SECRET **A. D. I. (K) Report No. 369/1945**

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RADIO AND RADAR EQUIPMENT IN THE LUFTWAFFE – VI.

Target Homing for Night Fighters.

German early warning Ground Radar.

1. This report is the sixth of the series dealing with radio and radar equipment in the Luftwaffe. As in the case of the previous five reports (A.D.I.(K) 343, 357, 362, 363 and 365/1945),it is based on interrogation of General Nachrichtenführer MARTINI, Director General of Signals, and some members of his staff, and has been supported by a number of relevant documents of recent date which were in the possession of the General's Chief of Staff.

POLICY AND REQUIREMENTS

2. Members of General MARTINI’s staff have often repeated a catch phrase "Aller Funkverkehr ist Landesverrrat" - all radio traffic is treasonable, and the G.A.F. were only too well aware that a transmission of any type could be listened in to by the Allies and then D/F'd. They were, therefore, fully aware of the opportunities of homing on to transmissions from Allied aircraft and so when airborne countermeasures against the Freya ground installations were first taken by the Allies, Köthen developed an apparatus which would enable a German night fighter to home on to the source of the jamming transmission.

3. This equipment was called Freya-Halbe (Halbe = half signifying that it was a radar apparatus equipped with the receiver half only and not the transmitter), and it was tried out at Werneuchen in early 1943. The trials were successfully completed by about June of that year and it was then demonstrated to the authorities for use by the G.A.F. night fighter units.

4. At that time, however, the German night fighter force was commanded by General KAMMHUBER who was the creator of the Kammhuber line and whose night fighter organisation relied essentially on ground-controlled night fighter aircraft operating in comparatively limited boxes. The suggestion of homing on to jammers was turned down by KAMMHUBER out of hand because he was a rabid opponent of any form of freelance night fighting and insisted on strict adherence by his aircraft to the limits of their box.

5. With the discovery of Monica and the development of the Rosendahl and later the Flensburg homers on to Monica, KAMMUBER still maintained his obstinate stand against any departure from the box system of control. It was, therefore, not until General SCHMIDT assumed the control of the night fighting force in November 1943 and proceeded to introduce freelance methods that D/F homers on to transmissions from the bombers could be used operationally.

6. Although the technical experts were satisfied that the homers on to transmissions of metric wavelengths were successful, aircrews seemed to be unable to use them well and results obtained were never wholly satisfactory. Exactly the same applied to Naxos for homing on to H2S is its early days, particularly when a number of minor troubles were still being encountered with its electrical parts and, though it was available in January 1944, for the first three or four months comparatively little use was made of an excellent homing device.

7. By about Easter 1941 the early troubles of Naxos were overcome and crews began to gain confidence in its use; with the success of Naxos reliance on all types of homing apparatus increased. At this stage, however the R.A.F. had almost ceased to use Monica and Naxos remained the only important set of its type.

8. In view of the change of policy governing night fighter operations experimental D/F receivers known as X-Halbe were designed capable of adaptation to any metric wavelength which might be used by the Allies. In addition one of the tactical requirements laid down after 1943 for all future A.I. sets was that provision should be made for the switching off of the transmitter portion so that the receiver could act as a homer on to any airborne jammers employed by the Allies. Naxos and Korfu Z which covered the 1.5 cm. to 20 cm. band already existed.

9. As R/T and W/T Jamming became more intense and even ground control by commentary broke down, increasing use was

made of homing on to the bomber stream by means of receivers of the Naxos type but there remained always the serious disadvantage that these receivers did not supply range. It was claimed that both Naxos and Korfu were so sensitive that the bomber stream could be picked up at a range of 200 km. and that in consequence useless chases often ensued. Estimates of range had to be made by deduction and even in the case of experienced crews the estimate of range by indirect means was not always reliable.

10. Short mention is made below of another form of homing device, the Kiel Z, which attempted to use the infra-red radiations from the exhaust stubs of the bomber. A fuller description of the Kiel Z was given in A.D.I.(K) 390/1945, paras 41 to 48.

FREYA-HALBE.

11. The Freya-Halbe, officially known as the FuGe. 221, was designed early in 1943 to home on to airborne Freya jammers but owing to KAMMHUBER's opposition to freelance night fighting was not adopted. Towards the end of 1943 when free-lance operations were introduced it was proposed to install the twenty-five Freya-Halbe sets which had been manufactured but, when they were indented for, it was found that the makers had used various parts for manufacturing other apparatus and that the sets had been virtually consumed as spares. Freya-Halbe was, therefore, never used on operations.

ROSENDAHL-HALBE.

12. The first Monica set obtained by the Germans was recovered from a British four-engined bomber which was shot down over the town of Rosendahl in Holland and the name of Rosendahl or FuGe. 221.A was then given to the D/F equipment developed for homing on to Monica.

13. According to one of the P/W who had flown the trials with Rosendahl, it was quite successful, and gave good D/F until the night fighter came within 4 km. of its target, after which the D/F became unreliable. For this reason the general introduction of Rosendahl-Halbe was delayed.

14. It was ultimately discovered that the polarisation of the receiver aerials was at 90° to that used by the bombers and it was assumed that this was the cause of the poor D/F. For some technical reason it was not found possible to twist the aerial through 90° in order to obtain the right polarisation and by the time that these difficulties had been overcome the R.A.F. use of Monica had ceased.

15. An interesting experiment was carried out with Rosendahl-Halbe when a set of Rosendahl aerials was mounted round a 150 cm. searchlight. The idea was to align the searchlight beam on to an aircraft transmitting Monica. Considerable difficulty was encountered in getting the searchlight beam and the axis of the receiving lobe to coincide and by the time this had being achieved R.A.F. bombers were no longer using Monica.

16. The Flensburg, officially known as FuGe.227, was another attempt at solving the problem of producing a homer to D/F on to Monica transmission. Difficulty was encountered with D/F properties but the set was satisfactorily selective and could discriminate between a large number of signals by tuning to both the r.f. and p.r.f. It was used to a limited extent in night fighter operations.

17. With the cessation of the use of Monica the original Flensburg became known as Flensburg I and a series of other F1ensburgs, numbered from II to VI, were manufactured to cover the frequencies used by the mandrel screen and other Freya jammers. The frequencies as given in documents were:-

Flensburg I	1.3 m. to 1.75 m. against Monica.
Flensburg II	1.7 m. to 2.6 m. against Freya A and B band and Jagdschloss jammers.
Flensburg III	2.3 m. to 3.8 m.) against SN 2 and Freya
Flensburg IV	3.8 m. to 5.0 m.) C frequency jammers.
Flensburg V	25 cm, band against 25 cm. P.P.I. ground radar jammers.
Flensburg VI	50 cm. band against Würzburg jammers.

18. It was not known to what extent these additional Flensburgs had been used in operations. They were considered to be a successful solution to the homing problem except for the fact that the large aerials, particularly on the Freya frequencies, reduced the speed of the aircraft considerably.

A.G.L.T.

19. The interrogation of British prisoners of war had provided information with regard to Village Inn and some details of it were known. It was thought to operate on a centimetre wavelength and pieces of equipment had been found. Nevertheless, P/W were convinced that though preparations for using it had been made it had not yet been employed operationally.

X-HALBE.

20. This was the designation of the airborne receiver which could be adapted for D/F'ing any new metric radar that was observed by the monitoring service.

NAXOS.

21. The Naxos, known as the FuGe.350, was a detector set which received all transmissions on the 8 to 12 cm, band but could not discriminate between different wavelengths in the band.

22. The problem of producing a homer on to a beamed transmission rotating at 60 r.p.m., as in the case of H2S, was first tackled in March 1943, some two months after the discovery of H2S. Little progress was made until an engineer hit on the idea of getting continuous presentation of the signals received by employing aerials rotating about twenty times faster than those of the transmitter. The G.A.F. signals staff were so impressed with the ease with which it was possible to home on to a slowly rotating beam such as that of the H2S that one of the requirements for the Berlin A was that its rate of rotation in searching should be very high to ensure that the Naxos solution to the homing problem could not be employed against it.

23. The first trials with the Naxos were flown in December 1943 at Werneuchen and the first operational Gruppe to be equipped with the set had it installed in all their aircraft by the 25th January 1944.

24. A whole series of Naxos sub-types were produced and of those the following were mentioned:-

Naxos Z. = (Zielanflug = Target Approach): was the original homing device operating on the 8 to 12 cm. band; it could not differentiate between frequencies in the band so that if there was more than one H2S aircraft in the neighbourhood, a confused picture was obtained.

Naxos ZR. (R Rückwärts = Backward): employed aerials placed both above and below the after part of the fuselage of the Ju.88 and served as a backward warning device for the approach of British night fighters using Mark VIII or Mark XI on the 9 cm. wavelength.

Naxos ZX. (X = X-band = 3 cm. band): was the 3 cm. equivalent of the original Naxos Z. It operated on the 2.5 cm. - 4 cm. band.

Naxos RX. was the 3 cm. equivalent of the Naxos R and was used as a backward warner against 3 cm. A.I.

Naxos ZD. was a combined homer for both the 9 cm. and the 3 cm. bands. The 3 cm. aerial rotated on the same axis but above the 9 cm. aerials.

25. As stated, the value of Naxos was first appreciated by crews in the early summer of 1944 when the increase in British jamming had reached such a pitch that communications with the ground were affected and it was difficult to find the bomber stream. The picture obtained by Naxos, however, was non-selective and it was not always possible to home on to a single aircraft unless the aircraft in question was separated from the others in the stream. On the other hand Naxos made it easy to locate the bomber stream, which at that period was the main preoccupation of the G.A.F.

26. Although estimate of range could be gained if the height at which the bombers were flying was known, since, by climbing and determining at what point the Rotterdam signals were no longer picked up, the night fighter aircraft could judge the distance of the transmitting aircraft. A full description of the method of approach employed appeared in A.D.I.(K) 125/1945. paras. 93-98.

KORFU Z.

27. The original Korfu set, otherwise known as the FuGe.351, was a development of a superhet receiver designed for frequency modulated 9 cm. carrier communications purposes. After the discovery of H2S it was adapted for use by the German "Y" service and towards the end of the war was further modified for use as an airborne set and then became known as the Korfu Z or FuGe.351Z.

28. The aerials employed were of the Naxos type and gave the relative bearing of the transmitter but the advantage of the Korfu Z lay in the fact that it could be sharply tuned and could, therefore, home on to individual aircraft.

29. It was also hoped that with the help of the Korfu Z night fighters would be able to differentiate between H2S and 9 cm. A.I. which the Germans presumed used different sections of the 9.0 to 9.3 cm. band. In this connection, as mentioned in A.D.I.(K) 363/1945, it was hoped in due course to produce the Berlin and other German "9 cm. " radar on the 8.6 to 8.9 cm. band in order to aid German night fighters to differentiate between British and German aircraft.

30. The Korfu Z was to have been ready by mid-summer of 1944 but its advent was delayed by the shortage of magnetrons, all available specimens of which were required for the ground

Korfu used by the "Y" service. So far as was known the Korfu Z was never used operationally.

Kiel Z.

31. The Kiel Z was manufactured by Zeiss and known officially as the FuGe 280. Infra-red radiations from the exhaust stubs of aircraft were picked up in a parabolic mirror and focused on to an Elac lead sulphide cell. The field of view in a cone of ± 10° was scanned. A wider field of view could be obtained by moving the entire scanner by hand in the same manner as employed with the Berlin M.1.A.

32. Shortly before the end of the war a number of Kiel Z sets were tried out in operations but it was found that, although they gave a range of about 4 km. on a four-engined bomber, various difficulties arose. Infra-red radiations from the moon and stars formed "permanent echoes" on the cathode ray tube used as viewing screen, and were not always easily distinguished from a moving aircraft. In addition, if the target aircraft was between the fires caused by the raid and the night fighter aircraft, the target was obviously quite indistinguishable against the background of the fires.

33. Night fighters equipped with the Kiel Z were also to carry the FuGe 218 Neptun R3 backward warning radar so that they at least had warning of British night fighters approaching from the rear.

FALTER

34. Falter was an infra-red telescope of the Bildwandler type used by German night fighters for homing on to British infra-red recognition lamps. Reference to Falter appeared in A.D.I.(K) 365/1945, paras. 72-76. It was not known if it had been used operationally.

A.D.I.(K)and
U.S. Air Interrogation.
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