Introduction

This manual covers the subject *Aeroplane Operation, Performance and Planning*. It has been prepared to meet the requirements set forth in the CASA Manual of Standards (MOS) for both PPL and CPL.

The manual covers the following three subject areas:

- aeroplane performance;
- flight planning; and
- aircraft operations.

In the initial chapters, we give you an introduction to the size of aerodromes (including aeroplane landing areas), and show you how to select the runway you will use for take-off and landing. Following this we explain take-off and landing performance, and show you how to use different types of graphs to determine the maximum weight at which you can operate on the runway selected. We then describe the methods you can use to calculate the fuel needed for your proposed flight, including the climb, cruise and descent.

We then explain how to prepare for a flight. We describe the self-briefing facilities which are available, factors affecting route selection and preparation of your navigation charts, how to prepare the navigation and fuel plans, and the various procedures for submitting notification of your proposed flight. Note that the CASA publishes the minimum final reserve and contingency fuel requirements in the MOS. The following is an extract of *Advisory Circular 91-15* stating these requirements.

Note: Fixed fuel reserve is now termed final fuel reserve, and variable reserve fuel is now termed contingency fuel.

	Aircraft (by aircraft category)*	Kind of flight (by flight rules)	Final reserve fuel flight time	Contingency fuel amount
Item	Column 1	Column 2	Column 3	Column 4
1	Aeroplane with an MTOW of not more than 5 700 kg (piston engine or turboprop)	Day VFR	30 minutes	N/A
2		Night VFR	45 minutes	N/A
3		IFR	45 minutes	N/A
4	Turbojet aeroplane or aeroplane with an MTOW of more than 5 700 kg (turboprop)	IFR or VFR	30 minutes	5% of trip fuel
5	Aeroplane with an MTOW of more than 5 700 kg (piston engine)	IFR or VFR	45 minutes	5% of trip fuel
6	Rotorcraft	VFR	20 minutes	N/A
7	Rotorcraft	Night VFR	30 minutes	N/A
8	Rotorcraft	IFR	30 minutes	N/A

* The defined terms '*small aeroplane'* and '*large aeroplane'* appeared in the initial versions of the Part 91 MOS and the Plain English Guide and have historically referred to aeroplanes below and above the 5 700 kg MTOW limit. To avoid potential confusion with the new terms, '*smaller aeroplane'* (Part 135) and '*larger aeroplane'* (Part 121), all references to the terms '*small aeroplane'* and '*large aeroplane'* are to be replaced with explicit MTOW limits.

Figure 0-1 **AC 91-15 Table 2.**

Chapter 1

Aerodromes & Aeroplane Landing Areas (LAs)

Aerodromes

Regulations regarding the use of Aerodromes

Regulations regarding aerodromes are contained in the *Civil Aviation Safety Regulations Part 139 'Aerodromes'*. They cover such things as:

- their establishment and licensing;
- their operation and maintenance; and
- the facilities which must be provided such as marking of the movement area;
- wind direction indicators;
- lighting;
- notification of obstacles and their marking; and
- the right to use and the air traffic services that must be provided.

Although you do not need to know the full details in the CASRs, you should at least know that aerodrome information is published by the Airservices in the *Aeronautical Information Publication (AIP)*, through the medium of the Facility Directory in the *Enroute Supplement Australia (ERSA - FAC)*. Further information is also contained in the *Advisory Circular (AC) 139 series*.

Use of Aerodromes

An aerodrome is defined as, *"a defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft." CASR 91.410* specifies the requirements for the use of aerodromes.

91.410 Use of aerodromes

(1) The operator and the pilot in command of an aircraft for a flight each contravene this subregulation if:
  (a) the aircraft takes off from, or lands at, a place; and
  (b) the place does not meet the requirement in subregulation (2).

Note: This regulation does not apply to the operation of an aircraft if regulation 121.205 applies to the operation: see regulation 91.035.

(2) The requirement is that:
  (a) the place is one of the following:
    (i) a certified aerodrome;
    (ii) a registered aerodrome;
    (iii) an aerodrome for which an arrangement under section 20 of the Act is in force;
    (iv) a place that is suitable for the landing and taking-off of aircraft; and
  (b) the aircraft can land at, or take off from, the place safely having regard to all the circumstances of the proposed landing or take-off (including the prevailing weather conditions).

(3) For the purposes of the definition of ***aerodrome*** in the Act, a place mentioned in subparagraph (2)(a)(iv) is authorised to be used as an aerodrome.

Figure 1-1 **CASR 91.410.**

The majority of aerodromes are public and operated by private companies. There are also aerodromes which are available for both military and civil use, in which case they are known as *joint-user government aerodromes* (e.g. Townsville, Darwin, Canberra, Wagga Wagga) operated by the Department of Defence (Air Force Office) and others.

The proprietor of any place in Australia may apply to the CASA for an aerodrome licence authorising the use of that place as an aerodrome. A licence, subject to certain conditions, may be granted by the CASA, in which case the place will be known as a licensed aerodrome (e.g. Kingscote, SA, operated by the Kangaroo Island Council and available for public use; Hamilton Island, Qld., operated by the Hamilton Airport Pty. Ltd. and available for private use, *prior permission* required from the facility operator if you wish to use it).

Enroute Supplement Australia (ERSA)

The primary source of aeronautical information for planning a flight is the Enroute Supplement Australia (ERSA), which is a joint military/civil publication re-issued on a 12–12–16–12 week cycle. You will be required to extract data from this book in both the PPL and CPL examinations.

Aerodrome & Facility Directory (FAC)

The FAC directory in the ERSA lists alphabetically details of aerodromes (AD), navigation aids, air traffic services, ground services, public facilities available and special procedures.

Aerodromes having more than one name are usually identified by the city/AD method and, where necessary, cross reference is made between alternate names and the name by which the aerodrome is listed.

The following aerodromes are published in the ERSA with full information:

- certified;
- military; and
- uncertified aerodromes that opt to be listed in ERSA.

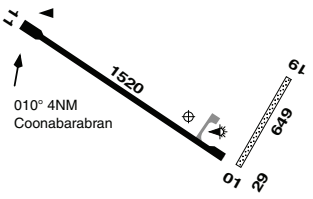
Certified and military aerodromes are open to inspection and are subject to NOTAM action.

Figure 1-2 shows a typical certified aerodrome entry showing a schematic diagram of runway layout and dimensions, name of operator, details of movement area, air traffic services.

In the introduction to ERSA you will find a complete description of how to decode the information given in the FAC for each entry, and you should take some time to familiarise yourself with this. As part of the process, you should quickly be able to deduce the following information about Coonabarabran from the example shown:

- the aerodrome is at an elevation of 2,117 ft (AMSL) and is located 4 nm on a bearing of 010°M to the town, measured from the aerodrome reference point (ARP);
- one runway is sealed and is aligned 11/29, the other is grass and oriented 01/19;
- the take-off run available (TORA) for the sealed runway is 1,520 m and it has a flexible surface of low strength with a PCN of 12 and a maximum tyre pressure of 84 psi;
- the grass runway is unrated and has a TORA of 649 m;
- both runways are 30 m wide; and
- air traffic services (Brisbane Centre) are available on 127.1 MHz.

COONABARABRAN **ELEV 2117**
AVFAX CODE 2033



NSW UTC +10 YCBB
311957S 1491602E VAR 11 DEG E CERT
AD OPR Warrumbungle Shire Council, PO Box 191, Coonabarabran, NSW, 2357. PH 02 6849 2000. ARO 6849 2000. Fax 6842 1337.

AERODROME OBSTACLES
1. LIT COM TWR 2,222FT AMSL, 312008.10S 1491712.76E BRG 084 MAG 1,770M FM ARP.
2. LIT COM TWR 2,939FT AMSL, 311919.50S 1491124.42E BRG 266 MAG 7,600M FM ARP.

PHYSICAL CHARACTERISTICS

01/19	019	21c	Unrated. Grass.	WID 60	RWS 90
11/29	112	50a	PCN 12 /F /C /580 (84PSI) /T	WID 30	RWS 150

AERODROME AND APPROACH LIGHTING
RWY 11/29 LIRL PAL 119.2

ATS AND AERODROME COMMUNICATION FACILITIES
FIA BRISBANE CENTRE 127.1 Circuit area

Figure 1-2 **ERSA FAC (Extract) – Certified Aerodrome.**

Uncertified aerodromes which do not come into the category for full listing in the ERSA, can nonetheless be listed with limited information under the following circumstances:

- aerodromes, other than those with full information, which have a published instrument approach; and
- where the operator of an unlicensed aerodrome has requested information be included in ERSA.

Under the *Civil Aviation Safety Regulations, part 139*, certified aerodromes are subject to inspection and NOTAM action - whereas non-certified aerodromes are generally not. They are shown in the ERSA with a grey background. Such aerodromes are discussed in detail later in this chapter.

WARRABER ISLAND **ELEV 10**
FULL NOTAM SERVICE NOT AVBL

QLD UTC +10 YWBS
101224S 1424924E VAR 5 DEG E UNCR
AD OPR Torres Strait Island Regional Council, PO Box 7336, Cairns, QLD, 4870. PH 07 4034 5700. ARO 07 4083 2550 or 0417 186 452 (H24).

REMARKS
1. RESTRICTED OPS: PPR from AD OPR.
2. This AD is a Security Controlled Airport.

PHYSICAL CHARACTERISTICS

12/30		24a	Sealed	WID 18	RWS 60

ATS AND AERODROME COMMUNICATION FACILITIES
FIA BRISBANE CENTRE 120.3 Circuit Area

CTAF 126.5

CHARTS RELATED TO THE AERODROME
WAC 3097.

Figure 1-3 **ERSA FAC (Extract) – Uncertified Aerodrome (letters UNCR appear top right).**

Runway Distances Supplement

You will already have seen from your study of ERSA FAC, that the only information given about the dimensions of a runway is its length and width. The length is normally the take-off run available (i.e. the physical length of the runway) in both directions.

Although this information is normally quite adequate for light aircraft operations, ideally more information is needed when checking on take-off and landing performance.

For some aerodromes, this additional information is provided in the Runway Distances Supplement to ERSA, and an extract of this is shown in figure 1-4.

Full details on this subject will be covered when we discuss take-off and landing performance in chapter 2.

BALLINA/BYRON GATEWAY

RWY	(CN)	TORA	TODA	ASDA	LDA
06	(3)	1900 (6234)	1960 (6430) (3.8%)	1900 (6234)	1900 (6234)
24	(3)	1900 (6234)	1960 (6430) (3.27%)	1900 (6234)	1900 (6234)

APCH SFC survey based on 150M inner edge WID, gradient 3.33%.
Slope Level. RWY WID 30 RWS WID 150

SUPPLEMENTARY TAKEOFF DISTANCES

RWY06- 1137(3730)(1.6) 1508(4947)(1.9) 1662(5453)(2.2) 1753(5751)(2.5) 1900(6234)(3.3)
RWY24- 993(3258)(1.6) 1327(4354)(1.9) 1533(5029)(2.2) 1690(5545)(2.5)

BALRANALD

RWY	(CN)	TORA	TODA	ASDA	LDA
08	(1)	650 (2133)	710 (2329) (3.88%)	650 (2133)	650 (2133)
26	(1)	650 (2133)	710 (2329) (2.17%)	650 (2133)	650 (2133)

Slope Level. RWY WID 30 RWS WID 90

18	(1)	1185 (3888)	1245 (4085) (3.38%)	1185 (3888)	1185 (3888)
36	(1)	1185 (3888)	1245 (4085) (2.03%)	1185 (3888)	1185 (3888)

Slope Level. RWY WID 18 RWS WID 90

SUPPLEMENTARY TAKEOFF DISTANCES

RWY18- 809(2654)(1.9) 946(3104)(2.2) 1050(3445)(2.5) 1240(4068)(3.3)
RWY36- 1216(3989)(1.6) 1238(4062)(1.9)

BARCALDINE

RWY	(CN)	TORA	TODA	ASDA	LDA
01	(3)	1702 (5584)	1762 (5781) (3.05%)	1702 (5584)	1702 (5584)
19	(3)	1702 (5584)	1762 (5781) (2.85%)	1702 (5584)	1702 (5584)

Slope 0.1% down to N. RWY WID 30 RWS WID 150 Graded 90

14	(2)	1115 (3658)	1175 (3855) (2.5%)	1115 (3658)	1115 (3658)
32	(2)	1115 (3658)	1175 (3855) (2.04%)	1115 (3658)	1115 (3658)

Slope 0.2% down to NW. RWY WID 30 RWS WID 90

SUPPLEMENTARY TAKEOFF DISTANCES

RWY01- 1424(4672)(1.6) 1554(5098)(1.9) 1650(5413)(2.2)
RWY19- 1452(4764)(1.6) 1564(5131)(1.9) 1646(5400)(2.2) 1707(5600)(2.5)
RWY14- 872(2861)(1.6) 1012(3320)(1.9) 1107(3632)(2.2)
RWY32- 975(3199)(1.6) 1131(3711)(1.9)

Figure 1-4 **Extract from Runway Distance Supplement.**

Aeroplane Landing Areas

There are many places other than government and licensed aerodromes which are suitable for light aeroplane operation.

CASR 91.410 states that *'the pilot in command of an aircraft for a flight must take-off and land at a place that meets the the following requirements: the place be certified, registered or be suitable for landing or take-off. The place must be safe with regard to all the circumstances of the proposed take-off or landing (including the prevailing weather conditions)'*. The prevailing rule is that the pilot must not operate an aircraft in a manner that may cause a hazard, and with the guidelines of *AC 91-02*, the pilot may conduct operations at a LA.

The Civil Aviation Safety Authority takes no responsibility for LAs. It is the responsibility of the pilot-in-command to ensure that the landing area satisfies the requirements for an LA, and that performance-chart figures allow the aeroplane to operate safely from it.

For your own safety and that of your passengers, you must ensure that the area is suitable to be an LA, and that the take-off and landing charts verify that the aeroplane is capable of operating from it.

Information on LAs will normally not be available through Civil Aviation Safety Authority sources, and it is the pilot's responsibility to establish that an LA is suitable for use.

An example of an LA listed with limited information in ERSA is shown in Figure 1-3. Note the fact that NOTAM action is not available.

Details of the standards that should be met to determine the suitability of a place for use as an area for taking off and landing are given in *AC 91-02*. In the following paragraphs, we have amplified the data given in *AC 91-02* for those aspects which require particular care and attention.

Landing Area Definitions

The following important definitions are used to describe the various components of an LA.

Runway

The runway is that portion of the landing area which is intended for the landing or take-off of aeroplanes. You will find different surfaces; they may be sealed (e.g. bitumen or concrete), or natural (e.g. grass, clay, gravel etc.), and you must ensure you select the correct surface when using the take-off data.

Runway Strip

The runway strip is an area each side of the runway which is in a condition that ensures minimal damage to an aeroplane which may run-off the runway during take-off or landing. The runway strip is not intended for normal taxi, take-off or landing.

Fly-Over Area

The fly-over area is an area of ground adjacent to each side of the runway strip which is free of tree stumps, large rocks or stones, fencing, wire or any other obstacles above ground. It may, however, have ditches or drains below ground level.

Physical Dimensions & Characteristics of a Landing Area

Runway Widths

A minimum runway width of 15 m is recommended for all operations. However, when considering all of the circumstances of a landing or take-off, different aeroplane types often have similar considerations although specific requirements may differ. It is recommended that safety factors be applied to an aircraft's operation to make allowances for degraded aeroplane performance or pilot reaction time.

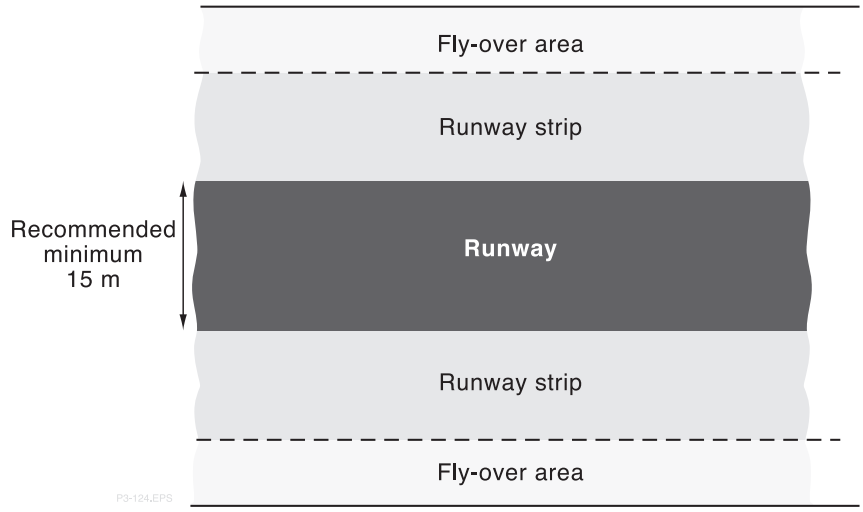


Figure 1-5 **LA runway widths.**

Runway Length

The runway length must be not less than that specified for take-off or landing in the aeroplane flight manual or approved performance charts, for the prevailing conditions.

Slopes

Longitudinal Slope

The maximum allowable longitudinal slope between runway ends is 1:50 (i.e. 2%).

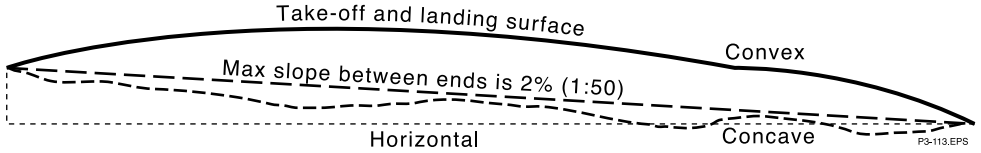


Figure 1-6 **Longitudinal slope should be less than 1:50.**

Runway gradient or average slope is based on the elevation at each end of the runway.

$$\text{Slope} = \frac{\text{difference in elevation of either end (in metres)}}{\text{runway length (in metres)}}$$

Transverse Slope

The pilot must develop sound judgment when operating on uneven surfaces. A transversal or lateral slope (i.e. across the width of the runway) must be accounted for. Affects of transverse slope may result in a longer take-off roll because the pilot needs to use asymmetric brake, nosewheel steering or rudder to keep straight.

Of course it is unlikely that you would have the equipment to measure gradients to this accuracy, so you should develop a mental picture of how known slopes at licensed aerodromes look and apply this when assessing gradients at an LA.

Transitional Slopes

To provide greater lateral clearance when the aeroplane is in the fly-over area, it is recommended (but not mandatory) that tall objects either side of the fly-over area be cleared out to a distance of 45 m. Ideally, a transitional slope of 20% (1:5) should not be infringed. The removal of these objects (e.g. trees) will also reduce the degree of turbulence and/or windshear during windy conditions.

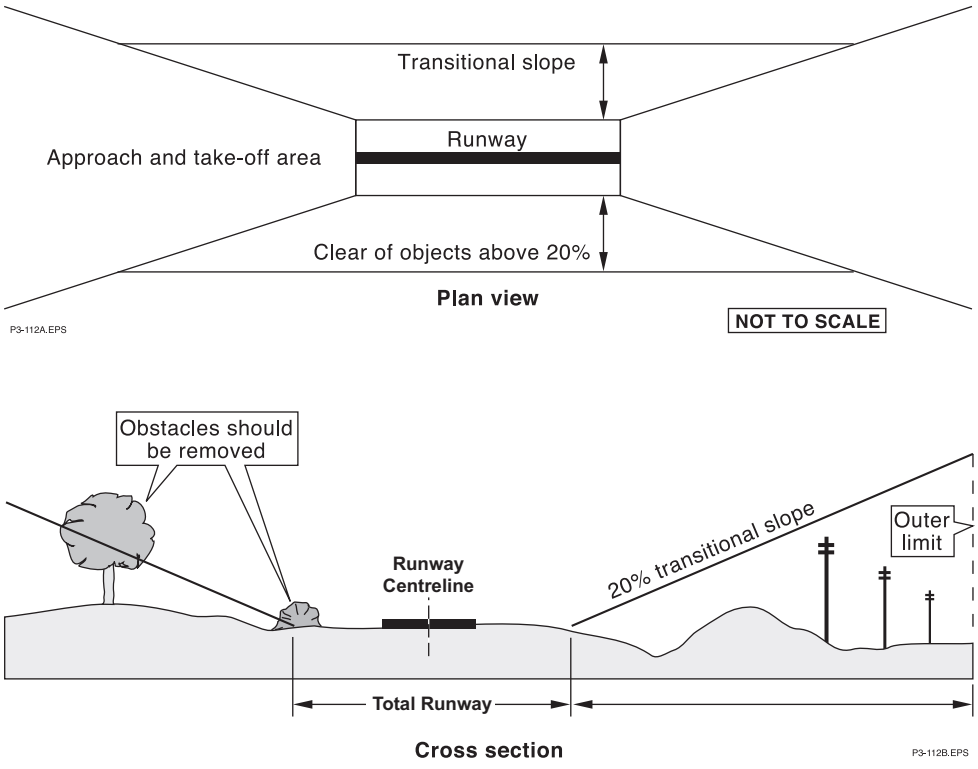


Figure 1-7 **Transitional slopes.**

Approach & Take-Off Splays

At each end of the landing area, take-off and approach splays should extend at an angle of 5% (i.e. the width increases at the rate of 1:20).

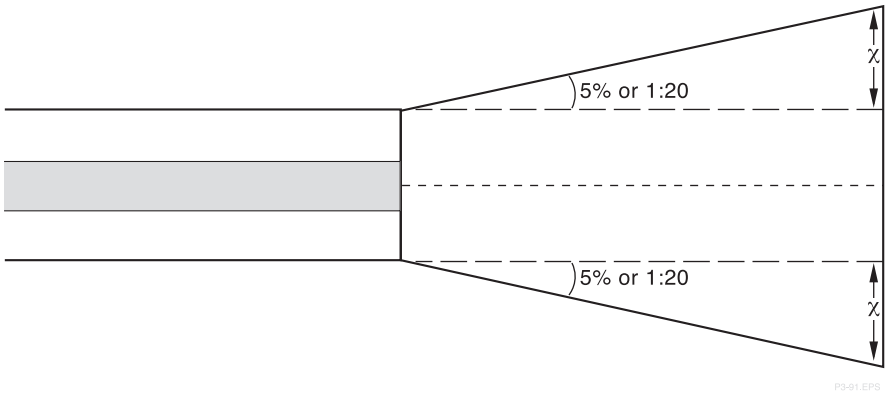


Figure 1-8 **Approach & take-off splay example.**

Obstacle Clear Gradients for Take-Off & Landing

To ensure a safe approach to land, and a safe climb-out after take-off, an obstacle-clear surface must be available within the approach and take-off splays.

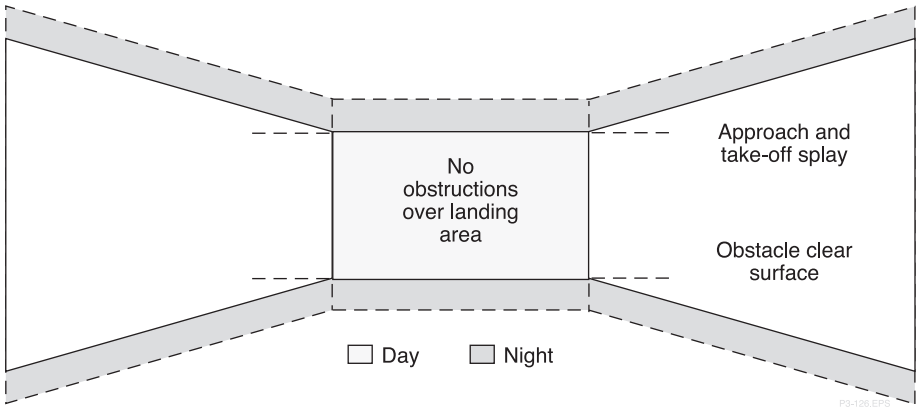


Figure 1-9 **Obstacle clearance in approach and take-off splays.**

If any obstruction within the take-off and approach area penetrates this obstacle-clearance surface, then the runway end must be moved inwards until the infringement is excluded, i.e. the usable runway length will be reduced. Additionally, there must be no obstructions (including wires, sheds, etc.) on or over the landing area.

An aeroplane of less than 5,700 kg MTOW is required to have a take-off climb capability of at least 6%.

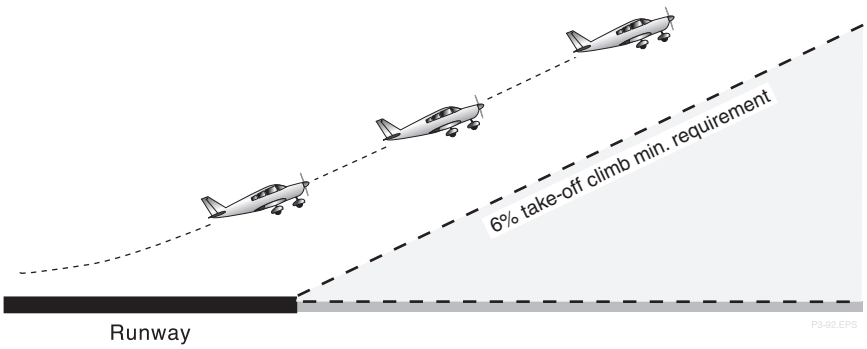


Figure 1-10 **Obstacles in the take-off and approach splays must be cleared by ay least 50 ft.**

Usable Runway Length

The usable length of an LA runway can differ between each of the two directions available for take-off and landing. For example, an LA with runway directions of 09/27 may have its usable length for take-off into the west (or landing into the east) severely restricted by a factory chimney within the splay area, whereas the lack of similar obstacles to the east means that a greater runway length is available for take-off in that direction (Figure 1-11).

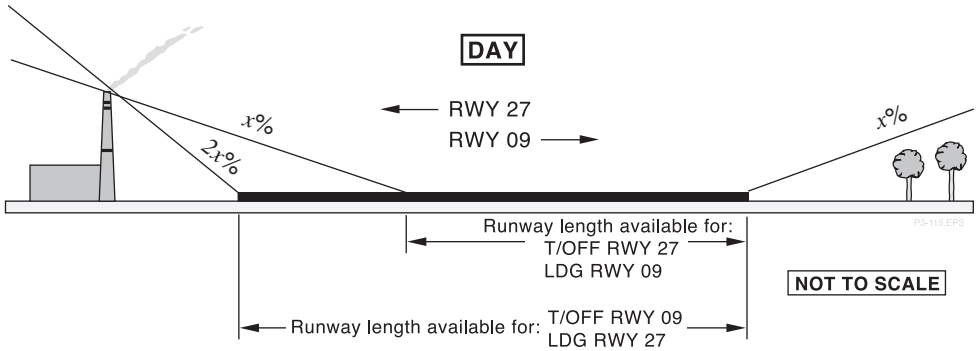


Figure 1-11 **LA runway length available may vary between different runway directions.**

Determination of Obstacle Clearance

In evaluating the effect of an obstacle on a proposed LA, you need to determine:

- whether the obstacle is within the splay; and if so
- does the obstacle penetrate the obstacle-clearance plane originating from the end of the strip; and if so
- by what amount must the usable runway length be reduced, to provide the required obstacle-clearance gradient; and if so
- does the revised splay, based on the end of the reduced strip, include significant obstacles not considered previously.

Note: If there is more than one significant obstacle, determine the critical one, and base all calculations upon it.

Pilot Responsibilities Regarding Landing Areas

Landing areas which comply with the recommendations listed in *AC 91-02* (i.e. LAs) are not the responsibility of the Civil Aviation Safety Authority. (Note that ACs are recommendations only – not requirements.) There is no formal reporting system about their serviceability. If a landing area satisfies the recommendations laid down in the *AC 91-02* then it is an aeroplane landing area. An LA may be just a farmer's paddock or it may be a highly developed training field.

Remember that an LA is private property and you must have permission to use it.

One exception to this would be where you are faced with an emergency due to stress of weather or mechanical difficulties requiring a forced or precautionary landing.

Apart from the legal aspect of trespass, it is your responsibility to make inquiries as to the serviceability and suitability of the LA for your operation. For example, a trench may have been dug across the strip and, after being filled, a soft area may exist which could cause your aeroplane to nose-over on landing. This may result in the insurance company declining a claim for damages to the aeroplane. Obviously the simple way around all of the legal 'imponderables' is to do the right thing and obtain permission to use the LA in the first place.

Be aware that the owner of the area may have very limited aviation experience, so exercise caution. Be wary of statements from LA owners that the strip is used 'quite often' by neighbouring pilots: when the strip was last used and by what type of aircraft can affect deterioration. Also, many remote area station property strips are often used as tracks for vehicles and could be adversely affected.

Take-off and Landing Safety Factors

Refer to AC 91-02 para 7

The aircraft flight manual (AFM)/pilot operating handbook (POH) state unique take-off and landing distance figures based on certain pre-determined tested conditions. It is important to note that the pilot is unlikely to replicate the testing performance during routine flying conditions. The pilot should apply safety factors to increase safety margins for calculated take-off and landing distances.

AC 91-02 states that additional safety margins mitigate risks for a range of issues, including, but not limited to:

- pilot skill;
- runway characteristics;
- aerodrome density altitude;
- changed external drag configuration of the aeroplane; and
- underperforming engine compared to that used for performance testing.

Whilst, not a mandate in *CASR Part 91* for general operations, it is nevertheless highly recommended. The following extracted tables give advice on safety margins under general and specific circumstances.

Table 1: Recommended minimum standard safety factors

Aircraft weight	Minimum standard safety factor
For take-off	
up to 2 000 kg MTOW	1.15 or 115%
2 000 to 3 500 kg*	1.15 to 1.25 (or 115 to 125%)
3 500 kg to 5 700 kg	1.25 or 125%
For landing	
up to 2 000 kg MTOW	1.15 or 115%
2 000 to 4 500 kg†	1.15 to 1.43 (or 115 to 143%)
4 500 to 5 700 kg	1.43 or 143%

* In the case of aeroplanes with MTOW between 2 000 kg and 3 500 kg, apply a safety factor determined by linear interpolation between 1.15 and 1.25.

† In the case of aeroplanes with MTOW between 2 000 kg and 4 500 kg, apply a safety factor determined by linear interpolation between 1.15 and 1.43.

Figure 1-12 **AC 91-02 para 7, Table 1.**

Table 2: Recommended additional take-off allowances

Circumstance	Factor increase expressed as a percentage	Multiply minimum standard safety factored take-off distance by
per 10% increase in aeroplane weight	20%	1.2
an increase of 1,000 ft in aerodrome elevation above mean sea level	10%	1.1
an increase of 10°C in ambient temperature above ISA	10%	1.1
tailwind component, per 10% of lift-off speed	20%	1.2
2% uphill slope*	10%	1.1
soft ground or snow†	25%+	1.25+
dry grass† up to 20 cm (on firm soil)	20%	1.2
wet grass‡ up to 20 cm (on firm soil)	30%	1.3

* The effect on aeroplane performance of this circumstance is variable and possibly unpredictable. Expect a ground distance increase, but airborne distance remains the same.

† The effect on aeroplane performance of this circumstance is variable and possibly unpredictable. While rolling resistance is increased, steering and braking effectiveness is reduced. Airborne distance remains the same but expect an increase in ground distance.

‡ If wet grass is on soft ground the effect on rolling resistance is cumulative, so both elements must be considered.

Figure 1-13 **AC 91-02 para 7, Table 2.**

Table 3: Recommended additional landing allowances

Circumstance	Factor increase expressed as a percentage	Multiply minimum standard safety factored landing distance by
a 10% increase in aeroplane weight	10%	1.1
an increase of 1,000 ft in aerodrome elevation above mean sea level	5%	1.05
an increase of 10˚C in ambient temperature above ISA	5%	1.05
tailwind component, per 10% of landing speed*	20%	1.2
2% downhill slope	10%	1.1
muddy surface or light snow†	25%+	1.25
dry grass† up to 20 cm (on firm soil)	20%+	1.2
wet grass† up to 20 cm (on firm soil)	30%+	1.3
short and dense or very green grass†	60%	1.6
20–50 mm standing water†	50%+	1.5

* In factoring the effect of wind, reduce estimated headwind by 50 percent and assume a tailwind is 50% greater than the estimate.

† The effect on aeroplane performance of this circumstance is variable and possibly unpredictable. While rolling resistance is increased, steering and braking effectiveness is reduced. Airborne distance remains the same, but expect an increase in ground distance.

Figure 1-14 **AC 91-02 para 7, Table 3.**

Review 1

PPL & CPL

1. Details of aerodrome facilities are given in the (ERSA/AIP/CASR).
2. To evaluate a potential landing area on a paddock you would refer to:
3. The total runway width is comprised of three areas, they are:
4. The responsibility of determining the serviceability of a landing area falls to (the pilot in command/CASA/land owner).
5. The minimum take-off climb gradient for a single engine aeroplane with a MTOW less than 5,700 kg is:
6. Factors that limit take-off and landing distance include:
7. According to AC 91-02, the recommended minimum standard safety factor for an aeroplane with a MTOW of 4,000 kg is:
8. When landing on wet grass up to 20 cm, the recommended safety factor increase for the landing roll is:
9. The AIP is published on a cycle of:
10. The maximum allowable longitudinal slope between the runway ends is?
11. The regulations pertaining to certified aerodromes are contained within which CASR part?

Answers to Review 1 are given on page 351.

Chapter 8

Airworthiness & Equipment

Airworthiness

To ensure that all aircraft are operated safely and in an airworthy condition, it is necessary for rules to be established. These rules are set down in various documents, such as the certificate of airworthiness, the maintenance release and the flight manual. An introduction to some of the various documents is given in '*Flight Rules & Air Law*.'

In this section, we will cover:

- certificate of registration;
- certificate of airworthiness;
- flight manual;
- maintenance schedule; and
- maintenance release.

Certificates of Registration & Airworthiness

Certificate of Registration

In accordance with the Civil Aviation Act, Regulation 20AA an aircraft is required to be registered. The CASA must keep a register of such aircraft.

47.015 Requirement for aircraft to be registered

(1) For paragraph 20AA (1) (b) of the Act, an aircraft is required to be registered unless it is one of the following:

(with some exceptions refer to *CASR 47.015*)

47.025 Australian Civil Aircraft Register

CASA must keep a register called the Australian Civil Aircraft Register, or ensure that it is kept, in accordance with this Subpart.

Note: The Australian Civil Aircraft Register is the successor to the Aircraft Register mentioned in regulation 8 of CAR: see regulation 202.221.

47.030 Access to Australian Civil Aircraft Register

(1) CASA must make the entries in the Australian Civil Aircraft Register about aircraft registered under Division 47.C.1 available for inspection by members of the public at reasonable times and places, and subject to reasonable conditions.

(2) CASA may comply with subregulation (1) by making the information in those entries accessible on the internet or by another suitable electronic means.

Figure 8-1 **CASR Part 47.015 - 47.030.**

Once the CASA has received an application for the registration of an aircraft, (*CASR 47.060*) it must enter the details in the Aircraft Register and issue a certificate of registration (*CASR 47.080 and 47.090*).

47.080 Registration of aircraft

(1) CASA must register an aircraft if the application for the registration of the aircraft is made in accordance with regulation 47.060.

(2) If CASA registers an aircraft, CASA must enter the following information about the aircraft in the Australian Civil Aircraft Register:
- (a) the registration mark assigned to the aircraft;
- (b) whether the aircraft is a manned free balloon, an airship, a glider, a power-driven aeroplane, a rotorcraft or an ornithopter;
- (c) its manufacturer, model and serial number;
- (d) its country and year of manufacture;
- (e) the name and address of the owner;
- (f) the name and address of the registered operator;
- (g) the day on which it was registered.

47.090 Issue of certificate of registration

If CASA:
- (a) registers an aircraft because it has received a written application; or
- (b) receives confirmation of an oral application for the registration of an aircraft;

CASA must give a certificate of registration for the aircraft to the aircraft's owner (the ***registration holder***).

Note: The certificate of registration replaces any interim certificate of registration issued under regulation 47.085.

Figure 8-2 **CASR Part 47.080 - 47.090.**

Certificate of Airworthiness

Certificates of Airworthiness (C of A) are issued in accordance with the terms of *CASR Part 21.* The C of A is normally granted for an unlimited period – its validity being subject to regular inspections. However, in some cases, the C of A may be issued for only a specified period.

There are two classifications of certificates of airworthiness:
- Standard C of A issued for an aircraft type certificated in the normal, utility, aerobatic, commuter or transport categories, and for aircraft in the special class.
- Special C of A issued for an aircraft type certificated in the primary, intermediate or restricted category, or an aircraft in the limited category, or an amateur-built accepted under the Amateur Built Aircraft Acceptance (ABAA).

During your training for the issue of a PPL or CPL, you are likely to fly in any of the following:
- a normal category aeroplane (below 5,700 kg, non-aerobatic, manoeuvres limited to stalls and steep turns of 60 degrees with typical limit load factors +2.5g and –1.0g);
- a utility category aeroplane (as for a normal category, plus limited aerobatics with typical limit load factors of +4.5g and –1.8g.); and
- an aerobatic category aeroplane, which is fully aerobatic (typical limit load factors are +6.0g and –3.0g).

Civil Aviation Authority AUSTRALIA

CERTIFICATE OF REGISTRATION - AIRCRAFT

Certificate No:

Nationality & Registration Marks	Manufacturer & Manufacturer's Designation of Aircraft
	Aircraft Serial Number

Certificate of Registration Holder

Residential or Business Address

Postal Address (Address for Service of Notices)

It is hereby certified that the above described aircraft has been duly entered in the Register of Australian Aircraft in accordance with the Convention on Civil Aviation dated 7th December 1944 and the Civil Aviation Regulations.

Date Certificate of Registration issued

This certificate, issued to the person described above, does **NOT** confer title to the aircraft.

..... For the Authority Issuing Office

Date of first entry in Register of Australian Aircraft.

ALL CERTIFICATES PREVIOUSLY ISSUED IN RESPECT OF THIS AIRCRAFT ARE HEREBY SUPERSEDED AND CANCELLED

Certificate holders should read the notes overleaf

DA 13 (Rev 11/91) Stock No. 16712.6

Figure 8-3 **A certificate of registration and a certificate of airworthiness.**

Civil Aviation Authority AUSTRALIA

CERTIFICATE OF AIRWORTHINESS - AIRCRAFT

No.

1. Nationality and Registration Marks VH-	2. Manufacturer Manufacturer's Designation of Aircraft	3. Aircraft Serial No. Place and Year of Construction
4. Categories		

5. This Certificate of Airworthiness is issued pursuant to the Convention on International Civil Aviation dated 7th December, 1944, and the Civil Aviation Regulations of Australia, in respect of the above mentioned aircraft which is considered to be airworthy when maintained and operated in accordance with the Civil Aviation Regulations and the limitations specified in the flight manual approved or issued for the aircraft under the Civil Aviation Regulations.

6. Subject to suspension or cancellation under the Civil Aviation Regulations, the period during which this certificate shall remain in force shall be from this date of issue until

..... or until the aircraft ceases to be registered in the Register of Australian Aircraft.

Date of Issue

Signature Printed Name

Appointment *(please tick appropriate box)*

Delegate of the Authority ☐

Authorised Person appointed under the Civil Aviation Regulations ☐

No entries or endorsements may be made on this certificate except in the manner and by a person authorised as a Delegate of the Authority.

ALL CERTIFICATES OF AIRWORTHINESS PREVIOUSLY ISSUED IN RESPECT OF THIS AIRCRAFT ARE HEREBY SUPERSEDED AND CANCELLED

DA 2600 (Rev 7/90) Stock No. 17315.5

Do not intentionally carry out inappropriate manoeuvres for the category of your aeroplane; structural damage or destruction is a very real possibility. Some aircraft in the normal category may be allowed to operate in the utility category within certain specified weight limits – usually with fuel or passenger restrictions – and these will be seen on the weight and balance schedule as limits on the weight and position of the CG.

The certificate of airworthiness has other documents associated with it – in particular, the flight manual and the maintenance schedule. A very important part of the latter is the maintenance release.

The Flight Manual

The flight manual sets out all of the requirements, procedures and limitations with which the pilot must comply in the operation of the aeroplane. Placards placed in the cockpit will often reflect the flight manual limitations, and have the same status, i.e. these instructions must be adhered to.

The flight manual for Australian aircraft must be produced by the aircraft manufacturer and approved by their relevant National Airworthiness Authority. CASA approval of the flight manual is not required.

The flight manual must be carried in the aeroplane on all flights, which means that a pilot cannot take it home for reference. An easy-to-follow booklet derived from the flight manual and other operational documents is the information manual, which a pilot should have for each type of aeroplane that he flies and which may have to remain with the aeroplane. The pilot's operating handbook does not have the same legal standing as the flight manual.

The Maintenance Schedule

Each aeroplane must have a maintenance schedule approved by the CASA. This requires a system of regular checks and inspections by licensed and approved people (licensed aircraft maintenance engineers, LAMEs) as laid down in CAO 100.5. Logbooks must be kept for the airframe, the engine and the propeller (constant speed propeller). Instrument flight rules aircraft will have a radio and navigation aids logbook.

A typical maintenance schedule will include:

- scheduled major inspections (in general aviation, every 3 years except for aircraft in the agricultural category, which are annual);
- inspections to be carried out every 100 hours (the '100 hourly');
- 25 or 50 hour inspections (not in all cases); and
- the daily inspection.

The maintenance schedule is an airworthiness requirement. The operational document associated with it is the *maintenance release.* (*CASR Part 42.H*).

The Maintenance Release

When the periodic inspection has been completed, the maintenance release can be issued by an authorised person and signed by the person who coordinated the inspection. It is divided into three parts which, in combination, provide the pilot with all the information he needs to be assured that all necessary maintenance has been carried out. It also provides maintenance personnel with details of any mandatory work required and when it has to be done.

You will refer to the maintenance release before and after every flight, so it is important that you have a good understanding of it. We will now consider it in detail. As pilot in command, you are responsible for ensuring that the aircraft is safe to fly.

Part 1 of the Maintenance Release

This part specifies the type and registration of the aeroplane and the class of operation for which it is approved. As the holder of a PPL or CPL, you will usually fly an aircraft approved for private (PVT), aerial work (AWK) or air transport. You must ensure that the aeroplane is suitable for the type of operation for which it is to be used, and suitably equipped for a flight conducted under IFR, VFR night or VFR day. This information is found in the maintenance release. For example, in the maintenance release extract shown in Figure 8-4, you will see that the aeroplane is equipped for VFR flight, and is in the operational category of private operations.

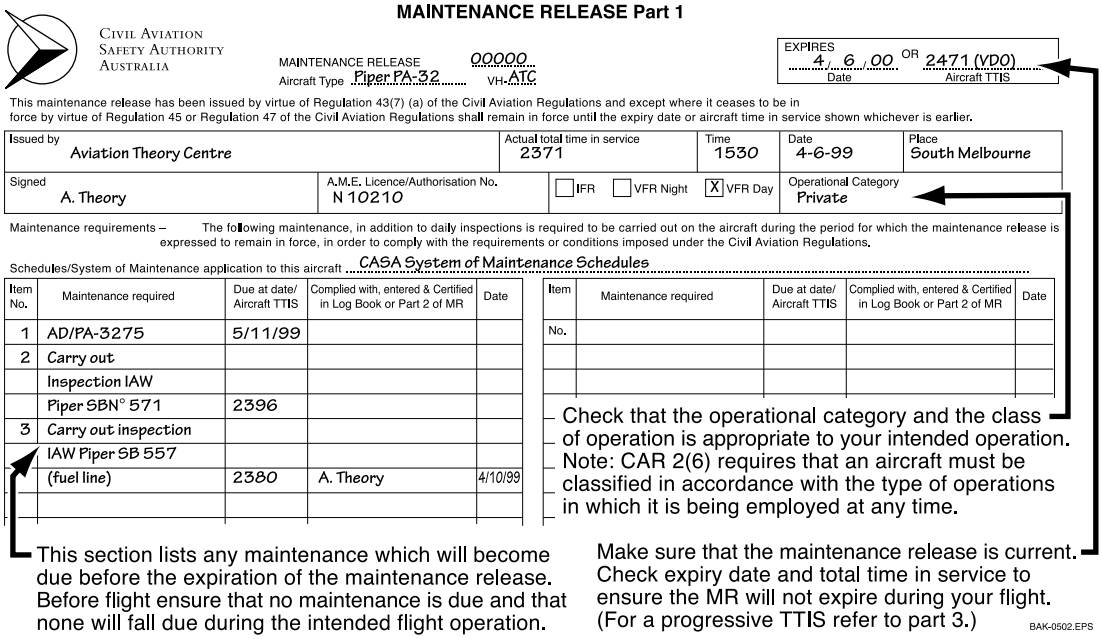


Figure 8-4 **Part 1 of the maintenance release.**

Part 1 is concerned mainly with routine maintenance:

- it certifies that all routine maintenance has been completed;
- it specifies that the period of validity of the maintenance release (normally 100 hours or 12 months); and
- it records any inspections or maintenance tasks required during the period of validity of the maintenance release, such as oil changes, airworthiness directives, time-expired components, etc.

Before flight, the pilot should check that the maintenance release is current, i.e. the period of validity, in either hours flown or elapsed time, has not expired. This is done by checking the expiry date, and comparing the time in service shown in part 1 with the progressive total shown in part 3. It is essential to check part 1 to ensure that maintenance has not become overdue.

Part 2 of the Maintenance Release

This part of the maintenance release provides you with the means of reporting defects and shows whether previously reported defects have been rectified. An open entry in part 2 does not mean necessarily the aircraft should not be flown (see later). Endorsements must be signed and dated. Part 2 provides you with a history of defects on the aircraft for the period of validity of the maintenance release. It is worth stressing that it is required that defects be entered in the maintenance release – either by the pilot or his agent (flight instructor, engineer, etc). (See later under after flight.)

Before flight, you should examine part 2 for endorsements and check that the certification clearing any endorsement is appropriately signed and authenticated with a licence number. The presence of an open endorsement does not necessarily ground the aeroplane. CAOs, supplemented by the aircraft's flight manual, list the aircraft equipment requirements for various flight categories and classes of operation. An endorsement affecting any of those items or the airworthiness of the aeroplane must obviously be cleared before the aeroplane is flown.

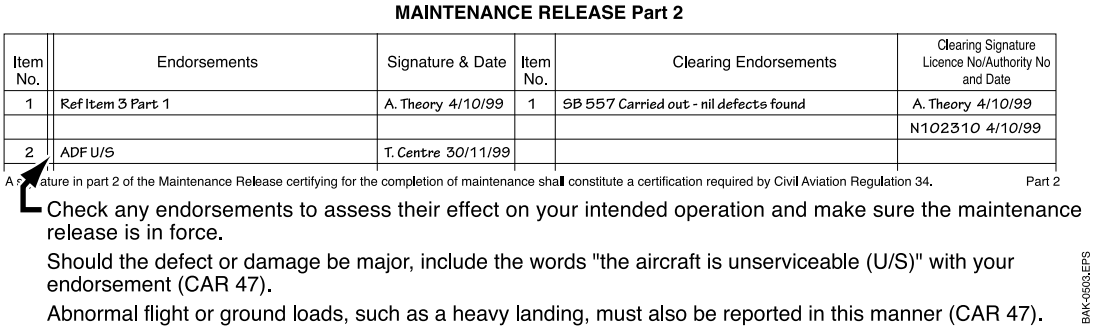


Figure 8-5 **Part 2 of the maintenance release.**

Some unserviceabilities, of course, do not affect either the airworthiness of the aircraft or the mandatory equipment requirements. For example, an endorsement placing IFR (instrument flight rules) navigational equipment, like the ADF, unserviceable does not prevent the use of that aircraft for a VFR flight by day. Other unserviceabilities, however, do mean that the aeroplane is no longer airworthy, and it should not be flown. An example would be warping of the airframe after excessive g-forces or a very heavy landing. In such a case, an authorised person should endorse the maintenance release saying that the aeroplane is not airworthy, whereupon the maintenance release ceases to be in force. (For further reading, see *Civil Aviation Regulation 49*.)

After flight, any defects should be entered on part 2 of the maintenance release and endorsed (signed) by the person making the entry. This is an official operational document and gets any defect into the 'system' where it must be handled.

The next pilot to fly the aircraft will refer to part 2 of the maintenance release to see if previously reported defects have been rectified, and if not, ensure that they are of a nature that further flight under certain conditions is permissible. The entering of appropriate defects into part 2 of the maintenance release is a legal and moral responsibility – it is a form of protection for the following pilots, ensuring that they will be flying an airworthy machine.

Entering Defects on Part 2 of the Maintenance Release by the Pilot

Part 2 is the interface document between the ground engineers and the pilots – any defect not entered in part 2 but, mentioned casually to someone or scribbled on a piece of loose paper, may be forgotten or lost.

There is no guarantee that the defect will be picked up in routine maintenance unless it is noted in part 2. It is a good idea, however, for an inexperienced pilot especially, to discuss any problem or defect with a ground engineer or more experienced pilot, prior to making an entry in part 2.

Items such as a heavy landing or an excessive in-flight load on the aircraft (e.g. a too-hard pull-out from a dive or an inadvertent spin in an aircraft not authorised for spinning) should be mentioned, as these can place excessive stress on the aeroplane. For the well-being of the following pilots and passengers, such events, even though possibly embarrassing, should be reported – this shows good airmanship.

Part 3 of the Maintenance Release

Part 3 provides a record of the hours flown and certifications for the daily inspections carried out. The record of hours flown is necessary to keep a check on the currency of the maintenance release and to show when maintenance called up in part 1 is due. It is a requirement that flying hours and number of landings be entered at least at the end of each day's flying for that aircraft. The operator will indicate in the operations manual the method to be used for recording this information.

Part of the CASA maintenance schedule for an aeroplane as defined in CAR subregulation 2(1) is the daily inspection (DI), which must be carried out each day before the first flight of the day.

The daily inspection is more comprehensive than the preflight inspection which you must carry out prior to every flight throughout the day. The items to be checked in the daily inspection are listed in *CAR Schedule 5, Part 1, Section 1*. You should know these items and you may be examined on them. An extract from Schedule 5 is shown in Figure 8-7. Refer to the pilot's operating handbook for your particular aircraft to obtain more guidance.

The daily inspection may be performed by a licensed aircraft maintenance engineer or the holder of a pilot's licence (other than a student pilot licence) that is valid for the aircraft.

The daily inspection certification in part 3 of the maintenance release shall be signed by the person making the inspection and shall include his or her pilot licence number (i.e. ARN) or airworthiness authority number and the date on which the inspection was made (*CAR Schedule 6 para 3.11 a,b, and f*).

MAINTENANCE RELEASE Part 3

DAILY INSPECTION CERTIFICATION AND AIRCRAFT TIME - IN - SERVICE

Date	Daily Inspection Certification		Aircraft Time-In-Service				Progressive Total of		
			This Flight		Progressive				
	Signature	Licence No	Hrs	Mins	Hrs	Mins	Landings		
	BROUGHT FORWARD				2371	00			
29/9/99	C.Smith	123456	7	00	2378	00			
4/10/99	C.Smith	123456	2	00	2380	00			
1/11/99	W.JONES	246800	4	35	2384	35			
7/11/99	P.BEAR	130068	3	20	2387	55			
20/11/99	J.WILSON	196802	2	15	2390	10			
30/11/99	J.WILSON	196802	3	50	2394	00			
1/12/99	C.Smith	123456	1	00	2395	00			

A signature in part 3 of the Maintenance Release certifying for the completion of maintenance shall constitute a certification required by Civil Aviation Regulation 34.

For a 'B' Class aircraft any pilot (not a student pilot) can certify. The person certifying must have performed the daily inspection.

BAK-0504.EPS

Figure 8-6 **Part 3 of the maintenance release.**

Before flight the pilot must check part 3 to ensure that the daily inspection has been done and signed off. If not, he or she should carry it out (unless only a student pilot).

Note: The authority for pilots to carry out the daily inspection is in *CAR Schedule 8*.

The progressive time entered in part 3 of the maintenance release should be compared with the expiry date or time-in-service in part 1. These total hours are airframe hours (and not engine hours).

After flight, you must enter the appropriate times in the part 3, so that a correct progressive total of hours for the aircraft can be maintained. An accurate record of hours flown is essential to preserve the integrity of the maintenance system.

It is a legal requirement that the hours flown should be entered at least at the end of each day on which the aircraft is flown. This allows the engineers to monitor maintenance requirements against time-in-service, and enables pilots to ensure that those requirements have been satisfied before they accept an aeroplane for flight.

Schedule 5—CASA maintenance schedule

(subregulation 2(1), definition of ***CASA maintenance schedule***)

Part 1—Daily inspection

1.1 An inspection (in this Part called a ***daily inspection***) must be carried out on the aircraft before the aircraft's first flight on each day on which the aircraft is flown.

1.2 A daily inspection must consist of the making of such of the checks set out in the table at the end of this Part as are applicable to the aircraft.

Table of checks included in a daily inspection

Section 1 General

(1) *Check* that the ignition switches are off, the mixture control is lean or cut off, the throttle is closed and the fuel selector is on.

(2) *Check* that the propeller blades are free from cracks, bends and detrimental nicks, that the propeller spinner is secure and free from cracks, that there is no evidence of oil or grease leakage from the propeller hub or actuating cylinder and that the propeller hub, where visible, has no evidence of any defect which would prevent safe operation.

(3) *Check* that the induction system and all cooling air inlets are free from obstruction.

(4) *Check* that the engine, where visible, has no fuel or oil leaks and that the exhaust system is secure and free from cracks.

(5) *Check* that the oil quantity is within the limits specified by the manufacturer for safe operation and that the oil filler cap, dipstick and inspection panels are secure.

(6) *Check* that the engine cowlings and cowl flaps are secure.

(7) *Check* that the landing gear tyres are free from cuts or other damage, have no plies exposed and, by visual inspection, are adequately inflated.

(8) *Check* that the landing gear oleo extensions are within normal static limits and that the landing gear doors are secure.

(9) *Check* that the wing and fuselage surfaces are free from damage and that the inspection panels, flight control surfaces and flight control devices are secure.

(10) *Check* that the interplane and centre section struts are free from damage and that the bracing wires are of the correct tension.

(11) *Check* that the pitot heads and static ports are free from obstruction and that the pitot cover is removed or is free to operate.

(12) *Check* that the fuel tank filler caps, chains, vents and associated access panels are secure and free from damage.

(13) *Check* that the empennage surfaces are free from damage and that the control surfaces control cables and control rods, where visible, are secure.

Figure 8-7 **Extract from Schedule 5, to CAR 1988 (Volume 4).**

(14) *Check* that the canard surfaces are free from damage and that the control surfaces, control cables and control rods, where visible, are secure.

(15) *Check* that the flight controls, the trim systems and the high lift devices operable from the ground have full and free movement in the correct sense.

(16) *Check* that the radios and antennae are secure and that where visible, radio units and interwiring are secure.

(17) *Check* that the drain holes are free from obstruction.

(18) *Check* that there is no snow, frost or ice on the wings, tail surfaces, canards, propeller or windscreen.

(19) *Check* that each tank sump and fuel filter is free from water and foreign matter by draining a suitable quantity of fuel into a clean transparent container.

(20) *Check* that the windscreen is clean and free from damage.

(21) *Check* that the instruments are free from damage, legible and secure.

(22) *Check* that the seat belts, buckles and inertia reels are free from damage, secure and functioning correctly.

Figure 8-8 **Extract from Schedule 5, to CAR 1988 (Volume 4) continued.**

Flight time for entry into a maintenance release (take-off to landing) is different to the flight time entered in the pilot's logbook (start-up to shut-down). How this is calculated depends upon how the operator records the times – by watch, VDO, tacho or air pressure switch. The complete and successful maintenance and continuing airworthiness of an aeroplane depends heavily upon communication between pilot and ground engineer. The document to achieve this is the maintenance release.

Check the maintenance release with thoroughness and accuracy.

Maintenance Information in the Civil Aviation Orders

The CAO 100 series covers the airworthiness and maintenance of aircraft. It is a very lengthy document and is not normally referred to by pilots. However, a lot of orders in it have been amended and are now contained in the *Civil Aviation Safety Regulations*, which you should have. Relevant sections of the regulations have been included in this chapter. This will simplify your job in finding them if you decide on further reading. LAMEs (engineers) and maintenance organisations have a full copy of these particular CAOs and you may purchase them from Airservices Australia.

When sitting the PPL/CPL examinations it is a requirement that you have a copy of all CASA Publications appropriate to your licence level, and it is imperative that you are familiar with them. You do not have to memorise their content, but must be able to find the required information. Maintenance allowed by the pilot in command (other than a student pilot) is listed in *CAR Schedule 8*. While it is legal for the pilot to carry out this maintenance, we recommend using a licensed engineer to do the work.

Schedule 8—Maintenance that may be carried out on a Class B aircraft by a pilot entitled to do so under subregulation 42ZC(4)

(subregulation 42ZC(4))

1. Removal or installation of landing gear tyres, but only if the removal or installation does not involve the complete jacking of the aircraft.
2. Repair of pneumatic tubes of landing gear tyres.
3. Servicing of landing gear wheel bearings.
4. Replacement of defective safety wiring or split pins, but not including wiring or pins in control systems.
5. Removal or refitting of a door, but only if:
   (a) no disassembly of the primary structure or operating system of the aircraft is involved; and
   (b) if the aircraft is to be operated with the door removed—the aircraft has a flight manual and the manual indicates that the aircraft may be operated with the door removed.
6. Replacement of side windows in an unpressurised aircraft.
7. Replacement of seats, but only if the replacement does not involve disassembly of any part of the primary structure of the aircraft.
8. Repairs to the upholstery or decorative furnishings of the interior of the cabin or cockpit.
9. Replacement of seat belts or harnesses.
10. Replacement or repair of signs and markings.
11. Replacement of bulbs, reflectors, glasses, lenses or lights.
12. Replacement, cleaning, or setting gaps of, spark plugs.
13. Replacement of batteries.
14. Changing oil filters or air filters.
15. Changing or replenishing engine oil or fuel.
16. Lubrication not requiring disassembly or requiring only the removal of non-structural parts, or of cover plates, cowlings and fairings.
17. Replenishment of hydraulic fluid.
18. Application of preservative or protective materials, but only if no disassembly of the primary structure or operating system of the aircraft is involved.
19. Removal or replacement of equipment used for agricultural purposes.
20. Removal or replacement of glider tow hooks.
21. Carrying out of an inspection under regulation 42G of a flight control system that has been assembled, adjusted, repaired, modified or replaced.
22. Carrying out of a daily inspection of an aircraft.

Figure 8-9 **Extract from Schedule 8 to CAR 1988 (Volume 4).**

Equipment of Aircraft for VFR Flight

As the pilot in command of an aeroplane operating on a VFR flight, it is your responsibility to ensure that your aeroplane is fitted and checked with the appropriate instruments and equipment.

91.245 Matters to be checked before take-off

(1) The pilot in command of an aircraft for a flight contravenes this subregulation if, when the aircraft takes off for the flight, a check prescribed by the Part 91 Manual of Standards has not been carried out.

Figure 8-10 **CASR 91.245.**

The equipment and instruments which must be carried in an aeroplane are specified by CASA.

Communications & Navigation Systems & Transponders

Definitions

The CASR refers to Vol. 2, Annex 10, of the Chicago Convention to define aeronautical telecommunication terms.

A radio communication service is defined as "two-way communication between aircraft and stations or locations on the surface of the earth".

A radio navigation service is defined as "a radio navigation service intended for the benefit and for the safe operation of aircraft".

See this link for terms:
https://www.icao.int/Meetings/anconf12/Document%20Archive/AN10_V2_cons%5B1%5D.pdf

Radio Communications

Full details of radio communication requirements are given in *AIP GEN*. The underpinning rule for all radio communication equipment requirements is that an aircraft must have radio communication systems capable of communicating on all frequencies necessary to meet the reporting, broadcast and listening watch requirements under the regulations. The CASR detail requirements under specific operation types. The regulations or general and smaller air transport operations are shown below. All of these items are explained in our manual, *Flight Radio for Pilots*.

26.18 Radiocommunication systems

(1) Subject to subsection (2), an aircraft for a flight, in any class of airspace, whether controlled or uncontrolled, must be fitted with radiocommunication systems capable of:

(a) collectively communicating on all frequencies necessary to meet the reporting, broadcast and listening watch requirements under regulations 91.630, 91.635, 91.640 and 91.675, from any point on the route of the flight, including in the event of any diversions; and

(b) 2-way voice communications; and

(c) communicating on the aeronautical emergency frequency 121.5 MHz.

Note 1 Certain light sport aircraft and experimental aircraft do not have to comply with the requirement for this equipment to be approved under Part 21 of CASR: see subsection 26.02 (5).

Note 2 Regulation 91.400 places certain requirements on aircraft without an operative radio at certain non-controlled aerodromes.

(2) Subject to subsections (3) and (4), an aircraft for a flight under the VFR by day in Class G airspace at or below 5 000 ft AMSL (a ***relevant aircraft***) is not required to comply with subsection (1).

Figure 8-11 **CASR Part 91 MOS 26.18.**

(3) Subsection (2) does not apply if a relevant aircraft is operating in accordance with the VMC criteria at item 4, 5 or 6 of Table 2.07 (3).

(4) Subsection (2) does not apply if a relevant aircraft is operating within, or intending to enter, an MBA.

Note Certain operational requirements for MBA are contained in section 11.10A. Radio broadcast requirements for MBA are contained in section 21.09.

Figure 8-12 **CASR Part 91 MOS 26.18 continued.**

Radio Communications - CPL Only

The following is an extract from *CASR Part 135 MOS* for smaller air transport operations radio communication requirements.

11.08 Radiocommunication systems

(1) An aeroplane, for a flight, must be fitted with 1 radiocommunication system that is capable of continuous communication on all frequencies necessary to meet reporting, broadcast and listening watch requirements under regulations 91.630, 91.635, 91.640, and 91.675 of CASR.

(2) Subject to subsection (3), and without limiting subsection (1), for a flight in any class of airspace, an aeroplane must be fitted with at least 2 independent radiocommunication systems:

(a) each capable, under normal operating conditions, of communicating with an appropriate ground station from any point on the route, including in the event of any diversion; and

(b) each capable of receiving meteorological information at any time during the flight; and

(c) at least one of which must have two-way voice communication capability; and

(d) at least one of which must provide for communication on the aeronautical emergency frequency 121.5 MHz.

(3) Despite subsection (2), an aeroplane for a VFR flight by day must be fitted with the following radiocommunication systems:

(a) at least 1 VHF radiocommunication system;

(b) if a VHF radiocommunication system would not allow for continuous communication with ATS at all stages of the flight — one of the following:

(i) an additional radiocommunication system capable of continuous two-way communications with ATS or the rotorcraft's operator;

(ii) an additional radiocommunication system capable of, after activation of the system by a crew member of the rotorcraft, sending an automatic notification to the rotorcraft's operator, or a person nominated by the operator, which:

(A) notifies the operator or person of an emergency situation during the flight; and

(B) includes information about the rotorcraft's general location.

Note: The notification may involve a signal from the radiocommunication system being relayed via multiple communication technologies, for example, satellite relays or mobile phone networks.

Figure 8-13 **CASR 135 MOS 11.08.**

Radio Navigation Systems

There are no requirements specified for the carriage of radio navigation systems for flights under VFR by day. This is hardly surprising since the primary means of navigation for such flights is visual reference to the ground or water.

However, since VFR flights are allowed to operate above cloud, VFR on top, and in controlled airspace using radio aids for navigation, it is your responsibility to ensure that the aeroplane is properly equipped. To this end, we suggest that a VOR or ADF would be appropriate.

If you intend to operate VFR on top or in controlled airspace, you must read the appropriate sections of AIP to ensure that you are suitably qualified, and can comply with the requirements for frequency of fixing position and track-keeping accuracy.

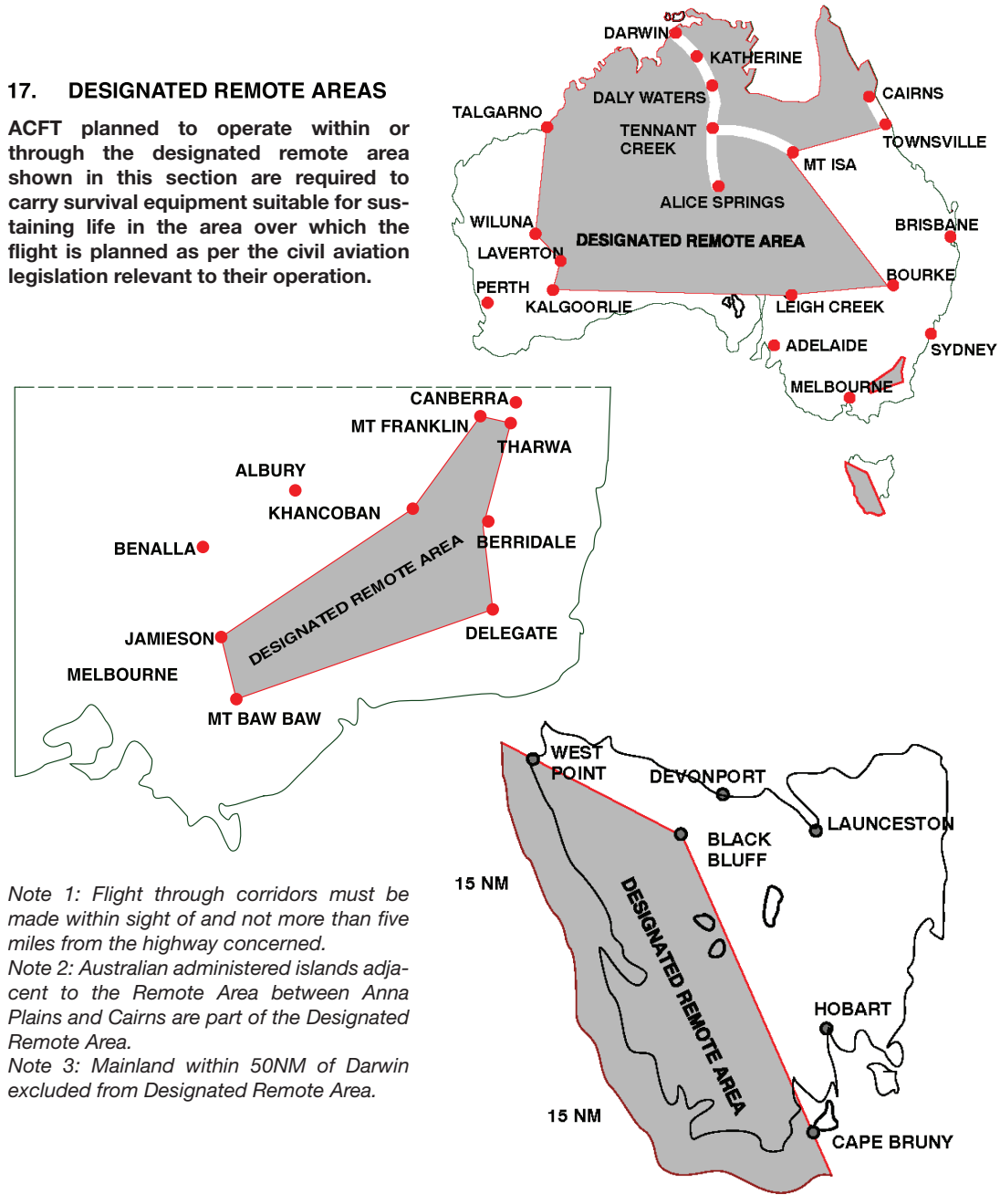


Figure 8-14 **ERSA GEN-FIS 17.**

Secondary Surveillance Radar (SSR) Transponders

Before you will be allowed to operate in controlled airspace, other than Class D control zones, your aeroplane must be equipped with an SSR transponder. The requirements for the carriage and use of SSR are detailed in the relevant *CASR MOS*. Further advise is contained within *AC 91-23*. The following is an extract of the *Part 91 general operating requirements*.

26.68 Required surveillance equipment

(1) An aircraft for a flight for which surveillance equipment is required under this section must be fitted with surveillance equipment that meets the requirements relevant to the intended operation and class of airspace.

Note See section 26.66 regarding certain aircraft that can be fitted with, or carry, surveillance equipment that is not in accordance with a TSO or ETSO provided certain conditions are met.

(1A) An aircraft operating at Brisbane, Sydney, Melbourne or Perth aerodrome must be fitted with, or carry, at least 1 approved Mode S transponder with ADS-B capability.

Note An approved Mode S transponder with ADS-B capability is not required to transmit ADS-B OUT for a VFR flight.

(2) For subsection (1), an aircraft in an operation mentioned in column 1 of an item in Table 26.68 (2), in the class of airspace mentioned in column 2 of the item, must be fitted with surveillance equipment meeting the requirements mentioned in column 3 of the item.

Table 26.68 (2) – Surveillance equipment – requirements

	Column 1	**Column 2**	**Column 3**
Item	**Operation**	**Class of airspace**	**Requirements**
1	IFR	Any (Classes A, B, C, D, E and G)	At least 1 approved ADS-B OUT equipment configuration.
2	VFR	Any — from FL290 and above	At least 1 approved ADS-B OUT equipment configuration.
3	VFR	Class A, B or C (below FL290)	At least 1: (a) approved ADS-B OUT configuration; or (b) approved Mode S transponder with Class B TABS position source device configuration; or (c) approved transponder being: (i) for an aircraft, manufactured on or after 6 February 2014, or modified by having its transponder installation replaced on or after 6 February 2014 — an approved Mode S transponder with ADS-B capability; or (ii) for any other aircraft — approved transponder. *Note* An approved Mode S transponder with ADS-B capability is not required to transmit ADS-B OUT for a VFR flight.

Figure 8-15 **CASR Part 91 MOS 26.62.**

4	VFR	Class E (not above FL290) Class G — from 10 000 ft to not above FL290	At least 1: (a) approved ADS-B OUT configuration; or (b) approved equipment configuration of a Mode S transponder with Class B TABS position source device; or (c) approved transponder being: (i) for an aircraft, manufactured on or after 6 February 2014, or modified by having its transponder installation replaced on or after 6 February 2014 — a Mode S transponder with ADS-B capability; or (ii) for any other aircraft — an approved transponder; or (d) an approved integrated TABS device. *Note* An approved Mode S transponder with ADS-B capability is not required to transmit ADS-B OUT for a VFR flight.

(3) Item 4 in Table 26.68 (2) does not apply to an aircraft if the aircraft does not have:
(a) an engine; or
(b) sufficient engine-driven electrical power generation capacity to power the surveillance equipment.

Figure 8-16 **CASR Part 91 MOS 26.62 continued.**

Flight Instruments

The flight instrument requirements are specified in *CASR Part 91 MOS Division 26.3*. If any instruments or indicators referred to in this list are unserviceable, the aeroplane must not be flown until the faults are rectified.

26.06 Aeroplane VFR flight by day

(1) Subject to subsection (2), an aeroplane for a VFR flight by day must be fitted with equipment for measuring and displaying the following flight information:
(a) indicated airspeed;
(b) pressure altitude;
(c) magnetic heading;
(d) time;
(e) Mach number — but only for an aeroplane with operating limitations expressed in terms of Mach number;
(f) turn and slip — but only for an aeroplane conducting an aerial work operation;
(g) outside air temperature — but only for an aeroplane conducting an aerial work operation from an aerodrome at which ambient air temperature is not available from ground-based instruments.

Figure 8-18 **CASR 91 MOS Division 26.3.**

(2) For subsection (1), the equipment for measuring and displaying the flight information mentioned in column 1 of an item in Table 26.06 (2) must meet the requirements mentioned in column 2 of the item.

Table 26.06 (2) – Requirements for equipment – aeroplane VFR flight by day

	Column 1	Column 2
Item	**Flight information**	**Requirements**
1	Pressure altitude	The equipment must: (a) have an adjustable datum scale calibrated in millibars or hPa; and (b) be calibrated in ft, except that, if a flight is conducted in a foreign country which measures FLs or altitudes in metres, the equipment must be calibrated in metres, or fitted with a conversion placard or device.
2	Magnetic heading	The equipment must be: (a) a direct reading magnetic compass; or (b) both: (i) a remote indicating compass; and (ii) a standby direct reading magnetic compass.
3	Time	1. The equipment must display accurate time in hours, minutes and seconds. 2. The equipment must be: (a) fitted to the aircraft; or (b) worn by, or immediately accessible to, the pilot for the duration of the flight.

Figure 8-19 **CASR 91 MOS Division 26.3 continued.**

Air Transport Operations

In addition to the basic requirements discussed above, additional flight instrument requirements are laid down in *CASR Part 135 MOS 11.05* for air transport operations.

11.05 Day VFR flight instrument requirements

(1) An aeroplane in an operation under the VFR by day must be fitted with equipment for measuring and displaying the following flight information:
- (a) indicated airspeed;
- (b) pressure altitude;
- (c) magnetic heading;
- (d) time;
- (e) Mach number — but only for an aeroplane with operating limitations expressed in terms of Mach number;
- (f) turn and slip;
- (g) outside air temperature.

(2) An aeroplane in an operation under the VFR by day, for which 2 pilots are required under the civil aviation legislation or the aeroplane's flight manual, must be fitted with equipment, separate from, and independent of, the corresponding equipment mentioned in subsection (1), for measuring and displaying the following flight information:
- (a) indicated airspeed;
- (b) pressure altitude;
- (c) Mach number — but only for an aeroplane with operating limitations expressed in terms of Mach number
- (d) turn and slip.

Figure 8-20 **CASR Part 135 MOS 11.05.**

(3) Despite subsections (1) and (2), for an aeroplane in an operation under the VFR by day, the equipment for measuring and displaying the flight information mentioned in column 1 of an item in Table 11.05(3) must meet the requirements mentioned in column 2 of the same item.

Table 11.05(3)—Requirements for flight instruments – VFR flight by day

Item	Column 1 Flight information	Column 2 Requirements
1	Pressure altitude	The equipment must: (a) have an adjustable datum scale calibrated in millibars or hPa; and (b) be calibrated in feet, except that, if a flight is conducted in a foreign country that measures flight levels or altitudes in metres, the equipment must be calibrated in metres or fitted with a conversion placard or device.
2	Magnetic heading	The equipment must be: (a) a direct reading magnetic compass; or (b) a remote indicating compass and standby direct reading magnetic compass.
3	Time	1. The equipment must display accurate time in hours, minutes, and seconds. 2. The equipment must be: (a) fitted to the aeroplane; or (b) worn by, or be immediately accessible to, the pilot for the duration of the flight.

Figure 8-21 **CASR Part 135 MOS 11.05 continued.**

Having established what instruments are required for VFR flight, *CASR Part 91 MOS 26.04* refers to the serviceability requirements.

26.04 Serviceability of equipment

Any equipment required by this Chapter to be fitted to, or carried on, an aircraft for a flight must be operative unless:

(a) another section of this Chapter provides otherwise; or

Note A minimum equipment list (a ***MEL***), approved under regulation 91.935, can only permit equipment required to be fitted to, or carried on, an aircraft by this Chapter, to be unserviceable within the limits of the requirements contained in this Chapter. For example, section 26.26 contains an allowable time period of 72 hours related to flights with inoperative altitude alerting equipment. An MEL would not be approved if it contained a maximum time period for altitude alerting equipment to be inoperative that was greater than the time period specified by either a master minimum equipment list (MMEL) or the legislation.

(b) the equipment:

(i) is inoperative because of a defect that has been approved as a permissible unserviceability for the aircraft for the flight; and

(ii) is fitted or carried in accordance with the permissible unserviceability.

Figure 8-22 **CASR Part 91 MOS 26.04.**

Emergency & Life Saving Equipment

Flotation Equipment – Life Jackets & Life Rafts

For obvious reasons, there is a need to have life jackets and life rafts available for over-water flights. (For general rules concerning overwater flights, see volume 4 of this series, *Flight Rules & Air Law*, and *CASR Part 135 MOS 11.55* for air transport operations.)

Life Jackets

Refer to CASR Part 91 MOS Chapter 26.56 & 26.58.

The pilot in command must plan to carry a life jacket for every person on board when conducting an over water flight in the following aircraft types:

- seaplane or an amphibian;
- single-engine aircraft that is not a seaplane or an amphibian - if, during the flight, the aircraft is flown further over water than the distance from which, with the engine inoperative, the aircraft could reach an area of land that is suitable for a forced landing;
- multi-engine aircraft that is not a seaplane or an amphibian - if during the flight the aircraft is flown more than 50 NM from an area of land that is suitable for a forced landing.

Note: The life jackets must have an attached whistle. For each infant on board another equally effective flotation device, that may have a whistle, is acceptable.

A person (other than an infant) on board a single-engine aircraft must wear a life jacket if the flight is over water that is further than the distance from which, with the engine inoperative, the aircraft could reach land. This does not apply for the purposes of departing or arriving at an aerodrome, or when the aeroplane is being flown higher than 2,000 ft above the water.

Lift Rafts

Refer to CASR Part 91 MOS Chapter 26.60

The pilot in command must plan to carry a life raft sufficient to carry each person on the aircraft (excluding infants) if during the flight the aircraft is flown further over water than the following distances:

(a) for a jet-driven multi-engine aeroplane with an MTOW of more than 2,722 kg - whichever is the shorter of the following:
- the distance the aeroplane would fly in 2 hours at its normal cruising speed in still air
- 400 NM;

(b) for a turbine-engine propeller-driven aeroplane with an MTOW of more than 5,700 kg - whichever is the shorter of the following:
- the distance the aeroplane would fly in 2 hours at its normal cruising speed in still air;
- 400 NM

(c) for any other aircraft — whichever is the shorter of the following:
- the distance the aircraft would fly in 30 minutes at its normal cruising speed in still air;
- 100 NM.

The lift raft must be stowed and secured so that it can be readily deployed if the aircraft has to ditch. If a life raft is stowed in a compartment or container, the compartment or container must be conspicuously marked as containing the life raft. When the aircraft begins the flight, it must carry survival equipment for sustaining life, as appropriate for the over-water area to be overflown, and signalling equipment that can make the distress signals set out in *Appendix 1 to ICAO Annex 2*, Rules of the Air if required.

Note: *CASR Part 135 MOS* states specific emergency and life saving equipment to be carried. CPL candidates should refer to *division 12* of the *CASR part 135 MOS.*

Survival Kits

ERSA EMERG provides much useful information on survival, ground-to-air signals for survivors, recommended contents of first aid kits, emergency procedures, and medical hazards. It also gives advice on survival procedures for different conditions, such as desert, sea, and jungle, all of which exist in Australia. Although you may never have to carry out a precautionary or forced landing in such an area, we would strongly recommend that you study this section of the ERSA from time to time. You never know, it may save your life one day. *CASR Part 91 MOS 26.64* states that an aircraft must carry survival equipment for sustaining life, as appropriate, for flights over remote areas. Further, *Section 26.62* states that if an aircraft is required to carry a life raft under the regulations, then the flight must carry appropriate survival equipment and signalling equipment..

Note: Flight within the corridors from Alice Springs to Darwin, and Mount Isa to Tennant Creek, is considered to be outside the designated remote area, provided you comply with note 1, which states: 'Stay within sight of the highway, but in no case more than 5 nm therefrom'.

Signalling Equipment

In addition to the signalling equipment requirements in *Section 26.62*, regulation exists to carry appropriate signalling equipment in the form of VHF survival beacons (VSB), emergency locator beacons (ELB) and emergency locator transmitters (ELT) on over water flights and, when not equipped with HF radio as already discussed, when operating in designated remote areas.

26.51 Survival ELT

(1) In this Division:

survival ELT is an ELT that meets the requirements in:

(a) section 26.49; and

(b) subsection (2).

(2) For paragraph (1) (b), the ELT must be:

(a) removable from the aircraft; and

(b) 1 of the following types:

(i) an emergency position-indicating radio beacon of a type that meets the requirements of AS/NZS 4280.1:2003;

(ii) a personal locator beacon of a type that meets the requirements of AS/NZS 4280.2:2003;

(iii) a type authorised by the FAA or EASA in accordance with (E)TSO-C126;

(iv) a type authorised by EASA in accordance with:

(A) ETSO-2C91a for operation on 121.5 MHz; and

(B) ETSO-2C126 for operation on 406 MHz;

(v) a type approved under Part 21 of CASR as having a level of performance equivalent to a type mentioned in subparagraph (i), (ii), (iii) or (iv).

Figure 8-23 **CASR Part 91 MOS 26.51.**

Guidance on how to use the VSB, ELB or ELT, is given in ERSA EMERG, and you should ensure that you study and digest this material before you decide to operate on over-water flights or in designated remote areas. They can help to locate you and save your life.

Review 8

PPL & CPL

1. Is an aircraft required to carry a VHF radio if operating VFR by day in Class G airspace below 5,000 ft AMSL?
2. If operating in a designated remote area without an emergency locator beacon, do you require HF radio?
3. If you are taking off from an airfield located beside the sea and your take-off flightpath takes you over the water (e.g. Adelaide), are you required to wear life jackets?
4. If you are flying a single-engine aircraft 25 nm out to sea at 5,000 ft, does each occupant need to wear a life jacket?
5. If you plan on flying through a designated remote area and your aircraft is not equipped with an HF radio, are you required to carry an ELT?
6. Are you required to carry survival kits for flights through designated remote areas?
7. Must your aircraft have a serviceable airspeed indicator?
8. Must your aircraft be fitted with an accurate and serviceable clock for VFR operations?
9. Must your aircraft have a serviceable altimeter for VFR operations?
10. Must your aircraft have a serviceable compass for VFR operations?
11. Is an ELT required for cruising flight over water in a single-engine aeroplane where continuous radio communication will not be possible?
12. What is the requirement for life jackets for an overwater flight in a single-engine aeroplane?
13. Is a survival kit required for a flight through a designated remote area?
14. Is a survival kit required for overwater flights?
15. Following a forced landing in which injuries are suffered, you should activate the ELT (immediately/at last light/at SARTIME).
16. The document issued by the CASA to indicate that a particular aeroplane complies with the appropriate airworthiness requirements is the (flight manual/certificate of airworthiness/company operations manual).
17. The certificate of airworthiness is usually issued for (12 months/24 months/an unspecified period).
18. Placards in the cockpit have the same status as instructions in the . . . . . and should be adhered to.
19. The validity of the maintenance release may be checked in part (1/2/3) of the maintenance release.
20. The class of operation for which an individual aircraft is approved is specified in part (1/2/3) of the maintenance release.
21. Defects should be reported by the pilot in Part (1/2/3) of the maintenance release.
22. A daily inspection carried out prior to a previous flight by the holder of a private pilot licence (is/is not) valid for a subsequent flight on the same day by another pilot.
23. The time remaining to the next major inspection as laid down in the approved maintenance schedule can be determined from the:
    a. certificate of airworthiness.
    b. flight manual.
    c. maintenance release.
    d. Civil Aviation Regulations.
24. Maintenance that may be carried out on a Class B aircraft by the holder of a pilot licence (other than a student pilot licence) that is listed in the:
    a. flight manual.

b. Civil Aviation Regulations. *(Continued next page)*
c. certificate of airworthiness.
d. Civil Aviation Orders.
e. maintenance schedule.
f. pilot's operating handbook.

25. Who is responsible for ensuring that the maintenance documents of an aeroplane are in order prior to flight?
26. Defects requiring maintenance after flight should be entered by the pilot in the:
    a. certificate of airworthiness.
    b. flight manual.
    c. maintenance release.

Answers to Review 8 are given on page 358.

Appendix 4

Answers to Review Questions

Review 1

PPL & CPL

1. ERSA.
2. AC 91-02.
3. The runway, runway strip and fly-over area.
4. The pilot in command.
5. 6% at take-off safety speed (CAO 20.7.4 para 7.1).
6. pilot skill, runway characteristics, aerodrome density altitude, changed external drag configuration of the aeroplane, and under performing engine compared to the AFM minimums.
7. 1.25 (multiplied by the AFM take-off figure).
8. 1.3 (multiplied by the AFM landing figure).
9. 12-12-16-12 week cycle.
10. 2%.
11. Part 139 'Aerodromes'

Review 2

PPL & CPL

1. Worsens.
2. Decrease.
3. Decrease.
4. Decreases, 30 ft.
5. 0 ft.
6. 9,950 ft.
7. +10°.
8. ISA+11.
9. 4,900 ft.
10. Stay the same.
11. Decrease.
12. Short, dry grass.
13. Increase.
14. Longer.
15. Increase.
16. Increases.
17. (c).
18. Increase.
19. Need not.
20. Must.
21. Decreases.
22. Increases.
23. Does not affect.

Review 8

PPL & CPL

1. No (CASR 91 MOS 26.18 (2)).
2. Yes (AIP GEN).
3. No (CASR 91 MOS 26.56 (3)(a)).
4. No, unless you are out of gliding range (CASR 91 MOS 26.56 (b)).
5. Yes (CASR 91 MOS 26.48).
6. Yes (CASR 91 MOS 26.62).
7. Yes (CASR 91 MOS 26.06).
8. No, provided that a timepiece is available in flight (e.g. your watch) CASR 91 MOS Table 26.06(2) item 3.
9. Yes (CASR 91 MOS 26.06).
10. Yes (CASR 91 MOS 26.06).
11. Yes. An automatic ELT must be fitted (CASR 91 MOS 26.48 (1)).
12. One life jacket per person if the distance from land is greater than would allow the aircraft to reach land with the engine inoperative; i.e. gliding distance. (CASR 91 MOS 26.56 (1)(b).
13. Yes (CASR 91 MOS 26.64).
14. No, unless life rafts are required (CASR 91 MOS 26.62).
15. Immediately (ERSA EMERG).
16. Certificate of airworthiness.
17. An unspecified period.
18. Flight manual.
19. Part 1.
20. Part 1.
21. Part 2.
22. Is.
23. (c).
24. (b).
25. The pilot in command.
26. (c).