A.P. 3215
(2nd Edition)

FOREWARNED IS FOREARMED

ROYAL OBSERVER CORPS

TRAINING MANUAL

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AIR MINISTRY
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TRAINING MANUAL

Promulgated by Command of the Air Council

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AIR MINISTRY
MARCH, 1958

PREFACE

The Royal Observer Corps Training Manual is a handbook containing general information about the Corps, and covers its history, organization, role and equipment. A personal copy is issued to each member of the Corps. The publication is designed to give observers the background information which they require in order to become operationally proficient.

The training Manual does not include information on operational procedures. This is issued separately by Headquarters Royal Observer Corps in the form of Standard Operating Procedures (S.O.P.s) for Group Operations Rooms and for Post crews. S.O.P.s are distributed to the Corps on an authorized scale for use in operations and training. There are also Experimental Operating Procedures (E.O.P.s) which cover experimental, development and temporary procedures; these are issued to the Corps as required.

Detailed information on administrative and accounting matters is contained in A.P. 3306 "Regulations for the Royal Observer Corps", a copy of which is held by all officers and chief observers.

R.O.C. TRAINING MANUAL

CHAPTER 1

HISTORY OF THE ROYAL OBSERVER CORPS

1. The oldest thing associated with the Corps is the badge, which represents the beacon lighter of Elizabethan times. This person had much in common with the Observer Corps as it was first organized. To care for and light the beacons, part-time members of the local population were organized and paid by the county sheriff.

2. It would appear that the earliest system for the detection and reporting of aircraft was first started late in 1914. The Police were instructed to telephone reports of any aircraft seen or heard within 60 miles of London to the Admiralty, who were at that time in charge of defences. In 1915 it was decided to extend the area covered by such reports to East Anglia, and also to Northamptonshire, Oxfordshire, Hampshire and the Isle of Wight. The scheme was found to be unsatisfactory and in 1917 the War Office was given control. It can be said that Major General Ashmore, C.B., C.M.G., M.V.O., was the founder of the Corps on which the present system and organization has developed.

3. In an endeavour to reduce time lag, Major General Ashmore devised a scheme known as the London Air Defence Area, more familiarly known as "LADA". In this scheme he made use of all the various existing defence units which covered closely the London area, and districts to the south and south-east of London. The units comprised coastal and inland watching posts, searchlights, gun stations, balloon aprons, aerodromes, and emergency landing grounds. This scheme necessarily entailed a large amount of telephone construction work, and it was not until September, 1918 that it was put into full operation, while the last German raids had been made in May, 1918. It did prove, however, in practice that the time lag apparent in those days had been reduced appreciably, and it is fair to say that in its conception this system was the foundation of the Royal Observer Corps. With the Armistice of the First World War coming so soon after this date, and with the considerable reduction in the forces, the above-mentioned system appears to have faded away to practically nothing.

4. An inquiry was held in 1921 by the Committee of the Imperial Defence, and on its findings a joint War Office and Air Ministry Committee investigated the aerial defence of South-East England, south of a line drawn from Portland Bill to the Wash. It was decided that an organized system was essential for rapid collection and distribution of information regarding the movements of hostile and friendly aircraft, and this more or less had the effect of bringing the Observer Corps into being.

5. In August and September, 1924, the first experiments were organized by Major General Ashmore. It was decided to use the area between the Romney Marshes and Tonbridge, and these preliminary trials proved very satisfactory; so much so that in the following year two observation areas were formed to embrace the whole of Kent, Sussex and part of Surrey. With the co-operation of the Chief Constables concerned these two areas were manned at posts and centres by personnel who were enrolled as special constables. These first Observer Corps Groups were No. 1 with its headquarters in Maidstone, and No. 2 with its headquarters in Horsham, the former group having twenty-seven posts and the latter sixteen.

6. By November, 1926, the Observer Corps covered an area extending from Hampshire to the middle of Suffolk, and comprised Nos. 1 and 2 Groups already mentioned, and Nos. 3 and 18 Groups, the headquarters of which were at Winchester and Colchester. As the tests carried out with these groups proved successful, Major General Ashmore proposed a further extension in Hertfordshire and Buckinghamshire, and observer posts were also established at Harrow and Uxbridge.

7. On 1st January, 1929, control was handed over to the Air Ministry. The Observer Corps had now become a corporate body, and it was logical, therefore, that it should be given an officer in command. The suggestion was made by the A.O.C. in C. Air Defence of Great Britain, in a letter to the Air Ministry, that an officer of the rank of air commodore or group captain on the retired list should be appointed as the first Commandant of the Corps. As Commandant of the Corps, he would carry out his duties directly under Headquarters, Air Defence of Great Britain. He would be responsible to the A.O.C. in C. for the training and maintenance of centres and posts. The Air Ministry agreed to this, and on 1st March, 1929, Air Commodore E. A. D. Masterman, C.B., C.M.G., C.B.E., A.F.C., was appointed Commandant of the Corps. Air Commodore Masterman held this appointment until 1st March, 1936, when he retired. He was succeeded by Air Commodore A. D. Warrington-Morris, C.M.G., O.B.E., who was destined to lead the Corps until well into the Second World War.

8. Although the Corps had made a good start, progress in expansion had now become slow, and at the end of five years, in 1929, only the original four groups had been formed. On 15th May, 1931, however, a further group was formed, No. 17 Group, with the Centre at Watford; and No. 18 Group was enlarged by the addition of three new posts.

9. With the passing of years the situation in Europe had altered for the worse, and a conference was held to discuss the further expansion of the Observer Corps, with the result that recommendations were made for new groups to be formed. From this time until the start of the last war new groups were formed, and on 24th August, 1939, ten days before the start of the war, when the Corps was called out, the greater part of the country was covered by Observer Corps posts.

Wartime Activities and Achievements

10. There is no doubt that the first big trial of the Corps came with the Battle of Britain. How well the Corps did their job can be told from the fact that His Majesty King George VI on 11th April, 1941, granted the Corps the title of "Royal".

11. The tracking of aircraft overland was the responsibility of the Corps, but scientific research had developed means whereby it was possible to detect the presence of an aircraft over the sea area. This detection and the resultant tracking was treated as a form of early warning of the approach of possible hostile aircraft. The joining of those radar tracks produced over the sea approaches with R.O.C. tracks overland gave the fighter controllers a complete picture of enemy incursions and made possible a greater number of interceptions.

12. During this vital period experiments were also made in giving imminent danger warnings to factories on war work. These were so successful that the Ministry of Home Security installed air raid warning officers in R.O.C. centres to warn certain vital industrial undertakings.

SECTION 1

Royal Observer Corps General Information

CHAPTER

This warning scheme was extended considerably and was responsible for the largest saving of manpower of any single system during the war, running into many millions of hours, and playing a very vital part in the successful production, during the critical two years that followed, of a large bomber force, and a high production of war material which made possible the invasion of France.

13. Had the invasion of this country been attempted the Corps was prepared to play a most vital part in its defence. Staff officers of the home defence would have been stationed at each R.O.C. centre, where the display of attacking airborne forces would have been shown, and thus enabled the small defending force available in this country to be used to its best advantage.

14. In September, 1941, due to the increased call-up of manpower, women were introduced into the Corps and, as in all the other branches of the Services, they acquitted themselves well.

15. In June, 1942, Air Commodore G. H. Ambler, O.B.E., A.F.C., was appointed Commandant of the Corps. He made extensive changes in the organization. Some of his more important changes are listed below:—

(*a*) Reorganization of R.O.C. headquarters.

(*b*) Reorganization of area headquarters.

(*c*) Area territory to conform with the appropriate fighter groups.

(*d*) Greater employment of young women at centres.

(*e*) Training to become compulsory, and to be the official liability of Headquarters, Royal Observer Corps.

(*f*) Reorganization of the Corps on a non-military basis, but with graded ranks.

16. The first of these reorganizations to be put into effect was the adjustment of the area territory to make it conform more accurately with that of the fighter group with which it was concerned. The Southern and Western Areas were unaffected by these changes, as they already corresponded approximately in area with Nos. 11 and 10 Fighter Groups of the R.A.F. Having altered the area territories, the next logical step was to move the R.O.C. area headquarters to locations in close proximity to fighter group headquarters. There were now six R.O.C. area headquarters—Scottish, Northern, North-Western, Midland, Southern, and Western—but with the closing down of No. 13 R.A.F. Fighter Group, the Northern Area of the R.O.C. ceased to function and its groups were re-allocated to the Scottish and Midland Areas.

17. Up to now the centre controller had been responsible for the operations room, while the observer group officer had been responsible for the posts which supplied the information to the operations room. It was recommended that group commandants should be appointed to unify the policy within the group, assisted by a deputy group commandant. An adjutant was appointed for administration within the group.

18. Duty controllers and group officers were appointed in the rank of observer officers to take charge of operations room crews and sectors of posts respectively.

19. Up to this time training varied from group to group, but now that headquarters R.O.C. had undertaken the responsibility for training,

methods became standardized and a full training programme was instituted in each group.

20. At each post an observer was appointed as a training instructor with the rank of leading observer, and at the same time acted as deputy to the head observer, who was now termed "chief observer" and was responsible under his group officer for the administration of the post.

21. It became compulsory for group officers to attend training courses so that they, in turn, could train the post instructors.

22. Post meetings were held weekly and the periodic training visits of post personnel to the operations rooms were authorized. Finally, tests for post observers became compulsory.

23. Ranks were also given to operations room personnel. In the crews at the operations rooms, in addition to the duty controller, the following ranks were made:—

Duty Controller's Assistant	=	Chief Observer.
Post Controller	=	Chief Observer.
Floor Supervisor	=	Leading Observer.

24. In Fighter Group operations rooms the R.O.C. had been represented by a liaison officer. Under the reorganization he was given the rank of observer lieutenant. An addition was now made to this liaison service by providing R.O.C. representation in the sector operations rooms, where the R.O.C. representative was termed a sector liaison teller, with the rank of chief observer.

25. At this period, R.O.C. Group operations rooms were either built or altered to a standard design, and a new system of operational procedure was brought into use, including the long-range plotting board, designed to improve the hand-over of tracks from group to group. This board also made possible the decentralization of the civil air raid warnings. Ministry of Home Security officers were now situated in R.O.C. operations rooms. This brought about an almost perfect system of the sounding of the air raid warnings.

26. While the reforms mentioned in the previous paragraphs were being completed, Air Commodore Ambler returned to Fighter Command, and he was succeeded by Air Commodore Finlay Crerar, C.B.E., who remained as Commandant until November, 1945.

27. When the enemy started their tip-and-run raids on the south and south-east coasts, the co-operation of the R.O.C. played a big part in combating this type of raid. A large number of satellite posts were quickly constructed along the coast to give complete low coverage, which was vital as radar could not be expected to pick up all the low-flying aircraft. Air raid warnings to several coastal towns were sounded direct from the R.O.C. posts.

28. The Defence Committee had been expecting a new phase of enemy air activity which became known as the "Flying Bomb". Some doubt had been expressed as to the ability of the Corps to deal with this threat, but the R.O.C. once again rose to the occasion and proved its alertness and flexibility. Observers at the coastal post of Dymchurch identified the very first of these weapons and within seconds of their report the defences

were in action. This new weapon gave the R.O.C. much additional work both at posts and operations rooms. R.A.F. controllers actually took their radio equipment to two R.O.C. operations rooms at Horsham and Maidstone and vectored their fighters direct from the R.O.C. plotting tables. The critics who had said that the Corps would be unable to handle the fast-flying jet aircraft were answered when these aircraft were actually controlled entirely by R.O.C. information on their first operation.

29. It was fitting that in the last stage of hostilities the R.O.C. should again prove its worth. The C. in C. of the Allied Air Force, Air Chief Marshal Sir Trafford Leigh-Mallory, K.C.B., D.S.O., expressed concern at the number of friendly aircraft being shot down. In discussing this problem and its solution with the Commandant of the Corps, a need was stated for observers trained in aircraft recognition to advise gun crews on board the defence ships. This scheme became known as "Seaborne". The observers required to man the ships were drawn from the members of the Corps who volunteered for this duty. Letters of appreciation for this work were received from the Chiefs of the various Services.

Re-Formation of the Corps

30. Although a period of stand-down was ordered the complete disbandment of the Corps did not become effective, because it was stated that the R.O.C. must continue as a component of the defence system. As a result, Cabinet approval was given for the Corps to be re-formed as from January, 1947. Air Commodore the Earl of Bandon, C.B., D.S.O., who had been appointed Commandant of the Corps in November, 1945, drew upon a considerable number of wartime observers to form the nucleus around which the Corps was re-formed. During the next two years the R.O.C. was reorganized, the geographical layout being similar to that existing at the end of the war.

31. On 1st February, 1949, Air Commodore R. B. Jordan, C.B., D.F.C., A.D.C., was appointed Commandant, R.O.C., on relinquishment of the appointment by Air Commodore the Earl of Bandon, C.B., D.S.O.

32. On 1st March, 1950, the Air Officer Commanding in Chief, Fighter Command, assumed administrative control of the Corps. Under this change, Headquarters, Royal Observer Corps, continued to operate in its existing form and assumed a status comparable with that of a fighter group headquarters.

33. In recognition of the Corps' record of service during the twenty-five years of its existence, His Majesty King George VI assumed the position of Air Commodore in Chief, Royal Observer Corps, on the 11th April, 1950.

34. On 20th March, 1951, Air Commodore G. H. Vasse, C.B.E., was appointed to succeed Air Commodore R. B. Jordan, C.B., D.F.C., A.D.C., as Commandant of the Corps.

35. Early in 1953 it was decided that the area covered by the Corps should be extended to include Northern Ireland and, as a result of this decision, a new group was formed with its headquarters at Belfast.

36. On 1st June, 1953, it was announced that Her Majesty Queen Elizabeth II, on the occasion of her Coronation, had assumed the appointment of Air Commodore in Chief, Royal Observer Corps.

37. For some years it had been appreciated that the ever-increasing operating speeds of service aircraft would necessitate a revision of the operational layout of the Corps in order to maintain efficiency. Accordingly, a reorganization of the Corps was brought into effect on 1st November, 1953.

38. The main purposes of this reorganization were:—

(*a*) To rearrange group and area boundaries to conform with the boundaries of the Fighter Command sectors.

(*b*) To improve the handover of tracks from group to group by increasing the size of groups and providing additional facilities.

39. The rearrangement of area boundaries necessitated the splitting of Midland Area into two portions, named Northern and Eastern Areas. At the same time Southern Area was renamed Metropolitan Area, Western became Southern, and North-Western became Western; thus the names of these areas were made the same as those of the Fighter Command sectors to which they were affiliated. Scottish Area, however, although the boundaries became coincident with those of Caledonian Sector, retained its original name.

40. The increase in size of groups could only be effected by reducing their number from 40 (including the new Northern Ireland Group) to 31. The operations rooms at Maidstone, Lincoln, Bury St. Edmunds, Cambridge, Gloucester, Cardiff, Wrexham and Dunfermline were therefore declared redundant and became secondary operations rooms with facilities for training a reserve of personnel who, in the event of emergency, could operate at the parent operations room. In addition, the operations rooms of York 9 and York 10 were combined and the premises used by York 10 became the headquarters of the new Northern Area.

41. Concurrently with these alterations, new facilities were introduced to improve track handover. These took the forms of post clusters, arranged to straddle group boundaries, whose reports could be received simultaneously by the two or more groups concerned, or of open liaison lines between groups so that fast-flying aircraft could be "talked over" the group boundary.

42. On 29th March, 1954, Air Commodore J. H. T. Simpson, D.S.O., A.F.C., was appointed to succeed Air Commodore G. H. Vasse, C.B.E., as Commandant of the Corps.

Introduction of the Fall-Out Reporting Role

43. During 1955 it was announced that the Corps was to undertake the additional task of detecting, measuring and reporting the radioactive fall-out resulting from the use of nuclear weapons, in order to provide the National Warning Organization with information on which warnings to service and civil authorities could be based. Training for this additional role was begun on 3rd October, 1955.

44. The new role might require R.O.C. personnel to remain on duty and to continue reporting for up to a week during fall-out. Accordingly, a building programme designed to provide protected accommodation for each post and operations room was started in 1957. This programme required many posts and some operations rooms to be re-sited.

45. The first protected post (2/N.1) had already been built at Farnham, Surrey, in June, 1956, and during the ensuing years was the scene of most of the experiments required for the development of equipment and procedures. It was quickly followed by many others and building continued at about 250 each year so that by the end of 1963 the programme was almost complete.

46. Disused anti-aircraft operations rooms were converted for use as group headquarters for Nos. 12 and 31 Groups, Bristol and Belfast. Other conversions were at Inverness (No. 30 Group) and Preston (No. 21 Group) where disused R.A.F. sector operations centres were acquired. The remaining groups were provided with purpose-built group headquarters. These were of two types, semi-sunk and surface. The first of these were completed in 1960 at Fiskerton (semi-sunk) for Lincoln and Wrexham (surface) for the North Wales group.

47. On 4th May, 1959, Air Commodore J. M. Warfield, C.B.E., D.S.O., A.F.C., was appointed to succeed Air Commodore J. H. T. Simpson, D.S.O., A.F.C., as Commandant of the Corps.

48. During 1959 a cluster of four posts was established by the Isle of Man Government: these were linked to the mainland reporting system and became part of No. 22 Group, Carlisle.

49. To complete the fall-out monitoring coverage of the United Kingdom, an additional twenty-five posts were established in Scotland during 1960. Some of these filled gaps in the coverage of the mainland, but others were sited in the Orkney, Shetland and Hebridean Islands.

50. As a result of the provision of protected group headquarters and in order to provide reasonable safety of communications, some re-organisation of the Corps took place between 1960 and 1963.

51. Western Area was the first to be altered; the northern part of No. 19 Group, Manchester, was amalgamated with the greater part of No. 21 Group, Lancaster, to become a new No. 21 Group, Preston. The group headquarters at Manchester and Lancaster became redundant but continued to function as secondary operations rooms, later to be known as secondary training bases.

52. Scottish Area was next: No. 26 Group, Glasgow, was divided between Nos. 25, 27 and 28 Groups and other changes of boundary were made so that the Glasgow group disappeared altogether. This was followed by Northern Area: here only the sizes of the groups were affected. No. 18 Group, Leeds, was reduced substantially, while No. 20 Group, York, and No. 23 Group, Durham, were enlarged.

53. When re-organizing Western, Scottish and Northern Areas the opportunity was taken to dispense with the overlap clusters which were not required for the fall-out reporting role. The re-organization of the Corps was completed on 1st January, 1963, when the boundaries of the other three areas were altered to eliminate the remaining overlap clusters.

54. In the meantime on 29th May, 1961, Air Commodore J. M. Warfield, C.B.E., A.F.C., D.S.O., had relinquished his appointment as Commandant of the Corps and had been succeeded by Air Commodore C. M. Wight-Boycott, C.B.E., D.S.O.

55. 1962 marked the end of the programme to equip the Corps with the instruments necessary to enable them to report nuclear bursts and fall-out and the beginning of a programme to improve the reliability of R.O.C. communications by providing radio as a backing to the normal telephone system. Posts of No. 14 Group, Winchester, were equipped on the basis of one radio per cluster: development of the system continued during the next two years and proved so successful that it was decided to equip further groups in the same way.

56. On 3rd June, 1964, Air Commodore C. M. Wight-Boycott, C.B.E., D.S.O., relinquished his appointment as Commandant of the Corps and was succeeded by Air Commodore J. H. Greswell, C.B.E., D.S.O., D.F.C.

57. Later in 1964 a working party was set up to investigate the feasibility of introducing teleprinter data transmission to replace speech telling of information between groups and from group to sector and other users. For this investigation a series of trials was conducted with an experimental installation at No. 1 Group's secondary training base at Beckenham. As a result of these trials a decision was reached in 1965 to install the system in the four groups covering South-East England, Nos. 1, 2, 4 and 5, with the intention of applying the system to the remainder of the United Kingdom should further trials be successful.

58. During the years following 1955, the fall-out reporting role increased in importance and complexity; nuclear burst reporting was introduced and developed and fall-out cells manned by R.O.C. personnel were set up in the Air Defence Operations Centre of Fighter Command and other operations rooms of the Royal Air Force Commands. Concurrently the importance of the aircraft reporting role diminished until in 1965 the Air Officer Commanding in Chief, Fighter Command stated in a new directive to the Commandant, Royal Observer Corps that there was no current operational requirement for aircraft reporting by the R.O.C., but that training in aircraft recognition was to continue in order to preserve the skill as an insurance against any possible requirement in the future.

59. In the same year, the administrative and training organization of the Corps was altered to effect economies in cost and to equalize the distribution of groups between areas. No. 23 Group, Durham was transferred to Western Area: the remaining two groups of Northern Area were combined with the four of Eastern Area to form a new Midland Area, Eastern Area being disbanded; the transfer of Nos. 3 and 14 Groups from Southern to Metropolitan Area completed the re-organization.

60. On the afternoon of 24th June, 1966, the Banner for the Royal Observer Corps was presented by Her Majesty Queen Elizabeth II, Air Commodore in Chief, Royal Observer Corps, in gracious recognition of the Corps' long service and achievement. The Banner was presented during a Royal Review at Royal Air Force, Bentley Priory, Stanmore, to mark the 25th Anniversary of the assumption of the style and description "Royal" Observer Corps conferred upon it by His late Majesty King George VI. The parade, totalling 103 officers and 653 observers, was comprised of contingents drawn from all areas and groups of the Corps, and was commanded by Observer Captain W. Rusby, O.B.E., Deputy Commandant, R.O.C. The Banner was dedicated by the Chaplain in Chief, Royal Air Force, after which it was handed by Air Commodore J. H. Greswell, C.B.E., D.S.O., D.F.C., Commandant R.O.C., to Her Majesty who pre-

sented it to Observer Officer J. D. Ballington, the Banner Bearer, who received it on bended knee. Following her address, Her Majesty graciously accepted a jewelled brooch depicting the R.O.C. badge. This was presented by the Commandant on behalf of all members of the Corps as an expression of loyalty and as a token of appreciation for the presentation of the Banner. The Banner was then received and marched to the front of the parade, the Central Band of the Royal Air Force playing the National Anthem. Her Majesty then inspected a Royal Observer Corps Exhibition, took tea in the Officers' Mess, and, before departing, walked amongst the 1500 officers, observers and guests assembled on the sports field, meeting and talking with many individuals.

CHAPTER 2

ROYAL OBSERVER CORPS ORGANIZATION

Control

1. The Commandant, Royal Observer Corps, is responsible to the Air Officer Commanding in Chief, Fighter Command, for the administration and operational efficiency of the Corps.

Organization

2. The Royal Observer Corps Headquarters is situated at Headquarters, Fighter Command, R.A.F., Bentley Priory, Stanmore, Middlesex. Five Royal Observer Corps area headquarters are responsible for the organization of the groups in their charge as follows:—

	Area Headquarters	*Group*	*No.*
(*a*)	METROPOLITAN AREA RAF Uxbridge	Maidstone	1
		Horsham	2
		Oxford	3
		Colchester	4
		Watford	5
		Winchester	14
(*b*)	SOUTHERN AREA RAF Rudloe Manor	Yeovil	9
		Exeter	10
		Truro	11
		Bristol	12
		South Wales	13
(*c*)	MIDLAND AREA RAF Spitalgate	Norwich	6
		Bedford	7
		Coventry	8
		Lincoln	15
		Leeds	18
		York	20
(*d*)	WESTERN AREA Preston	Shrewsbury	16
		North Wales	17
		Preston	21
		Carlisle	22
		Durham	23
		Belfast	31
(*e*)	SCOTTISH AREA Edinburgh	Edinburgh	24
		Ayr	25
		Oban	27
		Dundee	28
		Aberdeen	29
		Inverness	30

CHAPTER 3

ROYAL OBSERVER CORPS STAFF ORGANIZATION

1. HEADQUARTERS R.O.C.

- *Commandant* (Air Commodore R.A.F., or Observer Commodore)
  - *Deputy Commandant* (Observer Captain)
    - *Assistant Commandant North* (Observer Captain—spare time)
    - *Assistant Commandant South* (Observer Captain—spare time)
    - *Assistant Commandant Scotland* (Observer Captain—spare time)
    - *Chief Equipment Officer* (Observer Lieutenant 1st Class)
      - *Mobile Equipment Officer* (Observer Lieutenant or Observer Officer)
    - *Operations Staff Officer* (Observer Commander or Wing Commander R.A.F.)
      - *Operations* 1 (Observer Lieutenant 1st Class)
        - *Operations* 1(*a*) (Observer Lieutenant or Observer Officer)
      - *Operations* 2 (Observer Lieutenant 1st Class)
      - *Operations* (*Communications*) (Observer Lieutenant 1st Class)
    - *Staff Officer Administration* (Civil Servant—Higher Executive Officer)
      - *Personnel Staff Officer* (Civil Servant—Executive Officer)

NOTES

1. All appointments are held by whole-time officers except where otherwise stated.
2. The rank of Observer Lieutenant 1st Class is honorary and appropriate to certain appointments.
3. Clerical and typing staff of the Civil Service are added as necessary.

2. AREA HEADQUARTERS

- *Area Commandant* (Observer Captain—spare time)
  - *Deputy Area Commandant* (Observer Commander)
    - *Area Training Officer* (Observer Lieutenant 1st Class)
      - *Mobile Training Officer* (Observer Lieutenant or Observer Officer)
        - *R.O.C. Liaison Officers* (Observer Lieutenants or Observer Officers—spare time)
          - *A.D.O.C. Tellers* (Chief Observers—spare time)
    - *Administration and Accounting* (Civil Servant—Executive Officer)

NOTES

1. All appointments are held by whole-time officers except where otherwise stated.
2. The rank of Observer Lieutenant 1st Class is honorary and appropriate to certain appointments.
3. R.O.C. Liaison Officers, employed either as R.O.C.L.O.s or R.A.F.L.O.s, and A.D.O.C. tellers serve in sector operations centres, but are attached to their nearest group headquarters for training.
4. Members of special duties teams employed in military operations rooms hold appointments on the area headquarters section of the Establishment Schedule, but retain membership of their R.O.C. group for all purposes of administration and general training.
5. Clerical and typing staff of the Civil Service are added as necessary.

3. GROUP HEADQUARTERS

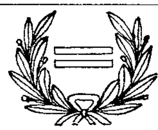
- *Group Commandant* (Observer Commander—spare time)
  - *Deputy Group Commandant* (Observer Lieutenant 1st Class)
    - *Group Training Officer* (Observer Lieutenant or Observer Officer)
      - POSTS
        - *Group Officers* (Observer Lieutenants or Observer Officers—spare time)
          - *Chief Observers* (One in control of each Post—spare time)
            - *Leading Observers* (One or more as Post Instructor for each Post—spare time)
      - *Administration* (Civil Servant—Clerical Officer)
      - OPERATIONS ROOM
        - *Duty Controllers* (Observer Lieutenants or Observer Officers—spare time)
          - *Assistant Duty Controllers* (Chief Observers—spare time)
            - *Post Controllers* (Leading Observers—spare time)
            - *Floor Supervisors* (Leading Observers—spare time)
          - *Triangulation Supervisors* (Chief Observers—spare time)

NOTES

1. All appointments are held by whole-time officers except where otherwise stated.
2. The rank of Observer Lieutenant 1st Class is honorary and appropriate to certain appointments.
3. Posts and operations rooms are manned by spare-time observers as necessary.
4. Clerical and typing staff of the Civil Service are added as necessary.

CHAPTER 4

ROYAL OBSERVER CORPS RANKS AND INSIGNIA

R.O.C. Rank	*Appropriate to Appointment as*	*Insignia*	*Equivalent R.A.F. Rank*
Observer Commodore	Commandant, Royal Observer Corps		Air Commodore
Observer Captain	Deputy Commandant, Royal Observer Corps Assistant Commandant. Royal Observer Corps Area Commandant		Group Captain
Observer Commander	Operations Staff Officer (H.Q.) Deputy Area Commandant Group Commandant		Wing Commander
Observer Lieutenant 1st Class (honorary)	Operations 1 (H.Q.) Operations 2 (H.Q.) Operations (Comms.) (H.Q.) Chief Equipment Officer (H.Q.) Area Training Officer Deputy Group Commandant		Squadron Leader
Observer Lieutenant	Operations 1(a) (H.Q.)* Mobile Equipment Officer (H.Q.)* Mobile Training Officer (Area H.Q.)* Group Training Officer* R.O.C. Liaison Officer (Area H.Q.)* Duty Controller* Group Officer* * On promotion		Flight Lieutenant
Observer Officer	Operations (1a) (H.Q.) Mobile Equipment Officer (H.Q.) Mobile Training Officer (Area H.Q.) Group Training Officer R.O.C. Liaison Officer Duty Controller Group Officer		Flying Officer
Chief Observer	A.D.O.C. Teller (Area H.Q.) Chief Observer (Post) Assistant Duty Controller (Operations Room) Triangulation Supervisor (Operations Room)		Sergeant
Leading Observer	Post Instructor (Post) Post Controller (Operations Room) Floor Supervisor (Operations Room)		Corporal
Observer	Post and Operations Room personnel, other than Chief and Leading Observers		Aircraftman

Note. As the Commandant of the Corps is usually a serving Royal Air Force officer, he carries the rank of air commodore and not observer commodore, which would be applicable if a Royal Observer Corps officer held the appointment.

CHAPTER 5

(*Not allotted*)

CHAPTER 6

THE GEOGRAPHIC REFERENCE SYSTEM AND THE NATIONAL GRID REFERENCE SYSTEM

Systems of Map Reference

1. A reporting organization must have a concise and unambiguous method of referring to a place on the surface of the earth, as represented on a map; clearly, it is desirable that the method is common to all units concerned.

2. However, the particular method chosen for use by a service depends upon the degree of accuracy that is needed and upon the extent of the territory to be covered by the reference system. For instance, the commander of a Civil Defence mobile column requires a more precise reference to pin-point a rendezvous than does the R.A.F. to plot a moving aircraft.

3. The basic principle of all such systems of map reference is the same: that of defining distances to be travelled from a known point, referred to as the point of reference, first in an easterly direction (known as "eastings") and thence in a northerly direction (known as "northings"), in order to arrive at the required location.

4. The Modified British Grid System was used during the Second World War by all units associated with the Fighter Command Control and Reporting Organization; this, however, was only applicable to England, Scotland and Wales and could not be extended without the variation between grid north and true north becoming intolerable. For this reason, coupled with the limitation of the map projection used, separate grids were necessary to cover Ireland and other European countries.

5. Since the Second World War the requirements of Western Union and the North Atlantic Treaty Organization, together with a need for the close integration of allied air forces, made it necessary to evolve a map system for international use. The system finally decided upon is known as the Geographic Reference System or, for convenience, by the short title "Georef". This system, although unsuitable for pin-pointing precise locations, is the one mainly used by the R.O.C.

5A. However, Civil Defence and military land forces require a system which permits the precise pin-pointing of locations. They therefore use the National Grid Reference (Military) System which is similar to that used during the Second World War. Accordingly, when information is reported to users of Georef and to users of National Grid, both types of reference are included in the message. Georef is always given first.

Use for which Georef was Designed

6. Georef has world-wide application and was designed for use:—

(*a*) Specifically in the control and direction of forces engaged in air defence.

(*b*) In all other air operations (other than air support and amphibious land combat operations, when a military grid is used).

(*c*) In seaward defence.

(*d*) In inter-service and inter-allied position reporting.

Basis and Construction of Georef

7. Georef is based on lines of longitude (meridians) and on lines of latitude (parallels). The graticule formed by the intersection of the meridians and parallels divides the earth's surface into quadrangular areas the sides of which are a specific length of longitude and latitude and which can be expressed in terms of degrees or minutes.

8. Because the meridians all converge on the Pole, it will be appreciated that in the northern hemisphere (*i.e.* north of the Equator) the Georef areas of the same *unit* size will, in fact, gradually decrease in width as they become more northerly. A Georef area on, say, the south coast of England is appreciably wider, from east to west, than the same unit area in Scotland. For all practical purposes, however, a Georef area of the same unit size is considered to be standard throughout the Corps.

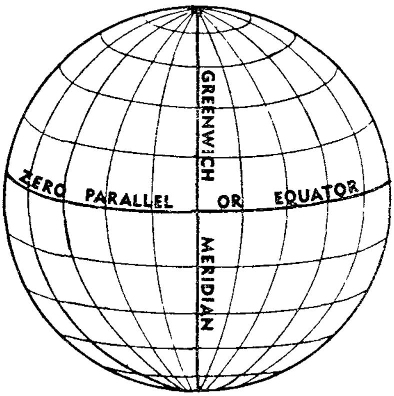


Fig. 1.
Illustrating the convergence of meridians and the resultant variation in the actual size of the same unit area according to its geographic location.

9. **Degrees and Minutes.** To understand fully the construction of Georef it is necessary to realize that the division and sub-division for lettering and for numbering is based on degrees and minutes of longitude and latitude. It must be realized that:—

(*a*) There are 360 degrees of longitude:—
  (i) 180 degrees East of the Greenwich Meridian.
  (ii) 180 degrees West of the Greenwich Meridian.

(*b*) There are 180 degrees of latitude:—
  (i) 90 degrees North of the Equator.
  (ii) 90 degrees South of the Equator.

(*c*) There are sixty minutes (60′) in one degree (1°).

Lettering System

10. **Point of Origin.** In its world-wide application the lettering system originates on the 180° meridian at the South Pole: this point being known as the "Point of Origin".

11. **Primary Letters.** Each 15° band of longitude eastward from the point of origin is lettered, using A to Z, but omitting I and O—to avoid confusion with the figures "one" and "zero". In the same way, each 15° band of latitude northward from the point of origin is lettered, using A to M, but omitting "I" to avoid confusion with the figure "one". The two letters of each 15° area so defined are obtained by reading longitude before latitude, and are known as Primary Letters. (See Fig. 2.)

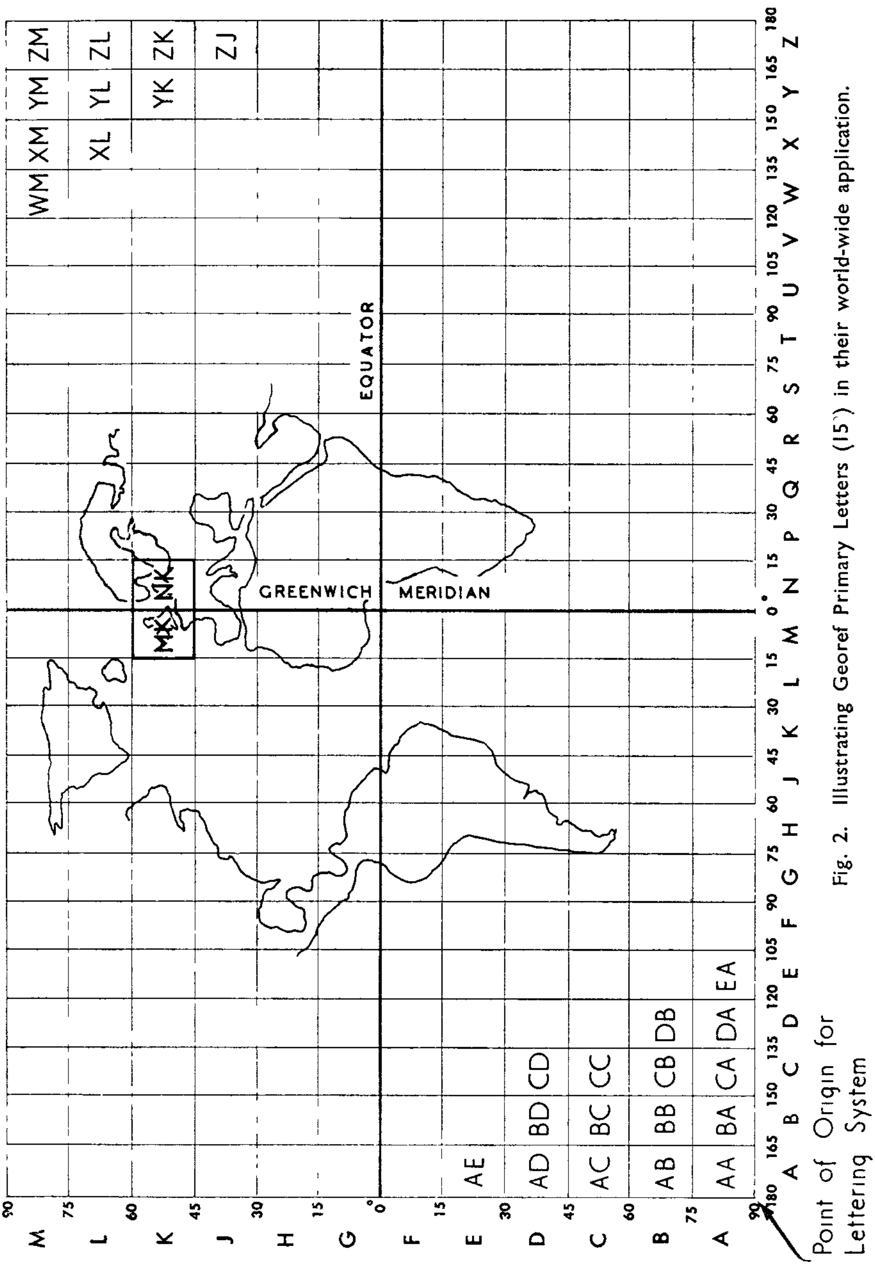


Fig. 2. Illustrating Georef Primary Letters (15°) in their world-wide application.

12. **Secondary Letters.** Within each 15° band of longitude, each 1° band of longitude is lettered eastwards, using A to Q but omitting "I" and "O", and within each 15° band of latitude each 1° band of latitude is lettered northwards, using A to Q, but omitting "I" and "O". The two letters of each 1° area so defined are obtained by reading longitude before latitude, in the same way that applied to the 15° areas. The two letters of the 1° areas are known as secondary letters.

13. Fig. 3 shows the allocation of secondary letters to the 1° areas within the 15° area MK, which, together with a portion of the 15° area NK, covers the British Isles. It will also be noted that the secondary letters of the 1° areas are non-recurring over the British Isles. For this reason the R.O.C. need not qualify the 1° areas by use of the primary (15°) letters, as it is obvious that any such report can refer only to the British Isles. In practice the 1° area covering Lands End is given as KF and *not* as (MK) KF.

Fig. 3.

Illustrating Georef Primary and Secondary Letters in their application over the British Isles (15° areas MK and NK).

Numbering System

14. **Division and Sub-division of 1° Areas.** Up to this stage the earth's surface has been divided and sub-divided into 15° and 1° areas, which have been identified by letters. In dividing and sub-dividing the 1° areas a numbering system is introduced which is based on the fact that there are sixty minutes in one degree. The stages are first to divide the 1° area into 10′ areas and then to divide the 10′ areas into 1′ areas; the 1′ area is the minimum reporting unit used by the R.O.C.

15. (*Deleted*)

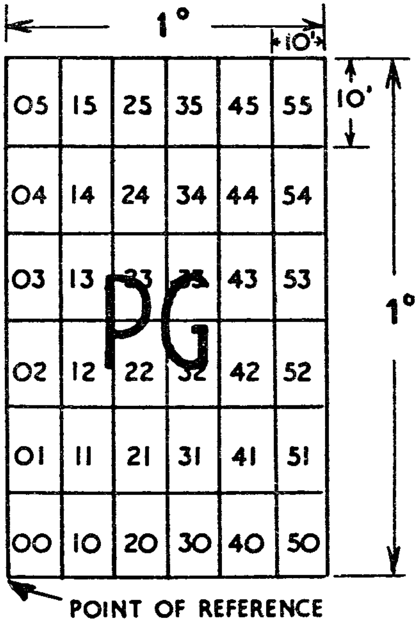


Fig. 4.
Illustrating division of the 1° area PG into thirty-six 10′ areas, and the numbering system used.

16. **Division of 1° Areas into 10′ Areas.** Each 1° area is divided into areas with sides 10′ in length. As there are 60 minutes in one degree it follows that each 1° area is divided into thirty-six 10′ areas. Each of these 10′areas is then given a two-figure number, according to the "eastings" and "northings", in tens of minutes, *of its own south-west corner measured from the south-west corner of the* 1° *area in which it is contained.* If the number of minutes is less than ten, this will be written as "O" (Zero). The south-west corner of the 1° area from which the "eastings" and "northings" are calculated is known as the "point of reference".

17. A 10′ area is referred to by the two letters of the parent 1° area, followed by the *two figures* of the particular 10′ area—for example, the 10′ area in the north-east corner of Fig. 4 is PG 55, which means that its south-west corner is located fifty minutes east, then fifty minutes north of the point of reference in 1° area PG.

18. It must also be noted that the numbering system for 10′ areas is exactly the same within every 1° area, irrespective of its geographic location. It should be realized that the figures are *not* those of longitude and latitude, but that they merely indicate a degree of travel east, and then north, from the "point of reference".

19. **Division of 10′ Areas into 1′ Areas.** In dividing a 10′ area into areas with sides 1′ in length, one hundred 1′ areas are produced within that 10′ area.

20. A 1′ area (as for the 10′ area) is referred to by the two letters of the parent 1° area, but in this case the letters are followed by a *four-figure number.* The four-figure number indicates the two figures of "eastings", followed by the two figures of "northings" of the south-west corner of the 1′ area from the "point of reference". For example, in Fig. 5 the 1′ area in the north-east corner is PG 3919; in other words, the south-west corner of that area is 39 minutes east, and then 19 minutes north, from the south-west corner of 1° area PG (*i.e.* the "point of reference").

21. It will be seen that all the 1′ areas, within the 10′ area PG 31, have 3 and 1 as the first and third figures respectively. This is because the south-west corner of that 10′ area is known to be thirty minutes east and ten minutes north from the "point of reference" (hence 31). The second and fourth figures merely indicate the degree of travel, in minutes, within the 10′ area PG 31.

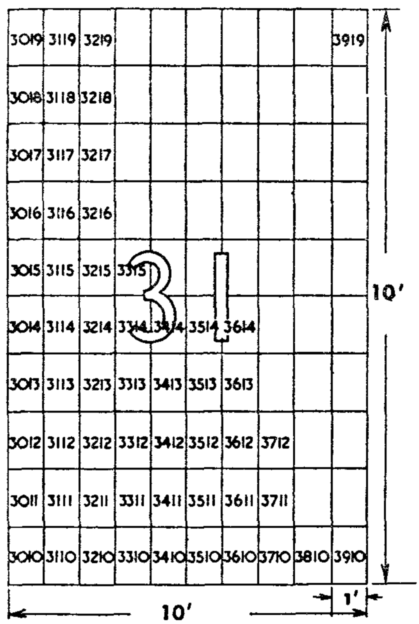


Fig. 5.
Illustrating a 10′ area PG 31 divided into one hundred 1′ areas, and showing the numbering system used.

Pinpoint Reference

22. Georef can be used for pinpointing a precise location with a reasonable degree of accuracy. There are various methods; for instance, by quoting two figures of minutes followed by a third figure representing one-tenth of a minute, east, and then two figures of minutes followed by a third representing one-tenth of a minute, north, one arrives at a six-figure Georef point which gives accuracy to approximately 600 feet. In practice, pinpointing by Georef is *never* used by the observer and its main use is in the accurate location of post sites when making up post charts, or when setting out a main plotting table map.

Use for which the National Grid Reference (Military) System is Designed

23. The National Grid Reference (Military) System (known as N.G.R.) is restricted in its application to England, Scotland and Wales and is designed for use of Military, Civil Defence and Police units, *etc.*, who may require to pinpoint a position with considerable accuracy. A separate grid is used to cover Northern Ireland.

24. Grid systems of this kind are used locally all over the world and in each case a particular meridian is chosen as the Standard Meridian upon which is based a grid consisting of lines drawn parallel and at right angles to it.

25. In the Georef system, the north-south lines are true "North-South" as they are meridians. These lines converge on the north and south poles and are therefore not parallel. Grid lines, on the other hand are parallel. Hence it follows that grid lines do not coincide with meridians (except for the Standard Meridian), *i.e.* grid lines are not "true" north-south lines. In other words, there must necessarily be a "Grid North" and a "True North"; the difference between them is called the "grid deviation". (*See* Fig. 6.)

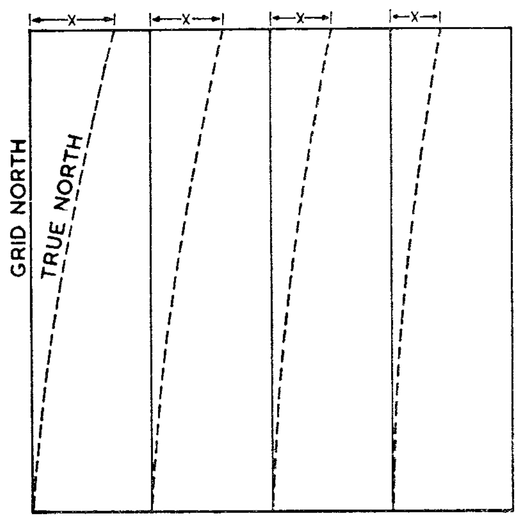


Fig. 6.

Grid Deviation. The unbroken lines are grid lines: the dotted lines are meridians. Grid deviation is denoted by ←— X —→.

Basis and Construction of N.G.R.

26. N.G.R. is based on the construction of squares having sides of specified lengths; all measurements are based on the metric system using kilometres and metres and, in contrast with Georef, similar units are identical in size and shape.

27. In order to minimize grid deviation the Standard Meridian chosen was 2° West and the grid was drawn on a Transverse Mercator projection based on the Standard Meridian and the 49° parallel.

28. For convenience a point of origin was then chosen 100 kilometres north of the 49° parallel and 400 kilometres west of the 2° West Meridian, *i.e.* at a point some distance south-west of Land's End.

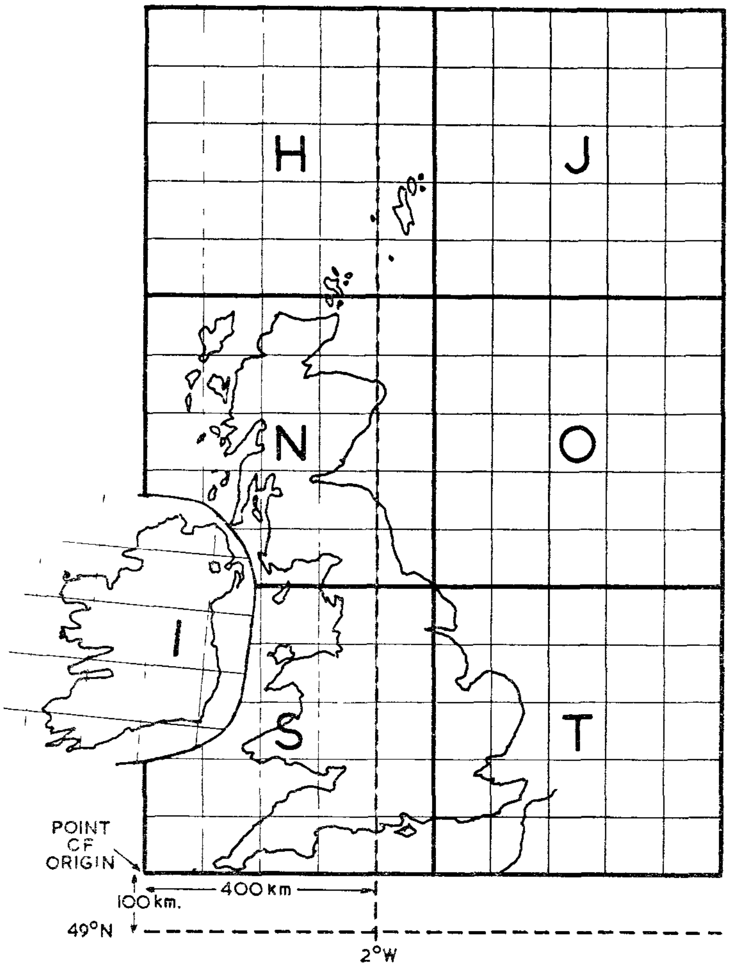


Fig. 7.
Lettering of 500-km. squares and incidence of Irish Grid.

Lettering System

29. **Primary Letters.** From the point of origin a series of 500-km. squares was built up and lettered as shown in Fig. 7. Also shown is the incidence of the Irish Grid Reference system which uses 8° W as the Standard Meridian and the letter "I" as the Primary Letter.

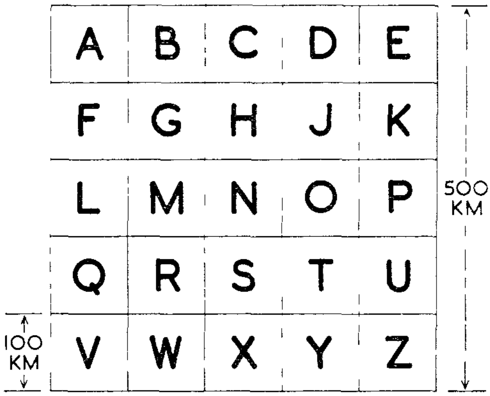


Fig. 8.
Lettering of 100-km. squares within a 500-km. square.

30. **Secondary Letters.** The 500-km. squares are each sub-divided into 25 squares with 100-km. sides which are lettered as in Fig. 8. It will be noted that the letter "I" is omitted in order to avoid confusion with the figure "1" thus reducing the alphabet to the required 25 letters.

Numbering System

31. **Point of Reference.** All squares within a 100-km. square are numbered by easting and northing from the south-west corner of the 100-km. square in which they are contained. This south-west corner is referred to as the "point of reference".

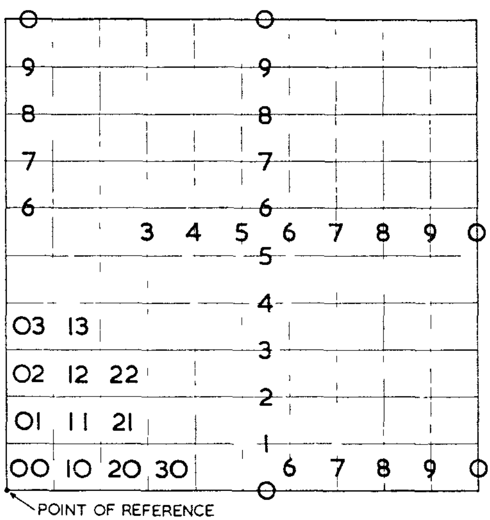


Fig. 9.
Numbering of 10-km. squares within a 100-km. square.

32. **10-Km. Square.** Each 100-km. square is sub-divided into 100 squares of 10-km. side which are given a two-figure number according to the easting and northing in tens of kilometres of their south-west corners from the point of reference. See Fig. 9, which shows also two different methods of marking maps. In one method the two-figure number of the 10-km. square is shown in each square; in the other each grid line is marked at convenient points with its easting and northing from the point of reference; the latter system is usually used on Ordnance Survey Maps of scale $\frac{1}{4}''$ to 1 mile or smaller and on maps used for triangulation of nuclear bursts.

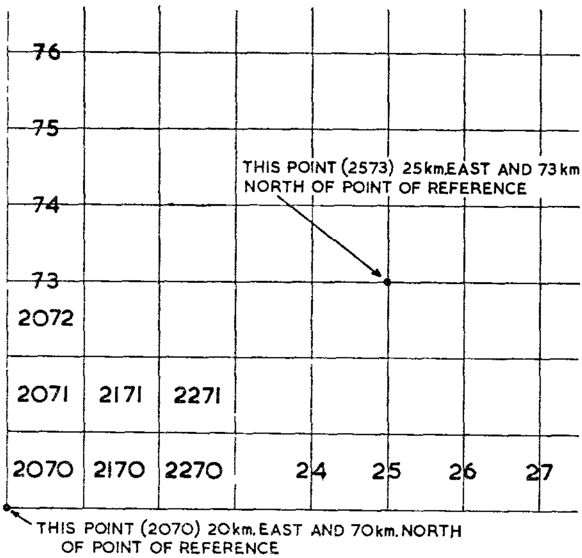


Fig. 10.
Numbering of 1-km. squares within a 10-km. square.

33. **1-Km. Square.** Each 10-km. square is sub-divided into 100 squares of 1-km. side each of which is given a four-figure number according to the easting and northing of their south-west corner from the point of reference of the 100-km. square. *See* Fig. 10: again two methods of marking are shown, *i.e.* the numbering of each square and the numbering of lines. The latter method is normally used on Ordnance Survey Maps of scale 1" to 1 mile or larger.

34. The four-figure reference is used by the R.O.C. when referring to the ground zero of a nuclear burst. It is obtained by the triangulation supervisor from the map mentioned in para. 32. The triangulation map is marked with 10-km. squares and the 1-km. square is obtained by eye or by using a romer.

35. **Further Sub-Division.** 1-km. squares may be further sub-divided into 100-metre squares giving a six-figure reference and even further sub-divided to give an eight-figure reference applicable to a 10-metre square. These sub-divisions are only used for pin-pointing precise locations and need not concern the observer.

CHAPTER 7

PHONETIC ALPHABET AND NUMBERS

1. All forms of passing information by means of speech over telephone circuits are liable to distortion through variations of pronunciation with consequent misunderstanding. To lessen these risks, conventional models of pronouncing the letters of the alphabet and the numbers have been designed, and the following alphabet was adopted for international use on 1st March, 1956:—

(*a*) **Normal Phonetic Alphabet**

Letter	*Telling Jargon*	*Pronunciation*
A	ALFA	*AL* FAH
B	BRAVO	*BRAH VOH*
C	CHARLIE	*CHAR* LEE
D	DELTA	*DELL* TAH
E	ECHO	*ECK* OH
F	FOXTROT	*FOKS* TROT
G	GOLF	GOLF
H	HOTEL	HOH *TELL*
I	INDIA	*IN* DEE AH
J	JULIETT	*JEW* LEE ETT
K	KILO	*KEY* LOH
L	LIMA	*LEE* MAH
M	MIKE	MIKE
N	NOVEMBER	NO *VEM* BER
O	OSCAR	*OSS* CAH
P	PAPA	PAH *PAH*
Q	QUEBEC	KWEE *BECK* or KEY *BECK*
R	ROMEO	*ROW* ME OH
S	SIERRA	SEE *AIRRAH*
T	TANGO	*TANG* GO
U	UNIFORM	*YOU* NEE FORM or *OO* NEE FORM
V	VICTOR	*VIK* TAH
W	WHISKEY	*WISS* KEY
X	XRAY	*ECKS RAY*
Y	YANKEE	*YANG* KEY
Z	ZULU	*ZOO* LOO

(*b*) **Phonetic Equivalent of Numbers**

Number	*Telling Jargon*
1	WUN
2	TOO
3	THREE
4	FOWER
5	FIFE
6	SIX
7	SEV-EN
8	ATE
9	NINER
0	ZERO

Note. Except in certain special cases, combined numbers are spoken by the phonetic equivalent of each individual figure, *e.g.* 5749 as FIFE SEV-EN FOWER NINER.

2. Exceptions to the normal phonetic numbers are used when telling and reporting 24-hour clock times within the Royal Observer Corps. These are spoken as follows:—

(*a*) The hours are to be spoken as a whole number (*e.g.* "Fifteen"). If less than ten, the figure is to be preceded by the word "Oh" (*e.g.* "Oh-Ate"). If less than one, the hour is to be spoken as "Oh-Oh".

(*b*) The minutes are to be spoken as a whole number (*e.g.* "Twenty-Three"). If the time is "on the hour" the word "Hundred" is to be used. If the minutes are less than ten, the figure is to be preceded by the word "Oh".

(*c*) Midnight is to be spoken as "Twenty-Fower-Hundred". (Examples of such times are: Ten minutes after midnight spoken as "Oh-Oh-Ten", 1.17 a.m. as "Oh-Wun-Seventeen", 3 p.m. as "Fifteen-Hundred", 9.42 p.m. as "Twenty-Wun-Forty-Too", 11.02 p.m. as "Twenty-Three-Oh-Too").

Note. When passing times to the sector operations centre, they are usually spoken by the phonetic equivalent of each individual figure followed by the word "hours". (The examples above would be spoken as "Zero-Zero-Wun-Zero Hours", "Zero-Wun-Wun-Seven Hours", "Wun-Fife-Zero-Zero Hours", "Too-Wun-Fower-Too Hours", "Too-Three-Zero-Too Hours".)

CHAPTER 8

THE FUNCTION OF THE ROYAL OBSERVER CORPS IN THE UNITED KINGDOM WARNING AND MONITORING ORGANIZATION

1. The function of the Royal Observer Corps is to cover four tasks:—

(*a*) *The Reporting of Nuclear Bursts.* The initial occurrence of a nuclear burst is to be reported with the utmost speed. Subsequently, initial nuclear burst reports are to be amplified by giving the accurate location, height and power of each burst to provide the basic information from which group and sector warning teams can issue initial fall-out warnings and predictions.

(*b*) *The Reporting of Fall-Out.* The occurrence and intensity of radio-active fall-out resulting from nuclear bursts is to be measured, reported and plotted so that the group and sector warning teams can be provided with the information necessary for the issue of fall-out warnings and the refinement of predictions already made.

(*c*) *The A.D.O.C. Broadcast.* Nuclear burst and fall-out information from the United Kingdom Warning and Monitoring Organization sector displays is to be passed to and displayed at the Air Defence Operations Centre and other appropriate military headquarters.

(*d*) *The Reporting of Aircraft.* Posts are to maintain the skill of aircraft recognition so that information on selected aircraft movements at low level can be reported to the Royal Air Force should such information be required.

2. The reporting of nuclear burst information as in paragraphs 1(*a*) and (*c*) is to receive the highest priority and the reporting of fall-out information as in paragraphs 1(*b*) and (*c*) is to take precedence over aircraft reporting.

Function

3. The United Kingdom Warning and Monitoring Organization is responsible for:—

(*a*) Originating warnings to the public of the threat of air attack and of the approach of fall-out.

(*b*) Providing civilian and military authorities in the United Kingdom and neighbouring N.A.T.O. countries with details of nuclear bursts and with a scientific appreciation of the predicted path and likely intensity of fall-out.

The Warning Code

4. The following types of warnings would be issued to the public:—

Warning	*How given*	*Meaning*
RED	To the public by siren (rising and falling note); also broadcast by the B.B.C.	Imminent danger of air attack, take cover.
GREY	To the public by siren (interrupted note of steady pitch).	Fall-out expected in one hour.

BLACK	To the public by maroon sounding a Morse "D"—dash dot, dot.	Imminent danger of fall-out, take refuge until further advice is received.
WHITE	To the public by siren (steady note).	No further danger from air attack or from fall-out.

Warning of Air Attack (RED Warning)

5. It is planned to give the public warning by siren of air attack at least four minutes before any attack develops whether it is delivered by manned aircraft or by missile, and Home Office warning officers will be stationed at the R.A.F. Air Defence Operations Centre for this purpose. The Air Defence Operations Centre receives intelligence and early warning information from the appropriate military sources including the Ballistic Missile Early Warning System and allied radar chains. Home Office warning officers will also be stationed at R.A.F. radar stations in the United Kingdom. Their function is to keep sector apprised of the aircraft threat and in certain circumstances to initiate warnings.

6. The attack warning RED will be cancelled by the attack message WHITE, also given by siren, when it is considered that there is no further threat of air attack, provided that no fall-out hazard exists or is likely to arrive within an hour.

7. Attack warning messages, whether missile or aircraft attack, will be passed by a line broadcast system directly from the Air Defence Operations Centre to some 250 carrier control points installed in major police stations throughout the country. From each carrier control point warning messages will be distributed simultaneously to carrier receivers installed at warning points and on the premises of warning list recipients (such as hospitals and industrial premises) in the carrier area. (*See* Fig. 1.) For this purpose a unidirectional carrier line broadcast system has been developed which superimposes additional signals upon the existing General Post Office local telephone cable layout. In 12 areas in the North and West of Scotland the carrier system will not be used but the warning messages will be disseminated through the telephone system.

8. Warning points are the places from which the warnings to the public will be issued. For attack warnings they are equipped in populous areas with power operated sirens; in the less densely populated areas hand-operated sirens are provided. Warning points have been established at Royal Observer Corps posts, group headquarters, police, fire and coastguard stations, installations of the armed services, and at other places which are either in normal 24-hour occupation or can be swiftly manned in an emergency. Where it is not possible to obtain full warning cover from such official premises, additional warning points are being established at private premises where owners and occupiers are prepared to co-operate.

9. The carrier receiver equipment for each warning point consists of an instrument of approximately the same size as a normal household telephone. It includes a loud speaker and contains its own batteries. The telephone and the carrier receiver will be able to operate at the same time

without interfering with one another. The carrier broadcast system is capable of delivering:—

(*a*) A monitoring signal—
(*b*) A calling signal to alert the operator—
(*c*) An alarm signal different from (*b*)—
(*d*) Spoken messages.

The system has also been developed so that power sirens may be operated directly from the carrier control point.

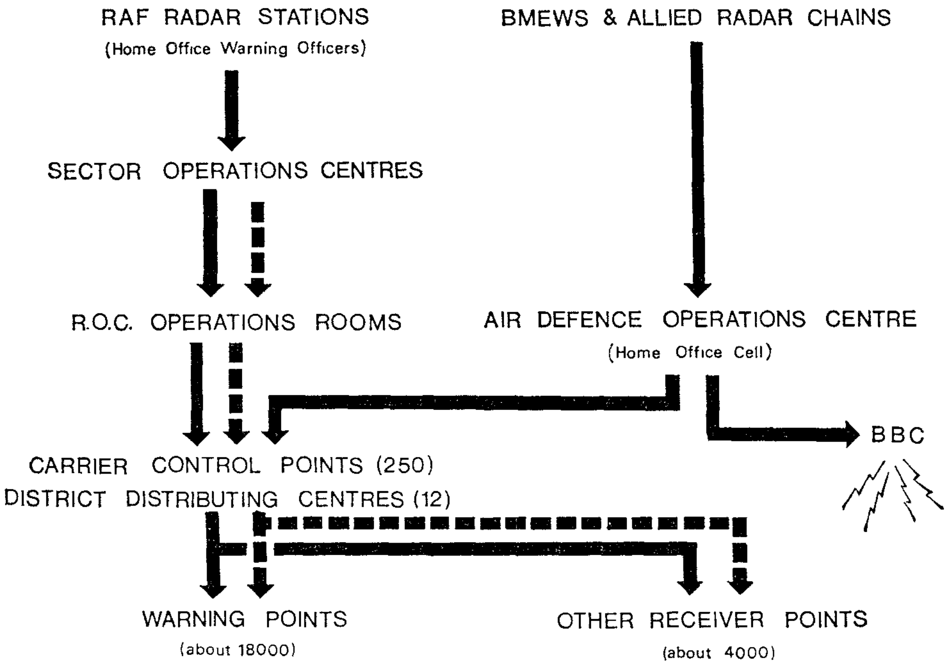


Fig. 1.

The communications chain for attack warnings ➡ and fall-out warnings ➡

Fall-Out Warning and Monitoring

10. Fall-out warnings are based on two kinds of prediction; the initial prediction indicates the outer limits of the area within which fall-out would be contained during the first hour or two after a nuclear burst; it is based on information about the position and height of burst, the power of the weapon and the forecasts of upper wind speeds and directions. Subsequent predictions are based upon the actual times of fall-out arrival on the ground and on further meteorological forecasts; they give a more accurate picture of the probable path of fall-out up to three hours ahead of its arrival.

Reporting System

11. The information about nuclear bursts and radioactive fall-out which forms the basis of these predictions is collected by the Royal Observer

Corps posts and reported by telephone or radio to an R.O.C. operations room. There are 1,560 posts reporting to 29 operations rooms. These latter report to five sector operations centres (S.O.C.s) staffed by Home Office or Scottish Home Department personnel. The group headquarters report as follows:—

(*a*) Nos. 1, 2, 3, 4, 5 and 14 Groups to Metropolitan S.O.C.

(*b*) Nos. 9, 10, 11, 12 and 13 Groups to Southern S.O.C.

(*c*) Nos. 6, 7, 8, 15, 18 and 20 Groups to Midland S.O.C.

(*d*) Nos. 16, 17, 21, 22, 23 and 31 Groups to Western S.O.C.

(*e*) Nos. 24, 25, 27, 28, 29 and 30 Groups to Caledonian S.O.C.

12. Neighbouring R.O.C. operations rooms and neighbouring S.O.C.s are linked together for liaison and for the exchange of information. Radio is being provided in addition to telephone communications.

13. All posts and operations rooms and S.O.C.s are provided with accommodation giving protection from both blast and fall-out. Each has facilities enabling the crew to survive a prolonged period in a zone of high radioactivity.

14. From the S.O.C. information is passed according to their requirements to Government controls, Air Defence Operations Centre and neighbouring N.A.T.O. countries. The Air Defence Operations Centre collates the information from the five S.O.C.s and re-distributes a nation-wide picture to R.A.F. command and group headquarters, R.N. and maritime headquarters and other interested users.

Nuclear Burst Reporting

15. Each R.O.C. post is equipped with a bomb power indicator which records the peak over-pressure of the blast caused by a nuclear burst and a ground zero indicator which records photographically the bearing, elevation, *etc.*, of the fireball. The post observers report their information to their operations room where it is collated and processed to determine the position, height and power of the burst. From these details the initial prediction is made and fall-out warnings are assessed by the warning officers. The R.O.C. operations room also passes the details to adjacent groups and to the associated local Civil Defence headquarters.

Fall-Out Reporting

16. Each R.O.C. post has a remote-reading dose-rate meter (known as the "fixed survey meter") which can detect the arrival of fall-out and measure its current intensity. The time of first arrival of fall-out (termed "first report") and the dose-rate at five-minute intervals are reported to the operations room and thence as required to the S.O.C. They are also passed to the associated Civil Defence headquarters. First reports enable the S.O.C. staff to plot actual areas affected by fall-out and to modify initial predictions so that further warnings based on subsequent predictions will have greater accuracy.

17. The dose-rate readings are plotted on graphs by the sector staff and once the maximum level of fall-out has been reached (known as "fall-out maximum" or "F.O.M.") it is possible to compute the likely intensity of radiation at each post related to a standard time after burst. The time chosen as being most convenient is seven hours after burst and the computed

dose-rate for this time is known as the "DR7". From the DR7s contours of like intensity can be mapped and areas of high radiation can be determined. Second and subsequent arrivals of fall-out ("second reports", "third reports", *etc.*) can also be detected from the graphs.

Distribution of Information

18. The information available at sector is distributed to the users mentioned in paragraph 12 above in forms suited to their individual requirements. For example, one user might require only processed information such as nuclear burst details, initial predictions, actual areas of contamination and subsequent predictions; another user might require detailed information such as first and subsequent reports and DR7s.

19. In addition each S.O.C. is in contact with the other sectors and can obtain and supply information about nuclear bursts anywhere in the U.K. and neighbouring parts of Europe.

Fall-Out Warnings

20. It is planned to issue two kinds of fall-out warning to the public; a BLACK, indicating that fall-out is imminent, and a GREY, the object of which is to tell the public that fall-out is expected in one hour. This in favourable circumstances gives time for last minute preparations. Its value, however, is limited by three factors:—

(*a*) If a RED warning is still in force possible action must be very restricted.

(*b*) Another burst might occur near to the district under GREY warning and fall-out would then arrive in less than an hour.

(*c*) The longer ahead predictions have to be made the greater the chances of error and it cannot be assumed that fall-out will certainly arrive as predicted after a GREY warning.

21. Civil Defence and other services which have their own radiac instruments may continue operations after GREY or BLACK public warnings have been given when their commanders consider that circumstances require it.

22. Fall-out warnings are issued in terms of fall-out districts. There are about 700 of these districts in the United Kingdom, each district covering about 100 square miles.

Distribution of Fall-Out Warnings

23. Warning officers at R.O.C. operations rooms will originate fall-out warnings and relay them to carrier control points whence they will be passed to warning points. If as a result of severance of communications a warning point finds itself isolated, or if fall-out arrives without warning, the operator will sound the BLACK warning when the dose-rate on the survey meter at the warning point rises to 0.3 roentgens per hour.

Group Warning Team

24. The group warning team is responsible for originating fall-out warnings for districts covering an area roughly corresponding to that of the group in which they operate. Additionally, they are required to process information provided by the R.O.C. so that it is available to interested users, such as Civil Defence sub-regions.

25. Nuclear burst details are plotted by R.O.C. personnel on the reverse of a vertical plotting screen, together with first and subsequent reports and posts out of action. This display is used by the warning team for assessing the likely path of the fall-out plumes (including threats to their warning districts) and for identifying the nuclear bursts which originated the fall-out reported by the posts.

26. The warning team comprises a senior warning officer who co-ordinates the team effort and assists where pressure demands, and an assessor, a warning officer, a liaison officer and a log-chart officer. The assessor is responsible for all calculations on the screen. This assessment of threats to warning districts is checked by the warning officer who is responsible for ensuring that all appropriate warnings are issued. The liaison officer is the channel of communication by which the warning team exchanges useful intelligence with other teams.

27. The five-minute dose-rate readings are recorded by R.O.C. personnel on logarithmic graphs in the group operations room in the same way as at the S.O.C. The log-chart officer is responsible for interpreting and processing the dose-rate readings to produce fall-out maxima, second and subsequent reports and DR7s. This information is then available for use by the S.O.C., the team itself, adjacent groups or any other formation which may need it.

CHAPTER 9

EFFECTS OF NUCLEAR WEAPONS

General Features of Nuclear Weapons

1. Conventional weapons contain chemical high explosives which, when detonated, release energy as a result of chemical changes. Weight for weight, nuclear explosives liberate vastly greater amounts of energy, which comes from the nucleus of each atom. Various types of nuclear weapon can be made.

2. The fission or atomic weapon uses the process of splitting certain atoms; it is limited in size because above a certain critical size a lump of fissile material is self-disruptive.

3. The fusion or hydrogen weapon uses the process of fusing certain hydrogen atoms at very high temperatures; these weapons require a small fission charge as an initiator and are sometimes called "fission-fusion" or "thermo-nuclear" weapons. These are theoretically limited in size only by the method of delivery.

4. Another possible type of thermo-nuclear weapon is the so-called "dirty bomb" in which a "fission-fusion" device is contained in a heavy casing of fissile material. This results in the release as fall-out of a much larger quantity of fission products.

5. The energy released in a detonation at or near ground level is distributed in the following way:—

 45 per cent as blast and shock waves
 35 per cent as light and heat radiation
 5 per cent as initial nuclear radiations
 15 per cent as residual radiation from fission products.

6. Nuclear radiations are new effects in warfare, peculiar to nuclear weapons. The initial radiations include instantaneous radiation and, by general acceptance, all radiations emitted within a minute of detonation. The residual radiations come from the fission products, which with other contents of the bomb are vaporized by the intense heat of the fireball; these then condense on particles of debris or dust and fall to the ground over a wide area as radioactive fall-out. The residual radiation decays rapidly at first, but more slowly with time and may continue to be a hazard for a long period.

7. The power or yield of a weapon is expressed by comparing the release of energy with that from an equivalent weight of T.N.T.; weapon power can be varied to suit the target. The power of atomic weapons is expressed in kilotons (KT), one kiloton corresponding to the energy released by 1,000 tons of T.N.T. Hydrogen weapons require a unit 1,000 times as great: this is the megaton (MT or Meg), equivalent to 1,000,000 tons of T.N.T.

8. The atomic bombs dropped on Hiroshima and Nagasaki had a power of about 20 KT but in recent years thermonuclear devices of 50 megatons or more have been detonated in trials.

9. For normal purposes weapons below 500 KT in power are classed as kiloton weapons and more powerful types are referred to as megaton weapons, *e.g.* 500 KT is classed as a half-megaton.

10. The contents of a nuclear weapon are vaporized in the luminous fireball which expands rapidly and cools to form the familiar mushroom cloud and stem. The size of the fireball, its speed as it rises and the height to which it ascends depend mainly on the power of the weapon.

11. The cloud from a kiloton weapon would not normally rise higher than about 40,000 feet in the U.K., after which it would flatten into the familiar mushroom. That from a megaton weapon, however, might rise to 20 miles or more.

12. The effects of the burst will vary considerably according to whether the weapon is fused to burst:—

(*a*) On or near the ground.

(*b*) In shallow water in a harbour, lake or river, or in deep water at sea.

(*c*) High in the air.

13. For each weapon power there is a critical height above which the fireball will not touch the ground and therefore will produce neither appreciable contamination of the ground beneath it nor a significant fall-out hazard. (*See* Fig. 1.)

Power of Weapon	20 KT	100 KT	½ Meg.	1 Meg.	2 Meg.	5 Meg.	10 Meg.
Max. height for contaminating burst	600 ft.	1,100 ft.	2,200 ft.	2,900 ft.	3,800 ft. ¾ mile	5,400 ft. 1 mile	7,200 ft 1⅓ mile

Fig. 1.

Critical heights for Nuclear Weapons of certain sizes.

14. A ground burst is one in which the weapon is detonated below the critical height, *i.e.* on the ground or at such a low altitude that an appreciable part of the fireball touches the surface beneath it. As the fireball shoots upwards it carries much vaporized material but also creates a wind of 200 m.p.h. or more which carries large quantities of dust and debris on which the fission products can condense; these radioactive particles will ultimately be deposited as fall-out. Large particles and pieces of debris will fall close to the crater but smaller particles, carried to greater altitudes in the cloud, will fall at lower speeds according to their shape and size and may be carried considerable distances down-wind before returning to earth.

15. A water burst is one in which the weapon is burst below the critical height in or over shallow or deep water. In shallow water, mud and water will be carried into the fireball, the water will vaporize and then condense into radioactive rain. The fall-out pattern will be less extensive but more intensely radioactive than from a ground burst. A burst in deep water will produce similar effects apart from the absence of mud but more of the total energy will be expended in vaporizing water, producing a shock wave through the water and in forming surface waves. Most of the fission products will be trapped in water near the burst and will disperse rapidly.

16. An airburst is one in which the weapon is detonated above the critical height and the fireball is well clear of the ground. There are very few dust particles to which the fission products can adhere and

these are so light that they will have been dispersed far and wide before they reach the ground. No significant fall-out hazard will occur from this type of burst.

Biological Effects of Nuclear Radiation

17. The primary effect of nuclear radiations is to damage the living cells of the body.

18. The unit used to measure the *total* amount of radiation (the dose) received by any particular object or person is the roentgen(r). The intensity of radiation (or dose-rate) at any moment is measured in roentgens per hour (r.p.h.). Sub-units of one thousandth, the milli-roentgen (mr) and milli-roentgen per hour (mr.p.h.) are also used.

19. The injury caused by radiation will vary according to the dose received and will not necessarily be immediately apparent. As a general rule, a dose of 150 r will produce no immediate effect but an increasingly serious long-term hazard. Larger doses produce more serious and more immediate effects; doses over 600 r would result in death in most cases.

20. It should be remembered that all radiation is harmful and should be kept to a minimum. In peacetime, care is taken to ensure that radiation in industry or medicine does not agreed exceed tolerances. In a nuclear war, however, large sections of the population would have no option but to try and avoid or reduce the serious radiation hazard by seeking cover during the early rapid decay of radioactivity and by controlling exposure for some time after. In these circumstances, the permissible dose for personnel who must expose themselves on essential duty will obviously be much greater. This war-time emergency dose would be 75 r.

21. The biological effects of radiation appear in stages. The first, radiation sickness, may appear within a few hours after exposure depending on the dose received. Other effects are usually delayed and are mainly due to injury to the blood-forming system. Long-term effect may include anaemia or leukemia, *etc.*, and genetic damage.

Radioactive Decay

22. Radioactivity decays naturally and this decay cannot be accelerated or delayed by heat, pressure or chemical reaction. Some products of a nuclear explosion decay very rapidly, others very slowly so that the decay rate of a mixture of fission products is rapid at first and then slows down as the short-lived ones disappear. This decay-rate is expressed mathematically by a formula known as the "t to the minus one point two decay law".

23. For R.O.C. purposes a simplified version of this law known as the "seven-tenths rule" is applied. The rule is that the intensity of radiation falls by a factor of ten as the time lengthens by a factor of seven, that is, if you multiply the time by seven, you divide the dose-rate by ten. The application of the rule to a dose-rate of 100 r.p.h. at 1 hour after a burst is shown in Fig. 2.

Initial Nuclear Radiation

24. Nuclear radiations are emitted from the moment of detonation and for long periods thereafter. For convenience initial radiation is taken as that emitted within one minute of detonation; it consists of neutrons and gamma rays.

Time after burst	*Dose-rate in r.p.h.*
1 hour	100
(1¾ hours)	(50)
7 hours	10
2 days (49 hours)	1
2 weeks (14 days)	0.1
14 weeks	0.01

Fig. 2.

Application of seven-tenths rule. The 50 r.p.h. figure has been included because it is often useful to know that the dose-rate is halved when the time is multiplied by 7/4.

25. For all practical purposes, neutrons are not a hazard because the limit of their damaging range is well within the lethal limits of other effects.

26. For the same reason the initial gamma radiation from megaton weapons can be discounted but that from kiloton weapons is significant because it extends beyond the range of other effects. For example a 20 KT weapon would give a dose of 450 r at ¾ miles and 75 r at 1 mile; the corresponding distances for a 100 KT weapon would be 1 mile and 1¼ miles.

27. The only protection from initial nuclear radiation is to be under adequate shielding when the flash occurs. It must also be remembered that the radiation decreases with distance.

Thermal Radiation

28. The maximum size and duration of the fireball depends on the weapon power; that from a 20 KT weapon lasts about 1½ seconds while that from a 10 Meg weapon lasts about 20 seconds. The heat and light radiation can cause fires and skin burns out to considerable distances; it is absorbed by dark colours and reflected by light ones.

29. A 20 KT airburst will cause a main fire zone of more than 1½ miles radius, with isolated fires out to 2 miles; corresponding figures for a 5 Meg airburst are 15 miles and 22 miles. Weapons which are ground bursts will be effective over shorter distances.

30. Skin burns of varying severity will be suffered by persons directly exposed to the rays from the fireball. For example, blistering of the skin would be suffered by people directly exposed to the rays of the fireball of a 20 KT airburst weapon at a distance of 1¾ miles; a 5 Meg weapon would produce the same effect at 18 miles.

31. People caught in the open should dive behind any available cover to get out of the direct path of the rays of the fireball. In this way, serious burns can be avoided. Light coloured clothing gives better protection than dark; woollen garments are better than cotton.

Crater Formation and Ground Shock

32. When a nuclear detonation takes place on or near the ground a crater is formed and a shock wave is transmitted outward through the ground.

Much vaporized or pulverized material is sucked up by the rising fireball, but a still larger quantity is gouged out of the crater and deposited to form a highly radioactive "lip".

33. The ground shock effects from a megaton weapon would be similar to those of a moderate earthquake. Small underground structures and underground utilities (such as telephone cables, *etc.*) would be unaffected beyond a mile from a 5 Meg surface burst.

Effects of Air Blast

34. The enormous pressure produced by a nuclear weapon results in a wave of high pressure transmitted outwards and developing into a shock front. The pressure wave is followed by a suction wave. Initially, the pressure wave travels much faster than the speed of sound but gradually slows to the speed of sound at great distances.

35. Structural damage depends on the weapon power, whether it is air or ground burst and the distance from the detonation. It also, of course, depends on the type, strength, size, *etc.* of the structure.

36. Figure 3 shows the ranges of various categories of damage for ground burst weapons of various powers.

Weapon power	20 KT	100 KT	$\frac{1}{2}$ Meg	1 Meg	2 Meg	5 Meg	10 Meg
Total destruction	$\frac{3}{8}$	$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{3}{4}$	$3\frac{1}{2}$
Irreparable damage	$\frac{3}{8}$–$\frac{5}{8}$	$\frac{3}{4}$–1	$1\frac{1}{4}$–$1\frac{3}{4}$	$1\frac{1}{2}$–$2\frac{1}{4}$	2–3	$2\frac{3}{4}$–$3\frac{3}{4}$	$3\frac{1}{2}$–5
Moderate damage	$\frac{5}{8}$–$1\frac{5}{8}$	1–$2\frac{3}{4}$	$1\frac{3}{4}$–$4\frac{3}{4}$	$2\frac{1}{4}$–6	3–$7\frac{1}{2}$	$3\frac{3}{4}$–10	5–13
Slight damage	$1\frac{5}{8}$–$2\frac{1}{2}$	$2\frac{3}{4}$–$4\frac{1}{4}$	$4\frac{3}{4}$–$7\frac{1}{4}$	6–9	$7\frac{1}{2}$–12	10–$15\frac{1}{2}$	13–20

Fig. 3.

Average ranges (radii) of damage to typical British cities caused by ground-burst nuclear weapons.

37. Debris would be a serious problem in built-up areas, preventing or restricting movement of vehicles required for fire-fighting, rescue, *etc.*

38. The main blast risk to human beings (apart from being struck by debris or missiles) is being blown over by the blast wind; this risk can be considerably reduced by lying prone on the ground.

Effects of Residual Radiation

39. The radioactive fission products from a ground-burst weapon condense on debris and dust lifted by the explosion and would be deposited over a wide area in a complex pattern of radioactive fall-out, the shape and extent of which would be determined by the wind strength and direction at the various levels through which the particles fall. With the average winds in the United Kingdom the fall-out pattern might extend to several hundred miles down-wind of the point of burst (ground zero or G.Z.).

40. The extent of the fall-out pattern would also be dependent upon the power of the weapon. In typical British weather conditions, it would be irregular in shape with the more intensely radioactive areas towards the centre and closer to ground zero and with the intensity falling off towards the edges of the contaminated area and further down-wind.

41. In order to define fall-out contours in a contaminated area it is necessary for dose-rates to be related to a standard time. The time normally chosen is seven hours after burst. In practice, dose-rates would be measured and reported after maximum had been reached and for the decay law these dose-rates would be converted to the standard reference time and known as DR7s. A pattern of DR7s could then be drawn on a map and from these the fall-out contours could be defined; thereafter, the dose-rate at any place within the contours could be calculated for any given time.

The Different Hazards Presented by Fall-Out

42. The fission products decay by emitting:—

(*a*) Alpha particles, which lose their energy passing through a few inches of air; they cannot penetrate clothing or unbroken skin.

(*b*) Beta particles which are stopped by air within a few yards; they cannot penetrate deeply beneath clothing and skin but can cause skin burns.

(*c*) Gamma rays which can travel hundreds of feet in air and can penetrate through the deeper tissues and organs of the body.

43. Fall-out therefore presents two distinct hazards:—

(*a*) Contact with, or proximity to, the skin or organs of the body, *e.g.* fall-out on light clothing, on the skin and hair or inside the body by access through cuts or in food or water.

(*b*) Gamma radiation from fall-out over a wide area which can affect the whole body from a distance.

44. In some circumstances it may be possible to see or hear fall-out coming down, but for all practical purposes it should be assumed that it will not be noticed except by instruments.

Protection from Radiation

45. There are two factors involved in protection from radiation:—

(*a*) The distance between the person and the contamination.

(*b*) The shielding effect of the material between him and the contamination.

Effect of Distance

46. The intensity of gamma radiation diminishes as the rays travel through the atmosphere, so that in an area which is uniformly contaminated a person in the open is affected mainly by contamination close to him. Fig. 4 shows that half the dose comes from fall-out within 25 feet of him.

47. It will also be appreciated from Fig. 4 that a person in the centre of a building at 12½ feet from the walls and roof will be protected from ⅓ of the radiation, even ignoring any shielding effect of the walls and roof.

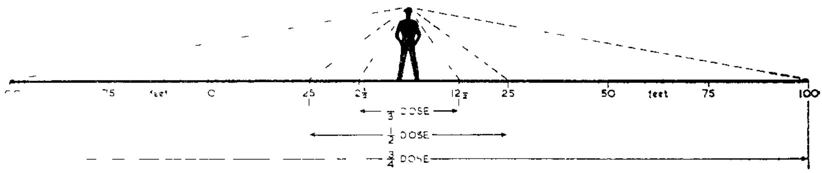


Fig. 4.
Total dose from fall-out—contributions from different distances.

Effect of Shielding

48. Gamma radiation can penetrate all material but its intensity is reduced and if the material is thick enough it gives protection of practical value. This protection increases with the weight and density of the material. (*See* Fig. 5.)

49. The thickness of shielding material needed to reduce the dose-rate by half is called the half-value thickness of that particular material. Typical half-value thicknesses are concrete, 2.2 inches, brick 2.8 inches, earth 3.3 inches and steel 0.7 inches.

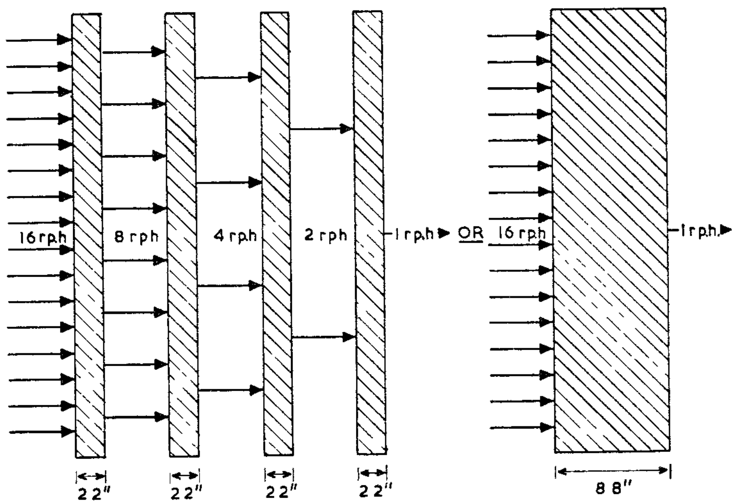


Fig. 5.
Diagram of reduction of gamma radiation by successive half-value thicknesses of concrete.

Protection Afforded by Buildings

50. The protection from fall-out afforded by a building is usually expressed as the "protective factor" of the building; that is the factor by which the dose-rate received by a person in the building is reduced compared with that received by a person standing in the open. Thus a person within a building with a protective factor of 40 would receive 1/40th of the dose received by a person standing outside.

51. Protective factors of ground-floor rooms used as a refuge in typical British houses are:—

Bungalow	5–10
Detached two-storey	15
Semi-detached two-storey	25–40
Terraced back-to-back	60

Personal Cleansing

52. If it is suspected that a person has become contaminated by fall-out settling on his clothing before he has taken cover or, if he has had to emerge from cover whilst fall-out is coming down, personal cleansing should be carried out as soon as practicable to remove as much as possible of the contamination.

53. The outer clothing should be removed as soon as possible, care being taken not to shake it unnecessarily. It should then be disposed of somewhere where it does not remain a hazard to other persons. Personal washing should then follow at once, soap and water being used as liberally as circumstances permit, particular attention being paid to the nails and hair.

First Aid for Radiation Sickness

54. If there is any suspicion that a person is suffering or will later suffer from radiation sickness, he should be treated for shock as well as for any injuries sustained from other causes. Complete physical and mental rest are very important and every care should be taken to prevent chilling. Scrupulous care should also be taken to prevent added risk of infection through wounds by flushing them freely with water if possible.

SECTION 2

Royal Observer Corps Posts

CHAPTER 10

FUNCTION OF POSTS

1. The R.O.C. post has two primary tasks, the relative importance of which varies according to prevailing circumstances.

2. The two primary tasks are :—

(*a*) *Aircraft Reporting.* To keep a constant watch from the observation post, observing the movement of aircraft and reporting the information, in stereotype form, to the operations room at its parent group headquarters. The reports indicate whether the aircraft are seen or heard, their position, direction of flight, and details of the number, height and type of the aircraft when these are known.

(*b*) *Fall-out Reporting.* To observe nuclear bursts and report information obtained visually and from instruments, to the operations room. From the underground posts to measure the intensity of radioactive contamination outside the post and report the time of arrival and the subsequent dose-rates to the operations room.

3. In addition, posts have a secondary task in observing and reporting air and ground information as set out in Chap. 12, para. 54.

4. The relative importance of the two primary tasks will be decided by the duty controller in the operations room, who has available to him a far wider picture of events than is available at posts. It is clear, however, that once the arrival of fall-out at a particular post has made it necessary for the observation post to be abandoned in favour of the underground post, reporting of aircraft becomes impracticable and the fall-out reporting task must of necessity become the primary one.

Operational Design

5. So that the primary functions of the R.O.C. may be served, posts are deployed as static units, normally at distances between six and ten miles apart over the whole country.

6. Posts are connected by direct landline telephone, in groups of three or four (termed clusters), to one plotter at the operations room main plotting table. They can thus overhear and take warning from reports given by posts on the same cluster or from information given out by the plotter.

7. Each post cluster is named with a letter of the alphabet, with each post in that cluster being allotted a number. For example, in an "A" cluster of three posts, the posts would be designated " A.1 ", " A.2 " and " A.3 ", and so on for each lettered cluster.

8. This method of designation, rather than the use of place names, assists in the speedy reporting of the information available and enables the operations room plotter immediately to know exactly which post is reporting, thereby avoiding unnecessary questioning and consequent time loss.

9. Each post is, whenever possible, sited at a point which provides a commanding view of the local countryside. At the same time, consideration has to be given to the telephone facilities available, the accessibility of

the site having regard to the convenience of the observers who will man it, and the soil, sub-soil, etc., on which the post is sited having regard to the construction of an underground post.

10. At the post site an observation post is constructed of sufficient size for the observers to carry out the aircraft reporting role and for them to be provided with protection from the weather. In addition, underground posts designed to reduce very substantially the effect of radiation on the observers occupying them are now being constructed. These underground posts are normally sited as near as possible to the observation posts.

11. In a few cases where a site has had to be vacated and a new site selected, no post structure exists and the telephone line may be terminated at the nearest telephone pole.

Manning of Posts

12. To ensure continuous duty watching, a number of observers are enrolled from the population in the neighbourhood. From this number, one observer at each post is appointed as chief observer and one as post instructor, the remainder serving as members of the duty-watching crews.

13. The chief observer is responsible to the group officer for the administration of his post and personnel, while the post instructor, in the rank of leading observer, is responsible to his chief observer and group officer for the training and instruction of the post personnel and for their operational efficiency.

14. In some cases, the responsibilities of the chief observer and of the post instructor may be shared or reversed to suit the capabilities of the particular persons selected for these appointments.

CHAPTER 11

OPERATIONAL LAYOUT OF OBSERVATION POST

Post Site

1. The chief observer must ensure that all personnel know the location of the post site well enough to find it by day or night. This will present no difficulty where a post structure exists, but where a resite has taken place and the building of a new structure is awaited, each member of the post must become acquainted with the spot chosen as representing the post site and also the position of the telephone and its terminal box.

The Post Chart Table

2. The post chart table is normally mounted on a fixed pedestal in the centre of the post look-out. The pedestal is constructed to suit the height of the average observer and is surmounted by a tripod head on which the chart table is fitted and made secure. On the top of the table which is circular in shape and made of cast aluminium or bakelite, is fitted a chart covering the terrain within a radius of 8½ miles from the post site. (See Fig. 1.)

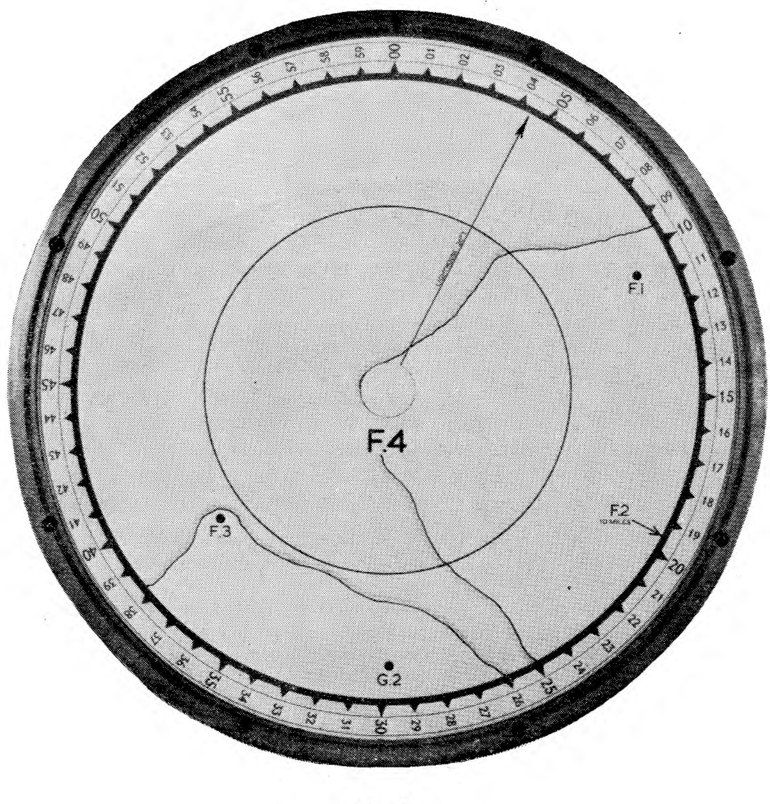


Fig. 1.

Post Chart Table.

3. This chart, which is drawn to a scale of one inch to one mile, is marked with the following items only:—

(*a*) The post designation, *i.e.* letter and number.

(*b*) Minute bearings round the perimeter, corresponding to the minutes on the clock face with the "00" minute bearing correctly orientated to true north.

(*c*) A "Reference Circle" drawn at a radius of five inches (representing five miles) from the post site.

(*d*) The position and designation of all posts within 8½ miles.

(*e*) An arrow showing the designation, direction and distance from the post of any other post on the same cluster beyond the limit of the chart.

(*f*) The aiming line, indicating the predetermined aiming point for the correct orientation of the chart.

(*g*) The coastline where applicable.

4. To protect the chart from weather or other damage a flat glass or celluloid cover is provided. This is kept in position by a hollow metal centrepiece and the outer edge is usually held in position by a metal retaining ring.

5. To assist in reading off the minute bearings they may be painted round the vertical edge of the chart table. For this purpose the figures on the vertical edge should be positioned diametrically opposite the same figures on the surface of the table. Thus the figures "00" on the vertical edge will be positioned to correspond with "30" on the surface of the table, "25" will correspond with "55", etc. (See Fig. 2.)

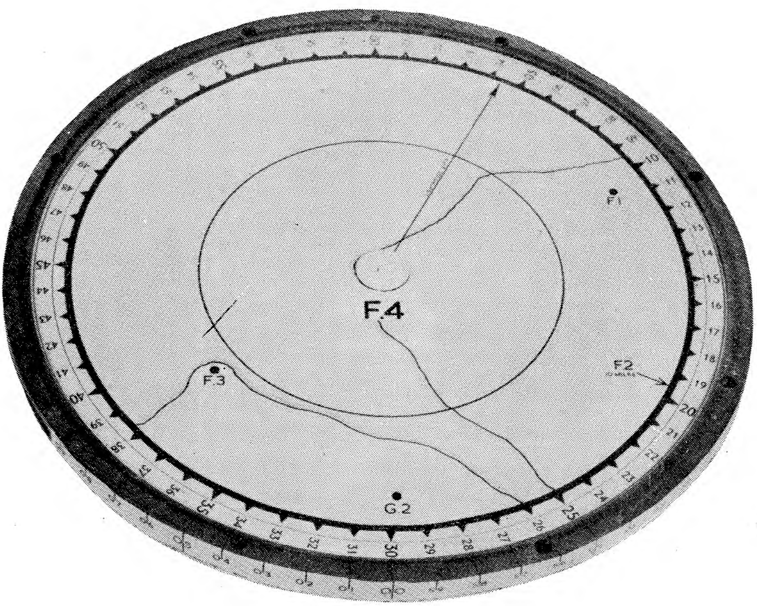


Fig. 2.

Minute Bearings on Vertical Edge of Chart Table.

Setting up the Chart Table

6. To set up the chart table on the pedestal:—

(*a*) Place the chart table over the tripod head so that the flange fits securely over the head.

(*b*) Move the chart table round so that the aiming line on the chart is sighted on the aiming point.

(*c*) Check to ensure that the table is reasonably level.

(*d*) Secure the chart table on the tripod head by means of the clamping bolt which is built into the flange underneath the table.

7. The setting of the chart table may be checked by aligning the Pole Star at night, or the sun at noon G.M.T. by day, with the bearings "Zero Zero" and "Three Zero" respectively.

Chart Table—Temporary Mounting

8. Where a post structure has not been built and therefore no pedestal is available a tripod is used in its place. Observers are to understand the use of the tripod in substitution for the pedestal where mentioned.

CHAPTER 12

OPERATIONAL PROCEDURE—AIRCRAFT REPORTING

States of Preparedness—Responsibilities of Duty Watch Crew

1. When a post becomes operational two observers are required to maintain the duty watch. This number is the normal manning needed to carry out the work.

2. During practices other members of the post crews should attend to gain as much experience as possible. On occasions such as exercises, when posts are manned for a considerable period, chief observers should arrange a duty roster so as to enable every member to attend.

3. Under operational conditions the normal state for the two observers forming the duty watch at a post is that of "Readiness". The duty controller is responsible for deciding when conditions are such that the relaxed state of "Available" can be permitted.

4. When at a state of "Readiness" both observers maintain a continuous watch beside the chart table, sharing the duties as follows:—

(*a*) No. 1 in charge of the post; wearing the binoculars; watching and listening for aircraft and associated incidents; recognizing the aircraft types where possible; and deciding the relative importance and order of reporting, in the absence of specific instructions.

(*b*) No. 2 wearing the head and breast set; acting as telephonist; reporting and logging in the order decided by No. 1.

Note. During the state of "Readiness" one observer is permitted to leave the look-out for short periods for the purpose of refreshment, etc., provided he remains within hearing distance of the telephone bell. The other observer is to wear the head and breast set in such a manner as to permit the hearing of messages from the operations room and the sound of aircraft at the same time, and is thus to maintain a constant watch by combining temporarily the duties of both No. 1 and No. 2 observers.

5. When at the state of "Available" one observer is to maintain a constant watch by the chart table. The other observer can be in the cubby-hole adjoining, provided that he is within hearing distance of the telephone bell. The head and breast set is to be worn either:—

(*a*) By the observer in the adjoining cubby-hole in the normal manner, or

(*b*) By the observer on the look-out, in such a manner that he can hear messages from the operations room and the sound of aircraft at the same time.

6. It is realized that to provide relief during a tour of duty it may be desirable for the two observers to exchange duties. This is permitted provided it is understood that the No. 1 observer for the time being is in charge of the post, and that each observer carries out the full duties applicable to the position he has taken over.

7. Under emergency conditions posts might be brought to a state of "Readiness" or to "Available" according to the prevailing circumstances. If posts are brought to "Readiness" or "Available" during the emergency, it might then be decided by higher authority that the situation was such

that further relaxation of vigilance was permissible. In this case the state of "Released" would be authorized, to be understood as follows:—

Released. All observers can be released from duty, provided arrangements are made to reach the state of "Readiness" within two hours of the receipt by the chief observer of a message requiring "Readiness".

Reporting from R.O.C. Posts

8. In order to achieve speed and efficiency of post reporting and operations room plotting there must be an accepted sequence of information. The sequence is designed to give all the essential information in the most concise form and in the order required by the operations room plotter.

9. In the following paragraphs methods of reporting are described and examples given. Observers must learn the basic methods and each variation so that no confusion or delay arises when any item of "air information" is being reported to the plotter at the R.O.C. operations room.

Speed in Reporting

10. All reports must be made *immediately* an aircraft is seen or heard. An initial visual report is not to be delayed until the aircraft is recognized. An initial sound report is not to be delayed until direction and/or height is established. When ascertained, these items are to be included in subsequent reports.

Methods of Reporting Individual Aircraft or Formations

11. There are three basic methods of reporting aircraft. These three methods are, however, variations of one another, differing only in the way in which the plan position of the aircraft being reported is indicated.

12. The three basic methods are:—

(*a*) *Overhead Report.* If an aircraft is estimated to be one mile or less from the post, No. 2 observer is to report using the following sequence:—

(i) Post designation (Plotter's reply).
(ii) The word "Heard" when applicable.
(iii) The word "Overhead".
(iv) The direction.
(v) The number of aircraft and the estimated height.
(vi) The type or class of aircraft.
(vii) The plotter's acknowledgement by saying "Thank you".

(*b*) *Bearing Report.* If an aircraft is estimated to be more than one and up to five miles inclusive from the post, No. 2 observer is to move round until the centre of the chart table is directly between him and the aircraft or sound. He is to align the aircraft or sound across the table to ascertain the bearing from the post. The report is then to be made using the following sequence:—

(i) Post designation (Plotter's reply).
(ii) The word "Heard" when applicable.
(iii) The minute bearing.
(iv) The direction.
(v) The number of aircraft and the estimated height.
(vi) The type or class of aircraft.
(vii) The plotter's acknowledgement by saying "Thank you".

(*c*) Bearing and Distance Report. If an aircraft is estimated to be more than five miles from the post, No. 2 observer is to carry out the same action as in sub-para. (*b*), but is to report using the following sequences:—

(i) Post designation (Plotter's reply).
(ii) The word "Heard" when applicable.
(iii) The minute bearing.
(iv) The distance in miles (visual) or the word "Distant" (sound).
(v) The direction.
(vi) The number of aircraft and the estimated height.
(vii) The type or class of aircraft.
(viii) The plotter's acknowledgement by saying "Thank you".

Special Sequences

13. In addition to the basic methods, described in para. 12, special sequences are used to cover certain circumstances, *e.g.* aircraft becoming airborne and landing, aircraft crashing, and formations dividing. Examples of these special sequences are given in Chap. 13, paras. 5 and 7 and Chap. 14, paras. 37 to 40. It should be noted that the two parts of a "formation dividing" sequence should follow the pattern of a normal sequence, *i.e.* each half should contain the items in para. 12 (*a*) (ii) to (vi), 12 (*b*) (ii) to (vi), or 12 (*c*) (ii) to (vii).

Priority Warning Call "Rats"

14. The reporting of low-flying hostile aircraft demands urgent priority so that the time lag between the sighting of such aircraft by the post observer and the laying of the resultant plot on the R.A.F. plotting tables is reduced to the absolute minimum.

15. To ensure that a report on such aircraft obtains priority and that the operations room plotter is ready temporarily to stop plotting other tracks and concentrate on the report to come, a significant code-word is used at the start of each report on that aircraft.

16. Post observers are to:—

(*a*) Use the warning call "Rats" followed by the post designation as a prefix to every report on a hostile or unidentified aircraft flying at 5,000 feet or less over land or sea.

(*b*) Allow a brief pause after making the priority warning call in order that the plotter may repeat the warning call and the post designation to the operations room. This will be overheard by the post observer and accepted as an acknowledgement.

(*c*) Allow a second brief pause during the report, after giving the direction, to enable any other post to report a "Rats" aircraft.

(*d*) Use the warning call for "Heard" aircraft, if they are satisfied that the sound is that of an aircraft which conforms to the definition in sub-para. (*a*).

(*e*) Cease reporting lower-priority aircraft when they hear a post on the same cluster using the priority call "Rats", and resume reporting when the "Rats" report has been completed.

Priority Warning Call "Jab"

17. The need for priority of acceptance by the plotter of a report on certain friendly aircraft is recognized by the use of the code-word "Jab". The need normally arises when reporting fast-flying jet aircraft, particularly (but not necessarily) when such aircraft are at low altitude.

18. Post observers are to:—

(*a*) Use the warning call "Jab" as a prefix to a visual report whenever it is necessary to obtain priority of acceptance because another post on the same circuit is reporting a non-priority aircraft.

(*b*) Use the warning call only when absolutely necessary and refrain from using it when another post on the same cluster is reporting on "Rats", hostile, unidentified, or S.O.S. aircraft.

(*c*) Cease reporting non-priority aircraft when they hear a post on the same cluster use the priority warning call "Jab", and resume normal reporting when the "Jab" report has been completed.

Post Designation

19. In all post reports the letter and number of the post designation is to be spoken by the phonetic equivalent, to be repeated by the operations room plotter as an acknowledgement, except in the case of a "Rats" report (see para. 16).

Type of Report

20. When appropriate the words "Navigation Lights" or "Contrail" are to be used in place of the word "Heard".

Minute Bearing

21. The bearing is to be spoken in separate figures, *e.g.* "30" as "Three Zero".

Distance (if over five miles)

22. The estimated distance in the case of a visual report is to be spoken, *e.g.* "Miles Sev-en". In the case of a sound report or a report on "Navigation Lights", the word "Distant" is to be used.

Direction

23. The direction of flight is to be reported by reference to the eight-point compass. The word "Circling" is to be used in place of a direction when appropriate. If no direction can be established the words "No direction" are to be included.

Number of Aircraft

24. (*a*) *Visual Reports.* The exact number of aircraft is to be reported as a complete number, *e.g.* "12" as "Twelve".

(*b*) *Sound Reports.* The estimated number of aircraft heard is to be reported as follows:—

(i) One aircraft as "Wun".
(ii) Two aircraft as "Too".
(iii) Three, four or five aircraft as "Too plus".
(iv) More than five aircraft as "Fife plus".

Note. When the exact number of aircraft in a formation has been established by a visual report, that number is still to be reported even if the formation subsequently passes out of sight and is plotted by its sound.

Height

25. Heights are to be estimated as from the level of the post and reported as follows:—

(*a*) All heights up to 500 feet inclusive as "Zero".

(*b*) All heights over 500 feet up to 1,000 feet inclusive as "Wun".

(*c*) All heights over 1,000 feet up to 15,000 feet inclusive to the nearest 1,000 feet above the height estimated.

(*d*) All heights over 15,000 feet to the nearest 5,000 feet above the height estimated, except in the case of reports on contrails (see paras. 31 to 34). For example, 17,000 feet would be reported as "Twenty".

(*e*) If no height can be established, the words "No height" are to be included.

(*f*) All heights over 9,000 feet, reported in accordance with sub-paras. (*c*) and (*d*) are to be spoken as whole numbers, *e.g.* "15" as "Fifteen".

Type of Aircraft

26. (*a*) *Visual Reports.* Aircraft types, when recognized, are to be reported by using, whenever possible, the common name (*i.e. not* the airline class name); otherwise by the type designation. When the type is unrecognized the word "Plane" is to be used.

(*b*) *Sound Reports.* When the aircraft type is not definitely known the class of aircraft is to be reported by using the words "Jet" or "Piston" in place of the type.

Final Reports

27. The word "Out" is to be added at the end of the sequence in the case of a final report on a particular aircraft or formation.

Acknowledgement of Receipt by Operations Room Plotter

28. The operations room plotter will acknowledge receipt of all reports by saying "Thank you".

Call between Posts on the Same Cluster

29. When it is necessary for one post to call another on the same cluster the following sequence is to be used:—

"Alfa Wun calling Alfa Too".

Phonetic Alphabet and Numbers

30. The phonetic alphabet and numbers listed in Chapter 7 are to be used where applicable.

Reporting of Condensation Trails (Contrails)

31. The difficulty of estimating the height of aircraft forming condensation trails (contrails) is recognized and, in order to assist the post observer in his task, the mean height at which contrails are likely to form is passed to the post by the operations room plotter.

32. The contrail height is to be logged by No. 2 observer as it is received from the operations room plotter and is thereafter to be adopted as being correct for all contrails which are seen during the current period. Subsequent receipt of an amended contrail height automatically cancels and supersedes any previous contrail height.

33. No. 2 observer is to:—

(*a*) Report all contrails which are estimated to be five miles or less from the post by using the normal methods described in para. 12(*a*) and (*b*). Examples of these reports are shown in Chap. 14, paras. 7 and 19.

(*b*) Report contrails which are estimated to be more than five miles from the post by giving the word "Contrail" and the bearing only (see Chap. 14, para. 32). Reports of this type should be given only when the contrail is first sighted; the operations room plotter will then inform No. 2 observer whether further reports at distances greater than five miles are required.

34. As a means of estimating the approximate distance of a contrail from the post the following may be applied:—

(*a*) With the arm raised to an angle of 45° above the horizontal, contrails appearing above the arm can be considered as being within five miles.

(*b*) With a stout wire or rod erected vertically in the centre hole of the chart table, readings can be taken by sighting from the rim of the table over the top of the rod, which must be exactly equal in height to the radius of the chart table. Contrails appearing above the line of sight produced in this way can be considered as being within five miles.

Examples of Sequences

35. For examples of sequences used for reporting individual aircraft or formations, see Chap. 14, paras. 1 to 40.

Congestion of Reporting Lines

36. For operational purposes, three or four posts are joined by one telephone circuit to a plotter. If more than one post wishes to report at the same moment, it becomes the responsibility of the operations room plotter to control the order of reporting.

37. The plotter will be guided in the first instance by any priority warning call which may be given, but if the aircraft being reported are all non-priority aircraft then the plotter will decide their relative importance and instruct the posts as in the following example:—

"Wait — Alfa Wun —— Report — Alfa Too".

38. When more than one post is reporting the same aircraft or formation of aircraft, the fact becomes obvious to the plotter who is to give priority to the reports of the post which is in the best position to continue the track, at the same time instructing the remaining posts in the cluster to stop reporting.

Warning of the Approach of Aircraft

39. Whenever possible, the operations room plotter will warn No. 2 observer of the approach of aircraft using a sequence consisting of the following items only:—

(*a*) Post designation (Await No. 2 observer's reply).

(*b*) The bearing of the aircraft from the post (in minutes).

(*c*) The direction of flight.

(*d*) The strength and height.

(*e*) The type or class of aircraft (*i.e.* Hunter, jet, piston, etc.).

(*f*) No. 2 observer acknowledgement by saying "Thank you".

40. It will be noted that this warning sequence conforms to the same pattern as that used by posts for reporting.

41. In addition to this verbal means of warning posts, provision is made for a special early warning signal to be given to indicate the presence of "Rats" aircraft in the vicinity of the post.

42. The "Rats" warning signal consists of a high-pitched "tone" of short duration which can be injected into the cluster circuit by the post controller.

43. On hearing this signal, No. 2 observer is to notify No. 1 observer immediately and a specially vigilant watch is to be kept for the approach of aircraft at low altitude. The warning tone may be followed by a verbal warning from the plotter.

Special Procedure for Overlap Clusters

44. The normal post cluster is positioned within the boundary of a group and reports to one operations room only. The overlap cluster is positioned to straddle the boundaries between two, three or four groups and is designed so that each report received from any post within the cluster is heard simultaneously by the plotters in the operations rooms concerned, thus making the territory covered by the overlap cluster common to all the groups concerned. The same reports, from the same posts, can then be plotted simultaneously in each of the operations rooms thus facilitating the passing of tracks from one group table to the next.

45. There are technical considerations which limit the provision of overlap clusters, so this system has to be limited to certain boundaries where correct track handover is considered to be of outstanding importance.

46. For administration and training purposes, the individual posts in an overlap cluster are each parented by the group in whose territory the post is sited; thus in one overlap cluster of four posts each might be administered by a different group.

47. For operational purposes, however, the overlap cluster is controlled by one group only insofar as only one of the two, three or four plotters connected to the cluster "does the talking". That plotter is known as the "Controlling Plotter".

48. The other one, two or three plotters who are also producing the tracks remain silent except at those specific times when there is a need for interjection as described in Chap. 23, para. 41. These plotters are known as "Silent Plotters".

49. Observers on overlap cluster posts are to:—

(*a*) Use the normal reporting methods and procedures which are appropriate to all posts.

(*b*) Operate under the direction of the controlling plotter but listen for the interjection of warning messages by the silent plotter or plotters.

(*c*) Make all reports crisply and strictly in accordance with reporting discipline so that the abnormal number of users of the circuit (posts, plotters, and post controllers) are all served.

(*d*) Report routine inquiries to the post controller at the controlling group.

(*e*) Report urgent non-routine incident reports, as listed in para. 54, to the post controller at the group in whose territory their post is sited.

Passing of Messages between Plotter and Post

50. When required to pass a message which concerns all the posts in a cluster, the plotter will call the cluster as a whole, for example, "Bravo Cluster—Stand by for Message". The posts are then to acknowledge this call by repeating their post designations in numerical order. On receipt of this acknowledgement the plotter will pass the required message. When the message has been completed each post, in numerical order, is to acknowledge receipt of the message by saying "Bravo Wun, Thank you", "Bravo Too, Thank you", etc. If the message is not received correctly, No. 2 observer is to request a repeat of those parts of the message which need clarification. An example is given in Chap. 14, para. 42, where the passing of a message relating to states of preparedness is shown. This procedure is not used for standard messages, such as notification of contrail heights, etc.

Operations Room Post Controller

51. The post controller in the operations room has monitoring facilities which enable him to listen-in to or to speak on any post circuit. He is responsible for:—

(*a*) Dealing with those reports and queries originated by posts which call for specialized attention, and, where his group is in control of overlap clusters, dealing with routine inquiries from all posts in such clusters.

(*b*) Making inquiry direct to the post concerned in cases of urgent non-routine incident reports as listed in para. 54. (If posts in overlap clusters are concerned, such reports will be dealt with by the post controller of the group in whose territory the post is sited.)

(*c*) Checking that posts are reporting in correct sequence.

52. Normally reports are made to the plotter but, in certain cases, it is expedient that No. 2 observer should report direct to the post controller. The cases are:—

(*a*) When aircraft distress signals are recognized, or thought to be recognized, or when other signs, such as damage or fire, are noted (see Chap. 13, para. 4).

(*b*) When an aircraft is *known* to have crashed (see Chap. 13, para. 5).

53. Whenever a query or complaint cannot be dealt with by the plotter to the satisfaction of the post observers, they should ask for the post controller.

Reporting Non-routine Incidents

54. In addition to the reporting of aircraft movements to meet the requirements of the primary function, reports are required from posts on secondary tasks. The following list shows the most common of these tasks:—

(*a*) Aircraft in distress, emergency landings, crashes, and emergency parachute descents.

(*b*) Airborne landings of enemy forces.

(*c*) Approach of enemy forces by sea or land.

(*d*) Bombing, minelaying, and marker flares.

(*e*) Suspicious events of any nature.

(*f*) Weather.

CHAPTER 13

ACTION TO AID THE SAFETY OF FRIENDLY AIRCRAFT

1. The post observer has responsibilities in aiding friendly aircraft in distress and in reporting crashed aircraft. In observing the movement of all aircraft which are seen or heard over the country, the Royal Observer Corps is in fact discharging an important duty by keeping constant watch on the progress of each aircraft.

Detecting and Reporting Aircraft in Distress

2. There are various means by which aircraft which are in distress can indicate this to the observer.

3. Post observers are to:—

(*a*) Be aware of the following signals used either together or separately in cases when an aircraft wishes to give notice of difficulties which *compel it to land* without requiring immediate assistance:—

(i) The repeated switching on and off of landing lights.

(ii) The repeated switching on and off of navigation lights at irregular intervals.

(iii) A succession of white pyrotechnic signals.

(*b*) Be aware of the following signals used either together or separately in cases *when grave and imminent danger threatens* and immediate assistance is required:—

(i) Any single red pyrotechnic light displayed singly or in succession.

(ii) A parachute flare showing a red light.

Note 1. An aircraft observed to be orbiting for a considerable time is likely to be trying to indicate that it is in distress. In the case of jet aircraft, however, such orbiting may not be practicable.

Note 2. Some aircraft, usually civil, are equipped with automatic flashing navigation lights. These are normally designed so that the flashing is regular and so that port and starboard lights flash alternately. Aircraft in distress will, as stated in sub-para. (*a*), flash navigation lights at irregular intervals.

4. No. 2 observer is to report direct to the post controller whenever an aircraft is seen to be in distress by reason of fire or damage, etc., or when any of the above distress signals are observed.

Reporting of Crashed Aircraft

5. No. 2 observer is to report an aircraft which is *known* to have crashed by day or night *direct to the post controller immediately*, by reference to the type of aircraft (if known), the minute bearing, and the estimated distance in miles either within or beyond the five-mile reference circle, followed as soon as possible by the topographical location.

For example:—

Post:	Alfa Wun
Plotter:	Alfa Wun
Post:	Post Controller, please
Post Controller:	Post Controller
Post:	Alfa Wun
Post Controller:	Alfa Wun
Post:	Hunter Crashed—Too Three—Miles Fower—Close to Manor Farm, Wembury.
Post Controller:	Thank you.

Note. If the topographical information cannot be determined at night it may be omitted.

6. Further details of the crash are to be reported later to the post controller when requested.

7. No. 2 observer is to report *to the plotter* an aircraft which is suspected to have crashed at night by reference to the bearing of the explosion, fire or other incident upon which the suspicion is based.

For example:—

Post:	Alfa Wun
Plotter:	Alfa Wun
Post:	Explosion (or Fire)—Fower Fife.
Plotter:	Thank you.

8. Further details of the incident are to be reported when requested by the plotter or the post controller.

CHAPTER 14

EXAMPLES OF SEQUENCES—AIRCRAFT REPORTING

Note 1. In the following examples the plotter's reply to the post call has been included, but the acknowledgement "Thank you" has been omitted.

Note 2. It is not possible to include specimens of all sequences, since there are so many permissible variations. The following are *examples* only.

Aircraft One Mile or Less from the Post

1. **Priority Warning Call "Rats"—Visual.**
   Rats M.3 (Plotter calls out Rats M.3)—Overhead—West—1 at 2—Meteor.

2. **Priority Warning Call "Rats"—Heard.**
   Rats M.3 (Plotter calls out Rats M.3)—Heard—Overhead—West—1 at 2—Jet.

3. **Priority Warning Call "Jab"—Visual Only Permitted.**
   Jab A.1 (Plotter repeats A.1)—Overhead—South—4 at 6—Hunters.

4. **Normal Visual.**
   A.1 (Plotter repeats A.1)—Overhead—North—3 at 2—Vampires.

5. **Normal Heard.**
   A.1 (Plotter repeats A.1)—Heard—Overhead—North—2 Plus at 20—Jet.

6. **Navigation Lights.**
   B.4 (Plotter repeats B.4)—Navigation Lights—Overhead—South—1 at 12—Piston.

7. **Contrail.**
   B.4 (Plotter repeats B.4)—Contrail—Overhead—West—4 at 34—Planes (or Hunters).

8. **Circling Visual.**
   C.1 (Plotter repeats C.1)—Overhead—Circling—1 at 10—Canberra.

9. **Circling Heard.**
   C.1 (Plotter repeats C.1)—Heard—Overhead—Circling—1 at 25—**Jet.**

Aircraft more than One and up to Five Miles inclusive from the Post

10. **Priority Warning Call "Rats"—Visual.**
    Rats M.3 (Plotter calls out Rats M.3)—15—West—1 at 2—Meteor.

11. **Priority Warning Call "Rats"—Heard.**
    Rats M.3 (Plotter calls out Rats M.3)—Heard—15—West—1 at 2—Jet.

12. **Priority Warning Call "Jab"—Visual Only Permitted.**
    Jab A.1 (Plotter repeats A.1)—12—South—4 at 6—Hunters.

13. **Normal Visual.**
    A.1 (Plotter repeats A.1)—48—North—6 at 25—Javelins.

14. **Normal Heard.**
    A.1 (Plotter repeats A.1)—Heard—27—West—1 at 5—Piston.

15. **Heard (Direction Not Established).**
B.4 (Plotter repeats B.4)—Heard—42—No Direction—1 at 20—Jet.

16. **Heard (Height Not Established).**
D.2 (Plotter repeats D.2)—Heard—40—West—2 Plus—No Height—Piston.

17. **Heard (Neither Direction nor Height Established).**
E.4 (Plotter repeats E.4)—Heard—52—No Direction—1—No Height—Jet.

18. **Navigation Lights.**
F.3 (Plotter repeats F.3)—Navigation Lights—06—North West—1 at 6—Piston.

19. **Contrail.**
H.2 (Plotter repeats H.2)—Contrail—16—South—1 at 36—Canberra.

20. **Circling Visual.**
J.1 (Plotter repeats J.1)—28—Circling—1 at 5—Provost.

21. **Circling Heard.**
J.1 (Plotter repeats J.1)—Heard—42—Circling—1 at 20—Jet.

22. **Final Visual.**
J.4 (Plotter repeats J.4)—45—South West—1 at 6—Hunter—Out.

23. **Final Heard (Type Not Known).**
K.2 (Plotter repeats K.2)—Heard—33—South—1 at 20—Jet—Out.

24. **Final Heard (Type Recognized on Earlier Report).**
K.2 (Plotter repeats K.2)—Heard—33—South—1 at 20—Valiant—Out.

Aircraft more than Five Miles from the Post

25. **Priority Warning Call "Rats"—Visual.**
Rats L.1 (Plotter calls out Rats L.1)—15—Miles 6—South—1 at 4—Thunderstreak.

26. **Priority Warning Call "Rats"—Heard.**
Rats L.1 (Plotter calls out Rats L.1)—Heard—15—Distant—North—1 at 2—Jet.

27. **Priority Warning Call "Jab"—Visual Only Permitted.**
Jab M.3 (Plotter repeats M.3)—35—Miles 7—North West—1 at 6—Super Sabre.

28. **Normal Visual.**
M.2 (Plotter repeats M.2)—42—Miles 8—West—1 at 15—Shackleton.

29. **Normal Heard.**
M.2 (Plotter repeats M.2)—Heard—03—Distant—East—5 Plus at 10—Piston.

30. **Heard (Neither Direction nor Height Established).**
M.2 (Plotter repeats M.2)—Heard—06—Distant—No Direction—1—No Height—Jet.

31. **Navigation Lights.**
N.3 (Plotter repeats N.3)—Navigation Lights—20—Distant—West—1 at 6—Piston.

32. **Contrail.**
P.4 (Plotter repeats P.4)—Contrail—32.

33. **Circling Visual.**
P.4 (Plotter repeats P.4)—14—Miles 6—Circling—1 at 8—Victor.

34. **Circling Heard.**
Q.2 (Plotter repeats Q.2)—Heard—43—Distant—Circling—1 at 20—Jet.

35. **Final Visual.**
R.3 (Plotter repeats R.3)—47—Miles 7—West—1 at 15—Vulcan—Out.

36. **Final Heard.**
R.3 (Plotter repeats R.3)—Heard—52—Distant—North West—1 at 7—Out.

Reports Covering Special Circumstances

37. **Formation Dividing.**
S.1 (Plotter repeats S.1)—Now Dividing—15—Miles 6—South—4 at 20—Meteors and 20—South West—3 at 20—Meteors.

38. **Aircraft Circling Aerodrome.**
D.2 (Plotter repeats D.2)—Circling Wattisham—3 at 2—Hunters.

39. **Aircraft Landed.**
D.2 (Plotter repeats D.2)—Landed Stradishall—Meteor.

40. **Aircraft Airborne.**
E.4 (Plotter repeats E.4)—Airborne Waterbeach—4 Venoms.

41. **Reports of Aircraft Crashed, etc.**
See Chap. 13, paras. 5 and 7.

Passing of Messages between Plotter and Post

42. Plotter: Bravo Cluster—Stand-by for Message.
Post Observers: Bravo Wun; Bravo Too; Bravo Three; Bravo Fower.
Plotter: All Posts may go to Available until Further Notice.
Post Observers: Bravo Wun, Thank you; Bravo Too, Thank you; Bravo Three, Thank you; Bravo Fower, Thank you.

Overlap Clusters

16. Overlap cluster posts are to use the normal reporting methods and sequences. They will be under the operational control of the same controlling plotter who controls the cluster when the aircraft reporting role is operative. They should also expect to hear from the silent plotter injection of fall-out warnings and, when necessary, requests for repetition of readings, etc. These injections will be made by the silent plotter announcing his own group and calling the appropriate post as follows:—

> "Winchester Hotel Three" followed by the warning or request for repeat.

Examples of Sequences

17. Examples of sequences are given in Chapter 16.

CHAPTER 16

EXAMPLES OF SEQUENCES—FALL-OUT REPORTING

1. **Warning of Approach of Fall-out.**

(*a*) *Whole Cluster to be Warned.*

Plotter:	Delta Cluster—Fall-out Warning—Stand by.
Post Observers:	Delta Wun—Warning Received; Delta Too—Warning Received; Delta Three—Warning Received; Delta Fower—Warning Received.

(*b*) *Two Posts Only to be Warned.*

Plotter:	Sierra Wun, Sierra Three—Fall-out Warning—Stand by.
Post Observers:	Sierra Wun—Warning Received; Sierra Three—Warning Received.

2. **First Report.**

Post Observer:	November Wun.
Plotter:	November Wun.
Post Observer:	Fall-out—Oh-Three-Twenty-Six.
Plotter:	Thank you.

3. **Subsequent Report (Complete Procedure).**

(*a*)	Plotter:	Delta Cluster—Stand by.
	Plotter:	Delta Cluster—Read.
	Plotter:	Delta Wun.
	Post Observer:	Delta Wun—Point Six—Point Six.
	Plotter:	Delta Too.
	Post Observer:	Delta Too—Forty—Fower Zero.
	Plotter:	Delta Three.
	Post Observer:	Delta Three—Too Hundred and Twenty—Too Too Zero.
	Plotter:	Delta Fower.
	Post Observer:	Delta Fower—No reading—No reading.
	Plotter:	Thank you.
(*b*)	Plotter:	Echo Cluster—Stand by.
	Plotter:	Echo Cluster—Read.
	Plotter:	Echo Wun.
	Post Observer:	Echo Wun—Three—Repeat—Three.
	Plotter:	Echo Too.
	Post Observer:	Echo Too—Wun Hundred and Ten—Wun Wun Zero.
	Plotter:	Echo Three.
	Post Observer:	Echo Three—Change—Twenty—Too Zero. etc., etc.

CHAPTER 17

WEATHER REPORTS

Weather Reports

1. Normal weather reports will be required from all posts at pre-determined (usually four-hourly) intervals. In addition, special coded weather reports for use by the Meteorological Office and known as "ROCMET" may be required from certain selected posts. "ROCMET" reports do not affect the majority of posts.

Sequence of Reports

2. The posts' normal weather report will consist of:—

(*a*) Strength and direction from which wind is blowing (Beaufort Scale number).

(*b*) Cloud extent (in eighths) and height (over whole area of sky visible).

(*c*) Horizontal visibility, in miles.

(*d*) General conditions (rain, hail, sleet, fog, snow, etc.).

Sudden Weather Changes

3. Sudden changes in weather must be reported immediately to the operations room on the post's own initiative. Foreknowledge of local weather can be extremely useful to the Royal Air Force, and information such as the approach of thunderstorms, mist, ground haze, frost, etc., may prove invaluable.

(*See next page for para. 4*)

Beaufort Scale

4. The Beaufort Scale has been more or less universally adopted as the standard by which the strength of wind may be easily and quickly gauged. The Beaufort number is to be quoted.

BEAUFORT NUMBER	GENERAL DESCRIPTION	SPECIFICATION OF BEAUFORT SCALE	LIMITS OF VELOCITY IN MILES PER HOUR
0	Calm	Smoke rises vertically	Less than 1
1	Light Air ..	Wind direction shown by smoke drift, but not by weathervanes	1 — 3
2	Slight Breeze ..	Wind felt on face, leaves rustle gently, weathervanes move	4 — 7
3	Gentle Breeze ..	Leaves and small twigs in constant motion; a light flag will be extended	8 — 12
4	Medium Breeze	Raises dust and loose paper; small branches are moved	13 — 18
5	Fresh Breeze ..	Small trees in leaf begin to sway	19 — 24
6	Strong Breeze ..	Large branches in motion; telegraph wires whistle	25 — 31
7	High Wind ..	Whole trees move	32 — 38
8	Gale	Twigs snap off; walking difficult	39 — 46
9	Strong Gale ..	Slight structural damage; chimney pots removed, etc.	47 — 54
10	Whole Gale ..	Trees uprooted; considerable structural damage	55 — 63
11	Storm	Widespread damage (very rarely experienced in Britain)	64 — 75
12	Hurricane ..	As above	Above 75

CHAPTER 18

POST LOGS

General Information

1. It is imperative that an accurate post log is kept of the movement of aircraft as reported by posts, together with a record of all important information passed through from the post to the operations room and from the operations room to the post. Logging is to be done by the No. 2 observer at the time of the incident.

2. The log should also contain a record of telephone failures, with times of fault and restoration of the line; time checks; contrail height; states of preparedness; the time of removal and replacement of telephones during severe thunderstorms; weather reports; and fall-out reports.

3. Log entries should always be as comprehensive as possible so that, if necessary, it will be possible to refer to the post log at any subsequent time when queries arise on matters which have been entered therein. It is particularly important that all "First and Last" plots should be entered.

4. All records of official visits by authorized visitors and other non-operational information must be entered in another special book kept for the purpose.

Time Checks

5. It is important that the correct time is used when making log entries. Standard (local) time is to be maintained. To ensure that all post log entries are correct in this respect, No. 2 observer is to ask the operations room plotter for a time check when first taking over duty at the post and synchronize the watch or clock at the post accordingly.

Post Logs—Entries

6. The post log is ruled as in the example below:—

R.O.C. POST LOG SHEET No.

GROUP............ POST............ DATE............

TIME IN	TYPE OF REPORT	Plan Position		Direction	Strength	Height	TYPE OF AIRCRAFT	TIME OUT	Plan Position		REMARKS
		Bearing	Distance						Bearing	Distance	
0830	L/Obs. A. C. Brown and Obs. J. Stevens on duty.										
0833	Test with Ops. Room. Line O.K.										
0835	Time check. Post Clock two minutes fast. Corrected.										
0845	Weather Report. Wind—3 NE: Cloud—5/8 at 7: Visibility 2 miles, Slight Mist										
0900	Contrails. 32										
0933	Visual	13		W	1	4	Canberra	0935	45		
0956	Heard	32		N	2+	20	Jet	0958	03	Dis	
1020	Rats										
	Visual	23		NW	1	3	Thunderstreak	1022	52		

Note 1. The first five entries shown above are typical of the items required at the start of an operational period.
Note 2. Post logs are not to be used for recording domestic messages; they are official documents and must be regarded as such.

CHAPTER 19

AIRCRAFT RECOGNITION

Introduction

1. Aircraft recognition is an essential qualification of all air defence services. The ever-increasing tempo of aerial warfare and the rapid development of supersonic fighters and high-subsonic bombers demand that the post observers must be highly efficient in speedy and accurate recognition. Positive recognition does not merely enable an observer to distinguish between friendly and hostile aircraft; his report with definite information as to type, etc., may avoid loss of valuable time, and be of great help in maintaining continuity of track on the operations room tables.

Learning Aircraft Recognition

2. Aircraft recognition, whilst never an easy subject for study, can be learned reasonably quickly by an observer with the necessary enthusiasm. An observer who is not enthusiastic is failing in his duty. Every post observer should keep abreast of the new types of aircraft coming into production, whether or not they are on the master test list.

Method of Learning

3. The method of study of aircraft recognition by the R.O.C. is based on that evolved by the R.A.F. Central School of Aircraft Recognition. Time and experience have shown that this is the best system and one which is particularly suited to the special needs of the Corps.

Instantaneous Bulk Recognition

4. The observer must train himself to look for the true recognition features of each aircraft, largely a matter of the overall shape and proportion. The term used for this is "Bulk recognition". Very often the important thing is not "is the wing tip round or blunt" but "is the wing tip broad or narrow", for it is this latter point and not the detail shape which will help identify the aircraft at a distance. A good analogy with bulk recognition is found in a child learning to read: at first words are spelt out letter by letter but, as familiarity comes with practice, words are understood at a glance without the child consciously examining each letter.

5. Furthermore, an observer must be so trained that when he sees an aircraft its name will instantly flash across his mind, for with the speeds of modern jet aircraft there is no time for hesitation. To know what the aircraft *was* rather than what it *is* may be as bad as not recognizing it at all. All training must be aimed at increasing the speed of recognition and even spotting photographs on the episcope should not be left on the screen for more than 1—1½ seconds.

Training Material

6. Each observer is issued with Packs "K", "L" and "M" of the R.O.C. episcope cards, and Pocket Folders "K", "L", and "M". These packs and folders are amended and brought up to date from time to time by

the issue of supplementary packs and sheets. Pack "K" comprises the head-on, plan and side view silhouettes of each of the 50 aircraft in the Primary Test. Pack "L" comprises similar silhouettes of a further 40 aircraft which, together with Pack "K", form the selection of 90 aircraft for the Intermediate Test. Pack "M" comprises photographs of the 90 aircraft in the Intermediate Test. Pocket Folders "K", "L" and "M" illustrate the same aircraft as Packs "K", "L", and "M". The R.O.C. episcope cards and folders are used for the initial study of aircraft recognition within the Corps. They are supplemented by the Joint Services Recognition Journal which is issued to all observers, and by large-scale silhouettes, air diagrams, aircraft models, and A.P. 1480, all of which are available through the chief or leading observer. In addition, the leading observer has available a copy of A.P. 4353, Joint Services Aircraft Recognition Instructors Manual. One episcope is issued to each post, and epidiascopes, flash trainers and film projectors are available through group officers.

Flash Trainer

7. The flash trainer is designed to teach rapid bulk recognition. Because of the limited exposure of the image projected on the screen there is not time to look for detail and the observer is forced to recognize the aircraft by its general impression. This manner of looking at an aircraft, which is called bulk recognition, will become a habit after sufficient training and will greatly improve the observer's practical recognition. A further important point is that the instrument speeds up recognition by training the observer to make up his mind quickly.

Sketching

8. An excellent medium which will greatly assist the student is to sketch the various aircraft as he progresses. It is unnecessary to be an artist to achieve the required result. It is merely necessary to commit to paper the simplest outline and no matter how crude the resulting caricature, it will be an invaluable aid to fixing the mental picture. After copying the shape from the episcope card once or twice all future sketching of that shape should be done from memory. The greater effort required will fix the shape more firmly in the observer's mind. It is particularly important that after one sketch has been completed it should be corrected before moving on to the next.

Films

9. Films of aircraft in flight should be studied. Silhouettes, photographs and slides are all "still". Films, on the other hand, not only have movement but are the next best thing to viewing an actual aircraft in flight. They present a vivid pictorial impression, change of background, change of perspective, and change of ranges.

Shadowgraph

10. Models and cutouts are used in the shadowgraph, and the projected image is free from photographic distortion. A perfect outline is shown, and, by the use of screens or filters, varying cloud effects may be reproduced, together with night, dawn, fog, or similar effects. This adds considerably to the realism.

Sound and Contrail Recognition

11. Whenever the opportunity arises, the observer should study the practical aspects of sound and contrail recognition as they will sometimes be a useful aid to the recognition of individual aircraft. It is emphasized that neither sound nor contrails on their own can be conclusive evidence as to the identity of an aircraft, particularly in wartime when many previously unheard or unseen aircraft types may appear.

General

12. Model-making, sketching and the compiling of scrapbooks are all excellent methods of getting thoroughly acquainted with every detail of an aircraft, but no form of training can be as effective as practical spotting of flying aircraft and, although opportunities for such practice may become more limited, every chance should be taken to study local flying aircraft and to visit airfields. It must be appreciated, however, that synthetic training by the means already described is essential, since opportunities of studying potentially hostile aircraft in the air are never likely to be numerous.

13. Intelligently used, these training methods will enable any keen observer to recognize an aircraft the very first time he sees it in the air, and they will certainly help in building up and maintaining interest in, and enthusiasm for, the subject of aircraft recognition.

CHAPTER 20

THE POST TELEPHONE

Types of Equipment in Use

1. Telephone equipment installed at R.O.C. posts falls into two main categories:—

(*a*) Equipment supplied by batteries at the local exchange (central battery feed equipment).

(*b*) Equipment supplied by batteries at the post (post telephone). This equipment is being replaced by C. B. feed equipment, which will become standard at all posts.

Head and Breast Set

2. All types of equipment require the use of a head and breast set worn by No. 2 observer. The transmitter microphone is operated automatically by moving the mouthpiece. The microphone is switched ON when the mouthpiece is drawn up to the mouth for speaking and OFF when turned downward to its fullest extent. It is important to make sure that the microphone is always switched to the OFF position except when actually speaking, in order to conserve the life of the battery.

Central Battery Feed Equipment

3. **Connecting the Telephone.** All C.B. feed equipment, except the head and breast set, is permanently installed at the post and it is only necessary to insert the plug of the head and breast set into the jack on the pedestal for speech contact to be made with the operations room plotter.

4. **Testing the Telephone.** The telephone is first to be tested by moving the mouthpiece up and down between the ON and OFF positions. This should produce a loud "click" in the earphones. Also, the act of blowing into the mouthpiece while it is in the ON position should result in loud rustling noises in the earphones. If these tests are negative, the plug is to be checked to ensure that it is fully "home" in the jack.

5. **Establishing Communication.** As soon as preliminary testing is completed, No. 2 observer is to make speech contact with the operations room plotter. If the plotter complains of faint speech, the observer should bring the mouthpiece closer to his mouth but should NOT raise his voice above normal speaking pitch. It is at all times essential that speech be clear and deliberate.

6. **Post Ringing to Operations Room.** If speech contact cannot be made, or if it is desired to test the ringing circuit, No. 2 observer is to operate the press-button on the pedestal for two or three seconds. This is normally to be done with the mouthpiece in the down (transmitter OFF) position. If no reply is received from the operations room the mouthpiece is to be moved to the up (transmitter ON) position and the press-button operated again.

7. **Operations Room Ringing to Post.** When a post is called by the operations room the bell set in the post cubby-hole is only actuated if the plug of the head and breast set is NOT inserted in the jack on the pedestal. Insertion of the plug automatically disconnects the bell.

8. **Care of the Head and Breast Set.** The head and breast set when not in use must be kept in a dry atmosphere and in no circumstances is it to be left at the post. Care should be taken not to damage the component parts during transport to the post; the transmitter mouthpiece is particularly vulnerable to damage in this respect.

Post Telephone

9. There are two types of post telephone in use:—

(*a*) A.C. Signalling .. G.P.O. DGM AD163

(*b*) D.C. Signalling .. G.P.O. DGM AD159.

10. **Connecting the Telephone.** At some posts the telephone terminal will be situated within the cubby-hole, and all that remains to be done is to insert the jack-plug on the flexible post telephone cable into the terminal socket; this should enable speech contact to be made with the operations room. At many posts, however, the terminal will be found on the telephone pole nearest the post. Also, if the post building has been dismantled, the terminal box will be found on a selected telephone pole on the main cable route. In either of these circumstances the terminal ends of the flexible cable are to be connected to the large terminal points in the pole box.

11. The other end of the flexible cable is passed through the aperture in the side of the post telephone box and connected to the terminals inside the box marked "L.1" and "L.2". It is immaterial to which of these terminals the ends are connected, but they must be bared and clean. Every precaution must be taken to keep the bared ends of the cable from contact with each other or with the other terminal. The head and breast set is to be removed from the post telephone box and connected by inserting the plug in the socket provided in the box, ensuring that it is pushed right "home" to obtain proper contact.

12. The post telephone box is to be placed in the cubby-hole when the length of lead permits; when this is not possible the box is to be so placed that the lead does not impede the movement of observers round the chart table. In this way the risk of accidental damage to the box and cable is minimized. The cover of the post telephone box is always to be kept closed except when it is necessary to ring the operations room.

13. **Earthing the Post Telephone.** For A.C. telephones (AD163) a suitable length of single cable with both ends bared is to be kept coiled in the post telephone box. It is only to be connected in the event of a thunderstorm occurring near the post (see para. 19(*b*)).

14. For D.C. telephones, however, the use of an earth is essential, for without one the post will be unable to make contact with the operations room and vice versa. To earth the telephone, one end of a piece of single cable, both ends of which are clean and bared, is to be connected to the terminal marked "E" in the telephone box; the other end is to be connected to the terminal on the earth pin which is provided. The earth pin is to be driven into the ground as near to the telephone box as possible.

15. When the instructions contained in paras. 10 to 14 have been carried out, it should be possible to establish speech contact with the operations room.

16. **Testing the Telephone.** This is to be done as described in para. 4, but if the tests are negative all connections are to be carefully checked. If the telephone is in working order, communication can then be established as described in para. 5.

17. **Telephone Bell.** To ring the operations room, No. 2 observer is to turn the generator handle inside the telephone box. When receiving a ring from the operations room it is not necessary to withdraw the plug as in the case of C.B. feed equipment. The ringing arrangements should be tested frequently.

Telephone Breakdown

18. In the event of failure to establish contact or of breakdown after contact has been established, all connections are to be rechecked. If the fault is not found or cannot be repaired by the observers, one observer is to proceed to the nearest available telephone, ring the operations room and report the fault to the duty controller. A transfer charge call may be made. The telephone number of the operations room is to be displayed in a conspicuous position at the post during exercises and when the post is operational. It is the responsibility of the duty controller to ensure that action is taken with the Post Office engineers to get the fault rectified.

Action in the Event of Thunderstorms

19. The following action is to be taken to ensure the safety of the personnel on the post in the event of a thunderstorm occurring near the post:—

(*a*) Where C.B. feed equipment is fitted, no action is necessary as the equipment is fully protected.

(*b*) Where A.C. post telephones (AD163) are fitted, the length of cable mentioned in para. 13 is to be connected, one end to the terminal marked "E" in the post telephone box and the other to the terminal on the earth pin, which is to be driven into the ground as near to the post as possible. As this lightning conductor is liable to cause faults in the circuit, it is to be used only when strictly necessary and is to be disconnected as soon as the storm is over.

(*c*) Where D.C. post telephones (AD159) are fitted, No. 2 observer is to remove the head and breast set and place it on the ground. Before doing so, however, he is to inform the operations room plotter that he is about to do so. It is important that an entry be made in the post log each time the head and breast set is so removed, together with times of removal and replacement. The earth is at no time to be disconnected (see para. 14).

Telephone Maintenance

20. The Post Office engineering system is entirely responsible for the maintenance of post telephone circuits and equipment. In the event of faults occurring in the post telephone box, the C.B. feed equipment, or the lines, these will be attended to by the Post Office engineers from group headquarters. In no circumstances must Post Office equipment be tampered with by the observers.

SECTION 3

Operations Rooms

CHAPTER 22

OPERATIONAL LAYOUT

1. So that the primary functions of the Royal Observer Corps may be served, an operations room (within the R.O.C. group headquarters building) is designed and furnished to receive and display all the items of air or fall-out information passed to it.

2. The R.O.C. group headquarters is designated in accordance with the name of the town from which its main telephone facilities are supplied.

3. The landline telephone communications for the intake of information are terminated on two separate display tables:—

(*a*) The main table for dealing with all reports from the R.O.C. posts with each cluster circuit terminated at one plotting position. The number of plotting positions varies according to the number of posts in the group and whether the posts are in clusters of three or four (see Fig. 1).

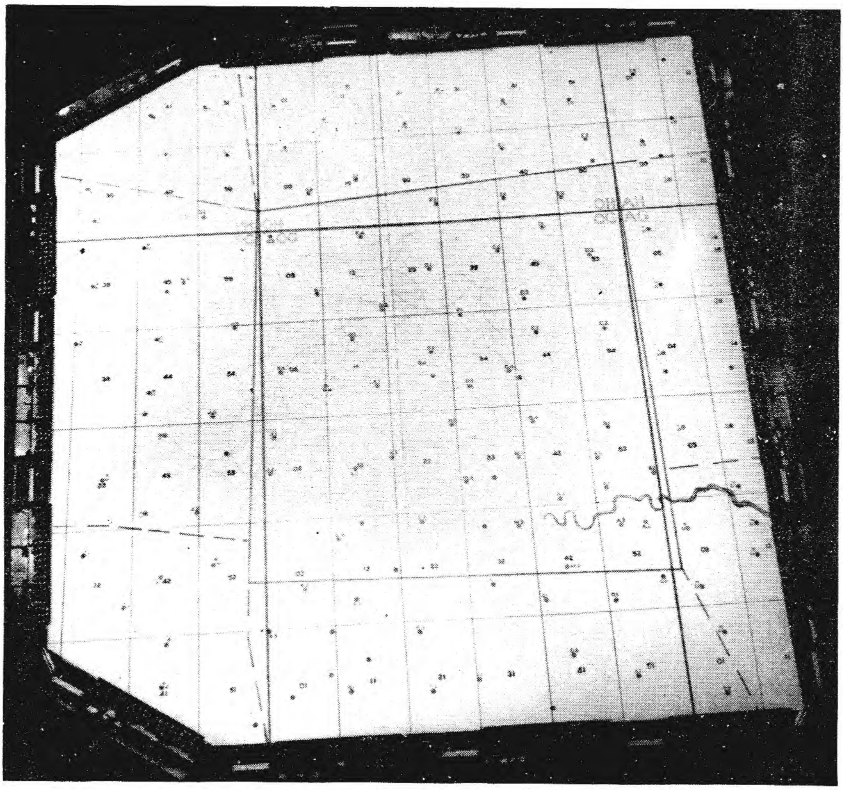


Fig. 1. Main Table.

(*b*) The long-range board for dealing with all reports irom adjacent R.O.C. operations rooms (see Fig. 2).

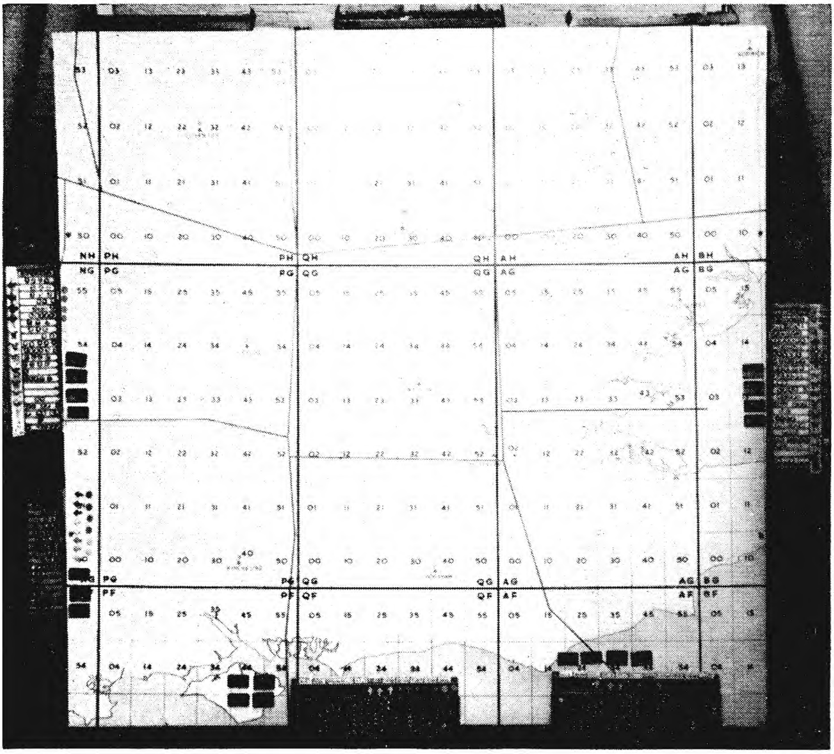


Fig. 2. Long Range Board.

4. When the information received by plotters has been displayed, the display reveals the current situation by showing either the tracks of aircraft or the dose-rate readings and other information in the area covered by fall-out.

5. To complete the primary functions of the R.O.C., provision is made for the onward transmission of information of the tracks which are required by those responsible for active air defence and of information on the location and intensity of fall-out to those responsible for giving warnings to the service and civil authorities concerned.

6. This is achieved by landline telephone communications (which go out from positions on a balcony overlooking the plotting tables on the floor below) terminating at plotting positions on the plotting tables in the appropriate R.A.F. Fighter Command operations room, or on the wall display at the appropriate Home Office operations room.

7. In addition to this method of onward transmission or broadcast, liaison facilities are provided for the R.O.C. liaison officer at the appropriate R.A.F. operations room to further the speed and accuracy of the essential air information.

Main Table

8. The production of tracks from air information reported to plotters is carried out on the main table. The surface of this table is of sufficient size to include the reporting areas of all the R.O.C. posts sited within the group boundary.

9. The surface is marked off in the Georef graticule and shows the lettering of the 1-degree areas, and the numbering of the 10-minute areas. The map scale is 1 inch to 1 mile.

10. Other items marked are:—

(*a*) The position of each post in the group and those posts of neighbouring groups which form part of overlap clusters, together with their designations and five-mile reference circles, the latter being graduated at five-minute intervals.

(*b*) The positions and designations of all other posts in adjoining groups which fall within the area of the main table.

(*c*) Coastlines and estuaries where applicable.

(*d*) The positions of airfields.

(*e*) A green line, representing the agreed boundaries between groups.

Note. This line does *not* indicate the operational limit of the boundary posts.

(*f*) A white line, parallel to and some 12 miles (inches) within the green line, defining the inner limit of the inter-group telling belt.

11. Plotters' positions are spaced round the edges of the table, one plotter's position being allocated to each cluster of posts, with the telephone circuit terminated at the keyboard. Each plotter's keyboard has the following facilities, reading from left to right as viewed by the plotter (see Fig. 3):—

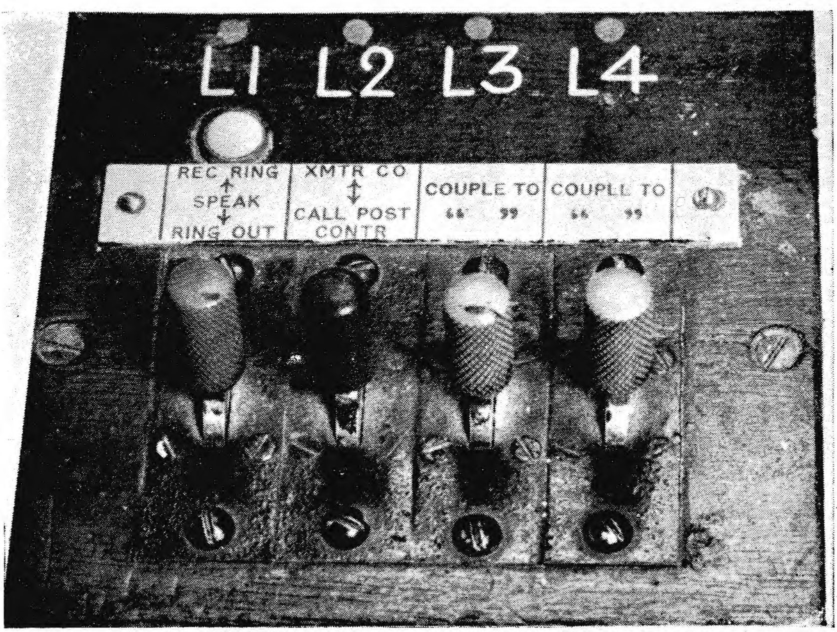


Fig. 3. Main Table Plotter's Keyboard.

(*a*) *No.* 1 *Red Key.*

(i) Red Key in forward position away from plotter—PLOTTER READY TO RECEIVE RING FROM POSTS.

(ii) Red key in normal (upright) position—PLOTTER SPEAKS TO POSTS AND VICE VERSA.

(iii) Red key pulled towards plotter—PLOTTER RINGS POSTS.

(*b*) *No.* 2 *Black Key.*

(i) Black key in forward position away from plotter—TRANSMITTER (MICROPHONE) IS CUT OUT.

(ii) Black key upright—NO ACTION.

(iii) Black key pulled towards plotter—PLOTTER RINGS POST CONTROLLER.

(*c*) *Nos.* 3 *and* 4 *Grey Keys.*
Coupling keys to adjacent plotter's position.

12. Incorporated in this plotter's keyboard are two jacks for the plotter's telephone (head and breast set), and trays to contain all the plotting counters and symbols.

13. The equipment described in paras. 11 and 12 is fitted in most operations rooms. At others, however, it has been redesigned so as to be more economical in the use of space. The redesigned arrangements are shown in Fig. 4.

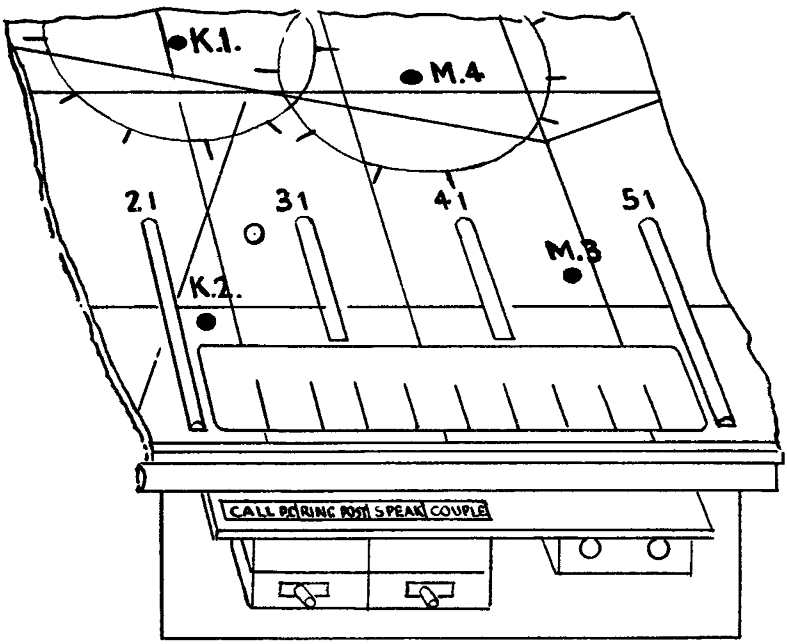


Fig. 4. Redesigned Main Table Plotter's Keyboard.

14. No special facilities are required for the plotting of fall-out information, other than special plotting equipment.

Long-Range Board

15. Continuity of track production and designation between adjacent groups is made possible by the long-range board display.

16. This plotting board includes the area of the parent group, together with the areas of all groups which surround it or the sea area in the case of coastal groups.

17. The plotting board is erected in an almost vertical position so that it may be clearly visible to all concerned in the operations room.

18. The surface is of metal, is marked off in the Georef graticule, and shows the lettering of 1-degree areas and the numbering of 10-minute areas. The map scale is ½ inch to 1 mile.

19. Other items marked are:—

(*a*) The boundaries of the group concerned shown by a red line.

(*b*) The boundaries of adjacent groups shown by green lines.

(*c*) The positions of all group headquarters sited within the limits of the map, marked with a green triangle with the group number and name alongside.

(*d*) Coastlines and estuaries where applicable.

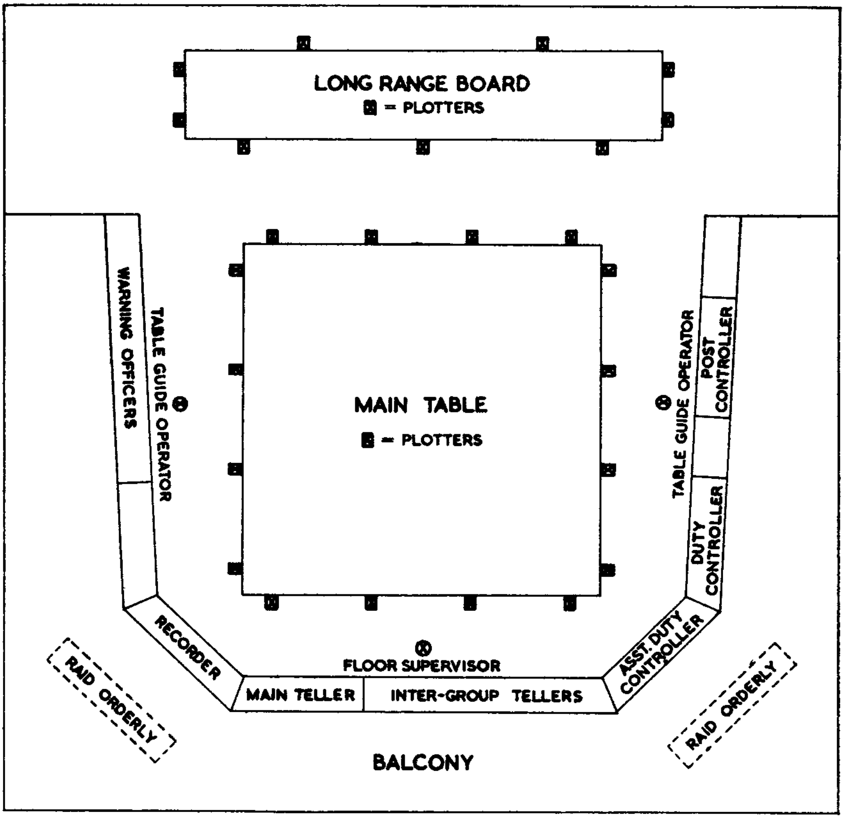


Fig. 5. Typical Layout of Operations Room.

20. Plotting positions are spaced around the edges of the board, one plotting position being allocated to each adjoining group.

21. Incorporated in each plotting position are two jacks for the plotter's telephone head set.

22. Finally, special trays are provided to contain the plotting counters and symbols.

23. Similarly, in the fall-out reporting role, the situation in adjacent groups is plotted on the long-range board and a picture is provided for use by the duty controller and warning officers.

24. In the operational layout, therefore, a broad outline has been given of the "intake of information" by plotters, and the "output of information" by tellers. Chapter 23 deals with the duties and responsibilities of each observer in the operations room and contains the detailed explanation of each part of this system. Fig. 5 illustrates in plan view the position from which the observers operate in most existing operations rooms. In new operations rooms, however, the layout of the balcony has been altered.

CHAPTER 30

TELEPHONES AND TESTING

Change-over Drill for all Telephone Jack Positions

1. When a relieving observer takes over a plotting or telling position from another during a duty period, it is essential to observe a definite drill to ensure continuity of operations.

2. The relieving observer is to ensure that:—

(*a*) The telephone head set is fitted and adjusted satisfactorily.

(*b*) The microphone breast set is worn (if applicable to the position to be manned) and the neck strap length so adjusted that the mouthpiece is on a level with the lips.

(*c*) Before the outgoing observer removes the telephone plug, the incoming observer's plug is properly connected in the spare position (see Fig. 1). Thus by listening and speaking to post observers, in the case of main table positions, or listening to the pip tone in the case of tellers and long-range board positions, the incoming observer makes certain that the telephone equipment is serviceable before starting duty.

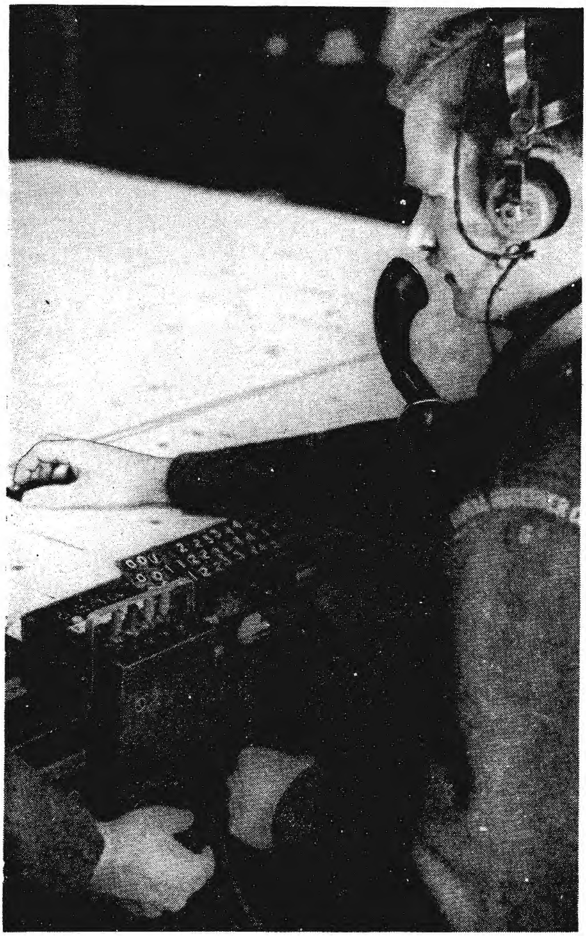


Fig. 1. Telephone Change-over Drill.

Testing of Unidirectional Circuits

3. In the R.O.C. system certain positions in an operations room are supplied with a unidirectional telephone circuit. These positions are:—

(*a*) Main teller (aircraft) to R.A.F. operations room.

(*b*) Main tellers (fall-out) to sector operations room.

(*c*) Inter-group tellers to adjacent R.O.C. operations rooms.

(*d*) Long-range board plotters.

4. The effect of a unidirectional circuit is that the recipient (*e,g.* the plotters at the R.A.F. operations room table and the R.O.C. long-range board) can hear the teller but cannot speak to him to ask, for example, for a repeat of a plot that the plotter has missed.

5. To ascertain that unidirectional lines are in working order, several tests are applied and, unless all these tests are made and give satisfactory results, speech by the teller might not reach the plotter. The tests required are as follows:—

(*a*) First, a pip tone is automatically transmitted from the telling group every half-minute on each unidirectional line and is heard by the teller and by the plotter at the other end. This tone indicates to the plotter that the line from the teller is in working order.

(*b*) Secondly, both the teller and the plotter must check that the plug of the telephone is fully inserted into the correct jack; and the teller must check that keys, if fitted, are correctly thrown.

(*c*) Thirdly, the teller must check that the microphone is working by blowing sharply into the mouthpiece and hearing the resultant sound reproduced in the headphones.

6. **Action by Tellers.** Tellers are to:—

(*a*) Wear a head and breast set and apply the tests described in para. 5(*b*) and (*c*), when taking over duty at any telling position.

(*b*) Repeat the tests at once if they are in any doubt that the instrument and/or line is in working order.

(*c*) Listen for the pip tone.

(*d*) Maintain the keys (if any) in the correct position and the telephone plug in the jack, even when not telling.

(*e*) Report all faults to the post controller.

(*f*) Refrain from making speech tests, unless instructed to do so by the post controller.

7. **Action by Long-Range Board Plotters.** Long-range board plotters are to:—

(*a*) Wear the head set and maintain the telephone plug in the jack.

(*b*) Listen for the pip tone, and report absence of pip tone at once to the floor supervisor, who will pass the information to the post controller.

(*c*) Report to the floor supervisor, even though they are receiving the pip tone, if they have reason to believe that a fault has developed at the teller's end, *i.e.* when the line sounds dead.

8. **Action by Post Controllers.** Post controllers are to:—

(*a*) Take action when faults are reported to them in accordance with Chap. 23, para. 6 (*m*), except in the circumstance mentioned in para. 7(*c*) when they are to ask the assistant duty controller to communicate with his opposite number at the group concerned.

(*b*) If the pip tone oscillator breaks down, instruct tellers to make speech tests at half-hourly intervals.

SECTION 4

Training and Tests

CHAPTER 31

TRAINING

Responsibility for training

1. Responsibility for training is vested in officers and chief and leading observers holding the following appointments:—

(*a*) *The Operations Staff Officer* (*O.S.O.*) at Headquarters Royal Observer Corps is responsible to the *Commandant, Royal Observer Corps* for the direction and co-ordination of all training within the Corps.

(*b*) The *area training officer* (*A.T.O.*) is responsible to the *area commandant* for the direction and co-ordination of training in his area.

(*c*) The *mobile training officer* (*M.T.O.*), who is based at area headquarters, acts as a relief training officer at the area headquarters or at any group headquarters in the area, where the need arises.

(*d*) The *group training officer* (*G.T.O.*) is responsible to the *group commandant* for the direction and co-ordination of training in his group. He maintains all training records and assists *group officers* and *duty controllers* in training the observers up to a standard of maximum operational efficiency. He has particular responsibility for the co-ordination of operations room training.

(*e*) The *group officer* is responsible to the *group commandant* for the efficiency and training of the posts in that sector of the group which is allotted to him.

(*f*) The *duty controller* is responsible to the *group commandant* for the efficiency and training of the operations room crew which is allotted to him.

(*g*) The leading observer of a post is normally to assume the responsibility of *post instructor*. As such he is responsible to the *group officer*, through his *head observer* for the efficiency and training of post personnel. The chief observer, in the appointment of *head observer*, normally carries out the administration of the post.

(*h*) The *assistant duty controllers, triangulation supervisors, post controllers* and *floor supervisors* of operations room crews assist the *duty controllers* in the training of the members of their crews. One chief observer in each crew (usually the *assistant duty controller*) is responsible for the discipline and administration of the crew.

Training Attendances

2. To qualify for payment of annual grant each observer is required to attend a minimum of 5 meetings lasting at least 2 hours in the March and December pay quarters and 4 in the June and September quarters.

Training of Recruits (Posts)

3. The post instructor is responsible for the initial training of post recruits. He will prepare a training schedule designed to cover the primary syllabus within four months.

Training of Recruits (Operations Rooms)

4. The G.T.O. has overall responsibility for ensuring that operations room recruits receive adequate training.

5. The training may be undertaken:—

(*a*) Within the training schedule of the crew to which the recruit has been attached; or

(*b*) By the formation of a training panel drawn from all crews.

6. When training is carried out within the crew, the duty controller will appoint one of his chief or leading observers to arrange a training schedule designed to cover the primary syllabus within seven months.

7. When a sufficient number of recruits is enrolled simultaneously into various crews it may be of advantage to form a panel of instructors to undertake the training. When this is done, the G.T.O. will be responsible, working with the duty controllers.

Continuation Training

8. Post meetings are called by the head observer at regular intervals; at these, continuation training is given under the direction of the post instructor. They are supplemented by cluster meetings attended by all posts of the cluster; these are normally called by the group officer at monthly intervals.

9. Similarly, crew meetings of operations room personnel are held at regular intervals as arranged by the duty controller and these are supplemented by combined crew meetings, arranged by the G.T.O.

10. The larger audiences available at cluster and combined crew meetings justify the attendance of outside speakers and the arrangement of training on a broader basis.

11. Arrangements are made as the need arises for post personnel to visit their parent operations room and for operations room personnel to visit posts.

12. Group meetings attended by both post and operations room personne are also held periodically.

Exercises

13. Exercises are held at frequent intervals to enable post and operations room personnel to practise the skills acquired during training under conditions which are as realistic as possible. These exercises are of various types: some affect one R.O.C. group only or perhaps the groups of one R.O.C. area; others may exercise the entire Corps as a component of the U.K. Warning and Monitoring Organization or as a part of the entire N.A.T.O. defence system.

14. Regular attendance at such exercises forms a vital part of the training of an observer and all personnel are required to be available for participation in major exercises.

Other Advanced Training

15. Week-end courses are arranged annually by group headquarters; at these, advanced training is given to officers and chief and leading observers from posts and operations rooms.

16. Additionally, officers and chief and leading observers may attend courses of various types held at the Home Office Civil Defence School, Easingwold, Yorkshire. These courses take place on week-days and are usually of about three days duration.

The Annual Training Camps

17. The annual camps are usually held at a Royal Air Force station in June and July. Five consecutive camps are arranged, each of one week's duration. The training programme is a comprehensive one in which the personnel attending are split up into small groups and are given theoretical and practical training in all aspects of R.O.C. work. In addition, there are some general lectures and a static exhibition. Attendance is voluntary.

CHAPTER 32

TESTS

Purpose and Nature of Tests

1. A series of tests for post and operations room personnel is held throughout the Corps each year, designed to measure the operational knowledge and standard of efficiency obtained from the training programmes carried out.

2. The tests are:

(*a*) Primary Test

(*b*) Proficiency Test

(*c*) The Combined Intermediate and Master Tests.

The Training Year

3. The training year commences in March on the day after the Combined Tests are held in any calendar year and concludes with the Combined Tests in the following calendar year.

4. Within each year, every observer must attain a minimum standard of efficiency to retain his membership of the R.O.C. and, with the specified number of training attendances, to qualify for payment of the annual grant.

Primary Test

5. The primary test must be taken by recruits within a specified period of enrolment. The standard of this test is the minimum which will enable an observer to carry out the simpler tasks under operational conditions, and is also a measure of aptitude.

6. Recruits on posts must take the primary test within six months of the date of enrolment. Operations room recruits must take the test within nine months of the date of enrolment.

7. In the event of a recruit failing to pass the primary test at the first attempt, he must retake and pass that section in which he failed, using different questions. Such retakes are to be taken within two months of the first attempt and not later than eight months from the date of enrolment in the case of post personnel or eleven months from the date of enrolment in the case of operations room personnel.

8. Failure to pass the primary test at the second attempt will render the recruit liable to discharge from the Corps.

9. Passing the primary test qualifies an observer for entry to the intermediate stage of the Combined Tests.

10. An entrant has the option of choosing whether or not his test includes aircraft recognition (for post personnel) or a main table aircraft plotting test (for operations room personnel).

11. The composition of the various types of test is:—

(*a*) *Posts—with Aircraft Recognition*

Part A—Practical	20 marks
Part B—Written Paper	70 marks
Part C—Aircraft Recognition	10 marks

(*b*) *Posts—without Aircraft Recognition*

Part A—Practical	20 marks
Part B—Written Paper	80 marks

(*c*) *Operations Rooms—with Main Table Plotting of Aircraft*

Part A—Practical—Main Table Plotting—Fall-out	20 marks
Part B—Practical—Long Range Board Plotting—Fall-out	20 marks
Part C—Practical—Main Table Plotting—Aircraft	10 marks
Part D—Written Paper	50 marks

(*d*) *Operations Rooms—Without Main Table Plotting of Aircraft*

Part A—Practical—Main Table Plotting—Fall-out	20 marks
Part B—Practical—Long Range Board Plotting—Fall-out	20 marks
Part C—Written Paper	60 marks

12. To achieve a pass the entrant must gain at least 60 per cent of the marks allocated to each part of the test.

13. The syllabus for the primary test for post personnel consists of:—

(*a*) *Practical Test* (*Oral*). Knowledge of location of post site, key holders and nearest water supply. Connection, testing and use of the post telephone equipment. Ability to read dosimeters, the fixed survey meter and the bomb power indicator. Ability to attach the ground zero indicator to its base, to mount the plastic dome cover of the fixed survey meter and the baffle assembly of the bomb power indicator. Ability to set up and orientate the chart table.

(*b*) *Written Paper*. Liability for training in peacetime and service in emergency. The phonetic alphabet and numbers. The 24-hour clock. The duties of observers in the underground post during a nuclear attack and the reporting of nuclear bursts. The name and purpose of each instrument used at the underground post. Fall-out reporting procedures. The effects of nuclear weapons (a general knowledge only—detailed questions will not be asked). R.O.C. staff organization and ranks. The function of posts.

(*c*) *Aircraft Recognition*. Ten silhouettes of aircraft drawn from the primary list of 15 aircraft. This list is published annually at the start of the training year.

14. The syllabus for the primary test for operations room personnel consists of:—

(*a*) *Practical Tests*. All the practical plotting tests will be carried out on the operations room main table or long range board and will be based on standard reporting and plotting procedures.

(*b*) *Written Paper*. Liability for training in peacetime and service in an emergency. The phonetic alphabet and numbers. The 24-hour clock. The name and purpose of each instrument used at posts and operations rooms. The reporting and recording of nuclear burst information from posts. Fall-out reporting and plotting procedures. Effects of nuclear weapons (a general knowledge only; detailed questions will not be asked). R.O.C. staff organization and ranks. The function of posts and operations rooms.

The Proficiency Test

15. Every observer, having passed the primary test, must take and pass a proficiency test or its equivalent each year.

16. All observers are required to take a proficiency test if they have:

(*a*) Not entered for the Combined Tests.

(*b*) Entered for the Combined Tests but failed to attain proficiency standard or higher.

17. Tests due as in para. 16(*a*) become due on the day after the Combined Tests are held: those due as in para. 16(*b*) become due on the day after publication of the results of the Combined Tests is authorized. All tests *must* be taken by 30th September following.

18. In the event of an observer failing to pass the proficiency test at the first attempt, he must retake and pass that section in which he failed, using different questions. Such retakes are to be taken within two months of the first attempt and not later than 30th November.

19. Failure to pass the proficiency test at the second attempt will render the observer liable to discharge from the Corps.

20. The composition of the tests is:

(*a*) *Posts*

Part A—Written Paper	90 marks
Part B—Aircraft Recognition	10 marks
Part C—Certificate of Competence	—

(*b*) *Operations Rooms*

Part A—Written Paper	100 marks
Part B—Certificate of Competence	—

21. To achieve a pass the entrant must gain at least 60 per cent of the marks allocated to each part of the test.

22. The syllabus for the proficiency test for post personnel consists of:

(*a*) *Written Paper.* Subject matter as listed in paras. 13(*a*) and (*b*).

(*b*) *Aircraft Recognition.* As for the primary test (*see* para. 13(*c*)).

(*c*) *Certificate of Competence.* The group officer must sign a certificate based on recent knowledge of the entrant's practical ability and indicating that he is competent to carry out his duties as a post observer.

23. The syllabus for the proficiency test for operations room personnel consists of:

(*a*) *Written Paper.* Subject matter as based on paras. 14(*a*) and (*b*).

(*b*) *Certificate of Competence.* The duty controller must sign a certificate based on recent knowledge of the entrant's practical ability and indicating that he is competent to carry out his duties as an operations room observer.

The Combined Intermediate and Master Tests

24. The Combined Tests are held annually on a Sunday in March. Entry for these tests is voluntary.

25. These written and practical tests form the culmination of the winter training programme and precede the summer exercise season.

26. The tests are held in stages as follows:

(*a*) *Posts*

(i) Intermediate stage comprising an aircraft recognition test (15 marks) plus Written Paper—Part I—Intermediate (85 marks).

(ii) Master stage comprising the intermediate stage (100 marks) plus Written Paper—Part II—Master (100 marks).

(*b*) *Operation Rooms*

(i) Intermediate stage comprising practical plotting tests (20 marks) plus Written Paper—Part I—Intermediate (80 marks).

(ii) Master stage comprising the intermediate stage (100 marks) plus Written Paper—Part II—Master (100 marks).

27. Within these tests there are four standards which may be obtained:

(*a*) Proficiency standard, representing the minimum standard which all observers must attain each year and exempting the entrant from taking a separate proficiency test.

(*b*) Intermediate standard, representing the standard which it is hoped all observers would wish to attain and carrying with it a monetary award of £2 (two pounds).

(*c*) First class certificate standard, representing a higher standard of attainment and carrying with it a certificate in addition to the monetary award applicable to the intermediate standard.

(*d*) Master standard, representing the highest standard of achievement and carrying with it a certificate, "Spitfire" badge and an additional monetary award of £3 (three pounds) making £5 (five pounds) in all. Attainment of master standard on five occasions entitles an observer to wear a red "Spitfire" badge. For each additional five passes the observer is entitled to wear a five-pointed red star.

28. The following are eligible to enter for the Combined Tests:

(*a*) *Intermediate Stage*

(i) All post and operations room chief and leading observers who are on the strength at the preceding 31st January.

(ii) All post and operations room observers who are on the strength at the preceding 31st January and who have passed a primary test by that date.

(iii) Any recruit, who having passed a primary test after the preceding 31st January opts to enter for the intermediate stage. If such an observer then fails to attain proficiency standard, however, he must take and pass a proficiency test in the same way as other unsuccessful entrants for the Combined Tests.

(*b*) *Master Stage.*

(i) All post and operations room chief observers, leading observers and observers who have gained intermediate standard in any previous year.

29. The syllabus for the tests is issued as a training instruction in the autumn of each year at the start of the winter training programme.

30. Pass levels are as follows:

(*a*) *Proficiency Standard*

(i) *Posts.* 40 marks out of the 100 available for the intermediate stage of the test. The entry must include an element of the aircraft recognition test.

(ii) *Operations Rooms.* 50 marks out of the 100 available for the intermediate stage of the test.

(*b*) *Intermediate Standard*

(i) *Posts.* 60 marks out of the 100 available for the intermediate stage. The entry must include an element of the aircraft recognition test.

(ii) *Operations Rooms.* 70 marks out of the 100 available for the intermediate stage of the test.

(*c*) *First Class Certificate Standard.* 160 marks (80 per cent) out of the 200 available for the master stage.

(*d*) *Master Standard.* 180 marks (90 per cent) out of the 200 available for the master stage.

31. If an entrant attempts the master stage and fails to obtain 80 per cent of the total of 200 marks, then his entry will be judged solely on the intermediate stage.

SECTION 5

Operational Equipment

CHAPTER

CHAPTER 33

THE BOMB POWER INDICATOR

GENERAL DESCRIPTION

Function

1. Provided that the distance from ground zero is known, the power of a nuclear weapon can be calculated from the peak over-pressure produced by the blast wave. The bomb power indicator is designed to record this pressure.

Construction

2. The over-pressure from a nuclear burst would be detected by a metal bellows, one side of which is exposed to normal atmospheric pressure. Attached to the bellows is a push rod which bears against a lever fixed to a spindle. When the bellows are expanded a pointer attached to the spindle moves over a dial reading from 0 to 5 pounds per square inch (p.s.i.). The pointer, not being actually attached to the bellows, does not return to zero after the passage of the blast wave but is left indicating the peak over-pressure. It may be reset to zero by means of a spring-loaded rod operated by a push-button.

3. The bomb power indicator is installed at all underground posts and at most operations rooms. It consists of four parts:—

(*a*) The blast pipe—a 4′ 6″ galvanized steel tube which extends about 6″ above the surface of the ground and which is incorporated in the structure of the post. A ¾″ screwed cover cap is fitted to the upper end (*see* Fig. 1).

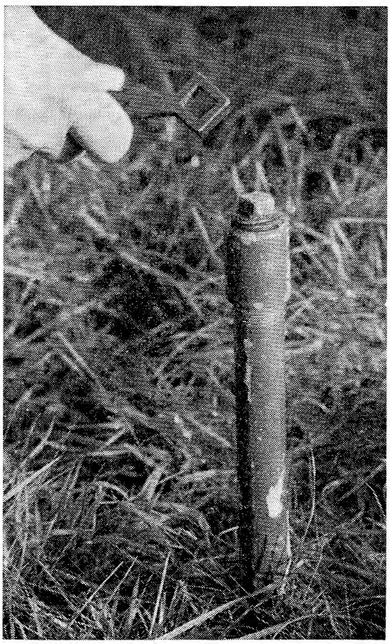


Fig. 1.
Cap and cock wrench

(*b*) The baffle assembly comprising two 6″ diameter steel plates spaced ½″ apart with a ¾″ hole in the lower plate (*see* Fig. 2).

(*c*) The galvanized extension pipe, 2′ in length and fitted with a collar and locking nut at each end (*see* Fig. 3).

(*d*) The indicator unit (8½″ in diameter and 4″ deep) (*see* Fig. 3).

Fig. 2.
Baffle assembly

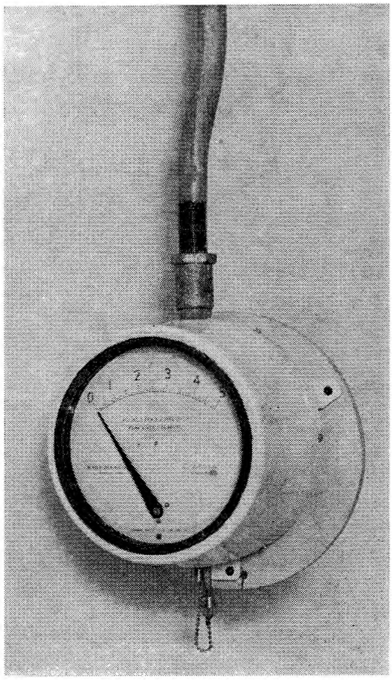


Fig. 3.
Indicator Unit attached to extension pipe

4. The extension pipe is attached to the lower end of the blast pipe by means of the collar and locking nut, with the bend of the extension pipe towards the lower end. The indicator unit is fitted to the extension pipe and screwed to a wooden plate which itself is fixed to the wall by means of an angled bracket. The indicator unit is thus positioned to face an observer seated at the instrument table.

Storage

5. The instrument is robust and the mechanism is made of non-corroding materials. It can therefore remain installed ready to operate at the post or operations room and can be left unattended for long periods. When not in use the upper end of the blast pipe must be kept covered by the cap provided. The baffle assembly is stored inside the post together with the cock wrench provided for removing the cap. The drain tube at the base of the indicator unit must be left open.

OPERATION

Preparation

6. To prepare the instrument for use:—

(*a*) Remove the cap covering the top of the blast pipe using the cock wrench provided and attach the baffle assembly. The cap and cock wrench are to be taken down to the monitoring room for safe keeping.

(*b*) Replace the cap at the lower end of the drain tube on the indicator unit. Care must be taken not to over-tighten the cap, otherwise the rubber seal may be forced into the drain tube itself, thus preventing drainage when the cap is subsequently removed.

(*c*) Ensure that the needle is set at zero by pressing the reset button.

Operational Use

7. Immediately a reading, however small, is shown on the B.P.I. dial, No. 1 Observer is to:—

(*a*) Enter the time of the reading and the pressure in p.s.i. in the B.P.I. log. The time and the reading are to be written in figures and the symbol "x" is to be used in place of a decimal point (*e.g.*, 1032, 1x2 or 1033, 2x0). If the needle is beyond the "5" mark, it is to be logged as "5x0+".

(b) Wait ten seconds and reset the B.P.I. to zero by means of the reset button.

(*c*) Treat subsequent bursts in a similar way in order that a post within B.P.I. range of a number of bursts may record as many times and pressure readings as possible.

8. In the event of the B.P.I. needle moving to a higher reading during the ten seconds between recording a reading and resetting to zero, the higher pressure and the time it is recorded are also to be entered in the log and a new ten-second count is to be started.

9. The B.P.I. reading will then be reported to the operations room in accordance with current instructions.

MAINTENANCE

10. The following maintenance is to be carried out annually, preferably immediately before the first national exercise:—

(*a*) Detach the indicator unit from the wooden plate and from the extension pipe.

(*b*) Turn the instrument upside down and blow out any particles of dirt, grit, *etc.*, by puffing into the drain tube.

(*c*) Replace the cap on the drain tube and after ensuring that the main orifice is clean, blow into the instrument to obtain a reading on the dial; return the needle to zero by pressing the reset button.

(*d*) Clean the inside of the blast pipe assembly by pulling through a piece of cloth, using the nylon rope available in the post.

(*e*) After cleaning the blast pipe and indicator unit ensure that the threads are well greased and reassemble the instrument.

11. The locking nut and collar may become jammed against one another when attempting to detach the indicator unit so that they cannot be moved without suitable tools. In many cases the chief observer owns or can borrow tools locally, but if local arrangements cannot be made he should

apply to the group headquarters for the loan of the 14″ Stilson wrench and 11″ adjustable spanner which are held there against such contingencies.

12. Apart from periodical greasing of the thread at the top of the blast pipe, no other maintenance is required.

CHAPTER 34

THE GROUND ZERO INDICATOR

GENERAL DESCRIPTION

Function

1. The position (ground zero) and height above ground of a nuclear burst can be established by triangulation provided that a bearing and elevation can be obtained from each of two or more posts. The ground zero indicator (G.Z.I.) provides this information.

Construction

2. The G.Z.I. consists in effect of four simple pin-hole cameras in which the image of the fireball together with that of a locating graticule showing bearing and elevation is photographed on sensitized paper.

3. The instrument is cylindrical in shape and is about ten inches high and fourteen inches in diameter (*see* Fig. 1). When the handle at the top of the

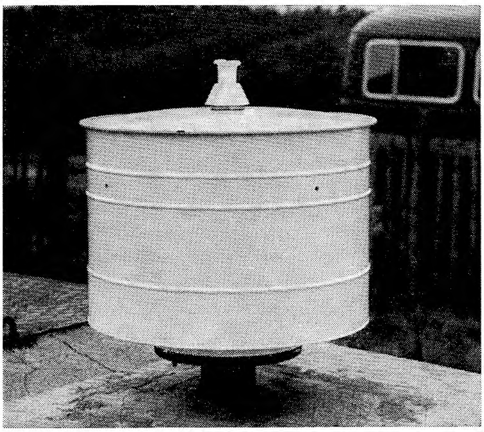


Fig. 1.
The Ground Zero Indicator

instrument is unscrewed, the cover, consisting of the top and sides of the cylinder, can be lifted off, revealing a central structure with four incurved faces (*see* Fig. 2). Each of these incurved faces is fitted with a transparent plastic pocket, known as a cassette, which is marked with a graticule graduated in degrees of bearing and elevation and which holds a sheet of photographic printing-out paper (*see* Fig. 3). This paper, when exposed to light, gradually darkens without the need for chemical development. Four holes, $\frac{3}{16}''$ in diameter, are positioned in the sides of the instrument, one opposite each cassette. A lug inside the lower edge of the cover fits into a corresponding slot in the base of the instrument and ensures that the cover is replaced correctly.

4. At the bottom of each incurved face is a small circular stud. This corresponds to a cut-out at the bottom of each cassette, the position of the stud and cut-out varying for each of the cassettes so that the correct cassette is always inserted in its proper face.

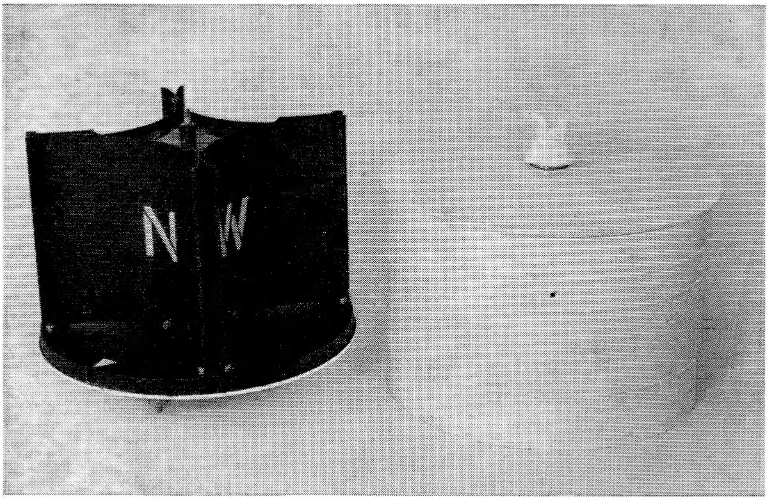


Fig. 2.
Ground Zero Indicator with cover removed

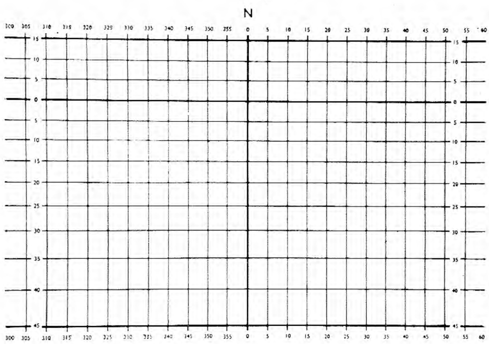


Fig. 3.
One of the transparent plastic cassettes

5. The four cassettes are positioned so that each faces a cardinal point of the compass and are designed so that there is an overlap at the edges of adjacent cassettes. The graticule on the cassettes is marked at five-degree intervals and the appropriate numerals are marked against each line. In addition, the letter of the cardinal compass point (N, E, S, W) is marked against the line running down the centre of the cassette. The limits of the cassettes are: N (North) 305° to 55°: E (East) 35° to 145°; S (South) 125° to 235° and W (West) 215° to 325°.

6. To record a nuclear burst accurately, the G.Z.I. must obviously be set up level and correctly orientated. This is achieved by accurate positioning of the base mounting, a mushroom-shaped casting the bottom of which is normally concreted into the front ventilator turret of the post (*see* Fig. 4). If this is unsuitable the rear ventilator turret is used or, in

exceptional cases, a purpose-built pillar. The instrument is lowered on to the mounting so that the three bolts under the base pass through the three holes in the mounting. The three bolts are placed eccentrically so that incorrect orientation is impossible.

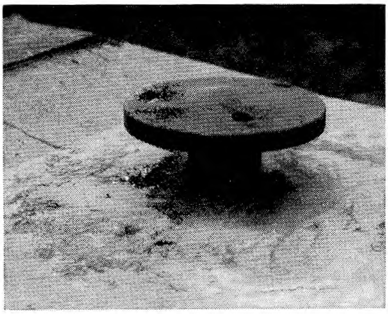


Fig. 4.
The base mounting concreted into position

Storage

7. The G.Z.I. is supplied in a cylindrical transit case complete with the base mounting, one set of cassettes and a spanner. After the base mounting has been detached and concreted into position the G.Z.I. is returned to its transit case for storage in the underground post.

8. The complete equipment required for operational purposes comprises:—

(*a*) One ground zero indicator.
(*b*) Two sets of four cassettes (N. E. S. and W).
(*c*) One light-proof satchel (*see* Figs. 5 and 6).
(*d*) Printing-out paper.
(*e*) Sellotape.
(*f*) One spanner.

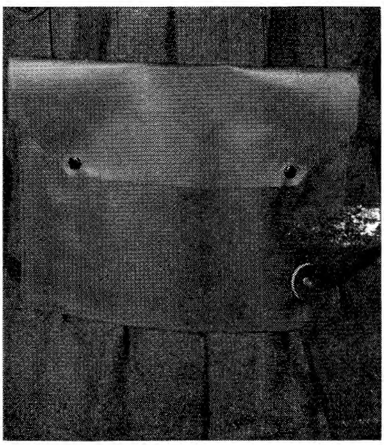


Fig. 5.
The light-proof satchel

Fig. 6.
The light-proof satchel showing the two pockets

9. All the above items including one box (32 sheets) of printing-out paper (P.O.P.) are stored at the post, with a spare light-proof satchel for use if required. The main stock of boxes of P.O.P. and an envelope containing one spare set of cassettes are stored at group headquarters for immediate distribution in the event of an emergency.

10. The spanner is chromium-plated and double-ended. The end marked $\frac{1}{2}$" BS $\frac{7}{16}$" W fits the nuts which hold the G.Z.I. to its base mounting: the other end serves no useful purpose once the base mounting has been con reted in position.

OPERATING INSTRUCTIONS

Pre-Exposure of Printing-Out Paper

11. In the weather conditions prevailing in this country it is doubtful whether the flash from a nuclear weapon would expose the paper sufficiently to print out the graticule and numerals clearly enough to be easily read. To obviate this at least ten sets of papers are to be prepared by exposing them in cassettes to daylight for about 1 to 30 seconds according to the strength of the light; that is, just enough to print out the lines and the numbers. This is best carried out at the bottom of the shaft of the underground post where exposure can be easily controlled.

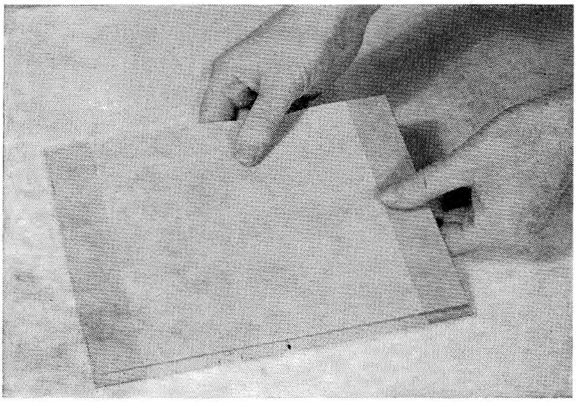


Fig. 7.
Back of cassette showing P.O.P. secured with sellotape

12. Whenever P.O.P. is handled great care must be taken to prevent unwanted exposure to light so as to avoid the gradual darkening of the paper which will otherwise occur. All paper must be kept in the box until required for use; when out of the box it should be kept face downwards whenever possible. Pre-exposed papers are to be treated as described in para. 13; the handling of papers exposed to nuclear bursts is described in paras. 27 and 44. Papers must never be exposed for an instant to direct sunlight.

13. If the third set of cassettes is available, all three should be used for the pre-exposure of paper; otherwise the two stored at the post should be used. As they are prepared, the papers except for the last three (or two) sets, are to be returned to their box in sets, ready for re-loading cassettes as necessary. Before a pre-exposed paper is removed from the cassette the appropriate letter (N, E, S, or W) is to be pencilled on the back in one

corner to facilitate re-loading the correct exposed paper into its proper cassette. The last three (or two) sets are to be marked in the same way, then the paper is to be fixed in position in each cassette with two small pieces of sellotape to prevent possible slip (*see* Fig. 7). One of these sets is to be loaded into the G.Z.I. (*see* para. 26), the second is to be placed in the outer pocket of the satchel (*i.e.* the pocket further from the wearer's chest), the third, if available, is to be placed in the envelope in which the cassettes were brought to the post.

14. When further pre-exposed sets are loaded into cassettes care must be taken that each paper goes into its appropriate cassette and that the pre-exposed lines correspond with the graticule on the cassette. The paper is then to be fixed in position with sellotape as before.

15. When placing sets of loaded cassettes into the satchel each set is to be arranged in the order N, E, S, W and placed so that the sensitized side of the paper faces the wearer's chest.

Mounting the G.Z.I.

16. The G.Z.I. is then to be taken out of the post and mounted as follows:—

(*a*) Remove the nuts from the bolts protruding from the underside of the G.Z.I.

(*b*) Lower the G.Z.I. into position so that the bolts pass through the corresponding holes in the base mounting.

(*c*) Replace the nuts on the bolts so that the conical face of each nut is uppermost and thus fits into a countersinking in the underside of the base mounting.

(*d*) Tighten the nuts finger-tight. The spanner is not to be used for this purpose; it is provided to enable a nut to be loosened which has become jammed by grit or by some other means.

17. The instrument is now ready for use.

Maintenance in Operational Condition

18. When once loaded and mounted some routine maintenance will be required to keep the G.Z.I. at operational readiness, if there should be a waiting period between a post becoming operational and the development of a nuclear attack. This will consist of changing the papers regularly to ensure that they are reasonably fresh when an attack develops; if this were not done, the papers might become so darkened by exposure that it would be extremely difficult to distinguish any marks caused by nuclear bursts.

19. The papers are to be changed twice a day in summer and every alternate day in winter. Summer is defined as the period between the vernal equinox and the autumnal equinox. As sets of pre-exposed papers are used up for these routine changes, further sets are to be prepared so that the stock remains at ten complete sets.

20. In winter, the papers are to be changed on odd-numbered dates; the change is to be effected just after sunset to allow as long a period as possible to elapse before the papers start to darken. In summer the papers are to be changed just after sunset and again at noon.

21. A routine reminder to change the papers will be given from the operations room.

Changing the Papers

22. No. 1 Observer is responsible for instructing No. 3 Observer when to change the G.Z.I. papers. This instruction is not to be given until one minute has elapsed since the last B.P.I. reading of 0.3 p.s.i. or more. No. 3 Observer is then to carry out his task as quickly as possible.

23. Instances may occur when the observers in the underground post hear a loud explosion but there is either no B.P.I. reading at all or one of less than 0.3 p.s.i. In such circumstances, No. 3 Observer is not to be instructed to change the G.Z.I. papers unless the duty controller instructs No. 1 Observer that this is to be done.

24. No. 3 Observer is to put on the light-proof satchel containing the fresh set of G.Z.I. papers as soon as an "Attack Warning Red" is received, and then stand by.

25. On being instructed to change the G.Z.I. papers, No. 3 Observer is to:—

(*a*) Leave the monitoring room taking the hatch key with him and closing the door behind him to prevent the entry of unnecessary light which may spoil the vision of No. 2 Observer who has become accustomed to the rather dim light in the post.

(*b*) Climb the ladder and open the access hatch.

(*c*) Step out of the post and close the hatch behind him to prevent the possible entry of blast.

(*d*) Insert the key in the access hatch.

(*e*) Unscrew the handle of the G.Z.I., lift off the cover and place it on the ground, or conveniently to hand where there is no risk of it being damaged.

(*f*) Take out all the exposed cassettes and place them in the empty inner pocket of the satchel, tucking the flap in over them to protect them from light and to prevent them being accidentally re-loaded into the G.Z.I.

(*g*) Take the fresh set of cassettes from the outer pocket and insert them in the holders, starting on the north face and continuing clockwise, *i.e.* N, E, S, W.

(*h*) Replace the cover checking that the lug inside fits into the slot in the base, and screw down the handle.

(*j*) Open the access hatch and remove the hatch key.

(*k*) Re-enter the post closing the hatch behind him and descend the ladder.

(*l*) Hand the exposed cassettes to No. 2 Observer for assessing.

26. When inserting cassettes into the holders the correct method is to place one vertical edge in position with the bottom edge about half an inch above the bottom stop, snap in the other vertical edge and tap the top of the cassette so that it drops down on to the stop. This is quicker and more satisfactory than sliding the cassette all the way down as it then tends to stick and often causes damage by cracking the edges of the cassette. (*See* Figs. 8 and 9.)

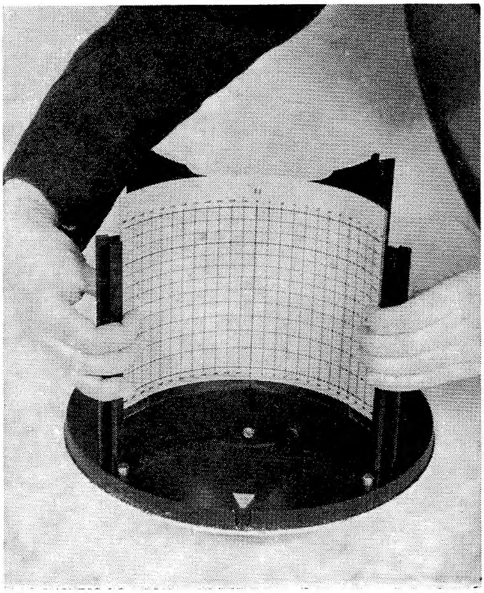


Fig. 8.
Snapping cassette into holder

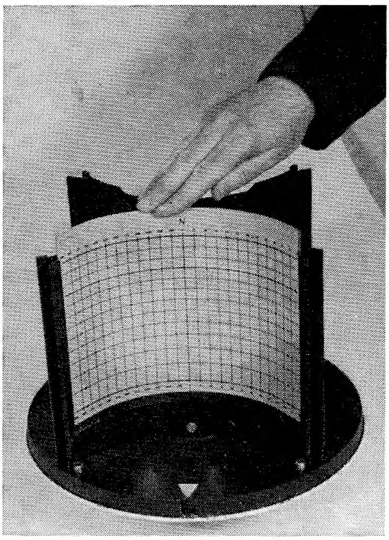


Fig. 9.
Cassette being tapped down to the stop

27. While the cover is off the G.Z.I. great care must be taken to ensure that no unnecessary light falls on the papers. Particular care must be taken when the sun is shining, when the observer should place himself between the sun and the papers to prevent sunlight falling directly on them.

28. If fall-out has previously affected the post, No. 3 Observer must pass the cassettes through the door to No. 2 Observer and then take any necessary decontamination action before re-entering the monitoring room.

29. As soon as an opportunity occurs No. 3 Observer is to transfer the reserve set of loaded cassettes from the envelope to the outer pocket of the satchel (*see* para. 15). No. 2 Observer is then to re-load the cassettes which have just been emptied (*see* para. 14) and place these in the envelope as a reserve.

Marks Likely to be Found on G.Z.I. Papers

30. When a nuclear burst occurs the intense light from the fireball passes through one or more of the holes in the G.Z.I. and on to the printing-out paper, exposing it and causing a brownish mark to appear; the bearing and elevation of the burst can then be assessed from the position of the mark in relation to the white lines left by the graticule on the cassette. The size of the mark can also be assessed in a similar way.

31. As each hole acts as a lens for "photographing" a nuclear burst, it will obviously record other objects which are sufficiently well lit. Therefore the post observer may expect to find on the paper such things as a trail caused by the sun, a horizon line and the images of any light-coloured objects in the vicinity, *etc.*, in addition to any mark which may have been caused by a nuclear burst. Such a mark of whatever shape, will hereafter be referred to as a "spot" (*see* Fig. 10).

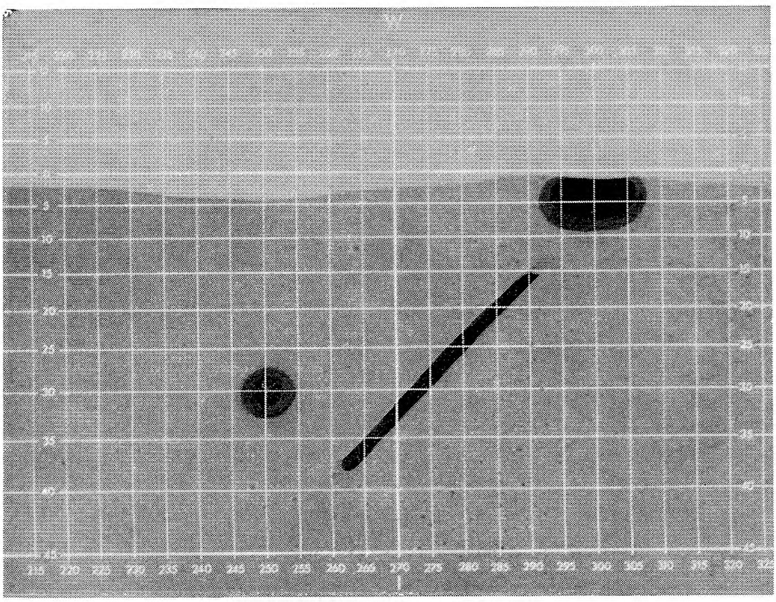


Fig. 10.
Diagram of exposed cassette showing horizon line, sun trail and two types of "spot"

Horizon Line

32. The term "horizon line" is used to define the line where the land and sky seem to meet. This is, of course, not necessarily the 0° line of the instrument. The horizon line may be wholly or partly above or below the 0° line according to how the G.Z.I. is sited in relation to the surrounding countryside.

Sun Trail

33. After a period of continuous sunshine the sun will leave a well-defined curved trail across the paper. When the weather is cloudy with sunny intervals the trail will be intermittent and when the weather has been overcast the trail will be absent entirely.

Spots Caused by Nuclear Bursts

34. The spot will normally consist of a uniformly dark centre (the umbra) sourrounded by a blurred zone of fading darkness (the penumbra). The umbra may be partially obscured by cloud, haze, *etc.* The penumbra will be present in clear visibility, but as atmospheric conditions worsen it may gradually disappear leaving only the umbra; it can never be more than 2½ degrees in width, even in the case of a large weapon burst close to the post in the clearest possible conditions. In the majority of cases it will be less than the maximum width. It will never be easy to determine precisely the outer edges of the umbra and penumbra.

35. The size of the spot will vary according to the power of the weapon and its distance from the post. It may be any size from about 2½ degrees ($\frac{3}{16}$"—the diameter of the hole) to 40 degrees or more in diameter.

36. The darkness of the spot will vary in a similar way to the size and it may be difficult or easy to detect. Close to the burst it is likely to be fairly dark but not so dark as a trail caused by full sun. Further from the burst it will be less dark so that at the maximum range of the G.Z.I. it will be barely perceptible.

37. The shape of the spot may also vary considerably. Some likely shapes are shown and described below. (*See* Fig. 11.)

Spots Caused by Air-Burst Weapons

38. A true air-burst (with the fireball well clear of the ground) will usually give a circular spot centred on the point of the burst. In cloudy conditions, however, some part or other of the spot may be cut out.

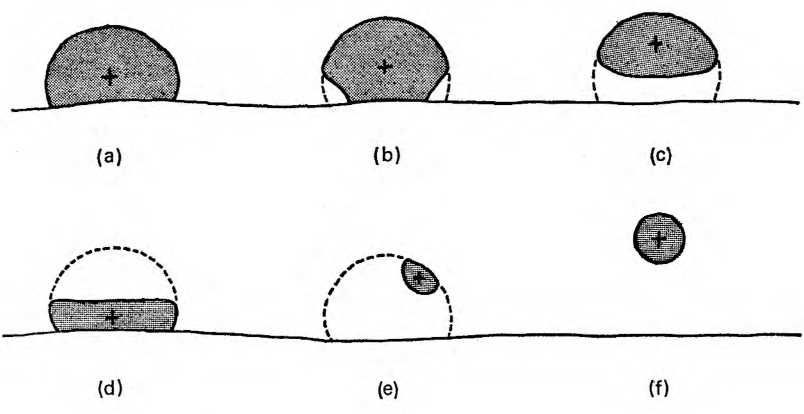


Fig. 11.
Some likely shapes of nuclear burst "spots"

Spots Caused by Ground-Burst Weapons

39. A true ground-burst can sometimes cause a semi-circular spot centred on the point of burst: this is only likely to happen close to a large burst when there is good visibility. Close to the burst it may also produce a spot more like a mushroom on a short stalk, due to the dust, rubble, *etc.*, obscuring to some extent the lower part of the fireball. In both these cases the spot will be touching the horizon line.

40. Further from the burst the lower part of the spot will tend to disappear, leaving a spot which is clear of the horizon line and which may be oval, roughly circular or irregular in shape. The reason for this is that the lower levels of the atmosphere are usually more dense than the upper levels. This is not always so, however, and occasionally the upper part of the spot may tend to disappear first.

41. A weapon which is burst above ground level but at a low enough height for the fireball to touch the ground and therefore produce fall-out, is of course, treated as a ground-burst. This type of burst will probably give a spot intermediate between that of a true air-burst and that of a true ground-burst.

42. In all the cases mentioned above, clouds may cut out any part of the spot.

Multiple Bursts

43. The possibility of more than one burst taking place within a few minutes must also be borne in mind. Where this occurs and there has been insufficient time between the bursts for the G.Z.I. papers to be changed, many spots may be seen. If two of these spots are on about the same bearing, they may be superimposed one on the other.

Handling of G.Z.I. Papers

44. As soon as No. 3 Observer hands over the exposed cassettes, No. 2 Observer is to remove the papers for assessment. He is to place them face downwards and then take them one at a time for examination. At all times care must be taken to ensure that they are not exposed to unnecessary light.

Assessments of G.Z.I. Papers by No. 2 Observer

45. On examining the G.Z.I. papers No. 2 Observer is to:—

(*a*) Establish the positions of any spots caused by nuclear bursts. He should bear in mind that the spots may be difficult to determine and that spots from the same burst may appear on two of the papers if the burst is on a bearing which falls within the overlap area between two adjacent cassettes.

(*b*) Decide which is the largest of the spots and estimate its centre as described in paras. 46–48.

(*c*) Read off the bearing of the centre of the spot in degrees against the graticule as accurately as possible and enter it in the G.Z.I. log as three figures.

(*d*) Read off the elevation of the centre of the spot in the same way and enter it in the log as two figures. If the centre of the spot is on or below the 0° line it is to be entered as "00".

(*e*) Decide whether or not the spot touches the horizon line. If it does, enter "T" (for "Touching") in the log; if it does not, enter "C" (for "Clear").

(*f*) Estimate the size of the spot as described in para. 49 below and enter it in the log as two figures.

(*g*) Deal in a similar way with the next largest spot and follow this with the next largest and so on until all spots have been logged in descending order of spot size.

Estimation of the Centre of the Spot

46. When the shape of the spot is irregular it may be difficult to determine its centre. Normally, however, the bearing reported should be that which is half-way between the left-hand and right-hand edges of the spot and the elevation reported should be that which is half-way between the top and bottom of the spot when it is "Clear" or half-way between the top of the spot and the horizon line when it is "Touching".

47. In each of the sketches in Fig. 11 the overall shape of the spot can be seen. Where part of the fireball is obscured by haze, cloud, *etc.*, the complete shape is shown by a dotted line. In each case the point to be reported is marked thus, +.

48. The sketches in Fig. 11 represent:—

(a) Ground-burst from a point close to G.Z.

(b) Ground-burst from a point further from G.Z. Edges obscured by haze, *etc.*

(c) Ground-burst from a point still further from G.Z. Lower part entirely obscured by haze, *etc.*

(d) Ground-burst from close to G.Z. Upper part entirely obscured by cloud.

(e) Ground-burst from some distance from G.Z. Lower part entirely obscured by haze, *etc.*, part of upper part obscured by cloud.

(f) Air-burst, good visibility.

Sketches (a), (b) and (d) would be reported as "Touching"; (c), (e) and (f) would be reported as "Clear".

Estimation of Spot Size

49. The spot size is to be measured in degrees and is defined as the width of the spot measured between the points on either side where the darkness of the spot fades to half its central darkness, *i.e.*, the distance between the middle points of the penumbra on either side of the spot.

Reporting of G.Z.I. Information

50. After the assessment has been made, No. 2 Observer is to pass the G.Z.I. log to No. 1 Observer, who will report the information to the operations room.

MAINTENANCE

51. Maintenance of the G.Z.I. is limited to re-touching the paint on the instrument itself and re-painting the base mounting.

52. If the paintwork of the G.Z.I. should become scratched or chipped, the fact is to be reported to group headquarters who will then supply, or

authorize local purchase of, suitable paint. The following paints are obtainable in small tins and are recommended:

(*a*) Outside of cover: "Humbrol" White Enamel.

(*b*) Inside of cover: "Humbrol" Camera Black, Matt, Plastic Paint.

53. Whilst it is unlikely the paint round the pin-holes will become damaged, it is of the utmost importance that care is taken when re-touching any part of the cover to ensure that the shape and size of these apertures is not altered by using too much paint, *etc.*

54. In the event of any damage occurring beyond the scope of the foregoing paragraphs, the G.Z.I. is to be returned to the group headquarters for exchange.

55. The base mounting should be examined regularly for signs of deterioration and re-painted as necessary under current arrangements for the maintenance of the post structure.

CHAPTER 35

THE FIXED SURVEY METER

GENERAL DESCRIPTION

Function

1. The fixed survey meter is a battery-operated instrument designed to measure gamma radiation dose-rate.

2. The range normally covered by the instrument is 0.1 roentgens per hour (r.p.h.) to 500 r.p.h.: but the upper limit can be increased to 5,000 r.p.h. or more by shielding the probe unit, *e.g.*, by withdrawing the probe unit down the probe pipe until the reading is reduced by a known factor (*see* paras. 13 to 17).

Facilities

3. The dose-rate is read on the scale of a meter in the indicator unit. This scale is about five inches in length and is roughly logarithmic (*see* Fig. 1).

4. It is possible to check the instrument zero and full-scale settings whether or not radioactivity is present.

5. Provision is made for checking the state of the individual batteries fitted in the battery pack.

Construction

6. (*a*) *Probe Unit*. The unit consists of an ionization chamber (*see* Fig. 2) attached to the inner section of a telescopic mounting rod (*see* Figs. 3 and 4) inserted into a pipe fitted into the roof of the underground post monitoring room. The chamber is connected to the indicator unit by an electric cable. A clamp (*see* Fig. 5) is also provided to fix the rod in the retracted position when shielded readings are being taken.

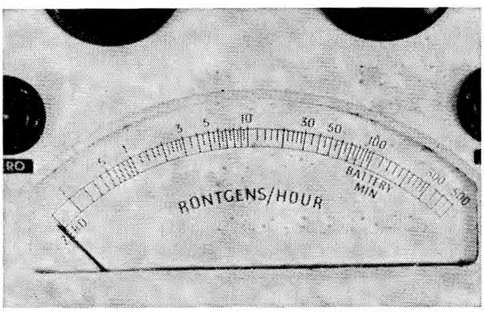


Fig. 1.
Fixed survey meter scale

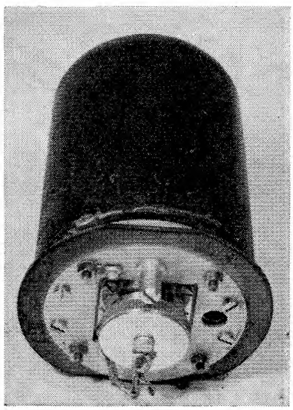


Fig. 2.
The ionization chamber

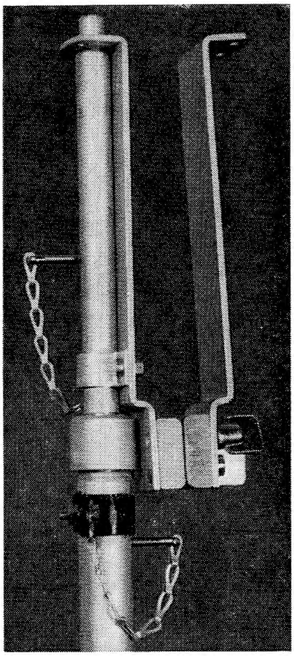


Fig. 3.
Upper end of telescopic rod with cable clamp assembly attached

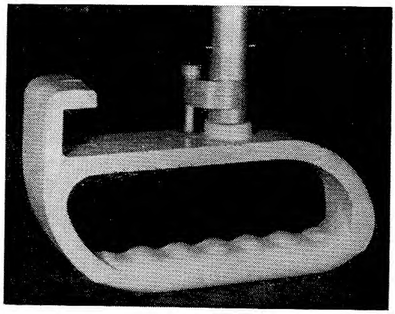


Fig. 4.
The handle of the telescopic rod

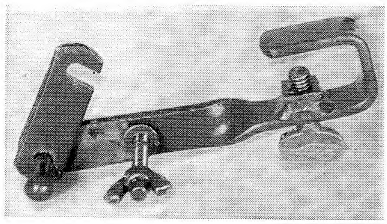


Fig. 5.
The rod clamp

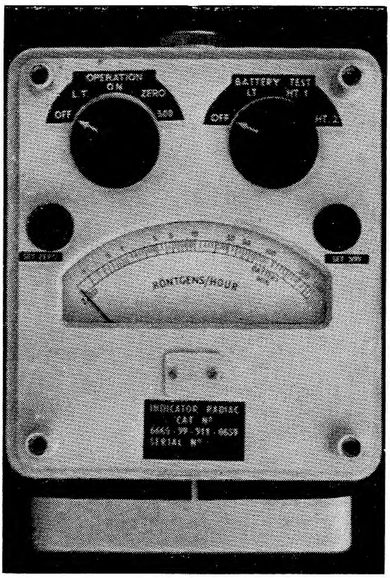


Fig. 6.
The indicator unit with cover removed

(*b*) *Indicator Unit.* The indicator unit (*see* Fig. 6) is enclosed in a metal case designed for screwing to the instrument table of the post monitoring room. Two rotary switches, with a mechanical interlock to prevent operation of one when the other is in an operational position, provide means for operating the instrument and checking the batteries. Two external pre-set controls provide facilities for adjusting the meter zero and full-scale deflections.

(*c*) *Inter-Connecting Cable.* The cable which links the ionization chamber to the indicator unit is a double concentric type fitted with a connector at each end (*see* Fig. 7). At one end of each cable the connector is fitted with a bayonet-type locking ring. This should always be fitted to the indicator unit when the instrument is assembled.

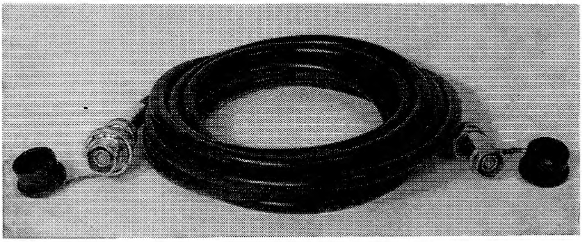


Fig. 7.
The inter-connecting cable

(*d*) *Battery Pack.* The batteries are located in a moulded, detachable pack which is plugged into the indicator unit (*see* Fig. 8). The three batteries perform the following functions:—

1.35-volt Mallory—Filament supply (operational life 200 hours)
10.8-volt Mallory—Anode supply (operational life 600 hours)
10.8-volt Mallory—Chamber polarizing supply (operational life 2 years).

Each battery has a shelf life of some 3 years.

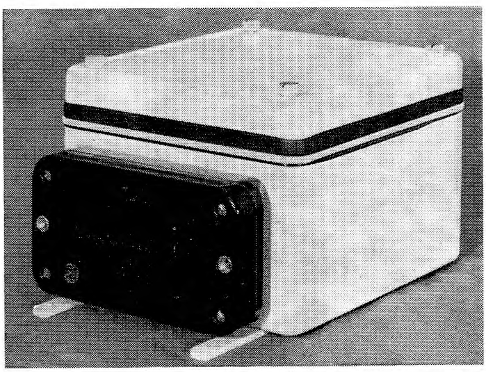


Fig. 8.
Battery pack in position with its protective cover removed

(*e*) *Plastic Dome Cover.* A cover of extremely robust rubberized P.V.C. material designed to protect the ionization chamber. It is fixed to the upper flange of the probe pipe by means of a securing ring and four bolts (*see* Fig. 9). A gasket prevents the entry of water between the flange and the securing ring.

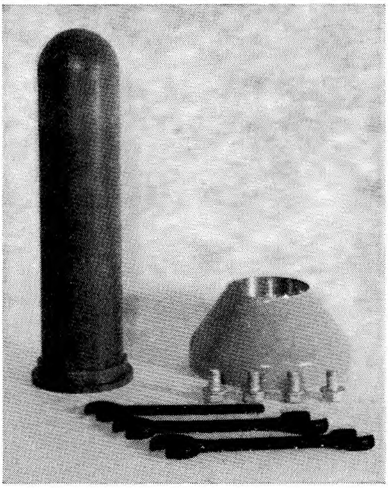


Fig. 9.
Plastic dome cover with securing ring, bolts and spanners

Storage

7. The instrument itself is normally stored at group headquarters in a portable wooden case which contains:—

Indicator Unit	— 1	(*see* Fig. 10)
Battery Pack	— 2	
Inter-Connecting Cable	— 2	
Ionization Chamber	— 1	
Screwdriver	— 1	
Screws, miscellaneous	— 1 set	

Two sets of batteries and a spare gasket are also stored at group headquarters.

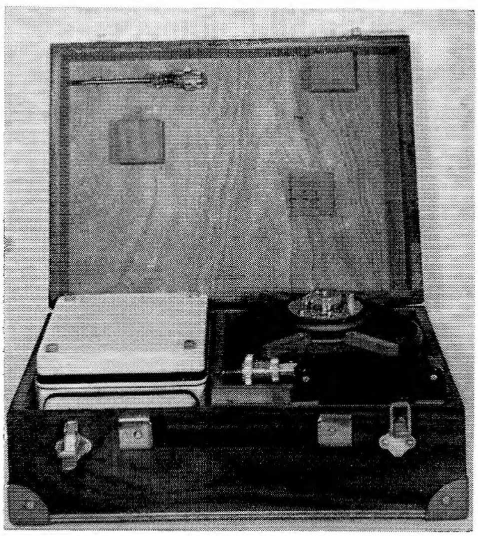


Fig. 10.
The instrument in its transit case

8. The telescopic mounting rod, rod clamp and plastic dome cover with its securing ring and bolts is to be stored in the underground post together with the necessary spanners. The mounting rod and cable clamp assembly is to be kept in the probe pipe.

OPERATING INSTRUCTIONS

Installation

9. (*a*) Remove the protective cover from the top of the probe pipe using the double-ended spanners provided. Inspect the existing gasket for signs of deterioration and replace if necessary. Fix the plastic dome cover to the pipe flange by means of the securing ring and bolts; the single-ended spanner is used for this.

(*b*) Remove the mounting rod from the probe pipe. Remove the cable clamp assembly from the rod (which should be kept telescoped at this stage), separate the two halves by unscrewing the wing screws and attach them loosely to the ionization chamber with the four screws provided. Make sure that the hole at the end of the cable clamp assembly, through which the mounting rod passes, is in alignment with the hole in the ionization chamber.

(*c*) Remove the protective caps from the socket on the ionization chamber and from the end of the inter-connecting cable which is without a locking ring, then push the connector fully home into the socket; locating keys ensure that the plug is correctly fitted. Tighten the four screws holding the cable clamp assembly to the ionization chamber and then the wing screws, making sure that the cable is firmly gripped by the clamp. Do not remove the protective cap from the *other* end of the cable at this stage. It is important that dust or other foreign matter should not be permitted to accumulate at either end of the cable termination. No attempt should be made to clean or dust the cable terminations or their associated sockets; failure to observe these precautions may render the instrument unserviceable. Care should also be taken to prevent kinking or twisting of the cable.

(*d*) Pass the end of the inner section of the mounting rod through the holes in the cable clamp assembly and secure with the split pin which is chained to it.

(*e*) Withdraw the split pin which is chained to the top of the outer section of the mounting rod and which fixes the two sections of the rod together. Insert the ionization chamber into the probe pipe and feed the inner section of the mounting rod up the pipe until a groove marked on it comes up to the shoulder of the outer section. Replace the split pin to fix the rod in the extended position. Feed the extended rod up as far as the pipe flange and latch the curved part of the handle over the flange. Hold the rod in this position and rotate the eccentric cam fitted to the bottom of the outer section (just above the handle) until it is possible to drop the fixing pin through the cam into the hole drilled in the handle. Ensure that the rod assembly is quite secure.

(*f*) Fix the indicator unit to the instrument table using the screws stored in the transit case.

(*g*) Remove the protective cap from the free end of the inter-connecting cable and plug it into the indicator unit; this plug also has locating keys to ensure that it is correctly fitted. Stow the cable neatly in position along the ceiling and down the wall using the cup hooks provided and taking care that it is not kinked or twisted.

Fitting the Batteries

10. (*a*) Unscrew the two milled screws and remove the protective cover from the battery pack, taking care not to allow the pack to fall away from the indicator unit as the cover actually retains it (*see* Fig. 11).

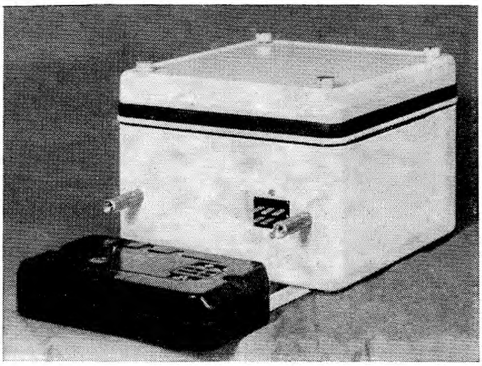


Fig. 11.
Battery pack removed from indicator unit

(*b*) Withdraw the empty pack by pulling on either side by means of the moulded recesses. Take the other empty pack from the transit case.

(*c*) Open both packs by removing the four screws from the corners. These screws are not captive and should be placed in the battery pack cover so that they are readily available for refitting.

(*d*) Withdraw the contact screws sufficiently to allow the batteries to be placed in the recesses. The negative and positive ends are marked on the batteries and on the pack. The HT batteries can only be fitted one way round (*see* Fig. 12). When fitting the HT1 battery take care that the side contact is properly made otherwise the instrument will not function correctly even though the battery checks which follow will give satisfactory readings. Tighten the contact screws so that a good, firm contact is made.

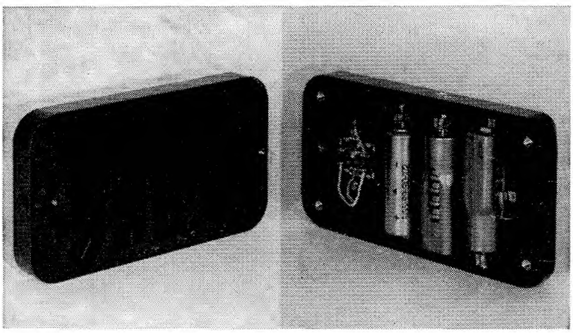


Fig. 12.
Battery pack open. Note the side contact against the HT 1 Battery

(*e*) Fit the two halves of each pack together, then replace and tighten the corner screws which were stored temporarily in the protective cover.

(*f*) Fit one of the two battery packs on the indicator unit. The connecting tongues on the latter fit into corresponding sockets on the pack which can therefore only be fitted one way round. Replace the other battery pack in the transit case.

(*g*) Replace the protective cover over the battery pack and screw up the two milled screws which secure it.

Check Procedure

11. (*a*) Remove the protective cover from the top of the indicator unit. Ensure that there are no signs of damage to the instrument. Check that both switches are in the "off" position.

(*b*) Rotate the battery test switch to each of the three positions, *i.e.* LT, HT1 and HT2. Observe the meter readings at each position. The readings must not be less than the "Battery Min." on the meter dial.

(*c*) Should any of the meter readings be less than the "Battery Min." mark, it will be necessary to change the battery pack or the batteries in the pack. (Details of the procedure are given in paras. 19 to 24.) Select the "off" position of the battery test switch.

(*d*) Rotate the operation switch from "off" to "LT", wait ten seconds, then rotate it further, past "on" to the "zero" position and wait until the needle comes to rest. If the meter needle does not lie on the "zero" position, unscrew the bakelite cap over the set zero control and, using the screwdriver, make any necessary adjustment. Replace the bakelite cap. (*See* also para. 18.)

Note. Whenever the operation switch is used it must first be rotated to the "LT" position, where it must remain for ten seconds before being rotated further. Failure to do this may result in damage to the instrument.

(*e*) Rotate the operation switch to the "500" position and wait until the needle comes to rest. If the meter needle does not lie on the "500" mark on the meter scale, unscrew the bakelite cap over the set 500 control and, using the screwdriver, make any necessary adjustment to produce the correct reading. Replace the bakelite cap. (*See* also para. 18.)

(*f*) Rotate the operation switch to the "on" position. The meter needle will fall to the "zero" mark on the meter scale. (Should the reading not fall to zero, repeat the check sequence above. If, after the double check has been carried out, the reading still lies somewhere above zero and it is *positively known that no external contamination exists*, then there is a fault in the instrument. Refer to paras. 19 to 26.)

(*g*) Rotate the operation switch to the "off" position.

(*h*) These checks should be repeated after the first half-hour of operation. Further checks are to be made at eight-hour intervals; reminders regarding these checks will be given from the operations room.

Gamma Radiation Measurement

12. To measure the gamma radiation dose-rate, carry out the following instructions:—

(*a*) Rotate the operation switch to the "LT" position, wait ten seconds, then rotate it further to the "on" position. (*See* note after para. 11(*d*).) The gamma dose-rate may then be read directly on the meter scale. (*See* also para. 18.)

(*b*) For operational purposes the instrument must be left switched on during the whole time for which readings are required. But, in any other circumstances, care should be taken to ensure that the instrument is switched off after use.

Shielded Readings

13. To measure a gamma radiation dose-rate in excess of 500 r.p.h. (the maximum deflection on the scale of the indicator unit) the probe unit is withdrawn down the probe pipe until the reading falls to one-tenth of the reading obtained with the probe unit in its original position. It is not possible to establish prior to the arrival of fall-out the exact position to which the probe unit will have to be withdrawn but it is calculated that a one-tenth reading will probably be obtained when the ionization chamber is about four inches below the ground surface, *i.e.*, when the chamber has been withdrawn a distance of about 3′ 4″. The mounting rod is capable of being telescoped by 2′ 8″.

14. The following procedure is to be adopted:—

(*a*) If the dose-rate reading rises to 350 r.p.h., fix the rod clamp to the pipe flange in the post.

(*b*) When the reading approaches 400 r.p.h., unhook the cable from its stowed position and unclamp the handle of the mounting rod by lifting and turning the eccentric cam. *Take care not to allow the probe unit to fall out of the probe pipe.*

(*c*) As soon as a reading of 400 r.p.h. is reached, withdraw the probe unit, remove the split pin holding the two sections of the rod together, telescope the rod, re-insert the split pin to pin the rod in the telescoped position and feed the ionization chamber up the probe pipe until a reading of 40 r.p.h. is obtained. Slight up or down adjustment may be necessary but this must not take more than a few seconds. Use the clamp to fix the probe unit in this position (*See* note below.)

(*d*) If, after attempting the above, a reading of 40 r.p.h. is not obtainable with the probe unit in its highest position, withdraw the probe unit, remove the split pin, extend the rod, replace the split pin and feed the ionization chamber up the probe pipe until a reading of 40 r.p.h. is obtained. Clamp in this position. (*See* note below.) Stow the cable again as in para. 9 (*g*) above.

(*e*) In the event of either of the above being unsuccessful, or taking so long a time that the accuracy of the shielded reading is suspect, restore the probe unit to its original position and repeat the whole procedure when the outside dose-rate reaches 450 r.p.h. The shielded reading to be obtained will, of course, now be 45 r.p.h. In the event of a further failure, a final attempt can be made when the outside dose-rate reaches 500 r.p.h., to obtain a shielded reading of 50 r.p.h.

Note. Clamping is carried out by positioning the rod in the jaws of the clamp and tightening the wing nut sufficiently to hold the probe unit in position. Over-tightening must be avoided or the rod will be distorted.

15. Readings reduced by a factor of 10 (as described above) will be reported in accordance with current instructions regarding shielded readings.

16. When radioactive decay has taken place and the reading has fallen to 40 r.p.h. with the ionization chamber in the shielded position, the probe unit is to be restored to its original extended position, fully inserted up the probe pipe and with the handle locked in position by means of the eccentric cam. Normal reporting is then resumed.

17. If, exceptionally, the dose-rate were to rise above 5,000 r.p.h., a further withdrawal of the probe unit beyond the position of one-tenth reading (*e.g.*, to a position where a one-hundredth reading were obtained) would enable the operator to continue to record the dose-rate. A drill for this additional withdrawal has not yet been devised.

Time for Meter to Stabilize

18. The instrument takes about three minutes to stabilize. When the meter is switched on, this period of time must be allowed to elapse before the "set zero" and "set 500" checks are carried out or dose-rate readings taken.

MAINTENANCE INSTRUCTIONS

Warning

19. Maintenance by R.O.C. personnel of those items which are stored in peace-time at group headquarters is limited to the replacement of the battery pack, changing the batteries in the pack and replacement of the interconnecting cable. Maintenance of those items stored at posts is described in paras. 29 to 31.

Batteries

20. Should a battery test as detailed in para. 11 show meter readings less than the "Battery Min." mark it will be necessary to replace either the battery pack (if a full pack is available) or the batteries in the pack. (It should be noted that the low tension battery has the shortest operational life; *see* para. 6.)

21. The pack may be removed from the indicator unit by unscrewing the two milled screws retaining the cover over the battery pack. *Take care not to allow the pack to fall away from the indicator unit as the cover actually retains the pack.* Withdraw the pack by pulling down on either side by means of the moulded recesses.

22. Fit the new pack in the reverse order to that detailed above and carry out the check procedures detailed in para. 11.

23. Should both packs contain one or more defective batteries, it may be possible to make up a usable pack by a selection of the batteries. To do this:—

(*a*) Carry out a battery check for each of the two packs, carefully noting the reading given by each battery.

(*b*) Open both packs and fit the better 1.35-volt cell and the two best 10.8-volt batteries into one pack. Close the packs (*see* para. 10).

(*c*) Fit the battery pack to the indicator unit and carry out the check procedures detailed in para. 11.

24. Should a choice be necessary between batteries fitted to HT1 or HT2, it is preferable that HT1 should be fitted with the better battery, *i.e.*, the battery which provides the larger deflection of the meter needle when a battery test is being carried out as detailed in para. 11.

25. Should a check of the individual batteries show meter readings of about the "Battery Min." mark or even lower, it may be possible to con-

tinue to use the batteries, although more frequent adjustment of the "zero" and "500" settings will be necessary. Eventually the battery voltage will drop to a point outside the range of adjustment of the pre-set controls.

26. Battery packs must be emptied when being placed in store: separate storage for batteries is essential to prevent possible corrosion.

Inter-Connecting Cable

27. A faulty cable may be suspected if any one of the following symptoms is observed:—

(*a*) If radioactivity is known to exist outside the post and no significant deflection of the meter needle is observed. This assumes that the operation switch is in the "on" position, the meter has been allowed to stabilize and that the check procedures detailed in para. 11 have been satisfactorily carried out.

(*b*) If a forward deflection of the meter needle is observed when it is definitely known that no radioactivity exists outside the post. This assumes that the operation switch is in the "on" position, the meter has been allowed to stabilize and also that the various check procedures detailed in para. 11 have been satisfactorily carried out, in particular that concerned with "set zero".

Repair

28. In any other circumstances where the instrument fails to operate or is in need of repair, it should be returned to group headquarters.

Equipment Stored at Posts

29. A routine inspection at intervals of not less than six months should be carried out on the mounting rod, cable clamp assembly and rod clamp which are stored in the underground post.

30. The following details should be noted during the inspection:—

(*a*) Ensure that the mounting rod and cable clamp assembly are complete.

(*b*) Look for signs of damage or corrosion on all metal parts. Deposits of dust or dirt should be wiped off, using a clean cloth.

(*c*) Extend and collapse the mounting rod to prove that the two parts are not corroded together.

(*d*) Ensure that the wing screws on the cable clamp assembly can be turned over their complete length. A small quantity of grease should be applied to the threads of the wing screws, if required.

(*e*) Inspect the rod clamp for signs of rust and, if necessary, apply grease to the screw threads.

31. If any serious fault is observed during the inspection a report should be submitted to group headquarters.

CHAPTER 36

THE FIXED SURVEY METER TRAINER

GENERAL DESCRIPTION

Function

1. The fixed survey meter trainer is a mechanical instrument designed to simulate the characteristics of the operational fixed survey meter.

Facilities

2. The trainer can be used for two purposes:—

(*a*) Training personnel in the check procedures used on the operational instrument.

(*b*) Training personnel in recognizing the arrival of fall-out and the subsequent reporting of the dose-rate.

Construction

3. In appearance, the trainer is identical to the indicator unit of its operational counterpart (*see* Fig. 1) with the following exceptions:—

(*a*) The main body of the trainer is enamelled black so that the two meters can be readily distinguished.

(*b*) The socket for the inter-connecting cable is absent from the trainer.

(*c*) There is a small circular key-hole in the side of the trainer.

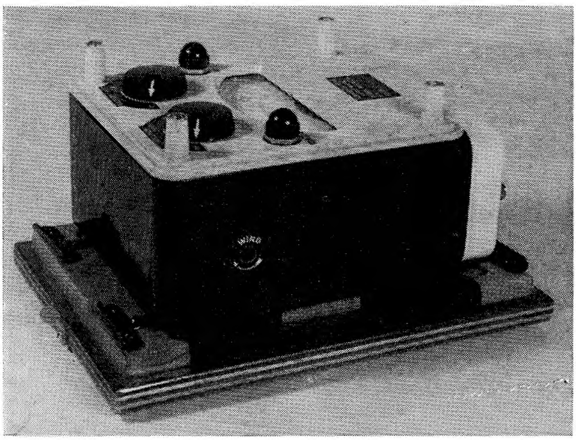


Fig. 1.
The fixed survey meter trainer showing key-hole

Storage

4. The instrument is supplied in a wooden transit case which contains, in addition to the trainer, a screwdriver, a set of screws and one or more

spools (*see* Fig. 2). It is sufficiently robust for storage at posts without deterioration.

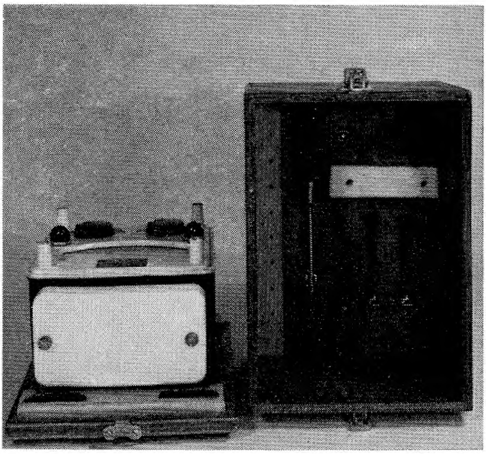


Fig. 2.
Fixed survey meter with base and lid of transit case

Design

5. The instrument is designed so that a prepared strip of transparent plastic material (known as a "pattern") is drawn through at a constant rate by means of a clockwork motor. As the pattern passes through, a small roller attached to the tail of the meter needle is held by a spring against one edge of the pattern. Variations in the width of the pattern will produce a rise or fall in the reading indicated by the meter needle.

6. Patterns will be cut at the Home Office Warning and Monitoring School and can simulate the build-up and decay of fall-out from a single burst or a number of bursts. Only patterns issued officially are to be used; "home-made" patterns may become jammed in the instrument and thus cause damage.

7. The instrument has two limitations:—

(*a*) It is not possible to simulate a very quick build-up of fall-out. Where the rate of increase of the readings required is greater than that corresponding to a rise from 0 to 500 r.p.h. in the space of 35 minutes, the trainer cannot give appropriate readings and these must be introduced artificially.

(*b*) It is not possible to simulate readings that would be given on the operational meter at the restoration of the probe to its normal position after a period of shielded readings.

OPERATING INSTRUCTIONS

Installation

8. Whenever it is used at posts and operations rooms, the trainer is to be removed from the base of the transit case and fixed to the instrument table using the screws provided in the transit case. It is essential that the trainer should lie flat on the table during operation.

9. Whenever possible this method of fixing should also be used at post training meetings to safeguard the instrument against accidental damage. If this is not possible the trainer should remain fixed to the base board of the transit case.

Training in Check Procedures

10. When training in check procedures is carried out a pattern should not be used. If a pattern has been fed into the instrument the meter needle may not fall to zero.

11. Rotation of the battery test switch to the "LT", "HT1" or "HT2" position will cause the meter needle to move mechanically to a point on the scale above the "Battery Min." mark. Rotation back to the "off" position will cause the needle to return to zero.

12. When the operation switch is rotated to the "zero" position the meter needle will remain at zero (provided that a pattern has not been fed into the instrument). Rotation of the switch to the "500" position will cause the needle to move mechanically to the "500" mark on the scale. When the switch is returned to the "off" position, the needle will return to zero.

Note. Whenever the operation switch is rotated from "off" to "on", "zero" or "500" it passes through the position marked "LT". The practice of leaving it at "LT" for 10 seconds, essential on the operational instrument (*see* Chapter 35, para. 11(*d*)), must be continued on the trainer to ensure that the same procedure is followed on both instruments.

13. The mechanical interlock which is fitted on the operational instrument to prevent rotation of one switch while the other is in operation is also fitted on the trainer.

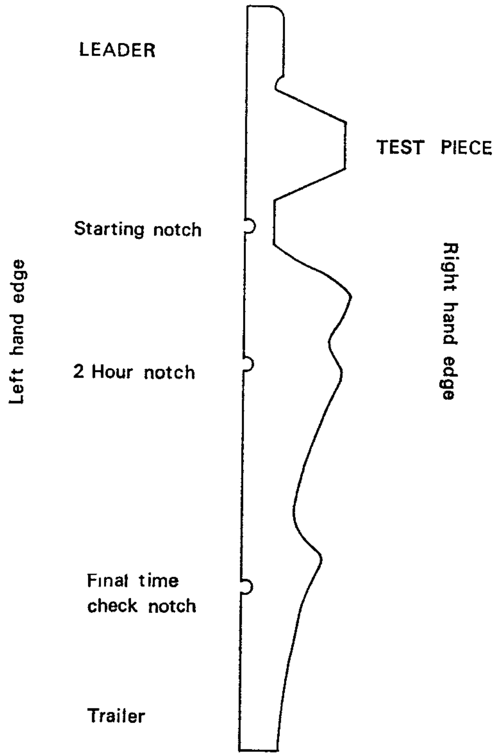
14. Dummy set zero and set 500 controls are provided but these are not linked to the meter needle and cannot, therefore, be used for making adjustments to the needle setting.

Use of Trainer for Exercises

15. Patterns will be cut by the Home Office exercise preparation staff to give the appropriate readings applicable to each post, based on the prevailing fall-out situation (*see* Fig. 3). A narrative will also be supplied giving the switch-on time, check times and times at which instrument readings are to be ignored (*see* paras. 22 to 27).

16. Each pattern will commence with a test piece designed to move the meter needle from "zero" up to at least "400" and then back to "zero". (Earlier patterns had a wider test piece designed to move the meter needle up to "500".) This will be followed by a strip which will give a reading of "zero". A short distance along this strip, on the left-hand (straight) edge of the pattern, there will be a small notch marked in blue. This notch marks the starting point for the pattern and will be followed by one or more increases and reductions in the width of the pattern. These represent rises and falls in the dose-rate. A second notch will be cut on the pattern at a point corresponding to 2 hours after the starting notch and, where readings will continue for 6 hours or more, a third notch will be cut about 2 hours before the end of the exercise. These notches will be used to check that the pattern is passing through the instrument at the intended speed.

17. Patterns for exercises will be sent out in bulk to group headquarters by the Home Office exercise preparation staff. On receipt at group headquarters, each pattern will be rolled on to a 3″ length of ⅜″ wooden dowel



TYPICAL PATTERN

Fig. 3.

and secured by a rubber band. Care must be taken that the pattern is rolled correctly, *i.e.*, exactly as it will go on the spool. Failure to do this may result in the pattern being difficult to insert in the trainer and may even cause damage. In this connection it must be remembered that the pattern, when received from the Warning and Monitoring School, may sometimes be rolled "inside out".

18. The pattern and intensity reading narrative can then be put in an envelope and dispatched to the post chief observer without damage.

19. When received at the post the pattern is to be unrolled from the dowel ready for attachment to the spool. Note carefully the leader, test piece, timing notches and trailer. Remove the clip from the spool. Hold the spool so that the red-painted end is to the left. Lay the end of the trailer over the spool, making sure that the left-hand (straight) edge of the pattern is close against the red-painted end of the spool, and fasten it in position with the clip. Wind the pattern back on to the spool making sure that, when fully wound back, the leader is on the upper side of the spool.

Preparation of Instrument

20. To prepare the trainer for use in an exercise:—

(*a*) Fix the trainer to the instrument table using the screws stored in the transit case. Remove the protective covers from the top of the instrument and from the spool assembly (*see* Fig. 4).

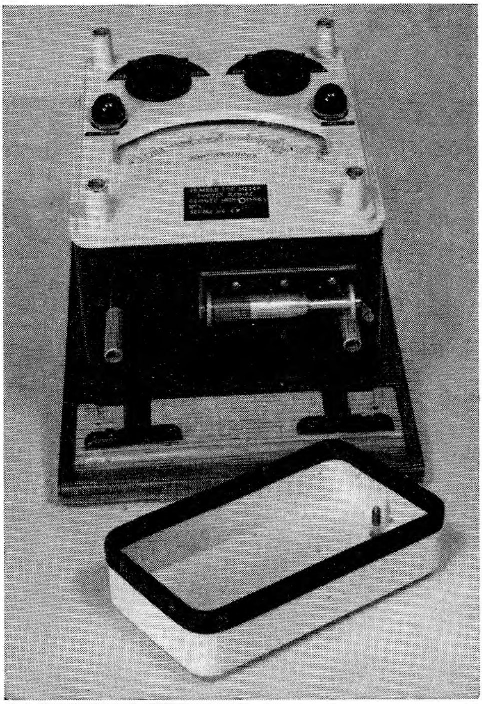


Fig. 4.
Trainer with covers removed. Unit is screwed to the instrument table when used in the post

(*b*) After checking that both switches are in the "off" position, feed about an inch of the pattern manually into the left-hand side of the intake slot, making sure that the red-painted end of the spool is to the left (*see* Fig. 5). Ensure that the pattern has engaged the roller by moving the pattern slightly to the right. This should produce a movement of the needle.

(*c*) Continue feeding the pattern in and keep it hard against the left-hand side of the slot. It is recommended that the spool be held in the right hand and the pattern in the left hand between thumb and fore-finger, the pattern being held close up to the slot in order to prevent buckling.

(*d*) When the front end of the pattern reaches the clock drum, in some instruments resistance to motion may be felt. This may be overcome by slight movement of the pattern backwards and forwards.

(*e*) Continue to feed the pattern in and as the test piece enters the instrument the meter needle must be watched to check that it moves from "zero" across the scale to "400", maintains this peak for a time, then falls back to "zero". At this stage the starting notch should

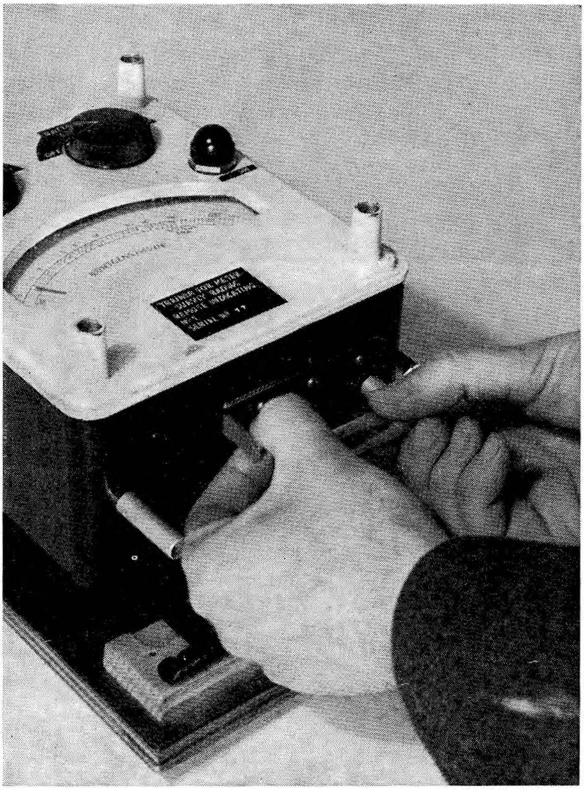


Fig. 5.
Feeding pattern into the intake slot

be visible close to the lips of the intake slot. Set this notch at about $\frac{1}{8}''$ from the lips of the slot (*see* Fig. 6(*a*)). Roll the remainder of the pattern tightly on the spool and fit the spool into its clips. This is done by first fitting the red-painted end of the spool so that the conical stud on the left-hand clip fits into the hole in the flat end of the spool. Take care that the tension spring on this clip presses against the outside flat end of the spool, otherwise the spring may be damaged. The right-hand clip is then pressed gently outwards so that the right-hand end of the spool can be fitted into place in a similar way. The tension spring will now hold the spool so that the springiness of the pattern does not cause it to unroll spontaneously.

(*f*) Remove the winding key from its clip in the protective cover, insert it in the hole in the side of the instrument and wind the clockwork motor up fully. Take care not to overwind. Return the key to its clip.

(*g*) Rotate the operation switch to the "on" position (*see* note to para. 12) and, after about 5 minutes, when the notch in the pattern has disappeared halfway through the lips of the intake slot, return the switch to "off". This operation takes up play in the clock mechanism. The trainer is now ready for the exercise (*see* Fig. 6(*b*)).

(*h*) Replace the protective cover over the spool assembly.

(*j*) Replace the protective cover over the top of the instrument if there is to be more than a short delay before switch-on time is reached.

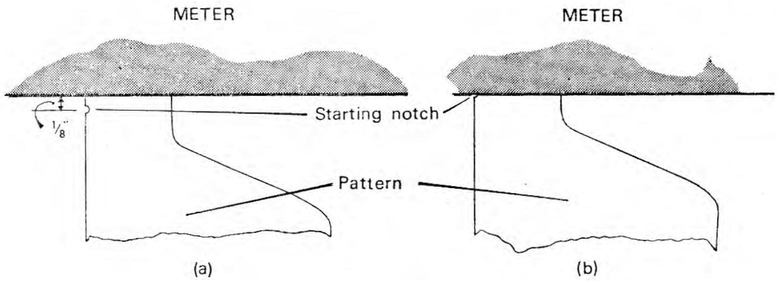


Fig. 6.
a. Starting notch $\frac{1}{8}''$ from intake slot
b. Starting notch halfway into the intake slot

Operation of the Instrument

21. Ten minutes before the time for switching on as given in the narrative:—

(*a*) Rewind the clockwork motor if hours have passed since performing the operations in para. 20.

(*b*) Remove the protective covers and check that the starting notch is halfway between the lips of the intake slot. If it has disappeared into the trainer owing to failure to switch off as in para. 20 (*g*), rotate the switch to the "off" position, remove the spool from the clip and gently pull the pattern back out of the trainer until the starting notch reappears. If any resistance is felt when pulling the pattern back, do not continue the attempt but remove the pattern completely as described in para. 32. Repeat the actions described in paras. 20 (*b*), (*c*), (*d*) and (*e*) as necessary. Replace the protective cover over the spool assembly.

(*c*) At switch-on time rotate the operation switch to the "on" position. (*See* note to para. 12.)

(*d*) Report the time at which the meter needle reaches the 0.1 r.p.h. mark and subsequent readings in accordance with current instructions.

(*e*) About $1\frac{3}{4}$ hours after the switch-on time remove the protective cover from the spool assembly and check that the two-hour notch is correctly positioned relative to the lips of the intake slot; in this respect it is useful to know that the pattern should move through the instrument at the rate of $\frac{5}{16}$th″ each 15 minutes. Inform the post controller if there appears to be any material departure from the expected rate of movement of the pattern. Before replacing the protective cover ensure that the left-hand edge of the pattern is tight against the left-hand edge of the slot, and adjust if necessary.

(*f*) The procedure described in (*e*) is to be repeated if and when the post narrative states that a further timing check is to be made.

(*g*) During a long exercise, independently of any timing checks, the spool cover should be removed periodically to check that the left-hand edge of the pattern has remained tight against the left-hand edge of the slot.

Variations Due to Limitations of the Instrument

22. As mentioned in para. 7 the instrument has two limitations. Where these limitations affect the operation of the instrument at a particular post, the details will be included in the post narrative.

23. In the case where a very quick build-up of fall-out is required, the readings provided by the pattern during the period of build-up will be unrealistic. The post narrative will give the first report time and the readings to be reported until the time at which the readings provided by the pattern become realistic.

24. For example, the switch-on time at a particular post might be 1330 hours, and the instrument would be prepared and started in the manner described in paras. 20 and 21. The post narrative might read as follows:—

Time	*Dose-Rate*
1403	0.1 (first report)
1405	1
1410	8
1415	60
1420	300
1425	RED 65

These readings would be reported at the times shown, the readings from the instrument being ignored. The readings for 1430 hours and subsequent readings would be reported from the trainer.

25. In the case where the readings rise gradually to more than 500 r.p.h., the sudden drop from a reading of 400 r.p.h. to a shielded reading of 40 r.p.h. (RED 40) can be simulated. The meter will not, however, accept the steep rise required when, after the shielded reading has risen to maximum and decayed to 40 r.p.h. (RED 40), the probe unit is assumed to have been restored to its normal position and a reading of 400 r.p.h. is required on the trainer. The pattern will be cut to rise from 40 r.p.h. to 400 r.p.h. in as short a time as possible but in the meantime the readings shown on the meter will be unrealistic. For this case also, the post narrative will give the readings to be reported until the time at which the readings provided by the pattern again become realistic.

26. Continuing the example given in para. 24, the dose-rate might have fallen to a shielded reading of 40 r.p.h. (RED 40) at 1540 hours. The instrument would be left switched on, but the readings shown would be ignored. The correct readings would be read from the post narrative which might read as follows:—

Time	*Dose-Rate*
1545	400
1550	400
1555	350

The reading for 1600 hours and subsequent readings would be reported from the trainer.

27. It will be appreciated that both of the limitations described above might be applicable at different times to the same pattern. In such cases a composite post narrative would be included with the spool. In all cases the pattern, once started, would be allowed to run until the end of the exercise, the readings from the post narrative being given at the appropriate times.

Importance of Correct Timing

28. It is essential that the trainer be switched on exactly at the starting time quoted in the post narrative and that, when switched on, the starting

notch be positioned correctly in the lips of the intake slot. A time check must be made with the operations room a few minutes before the starting time to ensure that the clock or watch in use at the post is correct.

29. Failure to synchronize the time correctly or failure to switch on at the correct time will cause the first report time to be given incorrectly and all subsequent readings to be in error. This will prejudice the value of the exercise.

Training Patterns

30. Apart from exercise patterns one or two training patterns are provided for use with each instrument. Training pattern 'A' is a simple example of a rise and fall without complications. Training pattern 'B' includes the variations described in paras. 22 to 27.

Disposal of Patterns after Exercises

31. Normally, after an exercise is over, the pattern is to be returned to group headquarters. At the end of the exercise, the pattern will have passed through the clock mechanism and into the storage space which can be seen through the rectangular hole below the spool assembly.

32. To remove the pattern:—

(*a*) Rotate the operation switch to the "off" position.

(*b*) Pull the used pattern out through the rectangular hole and continue pulling gently until almost all the pattern has passed through the instrument and the spring clip which holds the pattern to the spool is visible.

(*c*) Remove the spring clip whereupon the pattern will fall away from the spool.

(*d*) Replace the clip on the spool.

(*e*) Pull the remainder of the pattern through the instrument.

(*f*) Roll it on to the piece of dowel ready for return to group headquarters.

(*g*) Remove the spool from its clips and replace it in the lid of the transit case.

33. If the group headquarters does not require the pattern to be returned the procedure detailed in paras. 32 (*a*) to (*e*) and (*g*) is to be followed. The pattern should be rolled up and retained for use in training.

MAINTENANCE INSTRUCTIONS

Warning

34. *No maintenance whatsoever* is to be carried out on this instrument. In the event of any fault or damage occurring, it is to be returned complete in its transit case to group headquarters for exchange at Home Office stores.

35. At all times when the instrument is not in use or when it is being carried from place to place, it is to be kept in its transit case complete with all accessories.

CHAPTER 37

THE RADIAC SURVEY METER No. 2

GENERAL DESCRIPTION

Function

1. The radiac survey meter No. 2 (*see* Fig. 1) is a portable battery-operated instrument for the measurement of gamma radiation dose-rate over the range 0 to 300 roentgens per hour (r.p.h.).

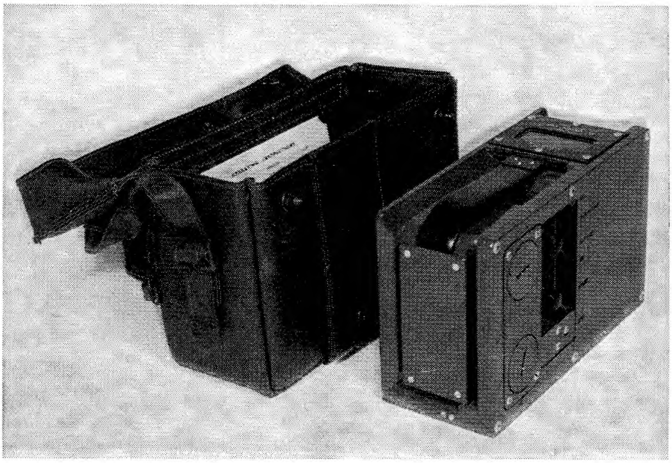


Fig. 1.
Radiac Survey Meter No. 2 with haversack

2. It is used in the R.O.C. as a reserve instrument for all posts in case of failure of the fixed survey meter and at master posts for the measurement of fall-out deposition.

Facilities

3. The dose-rate in r.p.h. is indicated on a direct reading meter with a linear scale. Three ranges are provided, 0—3 r.p.h., 0—30 r.p.h. and 0—300 r.p.h. A moving scale on the meter is mechanically linked to the range switch to indicate the range in use.

4. The instrument may be made sensitive to beta radiation by the removal of the base-plate. A hinged flap and beta window assembly is revealed when the plate is removed.

5. When used for gamma radiation measurement the instrument may be carried in its haversack, access to the controls being gained through a flap in the side. The meter scale can be viewed through a toughened glass window in the hinged lid and can be illuminated by a lamp for use when the instrument is operated in the dark.

Construction

6. The instrument is built in a rectangular metal case measuring $9\frac{1}{8}''$ long, $3\frac{3}{4}''$ wide and $5\frac{7}{8}''$ high and weighs $6\frac{1}{2}$ lb. including the batteries. A

collapsible carrying handle is fitted on the top. The case has two compartments; that containing the mechanical and electronic components is hermetically sealed and fitted with a desiccator, the other contains the batteries and is made waterproof by a rubber gasket on the cover.

7. The power supply consists of:—

(*a*) Two 1.5-volt cells	Filament supply (operational life—200 hours) Scale lamp supply (operational life—200 hours)
(*b*) One 9-volt battery	Anode supply (operational life—500 hours)
(*c*) One 30-volt battery	Chamber polarizing and grid bias supply (operational life—500 hours)

Each 1.5-volt cell has a shelf life of about 2½ years; the 9-volt and 30-volt batteries have a shelf life of about 1 year.

8. The desiccator is of the silica-gel type and is fitted to maintain a low relative humidity within the sealed compartment. The humidity indicator is azure blue when the compartment is in a dry condition and turns to salmon pink when in a saturated state.

9. The haversack is made of P.V.C. covered cotton material and measures 11″ long, 5″ wide and 7″ high. The lid contains a screwdriver for the adjustment of the set zero control.

10. There are two operational controls and two pre-set controls situated on the side of the instrument (*see* Fig. 2). They are:—

(*a*) The on/off switch, which is mechanically linked to a flag on the meter to indicate whether the instrument is "on" or "off" (*see* Fig. 3).

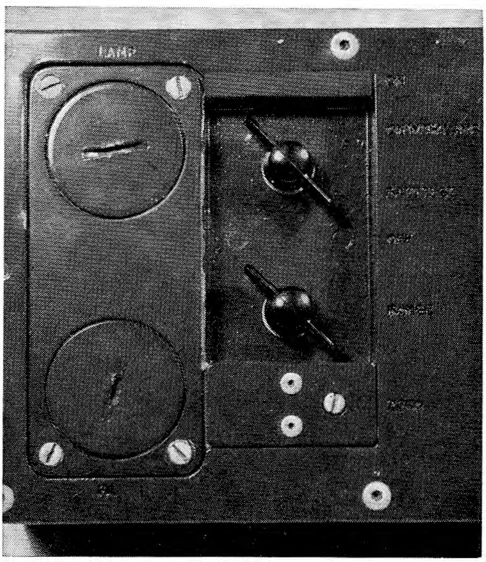


Fig. 2.
The controls and battery compartment covers on the Radiac Survey Meter No. 2

The switch has four positions, the sequence being in an anti-clockwise direction:—

(i) Off
(ii) Battery check
(iii) On with lamp
(iv) On without lamp.

(*b*) The range switch, which is mechanically linked to a moving scale on the meter to indicate the range in use (*see* Fig. 3). This also has four positions, the sequence being in an anti-clockwise direction:—

(i) Set zero
(ii) O—300 r.p.h. (Scale colour: red)
(iii) 0—30 r.p.h. (Scale colour: blue)
(iv) 0—3 r.p.h. (Scale colour: white).

(*c*) The set zero control, which is a pre-set control for adjustment of the meter zero.

(*d*) The calibration control, which is to be adjusted only by qualified maintenance engineers. Access to this control is barred by a protective panel which is not to be removed by R.O.C. personnel.

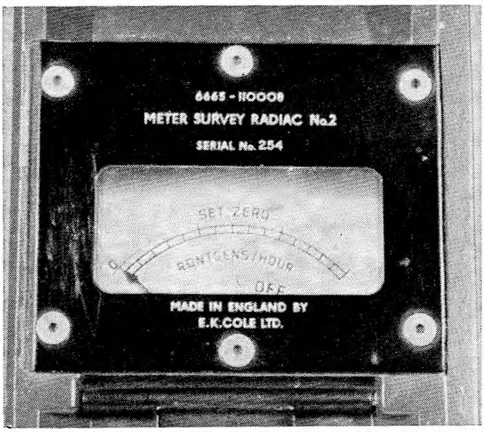


Fig. 3.
Meter scale and on/off indicator

Storage

11. The instrument will normally be stored at group headquarters in its haversack. One complete set of batteries and one spare 1.5-volt cell will be stored separately.

OPERATING INSTRUCTIONS

Fitting the Batteries

12. Before the instrument can be used the batteries must be fitted as follows:—

(*a*) Remove the instrument from its haversack and lay it on its side with the controls uppermost.

(*b*) Unscrew the four corner screws and remove the battery cover plate.

(*c*) Withdraw the battery holder from the centre of the compartment (*see* Fig. 4).

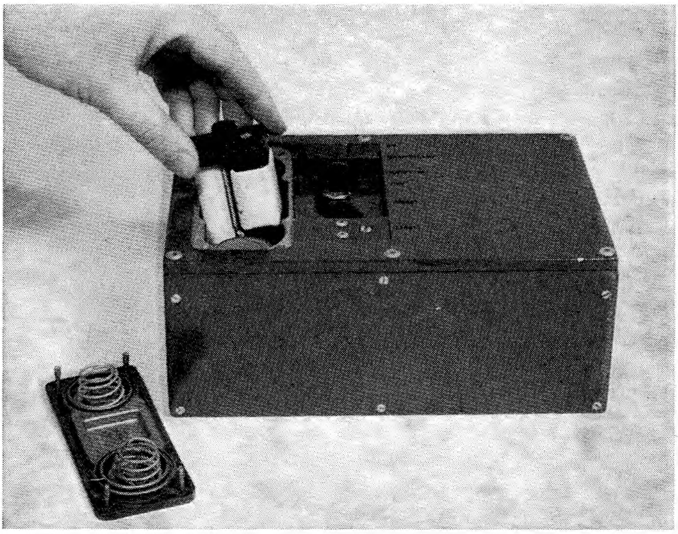


Fig. 4.
Withdrawing battery holder from centre compartment

(*d*) Slacken the knurled screws on the battery holder sufficiently to allow the batteries to be inserted, the 30-volt into the longer of the two spaces, the 9-volt into the shorter. Make sure that the batteries are correctly connected, positive (+) contact to the contact marked "+" on the battery holder (*see* Fig. 5).

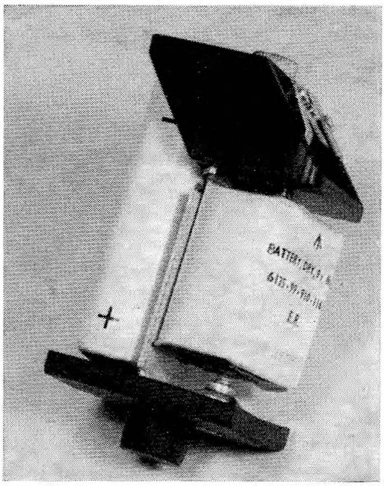


Fig. 5.
Battery holder with 30-volt and 9-volt batteries in position

(*e*) Tighten the knurled screws sufficiently to ensure good contact, but do not overtighten.

(*f*) Using the rubber handle, insert the battery holder complete in the centre of the compartment, making sure that the three contacts on the holder connect with the corresponding contacts in the battery compartment.

(*g*) Insert the two 1.5-volt cells, one into each of the spaces on either side of the battery holder with the brass cap (positive contact) downwards into the battery compartment. The lamp cell is that nearer the top of the instrument, the filament cell is the lower one (*see* Fig. 6).

(*h*) Replace the battery cover and tighten the four screws.

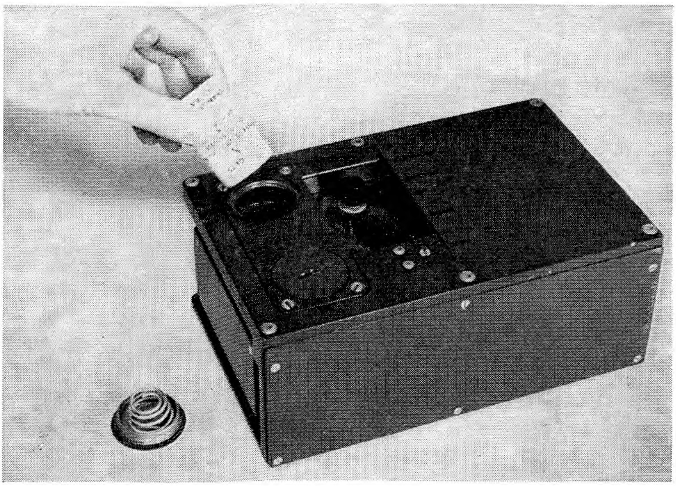


Fig. 6.
Inserting one of the 1.5-volt cells

Check Procedure

13. Before a measurement of gamma or beta radiation is made, the following pre-operational check is to be carried out:—

(*a*) Turn the on/off switch anti-clockwise from the "off" position to the "battery test" position.

(*b*) Check the meter indication. If the needle falls below the lower red line on the scale, replace the filament cell (*see* para. 23).

(*c*) Turn the on/off switch to the appropriate "on" position, *i.e.*, with or without lamp, and the range switch to "set zero".

(*d*) Check that the meter needle indicates zero. If it is not directly on zero, set to zero by adjusting the set zero control with the screwdriver supplied (stowed in the lid of the haversack).

(*e*) Return both switches to "off".

Gamma Radiation Measurement

14. When the on/off switch is turned to the appropriate "on" position and the range switch is turned to one of the scale positions, the instrument is ready for use. It is advisable initially to adjust the range switch to the least sensitive range, *i.e.*, 0—300 r.p.h., to avoid risk of damage to the meter.

Beta Radiation Detection

15. Beta radiation being less penetrating than gamma radiation is normally absorbed by the case of the instrument. A thin window has therefore been provided through which beta particles can penetrate. During normal use of the instrument for gamma radiation measurement, this window is covered by the base plate of the instrument and a hinged flap (*see* Fig. 7).

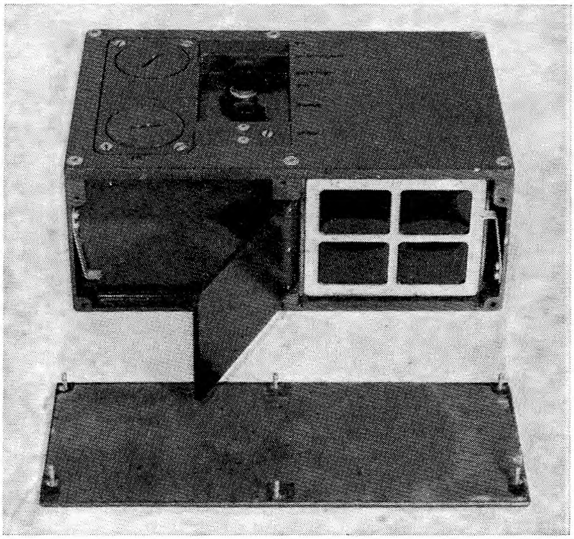


Fig. 7.
Radiac Survey Meter No. 2 with beta window exposed

16. If a reading of beta radiation is required, carry out the following instructions:—

(*a*) Remove the instrument from its haversack.

(*b*) Lay the instrument on its side and remove the base plate by unscrewing the six captive screws which hold it in place. This will reveal the hinged flap held in place over the beta window by a spring clip.

(*c*) Release the hinged flap by depressing the spring clip and expose the beta window by pulling the flat over until it is held in position by the spring clip at the other end of the instrument.

(*d*) Turn the on/off switch to the appropriate "on" position and the range switch to one of the three scale positions (*see* para. 14).

(*e*) With the underside of the instrument held at a set distance from the suspected contamination, note the meter reading with the window uncovered (beta plus gamma radiation).

(*f*) Restore the hinged flap to its original position covering the beta window.

(*g*) With the instrument in the same position as when the previous reading was taken, note the reading with the window covered (gamma radiation only).

(*h*) The difference between the first and second readings gives the contribution due to beta radiation.

17. When the beta window is exposed great care must be taken to avoid damaging the thin transparent plastic window as this will destroy the hermetic seal of the instrument.

18. As soon as the detection of beta radiation is no longer required, the base-plate is to be replaced and screwed into position, first making sure that the hinged flap is over the beta window.

Use of Lamp

19. The lamp which provides the illumination of the meter scale is intended for intermittent use only. As it is hardly visible in daylight care must be taken that the on/off switch is at the "on without lamp" position.

MAINTENANCE

Warning

20. Maintenance by R.O.C. personnel is confined to fitting or replacing the batteries and the filament and lamp cells. No other servicing whatever is permitted; if any fault occurs the instrument is to be exchanged for a serviceable one.

Batteries

21. The instruments are stored without batteries to avoid the risk of damage from corrosion during long periods of storage.

22. An indication of the state of the two batteries is given when the "set zero" procedure is carried out (*see* paras. 13 (*c*) and (*d*)). If the needle remains on the scale and cannot be brought down to zero, the 9-volt battery can be considered as suspect. If, however, the needle remains off the scale and cannot be moved up to zero, the 30-volt battery is suspect. During operations, replacements for these batteries will not normally be available; if they are, then the appropriate battery should be replaced using the method described in paras. 12 (*a*) to (*f*) and (*h*).

23. As stated in para. 13, the filament cell should be replaced when the battery test gives a meter indication below the lower red line. The lamp cell should be renewed as required. To replace either of these cells:—

(*a*) With the instrument out of its haversack and laid on its side, controls uppermost, unscrew and remove the appropriate coin-slotted cell cover.

(*b*) Remove the existing cell by turning the instrument over so that the controls are facing downwards and giving a gentle shake, whereupon the cell should fall out.

(*c*) Insert the new 1.5-volt cell with the brass cap (positive contact) downwards into the battery compartment (*see* Fig. 6).

(*d*) Replace the cell cover.

CHAPTER 38

THE LIGHTWEIGHT RADIAC SURVEY METER

GENERAL DESCRIPTION

Function

1. The lightweight radiac survey meter (*see* Fig. 1) is a portable battery-operated instrument for the measurement of gamma radiation dose-rate over the range 0—100 roentgens per hour (r.p.h.). The type normally used by the R.O.C. is the AVO Mk. 6, to which these instructions generally refer: the differences found on the Mks. 3 and 4 are contained in notes to the relevant paragraphs.

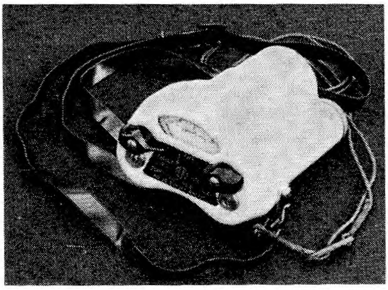


Fig. 1.
Lightweight Radiac Survey Meter

2. The instrument is available in R.O.C. group headquarters for use if a person had to leave the building to carry out an essential task after fall-out had arrived.

Facilities

3. The dose-rate in r.p.h. is indicated on a single logarithmic scale (Fig. 2).

4. The zero and full-scale settings of the instrument can be adjusted in an area free from radioactivity (other than natural background radiation).

5. The case is fitted with a carrying strap and a cord for fastening around the waist to hold the instrument in position.

Construction

6. The instrument is built in a semi-cylindrical case measuring 5¾″ long, 5″ wide and 3¼″ deep; it weighs under 3 lb. including the batteries. The case has three compartments: one is sealed and contains the mechanical and electronic components, the other two are made waterproof by rubber gaskets and each contains a battery.

7. The power supply consists of:—

(*a*) One 1.35-volt Mallory—L.T. supply (Operational life: 200 hours).

(*b*) One 10.8-volt Mallory—H.T. supply (Operational life: 500 hours).

Each battery has a shelf life of some 3 years.

8. There are four operational controls, all situated on the top of the instrument (Fig. 2). They are:—

(*a*) The on/off switch, which is of the two position rotary type.

(*b*) The check F.S. switch, which is similar but is spring-loaded. It is used for checking the full-scale deflection of the meter needle.

(*c*) The zero control, which is a pre-set slotted screw adjustment for setting the meter needle to zero.

(*d*) The calibration control (marked "CAL") which is similar but used for adjustment of the full-scale setting of the meter needle.

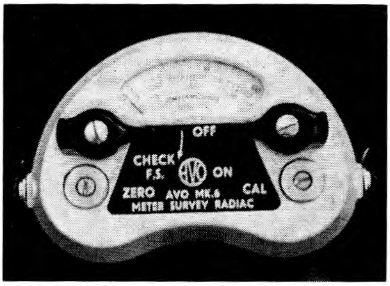


Fig. 2.
Lightweight Radiac Survey Meter—the four operational controls

Storage

9. The instrument is stored at group headquarters. Two complete sets of batteries are stored separately.

OPERATING INSTRUCTIONS

Fitting the Batteries

10. Before the instrument can be used the batteries must be fitted as follows:—

(*a*) Unscrew the red cap to which is attached the battery holder, from the base of the instrument, push up the battery retaining pin and insert the 10.8-volt battery with the round positive (+) end towards the red cap and with the cut-away in the side engaging the contact strip in the battery holder. Pull down the battery retaining pin and screw the holder back into place.

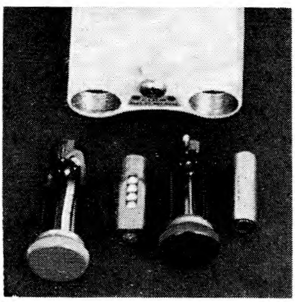


Fig. 3.
Lightweight Radiac Survey Meter—batteries and battery holders

(*b*) Unscrew the black cap to which is attached the battery holder, push up the battery retaining pin and insert the 1.35-volt battery with the positive (+) end towards the black cap. Pull down the battery retaining pin and screw the holder back into place.

Note. In the Mk. 3 and Mk. 4 instruments the battery holder is not attached to the cap but secured within the case. As the batteries are a tight fit in their compartments and may be difficult to remove, a strip of sellotape 2½″ long and ½″ wide should be attached to each for 1½″ of its length with the other 1″ folded over to form a tag. Care should be taken when inserting the batteries to ensure that the tag does not come between the end of the battery and the contact on the cap. The H.T. battery should be inserted round positive (+) end first with the cut-away portion engaging the contact strip in the battery compartment: the L.T. battery should be inserted negative (—) end first.

Check Procedure

11. Before a measurement of gamma radiation is made, the following check procedure is to be carried out:—

(*a*) Switch the on/off switch anti-clockwise to the "on" position and wait for the needle to settle.

(*b*) Check that the meter needle indicates zero. If it is not directly on zero adjust the zero control with a screwdriver. This adjustment must be carried out in an area free from radioactivity, other than natural background radiation. (*See* also para. 14.)

(*c*) Turn the check F.S. switch clockwise against its stop; the needle should move across the scale to the "100" mark. If it is not directly on "100" adjust the "CAL" control with a screwdriver. (*See* also para. 14.)

(*d*) The instrument is now ready for use.

MAINTENANCE

Warning

12. Maintenance by R.O.C. personnel is confined to fitting or replacing the batteries. No other servicing whatever is permitted: if any fault occurs the instrument is to be exchanged for a serviceable one.

Batteries

13. The instruments are stored without batteries to avoid the risk of damage from corrosion during long periods of storage.

14. An indication of the state of the batteries is given when the check procedure is carried out. If the zero or full scale checks cannot be carried out satisfactorily the 1.35-volt battery should be changed and the checks repeated. Should the trouble still persist, the H.T. battery should be checked with a voltmeter: if the voltage is less than 9.5 volts a new one should be fitted. If a steady reading of 100 still cannot be obtained the instrument is unservicable.

Note. In the Mk. 3 and Mk. 4 instruments, if it is not possible to set the needle to the "100" mark, remove the H.T. battery and check that the side contact is properly made.

Changing the Batteries

15. To change the batteries, proceed as in para. 10, pushing up each battery retaining pin before removing the battery. To assist in removing the 1.35-volt battery there is a hole in the holder through which a pencil or screwdriver will pass to push the battery out.

Note. When removing the batteries from the Mk. 3 and Mk. 4 instruments, it is important to remember that the instrument must not be subjected to vigorous shaking or banging. If the batteries have been treated as described in the note to para. 10, there should be no difficulty in removing them.

Other Maintenance

16. No local maintenance beyond that described above is to be attempted and the instrument is not to be opened or interfered with in any other way.

CHAPTER 39

THE RADIAC SURVEY METER TRAINER No. 1

GENERAL DESCRIPTION

Function

1. The radiac survey meter trainer No. 1 is a portable battery-operated instrument designed to train operators with the aid of radioactive sources of comparatively small size. It cannot be used operationally.

Facilities

2. The instrument measures gamma radiation only and is calibrated to read the dose-rate from 0—300 micro-roentgens per hour (μr.p.h.). It cannot be used for the detection of beta radiation.

3. A haversack is provided so that the instrument can be used while being carried. There is a window in the hinged lid through which the meter scale can be read and a flap in the side giving access to the controls. The scale can be illuminated by a lamp when the instrument is used in the dark.

Construction

4. The instrument is built into a rectangular metal case measuring 11″ long, $4\frac{1}{2}$″ wide and 7″ high; it weighs 12 lb. complete with batteries and haversack. A carrying handle is fitted to the top. The case has two compartments; one of these contains the mechanical and electronic components and is hermetically sealed and fitted with a desiccator, the other contains the batteries and is made waterproof by a rubber gasket on the cover (*see* Fig. 1).

5. The power supply consists of:—

(*a*) Four 30-volt batteries	H.T. supply (working life 300 hours)
(*b*) One 1.5-volt cell	Filament supply (working life 70 hours).

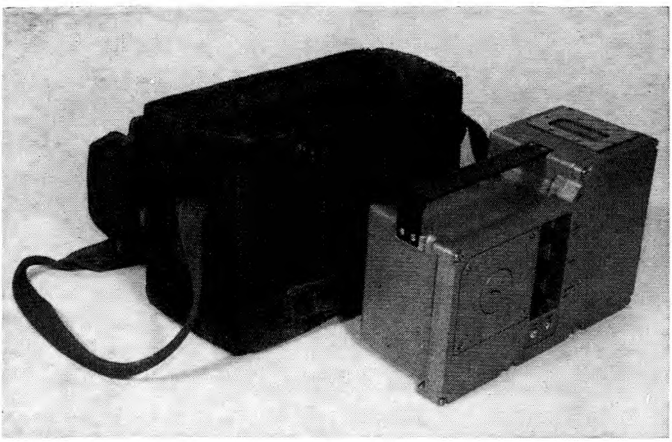


Fig. 1.
Radiac Survey Meter Trainer No. 1 with haversack

6. The silica-gel desiccator maintains a low relative humidity within the sealed compartment. The humidity indicator is azure blue when the compartment is dry and turns to salmon pink when it is saturated.

7. The haversack is padded to give protection against rough handling; it measures $12\frac{1}{2}''$ long, $6''$ wide and $8\frac{1}{2}''$ high. The hinged lid contains a screwdriver for the adjustment of the set zero control.

8. There are two operational switches, a battery test button and two pre-set controls on the right-hand side of the instrument (*See* Fig. 2). They are:

(*a*) The lamp on/off switch.

(*b*) The range switch which is mechanically linked to an indicator in a panel on the meter. It has three positions, the sequence being in an anti-clockwise direction as follows:—

(i) Off
(ii) Set zero
(iii) 0—1—2—3.

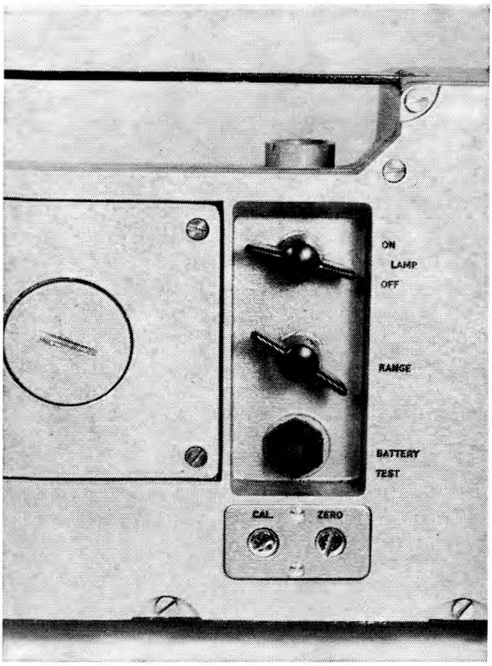


Fig. 2.
Controls on the Radiac Survey Meter Trainer No. 1

(*c*) The battery test button which is a rubber-covered push-button switch for testing the condition of the 1.5-volt cell. (*See* Fig. 3.)

(*d*) The calibration control which is a pre-set control to be adjusted only by qualified maintenance engineers and requires a special tool. It is not to be touched by R.O.C. personnel.

(*e*) The set zero control which is a pre-set control for adjustment of the meter zero.

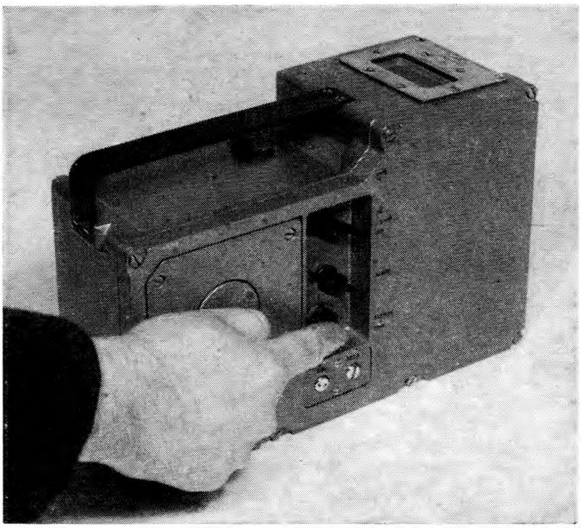


Fig. 3.
Operating the battery test button

Storage

9. The trainer will normally be in frequent use, but when it is not being used it is to be stored at group headquarters with the other radiac instruments. If the trainer is likely to be out of use for more than about three days, the batteries are to be removed to avoid the risk of damage from corrosion.

OPERATING INSTRUCTIONS

Check Procedure

10. Before a measurement of gamma radiation is made the following pre-operational check is to be carried out:—

(*a*) Turn the range switch one position anti-clockwise so that the words "set zero" appear in the panel on the meter scale.

(*b*) Press the battery test button. Note the position of the needle, which should be between the two red lines on the meter scale. If the needle lies below the lower red line, replace the 1.5-volt filament cell (*see* para. 17). Release the battery test button.

(*c*) About 30 seconds after the range switch has been turned to the "set zero" position, check that the needle is at zero. If it is not directly on zero, turn the set zero control with the tool provided in the haversack lid, until the needle lies on zero (*see* Fig. 4). If this cannot be done, replace the 30-volt batteries (*see* para. 16).

(*d*) Turn the range switch to the "off" position.

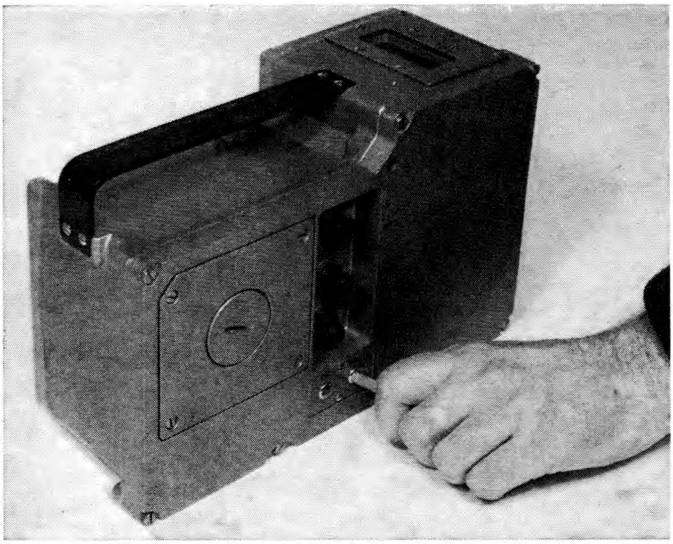


Fig. 4.
Adjusting the set zero control

Gamma Radiation Measurement

11. The instrument may be held in any position for radiation measurement but each time it is switched on 30 seconds should be allowed before taking a reading.

12. To switch on, turn the range switch from "off", through the "set zero" position until "0—1—2—3" (representing hundreds of μr.p.h.) appears in the panel on the meter scale. Even though the instrument is well removed from any known radioactive source there should be some slight "kicks" of the meter needle owing to normal natural radiation.

13. After use, always check that both the range switch and the lamp switch are set to "off".

MAINTENANCE

Warning

14. Maintenance by R.O.C. personnel is confined to fitting or replacing the batteries and filament cell. No other maintenance whatever is permitted; if any fault occurs the instrument is to be exchanged for a serviceable one.

Batteries

15. The instruments are stored without batteries to avoid risk of damage from corrosion during long periods of storage.

16. To fit or replace the four 30-volt batteries:—

(*a*) Remove the instrument from its haversack and lay it on its side with the controls uppermost.

(*b*) Unscrew the four corner screws and remove the battery compartment cover plate.

(*c*) Turn the instrument over on its side so that the controls face downwards. Give it a gentle shake and allow the battery holder to fall out into the hand. If the 1.5-volt cell falls out, but not the holder, place the fingers inside the cell compartment and withdraw the holder (*see* Fig. 5).

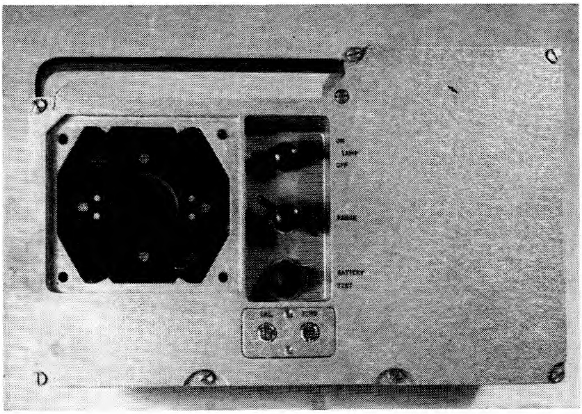


Fig. 5.
Battery compartment with holder in position and 1.5-volt cell removed

(*d*) Position the instrument so that the controls are uppermost.

(*e*) Insert new 30-volt batteries in the locations round the outside of the holder making certain that the negative and positive ends of the batteries correspond with the appropriate signs on the holder. Carefully insert the battery holder, complete with batteries, into the battery compartment.

(*f*) Check that the rubber sealing gasket on the cover plate is not damaged.

(*g*) Refit the cover plate, tightening up the four screws alternately to ensure that the plate is evenly fitted and forms an effective seal; this will ensure that a good contact is made with the batteries.

Note. On some 30-volt batteries the metal contacts are partially covered by the paper wrapping; this prevents a good contact being made. Care should therefore be taken to ensure that the contacts are completely clear before inserting.

17. To fit or replace the 1.5-volt cell:—

(*a*) Unscrew the cap in the centre of the battery cover, using a coin or screwdriver.

(*b*) Remove the cell (if fitted) by turning the instrument over so that the controls are facing downwards and giving a gentle shake whereupon the cell should fall out.

(*c*) Insert the new 1.5-volt cell with the brass cap (positive contact) downwards into the battery compartment (*see* Fig. 6).

(*d*) Replace the cell cover.

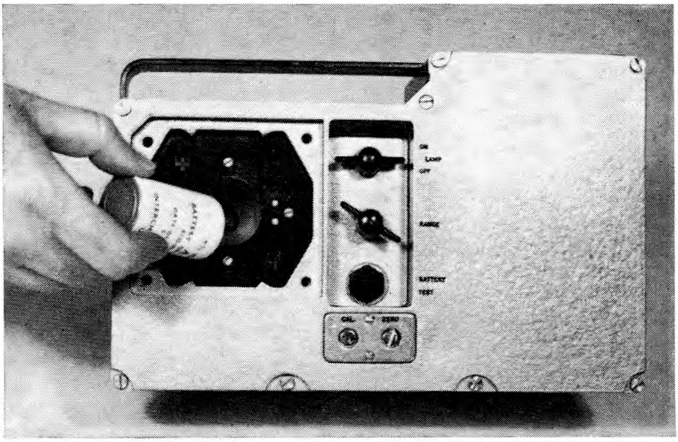


Fig. 6.
Inserting 1.5-volt cell in centre of battery holder
(This can be done with the whole cover plate or just the screw cap removed)

18. As stated in para. 10, the 1.5-volt filament cell should be replaced when the battery test gives a meter indication below the lower red line.

19. As the 30-volt batteries run down the meter needle tends to move to the right across the scale, necessitating adjustments of the set zero control in a clockwise direction. When the point is reached at which the needle cannot be brought down to zero, the batteries should be replaced.

CHAPTER 40

THE INDIVIDUAL DOSIMETER

GENERAL DESCRIPTION

Function

1. The individual dosimeter is designed to measure the accumulated dose of gamma or X-radiation received by an individual over a period of time.

Facilities

2. These dosimeters, which are of the quartz-fibre type, can be read at any time and are small and light enough to be clipped on the clothing or carried in a pocket.

3. The dose is recorded in roentgen units. Three types of dosimeter are currently used in the R.O.C.:—

(*a*) The No. 1, with a range of 0—0.5 roentgens (r.) used for training purposes and by personnel employed in the handling, transport and storage of radioactive sources.

(*b*) The No. 3, with a range of 0—50 r., for operational use at posts and operations rooms.

(*c*) The No. 4, with a range of 0—150 r., for operational use at posts and operations rooms.

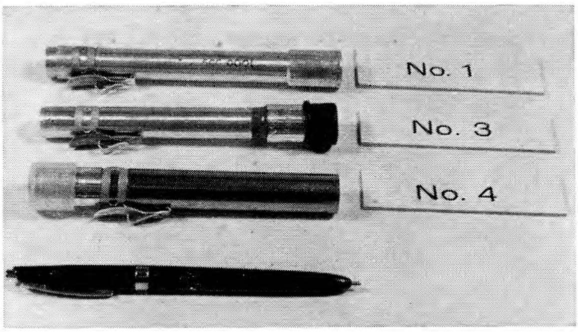


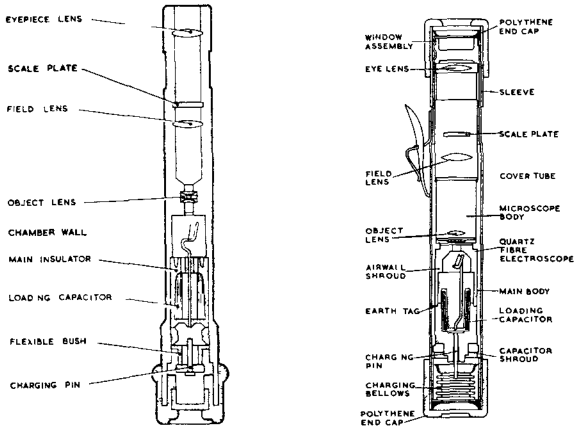
Fig. 1.
The three types of Individual Dosimeter used by the R.O.C. compared with a pocket pen

Construction

4. The instrument is similar in size and shape to a fountain pen, *i.e.*, about $4\frac{1}{2}''$ long and about $\frac{3}{4}''$ in diameter (*see* Fig. 1). The aluminium barrel contains in its lower portion (remote from the clip) the ionization chamber, quartz-fibre electroscope and charging pin assemblies. The upper portion contains a transparent scale and a magnifying lens system focussed on the quartz-fibre (*see* Fig. 2).

5. The electroscope assembly is mounted in the ionization chamber and is insulated from the case; it consists of a thin quartz-fibre formed in the shape of an elongated "U", the ends of which are attached to a thick wire

of similar shape. A spring-loaded charging pin is used with a separate charging unit (*see* Chapter 41) to give an electrical charge to the quartz-fibre and its support.



No. 3 No. 4

Fig. 2.
Sectional views of Dosimeters No. 3 and No. 4

6. When the dosimeter is charged the quartz-fibre moves away from its supporting wire so that when looking through the scale it moves towards zero. When correctly charged it will be seen to rest on the zero mark.

7. The effect of radiation on the ionization chamber is to make the air inside it, normally a good insulator, a poor one. This causes some of the

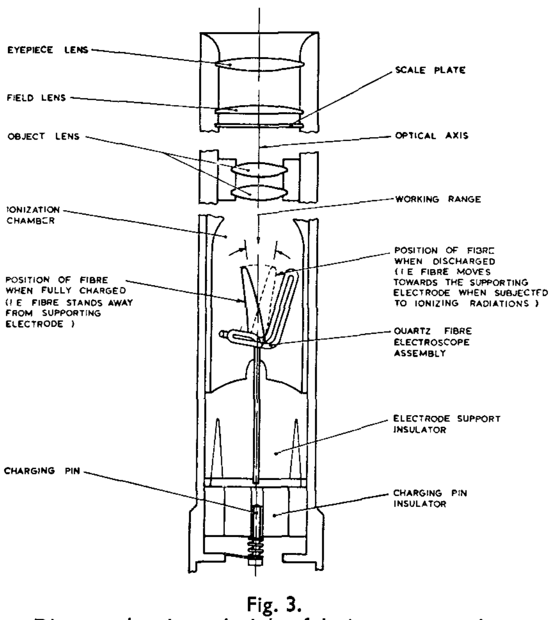


Fig. 3.
Diagram showing principle of dosimeter operation

charge on the electroscope assembly to leak away, allowing the quartz-fibre to move back towards its supporting wire and so up the scale from zero (*see* Fig. 3). The stronger the radiation or the longer the exposure to radiation, the greater will be the reduction of the charge and the higher will be the reading indicated on the scale.

8. The Nos. 1 and 3 dosimeters are not hermetically sealed, but the charging pin ends are made waterproof by a rubber end cap having a skirt which can be rolled back over the outside of the instrument. With the No. 4 dosimeter, however, the sealing is considerably improved by the use of rubber rings at both the microscope and charging pin ends. In addition, the charging pin is supported in a flexible rubber sleeve, or, in some versions, by a metal bellows assembly so that the instrument is effectively sealed even when the end cap is removed. These units are sealed at atmospheric pressure during assembly.

Note. Sealed dosimeters of certain manufacture are provided with polythene push-on end caps in place of the rubber skirted type.

Storage

9. For long-term storage the instruments require conditions of controlled temperature and humidity. They are therefore stored at group headquarters ready for immediate distribution in the event of an emergency.

OPERATING INSTRUCTIONS

Preparation

10. Before use the dosimeter must be correctly charged so that the setting of the quartz-fibre image coincides with the zero mark on the scale. The charging operation is carried out with one of the portable charging units described in Chapter 40.

11. During operational use the dosimeter is normally carried in a polythene bag to ensure that radioactive particles do not alight on the dosimeter itself. If the polythene bag becomes contaminated it can be washed or disposed of; the dosimeter needs to be removed from its polythene bag only for a reading to be taken or for re-charging.

12. The dosimeter is normally carried in one of the outer pockets for convenience.

Operational Use

13. To read the dosimeter, remove it from the polythene bag, hold the clip end to the eye and look towards a source of light. Note the position of the quartz-fibre image in relation to the scale and then return the dosimeter to its polythene bag.

Secondary Use

14. In addition to its primary use for measuring the radiation dose, the dosimeter can also be used as an improvised means of measuring the dose rate, as follows:—

(*a*) Note the reading on the scale and expose the dosimeter to radiation for a measured time, say 10, 12 or 15 minutes, any of which will conveniently divide into 60.

(*b*) Note the reading on the scale at the end of the measured time.

(*c*) Multiply the difference between the two readings by 6, 5 or 4 as appropriate to give an approximate dose rate in roentgens per hour.

Example: If a dosimeter originally reading 12 r. were to read 25 r. after 10 minutes' exposure, the dose-rate would be 13 × 6 = 78 r.p.h.

15. This method does not produce readings as accurate as those given by the fixed survey meter or radiac survey meter No. 2 and should only be used if neither of these is available. Such readings would be for local use only and would not be reported to the operations room unless requested.

MAINTENANCE

Warning

16. Although the case of the dosimeter is reasonably robust, some of the internal parts are more delicate. Accordingly, the instruments should be handled with care; if this is done they should remain serviceable for a considerable period. They should also be kept clean and dry to avoid electrical leakage.

17. No maintenance whatever by R.O.C. personnel is permitted. If it should be suspected that a dosimeter is faulty it is to be returned to the group headquarters for exchange.

Note. The "quartz-fibre image" is known in Standard Operating Procedures as the "hair line".

CHAPTER 41

THE CHARGING UNIT

GENERAL DESCRIPTION

Function

1. The charging unit is a portable hand-operated instrument designed for charging quartz-fibre dosimeters of the type and range described in Chapter 40.

Facilities

2. Two types of charging unit are used in the R.O.C.:—

(*a*) The No. 1, which has a charging control only (*see* Fig. 1): some models are fitted with an extractor for removing the tamper-proof metal end cap fitted to early No. 1 dosimeters. (This type of dosimeter No. 1 is not used in the R.O.C.)

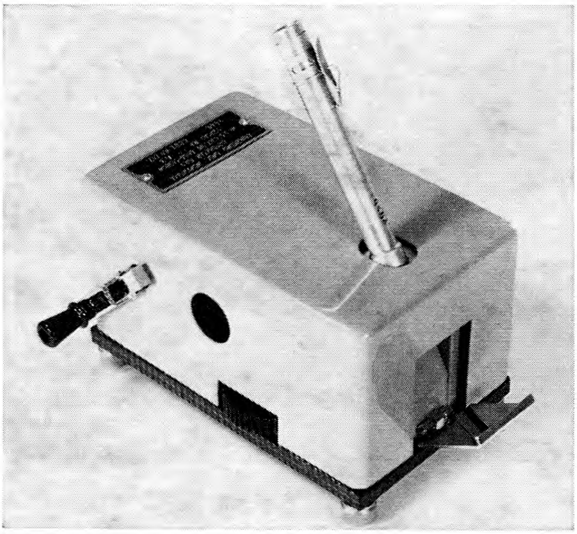


Fig. 1.
Charging Unit No. 1 with dosimeter in position for charging.

(*b*) The No. 2, which has a control with both charging and discharging positions (*see* Fig. 2): the end cap extractor is not fitted.

Construction

3. Each type of charging unit provides a d.c. supply through the medium of a hand-operated generator and a selenium rectifier to charge a series of capacitors. The capacitors can be discharged through a resistor to charge the dosimeter: in the No. 1, this is done by means of a cam-operated change-over switch; in the No. 2, a mechanically-biased switch charges the dosimeter when held in the "charge" position or, when held in the "discharge" position, allows any excess charge to leak away through a resistor.

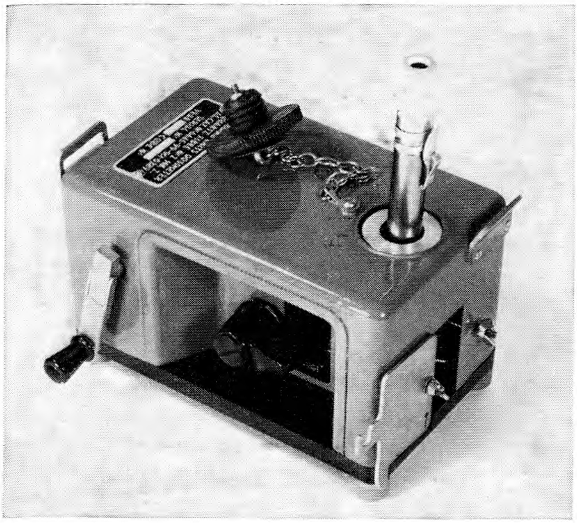


Fig. 2.
Charging Unit No. 2 with dosimeter in position for charging.

4. Both charging units have the components mounted on a laminated wood base and enclosed in a sheet metal casing. The charging socket of the No. 1 holds the dosimeter at an angle of some 40° from the vertical, whereas that of the No. 2 holds it vertically: no provision is made on the No. 1 for covering the charging socket, but the No. 2 has a sliding cover plate or rubber bung. Both types are fitted with a mirror at one end to reflect light through the dosimeter so that the scale can be seen: that on the No. 1 is hinged at the bottom and folds up when not in use; that on the No. 2 is fitted within the casing and is covered by a sliding plate. The generator handle of both types can be folded away when not in use.

Storage

5. For long-term storage the instruments require conditions of controlled temperature and humidity. They are therefore stored at group headquarters ready for immediate distribution in the event of an emergency.

OPERATING INSTRUCTIONS

Preparation (Charging Unit No. 1)

6. Before commencing charging operations:—

(*a*) Check that the charging pin appears central in its socket and is not damaged in any way.

(*b*) Unfold the generator handle until it clicks into position and turn it briskly clockwise for 2 or 3 seconds at a speed of about 5 revolutions per second.

(*c*) Position the charging unit to obtain maximum illumination from the available light source and pull the mirror down ready for use.

Charging (Charging Unit No. 1)

7. To charge a dosimeter:—

(*a*) Remove the rubber end cap from the dosimeter by folding back the skirt and withdrawing it. Place it for safe keeping in the right-hand breast pocket of the uniform until charging is completed.

(*b*) Look through the charging socket and adjust the mirror to give maximum light reflection.

(*c*) Insert the dosimeter carefully into the charging socket and, looking through it, turn it so that the scale is horizontal (*see* Fig. 3).

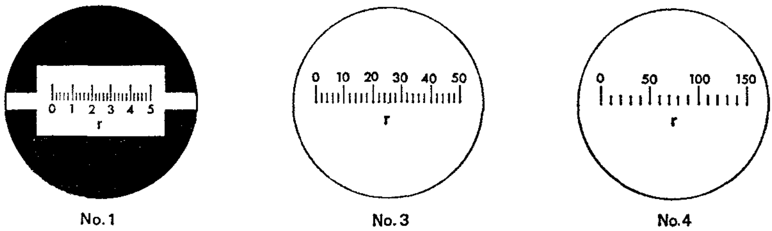


Fig. 3.
Diagram of the scales of dosimeters used by the R.O.C.

(*d*) Depress it with just sufficient pressure to compress the spring of the charging pin and note the position of the fibre image in relation to the scale. If it is discharged it will be on the right-hand side of the scale (*see* Fig. 4d) (it may be right off the scale and in some instances may not be visible).

(*e*) Rotate the charging control slowly until the fibre image returns to the zero position on the scale (*see* Fig. 4a).

(*f*) Still looking through the dosimeter, withdraw it about half an inch to break contact. This may result in a movement of the fibre image to the right of the zero mark (*see* Fig. 4b). This is known as the "charging

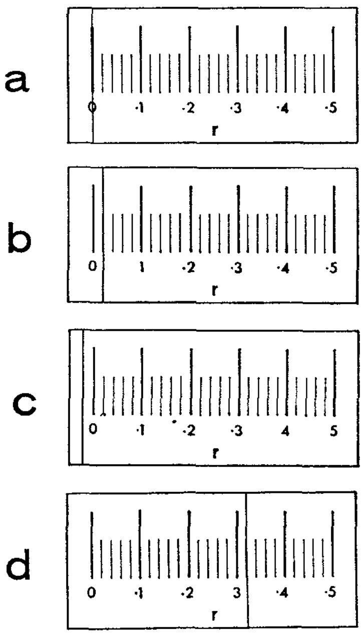


Fig. 4.
Diagram showing positions of the fibre-image during the charging process

kick" and is most noticeable with the No. 1 dosimeter but is less significant with higher range instruments.

(*g*) If a charging kick has taken place, re-engage the dosimeter and rotate the charging control to set the fibre image to the left of the zero mark by the same amount that it kicked to the right (*see* Fig. 4c).

(*h*) Remove the dosimeter, give it a light tap on the palm of the hand and check that the fibre image is at the zero position.

(*j*) Re-insert the rubber bung, but before folding over the skirt, press one side of the bung to release any air pressure, which might otherwise make the dosimeter temporarily over-sensitive to radiation.

8. If the fibre image is set too far to the left, the dosimeter cannot be set to zero unless the charge is reduced. To do this, remove the dosimeter from the charging socket and reduce the charge by touching the centre pin of the charging socket and its casing simultaneously with the finger to cause a short circuit. The charging procedure described in paras. 6 and 7 should then be repeated.

Preparation and Charging (Charging Unit No. 2)

9. When using a charging unit No. 2, the same procedure as for the No. 1 is followed with these exceptions:—

(*a*) When preparing the charging unit, the charging socket is exposed by sliding away the top cover plate or removing the rubber bung. The end cover plate is rotated anti-clockwise to expose the mirror.

(*b*) With the dosimeter in the charging socket and in contact ready for charging, the control is depressed until the fibre image is at the zero position.

10. If the dosimeter has been over-charged, the charge can be reduced by leaving it in contact in the charging socket and lifting the control, causing the fibre image to move to the right and so up to the zero position.

MAINTENANCE

Cleaning

11. The unit must be kept clean and dry. In particular the charging socket must be kept free from dirt and moisture to avoid possible leakage of the charge from the centre to the frame; a soft dry cloth or brush should be used. The mirror also should be kept clean and polished with a soft dry cloth.

Warning

12. No other maintenance by R.O.C. personnel is permitted; in the event of a charging unit becoming unserviceable it is to be returned to the group headquarters for exchange at Home Office stores.

CHAPTER 42

THE CONTAMINATION METER

GENERAL DESCRIPTION

Function

1. The contamination meters No. 1 and No. 1, Mk. 2 (*see* Fig. 1) are portable battery-operated instruments designed to measure and indicate to what degree a person or object has become contaminated by gamma radiation.

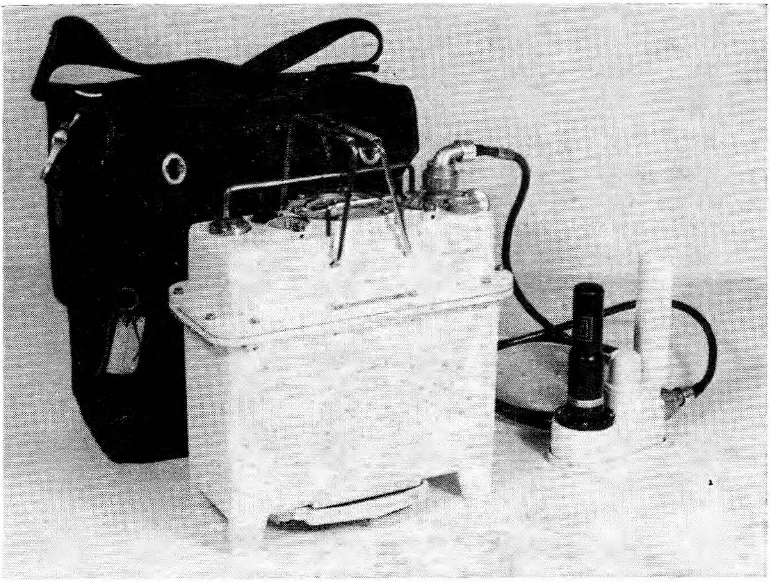


Fig. 1.
Contamination Meter with probe unit connected and haversack.

2. The range covered by the instrument is 0.1 milli-roentgens per hour (mr.p.h.) to 10 mr.p.h.

Facilities

3. The dose-rate is read on the scale of a meter in the indicating unit. This scale is about two inches in length and is roughly logarithmic; it is also divided into three divisions coloured green, amber and red.

4. Provision is made for checking the state of the batteries and, within limits, compensating for the reduction in voltage as they run down.

5. The instrument can also be used with a special sensitive probe for measuring beta contamination of liquids. Provision is also made for headphones to be plugged in to give aural indication of contamination. Neither of these special items is used in the R.O.C.

6. The Mk. 2 version of the instrument differs from its predecessor in having moulded rubber plugs, sockets and connecting cable.

Construction

7. The instrument comprises:—

(*a*) *Indicating Unit.* This has a cast metal case with the controls, meter and folding carrying handles on the top. It is hermetically sealed and contains the majority of the circuit components; it also houses the power unit in a compartment accessible from the underside. It is fitted with a silica-gel desiccator unit with a humidity indicator.

(*b*) *Probe Unit.* The case is of cast metal construction with a carrying handle; on the top of the case is mounted a Geiger-Muller tube and a valve cover. It may be stood on a table or on the floor or suspended from a hook by means of a metal loop on the carrying handle.

(*c*) *Connecting Cable.* This is a six-foot length of cable to link the probe unit to the indicating unit. The original type has metal connectors with threaded locking rings; the Mk. 2 has moulded rubber plugs with locating pips which must be aligned before insertion.

(*d*) *Power Unit.* Three alternative types are available:—

(i) *The vibrator unit* (*see* Fig. 2), which is a hermetically sealed unit fitted with a silica-gel desiccator complete with humidity indicator. A small drawer which fits into a compartment on the front panel accommodates four 1.35-volt Mallory cells: these have an operating life of about 120 hours and a shelf life of some 3 years. This is the unit used in instruments supplied to the R.O.C.

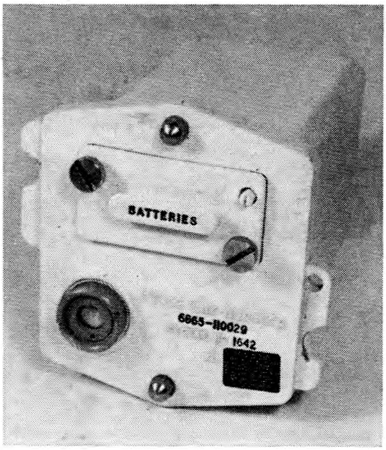


Fig. 2.
Vibrator power unit.

(ii) *The battery holder*, which uses two 150-volt dry batteries.

(iii) *The mains unit*, which operates off a.c. mains of 100–120 volts or 200–250 volts, 40–60 cycles.

(*e*) *Haversack.* This has three compartments: the front one houses the indicating unit; the two at the back house the probe unit and connecting cable. A small screwdriver is also supplied.

8. The equipment weighs about 16 lb. complete with power unit; the haversack measures 10″ long, 11″ high and 7″ wide.

9. There are four controls on the indicating unit (*see* Fig. 3):—

(*a*) *On/Off Switch.* For switching on the power supply to the instrument.

(*b*) *Test Switch.* A spring-loaded switch biased in the "off" position, used for checking the state of the power supply.

(*c*) *Pre-Set Control A.* A sliding cover reveals an eleven-position switch used by suitably qualified personnel for setting the voltage applied to the G.M. tube. *This control is not to be touched by R.O.C. personnel.*

(*d*) *Pre-Set Control B.* A sliding cover reveals a three-position switch used for adjusting the power supply voltage as the batteries run down.

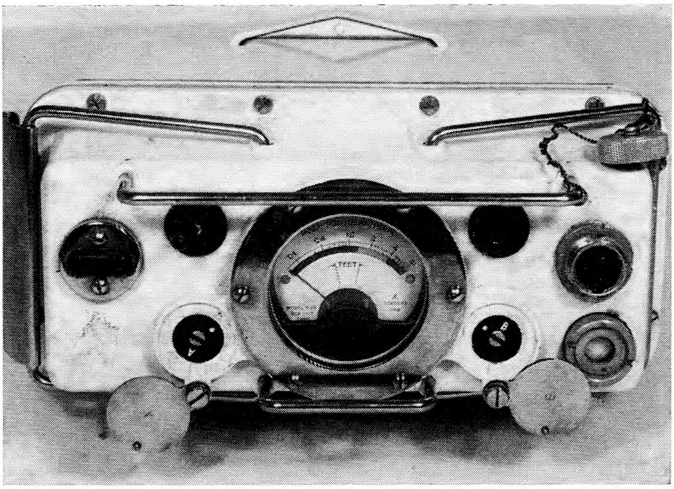


Fig. 3.
Contamination Meter dial and controls.

OPERATING INSTRUCTIONS

Operational Use

10. The instrument is supplied to operations rooms only and its function will be to monitor personnel, clothing, *etc.*, suspected of being contaminated by radioactive matter. Its value may be limited by the effect of other contamination in the vicinity and the masking effect of the background radiation in the heavily contaminated area.

11. It can be used for monitoring personnel in two ways:—

(*a*) As a general monitor to determine whether a person is contaminated by radioactive matter and decontamination is necessary.

(*b*) After decontamination to check whether the action has been effective by "frisking" the individual.

Setting Up the Equipment

12. To set up the equipment:—

(*a*) Remove the indicating unit, probe unit and connecting cable from the haversack.

(*b*) Fit the Mallory cells in the vibrator unit as follows:—

(i) Loosen the two captive screws of the tray marked "Batteries" in the vibrator unit in the underside of the indicating unit.

(ii) Withdraw the tray and remove the plastic retaining plate by unscrewing the central screw (*see* Fig. 4).

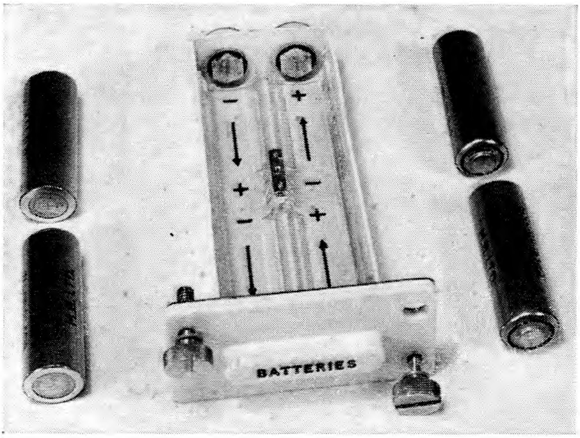


Fig. 4.
Battery tray showing positions for batteries

(iii) Insert the four 1.35-volt cells as marked on the tray; the brass end cap is the '+' terminal.

(iv) Replace the plastic retaining plate and re-insert the central screw.

(v) Replace the tray in the vibrator unit and tighten the fixing screws.

(*c*) Remove the dust cover of the plug on the indicating unit. (This cover must be replaced immediately the plug is disconnected.)

(*d*) Connect the probe unit to the indicating unit using the six-foot connecting cable provided. On instruments having moulded rubber plugs and sockets the rubber pips on each part must be aligned before insertion. On instruments having metal-cased plugs and sockets, push the plugs home and screw home the clamping rings.

(*e*) Replace the indicating unit in the haversack if it is to be operated whilst being carried.

Check Procedures

13. Check the state of the power supply as follows:—

(*a*) Press the test switch to the "on" position and whilst the switch is held over, check that the meter needle comes to rest within the region marked "Test" on the scale.

(*b*) If there is no reading at all, check that the plug and socket connections are firmly made.

(*c*) If the reading is not within the "Test" region, slide the cover from the pre-set control "B" and adjust the control using the screwdriver supplied in the haversack (*see* Fig. 5).

(*d*) If the reading cannot be brought up to the "Test" region, change the Mallory cells in the vibrator unit.

14. To check that the equipment is functioning:—

(*a*) Switch the on/off switch to the "on" position and, with the probe unit well removed from any known radioactive source, slight kicks of the meter pointer should be observed, *i.e.*, background radiation.

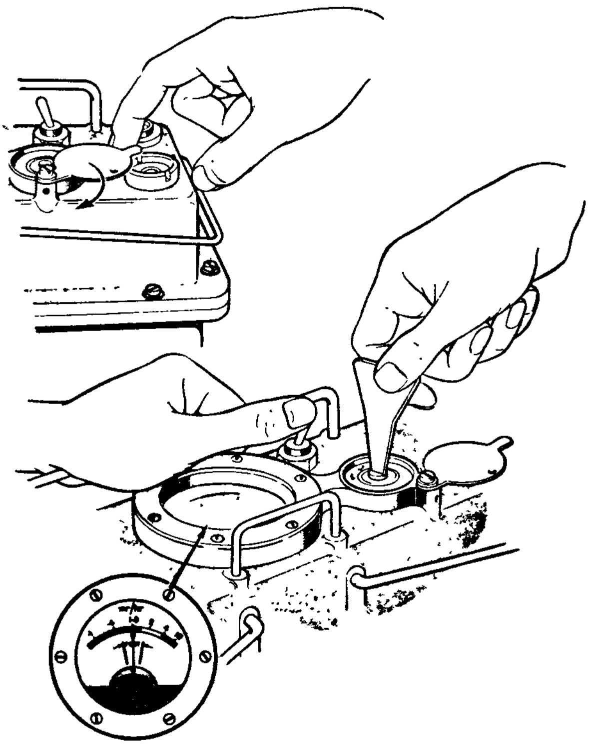


Fig. 5.
Check procedure

(*b*) Using a small radioactive source, *e.g.*, a luminous-faced watch, check that the reading increases as the source is brought nearer to the probe unit.

15. The instrument is now ready for use.

Operation

16. When used as a general monitor the probe unit must be placed in a position where it is adequately shielded from all radioactive sources other than that under investigation. For example, it might be placed on a table about 3′ 0″ from the ground and surrounded on three sides by a wall of sandbags. The indicating unit can be placed conveniently outside. The person under investigation should then stand about 20″ from the probe unit and turn slowly round whilst the dial of the contamination meter is watched. If any significant movement of the meter needle is noticed he should take normal decontamination action. Whilst the investigation is taking place any other suspects must not approach within 6′ 0″ of the person under investigation.

17. When used for frisking after decontamination, the probe unit should be held in one hand close to the person under investigation and moved over the body to check whether or not any areas of contamination still exist. Particular attention should be paid to any skin exposed while out in a contaminated area and to the hair, fingernails, *etc.*

18. Suspect clothing, food, *etc.*, may be monitored or frisked in the same way.

Handling

19. The following precautions must be observed when using the contamination meter:—

(*a*) The G.M. tube is susceptible to damage if mis-handled. As the satisfactory operation of the equipment depends entirely on this component it must be handled carefully.

(*b*) The flexible connecting cable must not be subjected to excessive strain.

(*c*) No part of the instrument, particularly the probe unit, should be allowed to come into direct contact with the subject under investigation as it might itself become contaminated and its readings therefore invalidated.

(*d*) The humidity indicators on the indicating unit and the vibrator unit should be inspected at intervals. They are normally blue: if they should turn pink the unit must be considered unserviceable and returned for exchange.

(*e*) After use always check that the on/off switch is "off".

(*f*) The Mallory cells should be removed to prevent corrosion when the instrument is not in use for long periods, *e.g.*, during storage.

MAINTENANCE

Warning

20. The only maintenance permitted by R.O.C. personnel is changing the Mallory cells in the vibrator unit and changing the vibrator unit itself. All other maintenance must be carried out in properly equipped workshops by suitably qualified personnel.

Changing the Mallory Cells

21. Proceed as in para. 12 (*b*), first removing and disposing of the used cells.

Changing the Vibrator Unit

22. Remove the vibrator unit by rotating the two catches clockwise; the complete unit can then be lifted out of the compartment. Insert the replacement unit into the compartment making sure that the locating pin on the base of the indicating unit enters the locating hole in the flange of the vibrator unit and that the four pins inside the power supply compartment enter the sockets at the rear of the vibrator unit. Rotate the two catches until the unit can be pushed fully home, then again rotate them to hold it in position.

CHAPTER 43

THE HAND-OPERATED SIREN

GENERAL DESCRIPTION

Function

1. The hand-operated siren is a portable instrument designed for giving audible warnings to the public.

Facilities

2. The pitch of the note given out by the siren varies according to the speed of rotation of the handle. A shutter is provided so that the sound can be damped, enabling an intermittent note to be given.

Construction

3. Two types of sirens are available, the Service Electric "Secomak" (*see* Fig. 1) and the Carter (*see* Fig. 2). Both have the same facilities and are similar, but not identical in construction.

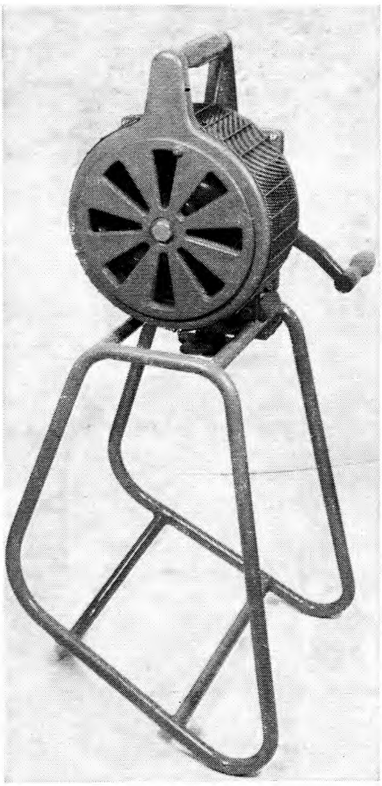


Fig. 1.
Hand-operated siren (Service Electric "Secomak type")

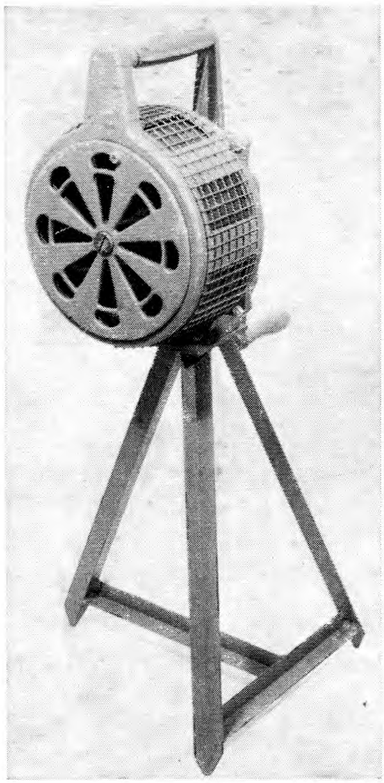
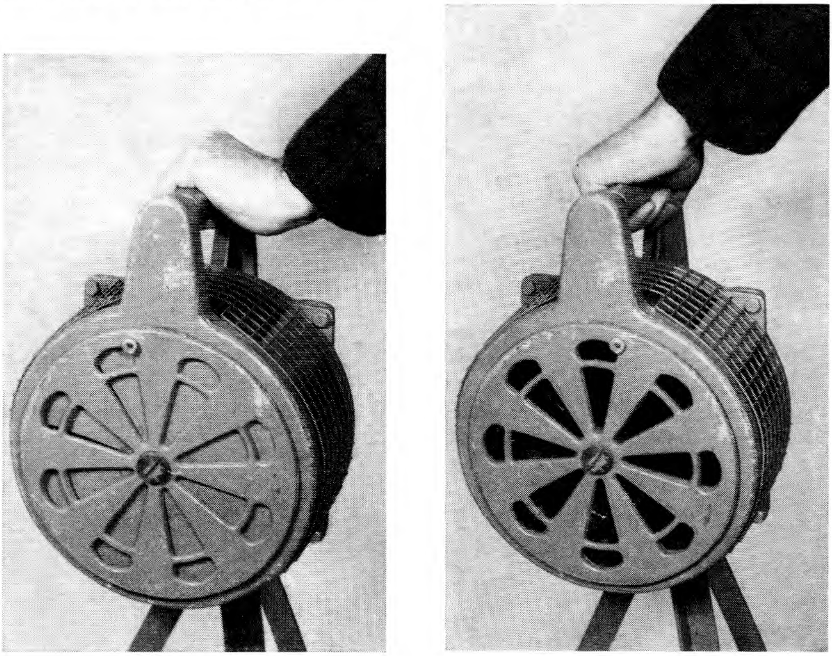


Fig. 2.
Hand-operated siren (Carter type)

4. The siren consists of a cast metal sound box containing the rotor, which is turned through gears by winding a handle. A steadying handle is fitted to the top of the sound box incorporating a twist-grip shutter control; turning this grip opens or closes the damping shutter fitted to the sound box (*see* Fig. 3).



a. Shutter closed b. Shutter open

Fig. 3.
Operation of twist-grip shutter control:

5. The siren is mounted on a metal stand at a height convenient for operation.

Storage

6. The siren is supplied in a wooden crate and is packed for long-term storage in a dry, unheated room; it is therefore normally stored in the underground post. The grease used in the assembly of the siren will not lose its lubrication properties even though left without attention for long periods.

OPERATING INSTRUCTIONS

Preparation

7. In order to prepare the hand-siren for operation some minor assembling is required after the unit has been removed from its crate. The method of uncrating and the amount and nature of the work of assembly will depend on whether the siren was manufactured by Service Electric Co., Ltd., or Carter & Co., (Nelson), Ltd.

8. Identification by make while the siren remains crated is easy. The Service crate has a hinged lid; the Carter crate has not. Normally the

Service crate has a label on the lid bearing the maker's name but this may become dislodged in transit.

The Service Electric Siren ("Secomak")

9. The hinged lid of the crate containing the Service hand-siren is opened by removing the nut and washer by which the lid is secured. The siren, which is stowed upside down, should be lifted out of the crate and prepared for use as follows:—

(*a*) Unscrew the clamp and, supporting the siren from underneath, give the clamp plate a quarter turn so that the siren may be removed from its stowed position within the stand.

(*b*) Mount the siren on top of the stand cross members with the handle side of the siren one inch from the side of the stand marked "Handle This Side". (This gives maximum stability.)

(*c*) Screw up the clamp plate (now positioned underneath the siren) with its groove fitting snugly into the frame cross member.

(*d*) Slide the rubber ring clear of the rotating handle and unscrew the wing bolt holding the handle in its stowed position.

(*e*) Remove the handle from the spindle, then replace it with the wooden part pointing outwards from the unit. (*See Note* below para. 12.)

(*f*) Replace the wing bolt and ensure that it is tightly screwed to hold the handle firmly in position (*see* Fig. 4(a)).

(*g*) Remove the packing material surrounding the voice box and the steadying handle.

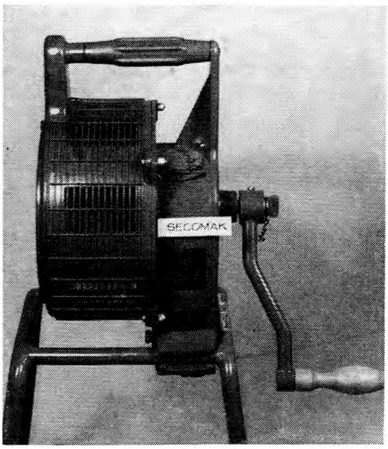


Fig. 4a.
Wing bolt securing handle ("Secomak" type)

10. The siren is now ready for use. Additional steadiness will be obtained during operation if the left foot is placed on the left side of the lower cross member of the stand.

The Carter Siren

11. The wooden crate containing the Carter hand-siren has a solid end and a slatted end. It is the solid end which should be opened by removing the screws holding it in position. The siren can now be lifted out of the

(*a*) The RED warning against air attack, notice of which will have been given through the carrier receiver in the form of an alarm signal (a continuous warbling note). The warning will also be broadcast over the BBC net-work.

(*b*) The WHITE warning ("All Clear") which will have been received verbally through the carrier receiver.

(*c*) The GREY warning, the object of which is to tell the public that there is danger of radioactive fall-out in about an hour. This warning message will also be given verbally over the carrier system.

Methods of Operating the Siren

16. (*a*) *To Sound a RED Warning.*

(i) Ensure that the damping shutter on the voice box is in the "open" position and that it remains open for the duration of the signal. (The open and shut positions of the damping shutter are controlled by a twist of the steadying handle on the top of the siren.)

(ii) With one hand grasping the rotating handle and the other holding the steadying handle, give the rotating handle five revolutions at a very fast speed by continuously increasing the pressure on the handle. (It is difficult to define "very fast", but the object will be to turn the handle for these five revolutions as quickly as possible.)

(iii) After these five revolutions have been given, drop the rate of turning to a slow speed by decreasing the pressure on the handle for the next five revolutions. (The "slow speed" rate of turning need be no greater than the speed at which the handle would rotate by itself from the momentum resulting from the previous five turns.)

(iv) Then give another five turns at high speed, followed by five turns at slow speed, and so on. This sequence should be followed for ONE MINUTE and it is important that this timing is strictly maintained since it is one of the distinguishing features of the signal. It is also most important that there should not be any variation of the five in number revolutions of the rotating handle during which the pressure is successively built up and then reduced. The resultant noise from the siren should be the wailing note with which many persons are familiar.

(*b*) *To Sound a WHITE Warning ("All Clear").*

(i) Ensure that the damping shutter is open and remains open for the duration of the signal.

(ii) With one hand grasping the rotating handle and the other hand holding the steadying handle, rotate the handle at the highest rate it is possible to maintain for the whole of ONE MINUTE during which the speed must remain constant in order to sustain the note at a level pitch. Here again, the duration of the signal is an important distinguishing feature. The resultant noise should be the long steady note with which the public are also familiar.

(*c*) *To Sound a GREY Warning.*

(i) Ensure that the damping shutter is in the open position at the start.

(ii) With one hand grasping the rotating handle and the other hand gripping the steadying handle, turn the rotating handle at the highest speed it is possible to maintain AT CONSTANT SPEED FOR TWO AND A HALF MINUTES.

(iii) Immediately after the first five revolutions of the rotating handle and without losing momentum with the turning arm, close the damping shutter by a twist of the steadying handle and keep it closed for the next five revolutions.

(iv) Immediately after these five revolutions, give another twist of the steadying handle to open the shutter for the next five revolutions. Repeat five revolutions with the shutter closed followed by five revolutions with the shutter open, and so on.

(v) Owing to the increased air resistance when the shutter is open, additional pressure is necessary in order to maintain the same speed of turning. The operator must, therefore, adjust the pressure on the handle as the shutter opens and closes in order to combat any fluctuations of pitch.

(vi) The sequence of five open and five shut must be maintained for two and a half minutes. The length of the warning is an important feature distinguishing it from the traditional alert and all clear signals. In effect, the GREY warning is a prolonged WHITE warning, regularly and significantly interrupted by movement of the damping shutter to mask the sound.

Note. An appreciable physical effort is necessary to provide the full volume of sound from the hand-operated siren, but care should be taken to avoid such violent operation that the siren loses stability. The necessary pressure should be applied to the operating handle as smoothly as possible, particularly when starting or stopping; sudden jerks may, because of the inertia of the moving parts, damage the mechanism.

Repacking of Siren after Use

17. After the siren has been tested or used for training it must be returned to its crate. This will entail reversal of the steps taken to uncrate it and set it up described in paras. 9 and 11, including the re-sealing of the sound box to prevent the entry of harmful particles of grit, *etc.*

MAINTENANCE

18. No maintenance is required but if the siren is unpacked for testing or training, the opportunity should be taken to inspect it carefully for any signs of deterioration. If such signs are noticed they should be reported to group headquarters, who will exchange the instrument if necessary.

CHAPTER 44

THE FALL-OUT WARNING MAROON

GENERAL DESCRIPTION

Function

1. The fall-out warning maroon (*see* Fig. 1) is a pyrotechnic device designed to produce a signal which is distinctive and recognizable within a radius of about 2 miles. The signal is made by a pattern of three explosions which occur at a height of over 300 feet and in a definite relationship to each other.

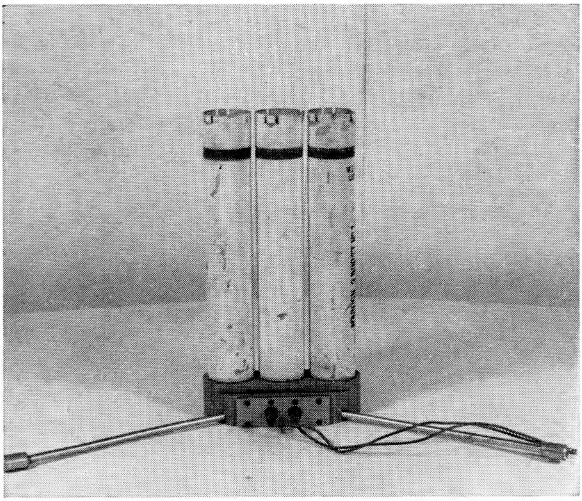


Fig. 1.
The fall-out warning maroon with stabilizing legs and firing lead in position

2. The time pattern of explosions is:—
BANG—2.5 seconds—BANG—0.8 seconds—BANG.

Construction

3. The maroon is constructed mainly of light alloy, inert plastic and synthetic rubber material with suitable protective finishes where necessary. It consists of three identical cartridge units screwed and locked into a common base.

4. Each cartridge unit comprises:—

(*a*) A sound unit containing the pyrotechnic explosive composition and duplicated flight delay which controls the height at which the explosion occurs.

(*b*) A propellant composition to eject the sound unit upwards and ignite the flight delay.

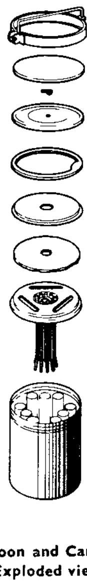
5. The base serves to ballast the maroon and contains the electrically-ignited pattern delay system, also duplicated, which determines the intervals at which the sound units are ejected and therefore the final pattern of explosions. Three stabilizing legs are fitted to the base to ensure that the maroon remains in the correct position when fired.

6. The maroon was designed to be fired from any 6-volt or 12-volt motor vehicle battery or a standard 6-volt lantern battery; the Nife battery in the underground post is therefore ideal.

7. Each maroon is supplied with a 30-foot length of firing lead with suitable terminations, and three stabilizer legs. The base measures 6¾″ by 3½″; the overall height is 13″; the weight is 7½ lb.

Storage

8. Three maroons are packed together in one vacuum canister with six plastic sandbags and closure strips (*see* Fig. 2). The canister, which is robustly made of metal to give good protection to the maroons, measures 11½″ in diameter and 15″ in height; it weighs 34 lb. when filled. The amount of vacuum in the canister can be checked periodically without disturbing the seal.



Maroon and Canister
Exploded view

Fig. 2.
Maroon storage container

9. Each vacuum container is packed in a stout wooden transit crate 14½″ by 16″ by 18½″ high. The total weight of three maroons packed for transit and storage is 52 lb.

10. The package store is intended to have a storage life of at least ten years and can safely be stored in the underground post.

OPERATING INSTRUCTIONS

Preparation

11. (*a*) Take the metal vacuum container out of the crate.

(*b*) Check that the terminals on the Nife battery are clean.

(*c*) Take off the top lid and carrying handle of the vacuum container; pull out the rubber bung in the centre of the lid to release the vacuum, then remove the inner lid.

(*d*) Take the six plastic sandbags and wire closure strips out of the container. Fill the sandbags with earth or sand from the area surrounding the post and close them with the closure strips. Stack them along one wall on the floor of the closet.

(*e*) Take out one of the maroons, three stabilizing legs and one of the firing leads and place them with the sandbags.

(*f*) Select a hard level surface above ground near to the access hatch which is clear of any overhead obstruction such as trees or overhead telephone wires; this will be used as the firing position.

Setting up Ready for Firing

12. (*a*) Stand the maroon upright in the selected firing position.

(*b*) Push the three stabilizing legs into the holes in the base of the maroon and place a filled sandbag over each leg to hold it steady.

(*c*) Insert the two plugs fitted to one end of the firing lead into the sockets in the base of the maroon and drop the other end of the lead down the shaft. Leave the end of the lead coiled at the foot of the shaft; DO NOT take it into the monitoring room at this stage and particularly DO NOT connect either terminal to the battery until the maroon is to be fired (*see* Fig. 3).

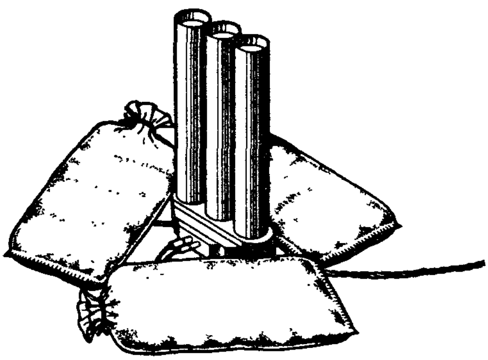


Fig. 3.
Maroon set up for firing

Firing

13. On receipt of the BLACK warning message or, if no warning is received, when the fixed survey meter shows a reading of 0.3 roentgens per hour, fire the maroon by taking the free end of the lead into the monitoring room, fitting the crocodile clip to one terminal on the Nife battery and touching the other pin on the other terminal.

14. Only one signal need be sounded to give the BLACK warning, but if one maroon fails to discharge correctly, another should be set up and fired as above. Three maroons are packed in each container to provide against failure or the need to issue a second warning.

Precautions

15. To avoid risk of an accidental discharge of the maroon it is important that one observer only carries out all the actions required for the setting up and firing of the maroon. At the time of firing all observers must be in the underground post.

16. DO NOT TOUCH any maroon which has failed to discharge. As soon as practicable place a prominent notice beside it reading "DANGER —DO NOT TOUCH—UNEXPLODED MAROON", and inform the appropriate Bomb Disposal Authority or Senior Ammunition Technical Officer, Royal Army Ordnance Corps, whose address may be obtained from the police.

MAINTENANCE

17. No maintenance whatever is required. Whilst in storage, however, the amount of vacuum in the canister will need to be checked periodically Further instructions will be issued as to when and how this is to be done.

AN OUTLINE OF TRIANGULATION PROCEDURE

1965

RESTRICTED

AN OUTLINE OF TRIANGULATION PROCEDURE

Post Procedure and Action by the Main Table Plotter

1. The procedures used at R.O.C. posts and by the main table plotters in operations rooms have been published in ~~Operation Instruction~~ S.O.P. No.6 (Issue 1) and are now well-known. This document now deals only with the work of the triangulation team itself.

Personnel Required

2. The triangulation team consists of a triangulation supervisor, two triangulators, two feeders, two B.P.I. plotters and a message orderly. The latter position is filled by one of the raid orderlies appointed by the floor supervisor he must be appointed before any attack starts.

Equipment

(ALC.I) 3. In standard operations rooms the team works in the ~~downstairs~~ designated alcove. In non-standard buildings this arrangement is reproduced as nearly as possible.

4. The following special equipment is required:-

(a) A perspex-topped table of sufficient size to carry a map of the group and a belt of territory surrounding it. This map, which is normally to a scale of ½" to 1 mile, will be sandwiched between a sheet of plate glass and the perspex working surface. The map is drawn with National Grid and the Georef is drawn onto the plate glass so that, when a switch is thrown, lights within the table are illuminated bringing up the Georef. A hole is drilled in the perspex and a North mark is drawn on the map for each post.

(b) Two triangulation protractors each of the fixed-arm type and with a stud under the centre to fit the holes in the perspex.

(c) A supply of black graphite and red, black and green chinagraph "Stabilo" pencils.

(d) A straight edge 10 inches long marked with a scale of miles.

(e) A circular calculator for converting B.P.I. and/or G.Z.I. information and distances from ground zero into powers and heights of weapons.

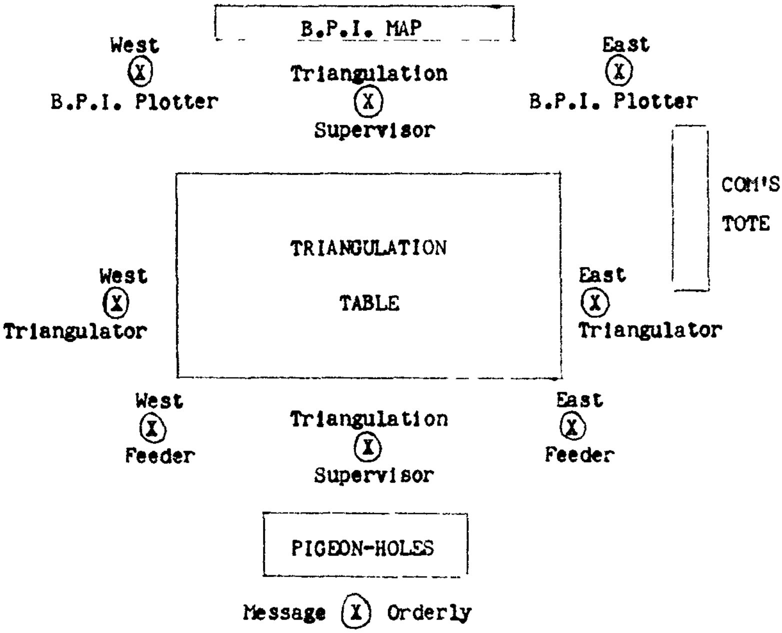
(f) A map of the group to the same scale as that used on the triangulation table to be mounted on the wall and covered by a sheet of perspex (the B.P.I. map). This map need not show so wide a belt of surrounding territory as that mentioned in (a) above.

(g) A set of templates to be used for checking weapon powers on the B.P.I. map.

/Lay-out........

Lay-out of Triangulation Team

5. The normal lay-out will be as shown below:-



Message Orderly

6. The raid orderly appointed by the floor supervisor will take up his position as message orderly by the pigeon-hole rack immediately a "Tocsin" call is heard and will remain in position until informed by the triangulation supervisor that his services are no longer required; he is not to be considered mobile.

7. The message orderly will receive Forms ROC/FO/3 from the floor supervisor or raid orderly, read off the information to the East triangulator and East feeder and pass the Form back to the floor supervisor for transmission to the next user. The Forms ROC/FO/3 are to be actioned at once; they are not to be delayed; they must not be passed to the East feeder or triangulator.

8. He will also receive Forms ROC/FO/7A and ROC/FO/7B and sort them ready for use; any ambiguous, incorrect or incomplete forms should be returned to the floor supervisor for checking.

9. Forms ROC/FO/7A will be sorted into two lots, those in the left-hand half of the group and those in the right-hand half, and handed direct to the B.P.I. plotters.

10. Forms ROC/FO/7B from the main table will be sorted into posts and placed in the appropriate pigeon-holes in the rack. The forms should be placed in the rack with the spot size nearest to the triangulation team and in order of spot size, the largest on the top.

/11........

11. Forms ROC/FO/7B giving information from posts in adjacent groups will be received from the assistant duty controller and placed in the appropriate pigeon-holes in the rack again in order of spot size, the largest on top.

12. Two copies of Forms ROC/FO/8 will be received from the supervisor; both will be handed at once to the floor supervisor or raid orderly for transmission to the dais.

13. Forms ROC/FO/7B giving information from posts in the home group which may be of value to adjacent groups are to be taken from the boxes on top of the rack, clipped into bundles by groups and the bundles marked with the name of the group to which they are to be sent, before handing to the floor supervisor or raid orderly for transmission to the assistant duty controller.

14. When time permits he should keep an eye on the long range board so that he can keep the supervisor informed of the positions and designations of bursts in adjacent groups near to group boundaries. Similarly, if he notices that communication has been lost with an adjacent group, he should inform the supervisor, who will instruct the appropriate triangulator to mark the group as out by drawing a large "X" to cover the lost group.

Phases of Operation

15. In most cases the task can be divided into two phases. Phase I will consist of the arrival and plotting of Forms ROC/FO/3 and ROC/FO/7A and the making of an assessment of the weight and distribution of attack by the supervisor. Phase II will consist of the arrival of Forms ROC/FO/7B, the working out of details of each burst and the checking of these details on the B.P.I. map. In some cases, of course, the two Phases will overlap.

PHASE I

Posts Out of Action

16. The message orderly will read the details off the Form ROC/FO/3; the East feeder will mark them on the table by drawing a "X" with black chinagraph pencil to the left of the post concerned; simultaneously the East triangulator will mark the details on the communications tote, writing the time out of action against the post concerned. The B.P.I. plotters should, if time permits, mark the posts out in a similar manner, but not so as to delay the writing up of pressures; if any posts out of action have to be missed, they can be inserted from the communications tote later.

B.P.I. Reports

17. Each B.P.I. plotter will be responsible for half of the B.P.I. map. The appropriate Forms ROC/FO/7A will be handed direct to the plotters who will write up the details with a black chinagraph pencil in the form of a list under each post position thus:-

• ~~[illegible]~~ 10

02 2 x 4
03 0 x 9
03 0 x 4

18. In each case only the minutes of the time are shown. The decimal point is shown by means of an "X". The writing up of pressure must be completed as quickly as possible; if another batch of Forms ROC/FO/7A is received before the first has been dealt with, the new batch should be put below the first so that they are dealt with in chronological order as far as possible.

Duties of Supervisor

19. As soon as B.P.I. information begins to appear on the map the supervisor will take up a position in front of the B.P.I. plotters, as shown in para. 5. He will watch the display and make an assessment of the number of bursts which have occurred within, or close to, his own group and, if possible, the distribution. This assessment is to be passed (A.L.I.) verbally to the duty controller for ~~transmission to the ROCLO and~~ the information of the group warning team.

20. In the early stages of a heavy attack the supervisor will concentrate on large pressures reported by posts. As a general rule, it can be said that any pressure of 2x0 or more signifies a separate weapon provided that it is separated by 8 inches or more from another. Thus, if large pressures which are separated by this distance are counted, an estimate of the number of bursts can be made.

21. As an attack develops and more pressures are listed, the supervisor will tend to concentrate more on the number of pressures recorded at individual posts. Obviously, if there were 8 pressures recorded at a post, then that post was within range of eight weapons.

22. In some cases it may be practicable to assess the distribution of the attack, i.e., heavier in the North part of the group than in the South.

23. In cases of light attacks the task of the supervisor is obviously much easier and quite accurate assessments can quickly be made.

24. It must be appreciated ~~that~~ that only a rough approximation of the number (A.L.I.) of weapons can be made but ~~[illegible]~~ EVEN this may be of ~~great~~ some value ~~to sector and to Civil Defence~~ in the period before details of each burst can be given, (A.L.I.) particularly when a heavy attack is experienced and details of individual bursts are likely to be delayed for some time.

25. The best method of learning the technique of assessing the weight and distribution of attack is by experience. It is not possible to lay down precise rules for assessment in all the widely different situations which may occur.

/26........

26. In this initial phase, the supervisor can also decide whether it is likely that he can use B.P.I. readings to establish weapon powers or whether he will be forced to use spot sizes. B.P.I. readings must be used whenever possible as they will give much more accurate results than spot sizes which have a tendancy to give under-estimates of weapon power. The decision as to which are used must, however, be related to the number of weapons and their distribution. For example, ten weapons within a group would make the use of B.P.I. readings impracticable. Similarly this might be difficult if there were only three bursts which were close together geographically. If, however, there were three bursts which were widely spaced, B.P.I. readings could easily be used.

PHASE II

Feeders and Triangulators

27. Each feeder will be allocated half of the table and will feed information to his triangulator.

28. The feeder will take Forms ROC/FO/7B from the pigeon-holes two at a time and read the information to the triangulator. When there are a number of forms in each pigeon-hole the feeder will work round his half of the group, taking the top two forms from each post; these will, of course, be the two largest spot sizes in each case. The order in which he deals with the posts is immaterial, but he must deal with all those on his half of the table. If no post has two forms, he should take two from different posts.

29. When the feeder has taken two from each post, he will then go round again taking two more from each post and continue in this manner. He must not start selecting information from particular posts without first asking the supervisor's permission.

30. Normally he will deal with all information from posts in his own group before using information from posts in adjacent groups.

31. The object of this method is to ensure that all the most valuable information (i.e., that with the largest spot sizes) is used first. In addition, it has been found by experience that this sytem, which obtains a "sample" of the bearings available from all posts, brings up ground zeros of bursts more quickly than any other.

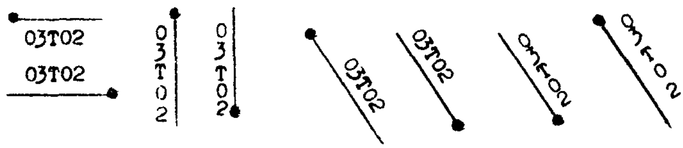
32. The feeder, when he has taken a Form ROC/FO/7B, will first read off to the triangulator the post designation and the bearing; this will enable the latter to position his protractor. This is done by turning the protractor to the approximate bearing and placing the stud in the hole in the perspex over the post concerned. The protractor is then adjusted so that the precise bearing is lined up with the North mark relevant to the post.

33. The feeder will then glance at the spot size and tell the triangulator whether a short or long line is required.

/A short.....

A short line is used for spot sizes of 9 or more and a long line for those of 8 or less. The triangulator will then draw the bearing line with a black graphite pencil; a short line will be 10 miles (¼ of the protractor arm), or a long one 20 miles (½ of the arm).

34. The feeder will then read out the elevation, "Touching" or "Clear" and the spot size, so that the triangulator can write this information against the line. The information can be written in any of the following ways:-



35. In every case the figures must be written close alongside the line, in the correct order and as clearly as possible. They must not be written at right angles to or across the line, thus:-

nor must oblique strokes be used between the figures and letters.

36. The information will be written close to the post and care should be taken that it is clear which details belong to which bearing.

37. As soon as a position is obtained where three bearings intersect at or close to the same point (known as a "triple") the triangulator will mark the intersection with a query in red chinagraph pencil to attract the attention of the supervisor. The supervisor will ring the position and erase the query when he is satisfied that it in fact represents a burst.

38. When the drawing of bearings commences it will obviously be essential that all bearings are drawn. After ground zeros have been established and ringed, however, the drawing of bearings which merely confirm the position of established bursts is unnecessary and confuses the picture. In such cases the supervisor should be consulted before additional bearings are drawn. A bearing a right angles to those already drawn should always be considered of value. Additionally, it is necessary for information which may be of value to an adjacent group to be put aside for transmission thereto.

39. Whenever a bearing is drawn and the triangulator considers that the information can be of no value to another group, he will say "Dead" and the feeder will put the ROC/FO/7B in the tray marked "Dead" at the top of the pigeon-hole rack.

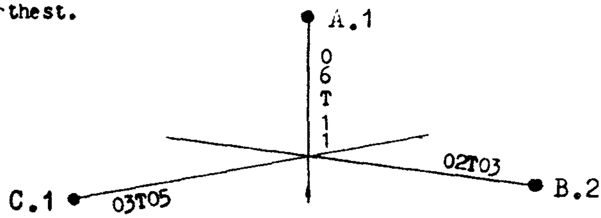
/When........

When a bearing confirms an established ground zero which has been ringed by the supervisor, the bearing will not be drawn (unless it is associated with a spot size larger than any already available or is at right angles to the bearings already drawn) and the triangulator will say "Confirmation of A (or B, etc.)", indicating that the feeder should mark the back of the form with the letter A (or B, etc.) before putting it in the tray marked "Confirmation". This will help any sorting of ROC/FO/7B's which may be required later. When the triangulator considers that the information may be of value to an adjacent group he will say to the feeder "Pass to....... (name of group)" and the feeder will place the form in the appropriate tray on the top of the rack.

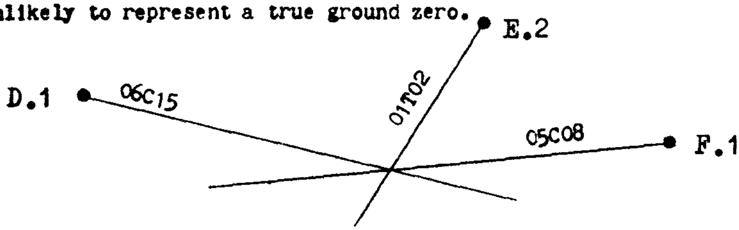
Supervisor

40. As soon as the supervisor has completed his assessment of the weight of attack or as soon as triples are notified to him by the triangulators, he will take up his position on the South side of the table.

41. His first action concerning a triple will be to check the spot sizes to ensure that they correspond. For example, the following is reasonable because the largest spot size is given by the nearest post and the smallest by the furthest.



On the other hand the following indicates a fortuitous triple and is most unlikely to represent a true ground zero.



42. When he is satisfied that a ground zero is a resonable one, he will erase the query and ring the cut neatly with red chinagraph pencil and mark it with a letter, starting with 'A' and continuing through the alphabet omitting 'I' and 'O'. Care must be taken to ensure that no letter is used twice during the same exercise or operation.

43. He will then take a Form ROC/FO/8, delete the bracketed words "Further Details" and "Correction", leaving "Original", and enter the burst designation, Georef and N.G.R.

/The.......

The lights for bringing up the Georef should be kept on for as short a time as possible to avoid confusing the triangulators and feeders.

44. He will then measure the distance from ground zero to the nearest post reporting and obtain the remaining details from the calculator using pressures whenever possible, calling for them as required from the B.P.I. map. If pressures are not available or cannot quickly be linked with particular weapons, spot sizes may be used.

45. The height will be entered as "GB" or "AB" followed in every case by the calculated height in feet.

46. The power will be given as megatons or kilotons, written as "Meg" or "KT" as appropriate.

47. The time should be quoted as accurately as possible, but inaccuracy of a minute or two is not of much significance; when a heavy attack takes place during a short period of, say, 5 to 10 minutes, a standard time may be quoted for all bursts.

48. Finally the words "Further Details Follow" can usually be deleted.

49. The bottom copy of the Form ROC/FO/8 will go to the B.P.I. map and the two top copies will go to the message orderly who will immediately pass them to the floor supervisor for transmission to the dais orderly.

50. In all cases full details of each burst should be obtainable when a triple has been established. If, however, an occasion arises when this is not possible, the spaces for the missing items will be marked "ND" (No Details) and "Further Details Follow" will not be deleted. The further details will be sent later on a separate form ROC/FO/8 giving the burst designation and the additional details only; "Original" and "Amendment" should be deleted from the top of the form and "Further Details Follow" from the bottom.

51. When amendment is necessary, the words "Original" and "Further Details" will be deleted from the top of the form, the burst designation and amended information only will be entered and the words "Further Details Follow" will be deleted when they are inapplicable.

52. All forms will show the time of origin by the supervisor at the top. It is essential that the supervisor completes the form clearly and legibly; serious delay and confusion has been caused by incomplete or illegible forms.

53. The supervisor will, as a normal rule, deal first with all bursts which occur within his own group boundary and will designate them in the normal way using his group ~~number~~ and a suffix letter.
Just three letter.

/54........

54. When he has completed the task within his own group boundary, he will turn his attention to bursts outside his group. He will be informed by the message orderly which of them have already been dealt with and can mark the designation on his own triangulation table.

55. Bursts which do not appear to have been dealt with by adjacent groups are then to be actioned and when the details have been assessed, they are to be entered on a Form ROC/FO/8, all three copies of which are to be passed up to the assistant duty controller. The designation given to the burst is to consist of the [redacted] [first three letters] of the adjacent group and the suffix "Z". This same designation is to be applied even if more than one burst in the adjacent group is triangulated.

56. As an example, the team at No.1 Group, Maidstone, having triangulated bursts ~~01A~~ [MAI-A], ~~01B~~ [MAI-B] and ~~01C~~ [MAI-C] within its own group boundaries, deals with one in Colchester which it calls [redacted] [COL-Z], one in Watford group which it calls [redacted] [WAT-Z], and two in Horsham group both of which it calls [redacted]. [HOR-Z]

57. Once completed in this way all three copies of the ROC/FO/8 are to be passed immediately to the assistant duty controller who is to contact his opposite number at the adjacent group or groups concerned and agree the details of the burst. The burst designation will always be allocated by the group in which the agreed ground zero lies. They will also agree which group will pass the information to sector, adjacent groups, etc. No time must be wasted in arguing over details but clearly the receiving assistant duty controller may need to consult his triangulation supervisor. Once the designation has been agreed the assistant duty controller should enter it in the forms and also note on the forms which group is to be responsible for passing it to sector, etc. If it is his responsibility he should circulate copies 1 and 2 in the normal way and return copy 3 to the triangulation team.

58. If the assistant duty controller in the group originating the "Z" burst is out of communication with his opposite number at the adjacent group concerned, he is to instruct the sector liaison to pass the details of the "Z" burst to sector only at once. The ROC/FO/8 is not to be passed to the inter-group teller, screen teller, or, in fact, to any other customer.

58a. While "Z" bursts reports are being dealt with by the assistant duty controller in accordance with paragraph 57 or 58 above the duty controller is to inform the group warning team of the details so that the team receives the earliest possible information on all likely sources of fall-out.

59. On receipt at sector it is the responsibility of the CSWO to examine all such burst details and arrange through the ROCLO and groups concerned for a proper designation to be allocated. He may designate such a burst by using the appropriate group-[redacted] [designation.] followed by a suffix letter starting

/with

with "Y" and continuing in reverse alphabetical order. When the proper designation has been allocated a nuclear burst message will be originated by sector and passed to the groups and other customers concerned.

60. The calculator is designed with a built-in safety factor so that it should be impossible for any ground-burst to be reported as an air-burst. This results in any low air-burst being reported, almost inevitably, as a ground-burst. This is accepted by the United Kingdom Warning and Monitoring Organization to ensure that no situation occurs where fall-out affects an area which has not been warned. As a result, queries may be received from sector or group warning officers as to whether a particular burst which has been given as a ground-burst might not be an air-burst.

61. When such a situation occurs or when the supervisor is himself suspicious that his original calculation might have been wrong, he should first recalculate the problem using the standard procedures. If his previous answers are confirmed he should then examine the details again and, if he notes that all or most of them are given as "Clear", he should recalculate the problem treating it as an air-burst and using reverse side of the calculator. He should then pass this revised information verbally, not on a Form ROC/FO/8, to the duty controller who should contact the ROCLO and tell him that "the standard procedures confirm the original assessment, but it might be an air-burst and if it were the revised details would be ....". It is then up to the sector scientist to make the final decision. The group warning officers should, of course, be kept informed throughout.

61a. In groups equipped with a bhangmeter the assistant duty controller is to ensure that bhangmeter information is passed to the triangulation supervisor as soon as the sector liaison has completed its transmission to sector. The presence of bhangmeter information is not to affect the normal process of triangulation but after details of all nuclear bursts have been calculated in the usual manner and the forms ROC/FO/8 passed onwards in accordance with paragraph 49 the supervisor is to compare the bhangmeter information with details of bursts of similar time. (In doing this it should be remembered that the bhangmeter range extends well into other groups and the times of bursts in adjacent groups should also be taken into account.) If they do not agree and a query is subsequently raised on the accuracy of the relevant nuclear burst report the bhangmeter information may then be taken into account in any recalculation.

62. The supervisor must have a thorough knowledge of the method of using the calculator. Frequent practice is essential to ensure that calculations are carried out quickly and accurately. The rapid production of ground zeros is pointless if the completion of the other details of the burst is delayed by inept handling of the calculator. Similarly, inadequate knowledge of Georef and National Grid can ruin an otherwise excellent performance.

/B.P.I.

B.P.I. Plotters

63. As soon as the B.P.I. plotters have completed their initial task of writing up all pressures they should check the communications tote to see that all posts out of action have been marked appropriately on their display and then prepare to execute their secondary function of checking weapon powers established on the main triangulation table by means of pressures. They must, however, be ready at any time to call out to the supervisor any pressures he may require to complete his calculations.

64. When the supervisor hands them the No.3 copy of a Form ROC/FO/8, their first action is to mark the GZ on the map using a small nuclear burst symbol with the letter written immediately below the point. Accuracy in transferring the ground zero from the table to the B.P.I. map is essential. The burst letter and calculated weapon power is then entered on the tote.

65. Selecting the line on the compound template appropriate to the weapon power, it is held up to the B.P.I. map with the spot marked G.Z. centred on the ground zero. The plotter will then rotate the template and check the posts which come within range to see whether pressure readings appropriate to the weapon power can be found. If they can they should be marked with the appropriate burst letter. An endeavour should be made to find a suitable pressure at each post within range and each one so found is marked so as to eliminate as many pressures as possible. Merely to find one or two pressures where they should be many is insufficient. Having found sufficient pressures to confirm the power a tick should be made against the burst letter on the tote.

66. If no suitable pressures can be found the B.P.I. plotters should transfer their attention to the next burst in alphabetical order and try to confirm this one.

67. When an attempt has been made on all bursts they should revert to those bursts which they have been unable to confirm and try again on those using smaller or larger powers as they think fit. By this time a considerable number of pressures should have been eliminated, making the task easier. If the plotters can find a line on the template which fits the pressures but increases or decreases the weapon power, their revised figure should be entered in the space provided on the tote and brought to the notice of the supervisor.

Second revision at Headquarters, Royal Observer Corps: August 1965.
ROC/231/5/Air

(A.L.1)

Distribution:-

Area Headquarters	5	Duty Controllers	1 each
ROCLO's/RAFLO's	1 each	Triangulation Supervisors	1 each
Group Headquarters	4		

DM 37459 1/67 XL