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Pilots Notes

PILOT'S NOTES

THE SUNDERLAND I & II AEROPLANES

SUNDERLAND I-
FOUR PEGASUS 22, 29 OR 32 ENGINES
SUNDERLAND II-
FOUR PEGASUS XVIII ENGINES

Prepared by direction of the

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Promulgated by order of the Air Council.

AIR MINISTRY.

AIR PUBLICATION ..

Volume I

Pilot's Notes

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LIST OF SECTIONS

R.T.P./984 1,000 9/41

SECTION 2.

HANDLING AND FLYING NOTES FOR PILOT

SUNDERLAND I - PEGASUS 22, 29 or 32 ENGINES

1. (i) Fuel - 87 octane or higher.

Oil summer - Key letters X/Z.

winter - Key letters W/Z.

(ii) The principal engine limitations are as follows:-

	R.P.M.	Boost lb/sq.in	Temp. °C. Cylr.	Oil Inlet
Take-off 3 mins.limit	2,600	Full throttle (5½-6)		
Climbing ½ hr.limit	2,250	+2½	210	80
Cruising Normal	2,250	+2½	190	70
Cruising Weak	2,250	+½	190	70
Emergency 5 mins.limit	2,600	+2½	235	90

Note.- On modified engines (marked 22F, 29F 32F) the permissible oil inlet temperatures are increased by 10°.

Oil pressure lb/sq.in.

Normal 80 Emergency Minm. (5 mins) 65

Oil temperature for take-off

°C minimum 5

(iii) The following limitations must also be observed:-

At take-off boost:	Minimum r.p.m.	2,140
Diving:	Maximum boost	+2½ lb/sq.in.
	Maximum r.p.m.	2,925
	2,600 r.p.m. may be exceeded only for 20 seconds, with throttle at least one-third open.	

(iv) Mixture control:-

(a) Manual. The following are the permissible positions.

Take-off	RICH only
Boost above + 2 lb/sq.in.	NORMAL only
Boost between +1 and + 2 lb/sq.in.	From NORMAL up to halfway towards the position at which r.p.m. begin to drop.
Boost between + ½ and + 1 lb/sq.in.	From NORMAL up to the position at which r.p.m. begin to drop.
Boost below + ½ lb/sq.in.	From NORMAL up to the position at which r.p.m. have fallen by 60

(b) Automatic. The control has two positions only, AUTOMATIC RICH and AUTOMATIC WEAK. The latter may only be used when the boost is below + ½ lb/sq.in.

(v) Fuel pressure.- 2½ lb/sq.in.

SUNDERLAND II - PEGASUS XVIII ENGINES.

2. (i) Fuel.- 100 octane only

Oil.- summer.- Key letter X/Z

winter.- Key letter W/Z

(ii) The principal engine limitations are as follows:-

	R.P.M.	Boost lb/sq.in.	Temp. °C. Cylr.	Oil Inlet
Take-off 3 mins. limit	2,600	full throttle (6 - 6¾)		
Climbing ½ hr. limit	2,250	+ 2½	210	80
Cruising Rich	2,250	+ 2½	190	70
Cruising Weak	2,250	zero	190	70
Emergency 5 mins. limit	2,600	+ 6¾	235	90

Note.- On modified engines (marked XVIII F) the permissible oil inlet temperatures are increased by 10°.

OIL PRESSURE LB/SQ.IN.

NORMAL 80 EMERGENCY MINM (5 MINS) 70

OIL TEMPERATURE FOR TAKE-OFF

°C MINIMUM 5.

(iii) The following limitations must also be observed:-

At + 6¾ lb/sq.in. boost: Minimum r.p.m. 2,400

Diving: Maximum boost + 6¾ lb/sq.in.
Maximum r.p.m. 2,825
2,600 r.p.m. may be exceeded for 20 seconds only, with the throttle at least one third open.

(iv) The mixture control has two positions only, AUTOMATIC RICH and AUTOMATIC WEAK.

(v) Fuel pressure.- 2½ lb/sq.in.

CORRECTIONS FOR POSITION ERROR.

3. The corrections for position error are as follows, provided that modification No.505 has been incorporated. This may be checked by observing whether the corrections given below agree with those given on a label in the cockpit.

I.A.S. knots	Correction
80	No correction
110	Subtract 2 knots
130	Subtract 4 knots
160	

Throughout the following notes, handling speeds are given for the old position error. The corresponding figures for the new position error, applying to modified aeroplanes, are given in brackets.

FLYING LIMITATIONS.

4. Maximum speeds:-

Flaps in	210 knots	I.A.S.(200)
Flaps one quarter out	130 knots	I.A.S.(115)
Flaps half out	125 knots	I.A.S.(110)
Flaps three quarters out	120 knots	I.A.S.(105)
Flaps fully out	115 knots	I.A.S.(100)

PRELIMINARIES.

5. (i) See that all flying control locking devices are removed and properly stowed.

(ii) Prime the throttle, airscrew and mixture controls and check by feel that these controls are definite in action.

(iii) Check that the engine maintenance doors are closed and fastened.

STARTING THE ENGINES AND WARMING UP.

6. The outboard engines should be started first and, if necessary, the mooring slipped before the inboard engines are started.

(i) Turn pilot's fuel cocks to ON

(ii) Instruct engineer to turn fuel cocks for all tanks to ON.

(iii) Instruct engineer to open gills fully.

(iv) Instruct engineer to set carburettor air-intake controls in COLD position.

(v) Set airscrew controls to correspond with airscrew positions. If airscrews have stopped in coarse pitch, set controls fully down; if airscrews are in fine pitch set controls fully up.

(vi) (a) Manual mixture control.- Set to NORMAL

(b) Automatic mixture control.- Set to AUTOMATIC RICH.

(vii) Set the throttle levers about 1 in. open on the quadrant.

(viii) Instruct engineer to prime the carburettor of each engine.

For each engine in turn

(ix) Switch ON ignition.

(x) Instruct engineer to switch ON the starting magneto.

(xi) Instruct engineer to prime each engine. A sudden increase in resistance should be felt when the suction and delivery pipes and the pump are filled. When this resistance is felt, a further 3 or 4 strokes in summer, or 6 in winter, should be given. If the sudden increase in resistance is not felt, the total number of strokes should be about 10 for inboard and 15 for outboard engines, in summer, or 15 for inboard and 20 for outboard engines in winter. The above figures are for a cold engine; the priming required by a hot engine is much less.

(xii) Press the starter button for each engine in turn. Turning periods should not exceed 10 seconds, with a 30 seconds wait between each.

(xiii) During prolonged turning check that the cockpit throttle lever remains in the starting position. At air temperatures below 0°C. it will probably be necessary to continue priming after the engine has fired.

(xiv) When the engine is firing steadily instruct the engineer to switch OFF the starting magneto, and screw down the priming pump.

(xv) If possible run the outboard engines slowly for at least two minutes before slipping the mooring.

(xvi) Before slipping the mooring, set airscrew controls of outboard engines to FINE (two pitch type) or fully forward (constant speed type). Set airscrew controls of inboard engines similarly, either before or after slipping.

TESTING ENGINES.

7. After warming up.-

(i) Check airscrews as follows:

(a) Two pitch. Set airscrew controls to COARSE. Open up to 1,800 r.p.m. and hold these r.p.m. until the pitch is fully coarse. Move airscrew controls from COARSE to FINE. The r.p.m. should rise considerably.

(b) Constant speed. Open up to about zero boost and move airscrew speed control back; the r.p.m. should fall. Set the control fully forward and the original r.p.m. should be restored.

(ii) Open up to as near rich mixture cruising boost as possible and test each magneto in turn. The drop should not exceed 100 r.p.m.

(iii) Open up to take-off throttle setting and check boost, r.p.m. and oil pressure.

TAXYING OUT.

8. (i) Whilst taxying manoeuvre on the outboard engines only as a general rule.

(ii) After taxying, clear the engines by running them in turn to as near zero boost as possible.

(iii) Ensure that all doors and hatches are closed and secured.

(iv) Check from engineer that carburettor air-intake controls are in COLD position.

FINAL PREPARATIONS FOR TAKE-OFF: DRILL OF VITAL ACTIONS.

9.

T - Trimming tabs	-	Rudder neutral to 2½ divisions port. Elevator neutral with C.G. normal. 1 to 2 divisions nose heavy with C.G. aft.
M - Mixture	-	RICH (Manual control) or AUTOMATIC RICH.
P - Pitch	-	FINE (two pitch) Airscrew speed controls fully up (constant speed).

Fuel - Check contents and cock settings.

Flaps - One third out.

Gills - Half open (operated by engineer).

Crew - Warn crew (signalling horn).

TAKE-OFF.

10. (i) Hold the control column hard back and open up the outer engines gradually to full throttle. When the nose rises and spray is clear of the inner airscrews, open the inner engines to full throttle. Any tendency to swing may be checked by throttling back slightly on one outboard engine.

(ii) Take-off speed at 50,000 lb. is approximately 105 knots I.A.S. (91).

(iii) With two pitch airscrews, it will probably be necessary to close throttles slightly on leaving the water, in order not to exceed 2,600 r.p.m.

(iv) Flaps should be retracted before reaching 125 knots I.A.S. (110).

(v) With two-pitch airscrews, change to COARSE at a height of 200 - 300 feet.

(vi) With manual mixture control, set to NORMAL when reducing to climbing boost and r.p.m.

CLIMBING.

11. The speed for maximum rate of climb at 50,000 lb. is 125 knots I.A.S. (110) up to 6,000 feet. Above this height reduce speed by one knot per thousand feet.

ECONOMICAL CRUISING.

12. (i) Speeds for greatest range:-

At 40,000 lb: 120 knots I.A.S. (105).
At 56,000 lb: 140 knots I.A.S. (125).

(ii) (a) Manual mixture control.- The mixture should be weakened, but the weakening should be kept well within the limits of para 1 (iv) and it should be checked that cylinder temperatures do not rise by more than 5°C as the result of weakening.

(b) Automatic mixture control.- Set to AUTOMATIC WEAK.

(iii) The greatest endurance will be obtained at the lowest practicable speed.

GENERAL FLYING.

13. (i) Change of trim.- The change of trim on operating the flaps is slight.

(ii) Turns.- Gentle turns may be made without the use of the rudder; the rudder control is somewhat heavy.

(iii) Gliding.- During a glide the engineer should be instructed to close the engine cowling gills and to watch the cylinder temperatures. If the temperature falls below 100°C. the engine should be opened up for a short period. The carburettor air-intake heat controls must be in the HOT position if the engines show signs of becoming unduly cold or if there is the least possibility of ice formation.

STALLING.

14. The stalling speeds are as follows, in knots I.A.S.

Weight	44,000 lb	50,000 lb	56,000 lb
Flaps in	94 (80)	100 (86)	106 (92)
Flaps fully out	82 (63)	87 (69)	92 (74)

APPROACHING AND ALIGHTING.

15. Until the pilot is thoroughly used to the aeroplane the approach should be made on a straight glide. If desired the flaps may be set one third out at an early stage, provided the speed is below 125 knots I.A.S. (110). The approach may be engine assisted to reduce the gliding angle. The engines should first be throttled back and then the inboard engines opened up as necessary.

(i) Preliminary approach.- Prime the throttle, airscrew (if constant speed) and mixture controls, and test switches. Throttle right back and reduce speed to 120 knots I.A.S. (105) and ensure from engineer that gills are closed.

(ii) Drill of Vital Actions.-

M - Mixture - RICH (manual control) or AUTOMATIC RICH.

P - Pitch - FINE (two pitch) or Airscrew speed controls fully up (constant speed).

Flaps - Two thirds out.

(iii) Final approach and alighting.- At 45,000 lb. the gliding speed should be about 110 knots I.A.S. (95) and the touch-down made at about 85 knots I.A.S. (67). The touch-down should be made with the tail slightly down. After the aeroplane has touched down, throttles should be closed. If the nose rises too high when coming off the step, the outer engines should be used; the inner engines should not be opened up on account of possible damage by spray to the airscrews.

Note.- For normal alighting, it is recommended that flaps be set two thirds out and not moved. When space is restricted and the pilot is thoroughly used to the aeroplane, the flaps may be set fully out on the final approach, after it is certain that the landing will not be baulked.

MISLANDING.

16. Should it be necessary to make a second circuit after the flaps have been set out, the engines should be opened up to full power before speed is lost. The flaps should not be retracted below a height of 200 - 300 ft.

AFTER ALIGHTING.

17. (i) Set mixture control (if manual) to NORMAL.

(ii) Instruct engineer to open cowling gills.

(iii) Flaps can be used fully out to stop the way of the aeroplane. Retract the flaps when moored.

(iv) The airscrews should preferably be left in coarse pitch, especially if maintenance work is to be done before the engines are to be started again. But unless mooring conditions are easy, setting the airscrews in coarse pitch may cause manoeuvring difficulties. If conditions permit, the airscrew controls should be set fully down and engines opened up sufficiently to change pitch to coarse before stopping.

(v) The inboard engines may be stopped before mooring.

(vi) To stop engines, close throttles and pull out the slow running cut-off controls. Unless mooring conditions make it necessary, the ignition should not be switched off until the engines have stopped. After stopping, return the slow running cut-off controls.

FAILURE OF ENGINES.

18. (i) It is easy to fly straight and maintain height in this aeroplane with one engine stopped. It is just possible to maintain height with two engines stopped when flying at very light load.

(ii) If constant speed airscrews are fitted, the airscrew speed control for the dead engine should be set to the positive coarse pitch position. Two pitch airscrews should be left in coarse pitch.

FUEL CONSUMPTION.

19. The approximate consumption <u>per engine</u> in gallons per hour at 2,000 feet are:-

	Sunderland I	Sunderland II
(i) At maximum cruising, mixture NORMAL or AUTOMATIC RICH	68	61
(ii) At maximum cruising, mixture weakened or AUTOMATIC WEAK	41	40
(iii) Most economical cruising (see para.12)	about 30	about 30