EASA
European Union Aviation Safety Agency

together4safety

For Helicopter Flight Instructors – Training Guide

Issue 4 : 2022

FOREWORD

One of the important ingredients for a safe and viable aviation industry is a properly resourced flight training sector. Some of these resources can be quite fundamental. For example, an important contribution to training is for flying instructors to have easy access to a basic guide to elementary flying training so that they can have all the information they need to support their students and develop their own skills

This is the fourth issue of the Helicopter Flight Instructor Guide. It is the second one badged EASA and Together4Safety, which was initially developed by the European Helicopter Safety Team (EHEST) based on the Australian Civil Aviation Safety Authority (CASA) Flight Instructor Manual (Helicopter). CASA has kindly made this manual freely available to the EHEST for educational and safety promotion purposes. Some changes have been incorporated to reflect European terminology and the EASA training syllabus content.

The EHEST closed in 2016 and was reestablished as the European Safety Promotion Network Rotorcraft (ESPN-R). EASA and ESPN-R safety promotion publications are branded Together4Safety to highlight the benefit of working together for enhancing safety.

In 2018 EASA launched the Rotorcraft Safety Roadmap[1] with the aim to significantly reduce the number of rotorcraft accidents and incidents. Training is seen as a risk area, and also as an opportunity. A large number of the in-flight accidents happen during training. The Rotorcraft Safety Roadmap tries to reduce these events by addressing training issues through different roadmap workstreams of which some are directly related to (flight) training. These training related workstreams are Training Safety and Training Devices. This very Flight Instructor Guide is in fact subject to continuous review and improvement under the workstream Training Safety of the Rotorcraft Safety Roadmap.

Certain additions in this fourth issue of the Flight Instructors Guide stem from these workstreams. The work under the umbrella of the Rotorcraft Safety Roadmap has triggered several initiatives, focusing on specific subjects related to risk management during flight training.

One of such topics is the encouragement to use appropriate training devices for high risk training maneuvers.

[1] https://www.easa.europa.eu/download/Events/Rotorcraft%20Safety%20Roadmap%20-%20Final.pdf

Therefor we try to promote the training on 'safe' training devices, to be understood as a device which 'operates' in a safe environment:

- without risking injury to the trainer, trainee or third parties,

- without risking damage to the actual aircraft or to property of third parties

so that on these devices :

- the required skills can be acquired progressively, and

- competence in applying these skills can be maintained

so that in case when these skills need to be applied in a real emergency, in real life they can be performed in a confident and successful way.

To reduce the risks related to training high risk training maneuvers during actual flight in a real helicopter - and thus, to reduce the number of accidents that occur during such training - roughly 2 avenues that are interconnected with each other are envisaged in the Rotorcraft Safety Roadmap.

These two avenues are:

- to distance from training the specific emergency maneuvers – individually, separately – in actual flight to encourage training these sets of emergencies on high fidelity training devices instead until a sufficient level of proficiency is reached, before these maneuvers are trained on actual aircraft

- to apply progressive training scenarios in actual flight, instead of training sets of emergencies, in order to make trainees aware of lurking dangers, making them able to recognize the situations conducive to (hidden) hazards and teach them how to fly in a pro-active safe way in order to prevent that their flight evolves into a situation that would require to apply (one of) those limited set of emergencies. Scenario-based training refers to training that incorporates maneuvers into real-world experiences to cultivate practical flying skills in an operational environment.

Of course, it remains well understood, that the trainee should be able to perform those specific 'sets of emergencies ' successfully in a real helicopter. It is only the way, the learning path towards that goal, to get to that point safely, in a less risky way that is promoted.

The 1st avenue is related to the device to be used for training high risk training maneuvers instead of the real helicopter. So this first avenue is clearly linked to Rotorcraft Safety Roadmap Work Stream 'Training Devices'.

The 2nd avenue is related to how to perform the training. This avenue is clearly linked to Rotorcraft Safety Roadmap Work Stream 'Training Safety'.

Where the ATO/DTO has a possibility to include such training devices in the students learning path, the use of such devices should be encouraged. Yet there is an important caveat to this. Any training device used should provide accurate fidelity and should be validated properly to avoid negative training. Negative training refers to training which unintentionally introduces incorrect information or invalid concepts, which could actually decrease rather than increase safety. Any use of a training device in regions of the flight envelope beyond the training device's ability to provide accurate fidelity has the potential to introduce misleading concepts or an inappropriate understanding of techniques which can result in negative training.

In Part 2, air exercise objectives and lesson checklists have been included for all the flying exercises. The numbering of the exercises is aligned with the PPL(H) syllabus as set out in AMC2 FCL.210 PPL(H). Other changes have been incorporated and sections re-written as a result of suggestions received following publication of previous issues.

Readers are encouraged to provide feedback to ensure that any further versions meet industry needs. You can email your feedback to us at: SafetyPromotion@easa.europa.eu.

For comments and questions contact:

Safety Promotion
Safety Intelligence and Performance Department
European Union Aviation Safety Agency (EASA)
Postfach 10 12 53, D-50452 Cologne, Germany
Tel: +49 221 89990 2024
Fax: +49 221 89990 2524
SafetyPromotion@easa.europa.eu

Important Notice

This guide is for general information only.

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

All EASA Approved Training Organisations (ATO) are required to maintain an 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 guide or in the case of a Declared Training Organisation (DTO), the verified training Programme.

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

The information contained in this document is subject to change without notice. This fourth issue of the guide has been prepared by EASA for educational purposes only. The guide should never be used for any other purpose. The contents of this document have been adapted with permission from the Civil Aviation Authority of Australia (CASA). The CASA Manual was based on the Civil Aviation Authority (CAA) of New Zealand Helicopter Flight Instructor Manual, which in turn was based on Department of Transport Canada Helicopter Flight Training Manual with permission. While use of this material has been authorised, CASA, the CAA New Zealand and the Department of Transport, Canada shall not be responsible for the manner in which this information has been presented or modified in this guide. The authors also wish to acknowledge the FAA's excellent publication The Helicopter Instructor's Handbook, which was a valuable source of material for Part 1 of this guide. We also acknowledge the work performed by Mike O'Donoghue in the transposition from the CASA manual to the EHEST produced versions 1 & 2.

Disclaimer

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INTRODUCTION

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 SET THIS 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
- continuously applying TEM principles.

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 and on the helicopter.

THE FLIGHT INSTRUCTOR

A trainer is a person who teaches a particular skill or type of behaviour through sustained practice and instruction'. Flight instructors are clearly trainers and their aim is to give students good instruction and sufficient practice so that they can fly the helicopter proficiently and safely. People usually remember their teachers from school or elsewhere often with a great deal of clarity. This is particularly true in flying instruction and most if not all pilots will remember who taught them to fly. They will recall the attributes of the instructor and more often than not will base their future flying on that of their instructor. Being a flying instructor is therefore extremely rewarding but it also carries with it great responsibility.

To student helicopter pilots, their flight instructor is one of the most important people in the world at this phase of their lives. They expect the instructor to have a thorough knowledge of the subject and a sincere desire to help them. They expect the instructor to be capable of teaching everything necessary for them to become proficient aviators. They trust that flight instructors will not only consider safety in the day-to-day progress of the course but in their ability to judge when they will be competent for solo operations or movement to another phase. They expect a lot and they have every right to do so.

The responsibilities of a flight instructor are therefore large but what about the rewards? Leaving aside financial considerations, instructing offers opportunities for much greater recompense. For example, the personal satisfaction received when a slow student shows unexpected progress or

when the instructor's efforts cause a blank look to change into an enlightened expression and the satisfaction of seeing someone who couldn't fly a helicopter before they met you becoming a confident and competent pilot.

Less experienced flight instructors, especially when they are also low time helicopter pilots, may be a source of additional risks. ATOs/DTOs should have a process in place in which they prevent accidents, incidents or undesired events or outcomes occurring during the demonstration and teaching of high risk training manoeuvers e.g. engine out landings, sloping ground manoeuvers, vortex ring state, etc. It is important that the student in all stages of his training receives positive training at all times. Therefore high risk training manoeuvers should be tought by experienced flight instructors only. The ATOs/DTOs should have a program in place under the scope of their safety management system to prevent less experienced flight instructors of performing high risk training manoeuvers. In addition this program should cover the steps to be taken to bring less experienced flight instructors up to an acceptable level of experience so that they can perform high risk training manoeuvers in a safe way, be ready to tackle any escalating conditions and defuse any potential undesired outcome.

This guide is not meant as a text book for the Flight Instructors Course (FIC) although it will be useful to trainee instructors undergoing such instruction. Rather it is designed to be a resource for FI(H) to review the basic knowledge and skills associated with helicopter flight instruction, assist in standardisation and help prepare them for their periodic assessments of competence.

At least every six years, instructors are required to pass an Assessment of Competence (AoC) with a Flight Instructor Examiner [FIE(H)]. During the AoC, the FIE(H) will assess the instructor's skills and competencies on the ground and in the air. The schedule for the AoC is shown in Table 1.

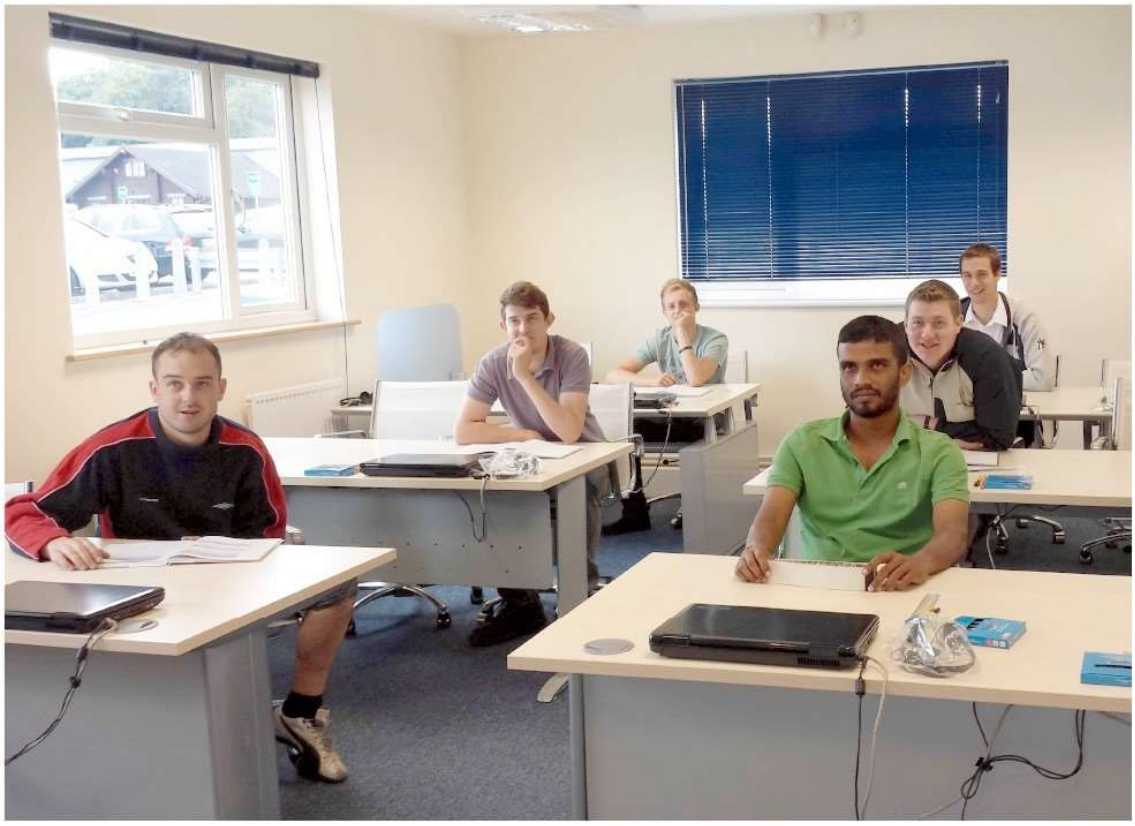
Table 1: AMC1 FCL.920 Instructor competencies and assessment

COMPETENCE	PERFORMANCE	KNOWLEDGE
Prepare resources	(a) ensures adequate facilities; (b) prepares briefing material; (c) manages available tools.	(a) understand objectives; (b) available tools; (c) competency-based training methods.
Create a climate conducive to learning	(a) establishes credentials, role models appropriate behaviour; (b) clarifies roles; (c) states objectives; (d) ascertains and supports trainees needs.	(a) barriers to learning; (b) learning styles.
Present knowledge	(a) communicates clearly; (b) creates and sustains realism; (c) looks for training opportunities.	teaching methods.
Integrate TEM or CRM	makes TEM or CRM links with technical training.	(a) HF, TEM or CRM; (b) causes and countermeasures against undesired aircraft states.
Manage time to achieve training objectives	allocates time appropriate to achieving competency objective.	syllabus time allocation.
Facilitate learning	(a) encourages trainee participation; (b) shows motivating, patient, confident and assertive manner; (c) conducts one-to-one coaching; (d) encourages mutual support.	(a) facilitation; (b) how to give constructive feedback; (c) how to encourage trainees to ask questions and seek advice;
Assesses trainee performance	(a) assesses and encourages trainee self-assessment of performance against competency standards; (b) makes assessment decision and provide clear feedback; (c) observes CRM behaviour.	(a) observation techniques; (b) methods for recording observations.
Monitor and review progress	(a) compares individual outcomes to defined objectives; (b) identifies individual differences in learning rates; (c) applies appropriate corrective action.	(a) learning styles; (b) strategies for training adaptation to meet individual needs.
Evaluate training sessions	(a) elicits feedback from trainees; (b) tracks training session processes against competence criteria; (c) keeps appropriate records.	(a) competency unit and associated elements; (b) performance criteria.
Report outcome	reports accurately using only observed actions and events.	(a) phase training objectives; (b) individual versus systemic weaknesses.

Part 1

TEACHING AND LEARNING

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



THE LEARNING PROCESS

The Teaching and Learning syllabus in the Manual is laid out in the same order as it appears in AMC1 FCL.930.FI FI for ease of reference and this is the primary difference between this version of the handbook and Issue 1. The numbering of the exercises is aligned with the PPL(H) syllabus as set out in AMC2 FCL.210 PPL(H).

There are many books on the subject of Teaching and Learning which cover this complex subject and which should be consulted for greater depth on some of the individual topics which are necessarily covered in headline detail only in this guide.

Part One of this guide describes some of the basic instructional techniques in accordance with the Teaching and Learning syllabus that apply to:

- Theoretical knowledge training
- Pre-flight briefing
- In-flight instruction
- Post flight briefing and debriefing
- Student assessment and evaluation

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

MOTIVATION

The factor that has perhaps the greatest influence on learning is motivation, the force that causes a person to move towards a goal.

Motivations may be subtle and difficult to identify or they may be obvious. Negative motivations are those which may engender fear and be accepted by the student as threats. They are not characteristically as effective in promoting learning as positive motivations. Positive motivations are provided by the promise or achievement of rewards. These rewards may be personal or social; they may involve financial gain; satisfaction of a person's sense of self-worth (self-concept) or public recognition. The flight instructor can use some of these to advantage, for example, the creation of a sense of achievement which, in turn contributes positively to an individual's self-concept.

Helicopter instructors need to understand the individual motivation of their students. These can be as varied as somebody who is just thrilled by the concept of vertical flight and is eager to acquire the skills necessary to achieve this, a person who wants to save time travelling or commuting to work and who plans to use the helicopter actively in the realm of his business, to people seeking to become commercial helicopter pilots. In these disparate cases, the individual motivation may be different and lead to differences in learning styles. In all cases, motivation may affect the student's rate of progress. If for example, the business person begins to form the opinion that it will be difficult to acquire the necessary skills in the time available, then his or her motivation may suffer as a result. The flight instructor needs to be aware of this and if necessary vary instruction to maintain interest and to highlight its relevance to the goal. On the other hand, as soon as it becomes clear that the time constraints of the business person will preclude a positive progress the flight instructor (or ATO/DTO) should be sufficiently assertive to pass the message that time constraints should not be a determining factor since that would not only put the student under additional stress, but could also detrimentally influence the instructor. By extension, when it appears during the course of the training that a student seeking to become a (commercial) helicopter pilot, would not be apt to do so, the instructor (or ATO/DTO) should be able to be sufficiently assertive to indicate that discontinuing the training may be the better option. Ultimately, the same applies to the business person if his time constraints would preclude positive progress at a regular pace !

If you tell me, I will listen,

If you show me, I will see,

If you let me experience, I will learn.

Lau-Tzu (c550 BC) - mystic philosopher of ancient China.

Lau-Tzu was one of the first philosophers to create an active learning philosophy.

PERCEPTION AND UNDERSTANDING

Perception is the basis of all learning. Items of information, called perceptions (sometimes called percepts) may be directed to the brain by any one or a combination of the senses.

The senses are the routes into the human brain. In the classroom the ears and eyes are the dominant routes but the kinaesthetic sense of feel can be used too, notably when using training aids and of course in the air when all of these senses will be used.

Routes or channels for information entering the brain can be described using the VARK acronym:

- Visual (See It)
- Aural (Hear/Say It)
- Reading and Writing (It)
- Kinaesthetic (Do It)

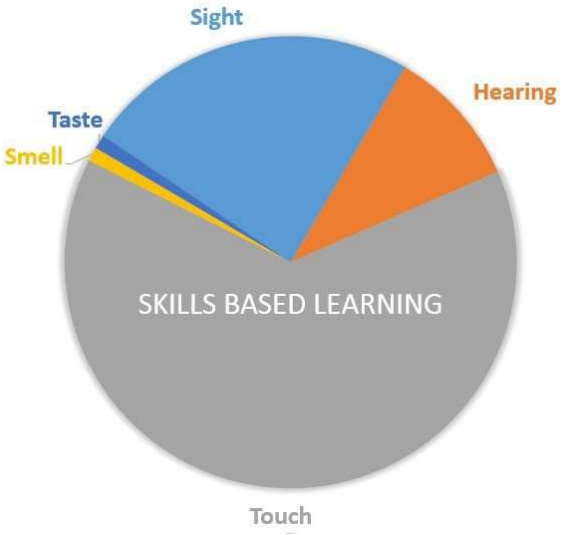
These channels for assimilating information will vary in effectiveness. For some people visual stimuli are very powerful and may well be the dominant route into the brain, for others reading and writing or perhaps the aural route will be the strongest. In practice a mixture of channels will be used. The resultant mix can be said to be the individual's learning preference. The most productive instructional output will be achieved if instructional content is delivered in accordance with the student's individual learning preference. It is therefore helpful if the instructor can establish what this is at an early stage. One way of doing this is to ask the person who may well know what works best for them. However, it's worth monitoring this at first because an individual may actually think that their preference is different from that which it actually is.

Among the most important factors which affect students' perceptions are:

- Their physical organism (e.g. is their perceptual apparatus working in the environment?)
- Their needs and requirements (e.g. could be as simple as basic needs such as food and water but also the student's sense of self-esteem)
- Their goals and values (e.g. motivation)
- Their self-concept (e.g. does it fit in with how they see themselves?)
- The time and opportunity for perception (e.g. making effective use of instructional time both in the air and on the ground)
- The element of threat (e.g. fear, not just of physical danger but also failure to make progress)

Insight involves the grouping of perceptions into a meaningful whole. Implicit in this is an understanding of how the knowledge is to be used (relevance); how one factor affects another and the interrelationship among the various sections of knowledge that have been taught. Evoking these is the flight instructor's principal responsibility.

Note: Although not strictly relevant here, it is worth noting that, perhaps surprisingly, the auditory channel to the brain is the quickest route. However, it is also likely that it will be the first one to be shed in conditions of high workload and stress. This can happen in classroom settings but is more likely to be noticed in high workload or stressful situations in flight.



These channels also vary depending on whether learning is acquiring knowledge or skills based. Given that flying instruction is a combination of the two, it is worth noting the difference in perception when the learning task is purely skills based. Again the proportions are purely illustrative but they do highlight to the instructor the potential variation in the perceptive channels depending on the type of learning.

MEMORY AND ITS APPLICATION

Memory is the major factor in learning. It constitutes essentially all of the learning classified as 'knowledge' and has a basic effect on the retention of motor skills. The following are five significant principles which are generally accepted as having a direct application to remembering and consequently to learning:

- Praise stimulates remembering. Responses which give a pleasurable return tend to be repeated. The absence of praise or recognition tends to discourage one and negative responses or lack of acceptance from the instructor tends to make recall less likely.
- Recall is promoted by association. Pieces of information or actions that are associated with something to be learned tend to facilitate their later recall by the student.
  Unique or disassociated facts tend to be forgotten unless they are of particular interest to the student.
- Favourable attitudes aid retention. We learn and remember only what we wish to. Without motivation there is little chance for recall. The most effective motivations are those based on positive or rewarding objectives.
- Learning with all our senses is most effective. Although we generally receive what we learn through the eyes and ears, other senses also contribute to most perceptions.
  When several senses respond together fuller understanding and greater chance of recall is achieved.
- Meaningful repetition aids recall. Each repetition gives the student an opportunity to gain a clearer and more accurate perception of the subject to be learned but repetition alone does not guarantee retention. Practice gives an opportunity for learning but does not deliver it in its own right. Theorists believe that three to four repetitions provide the maximum effect, after which the rate of learning and probability of retention fall off rapidly.
  This is consistent with the learning curve illustrated in Figure 1 and Figure 2 on page 10.

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 Figures 1 & 2 and the notes below each diagram.

Figure 1: Curve of remembering

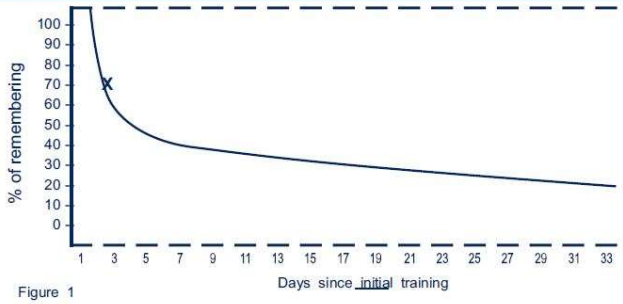


Figure 1

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

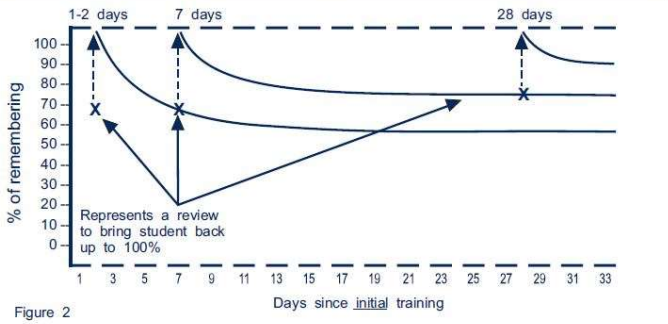


Figure 2

Notes:

- To maintain at least a 70% 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

HABITS AND TRANSFER

Learning by developing perceptions and combining them into insights is a process of forming performance habits and transferring the habits performed in one task to the performance of more complicated subsequent tasks. For example the application of forward cyclic when collective pitch is applied to maintain an accelerative attitude. The influence of these small habits in the subsequent task, in this case, applying forward cyclic when increasing collective pitch during the recovery to the climb following an autorotation is called a 'transfer'.

Transfer is generally considered to be either positive or negative. Negative transfer of training refers to the application (and 'transfer') of what was learned in a training environment (i.e. a classroom, a training device) to normal practice, i.e. it describes the degree to which what was learned in training is applied to actual, normal practices. In this context, negative transfer of training refers to the inappropriate generalization of knowledge and skills to a situation or setting in normal practice that does not equal the training situation or setting. In other words, applying what was previously learned in a particular training environment could lead to negative outcomes in a different operational environment such as e.g. a different type of helicopter. The application of aft cyclic when entering autorotation to prevent the nose dropping would be an example of a positive transfer while lowering the collective lever for touchdown when practising an engine-off landing in the hover would be an example of a negative transfer where the student has applied a procedure which has worked in other flight situations.

The syllabus of flight instruction must be arranged to take maximum advantage of positive transfer by introducing new manoeuvres in an order and manner which permit the lessons learned up till then to be applied in the new exercise.

Habit patterns are probably the most important factor in learning to control the helicopter, for example, the correct use of the sequences such as: Attitude-Power-Trim when levelling off from the climb or Select-Hold-Adjust to overcome flapback when accelerating. It is therefore the responsibility of the instructor to insist on correct procedures from the outset.

A specific case where instructors should be aware of the potential existence of negative transfer of training is the case where students have experience flying aeroplanes, having acquired aeroplane flying skills. Any student may do the unexpected but such fixed wing students should be closely supervised. There are many potential negative transfers of training from aeroplanes to helicopters. In stress situations, students with aeroplane experience, could be expected to revert instinctively to their first learned behaviors on fixed wing aircraft which can have detrimental consequences in helicopters.

OBSTACLES TO LEARNING

Students may fail to make progress or learn for reasons other than failing to understand the instruction imparted or the rules of memory and forgetting. It could be that there are other barriers or obstacles that are preventing the student from concentrating upon the task in hand and assimilating the instruction. A number of obstacles that are commonly found in flying instruction are set out below:

- A feeling of unfair treatment - Students who believe that their instruction is inadequate or that efforts are not being conscientiously considered and evaluated do not learn well and their motivation will also suffer.
- Impatience to proceed to more interesting operations - Impatience is a greater deterrent to learning pilot skills than is generally recognised. The instructor can do a great deal to help here by explaining how the student is progressing in terms of the syllabus of instruction and norms and why certain skills have to be mastered in a given order before progressing to the next lesson. If students can see that there is a plan with clear goals and milestones that are achievable and understand the underlying reason, their impatient feelings give way to eager anticipation and involvement. Of course there can be other factors that can cause frustration and impatience such as a prolonged spell of non-flying weather, helicopter and/or instructor unavailability which may have to be managed.
- Worry or lack of interest. Worry and/or lack of interest has a detrimental effect on learning. It can be difficult to deal with and can stem from a variety of causes such as other barriers. It could be external factors such as family or financial worries and in some cases inadequacies on the part of the instructor or the course. In the latter case the best solution is prevention rather than cure. Discouragement and emotional upsets are rare when students feel that nothing is being withheld from them or being neglected in their training.
- Physical discomfort, illness or fatigue. Students who are not completely at ease and whose attention is diverted by discomfort caused by their surroundings or illness cannot learn at a normal rate and flight instructors have to monitor this closely. In the case of fatigue this is particularly important as it is an insidious condition.
- Fear, anxiety or timidity. Student anxiety will limit the student's ability to absorb instruction. Flight Instructors are responsible for providing a safe and comfortable learning environment for their students. Those instructors who remain calm and professional in their demeanour will provide the necessary quiet reassurance to their students through their competence and the obvious priority that they place on flight safety. If the instructor appears to be tense and excitable in the helicopter then this will communicate itself rapidly to the already anxious student.
- Lack of standardization between instructors.

INCENTIVES TO LEARNING

Learning to fly should be an enjoyable experience. By making each lesson a pleasurable experience for the student, the flight instructor can maintain a high level of motivation in the student. This does not mean that things must be made easy for the student nor that the instructor should sacrifice his standards of performance to please the student. Students experience great deal of satisfaction from accomplishing a learning task well or by meeting the challenge of a difficult task.

People are not always attracted to things that are pleasant and easy. They are more likely to devote more effort to things which bring rewards such as self-enhancement and personal satisfaction. People want to feel capable and they are proud of difficult achievements. A good flight instructor helps the student to attain these goals by using alternative presentations and methods to impart instruction so that the students do not feel that they are simply following in the steps of others.

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 capture the imagination and stimulate interest.
- 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.

LEARNING METHODS

People learn through meaningful instruction which builds patterns of relationship in the student's consciousness. Rote learning on the other hand is superficial and is not easily retained, whereas meaningful learning goes deep because it involves principles and concepts in the student's own experience.

People learn when there is a reason for remembering. A desire to remember increases the chances of remembering. The flight instructor can help the student find and understand this desire.

Good study habits promote learning and the student must be encouraged to study for meaning and not to learn by rote.

Short periods of review are beneficial and recitations and quizzes can help.

Of the above, frequent opportunities for practice, is probably the best method of them all.

RATES OF LEARNING

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. An exaggerated ideal curve is shown in Figure 3 below.

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

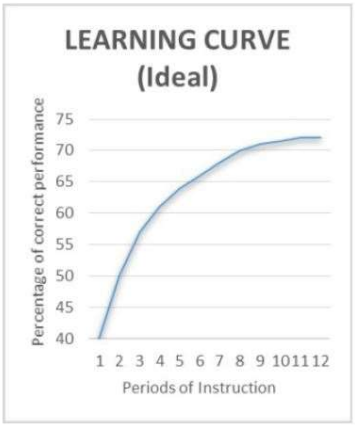


Fig 3 - The Ideal Learning Curve

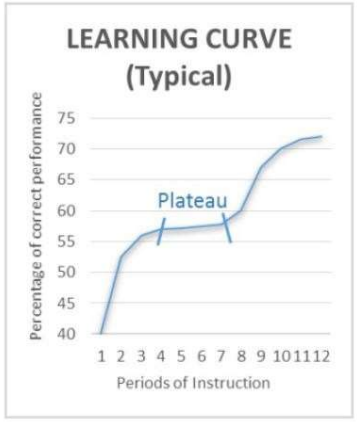


Fig 4 - A typical Learning Curve

Although it would be convenient if the rate of learning could be consistent and predictable as shown in Figure 3, it is not always so. Students may progress rapidly for a period, and then suddenly progress more slowly or even regress for a time. Such variations are to be expected and 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. It is the flight instructor's 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.

Slumps or plateaus in the rate of learning, as depicted in Figure 4, are more likely to occur as the 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 additional training and practice. The same is true for flying; students may be nearly ready for a skill test at an early stage but during the additional required training to reach the required standard 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.

Many helicopter students cannot attend regularly for reasons of cost or other commitments. In such cases much time will be spent in recapping previous instruction and progress can be somewhat laborious. This may not however be as a result of the student reaching a plateau of learning. Instead it is more likely to be due to the curve of remembering (see Memory and its Application) from which we note that at the end of a month, without reviews, students will remember only approximately 40% of the lesson material.

Instructors may be discouraged to discover that a well-planned lesson does not teach all students with equal effectiveness. This is normal. Students seldom learn at the same rate. Differences in rates of learning are based on differences in intelligence, background, experience, interest, desire to learn, and many other psychological, emotional, and physical factors. Instructors have to acknowledge that students are different and that this fact dictates how much can be taught at what rate, and when. Some student characteristics that may give rise to differences in the rate of learning are covered below:

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, a frank conversation may be required.

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 of 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.

THE TEACHING PROCESS

ELEMENTS OF EFFECTIVE TEACHING

Read the seven learning factors listed below carefully and determine to what degree 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.

Relationship is covered under Teaching from the Known to the Unknown later in the guide.

These factors are frequently referred to as Thorndike's Laws of Learning after E. L. Thorndike (1874 - 1949), a pioneer of educational psychology. His laws are universally accepted and apply to all kinds of learning. Since Thorndike set down his original four laws, three more have been added: the law of primacy, the law of intensity and the law of recency.

- **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 - see Memory and its Application)
- **RELATIONSHIP**: Present lessons in the logical sequence of known to unknown, simple to complex, easy to difficult. (Note: Relationship is covered under Teaching from the Known to the Unknown later in the Guide.)
- **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. (see Memory and its Application)
- **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. (see Incentives to Learning for suggestions on how to achieve this)

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.

A special point of attention is negative training. Negative training refers to training which unintentionally introduces incorrect information or invalid concepts, which could actually decrease rather than increase safety. There is always a risk for negative training if any manoeuver is not performed correctly at any time, even if it would not be in the context of the current lesson or exercise. Even more true, during demonstration of a manoeuver, the instructor should make sure that it is demonstrated the first time right. The student should be shown and taught a maneuver correctly since it is a very complex and time consuming process to re-train students with the correct procedure in case they learned it incorrectly from the start. It's even worse if the wrongly taught techniques go unnoticed for a considerable time.

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 to 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 2 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.

Table 2: 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 practices	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?

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.
- Test students' knowledge and abilities frequently. This reinforces learning and builds confidence. However, before testing you must be reasonably certain that students can answer the questions or perform the skills; otherwise they may become frustrated. Testing will also identify areas in which students have weaknesses, thus allowing you to re teach 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. Instructors will have to use their 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.

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.

Suggestions:

- 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 new material, 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 practice knowledge by answering questions and they practice 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.

PLANNING OF INSTRUCTIONAL ACTIVITY

This Guide has quite a lot to say about the need for properly structured lessons stressing how important thorough preparation is to successful delivery and ultimately to the effectiveness of the learning that takes place. In other words, thorough preparation and structured lessons are essential for the students' effective learning. However, even well-planned lessons in the classroom or helicopter won't be effective unless they take place within the context of a wellplanned delivery system. Instructional activity has to be resourced and managed to be effective. Lessons have to take place in a logical sequence, and facilities have to be available to provide the learning environment. In a large and busy ATO, the management of this will be the responsibility of a training operations team probably reporting directly to the Head of Training. It will be necessary to coordinate the flying programme with the ground instructional programme to include the availability of classrooms, teaching aids and instructors. Due consideration must be paid to the physical needs of both classroom and flight instructors and their students when planning the instructional activity. In a teaching establishment where instruction is full-time, then a training programme and timetable will be necessary. Detailed discussion of how to construct a training programme and timetable is outside the scope of this guide. Complex courses may call for detailed design by a training analyst but the basic principles (much simplified) are:

- Obtain the approved course syllabus and learning objectives from the appropriate authority then break this down into sections with individual lessons identified in each block of instruction. Naturally, this task is made much easier if lesson plans have already been developed for the course.
- Assign realistic timings to each lesson. In the case of air exercises, ensure that adequate time is allowed for preflight instructional tasks including planning and briefing, getting to the helicopter and carrying out the necessary preflight inspection. Realistic timings must be allowed to get airborne and position the helicopter for the lesson. Similarly sufficient time must be allowed to shut-down the helicopter, carry out a post flight walk round, return to the operations room, complete paperwork, debrief the student and complete the post flight assessment and report. Training organisations will naturally wish to compress these timings for business reasons but flying instructors should insist on adequate time for the activities to be completed quickly and efficiently but not rushed.
- When the 'block' programme of instruction has been assembled (a spreadsheet application can be very useful in speeding up the process particularly when the inevitable changes have to be made), a timetable can be constructed by arranging the lessons in a logical sequence taking account of available resources. Don't forget to allow sufficient time for administrative activity and it is sensible to include some spare or 'float' time to allow for the weather and other operational delays.

By comparison, construction of a course training plan for a smaller training organisation or a short course will be relatively straightforward. This does not mean however, that the process can be ignored. As flying instructors gain in experience, they will usually hold more senior positions in organisations and assume greater responsibility for the planning and management of instructional activity. However, the management of the training programme and planning of instruction is a shared responsibility and all helicopter flying instructors will be required to develop these skills to a greater or lesser degree. In a small training organisation employing a single helicopter instructor, it is quite likely that the instructor will be responsible for planning instructional activity or play a large part in the process.

TEACHING METHODS

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.

This method is ideally suited to ground instruction and pre and post flight debriefing. Good questioning technique is the cornerstone of developmental teaching and techniques for oral questioning and handling student answers are covered in depth later in the Guide in the section entitled Training Programme Development - Student Participation and Practice.

THE DEMONSTRATION PERFORMANCE METHOD

The Demonstration - Performance method of flight instruction (sometimes called the Demonstration Method) is widely accepted as the preferred method for in-flight instruction. It is discussed in some detail as part of the FLIGHT: AIRBORNE INSTRUCTIONAL TECHNIQUES section.

This method of instruction has five components :

- Explanation
- Demonstration
- Student Performance
- Instructor Supervision
- Evaluation

THE TELLING AND DOING TECHNIQUE

Another technique that can be used is the telling and doing technique which can be summarised as follows:

1. Instructor tells - instructor does
2. Student tells - instructor does
3. Student tells - student does
4. Student does - instructor evaluates

The difference between this technique and the Demonstration-Performance method is that the student is involved in the second demonstration by the instructor (student tells – instructor does) and thus cannot adopt a passive role. This strategy could be useful to confirm that students know and understand exactly what is required from them when it is their turn to perform the manoeuvre. This method requires high-order communication skills from students at a time when they may find it is all that they can do to fly the manoeuvre accurately.

TEACHING FROM THE 'KNOWN' TO THE 'UNKNOWN'

Thorndike's Law of RELATIONSHIP states that lessons should be presented : 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.

- 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.

USE OF LESSON PLANS

The lesson plan is an essential tool for the flight instructor. There are many formats available and they will differ depending on the type of instruction being undertaken. For a large class, covering a major theoretical knowledge topic, it is probable that a fairly complex and detailed plan will be involved. In contrast, for a one-to-one revision session, the requirement to produce a formal lesson plan will be greatly reduced.

Learning objectives are written so that they are exact, observable and measurable and are composed of the Performance Standard that has to be achieved, the conditions under which it has to be achieved and the standard that must be attained. For flying lessons, the objectives will form part of the pre-flight briefing, the conditions are normally standard, for example, by day under VFR and the standard that has to be obtained is ultimately that of the PPL(H)/LAPL(H) Skill Test.

These objectives should be noted down together with the standard to be achieved and the conditions. Enabling objectives that will have to be covered in order to meet the main objective(s) must also be included as they will also need to be covered in the lesson or briefing.

A simple lesson plan from which the briefing could be developed further is shown below. The contents have been drawn up using the details provided in Part 2 of the Guide for Exercise 16.

LESSON PLAN - PRE-FLIGHT BRIEFING
Ex 16 - SIDEWAYS AND BACKWARDS HOVER MANOEUVRING
Lesson Objective (Aim): To learn sideways and backwards hover manoeuvring into and out of the wind
Performance Standard: Ground drift: T/O hover IGE ± 3 feet
Conditions: Day VFR
Airmanship and TEM Discussion: Lookout; Obstructions; Wind Velocity and Weather Cocking; Temperatures and Pressure Limitations; Stability; Helicopter sideways and backwards speed limits; hover height
Enabling Objectives: (1) revision of hovering; (2) directional stability and weather cocking effect; (3) danger of pitching nose down on recovery from backwards manoeuvring; (4) helicopter limitations for sideways and backwards manoeuvring; (5) effect of CG position.
Air Exercise: (1) revision of hovering and 90° lookout turns; (2) manoeuvring sideways heading into wind; (3) manoeuvring backwards heading into wind; (4) manoeuvring sideways and backwards heading out of wind; (5) manoeuvring backwards too fast and recovery action.
Location: Small briefing room
Visual Aids: Helicopter model, whiteboard and markers and accessories

In this case, the items that will need further development are the long briefing objectives and the air exercise and the flight instructor would need to prepare his board layout in advance and rehearse it as necessary. However, It is likely that instructors will have their own board plans and notes already available from their own notes taken during their FIC training or perhaps using a standard set of lesson plans included in the ATO and DTO Manual. Whatever method is used, it is essential that flight instructors prepare their briefings thoroughly and the lesson plan is the tried and tested way of doing this.

For the air exercise, an aide memoire in card form is the usual method of ensuring that the lesson sequence is followed. So that flight instructors maintain situational awareness at all times and monitor what their students are doing, such aide memoires should contain the minimum amount of detail necessary to prompt the instructor and maintain the pace of the lesson. For this reason in some quarters, these kneeboard sized aides are called 'pace notes'. As experience is gained, they can largely be dispensed with but it is still important that the airborne lesson and sequence is planned or reviewed for each flight to take account of different factors, e.g. the student's ability and progress, the wind and weather conditions and the TEM special considerations for them.

TRAINING PHILOSOPHIES

THE VALUE OF A STRUCTURED (APPROVED) COURSE OF TRAINING

Courses offered as part of the curriculum of ATOs and DTOs are required to be structured. This means that ground and flight instruction is systematic and can be presented in a logical sequence which will help the student to make progress. It will also assist the flight instructor to prepare lessons properly and teaching will be more effective as a result.

The structured course is equally valuable to those learners who cannot take advantage of regularly paced instruction for whatever reason because their progress (or lack of) will be easier to measure from the standpoint of the performance standard that they should be at in contrast to their actual standard. Remedial action can then be instigated to restore their position within the training taxonomy.

THE IMPORTANCE OF A PLANNED SYLLABUS

In the same way as it is valuable to have a structured course, it is equally important to have a planned syllabus of instruction which enables the flying instruction to be correctly sequenced. Arguably, it would be difficult to have a structured course without a planned syllabus.

With a planned syllabus, any training gaps are readily identifiable to the student and instructor and it is easier to measure progress. This can help motivate the student where progress is apparent or highlight areas of weakness if this is not the case. This is particularly important where a student's attendance is irregular for any reason.

Another advantage of a planned syllabus is that it allows the operations staff and the instructor to plan ahead and book slots in the flying programme appropriate to the student's progress.

INTEGRATION OF THEORETICAL KNOWLEDGE AND FLIGHT INSTRUCTION

An approved course of training for the EASA PPL(H) should comprise at least 100 hours of theoretical knowledge instruction. The training should cover aspects related to non-technical skills in an integrated manner. The theoretical knowledge instruction provided by the ATO/DTO should include a certain element of formal classroom work but may include also such facilities as interactive video, slide or tape presentation, computer-based training and other media distance learning courses.

The arrangement of flying lessons set out in, for example, the Part FCL PPL(H) syllabus set out in Part 2 is progressive and although lessons do not always have to be carried out in the exact order of the exercise numbers, they broadly follow one another in sequence. The reason for this is that each exercise consists of training and enabling objectives which build on the knowledge and skills of gained during earlier exercises. In turn, these rely on underpinning theoretical knowledge to understand and make sense of the briefing which the student needs to understand the flying briefing and make progress in the air where time is so precious.

The laid down theoretical knowledge for the PPL(H) is shown under main subject headings in the table below.

Table 3: Syllabus of theoretical knowledge for the PPL(H) based on AMC1 FCL.210; FCL.215

1	Air Law and ATC procedures
2	Human Performance
3	Meteorology
4	Communications
5.2	Principles of Flight: Helicopter
6	Operational Procedures
7	Flight Performance and Planning 7.1 Mass and Balance 7.3 Flight Planning and Flight Monitoring 7.4 Performance: Helicopters
8	Aircraft general knowledge
9	Navigation

There is a lot to learn and this needs to be planned and integrated with the flying instruction. For example, the student should have completed the theoretical knowledge syllabus for Navigation a short time (Law of Recency) before embarking on the navigation phase of the course. Similarly, during the earlier lessons, if a student had not covered some of the aspects of Helicopter Principles of Flight, then it is likely that time will be wasted in briefing prior to flying the sortie at best or, at worst, the student won't understand the instruction and fail to make progress. For this reason, the Theoretical Knowledge syllabus should be integrated with the flying syllabus to the maximum extent possible.

TECHNIQUES OF APPLIED INSTRUCTION

THEORETICAL KNOWLEDGE: CLASSROOM INSTRUCTION TECHNIQUES

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 meter. (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 knowledge based 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.

- 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 knowledge based 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 FEEDBACK 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 'STUDENT PARTICIPATION AND PRACTICE'.
- 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.

GROUP LECTURES

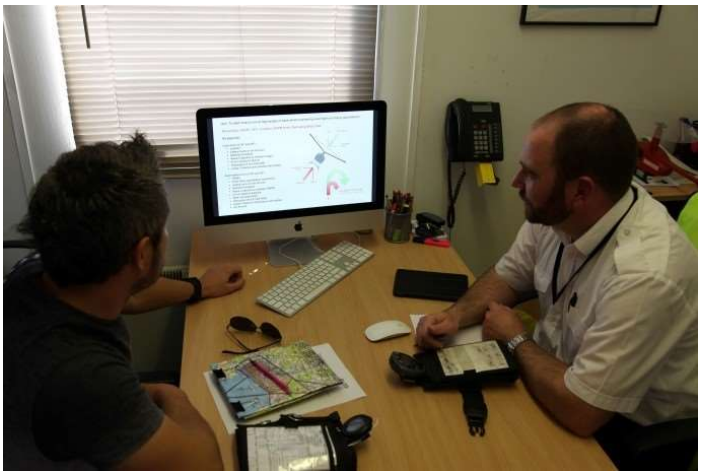
The techniques described above will work equally well for group instruction. In particular, group instruction calls for developmental teaching using oral questioning techniques.

These are covered in depth in the section entitled ‘STUDENT PARTICIPATION AND PRACTICE’ later on in the Guide. It is normal for a group lecture to be instructor led and while student participation and discussion is generally to be welcomed it can be harder to control leading to timings going awry unless care is taken.

INDIVIDUAL BRIEFINGS

Individual briefings lie at the heart of helicopter flying instruction. It is rare to get large or even medium sized groups together for classroom work so the theoretical knowledge lessons required may be given in a very small group or a one-to-one setting.

In the photograph below the instructor and student are making effective use of a computer during a one-to-one pre-flight briefing. Use of this sort of display, speeds up briefings and can provide high quality graphics with the ability to integrate video and other media seamlessly. There are some disadvantages as it can be harder to get the student to help build up the picture using question and answer technique than it would be if using a whiteboard.



STUDENT PARTICIPATION OR DISCUSSION

Properly managed, student discussion is very fruitful. It is an excellent way in which to explore certain topics and get the students involved and thinking about the subject. Careful preparation is needed by the instructor to identify a set of questions that will support the planned training objectives for the session so that he can 'seed' the discussion as necessary. It may be necessary to circulate some of the questions beforehand so that the learners can do some preparation in advance. For a discussion, the instructor should arrange for the classroom to be set out in seminar style and nominate a student to act as chairperson. The instructor can then take a backseat to observe and join in for time to time if necessary to clarify or correct a point.

FLIGHT: AIRBORNE INSTRUCTIONAL TECHNIQUES

THE FLIGHT OR COCKPIT ENVIRONMENT

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 THE 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, do so positively using the same procedure in reverse.
- 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 simulated engine off landings to the ground, when there is little time available to the instructor to correct errors. For low intervention time exercises such as this, the instructor's hands and feet should be very near to the controls at all times. Before entering the manoeuvre the flight instructor should confirm the procedure for closing the throttle and any other points.

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.

While safety in the classroom cannot be ignored, it is benign by comparison with the flight environment which is potentially hazardous. As well as imparting instruction, the instructor is responsible for all aspects of flight safety, maintaining situational awareness at all times and acting as a role model for the students on which they will base their own flying both while undergoing training and in the years to come. It is therefore vital that particular attention is paid to cockpit discipline, checks, lookout and the handover control at all times. For example, it is not sufficient for instructors to simply glance at the instruments to check that everything is working as it should be and move on to the next item, they must draw the student's attention to the fact that the necessary checks have been completed in accordance with the checklist or standard operating procedures. It is not simply sufficient to ensure all the safety requirements of the flight have been met, it is necessary to show overtly by example how this has been achieved. Instructors must therefore maintain a great deal of spare capacity at all times and be able to divide their attention so that due attention is given to the cockpit environment, the conduct of the flight and at the same time be able to impart instruction confidently and clearly as well as monitoring their student's performance at all times. This is not an easy task.

When planning the instructional flight, instructors have to take into account and mitigate the threats posed by the airborne environment and be prepared to trap any errors that occur quickly. A momentary lapse in situational awareness, possibly caused by concentrating on student performance or correcting an error could result in an airspace infringement, failing to notice other traffic, or even loss of control. It is therefore important to pay sufficient attention not just to what is to be taught during the lesson but how and where the air exercise will be conducted. The necessary spare capacity can be built into the instructional flight by careful planning and preparation and choice of exercise location.

THE DEMONSTRATION–PERFORMANCE METHOD OF TEACHING

This technique which is the basis of in-flight instruction was covered briefly in Teaching Methods earlier in the Guide. To recap, it consists of the five elements which are covered in more detail in this section:

- 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 guide, 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 practice 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 method is where students get an opportunity to prove that they can do the manoeuvre without assistance.

For the practice 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 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.

POST-FLIGHT AND IN-FLIGHT JUDGEMENT AND DECISION MAKING

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.

When the debriefing is complete a record of the flight should be made in the form set out in the 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.

STUDENT EVALUATION AND TESTING

ASSESSMENT OF STUDENT PERFORMANCE

In order to monitor students' progress with the aim of providing direction and raising the level of performance, periodic objective assessments must be made. These assessments can be entered into the student's records. It is important that such assessments are objective and that assessments are made against a defined standard or rubric. Not all ATO/DTOs will have a grading system in their Manuals but if there is one it should be used as it will provide examples of student performance against which a grade could be awarded. Typically an assessment based on Above Average, Average and Low Average might be made. An overview of these grades over a period of time will provide the instructor, Chief Flying Instructor and the Head of Training with an idea of whether the student is making satisfactory progress or whether another training strategy or one-to-one appraisal would be appropriate.

There is inevitably a degree of subjectivity when assessing skill based performance rather than examination results so it is worth considering some of the common errors that can be made and which persistently occur in all subjective rating systems. When the instructor understands these errors, it helps to reduce their effect.

- Halo Error. This error is described as a tendency, on the part of the instructor, to judge individual skills based on a general mental attitude toward the individual. In other words, the instructor's opinion of individuals such as speech, mannerisms, personality and demeanour does affect ratings.
- Central tendency. This error is commonly referred to as the tendency to centralise assessments and scores. It is the tendency to group ratings in a narrow range in the centre of whatever scoring scale is being used. The type of scale in use, e.g. a descriptive scale such as below average, average, and above average or a numerical scale e.g. a score of one to five, has no bearing on this error. The reason for this error seems to be the reluctance on the part of the instructor to use the extreme ends of a rating scale, since the use of average normally requires no further comment or qualification.
- Leniency. This error is the tendency for the instructor to mark too high on whatever scale there are using. Generally, the tendency is to the high side; however, there are some who tend to mark on the low side. This inclination among some instructors has been recognized for some time and students are generally aware of it perhaps referring to them as 'hard' or 'easy' graders. This area is more prevalent where the results must be made known to the student and in cases where the student and instructor are relatively more acquainted. If, for example, the student is a valued client then there could be a temptation to be more lenient during post-flight debriefs and write-ups. This must be resisted as it does nobody any favours in the long term and could even be a safety issue. Students have a right to expect an honest appraisal of their ability and progress. Experience would show that far from taking their business elsewhere they are likely to remain with an ATO or DTO where instructors have this ethos.
- Personal contrast. This error is found to be where the instructor tends to downgrade the student in areas where his personal performance excels and to upgrade the student where he feels he is less skilful.
- Logical Error. This error results from a tendency on the part of the instructor to see a similarity in unrelated skills and to rate them alike. An example of this is where an instructor may tie together two items such as ability to maintain heading and ability to maintain

altitude. When a high performance is observed in one, the instructor rates highly in the other.

- Error of narrow criteria. This is the error caused by an instructor grading his immediate students relative to each other bracket off (e.g. a flight instructor has three students and will see one as above average, one as an average, and one below average). Actually, they may be above or below average with respect to normal standards.

THE FUNCTION OF PROGRESS TESTS

Evaluation is one of the fundamental principles of the teaching process described earlier in the Guide. The evaluation of a student's progress is a continuing process carried on throughout each piece of instruction. Similarly, demonstration of piloting ability is one of the basic elements of flight instruction. It is a method of confirming that the instructional objectives have been met. It is reassuring for the students to know that they are making progress and it is useful for the instructor who will be confident in their ability to move on to the next stage of instruction.

For students who are failing to make the required progress, revision can be arranged and any mistakes and errors that have crept into their flying can be analysed and corrected. How this is done is covered later in this section.

RECALL OF KNOWLEDGE

Each of the theories of forgetting implies that when a person forgets something, it is not actually lost, it is simply unavailable for recall. The flight instructor's challenge is how to make sure that the student's learning is readily available for recall.

In addition to the five principles covered under Memory and Its Application earlier in the Guide, there is a considerable amount of research to show that the students who are most actively engaged in the learning process have a much higher retention thereby supporting the contention that active learning is superior to listening which has been a continual theme throughout the Guide.

There are other practical things instructors can do to assist their students to retain knowledge. The use of mnemonics is an example. The chief value in Mnemonics is that they allow items to be recalled in a particular order which can be particularly helpful. For example the well-known 'ANDS' acronym for East/West compass acceleration errors and UNOS for North/South turning errors:

Accelerate	Undershoot
North	North
Decelerate	Overshoot
South	South

Chaining is a way of remembering ordered and unordered lists and consists of creating a story in which each word or idea that needs to be remembered cues the next list.

A useful way of ensuring that knowledge and skills are retained is through the formation of good habits in aviation. If the instructor uses a particular technique to remember a sequence of last-minute checks in the cockpit just to confirm that all switch selections have been made and that the instrument readings are correct for take-off and, importantly he does this consistently and without variation before every flight, then his student is likely to imitate this and bring it into his or her own

practice. This is a good example of habit formation. Providing always that the habits are representative of good airmanship, this would be a very positive and repeatable way for the student to recall knowledge.

Instructors can do much to help students by sharing their own methods with them and explaining the limitations of short-term memory and the benefits of regular paced study rather than last minute 'cramming' for exams which may be effective but the retention will not be there in the long term.

TRANSLATION OF KNOWLEDGE INTO UNDERSTANDING

Students acquire knowledge from a mix of their learning experiences and the effort that they put into learning them. Ultimately, facts have to be learned and the skills acquired by a dint of hard work and application. This stage of knowledge acquisition is reached by Rote learning. Rote is the ability to recall facts and information that have been learned but without having anything other than a superficial understanding of their importance.

The next level is reached as the students begin to develop an understanding of the importance and relevance of the facts and information that they have at their disposal. At the point at which they comprehend or grasp the nature or meaning of something they can be said to have developed understanding or comprehension.

DEVELOPMENT OF UNDERSTANDING INTO ACTIONS

The next levels of learning occur when the student is able to deploy a particular bit of knowledge or a skill that has been learned because the relevance and use of it is now understood and the student can apply it successfully to a task. This is the point at which students are said to have turned their understanding into actions or application. Further progress up the taxonomy of the Cognitive Domain comes as the students are able to correlate their understanding of what they have learned, understood and applied with their previous or subsequent training. They will be able to synthesise their learning by putting different parts together to form a new and integrated whole. This represents the fifth of the six levels of the cognitive hierarchy developed by Benjamin Bloom in the mid-1900s which is known as Bloom's Taxonomy of the Cognitive Domain or Learning in Action.

NEED TO EVALUATE THE RATE OF PROGRESS

The final stage of Bloom's taxonomy is that of Evaluation and occurs when the students above are able to evaluate the importance of the information they have acquired. As flying students, they would be expected to evaluate the importance of the information for a pilot. They would be able to make judgements about the merits of the ideas, methods or materials being discussed.

ANALYSIS OF STUDENT ERRORS

When discussing a student's faults, always take control so that your student may devote full attention to the instruction.

ESTABLISH THE REASONS FOR ERRORS

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. 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 reoccurrence

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.

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 faults analysis.

TACKLE MAJOR FAULTS FIRST, MINOR FAULTS SECOND

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.

AVOIDANCE OF OVER CRITICISM

Do not be overly critical of minor faults during early stages. A useful method of doing this is to pick one thing that you would like your student to continue doing as a result of what you have seen during today's flight and one thing that you would like them to stop doing immediately. It is possible to increase the number in both categories but this technique will be more effective if you choose a very low number so that students can readily understand what has to be done to improve and sustain their performance and, most importantly, develop a strategy to address them. The more items in the list the harder this will be and will eventually lead to confusion.

THE NEED FOR CLEAR CONCISE COMMUNICATION

Effective communication between flight instructor and student is essential or instruction will be ineffective. The in-flight environment poses additional requirements given the added distractions of helicopter and intercom noise, the sensations of flight possibly accompanied by feelings of apprehension, anxiety and physical discomfort, e.g. feeling too hot and air sickness. Due allowance must be made for these and communication adjusted accordingly.

Communication is a three-stage rather than two-stage process. For example, if an instructor wishes to impart an instruction or convey some information to students then this has to be transmitted by the instructor in the first place. Secondly the students have to receive the instruction or information.

However, even if these two stages have been successful, it does not necessarily mean that the students have extracted the exact meaning intended by the instructor. Different word or tones or even mishearing may mean that the students' interpretation of what the instructor intended to tell them has been lost or distorted. A third stage is therefore needed to check that the students understanding of the meaning is the same as the instructor intended. This can best be achieved by the instructor posing a question to check understanding. This could be done by asking the student to describe briefly how they would go about the manoeuvre or procedure that was the subject of the initial communication. This need not be a protracted process but it should be possible to quickly ascertain whether or not the communication has been successful thereby avoiding situations where the student says… “But I thought you wanted me to turn on to a southerly heading when I reached …”

Communication is likely to be more effective if it is kept short using simple words and uncomplicated short sentences. This is even more important in the air.

TRAINING PROGRAMME DEVELOPMENT

LESSON PLANNING

The starting point for lesson planning is the course aim and objectives closely followed by the syllabus. The latter so that the lesson can be put into context. With these documents to hand, the instructor can begin the task of planning the lesson in outline to start with. If the course is a tried and tested one like, say the PPL(H), then the syllabus is already well defined. If this is a course already offered by the ATO/DTO, then details will be available already. The details will include the course training plan consisting of all the necessary documents to run the course including a model timetable.

If this is the first presentation of the course by the ATO/DTO then there is a great deal to do. An early and quite laborious task that has to be undertaken first of all is to translate the syllabus for the course into blocks of instruction showing the availability of resource. The next stage is to confirm the training objectives and prepare an outline timetable for the course. When this has been done and the details of each lesson objectives are known, work can begin on preparing the lesson plans.

PREPARATION

The preparation of lesson plans is covered in several places in this Guide and will not be repeated here.

EXPLANATION AND DEMONSTRATION

The Explanation and Demonstration elements of the Demonstration - Performance method of flying instruction is covered in depth in an earlier chapter.

STUDENT PARTICIPATION AND PRACTICE

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 recognize and provide for these differences. Therefore, you should consider giving the more difficult questions to the most advanced students. You also have to ensure that everyone in the class is called upon to provide answers with reasonable frequency. A number of systems commonly used to ensure this have serious drawbacks. For example, if members of a class are called on according to seating arrangement or alphabetical order, it becomes quite easy for students to determine when they will be named to answer; thus the lazy students will not give serious thought to any question until it is getting close to their turn to answer. Possibly the most practical approach is to call upon students in a random order, then indicate by a check mark on a seating plan card each time a student is asked a question. To get a broader sampling of learning and to maintain interest, you should periodically call upon other class members to confirm the answer made by the first student asked.

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 if 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 do not 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.

EVALUATION

Evaluation is a specialised subject and detailed consideration of it is beyond the scope of this Guide. Nevertheless, flying instructors have to be equipped with a basic knowledge of how training programmes are evaluated so that they can contribute to the process.

The Kirkpatrick Model is the worldwide standard for evaluating the effectiveness of training and was developed by Dr Donald Kirkpatrick, Professor Emeritus at the University of Wisconsin and past president of the American Society for Training and Development (ASTD). He first published his Four-Level Training Evaluation Model in 1959, in the US Training and Development Journal . The model was updated in 1975 and again in 1994 in his best-known work, Evaluating Training Programs. The value of any type of training, formal or informal is considered and it applies equally to flying training.

The Kirkpatrick Model considers the effectiveness of training across four levels:

Level 1: Reaction
The degree to which participants find the training favourable, engaging and relevant to their jobs
Level 2: Learning
The degree to which participants acquire the intended knowledge, skills, attitude, confidence and commitment based on their participation in the training
Level 3: Behaviour
The degree to which participants apply what they learned during training when they are back on the job
Level 4: Results
The degree to which targeted outcomes occur as a result of the training and the support and accountability package

From a practical standpoint, the model can be implemented in two ways, internally and externally. Internally, the training organisation establishes the effectiveness of its own training by monitoring the results of internal testing, quizzes and questionnaires. The organisation will seek and gather information from its students on all four of Kirkpatrick's levels. Armed with this information it will be able to make changes to its training programme addressing any weaknesses or areas for improvement identified by its customers (the students). This process which is one of continuous improvement, is known as INTERNAL VALIDATION.

As its name suggests, EXTERNAL VALIDATION takes place away from the ATO or DTO. The most obvious example of external evaluation at work is that of oversight by the National Aviation Authority (NAA). When skill and proficiency checks are carried out, even if they are done by a flight examiner employed by the training organisation, they are being carried out on behalf of the NAA and therefore this is external evaluation in the form of confirmation that the candidate has reached or maintained the standard required to exercise the privileges of his or her licence. Other external validation checks are carried out on the training programme by NAAs. Where an ATO is training candidates for another organisation, for example, a helicopter operating company, then examiners and the responsible for crew training from that company should be involved in the external validation (evaluation) of the effectiveness of the training and the training programme provided by the ATO as they will be able to comment on Level 3 and especially Level 4 of the model.

Helicopter flight instructors will therefore find themselves involved in evaluation of the training programme. Often this is simply limited to asking for feedback from students in a form that can be posted on social media. While there is nothing wrong with this, it is hardly the disciplined approach advocated by Kirkpatrick and while it might do much for the popularity of the training organisation - which is not a bad thing in itself - it is less likely to achieve the critical appraisal necessary for improvement. Professional helicopter flight instructors might consider seeking further training on how to get the most of the evaluation process as a tool to improve the effectiveness of their training programmes.

HUMAN PERFORMANCE AND LIMITATIONS RELEVANT TO FLIGHT INSTRUCTION

Human factors have a very profound effect on the performance of a student helicopter pilot. They can basically be divided into Physiological and Psychological Factors. Of the two, psychological factors will be constantly present while physiological ones tend to be transient in nature. They are of huge importance but once identified, they can usually be dealt with and strategy or method devised to keep them in check. For this reason, more space is devoted to the psychological factors in this Guide.

PHYSIOLOGICAL FACTORS

In order to absorb instruction and make the learning process work, students must not be distracted by their physical environment. Clearly, if someone is feeling unwell they will not feel up to studying, their concentration is likely to be affected and it is probable that their performance will be adversely affected. In this case the remedial action is evident and the student should take time off to rest and recover from minor ailments such as a heavy cold. In any cases of doubt, medical assistance should be sought and if there is any doubt about the illness, the advice of an authorised medical examiner (AME) must be sought. Flight instructors should look out for the welfare of their students and be able to offer the correct advice.

Apart from the everyday risks of spreading germs to other people which is socially most undesirable, the flying environment poses additional risks. It is an alien environment for the human body and flying instructors should take every opportunity to cover aeromedical aspects of flight with their students, possibly including them routinely in pre-flight TEM and briefings.

Some particular physiological considerations which the instructor has to monitor and brief student on are shown in the list below:

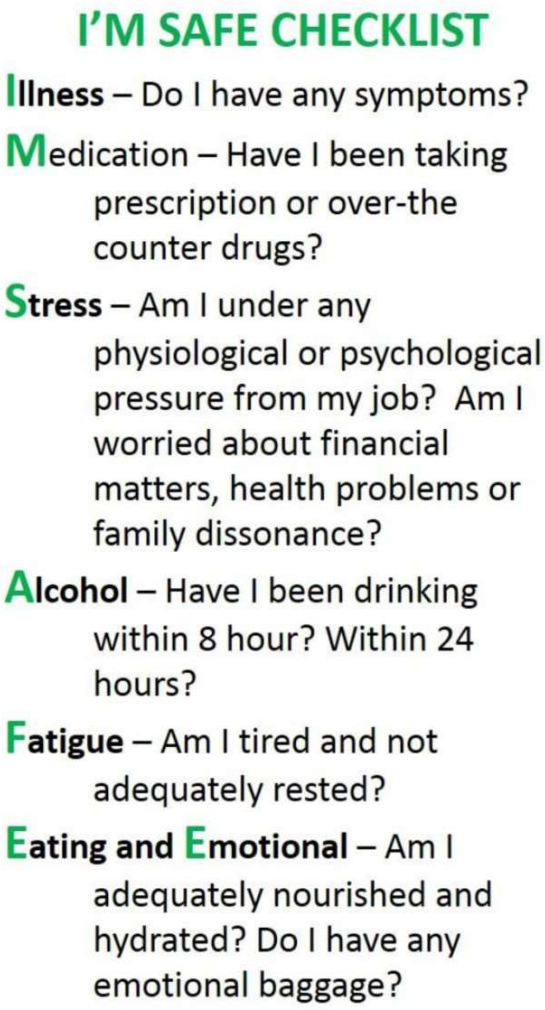
- Altitude Effects. Air pressure and barotrauma; lack of oxygen - hypoxia and its effect on night vision. Instructors need to be on the alert for signs of barotrauma (notably pain from the ears and sinus pain typically in the descent) particularly during autorotations.
- Eyesight. It is important to understand the limitations of human vision in order to carry out effective lookout. Although the students may have covered this subject in their theoretical knowledge training, they are unlikely to have completed the course before their first training flight. Instructors should therefore devote sufficient time to ensuring that the correct techniques are known and understood. Many pilots have poor visual scan techniques. If the correct technique is taught in the first place then it will become a habit and transfer positively to other aircraft and situations. This is another example of Thorndike's Laws of Primacy and Exercise at work. Different perspectives of the ground seen from the air can cause visual illusions which could be a barrier to learning if they are not discussed with the student.
- Vestibular Illusions. These can be powerful and need to be understood particularly before instrument flying. Helicopter Noise. If students are uncomfortable during flight, then they will be unable to absorb instruction. Also excessive noise can damage hearing and instructors must discuss hearing loss and how to prevent it with their students. Clearly students will be in difficulties in a short time if they have to struggle to catch what their instructor is telling them or they are having difficulty hearing what is being said on the radio.
- Vibration. Vibration too can cause health issues and students must know what is normal for a particular helicopter.
- Anthropometry. Students are likely to come in all shapes and sizes. It is important that they adopt the correct posture while flying and that seats (including restraints) and pedals are

correctly adjusted so that they can reach the controls while seated comfortably and correctly. Back pain is common in helicopters can be exacerbated by poor posture and vibration. A student suffering from back pain will not be able to concentrate on the task in hand.

- Medication. Only medication approved by an AME should be taken. Over the counter medicines may cause drowsiness and should not be used unless specific advice has been obtained. In some cases, the real issue may be that the medication is being taken to treat a minor ailment such as a headache or cold. In such cases the question of whether the student should be flying at all is the crucial one to ask. Again instruction and example falls to the instructor.
- Alcohol and Drugs. The rules for flying after imbibing alcohol are more stringent than for motoring in many European countries. The only safe advice is not to fly for 24 hours after drinking and even then if the drinking concerned was heavy, then traces of alcohol will still be in the blood after 24 hours. Indeed, even after as long as 72 hours have elapsed following a consumption of alcohol, traces have been found in the endolymph contained in the semi-circular canals of the ear. The dilution caused by the alcohol can lead to disorientation. Clearly, there is no place for recreational or other non-prescription drugs in aviation.
- Lack of awareness - radio calls or checklists that go unanswered
- Diminished motor skills - sloppy flying, writing that trails off into nothing as weather reports or clearances are written down
- Obvious tiredness - drooping head, staring or half-closed eyes
- Diminished vision - difficulty in focusing
- Slow reactions
- Short-term memory problems - unable to remember a clearance long enough to repeat it or write it down accurately
- Channelled concentration fixation on a single, possibly unimportant issue to the neglect of others and failure to maintain an overview of the flight
- Easily distracted by trivial problems or the other extreme either of which coul indicate fatigue
- Poor instrument flying - difficulty in focusing on one instrument, fixation on one instrument to the detriment of scan, drifting in and out of sleep
- Increased mistakes - poor judgement and poor decisions or even no decisions at all
- Abnormal moods - mood swings, depressed, periodically elated and energetic, diminished standards

All of the above focus on the student but, the helicopter flight instructor is also at risk. Flying instruction is a demanding profession. Often working hours are long and the breaks between briefings and flights short or non-existent. Nutritional opportunities can be equally few and far between so in the flight instructors commendable care for his or her students there is a possibility that they will neglect their own circumstances. So here again, the solution must be one of setting a good example and taking care of oneself too!

The IMSAFE acronym is a useful tool to assess your fitness before every flight in the same way as you assess your helicopter's airworthiness.



PSYCHOLOGICAL FACTORS

While it is not necessary for a helicopter flight instructor to be a certified psychologist, it is helpful to learn how to analyse student behaviour before and during each flying lesson. This ability helps a flight instructor develop and use appropriate techniques for instruction.

BEHAVIOURAL ATTITUDES

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 recognize 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.

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 behavior
- 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.

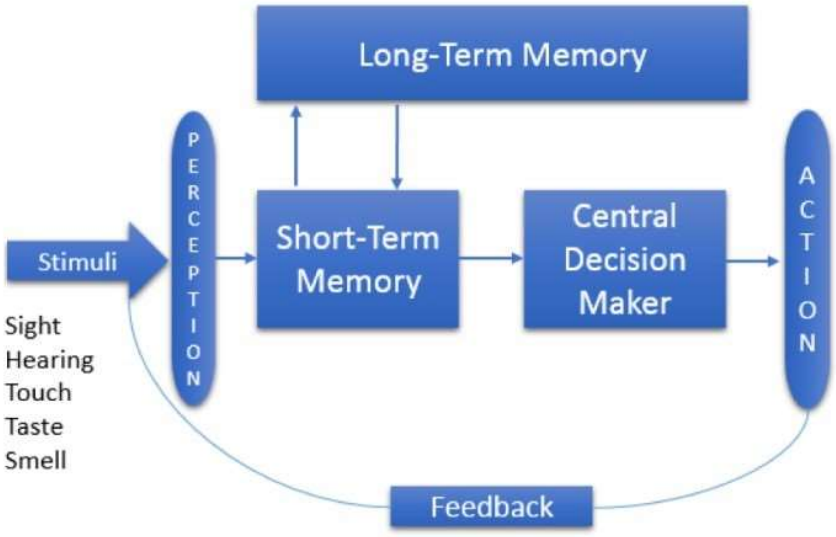
A student's over use of one or more of the escape mechanisms, along with other symptoms, may indicate an emotional problem. You should not wait until emotional tension becomes extreme before taking corrective action.

HUMAN INFORMATION PROCESSING

Human information processing theory uses the analogy of a computer system to describe the working of the brain. The model created visualises the brain processing incoming information in the same way as the central processor does in a computer. The information is collected by the senses, perceived, stored and transported to the Central Decision Maker. The Central Decision Maker takes care of our thinking. It can only deal with one thing at a time and therefore has to tackle things serially before generating the required action. This fundamental process of conscious decision making is also called cognition. The way in which this model of the brain copes with sensory overload caused by the Central Decision Maker's limitation of only being able to do one thing at a time is because many of the other demands do not need conscious decision making and can be controlled by motor programme or skills.

Knowledge of this process is useful to the flight instructor it will explain certain things about the way in which we learn. If students are concentrating hard on a task other stimuli will be ignored because the Central Decision Maker is fully occupied with the cognitive task in hand. Other things will go unnoticed. This can lead to a situation called inattentional blindness. Where other sometimes quite obvious things are just not seen. Instructors need to remember this in high workload situations both for themselves and the safety of the helicopter and crew but also when imparting instruction.

It is also useful to understand the limitations of the short-term memory which can only hold 7 ± 2 pieces of information. This is important to realise when giving instructions to students and wondering why they cannot retain it. There are ways in which this capacity can be increased by 'chunking' pieces of information. Remembered in this way it is possible to make room for one or two additional pieces of information.



A Basic Model of Human Information Processing

DEVELOPMENT OF JUDGEMENT AND DECISION MAKING

As early as possible in their training, pilots should be made aware of the characteristics and limitations of human decision making. Flight instructors should emphasise the importance of maintaining Situational Awareness, of prioritising responses to undesired aircraft states (1. Aviate -> 2. Navigate -> 3. Communicate), and of contingency planning (What if something goes wrong during this flight?).

The following strategies can improve decision making. Training pilots using these solutions will allow them to make better decisions. Teaching them at the beginning of a pilot's training and practising them regularly throughout the course will create a strong and almost unshakeable impression which will stay with pilots for the rest of their lives (Thorndike's Laws of Primacy and Exercise).

- Standard Operating Procedures (SOPs). If students are introduced to clear and concise SOPs from the start of their training and the instructor sets an example by following them rigorously thereby preventing any conflict in the minds of the student of the “don't do as I do”, “do as I say” variety, the use of SOPs will become ingrained and become a form of Rule-based behaviour which is known to be less error prone than Knowledge-based behaviour.
- Pre-Flight Planning. It is known that planning conducted prior to a flight in a low-stress environment can enable pilots to produce a safe strategy for the flight, selecting safe routes, establishing decision points for each flight phase and employing collaborative decision making with other agencies so that a sound plan is made which in turn will reduce the workload when airborne. Teaching students to carry out thorough pre-flight planning is a key part of the flight instructor's job and it will normally be done well. However, particularly during flights early in the syllabus there can be missed learning opportunities when instructors don't share their own strategies with students because of time pressures or the fear of overloading the student early in in the course.
- Single Pilot Crew Resource Management (SRM) Training. SRM training is a form of Crew Resource Management for single pilot operations. It helps pilots to maintain situational awareness by managing the flight and navigation tasks and to enhance the social skills needed to communicate and interact with, for example, the instructor and ATC and passengers in the future.
- Threat and Error Management (TEM) Training. TEM is covered in some detail in the next section. It is a useful and effective way of developing judgement and enhancing decision making skills.
- Simulator Training. Simulators are particularly effective in training decision making skills as high workload and high stress scenarios with poor or conflicting information can easily be created in complete safety. It is recognised that simulators are not readily accessible during PPL(H) training but they represent a highly effective training resource which could be used if available. For multiengine and/or multi crew operations, use of simulators is the norm for scenario based training.
- Decision Making Training. As early as possible in their training, pilots should be made aware of the characteristics and limitations of human decision making. Instructors should emphasise the importance of maintaining Situational Awareness at all times and of prioritising responses to undesired aircraft states and emergencies. (1 . Aviate - > 2 . Navigate - > 3 . Communicate).

Training Leaflet HE 4 produced by the then EHEST and available free of charge on line is an excellent starting point for Decision Making training and an invaluable resource for helicopter flight instructors.

- Decision Making Aids. Decision aids are easy to remember lists intended to support the decision maker and to avoid errors. They are particularly beneficial in the case of critical and stressful situations. If they are to be of use in the future, pilots need to use them as a matter of course. Flight instructors could, for example teach the FADEC model in scenarios or situations occurring during training for example: lost procedure during navigation training or dealing with an emergencies that do not call for an immediate landing
  Preparing to manage the crisis by prioritizing the tasks.
  The 'FADEC' decision aid helps in prioritizing tasks. It is also easy to remember.

F	FLY THE HELICOPTER	Be aware of the helicopter limits; Maintain Situational Awareness; Use all available aids to help.
A	ASSESS THE SITUATION	If there is time available use it to avoid snap decisions.
D	DECIDE ON A WORKABLE OPTION AND REFER TO ABNORMAL OR EMERGENCY CHECKLIST OR MEMORY ITEMS	What are the options given the environment I'm in? (i.e. my own knowledge, skills and attitude, the helicopter hardware and SOPs, rules, etc) Select the best one.
E	EVALUATE	Keep evaluating the situation
C	COMMUNICATE	Communicate with ATC for collaborative purposes; Brief crew and passengers; Enlist useful help if practical.

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;
  Sloping landing areas;
  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 helicopter 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, other traffic;
  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 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. Countermeasures 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 addition, and equally valid in the context of recurrent training, a safety briefing prior to any flight should be given. The aim of such briefing is to raise the student's safety awareness with regard to safely flying helicopters in general and thus promote safety. In a safety briefing of at least 15 minutes several safety issues can be discussed, referring to accidents and incidents in general or risks specifically related to the type of flights usually undertaken by the candidate. Threat and error management should be promoted as an effective mitigation. Practical application of TEM, illustrated with real-life examples should be discussed with the candidate. There is no restriction on the subjects that could be covered. It may range from weather related issues to personal or passenger induced pressure, 'press-on-it is', etc. The material that can be used to support this briefing could come from accident & incident reports, mandatory or voluntary safety reporting, safety campaigns of different sources as well as personal experience.
- **In-flight**: Brief on the planned procedures before takeoff and prior to commencing each significant flight sequence including anticipated threats and countermeasures 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 the helicopter 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 recognize these threats is to :

- Prompt (what is the threat)
- Question (how could it be mitigated) ?
- Direct (do this)
- Physical intervention if necessary (take control)

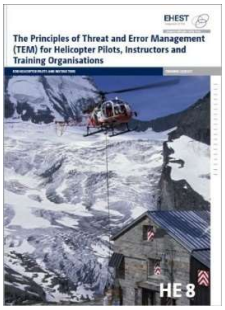
- **Post-flight**: Reconsider what threats, errors and/or UAS were encountered during the flight. Ask the student how well they were managed and what could be done differently to improve the management of similar threats and errors on future flights to assist with the development of improved TEM strategies.

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 minimize the chances of errors happening, and then if they do happen, recognize 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.



EHEST training leaflet HE8 covers the theory of Threat & Error Management and provides practical advice on how to teach the subject.

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'.

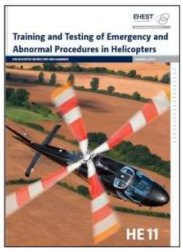
SPECIFIC HAZARDS INVOLVED IN SIMULATING SYSTEMS FAILURES AND MALFUNCTIONS IN THE HELICOPTER DURING FLIGHT

It should be the aim of all instructors to return a helicopter back to the dispersal in the same state as they found it. In order to do this they should use the principles of TEM described above to assess the possible threats they could encounter during the flight. In the case of teaching emergency and abnormal procedures the students and their actions (or inactions) could be considered as a source of threat and appropriate mitigations should be taken into account before and during flight before and during the flight.

Flight instructors are required to have completed the Teaching and Learning Syllabus laid out in Part 1 of this Guide. The syllabus includes the Specific Hazards involved in simulating systems failures and malfunctions in the helicopter during flight which lists the following items:

- Importance of touch drills
- Situational awareness
- Adherence to correct procedures

More detail can be found in EHEST training leaflet HE11 illustrated below.



IMPORTANCE OF TOUCH DRILLS

'Touch Drills' are used when a helicopter system is identified by touching (or being pointed to) without further action being taken. It is used to ensure that a pilot can in a timely manner correctly identify and reach a relevant system control without actually manipulating it and therefore preventing inadvertent de-selection (or selection) of the system. Prior to any flight where simulated emergency drills are to be performed it is essential that the instructor or examiner establishes the student's understanding of how, and when touch drills, are to be performed in the flight. The instructor/examiner should at all times monitor the student's actions to ensure that they do not inadvertently activate, or deactivate a system.

SITUATIONAL AWARENESS

As the Instructor/Examiner is ultimately responsible for the safety of the helicopter he should ensure that it is not placed in a dangerous situation. An ongoing assessment of potential hazards should be conducted of the immediate operating environment to include:

- the proximity of obstacles (including the ground),
- other traffic (as avoiding action may not be possible), escape routes,
- the terrain over which is being operated (in case a landing is required),
- the weather (in particular the cloud base, windspeed & direction and gusts, visibility and temperature).
- helicopter operating limits.

During initial instruction and demonstrations the student will be concentrating on dealing with the emergency and consequently his situational awareness may be compromised. However as the training progresses, and during testing, situational awareness will be assessed.

ADHERENCE TO CORRECT PROCEDURES

The FM or ATO training manual will often state the conditions or techniques to be used for training which should be adhered to for example:

- Weight, Altitude, Temperature charts
- MAUM to be used
- Maximum speeds to be used
- Training limitations
- Minimum heights
- Crew composition
- Areas/ground to be used

TRAINING ADMINISTRATION

The importance of keeping good instructional records cannot be emphasised enough. Well-kept records will ensure that a student's progress can be tracked and adjusted as necessary. This becomes all the more important when the student flies irregularly or with more than one instructor so that they can be reviewed and the instruction picked up seamlessly by the next instructor. 'What did you do last time? Is a question that should not be asked in a reputable training establishment unless used as a light-hearted icebreaker because the flight instructor should already be familiar with the student's training records and requirements and already have formulated a lesson plan before the briefing gets underway. This said, it is perfectly permissible and good practice to ascertain from students any areas that they wish to review or repeat because of perceived weakness.

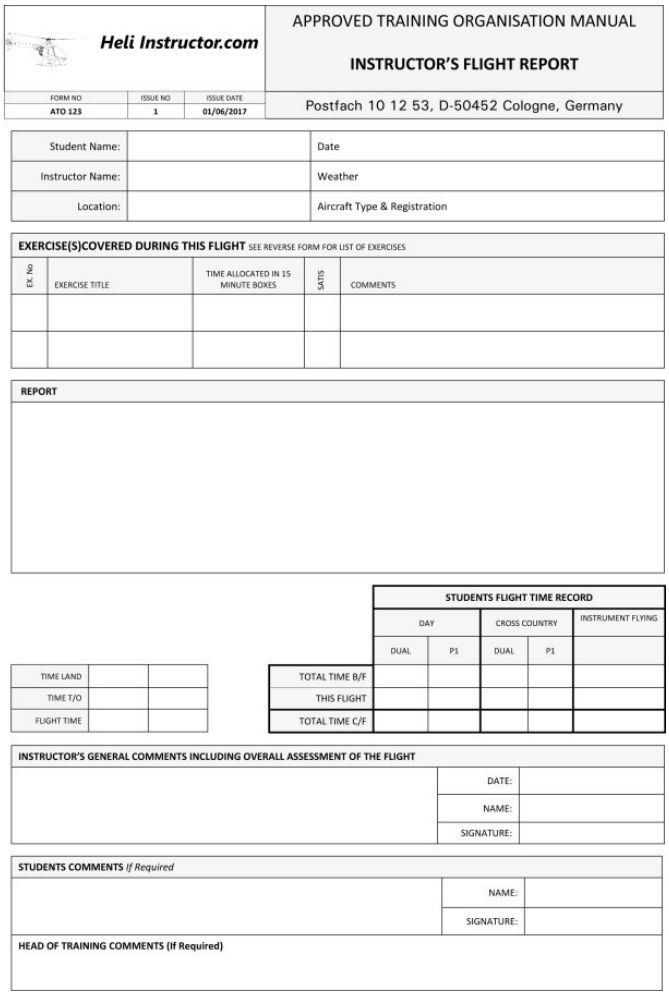
Training records also provide a legal record of the student's training and will be retained by the ATO or DTO for a specified period. An ATO/DTO can be called upon to produce the records in the sorry event of an accident involving the student in years to come. It is a fact of life today that legal process invariably takes place in the aftermath of a serious accident and the courts will wish to be satisfied that all the required training for the licence took place and was delivered in accordance with the ATO's/DTO's manual and the rules and regulations appertaining at the time.

FLIGHT OR THEORETICAL KNOWLEDGE INSTRUCTIONAL RECORDS

The required records will be set out in the ATO's Manual or as per a DTO's Verified Training Programme.

A full set of records will include records of each flight undertaken. Normally these will be kept with all the other paperwork for the student in a course record folder which may also include personal and contact details, including next of kin; a copy of the student's medical certificate, theoretical knowledge training and exam results. It is helpful to include a record of any student's pre-solo essential knowledge quiz results or similar together with copies of the required pre solo cross country authorisation certificates.

The details of instructional flight reports vary from organization to organisation to suit individual preferences and circumstances.



Heli Instructor.com

APPROVED TRAINING ORGANISATION MANUAL

INSTRUCTOR'S FLIGHT REPORT

FORM NO	ISSUE NO	ISSUE DATE
ATO 123	1	01/06/2017

Postfach 10 12 53, D-50452 Cologne, Germany

Student Name:		Date
Instructor Name:		Weather
Location:		Aircraft Type & Registration

EXERCISE(S)COVERED DURING THIS FLIGHT SEE REVERSE FORM FOR LIST OF EXERCISES

EX. No	EXERCISE TITLE	TIME ALLOCATED IN 15 MINUTE BOXES	SATIS	COMMENTS

REPORT

TIME LAND		
TIME T/O		
FLIGHT TIME		

	STUDENTS FLIGHT TIME RECORD				
	DAY		CROSS COUNTRY		INSTRUMENT FLYING
	DUAL	P1	DUAL	P1	
TOTAL TIME B/F					
THIS FLIGHT					
TOTAL TIME C/F					

INSTRUCTOR'S GENERAL COMMENTS INCLUDING OVERALL ASSESSMENT OF THE FLIGHT

DATE:	
NAME:	
SIGNATURE:	

STUDENTS COMMENTS *If Required*

NAME:	
SIGNATURE:	

HEAD OF TRAINING COMMENTS (If Required)

The mock-up of a typical flight report form opposite contains most of the information that is likely to be needed to track student progress.

Filling in these forms requires some practice and training. The report should contain all the timing and other detail such as helicopter type and registration, the date of the flight, what was covered and details of the weather. The most important part is the textual record of the flight. Completing this section calls for a succinct summary of the flight and the training given. How the student coped with the task; what was done well and what needs further work or revision. It is useful to make reference to basic qualities here. For example, Airmanship, Division of Attention and Control Touch. In the General comments box shown on this form the instructor could include an assessment of the sortie using a guide issued by the organisation together with a recommendation for the next lesson.

It is good practice to copy any scores and assessments into a taxonomy at the front of the folder. The aim of this is to provide a 'form at a glance' record that is useful to remind the student's own instructor of progress to date but is also very useful for a new instructor and most helpful to Heads of Training so they can identify students that are struggling and discuss remedial action with the student's instructor. In the example shown overleaf on Page 70, the amount of time allocated to each lesson is broken down into 15 minute blocks. There are other ways of doing this but it is a simple visual way of presenting the student's progress through the syllabus.

Ex N°	Exercise description (The list of exercises is based on the EASA Part FCL syllabus for PPL(H))	Time spent on each exercise 15 min blocks (The minimum target time to be spent on each exercise is respresented by the bold outline of the boxes)	Target time	FI signature Having reached a satisfactory standard	Date Having reached a satisfactory standard
1a	Familiarisation with the helicopter			F.I.	01/08/2021
1b	Emergency procedures			F.I.	01/08/2021
2	Preparation for and action after flight			F.I.	01/08/2021
3	Air experience		1:00	F.I.	01/08/2021
4	Effects of controls		0:30	F.I.	03/08/2021
5	Power and attitude changes		1:30	F.I.	07/08/2021
6	Straight and level		0:30	F.I.	09/07/2021
7	Climbing		0:30	F.I.	09/07/2021
8	Descending		0:30	F.I.	10/09/2021
9	Turning		0:30	F.I.	10/09/2021
10	Basic autorotation		1:00	F.I.	15/09/2021
11a	Hovering		2:00		
11b	Hover taxiing and spot turns		1:30		
11c	Hovering and taxiing emergencies		1:00		
12	Take-off and landing		1:30		
13	Transitions from hover to climb and approach to hover		1:00		
14a	Circuit, approach and landing		3:00		
14b	Steep and limited power approaches and landings		1:00		
14c	Emergency procedures		2:00		
15	First solo		1:00		
16	Sideways and backwards hover manoeuvring		1:00		
17	Spot turns		1:00		
18a	Hover OGE		0:15		
18b	HOGE hazards: vortex ring		0:30		
18c	HOGE hazards: unanticipated yaw		0:15		
19	Simulated EOL		3:00		
20	Advanced autorotation		1:30		
21	Practice forced landings		2:00		
22	Steep turns		1:00		
23	Transitions		0:30		
24	Quick stops		1:00		
25a	Navigation		2:00		
25b	Navigation problems at low heights and in reduced visibility		1:00		
25c	Radio navigation		1:00		
26	Advanced take-off, landings and transitions		1:00		
27	Sloping ground		1:00		
28	Limited power		1:00		
29	Confined areas		1:00		
30	Basic intrument flying		5:00		
			45:00		

PILOT'S PERSONAL FLYING LOG BOOK

It is a legal requirement for pilots to record details of the flights that they have made. The personal flying log book is often a source of great pride to the student and instructors will need to teach them how to complete it. Although completing it may appear straightforward to the student, there are details that will need explanation, for example, how flight time is recorded, what is meant by the holder's operating capacity and other details that may not be apparent to the new aviator. The National Aviation Authority responsible for issuing the licence will check the entries in the log book to verify that the requirements for issue of a PPL (H) or LAPL(H) have been fulfilled when checking the licence application. (The same applies to CPL(H) candidates undergoing instruction at ATO but it is assumed that by this stage they will be familiar with the use of their log book).

It is very important therefore that all details are correct from the outset. It may be a good idea for the log book to be kept with students' flying records, at least initially, and filled in after each flight under the guidance of their instructor. In this way, the entries and addition can be checked against the flying record folder to ensure that they match. This can save much frustrating work at the end of a course!

There is a wide selection of personal flying log books available from aviation equipment suppliers and bookshops and the layout varies among them. The ATO or DTO may have a preference but it is a good idea to check that the log book is suitable for the type of flying that the student is likely to do in the future. Keep in mind that in certain countries the NCA decides on which log book to be used.

This example below is taken from Part FCL.

The Personal flying record can be maintained electronically which offers advantages particularly in gathering data such as time on type or periodic summaries of flying hours. However, it is recommended that at least for the period of pre-licence training a physical log book is maintained so that students understands the procedure and process for recording flight details.

1	2		3		4		5				6		7	8	
DATE (dd/mm/yy)	DEPARTURE		ARRIVAL		AIRCRAFT		SINGLE-PILOT TIME		MULTI-PILOT TIME		TOTAL TIME OF FLIGHT		NAME(S) PIC	LANDINGS	
	PLACE	*TIME*	*PLACE*	*TIME*	*MAKE, MODEL, VARIANT*	*REGISTRATION*	*SE*	*ME*						*DAY*	*NIGHT*
						TOTAL THIS PAGE									
						TOTAL FROM PREVIOUS PAGES									
						TOTAL TIME									

9				10								11				12
OPERATIONAL CONDITION TIME				PILOT FUNCTION TIME								FSTD SESSION				REMARKS AND ENDORSEMENTS
NIGHT		*IFR*		*PIC*		*CO-PILOT*		*DUAL*		*INSTRUCTOR*		*DATE (dd/mm/yy)*	*TYPE*	*TOTAL TIME OF SESSION*		
																I certify that the entries in this log are true.
																PILOT'S SIGNATURE

THE FLIGHT OR GROUND CURRICULUM

A course of training is a complete series of studies leading to the attainment of a specific goal. This could be a course leading to the award of a PPL(H). Such a course will have learning objectives, a syllabus of instruction and course outline. The theoretical knowledge requirements will be described in detail together with the method of evaluation by exams. Similarly, airborne instruction will be covered in detail in accordance with the Part FCL syllabus of flying exercises as set out in Part 2 of this Guide.

It is likely that an ATO/DTO will be offering a range of courses which might include: LAPL(H); PPL(H); Night Rating; additional Type Ratings, FI ratings and CPL(H) courses. Each one of these courses will be described in detail in the ATO/DTO Manual setting out the syllabi for theoretical knowledge and flying exercise training and how they will be covered in the course together with the supporting learning objectives, syllabus of instruction and course outline forming a course training package. Taken together the associated course training packages for the different courses on offer would be described as the ATO's/DTO's Curriculum which could be further broken down to describe the flight or ground curriculums as required.

STUDY MATERIAL

It is common for organisations to have a preferred list of text books, study guides, leaflets, handouts and other supporting material to support its curriculum. These are listed in the ATO/DTO Manual and students should be directed to them for further reading and study.

The material may differ from that which the FI(H) used in his or her own training. If this is the case, then it is very important that flight instructors make themselves fully conversant with the material that the ATO/DTO references in its manual so that they understand what sources their students are using. They can then set study to assignments based on these sources for the students can use in preparation for their next lesson and for revision afterwards.

OFFICIAL FORMS

Each ATO/DTO will have a series of forms that it requires students and instructors to complete. A description of these forms and the student's responsibilities for their completion will form part of the initial student briefing adding to this as and when additional documentation is required.

In addition, National Aviation Authorities will require official forms to be completed for the issue of licences and type ratings. Students may find the bureaucratic process associated with this form-filling which may also be done on-line, daunting.

A good flight instructor will assist the student to navigate their way round these official forms by explaining what needs to be done, how to do it and when to do it. It is therefore necessary for instructors to have up-to-date information at their fingertips so that they can do this confidently and competently. If their instructor seems unsure who to deal with these fundamental issues, then students will quickly lose confidence.

There are other forms with which the student must be familiar, for example flight plans, meteo briefing forms, customs forms and others depending on national procedures and circumstance. Again instructors must ensure that their students are familiar with all the relevant pre and post flight documentation needed for safe and legal flying.

THE FLIGHT MANUAL OR EQUIVALENT DOCUMENT
(FOR EXAMPLE, OWNER'S MANUAL OR PILOT'S OPERATING HANDBOOK)

The flight manual (FM) or equivalent is the authoritative document that flight instructors must use for all training. Checklists must follow the exact sequence laid down in the FM as should all the procedures laid down. It is the authoritative source for all normal and emergency procedures and students should be completely familiar with the document. The FM is often expensive and it is required to be kept in the helicopter thereby limiting student access at times. Ideally, spare copies (which are kept up to date) should be available in briefing rooms and used during pre-flight briefings and knowledge tests.

The FM is also the authoritative source of performance information. Flight instructors are recommended to devise scenario based exercises to test knowledge of weight and balance calculations and assess helicopter performance.

FLIGHT AUTHORISATION PAPERS
All flights from an ATO or DTO need to be controlled from a practical point of view. In smaller organisations, it will be much easier to keep track of helicopter movements but in a busy ATO operating several helicopters, it could be possible to miss the fact that a helicopter due back at a certain time is late returning, thus delaying the start of overdue action. In addition to the flight safety reasons, it is essential to confirm that students and instructors are authorised and competent to carry out the training that has been briefed. There are additional considerations in the case of first solo flights which are covered in Exercise 15 in Part 2 of the Guide. Flight instructors are responsible for ensuring that their students understand the importance of flight authorisation and they have a complete grasp of the exercise that they have been set, where they have been authorised to fly it together with the minimum safe altitude and any other restrictions.

A good flight authorisation system offers the additional safeguard of checking that all the necessary up-to-date preflight information has been included in the brief such as NOTAM, Meteo together with any recently issued notices. It is good practice, to include a check sheet to confirm that this has been done. Similarly, there are instances when additional authorisation papers are required in the case of solo navigation exercises confirming that the student has successfully completed the necessary preparatory instruction and been briefed what to do in the case of emergencies and worsening weather.

HELICOPTER DOCUMENTS
In the same way as flight instructors are responsible for ensuring that their students understand flight authorisation and training documents, they also need to cover helicopter acceptance, including the technical log (if applicable), certificate of maintenance and helicopter serviceability documents. This is covered in Exercise 2 - PREPARATION FOR AND ACTION AFTER FLIGHT but will need constant re-enforcement throughout the course.

The importance of making accurate entries in the technical log and for checking on the serviceability of the helicopter, noting when servicing is due and how many hours are available before the

helicopter is due for planned servicing. If the instructor and student use the MATED sequence of pre-flight briefing checks, these details can be covered in the briefing under 'A' for aircraft.

THE PRIVATE PILOT'S LICENCE REGULATIONS

Licence regulations are quite involved and they do change from time to time. Students expect their instructors to have a good knowledge of the relevant regulations and be able to answer their questions authoritatively without having to refer continuously to Part FCL, other instructors or the National Aviation Authority. This said, if there is any doubt in the mind of instructors that the advice or information they are about to impart may not be 100% accurate then, it must be corroborated immediately. It would be good instructional practice to make the point that all aviation information should be checked with the relevant source document(s) before basing a decision upon it. It is therefore as important for instructors to be able to find all applicable regulations quickly and accurately.

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.

Part 2

AIR 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:

- the applicant's progress and ability
- the weather conditions affecting the flight; the flight time available
- instructional technique considerations; the local operating environment
- 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 POINTS

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, e.g. consider threats and errors in relation to the actual and forecast weather conditions for the area in which the training will be performed
- the helicopter to be used, its fuel state (consider fuel issues, in relation to actual and forecast weather, NOTAMs/airspace restrictions, ...), C of G (consider specific threats i.e. related to solo flight as compared to dual flight, servicing schedule, helicopter 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 and TEM points
- Threat and Error Management (in detail)

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.
- to couple back with the threats and errors defined/determined/covered/discussed during the pre-flight briefing.
- discuss any threats (& errors) that were not covered during the pre-briefing, but that became apparent (or could have become an issue) during the flight, in hindsight.
- 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. See pages 68-69 for more detail.

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.

COMMON ERRORS

In each exercise a list of Common Errors is added pointing out to the instructors the most common errors that may occur in the context of that specific exercise in order to be able to anticipate more easily on the occurrence of these errors and on recognizing them.

LESSON CHECKLIST

For convenience each exercise features at the end a Lesson Checklist. It will help prevent overlooking any subject of the exercise by the instructor.

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 training organisation (ATO/DTO).

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: For the student 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, raise awareness for FOD
- thorough pre-flight inspection
- knowledge of emergency drills, the helicopter's emergency equipment and fire extinguisher types

Teaching Points:

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 helicopter 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/DTO together with recommended publications for study during the course

Cover all the learning points in a logical sequence using the helicopter 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. Refer to theoretical lessons about the helicopter systems for more detailed information.

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 practice helicopter escape drills physically rather than just talk about them. Discuss other systems failures and avoid scaring people of helicopter flying. Instead apply Threat-and-Error management in an open, honest and integer way. However a pilot must be able to deal with all potential emergencies.

From the start, it is important to make it clear to the student that someone has to be in control of the helicopter at any time. That is not only true during flight training, but for any flight. Yet, specifically in the context of flight training the instructor needs to explain how control handover is to be understood. Therefor, explain to the student there are several variants of control handover, and that it is essential that either the instructor or the student is always in control of the aircraft.

- Follow through (no control transfer – the instructor remains in control)

  “Follow me through …” – the student is to gently place their hands or feet on the controls and feel what the instructor is demonstrating. They should not over-ride the instructors’ actions.

- Control Handover (control transfer from instructor to student)

  "You have control …" – If the instructor wishes you to take control/s, they will say these words. The student is to take the pressure on the control/s

  "I have control …" – Once the student has taken the pressure on the control/s they are then to say these words, it is only at this point that the instructor will relinquish control to the student.

- Control Handover (control transfer from student to instructor)

  "I have control …" – if the instructor requires to retake control, they will place their hands on the controls and then say these words.

  "You have control …" – once the instructor has taken control the student can remove their hands or feet from the controls and say these words.

TIPS FOR INSTRUCTORS

Show the student a thorough external check on the helicopter, with particular reference to items that are probably completely new to him or her (e.g. main rotor, tail rotor, transmission etc). Include the hazards related to the systems and related to the act of performing these checks. Include how to avoid errors in this process. Mention common errors, and how to not walk into that trap.

Reinforce the classroom instruction with practical exercises, e.g. reading the checklist; practical escape drills; dry use of fire fighting 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 helicopter 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.

COMMON ERRORS

- Failing to cover all of the items to be covered in Exercise 1a and Exercise 1b before proceeding to Exercise 2.

LESSON CHECKLIST

Exercise 1a: Familiarisation with the helicopter:

(A) characteristics of the helicopter, external features

(B) cockpit layout

(C) systems

(D) checklists, procedures and controls

(E) control handover

(F) Hazards, threats and errors mentioned

Exercise 1b: Emergency procedures:

(A) action if fire on the ground and in the air

(B) engine, cabin and electrical system fire

(C) systems failures

(D) escape drills, location and use of emergency equipment and exits

(F) Hazards, threats and errors mentioned

2 PREPARATION FOR AND ACTION AFTER FLIGHT

GROUND SCHOOL POINTS

Review Exercise 1 - Familiarisation with the Helicopter

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

- Helicopter airworthy
- Equipment and documents 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 and compare this to the expected wind as derived from the meteo report. If it is different, relate this concretely to TEM.
- the presence of any helicopter or obstacle that might affect the starting of the rotors or the departure procedure
- the location of any external firefighting 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 and relate this to TEM, with some practical examples. On any other opportunity, another threat or error could be mentioned to not overload the student with too much information at the beginning.

COMMON ERRORS

- Failing to cover all of the items to be covered in Exercise 2.
- Failing to cover all of the items to be covered in Exercises 1a and 1b in case Exercises 1a & 1b are combined with Exercise 2.

LESSON CHECKLIST

Exercise 2: Preparation for and action after flight:

(A) flight authorisation and helicopter acceptance

(B) serviceability documents

(C) equipment required, maps, etc.

(D) external checks

(E) internal checks

(F) seat, harness and flight controls adjustments

(G) starting and warm-up checks clutch engagement and starting rotors

(H) power checks

(I) running down system checks and switching off the engine

(J) parking, security and picketing

(K) completion of authorisation sheet and serviceability documents

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
- Control Handover
- Helicopter Limitations
- Spatial awareness, know where you are with respect to land features, air space and other aircraft

Teaching Points

Explain and relate concretely to TEM:

- how to enter and leave the helicopter with the rotors turning
- that the minimum crew is 1 pilot at the controls while rotors are turning
- that seat belts or harnesses should be fastened 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. Use the clock method for reporting aircraft to the other crew member.
- the need for flight clothing commensurate with the weather, area of operation and role being performed

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 helicopter 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.

Lookout is one of the most important safety factors in aviation and must be taught from an early stage.

We use lookout for the following reasons:

- Checking / Maintaining Aircraft Attitude
- Location, References, Navigation & Situational Awareness
- Safety against threats (e.g. – other aircraft, birds, drones, wires, obstacles)
- Watching weather to ensure safe flight parameters

We lookout using an effective scan technique

The eyes tend to focus only a few meters in front of the aircraft if just staring at one point, so to have an effective scan you need to divide the outside into blocks and scan each block in sequence, for example, moving from left to right as well as above and below. The whole sky should be covered during the lookout.

The student should also move their head during scanning to ensure that their vision is not obstructed by the aircraft fuselage or any blind spots.

Clock Code

When communicating about an item during a lookout the "Clock Code" should be used.

- 12 o'clock would be directly ahead of the aircraft,
- 3 o'clock 90° to the right,
- 6 o'clock directly behind, and
- 9 o'clock 90° to the left of the aircraft.

Additionally, "High or Low" should be added depending on the location you wish to look.

This should also be emphasised on any passenger briefing to assist.

Look-in

During the flight it is also required to look inside the aircraft, to scan the instruments, confirm parameters and perform aircraft checks.

80% of the time (except under Exercise 30 - BASIC INSTRUMENT FLYING) should be looking outside compared with 20% looking inside.

Turning

Emphasis should be given to look in both directions before turning the aircraft

Climbing

Emphasis should be given to look above before initiating a climb

Descending

Emphasis should be given to look below before initiating a descent

Lookout Turn

Certain maneuvers require a significant height loss (for example, autorotation) so the student should perform a 360° lookout turn prior to commencing such maneuvers.

Lookout in Hover

Operating close to the ground may also give additional threats to the helicopter, such as FOD, brown out (caused by dust & sand) or white out (caused by snow) and dangers of helicopter downwash. The student should pay additional attention to the surface when looking out in the hover.

Clearing Turn / Hover Maneuvers

When maneuvering in the hover (for example, spot turns or sideways flight) the student must pay additional attention to the tail rotor clearance to avoid contacting obstacles and look where the helicopter is going to position and in the opposite direction to ensure that it is clear all around the aircraft.

Prior to attempting any backways flight the student must perform a clearing turn first.

Prior to departing to climb the student must perform a clearing turn to ensure no aircraft are approaching from behind during the acceleration and climb out phase of the departure.

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.

Inflight Checks

Inflight the instructor should teach the student to make a regular check of the helicopter health, this should include:

- Warning Lights – OUT
- RPM - within Green Limits
- Power - as expected
- Temperature Gauges – in the Green & stable
- Pressure Gauges – in the Green & stable
- Fuel – as required for the flight
- Carburetor Heat (if applicable) – out of yellow arc
- Ampère-meter / Battery / Generator – as expected

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.

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 INSTRUCTORS

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.

COMMON ERRORS

- Student will be nervous and tense - encourage the student to relax and enjoy the flight. 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.
- Ambiguous control handover.

LESSON CHECKLIST

Exercise 3: Air Experience:

(A) to introduce the student to rotary wing flight

(B) flight exercise

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 carburetor 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
- Control Handover
- Helicopter Limitations
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- Windspeed & direction and gusts

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 is 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. carburetor heat, mixture, trim, rotor brake, anti-ice, windscreen, de-fogging, heater, etc.) as appropriate to type.

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 all main rotor 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.

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.

LESSON CHECKLIST

Exercise 4: Effects of controls:

(A) function of flight controls, primary and secondary effect

(B) 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

(C) use of carburetor heat or anti-icing control


G-ORAK

5 POWER AND ATTITUDE CHANGES

GROUND SCHOOL POINTS

POH/RFM: engine, transmission and airspeed limitations

Flapback

Power required diagram

PREPARATORY INSTRUCTION

Aim

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 helicopter airspeed.

Airmanship / TEM

- Lookout
- Control Handover
- Windspeed & direction and gusts
- Monitor /scan of engine temperatures and pressures – inflight checks
- Helicopter limitations
- Spatial awareness, know where you are with respect to land features, air space and other aircraft

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 helicopter 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 helicopter 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 helicopter is controlled by collective lever. When the lever is raised the power increases because of the correlater linkage and the helicopter 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 are practised.

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 helicopter type, demonstrate the methods of changing manifold pressure at constant rotor RPM and changing rotor RPM at constant manifold pressure.

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.

LESSON CHECKLIST

Exercise 5: Power and attitude changes:

(A) Relationship between cyclic control position, disc attitude, fuselage attitude and air speed

(B) Flapback

(C) Power required diagram in relation to air speed

(D) Power and air speed changes in level flight

(E) Use of instruments for precision

(F) Engine and air speed limitations

6 STRAIGHT AND LEVEL

GROUND SCHOOL POINTS

POH/RFM: engine, transmission and airspeed limitations

Flapback

Power required diagram

PREPARATORY INSTRUCTION

Aim

For the student to learn how to utilise speed control and power changes to achieve level balanced 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

- Lookout
- Control Handover
- Windspeed & direction and gusts
- Monitor /scan of engine temperatures and pressures – inflight checks
- Helicopter limitations
- Spatial awareness, know where you are with respect to land features, air space and other aircraft

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 40-80kts 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 descending.
- 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 helicopter is not significantly different between 40-80 kts.

AIR EXERCISE

Demonstrate straight and level balanced 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 helicopter 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.

LESSON CHECKLIST

Exercise 6: Straight and level:

(A) At normal cruising power, attaining and maintaining straight and level flight

(B) Control in pitch, including use of control friction or trim

(C) Maintaining direction and balance, (ball or yaw string use)

(D) Setting power for selected air speeds and speed changes

(E) Use of instruments for precision

7 CLIMBING

GROUND SCHOOL POINTS

POH/RFM, 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, recommended 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 helicopter.

Airmanship / TEM

- Lookout above
- Helicopter limitations
- Control Handover
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- Monitoring/scanning of engine parameters

Teaching points

Explain using the Power Required Diagram and the POH/RFM: 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 and include TEM in function of helicopter and engine limitations.

Explain the importance of initially adopting straight and level attitude, before commencing a climb and performing a lookout, including above the helicopter 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
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 helicopter 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 helicopter 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 climbing 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 helicopter, - LOOK OUT and CHECK IN (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 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.

LESSON CHECKLIST

Exercise 7: Climbing:

(A) optimum climb speed, best angle or rate of climb from power required diagram

(B) initiation, maintaining the normal and maximum rate of climb, levelling off

(C) levelling off at selected altitudes or heights

(D) use of instruments for precision

(E) look out above

8 DESCENDING

GROUND SCHOOL POINTS

POH/RFM, Power Limitations & Performance Data

Optimum Descent Speed, Best Rate of Descent, Best Angle of Descent, Carburetor 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 helicopter.

Airmanship / TEM

- Lookout below
- Carburetor Heat, if applicable
- Helicopter limitations
- Control Handover
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- Monitoring/scanning of engine parameters
- Threats & errors with regard to Low G pushovers in case of incorrect technique
- Threats & errors with regard to carburetor icing

Teaching points

Explain using the Power Required Diagram and the POH/RFM, 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 helicopter altitude, emphasising the difficulty in seeing aircraft below the horizon.

If the helicopter requires the application of carburetor heating emphasise the dangers of carburetor 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 helicopter 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 helicopter 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 helicopter, - LOOK OUT and CHECK IN (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 carburetor - explain the formation and dangers of carburetor icing, and explain the carburetor 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 helicopter instruments.

LESSON CHECKLIST

Exercise 8: Descending:

(A) optimum descent speed, best angle or rate of descent from power required diagram

(B) initiation, maintaining and levelling off

(C) levelling off at selected altitudes or heights

(D) descent (including effect of power and air speed)

(E) use of instruments for precision

(F) look out below

(G) low G pushovers

9 TURNING

GROUND SCHOOL POINTS

POH/RFM 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 or 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 in front, left, right, above and below
- Location and visual reference points
- Helicopter limitations
- Control Handover
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- Monitoring/scanning of parameters

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.

Explain that the location and visual reference points will assist with the student's situational awareness of the local area, as well as initially a target to roll wings level prior to using compass or direction indicator.

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 and balance should all 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 turns left and right on to nominated headings using the gyro heading indicator and compass.

Student practice

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

Student practice

TIPS FOR INSTRUCTORS

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

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 (attitude & instruments) !

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.

COMMON ERRORS

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

LESSON CHECKLIST

Exercise 9: Turning:

(A) initiation and maintaining medium level turns

(B) resuming straight flight

(C) altitude, bank and co-ordination

(D) climbing and descending turns and effect on rate of climb or descent

(E) turns onto selected headings, use of gyro heading indicator and compass

(F) look out left, right, above & below

10 BASIC AUTOROTATION

GROUND SCHOOL POINTS

HV-curve

POH/RFM

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

(E) 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
- Throttle manipulation
- Post-entry checks as appropriate to type
- Helicopter limitations, specifically RPM
- Hazards of carburetor icing

- Hazards of an unstable autorotation (entry) and the potentially detrimental effect on successful recovery
- Hazards, i.e. rollover, related to the touch down surface in case of full touch down autorotations
- To be prepared to continue in full autorotation at any time, in any fase of the exercise in case the engine really quids
- HASEL checks

A mnemonic commonly used in the context of practicing autorotations and high risk training maneuvers e.g. involving rapid descends, is HASEL. Explain that prior to initiating such a maneuver this mnemonic can be used to perform – HASEL – checks in order to verify that the maneuver can be initiated safely.

HEIGHT: Is the height sufficient to establish and recover from e.g. an autorotation or from an initiated vortex ring state ?

AREA: Is the area below the helicopter safe ? Is the area suitable for a real forced landing or a precautionary landing ? Is it legal to perform maneuvers in this area below the minimum flight altitude ?

SECURITY: Are any loose items in the cockpit and cabin i.e. kneepads, charts, seat belts, etc. securely stowed ? Are doors securely closed and latched ? Nothing in the way that might interfere with the free movement of the controls ?

ENGINE: Is the engine operating properly ? Therefor apply the inflight engine checks :

Warning Lights - OUT

RPM - within Green Limits

Power - as expected

Temperature Gauges – In the Green & Stable

Pressure Gauges – in the Green & Stable

Fuel – as required for the flight

Carburetor Heat (if applicable) – out of yellow arc

Ammeter / Batt / Gen – as expected

LOOKOUT: Perform during a turn a good lookout, particularly below the current flight path and behind the helicopter.

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 rotor RPM to increase and decrease.

Rotor RPM is controlled by collective.

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

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
- Prevent yaw

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.

Explain that, initially, the throttle manipulation will be conducted by the instructor. Explain how the instructor will use the throttle upon entry and also go-around in autorotation.

AIR EXERCISE

Demonstrate a straight-ahead autorotation with a go-around to the climb.

Student practice

Demonstrate 90°, 180° and 360° autorotations with a go-around to the climb. Point out increased rotor RPM and rate of descent.

Student practice

Demonstrate an autorotational landing

TIPS FOR INSTRUCTORS

Ground presentations and air demonstrations should make the point that autorotations need not be a stressful or frightening manoeuvre.

A low cloud base will cause demonstrations to be rushed. Fly this exercise in conditions that will allow sufficient altitude to make the demonstrations effective.

Encourage students that throughout the course they will practise autorotations until they are proficient and their actions become second nature.

It should be noted that this exercise is to familiarise students with autorotation, not to unnerve them. Keep demonstrations and attitudes gentle until confidence is acquired.

Most schools have approved areas for all autorotational exercises and practise them only dual. Be sure that your students are aware of the school policy.

It is a good practice to introduce this exercise at altitude to demonstrate the characteristics and the recovery from autorotation. This generally helps to build students' confidence, as the ground is not 'rushing up' at them in the middle of the power recovery.

COMMON ERRORS

- Allowing the nose to drop during entry.
- Allowing the helicopter 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.
- Unable to ensure safe airspeed, before initiating go-around, to prevent Vortex Ring state.

LESSON CHECKLIST

Exercise 10: Basic 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

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

(F) vortex condition during recovery

(G) gentle and medium turns in autorotation

(H) demonstration of variable flare simulated engine off landing

11a HOVERING

GROUND SCHOOL POINTS

Ground Effect

Tail Rotor Drift/Roll

POH/RFM performance charts:

- Hover in-ground effect
- Hover out-of-ground effect
- HV-curve - 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
- Helicopter limitations
- Windspeed & direction, including gusts
- Downwash & FOD
- Main rotor clearance (obstacles)
- Tail rotor clearance
- Effect of FOD, creating FOD
- Effect of snow, sand or dust
- Minimum height
- Monitor radio for conflicting traffic and ATC instructions

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 without fixating. Peripheral vision assists maintaining height. Keep looking out for obstacles and FOD.

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), indicate what the differences are and relate this to TEM.

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.

COMMON ERRORS

- Tenseness on the controls, particularly the pedals.

LESSON CHECKLIST

Exercise 11a: Hovering:

(A) demonstrate hover IGE, importance of wind effect and attitude, ground cushion, stability in the hover and effects of over controlling

(B) student holding cyclic stick only

(C) student handling collective lever (and throttle) only

(D) student handling collective lever, (throttle) and pedals

(E) student handling all controls

(F) demonstration of ground effect

(G) demonstration of wind effect

(H) demonstrate gentle forward running touchdown

(I) specific hazards for example snow, dust and litter

11b HOVER TAXIING AND SPOT TURNS

GROUND SCHOOL POINTS

POH/RFM: 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, including engine limitations
- Windspeed & direction and gusts
- Downwash – FOD
- Main rotor and tail rotor clearance
- Unanticipated yaw due to gusts or pilot induced or wind shear, hot & high density altitude, high power settings, etc. that can lead to perceived loss of tail rotor effectiveness (LTE)
- Dynamic rollover
- Monitor radio for conflicting traffic and ATC instructions

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

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 stronger 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.

COMMON ERRORS

- Inability to recognize attitude changes until the helicopter moves.

LESSON CHECKLIST

Exercise 11b: Hover taxiing and spot turns:

(A) review hovering

(B) precise ground speed and height control

(C) effect of wind direction on helicopter attitude and control margin

(D) control and co-ordination during spot turns

(E) carefully introduce gentle forward running touchdown

11c HOVERING AND TAXIING EMERGENCIES

GROUND SCHOOL POINTS

POH/RFM: 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
- Windspeed & direction and gusts
- Monitor radio for conflicting traffic and ATC instructions
- Unanticipated yaw
- Issues related to hydraulic failures
- Dynamic rollover

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 the POH/RFM

Student practice as appropriate

Over-pitching

Use technique as appropriate to helicopter type

Student practice.

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 guide 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.

The instructor should include in the ground school briefing how they will roll the throttle and at what rate, and also any verbal warning that may be given.

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.

COMMON ERRORS

- Failure to distinguish between drift and yaw.
- Visual reference on the ground immediately in front of the helicopter.
- 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.

LESSON CHECKLIST

Exercise 11c: Hovering and taxiing emergencies:

(A) review hovering and gentle forward running touchdown, explain (demonstrate where applicable) effect of hydraulics failure in the hover

(B) demonstrate simulated engine failure in the hover and hover taxi

(C) demonstrate dangers of mishandling and overpitching

(D) explain/review HYD FAIL TRAIN issues

12 TAKE-OFF AND LANDING

GROUND SCHOOL POINTS

Dynamic rollover

Ground resonance

POH/RFM: 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 – Helicopter limitations
- Pre-takeoff /after take-off/pre-landing checks
- Windspeed & direction
- Monitor radio for conflicting traffic and ATC instructions
- Ground resonance
- Low rotor RPM
- Rotor stall
- Stabilize hover before take-off

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

- to come into hover and establish a stabilized hover
- hover checks 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.

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 fulldown, controlling yaw accordingly.

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.

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 from 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.

LESSON CHECKLIST

Exercise 12: Take-off and landing:

(A) pre-take-off checks or drills

(B) look-out

(C) lifting to hover

(D) after take-off checks

(E) danger of horizontal movement near ground

(F) danger of acting too fast

(G) danger of mishandling and overpitching

(H) landing (without sideways or backwards movement)

(I) after landing checks or drills

(J) take-off and landing crosswind and downwind

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

POH/RFM:

Height velocity chart

Climb and descent power

Airspeed settings

PREPARATORY INSTRUCTION

Aim

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, verify for other traffic
- Windspeed & direction
- Checks
- Unanticipated yaw
- Threats and errors related to the backside of the power curve
- Vortex ring state
- Monitor radio for conflicting traffic and ATC instructions

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
Perform hover checks
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.
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 crosscheck 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 taught to go-around if the rate of descent is high and the airspeed is low.

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.

LESSON CHECKLIST

Exercise 13: Transitions from hover to climb and approach to hover:

(A) look-out

(B) review take-off and landing

(C) ground effect, translational lift and its effects

(D) flapback and its effects

(E) effect of wind speed and direction during transitions from or to the hover

(F) the constant angle approach

(G) demonstration of variable flare simulated engine off landing

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 operating 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
- Windspeed & direction and gusts
- Spatial awareness and spacing with other traffic
- Local noise abatement procedures
- Unanticipated yaw
- Threats and errors related to the backside of the power curve
- Vortex ring state
- Monitor radio for conflicting traffic and ATC instructions

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.

Explain that if at any time the student believes that the approach becomes unstable (e.g. too high) or there is a threat (e.g. a runway incursion) that appears they should perform a go-around. Recap the procedures for go-around, especially to confirm positive airspeed prior to raising the collective.

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-around procedures

Student practice

Demonstrate emergencies in the circuit

Student practice

TIPS FOR INSTRUCTORS

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.

Students should be taught 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

LESSON CHECKLIST

Exercise 14a: Circuit, approach and landing:

(A) review transitions from hover to climb and approach to hover

(B) circuit procedures, downwind and base leg

(C) approach and landing with power

(D) pre-landing checks

(E) effect of wind on approach and IGE hover

(F) crosswind approach and landing

(G) go-around

(H) noise abatement procedures

(I) RT & ATS procedures

14b STEEP AND LIMITED POWER APPROACHES AND LANDINGS

GROUND SCHOOL POINTS

POH/RFM:

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 8, 12 and 13 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
- Windspeed & direction and gusts
- Vortex ring state
- Ground Effect
- Unanticipated yaw
- Dynamic rollover
- Monitor radio for conflicting traffic and ATC instructions

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 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 minimize 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:

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.

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.

COMMON ERRORS

- Failure to anticipate height to level off.

LESSON CHECKLIST

Exercise 14b: Steep and limited power approaches and landings:

(A) review the constant angle approach

(B) the steep approach (explain danger of high sink rate and low air speed)

(C) limited power approach (explain danger of high speed at touch down)

(D) use of the ground effect

(E) vortex ring state

14c EMERGENCY PROCEDURES

GROUND SCHOOL POINTS

POH/RFM

PREPARATORY INSTRUCTION

Aim

For the student to learn how to conduct:

- an aborted 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
- Windspeed & direction and gusts
- ATC calls
- Vortex ring state
- Checks
- Touch drills
- Spatial awareness, know where you are with respect to airfield, wind direction and other aircraft
- HASEL checks
- Issues related to hydraulic failures

Teaching Points

Aborted Take-off

The importance of conducting hover 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 unassisted. 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.

Simulated Emergencies in the Circuit / Hydraulic-off Landing

If safe to do, the hydraulic failure demonstration should take place initially in flight at altitude, demonstrating how to recover the helicopter to an appropriate safe flight condition before conducting the relevant POH/RFM procedures. This can then be progressed to conduct the approach and appropriate landing technique in accordance with the POH/RFM 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 Exercise 21. The student should also have had demonstrated and practised basic EOLs from Exercise 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 practiced to those sites.

Governor Failure

As appropriate to the helicopter 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 helicopter to an appropriate safe flight condition before conducting the relevant POH/RFM procedures.

This can then be progressed to conduct an approach and appropriate landing technique in accordance with the POH/RFM 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 POH/RFM 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 aborted 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 helicopter 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 Rotorcraft Flight Manual (RFM) 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 helicopter 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 helicopter 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 POH/RFM. A useful procedure to follow using an adaptation of the DODAR decision making cycle is:

> **D**etect - 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.
> **O**btain 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 helicopter 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 RFM/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 deselecting 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 helicopter 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 helicopter type, airfield and student’s ability.

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.

LESSON CHECKLIST

Exercise 14c: Emergency procedures:

(A) aborted take-off

(B) missed approach and go-around

(C) hydraulic off landing (if applicable)

(D) tail rotor control or tail rotor drive failure (briefing only)

(E) 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

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:

- the change of attitude from reduced and laterally displaced weight
- the requirement for less power, and hence less collective, due to reduced weight
- the danger of low tail, low skid or wheel during hover, landing
- dangers/recovery from of loss of RRPM and overpitching
- pre take-off checks
- into wind take-off
- procedures during and after take-off
- normal circuit, approaches and landings
- action if an emergency
- wind and weather issues

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.

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.

COMMON ERRORS

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

LESSON CHECKLIST

Exercise 15: First solo:

(A) instructor's briefing, observation of flight and debriefing

(B) warn of change of attitude from reduced and laterally displaced weight

(C) warn of low tail, low skid or wheel during hover, landing

(D) warn of dangers of loss of RRPM and overpitching

(E) pre-take-off checks

(F) into wind take-off

(G) procedures during and after take-off

(H) normal circuit, approaches and landings

(I) action if an emergency

(J) weather

(K) check compliance with ATO/DTO manuals, for legal aspects

16 SIDEWAYS & BACKWARDS HOVER MANOEUVRING

GROUND SCHOOL POINTS

POH/RFM - 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, ensure tail rotor clearance
- Obstacles and obstructions
- Windspeed & direction and gusts and Weather Cocking
- Helicopter limitations
- Stability
- Helicopter Sideways & Backwards Speed Limits
- Hover Height
- Monitor radio for conflicting traffic and ATC instructions
- Unanticipated yaw

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

helicopter CoG and change in wind direction and speed. 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.
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 helicopter to sink during sideways hovering may lead to inadvertent ground contact, which could cause the helicopter 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 helicopter 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 17), 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.

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.
- No clearing Spot Turn before Backwards Hover.

LESSON CHECKLIST

Exercise 16: Sideways and backwards hover manoeuvring:

(A) manoeuvring sideways flight heading into wind

(B) manoeuvring backwards flight heading into wind

(C) combination of sideways and backwards manoeuvring

(D) manoeuvring sideways and backwards and heading out of wind

(E) stability and weather cocking

(F) recovery from backwards manoeuvring (pitch nose down)

(G) limitations for sideways and backwards manoeuvring

17 SPOT TURNS

GROUND SCHOOL POINTS

POH/RFM – 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 helicopter safely through 360 degrees in order to check clearance all around the helicopter before manoeuvring.

Airmanship / TEM

- Lookout
- Obstructions
- Windspeed & direction and gusts
- Helicopter limitations
- Helicopter Sideways & Backwards Speed Limits
- Hover Height
- Monitor radio for conflicting traffic and ATC instructions
- Main rotor and tail rotor clearance
- Effect of FOD and creating FOD
- Dynamic rollover
- Unanticipated yaw

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 and main rotor 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 helicopter CoG and change in wind direction and speed.

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.

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.

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 obstacles.

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 helicopter 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 known clear area where the helicopter was previously positioned. Repeat as required 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.

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.

LESSON CHECKLIST

Exercise 17: Spot turns:

(A) review hovering into wind and downwind

(B) turn on spot through 360°:

(a) around pilots position
(b) around tail rotor
(c) around helicopter geometric centre
(d) square and safe visibility clearing turn

(C) rotor RPM control, torque effect, cyclic limiting stops due to CoG position and wind speed and direction

18a HOVER OGE

GROUND SCHOOL POINTS

POH/RFM :

- Limitations
- Critical wind azimuth areas
- Performance – HV-curve, OGE Hover Charts

PREPARATORY INSTRUCTION

Aim

For the student to:

- Learn Hovering OGE

Review

Exercise 11a: Hovering

Exercise 13: Transitions

Exercise 14b: Steep and limited power approaches and landings

Exercise 16: Sideways and backwards hover manoeuvring

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 helicopter which can lead to hazardous situations such as unanticipated yaw or to Vortex Ring State condition.

Airmanship / TEM

- Lookout
- Windspeed & direction and gusts (also the absence of wind)
- Helicopter limitations
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- HASEL checks
- Unanticipated yaw
- Vortex Ring State

Teaching Points

OGE Hover

Describe what the OGE hover is, when it would be utilized 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 helicopter 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.

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

TIPS FOR INSTRUCTORS

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.

COMMON ERRORS

- Unintentional loss of airspeed caused by pilot inattention to flight regime, especially during low speed orbit and downwind manoeuvring.
- Unable to maintain steady altitude

LESSON CHECKLIST

Exercise 18a: Hover OGE:

(A) establishing hover OGE

(B) drift, height or power control

18b HOGE HAZARDS: VORTEX RING

GROUND SCHOOL POINTS

POH/RFM :

- Limitations
- Critical wind azimuth areas
- Performance – HV-curve, OGE Hover Charts

Principles of Flight:

- Vortex ring state

PREPARATORY INSTRUCTION

Aim

For the student to:

- Recognise and carry out the recovery action for the incipient stage of vortex ring

Review

Exercise 11a: Hovering

Exercise 13: Transitions

Exercise 14b: Steep and limited power approaches and landings

Exercise 16: Sideways and backwards hover manoeuvring

Exercise 18a: Hover OGE

Motivation

While in HOGE or flying at low airspeeds without immediate ground references (and not monitoring the instruments) it is possible to mishandle the helicopter and get in a situation which can lead to Vortex Ring State condition. Therefore it is essential to be able to identify the conditions leading to it in order to avoid it and, if encountered, recognise the symptoms and carry out the correct recovery actions.

Airmanship / TEM

- Lookout
- Windspeed & direction and gusts (also the absence of wind)
- Minimum entry & recovery height – as per ATO/DTO manual
- Helicopter limitations
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- HASEL checks
- Unanticipated yaw
- Vortex Ring State

Explain to the student that for some hazards prevention is the best, if not - depending on the location and situation - the only action to prevent further harm, because there may be no safe recovery possible once a hazard is fully developed or there may be insufficient height and or space available for a successful recovery.

Teaching Points

Vortex Ring State

Review the conditions for Vortex Ring state and describe that how at low airspeeds (generalised rule-of-thumb: IAS < 30 kts) with RoD (generalised rule-of-thumb: > 300 ft/min) and sufficient power, (such as in an 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 high RoD.

Specific situations that can be conducive to entering vortex ring state :

- HOGE and (un)intentional vertical descent
- Steep approaches
- Downwind approaches
- Transitions from approach to hover
- Slow speed orbiting (e.g. during photo flights)
- Power recovery from autorotation
- (downwind, turning) Quick stops and flares

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.

Explain that an incipient vortex ring state should initially be recognized by a feeling of ‘lightness’ as in a low G and there will be no positive G-force feeling when the collective is raised. A further indication is a limp hanging yaw string or woolometer. A change in vibrations may be felt. And the rate of descent will continue to increase.

Currently 2 techniques are widely used to recover from a Vortex Ring State. As long as not all rotorcraft manufacturers are aligned about the best way to recover from an incipient and developed Vortex Ring State, both techniques are included in this guide. Yet, the flight instructor should verify in official manufacturers documentation for the type of helicopter used for training, whether both techniques may be applied, or if any restrictions apply.

Flight exercise :

- bring the helicopter to an altitude above the minimum altitude as specified by the ATO/DTO procedures
- perform a power check
- perform HASEL checks
- bring the helicopter into a HOGE
- allow the helicopter to sink into its downwash
- maintain the heading by using the pedals
- as soon as the onset of vortex ring state is felt, give the 'go around' order
- apply recovery actions
- Recovery option 1: Standard recovery technique:
    - Reduce collective
    - Ease cyclic forward to adopt a nose down attitude
    - Maintain heading by using the pedals
    - When the airspeed is above translational lift, increase collective to maximum continuous power to climb
- Recovery option 2: Vuichard recovery technique:
    - Raise collective
    - Maintain heading by using the pedals
    - Apply lateral cyclic in the direction of the tail rotor thrust
    - Once the descend is stopped, ease cyclic forward to regain airspeed

AIR EXERCISE

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

Student practice

TIPS FOR INSTRUCTORS

It is of the utmost importance that instructors teach how to avoid vortex ring state. Early recognition of the conditions conducive to vortex ring state should be taught thoroughly in order to prevent (unintentionally) entering VRS. It is strongly advised to use training scenarios in order to show how a situation could lead, escalate to VRS. In addition the importance of a go-around should be stressed and students should be taught to take a go-around decision as soon as it becomes apparent that the prerequisites for a vortex ring state are being approached.

For Vortex Ring State demonstrations the ATO/DTO should have a prescribed minimum entry and recovery 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 by himself, it should be explained that these exercises are only to be practised with an instructor!

In addition, where the ATO/DTO has access to an adequate synthetic training device, maneuvers such as the recovery from Vortex Ring State should preferably be trained in the safe environment of a training device other than the helicopter itself.

COMMON ERRORS

- Unintentional loss of airspeed caused by pilot inattention to flight regime, especially during low speed orbit and downwind manoeuvring.
- Not recognizing the conditions leading to VRS
- Exercise can overly worry the student.

LESSON CHECKLIST

Exercise 18b: Hover OGE hazards: vortex ring:

(A) establishing hover OGE

(B) drift, height or power control

(C) demonstration of incipient stage of vortex ring, recognition and recovery (from a safe altitude)

(D) scenarios leading to VRS

18c HOGE HAZARDS: UNANTICIPATED YAW

GROUND SCHOOL POINTS

POH/RFM :

- Limitations
- Critical wind azimuth areas
- Unanticipated yaw leading to perceived Loss of Tail Rotor Effectiveness (LTE)
- Performance – HV-curve, OGE Hover Charts

PREPARATORY INSTRUCTION

Aim

For the student to:

- Recognise and carry out the recovery actions for unanticipated yaw (which could lead to a perceived LTE)

Review

Exercise 11a: Hovering

Exercise 13: Transitions

Exercise 14b: Steep and limited power approaches and landings

Exercise 16: Sideways and backwards hover manoeuvring

Exercise 18a: Hover OGE

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 helicopter and get in a situation which can lead to unanticipated yaw leading to perceived loss of tail rotor effectiveness (LTE). Therefore it is essential to be able to identify the conditions leading to it in order to avoid them and, if encountered, recognise the symptoms and carry out the correct recovery actions.

Airmanship / TEM

- Lookout
- Windspeed & direction and gusts (also the absence of wind)
- Minimum entry & recovery height – as per ATO/DTO manual
- Helicopter limitations
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- HASEL checks
- Unanticipated yaw
- Vortex Ring State

Teaching Points

Unanticipated yaw leading to perceived Loss of Tail rotor Effectiveness

Review the conditions for unanticipated yaw 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 helicopter's directional stability. Explain that the perceived 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 unanticipated yaw 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.

AIR EXERCISE

Demonstrate at a safe height, the conditions, recognition and recovery for unanticipated yaw which could lead to a perceived LTE

Student practice

TIPS FOR INSTRUCTORS

For the unanticipated yaw demonstrations the ATO/DTO should have a prescribed minimum entry and recovery 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.

It is strongly advised to use training scenarios in order to show how a situation could lead to an unanticipated yaw.

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

In addition, where the ATO/DTO has access to an adequate synthetic training device, maneuvers such as the recovery from unanticipated yaw should preferably be trained in the safe environment of a training device other than the helicopter itself.

COMMON ERRORS

- Unintentional loss of airspeed caused by pilot inattention to flight regime, especially during low speed orbit and downwind manoeuvring.
- Unintentional loss of heading control caused by pilot inattention.
- Exercise can overly worry the student.

LESSON CHECKLIST

Exercise 18c: Hover OGE hazards: unanticipated yaw:

(A) establishing hover OGE

(B) drift, height or power control

(C) demonstration of unanticipated yaw leading to perceived loss of tail rotor effectiveness

(D) scenarios leading to unanticipated yaw

19 SIMULATED ENGINE OUT LANDING

GROUND SCHOOL POINTS

The HV-curve

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

The autorotative flare

Flare theory

POH/RFM emergency procedures

PREPARATORY INSTRUCTION

Aim

For the student to:

- understand the effect of weight, disc loading, density attitude and RRPM decay
- review basic autorotation entry
- practise optimum use of cyclic and collective to control speed or RRPM
- practise variable flare simulated EOL
- have demonstrated constant attitude simulated EOL
- have demonstrated simulated EOL from hover or hover taxi
- 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

- Lookout
- Pre-entry checks
- Post-entry checks as appropriate to type
- Helicopter limitations
- Windspeed & direction
- Suitable landing area
- Monitor radio for conflicting traffic and ATC instructions
- HASEL checks

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 helicopter and apply collective pitch as required to reduce the rate of descent and cushion the landing. Alternatively use the collective lever to control the RoD before levelling the helicopter 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.

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 helicopter's performance characteristics, the wind conditions, helicopter weight, unstable ground conditions, or the density altitude conditions, power recoveries to the hover or hover-taxi may be used to provide continuation in autorotation practice.

Describe the technique for carrying out a power recovery 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 helicopter.
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, helicopter 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 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 helicopter 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' should be performed.

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, helicopter weight, air density and size/surface of the selected landing area.

Both zero-speed and run-on touchdowns should be practiced 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 practiced solo.

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 helicopter 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.

LESSON CHECKLIST

Exercise 19: Simulated Engine Out Landing:

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

(B) review basic autorotation entry

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

(D) variable flare simulated EOL

(E) demonstrate constant attitude simulated EOL

(F) demonstrate simulated EOL from hover or hover taxi

(G) demonstrate simulated EOL from transition and low level

20 ADVANCED AUTOROTATION

GROUND SCHOOL POINTS

POH/RFM: 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 recovery and 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

- Lookout
- Safety checks
- Safe landing area
- HASEL checks
- Windspeed & direction and gusts
- Spatial awareness, know where you are with respect to land features, air space and other aircraft

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 helicopter 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 a landing spot underneath or close to the helicopter.

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.

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 get to a landing spot close to the helicopter 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 helicopter 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 landing spot 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 get to a landing spot directly underneath the helicopter.

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 helicopter 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.

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 helicopter into an accelerating attitude thus risking vortex ring.
- Poor RPM control, in varying load conditions.

LESSON CHECKLIST

Exercise 20: Advanced autorotation:

(A) recce of the intended landing spot

(B) over a selected point at various height and speed

(C) review basic autorotation: note ground distance covered

(D) range autorotation

(E) low speed autorotation

(F) constant attitude autorotation (terminate at safe altitude)

(G) 'S' turns

(H) turns through 180° and 360°

(I) effects on angles of descent, IAS, RRPM and effect of AUM

21 PRACTICE FORCED LANDINGS

GROUND SCHOOL POINTS

POH/RFM: 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

- Lookout
- Safety checks
- Safe landing area
- HASEL checks
- Recovery altitude or height
- Windspeed & direction and gusts
- Verbal warning
- Spatial awareness, know where you are with respect to land features, air space and other aircraft

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
Identify 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 helicopter 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.

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.

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 helicopter accelerates, thus risking vortex ring.
- Poor choice of landing area.

LESSON CHECKLIST

Exercise 21: Practice forced landings:

(A) procedure and choice of the forced landing area (recce)

(B) forced landing checks and crash action

(C) re-engagement and go-around procedures

22 STEEP TURNS

GROUND SCHOOL POINTS

POH/RFM: Power L imitations

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

Exercise 20: Advanced autorotation

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 left & right
- Power limitations
- RRPM limits
- Helicopter limitations
- Spatial awareness, know where you are with respect to land features, air space and other aircraft

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.

LESSON CHECKLIST

Exercise 22: Steep turns:

(A) steep (level) turns (30 ° bank)

(B) maximum rate turns (45 ° bank if possible)

(C) steep autorotative turns

(D) faults in the turn: balance, attitude, bank and co-ordination

(E) RRPM control and disc loading

(F) vibration and control feedback

(G) effect of wind at low level

23 TRANSITIONS

GROUND SCHOOL POINTS

POH/RFM

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 helicopter 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
- Windspeed & direction
- Helicopter limitations
- HV diagram
- Monitor radio for conflicting traffic and ATC instructions
- Unanticipated yaw

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 helicopter 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 helicopter 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 helicopter 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.

LESSON CHECKLIST

Exercise 23: Transitions:

(A) review ground effect, translational lift and flapback

(B) maintaining constant height, (20-30 ft AGL)

(C) transition from hover to minimum 50 knots IAS and back to hover

(D) demonstrate effect of wind

(E) look out for ground traffic

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 to downwind terminating into wind

Review

Exercise 5: Power and attitude changes

Dangers of vortex ring

Dangers of high disc loading

Exercise 23: Transitions

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.

Airmanship / TEM

- Lookout
- Helicopter limitations
- Windspeed & direction
- HV diagram
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- Obstructions
- Unanticipated yaw
- Vortex ring state

Teaching Points

Quick stops 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 helicopter 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 shaded area (avoid area) of the HV diagram 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:

Quick stops from crosswind:

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.
As the helicopter 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 shaded area (avoid area) of the HV diagram into low hover without delay.
Come to a hover or resume forward speed.
Maintain height throughout.
Maintain balanced flight and prevent yaw.

Quick stops from downwind:

Describe the techniques of performing a rapid deceleration involving a level turn from the downwind 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 unanticipated yaw and vortex ring state).
As the helicopter 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 shaded area (avoid area) of the HV diagram 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 unanticipated yaw).
As the helicopter 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 shaded area (avoid area) of the HV diagram 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.

COMMON ERRORS

- Lack of accurate yaw control due to large power changes.
- Loss of height in the turns and when losing translational lift.
- 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.

LESSON CHECKLIST

Exercise 24: Quick stops:

(A) use of power and controls

(B) effect of wind

(C) quick stops into wind

(D) quick stops from crosswind and downwind terminating into wind

(E) danger of vortex ring

(F) danger of high disc loading

(G) look out for ground traffic

(H) hazards related to unanticipated yaw and vortex ring state

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

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 100 NM 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 Skill Test.

Airmanship / TEM

- Lookout
- Windspeed & direction
- Correct altimeter setting
- Helicopter limitations
- Flight Planning
- Deteriorating weather
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- Use up to date maps and charts
- 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 NAVAIDS 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):

Meteo - 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 helicopter for the flight to include; fuel planning, AUM, CoG, (take-off and landing), Helicopter documentation including: ARC/Maintenance requirements, insurance, CofA, Registration, MEL, other NAA legal requirements. Aircraft configuration and equipment: all doors on; MEL applied.

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:

Obtaining applicable and relevant weather information. Analysing the obtained weather information in function of the intended routing and potential diversions. Making a GO/NO GO decision based on previous analysis and if necessary cancel or postpone the flight.

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 , helicopter checklist, pens, passenger briefing, safety equipment, all doors and windows closed, etc

Departure/En route:

Setting heading procedure, altitude, timings/ ETAs, fuel recalculations, instrument checks, radio calls. Maintaining 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 of position/lost procedure:

When uncertain of position the following should be considered:

Check compass heading, direction indicator 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
Make a note of the time if you are in contact with an ATSU, requesting assistance.
As soon as you realise that you are lost stay calm, and remember your training
If the cloud base permits, climb to your Safety Altitude.

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 wait until it is too late
Meteo 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! Land and Live!

En-route Diversion:

An en-route diversion may be necessary due to insufficient fuel to reach your destination, deteriorating weather, passenger request, helicopter 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:

Listen to ATIS where available. 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, refueling, 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. Include a diversion during training, at least before the student will fly his first solo navigation.

COMMON ERRORS

- The major fault in both MDR 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.

LESSON CHECKLIST

Exercise 25a: Navigation:

(A) flight planning:

(a) weather forecast and actuals
    (1) make a Go/No-Go decision based on the weather analysis
(b) map selection and preparation and use
    (1) choice of route
    (2) controlled airspace, danger and prohibited areas
    (3) safety altitudes and noise abatement considerations
(c) calculations:
    (1) magnetic heading(s) and time(s) en-route
    (2) fuel consumption
    (3) mass and balance
(d) flight information:
    (1) NOTAMs, etc.
    (2) radio frequencies
    (3) selection of alternate landing sites
(e) helicopter documentation
    (1) check equipment (MEL-items) necessary for the flight and navigation
(f) notification of the flight:
    (1) pre-flight administrative procedures
    (2) flight plan form (where appropriate)
    (3) filing ATC flight plan

(B) departure:

(a) organisation of cockpit workload
(b) departure procedures:
    (1) altimeter settings
    (2) ATC liaison in controlled or regulated airspace
    (3) setting heading procedure
    (4) noting of ETAs

(C) En route:

(a) maintaining height or altitude and heading
(b) revisions of ETA and heading:
    (1) 10 ° line, double track and track error and closing angle
    (2) 1 in 60 rule
    (3) amending an ETA
(c) log keeping
(d) use of radio

(e) use of NAVAIDS (if fitted)
(f) minimum weather conditions for continuation of flight
(g) perform fuel checks
(h) in-flight decisions
(i) transiting controlled or regulated airspace
(j) uncertainty of position procedure
(k) lost procedure

(D) arrival and aerodrome joining procedure:

(a) ATC liaison in controlled or regulated airspace
(b) altimeter setting
(c) entering the traffic pattern
(d) circuit procedures
(e) parking
(f) security of helicopter
(g) refueling
(h) closing of flight plan (if appropriate)
(I) post-flight administrative procedures

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 (traffic, terrain, obstacles)
- Windspeed & direction
- Helicopter limitations
- Flight Planning
- Deteriorating weather
- Obstructions
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- Legal aspects

Teaching Points

Actions before descending:

> Explain that prior to descending to low level it is important to ensure that the helicopter 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 (carburetor 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.

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
- The distance to obstacles will be closer than usual
- Terrain will be closer too

Serious considerations should be given to terminating the flight and conducting a safe, controlled precautionary landing. Land and Live!

Precautionary landing:

It should be noted that a 'forced' or 'precautionary' landing that is made in response to an helicopter 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.

COMMON ERRORS

- Over-emphasis on map details tends to confuse a student pilot.
- Too long heads-down activities, especially in the case of DVE.

LESSON CHECKLIST

Exercise 25b: Navigation problems at low heights and in reduced visibility:

(A) actions before descending

(B) hazards (for example obstacles, other aircraft and terrain)

(C) difficulties of map reading

(D) effects of wind and turbulence

(E) avoidance of noise sensitive areas

(F) actions in the event of encountering DVE

(G) decision to divert or conduct precautionary landing

(H) bad weather circuit and landing

(I) appropriate procedures and choice of landing area

(J) precautionary landing

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

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 utilize them.

Airmanship / TEM

- Lookout
- Windspeed & direction
- Helicopter limitations
- Flight Planning
- NOTAMs
- Hazards related to too long heads-down activities including : consultation of (hardcopy) documentation, tablet, NAV systems (GPS, moving maps and other non-IFR apps)
- Minimum use height of land based radio navigation aids
- Threat of aircraft on reciprocal track using GPS for point to point navigation

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 guide for the specific navigational aids fitted to the helicopter 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 helicopter 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.

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.

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.
- Too long heads-down activities.
- Selection of wrong or inappropriate station.
- Fail to identify the station.
- Fail to track in a straight line.

LESSON CHECKLIST

Exercise 25c: Radio navigation:

(A) use of 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.

(B) use of VHF omni range:

(a) availability, AIP and frequencies;
(b) selection and identification;
(c) OBS;
(d) to or from indications and orientation;
(e) CDI;
(f) determination of radial;
(g) intercepting and maintaining a radial;
(h) VOR passage;
(i) obtaining a fix from two VORs.

(C) use of ADF equipment: NDBs:

(a) availability, AIP and frequencies;
(b) selection and identification;
(c) orientation relative to the beacon;
(d) homing.

(D) use of VHF/DF:

(a) availability, AIP and frequencies;
(b) RTF procedures and ATC liaison;
(c) obtaining a QDM and homing.

(E) use of en-route or terminal radar:

(a) availability and AIP;
(b) procedures and ATC liaison;
(c) pilots responsibilities;
(d) secondary surveillance radar (if transponder fitted):
    (1) transponders;
    (2) code selection;
    (3) interrogation and reply.

(F) use of DME:

(a) station selection and identification;
(b) modes of operation: distance, groundspeed and time to run.

26 ADVANCED TAKE-OFF, LANDINGS AND TRANSITIONS

GROUND SCHOOL POINTS

POH/RFM:

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
- Windspeed & direction and gusts
- HV diagram
- Vortex Ring State
- Dynamic rollover
- Spatial awareness, know where you are with respect to land features, air space and other aircraft
- Landing Site Recce:
    - Size - is it large enough?
    - Shape - is the landing site aligned with the wind/direction of approach?
    - Surrounds - are there any obstacles on the approach/overshoot?
    - Slope - is the landing site 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, or worse will lead to rollover.

Describe the technique for a running take-off as follows:

> Raise the collective lever until the helicopter is light on the skids and gently move the cyclic forward to achieve acceleration. As the speed increases allow the helicopter 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 progressive.

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 shaded area (avoid area) of the HV diagram.

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 hover 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 helicopter 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 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 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 minimize 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 translation 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 operational 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 climb 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 helicopter will drift towards the landing site when turning on to base/final legs. On finals the speed should be decreased to approximately 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 performed 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 helicopter 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.

COMMON ERRORS

- Slow to appreciate dangers of downwind 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.

LESSON CHECKLIST

Exercise 26: Advanced take-off, landings and transitions:

(A) landing and take-off out of wind (performance reduction)

(B) ground effect, translational lift and directional stability variation when out of wind

(C) downwind transitions

(D) vertical take-off over obstacles

(E) running take-off

(F) cushion creep take-off

(G) reconnaissance of landing site

(H) running landing

(I) zero speed landing

(J) crosswind and downwind landings

(K) steep approach

(L) go-around

27 SLOPING GROUND

GROUND SCHOOL POINTS

Dynamic /Static rollover

POH/RFM: 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

- Lookout
- Landing Site recce[2]:
    - 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 helicopter/capabilities of the pilot?
    - Surface - is the surface firm and not slippery (wet grass)?
      - do you have a full, clear view over the surface ?
- Windspeed & direction and gusts
- Helicopter limitations
- Escape path
- Static & Dynamic rollover
- Unanticipated yaw
- Go-around procedures

[2] For a full description of how a site reconnaissance should be taught, refer to Exercise 29 Confined Areas.

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
- 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.

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.

Indicate differences in touch down attitudes between clockwise and counter-clockwise turning rotor helicopters.

Indicate the influence of the center of gravity and the wind.

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 helicopter 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 helicopter 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, to indicate the influence of the center of gravity, the wind and the clockwise or counter-clockwise turning rotor

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.

COMMON ERRORS

- Failure to maintain disc attitude.
- Jerky control movements.
- Failure to maintain heading and yaw during power changes.
- Allowing the helicopter to roll with one skid in contact with the ground and rapidly reducing / raising collective lever.

LESSON CHECKLIST

Exercise 27: Sloping ground:

(A) limitations and assessing slope angle

(B) wind and slope relationship: blade and control stops

(C) effect of CoG when on slope

(D) effect of clockwise or counter-clockwise turning rotorsystem

(E) ground effect on slope and power required

(F) right skid up slope

(G) left skid up slope

(H) nose up slope

(I) avoidance of dynamic roll over, dangers of soft ground and sideways movement on touchdown

(J) danger of striking main or tail rotor by harsh control movement near ground

(K) hazards related to objects and people upslope

28 LIMITED POWER

GROUND SCHOOL POINTS

POH/RFM

Limitations

Load and density altitude performance charts

Power curve

Vortex Ring

Unanticipated yaw

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 a helicopter 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 a helicopter that has a malfunction or is operating at above all up mass.

Airmanship / TEM

- Lookout
- Windspeed & direction and gusts
- Landing site recce
- Helicopter limitations
- Power Checks
- Unanticipated yaw
- Rollover
- Vortex ring state
- Low rotor RPM
- Hard landing

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 helicopter limits is exceeded) and note the power achieved. The difference between the 2 readings is the power margin available 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:
As an example for a particular helicopter:

<3 inches MAP available – a running landing is required
4 inches MAP available – a zero speed may be conducted dependent on wind direction & speed 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

The Take-Off Power Check:

The helicopter 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:
As an example for a particular helicopter:

<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 utilizing 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.

COMMON ERRORS

Take-off:

- Pulling cyclic aft as helicopter 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.

LESSON CHECKLIST

Exercise 28: Limited power:

(A) take-off power check

(B) vertical take-off over obstacles

(C) in-flight power check

(D) running landing

(E) zero speed landing

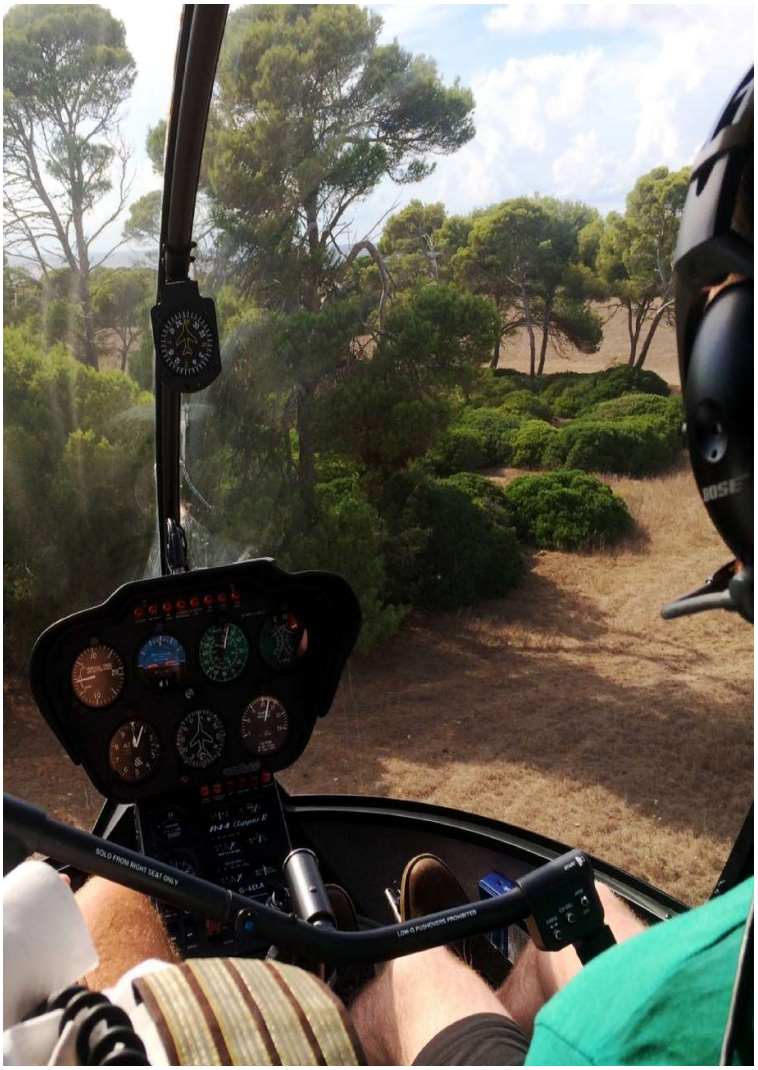
(F) approach to low hover

(G) approach to hover

(H) approach to hover OGE

(I) steep approach

(J) go-around



29 CONFINED AREAS

GROUND SCHOOL POINTS

Recirculation

HV-curve considerations

Dynamic rollover

Unanticipated yaw

Vortex Ring

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. A landing site 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
- Windspeed & direction, gusts, turbulence and wind shifts
- Landing site recce
- Vortex Ring State
- Unanticipated yaw
- Power Checks, to determine the power (margin) available
- Obstructions and surface condition hidden by tall grass/foliage
- Threat of personnel unfamiliar with helicopters in a landing site
- Wires

- Low rotor RPM
- Changing payload, changing CoG

Teaching Points

Describe the different stages of locating, conducting the recce/approach/manoeuvring and the departure from a confined area.

Locating the Landing Site (LS)

Explain it is unlikely that the landing site 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 landing site.
Photographs - A regularly used site may have a photograph in a brochure or a landing site 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 a landing site.
Markers – A landing site may have an 'H', helipad or a windsock indicating the location

The recce of a confined area

Explain what information should be obtained during a recce. Make the student understand the value of the information obtained during the recce and the correlation of this information in function of his intentions.
Explain a recce starts at the planning phase of the flight.
Performance should be checked for the current (WAT) conditions to determine if out of ground effect power is available. Explain to take into account any additional payload that is intended to be picked up at the landing site and the additional power that consequently would be needed for the departure out of the confined area.
Use available map data as detailed as possible to study the terrain in the area and to identify any charted obstacles in the vicinity. Explain to the students that not all obstacles are charted and there is always the unexpected to be anticipated for, e.g. the temporary erected crane next to the intended landing site, the new powerline that hasn't been charted yet …
Explain the importance to obtain a good weather briefing of the area and to familiarise with any specific local weather phenomena that may exist in that particular area e.g. ground fog in valleys, wind shear, turbulence, up & downdrafts, …
Explain an airborne recce of a landing site is required, even if the site has been previously used, to assess the suitability of the site for the individual pilot/helicopter capability, the given wind direction and speed, 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 POH/RFM HV-curve in case of an engine failure and to avoid unnecessary disturbance of the local population. Ensure that any legal requirements regarding low flying and landing location (e.g. congested areas) have been met.

Explain that the airborne recce can be divided in three different stages.

High reconnaissance

Explain the importance to conduct the high reconnaissance at an altitude providing sufficient clearance from any obstructions, allowing for safe evasive action from any potential hazards such as downdrafts, turbulence, wind shifts and allowing for an emergency landing in case of an engine failure along the route.
Explain the purpose of the high reconnaissance is to determine the suitability of an area for landing and subsequent departure.
The high reconnaissance is used:

- to determine the direction of the wind and the windspeed. Give examples of 'alternative wind indicators' such as flags, smoke, direction in which the clouds move. Explain how to determine the wind by making an orbit.
- to identify all obstacles (buildings, vegetation, wires, towers, …) along the approach path, around the landing site and along the departure route.
- to decide on the preferred approach path. Stress the higher importance of the availability of forced landing spots along the route as compared to the requirement to fly the approach always into the wind. Explain that depending on the time of the day the position of the son should be taken in consideration as well.
- to decide on the type of approach to be flown into the landing spot. Explain that, conditions permitting, a normal approach should be flown.
- to assess the suitability of the intended area for landing often referred to as the 5 S's):
  - **Size**: is the area large enough to accommodate landing and take-off taking into account the dimensions of the helicopter and the experience level of the pilot?
  - **Shape**: what shape is the landing site and what is its orientation in relation to the wind and the intended direction for the approach/departure axes?
  - **Surrounds**: assess the obstacles in and around the area. How do these obstacles affect the wind? How do they affect the intended approach route? How do they affect the type of approach? Are sufficient potential forced landing spots available? What markers can be used as reference points to fly the approach?
  - **Slope**: identify any perceivable slope in the landing site. Is there any perceivable unevenness, sunken or soft ground in the terrain?
  - **Surface**: identify the nature of the landing site surface including ground clearance. What is the type of soil? Hard or soft ground? Sand, snow or dirt covered? Relate the presence of sand, dirt or snow to the threats of brownout and whiteout. Any tall grass? Scrub? Any potential FOD?
- to assess the suitability for a go-around and to assess the suitability of the intended area for take-off:

- determine a route in case a decision is taken to go-around at any point along the approach. Again, check for obstacles and potential emergency landing spots.
- to decide on and assess the departure route, preferably into the wind, yet stress the importance to have potential forced landing areas available along the route
- Size: is the area large enough to accommodate repositioning before take-off, to allow for more room to facilitate the departure?

- to perform an in-flight power check and assess the power available for landing and subsequent take-off, considering any additional payload to be picked up.

Explain to the student that options are always available, that the high reconnaissance is used to help choose between the best of options. The student should be taught that If the initially intended location seems unsuitable, the approach should not even be started. Evenmore, when during the high reconnaissance or the low reconnaissance at any time it becomes clear that for whatever reason the situation might become more hazardous than initially assessed and a successful outcome is jeopardized a go-around should be made. If the threat remains in place another attempt should not be made and an alternative landing site should be looked for.

Low reconnaissance

Explain that a low reconnaissance is performed to verify and confirm all the information gathered during the high reconnaissance. The student should also be taught to check for anything new that might have been missed during the high recce or things difficult to notice from a higher altitude, e.g. slopes & crevices, (thin) wires. Explain that if the information from the high reconnaissance was sufficient to decide that an approach, landing, go-around if needed and take-off can be made safely to/from the intended landing site, then the low reconnaissance may be combined with the approach itself.

Explain that during the low recce it is important that:

- a more detailed assessment of the approach and departure path should be performed
- the effects of the wind on surrounding terrain and obstructions (buildings, terrain elevations) shall be considered
- the touchdown zone shall be (re)examined assessing the 5 S's
- it is determined whether the approach will be terminated to a hover or to the ground. Explain that, when there is no risk for brownout or whiteout, an approach to a hover is preferred so that the touch down point can be carefully checked before landing the helicopter.

Ground reconnaissance

Explain that when the approach was terminated into the area, a ground reconnaissance should be done to determine a touch down spot, a take-off point and to re-assess the take-off direction that was decided on during the high and low recce. In case the helicopter is shut down in the confined area, the best way to perform the ground reconnaissance in view of the departure, is to perform this recce on foot.

Explain that the following items should be evaluated (re-assessed) during the ground recce:

- the wind direction and effect of the wind within the confined area
- the location of smaller and lowest obstacles in the landing site, their effect on the wind and decide whether the take-off direction might be altered

Explain that the following should be performed:

- to decide on the most advantageous and safe point to initiate the take-off to ensure the maximum amount of available area for the take-off profile taking into consideration the wind direction and departure route
- to decide on which reference points shall be used as a marker during repositioning to the intended point to initiate the take-off so that tail and main rotor would have sufficient clearance from obstacles
- to decide on the type of take-off to be applied

Explain there are different types of recce that can be flown:

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 landing site 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 landing site (e.g. if the terrain on one side is unsuitable for an emergency landing) it may be possible to fly past the landing site over a suitable area – ideally with the landing site 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 landing site over terrain more suitable for an emergency landing.

Describe how to fly a recce 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 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 landing site 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 a near out of ground effect hover over the centre of the landing site. In the final approach path the angle of descent should not be steeper than necessary to clear any obstacle with the tail rotor.
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 hover.

Describe how to manoeuvre within a confined area as follows:

Explain due to danger of blade strike/tail strike/FOD, manoeuvring within a landing site should only be conducted when it is entirely necessary to do so. If it is necessary to manoeuvre, either to park the helicopter 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 helicopter 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 and branches flexing back

Sideward Movement (Box Turn):

Adopt a slightly higher than normal hover
Hover taxi sideward whilst maintaining heading, at least an helicopter 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 helicopter 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 and branches flexing back

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
- Hover 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 landing site

A normal transition using best RoC should be flown wherever possible. 'Backtracking' to the rear of the landing site 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 shaded area (avoid area) of the HV diagram should only be used as a last resort.

Vertical Climb (to outside ground effect):

Establish low hover in centre of the landing site
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 landing site.

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 and relate these to relevant TEM items

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.

Teach the student to anticipate for a change of the wind in the final stages of the approach when the helicopter descends below the height of the obstacles surrounding the landing spot. Discuss the consequences of possible turbulence and of less wind when descending in the confined area. Help

the student understand the potentially resulting increased rate of descent and the corresponding need for power that comes with it.

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!

COMMON ERRORS

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 landing site recce which may lead to unanticipated yaw 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 which could lead to entering Vortex Ring State.
- Incorrect identification of wind direction and speed resulting in downwind approach with hard landings and/or excessive power demands.
- Blade strike/tail strike on unseen obstacles/foreign object damage in the landing site.
- Persons being hit by tail/main rotor blades.
- Damage to underside of helicopter due to landing on unseen obstruction.
- Helicopter rolling over because sloping ground technique not used for landing/take-off.

Approach and Landing:

- Certain ‘hard-to-see’ obstacles e.g. power lines may go undetected.
- The desire to make an approach directly into the wind may be stronger than the need to fly over areas that are suitable for a safe landing in case of an emergency.
- Not appreciating changes in 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 (and take-off).

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 helicopter'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.

LESSON CHECKLIST

Exercise 29: Confined areas:

(A) landing capability and performance assessment

(B) locating landing site and assessing wind speed and direction

(C) reconnaissance of landing site

(D) select markers

(E) select direction and type of approach

(F) identify potential emergency landing spots

(G) circuit

(H) approach to committed point and go-around

(I) approach

(J) clearing turn

(K) landing

(L) power check and performance assessment in and out of ground effect

(M) normal take-off to best angle of climb speed

(N) vertical take-off from hover

30 BASIC INSTRUMENT FLYING

GROUND SCHOOL POINTS

POH/RFM

Limitations

Helicopter 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 helicopter in the event of an inadvertent entry into IMC. In this exercise instrument flight will be simulated.

Airmanship / TEM

- Lookout for traffic – instructor
- Windspeed & direction
- Helicopter limitations
- Degraded Visual Environment
- Unusual attitudes
- Spatial disorientation
- Loss of control

Teaching Points

Explain that enhanced ground instruction in weather interpretation, planning, route assessment , TEM, and Decision Making on encountering a Degraded Visual Environment (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. Land & Live!

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 helicopter 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 helicopter instruments, environmental effects, and unstabilised helicopter, 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 Attitude Indicator (AI) is used as the centre of the scan. The scan then radiates outwards to one of the instruments Direction Indicator (DI)/Air Speed Indicator (ASI)/Vertical Speed Indicator (VSI)/altimeter for selected information then returning to the Attitude Indicator (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 attitude indicator (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 the vertical speed indicator (VSI) for level flight and adjust the collective/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 direction indicator (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 helicopter speed/attitude to achieve a nominal 500ft a minute RoC. Apply collective power while maintaining attitude and scan balance, vertical speed indicator (VSI), altimeter.
> 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, vertical speed indicator (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.

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 attitude indicator (AI) for turn/bank and level the helicopter
- Attitude - check attitude indicator (AI) for accelerative/decelerative attitude and correct
- Speed - check air speed indicator (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 helicopter 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 instrument flying (IF) is a skill which can fade quickly in the absence of continuous practice and should therefore be reviewd 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.

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.

LESSON CHECKLIST

Exercise 30: Basic instrument flight:

(A) physiological sensations

(B) instrument appreciation:

(a) attitude instrument flight

(b) instrument scan

(C) instrument limitations

(D) basic manoeuvres:

(a) straight and level at various air speeds and configurations

(b) climbing and descending

(c) standard rate turns, climbing and descending, onto selected headings

(E) recoveries from climbing and descending turns

(F) recoveries from unusual attitudes

Part 3 ACRONYMS

ADF	Automatic Direct Finder
AGL	Above Ground Level
AI	Attitude Indicator
AIP	Aeronautical Information Publication
AMC	Acceptable Means of Compliance
AME	Aeromedical Examiner
AoC	Assessment of Competence
ARC	Airworthiness Review Certificate
ASI	Air Speed Indicator
ASTD	American Society for Training and Development
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATO	Approved Training Organisation
ATSU	Air Traffic Service Unit
AUM	All Up Mass
CAG	Collaborative Analysis Group
CASA	Civil Aviation Safety Authority of Australia
CDI	Course Deviation Indicator
CofA	Certificate of Airworthiness
CoG	Center of Gravity
CPL(H)	Commercial Pilot License Helicopter
CRM	Crew Resource Management
DA	Decision Altitude
DA	Density Altitude
DF	Direction Finding
DI	Direction Indicator
DME	Distance Measuring Equipment
DODAR	**D**etect - **O**btain information - **D**ecide - **A**ct – **R**eview
DR	Dead Reckoning

DTO	Declared Training Organisation
DVE	Degraded Visual Environment
EASA	European Union Aviation Safety Agency
EHA	European Helicopter Association
EHEST	European Helicopter Safety Team
EOL	Engine off landing
ESPN-R	European Safety Promotion Network Rotorcraft
ETA	Estimated Time of Arrival
FADEC	**F**ly the helicopter – **A**ssess the situation – **D**ecide on a workable option and refer to abnormal or emergency checklist or memory items – **E**valuate – **C**ommunicate
FCL	Flight Crew Licensing
FE	Flight Examiner
FE(H)	Flight Examiner Helicopter
FI	Flight Instructor
FIC	Flight Instructors Course
FIE(H)	Flight Instructor Examiner Helicopter
FI(H)	Flight Instructor Helicopter
FM	Flight Manual
FOD	Foreign Object Debris
GM	Guidance Material
GNSS	Global Navigation Satellite System
HASEL	Height – Area – Security – Engine – Lookout
HF	Human Factors
HV	Height Velocity
IAS	Indicated Airspeed
IF	Instrument Flying
IGE	In Ground Effect
IMC	Instrument Meteorological Conditions
LAPL(H)	Light Aircraft Pilot License Helicopter
LS	landing spot, landing site
LTE	Loss of Tail Rotor Effectiveness

MAP	Manifold Pressure
MATED	**M**eteo - **A**ircraft - a**T**c - **E**xercise – **D**uties
MAUM	Maximum All Up Mass
MDR	Mental Dead Reckoning
MEL	Minimum Equipment List
NAA	National (Civil) Aviation Authority
NCA	National Competent Authority
NDB	Non-directional (radio) Beacon
NOTAM	Notice to Airmen
OBS	Omni Bearing Selector
OGE	Out of Ground Effect
PAT	Power Attitude Trim
PFL	Practice Forced Landing
POH	Pilot Operating Handbook
PPL(H)	Private Pilot License Helicopter
QDM	Magnetic bearing to a radio station
RCOM	Rotorcraft Committee
RFM	Rotorcraft Flight Manual
RoC	Rate of Climb
RoD	Rate of Descend
RPM	Revolutions Per Minute
RRPM	Rotor Revolutions Per Minute
RT	Radio Telephony
SAB	Stakeholder Advisory Board
SOP	Standard Operating Procedure
TEM	Threat and Error Management
T/O	Take-off
UAS	Undesired Aircraft States
VHF	Very High Frequency
VSI	Vertical Speed Indicator