Safety Regulation Group

Civil Aviation Authority

PAPER 2007/05

The Effect of JAR-FCL on General Aviation Safety

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Executive Summary

This paper has been prepared by an engineering undergraduate on a placement at the Safety Regulation Group, CAA.

After the introduction of the Joint Aviation Requirement for Flight Crew Licensing (JAR-FCL) in 1999, the revalidation requirements for pilot licences experienced significant change. This study initially summarises these revalidation changes for various ratings. Two sets of data, before and after the introduction of JAR-FCL, are then examined, in order to establish whether its introduction has had any effect on the number of serious incidents and accidents in General Aviation for fixed wing aeroplanes and microlights with a MTOW < 5,700 kg, particularly focusing on training related issues (experience, recency and training).

The main finding of the study is that the changes to revalidation requirements for pilot licences, which JAR-FCL has implemented, have had no significant effect on the number of serious incidents and accidents involving general aviation aircraft in the UK.

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Glossary of Terms

AAIB	Air Accidents Investigation Branch
Aeroplane	Power driven heavier-than-air aircraft with wings
ANO	Air Navigation Order 2005 (as amended)
ATPL	Airline Transport Pilot Licence
CAA	Civil Aviation Authority
CAST	Commercial Aviation Safety Team
CICTT	CAST and ICAO Common Taxonomy Team
CPL	Commercial Pilot Licence
EASA	European Aviation Safety Agency
EC	European Commission
EU	European Union
FAA	Federal Aviation Administration
FCL	Flight Crew Licensing
GA	General Aviation
GASRWG	General Aviation Safety Review Working Group
GAWG	General Aviation Working Group
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
IR	Instrument Rating
JAA	Joint Aviation Authorities
JAR	Joint Aviation Requirements
LASORS	Licensing Administration Standardisation and Operating Requirements Safety
MEP	Multi Engine Piston

Microlight Aeroplane	Means an aeroplane designed to carry not more than two persons which has: a) a maximum total weight authorised not exceeding: i) 300 kg for a single seat landplane, (or 390 kg for a single seat landplane in respect of which a permit to fly or Certificate of Airworthiness issued by the CAA was in force prior to 1st January 2003); ii) 450 kg for a two seat landplane; iii) 330 kg for a single seat amphibian or floatplane; or iv) 495 kg for a two seat amphibian or floatplane; and b) a stalling speed at the maximum total weight authorised not exceeding 35 knots calibrated airspeed.
MOR	Mandatory Occurrence Report
MTOW	Maximum Take-Off Weight
NAA	National Aviation Authorities
NPPL	National Private Pilot Licence
PIC	Pilot in Command
PPL	Private Pilot Licence
Self-Launching Motor Glider (SLMG)	Means an aircraft with the characteristics of a non-power-driven glider, which is fitted with one or more power units and which is designed or intended to take-off under its own power
Simple Single Engine Aeroplane	Means, for the purposes of the National Private Pilot's Licence, a single engine piston aeroplane with a maximum take-off weight authorised not exceeding 2,000 kg and which is not a microlight aeroplane or a self-launching motor glider
SEP	Single Engine Piston
SRG	Safety Regulation Group
SVFR	Special Visual Flight Rules
TRI	Training Related Issue
Touring Motor Glider (TMG)	Has the meaning specified in paragraph 1.001 of Section 1 of JAR-FCL 1
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

Report The Effect of JAR-FCL on General Aviation Safety

1 Introduction

1.1 Background

Individuals wishing to fly powered aeroplanes in the United Kingdom must hold some form of pilot's licence in order to do so legally. Furthermore, the licence must also have a valid rating endorsed upon it. The rating will allow the pilot to fly a certain class or type of aircraft (e.g. a Single Engine Piston class rating). Class and type ratings are discussed more extensively in Appendix 6, paragraph 1.2.

The licence is normally valid for a longer period than the rating, but, once the rating has expired, the pilot cannot exercise the privileges of it. It should be noted that a pilot may have more than one rating endorsed on their licence, but if an SEP class rating expires the pilot cannot fly aircraft in the SEP class.

Therefore a key element of a pilot's licence is how long a rating endorsed on the licence, is valid for and how this period is extended before its expiry - known as *revalidation*.

To clarify the concept of revalidation it is useful to compare a pilot's licence with a driving licence. They are alike since once some form of test is passed, the licence holder may exercise the privileges of the licence. However, a person holding a driving licence may then drive as much or little as they desire, and continually exercise the privileges of the licence held. Flying an aeroplane requires considerably more skill than driving a car. A pilot who has not flown for a long period may lack the required skill to fly in a safe manner. Therefore a rating endorsed on a pilot's licence is only valid for a short period, normally one or two years (although the licence may be valid for 5 years).

If a pilot demonstrates they are able to practise the considerably difficult skills required to fly an aeroplane safely, they are able to extend the validity of the rating. Typically, flying a certain number of hours, or taking a proficiency check will lead to rating revalidation.

Until 1999, pilots were issued with a UK pilots licence; the Civil Aviation Authority (CAA) established the requirements for this licensing.

The Joint Aviation Authorities (JAA) is a body that represents the national aviation authorities of its European members (the JAA member states are listed in Appendix 1). Members of the JAA have joined together with a common purpose: to co-operate in developing and implementing common safety regulatory standards and procedures[1].

In 1999 the JAA introduced a Joint Aviation Requirement for Flight Crew Licensing: JAR-FCL. Although, after this, the requirements for obtaining a licence remained relatively unchanged, the *revalidation requirements* to maintain and exercise the privileges of the licence were significantly amended. Pilots issued with a licence before 1999, and possibly still holding a UK (CAA) licence (if it has not been converted to a JAA licence), are also bound by the new revalidation requirements contained with

1. JAA, 2005. *Introduction to JAA* [online]. Available from: www.jaa.nl/introduction/introduction.html [Accessed May 2006]

JAR-FCL. For individuals that gained a UK PPL before 1999, it remains a lifetime licence.

The intention of JAR-FCL was to harmonise pilot licensing standards across Europe. Before 1999, aviation systems in Europe had developed with great variation in structure and detail. The old UK licence was, and still is, internationally recognised by the International Civil Aviation Organization (ICAO). It would allow the licence holder to fly in other European countries, however, not all countries' pilot licences would have the same privileges.

JAR-FCL allows an individual holding a JAA licence to fly, as a member of the flight crew, in any of the JAA member states. Oversight and issuing of these licences in the UK is still conducted by the CAA. The regulations of the licence are enforceable through UK law under the Air Navigation Order (2005)[2].

The European Aviation Safety Agency (EASA) was formed in September 2003. Its aims and objectives are similar to that of the JAA, and EASA will eventually replace the JAA. Competence for aircraft operations and licensing will ultimately be transferred to EASA within the next 2- 3 years.

The main difference between the two European bodies is that EASA has legal powers, enforceable through European Regulations, which immediately take effect in all Member States. The JAA has no legal powers; member states merely hold informal agreements with each other regarding the issue of JAR-FCL.

It should be noted that the CAA is likely to continue the issuing of licences when operations and licensing competence is transferred to EASA.

1.2 Objective

The objective of this study is to ascertain if the introduction of the JAR-FCL requirements have had any effect on accidents and serious incidents involving General Aviation (GA) fixed-wing aeroplanes and microlights, with a maximum take-off weight < 5700 kg that are UK registered, or flying in the UK. The study will focus on training, recency and experience issues, for both private pilots and instructors.

In order to achieve this objective two sets of data will be reviewed; before and after the introduction of JAR-FCL. Analysis will be conducted comparing the two data sets.

The term 'General Aviation' does not have a strict definition, and means different things throughout the world. However, it was important to adopt a definition that will be used throughout the study in order to construct a database containing occurrences involving General Aviation aircraft. For the purposes of this study, 'General Aviation' is considered to mean a civil aircraft operation other than a public transport operation.

Aviation activity excluded from GA, and therefore considered public transport, includes aircraft carrying fare paying passengers and/or freight, search and rescue, police support and air ambulance flights. Furthermore, occurrences that involved a violent cause (sabotage, hijacking or terrorism) or suicides (as designated by a coroner's inquiry) have not been included. Other occurrences that are excluded from the database and that are of no relevance to the study are discussed later.

1.3 Wider Picture

The General Aviation Safety Review Working Group (GASRWG) was established as a subgroup of the CAA's General Aviation Steering Group (GASG) to review General Aviation accidents and serious incidents from 1997 to 2001[3].

2. Office of Public Sector Information, 2005. *Air Navigation Order* [online]. Available from: www.opsi.gov.uk/si/si2005/20051970.htm [accessed May 2006]
3. CAA, 2003. *Report of the General Aviation Safety Review Working Group*. Unpublished.

Research conducted by the group found that 70% of General Aviation accidents and serious incidents can be attributed to four main factors, one of which was a lack of training or experience by the Pilot in Command. The other three main factors were: flight handling skill, poor judgement or airmanship and omission or inappropriate action. An action plan was produced, which included areas of interest that warranted further work. Two of these areas were the pilot training syllabus and instructor training and their qualifications.

The work conducted in this study is of direct interest to the GASRWG and was presented at a GASRWG meeting in August 2006.

This area of study is also of particular interest amongst the aviation industry as many opinions have been expressed as to whether JAR-FCL has had an effect, but no research has been conducted to support a particular hypothesis.

1.4 Revalidation Summary

There have been some major and also more subtle changes to licence revalidation after the introduction of JAR-FCL. The details of revalidation requirements before and after the introduction of JAR-FCL are contained in Appendix 6. This section aims to summarise these changes and suggest what effect they may have had on occurrences in General Aviation after their introduction.

Some of the below examples are clearly worst-case scenarios, and the vast majority of pilots and instructors would not find themselves in the following situations through sensible practice. The inclusion of these examples aims to place emphasis on what could happen under the described regulations. Many flying clubs employ tighter regulations, for example instructors are not permitted to instruct if they have not instructed on a training flight for a 90 day period.

1.4.1 Private Pilots

Revalidation for PPL licence holders has changed to an extent that may result in some recency issues. Before 1999, a PPL holder must have completed at least 5 hours of flying during the 13 month period for which the licence was valid, of which at least 3 hours was as pilot-in-command.

After 1999 (with the exception of microlight pilots), a pilot must complete at least 12 hours (including 12 landings and take-offs) during the second half of the 2 year period for which the licence was valid, of which at least 6 hours is as pilot-in-command, and a one hour training flight. It is therefore possible a pilot may not fly at all during the first 23 months and complete the required 12 take-offs and landings and then the training flight in the last month. This raises questions as to whether the pilot has adequately practised his flying skills - a recency issue. Similarly a pilot may not fly for the same period of time (23 months) before taking his proficiency check in the last month before the licence expiry date.

1.4.2 Instructors

Revalidation for instructors has experienced significant change; the term revalidation is not even applicable to *Flying* Instructors (pre 1999).

The main change is a requirement for *Flight* Instructors (post 1999) to complete a minimum number of hours of flight instruction (100 hours during 36 months) to revalidate their licence. If they do not do so they must attend a refresher seminar and complete a proficiency check.

Before 1999, Flying Instructors had no requirement to complete any hours acting as an instructor. They would only have to pass a proficiency check. Revalidation, in the context used so far, did not exist for instructors. The proficiency check could be

completed at any time, and the licence would be extended for a further 25 month (Flying Instructors) period.

Furthermore, the licence could also be 'revalidated' by passing a proficiency check up to 25 months after the licence lapsed.

2 The Dataset

2.1 Sources, Validity and Quality of Data

2.1.1 The Mandatory Occurrence Reporting (MOR) Scheme

The CAA operates the MOR scheme in the UK. Its intention is to prevent future accidents and incidents, and not to attribute blame or liability. The occurrences in the dataset are taken entirely from Mandatory Occurrence Reports.

An occurrence can be one of three types: an accident, a serious incident or an incident[4]. The actual definitions of these are in Appendix 2. A person suffering injuries and whether they are fatal, minor or serious will have some bearing on which type an occurrence is designated as. The definitions of these injuries are found in Appendix 3. As previously mentioned, only occurrences that are designated either an accident or a serious incident will be included in the dataset.

Although individuals (flying General Aviation aircraft) are not obligated by law to report occurrences directly to the CAA, the vast majority of occurrences do end up as an MOR, since pilots *are* obliged by law to inform the AAIB of a serious incident or accident[5]. In turn the AAIB will inform the CAA of the occurrence. Therefore all serious incidents and accidents in General Aviation will be indirectly reported to the CAA, and an MOR will be produced.

The MOR data used for this study is the most comprehensive source available, and more than adequate to support conclusions.

2.1.2 General Aviation Utilisation Data

GA utilisation data provides the number of hours GA aircraft fly each year. This data will allow accident and serious incident rates to be calculated per 1000 flying hours. It is likely that the two periods from which occurrence data is taken (pre and post JAR-FCL), will have different values for GA utilisation. Therefore making a comparison of the number of accidents may be an unjustifiable one if the difference in GA utilisation is large. By comparing occurrence (accidents and serious incidents only) rates, and not counts of occurrences, a more accurate comparison can be made.

However, the GA utilisation data does have a limitation. In order to calculate the utilisation for GA aircraft, two sets of data had to be compared. The first contained utilisation data for UK registered aircraft with an MTOW < 5700 kg (1). The second set contained utilisation data for UK registered Public Transport Flights with an MTOW < 5700 kg (2). As previously described, the definition for General Aviation aircraft are those with an MTOW < 5700 kg, and non-public transport (3). To calculate this, data (2) was subtracted from data (1). An example to clarify this follows:

(1) 1999 Aeroplane MTOW < 5700 kg Utilisation = 834,836 hours.

(2) 1999 Aeroplane MTOW < 5700 kg, Public Transport Flights Utilisation = 39,741 hours

(3) 1999 Aeroplane MTOW < 5700 kg, Non-Public Transport Flights Utilisation

(3) = (1) - (2) = 795,095 hours

The limitation of this data arises since the sources of data (1) and (2) are different. Furthermore, utilisation data for 2003 and 2004 is not actual data but has been

4. CAA, 2005. *Civil Aviation Publication 382 (CAP 382).*
5. Office of Public Sector Information, 1996. *Statutory Instrument 1996 No. 2798: The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations* [online]. Available from: www.opsi.gov.uk/si/si1996/Uksi_19962798_en_1.htm [accessed May 2006]

estimated based on previous years utilisation. This is because the utilisation data comes from renewals of Certificates of Airworthiness or Permits to Fly, for which there can be up to three years lag in receiving information. Despite this, analysis conducted using the utilisation data will be valid.

3 Methodology

Generating a definition of GA aircraft led to the construction of a dataset that would be used to obtain the number of accidents and serious incidents involving training, recency and experience issues. Two extracts were taken from the previously described MORS database to populate the dataset used for this study.

The extracts contain *serious incidents and accidents* involving UK registered General Aviation fixed-wing aeroplanes and microlights (MTOW < 5700 kg) worldwide, and foreign registered aircraft flying in UK airspace.

To make a comparison of accidents pre and post the introduction of JAR-FCL, data before and after 1999 was used. The first extract contains data between 1/1/1997 and 31/12/1998. The second extract needed to be carefully selected; it was important that sufficient time was allowed to pass in order for any effects of the introduction of JAR-FCL to have become apparent. The second extract contains accident data between 1/1/2002 and 31/12/2003.

3.1 Finalising accident dataset

The two extracts from the database contain a wide variety of data including pilots of various nationalities, with many different licences and combinations of ratings, flying a variety of different aircraft. In spite of this, it is of no surprise that some of the data is of no relevance to the study.

It was therefore necessary to make some exclusions from the dataset to arrive at a finalised dataset, the complete contents of which would be relevant to the study. Generally the exclusions have been applied to accidents where the pilot in command does not hold a licence issued by a country that is a member of the Joint Aviation Authorities - Appendix 1 lists the member states.

3.1.1 Exclusions

- Students flying solo who do not hold a licence of any form. Although serious incidents and accidents involving solo students are not of direct importance for this study, they may be considered separately; it has been suggested there could be a training issue amongst instructors sending students solo at an inappropriate time. Furthermore, this report concentrates on the post licence revalidation;
- Non JAA licence holders / pilots holding foreign licences, i.e. US PPLs or ATPLs;
- Holders of microlight / glider licences that do not also hold a full PPL;
- Civilian registered aircraft but owned by the Royal Air Force and used for military training - the RAF use the Grob G115E 'Tutor' for elementary flying training. The aircraft fleet is civilian registered, however, those flying the aircraft do not hold JAR licences. Instructors hold a military licence - Qualified Flying Instructor (QFI);
- An *accident or serious incident* where the pilot in command has a licence in the "other" or "unknown" category.

3.1.2 **Reviewing the Accident Dataset**

Having researched the many topics related to pilot licensing, the types of licences and their revalidation requirements, it was possible to start reviewing the accident dataset, and highlighting those records that involved a training, experience or recency issue. The list of fields for each of the occurrences follows:

MORs Ref	Total Hours Flown on Type
Date	Total Hours Flown during previous 90 days
Occurrence Class	Total Hours Flown during previous 28 days
Aircraft Class	Damage to aircraft
Aircraft Type	Fatal (Yes / No)
Aircraft Generation	Number of Fatal Injuries
Aircraft Engine	Number of Serious Injuries
Aircraft Registration	Number of Minor Injuries
Phase of Flight	Number of People on Board
Nature of Flight	Number of Third Party Injuries
Location	Training Issue (Yes / No)
Departure Location	Unable to Say (Yes / No)
Arrival Location	Recency (Yes / No)
Licence	Experience (Yes / No)
Ratings	Training (Yes / No)
Investigation Type	Notes
Pilot Age	More info
Total Hours Flown	Air Accident Investigation Branch Reference
Confidence	Summary
Description	

The Air Accident Investigation Branch (AAIB) Reference field contained a link to the associated document on the AAIB's website. This link could have been to one of three types of document, depending on the severity of the accident. In order of severity (highest first), they are: a Formal Investigation, a Field Investigation and an Aircraft Accident Report Form.

These documents would aid the analysis process, often providing extra details regarding the circumstances surrounding the accident.

To assist making judgement as to whether an occurrence in the dataset involved a training related issue, Causal and Contributory Factors have been included for some occurrences. The GASRWG evaluated a number of occurrences and allocated Causal and Contributory Factors to some. These factors are listed in Appendix 4.

Causal Factor: an event or item that is judged to be directly instrumental in the causal chain of events leading to an accident/incident.

Contributory Factor: an event or item that is judged not to be directly in the causal chain of events but could have contributed to the accident/ incident.

One way of deciding whether a factor was *causal* or not would be to ask whether the accident or incident would have occurred had that factor not been present. If the answer is no, then the factor was *causal*.

If included in any of the factors were *F8.17 - Lack of training, currency or inexperience,* the accident clearly involved a training related issue. However, not all occurrences had factors allocated to them.

All records in the dataset were reviewed; those with a training related issue were flagged. The highlighted occurrences were then designated as a certain type (experience, recency or a training issue). These types are not mutually exclusive; an occurrence could involve more than one of these issues. Each of the three categories were then further divided into one of the following sub-categories:

Recency:	**Experience:**	**Training:**
In general On type Unknown Other	In general On type Unknown Other Location Weather	In general On type Unknown Other Instructor

3.2 Occurrence Examples

The following section contains examples of "characteristic" occurrences that fit into a certain category, be it recency, training or experience. They serve to illustrate how an occurrence was analysed, and the particular details that influenced whether the record did involve a training related issue, and if so, of what kind.

Some of the fields from the accident dataset and any causal or contributory factors allocated by the GASWRG have been omitted in order to preserve sensitivity for the occurrence.

Aircraft:			
Class:	Aeroplane	**Type:**	Cessna 152
Engine:	Single piston aeroplane		
Flight:			
Nature of Flight:	Private	**Flight Phase:**	Landing
Pilot:			
Licence:	ATPL	**Ratings:**	Instrument
Total Hours:	7220	**Hours on Type:**	6
Previous 90 Days:	28	**Previous 28 Days:**	15
Description:			
UK Reportable Accident: Hard landing. NLG collapsed and propeller struck ground. No injury. It was the pilot's first solo flight in a Cessna 152. Following a local sortie of about 1.5 hours the a/c was positioned for an approach to R/W27, with the intention of completing a touch and go landing. However, as the a/c came to the flare, a pitch oscillation developed and the a/c landed heavily, resulting in NLG collapse. The pilot subsequently commented that the accident occurred as a result of his incorrect handling of the elevators and throttle, probably as his previous flight had been in a PA28 which has different handling characteristics in the flare. See AAIB Bulletin 9/97, ref: EW/G97/06/19.			

Specific Type of Training Related Issue: Experience (On Type)

The pilot had a wealth of flying experience, 7220 hours, and held an ATPL with an instrument rating at the time of the accident. However, he had little experience flying the Cessna 152. This lack of experience on that type contributed to the pilot mishandling the aircraft, which led to the accident.

Aircraft:			
Class:	Aeroplane	**Type:**	Piper PA-38-112 Tomahawk
Engine:	Single piston aeroplane		
Flight:			
Nature of Flight:	Private	**Flight Phase:**	Cruise
Pilot:			
Licence:	PPL	**Ratings:**	
Total Hours:	237	**Hours on Type:**	218
Previous 90 Days:	12	**Previous 28 Days:**	3
Description:			
UK Reportable Accident : Aircraft crashed in poor weather. Serious injury to 1 POB. AAIB Field investigation. AAIB Bulletin 5/2004, ref: EW/C2003/07/05 - Summary: The aircraft departed Tollerton, Nottingham, for Caernarfon, Gwynedd, routeing from Tollerton to Crewe and then direct to Caernarfon. The pilot received a Flight Information Service from Liverpool ATC, but at 0939 hrs the pilot left the Liverpool frequency and made no further contact with ATC. At about 0945 hrs three hill walkers who were in hill fog on a track just to the east of Elidir Fawr in Snowdonia heard an aircraft fly past them. Very soon after, they heard an impact and the engine noise ceased. The walkers reported what they had heard to the police, and several hours later the wreckage of the aircraft and the pilot, who was seriously injured, were located. The pilot made a full recovery but was unable to remember anything of the flight. The investigation, therefore, was based on examination of the wreckage, witness evidence, recorded radar data and data recovered from the aircraft's GPS. The engineering examination found no fault with the aircraft that could have caused the accident and the report concludes that the aircraft probably flew into terrain whilst in IMC.		

Specific Type of Training Related Issue: Experience (Weather)

The pilot in command did not hold a rating that allowed the pilot to fly in Instrument Meteorological Conditions (either an Instrument Rating or an Instrument Meteorological Conditions qualification). It can be concluded that the pilot, not holding an appropriate licence, had no experience of flying in bad weather.

Aircraft:			
Class:	Aeroplane	**Type:**	Cessna 172 Skyhawk
Engine:	Single piston aeroplane		
Flight:			
Nature of Flight:	Private	**Flight Phase:**	Landing
Pilot:			
Licence:	PPL	**Ratings:**	
Total Hours:	71	**Hours on Type:**	71
Previous 90 Days:	7	**Previous 28 Days:**	2
Description:			

UK Reportable Accident : Aircraft bounced on landing and NLG collapsed. Substantial damage. Minor injury to 1 POB. AAIB AARF investigation.

The pilot was returning to Henlow and was performing a 'straight-in' approach to runway 27R, a grass surface of 762 metres, with very low winds. The approach seemed high so the pilot applied 30deg flap and it appeared the approach was returning to the correct angle. The first touchdown resulted in a bounce and he heard the sound of the nose leg fracturing as the nose wheel touched the ground. The pilot incurred only superficial injury. An instructor who observed the landing commented that the first stage of the approach had appeared normal but, during the final stage, the aircraft was higher and faster than other light aircraft. In the final 30-40 feet the aircraft nose lowered further, the rate of descent became excessive and the aircraft bounced heavily. The aircraft began a 'porpoise' oscillation between the nose and main landing gears and the nose leg snapped. The pilot later discussed the accident with his instructor. Their conclusion was that the approach was high and fast and, even with no power, the pilot was unable to maintain his aiming point. At the threshold the aircraft was still high but the airspeed had stabilised at 70mph. The pilot then slightly lowered the nose, resulting in an increase in airspeed and, in the subsequent bounce, did not maintain back pressure on the control column. This resulted in the induced oscillation. The pilot considers that he should have abandoned the approach at a safe height. He considers that he had not made that decision because he had not appreciated what was going wrong with the approach. As a result he requested further training. He commented that, in his initial training, he had not fully appreciated the difference that a lack of headwind can make to an approach and the ability to make a safe landing after having excess height near the threshold of a short runway. See AAIB Bulletin 9/2003, ref: EW/G2003/07/02.

Specific Type of Training Related Issue: Training (In General)

The wind conditions during the accident were calm. The pilot stated that during his initial training "he had not fully appreciated the difference that a lack of headwind can make to an approach". The pilot lowered the nose during the final stages of approach. This is something the instructor should have emphasised not to be done, as it can lead to pilot induced oscillation, the cause of the accident in this case. After the accident the pilot requested further training.

Aircraft:			
Class:	Aeroplane	**Type:**	Reims Cessna FRA150L Aerobat
Engine:	Single piston aeroplane		
Flight:			
Nature of Flight:	Private	**Flight Phase:**	Landing
Pilot:			
Licence:	PPL	**Ratings:**	
Total Hours:	125	**Hours on Type:**	124
Previous 90 Days:	2	**Previous 28 Days:**	1
Description:			
UK Reportable Accident : A/c bounced during crosswind landing. NLG collapsed. No injuries. Following a local flight pilot made an overhead rejoin in order to observe windsock & elected to make an approach to grass R/W31. Speed noted as higher than normal at flare. A/c touched down & bounced with NLG collapsing on third bounce. With hindsight, pilot believes that he had misread windsock & that there was a tailwind component on R/W31 & that he should have executed a go around in order to reassess the situation & to reposition a/c for an approach to R/W13. Pilots report indicated surface wind was from 060-090deg at 8-10kt, met office aftercast reported surface wind was from 200deg at 15kt. See AAIB Bulletin 5/98, ref: EW/G98/02/03.			

Specific Type of Training Related Issue: Recency (In General)

The pilot had only flown two hours in the past 90 days, of which only 1 hour in the past 28 days. Flying this infrequently will often mean a pilot's skill is not as high as if he had been flying more often. A fundamental part of flying, joining a circuit and making a landing, can become difficult if the pilot has not practised recently. This phase of flight requires the pilot to combine many different techniques in a short period of time.

If the pilot is not used to this high workload, he may have little spare mental capacity to consider aspects like the wind direction and strength. The pilot may have lacked the mental capacity to consider a go around having struggled to maintain the correct height and speed during the approach and flare. Certainly the pilot having not accumulated many flying hours recently would have contributed to the accident.

Aircraft:			
Class:	Aeroplane	**Type:**	Robin DR400-140B
Engine:	Single piston aeroplane		
Flight:			
Nature of Flight:	Private	**Flight Phase:**	Landing
Pilot:			
Licence:	PPL	**Ratings:**	
Total Hours:	122	**Hours on Type:**	102
Previous 90 Days:	3	**Previous 28 Days:**	1
Description:			

UK Reportable Accident: Aircraft moved forward on start up following refuel and struck a parked MS Rallye. Damage to both aircraft. No injuries reported. AAIB AARF investigation.

The aircraft was parked beside the fuel pumps when the engine was started. The aircraft rolled forwards and accelerated in a straight line towards a parked Rallye aircraft. The Robin's nose hit the engine cowling of the Rallye at a 90 deg angle. During the impact, the engine frame of the Robin collapsed and the propeller on the Rallye was sheared off its crankshaft. There were no injuries to a passenger seated in the Rallye or its pilot, who was kneeling on the left wing. The Robin's engine stopped during the collision but its cockpit canopy was jammed. The pilot was freed when the canopy was removed with a crowbar and crash axe. The Robin was equipped with a central, hand-operated brake lever and no toe brakes. Before engine start, the pilot had omitted to check that the wheel-brakes had been applied; it was later found that they had not been. Moreover, the throttle was set at a higher than normal power setting for an engine start. The pilot reported that when the aircraft accelerated, he panicked and applied pressure to both rudder pedals in an effort to stop. It seems probable that he also omitted to close the throttle. See AAIB Bulletin 5/2002, ref: EW/G2002/04/02.

Specific Type of Training Related Issue: Recency (On Type)

The pilot's only flight during the past 28 days had been on a Cessna 152. The pilot had not flown the Robin DR400 for over 28 days.

The brakes on the Cessna 152 are operated by pressing on foot pedals located at the top tips of the rudder pedals. Pulling a lever by hand operates the brakes on the Robin aircraft. The pilot had not flown on this type of aircraft recently and "reverted back to type", adopting procedures used in the Cessna.

4 Analysis of Results

4.1 Overview

In this section the use of the word 'occurrence' refers only to serious incidents and accidents.

Year Group	Occurrences	%
1997/8	432	52
2002/3	392	48
Total	**824**	

Table 4.1 All Occurrences

The data extracted from the MOR database to form the dataset for this study contained 824 occurrences - see Table 4.1. Of those, approximately a quarter involved a training related issue for both year groups - see Table 4.2.

% All - in the following tables this refers to the number of occurrences expressed as a percentage of all occurrences, e.g. the number of occurrences that involve a training related issue expressed as a percentage of all occurrences.

Year Group	Occurrences	% All
1997/8	110	25
2002/3	105	27

Table 4.2 All Occurrences Involving a Training Related Issue

Once exclusions had been applied, as described in section 3.1.1, the numbers of occurrences were reduced, since not all were relevant to the study - see Table 4.3.

Year Group	Occurrences	% All
1997/8	85	20
2002/3	82	21

Table 4.3 Occurrences Involving a Training Related Issue with Exclusions Applied

Year Group	Fatal Occurrences	% All
1997/8	7	1.6
2002/9	2	0.5

Table 4.4 Number of Occurrences Involving a Person on Board Suffering a Fatal Injury

Table 4.4 shows the number of occurrences with at least one fatality, involving a training related issue, represents a small proportion of all occurrences. Of the total 824 occurrences contained in the dataset, 40 involved a fatal injury to a person on board the aircraft (4.9%).

4.2 Complex Aircraft

The following section makes a comparison between aircraft considered complex and those that are not, since the proportion of those occurrences involving complex aircraft is of interest. LASORS defines a complex aircraft as one having more than four seats, retractable undercarriage and a variable pitch propeller.

% TRI - This refers to the number of occurrences expressed as a percentage of all occurrences with a training related issue.

Year Group	Complex	%TRI	Non Complex	%TRI	Total
1997/8	7	8	78	92	85
2002/3	9	11	73	89	82
Total	16	10% of Total	151	90% of Total	167

Table 4.5 Occurrences involving a TRI by aircraft complexity

In each year group, an additional aircraft has been added to the complex category that does not meet the LASORS definition. In the 1997/8 group a Cessna 501 Citation I has been included, and in the 2002/3 group an Aero Vodochody L-39C Albatros has been included. They fail to meet the LASORS definition since they are turbine powered - and will obviously not have a variable pitch propeller; nevertheless they are certainly complex aircraft.

Table 4.5 shows that for both year groups the numbers of occurrences (involving 'complex' aircraft) with training related issues form approximately 10% of all occurrences. There has been no significant change in the proportion of occurrences on complex aeroplanes after the introduction of JAR-FCL.

4.3 Occurrence Categories

Figure 4.6 contains occurrences that have been grouped by an occurrence category. The International Civil Aviation Organization (ICAO) and the Commercial Aviation Safety Team (CAST) joined together to form the CAST/ICAO Common Taxonomy Team (CICTT). The CICTT have developed occurrence categories[6], aiming to "improve the aviation community's capacity to focus on common safety issues". These categories have been applied to training related occurrences with the intention of identifying common consequences. It should be noted that these consequences are not mutually exclusive. The full list of occurrence categories can be found in Appendix 5.

A Controlled Flight into Terrain (CFIT) and Loss of Control (LoC) - In Flight both have the same end result: a collision with some form of terrain. Therefore, the *Collision with Terrain Category (CWT)*, used below, may seem repetitive or unnecessary.

However, CICTT use CWT in conjunction with LoC - historically this categorisation has been followed. Furthermore if there is little detail regarding an accident, and it is not known whether the aircraft was under control when it collided with terrain, the accident will be solely categorised as CWT.

6. CICTT, 2005. *CICTT Occurrence Category Definitions v4.1.2 November 2005*. Unpublished.

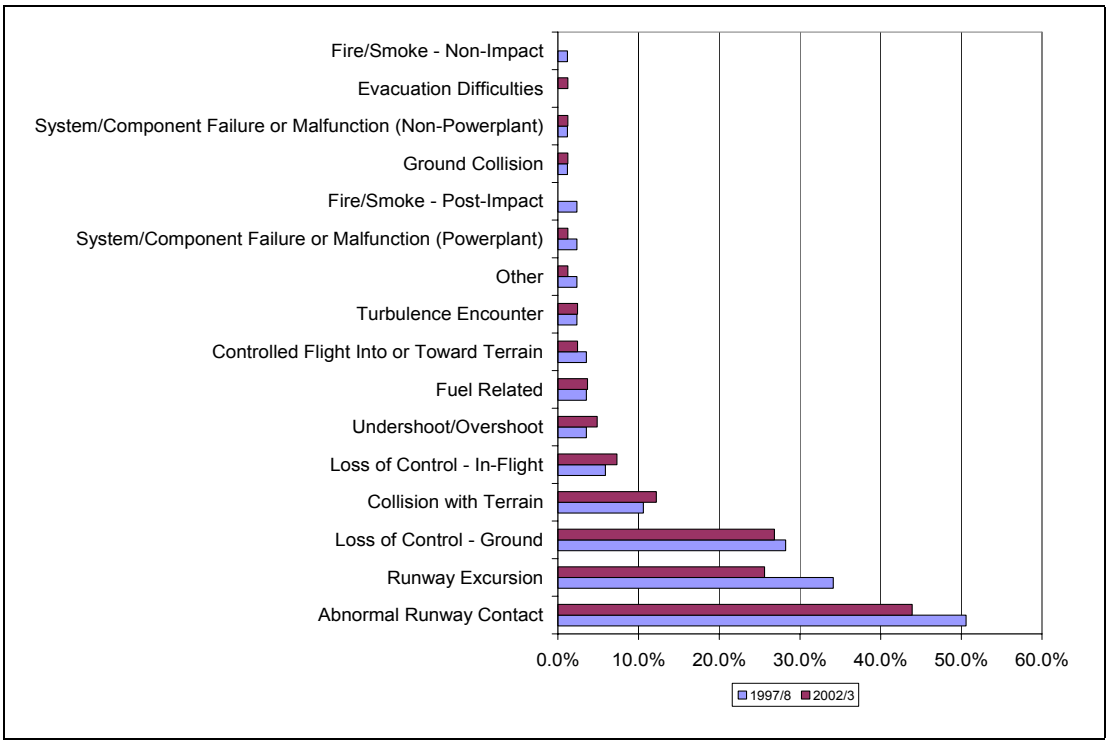

Figure 4.7 Occurrence Categories

The most frequent consequences of the occurrences before and after the introduction of JAR-FCL are unchanged; the top three consequences in ranked order are the same for both before and after 1999.

These three consequences take place in close vicinity of the ground and are discussed more extensively below.

The most frequent consequence for both year groups is an abnormal runway contact: 1997/8 - 50.6%, 2002/3 - 43.9%. This term describes a wide variety of outcomes; these are illustrated in Figure 4.7.

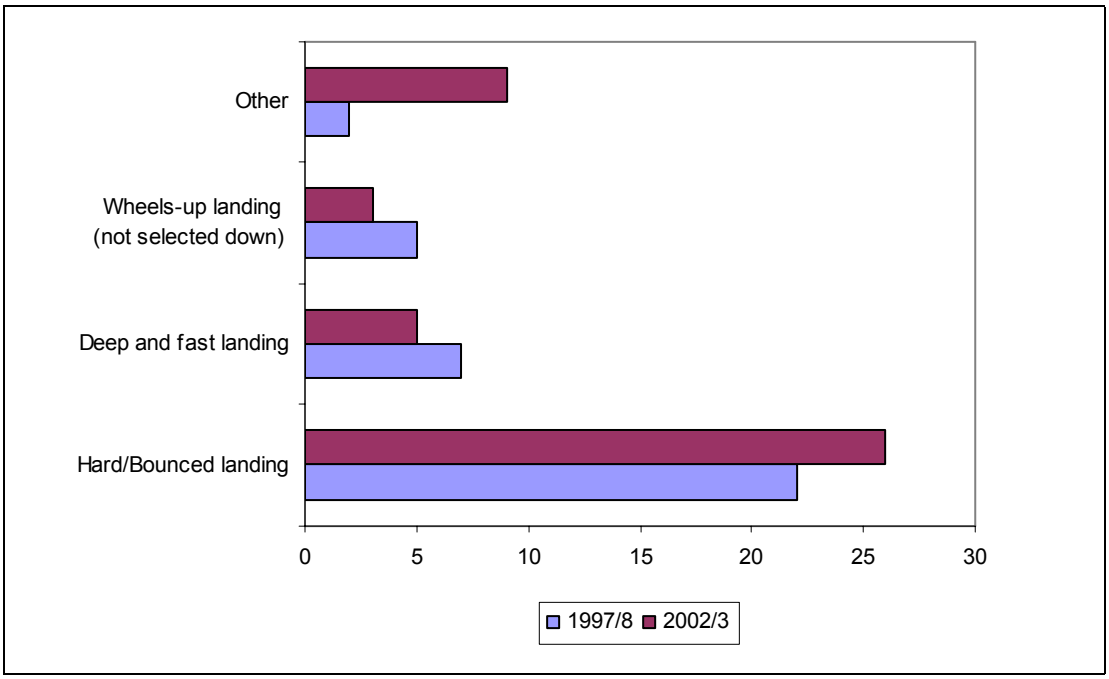

Figure 4.7 Abnormal Runway Contacts

The 'Other' category includes: Wing-strike on landing [4%], Gear collapsed during landing roll (inadvertent retraction) [3%], Crabbed landing [1%], Gear collapsed during landing roll (not locked down) [1%], Nose-wheel landing [1%] and Tail-strike on take-off [1%].

The second most common outcome were runway excursions: 1997/8 - 34.1%, 2002/3 - 25.6%. See Figure 4.8 for a breakdown of when and where the excursions took place.

End - Aircraft ran off the end of the runway T/O - Take-off

Side - Aircraft ran off the side of the runway

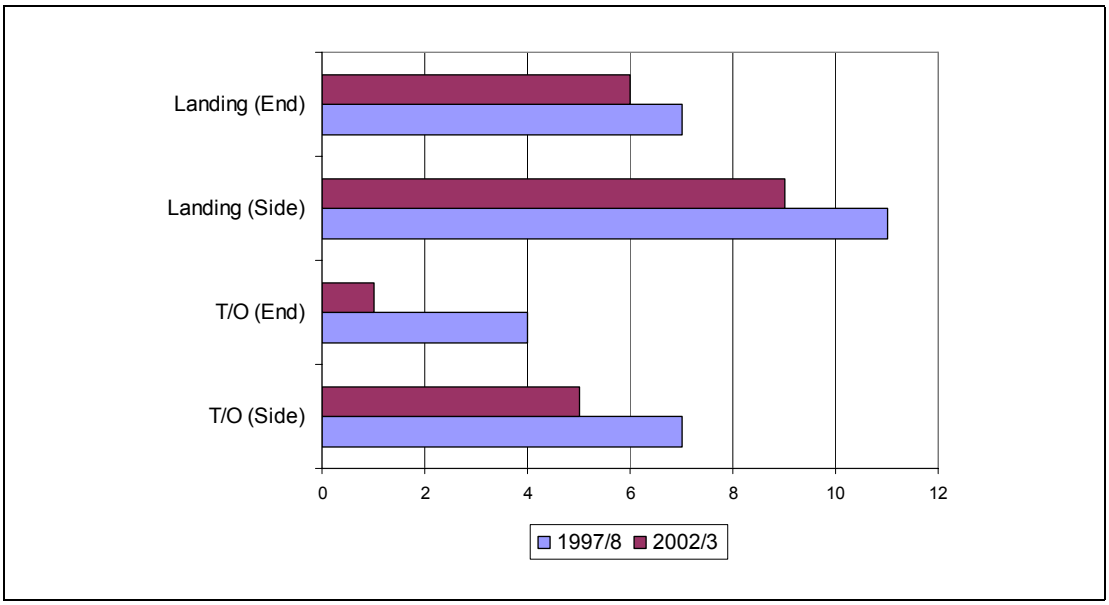

Figure 4.8 Runway Excursions

The third most common occurrence outcome was a loss of control on the ground: 1997/8 - 28.2%, 2002/3 - 26.8%. See Figure 4.9 for a breakdown of when the loss of control occurred.

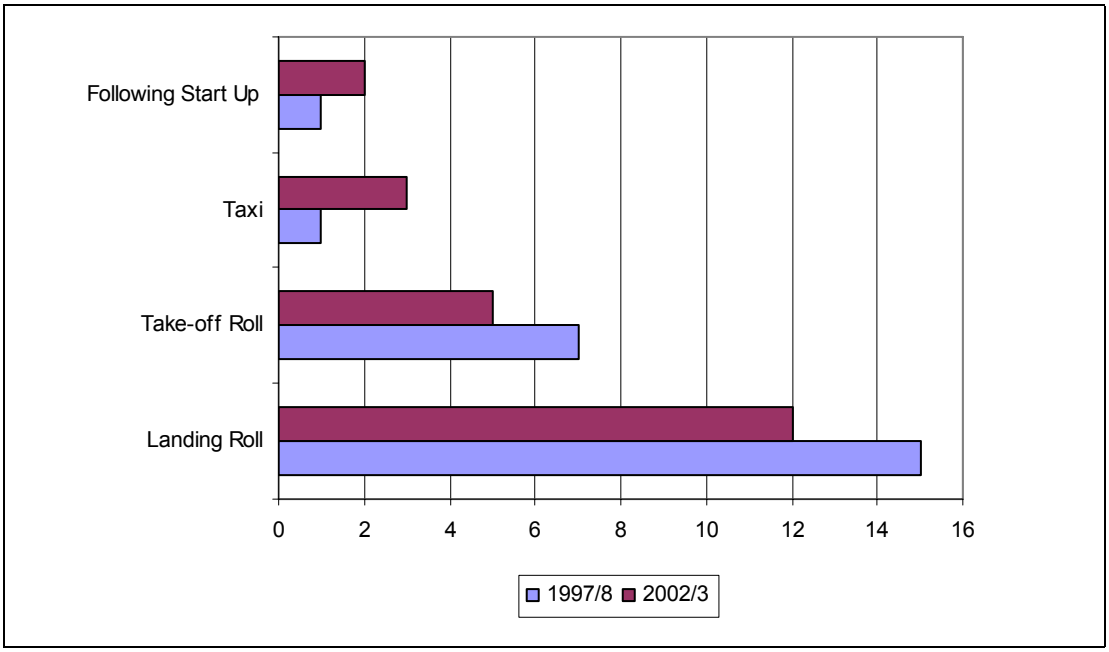

Figure 4.7 Loss of Control on the Ground

The following table utilises the CICTT occurrence categories in Appendix 5, but applied only to the fatal accidents contained in the dataset. Again, occurrence categories are not mutually exclusive.

Occurrence Category	1997/8	2002/3
CFIT	3	1
Collision with terrain/obstacles	4	0
Fire Post Impact	1	0
Fuel Related	1	0
LoC in Flight	4	0
Other	0	1
Runway Excursion	0	1
System Failure	0	1
Number of Fatal Accidents	7	2

Table 4.10 CCIT occurrence categories - Fatal Accidents

Table 4.10 shows the top three occurrence outcomes for all occurrences (abnormal runway contact, runway excursion and loss of control on the ground) are not the same for fatal accidents - there was only one fatal accident with one of these outcomes (a runway excursion).

4.4 Breakdown of Occurrence Data

Occurrences that involve training related issues clearly form a significant percentage of all occurrences (Table 4.3). The number of occurrences is almost the same, before (85) and after (82) 1999, when JAR-FCL was introduced. However, it is not yet possible to draw conclusion as to whether the introduction of JAR-FCL has had an effect on GA serious incidents and accidents. A more thorough analysis will follow looking at each of the individual training related issues.

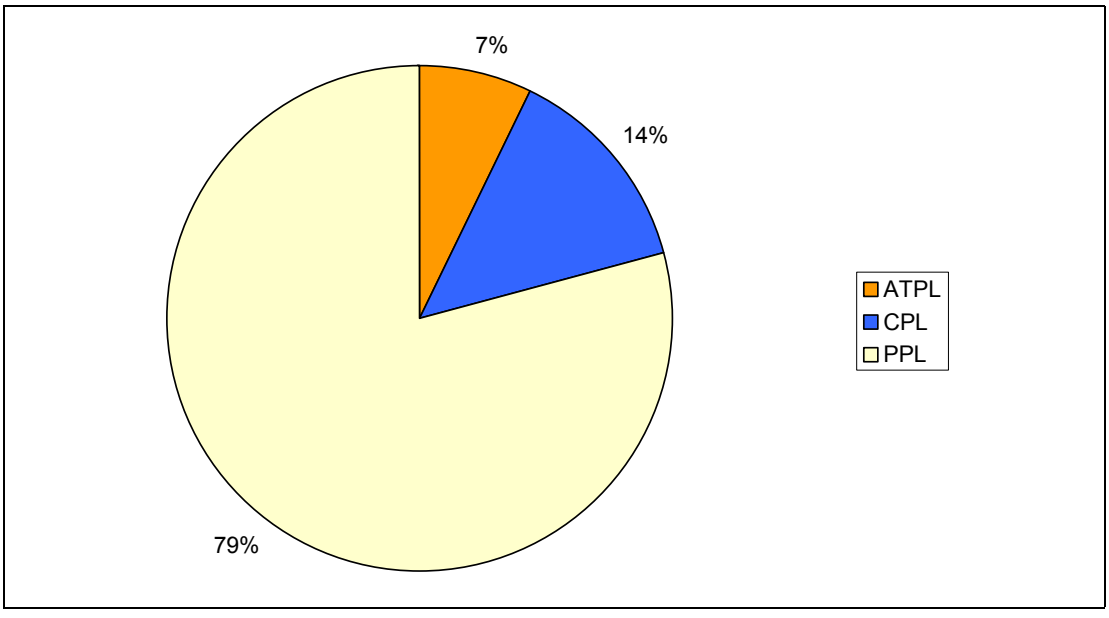

Figure 4.11 All Occurrences Involving Training Related Issues by PICs licence

Figure 4.11 shows that the ratio of private pilot licence holders to professional (CPL + ATLP) licence holders acting as PIC in a serious incident or accident is approximately 4:1.

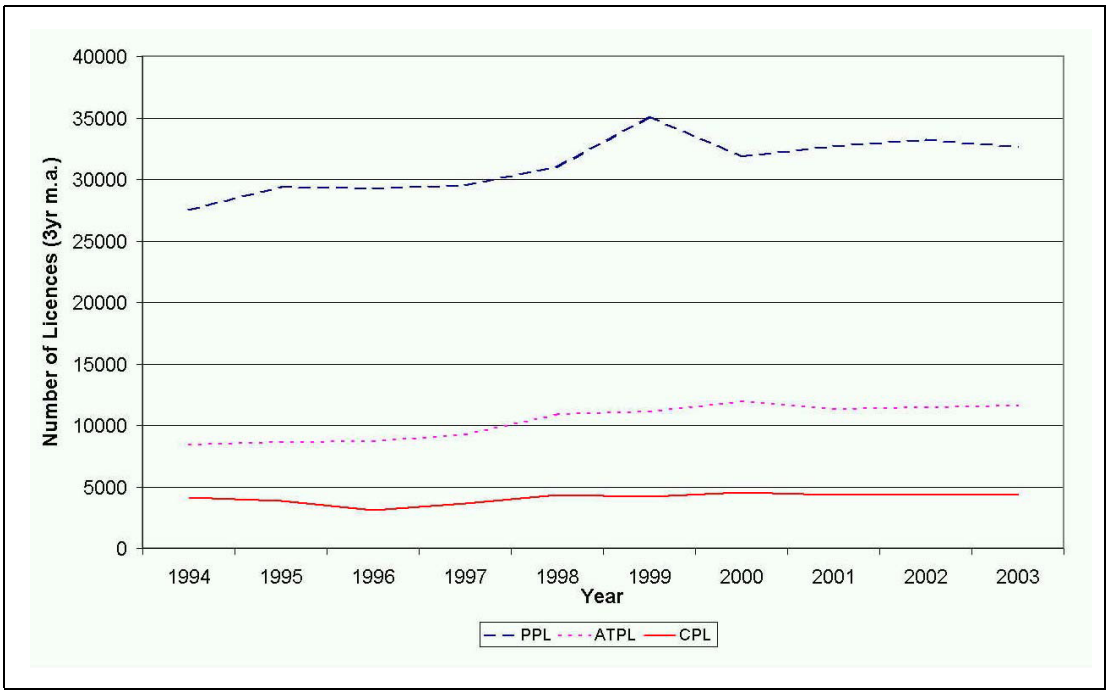

Figure 4.12 Number of Licence holders in the UK, by type

The number of valid licences in the UK is displayed in Figure 4.12. The ratio of Private to Professional licences is approximately 2:1.

It is justifiable to conclude that the majority of occurrences in this study involve pilots holding private licences, although it is not possible to calculate the actual number of hours flown on GA aircraft for each licence holder type - the proportion of professional licence holders that do not fly GA aircraft is unknown. Again, it is not possible to calculate this from data available.

The following tables (Tables 4.13 to 4.18) show that this argument is true for both year groups. There had been no significant changes in the proportions of licence holders involved in occurrences, although in 2002/3 the proportion of all training related issues involving CPL holders increased by 6% and those involving PPL holders decreased by 10% - see Tables 4.14 and 4.15 respectively.

ATPL			
Year Group	**Occurrences**	**% TRI**	**% All**
1997/8	5	6	1
2002/3	7	9	2

Table 4.13 Occurrences Involving a Training Related Issue with an ATPL holder as PIC

CPL			
Year Group	**Occurrences**	**% TRI**	**% All**
1997/8	9	11	2
2002/3	14	17	4

Table 4.14 Occurrences Involving a Training Related Issue with a CPL holder as PIC

PPL			
Year Group	**Occurrences**	**% TRI**	**% All**
1997/8	71	84	16
2002/3	61	74	16

Table 4.15 Occurrences Involving a Training Related Issue with a PPL holder as PIC

Year Group	ATPL	CPL	PPL	Total
1997/8	3	7	66	**76**
2002/3	4	11	53	**68**

Table 4.16 Occurrences Involving Training Related Issues on SEP aircraft by PIC's Licence (excluding SLMGs and Microlights)

Year Group	ATPL	CPL	PPL	Total
1997/8	0	1	2	**3**
2002/3	2	3	0	**5**

Table 4.17 Occurrences Involving Training Related Issues on MEP aircraft by PIC's Licence

Year Group	ATPL	CPL	PPL	Total
1997/8	2	1	2	**5**
2002/3	1	0	8	**9**

Table 4.18 Occurrences Involving Training Related Issues on aircraft with 'other' engine types by PIC's Licences

'Other' includes the following: Single piston SLMGs, Twin turbofan aeroplanes, Single piston microlights and Single turbofan aeroplanes.

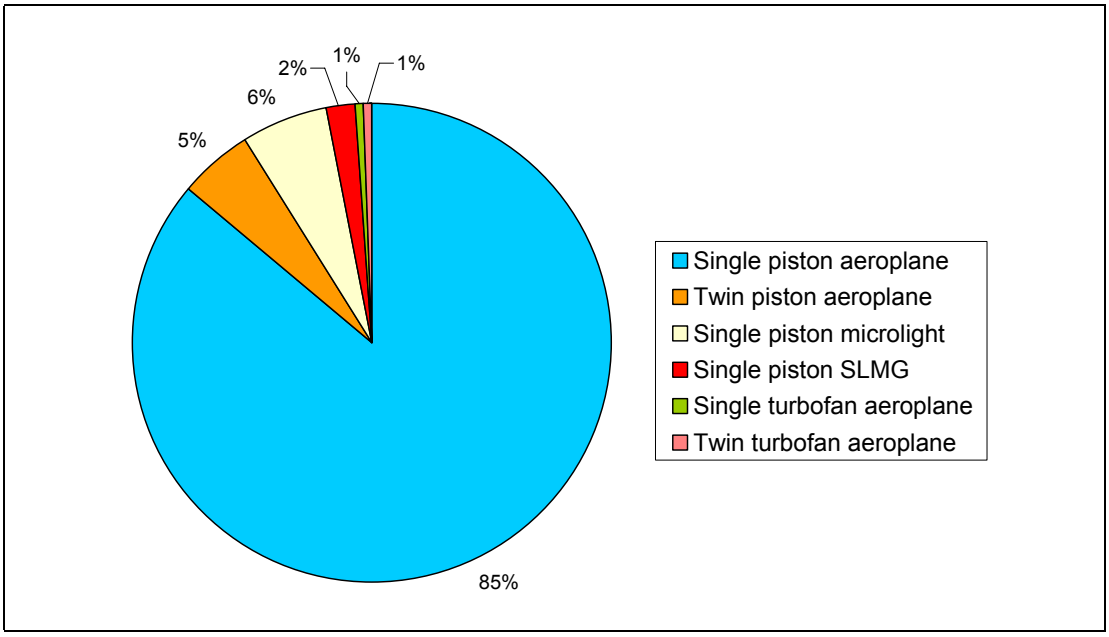

Figure 4.19 All Occurrences Involving Training Related Issues by Engine and Aircraft Type

Year Group	Occurrences	Aircraft/Engine Type
1997/8	76	Single piston aeroplane
	3	Single piston microlight
	2	Single piston SLMG
	3	Twin piston aeroplane
	1	Twin turbofan aeroplane
	85	**Total**
2002/3	68	Single piston aeroplane
	7	Single piston microlight
	1	Single piston SLMG
	1	Twin piston aeroplane
	5	Twin turbofan aeroplane
	82	**Total**

Table 4.20 All Occurrences Involving Training Related Issues by Engine and Aircraft Type - by year

Since revalidation changes have been different for different class ratings, and hence different aircraft, i.e. SEP or MEP, it is necessary to compare them separately. However, the vast majority of occurrences (Figure 4.19 and Table 4.20) involve Single Engine Piston aircraft. There are so few occurrences involving Multi Engine Piston and other types of aircraft that a comparison cannot be made.

All results presented henceforth are only occurrences involving Single Engine Piston aircraft. It should be noted that the totals of recency, experience and training related occurrences exceed the total number of occurrences since they are not mutually exclusive.

Year Group	Recency	% TRI	% All
1997/8	31	36	7
2002/3	18	22	5

Table 4.21 All Occurrences Involving Training Related Issues - recency

Year Group	Experience	% TRI	% All
1997/8	43	51	10
2002/3	44	54	11

Table 4.22 All Occurrences Involving Training Related Issues - Experience

Year Group	Training	% TRI	% All
1997/8	14	16	3
2002/3	11	13	3

Table 4.23 All Occurrence Involving Training Related Issues - Training

As described in section 2.1.2, utilisation of GA aircraft would be used in order to calculate occurrence rates. This meant occurrence rates, which are a better measure than the number of occurrences, could be compared.

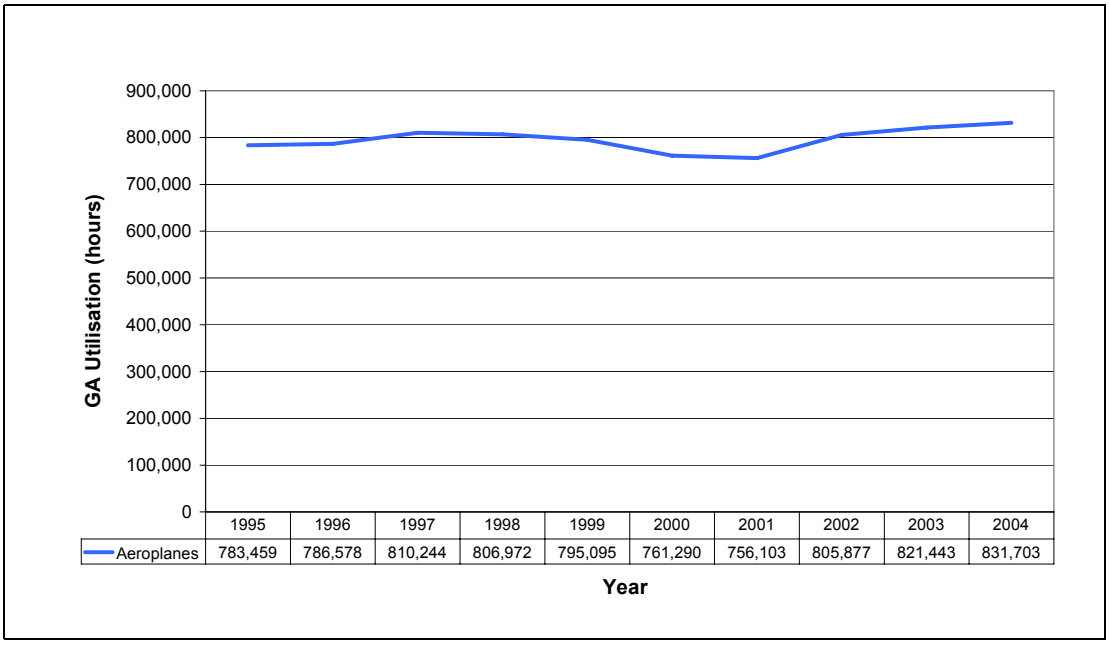

Figure 4.24 GA Utilisation for Aeroplanes 1995 - 2004

Figure 4.24 shows that the utilisation for GA aircraft has neither increased nor decreased significantly over the time period shown. This trend, combined with the fact that the data is somewhat estimated (as previously described the utilisation was calculated using data from two different sources), means a direct comparison of the number of occurrences as apposed to calculating rates of occurrences will make little, if any difference, to the analysis.

Furthermore the utilisation data is for all types of GA aircraft. It would not be valid to calculate rates for SEP GA aircraft using utilisation for all GA aircraft including those with different engine types. The number of occurrences as opposed to occurrence rates will be compared.

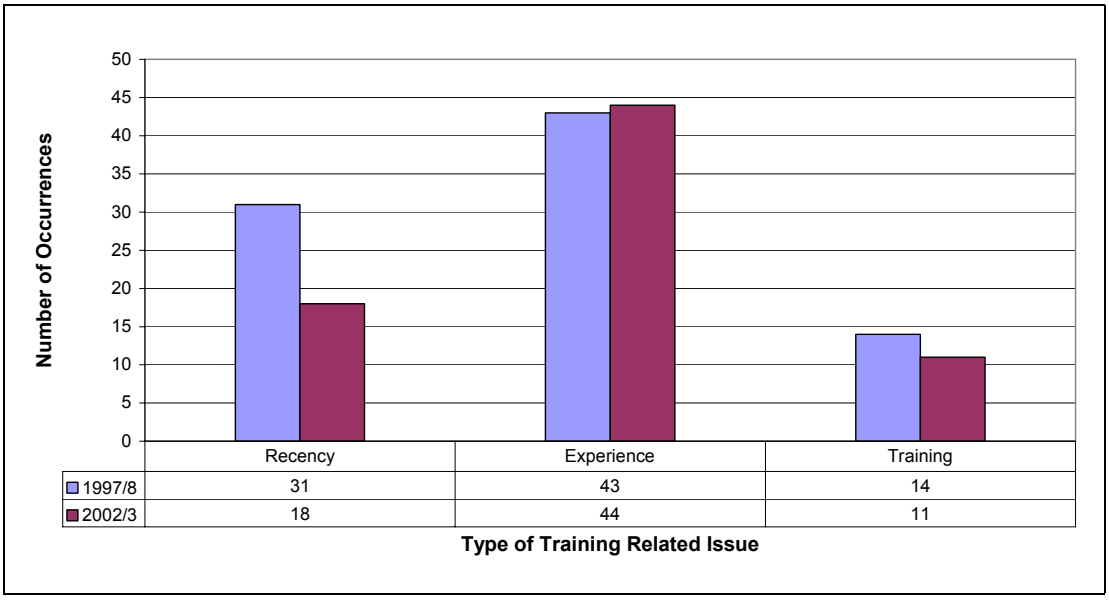

Figure 4.25 All Occurrences Involving Training Related Issues - by category

Figure 4.25 shows that there has been no significant change in the number of occurrences involving training or experience issues.

However, there has been a reduction in the number of recency issues by 42%. This is contrary to the initial hypothesis that the number of recency issues may increase due to the revalidation period for SEP class ratings extending over two years instead of one.

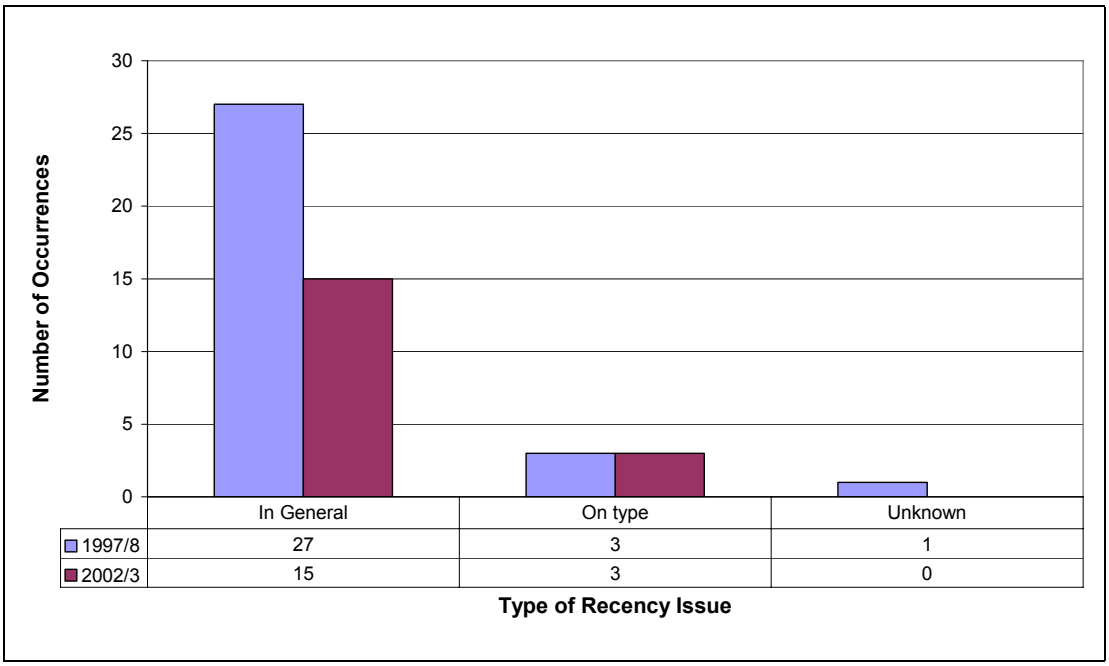

Figure 4.26 All Occurences Involving Training Related Issues - recency

Figure 4.26 shows that the reduction in recency related occurrences are specifically due to the reduction in recency issues 'In General'.

Recency, 'In General', refers to a pilot having accumulated few flying hours on any aircraft type in the past 28 days or even 90 days. Whereas recency on type refers to a pilot having flown few hours on a particular type of aircraft in the previous 28 or 90 days, although they may have accumulated many hours on a different type.

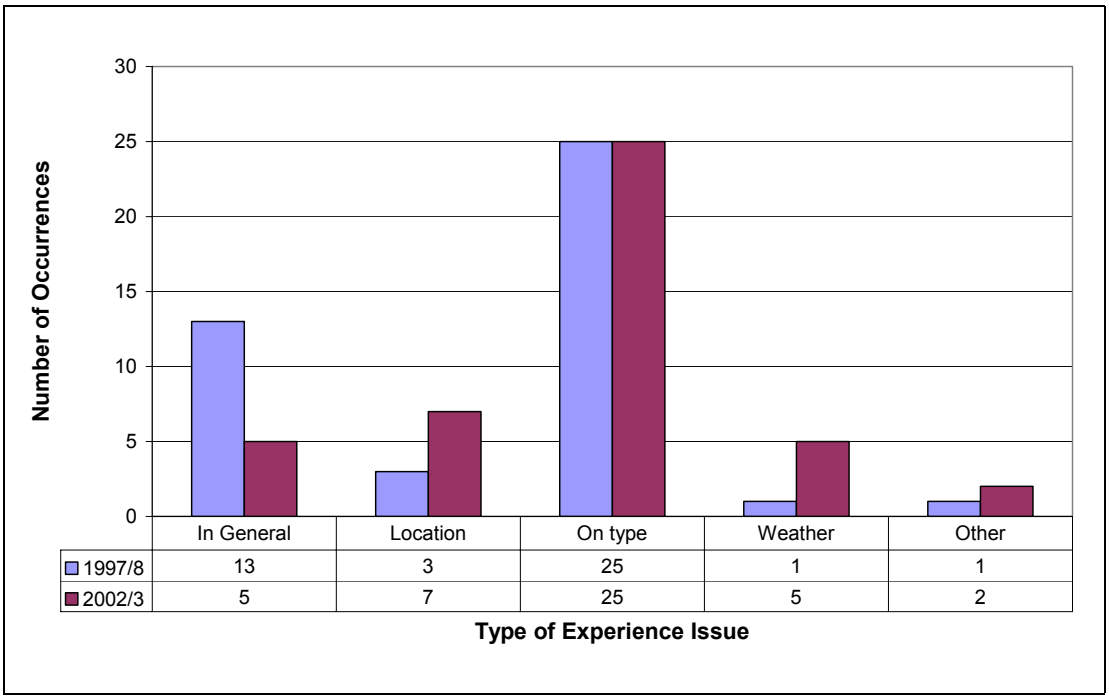

Figure 4.27 All Occurrence Involving Training Related Issues - Experience

Figure 4.27 shows that the total number of experience related occurrences has almost remained the same. However, when the specific types of experience related issues are considered, there have been some minor changes. The number of

experience issues in general have fallen, however, this has been countered by a slight rise in the number of location, weather and other experience issues.

The number of occurrences with an 'experience on type' issue are dominant for each year group. For 1997/8 and 2002/3 they form 29% and 30% of all occurrences with training related issues. A further analysis found that of the 50 occurrences, in total, for both year groups, 22 (44%) of these occurrences involved tail wheel aircraft. This does suggest that some occurrences not only take place because pilots are inexperienced on particular types of aircraft, but also lack the experience on aircraft with tail wheel configurations.

For pilots outside the school or club environment there is currently no requirement to complete type conversion training for aircraft that are contained within a particular class (e.g. the SEP class), although differences training does aim to provide pilots with the skills to fly more 'complex' aircraft.

However, under JAR-FCL, a pilot that has completed retractable undercarriage and pressurisation differences training with an SEP class rating would be permitted to fly solo in a 'high performance aircraft' (HPA) such as the Glasair III, capable of cruising at 250 kt. The simple (when compared with a more rigorous training regime for type rated aircraft) differences training might fail to fully prepare a pilot to fly such an aircraft, particularly since there is no requirement to fly under supervision before going solo. Furthermore, the Glasair III is not designated an HPA within JAR-FCL - there is not a requirement to complete ATPL level theoretical knowledge exams.

It could be argued that this particular issue could be resolved by the introduction of a type rating for the Glasair III. However, some aircraft that do not even require any differences training exhibit rather different handling qualities: the Piper PA-28 and Cessna 152 have different handling characteristics in the flare, and again there is no requirement for a type conversion in order to fly either type.

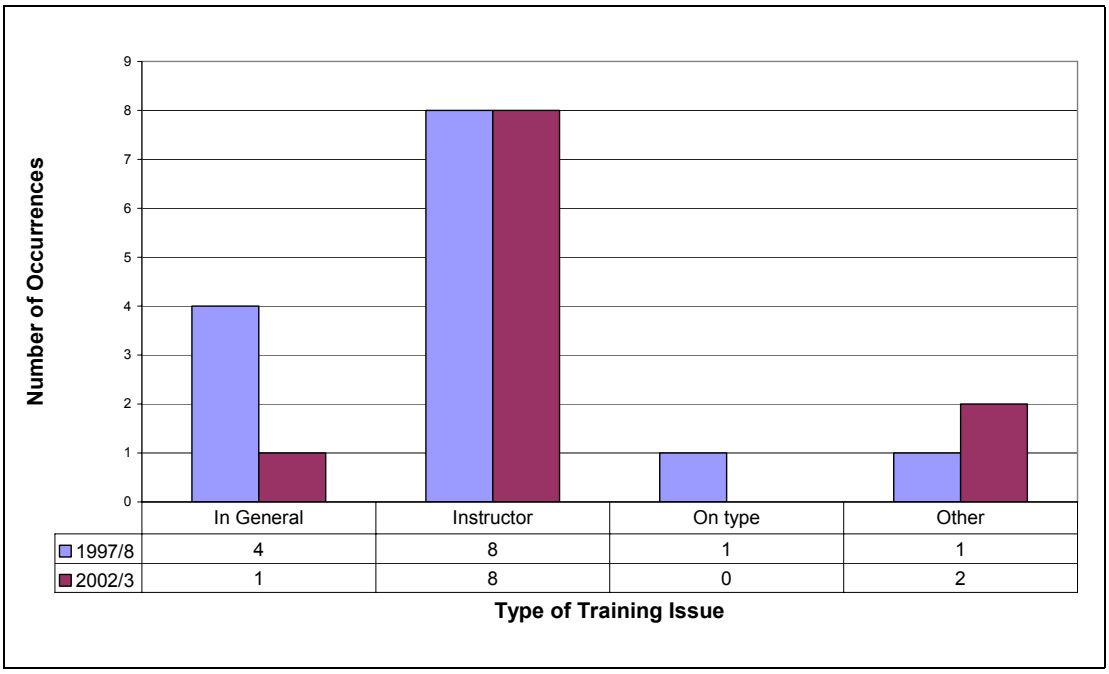

Figure 4.28 All Occurrences Involving Training Related Issues - Training

Figure 4.28 shows that occurrences that have involved actual problems with training are mostly represented by a flight where the instructor has failed to intervene, which led to an accident. These types of occurrences are discussed more extensively in the following section.

Occurrences that have involved a training issue 'In General' are characterised by the pilot mishandling the aircraft, assumed to be due to the quantity or quality of training they have received.

Those occurrences that have involved "other" training issues are characterised by a pilot stating they could not cope with a situation with which they were presented, through a lack of training.

4.5 Instructional Flights

The next section aims to identify whether there has been any variation in the number of occurrences after the introduction of JAR-FCL because of an instructor lacking training, experience or recency.

The following data is where the nature of flight is instructional - the pilot on board is undertaking training to gain a licence or rating they currently do not hold. It should be noted that the occurrences involving training related issues previously tabulated have excluded flights where the pilot undertaking training is a student or does not hold the licence for which they are training.

Also, aircraft of all engine types have been included in this section since the revalidation changes for instructors have been the same for instructing on different types and classes of aeroplane (in the previous section only aircraft with single piston engines were considered).

Year Group	Recency	Experience	Training
1997/8	0	3	9
2002/3	0	2	11

Table 4.29 Instructional Flights with the Instructor and Student on board

Table 4.29 shows there has again been no significant change after the introduction of JAR-FCL, the numbers of occurrences involving experience issues have hardly changed. For both year groups the number of occurrences involving recency issues are zero - this is to be expected since an instructor should certainly be current when instructing a student.

However, the number of occurrences that involve a training issue is of interest since it forms a significant proportion of all the occurrences during instructional flights. The breakdown of the type of training issue is of particular interest.

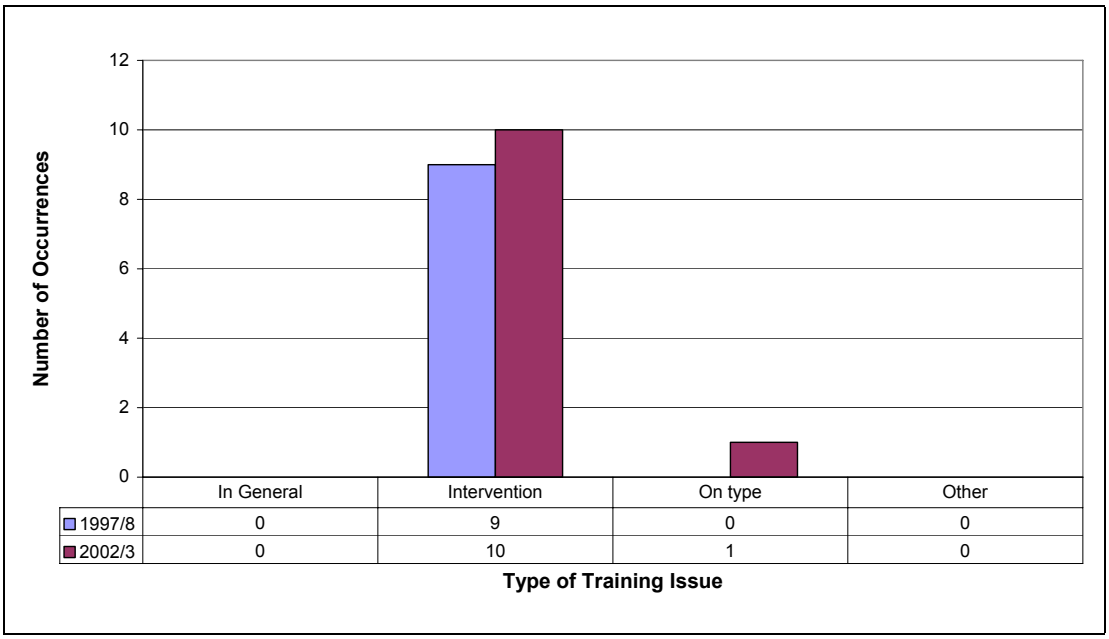

Figure 4.30 All Occurrences Involving Training Related Issues, Instructional Flights - Type of Training Issue

Figure 4.30 illustrates that a large number of occurrences take place as a result of the instructor failing to intervene. Although, again, there has been no significant change after the introduction of JAR-FCL, this is an area that warrants further work.

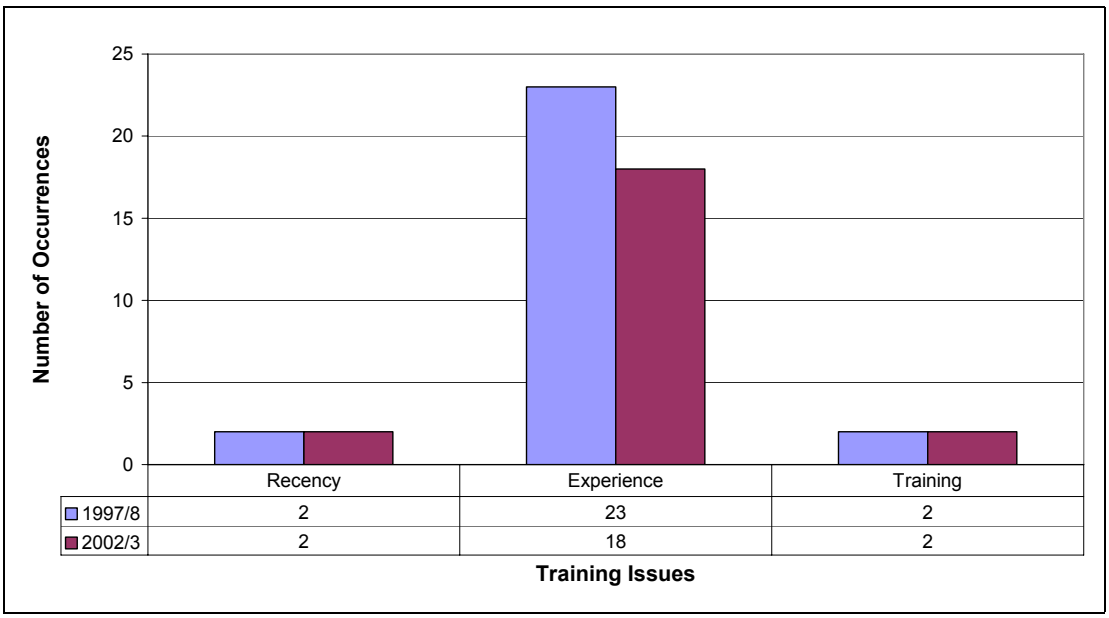

Figure 4.31 Students on solo flights

Figure 4.31 contains occurrences on flights where a student not holding a licence is flying solo without an instructor. As expected, the majority of serious incidents and accidents that occur are merely because the student is an inexperienced pilot.

5 Conclusions

5.1 Conclusion 1

The introduction in 1999 of new revalidation requirements contained within JAR-FCL had no significant effect on the number of serious incidents and accidents involving fixed-wing GA (Single Engine Piston) aircraft for both private pilots and instructors. It is possible that stringent currency requirements imposed on pilots that hire aircraft from flying clubs and the introduction of the biennial flight with an instructor could have offset any potential increase in occurrences associated with the change in the revalidation requirements.

5.2 Conclusion 2

The proportion of all serious incidents and accidents that involved a training related issue remained significant following the introduction of JAR-FCL (20% before and 21% after).

5.3 Conclusion 3

Serious incidents and accidents involving a training related issue on GA aircraft primarily involved Single Engine Piston Aeroplanes both pre and post JAR-FCL. It was not possible to assess the effect of JAR-FCL on Multi Engine Piston aeroplanes, and aircraft with other engine types (for which the extent of revalidation change has been different) because there was not enough data available to make a justifiable comparison.

5.4 Conclusion 4

The number of serious incidents and accidents involving a recency issue reduced by 42% on SEP aircraft. This was primarily due to a decrease in the number of recency issues that specifically involved a lack of recency in general, as opposed to on a particular type of aircraft. The 42% reduction may appear to be a large change, however, when related to all serious incidents and accidents, it only represented a 2% decrease. Furthermore the 42% reduction should be treated with caution since there were few occurrences in this category; the number of occurrences reduced by 13 from 31 to 18.

5.5 Conclusion 5

The number of serious incidents and accidents specifically involving an experience or training issue did not significantly change on SEP aircraft. However, for both year groups a substantial number of occurrences were due to the pilot having little experience on a particular type of aircraft.

5.6 Conclusion 6

A comparison involving the effect of the introduction of the National Private Pilot Licence (NPPL) could not be made since there were no serious incidents or accidents in the dataset where the pilot in command held an NPPL.

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Appendix 1 Members of the Joint Aviation Authorities

The following list of JAA member states only includes those that have received recommendation for mutual recognition having implemented JAR-FCL[7].

Belgium
Croatia
Czech Republic
Denmark
Finland
France
Germany
Greece
Iceland
Italy
Malta
Netherlands
Norway
Poland
Portugal
Romania
Slovenia
Spain
Sweden
Switzerland
Turkey
United Kingdom

7. JAA, 2005. *List of JAA Members: Annex 1* [online]. Available from: www.jaa.nl/introduction/introduction.html [accessed April 2006]

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Appendix 2 Definition of Occurrence Types

Accident (Reportable): An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which:

a) a person suffers a fatal or serious injury as a result of:

- being in or upon the aircraft;
- direct contact with any part of the aircraft, including parts which have become detached from the aircraft;
- direct exposure to jet blast;

except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or

b) the aircraft sustains damage or structural failure which:

- adversely affects the structural strength, performance or flight characteristics of the aircraft; and
- would normally require major repair or replacement of the affected component, except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennae, tyres, brakes, fairings, small dents or puncture holes in the aircraft skin; or

c) the aircraft is missing or is completely inaccessible.

Incident: Means an occurrence, other than an accident, associated with the operation of an aircraft which affects, or would affect, the safety of operation.

Serious Incident: Means an incident involving circumstances indicating that an accident nearly occurred.

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Appendix 3 Definition of Injuries

Fatal injury: An injury which is sustained by a person in a reportable accident which results in death within thirty days of the date of the accident.

Serious injury: An injury which is sustained by a person in an accident and which:

a) requires hospitalisation for more than 48 hours, commencing within seven days from the date the injury was received;

b) results in a fracture of any bone (except simple fractures of fingers, toes or nose);

c) involves lacerations which cause severe haemorrhage, nerve, muscle or tendon damage;

d) involves injury to any internal organ;

e) involves second or third degree burns, or any burns affecting more than 5 per cent of the body surface; or

f) involves verified exposure to infectious substances or harmful radiation.

Minor injury: An injury, other than fatal or serious, which is sustained by a person in a reportable accident.

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Appendix 4 Accident Causal and Contributory Factor Groups

Factor Group/Subgroup	Individual Factor	
F1 Aircraft-Systems	1.1	Failure - affecting controllability
	1.2	Failure - cockpit information
	1.3	Failure - other
	1.4	Aircraft systems fire
	1.5	Non-fitment of presently available safety equipment
	1.6	Failure or inadequacy of safety equipment
F2 Aircraft-Propulsion	2.1	Engine failure or malfunction
	2.2	Propeller failure
	2.3	Damage due to non-containment
	2.4	Engine fire
	2.5	Engine failure simulated
	2.6	Fuel contamination
	2.7	Damage due to detachment
F3 Aircraft-Structure	3.1	Corrosion or fatigue
	3.2	Overload failure
	3.3	Flutter
	3.4	Other structural factor
F4 Aircraft-Design/Production	4.1	Design shortcomings
	4.2	Unapproved modification
	4.3	Manufacturing defect
	4.4	Aircraft handling characteristics
F5 Aircraft-Performance	5.1	Unable to achieve scheduled performance
	5.2	Aircraft becomes uncontrollable
F6 Aircraft-Other	6.1	Component failure or wear
	6.2	Fire - other cause
	6.3	Other aircraft factor

Factor Group/Subgroup	Individual Factor	
F7 ATS/Ground aids	7.1	Lack of appropriate ATS
	7.2	Incorrect or inadequate instruction
	7.3	Misunderstood/missed/inappropriate communication
	7.4	Failure to provide separation - in air
	7.5	Failure to provide separation - on ground
	7.6	Lack of ground aids
	7.7	Ground aid malfunction
	7.8	Other ATS/ground aids factor
	7.9	Non-fitment of presently available ATC safety equipment
	7.10	Non-precision approach flown
F8 Flight crew	8.1	Lack of positional awareness - in air
	8.2	Lack of positional awareness - on ground
	8.3	Incorrect selection on instrument or navaid
	8.4	Action on wrong control or instrument
	8.5	Omission of action or inappropriate action
	8.6	Press-on-itis
	8.7	Poor judgement or airmanship
	8.8	Inadequate pre-flight preparation
	8.9	Disorientation
	8.10	Fatigue in crew
	8.11	State of mind
	8.12	Interaction with automation
	8.13	Fast and/or high on approach
	8.14	Slow and/or low on approach
	8.15	Loading incorrect
	8.16	Flight handling
	8.17	Lack of training, currency and/or experience
	8.18	Training inadequate
	8.19	Medical factors
	8.20	Failure in look-out
	8.21	Distraction
	8.22	Deliberate non-adherence to procedures
	8.23	Pilot induced stall

Factor Group/Subgroup	Individual Factor	
F8 Flight crew (cont.)	8.24	High workload
	8.25	Poor cockpit resource management
	8.26	External pressure
	8.27	Inability to assimilate radio calls
	8.28	Inadequate instructor intervention
	8.29	Other pilot factor
	8.30	Lack of awareness of circumstances in flight
F9 Environmental	9.1	Poor weather
	9.2	Poor visibility
	9.3	Turbulence
	9.4	Wake turbulence
	9.5	Icing - induction system
	9.6	Icing - other
	9.7	Lightning
	9.8	Birds
	9.9	Runway or taxiway condition
	9.10	Wind
	9.11	Other environmental factor
	9.12	Volcanic ash, sand, precipitation, etc.
	9.13	Runway condition unknown to the crew
F10 Infrastructure	10.1	Incorrect or inadequate information to pilots
	10.2	Inadequate aerodrome support
	10.3	Inadequate aerodrome design or location
	10.4	Incorrect or inadequate procedures
	10.5	Inadequate regulation
	10.6	Inadequate regulatory oversight
	10.7	Other infrastructure factor
	10.8	Company management failure
	10.9	Commercial pressure

Factor Group/Subgroup	Individual Factor	
F11 Maintenance	11.1	Failure to carry-out required maintenance
	11.2	Maintenance error, oversight or inadequacy
	11.3	Bogus parts
	11.4	Other maintenance factor
	11.5	Fatigue in engineer
	11.6	Airworthiness management
F12 Other	12.1	Caused by other aircraft/vehicle/person
	12.2	Post crash fire
	12.3	Low fuel state
	12.4	Carriage of dangerous goods
	12.5	Non-safety related restrictions
	12.6	Any other factor
	12.7	Disruptive passenger
	12.8	Non-adherence to cabin safety procedures
	12.9	Unsafe action by other personnel
F13 Ground handling	13.1	Lack of awareness by ground staff
	13.2	Loading error
	13.3	Unsupervised passengers
	13.4	Faulty ground handling equipment
	13.5	Fatigue in ground staff
	13.6	Other ground handling factor

Appendix 5 CICTT Occurrence Categories

- Abnormal Runway Contact
- Runway Excursion
- Loss of Control - Ground
- Collision with Terrain
- Loss of Control - In-Flight
- Undershoot/Overshoot
- Fuel Related
- Controlled Flight Into or Toward Terrain
- Turbulence Encounter
- Other
- System/Component Failure or Malfunction (Powerplant)
- Fire/Smoke - Post-Impact
- Ground Collision
- System/Component Failure or Malfunction (Non-Powerplant)
- Evacuation Difficulties
- Fire/Smoke - Non-Impact
- Abrupt Manoeuvre
- Aerodrome Related
- Airborne Loss of Separation/TCAS/Airprox/Collision
- ATM/CNS Related
- Cabin Safety Events
- Ground Handling Related
- Icing Related
- Low Altitude Operations
- Runway Incursion - Animal
- Runway Incursion - Vehicle/Aircraft/Person
- Security Related
- Unknown
- Windshear or Thunderstorm

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Appendix 6 Pilot Licensing and Revalidation

This study specifically focused on the training, recency and experience aspects of pilots. An excellent indication of how much training a pilot has undertaken and how much experience they have is provided by the licence they hold and any ratings they have endorsed on the licence. In order to gain a specific rating or licence the pilot must fly a minimum amount of hours.

Pilot licensing is an extensive subject, and extremely complicated. The following section aims to summarise the different types of licences that exist, the ratings that may be added to these licences, and the requirements and privileges of both.

Licences and Ratings have a limited period of validity. In order for the pilot to exercise the privileges of the licence and/or ratings they must be revalidated. The revalidation requirements before and after the introduction of JAR-FCL are also reviewed, accompanied by some discussion that attempts to summarise the changes.

1 Licences and Ratings

There are four types of pilots licence:

- NPPL - National Private Pilot Licence (UK only): a licence introduced in 2002 with the intention of allowing access to flying for more people by reducing the training and medical requirements at the expense of certain privileges afforded to regular PPL holders.
- PPL - Private Pilot Licence: a licence held by many pilots who fly for pleasure and enjoyment.
- CPL - Commercial Pilot Licence: This licence is a requirement for individuals wishing to become professional pilots and carry fare paying passengers (commercial public transport)
- ATPL - Airline Transport Pilot Licence: This is the highest level of pilot certification. It allows the licence holder to act as a crew member on an aircraft in service with an airline. It requires considerably more experience than a CPL requires to gain the licence (1500 hours).

The latter three licences are internationally recognised, although there are some minor variations in licences acquired from different regions and countries, e.g. America and Europe. The CPL and ATPL are both professional pilot licences. The following table summaries all the different licences.

1.1 Pilot licence types[8]

Licence	Min. no. of Flying Training Hours	Test Type	Privileges	Other Notes	Previous Flying Experience Required	Medical Required
NPPL	32	• Navigation Flight Test • General Skill Test • 7 written exams (same as PPL)	Able to fly as Pilot in Command of the aircraft for which you are qualified in VFR conditions in UK airspace.	Valid in the UK only. No additional ratings may be added to the licence.	None	DVLA Group 1 or Group 2
PPL	45	• Skill Test • Cross Country Flight of no less than 150 NM • 7 written exams	Able to fly as the Pilot in Command of the aircraft for which you are qualified in VFR conditions (in sight of ground).		None	JAR-FCL Class II
CPL	25 (200 hours total experience to gain CPL)	• Skill Test • 7 written exams (unique to CPL)	As PPL, plus ability to act as Pilot in Command on a commercial air transport aircraft.		150 hours and a PPL holder	JAR-FCL Class I
ATPL	1500*	• Skill Test • Written exams	As CPL, plus can fly an aeroplane on a flight for the purpose of public transport even if it is certified for multi-pilot operation only.	*Pilot must accumulate 1500 hours before taking Skill Test.	1500*	JAR-FCL Class I

8. CAA, 2006. *Licensing Administration Standardisation Operating Requirements Safety (LASORS)*. London: The Stationery Office

After gaining a licence, a pilot has the option of adding ratings to their licence to enable them to legally fly in certain conditions or on other aircraft. These ratings are summarised in the following table:

1.2 Licence Ratings

Rating/Qualification	Min. no. of Flying Training Hours	Test Type	Privileges	Other Notes	Previous Flying Experience Required
Instrument Meterological Conditions (IMC)	15	• Skill test • One written exam	Entitle holder to fly: 1 as Pilot in Command of an aeroplane in Class D or E airspace under IFR; 2 out of sight of the surface 3 in any controlled airspace with visibility <3 km under SVFR.	Valid in UK only.	
Instrument Rating (IR)	50	• Skill Test • Written exams	Entitle holder to fly: 1 as IMC 2 as pilot in command or co-pilot of an aeroplane flying in any controlled airspace under IFR.		PPL holder +50 hours experience
Night Qualification	5	• Skill test	Entitle holder of the licence to fly as pilot in command under VFR at night.	Valid in UK and some other countries.	PPL Holder
AOPA Aerobatic Certificate of Competency	5-8	• Flight Competency test	Legally no privileges acquired compared to (N)PPL (see notes).	Not required to fly aerobatics but recommended.	PPL/NPPL Holder

2 Aircraft Classes and Types

2.1 Class Ratings

Aircraft vary massively in complexity and, as a result, require considerably different amounts of training before they can be flown.

Basic aircraft, such as one having a single piston engine, will be included in an aircraft class. The pilot then only has to undertake training on that particular class of aircraft, and once this is completed will obtain a class rating. This allows the pilot to fly any aircraft in that class.

Some further training is required to fly aircraft in the same class that have some minor differences, but these differences are not significant enough to warrant placing the aircraft in a different class. This is known as differences training. Differences training remains valid indefinitely. If a licence expires and the pilot regains the privileges of their licence by meeting the renewal requirements, they will still be qualified to fly aircraft in that class for which they have previously completed differences training.

The four classes are:

- Single Engine Piston aeroplanes (land and sea) [SEP].
- All Touring Motor Gliders - self launching motor gliders [TMG]
- Each manufacturer of a Single Engine Turbo Prop aeroplane (land and sea) [SET]
- All multi-engine piston aeroplanes (land and sea) [MEP]

The following table is an example of an aircraft class: the Single Engine Piston Class of aeroplanes. Contained within it are the minor variations that exist in each class, which require differences training:

Manufacturer	Aeroplanes	Differences Training Required	Licence Endorsement
All Manufacturers	Single-engine piston (land)	No	SEP (Land)
	Single-engine piston (land) with variable pitch propellers (VP)	Yes	
	Single-engine piston (land) with Retractable Undercarriage (RU)	Yes	
	Single-engine piston (land) with Turbo/Super Charged engines (T)	Yes	
	Single-engine piston (land) with Cabin Pressurisation	Yes	
	Single-engine piston (land) with Tail Wheel (TW)	Yes	
	Single-engine piston (sea)	Yes	SEP (Sea)
	Single-engine piston (sea) with variable pitch propellers (VP)	Yes	
	Single-engine piston (sea) with Turbo/Super Charged engines (T)	Yes	
	Single-engine piston (sea) with Cabin Pressurisation	Yes	

2.2 Type Ratings

Once an aircraft reaches a certain level of complexity it is no longer practical to include it within a specific class. These aircraft require the pilot to gain a type rating. Type rated aircraft require the pilot to undertake special training for that particular aircraft before they are able to fly it.

All aircraft with a Maximum Take-off Weight above 5700 kg or turbine-powered are type rated. The only exception to this is aircraft with a MTOW < 5700 kg that are powered by a single turbo-prop engine (turbine) and are operable by a single pilot. These aircraft have their own class for each engine manufacturer.

2.3 Aircraft Class and Type Ratings Summary

Aircraft Rating	Privileges	Other Notes
Class Rating	Entitle the holder to fly any aircraft in the class for which the holder is qualified.	Aircraft slightly more complex (i.e. retractable landing gear, variable pitch propellers) require differences training.
Type Rating	Entitle the holder to fly aircraft for which the holder is type rated.	All aeroplanes with MTOW > 5700 kg or those considered 'complex' require a type rating.

2.4 Revalidation Requirements

The revalidation requirements for pilot licences are extremely complex, and include large amounts of detail, as these requirements are enforceable under UK law through the Air Navigation Order (ANO). For the purpose of this study, unnecessary detail has been removed in order to clarify best the relevant changes.

2.5 Definitions

Revalidation Period/Period of Validity: The period before a rating endorsed on the licence expires (e.g. 2 years for an SEP Class rating). Prior to the introduction of JAR-FCL a rating would be valid if the certificate of test or certificate of experience had not expired. After JAR-FCL was introduced the rating would expire when the certificate of revalidation would expire.

Renewal Period: The period proceeding the revalidation period up to five years after the rating was last re-issued.

Revalidation can only occur when a rating has not expired[9]. If it has expired it will need to be renewed. After the renewal period has passed the licence holder will have to undertake further training and the same tests taken as to initially gain the licence.

9. Bonus Aviation. Licence Revalidations [online]. Available from: www.bonus.flyer.co.uk/ [accessed April 2006]

3 Revalidation Requirements Pre JAR-FCL

3.1 Private Pilots

Licence/Rating	Period of Validity	Revalidate	When	Renew	When
Single engine single pilot class rating (1)	13 months	5 hours of flying experience to include: • 3 hours as Pilot in Command. The remaining time may include: • Pilot in Command under supervision; • Flight time with a Flying Instructor or authorised examiner on a successful test flight; or • Dual flying instruction flown with a Flying Instructor but only if, at the end, the pilot was considered by the FI fit to fly as PIC.	During period of validity	Complete proficiency check	Up to five years after licence issue
Type rating and/or multi engine class rating	13 months	As above. Pilots holding more than one class or type rating may revalidate each rating by flying at least 1 hour as PIC on each group or class.	During period of validity	Complete proficiency check	Up to five years after licence issue

It should be noted that an ATPL or CPL holder is bound by the same revalidation requirements to fly a Single Engine Piston Class aeroplane as a PPL holder.

3.2 Instructors

Licence/Rating	Period of Validity	Revalidate	When	Renew	When
Assistant Flying Instructor (Aeroplane)	13 months	Complete flight and ground tests	During period of validity	Complete flight and ground tests	Up to 13 months after licence expiry
Flying Instructor (Aeroplane)	25 months	Complete flight and ground tests	During period of validity	Complete flight and ground tests	Up to 25 months after licence expiry

4 Revalidation Requirements Post JAR-FCL

4.1 Private Pilots

Licence/Rating	Period of Validity	Revalidate	When	Renew	When
Single engine single pilot class rating (1)	24 months	12 hours of flying experience, to include: • 12 take-offs and landings • One training flight lasting at least one hour with a JAA instructor (signed in logbook) • Six hours as Pilot in Command or • Complete proficiency check*	During second 12 month period Within 3 months prior to licence expiry date	Complete proficiency check	Up to five years after licence issue
Type rating and/ or multi engine class rating (2)	12 months	• Fly 10 route sectors or one route sector with an examiner and • Complete proficiency check	During period of validity Within 3 months prior to licence expiry	Complete one route sector with examiner and any refresher training requirement as determined by the examiner	Up to five years after licence issue
NPPL - Simple Single Engine Aircraft (SSEA)	N/A**	Continuous validation process: have completed 6 hours flying experience, to include: • 4 hours as PIC and • a one hour instructional flight or • complete a general skills test	 Within previous 12 months Within previous 24 months Within previous 24 months	Complete a general checklist Complete any training as deemed necessary by a flight instructor, a general skill test and a navigation skill test	Up to five years after licence issue Up to ten years after licence issue

* See notes on the (1) group in Appendix 6, paragraph 4.2.

** The NPPL does not have a normal revalidation period, since the licence does not have an expiry date. It will continue to be valid for as long as the above requirements are satisfied.

4.2 **Instructors**

Licence/Rating	Period of Validity	Revalidate	When	Renew	When
Flight Instructor (Aeroplane) - restricted and unrestricted	36 months	Complete two of the following: • 100 hours flight instruction including 30 hours within last 12 months • Refresher seminar • Proficiency check	During period of validity Wthin 12 months prior to licence expiry	• Refresher seminar and • Proficiencyy check	Up to five years after licence issue

Included in (1):

- Single Engine Piston [SEP] (class rating)
- Touring Motor Gliders [TMG] (class rating)
- Single pilot Single Engine Turbo prop [same manufacturer SET] (class rating) - *this rating cannot be renewed by experience - it may only be renewed by passing the proficiency check.

Included in (2):

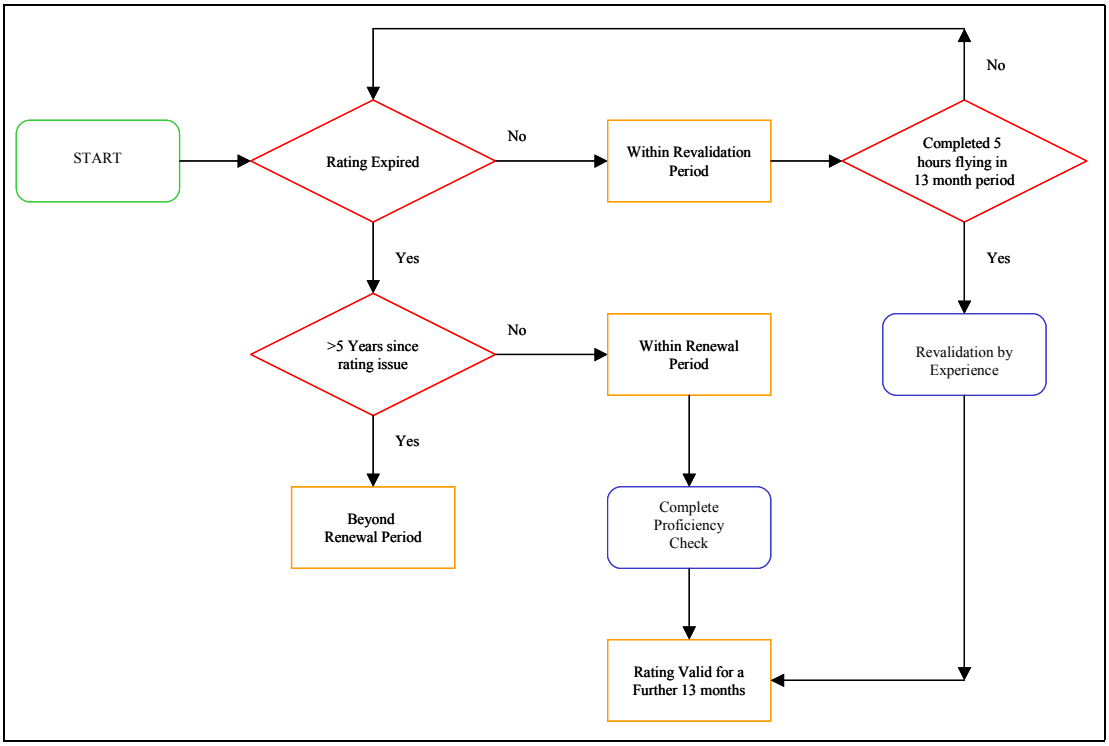
- Single pilot Multi Engine Piston [MEP] (class rating)
- Single pilot Multi Engine Turbo prop and Turbo jet type (type rating)
- Single pilot Single Engine Turbo prop and Turbo jet type (type rating)
- All multi-pilot (multi crew operation) aircraft (type rating)

NOTE: A route sector is defined as a flight comprising a take-off, cruise of not less than 15 minutes, arrival, approach and landing.

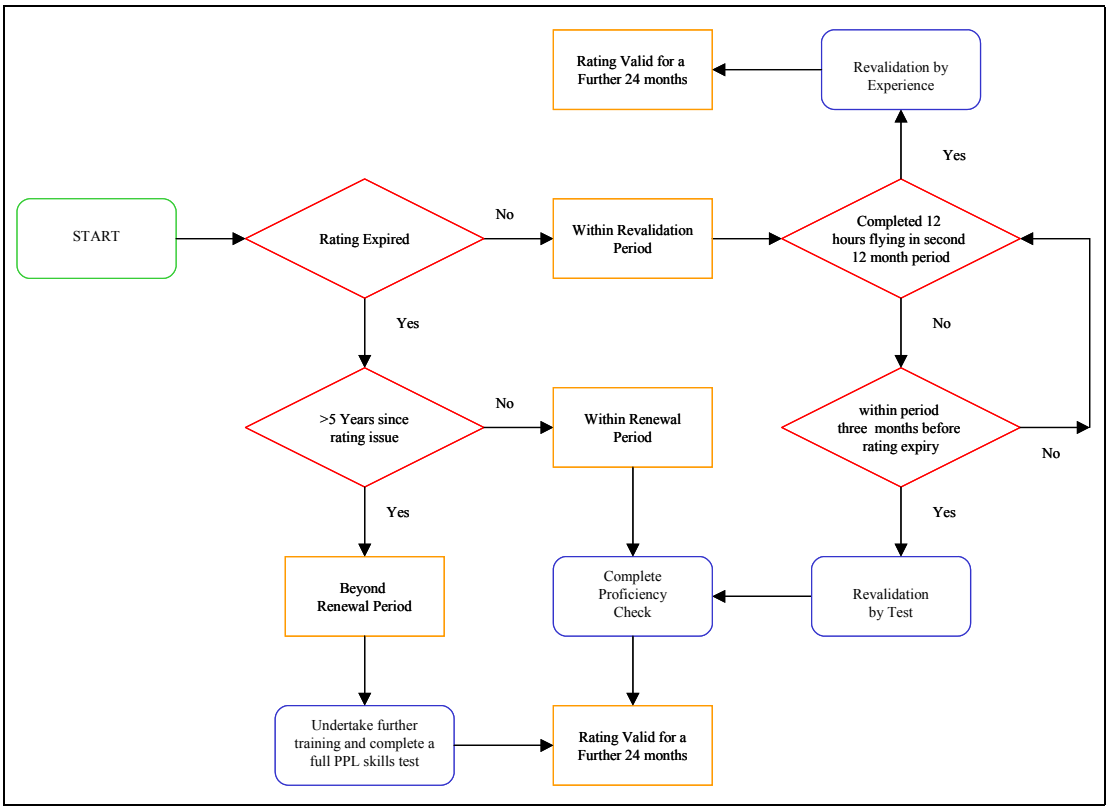
5 Summary of Revalidation Changes

The next few pages contain flows charts that show the steps (simplified) a pilot must take in order to revalidate their licence.

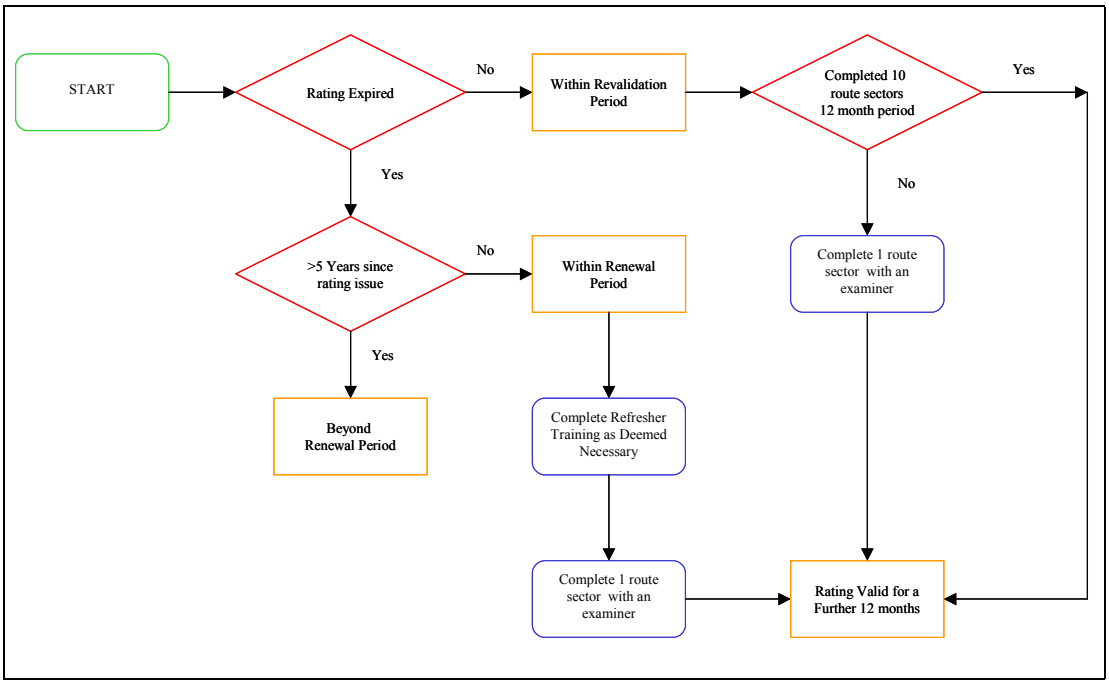
5.1 SEP and MEP Classes and Types Pre JAR-FCL



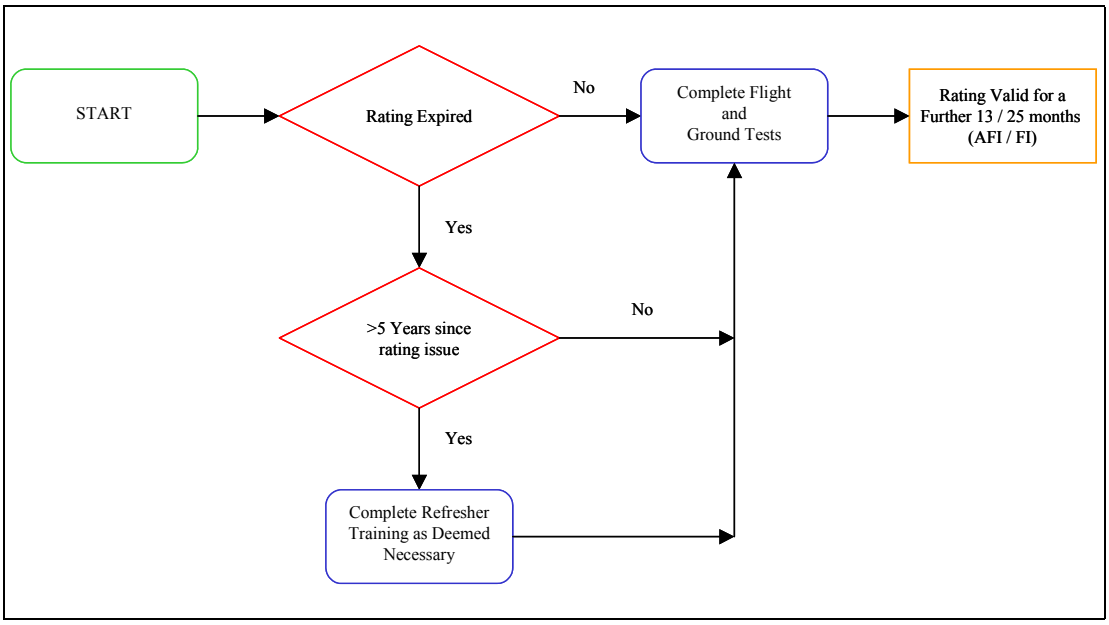
5.2 SEP Post JAR-FCL



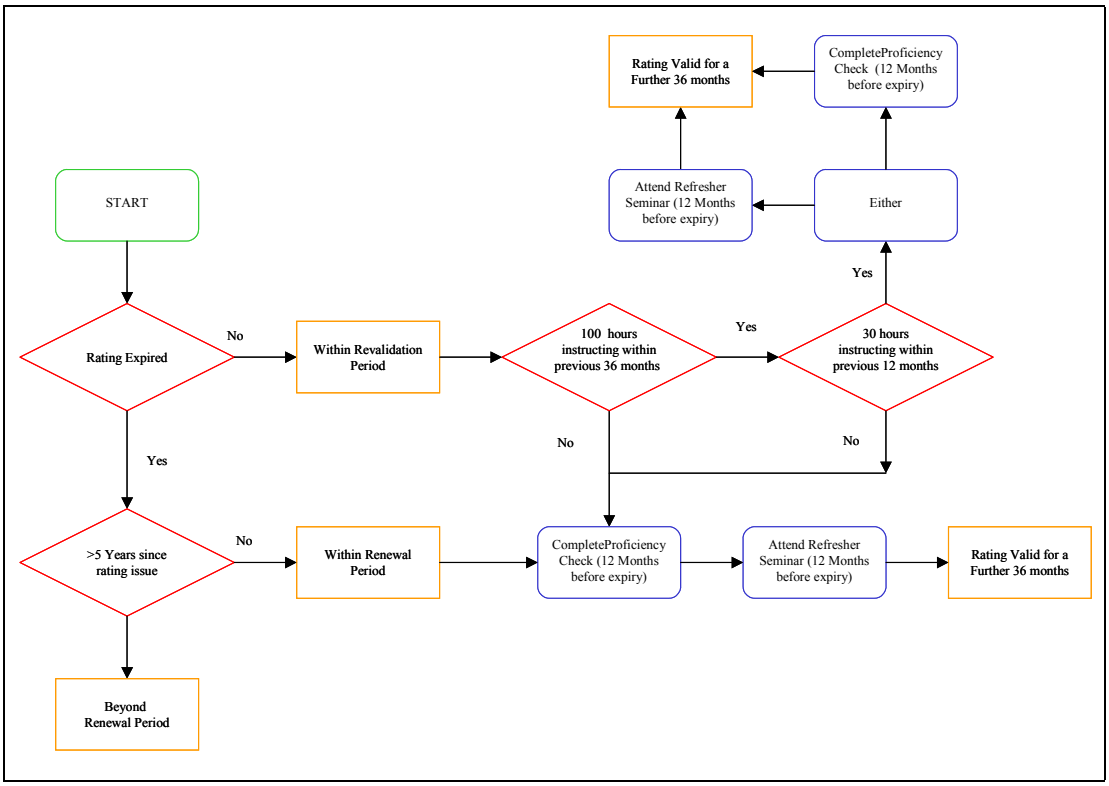
5.3 MEP Post JAR-FCL



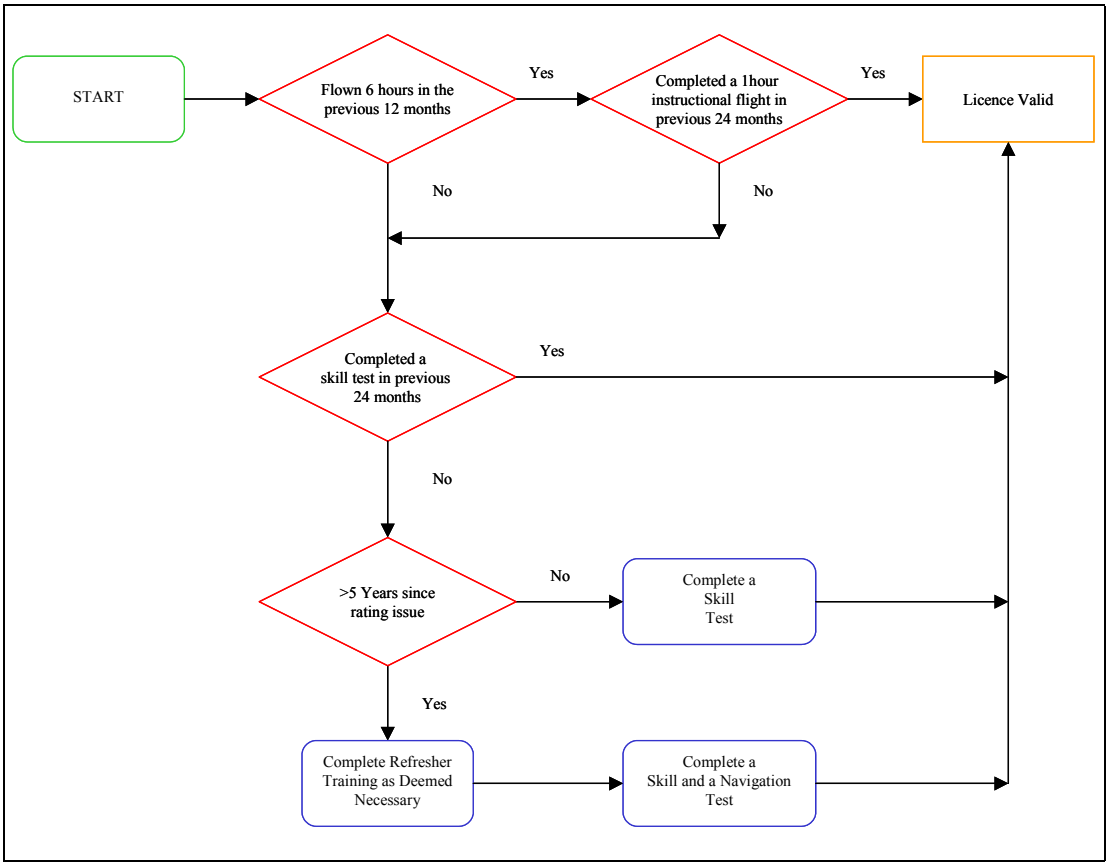
5.4 (Assistant) Flying Instructors Pre JAR-FCL



5.5 Flight and Flight Instructor (Restricted) Post JAR-FCL



5.6 NPPL



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