De Havilland

DHC 1-A-1   Chipmunk 34

ZK-CVM

Pilot's Notes

Fourth Edition – June 2022

Derived from various material by

Waypoints Aviation Ltd

De Havilland

DHC 1-A-1 – Chipmunk 34

ZK-CVM

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Amendment to walk around and shutdown procedures
Tidy up typos and formatting errors
Amendments to Syndicate Rules

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Introduction

While these Pilots Notes have generally been prepared for the De Havilland DHC 1 Chipmunk, because of the age of these aircraft and the range of type and systems variations developed over the years, these Pilots Notes have been prepared with a focus on one particular aircraft, that being the Canadian built De Havilland DHC 1-A-1 Chipmunk 34, registration ZK-CVM, fitted with a Gipsy Major 10 Mk 2-1 engine.

These notes have been compiled to give pilots an operational knowledge of the Chipmunk, together with airframe and engine data and notes on the handling of the aircraft. They should be read in conjunction with the approved Flight Manual for each particular aircraft flown. Should the information given in these Pilots Notes conflict with that in the applicable Flight Manual, the latter should be taken as the overriding authority.

Should you or anyone you know wish to offer constructive comments on the content of these notes they would be highly valued. Please contact Mark Woodhouse at waypointsnz@gmail.com.

Should you or anyone you know wish to obtain an electronic copy of these notes, they are freely available on our website, www.waypoints.co.nz/freestuff, or by contacting Mark Woodhouse at waypointsnz@gmail.com.

Disclaimer

This publication is intended to be a learning tool for pilots converting onto and operating the De Havilland DHC 1 Chipmunk.

These notes were derived and compiled from a wide range of sources, and while the quality and accuracy of these sources appears to be reliable, there is every possibility that errors exist in this document.

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Chapter One

General

Introduction

The De Havilland DHC 1 Chipmunk is a two seater, low wing, cantilever monoplane. ZK-CVM is a Canadian build Chipmunk powered by a Gipsy Major 10 Mk 2-1, four cylinder, in-line inverted, air cooled engine. In all cases the engine drives a two bladed, fixed pitch, metal or wooden propeller.

British Chipmunk variants are similar in many respects, however the Canadian Chipmunk does have a number of significant differences. All variants were fitted with complete dual controls.

History of Chipmunks

The DHC-1 Chipmunk was designed as the successor to the classic DH82 Tiger Moth. The design was assigned to De Havilland's Canadian subsidiary, as Hatfield in the UK was fully occupied with the Comet and other post-war aircraft.

The prototype first flew in 1946 and after evaluation by the RAF production was initiated in both Canada and England. Eventually nearly 1,300 were built, about 1,100 in England, and about 200 in Canada, with about 60 being built under licence in Portugal.

The Royal Airforce (RAF) was the largest user of the Chipmunk, with 735 in service, however the type never become the standard RAF primary trainer, rather they were flown by University Air Squadrons and Volunteer Reserve flying schools.

Large numbers were released onto the surplus civil aviation market at the end of the 1950's, many of which were subsequently considerably modified, including horizontally opposed engines, single seat versions, etc.

The History of ZK-CVM

ZK-CVM is a DHC 1-A-1 Chipmunk, manufactured by De Havilland Canada in 1947. Its serial number is 34, and it is one of 38 Chipmunks brought by the Indian Government in 1948/49 and used to train ab-initio pilots to commercial standard at approved flying schools in India.

The very first logbook showed that CVM was assembled at Mumbai and ferried to Bamrouli on the 28th of May 1949, where it was then operated by the Royal Bengal Flying Club.

The logbook included records of minor incidents etc., including one case of damage to a wing when the aircraft collided with a vulture. It didn't say whether it was the leading edge or trailing edge that was damaged!

It is our understanding that this group of Chipmunks were operated until the late 70's, after which time they were dismantled and put into storage. In 1994 Colin Smith of Croyden Aircraft Company, Mandeville near Gore obtained five of these aircraft for restoration, along with engines etc. CVM was purchased by Don Pennial later that year.

While in Mandeville the fuselage was completely stripped down and re-skinned. The wings were de-riveted, cleaned, primed and re-riveted, and some of the control surfaces were primed and re-covered.

In 1997, CVM was moved up to Christchurch by Don where he undertook the completion of its restoration. The first task was the re-covering of the wings using ceconite. The engine, a Gipsy Major 10 Mk 1-3A, was completely overhauled/rebuilt by Bob McGarry Aviation at West Melton and all fitting out was completed in Don's garage, with final assembly at Rangiora.

Other aspects of the restoration and modifications include:

- A new bubble canopy, manufactured in Ohio USA;
- New Cleveland brakes and wheels;
- An alternator to replace the generator; and,
- A Hoffman propeller.

All instruments, apart from the tacho, were replaced with new items. Gyro instruments were fitted front and rear and a new radio, intercom and transponder were fitted. The aircraft was completely rewired and converted to a 12 volt system.

During the restoration of CVM many challenges had to be overcome, parts found or fabricated and approvals to be obtained. Time consuming and costly. Many skilled and helpful people assisted Don. A standard Certificate of Airworthiness from the NZCAA was issued in early April 2003 and the aircraft's first flight, post restoration, was on the 12th of April 2003.

In September 2020, CVM suffered a nose over and prop strike during a full power engine run. This led to the engine being replaced with a Gypsy Major 10 Mk 2-1 and a Hercules prop (the first in the world on a Chipmunk. A Special Category - "Limited" Certificate of Airworthiness from the NZCAA was issued in early August 2021 and the aircraft's first flight, post engine and propellor replacement, took place on the 10th of August 2021.

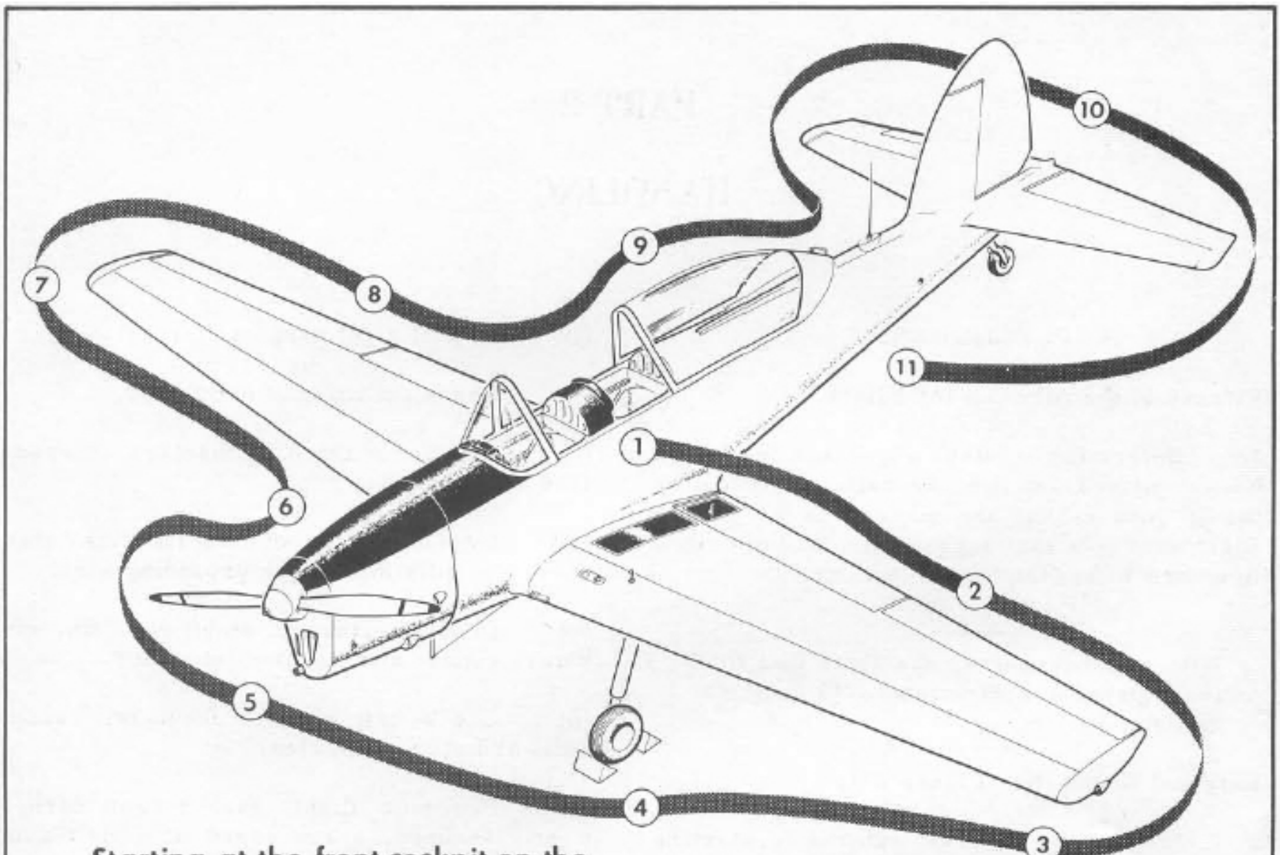
Aircraft Callsigns

"CVM" and "Chipmunk 34" are our accepted callsigns.

Chapter Two

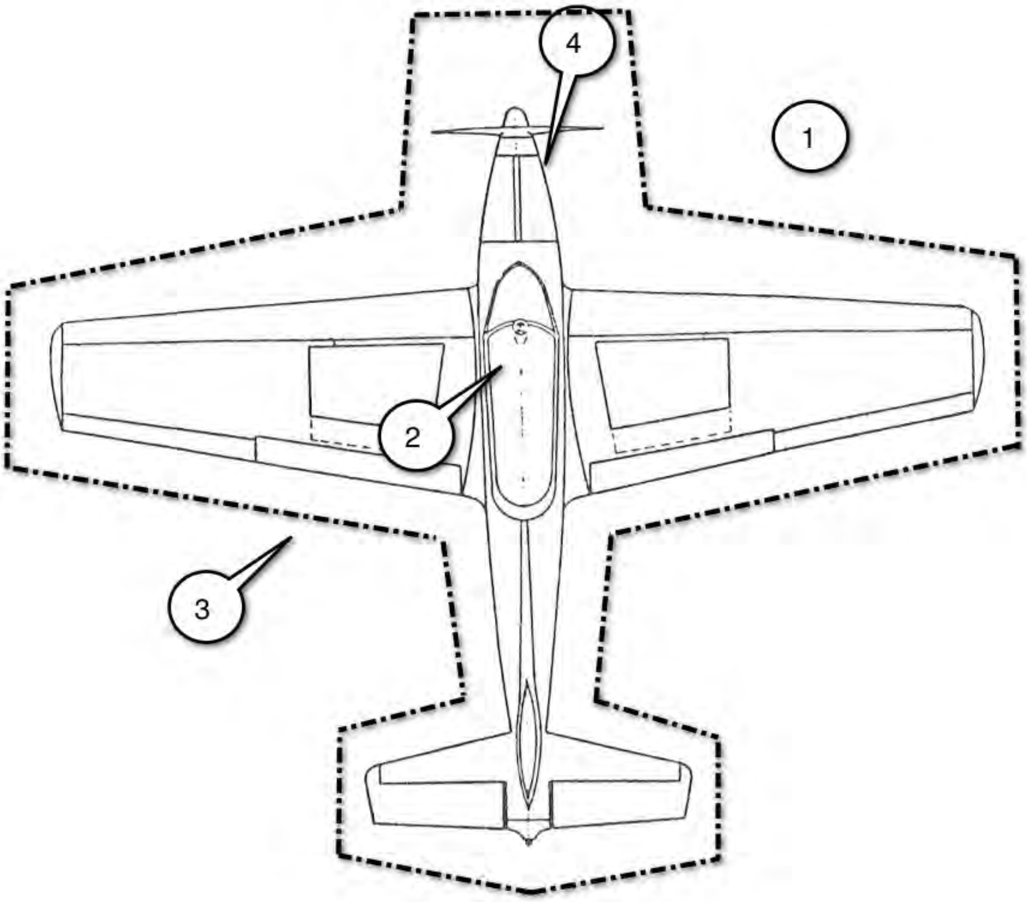
Preflight Inspections

The diagram below comes directly from the De Havilland Canadian Chipmunk Flight Manual. While it is slightly different to the more comprehensive notes on the following pages, I felt it was worth including as it is reasonably concise.



Starting at the front cockpit on the left side make the following checks

1. **COCKPIT** Hood open. Ignition and battery master switch off. Brakes off. Flap lever up. Fuel contents and filler caps secure. Unlock controls.
2. **LEFT WING** Flap position corresponds to lever selection. Condition of upper and lower wing surfaces, flap and aileron. All hinges clear. No fuel leakage.
3. Condition of wing tip, navigation light and landing light. Pitot tube unobstructed and cover removed. Leading edge for damage. Zipper panels closed and wired secure.
4. **LEFT LANDING GEAR** Wheel chocked. Landing gear for damage. Brake pipes and hose for fluid leaks. Tire for cuts, bruises, slippage and proper inflation.
5. **POWER PLANT** Cowlings for damage and security. Carburettor and oil cooler intakes clear. Exhaust manifold for condition. Propeller blades for nicks and fairing for condition.
6. **RIGHT LANDING GEAR** Wheel chocked. Strut for damage. Brake pipes and hose for fluid leaks. Tire for cuts, bruises, slippage and proper inflation.
7. **RIGHT WING** Leading edge for damage. Condition of wing tip and navigation light. Zippers closed and wired secure.
8. All hinges clear. Condition of upper and lower surfaces of aileron, flap and wing. Flap position corresponds to lever selection. No fuel leakage.
9. **RIGHT FUSELAGE** Condition of surface, no dents or wrinkles. Antenna for security. Dorsal and vertical fin for condition.
10. **EMPENNAGE** Leading edges and surfaces for condition. All hinges clear. Elevator trim tabs correspond to handwheel selection. Condition of navigation light. Tailwheel tire for cuts, bruises, slippage and proper inflation. Shock strut extension. Check grounding wire.
11. **LEFT FUSELAGE** Condition of surface. No dents or wrinkles. Dorsal and vertical fin for condition. Hood for security and smoothness of operation. External power receptacle clean. Static vent clear, First Aid kit and battery cover secure, crash instructions in place.



1. Approaching the Aircraft

As the pilot approaches the aircraft, check:

- ✈ The general appearance and suitability of the position of the aircraft;
- ✈ The condition of the tyre inflation; and,
- ✈ Whether or not the wheels are chocked.

Position the aircraft in an appropriate position for starting and taxiing, preferably with the nose into wind and on a suitable surface where the propeller area is clear of stones and gravel.

Remove the:

- ✈ Pitot cover and any other blanks;
- ✈ Cockpit canopy cover; and/or,
- ✈ External control locks.

With the electric starter fitted and serviceable there is no requirement to use wheel chocks. If the aircraft is to be started by hand swinging the propeller, then CHOCK THE WHEELS.

2. Cockpit Preflight Preparation

Open and secure the cockpit canopy. Check the condition and operation of the canopy.

Stow the:

- ✈ Pitot cover;
- ✈ Cockpit canopy cover; and,
- ✈ External and internal control locks.

Check the Flight Manual and Tech Log to ensure the aircraft is in a fit state for flight and to determine whether there are any restrictions.

Check that the baggage, fuel and other item load distribution is within the centre of gravity limitations for the type of flight to be undertaken.

Stow:

- ✈ Personal baggage, etc.;
- ✈ Headsets;
- ✈ Maps and flight documents;
- ✈ Parachutes, if carried; and,
- ✈ Survival equipment.

Verify that the:

- ✈ Master switch is OFF;
- ✈ Fuel is ON the fullest or preferred tank;
- ✈ Brakes are off (brakes off is required to check the rudder); and,
- ✈ Ignition switches in the front cockpit are both OFF **(Down)**.

Check that the:

- ✈ Flight controls are free;
- ✈ Windscreen is clean; and,
- ✈ Canopy is clean.

Prepare the rear cockpit, as required:

- ✈ Ensure the ignition switches are both ON (up); and,
- ✈ If solo, secure the harness straps and any other loose objects.

For solo flight, returning to the departure airfield, it is recommended that you remove **EVERYTHING** from the rear cockpit seat before securing the harness, regardless of whether you are doing aerobatics or not. This includes:

- ✈ All seat cushions and/or seat pad; and,
- ✈ Any other loose objects.

For solo flight, move the canopy to the half forward position before entering the aircraft.

Deploy the flaps to max (30 degrees) checking for symmetrical deployment. Return the flaps to the fully up position.

3. Preflight Walk Around

Perform a normal preflight walk around of the aircraft. During the walk around, pay particular attention to the:

- ✈ Aircraft surfaces for damage, i.e., popped rivets, dents, and any distortions;
- ✈ Ailerons, elevators and rudder control surfaces. Check for free and easy of movement. Check the hinges, security of bolts, nuts and locking mechanisms;
- ✈ Fabric covering of all control surfaces for holes, rips, tears, peeling, etc., especially the underside of the flaps;
- ✈ Propeller. Check the security and mounting of the propeller and spinner. Examine the blades for damage. Check for compression and hydraulicing by turning the propellor through four blades;
- ✈ Tires. Check for cuts, cracks, bald spots, etc.;
- ✈ Tailwheel inflation;
- ✈ Undercarriage oleo legs. Check for leaks, excessive compression, etc. Check the hydraulic wheel brake hoses/connections for leaks, signs of scuffing etc.;
- ✈ Wheel chocks. In place if required;
- ✈ Fuel tank capacities. Complete a water drain test on each of the fuel tanks to remove excess water;
- ✈ Tightness and security of the fuel tank caps;
- ✈ Check that the pin holes on the fuel vent stems are not clogged;
- ✈ Clearance between elevator and rudder with full deflection of both;
- ✈ External panels. Check that they are all locked and secure;
- ✈ Drain holes. Check that all are clear and there are no obvious leaks.

4. Engine Inspection

Recheck that the:

- ✈ Master switch is OFF; and,
- ✈ Front ignition switches are OFF **(Down)**.

WARNING
Never allow yourself or anyone else to stand or put any part of the body within the arc of the propeller, since a loose or broken wire, or a component malfunction, could cause the propeller to be live and to suddenly rotate.

Open and latch both the port and right engine cowlings. In the engine compartment:

- ✈ Check for excessive oil or other fluid deposits;
- ✈ Check for excessive oil leakage from cylinder heads;
- ✈ Check for cracks in the inlet or exhaust manifolds;
- ✈ Check for loose wires and loose fittings;
- ✈ Check that the oil cooler intake (left side engine cowling) is unobstructed;
- ✈ Check for cracks and evidence of oil leaks from the engine oil cooler;
- ✈ Check that the oil quantity is between 1.5 Imp gallons and full. Replenish as necessary;
- ✈ Rotate the oil filter through 90 degrees; and,
- ✈ Check for missing inlet and exhaust pipe gaskets/manifold securing nuts (right side of engine).

Close and secure both engine cowlings. Recheck that all cowling fasteners are securely locked.

Check all air intake areas for foreign debris.

Waypoints AVIATION

DHC 1-A-1 Chipmunk 34 ZK-CVM
NORMAL CHECKLISTS

BEFORE ENGINE START CHECKS

Seat Belts .... Secure
Brakes .... Parked
Master Switch...................... On - Volts Checked
Alternator............................. Off
Radio Master .... Off
CO Monitor .... On
Fuel Selector .... Fullest tank
Flaps .... Up

ENGINE START CHECKS

Throttle................................. Set ½ inch open
Mixture .... Rich
Carb Heat............................. Cold
Prime .... As required
Propeller Area .... Clear
Ignition .... Both On (Up)
Starter Switch...................... Press (5 seconds max)

AFTER ENGINE START CHECKS

Throttle................................. 600-800 rpm
Start Switch .... Guarded
Starter Engaged Light .... Out
Oil Pressure......................... Indicating within 30 seconds
Ignition .... Checked (L – Both – R – Both)
Alternator............................. On
Radio Master .... On; Radios set
Throttle................................. 1000-1200 rpm

Prepared by Waypoints Aviation

TAXI CHECKS

Oil Temperature .... > 15ºC
Oil Pressure.......................... > 30 psi
Chocks .... Removed
Brakes .... Release; Test; 3-4 clicks On
Flight Instruments................ Checked

ENGINE RUN UP CHECKS

Park .... Into wind (if possible)
Area .... Clear
Brakes .... Parked
Oil Temperature .... > 15ºC
Oil Pressure.......................... 30-40 psi
Control Column.................... Fully back
Throttle................................. 1600 rpm
Aircraft .... Stationary
Carb Heat .... Checked
Ignition .... Checked (L – Both – R – Both)
Suction .... Checked
Alternator / Ammeter .... Checked
Throttle................................. Check idle at 650-750 rpm;
.... Reset 1100 rpm

PRE-TAKE OFF CHECKS (D.V.A.'s)

T - Trim .... Full and free movement; Set as required
T - Throttle Friction .... Set
M - Mixture .... Rich
C - Carb Heat .... Cold
P - Pitch .... Fixed
F - Fuel............................. Selector On - Fullest tank;
.... Contents sufficient; Primer locked
F - Flaps........................... Set
I - Ignition .... Both On (Up)
I - Instruments .... Checked
H - Hatches & Harnesses Locked; Secure
C - Controls .... Full, free and correct movement

LINE UP CHECKS

Transponder .... On ALT
D.I. .... Aligned with the runway

AFTER TAKEOFF (CLIMB) CHECKS

Flaps .... Up at a safe speed and height
(min 60 kts and 200 feet AGL)
Brakes .... Off
Temps and Pressures .... Checked

PRE-LANDING CHECKS

B - Brakes......................... Checked; Park brake Off
U - Undercarriage .... Fixed
M - Mixture........................ Rich
P - Pitch............................ Fixed
F - Fuel Selector On - Fullest tank;
Contents sufficient; Primer locked
H - Hatches & Harnesses Locked; Secure

FINALS CHECKS

Landing Flap........................ Set
Landing Clearance.............. Received
Runway .... Clear
Carb Heat .... Cold

AFTER LANDING CHECKS

Flaps .... Up
Transponder .... Off
Brakes .... Test; 3-4 clicks On (or as required)

SHUTDOWN CHECKS

Brakes .... Parked
Throttle................................. 1000 rpm
Radio Master .... Off
Control Column .... Fully back
Throttle................................. 1600 rpm
Aircraft .... Stationary
Ignition .... Checked (L – Both – R – Both)
Throttle................................. Closed
Idle Cut-off Control .... Pulled out
Ignition .... Off (Down)
Alternator .... Off
Master Switch .... Off
CO Monitor .... Off
Fuel...................................... Off
Control Locks .... As required
Brakes .... As required

HASELL CHECKS

H - Height.......................... Sufficient for recovery at a safe height
A - Airframe .... Flaps as required; Brakes Off
S - Security .... Harness tight; Hood closed;
No loose objects
E - Engine .... Mixture fully rich;
Carb heat as required;
Temps and pressures checked
L - Location .... Not over built up areas
L - Lookout .... Around, above and below

SCADIE CHECKS

S - Suction .... Checked
C - Carbon Monoxide....... Checked
A - Amps & Volts............. Checked
D - D.I. .... Checked with compass
I - Icing............................. Check carb heat
E - Engine .... Instruments and fuel checked

PROP SWINGING - ENGINE START CHECKS

Before Engine Start CX ...... Complete
Wheel Chocks .... Secure
Brakes .... Parked
Safely Pilot .... Secure

Cold Engine:

Prime .... As required
Ignition .... Both Off (Down)
Throttle................................ Closed
Control Column................... Fully back
Propeller .... Pull through 4 compressions
Throttle................................ Set ½ inch open
Ignition .... Front (right) On (Up)
Propeller .... Swing to start

Hot Engine:

Throttle................................ Set ½ inch open
Ignition .... Front (right) On (Up)
Propeller .... Swing to start

If no start after 4-6 swings, proceed as for a cold engine.

PROP SWINGING - AFTER ENGINE START CHECKS

Ignition .... Both On (Up)
Throttle................................ 600-800 rpm
Oil Pressure......................... Indicating within 30 seconds
Ignition .... Checked
Alternator............................ On
Radio Master .... On; Radios Set
Throttle................................ 1000-1200 rpm

SPEEDS and LIMITATIONS

V_X	Best Angle of Climb	55 kts IAS
V_Y	Best Rate of Climb	60 kts IAS
V_{NE}	Velocity Never Exceed	174 kts IAS
V_{NO}	Velocity Normal Operations	118 kts IAS
V_A	Max Manoeuvring	108 kts IAS (@ 1,930 lb)
V_{SO}	Full Flap, Power Off...................	41 kts IAS
V_{S1}	Flaps Up	44 kts IAS
V_{FE}	....	74 kts IAS
V_{REF}	Full Flap.....................................	55 kts IAS

Max Demonstrated Crosswind .... 10 kts

POWER SETTINGS and PERFORMANCE

Normal Climb....................... Full power
70-80 kts IAS

Cruise .... 2100 rpm
90-100 kts IAS

Descent .... 2100 rpm
120 kts IAS

Glide .... approx. 2 nm/1000 ft
60 kts IAS

Fuel Consumption .... 7 Imp gal/hr below 3,000 ft
(32 litre/hr)

Fuel Quantity .... 25 Imp gal useable
(114 litres useable)

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Chapter Four

DHC 1-A-1 Chipmunk 34 ZK-CVM Expanded Normal Checklists

The following is an expansion of the DHC 1-A-1 Chipmunk ZK-CVM Normal Operations Checklists.

BEFORE ENGINE START CHECKS

Ideally, for engine start and run-up, or at any other time when the aircraft is stationary, the wind should be on the nose. In any case, to maximise engine cooling and reduce high abnormal loads on the propeller shaft and the engine mounts, the crosswind component should be less than 10 knots. The propeller area should be visually checked clear of personnel, obstructions and vehicles. The area ahead should be clear in case of brake failure. The intended taxi path should also be clear. The area behind the aircraft should be clear to avoid damage to equipment or other aircraft and inconvenience to other personnel.

With the electric starter fitted and serviceable there is no requirement to use chocks.

Seat Belts ....Secure

Brakes..Parked

Check the brakes by applying pressure and checking for acceptable resistance when applied, to ensure there is fluid and effective seal in the circuit. Then set the park brake fully ON.

Master Switch..On - Volts Checked

The nominal voltage of the battery is 12 Volts. The engine appears to be able to be started if the voltage is greater than about 10.5 Volts.

Alternator..Off

Radio Master ....Off

CO Monitor ....On

Fuel Selector ....Fullest tank

Flaps ....Up

ENGINE START CHECKS

Throttle ....Set ½ inch open

Set the throttle to ½ inch forward of the fully closed position.

Mixture ....Rich

Carb Heat..Cold

Prime ....As required

Six or seven positive strokes when the engine is cold, less when it is warm. Priming should be carried out prior to all starts, whether the engine is cold, hot or in between, with the exclusion perhaps of restarting within 5 minutes or so of shutdown. If it is a hot, still day you might get away with longer, on a cold windy day the opposite is likely to be the case. If in doubt it is recommended to prime the engine prior to a start attempt. **Double check that the primer is fully in and locked.**

Propeller Area ....Clear

A call of "**CLEAR THE PROP**" and a final look outside the aircraft should be made to ensure that it is all clear around the aircraft just prior to starting the engine.

Ignition..Both On (Up)

Both magnetos should be on for an electric start.

Starter Button..Press (5 seconds max)

Press the electric starter button until the engine fires. The electric starter should not be operated continuously for more than 5 seconds at a time. At least one minute must be allowed between each successive start attempt.

Over Priming

If, after several attempts, the engine fails to start, the cause is most probably due to over priming. To remedy this, switch both ignition switches (Magnetos) OFF, open the throttle wide and turn the propeller **backwards**, by hand, through six (6) revolutions. The starting procedure should then be repeated, making the first attempt without further priming.

If the engine fails to start after three successive attempts, have the cause investigated by an engineer.

AFTER ENGINE START CHECKS

Throttle ....600-800 rpm

Start Switch ....Guarded

Starter Engaged Light ....Out

If the Starter Engaged light is illuminated, then shut down the aircraft immediately by closing the throttle, pulling the Idle Cut-off Control fully out and switching both forward ignitions switches off.

Oil Pressure..Indicating within 30 seconds

As soon as the engine is running smoothly, the oil pressure should be checked. The oil pressure should rise and stabilise between 30 and 40 psi within 30 seconds of a successful start.

If the oil pressure does not rise within 30 seconds the engine should be shut down immediately to prevent engine damage.

CAUTION

Check the oil pressure immediately after starting the engine.

If no pressure rise is evident after 30 seconds, shut the engine down immediately and investigate the cause prior to any further start attempts.

> **NOTE**
>
> The minimum oil pressure should not be less than 30 psi, however at slow running, when the oil temperature is 65°C or above, the minimum is 20 psi.

Ignition..Checked (L – Both – R – Both)

To check the ignition system select the **LEFT** magneto OFF for about one second then back ON, then select the **RIGHT** magneto OFF for about one second then back ON**.**

This is a 'dead cut' check to see if the ignition goes dead when the **LEFT** and **RIGHT** magnetos are selected OFF. When each magneto is turned OFF the engine should continue running, albeit at reduced rpm. This confirms that both magnetos are operating correctly.

If the engine dies when the **LEFT** or **RIGHT** magneto is selected OFF then the other magneto (and the aircraft) is unserviceable and this should be rectified immediately.

> **CAUTION**
>
> If the engine dies when either of the magnetos is selected OFF **DO NOT** reselect the magneto back on to try to keep the engine running, as this may lead to a serious backfire and engine damage. Rather, leave the magneto OFF, close the throttle, pull out the idle cut-off control and when the engine has stopped rotating, turn the other magneto OFF.

Alternator..On

Check that the 'Centre-Zero' ammeter is showing a slight positive charge, indicating that the battery is being recharged after start.

Radio Master ....On; Radios set

Erect the artificial horizon(s) and align the DI. Also test the intercom if the rear seat is occupied. Set the QNH on the altimeter Set the radio frequencies. Set standby on the transponder and check that the appropriate code is set.

Throttle ....1000-1200 rpm

In cold conditions the indicated oil temperature tends to rise rather slowly. In such conditions, provided that at least 30 psi of oil pressure is indicated, it is permissible to warm the engine at 1,100 rpm. However, a minimum of 15°C is required before increasing the engine rpm above 1,100 rpm.

TAXI CHECKS

Oil Temperature ....> 15ºC

Oil Pressure...> 30 psi

Chocks...Removed

With the electric starter fitted and serviceable there is no requirement to use chocks, however if the aircraft has been started by hand swinging the prop, chocks are required and should be removed prior to taxiing.

Brakes ....Release; Test; 3-4 clicks On

When in a clear area, apply the brakes sufficiently to feel their operation, then continue. The brake test should be done gently, with even pressure on both brakes. If one brake is not working the aircraft will swing in the direction of the good brake. The brake test does not have to bring the aircraft to a complete stop.

Some other Pilot's Notes suggest that the brakes should be pre-set to about five (5) notches on a sealed surface or about two (2) notches on a grass surface, to enhance directional control during taxiing, especially in crosswind conditions. However this is not a universally accepted technique. Pilots should pre-apply brake if they feel it is appropriate.

Taxi with the control column fully back, especially over rough ground.

Flight Instruments ....Checked

Check the operation of the artificial horizon, the direction indicator and the turn and slip indicator.

ENGINE RUN - UP CHECKS

Park ....Into wind (if possible)

Preferably park the aircraft within 20º of the wind if it is 15 knots or more. Ideally, for run-up or at any other time when the aircraft is stationary, the wind should be on the nose. To maximise engine cooling and reduce high abnormal loads on the propeller shaft and the engine mounts, the crosswind component should be less than 10 knots.

Area ....Clear

Check that the area behind the aircraft is clear. There should be no aircraft or personnel close behind, and the run-up should be carried out in a situation where the slipstream will not cause damage or blow small objects around.

Brakes ....Parked

Centralise the rudder and apply the brakes fully for the run-up. However, do not rely solely on the park brake, keep an awareness of the aircraft position during the high power run-up.

Oil Temperature ....> 15ºC

Oil Pressure..30-40 psi

Minimum oil pressure should not be less than 30 psi.

Control Column...Fully back

Throttle ....1600 rpm

Hold the control column fully back and ensure the aircraft does not move against the brakes as the rpm is increased.

Aircraft ....Stationary

Carb Heat ....Checked

Select the carb heat ON for 10 seconds. There should be a small but noticeable drop of between 20 and 50 rpm when this happens. The rpm should return to normal when the carb heat is selected OFF.

CAUTION

If no rpm drop is noted when the carb heat is applied during run-up, the carb heat control may not be working.

In this case, **do not takeoff.**
Investigate the cause prior to further flight.

WARNING

Do not use carb heat excessively on the ground as this allows unfiltered air (i.e. air with dust, pieces of grass seed, etc.) to pass into the engine.

Ignition...Checked (L – Both – R – Both)

To check the ignition system select the **LEFT** magneto OFF for about two seconds then back ON, then select the **RIGHT** magneto OFF for about two seconds then back ON**.**

When the **LEFT** magneto is selected OFF note the rpm drop (from 1,600), then select the **LEFT** magneto back ON again. The rpm should return to 1,600 rpm. When the **RIGHT** magneto is selected OFF note the rpm drop (from 1,600), then select the **RIGHT** magneto back ON again. The rpm should return to 1,600 rpm.

Do not linger on only one magneto. Each magneto drop should be a maximum of 100 rpm, and the engine should continue to run smoothly on only one magneto.

On occasions it is possible to experience rough running when the ignition check is carried out. This may be due to plug fouling from an accumulation of oil or lead on the plug electrodes. If this problem is encountered the following procedure should be applied:

- ✈ Check that the area behind and adjacent to the aircraft is clear and the brakes are firmly applied. The park brake may not hold at full power - so you may need the rear seat occupant to hold the brakes on firmly. Obviously the control column must be held fully back throughout the run up.
- ✈ Run the engine at **full power** for 10-15 seconds then throttle back to 1,600 rpm and carry out a further ignition check.
- ✈ If the problem persists the aircraft is unserviceable and must be returned to engineering for rectification.
- ✈ Under no circumstances is the mixture to be leaned to clear the plugs.

CAUTION

The engine must not be run at full throttle on the ground
for more than 30 seconds.

If the selection of a single magneto, either **LEFT** or **RIGHT**, causes the engine to stop, or if any other malfunctions are noted, the engine should be shut down and the cause investigated prior to any further start attempts.

CAUTION

If the engine dies when either of the magnetos is selected OFF **DO NOT** reselect the magneto back on to try to keep the engine running, as this may lead to a serious backfire and engine damage. Rather, leave the magneto OFF, close the throttle, pull out the idle cut-off control and when the engine has stopped rotating, turn the other magneto OFF.

Suction...Checked

The suction reading in the green range is an indication that the vacuum pump, which is used to drive the gyros for the Attitude Indicator and the Direction Indicator, is operating.

Alternator / Ammeter ....Checked

By the run-up stage, the charge rate should be very small or zero. The centre-zero ammeter shows the flow of current into and out of the battery and should be very near the centre of the scale.

NOTE

If the ammeter shows a discharge during run-up, cycle the master switch once. This condition may have been caused by a sticking voltage regulator.

Throttle ....Check idle at 650-750 rpm
Reset 1100 rpm

Smoothly and completely close the throttle and check that the engine idles at between 650 and 750 rpm. Reset the throttle to 1,100 rpm. 1,100 rpm should always be set whenever the aircraft is stationary on the ground. If, for some reason, the engine has been run continuously below 1,000 rpm for 5 minutes or more, it must be opened up to at least 1,600 rpm for 10 seconds to clear the plugs.

WARNING

If during these power checks, the prescribed limits of rpm, oil pressure or temperature etc. are exceeded, the aircraft should not be flown.

PRE-TAKE OFF CHECKS (D.V.A.'s)
(Drills of Vital Action)

A complete set of Pre-Takeoff Checks should be carried out prior to the first takeoff of a day and if the After Landing Checks are begun, or the aircraft systems are significantly reorganised. However, following a "Stop and Go" or "Stop and Backtrack" an abbreviated Pre-Takeoff Check of 'Trims; Flaps; and Engine Temps and Pressures' is all that needs to be carried out.

T - Trim .... Full and free movement; Set as required

Set the elevator trim at neutral when both the front and rear cockpits are occupied and set slightly back when only the front cockpit is occupied.

T - Throttle Friction .... Set

The throttle friction should be firm, but not over tight.

M - Mixture .... Rich

Check that the mixture is set to FULL RICH (i.e. fully back).

C - Carb Heat .... Cold

P - Pitch .... Fixed

While virtually all Chipmunks are fitted with a fixed pitch propeller, consideration of the pitch is good preparation for flying larger, more sophisticated warbirds.

F - Fuel .... Selector On – Fullest tank
Contents sufficient; Primer locked

F - Flaps. .... Set

On long smooth runways, where there are no significant obstacles in the immediate takeoff path, no flap is required for takeoff. On runways where a reduced takeoff run, or obstacle clearance in the immediate takeoff path is required, select half flaps.

I - Ignition .... Both On (Up)

Check that the magnetos are both selected ON in both the front and rear cockpits.

I - Instruments .... Checked

A visual scan of the instruments left to right across the panel. Important items are:

- ✈ ASI zero;
- ✈ AI erect;
- ✈ Altimeters - QNH set. Airfield deviation ± 50 feet;
- ✈ Turn indicator - power warning flag away, bat and ball in the centre;
- ✈ D.I. and compass aligned;
- ✈ VSI ± 200 feet; and,
- ✈ Engine Temps and Pressures in the Green Range.

H - Hatches & Harnesses .... Locked; Secure

Various set of Pilot's Notes from the RAF, RCAF and De Havilland all have different recommendations and requirements for the cockpit canopy hood position on takeoff. The RCAF notes say "As required". Consequently my recommendation for normal operations is for the hood to be fully closed.

Check that the harnesses are fastened and tight.

C - Controls .... Full, free and correct movement

Check all of the flying controls for full and free movement.

LINE UP CHECKS

Ensure the approach path is clear and while the aircraft is being taxied into position on the active runway complete the Line Up Checks.

Transponder..On ALT

Set the transponder to **ALT** (altitude).

D.I. ....Aligned with the runway

AFTER TAKEOFF (CLIMB) CHECKS

Flaps ....Up at a safe speed and height
(min 60 kts and 200 feet AGL)

Once at a safe airspeed, (greater than 60 knots) and clear of obstacles (greater than 200 feet above ground level or above obstacles), smoothly retract the flaps if they have been set for takeoff or if these checks are being carried out after a go-round. Raising the flaps at too low an airspeed or too early can lead to a loss of lift that could cause the aircraft to sink back towards the ground or obstacles.

Brakes...Off

Temps and Pressures ....Checked

During the climb the oil temperature should not be allowed to exceed 85ºC.

PRE-LANDING CHECKS

B - Brakes..Checked; Park brake Off

Apply sufficient pressure to the brake lever to determine that there is resistance and that there is pressure for them to operate. Then assure they are fully OFF.

U - Undercarriage ....Fixed

M - Mixture..Rich

The mixture is fully rich when the mixture control lever is FULLY BACK. Unless specifically selected ON (HOT), the carb heat should be checked OFF (COLD).

P - Pitch..Fixed

While virtually all Chipmunks are fitted with a fixed pitch propeller, consideration of the pitch is good preparation for flying larger, more sophisticated warbirds.

F - Fuel ....Selector On – Fullest tank
Contents sufficient; Primer locked

H - Hatches & Harnesses....................................Locked; Secure

Various set of Pilot's Notes from the RAF, RCAF and De Havilland all have different recommendations and requirements for the cockpit canopy hood position on landing. The RCAF notes say "As required". Consequently my recommendation for normal operations is for the hood to be fully closed.

FINALS CHECKS

Landing Flap ....Set

Landing Clearance...Received

At a controlled aerodrome, ensure a landing clearance has been received. At aerodromes where a Flight Service is in attendance, and at unattended aerodromes, make a radio call advising intentions.

Runway ....Clear

Make a final check of the landing area before completing the final approach and landing.

Carb Heat..Cold

In case a go-round becomes necessary, the carb heat should be returned to the OFF (COLD) position when you are sure that you would be able to glide the aircraft to a safe landing area if the engine stopped. If it was still ON (HOT), the engine would only develop about 95% of full power.

AFTER LANDING CHECKS

Flaps ....Up

Flaps should be up when taxiing as they may be damaged by stones or other objects which may be flicked up by the propeller or tyres.

Transponder...Off

Brakes..Test; 3-4 clicks On (or as required)

Some other Pilot's Notes suggest that the brakes should be pre-set to 5 notches or so, to enhance directional control during landing, especially in crosswind conditions. However this is not a universally accepted technique. Pilots should pre-apply brake if they feel it is appropriate.

SHUTDOWN CHECKS

Before you reach the aircraft parking area recheck the brakes and the wind direction, then decide on your route to park the aircraft into wind in the required position.

Brakes..Parked

Throttle ....1000 rpm

Radio Master ....Off

Consider listening on the emergency frequency (121.5) to ensure that your last landing(s) did not activate the emergency beacon.

Control Column...Fully back

Throttle ....1600 rpm

Hold the control column fully back and ensure the aircraft does not move against the brakes as the rpm is increased.

Aircraft..Stationary

Ignition..Checked (L – Both – R – Both)

To check the ignition system select the **LEFT** magneto OFF for about two seconds then back ON, then select the **RIGHT** magneto OFF for about two seconds then back ON**.**

When the **LEFT** magneto is selected OFF note the rpm drop (from 1,600), then select the **LEFT** magneto back ON again. The rpm should return to 1,600 rpm. When the **RIGHT** magneto is selected OFF note the rpm drop (from 1,600), then select the **RIGHT** magneto back ON again. The rpm should return to 1,600 rpm.

Do not linger on only one magneto. Each magneto drop should be a maximum of 100 rpm, and the engine should continue to run smoothly on only one magneto.

Throttle ....Closed

Idle Cut-off Control ....Pulled out

Ignition..Off (Down)

Once the engine has completely stopped, turn both magnetos OFF.

Alternator..Off

Master Switch..Off

CO Monitor ....Off

Hold the off button for three seconds, as indicated on the monitor screen.

Fuel ....Off

Control Locks..As required

If parking outside for any period of time, install the rubber bungie and rudder control lock.

Brakes...As required

The park brake should not be left on after picketing as the hydraulic brake system does not like being pressurised for long periods.

HASELL CHECKS

These checks are completed prior to any manoeuvres which takes the aircraft close to it's limits, for example stalling, aerobatics and spinning.

H - Height ....Sufficient for recovery at a safe height

A - Airframe..Flaps as required; Brakes Off

Ensure the Di's in both the front and rear cockpits are caged. To ensure full rudder authority the brakes MUST be completely off prior to commencing aerobatic manoeuvres.

> **WARNING**
>
> The wheel brakes **must be completely OFF** during spinning and aerobatics to ensure full rudder travel is available.

S - Security ....Harness tight; Hood closed;
No loose objects

E - Engine...Mixture fully rich;
Carb heat as required;
Temps and pressures checked

L - Location..Not over built up areas

Consider identifying a suitable forced landing paddock within gliding range.

L - Lookout ....Around, above and below

Waypoints AVIATION

SCADIE CHECKS

These checks should be completed at regular intervals, say every 15 minutes.

S - Suction ....Checked

Check the suction gauge and check for normal operation of suction driven instruments.

C - Carbon Monoxide ....Checked

Check the CO monitor and check for signs of Carbon Monoxide leaking into the cockpit.

A - Amps & Volts ....Checked

Check that the ammeter is close to zero and that the voltmeter shows about 12 volts.

D - D.I. ....Checked with compass

Before checking the Direction Indicator (D.I.) against the Magnetic Compass ensure straight, level and unaccelerated steady flight.

I - Icing ....Check carb heat

Cycle the carb heat to check for carb icing, leave it ON for 10-15 seconds. If the engine runs a little roughly it is an indication of normal operation. If the engine initially runs roughly then runs smoothly at an increased rpm, it is an indication that you had carb icing. You should increase the frequency of carb icing checks or leave it on until you have left the area of carb icing.

E - Engine..Instruments and fuel checked

Check temperatures and pressures. As well as confirming normal engine operation. If the temperatures are high it may be good practice to ease the power back to enable the engine to cool slowly. Check the fuel contents and consumption rate. When over a suitable forced landing area, change tanks as required.

PROP SWINGING - ENGINE START CHECKS

Before Engine Start Checks ....Complete

Wheel Chocks ....Secure

Chocks MUST be securely placed ahead of the main wheels prior to starting the aircraft by hand swinging the propeller.

Brakes...Parked

Safety Pilot ....Secure

A qualified pilot MUST occupy either the front or rear cockpit prior to starting the aircraft by hand swinging the propeller. The person swinging the propeller MUST also be adequately trained.

When the pilot is securely seated in the cockpit and ready for start, indicate to the ground assistant that preparations for starting the aircraft are complete by calling:

- ✈ Brakes ON;
- ✈ Fuel ON;
- ✈ Ignition OFF (Down - Accompanied by a thumbs DOWN signal); and,
- ✈ Throttle Closed.

Cold Engine:

Prime..As required

Six or seven positive strokes when the engine is cold, less when it is warm. Priming should be carried out prior to all starts, whether the engine is cold, hot or in between, with the exclusion perhaps of restarting within 5 minutes or so of shutdown. If it is a hot, still day you might get away with longer, on a cold windy day the opposite is likely to be the case. If in doubt it is recommended to prime the engine prior to a start attempt. **Double check that the primer is fully in and locked.**

Ignition...Both Off (Down)

Throttle ....Closed

Control Column...Fully back

Propeller ....Pull through 4 compressions

On completion of priming, the ground assistant should call:

- ✈ Ready for starting; and,
- ✈ Contact (accompanied by a thumbs UP signal);

Throttle ....Set ½ inch open

Set the throttle to ½ inch forward of the fully closed position.

Ignition...Front (right) On

Switch ON the impulse magneto (No 1) and call:

- ✈ Contact (accompanied by a thumbs UP signal).

Propeller ....Swing to start

The ground assistant should then carefully swing the propeller through the compression stroke to start the engine.

Hot Engine:

Throttle ....Set ½ inch open

Set the throttle to ½ inch forward of the fully closed position.

Ignition...Front (right) On (Up)

Switch ON the impulse magneto (No 1) and call:

- ✈ Contact (accompanied by a thumbs UP signal).

Propeller ....Swing to start

The ground assistant should then carefully swing the propeller through the compression stroke to start the engine.

If no start after 4-6 swings, proceed as for a cold engine.

If the engine fails to start after 4-6 attempts, switch both magnetos OFF and give a clear call of:

- ✈ Ignition OFF (Down - Accompanied by a thumbs DOWN signal).

PROP SWINGING - AFTER ENGINE START CHECKS

Ignition...Both On (Up)

When the engine starts, switch the other (No 2) magneto ON.

Throttle ....600-800 rpm

Oil Pressure...Indicating within 30 seconds

As soon as the engine is running smoothly, the oil pressure should be checked. The oil pressure should rise and stabilise between 30 and 40 psi within 30 seconds of a successful start.

If the oil pressure does not rise within 30 seconds the engine should be shut down immediately to prevent engine damage.

> **CAUTION**
>
> Check the oil pressure immediately after starting the engine.
>
> If no pressure rise is evident after 30 seconds, shut the engine down immediately and investigate the cause prior to any further start attempts.

> **NOTE**
>
> The minimum oil pressure should not be less than 30 psi, however at slow running, when the oil temperature is 65°C or above, the minimum is 20 psi.

Ignition...Checked (L – Both – R – Both)

To check the ignition system select the **LEFT** magneto OFF for about one second then back ON, then select the **RIGHT** magneto OFF for about one second then back ON**.**

This is a 'dead cut' check to see if the ignition goes dead when the **LEFT** and **RIGHT** magnetos are selected OFF. When each magneto is turned OFF the engine should continue running, albeit at reduced rpm. This confirms that both magnetos are operating correctly.

If the engine dies when the **LEFT** or **RIGHT** magneto is selected OFF then the other magneto (and the aircraft) is unserviceable and this should be rectified immediately.

> **CAUTION**
>
> If the engine dies when either of the magnetos is selected OFF **DO NOT** reselect the magneto back on to try to keep the engine running, as this may lead to a serious backfire and engine damage. Rather, leave the magneto OFF, close the throttle, pull out the idle cut-off control and when the engine has stopped rotating, turn the other magneto OFF.

Alternator...On

Radio Master ....On; Radios set

Erect the artificial horizon(s) and align the DI. Also test the intercom if the rear seat is occupied. Set the QNH on the altimeter Set the radio frequencies. Set standby on the transponder and check that the appropriate code is set.

Throttle ....1000-1200 rpm

In cold conditions the indicated oil temperature tends to rise rather slowly. In such conditions, provided that at least 30 psi of oil pressure is indicated, it is permissible to warm the engine at 1,100 rpm. However, a minimum of 15°C is required before increasing the engine rpm above 1,100 rpm.

Chapter Five

Aircraft Handling

Introduction

The De Havilland DHC 1 Chipmunk is very pleasant to fly, the controls are well harmonised and they remain light and responsive throughout the speed range. However, they tend to become heavier as the limiting speed is approached.

Airspeeds For Safe Operations (IAS)

The following airspeeds are those which are significant to the operation of the Chipmunk. These figures are for aircraft flown up to maximum gross weight, under standard conditions at sea level.

Performance for a specific aircraft may vary from published figures depending upon the equipment installed, the condition of the engine, propeller, airframe, equipment, atmospheric conditions and piloting technique.

Normal Takeoff .... 53 kts IAS
Normal Climb .... 70-80 kts IAS
Manoeuvring Speed (Va) .... 108 kts IAS
Never Exceed Speed (Vne) .... 174 kts IAS
Maximum Flap Speed (Vfe) .... 74 kts IAS
Glide - Clean .... 60 kts IAS
Glide - Half Flap .... 60 kts IAS
Normal Base and Initial Final Approach Speed .... 70 kts IAS
Final Approach Speed – Full Flaps Extended .... 55-60 kts IAS
Maximum Demonstrated Crosswind .... 10 kts IAS

Taxiing

When initially taxiing away after engine start, close the throttle and request removal of the chocks (if used during start and a ground assistant is available). When the chocks are clear, release the brakes and open the throttle sufficiently to allow the aircraft to move forward. Then test the effectiveness of the brakes by closing the throttle, and with the rudder bar central, applying gentle braking. The aircraft does not need to be brought to a complete stop to test the effectiveness of the brakes.

For control of direction while taxiing, the brakes are used differentially through the rudder bar. To obtain differential braking, apply rudder in the desired direction of turn and move the brake lever backward until pressure is felt on the rudder pedal. Vary brake lever and rudder bar application as required to manoeuvre the aircraft on the ground.

The maximum crosswind component, in which the aircraft has been demonstrated to be safe for taxiing is 30 kts. In high crosswinds during taxiing, care should be taken not to use excessive brake or excessive power against brake, and the stick should be held back to keep the tail down.

Use of Brakes During Taxiing

Some other Pilot's Notes suggest that the brakes should be pre-set up to five (5) notches or so, to enhance directional control during taxiing, especially in crosswind conditions. However this is not a universally accepted technique. Pilots should pre-apply brake if they feel it is appropriate.

Takeoff

Normal

Align the aircraft with the intended takeoff path, fully release the brakes and open the throttle smoothly and positively to full throttle. The full throttle static rpm on the ground will vary slightly according to the engine condition, the propeller fitted and the atmospheric conditions. The minimum static rpm before takeoff is 2,000 rpm.

NOTE

The engine should not be held at full throttle on the brakes for more than 30 seconds.

Maintain directional control with rudder. Initially significant rudder input is required, but this reduces as the airspeed increases. There is a slight tendency for the aircraft to swing to the right, especially if the throttle is opened too aggressively, however this is entirely manageable.

Raise the tail and fly the aircraft off at 53 kts. Accelerate smoothly to climb away at 70 kts.

Crosswind

Hold the control column into wind and open the throttle slowly to full throttle. Maintain directional control with rudder, and if necessary use differential brake appropriate to the wind conditions.

Raise the tail smoothly and progressively and hold the aircraft on the ground to 55 kts, then fly the aircraft off with a positive movement of the controls. Raising the tail too positively with a crosswind from the right will increase the tendency for the aircraft to swing to the right, so increased attention must be paid to keeping straight with rudder.

The maximum crosswind component in which the aircraft has been demonstrated to be safe for takeoff is 10 kts.

Maximum Performance

To achieve a maximum performance takeoff, select half flap prior to takeoff and align the aircraft into wind, using as much of the available takeoff distance as possible. Hold the control column fully back and smoothly open the throttle to the maximum power that can be held against the brakes. Release the brakes, increase to full throttle and maintain directional control with positive use of rudder.

Raise the tail as soon as possible and fly the aircraft off at 40 to 45 kts. Initially maintain a maximum angle climb at 55 kts until clear of obstacles, then lower the nose a little to climb at the maximum rate of climb speed of 60 kts. When at a safe height (200 feet above obstacles) select the flaps up and accelerate smoothly to climb away at 70 kts.

Use of Brakes During Takeoff

Some other Pilot's Notes suggest that the brakes should be pre-set to about five (5) notches, to enhance directional control during takeoff, especially in crosswind conditions. However this is not a universally accepted technique. Pilots should pre-apply brake if they feel it is appropriate.

Climb

Maximum Angle

A maximum angle climb in a propeller driven aircraft is achieved at the lowest safe speed above the stall. In the Chipmunk, a maximum angle climb is safely achieved at full throttle at an attitude for 55 kts IAS.

If a maximum angle of climb is required on the initial climb after takeoff or on a go-around, half or even full flap would normally have been selected, however as flap degrades climb performance full flap should be selected up as soon as a safe speed is achieved (>55 kts IAS) and half flap should be selected up as soon as a safe speed and height have been reached (>60 kts IAS and >200 feet above obstacles).

Maximum Rate

Climb at full throttle at an attitude for 60 kts IAS. If a maximum rate of climb is required on the initial climb after takeoff or on a go-around, half or even full flap would normally have been selected, however as flap degrades the climb it should be selected up as soon as a safe height has been reached (>200 feet above obstacles).

Normal

Climb at full throttle at an attitude for 70-80 kts IAS, with flaps up. This speed gives close to the maximum rate of climb and requires a reasonable attitude for handling and lookout. 70-80 kts also increases airflow for engine cooling.

Mixture Control

The mixture should normally be left in the fully rich position for all types of climb, to assist engine cooling. However, at altitudes above 3,000 feet AMSL, in order to obtain increased economy and smoothness in the engine running, the mixture may be leaned.

To effectively lean the mixture, set the throttle to attain the recommended rpm, and then move the mixture control gently forward toward the weak position until a slight drop in rpm is first detected or rough running commences, and then richen it again a little to restore the rpm to the highest value. The mixture control is thereby set for all throttle settings at that altitude. Changes in altitude require subsequent adjustments of the mixture control.

> **CAUTION**
>
> Do not operate the engine for more than the briefest time in the condition where the rpm is reduced by use of the mixture control.

> **NOTE**
>
> The De Havilland Approved Flight Manual states that the engine must not be operated in weak-mixture below 3,000 feet, and the RCAF Pilots Manual says do not lean the mixture below 3,000 feet.

Cruise

Normal

The normal cruise speed is between 90 and 100 kts. The maximum continuous power setting at full throttle is 2,300 rpm. The maximum continuous (weak) power setting is 2,100 rpm (independent of the mixture control setting), consequently it is recommended that 2,100 rpm is not exceeded in cruising flight.

At or below 2,100 rpm a weaker mixture is obtained and the possibility of rough running at higher rpm (up to 2,300) is avoided.

Flying for Range

The recommended range speed is 90 kts IAS. To obtain the most economical operation, lean the mixture in accordance with the instructions above.

Flying for Endurance

The recommended speed for maximum endurance is 60 to 65 kts IAS. In turbulent conditions increase the target endurance speed to 70 kts.

Slow Flying

In situations where the maintenance of slow flight is required, e.g. when flying in bad visibility, select half flap and maintain an airspeed of 65 kts IAS. The 1G stall speed in this configuration is about 40 kts IAS.

Carburettor Icing

Carburettor icing is indicated by rough running and/or loss of engine power. If carburettor icing is suspected, at low rpm settings and at regular intervals, select the carb heat control to HOT. If icing does not clear reasonably quickly after selection of the carb heat to HOT, manipulation of the throttle may assist.

NOTE

The RAF Pilots Manual recommends that the carb heat control be wired in the HOT position in temperatures below 30ºC.

This does not appear appropriate in New Zealand.

Stability and Control

Stick forces are light. Longitudinal stability is positive but with the flap retracted at high power is slightly reduced. Lateral stability is low but positive. Directional stability is positive.

Waypoints AVIATION

Effects of In Flight Trim Changes

The aircraft is stable and easy to trim under all conditions of flight and holds its trimmed speed well.

POWER ON causes a slight NOSE UP change of trim and a YAW TO THE RIGHT, requiring left rudder correction.

POWER OFF causes a slight NOSE DOWN change of trim and a YAW TO THE LEFT, requiring right rudder correction.

With constant power, an INCREASE OF SPEED causes a YAW TO THE LEFT, requiring right rudder correction.

With constant power, a DECREASE OF AIRSPEED causes a YAW TO THE RIGHT, requiring left rudder correction.

FLAPS DOWN causes a slight NOSE DOWN change of trim.

FLAPS UP causes a slight NOSE UP change of trim.

There is no change in trim if the cockpit hood is opened in flight.

Stalling

Prior to carrying out any manoeuvres which take the aircraft close to the limits of its control, for example practice stalling, spinning or aerobatics, carry out the pre-manoeuvre checks (HASELL).

> **WARNING**
>
> The wheel brakes **must be completely OFF** during spinning and aerobatics to ensure full rudder travel is available.

The 1G stall speeds at MAUW are approximately:

- ✈ Clean, engine power off 44 kts IAS;
- ✈ Half flap, engine power off 43 kts IAS; and,
- ✈ Full flap, engine power off 41 kts IAS.

Stalling speeds are reduced by about two knots if the aircraft is being flown solo.

In all configurations, warning of the stall is indicated by slight pre-stall buffeting felt through the elevator, about three (3) knots before the stall occurs.

At the stall with flaps up (clean) and power off the nose drops gently and the buffet continues. The control column must be fully back in order to demonstrate the nose drop at the point of stall. There is a slight tendency for the nose to pitch. With the flaps fully down, the stall is more positive.

In all cases a wing drop may occur, but this can easily be controlled by applying rudder to stop further yaw. Any attempt to raise the wing with aileron will aggravate the wing drop.

The stall recovery in all configurations is quite normal. Move the control column sufficiently forward to unstall the wings, and use rudder to prevent further yaw. To minimise height loss, smoothly increase the throttle to full power. When full control is regained, level the wings, apply appropriate rudder to achieve balanced flight and ease the aircraft out of the descent.

When approaching a high speed stall, e.g. in a steep turn, a positive pre-stall buffet occurs, which gives ample warning. There is little tendency to flick.

With the cockpit canopy hood open, there is no effect on the stall speeds and characteristics.

Spinning

In Australia and the UK practice spinning in the British Chipmunk is only permitted with anti-spin strakes fitted. That said, there is no evidence that this restriction need be applied to the Canadian Chipmunk and the New Zealand Flight Manual for ZK-CVM makes no such restriction. Advice from an RAF instructor, very experienced in spinning Chipmunks, is that this restriction is not applicable. The maximum weight for carrying out practice spinning is 1,560 lb (708 kg).

Prior to carrying out any manoeuvres which take the aircraft close to the limits of its control, for example practice stalling, spinning or aerobatics, carry out the pre-manoeuvre checks (HASELL). Ensure the canopy is fully closed and locked and the wing flaps are UP.

WARNING

The wheel brakes **must be completely OFF** during spinning and aerobatics to ensure full rudder travel is available.

Additionally, prior to carrying out spinning, the:

- ✈ Elevator trim should be neutral;
- ✈ Harness should be tight;
- ✈ Direction indicator should be caged;
- ✈ Mixture should be rich;
- ✈ Carburettor air should be set as required;
- ✈ Oil temperature and pressure should be within limits; and,
- ✈ Fuel should be sufficient.

As ZK-CVM is not fitted with anti-spin strakes, it is a NZ CAA Flight Manual requirement that spinning practice be commenced at least 6,000 feet above the ground (agl), and spin recovery MUST be commenced by 3,500 feet agl in order to be able to regain level flight by 1,500 feet agl, consistent with a height loss of up to 2,000 feet. The RAF (University Air Squadrons) require full recovery by 3,000 feet agl.

General

The aircraft is hard to properly establish in a stable spin at almost all centre of gravity positions. The characteristics of one aircraft may differ from another, where one will enter a stable erect spin, while another will enter a semi-stalled spiral dive. Some aircraft may enter either. The difference in behaviour depending on variables such as weight and position of the centre of gravity, the intended spin direction, and aileron deflection into or out of the direction of spin.

As the erect spin and the spiral dive can be confused it is essential to understand the difference between them.

The Semi-Stalled Spiral Dive

The spiral dive resembles the spin and is more likely to occur with a forward centre of gravity.

The following indicate that a spin entry attempt has led to a semi-stalled spiral dive:

- ✈ The attitude is steeply nose down;
- ✈ The airspeed will increase from about 40 kts at the entry to 80-90 kts after about two turns, regardless of the fact that the stick is held fully back and full rudder is applied to maintain the manoeuvre;
- ✈ The controls retain the forces of normal manoeuvres but there is some buffeting of the tail;
- ✈ There is usually noticeable noise and rattle due to buffeting at increasing airspeed; and,
- ✈ Upon releasing the controls the aircraft will recover by itself, or with some opposite rudder, after rotating through a quarter to a half a turn.

The Spin

The spin has the following characteristics:

- ✈ Initially the attitude is steep but after about two or three turns the spin usually becomes flatter, with the nose generally 30 to 50 degrees below the horizon, although it will appear less so;
- ✈ The airspeed will remain steady at between 30 and 50 kts IAS depending on the direction of spin;
- ✈ The rudder force is light; and,
- ✈ The stick force is light when aft of neutral. A relatively positive to heavy push force is needed to move the stick fully forward on recovery, and this may be accompanied by some buffeting.

Entry to the Spin

Close the throttle and, at 50 knots, apply full rudder in the intended direction of spin and move the control column (stick) fully back. A more positive spin entry can usually be achieved by applying aileron opposite to the direction of the intended spin. If aileron is so used it must be centralised when a stable spin entry is achieved.

If the control column is not moved fully back until after the spin has been entered, a semi-stalled spiral dive may be encountered. In this case the speed will remain stable at about 80 knots and normal recovery action is immediately effective.

The aircraft may be reluctant to enter a spin, especially to the left and at forward centre of gravity. A spiral dive may develop instead, particularly if the control column is not kept fully back. The spiral dive can be recognised by an increase in the control column forces and a fairly rapid rise in airspeed during the first two turns.

Characteristics of the Stable Erect Spin Entry

After a half roll in the direction of spin, the nose drops sharply as rotation continues. Slight pitching may be apparent at this stage. The spin stabilises in two to five turns with the nose gradually rising to about 30-50º below the horizon. The rate of rotation is slightly lower than in the initial stage and the airspeed is low and steady.

While the aircraft is cleared for practice spins of up to eight (8) turns, this is not encouraged and certainly not a requirement of a type rating.

Spin Recovery Actions

Close the throttle, if not already closed. Check ailerons neutral. Check direction of yaw, as indicated by the turn needle.

Apply and maintain full rudder to oppose the direction of yaw. After a brief pause (the RAF recommends two seconds), move the control firmly, progressively, centrally and fully forward until the spin rotation ceases. Centralise the rudder as soon as the spin stops. Level the wings and ease out of the dive.

In the UK, civil registered Chipmunks are required to display the following placard in full view of each pilot.

SPIN RECOVERY

MAY NEED FULL
FORWARD STICK
UNTIL ROTATION STOPS

Spin Recovery Characteristics

The relatively flat attitude may cause longer recovery time than for many other aircraft types. Consequently it is important to appreciate that full and decisive control inputs are needed to recover especially nose down elevator.

A moderate push force is required to move the control forward and care is necessary to ensure that the ailerons are maintained neutral throughout. If recovery action is taken before the spin has become stable, recovery is achieved very quickly. If normal recovery action is taken for recovery from a stable erect spin recovery is achieved within one to two turns, which may involve a height loss of about 1,000 feet to straight and level flight.

After prolonged spinning (six to eight turns), a heavier push force may be necessary to effect the recovery and this may be accompanied by some buffeting. In a stable spin, particularly when the rear seat is occupied, the aircraft may continue rotating for up to three turns after taking recovery action. During this period, the rate of rotation increases and the angle steepens before the spin stops. This is an indication that the correct spin recover actions have been taken. In this case recovery from the spin may involve a total height loss of about 2,000 feet to straight and level flight.

Delayed Spin Recovery

If the aircraft is slow to recover from the spin, the application of aileron in the direction of the roll will assist normal recovery action. If spin recovery action has not been effective by 3,000 feet agl, and parachutes are worn, abandon the aircraft.

Aerobatics

In Australia and the UK aerobatic manoeuvres in the British Chipmunk are only permitted with anti-spin strakes fitted. That said, there is no evidence that this restriction need be applied to the Canadian Chipmunk and the New Zealand Flight Manual for ZK-CVM makes no such restriction. Advice from an RAF instructor, very experienced in spinning Chipmunks, is that this restriction is not applicable.

The maximum weight for aerobatics (excluding snap manoeuvres) is 1,930 lb (876 kg). If snap manoeuvres or spinning are intended the maximum weight for aerobatics is 1,560 lb (708 kg).

The acceleration limits between which the structure has been designed to withstand without permanent deformation, at a weight of 1,930 lb is +6.0 to -3 G. Intentional manoeuvres should be confined to load factors well below this maximum value.

While the placard in the cockpit and other references has 2,550 rpm as the engine limit when aerobatting, **it is not necessary to exceed 2,400 rpm**. As no Chipmunk engines can be described as young, syndicate policy is to use 2,400 rpm as a prompt to reduce the throttle. In other words 2,400 rpm is a quasi-limit.

The Pilots Notes for some Chipmunks state that in a dive with full throttle set, 120 kts is the prompt to start pulling the nose up and/or reducing power to avoid an engine overspeed, however as CVM has a fairly fine pitch wooden propeller this yardstick is NOT applicable. In CVM at 105 kts IAS, whether in a climb, cruise or descent the rpm will reach 2,400. Consequently the throttle should be actively manipulated to keep the rpm within the specified limits.

Unlike other Chipmunks, in CVM syndicate policy is to not do aerobatics with the throttle remaining fully open.

When diving, have the throttle set to AT LEAST 1/3 open.

Prior to carrying out any manoeuvres which take the aircraft close to the limits of its control, for example practice stalling, spinning or aerobatics, carry out the pre-manoeuvre checks (HASELL). Ensure the canopy is fully closed and locked, the brakes are completely OFF and the flaps are UP.

> **WARNING**
>
> The wheel brakes **must be completely OFF** during spinning and aerobatics to ensure full rudder travel is available.

Additionally, prior to carrying out aerobatics, the:

- ✈ Elevator trim should be neutral;
- ✈ Harness should be tight;
- ✈ Direction indicator should be caged;
- ✈ Mixture should be rich;
- ✈ Carburettor air should be set as required;
- ✈ Oil temperature and pressure should be within limits; and,
- ✈ Fuel should be sufficient.

With the stated aerobatics limitations complied with, the aircraft has been demonstrated to have safe handling characteristics in the following manoeuvres:

Tight Turns	Inside Loops	Slow Rolls	Stall Turns
Barrel Rolls	Aileron Rolls	Half Roll off a Loop	Half Roll & Pull Through

Until experience is gained, the following entry speeds are recommended:

Aileron Roll	120 kts IAS	As experience is gained reduce entry speed to 115 kts
Slow Roll	120 kts IAS	As experience is gained reduce entry speed to 115 kts
Stall Turn	120 kts IAS	As experience is gained reduce entry speed to 115 kts
Barrel Roll	120 kts IAS	As experience is gained reduce entry speed to 115 kts
Inside Loop	130 kts IAS	As experience is gained reduce entry speed to 120 kts
Half-roll off a Loop	140 kts IAS	As experience is gained reduce entry speed to 130 kts

While many aerobatics may normally be flown with the throttle set fully open, for manoeuvres in the looping plane, care should be taken not to exceed the rpm limitation at high speed. Syndicate policy has set 2,400 rpm as the engine limit when aerobatting. In a dive with full throttle set, 105 kts is the prompt to start reducing throttle and/or pulling the nose up to avoid an engine overspeed.

The Chipmunk is not cleared for inverted flight, as over fuelling of the engine may occur, leading to a rich cut and possible failure to restart in flight. During manoeuvres involving transient periods of negative G, such as slow rolls, the throttle should be closed before reaching the inverted attitude and the negative G phase confined to a period not exceeding 5 seconds. The engine should be cleared at normal power for several seconds after such a manoeuvre.

At low airspeed and a closed throttle, i.e. out of a stall turn, the propeller WILL occasionally stop. While an air-load or starter assisted restart will probably be successful, before doing aeros, think about a suitable forced landing area.

Since structural damage is likely to occur during a tail-slide, vertical manoeuvres should be completed and recovery action completed before aerodynamic control is lost. If aerodynamic control is lost and an inadvertent tail-slide is about to develop, close the throttle, centralise the control column (stick) and rudder pedals and brace them VERY firmly. Grip the stick with BOTH hands and remain braced until the nose has dropped and any oscillations have ceased.

As a precaution return to land and have a maintenance inspection carried out, to assess for potential tail-slide damage, before further flight.

Diving

Set the mixture control to fully rich before starting the dive. As the speed increases, a progressively greater push force is necessary to hold the aircraft in the dive. However, the limiting speed can be reached without re-trimming. Maintain the aircraft in balance by a progressive application of right rudder.

In the dive, keep the throttle at least one-third open. 2,550 rpm is the maximum permissible for up to 20 seconds, however, please note that to preserve engine life, the syndicate limit is 2,400 rpm. At larger throttle settings, as speed increases, it is necessary to throttle back significantly to keep the rpm within limits.

Gliding

The optimum glidepath is achieved at 60 kts in the clean configuration, and with half flap.

Base Turn Procedure

Mid to late downwind identify a feature on the ground over which you wish to have the aircraft established straight-in on final approach at 500 feet AGL. As the aircraft approaches abeam this 'straight-in feature' initiate the following procedure:

- ✈ Carry out a thorough **lookout**;
- ✈ Select the Carb Heat ON;
- ✈ Reduce the throttle to an appropriate power setting for the type of approach you are intending to carry out;
- ✈ Immediately begin a medium turn to track toward your straight-in feature;
- ✈ Allow the aircraft to descend and trim for the desired airspeed.

Naturally this 'standard' base turn procedure should be varied to take into account operational considerations such as wind, other air traffic and/or terrain/obstacles on final approach. However, do not continue extending the downwind beyond your selected base turn point waiting for the aircraft to slow down before turning.

Base Leg

Check that the airspeed is below the maximum speed for deploying flap (74 kts IAS), then select the flaps to half and maintain 70 kts. Retrim for the new configuration and airspeed.

Final Approach

Prior to turning onto final approach, carry out a thorough **lookout** of the area around the opposite base and long finals, then turn to roll out on the extended centreline of the runway.

Where conditions dictate that full flap is appropriate, the full flap is usually taken at about 300 feet above the ground. Check the airspeed then select full flaps and allow the airspeed to reduce to the applicable final approach speed. Retrim for the new configuration and speed.

Final Approach Configurations and Recommended Speeds

Normal Powered Approach:	Full or half flap 60 kts IAS Reducing to 55 kts into the flare.
Flapless Powered Approach:	65 kts IAS Reducing to 60 kts into the flare.
Glide Approach:	Full or half flap 60 kts IAS Reducing to 55 kts into the flare. Flapless 65 kts IAS Reducing to 60 kts into the flare.
Short Field Approach:	Approach with full flap, at 55 kts IAS, Reducing to 45-50 kts into the flare.

The 'Three-Point' Landing

The aim of the three point landing is to fly the aircraft into the three point attitude, at minimum height above the runway and at near minimum flying speed. A perfect three-point landing would involve flying about 1cm above the ground with decaying airspeed (stall warning, if fitted, may be blaring).

The approach to a three-point landing involves maintaining the descending attitude until at the round-out (flare) height, approximately 2-3 metres above the ground. At that point, slowly begin to raise the nose to reduce the rate of descent, take all of the power off by smoothly closing the throttle, maintain balance and keep the wings level with aileron. Hold off by flying parallel to and just above the ground (about ½ metre), slowly and continuously raising the nose to the three point attitude. When you reach this attitude, MAINTAIN IT! Do not just keep raising the nose. The three point attitude is the same attitude as you see while you are taxiing on the ground.

The hold off (or float) requires steadily more back pressure because the elevator is becoming less effective as the airspeed reduces, and because of the tendency of the nose to drop when power is reduced. If you apply the back pressure too quickly however, the wings will generate too much lift and the aircraft may balloon upwards. Consequently a slow application of back pressure is required, just sufficient to keep the aircraft flying parallel to and just above the ground. At the moment of touchdown the aircraft will be very close to the stall.

Touch down on all three wheels at the same time. All excess energy will have been dissipated, the aircraft should have no energy to float, bounce or go anywhere! Touching down tailwheel first (slightly nose high) is usually a good thing as the subsequent nose drop until the main gear touches reduces the angle of attack (lift), and the aircraft tends to stay on the ground. The reverse is true if you touch down main gear first, and this often results in a bounce…. or bounces….

When the tailwheel is firmly on the ground, promptly and smoothly move the control column (stick) until it is fully back. Keep straight with rudder and carefully use brakes as required to bring the aircraft to a stop or slow taxi speed.

The advantages of a three-point landing include that the aircraft is on the ground to stay and there is minimal energy remaining for the ground roll. The disadvantages include that the aircraft is vulnerable to wind gusts at a high angle of attack, at a time when the rudder is shielded and the throttle is closed, and there is reduced forward visibility at touchdown.

The 'Wheeler' Landing

The aim of the wheeler landing is to fly the aircraft onto the ground in a near level attitude. Although the aircraft's main wheels are in contact with the surface you will have full flying speed and hence more control.

For the wheeler landing, maintain the descending attitude until virtually on the ground. Apply a tiny flare and smoothly close the throttle. At touchdown gently check forward on the control column (stick) to pin the main wheels on and to prevent the tail from dropping. "Check forward, hold it on." If the tail is allowed to drop significantly on touchdown the extra angle of attack will probably cause the aircraft to balloon or bounce back into the air, and a go-round should be considered if the bounce is excessive.

Hold the nose attitude and assess the tracking and runway remaining, etc. Remember that with a wheeler landing, at touchdown the aircraft is still "flying", albeit the main wheels are in contact with surface.

Ask yourself "How's it looking? Straight? Under control? Enough runway?". If the answer to any of these considerations is No - then apply full power, hold the attitude and fly away from the ground into a go-round. If the answer to all of the considerations is Yes - then turn the touchdown into a full landing.

Keep straight with rudder and maintaining the nose attitude by gently closing the throttle and increasing forward control column (stick) as the airspeed reduces. When the tail feels like it is ready to settle, "follow the tail down with the elevator". Expect some yaw, but the slower the tail is flown onto the surface the less the gyroscopic effect will be. Don't hold the tail up until it falls quickly as this may lead to a significant yaw. When the tail is in contact with the surface, keep straight with rudder and move the control column (stick) fully back and begin to apply the brakes as required to bring the aircraft to a stop or slow taxi speed.

The advantages of a wheeler landing include greater aerodynamic control, better response to wind gusts or crosswinds, more precise wheel placement and a better forward view at touchdown. The disadvantages include higher touchdown speed and usually a slightly longer landing roll, and the aircraft is more lively at touchdown due to the greater energy. Consequently the aircraft can be more prone to bouncing or ballooning if the touchdown is too firm, as the energy is yet to be fully dissipated after touchdown.

The 'Tail Low Wheeler' Landing

The tail low wheeler is a hybrid landing technique which is designed to take advantage of the best features of both the three-point and the wheeler landing. The tail low wheeler landing tends to be used by Harvards and other heavier Warbirds aircraft such as the DC3, etc. The tail low wheeler gives better speed and visibility and better control response than the three-point landing and generally a shorter landing roll than a pure wheeler. It is seldom an appropriate technique for light aircraft, which are far more likely to bounce and balloon than the heavier aircraft.

General

Decide early on the type of landing you wish to undertake, e.g. decide on the downwind leg or on early base. Then brief yourself on the speeds, attitudes, technique and most importantly actions after touchdown.

Also, make a habit of MAINTAINING a sensible glidepath, and MAINTAINING your target approach speed ALL THE WAY INTO THE FLARE. This will often require lowering the nose through the last 50 to 100 feet, as you transit the "friction layer" and the (head) wind speed drops. A high percentage of (ex-nosewheel?) pilots consistently go low during the last 200 feet or so, and end up increasing power such that they cross the threshold almost in level flight, with the nose high, 1,600 to 1,700 rpm, and 10 knots slow. Subsequent throttle closure results in big doses of yaw, sink, bouncing, windshear/gust vulnerability, and instructor hypertension. Please don't do this, we are aging fast enough on our own!

Once thoroughly trained in each technique, you should practice and maintain competency and confidence in each.

Protecting the Tailwheel

In order to reduce wear on the tailwheel (expensive), avoid landings on sealed runways if there is a grass alternative. If a landing on a sealed runway is required, make a wheeler landing and endeavour to fly the tailwheel onto the ground at a low speed.

Crosswind Landing

The maximum crosswind component in which the aircraft has been demonstrated to be safe for landing is 10 kts.

The crosswind landing technique is conventional. In crosswind conditions, especially if there is a significant gust factor, not more than half flap is recommended and a wheeler landing is often the more appropriate technique.

During the landing run it will be necessary to hold the control column (stick) into wind.

Flapless Landing

With flaps retracted the drag of the aircraft is significantly less and the nose attitude significantly higher than for a normal approach. Consequently the power required on final approach is less and a slightly shallower approach should be flown. An approach speed of 65 kts, reducing to 60 kts into the flare, has been found to be satisfactory, giving an adequate speed margin above the stall, although the float may be slightly longer than normal.

A wheeler landing is generally recommended for a flapless landing.

The Touch and Go Landing

If you are completing a touch and go landing, allow the aircraft to slow as if you were completing a normal full stop landing, keeping straight with rudder. Leave the flap set at the setting used for the final approach and touchdown, up to and including full flap. When ready, smoothly reapply full power, keep straight with rudder and continue the takeoff. Initially climb out at 55 to 60 kts IAS and then, when safely established in the climb at a safe speed and a safe height, slowly retract the flaps. Note that retracting the flaps from full to half has virtually no effect on stall speed, but it will DRAMATICALLY reduce drag. It follows that if you are climbing with full flap at more than 60 kts, you are giving away lots of energy, since drag increases with the square of speed.

Use of Brakes During Landing

Some other Pilot's Notes suggest that the brakes should be pre-set to about five (5) notches, to enhance directional control during landing, especially in crosswind conditions. However this is not a universally accepted technique. Pilots should pre-apply brake if they feel it is appropriate.

Go-Round

If a go-round is required from an approach or following some other exercise, with the aircraft in any given configuration, smoothly advance the throttle to full power, maintain balance and select an appropriate nose attitude for an initial climb speed of 55 to 60 knots IAS, and trim as required to maintain the desired attitude. Then check that the carb heat is selected OFF.

Initially climb out at 55 to 60 kts IAS and then slowly retract the flaps in stages when safely established in the climb at a safe speed and a safe height. Then complete the After Takeoff Checks.

The aircraft will climb away with full flap down. If the aircraft has been trimmed for the glide with full flap, then re-trimming will be required as soon as the throttle is fully open. The flaps may be raised in two stages with very little loss of climb performance.

A good mnemonic for the go-round is: **"Power up; Nose up; Clean up"**.

Shutting Down

Upon returning to the aircraft parking area after flight, the correct run down and switching off procedure should be followed. If an engine is shut down when it is very hot, uneven cooling between the fixed and moving parts may take place, leading to deformation and potentially to engine damage. However, the taxiing time after landing will normally have allowed the engine to cool evenly so only a minimal delay is required. The correct method of shutting down is detailed in the Shutdown Checks and should be adhered to.

While idling, switch the Radio Master OFF and then check the magnetos for a dead cut. Stop the engine by closing the throttle and pulling the Idle Cut-off Control fully out. When the engine dies, switch both ignition switches OFF. Then switch the Alternator, Master Switch and Fuel OFF.

On leaving the aircraft, apply the control locks and brakes if required. Then secure the cockpit canopy hood. Ensure the aircraft is chocked securely and tied down properly if required. If parking for an extended period of time consider moving the aircraft into the shade or into a hangar, in order to minimise UV damage to the fabric covered surfaces.

If the aircraft is left outside, install the external and internal control locks.

The park brake should not be left on after picketing as the hydraulic brake system does not like being pressurised for long periods.

Waypoints AVIATION

Prop Swinging

General Rules

Rule 1: ALWAYS treat the prop as "live".

Stating the obvious perhaps, but sometimes it doesn't stay obvious, especially when you have a wet or weak magneto, and you have been swinging the prop for half an hour with no result. By then your shoulder will be aching, its 12°C with a 15 knot breeze, its drizzling, and it's getting wet and muddy and slippery on the ground in front of the prop from your repeated walking over the same spot. In these circumstances it is easy to treat the prop with less respect than it deserves. Also, just because the switches are off, there is no guarantee that the mags are not live.

Rule 2: ALWAYS use chocks.

Even if you have brakes set hard on, a piece of 4x2 is a lot better than nothing. Then the worst that can happen, if the engine somehow goes to full throttle and the stick isn't held hard back, is that the aircraft can tip onto its nose.

Rule 3: ALWAYS have a PILOT in the cockpit.

The pilot should preferably be experienced and qualified on type. Farmers are good practical blokes, but the throttle on a Massey Ferguson works in the reverse sense to the throttle in an aircraft. If you HAVE to start the aircraft on your own, i.e. you are being shot at, or you can see the approaching tsunami, then tie the tailwheel to a fence or some pickets, tie the stick back with the harness, and chock the wheels.

Rule 4: The person swinging the prop is in charge of the process, and calls the shots.

The cockpit occupant can obviously share his intellectual property re the process, but it is the person risking life and limb (literally) who dictates how things will be done.

Rule 5: Remove any lose, trailing, or baggy clothing that might get caught by the prop.

Scarves, helmet leads, wedding dresses etc. In fact, remove your helmet also so you can hear what is going on.

Rule 6: Get some practical instruction on how to do this.

These notes are not a license to go and try it by yourself.

How to Swing a Prop

So, with respect for the prop foremost in their mind, chocks in position, brakes on, and a pilot in the cockpit, the ground assistant is ready to get started. Prime as appropriate. Prime six or seven positive strokes when the engine is cold, less when it is warm. Priming should be carried out prior to all starts, whether the engine is cold, hot or in between, with the exclusion perhaps of restarting within 5 minutes or so of shutdown. If it is a hot, still day you might get away with longer, on a cold windy day the opposite is likely to be the case. If in doubt it is recommended to prime the engine prior to a start attempt. Try starting the engine and if there is no response after five or six swings, then re-prime it.

Now, assuming the prop MAY be live, the ground assistant should swing the prop through four compressions, to ensure each cylinder is primed. Use these "low threat" swings with the ignition off, as a practice for the live ones coming up. The ground assistant should face the prop with both hands on the down going blade, with their right hand 2/3 to 3/4 of the way down its length. They will need to curl their fingers slightly around the trailing edge of the blade in order to get sufficient grip to pull it through the compression.

Use the minimum curl necessary, as in the unlikely event of the prop kicking backwards, they don't want to damage or lose their fingertips, or be pulled back into the prop arc. A pair of leather gloves is a good idea for the person swinging the prop to use during prop swinging.

Balance is very important, so the ground assistant should be mindful of the state of the ground underfoot. If it is wet/slipper/boggy/uneven etc. – then this adds another challenge. Consider moving the aircraft.

The ground assistant should stand at an appropriate distance from the prop for maintaining your balance. There is little natural incentive to stand too close for some reason, but many people stand too far away. This results in them having to lean toward the prop in order to reach and swing it. This puts their CofG in the wrong place, and if the prop suddenly swings through on a low compression, or an early firing of one cylinder, it is easy to fall into the prop arc.

The ground assistant should pull the prop through initially with both hands, but as the prop starts to move they should bring your left hand away (helps with CofG), and as their right hand pulls the prop through start to walk away, mostly in the direction the blade is travelling, but slightly away at the same time. I.e. if the aircraft is heading 360 degrees, the ground assistant should be walking on a track of approximately 070 to 080 degrees, slightly away from the plane of the prop. As soon as the ground assistant feels the prop go through the compression, they should pull their right hand away, and continue walking slowly away.

The swing itself should not be a high energy effort. Firstly, because doing so increases the chance of the ground assistant losing their balance. Secondly, because it is unnecessary, as the strength of the spark is dictated by the spring powered impulse in the right magneto. It will be the same regardless of how hard the swing. All the ground assistant has to do is pull through a compression for it to work.

Having done this practice four times each of the cylinders should be primed. If the ground assistant is now happy with their swing (so to speak) proceed with the start. If not, the ground assistant should have some more ignition off practice, or get someone else to do it.

If proceeding, the ground assistant should call to the pilot "Ready for starting" and "Contact" (accompanied by a thumbs UP signal)". The pilot should set the throttle to ½ inch forward of the fully closed position, switch ON the front (right) impulse magneto (No 1). The pilot should also have the stick hard back at this point, to cater for the possibility that the throttle linkage has broken and the engine is stuck on full throttle. Then when they are fully ready, the pilot calls back "Contact" (accompanied by a thumbs UP signal).

All terribly formal, but this is one occasion when you do not want any ambiguity.

The ground assistant should then go ahead and swing the prop until it starts. There is no need to repeat the call outs with each swing, everyone should consider that the right mag is ON and the throttle is set until such time as either the ground assistant or the pilot announces otherwise.

Give it at least half a dozen swings before moving on to "If the Engine Will Not Start" below.

If, after a swing, the prop stops in an awkward position, it may be prudent for the ground assistant to call "Switches OFF", check the appropriate response from the pilot. Then stretch and reach up to pull the prop into an ideal position. Then, when the ground assistant is happy again, they should call "Contact" (accompanied by a thumbs UP signal). Likewise, when they are fully ready, the pilot calls back "Contact" (accompanied by a thumbs UP signal).

If the ground assistant or the pilot wants to stop swinging for any reason, then they should call "Switches OFF" and check the appropriate response from the other person.

After Engine Start

When the engine does start, the ground assistant should walk out to the right wingtip where they will be easily visible to the pilot, and wait for the pilot to turn the left mag on and get the engine settled down. Then, when the pilot is happy, they should signal the ground assistant to remove the chocks. The ground assistant should walk up the leading edge slowly and carefully, and remove the right chock. This will be easier if the pilot has throttled back a bit.

Having successfully removed the chock the ground assistant should walk carefully back out along the wing leading edge, at least as far as the roundel, and then walk around the front of the aircraft in a VERY wide arc and approach the left wing, no further inboard than the left side roundel, then walk slowly and carefully in along the left wing leading edge to remove the left chock.

Some advocate walking around the tail, your choice. However, walking around the front keeps the ground assistant in sight of the pilot, and saves them from having to adjust their hair piece.

If either of the chocks is jammed in front of the wheel, typically after a high power run up, ensure that the park brake is off, and move back out along the wing leading edge until you are well clear of the prop arc, and push the wing back to ease the wheel away from the chock. Then go back and remove it.

If the ground assistant now has to climb in to one of the cockpits, they should be very careful not to connect their left boot with the throttle as they climb in. The pilot, waiting for someone else to clamber aboard, should throttle back as the person climbs aboard, and clamp their hand on the throttle.

If the Engine Will Not Start

The possible reasons for an engine failing to start are not enough petrol, too much petrol i.e. too rich, and finally, no spark.

An engine which has not starting because of not enough petrol is unlikely if normal priming carried out and it was within the last 10 mins or so. However if the cures below don't work then it is probably worth priming again and having another go.

Not starting due to too much fuel is not that likely with a Chipmunk, but may be possible with a hot engine, on a hot day, and/or with the temperament of that particular engine. In theory if you just keep swing the prop without repriming, the mixture in the cylinders should slowly get leaner and leaner until you hit the sweet spot.

A quicker way of making it "more lean" is to open the throttle fully, and pull the prop backwards for 8 to 10 compressions. Ensure the switches are OFF, the pilot has his hand on the throttle "expecting" it to fire, and that the stick is held hard back during this exercise.

Finally, no spark or not a big enough spark is quite a common problem with the Gypsy Major. This can be for many reasons, including damp or wet mags, an impulse which is stuck, windings that are old and tired, oil in the mag, or a short in the mag. If the mag is producing only a weak spark, then this may show up as reluctance to start, i.e. it will only start when the mixture is perfect. We are of course talking about the right mag here – the one that has the impulse. It is not interchangeable with the left mag.

A first step to cure an engine that will not start is to listen for the impulse. When you pull the engine through a compression, you should hear a distinct, quite loud, “click” as the impulse does its thing. If you can’t hear the click after a few compressions, then the ground assistant should call “Switches OFF”, and lift the right engine cowling. Take the wooden dipstick (or similar shaped piece of wood) and give the “round silver part of the mag where it meets the engine” a couple of sharp taps. If there is no external ambient noise, you may hear a very soft “click” as the impulse releases itself from whatever gunk was holding it in the wrong place. If this happens, the ground assistant should close the cowl, call “Contact”, and expect the engine to start on the next swing. If the ground assistant doesn’t here the soft click, try another start anyway.

This was a common problem with another Chipmunk I am associated with, and the cure is exactly as described. That said, be VERY careful if you are having a challenge priming and starting a Gipsy, one gave me a huge, potentially life threatening surprise. I had been on my own trying to get a UK Chipmunk’s engine primed then started. The UK version does not normally have the primer pump in the front cockpit, but rather has a manual pump accessed from the left side of the engine. Consequently I had been in and out of the cockpit, priming, clearing the impulse mag and trying to start it. This aircraft has an electric starter, so hand swinging was not required.

However, I got out of sequence and inadvertently left the ignition switches ON, which on the UK version are not visible from outside the aircraft. On my next attempt I managed to get the engine primed and thought I would turn the prop through a couple of rotations to prime the cylinders. On (very slowly) moving the prop through about 90 degrees of arc, the impulse mag “fired” and the engine started!

To say I got a fright is an understatement. The tip of a blade clipped the back of one of my fingers and the aircraft sat there with the engine quietly turning over. Almost as if it was mocking me. “Now what you goanna do?” If the brakes hadn’t been firmly on… If the throttle hadn’t been closed… If I had any part of my body in the arc of the prop… I try not to think too hard about what ifs! But you might like to learn from my near miss.

Anyway, if the aircraft has been outside overnight, and/or it is cold, it is very humid, or it has been raining, then dampness is probably the prime suspect. There is a lot of Bakelite in the mag which loves to soak up water, and so the voltage produced by the mag has all sorts of places to go other than where you want it to. An extension cord, some masking tape, a two wheel hand trolley, and a hair drier is now required.

Sit the trolley upright close to the mag, and tape the drier to it with its outlet aimed at the mag – perhaps 8 inches to a foot away. Take the Bakelite cap covering the points off the mag. Plug the drier in and set it on high. Give it at least 20 minutes or so. It is probably worth staying in the vicinity and monitoring it though….. if it is an old drier there is the possibility it could get a bit hot in an area where you might just be able to smell petrol etc., and I’m not sure what Bill Beard might say if the unthinkable happened and you did finally get a spark, but not where you wanted it!

<u>Finally</u>

To repeat, **ALWAYS TREAT THE PROP AS LIVE** (I try to remember to!). There are a few flimsy and exposed wires around the mags, a break in any one of them could render that mag live even though the switches are off.

Chapter Six

Limitations

General

The De Havilland DHC 1 Chipmunk is cleared for use as a training aircraft, subject to limitations given in the following paragraphs. These limitations must be observed at all times when operating this aircraft.

Airframe Limitations (All speeds IAS)

Max crosswind component	10 kts
Max speed for flap extension	74 kts

The flap limiting speeds also apply to flight with the flaps lowered.

Manoeuvring Speed (Va) @ MAUW	108 kts

Manoeuvres involving an approach to the stall, or full application of aileron or rudder, must not be undertaken when the airspeed exceeds the manoeuvring speed (Va). Although the aircraft is strong enough for steady application of rudder at airspeeds up to the manoeuvring speed (Va), a violently checked manoeuvre might overstress the airframe. That is, any violent yaw must NOT be checked with sudden application of full opposite rudder. At aircraft weights less than the maximum AUW, the manoeuvring speed is reduced.

Snap manoeuvres and spinning are prohibited above 708 kg (1,560 lb) all up weight.

Maximum Structural Cruising Speed (Vno)	118 kts
Never Exceed Speed (Vne)	174 kts

Engine rpm Limitations

Idle rpm	650-750 rpm
Run Up rpm	1,600 rpm
Max Mag drop	100 rpm / smooth running either magneto
Minimum Takeoff rpm	2,000 rpm (Full throttle)
Max Takeoff rpm (5 min limit)	2,550 rpm (Full throttle)
Max Climb rpm (60 min limit)	2,400 rpm (Full throttle)
Aerobatics rpm (Syndicate Policy)	2,400 rpm
Normal Cruise rpm	2,100 rpm
Max Continuous rpm (Rich Mixture)	2,300 rpm
Max Continuous rpm (Lean Mixture)	2,100 rpm
Max Engine Overspeed (1/3 throttle)	2,675 rpm

More than 2,675 rpm or more than 2,550 rpm for more than 20 seconds requires that the engine and propeller be subject to maintenance inspection, and subsequently declared serviceable before the next flight.

Weak mixture operation is not permitted below 3,000 feet. The mixture control is only to be used to maintain "weakest mixture for maximum power" conditions when the engine is operated within the maximum weak-mixture power conditions or to avoid rough running due to over richness in all power conditions. The mixture control must never be used to cause a drop in engine rpm.

Engine Cylinder Head Temperature Limitations

Max Cylinder Head Temp (Takeoff)	255°C
Max Cylinder Head Temp (Continuous)	250°C
Max Cylinder Head Temp (Weak mixture)	230°C

Engine Fuel System Limitations

Total Fuel Capacity	27 Imperial Gallons (123 litres)
Unusable fuel	2 Imperial Gallon (9 litres)
Usable Fuel Capacity	25 Imperial Gallons (114 litres)
Fuel Consumption @ 2100 rpm	7 Imperial Gallons (32 litres) per hour
Endurance on full tanks @ 2100 rpm	3.5 hrs to fuel exhaustion

Engine Oil System Limitations

Normal Oil Pressure	40 - 45 psi
Min Oil Pressure in flight	30 psi
Min Oil Temperature for Run Up	15º C
Max Oil Temperature @ 2550 rpm	100º C
Max Oil Temperature @ all other settings	85º C
Oil Tank Total Capacity	11.4 litres (2.5 Imp Gal / 20 pints)
Air Space	4.5 litres (1.0 Imp Gal)
Effective Oil Capacity	9 litres (2.0 Imp Gal)
Min Oil Quantity before flight	7 litres (1.5 Imp Gal)
Max Oil Quantity before flight	9 litres (2.0 Imp Gal)
Max Oil Consumption	2.8 litres (5 pints) per hour

CVM is to use S100 oil at all times. The oil consumption varies from 0.85 to 1.14 litres (1.5 to 2.0 pints) per hour at economical cruising, to 2.6 litres (4.5 pints) per hour at full throttle.

Tyre Pressures

Main Wheels	38 psi
Tailwheel	40 psi

Maximum Operating Weights

Maximum AUW (Private Ops)	1,930 lb (876 kg)
Maximum AUW (Air transport Ops)	1,930 lb (876 kg)
Maximum AUW (Normal Aerobatics)	1,930 lb (876 kg)
Maximum AUW (Aerobatics with snap manoeuvres)	1,560 lb (708 kg)
Maximum AUW Spinning	1,560 lb (708 kg)
Maximum weight in rear seat	250 lb (114 kg)
Maximum load in luggage locker	24 lb (11 kg) 18 lb (8 kg) when the rear seat is occupied NIL when aerobatics with snap manoeuvres are flown.

Centre of Gravity (CofG) Limitations

The CofG datum is 42 inches aft of the engine firewall.

The CofG limits for normal and aerobatic flight (which exclude snap manoeuvres) are as follows:

Forward CofG	8.9 in (0.23 m) forward of datum.
Aft CofG	0.77 in (0.02 m) forward of datum.

The CofG limits for aerobatic flight (which include snap manoeuvres) are as follows:

Forward CofG	6.8 in (0.18 m) forward of datum.
Aft CofG	0.77 in (0.02 m) forward of datum.

The CofG moves aft as fuel is consumed.

Spinning and Aerobatic Limitations

WARNING

The wheel brakes **must be completely OFF** during spinning and aerobatics to ensure full rudder travel is available.

Practice spins of up to eight (8) turns are permitted.

Snap (flick) manoeuvres and spinning are NOT permitted at weights above 1,560 lb (708 kg).

In the case of the Chipmunk Mk 1-A-1 (i.e. ZK-CVM), aerobatic manoeuvres are permitted up to an all-up weight of 1,930 lb (876 kg).

The load factor limits when aerobatting are +6 to -3 G. While the maximum positive acceleration which the aircraft's structure has been designed to withstand without permanent deformation, at a weight of 1,930 lb, is +6 G, intentional manoeuvres should be confined to load factors well below this value.

WARNING

Care must be taken in manoeuvres at speeds above 100 kts IAS, as it is possible to exceed the load factor limitation of +6G.

To assess the airspeed at which rpm limits are reached, set full power and enter a gentle dive. Keep accelerating until you reach the limiting engine rpm. This will vary according to which version of Gypsy Major engine is fitted, and what the pitch of the prop is. IN CVM 2,400 rpm occurs with full throttle at about 105 kts IAS. Consequently, at any time your speed is equal to or less than 105 kts, you can use full throttle and be confident without reference to the Rev Counter that you are not overspeeding the engine (2400 rpm). Above 105 kts, you will have to throttle back to maintain the rpm within the 2,400 rpm limit.

While 2,550 rpm is the engine limit when aerobatting, syndicate policy is to not necessary 2,400 rpm when aerobatting. In a dive with full throttle set, 105 kts is the prompt to start pulling the nose up and/or reducing power to avoid exceeding this limit (>2,400 rpm). When diving, have the throttle set to AT LEAST 1/3 open.

Sustained inverted flying is prohibited at any time.

During manoeuvres involving transient periods of negative G, such as slow rolls, the throttle should be closed before reaching the inverted attitude and the negative G phase confined to a period not exceeding 5 seconds.

Miscellaneous Limitations

When the aircraft is flown solo the pilot must occupy the front seat.

The canopy (hood) may be opened in flight at any speed within these limitations. However the canopy should usually be latched open in flight only as far as the second catch. I.e., to the bulkhead between the front and rear seats. Also, the canopy should be fully closed for spinning and aerobatics.

Flight in icing conditions is not permitted.

Smoking is not permitted in the aircraft at any time.

DHC 1-A-1 Chipmunk 34 ZK-CVM
EMERGENCY CHECKLISTS

FIRE DURING START

Starter .... Keep winding

If the engine starts:

Throttle................................. Set 1600 for two minutes
Engine.................................. Shutdown and seek engineering support

If the engine fails to start or the fire continues on the ground:

Throttle .... Closed
Idle Cut-off Control .... Pulled out
Ignition Switches .... Off (Down)
Fuel Selector .... Off
Master Switch .... Off
Park Brake .... Off

Abandon the Aircraft

Attempt to extinguish the fire if safely possible without removing engine cowling and seek engineering support.

ENGINE FIRE IN FLIGHT

Throttle .... Closed
Fuel Selector .... Off

Raise the nose to reduce the airspeed and rpm. When the engine cuts:

Ignition Switches................... Off (Down)

Proceed with the forced landing.

If fire persists, abandon the aircraft if parachutes carried and sufficient height, otherwise make a high speed emergency descent.

ELECTRICAL FIRE IN FLIGHT

Master Switch.................. Off
Canopy................................. Opened

If smoke/fire continues:

Locate source and extinguish if possible.

If the smoke/fire continues carry out an emergency descent.

Land as soon as possible.

If smoke/fire stops:

All Electrics .... Off
Master Switch .... On

Essential electrics on, one at a time, to locate the source if possible.
If source identified, leave it OFF.

If unidentified smoke/fire reoccurs:

Master Switch.................. Off

Continue NORDO, remaining VMC and clear of controlled airspace if possible.

LOW OIL PRESSURE

Pressure less than 30 psi

Oil Temperature .... Monitor

Oil Pressure. .... Monitor

Set 1600 rpm, proceed to the nearest suitable airfield and land.

Maintain altitude and be prepared for complete power loss.

HIGH OIL TEMPERATURE

Oil Pressure. .... Monitor

If oil pressure is dropping set 1600 rpm, proceed to the nearest suitable airfield and land.

Maintain altitude and be prepared for complete power loss.

If oil pressure are steady continue to your destination. Check the oil level.

ENGINE ROUGH RUNNING

Carb Heat......................... On

If rough running continues after 1 minute:

Carb Heat .... Off
Fuel Contents .... Check
Fuel Selector......................... Change tank

Ignition............................ Checked

ENGINE FAILURE DURING TAKEOFF ROLL

Throttle .... Closed
Brakes.............................. Apply as required

Maintain directional control and advise ATC.

Complete the **After Landing Checks**

If signs of fire or engine completely stopped:

Ignition Switches................... Off (Down)
Master Switch .... Off

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

Nose .... Lower
Airspeed .... 60 kts IAS
Throttle .... Closed

Select a landing field and plan your approach.

Flaps .... As required

Fuel Selector......................... Off
Ignition Switches .... Off (Down)
Master Switch .... Off

ENGINE FAILURE IN FLIGHT (Restart procedure)

Airspeed .... 60 kts IAS
Throttle .... Closed

Ignition Switches .... On (Up)
Fuel Selector......................... Select fullest tank
Start Switch .... Press

If power cannot be restored carry out a forced landing or abandon the aircraft if parachutes carried and sufficient height.

WINDMILL START PROCEDURE

Throttle .... 1/3 open
Ignition Switches .... On (Up)
Attitude .... Near vertical dive (60-70°)

Recover from the dive prior to exceeding Vne.

If power cannot be restored carry out a forced landing or abandon the aircraft if parachutes carried and sufficient height.

Chapter Eight

Safety and Emergency Expanded Procedures

Introduction

This section provides the pilot with procedures that enable him or her to cope with emergencies that may be encountered in operating a Chipmunk.

Emergencies caused by aircraft or engine malfunction are extremely rare if proper maintenance procedures and operating procedures are followed and a proper pre-flight inspection is completed prior to every flight.

Likewise, careful flight planning and good pilot judgement can minimise enroute weather emergencies. However should any emergency develop, the Emergency Checklist items and the guidelines in this section should be considered and applied as necessary to correct or deal with the problem.

Procedures in the Emergency Checklists which are shown in **bold-faced type** are immediate actions which should be committed to memory.

The following paragraphs are presented to supply additional information for the purpose of providing the pilot with a more complete understanding of probable causes of and recommended actions in an emergency situation. Whenever possible seek the assistance/advice of your instructor, ATC or other pilots as available.

Fire During Start

Engine fires during start are usually the result of over priming or pumping of the throttle combined with a backfire during the ignition phase. The first attempt to extinguish the fire is to try to start the engine and draw excess fuel back into the induction system.

If a fire is present before the engine has started, open the throttle and crank the engine. This is an attempt to draw the fire back into the engine and to use up excess fuel. If the engine has started, continue operating the engine for a short time to try to pull the fire into the engine. In either case, if the fire continues, the aircraft must be shut down and vacated immediately, and the fire should be extinguished by the best available means.

Never attempt to restart the engine until engineering support has been received.

Engine Fire in Flight

The presence of fire is noted through smoke, smell and/or heat in the cabin. It is essential that the source of the fire be promptly identified through instrument readings, characteristics of the smoke, or other indications, since the action to be taken differs somewhat in each case.

First of all, check for the source of the fire. If an engine fire is present its source is more than likely the fuel, consequently the fuel should be ‘starved’ from the fire. Close the throttle, and switch the fuel selector to OFF. The canopy should be opened and the cabin heat turned OFF in an effort to clear the cockpits of smoke. When the engine stops, the ignition switches should both be turned OFF (Down). Proceed with the power off forced landing procedure.

If an electrical fire is indicated (smoke in the cockpit), the Master Switch should be selected to OFF. The canopy should be opened and the cabin heat turned OFF in an effort to clear the cockpits of smoke. If you can identify the source of the fire/smoke and can turn it off, then do so. Regardless, a landing should be made as soon as possible.

NOTE
The possibility of an engine fire in flight is extremely remote. The procedure given is general and pilot judgement should be the determining factor for action in such an emergency.

Low Oil Pressure

Loss of oil pressure may be either partial or complete. A partial loss of oil pressure usually indicates a malfunction in the oil pressure regulating system, and a landing should be made as soon as possible to investigate the cause and prevent engine damage.

A complete loss of oil pressure indication may signify oil exhaustion or may be the result of a faulty gauge. In either case, proceed toward the nearest aerodrome preserving altitude where possible, and be prepared for a forced landing. If the problem is not a pressure gauge malfunction, the engine may stop suddenly. Maintain altitude until such time as an engine out landing can be accomplished if necessary. Don't change power settings unnecessarily, as this may hasten complete power loss.

Depending on the circumstances, it may be advisable to make an off aerodrome landing while power is still available, particularly if other indications of actual oil pressure loss, such as sudden increases in temperatures, or oil smoke, are apparent, and an aerodrome is not close.

If the engine does stop, proceed with a power off landing.

High Oil Temperature

An abnormally high oil temperature indication may be caused by a low oil level, an obstruction in the oil cooler, damaged or improper baffle seals, a defective gauge, or other causes. Land as soon as practicable at an appropriate aerodrome and have the cause investigated.

Carburettor Icing

Under certain moist atmospheric conditions at temperatures of -5°C to +20°C, it is possible for ice to form in the carburettor air induction system, even in summer weather. This is due to the high air velocity through the carburettor venturi, with an associated pressure and temperature drop, and absorption of heat from the air by vaporisation of the fuel.

To avoid this, carburettor air preheat (carb heat) is provided to replace the heat lost by the venturi effect and vaporisation. Carburettor heat should be used whenever the engine rpm is set to a low power setting. This will help to keep the carburettor air temperature out of the caution range.

Engine Rough Running

Engine rough running is often due to carburettor icing, which is indicated by a drop in engine rpm and may be accompanied by a slight loss of performance. If too much ice is allowed to accumulate, restoration of full power may not be possible, therefore prompt action is required.

Turn the carburettor heat ON. The rpm will decrease slightly and roughness may increase. Wait for a decrease in engine roughness or an increase in rpm, indicating ice removal. If there is no change after approximately one minute, return the carb heat to OFF.

If the engine is still rough running, a check of the fuel contents should be made. Check the engine gauges for abnormal readings. If any gauge readings are abnormal, proceed in accordance with the appropriate Emergency Checklist actions. In the Chipmunk the mixture should be adjusted for maximum smoothness. The engine will run rough if the mixture is too rich or too lean.

Switch the ignition switches OFF momentarily, then back ON, one at a time. If operation is satisfactory on either magneto, proceed on that magneto at reduced power, with mixture full RICH to a landing at the first available aerodrome.

If roughness persists, prepare for a precautionary landing at the pilot's discretion.

Engine Failure In Flight

If you have an engine problem at any time in flight, again the most important thing is to **keep flying the aircraft**.

Maintain altitude as the flying speed reduces. Select a nose attitude for a glide speed of 70 kts. If you choose to glide with half flap lowered, a glide speed of 65 kts is applicable.

Follow normal engine failure procedures for a forced landing by selecting a suitable area for the landing and planning your approach to the area.

If and when time permits assess your situation. Have a good look around the instruments, listen to the engine, and look behind you for signs of fire. Consider anything that will help you establish what is wrong. Once you have an idea of the problem take whatever action you think is appropriate to preserve your life.

Complete whatever emergency procedures you think are appropriate and when you can, make a MAYDAY call.

If the forced landing seems inevitable, while still gliding, switch OFF the fuel and ignition switches, and select the Master Switch to OFF.

After touchdown, bring the aircraft to a stop and vacate the aircraft quickly.

It is far better to flying the aircraft to a safe landing having done no checks, than to meticulously complete the checks and lose control of the situation/aircraft.

Restarting a Stopped Engine

Engine failure because of a fire has one simple rule – DO NOT RESTART IN THE AIR.

And, on the ground, DO NOT RESTART UNTIL A FULL EXAMINATION IS MADE AND THE FAULT CORRECTED.

If the electric starter is serviceable, establish the aircraft in a glide at 70 kts, close the throttle and attempt a restart using the electric starter.

Propeller Stoppage in Flight

There is the remote possibility that the propeller could stop in flight during aerobatics. This could be a nuisance if the electric start was unserviceable.

The prop stopping is most likely to happen when falling out of a stall turn to the left, when the engine stops due to zero or negative G, and the aircraft comes down backwards for a few seconds removing the wind milling airflow through the prop. Apparently it may also happen in a spin to the left when the IAS drops below 20 kts, and conceivably during a (not so very good) slow roll.

There is some debate as to whether, due to its relatively high compression engine, the Chipmunk can be windmill started, i.e. dived to a speed at which the prop will start turning again. Achieving a windmilling restart is quite a common event in Gipsy Major powered Tiger Moths, there is every reason to believe it will work with the Chipmunk. However the syndicate has yet to put it to the test, and are in no hurry to do so! On the other hand, Bernie Lewis, who is a test pilot on the type, has carried out windmilling starts in the Chipmunk several times.

The exact speed at which the prop will start turning depends largely on the condition of the engine. A recently overhauled and therefore relatively tight engine, with high compression may take a lot of persuasion. With the Chipmunk the prop usually starts moving at between 130 and 135 kts.

Anyway, regardless of the serviceability state of the electric starter, prior to commencing aerobatics it would be a good idea to locate a suitable paddock within gliding range just in case, and to review the windmill start procedure.

Windmilling Restart Procedure

Throttle 1/3 open; Mags On (Up); and dive as steeply as possible (60-70 degrees nose down) as soon as possible.

Be prepared to go to nearly Vne (174 kts), but initiate a less than 6G recovery before you get there regardless of whether the engine has started turning. It is estimated that the correct procedure will require no more than 120 kts and 1,500 to 2,000 feet of altitude.

NOTE

If your dive is too shallow, say only 30 to 40 degrees, you will simply squander all of your height, and therefore subsequent gliding potential, for no result. Go aggressively for 90 degrees, which will probably ensure you get at least 60-70 degrees, which will probably do the trick.

Ditching

Because of the fixed undercarriage, it is expected that the ditching characteristics would not be good. Consequently, if parachutes are worn, it is recommended that the aircraft be abandoned rather than ditched.

If ditching is unavoidable lock the cockpit canopy open and tighten the safety harnesses.

Approach into wind at normal speed (65-70 kts IAS), using full flap. If power is available, hold the aircraft just clear of the water until ready to splash down at as slow a speed as possible. Close the throttle and stall in the three-point attitude, onto the crest of a wave if possible. If there is a heavy swell running, ditch along the swell.

Some other Pilots Notes recommend that the aircraft should be made to strike the water in a flat turn so the impact is taken on one wing. This is to avoid a rapid nose-under upon touching the water.

Be prepared for the aircraft to turn onto its back and float in a nose-down attitude. After splash down, release the harness, disconnect the R/T lead and leave the aircraft as rapidly as possible.

Flap Failure

While highly unlikely, the flap may fail due a jamming of the flap operating mechanism. If the flaps cannot be lowered, carry out a flapless landing.

A wheeler landing is generally recommended for a flapless landing.

The flapless landing does not pose any particular problem. Remember that without flap the aircraft's drag is slightly less and the stall speed is slightly higher. Consequently, you will require slightly less power and you should maintain slightly higher speeds. The approach should be made with a slightly shallow descent angle than normal. Without flap the nose attitude will be slightly higher, so be careful not to over flare on landing. The landing attitude when flapless is much the same as for a normal landing.

The final approach speed on a flapless approach is about 5 kts faster than usual. Because of the higher approach speed and less aerodynamic and ground drag, brakes should usually be applied for stopping during the landing roll.

If the flaps cannot be retracted, maintain full power and climb at a safe flying speed (60 kts) to a safe height. Even with full flap down at maximum weight the aircraft should still be able to climb adequately. When you have reached a safe height, allow the aircraft to accelerate to a little below the flap limiting speed and reduce the power to maintain that speed. Carry out a normal approach and landing at the nearest suitable aerodrome.

Open Canopy

The cockpit canopy is double latched, so the chances of it sliding open in flight is remote. However if you should forget or do not secure the canopy adequately it may slide partially open. This will usually happen on takeoff or soon afterward. A partially open canopy will not affect normal flight characteristics, and a normal landing can be made with the canopy fully open.

Do not attempt to close the canopy until you are well clear of the ground, at least above 500 feet AGL. Remember to **FLY THE AIRCRAFT** at all times!

Brake Failure Taxiing

If the brakes should fail whilst taxiing, the decisions to be made by the pilot are dependent on the situation at the time, but with the objective of stopping the aircraft whilst avoiding contact with persons or property.

To the best of your ability, steer the aircraft to avoid contact with obstructions. If the speed fails to decay at an acceptable rate, it is better to steer the aircraft between obstructions and allow the wings to absorb collision impact.

The quickest method of stopping the engine is to turn the ignition switches OFF. This will minimise any damage that may be caused by the rotating propeller.

Remember, grass surfaces will slow an aircraft at a greater rate than hard standing i.e. aprons, taxiways, etc.

Brake Failure Airborne

Should brake failure be detected prior to landing, plan to carry out a minimum length field approach using the longest vector available, preferably grass. This will help improve deceleration.

Remember, the landing roll will be considerably longer than normally experienced when braking is available.

Radio Failure

Modern aircraft radio equipment has a very good serviceability record. However, they do occasionally fail. Nevertheless, before declaring that a radio has failed, ensure that:

- ✈ The Radio master is ON;
- ✈ The volume control ON/OFF switch has not been accidentally turned to OFF, or the volume turned to minimum;
- ✈ Check for noise output by selecting the squelch OFF (i.e. pulling OUT the volume control); and,
- ✈ Change headsets if possible.

If you are sure that your radios will not function, set your transponder to 7600. Avoid busy and controlled airspace if it is practical to do so, and land at a suitable aerodrome. If you think that it is best to return to land at a controlled aerodrome then carryout an overhead join if you can, and keep an extra good lookout for other aircraft. You should look for light signals from the tower, but land when you are sure that it is safe to do so, even if you don't see light signals.

If you are in the circuit set your transponder to 7600, maintain your position (order) in the pattern of other aircraft and land off the next approach. The control tower will pretty quickly work out that you have a problem because you are not responding to their radio calls. Again, you should look for light signals from the tower, but land if you are sure that it is safe to do so, regardless of whether you see light signals.

Your transponder code 7600 will bring up an alarm in the area radar control centre, and they will contact the tower to warn them of your communications failure.

Bird Strike

Bird strikes are quite possible near aerodromes nowadays. Should one occur during normal flight, damage to the aircraft will normally be minimal but will depend on the size of the bird and impact location on the airframe.

If in doubt, proceed to a safe area/height, slow the aircraft to 70 kts and check by cautious handling, that the aircraft will still fly satisfactorily at slow speed.

Proceed to the nearest aerodrome at a slow, safe airspeed making a normal landing with a slightly higher minimum threshold speed.

If the slow speed handling check indicates some abnormal handling characteristics, maintain the airspeed at 5 kts above the "problem" airspeed for the return to the airfield, approach and landing. Obviously select an airfield with a sufficiently long runway.

Abandoning the Aircraft in Flight when Wearing a Parachute

If parachutes are worn for unusual manoeuvres or operations and it becomes necessary to abandon the aircraft, the following procedures should be followed if time permits:

- ✈ Shut down the engine by switching the ignition OFF (Down); and,
- ✈ Select the Master Switch to OFF.

> **WARNING**
>
> The minimum safe height for abandoning the aircraft is 1,500 feet agl, except in a spin, when it is 3,000 feet agl.

The canopy cannot be jettisoned in flight. To slide the cockpit canopy rearward:

- ✈ Trim an attitude for at least 100 kts; and,
- ✈ Grasp the normal canopy handles and slide the canopy as far open as possible, ideally fully open.

With the canopy open, the cockpit is windy and dust will swirl about.

Release the harnesses, stand and dive over the side of the cockpit toward the trailing edge of the wing. The rear seat occupant first, and finally the front seat occupant.

Don't forget to disconnect the R/T lead!

Waypoints AVIATION

Chapter Nine

Systems Description

General Description

The De Havilland DHC 1 Chipmunk is designed as a basic trainer aircraft. It has a fixed undercarriage, fully castering tailwheel, brakes and full dual controls. The tandem cockpits are enclosed by a single hood. The fuselage, tailfin, tailplane and leading edges of the mainplane are metal and the rest of the wings and control surfaces are fabric covered.

De Havilland DHC 1-A-1 Chipmunk 34, ZK-CVM specifications:

Engine:	Gipsy Major 10 Mk 2-1
Basic empty weight:	1,382.14 lb
Max gross weight:	1,930 lb

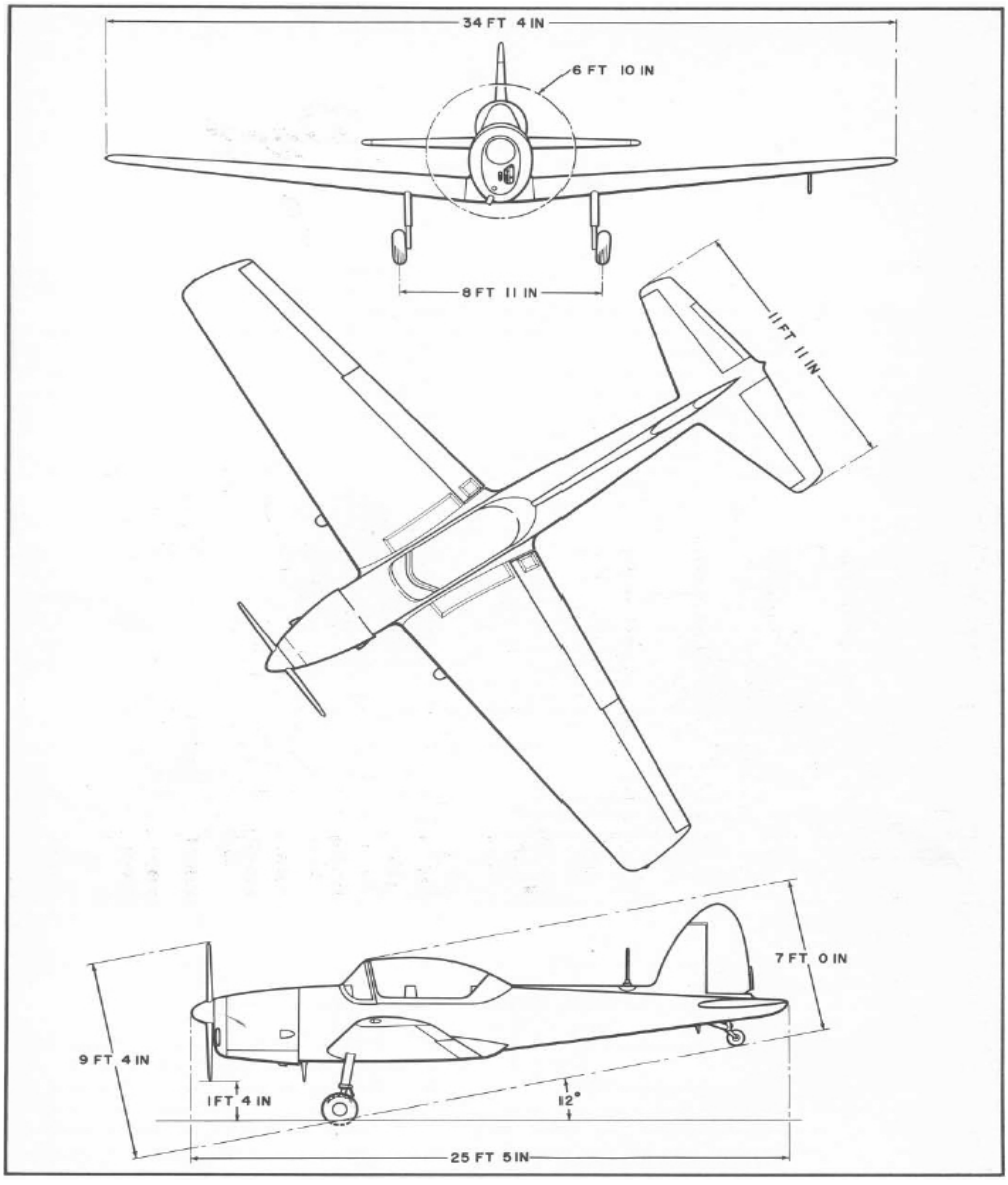


Figure 9-1 Aircraft

Seating Capacity

The De Havilland DHC 1 Chipmunk has two seats arranged in tandem and enclosed by a fixed windscreen, incorporating a crash pylon and a single sliding canopy. The pilot, when flying solo, MUST occupy the front cockpit. **The aircraft must not be flown solo from the rear seat.**

Fuselage

The fuselage is metal, with a semi-monocoque structure and is built in two parts. The joint is located near the trailing edge of the wing. The portion of fuselage between the rear cockpit and fuselage joint forms the luggage locker.

Mainplanes

The mainplanes are of single-spar, metal cantilever construction and are secured to the fuselage at the spars and leading edges. A metal skin covers the "D" shaped box beam leading edge which carries the flight and landing loads. The remainder of the mainplane structure is a fabric covered rear section containing a false spar which supports the flaps and ailerons.

Slotted ailerons are fitted, and hand operated slotted flaps extend from root fillets to the inboard ends of the ailerons. Both ailerons and flaps are fabric covered.

Empennage

A single fin and balanced rudder, mounted wholly above the fuselage, and a cantilever tailplane and balanced elevators form the empennage. The fin and tailplane are metal covered. The rudder and elevators are fabric covered.

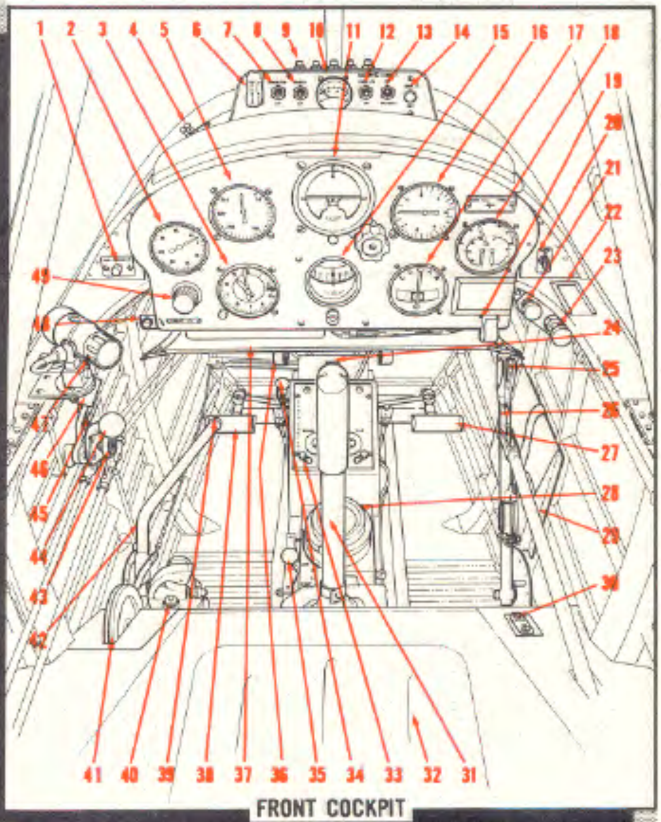
Cockpit Layouts

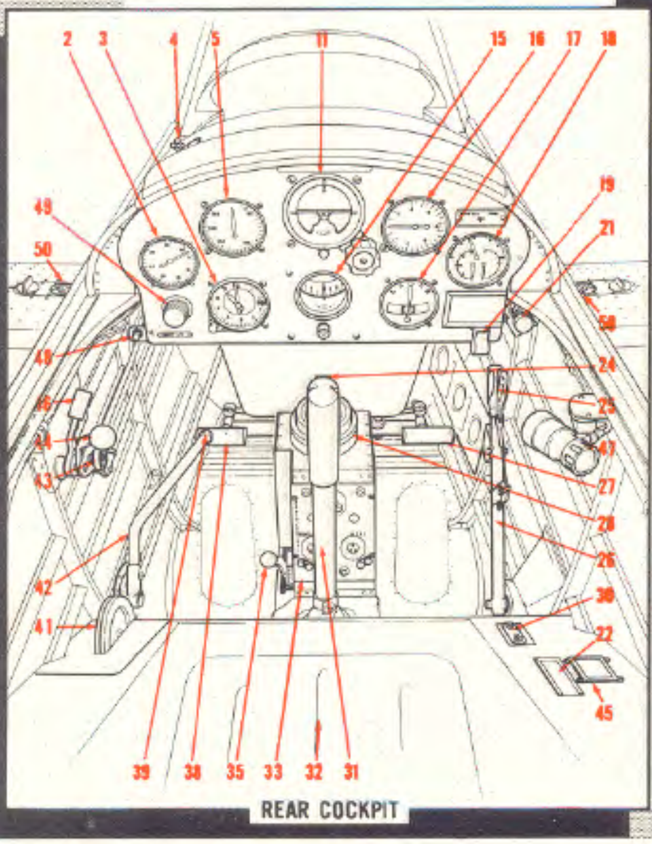
The diagram below gives, in reasonable detail, an idea of the 'standard' layout of the Canadian Chipmunk. Those familiar with the British Chipmunk will note some subtle differences.

During the restoration of ZK-CVM a number of small changes were made, which pilots will note as they become more familiar with the aircraft. In particular the electrical control panel shown on the centre console of the front cockpit has been moved to the left side of the front cockpit wall. A magnetic compass has been located where the electrical control panel used to be.

Figure 9-2 ZK-CVM Front Cockpit Layout

1.Fuel Contents Lights Switch
2.Tachometer
3. Altimeter
4.Ignition Switches
5.Airspeed Indicator
6.Starter Switch
7.Generator Switch
8.Battery Master Switch
9.Circuit Breakers
10.Voltmeter
11.Artificial Horizon
12.Navigation&Fuel Gauge Light Switch
13.Landing Light Switch
14.Identification Lights Switch
15.Direction Indicator
16.Rate Of Climb Indicator
17.Turn& Bank Indicator
18.Oil Temp.Pressure & Fuel Pressure Gauge
19.Headset Stowage
20.Radio Master Switch
21.Carburettor Heat Control
22.Radio Frequency Card Holder
23.Primer Pump
24.I/C Transmit Switch





25.Flap Selector Lever Release
26.Flap Selector Lever
27.Right Hand Rudder Pedal
28.Magnetic Compass
29.Map Stowage
30.Microphone & Headset Jacks
31.Control Column
32.Cockpit Seat
33.Radio Control Panel
34.Cockpit Heat Control
35.Fuel Selector
36.Control Locks Stowage
37.Luggage Rack
38.Left Hand Rudder Pedal
39.Parking Brake Release Button
40.Fire Extinguisher
41.Elevator Trim Wheel
42.Brake Lever
43.Friction Control Knob
44.Mixture Lever
45.Compass Deviation Card Holder
46.Throttle Lever
47.Instrument U/V Light
48.I/C Button
49.Cockpit Lights Rheostat
50.Fuel Contents Gauge

Figure 9-3 Canadian Chipmunk Standard Cockpit Layouts

Flying Controls

The controls are of the conventional type, i.e. a control column (stick) and individual rudder pedals. There are dual controls for flying from either the front or the rear cockpit. The rear control column can be removed, if required, e.g. for passenger flying, by removing a safety pin and then withdrawing the retaining pin at the base of the column and disconnecting the radio cable.

A transmit button is mounted on the top of each control column.

The rudder pedals can only be adjusted for leg reach on the ground. They may be moved to any one of three positions by raising the spring clip and pin and moving the rudder bar forward or aft as required. The rudder pedals also provide the differential braking action in conjunction with the position of the hand brake lever.

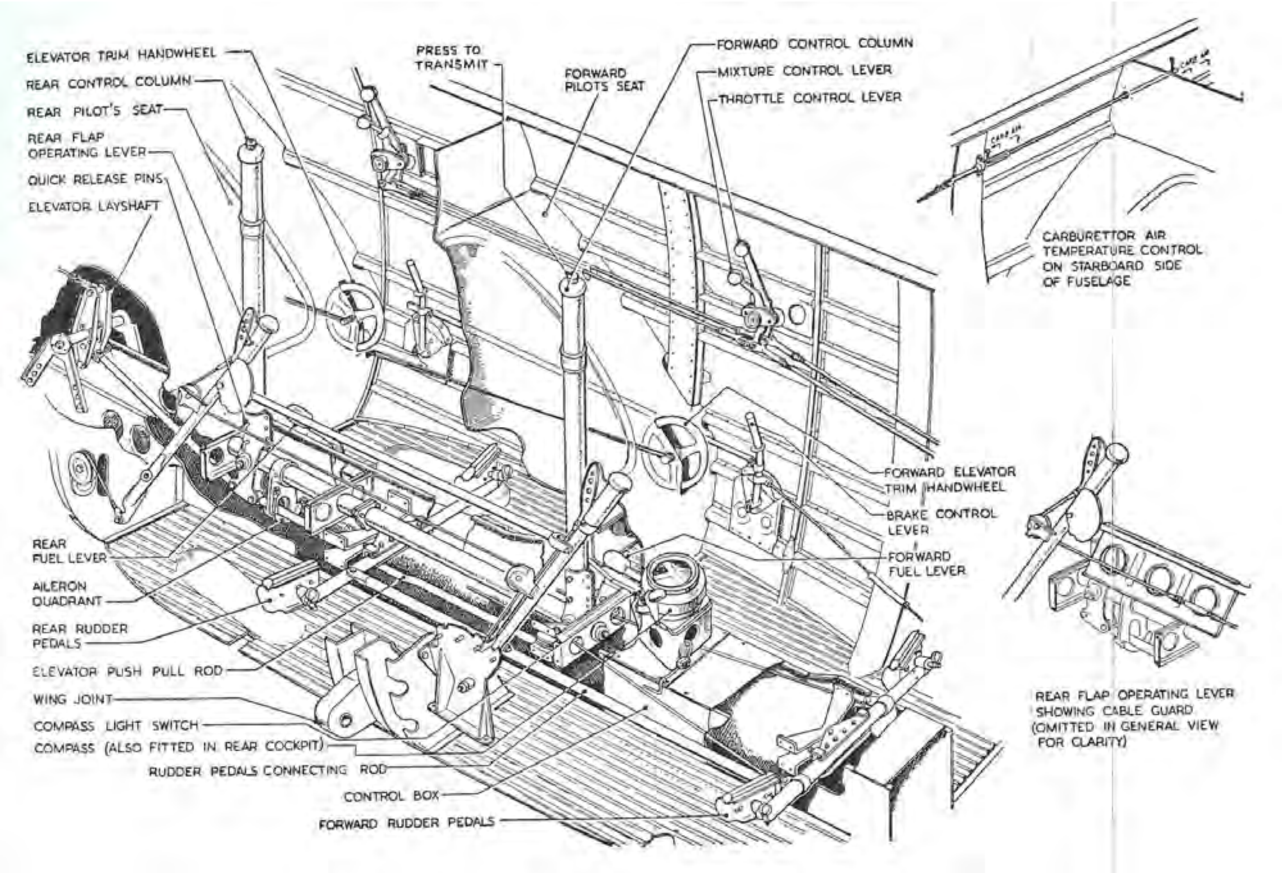


Figure 9-4 Flying Controls

Flying Controls Locking Gear

The flying controls locking gear in ZK-CVM consists of a short bungy cord which is wrapped around the control column (stick) in the front cockpit. The bungy is secured at each end into two holes in the radio mounting.

Trimming

Trim tabs are incorporated in the rudder, the right aileron and the right elevator. The rudder and aileron tabs are only adjustable on the ground. The elevator tab can be controlled in flight. The elevator trim tab is controlled by a handwheel on the left side of each cockpit. The wheel is labelled NOSE - UP/DOWN and is so marked that all nose-up trim positions are black and all nose-down positions are white, the setting being read against the top of the wheel casing.

Flaps Control

Flap operation is controlled by a 3-position lever on the right hand side of each cockpit, up (fully forward), half flap of 15° (mid position) or full flap of 30° (fully aft). No flaps position indicator is provided, as the flaps are easily seen from both cockpits. To move the flap lever forward, thereby reducing the amount of flap deployed, a guarded, spring loaded trigger at the top of the lever must first be operated to release a pawl in the front cockpit quadrant. The trigger is protected by a guard, to prevent accidental movement (reduction) of the flaps. The use of the trigger is not necessary when moving the flap lever aft (increasing the amount of flap deployed).

The flaps must not be raised on the ground if a tail wind component exists, due to the risk of the control cables leaving the pulleys.

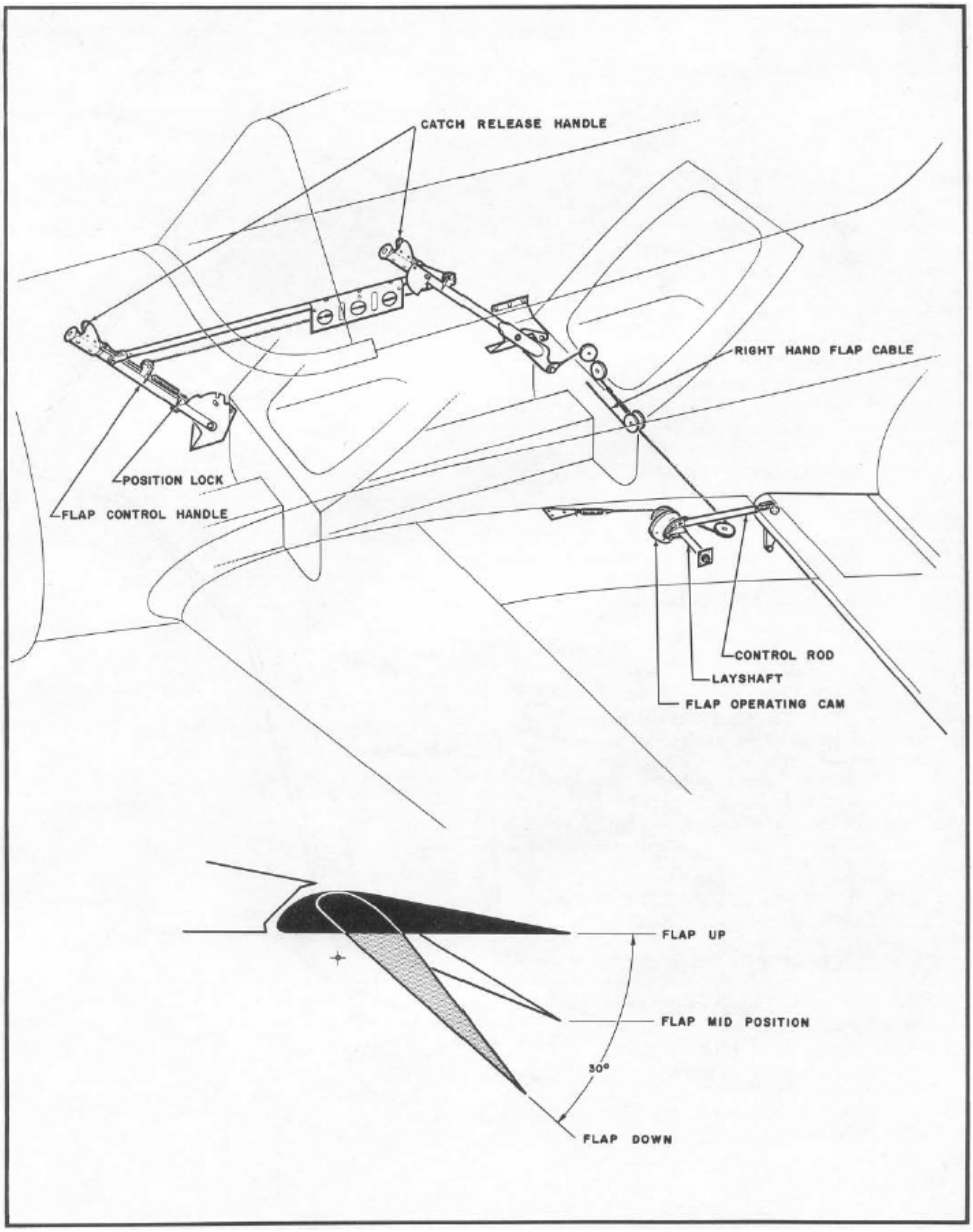


Figure 9-5 Flap Controls

Undercarriage

A conventional two wheel cantilever non-retractable undercarriage is secured to the wing. The shock absorbers on the main wheels are a rubber block type. The tailwheel is fully castering.

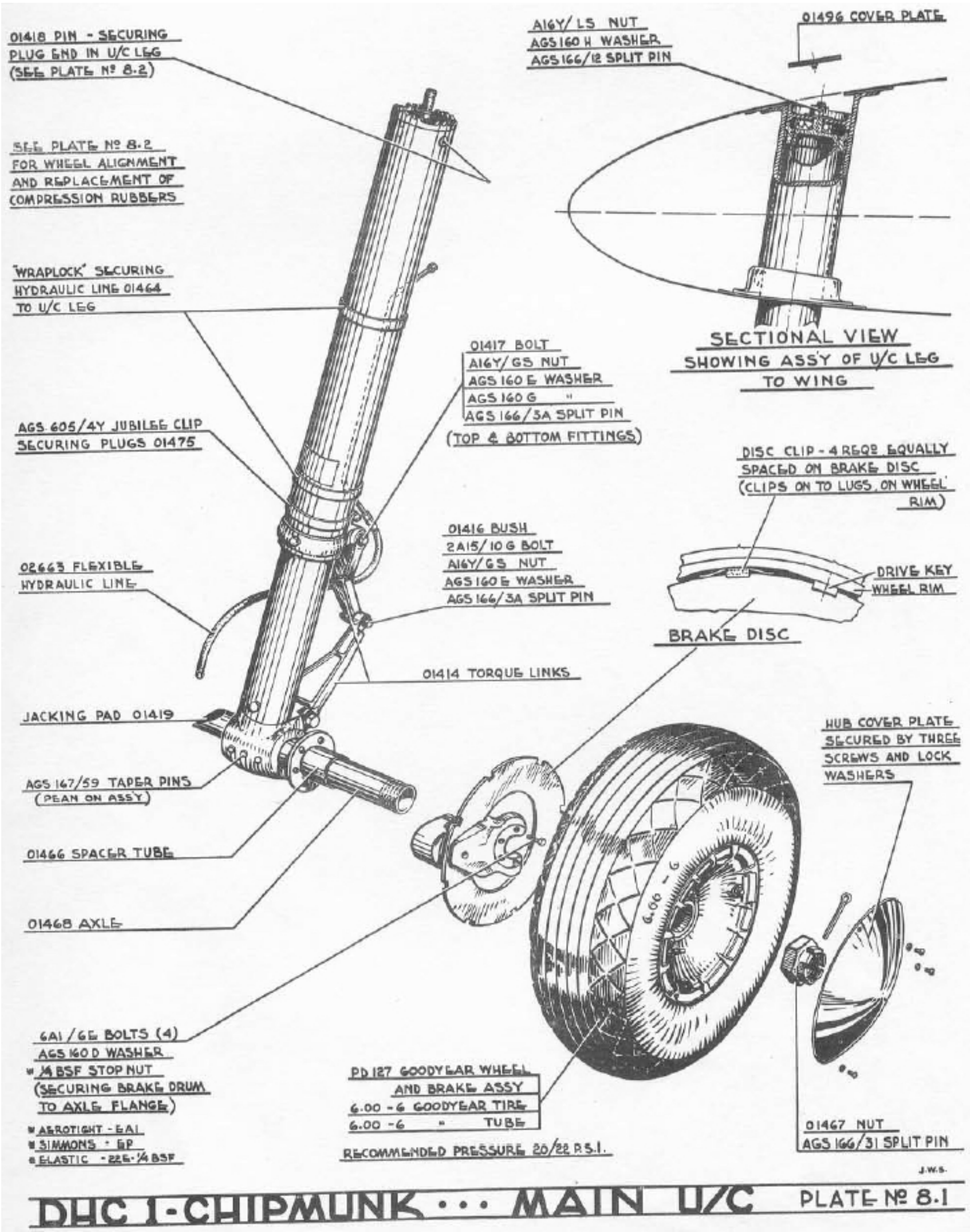


Figure 9-6 Main

Brakes

The main wheels are fitted with Cleveland hydraulic brake units. A master cylinder for each wheel is supplied with fluid from a reservoir on the forward face of the firewall.

The brakes are controlled by a hand lever on the left hand side of each cockpit. The lever is spring loaded and may be set to any position by pressing down the collar on the lever to engage a pawl on the quadrant. Slight backward movement of either lever releases the pawl so that the lever can be moved forwards to the OFF position.

With some brake lever applied, equal braking is applied to both wheels when the rudder is central. Setting the lever to an intermediate position and operating the rudder pedals provides differential braking for ground manoeuvring.

The park brake should not be left on after picketing as the hydraulic brake system does not like being pressurised for long periods.

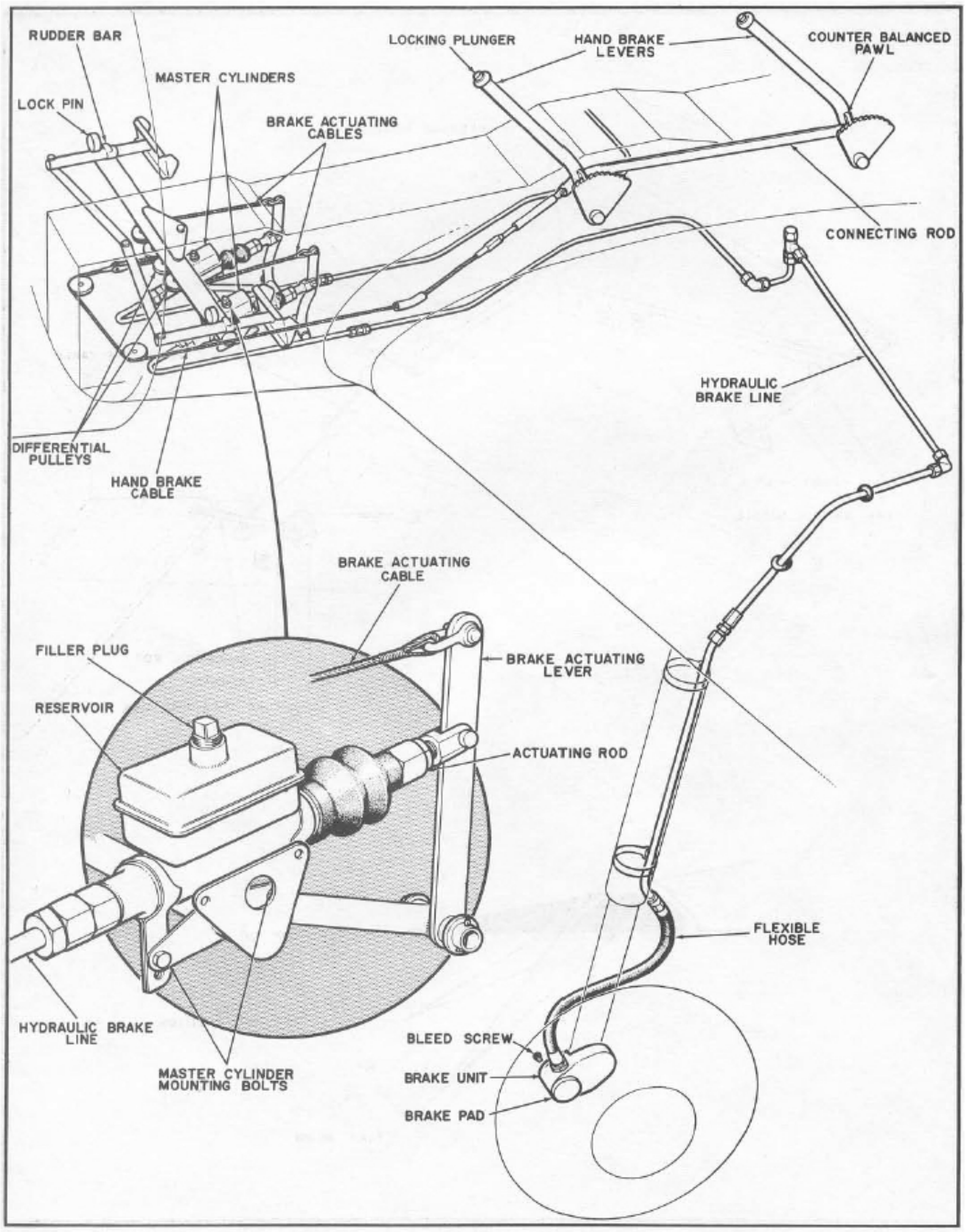


Figure 9-7 Brakes

Engine

The aircraft is powered by a four-cylinder, air-cooled Gipsy Major 10 Mk 2-1 engine, driving a two bladed, fixed pitch propeller. The engine develops about 136-142 BHP at sea level in ISA conditions. Two engine driven fuel pumps are provided and the engine also drives an alternator and a vacuum pump.

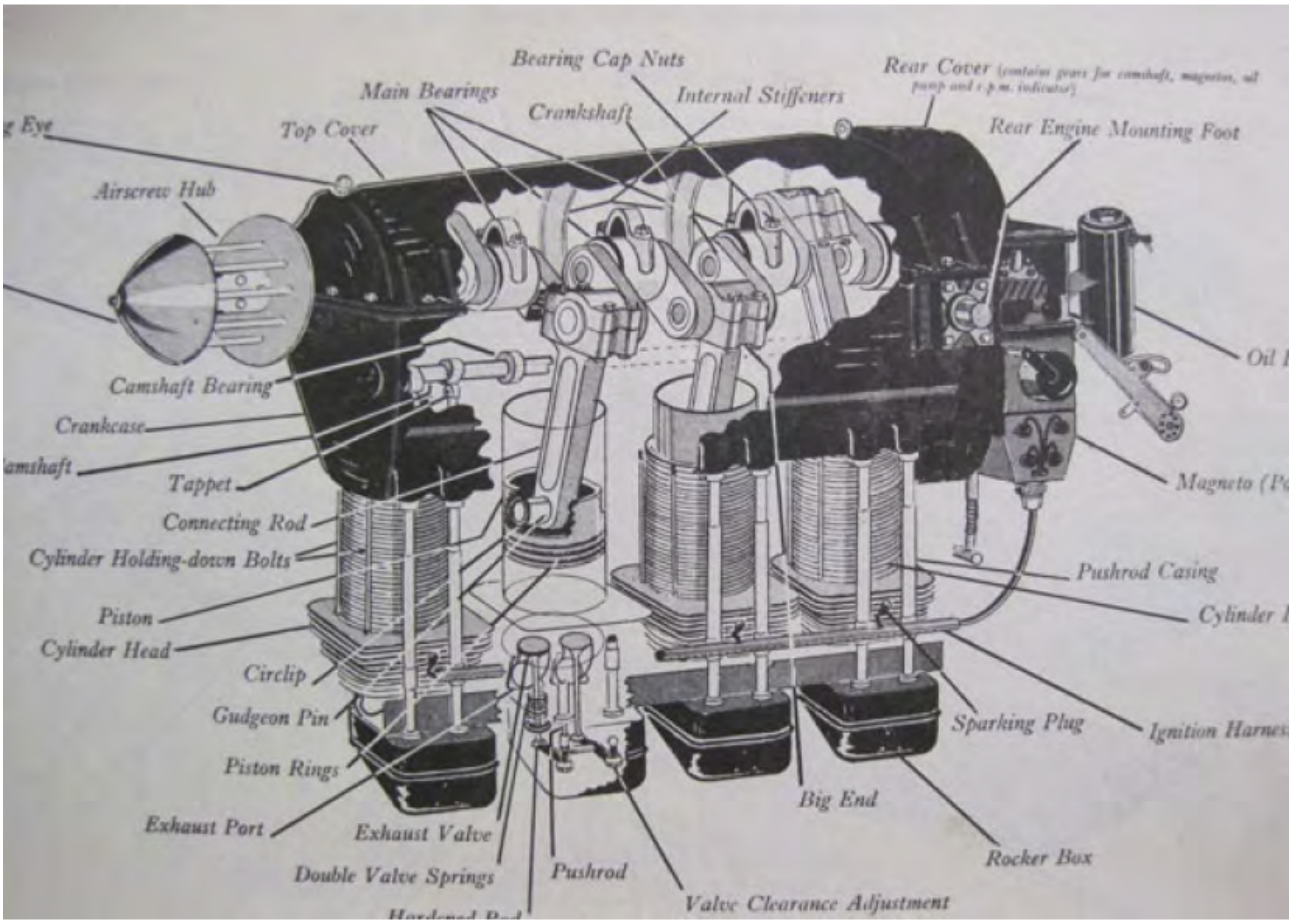


Figure 9-8 Typical Gipsy Major Engine

Priming

A hand operated primer pump is located to the lower right of the instrument panel in the front cockpit. The prime pump draws fuel from the right hand tank and injects it into the induction manifold at four points.

Starter Switch

An electrical starter switch is located on the left side of the front instrument console. The switch is protected by a guard to prevent inadvertent operation.

Throttle Quadrant

The throttle and mixture levers are mounted on common quadrants, one in each cockpit. The throttle and mixture levers are linked so that the throttle cannot be closed without moving the mixture control back to the full rich position.

Throttles

Two interconnected throttle levers are provided on the left side of each cockpit. A push-pull rod connects the throttle levers to the carburettor throttle valve.

Mixture Control

The fuel-air mixture is manually controlled by mixture control levers mounted inboard of the throttle levers in each of the two throttle quadrants. The mixture control levers are connected to the carburettor by a push-pull rod linkage.

The mixture control operates in the opposite sense to that of modern aircraft, i.e. the mixture lever is moved rearward to richen the mixture and forward to weaken the mixture.

The mixture control should be fully rich for starting, ground running takeoff and operations below 3,000 feet.

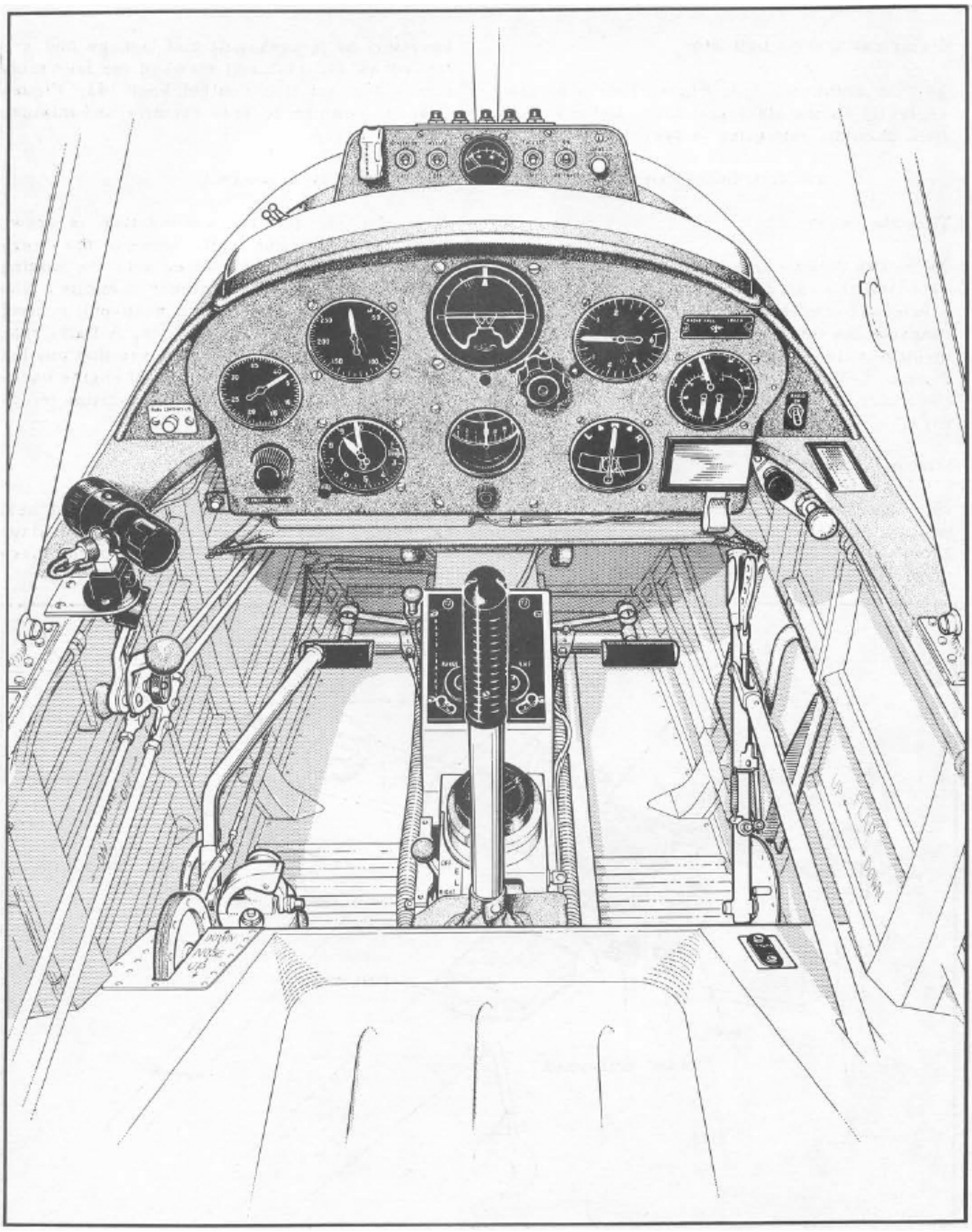


Figure 9-9 Front Cockpit Showing Throttle Controls

Friction Control

A common friction nut is provided on each throttle quadrant for both the throttle and the mixture control levers. When rotated clockwise the friction knob increases friction on the levers.

Carburettor Air-Intake Control

The carburettor air intake control (Carb Heat) supply is controlled by a flap valve which is operated by a push-pull control in each cockpit. When selected on, hot air from the carburettor is drawn from the crankcase wall, between the inter-cylinder baffles and passes into the carburettor's mixing chamber.

A flame trap is fitted in the hot air inlet to restrict the flame travel in the event of a backfire.

Carburettor Idle Cut-off Control

The aircraft is equipped with a carburettor idle cut-off control mounted beside the primer pump on the right side of the front cockpit. It is used to shut-down the engine from idle, as detailed in Chapters 3 and 4.

Engine Instruments

An RPM indicator is provided on the left-hand side of the instrument panel in each cockpit. The RPM gauge is driven by a direct drive cable from the engine. An electrically operated oil temperature gauge and a capillary-type oil pressure gauge are on the right hand side of each instrument panel.

Fuel System

Fuel Tanks

Fuel is carried in two flexible 13.5 Imp Gal (61.5 litre) tanks, mounted one in each wing. 12.5 Imp Gals (57 litres) is usable and 1 Imp Gal (4.5 litres) is unusable. The fuel flows from either of the two tanks by gravity feed to the fuel cock and thence through a fuel filter to two engine driven fuel pumps. The fuel selector valve prevents the contents of one fuel tank being transferred to the other.

Fuel Selector

The fuel selector valve is operated by either of two mechanically interconnected fuel selector levers, one in each cockpit, to the left of the control column.

The fuel selector levers operate the selector valve through a mechanical linkage. The positions are LEFT TANK; OFF and RIGHT TANK.

Fuel Pumps

There is a dual fuel pump on the left side of the engine block. Fuel from a single inlet hose is pumped through a common fed pipe to the carburettor.

Fuel Tank Venting

Each of the two fuel tanks is vented to atmosphere by means of a short vent pipe projecting vertically above the wing top surface and encased by a fairing.

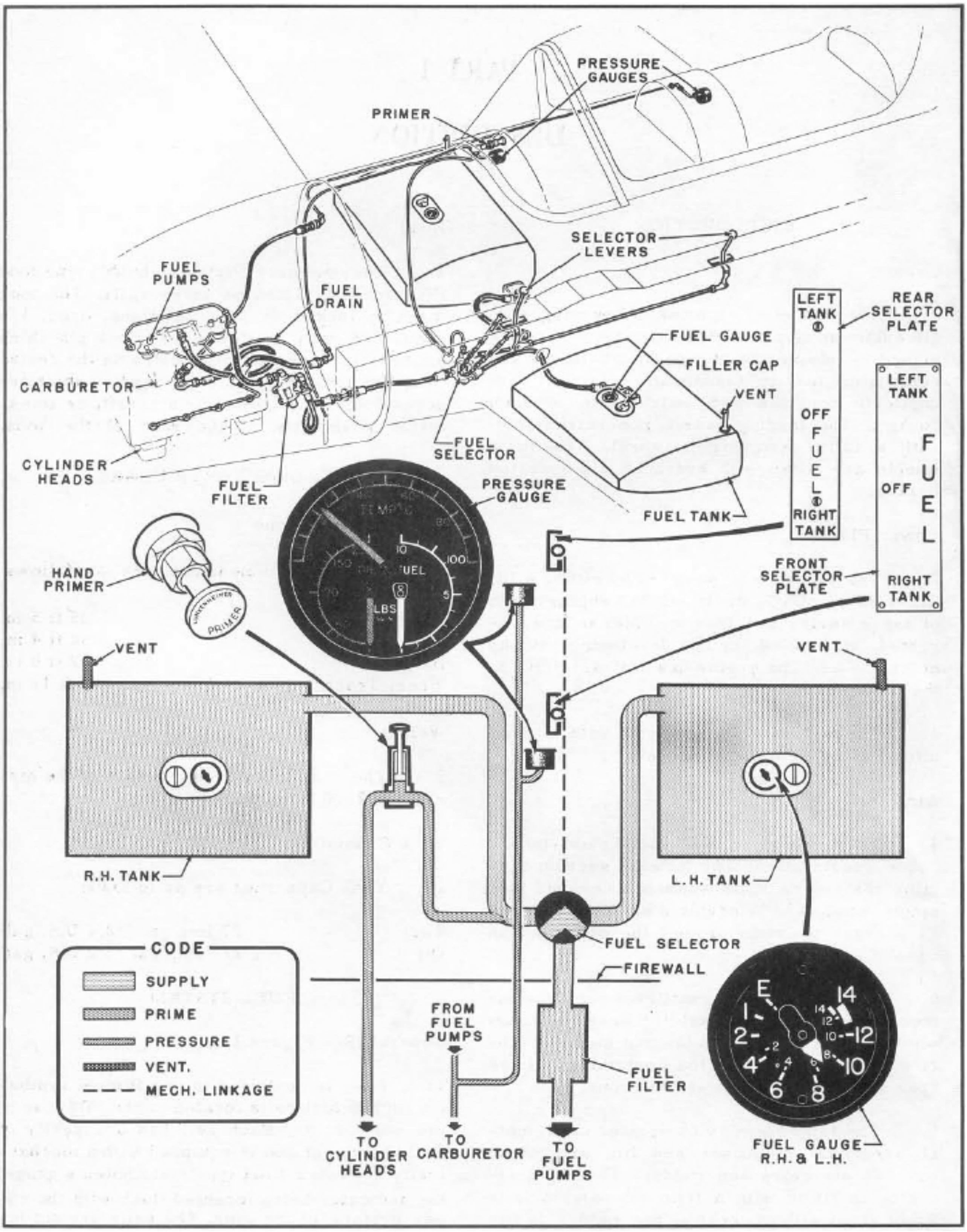


Figure 9-10 Fuel System - Overview

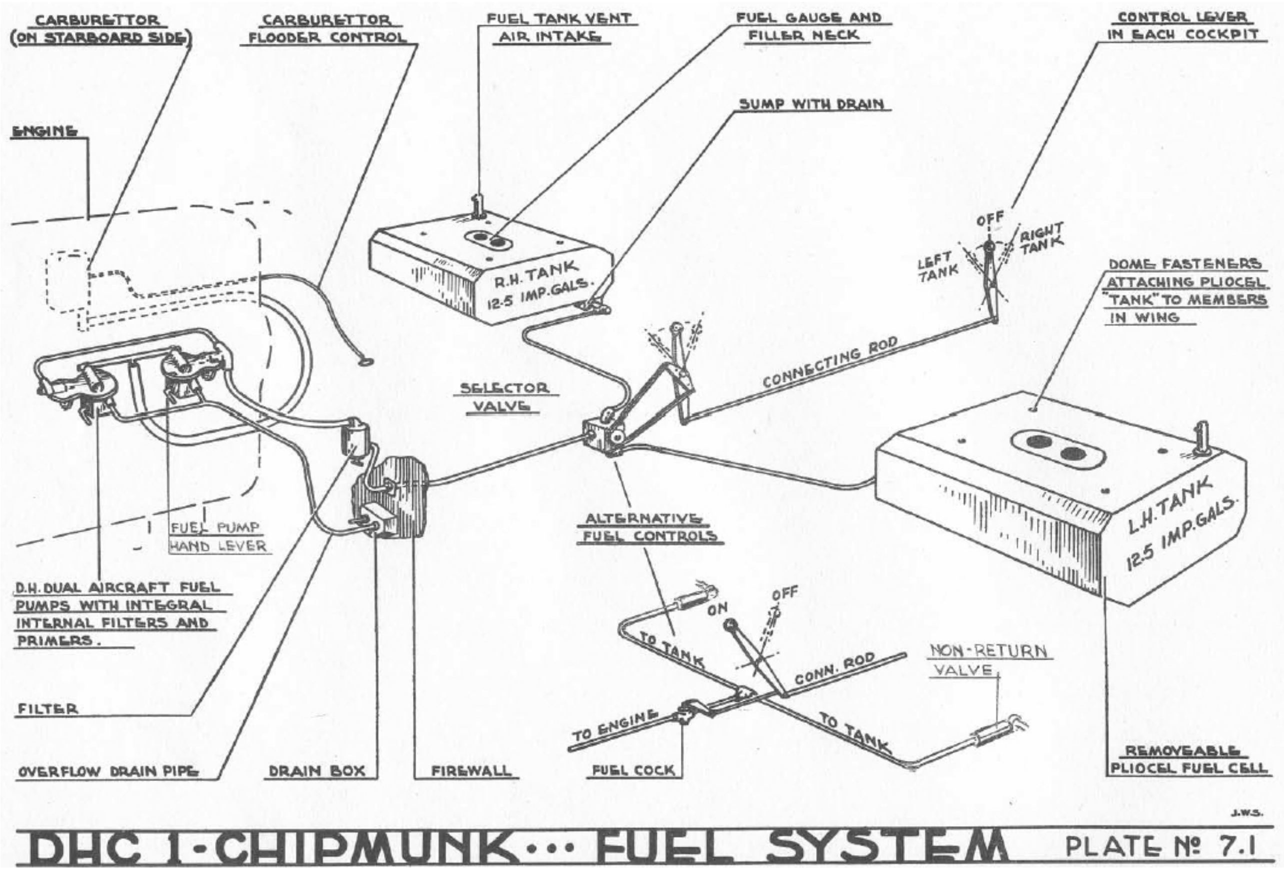


Figure 9-11 Fuel System - Detail

Fuel Gauges

A float-operated, direct-reading fuel gauge is located on the upper surface of each wing, next to the fuel filler cap. There are no cockpit gauges.

The fuel gauges are calibrated in large white figures to indicate the contents when the aircraft is in flight, and calibrated in small green figures to indicate the contents when the aircraft is in the three-point attitude, i.e. on the ground.

In flight, due to parallax, the gauges can only be read accurately from the front cockpit.

Oil System

An oil tank is mounted on the forward face of the engine bulkhead/firewall. This tank has a capacity of 11.4 litres (2.5 Imp Gal), which includes air space of 4.5 litres (1.0 Imp Gal).

Oil level is checked by a dipstick embodied in the oil filler cap, which is under a quick release panel in the oil tank cooling shroud on the tank's right hand side. The oil tank is accessed by opening the right hand side engine cowling. The minimum oil quantity before flight is 7 litres (1.5 Imp Gal) and the maximum oil quantity before flight is 9 litres (2.0 Imp Gal).

The oil consumption varies from 0.85 to 1.14 litres (1.5 to 2.0 pints) per hour at economical cruising, to 2.6 litres (4.5 pints) per hour at full throttle. Maximum oil consumption is 2.8 litres (5 pints) per hour.

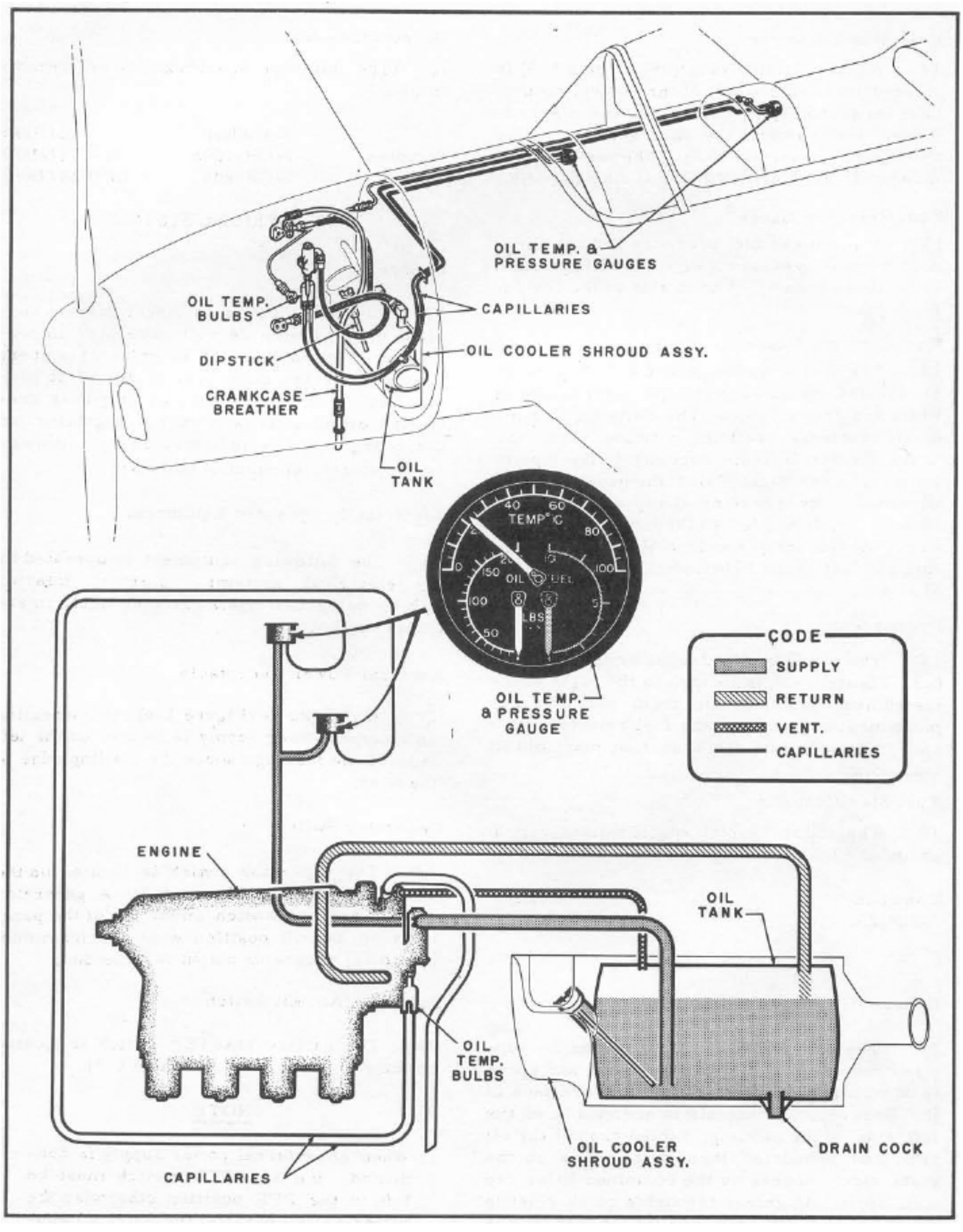


Figure 9-12 Engine Oil System

Cooling air is scooped in on the left hand side of the engine cowling, ducted around the oil tank and exhausted through a louvre on the right and side of the engine cowling.

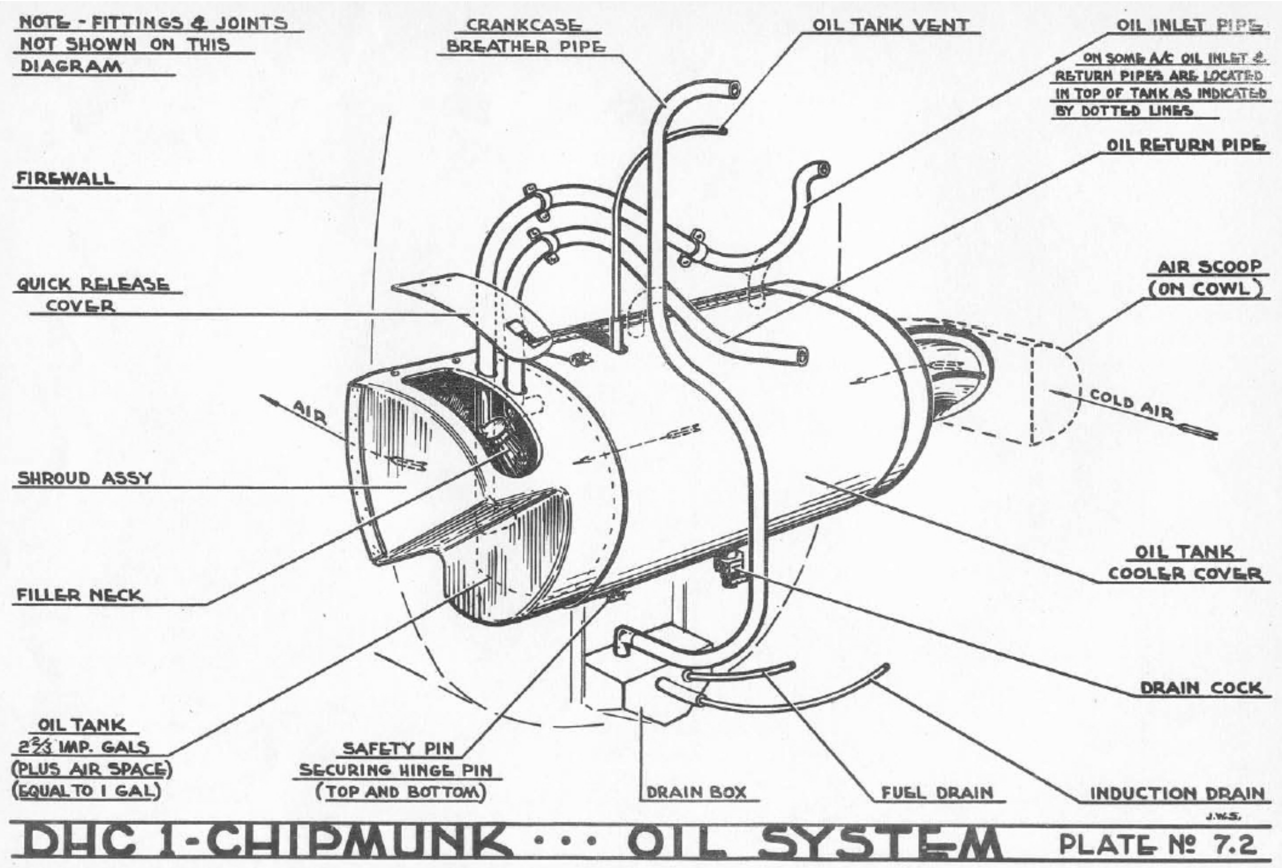


Figure 9-13 Engine Oil Tank Detail

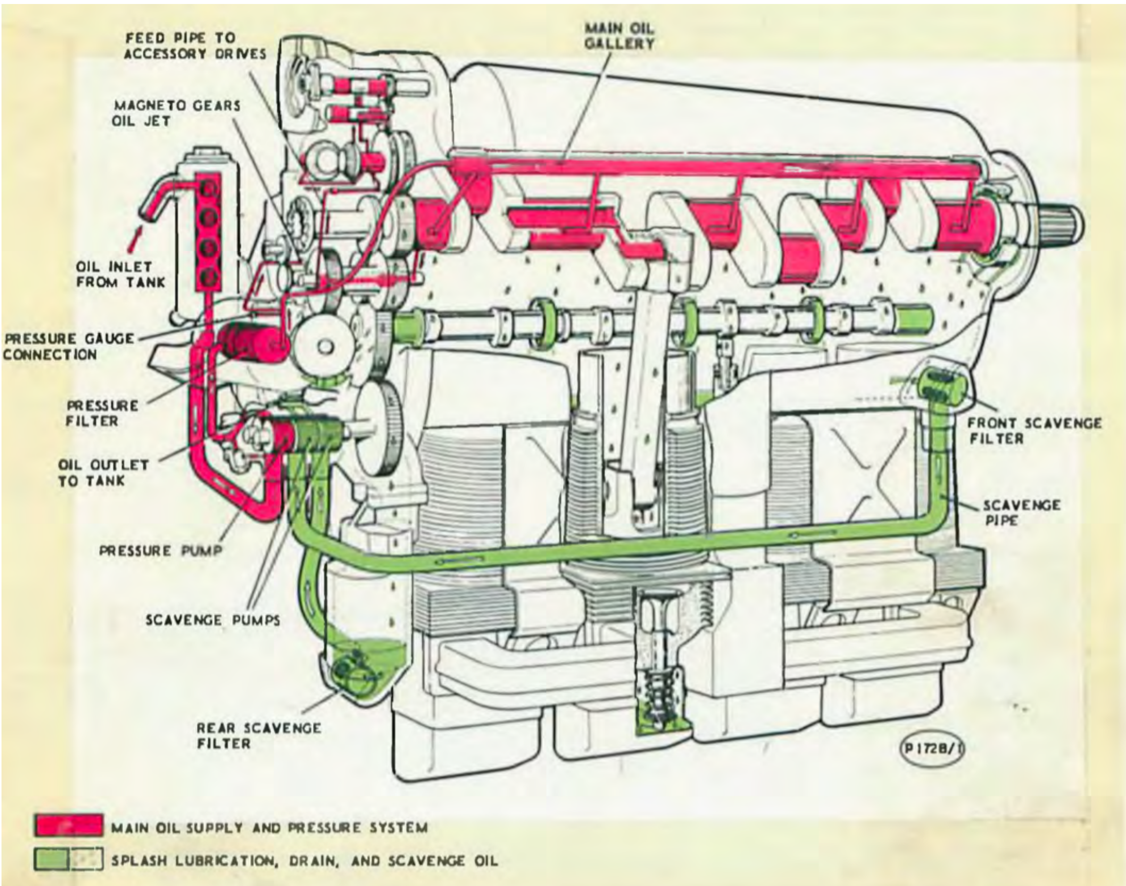


Figure 9-14 Engine Oil Lubrication Diagram

Engine Ignition Switches

There are two sets of magneto ignition switches provided on the left hand side of each cockpit console. One set on the left side of the front fuselage deck and the other on the left side of the fuselage deck between the two cockpits.

Both pairs of ignition switches must be ON (Up) for the engine to run.

An impulse starter coupling is fitted on the right magneto (Switch No 1, i.e. the front). When starting by hand swinging the propeller, this switch only should be set ON before swinging, the other (No 2) ignition switch should be put on as soon as the engine fires.

When the engine is being started with the starter motor both of the pairs of ignition switches should be ON.

The ignition switches are like your trousers, when they're up they're ON and when they're down they're OFF.

Vacuum System

An engine driven vacuum pump provides suction for the gyro-driven turn and slip indicators.

In ZK-CVM, a vacuum (suction) gauge is fitted in the front of both cockpit instrument panels. The normal gauge reading is 4.5 to 5.5 in Hg, at 2,100 rpm.

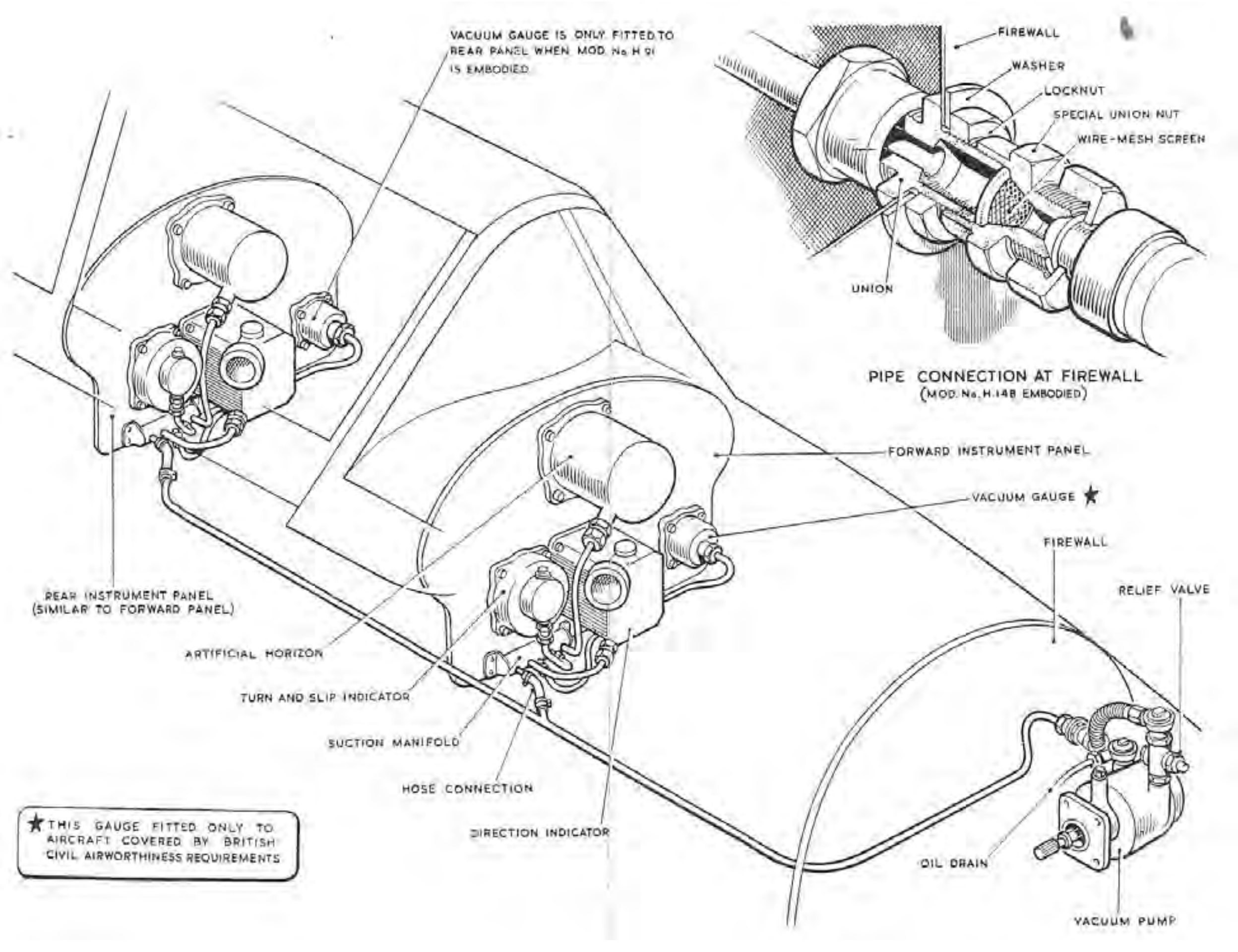


Figure 9-14 Vacuum System

Electrical System

Alternator

ZK-CVM has been fitted with an engine driven alternator which charges the battery and supplies 12 volt DC for external lighting, avionics and the oil temperature gauges.

If the alternator fails, the battery will supply the aircraft services. Electrical services and radio transmissions should be kept to a minimum.

Battery

One 12 volt battery, is housed in the rear fuselage and supplies the aircraft services when the alternator is not charging.

A socket on the left hand side of the rear of the rear cockpit allows the battery to be trickle charged from an external power source.

Master Switch

A Master Switch is the first switch on the electrical panel, which is on the left hand side of the front cockpit, above the throttle quadrant. When set to OFF, this switch isolates the battery from the electrical system. When set to ON, it allows the alternator to charge the battery and when the alternator is not charging, the battery to supply the aircraft services.

The Master Switch should be OFF whenever the aircraft is unattended or parked. It should be set to ON before starting the engine and left in this position throughout the flight.

Alternator Switch

An Alternator Switch is the second switch on the electrical panel. When set to OFF, this switch isolates the alternator from the electrical system. When set to ON, it energises the alternator and allows it to power the electrical system and charge the battery.

Radio Master Switch

A Radio Master Switch is the third switch on the electrical panel. When set to OFF, this switch isolates the radio, intercom and transponder from the electrical system. When set to ON, it allows power to the radio, intercom and transponder. Each of these avionics systems have their own ON/OFF capability.

Ammeter

An ammeter is located on the top of the centre radio console, above the radio and transponder. It is not easily visible to the pilot in their normal sitting position.

Voltmeter

A voltmeter is located on the left hand side of the front pilots seat. It is not easily visible to the pilot in their normal sitting position.

Fuses

A bank of fuses is located on the top of the centre radio console, above the ammeter and intercom control, in the front cockpit. They are not easily visible to the pilot in their normal sitting position.

Pitot Static System

A combined pitot static pressure head is located on the underside of the left wing and supplies pressure for the ASI, VSI and altimeter in each cockpit.

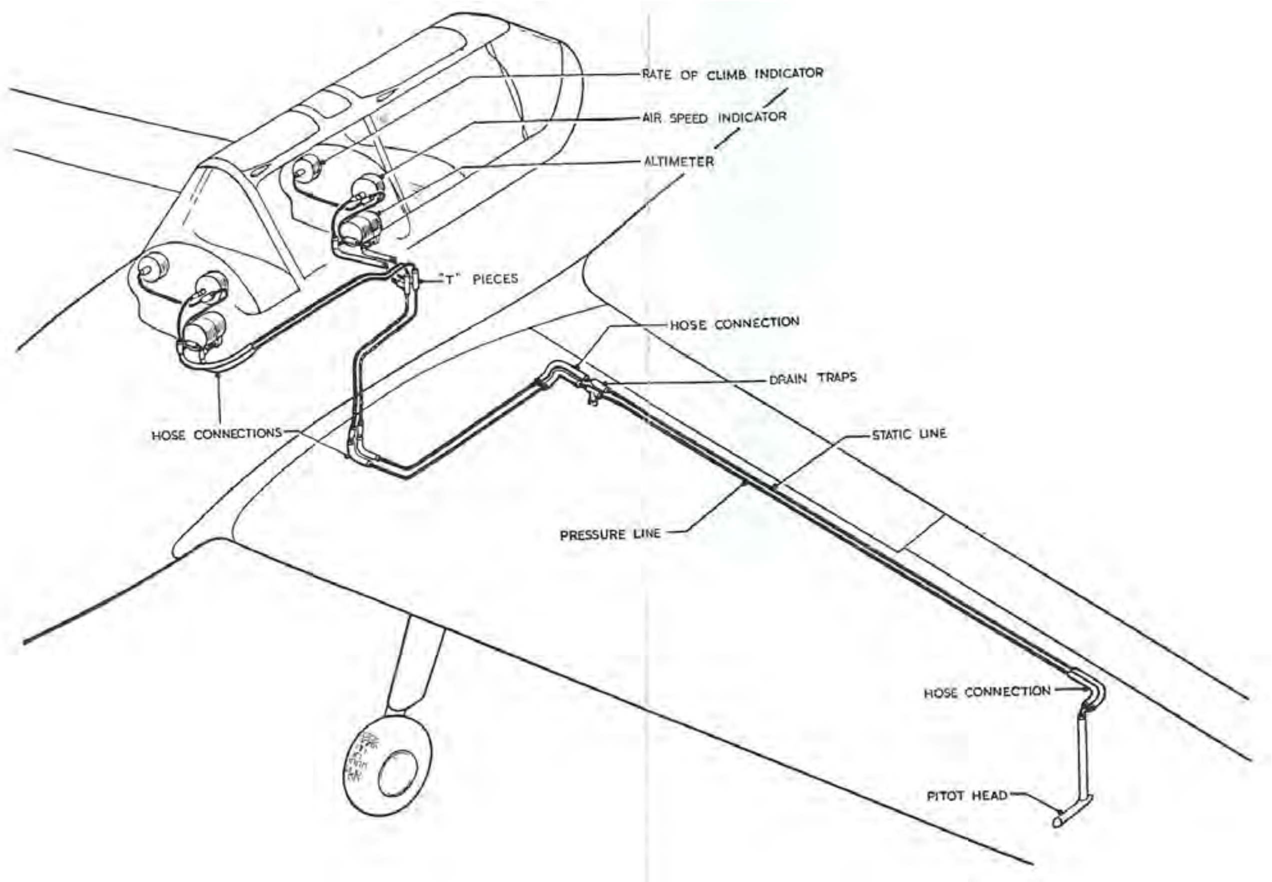


Figure 9-15 Pitot Static System

Flight Instruments

Garmin G5

A Garmin G5 Electronic Flight Instrument displaying attitude, heading, airspeed and altitude has been fitted in the front cockpit. The rear cockpit has no AI or DI fitted.

Gyro-Operated Instruments

The gyros for the turn and slip indicators in each cockpit are operated by suction from the vacuum system at 4.5 to 5.5 in Hg.

Compass

A standard wet (magnetic) compass is mounted in the centre of the front cockpit deck.

Cockpit Canopy

A single, one piece Plexiglas bubble type sliding canopy, slides on three rails and covers both cockpits. The cockpits are entered from walkways on the left and right mainplane surfaces and (retracted) flaps.

There is a single external handle at the rear of the canopy for opening the canopy from the outside. This external handle is connected to two levers inside the structure. Depressing the external pushbutton canopy release unlocks the canopy and allows it to be slid rearwards. These release mechanisms are connected to spring loaded plungers which engage holes in the centre canopy rail to provide the following four alternative locked positions:

- ✈ Fully closed;
- ✈ Partially (approximately a quarter) open;
- ✈ Approximately half open, giving access to the front cockpit only; and,
- ✈ Fully open, giving access to the both cockpits.

A key operated lock can be fit and locked into the external canopy rail so that the canopy can be secured closed. This lock must be completely removed and stored prior to flight.

Handgrips are provided internally to facilitate moving the canopy. The canopy must always be moved by the handles and not by pushing on the canopy structure.

The cockpit canopy is not jettisonable. The windshield structure serves as a crash pylon to protect the occupants in the case of a rollover.

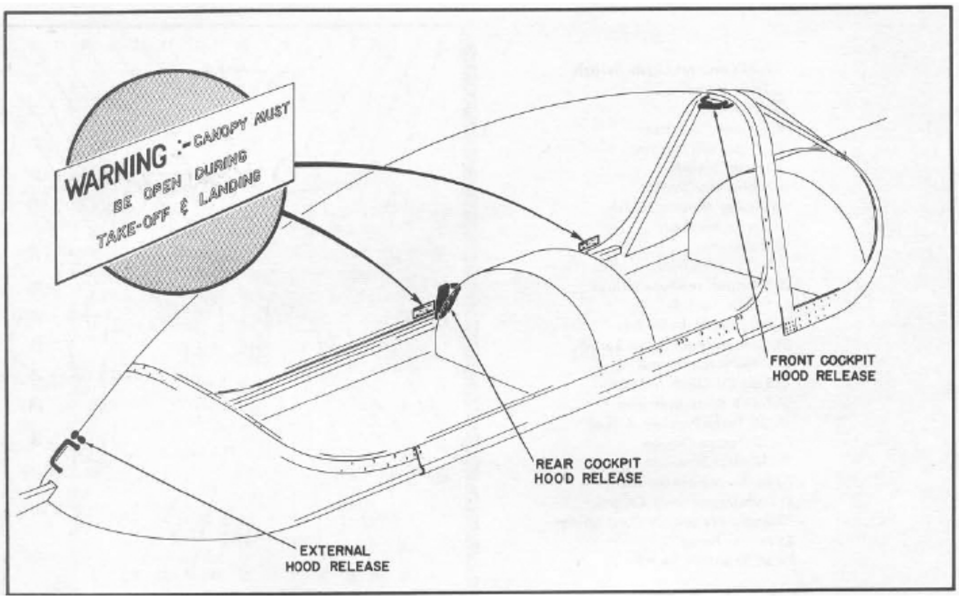


Figure 9-16 Cockpit Canopy

Various set of Pilot's Notes from the RAF, RCAF and De Havilland all have different recommendations and requirements for the cockpit canopy hood position on takeoff and landing. As you can see in Figure 9-16 some aircraft have a warning posted on the inside of the canopy stating that the canopy must be open during takeoff and landing. However, the RCAF notes say "As Required", and I have observed no pilots taking off or landing with the canopy open. Consequently, my recommendation for normal operations is for the hood to be fully closed.

Seats and Harnesses

The seats, in both the front and rear cockpits, are of metal construction built into the fuselage structure, are not adjustable, and are designed for use with seat-type parachutes.

The seats, in both the front and rear cockpits, are equipped with SL-type harnesses. These harnesses must not be allowed to hang outside the cockpit when not in use, as they can damage the aircraft skin.

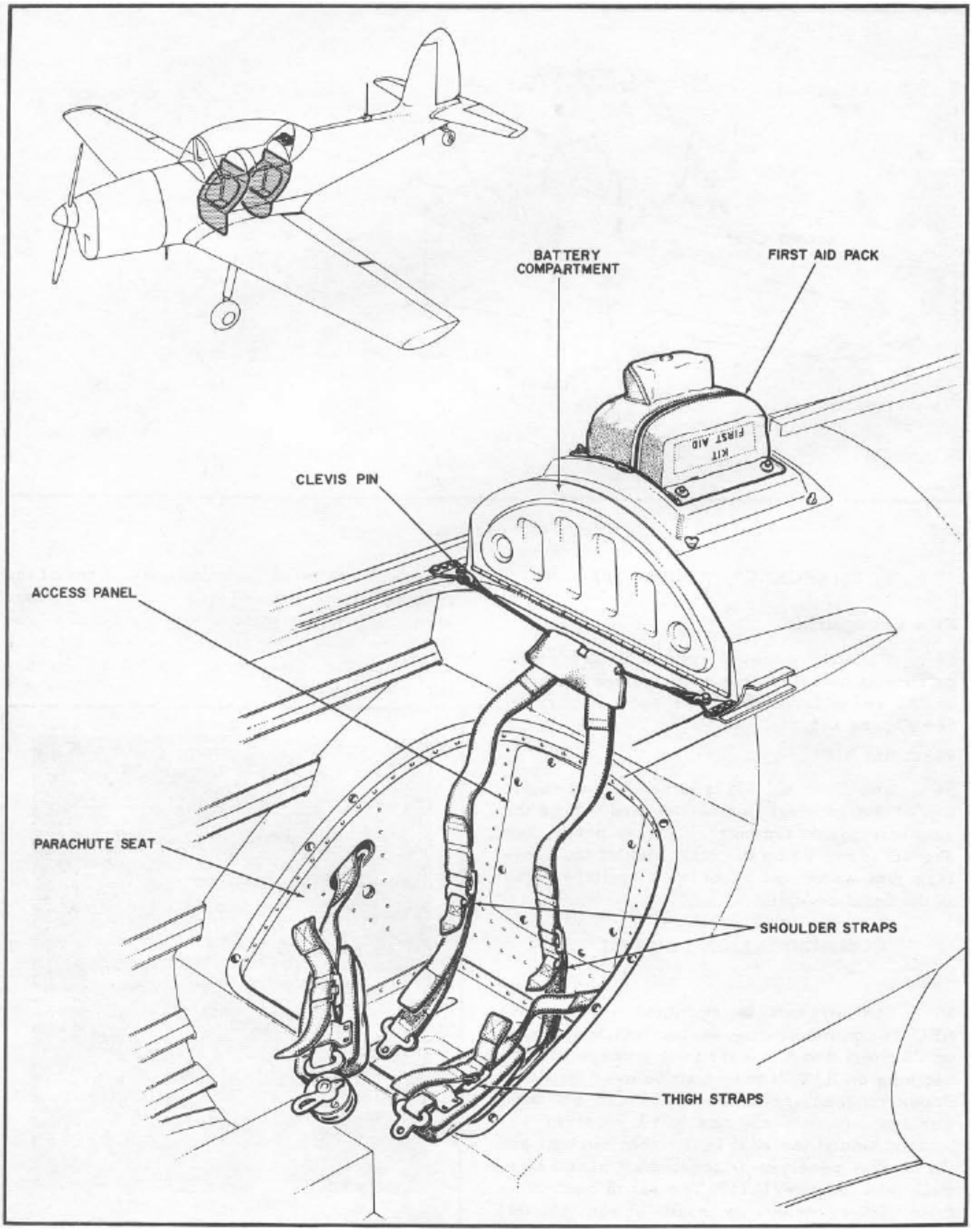


Figure 9-17 Seats and Harnesses

Cabin Heating

In Canada, where climatic condition often required heating into the cabin, warm air to the cabin was originally provided by a heater tube located inside the engine exhaust manifold. Cold air entered the tube through the nose cowl and after being heated was passed to the cockpits through flexible ducting. A dump valve containing a flap valve regulated the amount of heated air to the cockpits. This flap valve was operated by a selector mounted on the right side of the radio stack in the front cockpit. On CVM this system has not been re-installed following its restoration, and the flap valve and dump valve have been blanked off with aluminium tape.

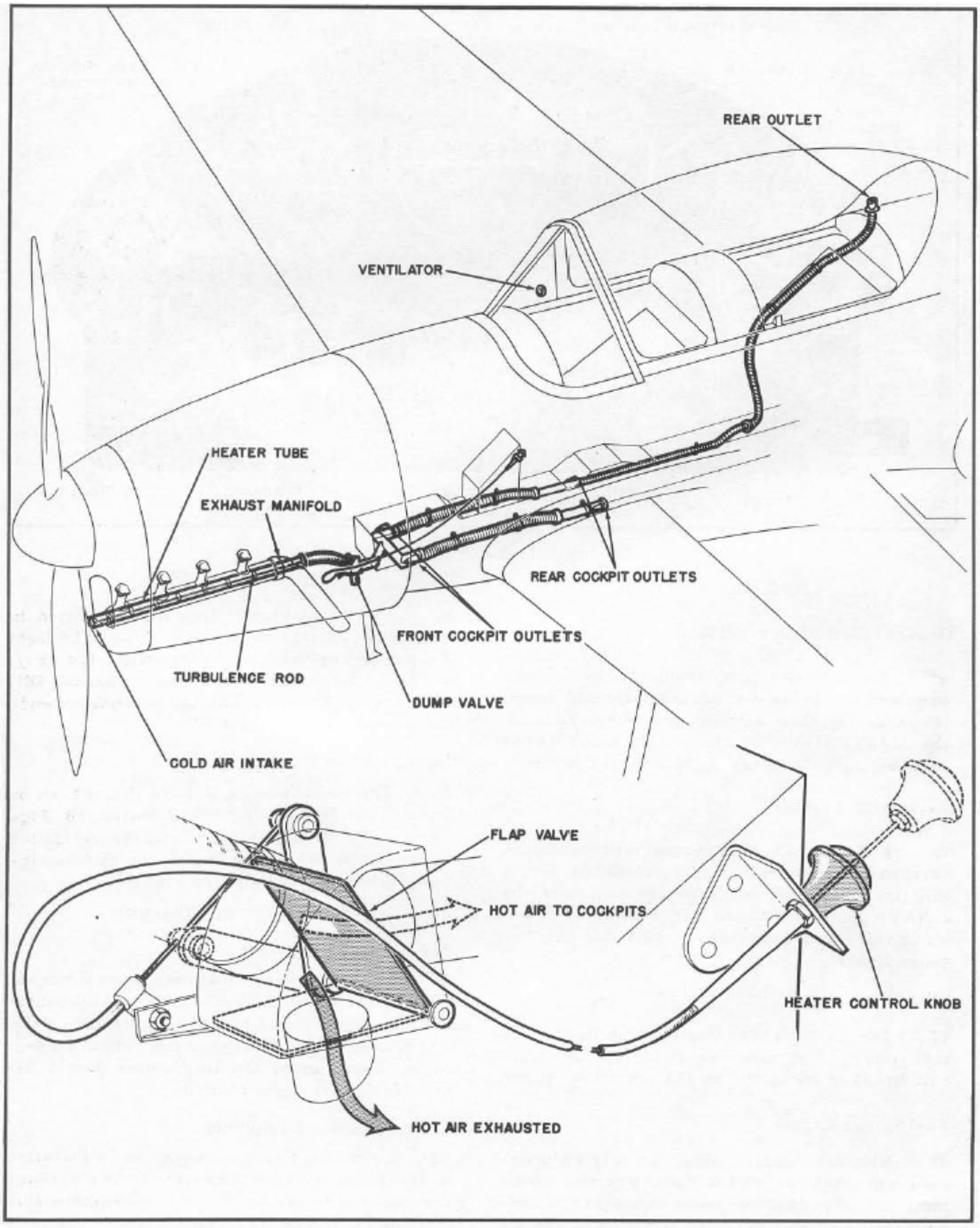


Figure 9-18 Cabin Heating

Internal Lighting

As far as I can see there is no internal lighting in either cockpit in ZK-CVM. Consequently, any time a flight is undertaken where there is any chance of a landing after ECT it is strongly recommended that the pilot(s) carry a torch.

External lighting

Navigation Lights

LED navigation lights on the wing tips and tail are controlled by a NAV LTS ON switch on the light switch box which is mounted on the left side of the front cockpit. The first activation of the NAV LTS switch turns the wing tip light on stead, second activation of the NAV LTS switch turns the wing tip light on flashing.

Landing Lights

Despite the presence of two landing light switches on the light switch box, there is no evidence that there are any landing lights on ZK-CVM.

Stowage

A luggage locker is provided aft of the seat in the rear cockpit. When flying solo the maximum permissible load in the luggage locker is 24 lb. When the rear cockpit is occupied the maximum permissible load in the luggage locker is 18 lb.

Avionics

ZK-CVM is fitted with the following avionics:

- A Garmin G5 EFIS (see above);
- A Bendix King KY97A VHF radio;
- An Artex ELT;
- An Appareo Stratus ES/ESG ADS/B Transponder;
- An AV8 Inspector SENSORCON PRO CO Monitor and,
- A Flightcom 403MC intercom.

The VHF transmitter/receiver is forward of and below the front instrument panel and the aerial is mounted on the top of the tail, forward of the fin.

A press-to-transmit button is provided on the top of each control column.

The intercom control is located beside the ammeter, on the top of the centre radio console, above the radio and transponder. It is not easily visible to the pilot in their normal sitting position.

Emergency Equipment

Crash Axe

A crash axe is securely mounted in the front cockpit forward of the control column.

First Aid Kit

A first aid kit is securely mounted on the left wall of the rear cockpit.

Fire Extinguisher

No fire extinguisher is currently provided in ZK-CVM.

Emergency Exits

To abandon the aircraft in flight, the hood should be opened fully.

Waypoints AVIATION

Chapter Ten

Performance

General Performance of the Chipmunk

The following paragraphs provide a general description of the performance of a Chipmunk. For calculation of more specific performance figures, required to meet CAR Part 91 requirements, refer to the performance graphs and tables in the NZCAA Aircraft Flight Manual, as reproduced on the subsequent pages in this chapter. The general performance figures apply to an aircraft at an all up weight of 1,930 lb, and in standard atmospheric conditions.

Takeoff - From a Hard Surface

The takeoff distance from the beginning of the takeoff roll to clear a 50 foot obstacle, in still air at sea level, using half (15º) flap, is approximately 450 yards / 1,350 feet / 414 metres.

The ground run component of the takeoff distance, in the conditions described above is approximately 220 yards / 660 feet / 200 metres.

Takeoff - From a Grass Surface

The takeoff distance from the beginning of the takeoff roll to clear a 50 foot obstacle, in still air at sea level, using half (15º) flap, is approximately 485 yards / 1,455 feet / 444 metres.

The ground run component of the takeoff distance, in the conditions described above is approximately 245 yards / 735 feet / 224 metres.

Climb

The figures given below are based on an aircraft at 1,930 lb, climbing at an indicated airspeed of 62 kts (71 mph). This airspeed approximates 1.2 times the power off stalling speed and results in very close to the best rate of climb and close to the best gradient of climb.

✈ Rate of climb at sea level	840 fpm
✈ Gradient of climb at sea level	12.6 %
✈ Rate of climb at 5,000 feet	600 fpm
✈ Gradient of climb at 5,000 feet	8.5 %
✈ Time to climb to 5,000 feet	7 minutes
✈ Service ceiling (ROC = 100 fpm)	15,800 feet

The sea level rate of climb in ISA conditions (840 fpm) reduces by approximately 45 fpm with each 1,000 foot of altitude increase.

The rate of climb is reduced by approximately 15 fpm for each 10ºC increase in temperature above ISA, and is increased by approximately 40 fpm for each 100 lb reduction in all up weight from 1,930 lb.

The fuel used for takeoff and climb to 5,000 feet is approximately 5 Imperial gallons.

Cruise

- ✈ Maximum level speed at sea level — 120 kts TAS (138 mph)
- ✈ Maximum level speed at 5,000 feet — 116 kts TAS (134 mph)
- ✈ Cruising speed at 2,100 rpm at sea level — 95 kts TAS (109 mph)
- ✈ Cruising speed at 2,100 rpm at 5,000 feet — 100 kts TAS (115 mph)
- ✈ Fuel consumption at 2,100 rpm at sea level — 7.0 gal/hr (14.2 nm/gal)
- ✈ Fuel consumption at 2,100 rpm at 5,000 feet — 6.8 gal/hr (14.8 nm/gal)

Range and Endurance

The recommended range speed is 90 knots IAS, at all altitudes.

The optimum endurance speed is 60 to 65 kts IAS.

The figures given below are based on 25 Imp gallons, in still air, at cruising speed (2,100 rpm), including an allowance for 30 minutes fixed fuel reserve and for takeoff and landing.

- ✈ Range at sea level — 325 nm
- ✈ Range at 5,000 feet — 330 nm
- ✈ Endurance at sea level — 3.1 hrs
- ✈ Endurance at 5,000 feet — 3.1 hrs

Descent

- ✈ Gliding gradient at 55 kts (63 mph) IAS — 9.5% (Approx. 2 nm per 1,000 feet)

Landing

The landing distance from crossing the threshold at 50 feet, in still air at sea level, onto a hard surface, using full flap and a normal landing and braking technique, is approximately 475 yards / 1,430 feet / 440 metres.

Pressure Error Corrections

The pressure error corrections to be made to the airspeed indicator are as follows:

IAS Range	**50-60**	**60-66**	**66-78**	**78-93**	**93-120**
Clean	+5 kts	+4 kts	+3 kts	+2 kts	+1 kt
15º Flap	+4 kts	+3 kts	+2 kts	+1 kt	-

Position Error Corrections

For position error corrections to be made to the airspeed indicator refer to the graph below.

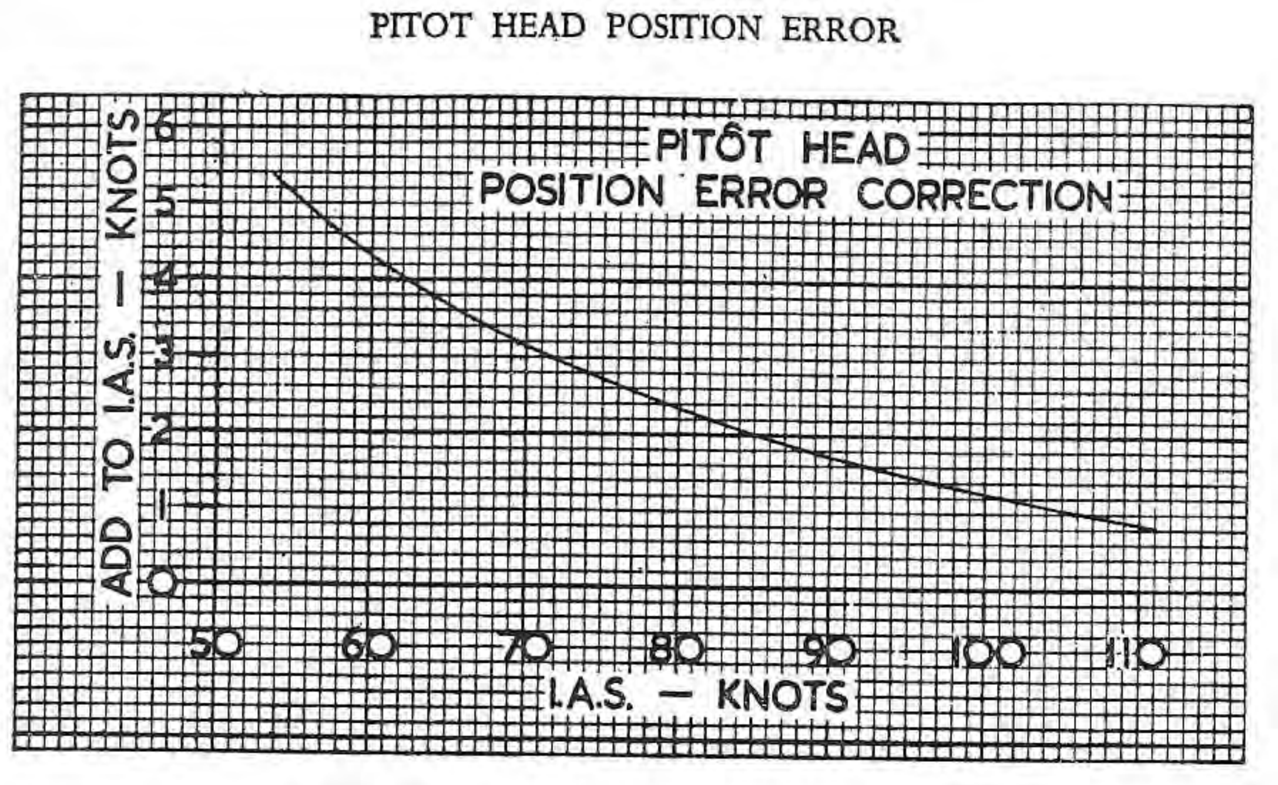


Figure 10-1 Pitot Head Position Error Correction

The position error correction graph above applies at a weight of 1,000 lb.

The position error correction graph on the following page shows the corrections to be made to the airspeed indicator for two weights, 1,600 lb and 2,100 lb, with flaps retracted. Pilots should interpolate for weights within this range. The correction applies at all altitudes.

With flaps selected to the takeoff position (15°) the correction derived from this graph should be reduced by 1 kt, and with flaps selected to the landing position (30°) the correction derived from this graph should be reduced by 2 kts.

Altimeter Error Correction

The position error correction graph on the following page shows the corrections to be made to the altimeter. The correction applies at a weight of 1,930 lb with the flaps retracted.

Compressibility Error Correction

The compressibility error affecting both the airspeed indicator and the altimeter is negligible at all permissible airspeeds.

The combined effect of the pressure and position error corrections is to add about 4 knots to the Airspeed Indicator Reading (ASIR) to determine actual Indicated Airspeed (IAS).

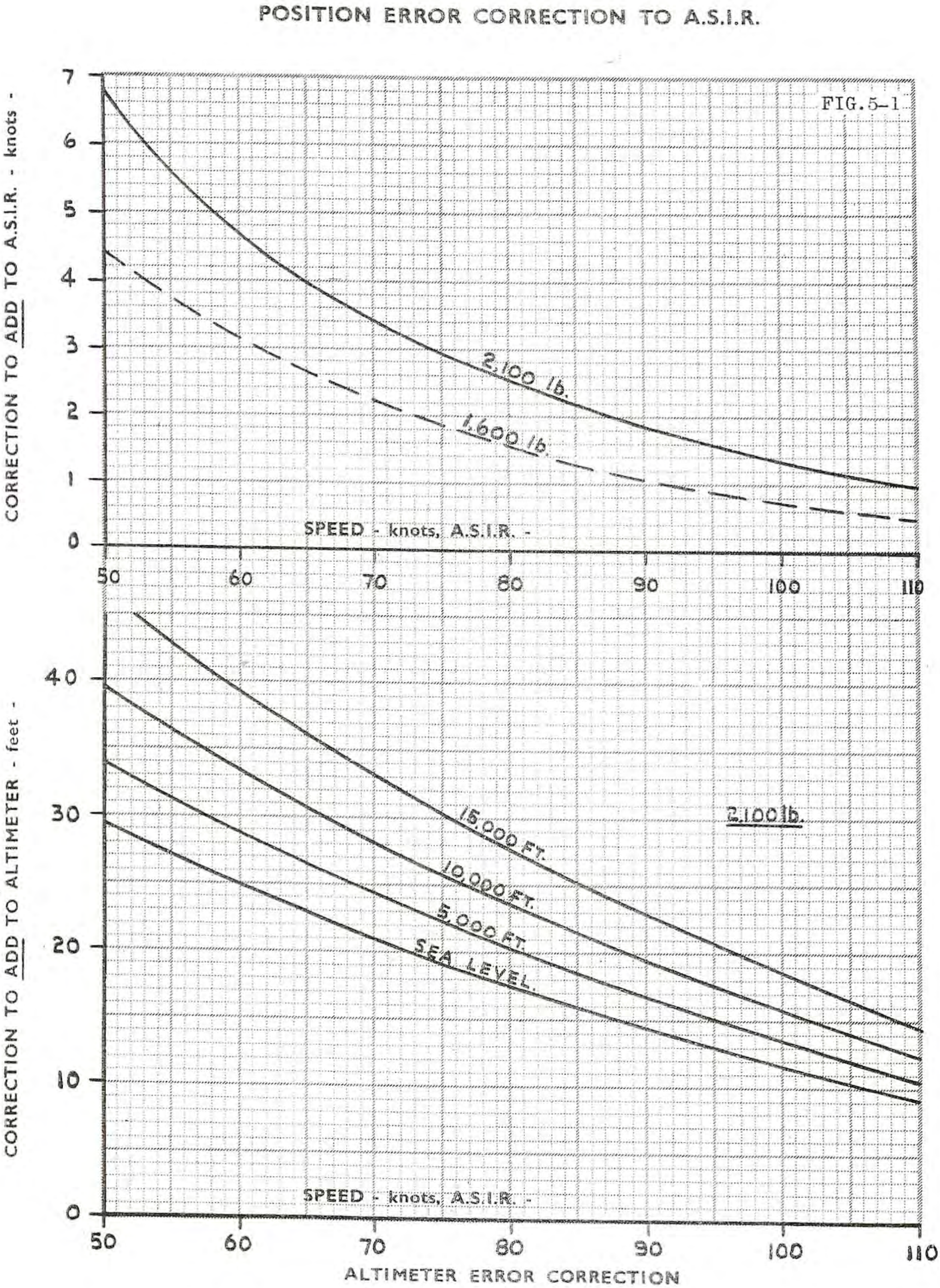


Figure 10-2 Position Error Correction
to the ASI and Altimeter

Stalling Speeds

The power off stalling speed can be derived from the graph below.

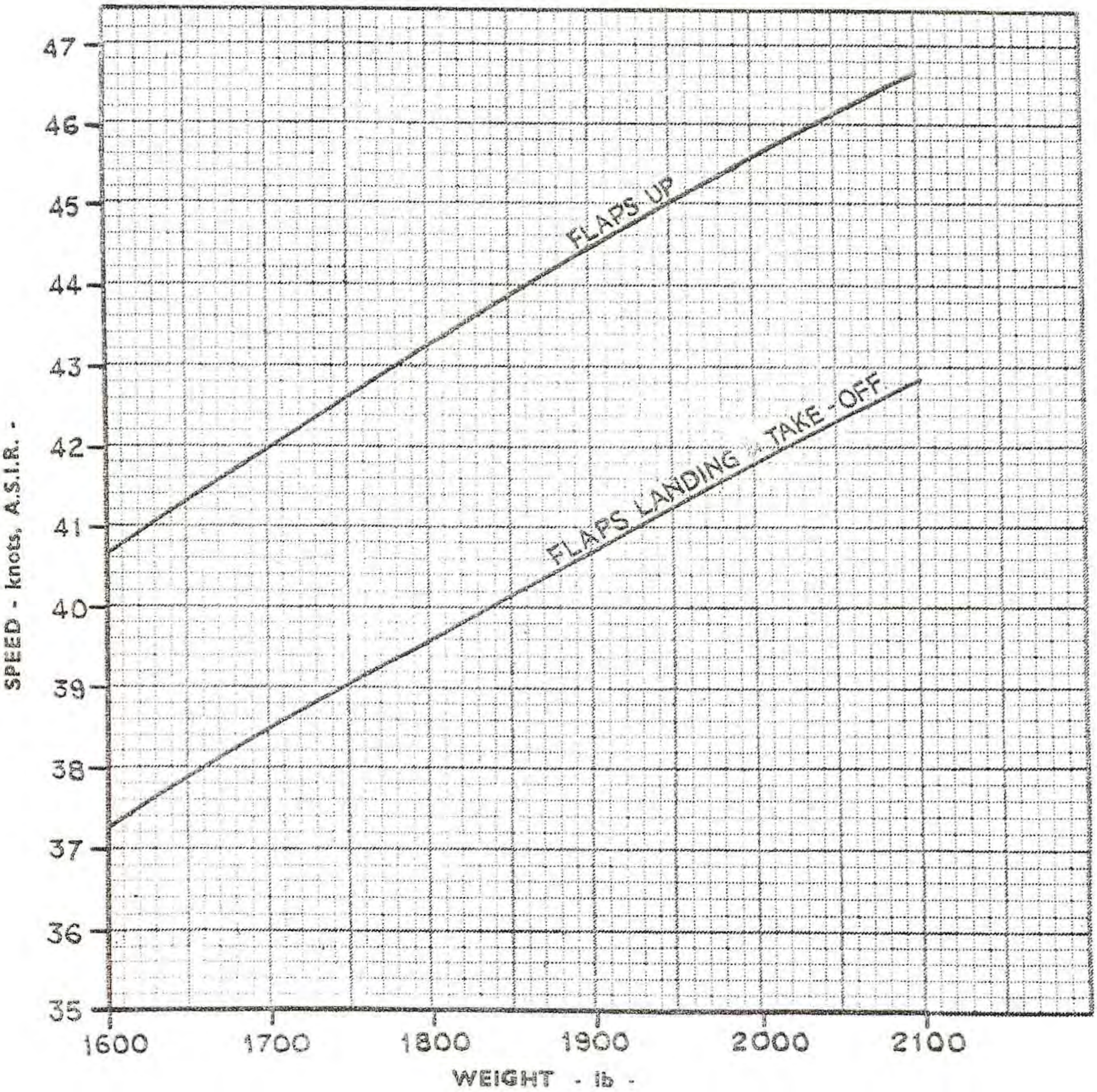


Figure 10-3 Approximate Power Off Stalling Speeds

Flight Envelope (Vn Diagram)

Like all manufacturers, De Havilland would design and certify aircraft for a given Maximum All-Up Weight and then be faced with an in-service need for an increase. Initially in 1948 the Anglicised Chipmunk was approved at 2000 lb. AUW, with a design Flight Envelope ranging from +6g to -3g, as depicted below, and a placarded VNE of 174 kt rather than the 155 kt which the Air Registration Board later imposed on civil Chipmunks.

The Vn diagram below is applicable to Canadian build Chipmunks such as ZK-CVM.

An Ultimate Factor of 1.5 is implicit in the graphs, that is to say the structure should not collapse at 1.5 times the loads associated with the extremes of the given Flight Envelope. This is NOT to infer that the Chipmunk is a +9.0g to - 4.5g aeroplane. After such treatment it would show permanent deformation and be fit only for melting into saucepans!

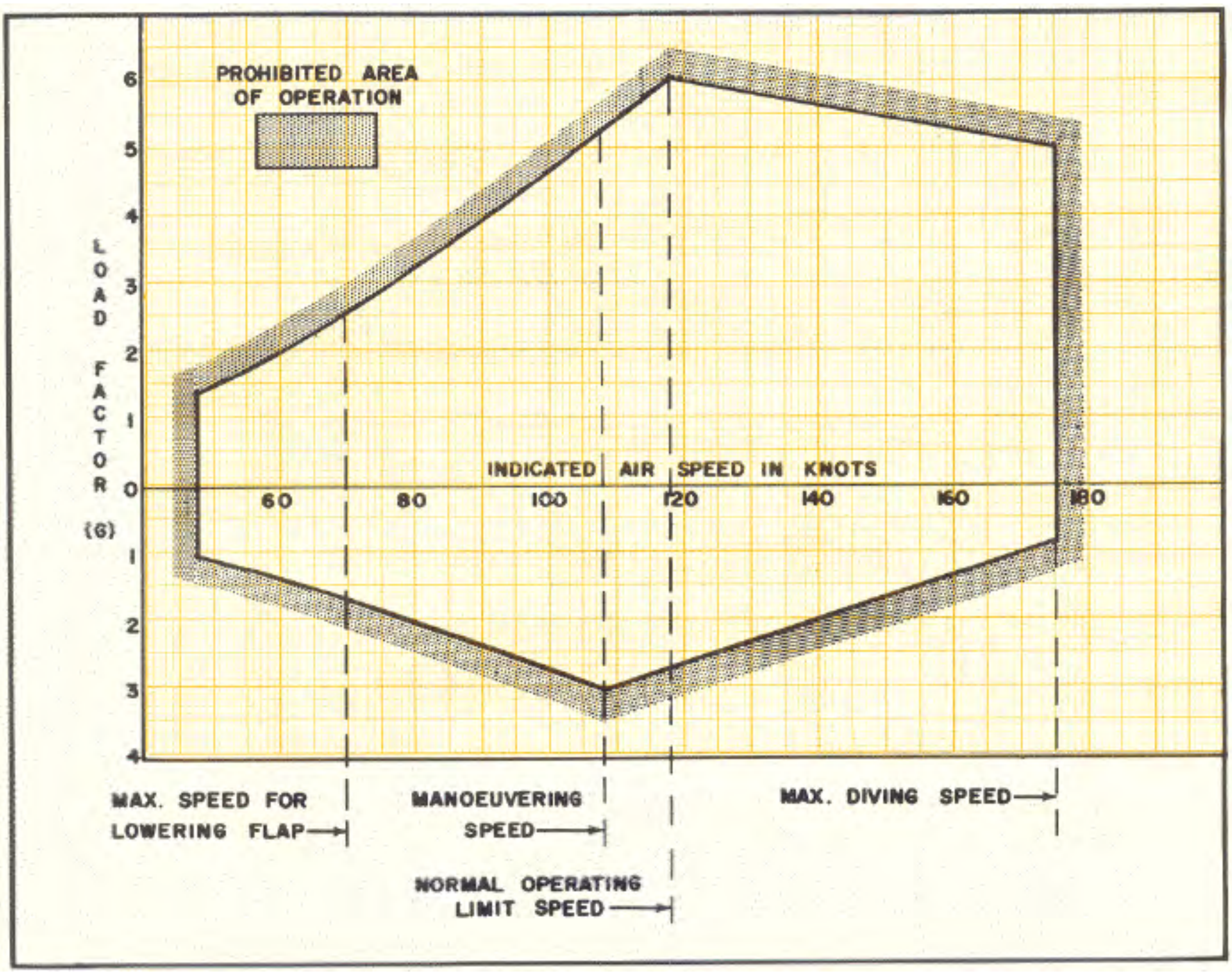


Figure 10-4 Flight Envelope

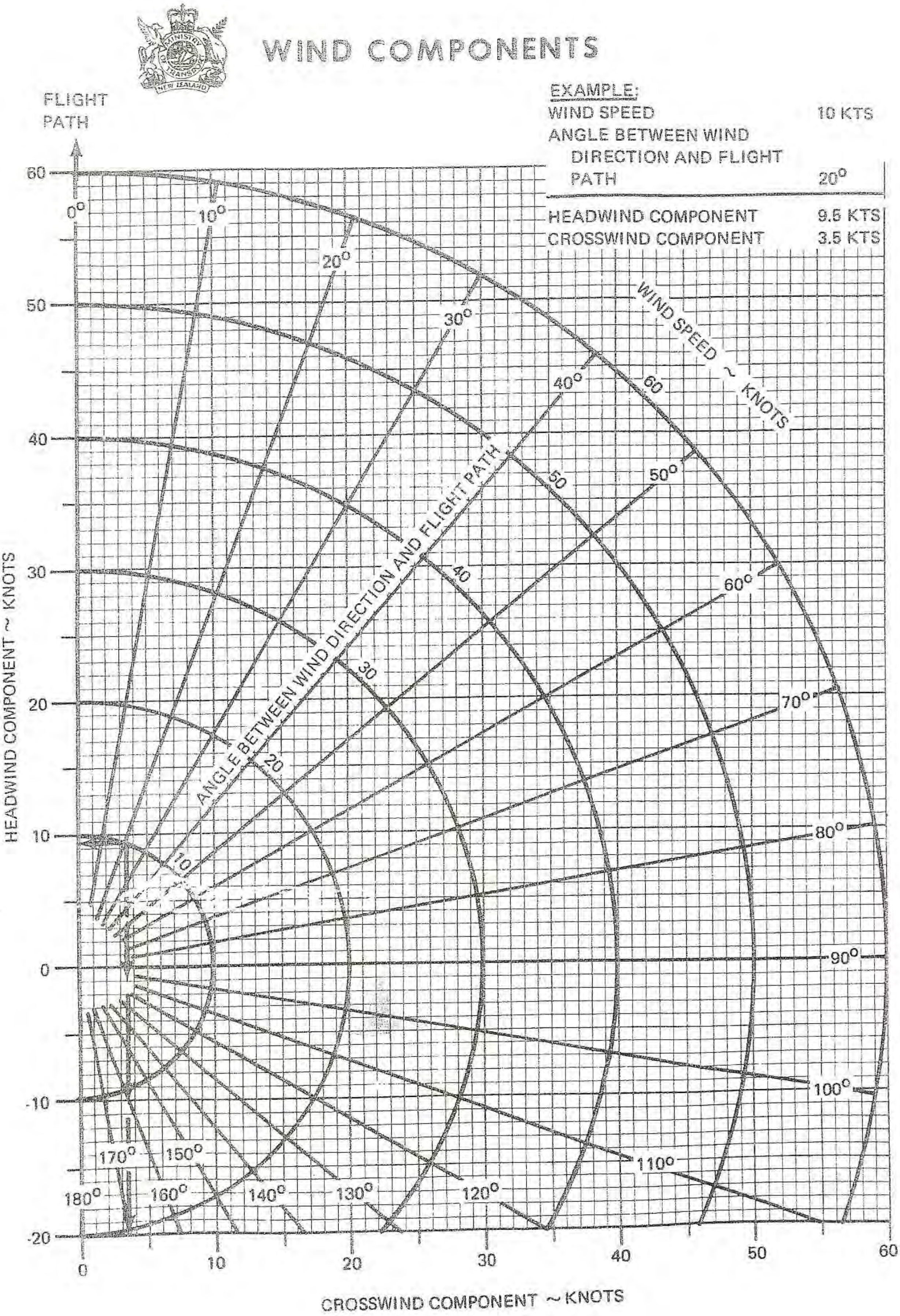


Figure 10-5 Crosswind Component

ISA CONVERSION

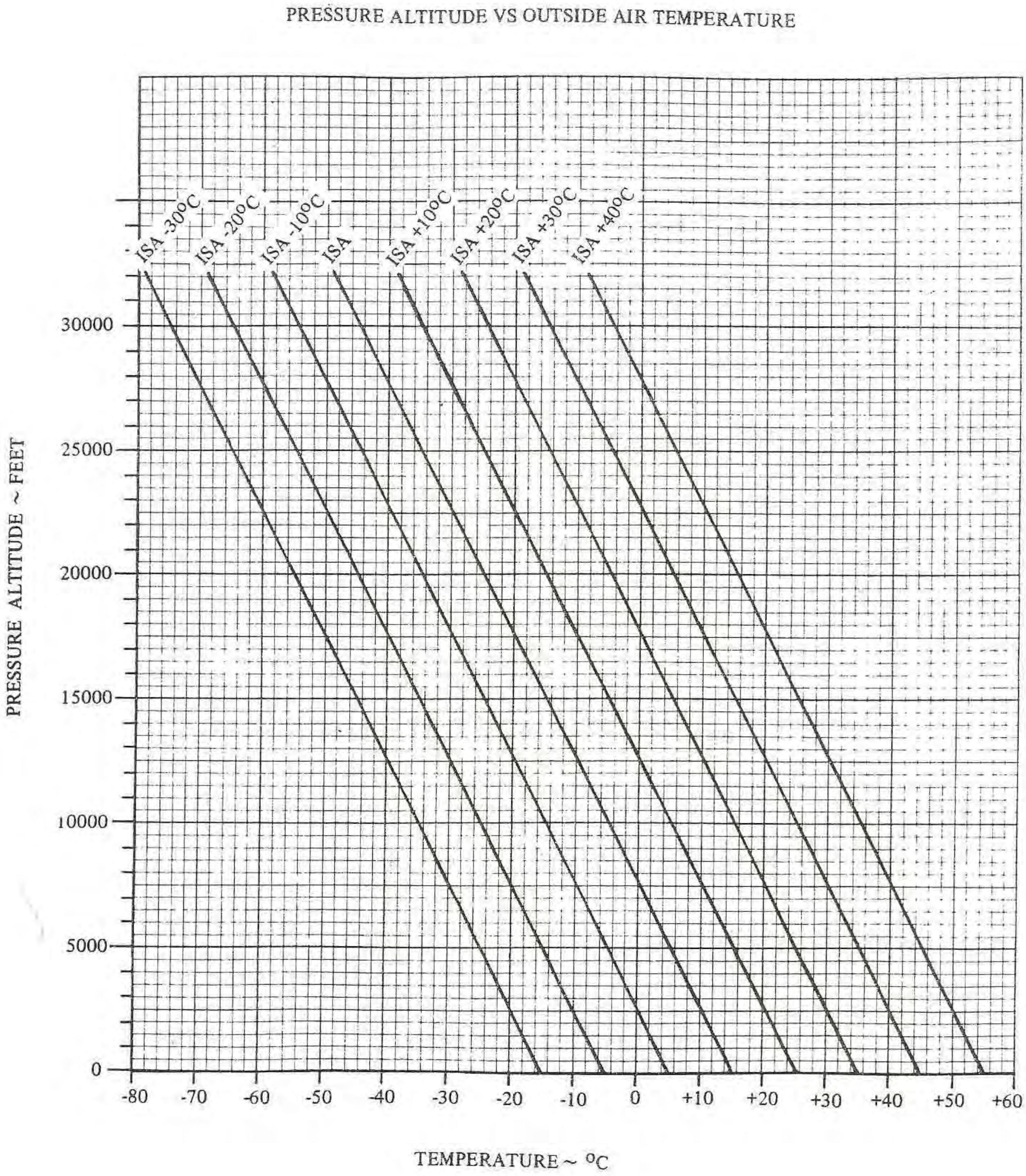


Figure 10-6 ISA Conversion Graph

Takeoff Safety Speed

The takeoff safety speeds for various weights, derived from the graph below, applies with flap selected to the takeoff (15º) position.

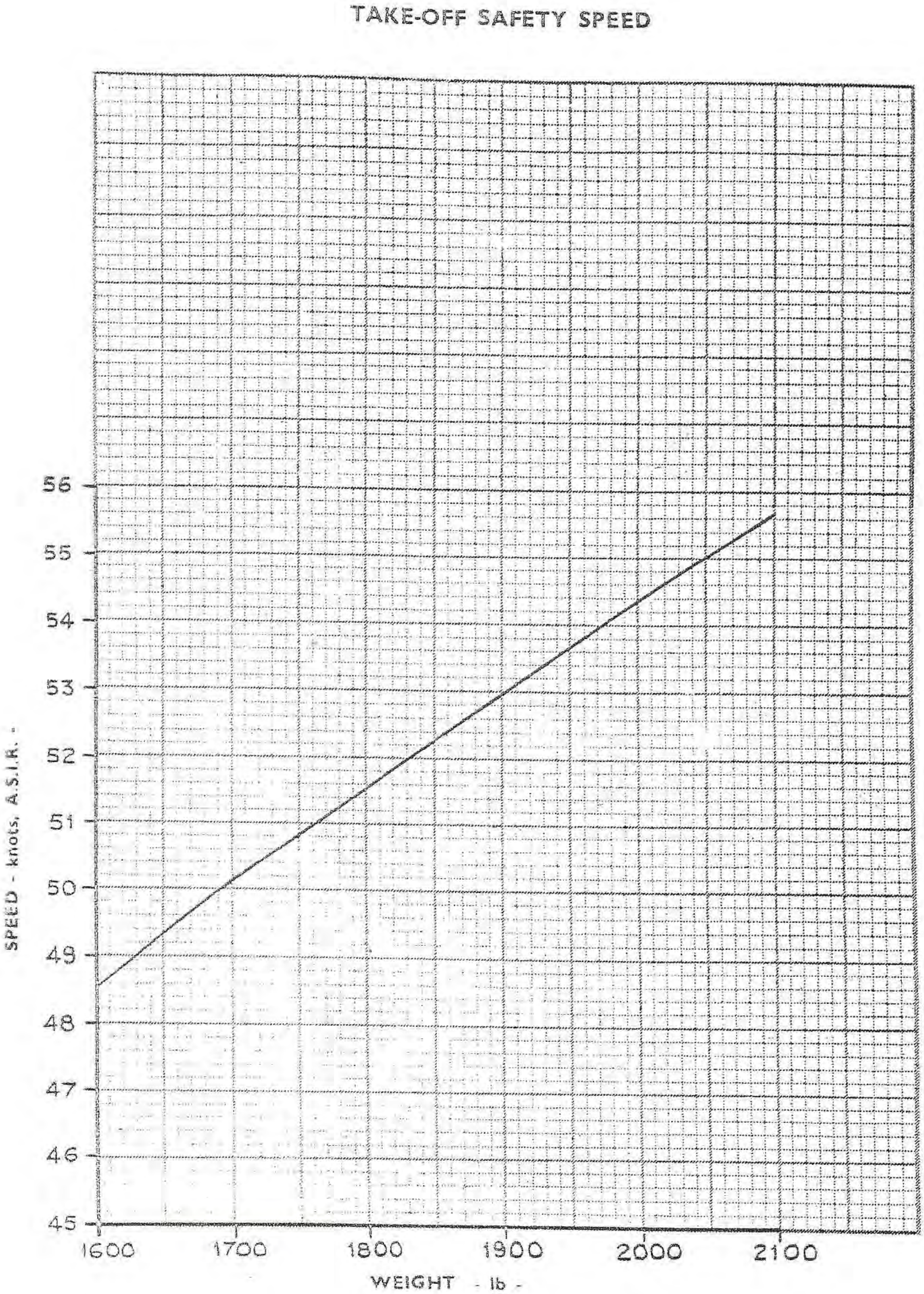


Figure 10-7 Takeoff Safety Speed

CASO 4 Takeoff Distance Graph

The CASO 4 takeoff distance for various weights, altitudes, air temperatures can be calculated from the graph opposite. This graph was created to meet New Zealand's old Civil Aviation Safety Orders (CASOs) requirements under the Civil Aviation Regulations 1953. These CASOs are still permitted to be used to meet the takeoff distance performance calculation requirements of New Zealand CAR Part 91. See Advisory Circular 91-3.

These distances have been factored for surface type, operation type, uniform runway gradient (slope) and wind component.

The performance information given in this graph is derived from gross data, that is, it is the expected performance of an average DCH1 Chipmunk aircraft and no margins have been applied.

Associated Conditions

- Engine: Full Throttle;
- Wing Flaps Takeoff Position (First notch - 15º);
- Airspeed 1.2 time the power off stalling speed (flaps 15º), appropriate to the weight: and,
- Technique The aircraft is held on the ground until the takeoff safety speed appropriate to the weight is reached and the initial climb is made at this speed.

The headwind correction grid on this graph is already factored, i.e. it is constructed on the basis that the effective headwind is 50% of the reported headwind component and the effective tailwind is 150% of the reported tailwind component. Consequently, to comply with NZ CARs, the reported wind component can be directly entered into the graph.

Deviation from the above conditions will affect the resulting takeoff distance performance achieved.

The takeoff distance calculated for private operations represents the absolute minimum distance acceptable and pilots should carefully consider all factors before taking off at an airfield with only this distance available.

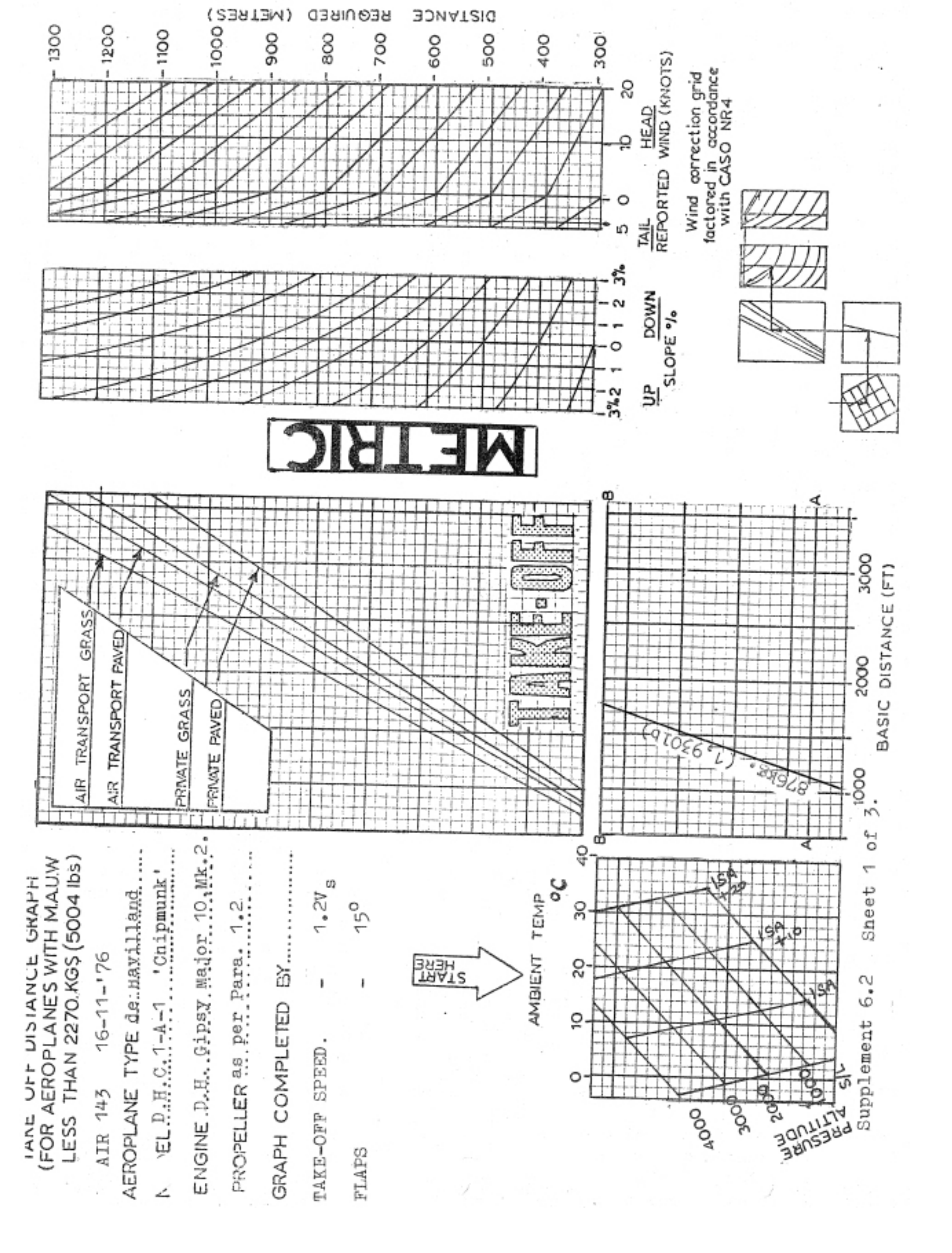


Figure 10-8 CASO 4 Takeoff Distance Graph

Initial Climb After Takeoff - Gradient

The gradient of climb for an initial climb after takeoff at various weights, altitudes and air temperatures, can be calculated from the graph opposite.

The performance information given in this graph is derived from gross data, that is, it is the expected performance of an average DCH1 Chipmunk aircraft and no margins have been applied.

Associated Conditions

- ✈ Engine: Full Throttle;
- ✈ Wing Flaps Takeoff Position (First notch - 15º); and,
- ✈ Airspeed Takeoff safety speed appropriate to the weight.

The example given in the arrowed dotted line shows that at an altitude of 3,000 feet, at an air temperature of 29ºC (ISA +20ºC) and at a weight of 1,800 lb, the gradient of climb at this point is estimated to be approximately 0.1095 (10.95%).

Deviation from the above conditions will affect the resulting gradient of climb performance achieved.

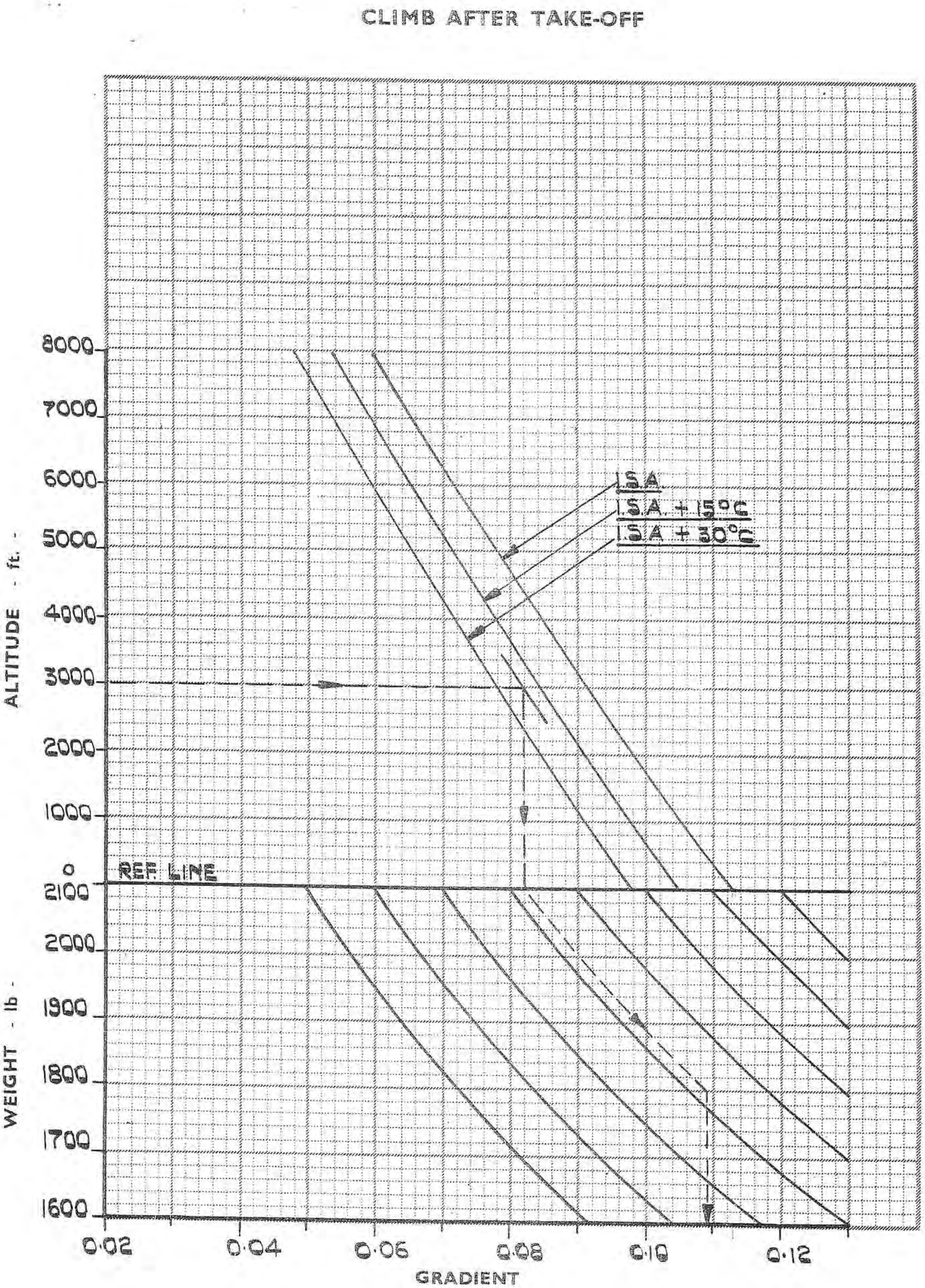


Figure 10-9 Initial Climb After Takeoff - Gradient

Initial Climb After Takeoff - Rate

The rate of climb for an initial climb after takeoff at various weights, altitudes and air temperatures, can be calculated from the graph opposite.

The performance information given in this graph is derived from gross data, that is, it is the expected performance of an average DCH1 Chipmunk aircraft and no margins have been applied.

Associated Conditions

- Engine: Full Throttle;
- Wing Flaps Takeoff Position (First notch - 15º); and,
- Airspeed Takeoff safety speed appropriate to the weight.

The example given in the arrowed dotted line shows that at an altitude of 3,000 feet, at an air temperature of 29ºC (ISA +20ºC) and at a weight of 1,800 lb, the rate of climb at this point is estimated to be approximately 670 fpm.

Deviation from the above conditions will affect the resulting rate of climb performance achieved.

CLIMB AFTER TAKE-OFF

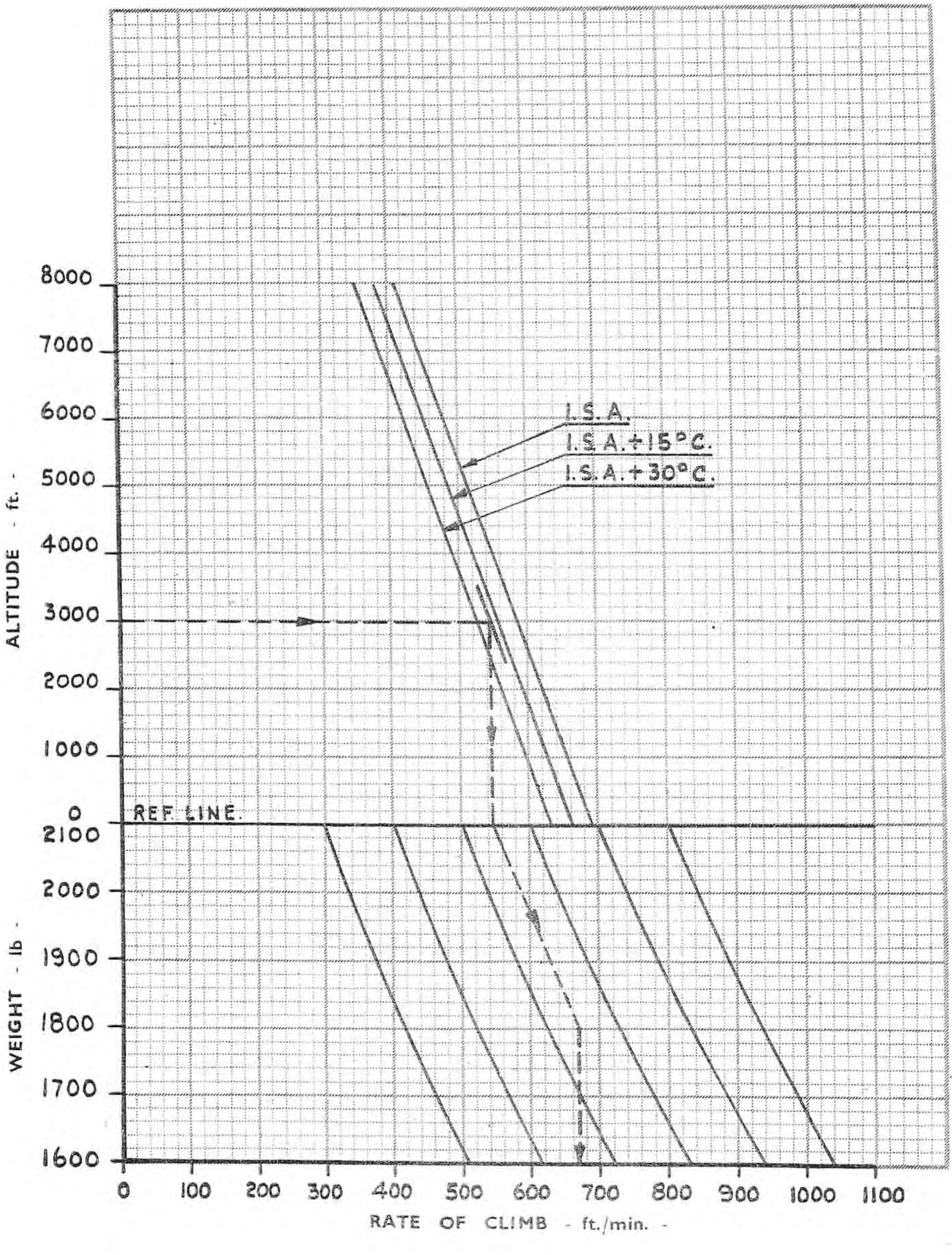


Figure 10-10 Initial Climb After Takeoff - Rate

Enroute Climb - Gradient

The gradient of climb for an enroute climb at various weights, altitudes and air temperatures, can be calculated from the graph opposite.

The performance information given in this graph is derived from gross data, that is, it is the expected performance of an average DCH1 Chipmunk aircraft and no margins have been applied.

Associated Conditions

- Engine: Full Throttle;
- Wing Flaps Retracted (0º); and,
- Airspeed 1.2 time the power off stalling speed (flaps UP), appropriate to the weight. This is 60 Kts IAS at 1,930 lb and 54 kts IAS at 1,600 lb.

The example given in the arrowed dotted line shows that at an altitude of 5,000 feet, at an air temperature of 25ºC (ISA +20ºC) and at a weight of 1,800 lb, the gradient of climb at this point is estimated to be approximately 0.10 (10%).

Deviation from the above conditions will affect the resulting gradient of climb performance achieved.

Waypoints AVIATION

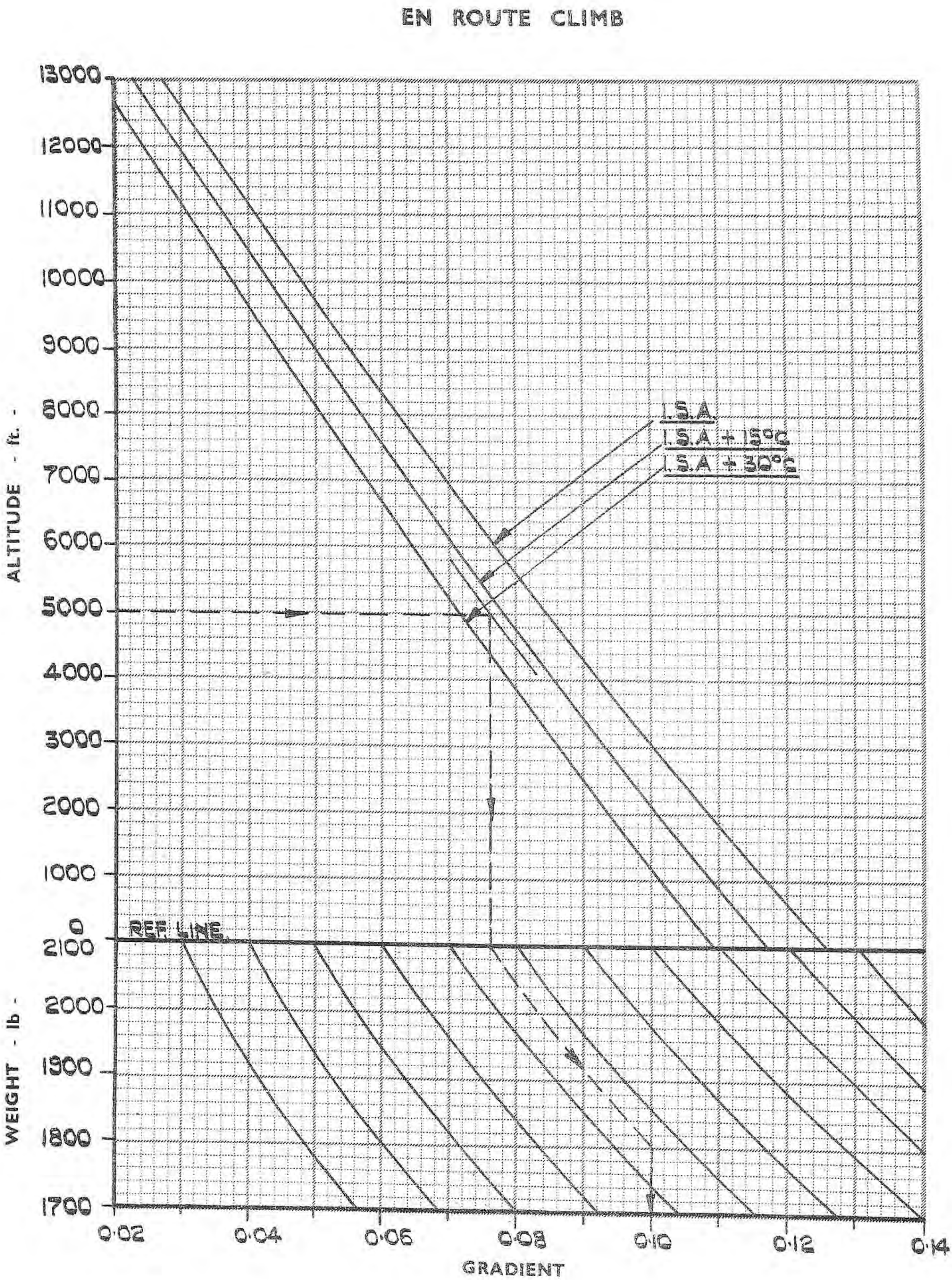


Figure 10-11 Enroute Climb - Gradient

Enroute Climb - Rate

The rate of climb for an enroute climb at various weights, altitudes and air temperatures, can be calculated from the graph opposite.

The performance information given in this graph is derived from gross data, that is, it is the expected performance of an average DCH1 Chipmunk aircraft and no margins have been applied.

Associated Conditions

- ✈ Engine: Full Throttle;
- ✈ Wing Flaps Retracted (0º); and,
- ✈ Airspeed 1.2 times the power off stalling speed (flaps UP), appropriate to the weight. This is 60 Kts IAS at 1,930 lb and 54 kts IAS at 1,600 lb.

The example given in the arrowed dotted line shows that at an altitude of 5,000 feet, at an air temperature of 25ºC (ISA +20ºC) and at a weight of 1,800 lb, the rate of climb at this point is estimated to be approximately 690 fpm.

Deviation from the above conditions will affect the resulting rate of climb performance achieved.

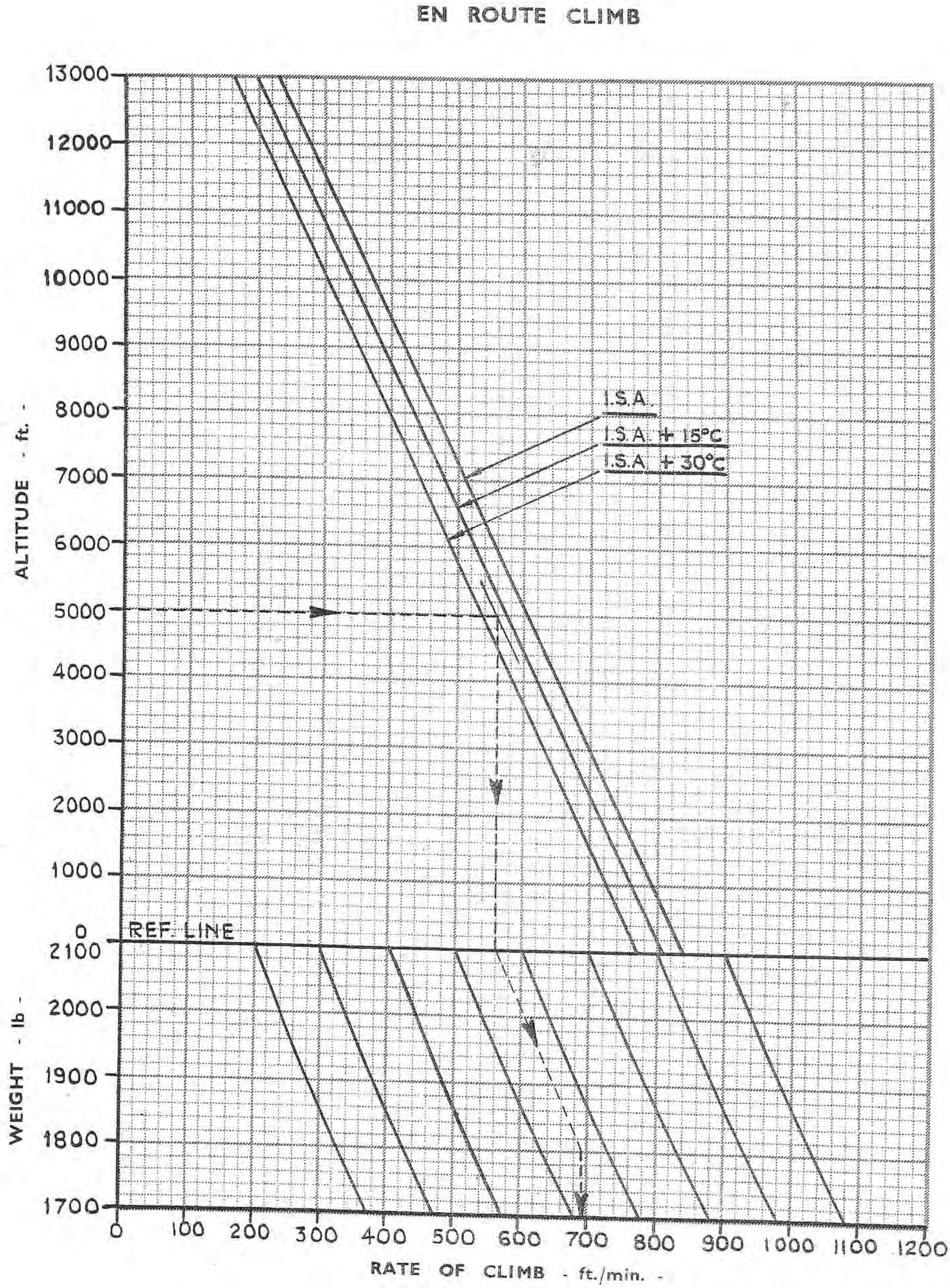


Figure 10-12 Enroute Climb - Rate

Enroute Glide Range - Engine Inoperative

The horizontal distance covered in an engine inoperative glide from various altitudes down to sea level and for various air temperatures, can be calculated from the graph opposite.

The performance information given in this graph is derived from gross data, that is, it is the expected performance of an average DCH1 Chipmunk aircraft and no margins have been applied.

Associated Conditions

- ✈ Engine: Inoperative;
- ✈ Wing Flaps Retracted (0º);
- ✈ Airspeed 1.1 times the power off stalling speed (flaps UP), appropriate to the weight. This is 53 Kts IAS at 1,930 lb and 48 kts IAS at 1,600 lb; and,
- ✈ Wind Component Zero.

The example given in the arrowed dotted line shows that at an air temperature of 27ºC (ISA +30ºC), the horizontal distance covered during a glide from an altitude of 9,000 feet down to seal level is estimated to be approximately 17.5 nm.

Deviation from the above conditions will affect the resulting horizontal distance performance achieved, however variation of weight has no appreciable effect on the horizontal distance achieved.

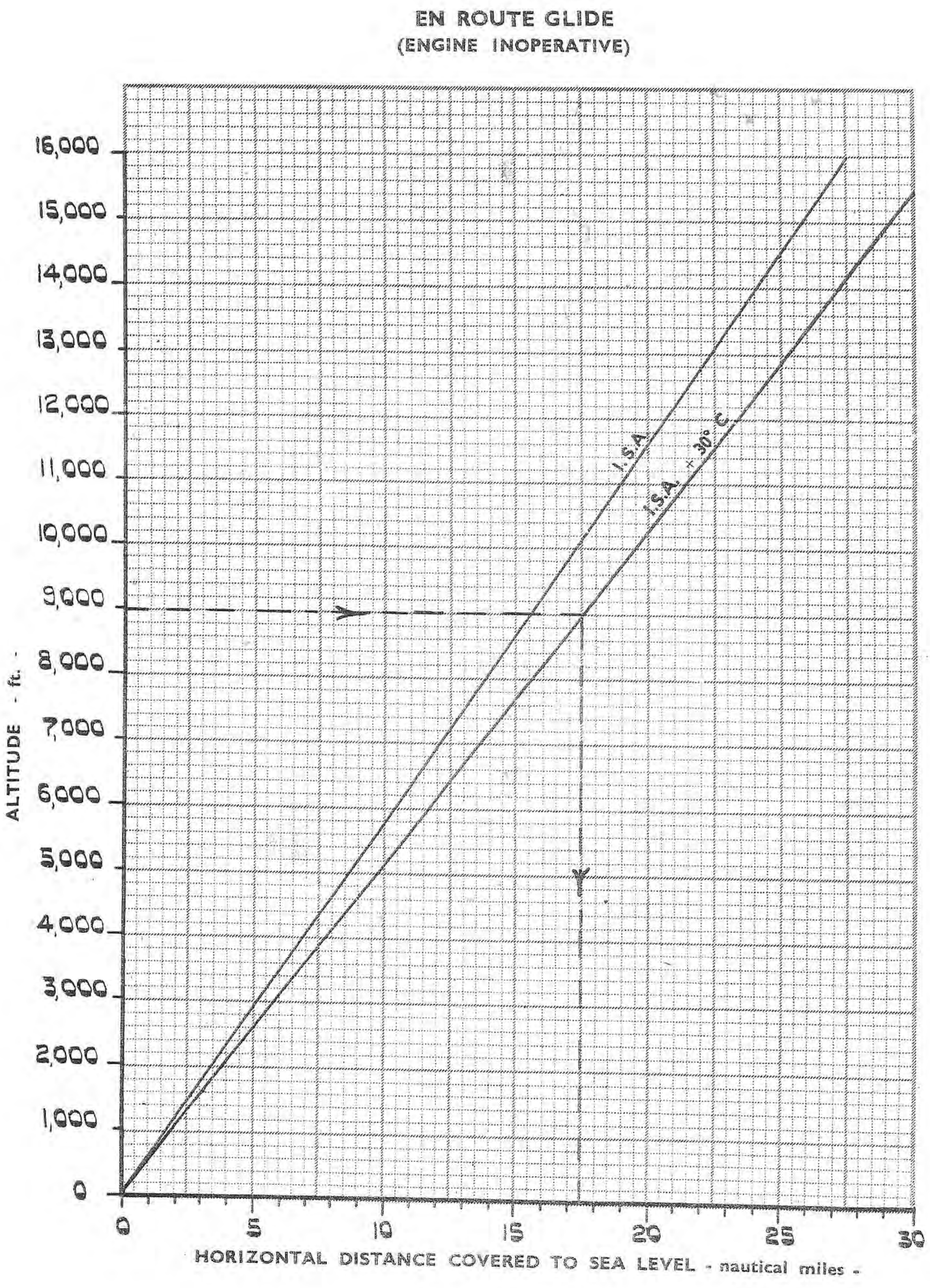


Figure 10-13 Enroute Glide – Engine Inoperative

CASO 4 Landing Distance Graph

The CASO 4 landing distance for a weight of 1,930 lb, at various runway elevations can be calculated from the graph opposite. This graph was created to meet New Zealand's old Civil Aviation Safety Orders (CASOs) requirements under the Civil Aviation Regulations 1953. These CASOs are still permitted to be used to meet the takeoff distance performance calculation requirements of New Zealand CAR Part 91. See Advisory Circular 91-3.

These distances are based on a 50 foot threshold crossing height and have been factored for surface type, operation type, uniform runway gradient (slope) and wind component.

The performance information given in this graph is derived from gross data, that is, it is the expected performance of an average DCH1 Chipmunk aircraft and no margins have been applied.

Associated Conditions

- ✈ Wing Flaps: Landing Position (Second notch - 30º);
- ✈ Technique: The airspeed at the 50 foot height point is 1.3 times the power off stalling speed (flaps 30º), appropriate to the weight. This is 53 Kts IAS at 1,930 lb; and,
- ✈ Braking: Normal.

The headwind correction grid on this graph is already factored, i.e. it is constructed on the basis that the effective headwind is 50% of the reported headwind component and the effective tailwind is 150% of the reported tailwind component. Consequently, to comply with NZ CARs, the reported wind component can be directly entered into the graph.

Deviation from the above conditions will affect the resulting landing distance performance achieved.

The landing distance calculated for private operations represents the absolute minimum distance acceptable and pilots should carefully consider all factors before landing at an airfield with only this distance available.

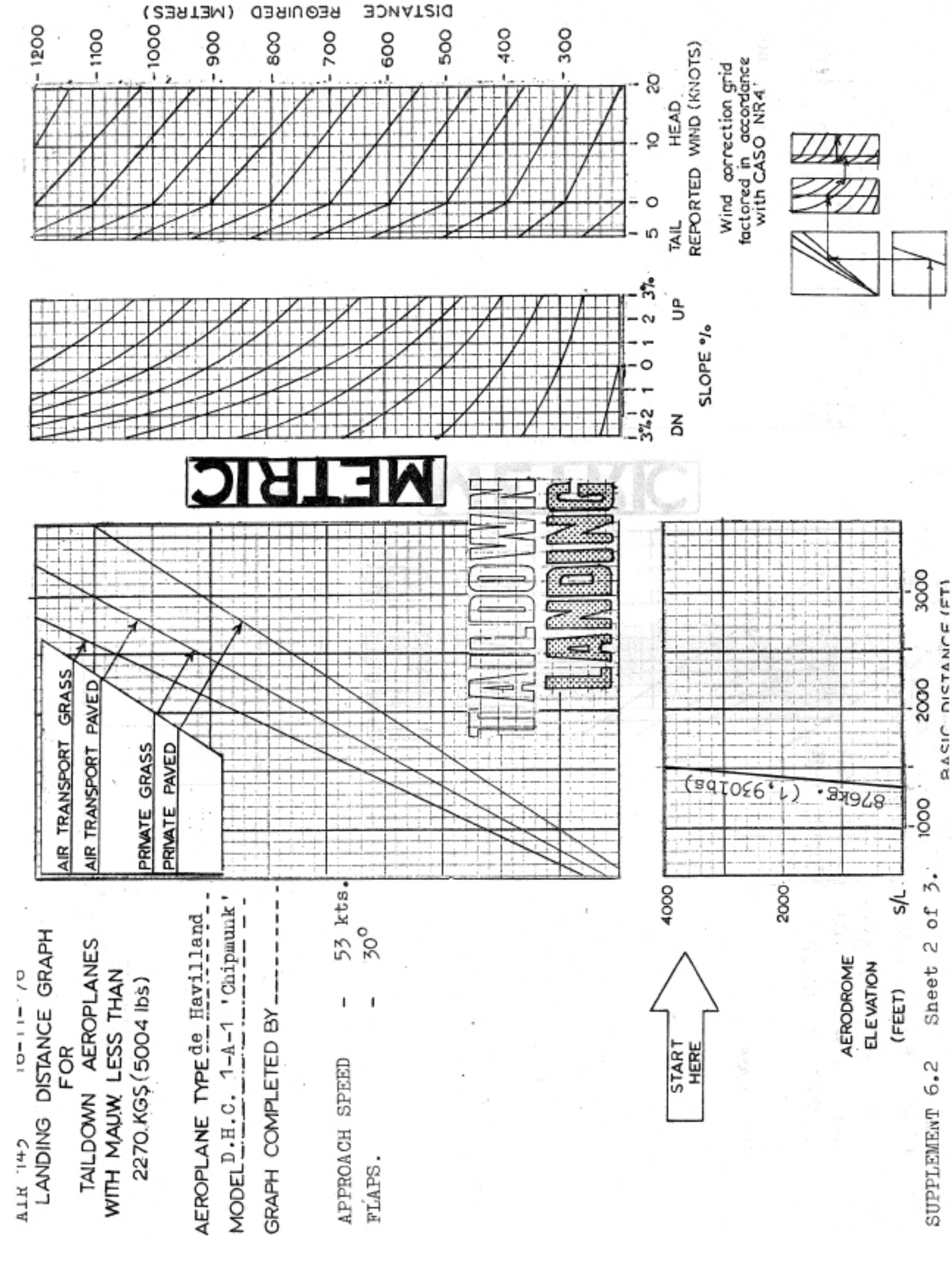


Figure 10-14 CASO 4 Landing Distance Graph

Chapter Eleven

Weight and Balance

Introduction

This chapter deals with the empty and limiting aircraft weights, and the effects of different weight loads on the fore and aft position of the centre of gravity (CofG) of the Canadian De Havilland Chipmunk Mk. 1-A-1, i.e. ZK-CVM.

ZK- CVM Weight and Balance

Basic Empty Weight (BEW)	1,382.14 lb
Moment arm	-9.31 in
Moment	-12,867.72 lb/in

CVM's Basic Empty Weight (BEW), was measured on the 4th of August 2021,following the fitment of a Hercules wooden propellor, and included all fixed parts and equipment (including the first aid kit and axe) and ¾ oil.

Maximum Operating Weights

Maximum AUW (Private Ops)	1,930 lb (876 kg)
Maximum AUW (Air transport Ops)	1,930 lb (876 kg)
Maximum AUW (Normal Aerobatics)	1,930 lb (876 kg)
Maximum AUW (Aerobatics with snap manoeuvres)	1,560 lb (708 kg)
Maximum AUW (Spinning)	1,560 lb (708 kg)
Maximum weight in the rear seat	250 lb (113.6 kg)
Maximum load in luggage locker	24 lb (10.9 kg)
	18 lb (8 kg) when the rear seat is occupied
	NIL when spinning or aerobatics with snap manoeuvres are flown

The weight in the luggage locker must be evenly distributed within the locker. It will normally be found that the weight in the luggage locker is restricted by CofG limitations.

It is not too difficult to exceed the gross weight limitation of 1,930 lb. For example, the BEW of 1,383 lb, with full fuel (196 lb), two pilots each up to 200 lb (91 kg), and an empty baggage locker you get the weight up to 1,979 lb.

So fuel must be managed with respect to the weight of the two pilots.

Waypoints AVIATION

Centre of Gravity (CofG) Limits

The CofG position is determined with the aircraft in the rigging position, i.e. with the fuselage datum line horizontal, and is found by taking moments about a fixed point known as the CofG datum point. The CofG datum is 42 inches aft of the engine firewall.

The CofG limits for normal and aerobatic flight (which exclude snap manoeuvres) are as follows:

Forward CofG	-8.91 in (-0.23 m)	- Forward of the datum.
Aft CofG	-0.72 in (-0.02 m)	- Forward of the datum.

The CofG limits for aerobatic flight (which include snap manoeuvres) are as follows:

Forward CofG	-6.8 in (-0.18 m)	- Forward of the datum.
Aft CofG	-0.72 in (-0.02 m)	- Forward of the datum.

The CofG must always be kept within these limits, even when the fuel and oil are partially or wholly expended.

The front seat pilot effectively sits on the CofG, consequently **when the aircraft is flown solo, the pilot MUST sit in the front seat.**

Fuel makes the aircraft slightly nose heavy, and obviously rear seat pilot/passenger and locker are tail heavy. The CofG moves aft as fuel is consumed.

With a 170 lb (77.2 kg) pilot in front seat and a 230 lb (104.5 kg) pilot/passenger in rear seat, an empty baggage locker and zero fuel, the CofG is just inside the aft limit. Consequently, it may not always be possible to load the rear seat or the locker to their maximum permitted weights without exceeding the centre of gravity limits.

There is a limitation of 250 lb (113.6 kg) in the rear seat. However with ZK-CVM it appears that with no fuel (the rearmost CofG case) you will reach the aft CofG limit with a 230 lb (104.5 kg) pilot/passenger in the rear seat. This is obviously a significant consideration for aerobatics/spinning.

Positive and Negative Moments

The distance of each load from the datum is known as its moment arm. With the Chipmunk, the loads are measured in pound and the moment arms in inches. If a load is forward of the datum point, its moment arm is taken as being negative and therefore the resultant moment is negative. Conversely, if the moment arms and moments of loads aft of the datum as taken as positive.

Waypoints AVIATION

Method of Calculating the Centre of Gravity (CofG) Position

The CofG position is determined from the following expression:

$$\frac{\text{(BEW x empty moment arm) + (The weight of all loads x their respective moment arms)}}{\text{BEW + The total weight of all loads}}$$

$$\frac{\text{Empty moment + Load moments}}{\text{The total weight}}$$

Centre of Gravity (CofG) Diagram

The CofG positions of various aspects of the Chipmunk are given below.

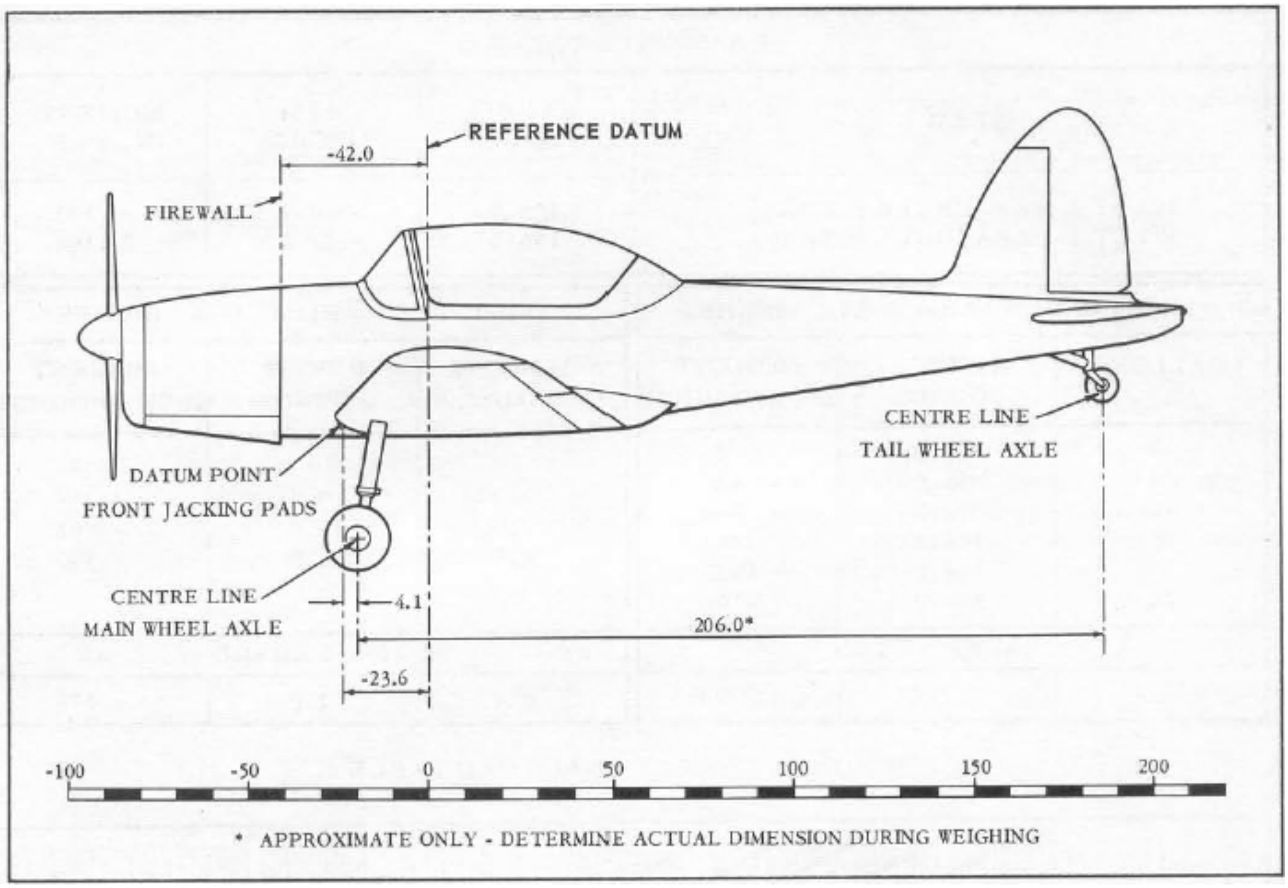


Figure 11-1 Centre of Gravity Diagram

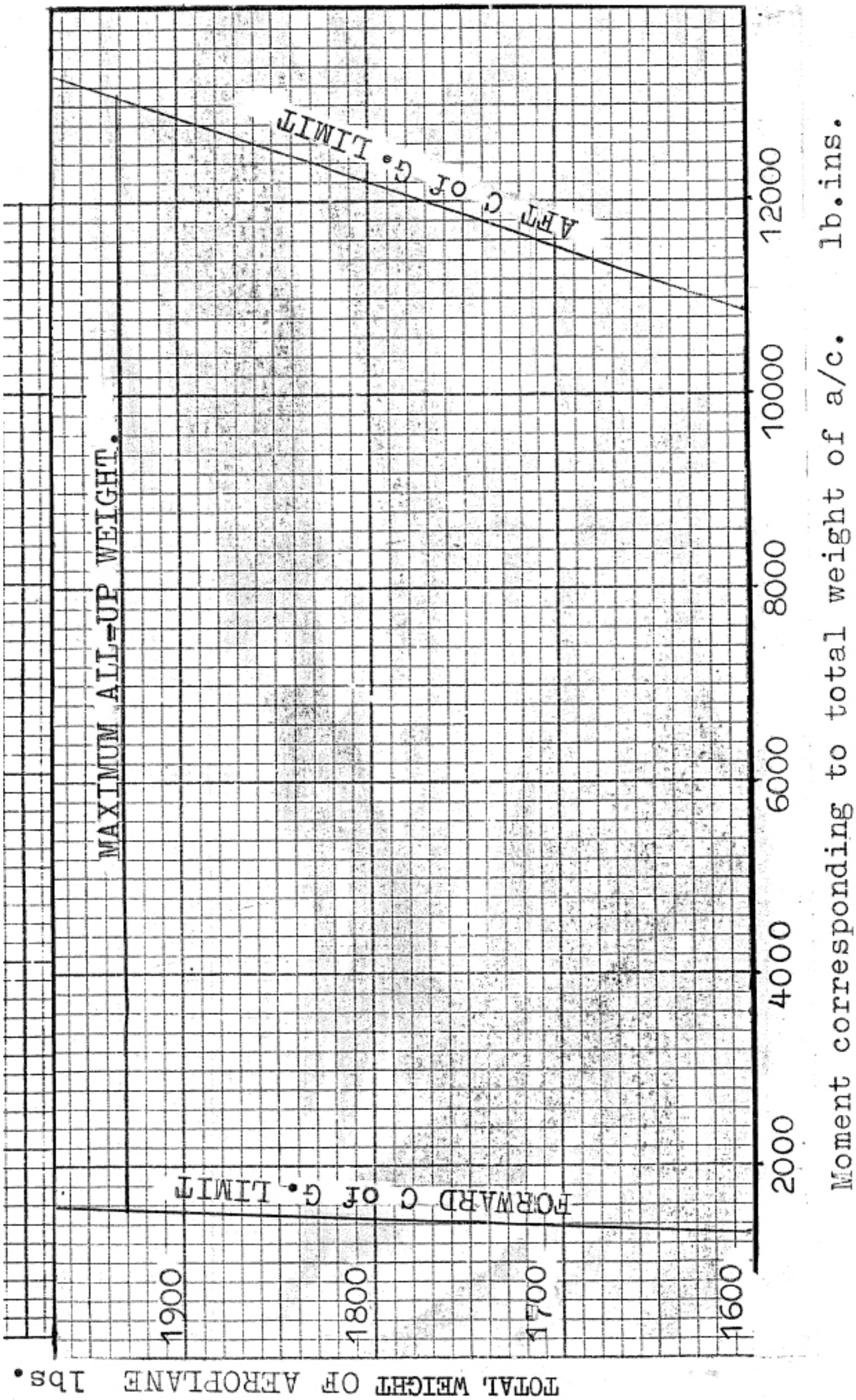


Figure 11-2 Loading Envelope

Loading Envelope

1. To the Basic Empty Weight (BEW) and moment of the BEW CofG, add the weight and moment of the:
   - ✈ Fuel;
   - ✈ Pilot;
   - ✈ Passenger/Instructor; and,
   - ✈ Baggage, etc.
2. Plot the total on the loading envelope.
3. The plotted point must fall within the loading envelope.

Example of Weights and Moments

Item	WEIGHT Lb	ARM Ins	MOMENT Lb.Ins
BEW	1,382.14	-9.31	-12,867.72
Fuel 112 Litres 24.6 Imp Gall	176.86	-11.7	-2,069.26
Pilot	185 (84 kg)	-0.75	-138.75
Passenger	185 (84 kg)	+32.6	+6,031.0
Baggage	0	+54	0
TOTAL	1,929	-2.14	-4,127.69

Notes:

Fuel Density	=	7.2 lb/Imp Gall	0.72 kg/litre
Oil Density	=	9.0 lb/Imp Gall	0.90 kg/litre

Weights and Moments - Worksheet

Item	WEIGHT Lb	ARM Ins	MOMENT Lb.Ins
BEW	1,382.14	-9.31	-12,867.72
Fuel 124 Litres 27 Imp Gall		-11.7	
Pilot		-0.75	
Passenger		+32.6	
Baggage		+54	
TOTAL			

Chapter Twelve

Ground Handling

Parking and Picketing

Where practical, park the aircraft so that it faces into the prevailing or expected wind. If the aircraft is to be parked for a short time outside on a smooth surface, set the park brake on, otherwise leave the brakes off and chock the wheels. Fully close the cockpit canopy hood.

If the aircraft is to remain parked outdoors for a period of time, fit the pitot head cover and if available, put on the cockpit canopy cover.

To tie the aircraft down, pass a rope through the tie down holes on the lower side of each of the wings. Pass a rope through the horizontal hole in the rear fuselage. Secure these ropes to the pickets or ground tie down points. Then place the control locks in position.

The park brake should not be left on after picketing, as the hydraulic brake system does not like being pressurised for long periods.

If parking for an extended period of time consider moving the aircraft into the shade or into a hangar, in order to minimise UV damage to the fabric covered surfaces.

Towing and Pushing

When handled by two persons, it is recommended that the aircraft be pushed by hand, as described below. When handled by one person, it is recommended that the aircraft be manoeuvred using a pole through the hole in the rear fuselage.

When two persons are pushing the aircraft forwards by hand, push at the wing tips. When pushing the aircraft rearwards by hand, push at the leading edges of the mainplane or tailplane.

DO NOT PUSH on the flaps, ailerons, elevators, rudder, or on the propeller blades under any circumstances. Undue strain might be placed on them in such a manner as to weaken the structure.

Cleaning

Pilots are encouraged to wash the aircraft after use, particularly if landing on wet grass.

Waypoints AVIATION

Chapter Thirteen

ZK-CVM Syndicate Rules & SOPs

1 GENERAL

1.1 These notes are issued for the guidance of all syndicate members for the safe, enjoyable and continued use of the Chipmunk for all members.

1.2 Any points of discussion on the operation of ZK-CVM should be taken up with the Chief Pilot without delay. Additions and amendments to these notes will be issued from time to time.

1.3 The aims of the syndicate are:

- To provide a facility for all Syndicate Members to undertake recreational flying activities in the Chipmunk. It is not to be used as a source of cheap flying for people wanting to build hours to obtain higher licences; and,
- To provide dual instruction for people who are not necessarily CVM Syndicate members, with a view to encouraging their participation in flying activities. These people will be charged a higher hourly rate than CVM Syndicate Members, and may only fly with approved Syndicate Instructors.

1.4 These notes are to be read in conjunction with the CVM Flight Manual, checklists and Pilots Notes which are available to all Syndicate Members.

2 PURPOSE

2.1 The purpose of these Rules and SOPs is to define the ownership and operation of a DHC-1 Chipmunk Aircraft ("the Aircraft") bearing the registration number ZK-CVM.

3 MEMBERSHIP

3.1 Only paid up Syndicate Members, with more than 100 hours total flying time and a minimum of 5 hours on type, may fly the Chipmunk as Pilot-in-Command.

3.2 The exception to the restriction in para 3.1 above, is invited Flying Instructors/Flight Examiners, who are rated and experienced on type, who are carrying out training or checking on syndicate members.

3.3 The secretary will keep a register of all Syndicate Members and notify the aircraft's insurers, as required.

3.4 All applications for new membership of the syndicate must be reviewed by the committee and approved prior to the sale/purchase of a share being finalised.

4 SHARES

4.1 The Aircraft will be owned jointly by the Members as "tenants in common". A Member may hold more than one share. There will be one vote per share.

4.2 The number of shares in the Aircraft will not exceed ten without the agreement of the Syndicate Members to the amendment of this clause.

4.3 Shares will have a nominal value of NZ$14,000.

5 SYNDICATE STRUCTURE

5.1 The Syndicate Committee will comprise:

A Chief Pilot;

A Treasurer/Secretary; and,

A Maintenance Controller.

5.2 In the event of a Committee Member standing down or selling out of the Syndicate a suitably qualified Syndicate Member will be appointed by the Shareholders.

5.3 The Syndicate Members will meet at least annually and at any other time as deemed necessary by the Members.

5.4 Committee Members can be appointed or removed by the Syndicate Members by majority vote (where each share gets one vote).

6 SALE OF SHARES

6.1 If a Syndicate Member wishes to sell their share in the Aircraft, they must notify the Syndicate Secretary in writing of their intention.

6.2 The Syndicate Secretary will maintain a list of shares that are being offered for sale. Shares will be sold in the order that notification was given to the secretary (the exception to this is if the Shareholder acquires a prospective purchaser for their own Share), and at the price specified by the committee. As with any other new member, the committee must approve the purchaser.

6.3 The Share will be offered to the other Syndicate Members in the first instance.

6.4 In the event of the other Syndicate Members failing to accept the offer or indicating that they do not wish to purchase the share the Syndicate Member selling their share may advertise the share for sale on the open market.

6.5 In the event of a prospective purchaser indicating a willingness to buy the share the selling Syndicate Member will inform the Committee of the identity of the prospective purchaser and the Committee will have the right to meet and interview him or her.

6.6 Prior to the sale of the share the selling Syndicate Member will obtain the consent of the Committee to his or her selling the share to the prospective purchaser. The share may not be sold without the consent of the Committee in consultation with Syndicate Members.

6.7 It will be a condition of any sale that the prospective purchaser agree to abide by the terms of these Rules and SOPs or any that succeed it.

6.8 All share sales attract a transfer fee of $1000 per Share, payable into the Syndicate Kitty.

6.9 The purpose of the transfer fee is to cover administrative aspects of the sale and purchase of a share and to apportion an amount to the Syndicate Kitty to cover insurance, hangarage and other fixed costs.

6.10 Until such time as a share is sold, the Syndicate Member remains liable, on a prorate basis, for the annual Syndicate Subscription of $2,000 (including GST) for fixed maintenance, hangarage and insurance of the aircraft.

6.10 Death of a Member

On the death of a Syndicate Member it shall be the responsibility of his or her Estate or Trustees to dispose of that Member's share under the provisions for sale and purchase outlined above and the Syndicate shall not be caused to be wound up because of such an event. The Estate or Trustees shall be responsible for any outstanding charges and ongoing fixed costs until the share is sold.

7 OPERATIONAL COSTS

7.1 The Treasurer will be responsible for ensuring that Members make such payments or contributions as are set out below. The Treasurer will ensure that payments in respect of the operation of the Aircraft i.e. insurance, hangarage etc. are made and kept up to date.

7.2 The Treasurer will have the authority to open a bank account for this purpose. Records of all transactions are to be kept and presented as required.

7.3 The Members agree to make such payments or contributions as are required of them promptly on request.

7.4 Any Member failing to make such payment and owing monies for a period of more than 28 days without the Agreement of the Committee will be ineligible to fly the Aircraft until any payments or contribution are brought up to date. Non-payment beyond 120 days shall be grounds for the delinquent Member's share to be sold to defray costs.

7.5 Fixed Costs

A Syndicate Kitty will be maintained to cover all annual fixed costs, such as but not limited to:

Insurance;

Hangarage at the base airfield; and,

Any other fixed costs (i.e. the ARA, Annual CAA Participation Levy, Registration Fees, legal costs, etc.).

An annual Syndicate Subscription of $2,000 (including GST) will be charged each calendar year, per Syndicate Member (not per Share). The annual subscriptions will fall due on the 1st of January each year. New members joining the syndicate will be asked to pay a prorated subscription based on their date of joining.

The Syndicate Subscription is to be paid in advance, directly by automatic payment into the Syndicate's bank account.

7.6 Hourly Operating Costs

The Syndicate Members will fix an hourly operating cost to include fuel, oil, routine maintenance and a reserve to cover such things as engine repair/replacement/overhaul, as the Syndicate Committee considers appropriate.

This hourly operating cost is $200 (including GST).

The hourly operating cost will be charged by reference to the Honeywell Air-switch which has been plumbed into the pitot-static system.

Any Syndicate Member purchasing fuel (when the Syndicate Fuel Card is not able to be used) or oil for the Aircraft will promptly provide the Treasurer with a copy of the invoice and such sum will be credited to the Syndicate Member's account.

7.7 A Documentation Folder will be kept in the Aircraft in which the Members are to accurately record the details of their flight. A record of start-stop times, Air-switch time, airfields of departure and arrival, of fuel and oil usage and of aerobatic flight undertaken are to be noted on the current Flight Record Card.

7.8 Flying for non-syndicate people will be charged at $360 per hour (including GST).

7.9 Landing Fees and Airways Charges

7.10 All landing fees and Airways charges incurred by an individual Syndicate Member will be charged separately to that Member.

7.11 Any landing fees, parking fees and/or hangarage fees incurred away from the base airfield and any charges for airways services will be the responsibility of the Syndicate Member incurring them. When billed to the Syndicate, these will be paid and then invoiced to the appropriate Syndicate Member.

7.12 The Treasurer will invoice the Members monthly in respect of any payments due from them.

7.13 Members will arrange payment of monies due by deposit to the Syndicate bank account or direct to the Treasurer as may be arranged.

7.14 Unscheduled Repairs

7.15 Each Syndicate Member will pay an equal share (total divided between the number of Shareholder Members not per Share) of any repair or replacement brought about through normal wear and tear.

7.16 Where any repair or renewal is required through damage being occasioned by the negligence or lack of airmanship of an individual Syndicate Member and where such cost is not covered by insurance, the Syndicate Member responsible will solely bear that cost.

7.17 In the event of an accident being attributable to pilot error, negligence, poor airmanship or a failure to comply with Civil Aviation Act or Rules, air traffic services instructions, Syndicate rules or policies, the Pilot-in-Command shall be solely liable for the monetary value of the current insurance excess. Where a Syndicate Member or other approved person is receiving instruction or undergoing a proficiency check with the Chief Pilot or other Syndicate Instructor as Pilot-in-Command, the insurance excess will be shared equally between the two pilots.

7.18 In the event of an accident attributable to mechanical failure, ‘Act of God’ or other unforeseen cause(s) and not arising from negligence, pilot judgement or behaviour, the insurance excess shall be shared equally between all of the Syndicate Members.

7.19 In the event of an accident being attributable to pilot error, negligence, poor airmanship or a failure to comply with Civil Aviation Act or Rules, air traffic services instructions, Syndicate rules or policies, AND where the costs of repair or damages to the aircraft and/or other property are NOT covered by insurance, the Pilot-in-Command shall be solely liable for any additional monetary sum claimed by a third party. The Pilot-in-Command will be solely responsible and solely liable for any third party claims or damages and he/she absolves the other Syndicate Shareholders from any legal liability relating to such a claim.

8 BOOKINGS

8.1 Bookings are made using an online booking system for ZK-CVM. It can be found at: http://www.aircraftbookingsystem.com

8.2 The first time you try to log-on enter your Christian name and the first initial of your Surname (E.g Mark W) and use '123456' as the password.

8.3 No Syndicate Member may fly the Aircraft without ensuring that it does not conflict with a prior booking made by another Member.

8.4 If a member books the aircraft and then changes their plans, they should update the booking site as soon as possible so that the aircraft will be available to other members. Failure to arrive prior to the time that the aircraft is booked, will in effect invalidate the booking and other Syndicate Members may then use the aircraft.

8.5 The essence of this Agreement is mutual co-operation and a degree of give and take. If Syndicate Members abuse this by making multiple bookings, repeatedly book for periods of more than a few days or at times when the Aircraft is likely to be in high demand, more rigid rules placing restrictions on the number or length of bookings may be made, providing a majority of the Syndicate Members agree.

9 FLYING

9.1 The Aircraft is to be used for private operations only (insured for private and pleasure).

9.2 The Pilot-in-Command of the Aircraft must be a Member of the Syndicate, or flying with a Member of the Syndicate.

9.3 Ownership of a share does not vest in a Syndicate Member a right to fly the Aircraft except as follows:

A Member may fly the Aircraft as Pilot-in-Command providing the following criteria are fulfilled:

(i) The Syndicate Member holds a valid Pilot's Licence and current medical certificate, or a medical certificate issued in accordance with rule 44(1) of the Land Transport (Driver Licensing) Rule1999, that is applicable for a Class 2, 3, 4 or 5 driver licence with passenger endorsement - a DL9 form;

(ii) The Syndicate Member holds a type rating on the DHC-1 Chipmunk, or is specifically authorised and supervised by the Chief Pilot or an approved Syndicate Instructor;

(iii) The Syndicate Member is approved in accordance with the Aircraft insurance requirements;

(iv) The Syndicate Member has a minimum number of 100 hours total experience, and a minimum of 5 hours on type.

(v) The Syndicate Member's first flight will take place after a briefing from the Chief Pilot or an approved Syndicate Instructor, and that person will be present at the airfield for the takeoff and landing.

9.4 The Chief Pilot will define such requirements for training, currency or periodic check flights as necessary. Failure to comply with such requirements will be grounds for withdrawal of consent for a Syndicate Member to fly the Aircraft.

9.5 Any Syndicate Member flying the Aircraft as Pilot-in-Command is to ensure that, at all times, it is operated in accordance with the terms of the Civil Aviation Act and Rules, that it is airworthy, that there is insurance cover in force, that any flight is carried out safely, that the Aircraft is not operated for any illegal purpose and that they demonstrate at all times a good and proper degree of airmanship.

9.6 Syndicate Members may only fly the aircraft as Pilot-in-Command from the front seat, unless specifically authorised by the Chief Pilot to operate it from the rear seat.

9.7 Syndicate Members are not to carry passengers in the aircraft unless current to do so. If passengers are carried the Syndicate Member must hold a current BFR, current instructors rating or current CAR Part 119 Operation Competency Assessment and meets recent experience requirements.

9.8 Instructor CCA's and BFR's may be carried out in the aircraft by members when flying with an approved Syndicate Flight Examiner.

9.9 Prop swinging to start the engine may only be carried out by people who have had a thorough briefing on the procedure, and who have undertaken supervised practise to proficiency by an appropriately qualified person. Engine starting may only be carried out whilst one of the cockpits is occupied by a qualified pilot, and whilst the park brakes are set ON and the wheels are CHOCKED.

10 AIRFIELDS

10.1 The Aircraft is only to be operated on licensed airfields unless a specific authorisation is obtained from the Chief Pilot. Landings at places other than licensed airfields may be subject to dual check with a Syndicate Instructor.

11 STANDARDISATION FLIGHTS

11.1 The Chief Pilot, at their discretion, may require a given Syndicate Member to carry out a standardisation flight with a Syndicate Instructor.

11.2 In the exercise of this discretion the Chief Pilot will consider whether the Syndicate Member carried out their last BFR on the Chipmunk, their experience level or whether the Member is in current flying practice, etc. It should be remembered that a standardisation flight is intended to ensure that a Syndicate Member maintains proficiency on the aircraft, which is in the interests of all Syndicate Members.

12 AEROBATICS

12.1 All Syndicate Members must be conversant with and observe Civil Aviation Rule Parts 61 and 91 with regards to Aerobatic Flight.

12.2 Syndicate Members must complete an aerobatic check flight with the Chief Pilot or with a Syndicate Instructor prior to carrying out aerobatics. If a Member does not hold an Aerobatic Rating but has been receiving dual instruction in aerobatics, they may be authorised by a Syndicate Instructor to carry out solo consolidation flight in the aircraft. Such authorisation will include specific manoeuvres, minimum altitudes, etc.

12.3 Syndicate Members who are not in current aerobatic practice should have a six-monthly dual check with a Syndicate Instructor. This will reduce the risk of damaging the engine or over-stressing the aircraft and maintain flight safety standards.

12.4 Pilots must record which flights were "aerobatic flights", with a tick in the applicable column on the Flight Record Card. The aerobatic factor can then be applied to the cumulative fatigue hours.

13 FORMATION FLYING

13.1 No Syndicate Member may fly the Chipmunk in formation with another aircraft unless they have been issued with a Formation Rating by the Chief Pilot or a Syndicate Instructor. All formations must be specifically briefed by the designated formation leader, and all formation members must be present at the briefing.

14 REFUELLING

14.1 Two Syndicate Fuel Cards, one for BP and one for Z Energy, have been supplied for the Aircraft. These are in the Documentation Folder which is in the locker behind the rear seat.

14.2 These fuel cards must remain with the Aircraft at all times, and may not be used to refuel other aircraft.

14.3 The PIN for both fuel cards is 3434.

14.4 Fuel may be purchased using either card and fuel dockets should be placed in the plastic sleeve in the Documentation Folder for the Secretary/Treasurer's records.

14.5 Members may use their own cards to purchase fuel but this must be annotated in the log so that fuel usage can be monitored.

14.6 The aircraft should normally be refuelled to full fuel tanks after each flight.

15 AIRCRAFT DOCUMENTATION FOLDER

15.1 A Documentation Folder containing the Syndicate Flight Record Card, the CAA Tech Log, the Syndicate Notes Card, the Maintenance Release and the Aircraft Flight Manual is in the locker behind the rear seat.

15.2 Each Pilot-in-Command is to ensure details of each flight are entered into the current Syndicate Flight Record Card at the completion of each flight. Details include the syndicate member to be charged, flight times, fuel uplift, oil uplift and sortie details.

15.3 Defects which may render the aircraft unairworthy are to be entered into the CAA Tech Log. Defects that are entered on the CAA Tech Log must be cleared or deferred by an engineer, the Maintenance Controller (MC) or the Chief Pilot (CP), prior to the aircraft being serviceable for flight. If a defect is deferred then any limitations on the operation of the aircraft will be entered on the CAA Tech Log.

15.4 Notes entered on the Syndicate Notes Card do not affect the serviceability of the aircraft for flight, but simply inform members of minor issues and keep a record of such issues for the Maintenance Controller (MC) to manage as required.

16 AIRCRAFT MAINTENANCE

16.1 The syndicate maintenance provider is Jay McIntyre, owner of JEM Aviation at Omaka aerodrome in Blenheim. Phone 03 578 3063, or Jay McIntyre on 021 504 048.

16.2 Maintenance will be monitored and coordinated by the committee member designated as Maintenance Controller (MC). The MC is also responsible for ensuring that all the aircraft documentation is kept up to date.

16.3 If the aircraft becomes unserviceable during a flight, the member acting as Pilot-in-Command is responsible for entering the defects in the Tech Log, and for contacting the MC and if necessary the Chief Pilot. If the Syndicate Member is unsure about any aspect of the defect or how it may affect a subsequent flight, they should contact the MC or Chief Pilot to discuss the matter further.

16.4 Where possible, the MC will contact other members who have subsequent bookings for the aircraft.

17 HANGAR ACCESS

17.1 The main base for the Aircraft is the Waypoints Hangar at Motueka aerodrome. This hangar is also used by other aircraft and should usually be securely locked.

17.2 A key or an electronic swipe pass will be issued to each Syndicate Member.

17.3 Each Syndicate Member is responsible for the safe and careful movement of the Aircraft and any other aircraft within, from or into the hangar.

17.4 The hangar and all other aircraft must be left secure at all times.

18 AIRCRAFT SECURITY

18.1 Whenever the aircraft overnights away from our base aerodrome, it should either be hangared or picketed. Picket gear is available in the Syndicate Locker.

19 ARBITRATION

19.1 In the event of any dispute arising Syndicate Members agree that such will be determined by an Independent Arbitrator in accordance with Arbitration Act 1996. The decision of such Arbitrator will be final and, save for any procedural irregularity amounting to a breach of the Arbitration Act or in breach of natural justice, not subject to any further appeal or action in a court of law.

19.2 The Arbitrator will be entitled to his/her reasonable expenses of carrying out the arbitration. The responsibility for the costs of such arbitration will be determined by and at the discretion of the Arbitrator.

19.3 The essence of these Rules is mutual cooperation and flexibility. Syndicate Members agree to reflect the spirit of this at all times in their dealings with the Aircraft and other Syndicate Members.

Waypoints AVIATION