2nd Edition

A.P. 2219-A P.N.

PILOT'S NOTES

FOR

HAMILCAR I GLIDER

WITH APPENDICES FOR TUG AIRCRAFT PILOTS

PROMULGATED BY ORDER OF THE AIR COUNCIL

RESTRICTED

(FOR OFFICIAL USE ONLY)

NOTES TO USERS

This publication is divided into three parts: Descriptive, Handling, and Notes for tug aircraft pilots (with appendices for individual tug aircraft). Part I gives only a brief description of the controls with which the pilot should be acquainted.

These Notes are complementary to A.P.2095 Pilot's Notes General and assume a thorough knowledge of its contents. All pilots should be in possession of a copy of A.P.2095 (see A.M.O. A95/43).

Words in capital letters indicate the actual markings on the controls concerned.

Amendments to this publication will be issued as necessary and incorporation must be certified on the Certificate on the inside of the back cover.

Additional copies may be obtained from A.P.F.S., Fulham Road, S.W.3, by application on R.A.F. Form 294A, in duplicate, quoting the number of this publication in full - 2219A-P.N.

Comments and suggestions should be forwarded through the usual channels to the Air Ministry (D.T.F.)

January 1944
AIR MINISTRY

HAMILCAR GLIDER
PART I
CONTROLS & EQUIPMENT FOR PILOTS

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RTP/2180. 1000. 1/44

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With Appendices for Tug Aircraft

PART I

CONTROLS AND EQUIPMENT FOR PILOTS.

INTRODUCTORY

1. Note:- This section deals with the location of the controls and equipment with which the pilots are concerned and, where necessary, describes their function and method of operation.

The cockpit accommodates two pilots seated in tandem. Flying controls and flying instruments are provided for both pilots. Two types of undercarriages are used, one jettisonable type for operational duty and one non-jettisonable for ferrying duty. Skids are provided for landing when the undercarriage has been jettisoned, and a non-retractable and non-jettisonable, fully castoring tail wheel complete with shock absorber strut, is fitted.

SERVICES

2. Pneumatic system.- There is a high-pressure cylinder (1,800 lbs/sq.in.) which supplies through a reducing valve-

(i) A 200 lb/sq.in. storage cylinder for operation of the flaps and airbrakes.

(ii) A second 200 lb/sq.in. storage cylinder for the wheel brakes which are operated at 80 lb/sq.in. through a second reducing valve incorporated in the differential control valve unit. Gauges are on the front pilot's instrument panel.

3. Electrical system.- A 24-volt battery supplies current for all lights. Separate batteries supply the telephone intercommunication system and the TR9k set.

FLYING CONTROLS AND INSTRUMENTS

4. Primary controls.- The primary controls are conventional consisting of a control column (15) with aileron wheels (16) for each pilot, and rudder control pedals, (14) adjustable for reach to any one of seven positions, on the ground only.

5. Primary controls locking gear (See fig.2.)
There is a framework (43) for locking the primary controls attached by a lanyard to a bar (44) for locking the flap actuating mechanism situated below the hatch cover (53) aft of the cockpit fairing. The flaps controls must not be operated until the flap locking bar has been removed. In flight the gear is stowed in the cabin on the starboard side aft of the ladder.

6. Trim tab controls.-

(i) The elevator tabs are controlled by knurled wheels (3) mounted on the trim tab boxes to port aft of the tow release control units. Each control works in the natural plane and sense, and there is an indicator (6) at the outboard edge of the box. The pointer moves forward to NOSE DOWN and back to NOSE UP.

(ii) The aileron tab controls are knurled wheels (7) mounted at approximately 45° with integral indicators (8) which operate in the natural plane and sense.

(iii) The rudder tab controls are knurled wheels (4) mounted horizontally, these also operate in the natural plane and sense, and incorporate indicators (5).

7. Flap controls.- The flaps are pneumatically operated and controlled by either of the levers (12) which are mounted on the port side in quadrant mountings with the airbrake control levers (13) inboard of them (when fitted).
Flap position is indicated by a scale (11) mounted on the quadrant frame.

8. Airbrake control.- The airbrakes are pneumatically operated and, when fitted, are controlled by levers (13). Airbrake position is indicated by a scale combined with the flap indicator scale (11).

9. Wheel brakes controls.- The brakes for operational and ferrying undercarriages are controlled by a thumb lever (20) mounted centrally on the front control wheel only. It is depressed to apply the brakes and there is a pin which is screwed home to engage with a hole in the lever, so retaining it in the "on" position for parking. Differential brake control is effected by means of the rudder pedals.

10. Undercarriage jettison control.- The jettisonable undercarriage is released by pulling either of the levers (36) mounted, one in each cockpit, on the starboard side.

10A. Undercarriage automatic release.-

(i) When this device is fitted the glider can be "flown off" the undercarriage which is released automatically when the wheels are about 2 to 3 feet clear of the ground.

(ii) A long trigger arm, outside the fuselage on the starboard side, trails along the ground and as the glider lifts this is free to swing forward under spring action. As soon as the arm clears the ground, it snaps up into a retaining catch and, as it passes through the vertical position, a cam mechanism is tripped allowing a spring loaded cable to operate the undercarriage release gear. The undercarriage is thus released, drops clear and runs along the runway being steered to one side, and finally brought to rest, by drag chutes and grapnels attached to the axle beam.

(iii) A panel on the starboard side, labelled U/C AUTOMATIC RELEASE, carries a white indicator light with a switch below it. When switched ON the light appears and goes out automatically as the undercarriage drops clear.

11. Tow release controls.- These are self-contained units mounted on the port side of the cockpit. Either of the horizontal triggers with round knobs (9) is pulled toward the pilot to release the tow cable. If this trigger release fails to operate, the emergency lever (10) is pulled back.

12. Flying Instruments.-

(i) Both instrument panels (17) and (29) carry the following:-
Air speed indicator (21) Altimeter (19) Artificial horizon (23) Direction indicator (25), Turn and bank indicator (26) and clock (18). A compass (33) and its compass card (34), and card (32) for the direction indicator are mounted on the starboard side ((33) and (34) are on the port side in the rear cockpit).

(ii) Air pressure gauges are mounted on the front pilot's instrument panel (29) only, as follows:- Pressure gauge: 0-2000 lb/sq.in. (27) for the high pressure cylinder, a pressure gauge: 0-250 lb/sq.in. (28) for the low pressure supply, and a triple pressure gauge (31) showing pressure in the brake storage cylinder, and in each wheel brake operating cylinder, when the brakes are applied. A small

instruction plate (22) is fitted on the front instrument panel below the flying limitations plate.

SEATS, ACCESS AND EQUIPMENT

13. Access.- (see fig.3) The pilots enter the glider through a door (52) in the cabin on the port side. A fixed ladder (51) leads by way of hatch (50) in the top of the cabin to walkways (49) along each side of the cockpit hood. The front pilot enters the cockpit through a hinged door (47) on the port side, and the rear pilot through a similar door (48) on the starboard side of the hood. The walkways are steep and care is advised, particularly when wet.

Note:- The nose of the fuselage swings open to permit entry of the vehicles.

14. Seats.- The pilots' seats (1) are adjustable fore and aft to either of two positions on the ground only, by removing two locking bolts (41) each side of the seat frame and re-setting as required. A rail (2) for attaching Sutton harness is fitted at the back of each seat and small release control levers (37), one for each pilot, are fitted on the starboard side of the cockpit; they are pushed down to release. Seat cushions are provided for use when parachutes are not carried.

15. Thermos flasks.- Two flasks (40) are mounted in clips on the starboard side of the cockpit.

16. Torches.- Two torches (39), are mounted in clips on the port side of the cockpit.

17. Map cases.- Two map cases (38) are mounted on the starboard side of the cockpit.

18. Sanitary bottles.- Two bottles (35) are mounted on the starboard side of the cockpit.

INTERCOMMUNICATION RADIO, LIGHTING, & SIGNALLING

19. Intercommunication.- For operational duties a cable telephone intercommunication system enables the glider pilots to communicate with each other, with the tug pilot, and with the vehicle crew. An amplifier having an integral ON-OFF switch is fitted in the cabin on the starboard side near the ladder, and a call light system, with push-button switches (D), mounted on the starboard side for each pilot, is provided. Head set plug-in sockets (F) for each pilot are fitted on the starboard side.

20. Radio.- For training duties only, a TR9k installation with independent batteries is fitted in the fairing behind the second pilot's head. This installation is independent of the telephone intercommunication and is intended primarily for Glider/Ground communication but can also be used for Glider/Tug intercommunication. The controls are as follows:-

(i) A radio control panel (E) on the starboard side of the first pilot's seat carrying:-

(a) T.R.9k - ON-OFF switch, and Volume control.

(b) Change-over switch for connecting the first pilot's head set to either the telephone intercommunication system or to the TR9k circuit as required.

(ii) A second head set plug-in socket (F) by the second pilot's seat to enable him to plug in on the TR9k circuit (he has no change-over switch).

(iii) TR9k press-to-transmit pushbuttons (G) on both first and second pilots control wheels (The second pilot has no other control over the TR9k installation).

Note: As the TR9k and telephone intercommunication systems are independent; the first pilot can use one while the second pilot uses the other.

21. Lighting

(i) A 24 volt supply (two 12 volt batteries in series, in the main cabin) provides current for all lights. A distribution panel (A) is mounted on the starboard side of the rear cockpit; this panel carries fuses for all circuits, excepting the cabin lights, as well as switches for the following:-

(a) Navigation and identification lights; controlled from a Mk. III identification switch box.

(b) Resin lights; controlled by an on-off switch.

(ii) Landing lamp
A switch (B) for this is fitted on the port side of each cockpit.

(iii) Two independently wired panel flood lights (C) are fitted on the port and starboard side of each cockpit, with on-off dimmer switches.

22. Signal discharger
A Mk. III (on some early gliders a Mk. II) discharger is fitted. The Mk. III selector handle, firing trigger and cartridge indicator, are on a panel (42) on the port side of the front cockpit. When the Mk. II discharger is fitted the corresponding controls are on the front tow release unit, but no indicator is incorporated.

EMERGENCY EXITS

23. Pilot's exits.-(See fig.3) The access doors (47) and (48) in the cockpit hood can be used as parachute or crash exits. These doors are secured by spring catches (46) and can be jettisoned by pulling back the handles (45) which withdrew the hinge pins.

24. Exits for the crew.- (See fig.3) Both the main access doors (52) on the port side and the hatch (50) in the main cabin roof can be used as emergency exits.

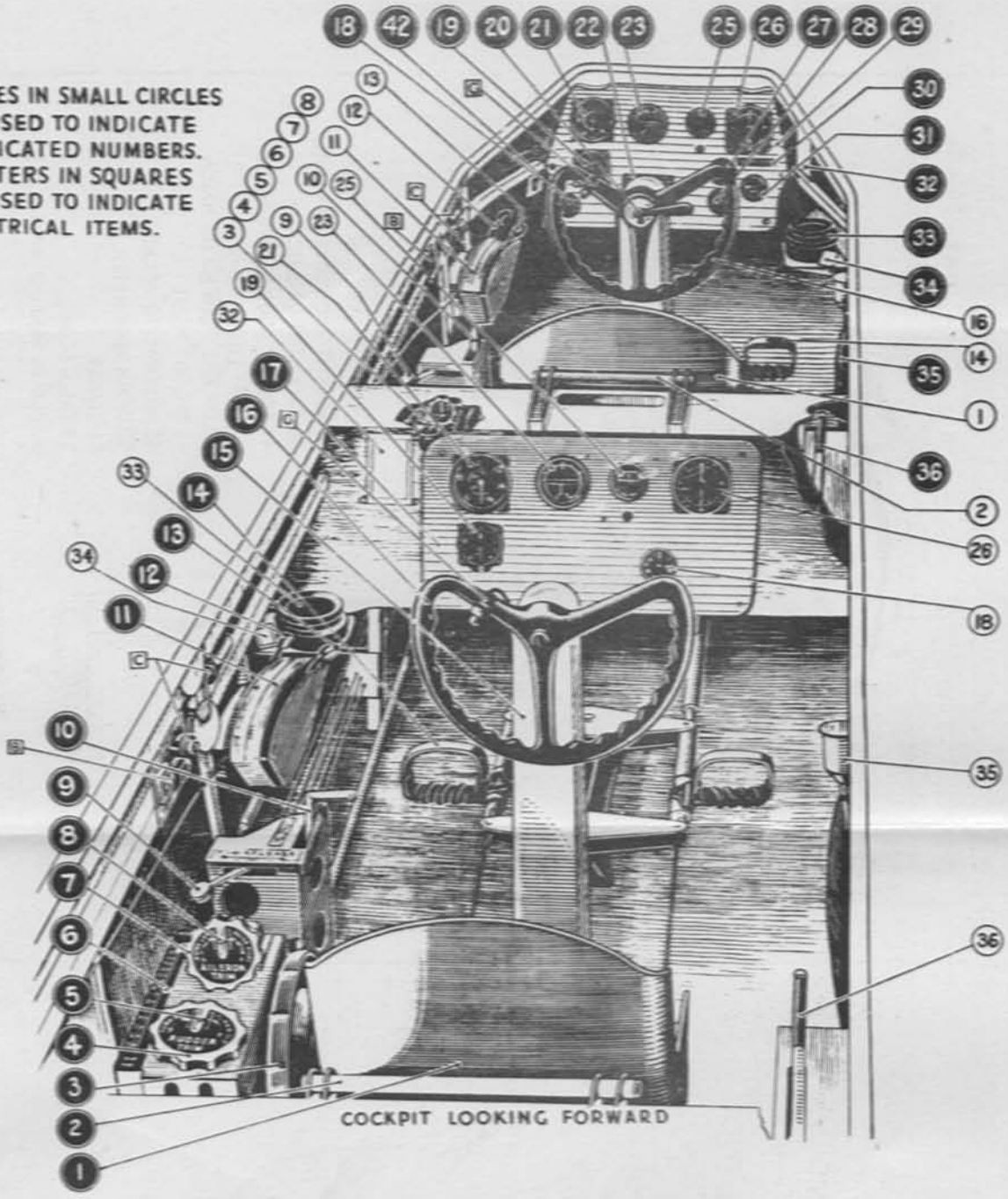
1. Pilots' seats
2. Sutton harness rails
3. Elevator tab controls
4. Rudder tab controls
5. Rudder tab indicators
6. Elevator tab indicators
7. Aileron tab controls
8. Aileron tab indicators
9. Tow release levers
10. Emergency tow release levers
11. Flaps and airbrakes indicator scales
12. Flap control levers
13. Airbrake control levers
14 Rudder pedals
15. Control columns
16. Aileron control wheels
17. Rear instrument panel
18. Clocks
19. Altimeters
20. Brakes control lever
21. Air speed indicators
22. Label (Air pressure system)
23. Artificial horizons
24. Deleted
25. Direction indicators
26. Turn and bank indicators
27. Low pressure gauge
28. High pressure gauge
29. Front instrument panel
30. Label (brake pressure)
31. Triple pressure gauge.
32. Direction indicator card holder
33. Compasses
34. Compass card holder
35. Sanitary bottles
36. Undercarriage release levers
37. Sutton harness release catches
38. Map cases
39. Torches (Port side of fuselage)
40. Thermos flasks
41. Seats adjustment bolts
42. Signal discharger

A. Distribution panel
B. Landing light switch
C. Cockpit floodlight and switch
D. Call light
E. Radio control panel
F. Plug-in socket
G. Push-button for transmitting

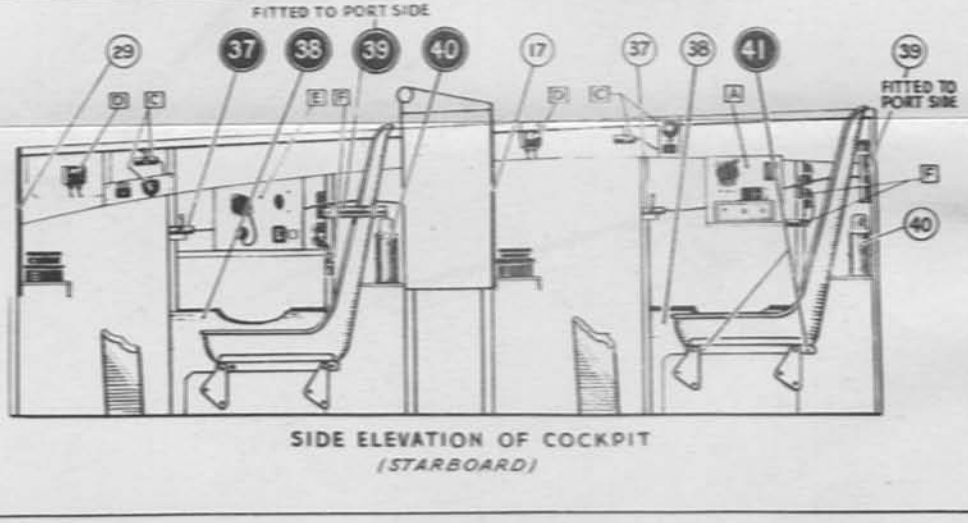
KEY TO FIG.1

FIG 1

FIGURES IN SMALL CIRCLES ARE USED TO INDICATE DUPLICATED NUMBERS.
LETTERS IN SQUARES ARE USED TO INDICATE ELECTRICAL ITEMS.



COCKPIT LOOKING FORWARD



SIDE ELEVATION OF COCKPIT
(STARBOARD)

FIG 1 CONTROLS & EQUIPMENT IN COCKPIT

ISSUE B

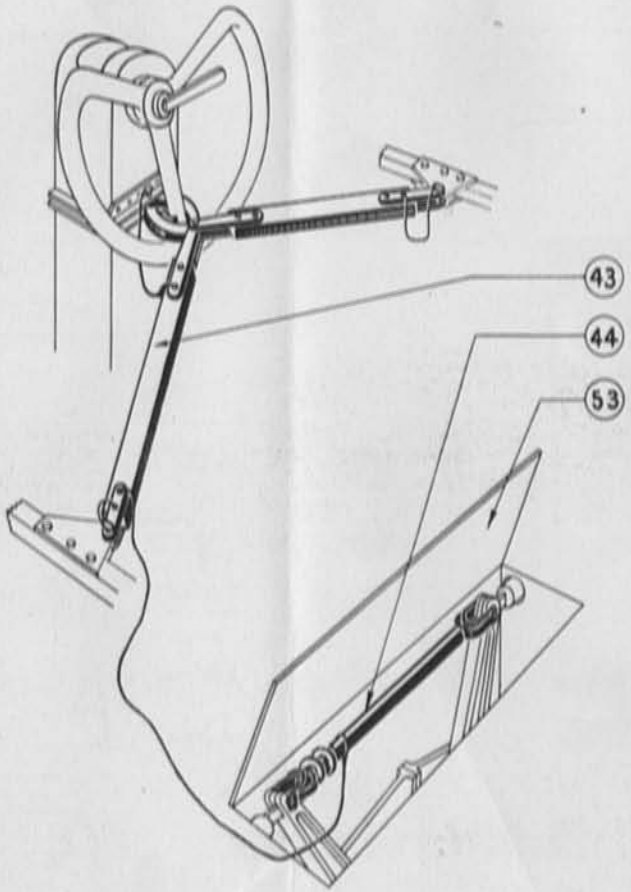
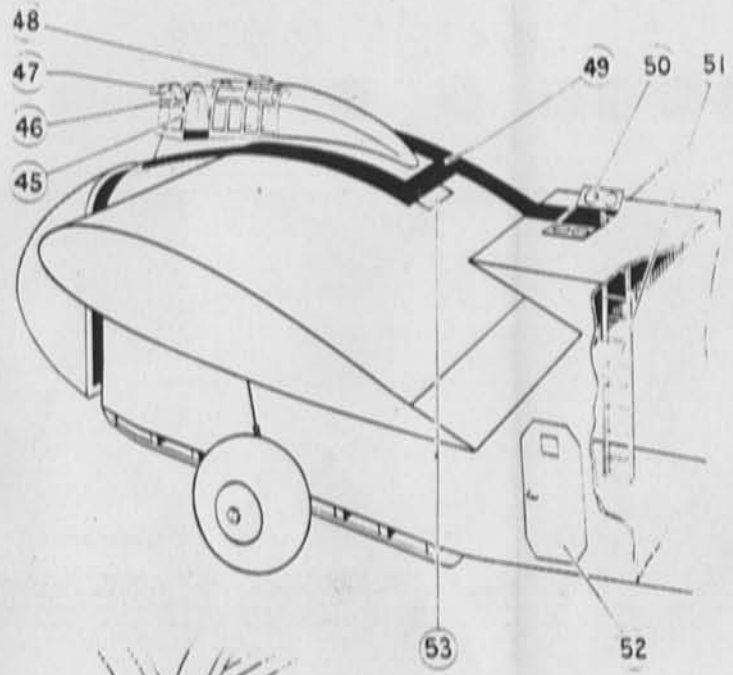
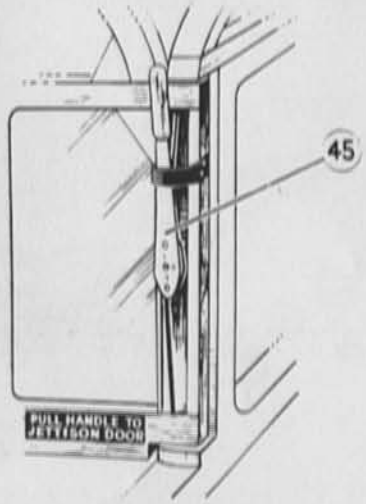


FIG 2 CONTROL LOCKING GEAR FIG 2





JETTISON LEVER
(COCKPIT DOOR ESCAPE HATCH)

45 COCKPIT DOOR JETTISON LEVER
46 COCKPIT DOOR CATCH
47. COCKPIT DOOR ESCAPE HATCH FIRST PILOT
48 COCKPIT DOOR ESCAPE HATCH SECOND PILOT
49. WALKWAY TO COCKPIT
50. CABIN ROOF HATCH
51. LADDER
52. CABIN DOOR
53. ACCESS PANEL (FLAP LEVERS)

FIG 3 EMERGENCY EXITS FIG 3

PART II

HANDLING AND FLYING NOTES FOR PILOTS

1. INTRODUCTION

(i) These notes are for the guidance of pilots flying Hamilcar combinations. Tug aircraft pilots should also refer to Part III as well as to the appropriate appendix covering the tug aircraft to be used.

(ii) The method of signalling (intercom or visual) to be used between the glider and tug pilots, both on the ground and in the air, should be agreed and the code of visual signals to be used in emergency (or if intercom is not to be used) should be in accordance with the code as laid down by the Command concerned.

Note: It is of vital importance that glider and tug pilots shall agree and understand the code of signals to be used - THE TUG PILOT is CAPTAIN of the COMBINATION.

(iii) The direction in which the glider and tug should turn after casting off should be in accordance with procedure laid down by the Command concerned and should be agreed between the pilots.

2. FLYING LIMITATIONS

(i) The maximum permissible weight is 36,000 lb. Weight limitations applying to specific combinations are given in the appropriate tug aircraft appendix.

(ii) Maximum permissible speeds in m.p.h. I.A.S. are;-

Towing	150	(147 R.A.S.)
Diving	190	
Flaps half down	120	
Flaps fully down	100	
Air brakes open	150	

Note: (i) All limitations and handling speeds quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue of these notes or which may be imposed subsequently from time to time by Special Instructions.

(ii) The rectified airspeed (R.A.S.) given in brackets is for the use of tug pilots in converting to tug I.A.S.

3. POSITION ERROR CORRECTION

Flaps up

m.p.h. I.A.S.					
From	80	95	110	125	140
To	95	110	125	140	160
Add	4	2	0		
Subtract			0	2	4

4. PRELIMINARIES

Before entering the cockpit

(i) See that the vehicles and other load are properly secured. Report the all-up weight of the glider to the tug pilot.

(ii) See that the nose section door is closed and properly secured.

(iii) See that the intercommunication system is properly connected up to the vehicle.

(iv) See that the glider is directly behind the tug and on the same heading.

(v) See that the tail-wheel is straight and that the ground handling bar has been removed.

(vi) On the way to the cockpit check that the flaps locking bar has been removed.

NOTE: the flap control lever must never be operated until this has been removed.

On entering the cockpit

(vii) See that the flying controls locking gear has been removed.

(viii) See that both cockpit access doors are closed and secured and see that the emergency release levers are home and secured.

(ix) Test intercommunication with crew and check with crew that the access hatch in the roof as well as the main access doors have been secured from inside. With line intercom. the amplifyer switch must be ON at all times in flight.

(x) Test intercommunication with the tug.

(xi) See that the bridle is attached and that both tow release controls are fully home.

(xv) Test all flying controls for full and free movement.

(xvi) Unlock brake lever.

(xvii) If the undercarriage is to be jettisoned, check that the lever can be reached while wearing the Sutton harness.

(xviii) If the glider is to be "flown off" the undercarriage, switch IN the U/C AUTOMATIC RELEASE indicator and check - white light on.

5. PREPARATIONS FOR TAKE-OFF

(i) Check list before take-off

Flaps - UP) levers
Spoilers - OFF) forward
Air pressure - Main cylinder - minimum 1000 lb/sq.in.
Brake " - " 100 "
Trim
Ailerons - neutral
Rudder - neutral
Elevator - neutral to 1/2 division back NOSE UP

Note: The above settings are approximate, the best settings will be found to vary slightly with different gliders and may even vary on individual gliders as the structure weathers.

Altimeter - Zero
Brakes - Off

(ii) When ready for take-off:- Apply brakes and instruct tug pilot by intercom to:-

(a) "Take up slack"
(b) as cable goes taut - "Take off".

(iii) As soon as the cable takes the strain release the brakes.

NOTE: When the cable takes the strain the cable angle indicator cord may twist but, provided it does not foul the operating arm, this does not matter.

6. TAKE-OFF

(i) With a glider of the weight of the Hamilcar it is of great importance to keep straight and directly behind the tug; if necessary by careful use of the brakes to check swing.

(ii) At an I.A.S. of 80 m.p.h. or over, ease the glider off the ground and maintain position level with the top of the rudder of the tug until a height of 300 to 400 feet is reached.

(iii) If the glider is "flown off" the undercarriage, hold down until a speed of 85-95 mph IAS is reached. This speed depends on the loading and should be about 10 mph faster than the minimum take-off speed. At this speed ease the glider off in the normal manner and check - white light out.

If the white light fails to go out - if possible instruct crew to check visually through port holes. If the undercarriage has not gone, do not attempt to release it manually by means of the lever in the normal manner, until a safe height is reached. - See para. 8.
After undercarriage has dropped, switch indicator OFF.

(iv) If the Mk. II indicator is to be used, allowing three minutes after take-off for the gyro to erect, zero the pointer; this should be done with the tug flying straight and the glider central below the slip-stream (the instrument only functions in the low tow position).

Note. With the Mk. III indicator the switch to the left of the dial should be set to ON TOW and there is no necessity to zero the pointer.

7. CROSS WIND TAKE-OFF

(i) Any tendency for the glider to turn into wind while on the ground must be checked immediately, and if necessary continuously, by means of opposite brake. With the operational undercarriage crosswind take-offs are not recommended if the wind speed exceeds 10-12 m.p.h.

(ii) In cross winds or bumpy conditions the glider should delay take-off until a speed has been reached at which aileron control will be available to counteract drift (this will be found to be about 95 to 100 m.p.h. I.A.S.)

8. UNDERCARRIAGE JETTISON (See also para. 6(iii))

The operational undercarriage should not be jettisoned below 200 ft. to prevent damage to the glider should the undercarriage bounce after touching the ground. In training conditions the undercarriage should not be jettisoned unless authority has been given to do so by the parachute method, when it should be dropped from not less than 350 ft. With wind speeds in excess of 10 m.p.h. the undercarriage should not be jettisoned at all as it is liable to be damaged if it lands with considerable drift; practice drops over runways or hard surfaces should be avoided.

9. CLIMBING

Keep straight behind the tug and avoid getting too high above it lest trim difficulties are introduced for the tug.

10. BEST POSITION ON TOW

To obtain the maximum rate of climb and range it is of importance that on climb, once steady climbing conditions have been reached - as well as in level flight - the glider shall maintain the correct position in relation to the tug flight path. These positions are as follows:-

(i) High tow Position. Directly behind the tug and one half the wing-span of the tug above it (with experience this position may be gauged by observing the relationship between the tug tailplane and main-plane) it is not sufficient to keep just clear of the slipstream.

(b) The correct vertical position is such that the glider is just clear of the slipstream and can therefore be more precisely gauged.

(iii) NOTE

(a) In both high and low tow positions the glider should not be allowed to get more than one tug wing span above or below it, as otherwise cable drag becomes excessive.

(b) The charts - Figs.1 & 2 - show the relationship between the salient features of tug aircraft, as seen from the glider when flying in the BEST and LIMIT positions on both high and low tow. The true BEST and LIMIT positions will vary with tug loading and IAS, in particular in some conditions the LOW-BEST position as illustrated may be found to be on the edge of, or just within, the slipstream. The silhouettes, which are based on incidence angles at certain specific loadings and speeds, must therefore be taken as a general guide only. Pilots will find the most comfortable high and low tow positions by experience and, as it is tiring to maintain one position for long periods, some variation is permissible provided, generally, that the outline of the tug remains between the positions depicted by the silhouettes marked BEST and LIMIT. Reproductions of the individual tug silhouettes on cards to a larger scale are available on application to APPS, Fulham Rd., London, S.W.3, using RAF form 294A and quoting the following references.-

WHITLEY	Tow	Position	Card	No.2
HALIFAX	"	"	"	No.3
ALBEMARLE	"	"	"	No.4
WELLINGTON	"	"	"	No.5
LANCASTER	"	"	"	No.6
DAKOTA	"	"	"	No.7
STIRLING	"	"	"	No.8

Note: The chart and cards are common to <u>all</u> gliders but some of these tugs are not cleared for towing the Hamilcar.

11. LEVEL FLIGHT

(i) With the Hamilcar it is particularly important to keep straight behind the tug; as otherwise the unequal pull on the bridle arms will effect lateral stability. If, therefore, the glider appears to be out of trim laterally, check the rudder trim before moving the aileron trim from neutral.

(ii) Coarse use of the elevator trim control should be avoided as the tab is very powerful.

(iii) On turns keep slightly above and inside the tug; keep rudder central and once in the turn hold off bank. The glider is stable in turns.

12. CLOUD FLYING

If cloud is entered the glider pilot should release tow immediately unless a tow cable angle indicator is fitted and authority for blind flying has been given.

13. CASTING OFF

(i) The tug pilot as CAPTAIN of the combination will normally give the order to cast-off. The glider will normally warn the tug pilot before casting off so that he may be prepared for the resultant change of trim which may be considerable if the glider is high or low relative to the tug.

(ii) Cast off in level flight with the glider level with, or slightly above, the tug. Except in emergency do not cast off from below the tug.

(iii) After casting off, the tug and glider will turn as prescribed.

(iv) With military loads stowed, the compass deviation may be considerably affected. If it is necessary for the glider to fly on a compass course after casting off, the tug should fly steadily on the required course, and should give the compass reading to the glider pilot by intercom, before release. The glider pilot should note the corresponding reading on his own compass.

14. STALLING

(i) Stalling speeds in m.p.h. I.A.S. are about:-

Load	25,000 lb.	36,000 lb.
Flaps UP	53	64
Flaps Full Down	43	52

(ii) Characteristics of the stall. At a few mph above the stall a slight shake develops, there is a tendency for the starboard wing to drop but the stall is mild and recovery presents no difficulty.

15. APPROACH AND LANDING

(i) One method of approach which has been found satisfactory in "light airs" is given below as a guide;

(a) Glide in across wind at about 100 mph IAS on a path parellel to, and about 1000 yards down wind of, the leeward boundary of the landing ground.

(b) About 1½ miles from the line of the landing path, when the glider should be at 2000 ft, put the flaps ½ down and maintain speed at 100 mph IAS parallel to the leeward boundary.

(c) At 1000 ft, when the glider should be approaching a point above an extension of the line of the landing path, turn into wind and lower the flaps fully down.

(d) The nose of the glider should now be pointing directly at the desired touch-down point. Glide in at just under 100 mph IAS.

(ii) In winds of greater strength, and to correct under shooting or overshooting, the glide path may be controlled at 100 mph IAS by lowering and raising the flaps as necessary; no undue sink results when the flaps are raised from the full down to the 1/2 down position, but if raised further some temporary sink will occur.

(iii) With full flap at 80 mph IAS, a shake will be noticed, this is normal.

(iv) With full flap the glide path is very steep, especially in high wind, but there is ample elevator trimmer control to effect a satisfactory landing at all loads and permissible c.g. positions.

(v) Satisfactory approaches and landings are possible with flaps 1/2 down.

(vi) When landing with the ferry undercarriage start to flatten out at about 40 ft and make a normal 3-point landing.

(vii) Brakes should be used to check any tendency to swing.

(viii) If necessary, full brake may be used to stop.

(ix) When landing on skids start to flatten out early but allow the glider to get slightly closer to the ground before pulling the stick right back to complete the operation of a tail down landing, this makes it easier to touch down with as little vertical velocity as possible. It is better to touch before the tail is right down than to touch with any appreciable rate of descent. Hold the

stick right back, until the glider comes to rest, to counteract any tendency for the nose of the skid to dig in. The landing is comfortable, there is no tendency to swing, and the glider decelerates very rapidly coming to rest in about 200 yards.

(x) Landings on the operational undercarriage are not recommended; the wheels are not sprung and the violent bouncing which occurs, especially at high loadings, is extremely difficult to control.

16. AFTER LANDING

(i) See that all controls and surfaces are locked before towing in.

(ii) Park facing into wind with all controls and surfaces locked and the parking brake locked on.

(iii) Turn off all electrical switches and air bottles.

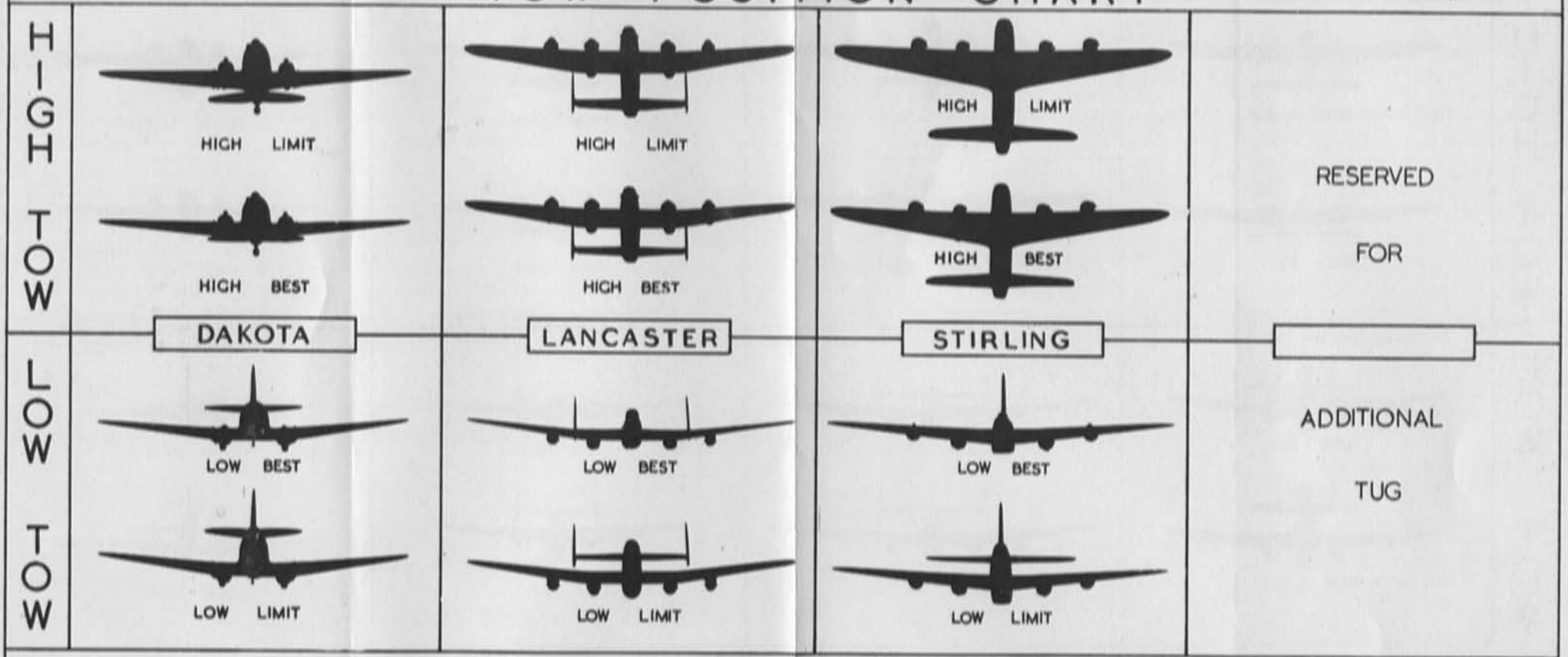
17. EMERGENCIES

(i) Although the tug pilot is CAPTAIN of the combination the glider pilot may, in emergency, cast off and take other action on his own initiative; he should, however, warn the tug pilot first if possible.

(ii) Abandoning tow before tug is airborne
The glider pilot should release tow, first if possible; should land (if airborne); apply his brakes and turn as necessary.

(iii) Engine failure on take-off after tug is airborne
If warned in time the glider pilot should release tow first and land straight ahead. He may make partial turns to avoid the tug or other obstacles but in no circumstances should he attempt to turn back to the airfield. Unless there is ample room for a normal landing the undercarriage should (if possible) be jettisoned.

A.P. 2219-A, P.N. — TOW POSITION CHART — P.N., PART II



1. When flying in the best positions on HIGH (or LOW) TOW, the tug aircraft should appear as shown in the silhouettes marked HIGH (or LOW) BEST.
2. The glider should not be allowed to get above (or below) the positions in which the tug aircraft appears as shown in the silhouettes marked HIGH (or LOW) LIMIT.

FIG. 2 FIG. 2

A.P. 2219-A, P.N.

TOW POSITION CHART

P.N., PART II

HIGH TOW

HIGH LIMIT

HIGH BEST

WHITLEY

LOW BEST

LOW LIMIT

LOW TOW

HIGH LIMIT

HIGH BEST

HALIFAX

LOW BEST

LOW LIMIT

HIGH LIMIT

HIGH BEST

ALBEMARLE

LOW BEST

LOW LIMIT

HIGH LIMIT

HIGH BEST

WELLINGTON

LOW BEST

LOW LIMIT

1. WHEN FLYING IN THE BEST POSITIONS ON HIGH (OR LOW) TOW, THE TUG AIRCRAFT SHOULD APPEAR AS SHOWN IN THE SILHOUETTES MARKED HIGH (OR LOW) BEST

2. THE GLIDER SHOULD NOT BE ALLOWED TO GET ABOVE (OR BELOW) THE POSITIONS IN WHICH THE TUG AIRCRAFT APPEARS AS SHOWN IN THE SILHOUETTES MARKED HIGH (OR LOW) LIMIT.

FIG. 1

FIG. 1

F.S./5

PART III

GENERAL NOTES FOR TUG AIRCRAFT PILOTS

All normal limitations and handling recommendations in Pilot's Notes for individual tug aircraft should be observed, as modified and added to, by the instructions contained in these notes, as well as in the appropriate appendix covering the particular Tug aircraft to be used. These appendices apply only to those Marks of the respective aircraft which have been formally released for towing the particular gliders.

1. GENERAL

(i) When towing a glider the general performance will not be as good as that of the tug in normal free flight. This calls for care on the part of the pilots, particularly during and after take-off, and on the initial climb. Care is also necessary to avoid overheating the engines.

(ii) The method of signalling and code of visual signals to be used in emergency (or if intercom is not fitted) must be agreed with the glider pilot. The TUG AIRCRAFT PILOT is at all times CAPTAIN of the COMBINATION but glider pilots may in emergency, or if cloud is entered, cast off and take other action on their own initiative; if possible, they should, however, warn the tug pilot first.

(iii) The direction in which glider and tug will turn after casting off should be agreed between the pilots.

2. LIMITATIONS

(i) Weight:- Combinations are cleared to fly at specified maximum weights; these are quoted in the appropriate tug appendices.

(ii) Speed:- Speed limitations are quoted in the appropriate appendices in terms of tug and glider ASI readings. Where, however, temporary speed restrictions are in force for the glider, the tug pilot shall ascertain the corresponding speed in terms of the tug aircraft ASI reading, as follows:-

Correct the glider limiting IAS for position error. This gives speed limitation in terms of rectified airspeed (RAS).

Apply to this RAS figure the appropriate tug position-error correction reversed, i.e. if the pec. is plus, subtract and vice versa.

(iii) Engine limitations:- Unless otherwise specified in the appropriate appendix the normal limitations for the type should be observed.

3. PRELIMINARIES

(i) The tug pilot as CAPTAIN of the combination should check that aircraft weights are in accordance with limitations and that the state of both aircraft, and distribution of loads, are in accordance with any special conditions specified in the combination release.

(ii) To avoid overheating during climbing, run the engines as little as possible on the ground. If, after reaching the take-off point, take-off is delayed, engines should be stopped. A ground battery should be at the take-off point for restarting.

(iii) Check position of glider.

(iv) Check that the rope is properly attached, test quick release, re-attach rope making sure that the hook is locked and that the release control is in the locked position. If the hook is attached to a towing yoke, check that this is unlocked.

(v) After agreeing the code of visual signals with the glider pilot or pilots, test the intercom. (if to be used) with glider with engines running. With line intercom. the switch must be set to MIX or held to LINE at all times with a glider in tow.

4. TAKE-OFF

NOTE: It is advisable to have a member of the crew available to operate the tow release if it becomes necessary to abandon tow during take-off. It is recommended that the same member of the crew be detailed for this duty on each take-off, as good co-operation is important.

(i) CHECK LIST - See appropriate Appendix.

(ii) Except in very cool weather, and when experience indicates that temperature limitations will not be exceeded on climb, do not take-off if the engine temperatures are in excess of any recommended in the appropriate appendix.

(iii) Clear engines before take-off.

(iv) When ready, the glider pilot will give the signal "Take up slack".

(v) The tug pilot will release his brakes and move slowly forward until increased resistance indicates slack has been taken up. The glider pilot will then signal "Take-off".

(vi) There must be no pause between taking up slack and commencing to take-off as any hesitation may cause a slack rope which the glider may overrun.

(vii) Any tendency to swing should be checked promptly before it is communicated to the glider. Ease the tug off the ground and raise undercarriage and flaps (if used) in accordance with recommendations in the appropriate appendix.

5. CLIMBING

(i) Climb steadily at the speed recommended in the appropriate appendix. If the recommended speed is below the safety speed of the aircraft the pilot should, in the event of engine failure before a safe height is reached, warn the glider pilot (if possible), release tow, shut throttles and make the best landing possible.

(ii) Use maximum climbing boost and rpm.

(iii) Oil cooler shutters (if not automatic) and gills (or radiator shutters, if not automatic) should be adjusted as necessary; gills should, however, not be open beyond the setting recommended in the appropriate appendix, as otherwise the drag is excessive.

(iv) (a) If oil and/or cylinder (or coolant) temperatures approach limitations increase IAS to the speed recommended in the appropriate appendix.

(b) If overheating is still experienced reduce rpm as recommended but maintain the same increased IAS unless any other speed is specifically recommended in the appropriate appendix.

NOTE: These measures will reduce rate of climb and ceiling.

6. CRUISING

(i) The combination may be flown at the highest speed which can be maintained using maximum cruising power provided that the maximum permitted towing speed is not exceeded.

(ii) The relevant appendices quote an IAS recommended for maximum range and for use if engine temperatures exceed limitations when flying at a higher speed (this speed is also the minimum comfortable speed at which the combination can be flown for long periods). To fly at the above IAS use weak mixture (except when this is not possible - see (iv)) and the highest obtainable boost (not exceeding the maximum permitted for weak mixture cruising) adjusting the rpm, which may be as low as practicable, as necessary.

(iii) Adjust oil cooler and radiator shutters (if non automatic) or gills as necessary. Gills should, however, not be opened beyond the settings recommended in the relevant appendices.

(iv) If the recommended IAS cannot be maintained at the required operational height at maximum weak mixture power, or if, when flying at the recommended IAS, the engines still over-heat, change to rich mixture (if a mixture control is fitted), and on all British engines (for American engines see NOTE) increase to the highest obtainable boost (not exceeding the maximum permitted for rich mixture cruising) adjusting rpm, which may be as low as practicable, to give the recommended IAS. In those cases where these measures may be necessary the relevant appendices will include a note to this effect. In certain cases better cooling in rich mixture may be obtained by flying at a higher speed than that recommended for maximum range - When this applies the relevant appendices give full details. (At the time of going to press this does not apply to any tug aircraft tested with the Hamilcar).

NOTE: With American engines, minimum rpm restrictions apply when cruising at boosts in excess of the maximum permitted in weak mixture. It is, therefore, necessary to use a combination of the highest boost and lowest rpm (within the limits set out in tabular form for the individual engines in the appropriate appendices) which will give the recommended IAS. This may be done as follows:

(a) Set rpm to the highest permitted for rich mixture cruising.

(b) Adjust boost until flying slightly faster than the recommended IAS.

(c) Then reduce rpm as necessary.

(d) If it is then found that the combination of boost and rpm is not in accordance with the table, both boost and rpm should be adjusted until the best combination (i.e. highest boost and lowest rpm permitted), which gives the required IAS, is found.

(v) The use of rich mixture results in loss of range so that (unless rich mixture is being used because temperatures cannot be maintained within limitations in weak mixture) as fuel is used and weight is reduced sufficiently to enable the recommended IAS to be maintained at maximum weak mixture power, a change to weak mixture boost and rpm (and to weak mixture if a control is fitted) should be made.

(vi) Turns should be gradual.

(vii) Descent on tow:-

(a) Keep the speed steady and within limitations.

(b) Recovery should be gradual, throttles being opened slightly to maintain speed.

(viii) Flying in cloudy weather:- Avoid flying into cloud, if it is unavoidable the glider pilot will cast off (unless a tow cable angle indicator is fitted and authority for blind flying has been given).

7. CASTING OFF

The tug pilot will give the order to cast off and should not (except in emergency) release until the glider has done so. The tug pilot should avoid getting in the way of the glider. After casting off retrim as necessary. With line intercom. return switch to I/C.

NOTE: Should the glider require to fly on a compass course after release, a special compass check may be necessary.- see part II, para.15(iv)

8. DROPPING THE ROPE

Under training conditions fly upwind at about 400 ft. and release the rope over the rope dropping area. If a towing yoke is fitted the pilot should instruct crew to lock it.

EMERGENCIES

i) Abandoning tow before tug is airborne - Unless necessary, the tug pilot should not release until after the glider pilot. He will then throttle back and apply brakes. The glider will cast off, apply brakes and turn as necessary to avoid the tug.

(ii) Engine failure on take-off after tug is airborne - If possible the glider pilot should be warned so that he may release tow at his end first. The tug pilot will in any case release tow and will then take normal action disregarding the glider. If the tug has to land the glider pilot will turn as necessary.

(iii) Take-off abandoned by the glider - If the glider pilot decides to abandon the take-off and releases the tow, the tug pilot should also release.

(iv) Engine failure in flight -

(a) In the event of engine failure, before deciding to abandon tow, the tug pilot should instruct the glider pilot to jettison the undercarriage as well as any items of loose equipment possible; he should also jettison any loose equipment in the tug and as much fuel as practicable.

(b) If height cannot be maintained and the tug pilot decides to release the glider, he should warn the glider pilot who should release first if possible, or in any case immediately after the tug releases.

(c) If the rudder has been trimmed for no load with the dead engine, the change of rudder trim will be considerable after releasing the glider. This should be trimmed out as speed is gained.

On four-engined aircraft if the tow is being continued after engine failure apply appropriate trim. Before releasing the glider it is then essential to return rudder trim to neutral by throttling back on the opposite engine.

NOTE

See also appropriate appendix as follows:-

Tug	Appendix
HALIFAX	I
LANCASTER	II
STIRLING	III

APPENDIX I

Notes for HALIFAX tug aircraft Pilots when towing HAMILCAR GLIDERS.

1. FLYING LIMITATIONS

(i) Maximum permissible weights are.-

HAMILCAR	36,000 lb.
HALIFAX II	48,000 lb.
HALIFAX V	48,500 lb.

(ii) Maximum permissible speeds are.-

	Readings in mph	
	On Tug ASI	On Glider ASI
Towing	140	150

Note: All limitations and handling speeds quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue, or which may be imposed subsequently from time to time by Special Instruction.

2. ENGINE LIMITATIONS

The normal limitations should be observed.

3. PRELIMINARIES

(i) Check weights and fitness of aircraft for flight - see Part III.

(ii) Check glider stationing, test quick release (this is a "pull" handle on the right of the throttle box; it is pulled to release), agree code of signals and test intercom - See Part III.

4. CHECKS BEFORE TAKE-OFF

Set Flaps	- 15°
Trim	
Rudder & Ailerons	- NEUTRAL
Elevator	- 1½ divisions back
Radiator shutters	- fully open

5. TAKE-OFF

(i) Ease the aircraft off at 95 mph IAS trimming the elevator back to assist take-off.

(ii) Fly level until a speed of 115 mph IAS is reached. This is below the safety speed - see Part III, para.5.

(iii) Raise the undercarriage as soon as safely airborne.

(iv) Maintain take-off power until the flaps are up; they should not be raised below 200 ft. (500 ft. on the Halifax V). The flaps should, if possible, be raised in stages by selecting flaps UP and at once returning the control to NEUTRAL, repeating the operation several times. If flaps are raised quickly the aircraft will sink but at 200 ft. (or 500 ft.) this is not dangerous.

6. CLIMBING

(i) The recommended speed for best climb is 118 to 120 mph IAS.

(ii) If engines overheat, speed may be increased to 125 mph IAS. Rate of climb at operational weights will be considerably reduced if speed is further increased or rpm reduced.

7. CRUISING

(i) The speed recommended for maximum range is 120 to 125 mph IAS.

(ii) Rich mixture power may be required, to maintain height, and for cooling in hot weather, at full operational loads.

8. TURNS, DESCENT ON TOW, CASTING OFF, ROPE DROPPING AND EMERGENCIES.

See Part III.

APPENDIX II

Notes for LANCASTER tug aircraft pilots when towing HAMILCAR GLIDERS.

1. FLYING LIMITATIONS

(i) Maximum permissible weights are:-

LANCASTER I & III	49,500 lb.
HAMILCAR	36,000 lb.

(ii) Maximum permissible speeds are:-

	Readings in mph	
	On Tug ASI	On Glider ASI
Towing	146(138)	150

NOTE:

(a) The tug speeds (not in brackets) quoted above and throughout this appendix apply with the ASI connected to the static vent. The speeds quoted in brackets are for use when the ASI is not connected to the static vent.

(b) All limitations and handling speeds quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue or which may be imposed subsequently from time to time by Special Instruction.

2. ENGINE LIMITATIONS

The normal limitations should be observed.

3. PRELIMINARIES

(i) Check weights and fitness of aircraft for flight - See Part III.

(ii) Check glider stationing, test quick release (the control is a red toggle labelled GLIDER RELEASE mounted on the floor aft of the throttle box; it is pulled up to release), agree code of signals and test intercom. - See Part III.

4. CHECKS BEFORE TAKE-OFF

Set - Flaps - 15°
- Trim - all tabs - Normal
- Radiator shutters - fully open (by means of the manual override switch); they should be left so set (except in very cool weather) at all times with a glider in tow.

5. TAKE-OFF

(i) At normal loads ease the tug off at about 97(92) mph IAS. For cross-wind take-offs or in bumpy conditions and at full operational loads an increased speed of 100(95) to 105(100) mph IAS is recommended.

(ii) Commence to climb at 110(105) to 115(110) mph IAS. (115(110) to 120(115) mph IAS at full operational loads). This is below safety speed - see Part III para.5.

(iii) Raise the undercarriage as soon as safely airborne and maintain take-off power at least until the flaps have been raised at 200 ft and if possible at not less than 120(115) mph IAS. They should be raised by degrees, and at full operational loads in particular as gradually as possible, by intermittent operation of the selector.

6. CLIMBING

The recommended speed for best climb is

125 to 130 mph IAS
(120) (125)

No increase of speed or reduction of rpm should be necessary for cooling except possibly in hot weather at full operational loads.

7. CRUISING

(i) The speed recommended for maximum range is

125 to 130 mph IAS
(120) (125)

(ii) Rich mixture power may be required to maintain height, and for cooling in hot weather, at full operational loads.

8. TURNS, DESCENT ON TOW, CASTING OFF, ROPE DROPPING, AND EMERGENCIES. See Part III

APPENDIX III

Notes for STIRLING tug aircraft Pilots when towing HAMILCAR GLIDERS.

1. FLYING LIMITATIONS

Maximum permissible weights are:-

HAMILCAR	23,000 lb.
STIRLING	50,500 lb.

Maximum permissible speeds are:-

	Readings in mph	
	On Tug ASI	On Glider ASI
Towing	150	150

Note: All limitations and handling speeds quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue, or which may be imposed subsequently from time to time by Special Instruction.

2. ENGINE LIMITATIONS

The normal limitations should be observed.

3. PRELIMINARIES

(i) Check weights and fitness of aircraft for flight - see Part III.

(ii) Check glider stationing, test quick release (this is a long lever on the right of the throttle box; it is pulled up to release), agree code of signals and test intercom. - See Part III.

(iii) Check oil cooler shutters - preset: inner - open
outer - 2/3 open

4. CHECKS BEFORE TAKE-OFF

Set Flaps - 1/3
Trim
Rudder - neutral
Elevator - 3 divisions forward
Gills - 1/3 open

5. TAKE-OFF

(i) Trim elevator back to assist take-off and ease the tug off at 95 to 100 mph IAS.

(ii) Fly level until a speed of 120 mph IAS is reached. At full operational loads a shorter take off can be obtained by commencing to climb at 110 mph IAS but it must be remembered that this is very much below the tug safety speed - see Part III para.5.

(iii) Raise undercarriage as soon as safely airborne and reduce to climbing power as the wheels come up.

(iv) Raise flaps and retrim as necessary. With the glider flying in the high tow position considerable tail down trim will be required.

6. CLIMBING

(i) The recommended speed for best climb is 135 mph IAS.

(ii) Gills should not be opened beyond the 2/3 position.

(iii) No increase of speed or reduction of rpm should be necessary for cooling.

7. CRUISING

(i) Retrim elevator as necessary - See para.5(iv).

(ii) The speed recommended for maximum range is 130/135 IAS.

(iii) Rich mixture power may be necessary to maintain height, and for cooling in hot weather.

8. TURNS, DESCENT ON TOW, CASTING OFF, ROPE DROPPING AND EMERGENCIES - See Part III.

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May 1944
AIR MINISTRY

Amendment List No.1
to
AIR PUBLICATION 2219A-P.N.

HAMILCAR I GLIDER

Incorporation of this Amendment List must be certified by inserting initials and date in the space provided against the above A.L.No. on the inside back cover.

---

(1)	PART I LIST OF CONTENTS	Insert, "Undercarriage automatic release.....10A"
(2)	PART I	Remove sheets bearing paras. 10 to 24 and substitute sheets herewith bearing these with para.10A added.
(3)	PART II	Remove sheets bearing paras.5 to 15 and substitute sheets bearing these as amended.
(4)	PART III	Remove sheet bearing paras. 7 and 8 and substitute sheet herewith bearing these paras as amended.
(5)	PART III APPENDIX III	Remove sheet bearing this appendix and substitute sheet herewith.

A.T.P/2285 1100 5/44.

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October 1944
AIR MINISTRY

Amendment List No.3
to
AIR PUBLICATION 2219A-P.N.

HAMILCAR I GLIDER

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---

(1)	PART II	Remove sheet bearing paras. 5 to 10(i) and substitute sheet herewith bearing these with para.7(ii) amended.
(2)	PART III APPENDIX II	Remove and dispose of sheet bearing paras.1 to 8 and substitute sheet herewith bearing this as amended to include Lancaster I & III at 49,500 lb.

R.T.P./2359. 1100. 9/44

AMENDMENT CERTIFICATE

Incorporation of an amendment list must be certified by inserting date of incorporation and initials below.

A.L. NO.	INITIALS	DATE	A.L. NO.	INITIALS	DATE
1			11		
2			12		
3			13		
4			14		
5			15		
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