

CFM-Aircraft

SHADOW

Series D-D

PILOT'S NOTES



These Pilot's Notes are relevant excerpts from the original CFM-Aircraft manufacturer's '*Pilot's Notes / Service Manual*' (PN-SH/D and SM-SH/D first issued on 17 April 1996 and updated March 1997). [courtesy of G Webster, Scotland]

Annex C – Limitations

C.2 Flying Limitations

Control movements are to be restricted to 1/3 deflection at speeds in excess of Va (70 kts / 80mph)

Vne	(V never exceed)		108 kts	(= 124mph)	198 kmph
Vfe	(V flap extend)	15°	61 kts	(= 70mph)	
		30°	59 kts	(= 68mph)	
Va	(Design manoeuvre speed)		70 kts	(= 80mph)	129 kmph
Vso			30-35 kts IAS	(= 35–40 mph)	55–64 kmph
Stall or Minimum Flying Speed:			35 kts	(= 40 mph)	64 kmph

Rate of Climb: 850 ft/min @ 60 KIAS
Ceiling: 10,000 feet (without oxygen)

Operation: VFR (Day only)

Maximum Wing Loading: 25 kg/m²
Permitted Manoeuvres: 45° Nose up / 60 ° nose down
60° Maximum bank angle
+4 / -2g Normal acceleration limits
Aerobatics and Spinning prohibited

C.3 Dual Control Limitations

Do not attempt to fly the aircraft solo from the rear cockpit (see Section **D.22**)

REPEAT - AIRCRAFT MUST <u>NOT</u> BE FLOWN SOLO FROM REAR SEAT!!

Annex D – Handling

D.1 Pilot's External pre-flight checklist

Adopt a routine, first checking for overall symmetry from a vantage position clear of the aircraft and then start from front Starboard Nose area and progress with a 360° walk round inspection.

Pitot Head

- Check Pitot tube fitted and unobstructed

Nose Gear

- Check security, free castoring movement, bungee condition and restraint wire. Tyre pressure, valve, bearing and bead creep.

Front Cockpit

- Canopy hinges and latches secure
- Master Switch "OFF"
- Master Switch "ON"
- Check Operation of Magneto Switches – then to "OFF"
- Check Operation of Fuel Gauge, electric trim and Indicators
- Check electrical ancillaries (Radio, GPS, Intercom)
- Check circuit breakers
- Check Gauges, general condition, glass intact
- Engine hours meter functioning
- Oil level warning light – if low, illuminated.
- Master Switch "OFF"
- Nose wheel tube / check wire secure
- Throttle full and free movement
- Choke full and free movement
- Controls full and free movement
- Rudder pedals/ cables / brake levers full and free movement
- Flaps full and free movement
- Emergency Fuel cut-off button full down position
- Check harnesses

Rear Cockpit

- Canopy hinges and latches secure
- Oil Reservoir – check level and fill as required (TTS)
- Throttle full and free movement
- Controls full and free movement
- Rudder pedals/ cables / brake levers full and free movement
- Check harnesses
- Check bolts / penny washers on floor and rear wall
- Check Pulleys and recoil starter rope condition
- Check A frame, bolts and roof / boom
- Check aileron torque tube and pins
- Secure canopy latches both sides

Starboard Main wheel

- Check wheel and tyre, pressure, creep, brake cable/operation
- Check Nut and Split pin secure

Starboard Wing

- Unzip inspection cover, check aileron linkage and pin secure
- Check wing strut nuts and bolts, jury strut and pins
- Check two wing pins secure and safety pins fitted
- Check wing leading edge and general condition
- Check wing tip
- Check aileron linkage, bell crank and hinges piano wire secure
- Check Flap linkage, piano wire secure.

Engine - Starboard side

- Check air filters, carbs, cables and rubbers for security
- Check Oil injection metering marks set
- Check fuel level visually – fill tank as required
- Operate fuel lift bulb and primer
- Fuel cap secure and locked
- Primer secure and locked
- Fuel and oil hoses / “D” clips and connectors secure
- Electrical connections secure
- Aileron tube secure, full and free
- Check coolant level
- Radiator cap secure
- Check rotary valve oil reservoir contents
- Vent line unobstructed
- Check Curtis drain valve for water contamination

Propeller

- Check from rear, all mountings and bolts/nuts secure
- Check each blade for stone damage, clean as required
- Check all bolts secure
- Propeller pitch witness dots in centre line of pinch blocks
- Spark plug leads secure
- Radiators and hoses secure and jubilee clips tight

Boom - Starboard side

- Check attachments and condition

Fin and Rudder

- Check hinges, lock wire, Teleflex, bolts and pins

Tailplane

- Check security of spigot tubes, Teleflex, elevator pins
- Check elevator movement, and “flutter” mod friction / resistance

Boom - Port side

- Check attachments and condition

Engine - Port side

- Fuel hoses / filter, “D” clips and connectors secure
- Exhaust secure and springs are wire locked

Port Main wheel

- Check wheel and tyre, pressure, creep, brake cable/operation
- Check Nut and Split pin secure

Port Wing

- Check Flap linkage, piano wire secure.
- Check aileron linkage, bell crank and hinges piano wire secure
- Check wing tip
- Check wing leading edge and general condition
- Check two wing pins secure and safety pins fitted
- Check wing strut nuts and bolts, jury strut and pins
- Unzip inspection cover, check aileron linkage and pin secure

D.2 Pilot’s Internal pre-flight checklist

STAIP – Pre Start Checks

Secure	Everything secure, no loose objects in cockpit
Throttle	Throttle full and free, closed and choke “ON” (if required)
All Clear	No person or objects close to aircraft, prop wash. All clear behind?
Ignition	Mag switches “ON”
Prop	Call “ <i>CLEAR PROP</i> ” and start engine

CHIFTWAP – Pre Take-Off Checks

Controls	Flying controls full and free movement
Hatches / Harness	Seatbelts fastened, cockpit closed and latches secure
Instruments	All instruments reading correctly
Fuel	Fuel contents sufficient, emergency stop “ <i>Down</i> ”, fuel cap secure
Trim	Set trim for take off
Wind Spd / Directn	Select correct runway, into wind
All Clear	Check for obstructions, persons, animals in vicinity of prop
Power check	Check engine operation/temps. Check Mags @ 3000rpm. Line up.

D.3 Engine Handling

The engine may be started by use of the rope/pulley recoil starter, or by the optional electric starter, or by cautious hand propping. Whenever practical or possible another person should help with starting.

Do not “blip” the throttle as this subjects the reduction drive gear to excessive strain.

D.4 Engine Starting

Cold Start

1. Check Fuel “ON”
2. Prime Engine with primer bulb
3. Ignition/Magneto switches “ON”
4. Throttle closed
5. Full choke
6. Pull engine through several blades
7. Pull engine to compression stroke
8. Pull starter cable smoothly

Hot Start

1. Leave throttle closed or at 10%
2. Check Fuel “ON”
3. Full choke if no reading on CHT gauge
4. Pull engine to compression stroke
5. Ignition/Magneto switches “ON”
6. Pull starter cable smoothly
7. After start, close choke + allow to idle. Warm up for at least 2 mins @ 3000 RPM.

Re-Start in Flight

The engine can be re-started in flight provided it is warm. It is not advisable to switch the engine “OFF” in flight. The engine cools rapidly (1-2 minutes) and once cold it may not be possible to re-start it. Depending on pilot strength and technique, the starter pulley rope can be managed with either hand, but it may be necessary to use both hands taking care not to strike the canopy.

1. Set throttle closed or at 10%
2. Check Fuel “ON”
3. Apply choke only if engine cold (no or low reading on CHT gauge)
4. Pull engine to compression stroke
5. Ignition/Magneto switches “ON”
6. Pull starter cable smoothly

D.5 Taxying

Ensure passenger harness is secured before starting. Apply brakes as soon as the aircraft is boarded. Power may be increased to 3000rpm to clear engine whilst seat belts and canopy / hatches are secured.

Taxying on runways may be increased to 20 kts (approx 35 kmph). On grass or rough surfaces, do not taxi above 10 kts (approx 20 kmph). Steering below 10 kts can be accomplished by differential braking, but the rudder should be applied as well. The propeller blast will assist the rudder to turn the aircraft at all taxiing speeds, thus saving brake wear. The nose gear will free swivel enabling very tight turns, but always ensure that the gear is straight ahead before applying full power. Point the aircraft into wind whenever stationary.

Keep hands clear when taxiing with canopy open. However this should be avoided to minimise stress on the canopy hoop restraint attachment point.

Do not taxi through standing water or puddles. It can damage the propeller.

D.6 Take-Off

Only use prepared or semi prepared runways. Complete the pre take-off checks and double-check that the canopy / latches are secure. Ensure the nose wheel is straight and taxi forward a few feet to achieve directional control. Be advised the Shadow accelerates rapidly.

Full Throttle recommended for two minutes only.

Normal

Neutralise ailerons by visually setting, then set control stick to full aft. Brakes "ON", apply power smoothly. Brakes "OFF" at full power. When nose rotates, check the pitch rate and hold slightly nose up. At 50 KTS the aircraft will become airborne.

Rough Fields

Very rough fields are not recommended due to high undercarriage loads. Fields that are semi prepared are acceptable. The nose-wheel must be raised as soon as possible, select 30° Flap and rotate at 40 – 45 KTS.

Crosswind

Normal take-off procedure with bias aileron towards wind direction. Aircraft will respond much as usual and is minimally affected. (Limitation 20 KTS at 90°)

D.7 Climbing

For the best rate of climb, maintain 60 KTS – the best angle of climb is attained at 50 KTS on full power. For good visibility a climb speed of 60 – 65 KTS is used. Maximum rate of climb at AUW is 850 feet per minute.

D.8 General Flying

Cruise – Maximum continuous cruise power setting is 6000 RPM giving a high cruise speed of 85 – 90 KTS.

Cruising at 5500 RPM is a good compromise for fuel economy and should enable an airspeed of around 80 KTS. In rough air, reduce to 75 KTS.

Pilot position – The excellent visibility featured on the Shadow allows both short and tall pilots excellent forward and all round visibility. Short pilots should use a cushion behind them so that their feet are firmly situated on the non-adjustable rudder pedals.

Wind Limitations – It is recommended that flight is not undertaken in winds gusting to or over 20 KTS (25 MPH)

- Beware ground handling in these conditions

Do not attempt to take off or land with a cross wind of more than 20 KTS at 90°.

Canopies – Do not attempt to open any canopy / hatch during flight.

D.9 Range and Endurance

Normal still air endurance with full fuel will not be less than 1.5 hours with 15 minutes reserve but it is entirely dependent on AUV and cruise / power setting. At economical cruise power setting of 5000 RPM, fuel consumption is around 2.5 Gallons per hour (11.3 litre/hr).

Normal Tank Capacity –	35 litre
Slipper Tank Capacity –	NA
Wing tank capacity –	27 litre

D.10 Stalling

There is no defined stall as generally accepted – with engine off or on idle a gentle “mushing” descent starts at around 30 – 35 KTS. Even with full power and a pitching angle of 60° there is no evident stall – above this angle a gentle “nod” develops after which the aircraft regains its original attitude. There is no difference to this effect with Flaps in – either at 15° or 30°, power “on” or “off” however the aircraft becomes more positive to roll control. At no time is buffeting of the wings felt, nor will a wing drop.

D.11 Turning

There is no tendency to side slip and sink rates are comparable to those in level flight. No buffeting of the controls occurs. With power on it is possible to turn steeply without any trace of ‘mushing’ descent – remember that banking is limited to 60°.

D.12 Spinning

Spinning is prohibited

D.13 Side Slipping

This manoeuvre is to be avoided as it places unnecessary stress on the forward wing attachment points.

D.14 Aerobatics

These manoeuvres are prohibited. The aircraft is stressed at +4G and -2G at maximum AUW and is therefore non-aerobatic.

D.15 Checks before Landing

- Reduce speed to not more than 60 KTS
- Check that resistance is felt at brake pedals
- Flaps as required
- Harnesses tight and hatches locked – canopy secure

D.16 Approach and Landing

Into Wind

– Descent may be made with engine at idle. Rates of up to 1500 feet per minute can be reached without exceeding 60 – 65 KTS. The best circuit speed is 60 KTS when the Flaps may be extended to 15° down. Maintain this speed for the approach. Generally 30° flap will seldom be required in normal conditions. Ensure that extra speed is not built up because the Shadow has a very long extended glide compared with other microlights and more runway may be used than intended. Check descent at 2 – 4 feet above the runway and hold off the main wheels until below 50 KTS. The nose wheel may be held off until below 20 KTS with full visibility to the pilot. Under heavy braking apply up elevator to ease the nose wheel loads.

Crosswind

A recommended landing attitude is the 'low wing towards the wind' method, grounding the upwind main wheel first. The rudder remains very responsive to directional control.

D.17 Going Around

1. Open throttle smoothly to full power
2. Return Flaps as required

At lighter weights, only 90% RPM need be used

D.18 Checks after Landing

UNBOARDING CAUTION – Unladen, the Shadow will adopt a tilted-back parked posture resting on its tail skid, with the nose wheel off the ground. When leaving the front cockpit ensure that the aircraft posture is gently attained. Neither the Pilot nor passenger should disembark while the engine is still running.

D.19 Stopping the Engine

Only switch “OFF” when the EGT has reached low readings.

D.20 Engine Failure in Flight

In the event of an engine failure:-

1. Quickly determine landing area, * no wires or obstructions
2. Shut the Fuel Valve by pulling red knob “UP”
3. Switch Ignition (Magneto Switches) “OFF”

Ensure the actual approach speed is faster than usual (70 KTS) to reach the selected landing area. Select Full Flap to kill off any ground effect float-on when over the threshold. Hold off as long as possible with a high angle of attack and touch down slowly and gently.

* Always try to land into wind and on fields in the direction of cropping – not across

Emergency glide speed is 50 KTS – there is a placard to this effect on the cockpit panel. This is the minimum sink speed.

D.21 Action in the Event of Fire

Fire is normally caused by two sources in an aircraft - electrical or fuel systems.

- **Fire on the ground - shut off fuel and switch off battery master**
- **Fire in the air - shut off fuel, carry out an emergency landing as soon as possible**

D.22 Flying from the Rear Cockpit – Dual Controls

Controls for the throttle, rudder, elevator and ailerons are duplicated in the rear cockpit for series D-D aircraft. There is no flap select lever or Fuel Cut-Off facility in the rear cockpit. Brakes and ignition switches are optional and available for this position.

The only instrument that is repeated is the Air Speed Indicator – this is certified to a 2% error of the ASI in the front cockpit. Forward vision from the rear cockpit is somewhat restricted, but is excellent to the sides. Practice will be required to get used to the slightly different attitude from the rear cockpit, but in all other aspects the handling of the aircraft remains unaltered.

Instructing from the rear cockpit –if not equipped with the relevant controls in the rear cockpit it is essential to ensure that the front pilot has the ability to ground handle the aircraft with the use of the differential brakes, can use the flap lever correctly and is capable of operating both the ignition switches and the emergency Fuel Cut-Off valve.

AIRCRAFT MUST NEVER BE FLOWN SOLO FROM THE REAR SEAT!!

Annex E - Rigging And De-Rigging

E.1 Description

The aircraft can be rigged and de-rigged by two persons.

Detachable items are as follows:-

- **Rudder/Fin post unit**
- **Elevator**
- **Port + starboard Tailplane halves**
- **Port + starboard Wing panels**

NOTE - The main cockpit / boom structure will assume a tail-down posture before and after rigging when the front cockpit is unloaded. Failure to be very careful when the aircraft is in this nose-high attitude will result in damage.

E.2 Rigging

1. Assemble aircraft on level ground
2. Insert rudder fin post up into the rear of the boom. Align securing pin hole through boom with hole in rudder / fin post. Insert securing pin and safety clip, then add clevis pin to rudder horn with safety clip
3. Ensuring that port Tailplane is horizontal, gently push into the cut-out holes in the rear of the boom, until flush with the boom. Check that the end of the port Tailplane tubes have extended through to the holes in the starboard side. Hold in position and, ensuring that the starboard Tailplane half is horizontal, gently ease the starboard Tailplane half into the port half until flush against the boom. A very light lubrication of the tubes may be used if considered necessary. A visual check for the alignment of the holes should be made by looking through the two holes at the top of the boom.

IMPORTANT: Do not use force when rigging the Tailplane.

The use of force could result in damage to the boom, the backing plates or the tailplane. When satisfied that the holes are aligned, insert both forward and rear securing pins from the upper surface and secure with safety clips.

4. Attach elevator with four clevis pins and fit safety clips. Connect Teleflex operating jaw to elevator horn with clevis pin and safety clip. Connect electric lead / plug for trimmer.
5. With the wings supported by a person at each end, engage flap torque tube into wing rib. Push wing into position and insert the two main wing pins. Connect wing strut with bolt, nut and safety clip.

NOTE: Keep this wing supported whilst fitting other wing

6. When both wings have been fitted, insert the safety clips in wing pins. Connect aileron push / pull tubes with clevis pins and safety clips. Secure zip fasteners on underside of wing panel. Connect Jury Struts on each wing with clevis pins and safety clips.

CHECK

Securing devices in all places with safety clips on the following items:-

- 4 x Main wing strut pins, plus safety clips
- 2 x Wing strut bolts and nuts, plus safety clips
- 2 x Aileron connect pins, plus safety clips
- 2 x Flap connect pins, plus safety clips
- 2 x Tailplane connect pins, plus safety clips
- 4 x Elevator pins, plus safety clips
- 1 x Rudder / Fin post pin, plus safety clip
- 1 x Elevator horn clevis pin, plus safety clip
- 1 x Rudder horn clevis pin, plus safety clip
- 2 x Jury strut clevis pins, plus safety clips

E.3 De-Rigging

A special slide hammer is required to de-rig (supplied with the aircraft tools)

Wings

- Remove clevis pins and safety clips from aileron push / pull tubes and flap connect rods.
- Remove wing strut safety clips, nuts and bolts.
- Remove jury strut safety clips and clevis pins.

NOTE: The wing is cantilever type and can support its own weight without the struts being connected when being de-rigged, but it is better to support it whenever possible.

- Insert slide hammer from top of wing and engage by rotating its shaft for two turns.
- Support both wing tips and apply gentle pressure upwards
- Use slide hammer only to remove wing pins from above
- Remove wing and repeat procedure for the other wing

TAILPLANE

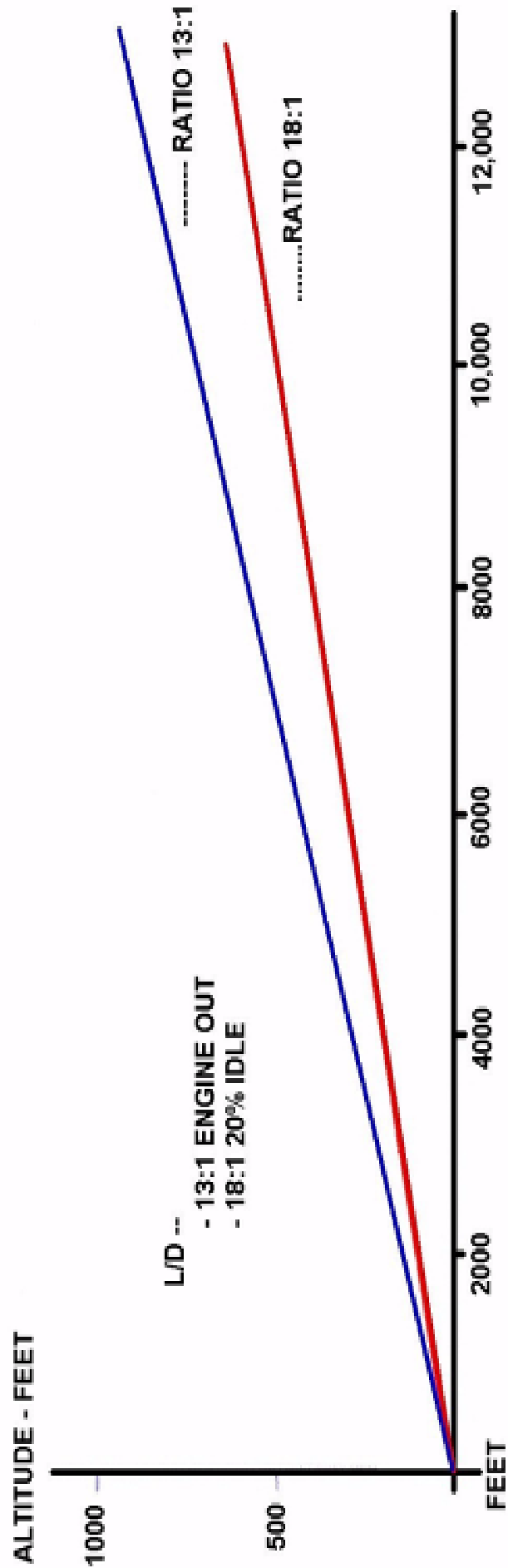
- Remove safety clips and securing pins from boom, elevator and Teleflex elevator horn. Separate tailplane halves.

RUDDER FIN POST

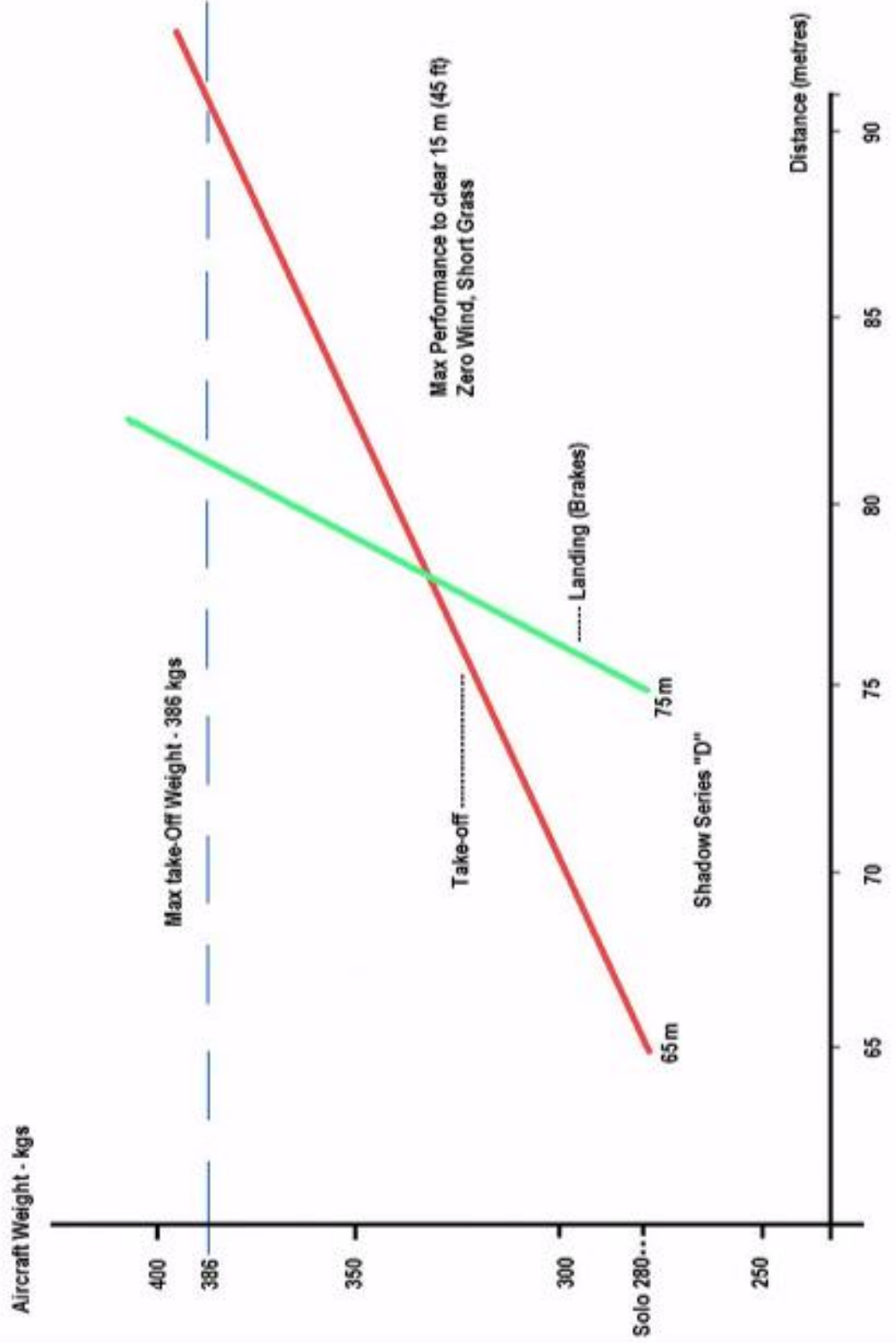
- Remove safety pin and securing pin. Separate from boom.

<p>NOTE: It is recommended that all safety, securing and clevis pins are placed back into their assembled position to avoid loss.</p>
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6.1 HEIGHT LOST AGAINST DISTANCE COVERED



6.2 TAKE-OFF AND LANDING PERFORMANCE



Annex H - Electric Trim Tab (optional)

H.1 Introduction

An adjustable elevator trim tab, operated electrically, is provided for the aircraft. The system provides a servo motor situated in the elevator with a console or control stick mounted “rocker” switch and tell tale position lights to indicate trim setting.

The trim rocker switch is mounted in front of the throttle on some Shadow aircraft, and on the control stick on the D-D series. Forward pressure will raise the trim tab and lower the nose. Aft pressure will lower the trim tab and raise the nose.

A trim position indicator is fitted on the dash panel. One version displays three lights positioned vertically, green when the trim tab is neutral and red when the trim tab is “full down” or “full up”.

Placards “Nose Down” and “Nose Up” are located next to the rocker switch and indicator lights.

The version fitted on D-D series aircraft has a dash mounted LED display showing a more accurate trim tab position.

The trim position is operated by the P1 pilot from the front cockpit only; however, series D-D aircraft have a changeover switch on the dash panel to enable operation from the rear cockpit control stick.

H.2 Operation

Pre Take-Off checks

Set the trim rocker / control stick switch (D-D) to neutral with the green light showing / indicating centre position (D-D)

Cruise

Adjust the trim rocker / control switch to suit “hands-off” stick loads

Landing

Set the trim rocker / control stick switch to indicate “Nose Up” whilst reducing airspeed to 55-60 kts.

NOTES

The neutral position of the trim tab is 5° down as located on the elevator (when set to neutral with the green light showing).

It should be noted that trim speeds are limited to **95 kts MAX** and **60 kts MIN**. Pilot inputs are required for airspeeds less or greater than these limits.

CENTRE OF GRAVITY ENVELOPE

NOTES

Forward Limit at 40.5" - Aft Limit at 46.1"

1/4 MAC at 41.4"

Stick fixed NP at 47.2"

TAKE-OFF WEIGHT IN POUNDS

TYPICAL CENTRE OF GRAVITY ENVELOPE

CFM SHADOW

D-SERIES

KEY

P1 = PILOT

P2 = PASSENGER (AFT COCKPIT)

F = FUEL

