and backwards safely and accurately for short distances is often required in helicopter operations.

Airmanship / TEM

- Lookout
- Obstructions
- Wind W/V and Weather Cocking
- Helicopter Temperature & Pressure Limits
- Stability
- Helicopter Sideways & Backwards Speed Limits
- Hover Height

Teaching Points

Lookout

Explain the importance of the lookout before commencing manoeuvring in order to identify any obstacles, other aircraft and ensure adequate tail clearance.

Controls

Describe the helicopter controls' specific function during sideways and backwards manoeuvring:

Cyclic - controls the helicopter direction of travel and ground speed. Ground speed should be slow and constant throughout this manoeuvre. Cyclic movements should only be small to initiate small attitude changes to prevent over-controlling while anticipating the lag of the cyclic control. Caution should be exercised as cyclic stop limits may be reached due to the aircraft CoG and change in W/V.

The wind can affect the cyclic position depending upon the direction and speed relative to the helicopter and there can be tendency for the helicopter to 'weather cock' when travelling sideways

Collective – controls the height. Small adjustments may be required in power and to maintain rotor RPM during the manoeuvre. Height should be referenced to features outside the helicopter.

Pedals – control the heading of the helicopter. While the helicopter is downwind the airflow through the tail rotor may become disturbed creating unstable yawing and when crosswind a weather cocking tendency may cause an increased rate of turn. Both should be prevented/ overcome with appropriate pedal input.

Sideways flight into the wind;

Emphasise that before starting the manoeuvre a look sideways towards the direction the helicopter is intending to travel is essential. A reference point to the side should also be selected to assist in accuracy in the sideways hover. During the manoeuvre the lookout should then be broken down to looking both forward of the helicopter and the direction of travel, as looking only in the one direction will make the exercise harder to achieve. The lookout and scan should be moved continuously between the direction of travel, the helicopter heading, the height and the instruments.

COMMON ERRORS

- *Students making too large an attitude change, and moving too fast.*
- *Students failing to maintain the selected attitude and subsequently over controlling on the cyclic.*
- *Poor height control.*
- *Failure to maintain heading or "pedalling" on the yaw pedals.*
- *Poor look out.*
- *Clearing Spot Turn before Backwards Hover.*

Describe how the cyclic should be displaced into the direction of travel to initiate the manoeuvre. This will alter the helicopter disc attitude and then the helicopter will move in the direction of travel. Collective should be used to maintain the height. Pedals are used to maintain the helicopter heading. To stop the sideways movement the cyclic should be used to reselect the normal hover attitude, collective to maintain height and pedals to maintain helicopter heading.

During sideways hovering it is possible for one skid to be lower than when in the normal hover attitude. Hovering too low or allowing the aircraft to sink during sideways hovering may lead to inadvertent ground contact, which could cause the aircraft to roll over.

Backwards flight heading into wind:

Emphasise that before any backwards manoeuvre it is critical to perform a spot turn to ensure that the helicopter will be travelling into a safe and unobstructed area. Describe how, when moving backwards the helicopter will have a nose up attitude. Consequently the tail and tail rotor will be lower than when in a normal hover attitude. Therefore the hover height should be increased before commencing the manoeuvring.

Describe how a reference point in front of the helicopter should be selected to assist in maintaining helicopter heading. The cyclic should be moved aft, which will cause a nose up attitude and the helicopter will then start to hover backwards. It is essential that a slow speed is maintained as excessive speed can cause the airflow over the horizontal stabiliser to produce a nose down tendency, which may not be possible to correct by aft cyclic when attempting to recover . The collective is used to maintain height and the pedals to maintain the helicopter heading.

Sideways and backwards flight out of the wind:

Explain that how once competent in manoeuvring sideways and backwards into wind, the exercises can be repeated out of wind. Describe the different cyclic positions required relative to the wind, and how hovering sideways or backwards out of wind will require the helicopter to overcome the wind before the helicopter will begin to move. Explain why the power requirements will differ with weight and wind direction relative to the helicopter and why attention will be required to ensure power limits are not exceeded during any manoeuvres.

Combination of sideways and backward manoeuvring:

Explain that how once competent in manoeuvring sideways and backwards into, and out of wind, it is possible to use a combination of the techniques to fly the aircraft in any given direction and hold any given heading.

AIR EXERCISE

Demonstrate sideways hovering, in both directions, while heading into wind.

Student Practice

Demonstrate sideways hovering, in both directions, whilst out of wind including recovery from excessive pitch nose down.

Student Practice

Demonstrate backwards hovering while heading into wind.

Student Practice

Demonstrate backwards hovering while heading out of wind.

Student Practice

Demonstrate a combined sideways and backwards hovering manoeuvre.

Student Practice

TIPS FOR INSTRUCTORS

Emphasise the need for lookout, before and during the manoeuvre, especially in the direction of travel. Make a thorough reconnaissance of the area to be used for sideways and backwards hovering for obstructions, F.O.D., and ground features. The exercise will be performed close to the ground.

Initially the student may find it difficult to maintain a constant heading/speed/height, which often leads to over controlling. References are useful for a student to gain accuracy. For sideways hovering, where possible, choose a line feature in front of the helicopter to follow. For backwards hovering choose a feature in front of the helicopter. The student may not anticipate the wind, the weather cocking effects and sink rate. Therefore as the exercise will be performed close to the ground careful monitoring of all the controls is important.

The student can find this exercise fatiguing and it may be necessary to break up the lesson with other simple exercises. Once the student is proficient in this exercise it is possible to combine manoeuvres with spot turns (Exercise 16), in relation to flying a square pattern over the ground with the helicopter heading in various directions.

If long distances are required to be travelled while hovering backwards, then frequent stops and clearing spot turns should be performed for safety.

Explain that it is preferable to hover taxi the helicopter in a forward direction rather than sideways or backwards, due to difficulties with lookout and engine failure considerations. Hover taxiing in a forward direction also improves helicopter stability and pilot control.

If the engine failed during sideways hover, the student must stop the sideways movement with cyclic, maintain heading with pedals, allow the helicopter to settle and cushion the landing with collective. Not preventing the helicopter from sideways movement with ground contact may lead to the helicopter rolling over.

17
SPOT TURNS

GROUND SCHOOL POINTS

Flight Manual – Limitations

Centre of Gravity

Wind Direction

PREPARATORY INSTRUCTION

Aim

For the student to learn how to turn the helicopter on the spot through 360,˚ while maintaining a constant position and height by turning about

- the pilot position;
- around the tail rotor;
- about the geometric centre;
- by making a square and safe visible clearing turn;

Review

Exercise 11a, 11b and 11c - Hovering

Exercise 16 - Sideways & Backwards Hover Manoeuvring

Motivation

Having already learned the 90 degree 'lookout turn' in previous exercises this exercise will teach how to turn the aircraft safely through 360 degrees in order to check clearance all around the aircraft before manoeuvring.

Airmanship / TEM

- Lookout
- Obstructions
- W/V
- Helicopter Temperature & Pressure Limits
- Helicopter Sideways & Backwards Speed Limits
- Hover Height

Teaching Points

Lookout;

Explain the importance of the lookout before commencing any turns in order to identify any obstacles, other aircraft and to ensure adequate safe tail clearance. Describe how during the lookout that reference points for the turn are selected to assist in accuracy and that whilst the aim is to perform 360˚ spot turns at a constant rate, initially the turns will be broken down into 90º quadrants.

Controls;

Describe the helicopter controls' specific function during spot turns:

Cyclic - controls the position over the ground. The cyclic will need to be moved into wind to maintain position and prevent drift. Cyclic movements should only be small to initiate small attitude changes to prevent over-controlling whilst anticipating the lag of the cyclic control. Caution should be exercised as cyclic stop limits may be reached due to the aircraft CoG and change in W/V.

Collective – controls the height. Small adjustments may be required in power and to maintain rotor RPM during the manoeuvre. Height should be referenced to features outside the helicopter.

Pedals – control the rate of turn of the helicopter. While the helicopter is downwind the airflow through the tail rotor may become disturbed creating unstable yawing and when crosswind a weather cocking tendency may cause an increased rate of turn, both should be prevented/overcome with appropriate pedal input.

Turning Around Geometric Centre;

Describe how this turn uses the vertical axis of the helicopter as the centre of the circle, and the helicopter rotates around the vertical axis (generally taken as the rotor mast). Pedals are used to initiate the turn in the desired direction and then to control the rate of turn at a steady, constant rate.

COMMON ERRORS

- *Failure to control rate of turn resulting in erratic movement.*
- *Failure to correct drift.*
- *Poor rotor RPM control and failure to anticipate effect of large yaw pedal applications.*
- *Failure to maintain a constant height.*
- *Poor Lookout in all directions before commencing turn.*
- *Failure to adjust for wind direction and speed during the turn.*

Turning Around Tail Rotor;

Describe how this turn uses the tail rotor as the centre of the circle, and the helicopter prescribes a circle around the tail rotor. The cyclic is applied laterally to move the helicopter sideways in the direction of turn. At the same time the pedal should be applied in the direction of turn. This technique is useful for turning the helicopter in confined areas as it may protect the tail rotor from obstructions.

Turning Around Pilots Position;

Describe how this turn uses the pilot's position as the centre of the circle, and the helicopter prescribes a circle around the pilot's position. The cyclic is applied laterally to move the helicopter sideways in the direction of turn. At the same time the pedal should be applied in the direction of turn.

Square and Safe Visibility Turn;

Adopt a slightly higher than normal hover height. Hover taxi sideward whilst maintaining, at least an aircraft length ideally in the direction the pilot can see (i.e. pilots side). Spot turn through 90 degrees so the tail is now in the know clear area where the aircraft was previously positioned. Repeat as required through around the 4 sides of the square until back at start position whilst maintaining a lookout for obstructions.

AIR EXERCISE

Demonstrate 360˚spot turns, about the geometric centre in both directions.

Student Practice

Demonstrate 360˚ spot turns, around the tail rotor in both directions.

Student Practice

Demonstrate 360˚ spot turns, around the pilot position in both directions.

Student Practice

Demonstrate square and safe visibility clearing turn.

Student Practice

TIPS FOR INSTRUCTORS

Emphasise the need for lookout, before and during the manoeuvre, especially in the direction of travel. Make a thorough reconnaissance of the area to be used for spot turns for obstructions, F.O.D., and ground features. Initially the turns can be broken down into 90º quadrants using reference points in each quadrant.

Initially the student may find it difficult to maintain a constant rate of turn, which often leads to over controlling with the pedals. The student may not anticipate the wind and weather cocking effects and, as the exercise will be performed close to the ground, careful monitoring of all the controls is important.

The student can find this exercise fatiguing and it may be necessary to break up the lesson with other simple exercises. Once the student is proficient in spot turns it is possible to combine manoeuvres with sideways hovering (Exercise 16), in relation to flying a square pattern over the ground with the helicopter heading in various directions.

18
HOVER OGE AND VORTEX RING

GROUND SCHOOL POINTS

Flight manual:

- Limitations
- Critical wind azimuth areas
- Loss of Tail Rotor Effectiveness (LTE)
- Performance - HV Graph, LTE and OGE Hover Charts

Principles of Flight:

- Vortex Ring

PREPARATORY INSTRUCTION

Aim

For the student to:

- Recognise and carry out the recovery actions for LTE.
- Learn Hovering OGE
- Recognise and carry out the recovery action for the incipient stage of vortex ring.

Review

Exercise 13: Transitions

Exercise 11a: Hovering

Motivation

Hover OGE has applications in later exercises such as confined areas operations. While at low airspeeds without immediate ground references (and not monitoring) the instruments it is possible to mishandle the aircraft and get into a LTE or Vortex Ring condition. Therefore it is essential to to be able to identity the requirements for LTE/Vortex Ring in order to avoid them and, if encountered, recognise the symptoms and carry out the correct recovery actions.

- Lookout:
- Helicopter limitations: temperatures and pressures, power and transmission limits as applicable.

Teaching Points

OGE Hover

Describe what the OGE hover is, when it would be utilised and how it will be practised in later exercises Ex 26, 28 and 29.

Explain how a power check is conducted in the IGE to establish the available power margin. Then how, by use of forward and side reference markers, it is possible to climb vertically until outside of IGE and establish a steady hover by controlling drift height and power. Then describe how it is possible, by use of the references, to descend slowly with low rate of descent to a normal hover height maintaining the same ground position.
Describe how then it is possible to bring the aircraft to a steady controlled hover from forward flight, at altitude using, outside and inside references to maintain heading, prevent drift and control height.

Explain where OGE Hover operations are conducted within the HV or Height-Velocity Diagram's shaded areas (avoid areas), prolonged exposures for training purposes must be minimised.

Vortex Ring

Revise the requirements for Vortex Ring state and describe that how at low airspeeds with ROD and high power settings, (such as in the OGE hover, steep approach, downwind approach etc), it is possible to get into initially, incipient, then the full stage of vortex ring, if the inappropriate action is taken to correct a rate of ROD (which can be as low as >300ft/min).

Explain how incipient vortex ring will be induced in the flight exercise at a safe height under controlled conditions, the symptoms to look for and the recovery action to be taken.

LTE

Revise the requirements for LTE and describe that how, at low airspeeds, with high power settings, (such as in the OGE hover, steep approach, downwind approach etc), it is possible to reduce the effectiveness of tail rotor and the aircraft's directional stability. Explain that LTE is generally considered to be an insufficient tail rotor thrust associated with a control margin deficiency, which can result in an uncommanded rapid yaw rate. This yaw may not subside of its own accord and, if not corrected, can result in the loss of a helicopter.

Explain how LTE will be induced in the flight exercise at a safe height under controlled conditions, the symptoms to look for and the recovery action to be taken.

COMMON ERRORS

- *Caused by pilot inattention to flight regime, especially during low speed orbit and downwind manoeuvring.*
- *Exercise can overly worry the student.*

AIR EXERCISE

Demonstrate hover IGE and power check

Student practice

Demonstrate hover OGE

Student practice

Demonstrate coming to, and maintaining steady hover OGE from forward flight at altitude.

Student practice

Demonstrate at safe height, the requirements, recognition and recovery for incipient vortex ring state.

Student practice

Demonstrate at a safe height, the requirements, recognition and recovery for LTE.

Student practice

TIPS FOR INSTRUCTORS

Make a thorough reconnaissance of the area before and during the lesson, looking particularly for bushes, fences, rocks, stumps and loose articles (FOD), as you will be operating close to the ground.

For the Hover OGE demonstration a suitable obstacle with vertical extent, e.g. a large bush or small tree should be used to provide vertical reference. There should be a choice of lateral and longitudinal reference points available.

For the HOGE from forward flight/Vortex Ring/LTE demonstrations it is very likely that the ATO has a prescribed minimum height for the exercises which should be adhered to. Although the exercises should generally be conducted into wind they could be conducted out of wind. However the onset of the symptoms is likely to be more rapid and unpredictable and therefore this should be taken into account when deciding the safe height for the exercises to be commenced from.

Although it is unlikely that a student should wish to intentionally practise Vortex Ring and LTE by himself, it should be explained that these exercises are only to practised with an instructor!

19
SIMULATED EOL

GROUND SCHOOL POINTS

The Avoid Curve

The effects of weight, disc loading, density altitude and RRPM decay in autorotation.

The autorotative flare

Flare theory

Flight manual emergency procedures

PREPARATORY INSTRUCTION

Aim

The aim is for the student to;

(A) understand the effect of weight, disc loading, density attitude and RRPM decay;

(B) revise basic autorotation entry;

(C) practise optimum use of cyclic and collective to control speed or RRPM;

(D) practise variable flare simulated EOL;

(E) have demonstrated constant attitude simulated EOL;

(F) have demonstrated simulated EOL from hover or hover taxi;

(G) have demonstrated simulated EOL from transition and low level.

Review

Exercise 10: Basic autorotation

Exercise 11c: Engine Failure in the Hover or Hover-taxi

Motivation

The primary purpose of autorotations is to save crew and passengers from injury following an in-flight engine failure or similar major emergency. In practice autorotations, there is also the need to avoid damaging the helicopter. These skills can be acquired and maintained only with practice in varying conditions and configurations..

Airmanship / TEM

- Pre-entry checks
- Post-entry checks as appropriate to type
- Aircraft performance limitations
- Wind speed and direction
- Suitable landing area
- Lookout

Teaching Points

Review the procedures for basic autorotation and describe the technique for landing as follows:

Ensure that a safe landing area is within autorotative range and check the wind velocity.

Enter autorotation and select airspeed for the minimum rate of descent.

When certain that the landing will be in the safe area, close the throttle completely, where appropriate to type.

At the appropriate height above the ground, commence the flare and vary the amount of flare as required to control speed, RoD and RRPM.

As appropriate to type at the specified height either level the aircraft and apply collective pitch as required to reduce the rate of descent and cushion the landing. Alternatively use the collective lever to check the RoD descent before levelling the aircraft and cushioning the touchdown with the remainder of the collective lever. A slight accelerative attitude may be required to perform a running landing.

Prevent yaw throughout with the pedals.

COMMON ERRORS

- *Incorrect flare height and failure to hold the flare.*
- *Failure to recover to touchdown attitude, thus endangering the tail rotor.*
- *Failure to correct for drift or yaw.*
- *Incorrect use of the collective lever either too early or too late.*
- *Failure to lower collective lever after aircraft has stopped or lowering too quickly during the landing run.*
- *Making a second flare if run on speed appears too fast.*
- *Moving cyclic rear-wards on touchdown.*

Describe the post-landing procedures:

- Ensure that the cyclic is in a neutral or forward position. Avoid moving the cyclic aft during or after touchdown.
- Lower the collective slowly to the bottom position. Care must be taken if the tail boom is pitching due to forward movement on the ground.
- Carry out pre-take-off checks.

Explain that, where EOLs are considered unsafe in light of the aircraft's performance characteristics, the wind conditions, aircraft weight, unstable ground conditions, or the density altitude conditions, power terminations to the hover or hover-taxi may be used to provide continuation in autorotation practice.

Describe the technique for carrying out a power termination to the hover or hover-taxi, as appropriate to type and local conditions:

- Ensure that a safe landing area is within autorotational range.
- Enter autorotation and select the airspeed for minimum rate of descent. Reduce power to idle as appropriate to type.
- Ensure that the RPM is in the correct range.
- At a safe height, adjust RPM as appropriate.
- At the appropriate height, flare.
- At the appropriate height, level the aircraft.
- Apply power to stop sink and establish a hover or hover-taxi; preventing yaw and drift.

AIR EXERCISE

Demonstrate a variable flare autorotation into wind terminating in a power recovery.

Student practice (dual only)

Demonstrate a variable flare autorotation into wind terminating in a simulated EOL.

Student practice (dual only)

Demonstrate constant attitude simulated EOL.

Student practice (dual only)

Demonstrate simulated EOL from hover or hover taxi.

Student practice (dual only)

Demonstrate simulated EOL from transition and low level.

Student practice (dual only)

TIPS FOR INSTRUCTORS

EOL training is not without risk. However careful planning/ preparation and good use of CRM and TEM should mitigate the associated risks.

Prior to entry all the conditions should be verified as suitable including the wind (not too little/too strong, no gusts, turbulence or wind shear, aircraft weight (too heavy high RoD; too light low RRPM) and the landing area (not waterlogged, long grass, uneven etc). It is advisable to initially conduct a a datum autorotation to a power recovery to verify these factors and establish an entry point for the EOL. As a final check, at a minimum of 300' AGL the aircraft should be 'straight and level, no yaw or drift, good RoD, RRPM in limits, correct airspeed and going to make the area'. If one of these parameters is not correct or, if in doubt, a 'go around' is advisable.

There is a need for the instructor to follow through on the controls during autorotational landings. Take care that you do not make the exercise worthless by inadvertently leading, rather than following, through.

This exercise should be practised only in areas known to be safe and suitable for an EOL.

The student should practise autorotations in as many varied conditions as possible, because the type of autorotative flare will vary. Varying conditions include the wind, aircraft weight, air density and size/, surface of the selected landing area.

Both zero-speed and run-on touchdowns should be practised and the student taught when to employ each technique.

This is a stressful and demanding exercise for both student and instructor. Resist the temptation to attempt 'just one more' at the end of the lesson, as you will usually find the student's performance will get worse, not better.

Brief the student on the school's policy on autorotations to touchdown. Most schools do NOT allow them to be practised solo.

MR CHIP
CARBON MONOXIDE
STARTER ON
TR CHIP
LOW FUEL
LOW RPM
SKYMAP CLASS 3
KNOTS
MPH
AIRSPEED
E R
% RPM
PULL TO CAGE

20
ADVANCED AUTOROTATION

GROUND SCHOOL

Flight manual: Limitations

PREPARATORY INSTRUCTION

Aim

For the student to learn how to vary range in autorotation by the use of:

- range autorotations;
- low speed autorotation;
- constant attitude autorotation 'S' turns;
- turns through 180° and 360°;
- the effects on angles of descent, IAS, RRPM and effect of AUM.

Review

Entry to Autorotation and power terminated/touchdown autorotations

Autorotational flight envelope, including airspeed and rotor RPM limitations

Effects of airspeed, RRPM, turns and RoD on range and angle of descent when in autorotation.

Motivation

Autorotation at the manufacturer's recommended airspeed is the ideal. It is vital, that the student be capable of taking full advantage of the helicopter's capabilities in autorotation to reach the intended landing spot.

Airmanship / TEM

- Safety checks
- Safe landing area
- Lookout
- Wind velocity

Teaching Points

State the airspeed and RRPM for maximum range and VNE in autorotation. Point out the increase in rate of descent, as appropriate to type.

Minimum Rate of Descent;

Indicate what the typical distance, angle of descent and RoD would be using the aircraft minimum rate RoD autorotation speed.

Extending the range

Point out that there is no benefit from exceeding the manufacturer's recommended maximum range speed, and that exceeding autorotational VNE will result in drastic rotor RPM decay.

Describe the techniques, speeds, and RRPM to be used for the range/maximum range autorotations and the resultant angle of descent, RoD and distance achievable.

Point out that it is advantageous to reduce the airspeed to minimum rate-of-descent speed as early as possible in order to reduce the rate of descent to more desirable proportions.

Reducing the range

Describe the techniques, speeds, angles of bank and RRPM to be used in the low speed, constant attitude, 'S' turns and turns through 180° and 360° autorotations and the resultant angle of descent, RoD and distance achievable.

Low Speed

Describe the hazards associated with the low speed autorotation including high RoD, RRPM control and directional stability and how it is important to keep a positive airspeed (ideally 10-20kts). Explain how in a strong wind condition this may result in a negative or rearwards movement across the ground, which can be utilised if trying to achieve an LS underneath or close to the aircraft.

Stress the height loss and need to increase airspeed to the minimum rate-of-descent speed as soon as possible, in order to reduce the rate of descent to manageable proportions.

COMMON ERRORS

- *Trying to turn into wind when too low. Emphasise that wind is only one of the factors involved.*
- *Allowing the speed to drop too low when re-engaging after constant attitude autorotation.*
- *Continuing the flare too near the ground.*
- *Re-applying power before putting the aircraft into an accelerating attitude thus risking vortex ring.*
- *Poor RPM control, in varying load conditions.*

Constant Attitude

Describe the hazards associated with the constant attitude autorotation especially the high RoD, RRPM control and directional stability and how it is important to maintain the recommended airspeed. Describe how this technique can be utilised to achieve an LS close to the aircraft or at night/poor visibility where a flare height cannot be judged and the constant attitude EOL could be used.

Emphasise the need to maintain the aircraft attitude in the recovery and the need to apply an element of forward cyclic when raising the collective lever to prevent speed reduction, - which if reduced could lead to vortex ring as the power is applied at low airspeed with a high RoD.

Turns

Describe the hazards associated with turns in autorotation especially the high RoD, RRPM control and maintaining attitude/airspeed. Explain that normally the minimum RoD airspeed should be used in the turns but this can be varied to extend/shorten the radius of turn to achieve a nominated LS.

Explain how the 'S' turns can be used effectively to lose height when close to a LS whilst maintaining airspeed.

Explain how the 180° turn can be used from downwind to turn back into wind and what the typical height loss can be in the turn.

Explain how the 360° turn can be used in light wind conditions to achieve an LS directly underneath the aircraft and what the typical height loss can be in the turn.

AIR EXERCISE

Over the same selected point at a safe height (normally minimum 1500-2000 agl) demonstrate the following autorotation techniques, highlighting in each case the angle of descent, the RoD and distance achievable:

Demonstrate datum autorotation

Student practice

Demonstrate range autorotation

Student practice

Demonstrate maximum (extended range) autorotation

Student practice

Demonstrate constant attitude autorotation

Student practice

Demonstrate low speed autorotation

Student practice

Demonstrate 'S' turns in autorotation

Student practice

Demonstrate 180/360 turns in autorotation

Student practice

TIPS FOR INSTRUCTORS

On the initial demonstration of each type of range variation, use the same line feature (such as a fence or road perpendicular to direction of travel) as a reference point to enter when the aircraft is directly over it and pick a feature in the middle distance to assist with heading and yaw control. Always enter using the same height, speed or power setting. This ensures that the student appreciates the difference in distance and angle of descent for each technique.

After teaching the individual methods of range variation,be sure that students understand that these are the basics, and that they usually have to use combinations to make the landing spot. When students have grasped the basics, introduce situations that require them to assess and use a combination of different techniques.

Emphasise that, when you vary the range, the helicopter should be returned to the normal autorotational touchdown profile by 300 feet.

In some helicopters, there is a high risk of the engine and rotor overspeeding occurring when the disc is loaded. Instructors should be particularly vigilant during student's practice and teaching the student to anticipate the increased disc loading with collective pitch.

21
PRACTICE FORCED LANDINGS

GROUND SCHOOL POINTS

Flight manual: Emergency procedures

PREPARATORY INSTRUCTION

Aim

For the student to learn how to carry out a safe forced landing following an engine failure

Review

Autorotations: Exercises 10, 19 & 20.

Motivation

Although helicopter engines are nowadays generally reliable, failures do still occur. The lives of pilots and their passengers are dependent on pilot skill and judgement in achieving a safe landing should an engine failure occur.

Airmanship / TEM

- Safety checks
- Safe landing area
- Recovery altitude or height
- Wind velocity
- Lookout
- Verbal warning

Teaching Points

Describe the immediate actions that must be taken in the event of an engine failure:

Enter autorotation

Select a suitable landing area

Plan approach

Select airspeed(s) and heading(s) in order to make the selected area

Transmit MAYDAY

Identifly the cause of failure and correct it if possible

Actuate the ELT (if equipped with manual control)

Warn passengers

Switch off electrics if fire is suspected

Land.

Re-engagement and go around procedures from practice forced landing.

Describe the actions that should be taken, time, height and other factors permitting, during a forced landing including the aircraft engine relight procedures.

Stress that pilots should be aware of wind velocities at all times. It is always preferable to be into-wind on a forced approach, but a suitable landing area is the prime consideration. In other words, it is better to land down-wind in an open field when the only alternative is to land in tall trees with the wind on the nose.

Discuss requirements of a forced landing area in relation to size, shape, surrounds, surface and slope.

Remind the student that turns and speeds above or below the manufacturer's recommended speed in autorotation increase the rate of descent substantially.

Discuss the relationship between stored energy (kinetic/potential), RRPM, airspeed and height.

Discuss the problem associated with ditching a helicopter.

Discuss the techniques of forced landing into trees, mountainous terrain and built-up areas.

Point out that an engine failure when flying at low level and low speeds, over obstacles will result in a forced landing that is difficult to successfully accomplish without damage and injury. For this reason, pilots should never fly lower or slower than is necessary.

Discuss re-engagement and go around procedures appropriate to type.

COMMON ERRORS

- *Continuing to turn into wind too low.*
- *Neglecting checks or concentrating too much on checks to the detriment of judgement.*
- *Failure to adjust flight path when going around or to select another landing area if too low.*
- *Not deciding early enough on the type of touchdown to be carried out resulting in confusion at the later stages.*
- *Failure to correct for drift and maintain balanced flight.*

  Continuing the flare too near the ground.
- *Re-applying power before the aircraft accelerates, thus risking vortex ring.*
- *Poor choice of landing area.*

AIR EXERCISE

Demonstrate forced landings from a height that will allow the full procedure to be carried out without haste.

Student practice

Demonstrate practice forced landings of increasing difficulty from different altitudes.

Student practice

TIPS FOR INSTRUCTORS

This is not a procedure that can be allotted a certain time period for the course and left at that. After students are competent they should be given surprise practice engine failures without sufficiently warning them on as many dual flights as possible. This enables students to practise the procedure regularly and will develop the judgement skills necessary to consistently make the selected area, practise the immediate actions and simulate the radio calls.

22
STEEP TURNS

GROUND SCHOOL POINTS

Flight manual: Power Limitations

Requirements for a Steep Turn

Offset Seating

PREPARATORY INSTRUCTION

Aim

For the student to learn how to carry out;

- steep (level) turns (30 degrees bank)
- maximum rate turns (45 degrees bank if possible)
- steep autorotative turns

Review

Exercise 9: Turning

Motivation

Operationally, the steep turn is a flight manoeuvre that can be used for traffic, obstacle or terrain avoidance. It is included in the pilot flight training for this reason.

Airmanship / TEM

- Lookout
- Power limitations
- RRPM limits

Teaching Points

Describe the visual cues, vibration, control feedback and where applicable, instrument indications in order to maintain balance, attitude, RRPM, disc loading, bank and co-ordination.

Review the effects of controls in the turn.

Describe the effect of wind on the radius of turn at low level.

AIR EXERCISE

Demonstrate steep/maximum bank rate turns in both directions.

Student practice

Demonstrate steep autorotative turns.

Student practice.

Demonstrate the effect of wind on turns at low level.

Student practice.

TIPS FOR INSTRUCTORS

Emphasise the importance of a good lookout before and during the turn.

This is an excellent coordination exercise of all controls at altitude, but when practised at low level, emphasise the dangers of sinking in a turn towards the ground and of drifting in strong wind conditions towards obstacles.

COMMON ERRORS

- *The student often fails to appreciate that speed is reduced if cyclic is used to maintain height.*
- *In autorotative turns, it is sometimes not fully appreciated that there is a lag between collective lever application and a change in RRPM which can lead to over controlling. Furthermore, if the attitude is not held there is a very quick increase/decrease of airspeed.*
- *Out of balance flight.*

23
TRANSITIONS

GROUND SCHOOL POINTS

Flight manual

Limitations

Ground effect/translation lift/flapback

PREPARATORY INSTRUCTION

Aim

For the student to learn how to transition from the hover into forward flight while remaining close to the ground and then transition back to the hover.

Review

Exercise 13 Transitions from the hover to climb and approach to hover.

Motivation

When hover taxiing large distances or when an aircraft is required to hover quickly, (for example crossing a runway of a large airport), it may be necessary to accelerate into forward flight remaining close to the ground and then return to the hover.

Airmanship / TEM

- Lookout
- W/V
- Helicopter limitations

Teaching Points

Describe how the transition from the hover into wind can be conducted as follows;

Before transitioning conduct a lookout turn, ensure the area ahead is clear and select a reference feature ahead as an aiming point.

Establish a higher than normal hover height before initiating a gentle transition. Use the collective to maintain height to compensate for loss of ground effect and the disc tilt. As the speed increases it will be necessary to lower the collective lever to prevent a height gain due to translation lift. Throughout the acceleration it will be necessary to compensate for the effects of 'flapback' by applying forward cyclic to maintain the accelerative attitude.

Initially use the yaw pedals to keep the aircraft pointing at the reference feature. As the speed increases past approximately 25 kts check the balance and adjust the pedal setting accordingly. Stabilise the helicopter at 50kts maintaining height.

Describe how to transition back to the hover as follows:

From 50 kts adopt a slight decelerative, nose up, attitude whilst at the same time lowering the collective lever sufficiently to prevent the aircraft climbing.

As the helicopter slows down, translational lift is lost and the collective has to be progressively applied to maintain height. Heading should be maintained using yaw pedals throughout.

As the power is increased the additional downwash over the horizontal stabiliser can tend to pitch the aircraft more nose up which should be overcome by use of cyclic.

As the speed approaches zero adopt the hover attitude and bring the helicopter to a steady hover before reducing height to a normal hover height.

AIR EXERCISE

Demonstrate the effect of wind on transitions

Demonstrate the transition from the hover into forward flight while remaining close to the ground and then transition back to the hover.

Student practice

TIPS FOR INSTRUCTORS

This is essentially an advanced coordination exercise which increases confidence when close to the ground and is a prelude to Exercise 24 Quickstops.

If required, the exercise may be broken down into transitioning from the hover and transitioning to hover required before combining the exercise.

COMMON ERRORS

- *Students usually have difficulty controlling height and engine rpm due to the fairly large power changes involved, particularly at the transition stage.*
- *Constant practice is required before a student reaches the required degree of accuracy.*

24
QUICK STOPS

GROUND SCHOOL POINTS

Dangers of Vortex

Dangers of High Disc Loading

Over Pitching

PREPARATORY INSTRUCTION

Aim

For the student to learn how to come to the hover into wind from various speeds, maintaining a constant altitude;

- into wind
- from cross wind and downwind terminating into wind

Review

Exercise 5: Power and attitude changes

Dangers of vortex ring

Dangers of high disc loading

Motivation

Rapid decelerations straight ahead are a useful exercise for developing coordination and accuracy during training. They are also a means of aborting a departure from larger confined areas. Those involving a level minimum radius turn have practical application in the avoidance of obstacles or bad weather conditions under operational conditions.

Airmanship / TEM

- Lookout
- Engine and airframe limitations.
- Wind speed and direction

Teaching Points

Straight ahead into wind

Describe how to carry out a rapid deceleration straight ahead into wind as follows:

From straight and level at 50kt, 20-30ft agl with cruise power set, commence a gentle flare with cyclic control while simultaneously lowering the collective lever to maintain height and maintain direction with yaw pedals.

At low forward speed, start levelling the helicopter.

As the aircraft slows anticipate the loss of translational lift by applying collective lever and establish a hover.

When safely established in high hover descend out of the avoid curve into low hover without delay.

Maintain height throughout with the collective.

Maintain RPM throughout with the throttle.

Prevent yaw with the pedals.

Explain that the deceleration will initially be gentle and gradual, from a fairly low speed of entry, in order to concentrate on smoothness and accuracy. The manoeuvre can be speeded-up as necessary after the basic ability has been acquired.

Explain that when you are making a more rapid deceleration there is a larger change of attitude in the flare and a greater resultant tendency to gain height. This, in turn, will require larger collective movements to prevent a climb and larger pedal movements to prevent yaw.

Point out that at no time should the flare be so harsh that it is necessary to split the needles in order to prevent an overspeed. It is important, however, to explain and demonstrate the recovery sequence should this happen inadvertently.

Review the dangers of potential vortex ring state when reducing speed downwind or height is lost at low or no forward airspeed.

Quick stops from cross wind and downwind terminating into wind

Describe the technique for performing a rapid deceleration involving a level turn from crosswinds into wind, as follows:

From cruise at 30 to 50 feet AGL, from level flight, commence a level, balanced turn.

Initiate a flare while in the turn whilst maintaining height.

Roll out heading into wind.

COMMON ERRORS

- *Lack of accurate yaw control due to large power changes.*
- *Maintaining the flared attitude after zero ground speed.*
- *Over pitching due to lack of anticipation of throttle movement when increasing power to establish hover after making a Quick Stop.*
- *Lack of awareness of possible Vortex Ring State during deceleration stage of Quick Stop.*
- *Failure to correct yaw with power changes.*
- *Applying too much power during acceleration, over pitching.*
- *Slow to rejoin the needles.*

As the aircraft slows anticipate the loss of translational lift by applying collective lever and establish a hover.

When safely established in high hover descend out of the avoid curve into low hover without delay.

Come to a hover or resume forward speed.

Maintain height throughout.

Maintain balanced flight and prevent yaw.

Describe the techniques of performing a rapid deceleration involving a level turn from the down wind terminating into wind.

Flare and Turn

From straight and level at 50kt, 30- 50ft agl with cruise power set, commence a flare with cyclic control whilst simultaneously lowering the collective.

As speed reduces, commence 180 degree turn whilst maintaining height in the turn with collective lever.

Maintain 30kts until within 30 degrees of the wind (to prevent LTE).

As the aircraft slows anticipate the loss of translational lift by applying collective lever and establish a hover. When safely established in high hover descend out of the avoid curve into low hover without delay.

Discuss the forward distance covered versus radius of turn.

Turn and Flare

From straight and level at 50kt, 30- 50ft agl with cruise power set, commence a turn through 180 degrees. Once established in the turn commence a flare to reduce speed using the collective lever to maintain height.

Maintain 30kts until within 30 degrees of the wind (to prevent LTE).

As the aircraft slows anticipate the loss of translational lift by applying collective lever and establish a hover. When safely established in high hover descend out of the avoid curve into low hover without delay.

Discuss the forward distance covered versus radius of turn.

AIR EXERCISE

Demonstrate a straight-ahead deceleration from cruising flight into wind.

Student practice

Demonstrate a rapid deceleration involving a 90° turn into wind.

Student practice

Demonstrate a rapid deceleration involving a 180° turn into wind using 'flare and turn' and 'turn and flare' techniques.

Student practice

TIPS FOR INSTRUCTORS

Decelerations involving a turn into wind require a high level of coordination and accuracy. They should be introduced as an advanced exercise towards the end of the training syllabus.

It is important to stress smoothness and accuracy. The student should initially master gentle decelerations from airspeeds outside the avoid areas of the height/velocity diagram for the helicopter to the hover, with the accent on smoothness, accuracy of height and RPM. Overpitching, yaw and tail rotor drift are common errors in the early stages and should be corrected before speeding up the manoeuvre.

After smoothness and accuracy have been established, the entry speeds can gradually be increased to the cruise and the rate of deceleration increased.

Loss of height in the turns and when translational lift is lost is a common fault.

25a
NAVIGATION

GROUND SCHOOL POINTS

Maps/charts: symbols, scales, etc.

Navigation Computer

Mental Dead Reckoning (MDR)

Departure and arrival procedures

Track selection: drift lines, increments

NOTAM's

Weather reports and forecasts

Lost procedures

Radio procedures

Publications

Helicopter documents

Flight plans/notifications

Minimum equipment to be carried on board

PREPARATORY INSTRUCTION

Aim

The aim is for the student to learn how to plan and conduct a navigational flight

Review

Exercise 6: Straight and level

Exercise 7: Climbing

Exercise 8: Descending

Exercise 9: Turning

Motivation

As part of the course a pilot has to complete a solo cross country flight of 100nm with full stop landings at two aerodromes different from the aerodrome of landing. The ability to navigate is also required to be demonstrated in Section 3 of the Licence SkillTest.

- Lookout
- W/V
- Helicopter limitations
- Flight Planning
- Legal aspects

Teaching Points

Flight Planning

The principles used in visual navigation are part of the PPL Theoretical Knowledge syllabus and these should be covered prior to this lesson.

Explain that successful navigation flights commence with thorough planning. Begin by deciding the route to be flown and selecting the appropriate maps.

The route may be a straight line between the point of departure and destination, but need not necessarily be so. The most appropriate route may involve a turning point to avoid for example, built up areas, controlled airspace, inhospitable terrain

Describe how to select an appropriate height/attitude to fly the route. Measure the true track and calculate magnetic headings and groundspeed. Select suitable checkpoints and measure distances. Calculate times between checkpoints and total time for the flight. Calculate fuel usage for each leg and total fuel required for the whole flight including the required reserves. Obtain the frequencies of the ATC units to be used en route, including any Nav aids and note this on the planning sheet. Check the flight plan for gross or obvious errors. Complete a flight planning log transferring relevant details as required on to the map for easy reference.

The following aspects should be taken into consideration for planning a cross country flight (the MATED brief is used as an illustration of a useful aide memoir):

Met - Interpretation of weather information by use of the appropriate significant weather charts, TAFs, METARS, observation etc for the time period and route of the flight. Ascertain the suitability of the en route weather and winds to be used for flight planning purposes . Identify any hazards and threats and the mitigations to put in place to overcome them.

Aircraft- the suitability of the aircraft for the flight to include; fuel planning, AUM, CoG, (take off and landing), Aircraft documentation including; ARC/ Maintenance requirements, insurance, CofA, Registration, MEL, other NAA legal requirements.

COMMON ERRORS

- *The major fault in both Mental DR and map reading is calculating in terms of fixed wind speeds and forgetting the relative slowness of the helicopter, and the greater effect of wind.*

a**T**c - NOTAMs for departure/en-route/destination/alternate airfields/LS Airfield information, plates, flight plan where appropriate, airspace restrictions, controlled airspace, prohibited and danger areas Navigational aids, radio frequencies and services available. Lost/diversion plan.

Exercise – The navigation plan! Route to be flown, maps and charts of appropriate scales, turning points, true track, wind corrections, magnetic headings to be flown, airspeed / groundspeed route times. Altitudes to be flown; minimum altitude, the safety altitude for the leg or route. Fuel planning including fuel consumption, trip fuel, diversion fuel, minimum land fuel, total fuel required,

Duties – if operating multi-crew; crew brief. FI/student division of responsibilities. Passenger brief

Explain the importance of phases of flight:

Pre Departure procedures

Filing a flight plan, booking out, ATIS /ATC liaison, airfield procedures, pressure settings. Organising cockpit management, including organisation of the cockpit including maps, flight log , aircraft checklist, pens, passenger briefing, safety equipment etc

Departure/En route

Setting heading procedure, altitude, timings/ ETAs, fuel calculations, instrument checks, radio calls. Maintenance of altitude/heading/speed. Making heading and ETA corrections using 1:60 rule, drift lines, MDR. Log keeping. Use of RT/navaids. Weather assessment / decision making. Transiting controlled airspace .

Uncertain/lost procedure

When uncertain of position the following should be considered:

Check compass heading, DI and time

Check steering correct heading with flight log

Calculate distance travelled since last known point – if not long apply +/- 10% along track and then draw 30˚drift lines either side of track and this should be the area you are in

Read the map from ground to map - identify a major/unique landmark

Inform ATC – ask for help

Immediately that you confirm you are lost stay calm, and remember your training

If the cloud base permits, climb to your Safety Altitude. Make a note of the time if you are in contact with an ATSU, requesting assistance

Consider the following items:

High ground/obstructions – are you near any?

Entering controlled airspace – are you close?

Limited experience, low time or student pilot – let them know

PAN call in good time – don't leave it too late

Met conditions – is the weather/daylight deteriorating?

Endurance – fuel remaining; is it getting low?

If in doubt consider a precautionary landing whilst fuel/weather/daylight/terrain permits you to do so!

En-route Diversion

An en-route diversion may be necessary due to insufficient fuel to reach your destination, deteriorating weather , passenger request, aircraft malfunctions etc. In such cases it may be advisable to orbit around a known position, draw a line on your chart or follow a line feature to your alternate, estimate the distance and time to the alternate and fuel required. Check the terrain, hazards and airspace along the proposed route using GNSS and radio navigation aids to assist.

Degraded Visual Environment (DVE)

Explain that if you encounter a deteriorating visual environment (DVE) it requires a timely decision to turn back, divert or land before becoming disorientated. A 180° turn in cloud can easily become a death spiral for those pilots not proficient in instrument flight.

Arrival and aerodrome joining procedure

Where available call ATC for joining instructions including circuit direction, runway, altimeter setting, joining direction/procedure, traffic information, helicopter landing area.

Post Flight

Security of helicopter, refuelling, closing of flight plan, post-flight administration.

AIR EXERCISE

Fly the cross-country exercise as prepared

Demonstrate VFR navigation/map reading techniques at various heights and speeds and using different scale maps as appropriate.

Student practice

TIPS FOR INSTRUCTORS

It is important to expose the student to as many different types of terrain and airspace as possible and not to just train in the local area. Therefore consideration should be given to long navigational training flights landing away at different airfields.

25b
NAVIGATION PROBLEMS AT LOW HEIGHTS AND REDUCED VISIBILITY

GROUND SCHOOL POINTS

Maps/charts: symbols, scales, etc.

Mental Dead Reckoning (MDR)

Track selection: drift lines, increments

Weather reports and forecasts

Lost procedures

Radio procedures

PREPARATORY INSTRUCTION

Aim

For the student to learn how to navigate at low level in reduced visibility.

Review

Exercise 25a: Navigation

Motivation

It is important that a student understands the difficulty of navigating at low level and the actions to be undertaken in the event of encountering DVE.

Airmanship / TEM

- Lookout
- W/V
- Helicopter limitations
- Flight Planning
- Legal aspects

Teaching Points

Actions before descending

Explain that prior to descending to low level it ts important to ensure that the aircraft is descending into a clear open area free of obstacles especially pylons and wires. It is advisable to reduce the speed to descend at Vy and conduct a form of checks similar to the pre-land checks including fuel, radio calls, engine temperature and pressures (carburettor heat) wind and altimeter setting.

Hazards and Difficulty of operating at low level

Describe how, when operating at low level, the pilot's visual range is reduced and the apparent groundspeed is increased. Therefore map reading becomes more difficult. With the reduction of visual range the acquisition of obstacles, other aircraft and birds can happen at a much later stage than when operating at a higher altitude, therefore reducing the amount of time a pilot has to react.

Operating at low level reduces the options for a landing site in the case of an autorotation, forced or precautionary landing. Wind velocity at low level is susceptible to surface friction, local topography, mechanical turbulence, up and down drafts and can be very difficult to predict.

Actions in the event of encountering DVE

Explain that a continuing significant number of accidents are due to pilot disorientation in a DVE. Research has demonstrated the strong relationship between pilot experience, helicopter handling characteristics and available visual cues. Whilst most pilots receive limited basic training in 'flight with sole reference to instruments', the competence in this skill can deteriorate rapidly and therefore cannot be relied upon to safely extricate the unprepared pilot from an inadvertent IMC situation. Analysis indicates that any, or a combination of, the following three scenarios could result in a serious accident:

Loss of control when attempting a manoeuvre to avoid a region of impaired visibility, i.e. backtracking, climbing above or descending below the DVE.

Spatial disorientation or loss of control when transferring to instrument flight following an inadvertent encounter with IMC.

Loss of situational awareness resulting in controlled flight into terrain/sea/obstacles or a mid air collision.

COMMON ERRORS

- *Over-emphasis on map details tends to confuse a student pilot.*

Explain that if a pilot experiences DVE other risk factors may come into play:

- A low level of ambient light.
- Poor defined or no visual horizon.
- Few, if any, visual cues from the ground plane.
- Changes of speed and height are not perceivable.
- Reducing height does not improve the perception of the horizon or cues on the ground.
- The view from the cockpit is obscured due to precipitation/misting.
- The cloud base is lowering causing an unintended descent to retain similar forward visual cues.

Serious consideration should be given to terminating the flight and conducting a safe, controlled precautionary landing as soon as is safe to do so.

Precautionary Landing

It should be noted that a 'precautionary' or 'forced' landing that is made in response to an aircraft malfunction/ emergency or deteriorating weather, will invariably be an 'off airfield' landing. Therefore the techniques prescribed for the recce, approach and departure in Exercise 14 & 29 should be utilised even if in an abbreviated format.

AIR EXERCISE

Demonstrate a descent and a navigational flight at low level

Student practice.

Demonstrate a precautionary landing simulating encountering DVE.

Student practice.

TIPS FOR INSTRUCTORS

During the low flying, stress the changes in visual cues and (if you are using a large-scale map) the speed at which the helicopter moves over the map. If possible, expose the student to different scales of map, particularly 1:500,000 and 1:250,000.

Students should have had some exposure to Exercise 14c Emergency Procedures, Exercise 27: Sloping Ground and Exercise 29: Confined Areas before being sent on the first solo cross-country. This is to ensure that they are capable of landing at a suitable site in the event they have to make a precautionary or emergency landing.

Enhanced ground instruction in the principles of threat and error management, weather interpretation, planning and route assessment, decision making on encountering DVE including reversing course or conducting a precautionary landing should be given prior to the flight exercise.

Wherever possible, flight simulation should be used to demonstrate to student pilots the effects of flight into DVE and to enhance their understanding and need for avoidance of this potentially fatal flight regime.

25c
RADIO NAVIGATION

GROUND SCHOOL POINTS

Maps/charts: symbols, scales, etc.

Track selection: drift lines, increments

Weather reports and forecasts

Radio procedures

GNSS operation

VOR/ADF NDB/VHF DF

Use of en-route terminal radar

PREPARATORY INSTRUCTION

Aim

The aim is for the student to learn how to navigate by use of radio navigation aids.

Review

The principles of the operation of radio navigational aids are part of the PPL Theoretical Knowledge syllabus and this should be covered prior to this lesson

Motivation

It is important that a student understands the availability, use and limitations of radio navigational aids to be able to utilise them.

Airmanship / TEM

- Airmanship/TEM
- Lookout
- W/V
- Helicopter limitations
- Flight Planning
- NOTAMs

Teaching Points

The principles of the operation of radio navigational aids are part of the PPL Theoretical Knowledge syllabus and this should be covered prior to this lesson. The user manual for the specific navigational aids fitted to the aircraft will explain the operation of the individual instrument to be used. If possible the operation of radio navigation aids should be practised either by use of an FNPT, computer based training or with the aircraft on the ground prior to getting airborne. Once the student is familiar with the operation of the aid the following elements should be demonstrated and practised in the air:

GNSS

(a) selection of waypoints;

(b) to or from indications and orientation;

(c) error messages;

(d) hazards of over-reliance on the use of GNSS in the continuation of flight in DVE.

Use of VHF Omni Range:

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) OBS/CDI functions;

(d) to or from indications and orientation;

(e) determination of radial;

(f) intercepting and maintaining a radial;

(g) VOR passage;

(h) obtaining a fix from two VORs.

Use of ADF NDB:

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) orientation relative to the beacon;

(d) homing.

Use of VHF/DF:

(a) availability, AIP and frequencies;

(b) RTF procedures and ATC liaison;

(c) obtaining a QDM and homing.

COMMON ERRORS

- *At low levels the wind direction can be affected considerably by terrain and large errors may occur if a constant check is not kept on the wind.*
- *Aviate - Navigate - Communicate.*

Use of en –route terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot's responsibilities;

(d) secondary surveillance radar (if transponder fitted):

(1) transponders;

(2) code selection;

(3) interrogation and reply.

Use of DME:

(a) station selection and identification;

(b) modes of operation: distance, groundspeed and time to run.

AIR EXERCISE

Demonstrate the use of radio navigational aids

Student practice.

TIPS FOR INSTRUCTORS

Enhanced ground instruction in the principles of threat and error management, weather interpretation, planning and route assessment, decision making on encountering DVE including reversing course or conducting a precautionary landing should be given prior to the flight exercise.

Wherever possible, flight simulation or computer based training should be used initially to demonstrate and give the student practice of the principles and operation in the use of radio navigation equipment.

Wherever possible, flight simulation should be used to demonstrate to student pilots the effects of flight into DVE and to enhance their understanding and need for avoidance of this potentially fatal flight regime.

26
ADVANCED TAKE-OFF, LANDINGS AND TRANSITIONS

GROUND SCHOOL POINTS

Flight manual:

Limitations

Load and density altitude performance charts

Vortex ring

Over-pitching - Rotor Stall

PREPARATORY INSTRUCTION

Aim

For the student to learn additional take-off and landing techniques

Review

Exercise 12: Take-off and Landing

Exercises 13 & 23: Transitions

Motivation

Although the techniques learned in Exercises 12, 13 and 23 are those that should continue to be used under optimum conditions, situations such as high all-up weight, high density altitude, unfavourable wind conditions or obstacles close to the flight path may dictate the use of advanced techniques for a take-off, transition to the climb, approach and landing. Another practical application is in conditions of restricted visibility, such as snow, dust or sand.

Airmanship / TEM

- Lookout: obstacles
- Helicopter limitations
- W/V
- Avoid Curve
- Landing Site Recce

Size - is it large enough?

Shape - is the Ls aligned with the wind/direction of approach?

Surrounds - are there any obstacles on the approach/ overshoot?

Slope - is the LS flat?

Surface - is the surface firm/even?

Teaching Points

Landing and take off out of wind

Describe the effects of hovering/ transitioning out of wind including the difference in ground effect, translational lift and directional stability.

Describe the technique for taking off when out of wind as follows:

Tilt the disc towards the relative wind to avoid the tendency to roll away from the wind and drift down wind. As the helicopter leaves the ground, reposition the cyclic to maintain ground position.

Describe the technique for landing out of wind as follows:

From a steady accurate hover, lower the helicopter on to the ground avoiding over-controlling. The skid that is likely to touch the ground first is dependent on wind direction, CoG and direction of rotation of rotor blades. When on the ground the rotor disc should be maintained level with cyclic as the collective lever is lowered. Over-controlling on the pedals may cause large power fluctuations.

Running take-off

Explain that this is not a conventional take off for a helicopter especially one with a skidded undercarriage. The take off path must be level, firm and clear of obstacles as even slight up slope, soft ground or long grass will require a higher power setting.

Describe the technique for a running take off as follows:

Raise the collective lever until the aircraft is light on the skids and gently move the cyclic forward to achieve acceleration.

COMMON ERRORS

- *Slow to appreciate dangers of down wind approach i.e.- Vortex Ring Condition: High Rates of Descent, Low Airspeed, Possible loss of yaw control.*
- *Exceeding maximum power available.*
- *Misjudging height and distances required.*
- *Failure to recover in the event of reaching Cyclic limits / control stops.*

As the speed increases allow the aircraft to fly off the ground. Care must be exercised as the helicopter breaks contact with the ground as there can be a tendency for the helicopter to pitch 'nose down' and this must be counteracted with cyclic control.

Cushion creep take-off

Point out that this type of departure is very economical in power required, since it involves making maximum use of the ground cushion until translational lift has been acquired. It does, however, require a relatively flat departure path that is free of obstacles. This technique can be effective in circumstances where it is not possible to take off into wind.

Describe the technique for carrying out a cushion take-off, as follows:

Carry out a hover check at a low hover in maximum ground effect facing into wind.

Lookout

Initiate slow forward movement with cyclic.

Apply sufficient power to prevent sink.

Maintain gentle acceleration, staying in maximum ground effect.

As the ground effect is lost and translational lift is acquired, select climb power and airspeed.

Stress that, in order for this type of take-off to be effective, all control movements must be gentle and

Vertical take-off over obstacles

Explain that this type of departure should only be considered if there is no reasonable alternative as the power requirement is greater and the helicopter will be operating in the avoid curve.

Describe the technique for carrying out a vertical or towering take-off, as follows:

Establish a low hover into wind and complete a power check and take-off checks.

Apply sufficient power to initiate and maintain a gentle vertical climb.

Ensure that the climb is vertical by reference to obstacles ahead and to the side of the helicopter.

As the transition point is reached, check for a positive rate of climb, the aircraft is clear of the obstacles and that there is still sufficient power margin for the transition. Then ease the cyclic forward so that the helicopter transitions and continues to climb.

As translational lift is attained, select a climb attitude and apply climb power.

Zero speed landing

Explain that this type of landing is useful in conditions where it is not desirable to approach to a hover, such as in dust, powdery snow or turbulence. It requires less power than a normal approach to a hover but more power than a running landing.

Describe the technique for carrying out a zero speed landing as follows:

Approach the selected landing spot as required.

When the approach is almost completed, and groundspeed is close to zero, anticipate loss of translational lift by applying sufficient power to minimise the rate of descent.

Let the helicopter sink gently through the cushion on to the ground.

Point out that this type of landing requires careful prior confirmation that the selected spot is suitable for landing.

Running landing

Explain that this type of landing can be used in similar conditions as the zero speed landing. Although it requires less power to perform and is easier to control the directional stability as translational lift is maintained throughout the approach, a large, flat, smooth surface such as a runway is essential.

Describe the technique for carrying out a run-on landing, as follows:

Approach the selected landing area as required.

As the approach is completed, run on at slow walking pace maintaining translational lift throughout.

Apply sufficient power to cushion the landing.

After landing, maintain the cyclic and collective positions until forward movement stops. Maintain heading throughout with pedals.

Approaches

Explain that in certain conditions it is sometimes necessary to approach to land at an angle other than standard, as follows:

Steep approach

This approach is for avoiding obstacles on the final approach path. Point out that airspeed will be lower than normal and that more power will be required.

Always prepare for a zero speed landing.

Stress the need to maintain airspeed >30kts for as long as possible owing to the danger of a vortex ring state occurring or of insufficient power to prevent a hard landing.

Shallow approach

Explain to the student that a shallow approach requires less power than a standard or steep approach. It should be employed when the approach path is free from obstacles and where conditions limit the power available, or where maximum power is available but inadequate for the use of standard techniques.

Stress that care should be taken to avoid making the approach angle too shallow, i.e. flat. This requires more power and can lead to problems in decelerating to a hover because of the possibility of the tail striking the ground.

Crosswind and downwind transitions

Explain that wherever possible crosswind and downwind transitions should be avoided as they require more power, they can be difficult to control and require a larger clear take off/landing area.

Describe the techniques for a downwind transition from the hover as follows:

Cushion transition is the preferred technique if a long open flat take-off area is available. From a low hover gently accelerate forward using power to maintain height. When translational lift is obtained and positive airspeed indicated on the ASI the maximum power available should be used to establish best rate of speed. If there are obstacles present then the best angle of climb speed should be used.

Vertical transition should only be used if the take off path does not permit a cushion transition and HOGE performance has been established. It is conducted from the low hover and a vertical climb is established. When above the obstacle height and before the vertical climb decreases apply gentle forward cyclic to achieve translation lift avoiding loss of height. Climb away using best rate or angle of climb as appropriate.

Explain the techniques for the downwind transition to the hover as follows:

Fly the circuit at an appropriate height extending the 'into wind' leg for about twice the normal length as the aircraft will drift towards the landing site when turning on to base/final legs. On finals the speed should be decreased to approx 30-40kts dependent on height. A slightly shallow constant angle approach should be flown with a RoD <300 fpm. Power required will be higher than normal and direction stability difficult to control, so all control movements should be kept to a minimum. A low hover should be established with the minimum possible attitude change as the tail will be close to the ground.

A go around must be considered if any of the following are experienced:

- directional stability becomes difficult or the rear cyclic stop is reached.
- excessive power is required to control the approach.
- the RoD is > 300 fpm with speed less than 30kts.

Go around

Explain that throughout the approach to the hover the pilot must be prepared to conduct a 'go-around' should the aircraft RoD, power requirement, or speed become excessive.

Discuss the technique to be employed for the go-around and why it is important to ensure airspeed is >30kts before power is applied to arrest the RoD and establish the climb.

AIR EXERCISE

Review the standard take off and landing techniques then demonstrate take offs and landings out of wind.

Student practice

Review normal transition to and from the hover including an LS recce.

Student practice

Demonstrate the following transitions:

Running take-off

Cushion creep take-off

Vertical take-off

Running landing

Zero speed landing

Cross wind/downwind takeoff/landing

Steep approach

Go-around

Student practice

TIPS FOR INSTRUCTORS

Initially this exercise should ideally be taught on a flat, firm, level open area free from obstacles such as an airfield. in order that the best rate of climb and a normal approach can be used. Only when proficient in the techniques should obstacles be introduced to demonstrate best angle of climb, vertical take off and steep approaches.

Once a technique has been demonstrated and the student practised it, then the exercises can be combined into a circuit practising the various transitions to and from the hover.

The techniques in this exercise are further practised using limited power in Exercise 28.

27
SLOPING GROUND

GROUND SCHOOL POINTS

Dynamic /Static rollover

Flight manual: Limitations

Tail rotor drift and roll

Ground effect

Ground resonance

PREPARATORY INSTRUCTION

Aim

For the student to learn procedures and techniques for operating from sloping ground

Review

Exercise 12: Take-off and landing

Exercise 26 Advanced take-offs and landings

Motivation

Describe the helicopter's ability to operate from unprepared surfaces and sloping ground. Explain that pilots are frequently required to use this ability.

Airmanship / TEM

- LS recce

  Size - is the slope big enough to land the helicopter ensuring blade/ tail clearance?

  Shape - the shape of the slope in relation to the wind may dictate direction of landing.

  Surrounds - check area free of obstacles, FOD, persons.

  Slope - does the slope look to be within the limits of the aircraft/capabilities of the pilot?

  Surface - is the surface firm and not slippery (wet grass)?

- W/V
- Helicopter limitations
- Escape path

Teaching Points

Explain that sloping ground techniques involve gentle and cautious control movements. The techniques used for sloping ground landing are all used for landing on all even ground or when the pilot is unsure of the firmness of the ground e.g. sandy, packed snow, wet/marshy, muddy conditions.

Explain that sloping ground operations can be divided into four phases:

- reconnaissance
- planning/manoeuvring
- landing
- take-off.

Reconnaissance:

Explain that all landing surfaces require careful attention during landing and take-off. Extra care must be taken where the surface is likely to be soft, slippery, or where there are obstacles such as rocks or tree stumps.

Describe how cross-slope landing performance is affected by cyclic control limitations and the fact that one skid hangs lower than the other at the hover.

Explain how it is possible to reach control stops on a slope especially when out of wind or close to CoG.

Explain that landing into wind is always desirable for helicopter handling, but that there are often occasions when the pilot must 'trade-off' wind and slope in order to get the best compromise between the ground and helicopter limitations.

Explain the effect of a slope on ground effect and the power required to maintain the hover.

Point out that, in view of the above, it is vital to make a careful assessment of the ground before attempting to land.

COMMON ERRORS

- *Failure to maintain disc attitude.*
- *Jerky control movements.*
- *Failure to maintain heading and yaw during power changes.*
- *Allowing aircraft to roll with one skid in contact with the ground and rapidly reducing / raising collective lever.*

Manoeuvring

Point out that the tail assembly is particularly vulnerable during sloping ground operations. Pilots should be constantly aware of the tail rotor when making hovering turns which should, whenever possible, always be made by turning the tail away from a slope and not towards a slope, when landing upslope in conditions where the ground levels out behind the helicopter, or when landing downslope.

Landing

Describe the landing performance and limitations of the type of training helicopter being used.

Describe how to land on sloping ground, with left/right skid up slope as follows:

Establish a steady hover.

Lower the collective gently until the upslope skid contacts the ground.

Continue lowering the collective, at the same time moving the cyclic gently towards the slope keeping the disc horizontal to prevent lateral movement of the helicopter.

When both skids are in full contact with the ground, smoothly lower the collective until it is fully down.

Prevent yaw throughout.

When certain the helicopter will not slide, centre the cyclic.

Point out the importance of maintaining flying RPM until the collective is fully down.

Point out the need for smooth and accurate control movements and for not overcontrolling. Explain that with one side of the landing gear in contact with the ground it is possible to induce a rate of roll that is impossible to counteract with opposite cyclic.

Describe the signs that tell you cyclic control limits are being reached because of excessive slope. Explain that when they start to occur, or if the helicopter starts to slide, the helicopter should be brought smoothly back to the hover and landed elsewhere.

Describe how to land on sloping ground with the aircraft nose up the slope as follows:

The technique for landing nose upslope is the same as that above. The first contact will be made with the front of the skids and the cyclic is moved forward to keep the disc level as the collective is lowered.

Caution should be exercised as both wheeled and skidded aircraft are prone to sliding down the slope when conducting a nose up slope landing.

Take-off

Describe how to take off from sloping ground, as follows:

Ensure that the RPM is at the take-off setting.

Carefully position the cyclic into the slope so that the disc is horizontal and gently raise the collective maintaining the disc position with cyclic so that the helicopter breaks contact with the ground vertically. Stress the vital importance of avoiding any excessive lateral movement.

Prevent yaw throughout.

Considerations

Point out the dangers of turning rotor blades to persons in the close vicinity of the helicopter in this type of operation, and in particular, to avoid embarking and disembarking passengers located uphill of the helicopter due to the reduced main rotor tip clearance above the ground. Explain that it is the pilot's duty to brief passengers and ground crew in this regard, whenever possible.

Review the dangers of dynamic/static rollover and the need to ensure before take-off that the helicopter is within C of G limits and that the landing gear is clear of snags and obstacles. Talk through the immediate action required in the event conditions likely to lead to dynamic rollover are encountered, ensuring that this is fully understood by the student as intervention time is minimal.

AIR EXERCISE

Select an area of sloping ground well within the helicopter's limits and demonstrate reconnaissance of, and manoeuvring over, the intended landing area.

Student practice

Demonstrate right and left skid up slope landings, landing in both directions, pointing out the difference in helicopter performance where appropriate.

Student practice

Demonstrate a nose up slope landing.

Student practice

Select an area of sloping ground that is close to the helicopter's limits and demonstrate landings and take-offs.

Student practice

Select an area of sloping ground that is beyond the helicopter's limits and demonstrate the indications that the limits are being approached, and the methods of aborting the landing.

Student practice

Demonstrate wind/slope trade-off.

Student practice of reconnaissance and selection of landing points.

TIPS FOR INSTRUCTORS

The performance and techniques involved with different types of helicopter on sloping ground vary. This exercise should be tailored to meet the performance of the training helicopter.

(1) Students tend to be very tense when introduced to sloping ground operations. They will be likely to overcontrol and will tire quickly. It is vital that the student is proficient at hovering and standard take-offs and landings before this exercise is introduced.

(2) Students will tend to look at the ground close to the helicopter. Overcontrolling frequently results, and it will often be necessary to remind the student to raise his or her eyes and use the horizon as a datum.

(3) When students are proficient, let them make the decision where to land so as to judge their own ability to evaluate slopes.

(4) Start the student on `beginners slopes' and gradually increase the severity as proficiency improves.

(5) Ensure that the student is shown some slopes that are a mix of cross slope and up/down slope, so that the helicopter has to be landed diagonally on the slope.

28
LIMITED POWER

GROUND SCHOOL POINTS

Flight manual

Limitations

Load and density altitude performance charts

Power curve

Vortex Ring

PREPARATORY INSTRUCTION

Aim

For the student to learn how to transition, to and from the hover, when the power is limited.

Review

Exercise 26 Advanced Take-off, Landing and Transitions.

Motivation

Helicopter pilots may wish to operate at maximum all up mass, or, in ambient conditions, where the power margin available may be limited, or land an aircraft safely with a malfunction that limits the power available. To do this the techniques previously learned in Exercise 26 can be utilised. It should be stressed to the student that these techniques should not be used for a take off with an aircraft that has a malfunction or is operating at above all up mass.

Airmanship / TEM

- Lookout
- W/V
- Landing site recce
- Helicopter limitations
- Power Checks

Teaching Points

Power Checks

Explain that in conditions where it is suspected the power may be limited it is essential to establish the margin between power available and power required to take-off or land before attempting the manoeuvre. This can be achieved by the following power check procedures:

The In-Flight Power Check.

The helicopter should be flown straight and level, normally at the recommended Vy speed, ideally within 500ft AGL of the landing site, in smooth air conditions. The power required should then be noted. The collective lever can then be raised to the maximum power available (ensuring that none of the aircraft limits is exceeded) and note the power achieved. The difference between the 2 readings is the power able to be used to conduct a landing. The landing capabilities of a piston engine helicopter are typically as listed below. However they may differ for each type and should be verified before use:

<3 inches MAP available – a running landing is required.

4 inches MAP available – a zero speed may be conducted dependent on w/v and surface.

5 inches MAP available – approach to a low hover.

6 inches MAP available – HOGE may be possible.

7 inches MAP available – a vertical descent from HOGE may be possible.

COMMON ERRORS

- *Take-off:*
- *Pulling cyclic aft as aircraft leaves ground.*
- *Incorrect use of collective lever, e.g. jerky movements.*
- *Large yaw control movements.*
- *Exceeding or not using simulated power.*
- *Inaccurate RPM control.*
- *In a towering take-off, continuing the vertical climb too long before starting the transition.*
- *Hover and/or Landing:*
- *Inaccurate Power Check.*
- *Allowing speed to fall too early so using up all the power available too soon.*
- *Running on at too high a speed without using all the power available.*
- *Not maintaining a constant angle of approach.*
- *Under/overshooting a selected landing point.*
- *Not making a gradual transition.*

The Take-Off Power Check.

The aircraft should be established in an IGE hover and the power required noted. The maximum power available can be calculated and corrected for temperature and altitude.

The power margin able to be used for take-off is established by subtracting the 2 figures.

The take-off capabilities of a piston engine helicopter are typically as listed below. However they may differ for each type and should be verified before use:

- < ½ inch MAP in hand – a running take –off is required
- ½ inch MAP in hand – a cushion creep may be achievable
- 2 inches MAP in hand – a vertical take –off over obstacles

The following exercises should be demonstrated and practised with a power limit set by the instructor utilising the techniques previously taught in Exercise 26

- Running take-off
- Cushion creep take-off
- Vertical take-off over obstacles
- Running landing
- Zero speed landing
- Approach to low hover
- Approach to hover OGE
- Steep Approach
- Go around.

AIR EXERCISE

Demonstrate the take-off power and the in-flight power checks.

Student practice

Review the standard take off and landing techniques then demonstrate take offs and landings out of wind.

Student practice

Review normal transition to and from the hover including an LS recce.

Student practice

Demonstrate the following transitions with a power limit set by the instructor:

- Running take-off
- Cushion creep take-off
- Vertical take-off
- Running landing
- Zero speed landing
- Cross wind/downwind takeoff/landing
- Steep approach
- Go-around
- Student practise

TIPS FOR INSTRUCTORS

Initially this exercise should ideally be taught on a flat, firm, level open area free from obstacles, such as an airfield, in order that the best rate of climb and a normal approach can be used. Only when proficient in the techniques should obstacles be introduced to demonstrate best angle of climb, vertical take-off and steep approaches.

If the student's performance is initially degraded because they are concentrating on achieving the power limit, they should practise the technique without a power limit just using as little power as possible and then refine the technique.

Once a technique has been demonstrated and the student practised it, then the exercises can be combined into a circuit practising the various transitions to and from the hover.

SOLO FROM RIGHT SEAT ONLY
LOW G PUSHOVERS PROHIBITED
R44 Clipper II
G-XELA
BOSE

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CONFINED AREAS

GROUND SCHOOL POINTS

Recirculation

Height/Velocity Graph Considerations

Dynamic Rollover

Legal Aspects including low flying and landing permissions

PREPARATORY INSTRUCTION

Aim

For a student to learn the procedures and techniques for conducting a recce, an approach, manoeuvring within, and departing from a confined area.

Review

Exercise 18: Hover OGE and Vortex Ring

Exercise 26: Advanced Take-offs and Landings

Exercise 27: Sloping ground.

Motivation

The helicopter's ability to approach, manoeuvre, land and take-off from an off airfield Landing Site (LS) or unprepared Landing Site is one of the most important aspects of helicopter operations. Pilots will want at some stage to fly passengers to various landing sites such as hotels, golf courses, sporting venues, etc. Whilst all these sites can vary in their dimensions, approaches, hazards, elevation, and location, the same basic principles should be employed. ALS that has obstructions that require a steeper than normal approach, where the manoeuvring space in the ground cushion is limited, or whenever obstructions force a steeper than normal climb-out angle is often defined as 'Confined Area'.

Airmanship / TEM

- Lookout
- W/V
- Recce
- Vortex Ring
- LTE
- Power Checks

Teaching Points

Describe the different stages of locating, conducting the recce/ approach/ manoeuvring and the departure from a confined area:

COMMON ERRORS

- *Approach and Landing:*
- *Not appreciating wind effect on rates of descent, height and speed.*
- *Impatience during approach and landing.*
- *Not maintaining a safe clearance from obstacles.*
- *Over-controlling with cyclic and collective lever with large yaw pedal movements.*
- *Not using sloping ground technique on landing.*

  Take-off:
- *A student will take off and attempt the vertical climb from a high hover and thus has less power available to overcome inertia and climb.*
- *Not making full use of the length of the clearing, and not selecting the best exit path.*
- *Attempting to "tower" out of too small a clearing or when the aircraft's performance is in doubt.*
- *If the collective lever is raised excessively overpitching will result and rpm can only be regained by lowering the lever.*
- *There is a marked tendency for students to attempt to climb over the approaching obstacle by moving the cyclic aft. This should be resisted.*

Locating the LS

Explain it is unlikely that the LS will be marked or obvious and consequently it may be difficult to identify from the air. Therefore it may be necessary to employ some of the following techniques to make sure you land in the right place – it should be noted that any co-ordinates given to the pilot should be double checked before use!

Passengers - The passenger may be familiar with the destination.

Maps - Larger scale maps will have individual buildings and fields marked.

GPS - GPS can be accurate down to 100 m. However they are unlikely to identify an individual LS.

Photographs - A regularly used site may have a photograph in a brochure or an LS directory.

Satellite Imagery - A satellite generated picture has the advantage of giving a plan view from the air.

Directory - More commonly used sites can be found in a published LS Directory.

Other pilots - Speaking to a pilot who has previous been to an LS.

Markers - An LS may have an 'H', helipad or a windsock indicating the location

The recce of a confined area

Explain an airborne recce of an LS is required, even if the site has been previously used, to assess the suitability of the site for the individual pilot/aircraft capability, the given w/v, the best approach/departure path, and local hazards. When conducting the recce, it is necessary to minimise the noise/disturbance to the public, and also to fly at a height/speed combination that will offer the best possible chance of a successful landing in the event of engine failure. Therefore as a principle:

Always fly environmentally and defensively and never lower or slower than is necessary!

Speed - The recce should be flown at a nominal speed close to Vy, but not normally slower than 40Kts or VTOSS.

Height - The recce should not be flown any lower than is necessary and ideally not less than 500ft AGL or the height specified in the RFM 'avoid curve/height velocity diagram' in case of an engine failure and to avoid unnecessary disturbance of the local population.

Explain the different types of recce that can be flown as follows:

Orbital - This is normally the easiest technique to fly. It involves flying an orbit around the landing site, usually with the landing site on the 'pilot's side' therefore allowing maximum visibility of the site. However it requires the pilot to identify safe precautionary landing sites as he flies the recce around the LS in case of engine failure. It can be difficult to fly accurately around a very small site or in strong wind conditions.

Fly by - If it is not possible to fly an orbital recce safely all around the LS (e.g. if the terrain on one side is unsuitable for an emergency landing) it may be possible to fly past the LS over a suitable area – ideally with the LS on the pilot's side to complete the recce elements. It may be then necessary to reposition for a second or third 'fly by' which can be achieved by flying the downwind elements away from the LS over terrain more suitable for an emergency landing.

Hover - As a last resort it may be possible to bring the helicopter to an 'out of ground effect' high hover to recce the LS.

However this technique requires training and skilful handling by the pilot as it requires an increased awareness of power margins, avoid curve/height velocity diagram, wind velocity, escape routes, prior identification of an appropriate emergency landing site in the event of an engine failure while in the high hover.

Once a pilot is competent at conducting an LS recce it should be possible to obtain all the necessary information from a safe height in as few orbits as possible. However for an inexperienced pilot or when faced with a more complex LS, it may be necessary to conduct a 'high recce' followed by a 'low recce'.

Explain that the recce should identify the following points (often referred to as the 5 S's),

Size - Is the LS big enough for me at my experience level to get this size aircraft in and what type of approach shall be required to fly (e.g. a large area – single angle approach, a medium sized area – a double angle approach, or a small area – a vertical approach) and what type of take-off will I decide to perform?

Shape - What shape is the LS in relation to the wind velocity (w/v) or direction of approach/departure?

Surrounds - Establishing a safe area to fly over (defensively and environmentally) while conducting the recce, including establishing any markers to be used for the circuit. Establish the hazards in the immediate LS area and any forward and lateral markers to be used in the LS to establish the centre of the area for the manoeuvring /landing.

Slope - Identify any perceivable slope in the LS. This is normally confirmed by coming to a slightly higher than normal hover while manoeuvring the LS.

Surface - Identify the nature of the LS surface for landing including ground clearance.

Describe how to fly a circuit as follows:

Choose the circuit direction. Sometimes it is not possible with the landing site on the 'pilot's side'.

Fly using markers, at Vy and at a height that would permit an autorotation to a clear area in the event of an engine failure.

Conduct power check (if not already conducted on the high/low recce) and verify the power margin available is sufficient for the approach/take off.

Describe how to conduct the final approach and landing as follows:

Turn on to finals – maintaining initially Vy until the turn is finished beware LTE. Monitor ROD/Speed/Power margin and – beware VORTEX RING STATE. Note escape routes, emergency landing areas, wind shear and turbulence and consider a go around using the planned overshoot path if:

- any yaw deviation from selected approach heading cannot be safely corrected.
- the power margin is insufficient to continue the approach safely.
- the rate of descent becomes excessive.
- the closing speed becomes excessive (especially with a rear cyclic application which may indicate a downwind component).
- the airspeed falls below 30kts with an excessively high rate of descent.

Check again Surface, Slope, Obstruction, wires, FOD

Reduce groundspeed in final stages ensuring a safe clearance from obstacles.

Maintain a constant angle approach, ideally to a spot ⅓ of the way into the area.

Ensure tail clearance by use of a lateral marker if required.

Establish slightly higher than normal hover while checking surface and slope.

Land using sloping ground technique.

Describe the different types of approach that may be required as follows:

Single Angle Approach

Maintain height until touchdown point is seen.

Hold line of sight with small collective movements.

Maintain a steady, controlled ROD with power/ speed combination to avoid Vortex Ring and also to avoid excessive ROD that may require large/rapid collective inputs to arrest the ROD.

In later stages reduce speed to slow apparent ground speed.

Descend to establish a ground cushion at slightly higher than normal hover.

Double Angle Approach

Initially a shallow angle may be flown to a point on the other side of the LS until the landing area is visible.

Once the touchdown point is visible the angle is steepened for final approach to hover.

Hold line of sight with small collective movements.

Maintain a steady, controlled ROD with power/speed combination to avoid Vortex Ring and also to avoid excessive ROD that may require large/rapid collective inputs to arrest the ROD.

In later stages reduce speed to slow apparent ground speed.

Descend to establish a ground cushion at slightly higher than normal hover.

Vertical Approach

Shallow approach to an out of ground effect hover over the centre of the LS. Note increased power requirement and ensure sufficient power margin for controlled descent.

Descend vertically maintaining ground position by use of lateral markers.

Maintain a steady, controlled ROD with power/ speed combination to avoid Vortex Ring and also to avoid ROD that may require large/rapid collective inputs to arrest the ROD.

Descend to establish a ground cushion at slightly higher

Describe how to manoeuvre within a confined area as follows:

Explain due to danger of blade strike/tail strike/FOD, manoeuvring within an LS should only be conducted when it is entirely necessary to do so. If it is necessary to manoeuvre, either to park the aircraft or reposition in preparation for a take-off, then extreme caution should be used and it may be advisable to taxi slightly higher and slower than normal, keeping a good look out.

Turn About the Tail

Adopt a slightly higher than normal hover.

Maintain the tail over the same ground position.

Turn the aircraft in the direction the pilot can see (i.e., pilot's side).

Look out throughout the turn for obstructions.

Monitor the blade tips and be aware of overhanging branches.

Sideward Movement (Box Turn)

Adopt a slightly higher than normal hover.

Hover taxi sideward whilst maintaining heading, at least an aircraft length in the direction the pilot can see (i.e., pilots side).

Spot turn through 90 degrees so that the tail is now in the known clear area where the aircraft was positioned.

Repeat (if required) until back on to original heading.

Look out throughout the turn for obstructions.

Monitor the blade tips and be aware of overhanging branches.

Describe the procedures for departing from a confined area as follows:

Prior to the departure from an LS, a thorough 'recce' of the landing site should be undertaken noting hazards, obstacles, wind velocity, sun position and possible safe departure routes. A power margin calculation from the RFM may be required as may a hover power check as a confirmation to establish the exact power margin available. Special attention should be paid to the re-calculation of C of G, weight and loading if passengers/ cargo have been off loaded or picked up. The pilot should then establish the climb out path from the LS by asking himself 'what is the safest way out of here?

The sequence for takeoff and departure from an LS should be as follows:

Pre-take-off checks.

Lookout – take-off using sloping ground techniques.

After take-off checks to include power check.

Confirm or reselect take-off path.

Reposition within area if required.

Select forward and lateral markers as appropriate.

Lookout above – check for overhead obstructions.

Transition using appropriate technique.

Thorough lookout on lifting from the confined area especially for any aircraft overflying/arriving/departing the LS.

A normal transition using best ROC should be flown wherever possible. 'Backtracking' to the rear of the LS extra room may make extra distance available for the transition. If the LS is surrounded by obstacles then the vertical climb technique should be used. However vertical climbs which necessitate prolonged periods in the avoid curve diagram should only be used as a last resort.

Vertical Climb (to outside ground effect)

Establish low hover in centre of LS.

Identify forward and lateral markers to ensure no forwards/sideward/rearward movement during climb.

Smoothly apply power up to maximum power available and climb vertically while maintaining heading.

Note initial rate of climb decreases with height.

When clear of obstacles, maintaining a rate of climb, adopt a gentle transition forward to prevent height loss.

Note: If insufficient power to maintain the climb then descend vertically and land back inside the LS.

AIR EXERCISE

Introduce the full confined area procedures, using an area that is large enough to permit a constant angle approach and best rate of climb departure.

Student practice in the same confined area

Demonstrate the full procedure in smaller areas that require double angle and vertical approaches with vertical climb departures.

Student practice in the same areas

Demonstrate go around techniques and aborted departures.

Student practice

TIPS FOR INSTRUCTORS

This is a comprehensive exercise that may well require more than one session of preparatory ground instruction. If there is a shortage of suitably confined areas in the local training area, consider planning cross-country navigation exercises to locations farther afield where there is more scope.

When introduced to this exercise, all students will require more than one orbit of the area to obtain all the information they require. Encourage them to cut down this number as their proficiency increases, until experience reduces it to a practical minimum.

Ensure that students pick out a reference near the area so that they maintain situational awareness.

Explain that the order in which the five 'S's are presented is flexible, and variations are permissible, providing all points are covered.

Usually the more different types of areas students are exposed to for demonstration and practice, the more proficient and confident they become in this important part of the course.

Explain the importance of looking for wires on the approach and on the final stages of the final approach.

Point out that, depending on the wind velocity, it is permissible to accept crosswind components to take advantage of size, shape, and gaps in obstacles (beware wires).

Alert the student to the possibility of wind masking/shear when descending below the height of the obstacle, normally on the final stages of the approach.

Landing sites that are remote from an airfield offer various challenges to the pilot and consequently have resulted in a significant number of accidents. Unlike at an airfield there is generally, little or no assistance in the assessment of wind, guidance on appropriate approach directions or information on other traffic. Hazards not normally experienced at an airfield such as wires, obstructions, uneven landing ground, trees, Foreign Object Damage, livestock and pedestrians are quite likely to be found and require a heightened degree of situational awareness by the pilot who needs to **expect the unexpected!**

The following are common pilot errors that have occurred at off airfield landing sites of which some have resulted in accidents:

Loss of airspeed while turning cross/downwind during an LS recce resulting in LTE.

Turning on to final approach too high/too fast/too close leading to an excessive ROD, with low airspeed and power applied resulting in Vortex Ring.

Incorrect wind w/v identification resulting in downwind approach with hard landings and/or excessive power demands.

Blade strike/tail strike on unseen obstacles/foreign object damage in the LS.

Persons being hit by tail/main rotor blades.

Damage to underside of aircraft due to landing on unseen obstruction.

Aircraft rolling over because sloping ground technique not used for landing/take off.

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BASIC INSTRUMENT FLYING

GROUND SCHOOL POINTS

Flight manual

Limitations

Aircraft Instruments indications, limitations and errors

Human Physiological

PREPARATORY INSTRUCTION

Aim

The aim is to introduce the student to basic instrument flying techniques.

Review

Exercise 7, 8 & 9 Climbing Descending and Turning.

Motivation

It should be stressed that intentional flight in IMC requires an appropriately certified and equipped helicopter and the pilot to hold an Instrument Rating. Therefore the aim of this lesson is to teach the pilot the correct techniques to be employed to recover the aircraft in the event of an inadvertent entry into IMC. In this exercise instrument flight will be simulated.

Airmanship / TEM

- Lookout
- W/V
- Helicopter limitations

Teaching Points

Explain that enhanced ground instruction in weather interpretation, planning, route assessment , TEM, and Decision Making on encountering DVE, including the ability to be able to reverse the course and/or conduct a precautionary landing should avoid inadvertent entry into IMC which is a **potentially fatal flight regime**.

Explain how the normal physiological sensations of vertical, balance, rotating, accelerating and decelerating are affected in flight and how in previous exercises the use of external references in conjunction with the aircraft instrument indications have assisted in maintaining a flight condition. However when flying with sole reference to instruments any deviation from the required flight condition will derive solely from the information provided by the instruments alone and pilots can no longer trust their senses to indicate what is going on.

Describe how due to lag and error of aircraft instruments, environmental effects, and unstabilised aircraft, in order to obtain a complete situational awareness a regular scan of the instruments is required to be maintained. The technique normally employed for this is known as the Selective Radial Scan. Explain that because of the fundamental requirement of attitude control in helicopters the AI is used as the centre of the scan. The scan then radiates outwards to one of the instruments DI/ASI/VSI/altimeter for selected information then returning to the AI before scanning the other instruments again.

Describe how to carry out the following basic manoeuvres with sole reference to instruments;

Straight and Level Flight at various airspeeds/configurations

The pitch attitude which maintains speeds in the range 40-80kts is normally virtually the same with the AI 'horizon' just above the 'wings'. To achieve a speed change, select 5˚ nose down to accelerate or 5˚ nose up to decelerate, scan the altimeter and VSI for level flight and adjust the lever/pedals as appropriate. When the desired speed is achieved, reselect the original attitude and adjust the power again. As the speed changes it is necessary to counter the effects of flapback with the cyclic.

Level Turns

Roll on the required bank (normally rate 1, maximum 30˚). Maintain the same pitch attitude. Adjust the collective to maintain height and scan for balance. Anticipate the roll out and roll out on to desired heading. Scan the DI again and adjust. Remember it is only possible to read the heading accurately with 'wings' level.

Climbing and Climbing Turns

If there is sufficient power and the climb is not prolonged, there may not be any need to adjust the aircraft speed/attitude to achieve a nominal 500ft a minute RoC. Apply collective power while maintaining attitude and scan balance, VSI, altimeter.

COMMON ERRORS

- *The student often fails to cross-refer to all his instruments.*
- *Lack of Radial Scan.*
- *Over-controlling, particularly with cyclic, and failing to appreciate that small attitude changes on the artificial horizon, if sustained, have large ultimate effect.*

As approaching new height anticipate the level off by 10% of RoC and reset pre climb power. Scan instruments as before. If a maximum RoC is required then set 5˚ nose up to select best RoC speed and increase power to maximum continuous power. Anticipate level off as before and level off initially by selecting 5˚ nose down to reselect speed and adjust power. Scan instruments as before.

To turn in the climb, it is recommended to initiate the climb first, then commence the turn anticipating an increase in power to maintain climb. As there is no requirement for a synchronised/coordinated climb and turn, straighten out/ level off whichever comes first followed by the other.

Descending and Descending Turns

To descend at the cruising speed decrease power to achieve 500ft RoD while maintaining attitude and scan balance, VSI, altimeter .To level off, anticipate by 10% RoD reset pre descent cruise power and scan instruments as before.

To turn in the descent it is recommended to initiate the turn first (which may set up a small RoD) then adjust the power for 500ft RoD descent. As there is no requirement for a synchronised/coordinated descent and turn, straighten out/ level off whichever comes first followed by the other.

Recovery from Unusual attitudes

An unusual attitude can occur because the normal scan has broken down due to a relatively simple task like changing a transponder code or it can be the result of the pilot experiencing the 'leans'. In all cases it is fundamental when instrument flying to believe the instruments and disregard physiological sensations.

The recommended recovery sequence from an unusual attitude is:

Wings level - check AI for turn/bank and level the aircraft

Attitude, - check AI for accelerative/decelerative attitude and correct

Speed, - check ASI, if airspeed is low or excessive do not apply power until corrected (cross check balance because if out of balance airspeed indication may not be accurate)

Power –set power as required

AIR EXERCISE

Demonstrate all the basic instrument flying techniques.

Student practice

TIPS FOR INSTRUCTORS

When manoeuvres are to be flown by sole reference to instruments, the instructor should ensure that a suitable method of screening is used to simulate IMC for the student without obscuring the instructor's field of view.

(Note: for the first flight, the student may need to use external references to compare the aircraft attitude in relation to the instrument indications).

There is not a minimum numbers of hours for this exercise and it is likely to require a number of flights for the student to achieve the required standard. It should be acknowledged that IF is a skill which can fade quickly in the absence of continuous practice and should therefore be revised throughout the flying course.

Wherever possible, flight simulation should be used to demonstrate to students the effects of flying into DVE and to enhance their understanding and need for avoidance of this potentially fatal flight regime.