SECRET **A.D.I.(K) Report No.525/1944**

THE FOLLOWING INFORMATION HAS BEEN OBTAINED FROM P/W AS THE STATEMENTS HAVE NOT AS YET BEEN VERIFIED, NO MENTION OF THEM SHOULD BE MADE IN INTELLIGENCE SUMMARIES OF COMMANDS OR LOWER FORMATIONS, NOR SHOULD THEY BE ACCEPTED UNTIL COMMENTED ON AIR MINISTRY INTELLIGENCE SUMMARIES OR SPECIAL COMMUNICATIONS.

FIGHTER DEFENCE OF GERMANY

CONTROL OF FIGHTERS BY THE "Y" PROCEDURE.

1. The Interrogation of G.A.F. fighter pilots in the past has made it possible to form a picture of German tactics against U.S.A.A.F. bomber formations from the point of view of fighter interception force. Knowledge by P/W of the raid tracking organisation on the ground, however, has up to the present been lacking, and many gaps have remained in the picture, particularly where the Fühlungshalter (shadowing aircraft) and the "Y" controlled fighters are concerned.

2. Two G.A.F. Signals Officers, who had been directly concerned with "Y" control sites - one man was a plotting officer - have now described in some detail the method of ground control at present being used in the operation of fighter interception forces and of the shadowing aircraft; their knowledge was chiefly confined to methods practised in France, but they state that the same principles also apply to operations in Germany.

3. Some of the information is of a semi-technical nature, and the present report is therefore divided into two parts; the first part concerns the operational aspect of fighter control, and the second part deals with the equipment and method of operation of the unit of control - the "Y" site.

I. CONTROL OF FIGHTER INTERCEPTION.

OPERATIONAL CONTROL.

4. In Allied attacks on Germany, the Jagd Division receives and plots all Radar information on the movements of the bomber formations, together with direct reports from the

Fühlungshalter aircraft shadowing those formations and the plotting reports from the fighter "Y" control sites. It is primarily on this information that the Divisional commentary and the control of a whole interception action are based.

5. The sole medium for transmission of the Divisional commentary is the "Y" site; the latter is connected by landline to the Divisional plotting centre so that the plotting of an operation is carried out at both those centres simultaneously.

6. An interception can therefore be directed either from Divisional Headquarters or from the "Y" site, but it is normally the plotting officer at the "Y" site who puts out the R/T commentary.

7. The area of control ("Führungsraum") of a "Y" site is limited by the range of the transmitters used, and according to P/W the average range may be taken as 250 to 300 kilometres; the Division therefore controls an operation over its territory by making use of a chain of "Y" sites.

8. The area of R/T control of a "Y" site may be increased by additional ground relay transmitters, known as "Brummer", so that R/T communications with fighters can be continued outside normal range. These stations and their operation are discussed in Part II of this report.

9. The present P/W stated that the Central Operational Headquarters ("Zentral Gefechtsstand"), situated in the Berlin area, receives simultaneous information from each Divisional plotting centre and makes its own plots on that basis; the fighter commentary on the "Reichsjägerwelle" or such orders as are put out on the broadcaster "Annemarie" emanate from that centre, but according to the present P/W are only utilised by fighter interception forces in case of failure of the Divisional commentary, or the breaking up of an interception formation.

"Y" CONTROL OF FIGHTERS.

General Principls.

10. The principles of "Y" fighter control, whereby the range and bearing of friendly fighter are determined by a "Y" ground station, are already well known.

11. In operations in Germany, the "Y" site, known as a "Stellung", usually consists of five separate stations ("Stationen"), each of which comprises a transmitter hut and mast, and a receiver pylon incorporating a D/F, and range-

measuring unit. All five stations are connected to a plotting room situated on the site.

12. Each station of the site is allotted a separate W/T channel, known as "Linie", consisting of a transmitter and a receiver carrier frequency; thus a number of individual aircraft can be controlled simultaneously within a given area.

13. In order to extend the control of a single aircraft, such as a night-fighter, to that of a number of aircraft, such as a day fighter interception force, it is only necessary to include a "Y" controlled aircraft amongst the fighters of the formation.

14. In this case the receivers of all aircraft in the formation wi11 be tuned to the ground transmitter frequency to receive R/T instructions from the plotting centre as well as from the fighter formation leader.

15. In this manner up to five separate interception formations can be controlled, each on a different frequency form a single "Y" site. If necessary, all five formations can be brought together to intercept a single bomber formation, or alternatively, each of the five formations can be despatched separately to meet the bombers or their fighter cover at various points.

16. The ground transmitter carrier frequencies, known as the "Gemeinschaftswelle", are distributed over the 40.4 to 42.3 mc/s. band at intervals of .05 mc/s. and the ground receiver carrier frequencies, known as the "Messwelle", are distributed over the 38.5 to 40.4 mc/s. band at the same intervals. A list of such frequencies numbered 1 to 40, appeared in a recently captured Signals Order (A.D.I.(K) 4.68/1944, paras.41-42).

17. In operation, the ground transmitter carrier frequency is modulated by a continuous note of 300 or 3,000 cycles; the receiver/transmitter in the "Y" aircraft (known in J.G.3 as the "Lotse" aircraft) receives its modulation and automatically re-transmits it on another frequency in the 38.4 to 40.4 mc/s. band; the aircraft transmitter frequency is normally 1.9 mc/s. lower than the ground transmitter frequency.

18. The re-transmission from the aircraft is picked up at the "Y" station by the D/F receiver, by which the bearing of the aircraft is than determined. The same transmission is also received by the range-measuring unit, and the distance of the aircraft from the station is determined by measuring the phase difference of the modulation received.

19. The height of the aircraft under control is not measured by the "Y" station, but is obtained over the R/T channel from readings taken in the aircraft, thus all the data required for the plotting of a controlled aircraft, viz. bearing, distance and height, are obtained.

20. There are two methods of controlling aircraft formations by means of the "Y" procedure, and these are illustrated diagrammatically in Sketch I.

21. The first method, known as the "Begleiter", has now dropped out of use, but is repeated here as a matter of interest. By this method, the leading aircraft of a formation, known as the "Führer" aircraft, also acted as the "Y" aircraft, whilst the accompanying aircraft of the formation were known as "Begleiter".

22. In the Führer aircraft the receiver was linked with the transmitter and the receiver frequency was tuned to the ground transmitter frequency, whilst the aircraft transmitter was set to the frequency of the ground receiver.

23. In all other aircraft of the formation the receiver was tuned to the transmitter frequency of the leader, and in none of them was the receiver linked to the transmitter. The formation was thus plotted solely by the position of the Führer aircraft.

24. The Begleiter method has, according to P/W, now been replaced by a newer method known as the "Gemeinschaftswelle", in which the receivers of all aircraft of a fighter formation, including that of the leader, are set to the ground transmitter frequency ("Gemeinschaftswelle"). In this method the aircraft is not the leader of the formation but he flies as N°2 to the leader, with one or more similar aircraft as reserves.

25. Upon referring to the Sketch, it will be seen that the formation leader's instructions are not heard directly by the "Y" station; they are picked up by the receiver of the "Y" aircraft (in this case on 41 mc/s.) and automatically re-transmitted (on 39.1 mc/s.) to the ground station.

26. On the other hand, should the pilot of the "Y" aircraft wish to speak to his own formation leader, he must pass his message to the ground station on 39.1, mc/s., and the plotting officer will repeat the message on the Gemeinschaftswelle.

Transmission of Commentary.

27. A plotting officer on the "Y" site, or his counterpart on the extended line to the Divisions, is provided with headphones connected to the receiver of the range-measuring unit, and with a microphone which is connected to the transmitter.

28. By depressing a key he can link the microphone with the ground transmitter and can impose R/T speech on the already modulated carrier frequency which it sends out. It is not necessary to discontinue the modulating note, so that D/F'ing and range measuring can therefore proceed at the same time as the commentary.

29. In practice, the fighter interception force is led by the "Y" control officer as far as within sight of the bomber formation, at which point R/T control ceases to allow the formation leader to direct the combat, and is only taken up after combat when the fighters have re-formed for a second interception, and the "Y" aircraft has made fresh contact with ground control. During this time, however, the ground station continues to plot the formation through the "Y" aircraft.

Fühlungshalter Aircraft.

30. It will be remembered that when a U.S. bomber force is reported to be entering German territory a special shadowing aircraft, the Fühlungshalter, wi11 be sent to meet and follow that force and report its movements and position.

31. The Fühlungshalter aircraft operates under the control of the "Y" plotting officer in the manner described above. In the opening stages of an operation, the Fühlungshalter is directed to the penetrating formation on the basis of Radar plots, and upon making contacts it takes up a position usually above and to the rear of the enemy formation.

32. The Fühlungshalter then reports strength, type of formation, direction, height and fighter cover of the penetrating force. After the initial report, further information is only sent in the event of major changes in the composition or movements of the U.S. formations.

33. As soon as the Fühlungshalter has made contact with the bomber formation, all R/T control by the "Y" site ceases; the Fühlungshalter aircraft communicates directly with Divisional Headquarters through the receiver of the "Y" station and the "Y" control officer stands by and listens to the R/T traffic whilst maintaining a plotting control by the "Y" procedure.

31. According to P/W, the Divisional Plotting Centre at this stage relies on Radar data for following the formations, and

only depends upon the Fühlungshalter aircraft to supply immediate details of such circumstances as withdrawal of fighter cover.

II. "Y" CONTROL SITE, AND IT'S OPERATION.

"Y" CONTROL SITE.

Manning.

35. A "Y" control station requires nine men per shift, or 27/30 men per 24 hour, for its operation and a site consisting of nine stations is normally occupied by a company of 150/160 operators and 50/60 maintenance personnel. The personnel of the "Y" control station is distributed as follows:

Transmitter hut:	One operator.
D/F Cabin:	D/F Operator and log-book keeper.
Range-Measuring Cabin:	A Supervisor, range-measurer and log-book keeper.
Plotting Room:	Plotter (friendly plots), plotter (enemy-plots) and plotting officer.

Communications.

36. Internal: The standard layout of the internal system of commutations in a "Y" site is shown diagramatically in Sketch II. In this Sketch "Station A" shows the general layout applicable to all five stations, while "Station B" shows a diagram of the internal communications which are in reality repeated in all five stations.

37. The internal lines which are shown in the Sketch have the following names and functions:

(a) Plotting line (Werteleitung): A telephone connecting the log-book keeper in the D/F cabin to the range-measuring cabin and "Y" plotting room for transmission of bearing readings. (R in Sketch).

(b) Telephone (Ringleitung): Connects the D/F cabin, the range measuring room and the transmitter hut for the passing of internal instructions. (I in Sketch).

(c) Modulation line (Modulationsleitung): Connects the range-measuring unit to the transmitter for carrying the modulation note. (M in Sketch).

(d) Diode line (Diodenleitung): Connects the rang-measuring room to the transmitter hut; required only when a Siemens range-measuring unit is used. (D in Sketch).

(e) Receiving line (Hörleitung): Open line which connects the receiver and the range-measuring unit to the control desk in the plotting room; a parallel line also runs to the Division. (H in Sketch).

(f) Transmitter Circuit (Besprechungsleitung): Open line which connects the Division and the plotting room to the range-measuring unit. This can be used as a closed line for internal speech or as an open line for transmission of R/T instructions to the aircraft from the Division or the "Y" plotting officer. (B in Sketch).

(g) Keying circuit (Tastleitung): Open line which connects the Division and the "Y" plotting officer to the range-measuring unit and transmitter. Depression of a key at Divisional Headquarters or on the "Y" plotting officer's control desk operates relays to the transmitter and modulation line of the range-measuring unit, allowing R/T instructions from the Division to be transmitted on the carrier wave to the aircraft under control. (K in Sketch).

38. According to P/W, the twenty Channels connecting the five stations of the site to the Division may be carried on two single lines utilising a multi-channel carrier frequency equipment.

39. External W/T Channels: The number of external W/T channels varies, depending on the location of the control site, but usually consists of the following:-

(a) Command network star (Befehlsstern d. Ln. Regt.) for reception of tactical orders and general administrative business from and to the headquarters of the Ln. Regt. to which the company operating the "Y" site belongs - a Saram or FuGe.3 set is used for this traffic.

(b) Divisional signals star (Divisionsbefehlsstern), used for operational orders and transmissions of range values in the event of failure of the ground lines to the Division. This traffic is also usually conducted on Saram or FuGe.3 sets.

(c) Aircraft reporting frequency (Frontflugmeldewelle, or more recently Gerätemeldewelle). On this channel W/T

transmissions are received from all Radar search sites giving briefly the important data relating to aircraft activity taking place within the area of the site. This transmission takes place by day and night and supplements and confirms information on enemy activity received from the Divisional Headquarters; messages are written out and handed to the "Y" plotting officer. A pack type W/T set is used for reception of this traffic.

Brummer Relay Stations.

40. According to P/W, Brummer relay stations are placed throughout German territory and are employed for relaying R/T speech in cases where aircraft have flown beyond the normal R/T range of the "Y" site.

41. The Brummer stations are connected to the Division H.Q. by landline and are controlled by the Division; should a "Y" plotting officer find that an aircraft under his control is nearing the limit of R/T range, he will request the Division H.Q., to connect with a Brummer station in the relevant area.

42. Whilst making this request, the "Y" plotting officer states the frequency on which the "Y" station is operating, and the Brummer will transmit at that frequency. According to P/W, the R/T traffic on Brummer stations is usually confined to directional and homing instructions, although "Y" control can sometimes continue after the limit of R/T range of the "Y" site has been reached.

Plotting Hut and Operational Procedure.

43. The plotting rooms of the five stations belonging to "Y" sites are grouped, in a single hut known as the "Auswertung" (plotting centre). According to P/W there are two types of hut at present in use and a plan view of both these types is shown in Sketch III.

44. The older type of hut contains a separate plotting room and table for each of the five stations, but this type of control contra is said to have offered no satisfactory method of centralised supervision of plots and each plotter had to act on his own responsibility.

45. The improved type of plotting hut has been developed by the Flugmeldedienst (aircraft reporting service) and is believed by P/W now to be widely in use in Germany. In this type of hut a series of six tables is arranged on one side of a rectangular room and each table is fitted with the normal control point and is occupied by an M.C.O. plotter. The chief plotting officer's table and control point are placed behind

the row of tables in such a position that he has a view of all proceedings.

46. The reason, for the six plotting tables is that on some "Y" sites the "Egon" method of fighter control is practised in addition to the normal "Y" control and an extra plotting table is set aside for this purpose.

47. According to P/W the Seeburg table has been withdrawn from the majority of "Y" sites in favour of the present simple method of plotting. In front of each group of three tables is a vertical glass screen marked with the German fighter grid and the main outlines of a 1:300,000 map of the area of control.

48. Behind each screen are four plotters, three of whom receive and plot friendly bearing and range values on the reverse side of the glass screen. Plots are compiled from range and bearing data in the range-measuring room of each station and are passed through to these plotters in terms of the fighter grid; the fourth plotter is responsible for receiving and marking enemy plots.

49. All plots are numbered and in addition the courses drawn on the glass screens during each operation are copied on to a sheet of paper for record and reference purposes.

50. The extremely close and continuous contact with the "Y" controlled aircraft enables the plotting control officer immediately to detect any deviation of the aircraft from the correct course and to rectify the error by ordering a slight correction of course when necessary.

51. The plotting officer bases his instructions to the controlled aircraft on the estimated position of the friendly and enemy aircraft; in doing this an allowance is made for a delay varying from five to ten seconds between the times of the observations of enemy aircraft when originally made and when finally received and plotted. By experience, specific allowances are made for the extent of the delay from the various stations supplying enemy plots.

52. When the fighters are nearing the limit of the range of the "Y" site, the "Y" plotting officer is responsible for handing the aircraft over to the next station; he must advise that station, through Divisional Headquarters of the receiver and transmitter frequencies in use, since the new station may have been operating on other frequency channels. This step is taken sufficiently early to allow the new station taking over control to tune in on the R/T traffic of the controlling station.

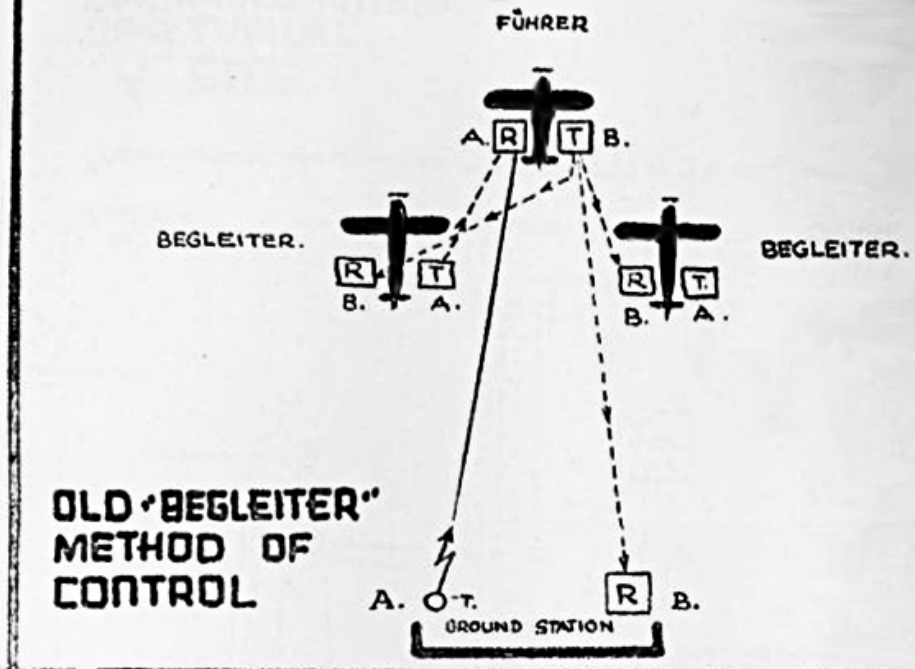
53. The "Y" plotting officer's task ceases for the time being when the control aircraft or accompanying formation is brought in sight of the enemy or, in the case of night-fighters, when the aircraft is sufficiently close to its target to be able to make an attack with the aid of search equipment.

54. Plotting by the "Y" station continues throughout the sortie and combat of a fighter interception force, and does not cease until the aircraft return to base after combat.

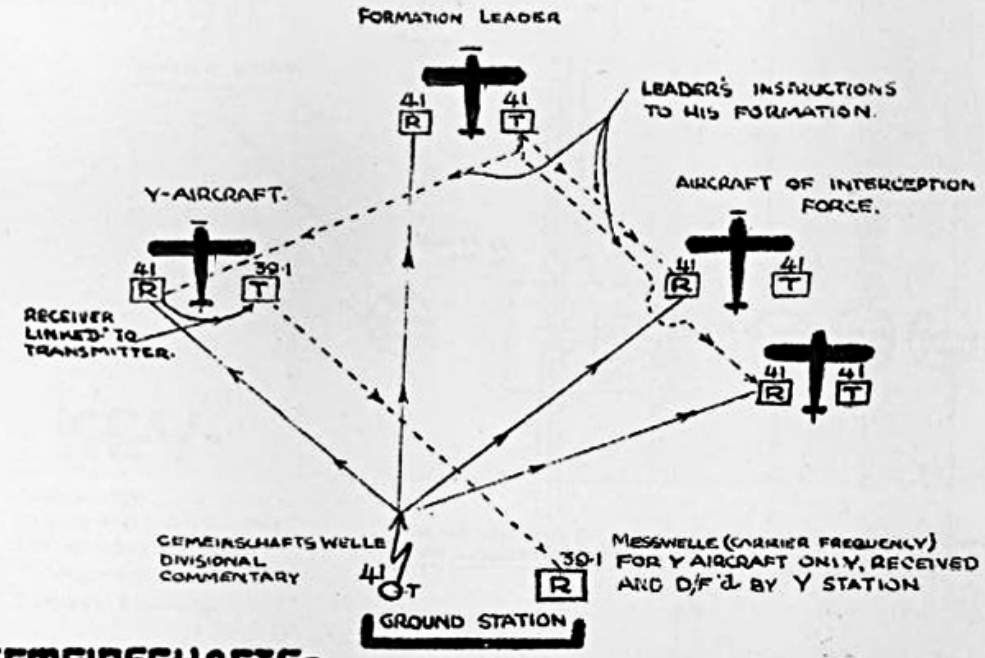
A.D.I.(K)
23 Sept.'44.

S.D. Felkin
Wing Commander

SKETCH I



OLD "BEGLEITER" METHOD OF CONTROL



"GEMEINSCHAFTS--WELLE" METHOD AT PRESENT IN USE.

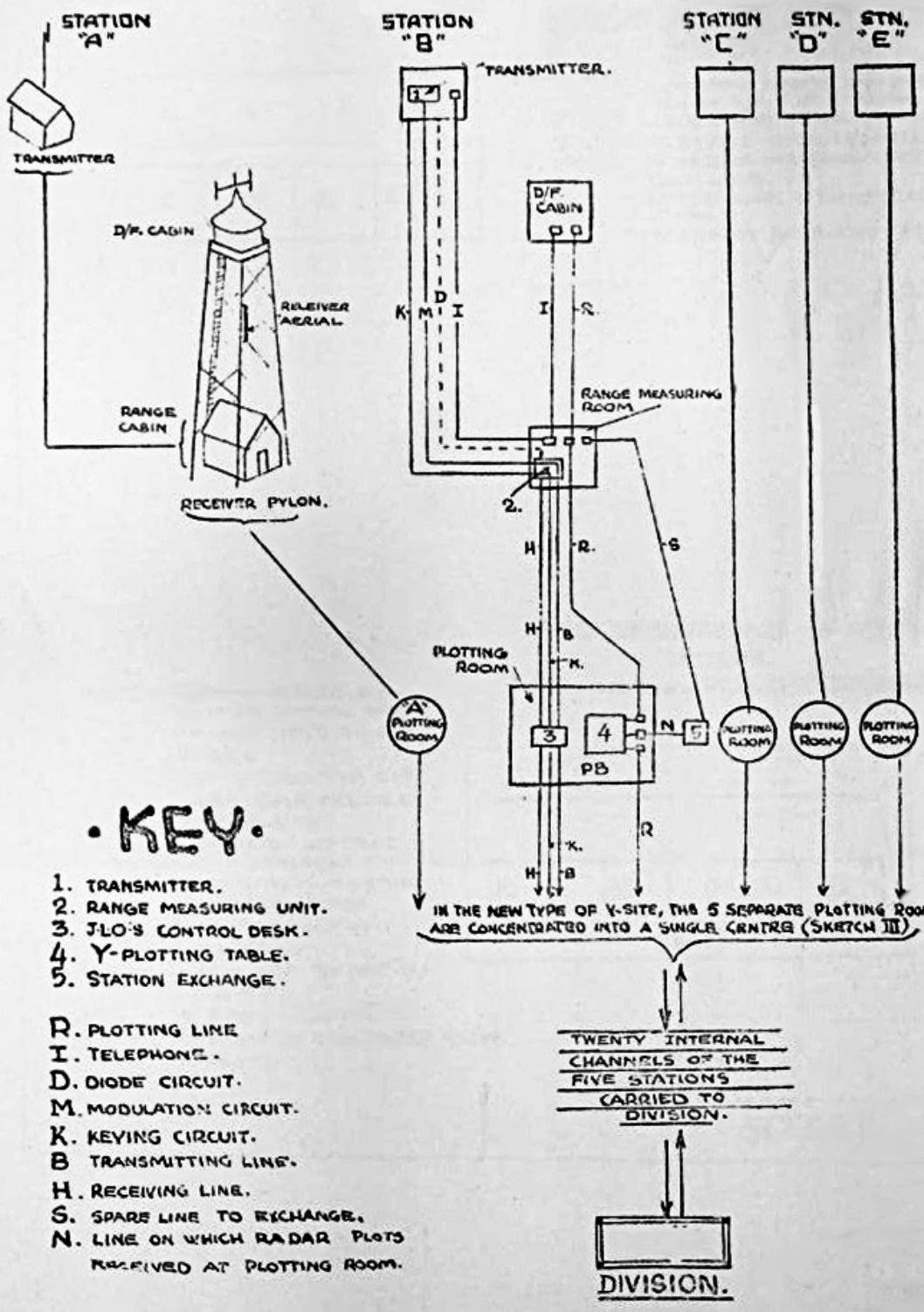
T = TRANSMITTER
R = RECEIVER
FIGURES INDICATE FREQUENCY IN MEGACYCLES

SECRET.

COMMUNICATIONS OF A TYPICAL "Y" SITE.

SKETCH II
SECRET.

STELLUNG



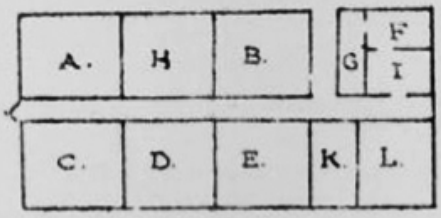
• KEY •

1. TRANSMITTER.
2. RANGE MEASURING UNIT.
3. J.L.O.'S CONTROL DESK.
4. Y-PLOTTING TABLE.
5. STATION EXCHANGE.

R. PLOTTING LINE
I. TELEPHONE.
D. DIODE CIRCUIT.
M. MODULATION CIRCUIT.
K. KEYING CIRCUIT.
B TRANSMITTING LINE.
H. RECEIVING LINE.
S. SPARE LINE TO EXCHANGE.
N. LINE ON WHICH RADAR PLOTS RECEIVED AT PLOTTING ROOM.

SKETCH III

LAY-OUT of a Y-PLOTTING HUT.

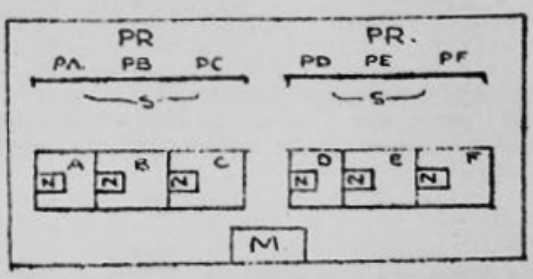


PLAN OF OLD-TYPE Y-PLOTTING ROOM.

A - E. = Y-PLOTTING ROOMS, ONE FOR EACH OF THE FIVE STATIONS.
F = CABLE DISTRIBUTION HEAD.
G = TELEPHONE SWITCHBOARD.
H = RESTROOMS FOR OPERATORS.
I = EXCHANGE.
K = W/T RECEIVING & TRANSMITTING ROOM.
L = RESTROOMS FOR PLOTTERS ETC.

PLAN OF IMPROVED Y-PLOTTING CENTRE
(adapted from FLUGMELDEDIENST)

AB→E = DESKS OCCUPIED BY PLOTTERS ACTING FOR THE 5 STATIONS OF THE Y-SITE
F = EXTRA DESK FOR USE WHEN EGON PROCEDURE IS EMPLOYED
N = PLOTTERS' CONTROL POINTS.
M = SUPERVISING PLOTTING OFFICER'S TABLE
S = VERTICAL GLASS SCREENS
PA→E = PLOTTERS FOR STATIONS AB→E.
PF = EGON PLOTTER
PR = PLOTTERS FOR ENEMY RADAR PLOTS



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