ANNEX W

TRIANGULATION

1. Triangulation is based upon the information derived at Post and Control from the BPI and GZI. The information is transmitted from the Posts using the sequences in Annex T2 and is processed in the Control Triangulation alcove to produce the Nuclear Burst details for transmission to all UKWMO formations and customers.

2. BPI

a. Immediately a reading, however small, is shown the No 1 Observer at the Post (and the Triangulation Supervisor at the Control) will control the timing:

(1) WAIT 10 SECONDS then reset BPI to zero.

(2) If the needle moves to a higher reading during the 10 seconds between recording a reading and resetting to zero, start a new 10 second count.

(3) Treat subsequent readings in the same way, so that as many times and pressures as possible are recorded and reported.

b. The No 2 Observer at the Post (or a designated member of the Triangulation Team at the Control) will:

(1) Enter the time of the reading and the pressure in kilopascals (kPa) in the "BPI" section of the Post Log.

(2) All readings, however small, are to be recorded together with the time of the reading.

(3) If the BPI needle moves to a higher reading during the 10 seconds between recording a reading and resetting to zero by No 1 Observer, enter the higher pressure and time in the BPI section of the Post Log.

(4) Treat subsequent readings in the same way so that as many times and pressures as possible are recorded and reported.

(5) The No 2 Observer at the Post is to:

(a) Report all pressures of O2 kPa OR MORE to the Control using the sequence in Annex T2.

(b) Enter the time report made in the BPI section of the Post Log.

c. The Post Display Plotter will record the BPI information on a Form Triangulation and pass it to the Group Information Orderly for filing in the BPI Map "IN" tray.

3. <u>Explosion Heard</u>. When an explosion is heard the No 2 Observer is to advise the Control using the message sequence in Annex T2, with "EXPLOSION HEARD and a TIME" as the text. The Post Display Plotter will complete a Form Triangulation and pass it to the Group Information Orderly for filing in the BPI Map "IN" Tray.

4. GZI

a. When the No 1 Observer at the Post (or the Triangulation Supervisor at the Control) receives the GZI papers:

(1) Write on the back of each sheet the time at which the Observer left the monitoring room to change the cassettes.

(2) Examine the papers for marks caused by Nuclear Bursts.

(3) If there is more than one mark (hereinafter referred to as "spots") decide which is the largest.

(4) Enter the cardinal compass point (N, E, S, W) of the cassettes in column 1 and the time the Observer left the monitoring room to change the cassettes in column 2 of Form GZI.

(5) Estimate the centre of the spot, read off the bearing of the centre in degrees against the graticule as accurately as possible and write the bearing in three figures (eg, 003) in column 3 of Form GZI.

(6) Read off the elevation of the centre of the spot in the same way and write it as two figures (eg, 04) in column 4 of Form GZI. (If the centre of the spot is on or below the 0 degree line, the elevation is to be written as 00).

(7) Decide whether or not the spot touches the Horizon Line, write 'T' (for Touching) or 'C' (for Clear) in column 5 of Form GZI.

 (8) Estimate the width of the spot in degrees by reference to the graticule and write it as two figures (eg, 04) in column 6 of Form GZI.

(9) At the Post pass the Form GZI to No 2 Observer for reporting.

(10) 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 dealt with in descending order of spot size.

(11) Re-load empty cassettes with new papers and place in envelope.

NOTE: The actions in sub-paras a(1) to a(10) above are to be carried out as quickly as possible, commensurate with accuracy.

b. The No 2 Observer at the Post is to:

(1) Report the nuclear burst details to the Control from the Form GZI using the sequence in Annex T2.

(2) Enter the time report made to the Control in column 7 of the Form GZI.

(3) In the Post Log enter in the GZI section the details of columns 2 to 7 of Form GZI.

(4) Return Form GZI to No 1 Observer for filing.

c. The Post Display Plotter will record the information on a Form Triangulation and hand it to the Group Information Orderly for filing in the Triangulation Rack.

5. <u>BPI Map</u>. On the receipt of the Forms Triangulation with BPI or Explosion Heard data from the Group Information Orderly the BPI Plotter is to:

a. Write under the appropriate Post position, in the form of a list, the time in minutes followed by the pressure reading, in BLACK omnicrom for TOCSIN data or 'EH' and the time in minutes in RED omnicrom for Explosion Heard data.

b. Place used forms in the "DEAD" rack.

6. The Nuclear Burst Situation

a. The Triangulation Supervisor is to take up a position from which the BPI Map can be seen as soon as information starts to be plotted, and is to make an assessment of the number and approximate NGR position of nuclear bursts in or near the Group by:

(1) Concentrating upon large pressures, ie any pressure of 14 kPa or more separated by 26 km from another.

(2) Accepting that each pressure recorded at a Post indicates a separate burst.

(3) Balancing the number of pressures at Posts against the distances between larger pressures to estimate the number and general distribution of bursts.

b. The Triangulation Supervisor is to:

(1) Pass the Group Nuclear Burst Situation to the Duty Officer by telephone.

(2) Decide whether to use pressures or spot sizes supported by AWDREY information to establish burst powers, remembering:

(a) Pressures are to be used whenever possible.

(b) Pressures must be related to Ground Zeros (GZs) with absolute certainty.

(c) Single bursts always require the use of pressures.

(d) A few bursts close together require the use of spot sizes.

(e) A few bursts widely spaced may enable the use of pressures.

(f) A large number of bursts will require the use of spot sizes.

(3) Ensure that the assessment of the Group nuclear burst situation does not interfere with the assessment of nuclear burst details.

7. Triangulation Table

a. <u>Triangulation Feeder</u>. On the delivery of Forms GZI with Nuclear Burst data to the "Pigeon Holes" in the Triangulation Rack the Triangulation Feeder is to take the Forms from the Triangulation Rack:

(1) In pairs from each Post (when there is more than one form per Post) from the top of the pile.

(2) In clockwise sequence round the whole of the Group checking every Post before starting another sequence.

(3) Only varying the sequence of selection on the instructions of the Triangulation Supervisor.

(4) Read the information on Form Triangulation to the Triangulator:

(a) Saying the Post number followed by the word POST and the bearing, eg TEN POST ONE SIX ZERO.

(b) Pausing briefly while the Triangulator sets out the protractor.

(c) Saying "short" or "long" according to the spot size, (short for spot size 09 or more, long for spot size of 08 or less).

(d) Pausing briefly while the Triangulator draws the bearing.

(e) Saying the elevation, the words "touching" or "clear" (shown by "T" or "C" on the form) and the spot size, (eg "Zero two, clear, one zero").

(f) Say the time on the form when the third line is drawn to complete the triple.

(5) Once told the Triangulation Feeder is to action used forms by:

(a) Placing them in a tray marked "dead" when told by the Triangulator.

(b) Marking them with a burst serial on the back and placing them in the tray marked "confirmation" when told "Confirmation ... burst" by the Triangulator.

(c) Placing them in the appropriate Group tray when told "to ... Group" by the Triangulator.

b. Triangulator

(1) The Triangulator is to plot the information told by the Triangulation Feeder on the Triangulation Table as follows:

(a) On hearing the post number and bearing by:

(i) Locating the Posts.

(ii) Setting the protractor to the approximate bearing.

(iii) Placing the protractor stud in the hole over the Post position.

(iv) Lining up the protractor on the precise bearing in relation to the north line of the Post.

(v) If the bearing confirms an ESTABLISHED burst, stopping the plotting and saying "Confirmation ... burst", quoting the relevant burst serial. (Should this bearing be associated with a larger spot size than those already drawn, or provide a better "triple", it may be drawn.)

(b) On hearing "short" or "long" by:

(i) Drawing a fifteen kilometres line for "short".

(ii) Drawing a thirty kilometres line for "long".

(c) On hearing the elevation "touching" or "clear" and the spot size by:

(i) Writing the information in that order along the line drawn, as close to the Post as practicable.

(ii) Writing the information in one of the following ways only, so that it is legible and easily read by the Triangulation Supervisor (Fig W.1).



Fig W.1

(2) The Triangulator is to instruct the Feeder to return the forms to the rack after plotting by:

(a) Saying "dead" when he considers the information to be of no value to an adjacent Group.

(b) Saying "to ... Group" when he considers the information to be useful to an adjacent Group.

(c) Saying "Confirmation ... burst" when the bearing confirms an established burst which will be indicated by a red ring and a serial letter.

(3) The Triangulator is to draw the attention of the Triangulation Supervisor to a triple intersection of bearing, either at a point or a "cocked hat" by:

(a) Marking the intersection with a red "query" sign.

(b) Writing the time, as shown on the Form Triangulation, after the other details (para 6 b. (c)) when it is the third line completing a triple.

(c) Continuing to lay bearings to the intersection, particularly those at right angles to any other, in consultation with the Triangulation Supervisor up to the moment that a burst is established.

8. <u>Assessment of Nuclear Burst Details</u>. The Triangulation Supervisor is to start to assess nuclear burst details as soon as he has made an assessment of the burst situation, or as soon as triples are notified to him by the triangulator by:

a. Examining triples to determine that they represent real ground zero's by:

(1) Comparing the three spot sizes to see that they correspond (Fig W.2)

(2) Comparing the three elevations to see that they agree with the proposed bomb type eg Air/Ground Burst, (Fig W.3)



Fig W.2

This is reasonable, as the largest spot size is from the nearest post and the smallest is from the farthest.



Fig W.3

This is unlikely to be a true ground zero, as spot sizes and elevations do not agree.

b. Erasing the query signs, ringing the ground zero in RED, marking it with the next burst serial letter (A to Y, omitting I and O) when satisfied that the ground zero is reasonable.

c. Assessing the NGR and GEOREF, using the Triangulation Table lights for GEOREF as little as possible.

d. Assessing the burst details using:

(1) The calculator - according to the instructions on it.

(2) The distance in km from the nearest Post to ground zero.

(3) The pressure reported from that Post if possible, or the spot size if it is not (calling for the pressure from the BPI plotter).

(4) The elevation reported from that Post.

(5) AWDREY information, when appropriate, to check the assessment made of the power.

e. Liaise with other Triangulation Supervisor's to obtain BPI and GZI details from adjacent Group's Posts only if the details are essential to obtain an assessment of a burst.

f. Refrain from passing BPI and GZI details to adjacent Group unless specifically requested.

9. The Triangulation Supervisor is to action the burst details by:

a. Writing with red board marker, on a nuclear burst slat, entering the information as indicated in Fig W.4.

(1) ORG, AMD or CAN (Original, Amendment or Cancel) as appropriate.

(2) G or A (ground burst or air burst) as appropriate.

(3) The NGR position of ground zero (2 letters, 4 figures).

(4) The GEOREF position of ground zero (2 letters, 4 figures).

(5) The burst designation (consisting of the Group indentification (3 letters) and the burst serial letter (1 letter).

(6) The power calculated: Kilotons in hundreds, Megatons in units, except 1.5; K for Kiloton, M for Megaton. (eg 100K, 500K, 1M 1 x 5M, 2M, 3M).

(7) The height calculated (in 500 Metre intervals. Nil height as 000).

ANNEX W

(8) The Date/Time of burst (the time of the wave of attack or the actual burst time if known. AWDREY information may be used to establish time of burst).



Fig W.4 NUCLEAR BURST SLAT

b. Completing every space on the nuclear burst slat, and hand to the BPI Plotter for further action.

10. The Triangulation Supervisor is to assess all bursts in the Group as quickly as possible, consistent with accuracy. If during this process, information is required from Posts in adjacent Groups the Triangulation Supervisor is to obtain the details from the Triangulation Supervisor of the adjacent Group(s) via the switchboard; this is only to be done when in real need of details.

11. When handed the Nuclear Burst Slat by the Triangulation Supervisor the BPI Plotter is to action the details as follows:

a. Enter the details of the Triangulation Nuclear Burst Tote.

b. At Sector Controls only tell the burst details from the slat to the Display 'A' Plotter using the wall mounted hand telephone. Priority is to be given to the telling by interrupting the Display 'A' Teller without waiting for a pause in the telling sequence, using the sequence in Annex T3.

c. Placing the slat in the next vacant position in the NB Display and calling the attention of the Group Information VDU Operator to it.

d. Plot the position of the Burst on the BPI map using a small nuclear burst symbol (red for GB, green for AB), the point of which is placed at ground zero, and the designation written below using the information on the Triangulation NB Tote.

12. a. When all pressures have been plotted on the BPI map, the BPI Plotter is to check the weapon powers, using pressures. For GB this power is taken from the NB Tote. The Triangulation Supervisor will give the power to be used for AB which is the GB equivalent derived from the Triangulation Calculator.

(1) Working through the bursts in the order in which they appear on the tote.

(2) Selecting the line on the compound template appropriate to the weapon power, holding it against the BPI map with the spot marked "GZ" centred on the ground zero, rotating the template and checking the Posts which come within range to see whether pressure readings appropriate to the weapon can be found.

(3) Marking those that can be related with the appropriate Burst letter, using green chinagraph. (An attempt should be made to find a suitable pressure at each Post within range and each one so found is to be marked to eliminate as many pressures as possible. Merely to find one or two pressures where there should be many is insufficient).

(4) Ticking with green chinagraph the power shown on the Triangulation NB Tote when sufficient pressures have been found to confirm the power of a Burst.

(5) Passing on to the next Burst when the power has been confirmed or when insufficient pressures can be found to confirm the Burst.

(6) When all Bursts have been worked on, reverting to those unconfirmed by using smaller or larger powers. (By this time most pressures should have been eliminated, making the task easier.) If a line on the template can be found which fits the pressures but increases or decreases the power, the revised figure should be entered on the Triangulation Nuclear Burst Tote, using green chinagraph, above the power shown.

(7) Drawing the attention of the Triangulation Supervisor to all confirmations and alterations.

b. The Triangulation Supervisor when he has assessed all bursts within the Group and no other tasks are outstanding, is to:

- (1) Recheck his work, using:
 - (a) Information received from the BPI Plotters.
 - (b) Other GZI information from the "confirmation" tray.

(2) Pass any necessary alterations found to the Duty Officer and request authority to raise an amendment.

(3) Action any authorised amendments by:

(a) Completing another Nuclear Burst slat, indicating that it is an amendment by writing the abbreviation and in the first box. The details which still apply are to be included in addition to that revised.

EXAMPLE:



(b) Passing the slat to the BPI Plotter for normal action.

(4) Action any necessary cancellations by:

(a) Completing another NB slat, indicating that it is a cancellation by writing the word CAN in the first box. Full details of the burst cancelled are to be included on the slat.

EXAMPLE:

AMD AB AG 2627 TQ 6672 MAI A 300K 700 191205

(b) Passing the slat to the BPI Plotter for normal action.

13. Bursts outside the Group Boundary. When the Triangulation Supervisor has completed the task within his group, he is to assess the burst details outside his group, by:

a. Obtaining, via the Group Information Orderly, the ground zeros and designations of bursts plotted on the Display A.

b. Marking the ground zeros of these bursts and their designations on the triangulation table.

c. Assessing the details of those not designated using the normal procedure.

d. Passing the details of the burst (G/A, NRG, GEOREF, POWER, HEIGHT and DATE/TIME only) to the Duty Officer by telephone. These details will be checked with the Sector Control to determine the correct designation.

14. Queries on Bursts. The Triangulation Supervisor is to deal with queries on the validity of ground bursts raised by the Sector Group, the Chief Warning Officer, the Duty Officer or because of his own doubts about his original calculations, by:

a. Recalculating the problem using:

- The standard procedure.
- (2) The original details used.

b. Examining the details again, if the original details are confirmed using:

- (1) The "Touching" or "Clear" information.
- (2) Additional details from other posts.

c. Recalculating as an air burst, if the original details showed a ground burst and all the posts are now shown to have reported "Clear".

d. Passing information so obtained to the Duty Officer by telephone.

e. Issuing an amendment, as in para 12 b (3), only when instructed by the Duty Officer.

15. <u>Difficulties</u>. The Triangulation Supervisor is to confer with the Group Information Supervisor or the Duty Officer in any case of difficulty in the assessment of Burst details.

16. Appendices

Appendix	1	-	Triangulation Rack - Layout.
Appendix	2		Triangulation Post Situation Tote.
Appendix	3	-	Triangulation Nuclear Burst Tote.
Appendix	4	-	Nuclear Burst Display and Nuclear Burst Slot.

17. References

Annex A - Instructions for Speaking/Writing Information.

Annex T2 - Reporting Sequences.

Annex T3 - Sector, Group Control, and NRC Display Telling Sequences.