PART 2 : SECTION 4

CHAPTER 11

TARGET TOWING

Introduction

1. Where air-to-air firing forms a part of the training for the operational role, efficient target towing plays an important part in ensuring successful sorties, and it calls for a high degree of skill from the towing pilot.

2. Most existing aircraft are easily adapted for target towing with negligible loss of performance, and all pilots on operational units with a target towing commitment should, as a matter of duty, qualify themselves for this task.

3. This chapter gives a brief description of the various types of towed target and towing gear in use, and the general procedure to be adopted by towing pilots. More detailed information about targets, special towing aircraft, and associated equipment is given in A.P. 1492A.

TARGETS AND EQUIPMENT

Types of Target

4. There are three main types of target in use :—

(*a*) Winged.

(*b*) Banner.

(*c*) Sleeve.

All may be metallized or fitted with reflectors for use with radar gunsights.

5. **Winged Targets.** The only target of this type in general use is the 25-ft.-span winged target (Fig. 1). It is of steel and fabric construction and is referred to hereafter as a glider.

6. This glider has four wheels which support it on the ground at a negative angle of incidence. This delays the take-off of the glider until the towing aircraft is comfortably airborne. Similarly on landing, once all four wheels are on the ground, the glider should not rise again unless heavily bounced or pulled off by the towing aircraft.

7. In flight the glider is trimmed to fly nose heavy and, if released from the towing aircraft, it should dive almost vertically.

8. An automatic release can be fitted to release the cable from the glider as soon as it touches down.

9. The best towing speed for the glider is 200 kts. I.A.S. This figure should not normally be

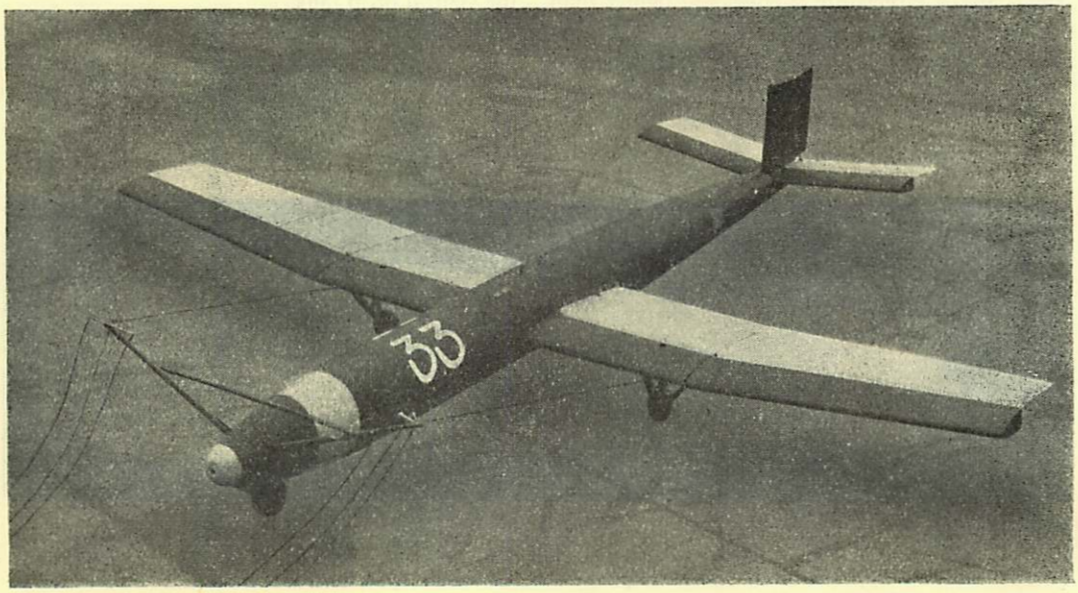

Fig. 1. 25-ft.-Span Winged Target

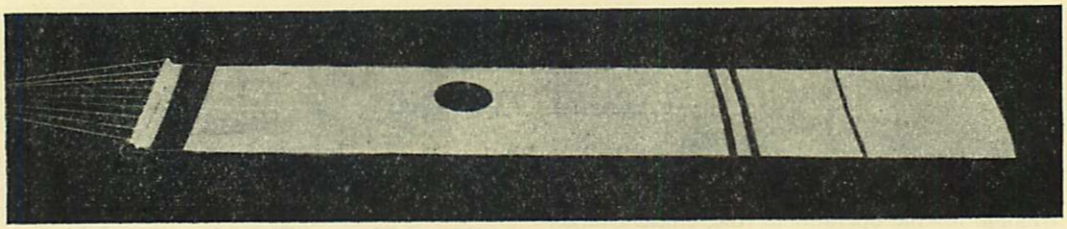

Fig. 2. Banner Target (30 ft. × 5 ft. 6 ins.)

exceeded, but speeds up to 220 kts. I.A.S. may be flown if the glider is undamaged and the occasion demands it.

10. **Banner Targets.** The standard banner or flag target is made of nylon net and its dimensions are 30 ft. × 5 ft. 6 ins. (Fig. 2). It has a metal bar at the front which is weighted at one end to make it fly upright.

11. The towing speed should not exceed 220 kts. I.A.S., otherwise the life of the banner will be appreciably shortened.

12. **Sleeve Targets.** There are several types of sleeve or drogue targets in use (Fig. 3). They all consist of tapering sleeves of strong reinforced fabric, open at the front and closed at the rear end. Sleeve targets are smaller and lighter than the other two types already mentioned and their maximum permissible towing speeds vary widely.

Towing Cable

13. An 800-ft. nylon rope of 15-cwt. breaking strain is used for towing most types of target ; but flexible steel cable may be used and is available in several strengths. The target is connected to the end of the rope or cable by a 100-ft. webbing towing link capable of absorbing two adjacent strikes from ball type 20-mm. ammunition.

Aircraft Towing Attachment

14. A simple modification normally enables suitable types of aircraft to tow targets, the usual modification being the fitting of an electro-magnetic release unit (E.M.R.U.) on the rear of the ventral drop tank.

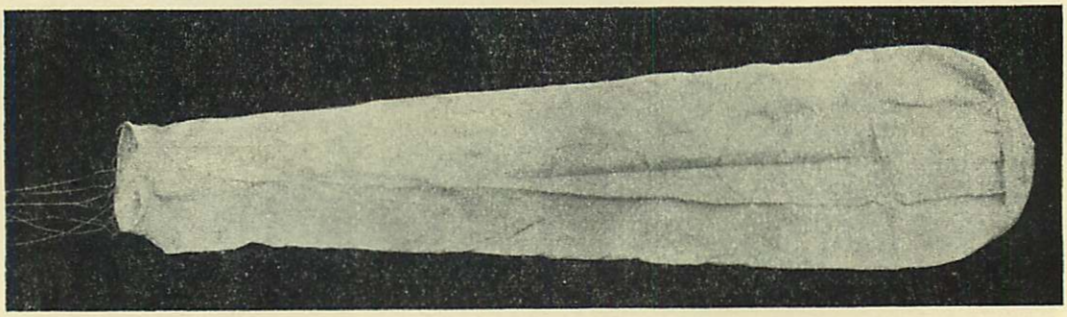

Fig. 3. 20-ft. Drogue Target

15. **Electro-Magnetic Release Unit.** The E.M.R.U. consists basically of a hook operated by an electro-magnetic unit (Fig. 4). It is set manually as follows :—

(*a*) *Cocking*. The cocking lever is depressed, the hook is closed, and the lever is then released again.

(*b*) *Opening*. The hook may be opened by pulling a toggle projecting from the front of the unit.

16. The E.M.R.U. is connected electrically to the aircraft camera circuit. When the camera button is pressed the hook opens and the cable is released. The camera circuit must first be made live, usually by switching on the camera master switch and/or the gun-butt Fire/Safe switch, as appropriate. Where gun-butt switches are incorporated in the circuit, they must be switched on to make the circuit live when the undercarriage is down.

17. Pilots are reminded that pressing the gun-firing trigger also operates the camera, which in turn opens the hook.

OPERATING PROCEDURE

Authorization of Flights

18. Before authorizing a towing flight, the person responsible is to ensure that :—

(*a*) The pilot is qualified, correctly briefed, and understands all local target-towing orders.

(*b*) The weather conditions and runway are suitable for the take-off, flight, and landing.

(*c*) When a winged target is to be landed at base, a competent officer or N.C.O. is available to carry out the talk-down and that air traffic control is informed.

Runway Length

19. The minimum safe runway length for towing-off targets depends on :—

(*a*) Type of aircraft.

(*b*) Fuel load.

(*c*) Wind velocity.

(*d*) Type of target and length of towing cable.

(*e*) Airfield elevation.

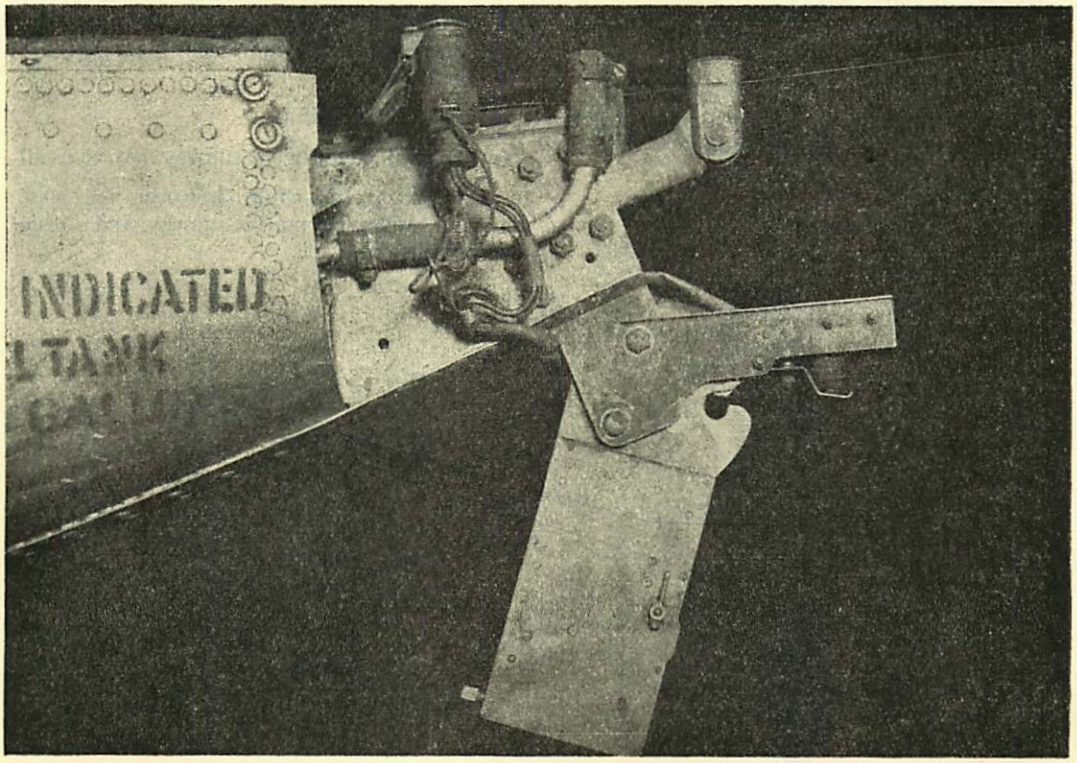

Fig. 4. Electro-Magnetic Release Unit

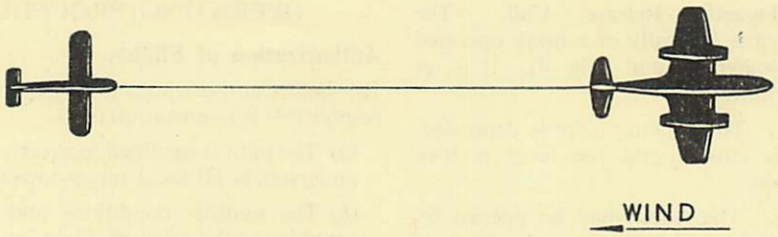

Fig. 5. Aircraft, Cable, and Target Layout for Drag Take-Off

20. The figures in the following table are given only as a guide (they are representative of Meteor aircraft), and it must be remembered that gliders require a longer take-off run on the part of the towing aircraft than other types of target.

Conditions	*Minimum Safe Length of R/W*
Favourable	1,200 yds. absolute minimum
Glider towed by jet-engined aircraft with normal fuel load. Wind conditions normal	1,500 yds.
Glider towed by jet-engined aircraft with full fuel load. No wind	2,000 yds.

Methods of Taking Off with a Target

21. There are three methods of towing-off targets in general use. They are referred to as :—

(*a*) Drag take-off.

(*b*) Normal snatch take-off.

(*c*) Full snatch take-off.

22. **Drag Take-Off.** The cable and target are laid out along the runway behind the aircraft (Fig. 5). This method is used on the following occasions :—

(*a*) When taking-off winged targets.

(*b*) When flexible steel cable is used.

(*c*) When a strong cross-wind or the weight of the target prohibits the use of the other two methods.

23. **Normal Snatch Take-Off.** This is the normal method used for towing-off banner and sleeve targets (Fig. 6). It has the following advantages over the drag take-off :—

(*a*) Less wear on the equipment from abrasion on the runway.

(*b*) Shorter take-off run.

(*c*) The full length of the runway may be used.

In very strong cross-winds, however, the rope may tend to blow across the runway, and a drag take-off must be used.

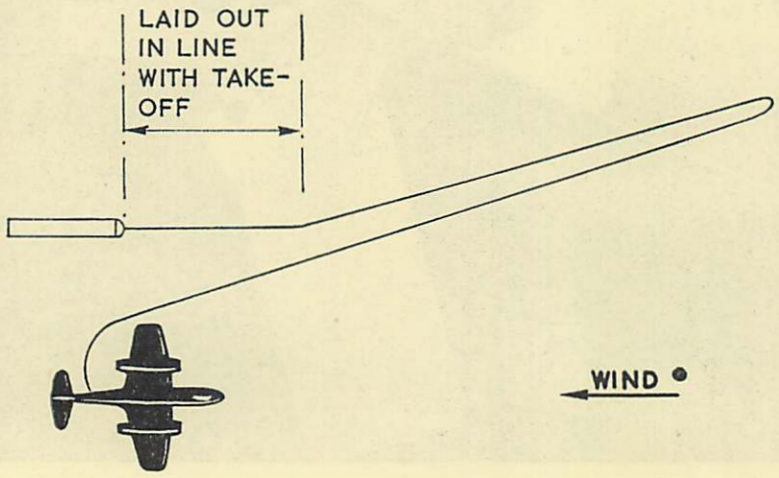

Fig. 6. Aircraft, Cable, and Target Layout for Normal Snatch Take-Off

24. **Full Snatch Take-Off.** This method (Fig. 7) gives the shortest possible take-off run for both the aircraft and the target, but its use should be restricted to light sleeve targets, as the sudden strain on the cable would otherwise be excessive.

25. **Layout in a Cross-Wind.** If the wind is blowing across the runway, the equipment should be laid out as close to the up-wind side as possible. During the take-off, the target will drift down-wind across the runway but, provided the pilot checks the drift of the towing aircraft, the target should be airborne before reaching the down-wind side.

Instructions for Towing-Pilots

26. **Pre-Flight Check.** The aircraft release equipment should be inspected for damage and checked for correct operation. If an E.M.R.U. is fitted the following checks should be made :—

(*a*) Cock the hook, and check that it locks closed.

(*b*) Open it manually, and cock again.

(*c*) Operate the release electrically and make sure that all the switches necessary to make the circuit live, *i.e.* the camera master switch and/or the gun-butt Fire/Safe switch, are left switched on. It is most important to switch on the gun-butt switch, where fitted, as the **pilot must be able to release the target in an emergency during take-off.**

27. **On the Runway.** After marshalling the aircraft into position, the ground handling party will attach the cable to the aircraft ; the pilot must not operate the flaps or dive brakes, run-up the engines, or release the brakes until he has been given the thumbs-up sign by the ground party, and is certain that all personnel are clear of the aircraft.

28. **Take-Off.**

(*a*) The shortest possible take-off is to be made using the appropriate flap setting.

(*b*) Immediately after the take-off the aircraft is eased into a steep climb to get the target into the air as soon as possible.

(*c*) At 300 ft. the angle of climb may be reduced and safety speed, if applicable, attained.

(*d*) During the take-off run and on the initial climb any tendency to drift, due to a cross-wind, must be checked.

29. **Towing To and From the Range.** The terrain between the airfield and the range may include built-up areas, and a route, which must be specified in local orders, is selected to avoid them as far as possible.

30. While towing to or from the range with the type of equipment in use, speed is to be kept down to 160 kts. I.A.S. and height below 1,000 ft.—particularly when towing a glider—to reduce the risk of breakaway and to localize the danger area should release occur.

31. Pilots should avoid flying over even the smallest village.

32. Should the target break away over land, it must be pinpointed and a full report submitted on landing.

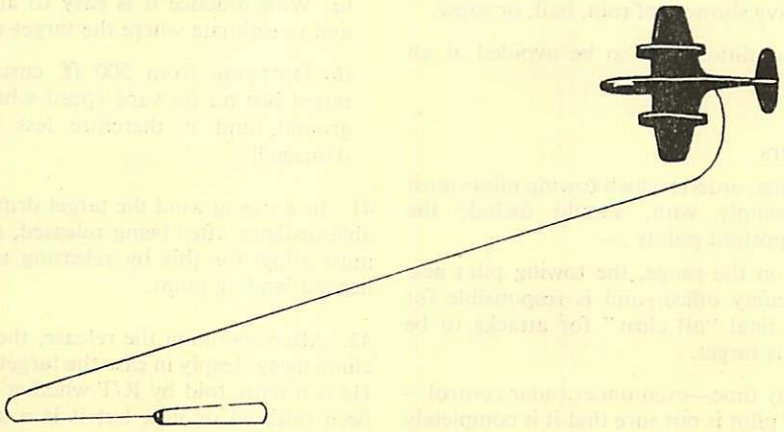

Fig. 7. Aircraft, Cable, and Target Layout for Full Snatch Take-Off

GENERAL INSTRUCTIONS

Manœuvres and Weather Limitations

33. **Turning.**

(*a*) Unless otherwise instructed, level turns up to rate 3 are permitted.

(*b*) When reversing steep turns, a short pause should be made while straight and level to allow the target to follow up smoothly without straining the cable.

(*c*) Climbing and descending turns should be restricted to rate 1 ; this applies to all turns if the tow length is less than 500 ft.

34. **Climbing and Descending.**

(*a*) The normal climbing or descending speed of the towing aircraft is usually greater than the maximum permitted towing speed of the target. Towing pilots must therefore be very careful not to let the speed build up while climbing or descending.

(*b*) Pilots of jet-engined aircraft, when towing present types of winged and banner targets, are recommended to use a speed of 200 kts. both for the climb and the descent. At high altitudes, however, this speed may have to be reduced.

35. **Weather Limitations.** The following limitations apply to all types of target :—

(*a*) Targets are not to be towed in cloud, or above more than 4/8 cloud, unless under direct radar control.

(*b*) When steel cable is used, pilots are to avoid flying near heavy electrical discharges, thunderstorms, heavy showers of rain, hail, or snow.

(*c*) Icing conditions are to be avoided at all times.

Range Orders

36. Local range orders, which towing pilots must read and comply with, should include the following important points :—

(*a*) While on the range, the towing pilot acts as range safety officer and is responsible for giving the final "all clear" for attacks to be made on his target.

(*b*) If at any time—even under radar control—the towing pilot is not sure that it is completely safe for an attack to be made on the target, he is to order the attacker to cease fire at once.

(*c*) The towing pilot must be in continuous two-way R/T contact with the attacker, and with the controller if under radar supervision. Unless other arrangements exist the exercise is to stop if R/T contact breaks down.

Damaged Gliders

37. On completion of the exercise the towing pilot must be satisfied, before leaving the range, that the target is safe to tow over land again. He should get a report on the condition of the glider from the pilot of the last attacking aircraft and, if any doubt exists, the glider must be released over the sea, well clear of shipping. A reduction of speed often steadies the flight of a damaged glider and may prevent it from breaking up.

Landing the Target

38. After leaving the range the towing pilot usually flies to a waiting area near the airfield or target dropping area and, on receiving permission, enters the approach lane for the final run in. Details of waiting areas and approach lanes are contained in local orders ; only the final run in and landing are dealt with here.

39. It is emphasized that cable and target can do much damage, and may cause injury or death if towed too low, or dropped in the wrong place. The landing procedure detailed below must therefore be carefully followed.

40. **Cables, Banners, and Sleeve Targets.** These should be released over the dropping area at 500 ft. and 150 kts. The reasons for giving a specific height and speed are :—

(*a*) With practice it is easy to allow for drift and to estimate where the target will fall.

(*b*) Dropping from 500 ft. ensures that the target has no forward speed when it hits the ground, and is therefore less liable to be damaged.

41. In a strong wind the target drifts a considerable distance after being released, and the pilot must allow for this by releasing up-wind of its desired landing point.

42. After operating the release, the pilot should climb away steeply in case the target fails to drop. He is usually told by R/T whether the cable has been released or not, but it is a sound rule to carry out this overshoot procedure after releasing any type of target—it may prevent an accident.

43. If only a few feet of cable remain attached to the aircraft, the pilot may land with it on.

44. **Gliders.** Gliders are landed by talking them down on to the runway in a similar way to G.C.A. The talk-down should be done by someone—preferably a pilot—who fully appreciates that the towing pilot has to rely completely on the talk-down information to land a target which he cannot see. A high degree of concentration is required from both the pilot and the controller if a safe, smooth landing is to be achieved. It is vital for both to remember that any change of direction or rate of descent of the towing aircraft takes an appreciable time to affect the flight of the glider.

45. Although it is primarily the responsibility of air traffic control to select a runway for the glider landing, the following points are worthy of note :—

(*a*) The runway in use is not necessarily the most suitable ; gliders may be landed in strong cross-winds, and a long runway with no obstacles on the approach is ideal.

(*b*) The talk-down controller must be able to see the whole of the approach and runway ; the best position is out to one side, as shown in Fig. 8.

(*c*) The sides of the runway should be kept clear of personnel, aircraft, and equipment, as the glider may swing off on landing while still travelling fast.

46. After establishing two-way contact with the controller, the towing pilot should, unless told otherwise by the controller, approach as follows :—

(*a*) Approach the runway at a constant rate of descent of about 400 ft. per min., aiming to cross the threshold of the runway at 400 ft. This height may, however, be altered on instructions from the controller during the approach.

(*b*) Keep the airspeed constant at 115 kts. or below if practicable, using the appropriate flap setting.

(*c*) On reaching the runway, continue to descend ; the glider should cross the threshold at between 50 ft. and 100 ft.

(*d*) When told that the glider is at 30 ft., start increasing power and, with the glider down to 10 ft., go into a steep climb without increasing speed.

(*e*) The glider should then touch down. Release the cable on the order "CUT-CUT-CUT" from the controller.

(*f*) Continue to climb as for normal overshoot procedure, in case the glider has not released.

The approach detailed above is under ideal conditions, but if the glider is damaged, or if the wind is gusty, the descent may not be steady. The pilot must therefore be prepared for sudden changes of instruction regarding his rate of descent, cut, or overshoot.

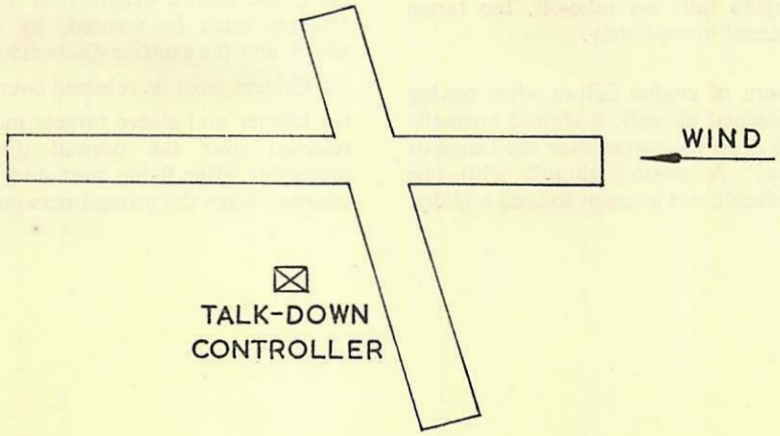

Fig. 8. Position of Talk-Down Controller on the Airfield

47. When the glider is clearly visible to the talk-down controller, he should inform the pilot and start the commentary. The following information should be passed at the initial stage :—

(*a*) Whether or not the glider is flying steadily.

(*b*) Wind conditions.

(*c*) The height at which to cross the end of the runway. This depends on the distance the glider is flying below the towing aircraft and can only be judged by experience. If in doubt, the pilot should be instructed to cross at 400 ft. and any corrections should be given at a later stage.

48. The talk-down consists mainly of estimates of the glider's height, passed by the controller to the pilot, in rapid succession. The pilot should also be kept informed of the behaviour of the glider during the commentary. Immediately the glider touches down, the order "CUT-CUT-CUT" is given.

49. If the glider shows any tendency to undershoot, it must be checked in good time. If it becomes obvious that the glider will not touch down on the first half of the runway, the order "OVERSHOOT" must be given.

50. It is the duty of the controller to inform the pilot whether or not the glider has released, after giving the order to cut.

EMERGENCIES

Engine Failure

51. If an engine fails on take-off, the target should be released immediately.

52. In the event of engine failure when towing with a twin-engined aircraft, it should normally be possible to drop the target over the range or dropping area. A towing aircraft with one engine failed should not attempt to land a glider.

Fuel Shortage

53. If the towing aircraft has only sufficient fuel for one approach, it is advisable to make sure of landing the glider at the first attempt by carrying out a steep approach and by "flying it in" should it be necessary. If the glider is obviously coming in too high, the controller should give the order to cut before it reaches the overshoot point half-way down the runway.

54. It is better to release the target over the range, before the fuel shortage becomes acute, than to drop it over land on the way back.

Failure to Release

55. Another attempt should be made to release the target after checking that all the necessary switches are on. If fitted, the gun-firing trigger should be operated at the same time as the camera button.

56. If the target still fails to release, it should be towed back over the range and the cable broken, either by increasing speed or by dragging the target in the sea. The aircraft should be landed well up the runway with the remaining cable attached.

57. In an emergency, a landing may have to be made with the target attached. Air traffic control should be warned as early as possible and a steep approach should be made, landing well up the longest runway available.

R/T Failure

58. In the event of R/T failure :—

(*a*) If the failure occurs over the range, the attacker must be warned, by waggling the wings, and the exercise discontinued.

(*b*) Gliders must be released over the range.

(*c*) Banner and sleeve targets may usually be released over the normal dropping area, preferably after flying past and waggling the wings to warn the ground personnel.