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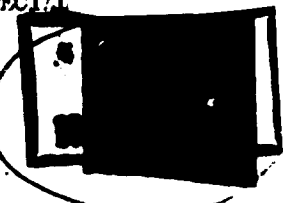
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A. D. I. (K) Report No. 343/1945

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RADIO AND RADAR EQUIPMENT IN THE LUFTWAFFE - I

Blind Landing and Airborne Communications Equipment.

1. General Nachrichtenführer MARTINI, the Director General of G. A. F. Signals, together with some members of his Staff, have recently become available for interrogation in England. A first report, A. D. I. (K) 334/1945, summarised the General's broad views on the development of the radio war, but it is intended to issue further reports which will deal with the more technical aspects of German signals and radar policy as seen by the Signals Staff.

2. A file of documents brought to England by General MARTINI has formed a useful basis for these continued interrogations; this file has already been microfilmed and its contents set out in A. D. I. (K) Documents List 45/9. The present report is based on document 45/9 fff entitled "Funkausrüstung der Flugzeugmuster, Notprogramm" (Signals equipment in aircraft types, emergency programme), and is the first of a series of reports involving an explanation of the contents of the document.

3. The document, which is reproduced in translation in Appendix I to this report, lists such radio and radar equipment as was projected for each type of aircraft under the Führer's emergency programme, and notes such improvements or modifications as were foreseen. The present P/W were able to explain the policy behind the employment of this equipment, which as far as possible is dealt with in the following paragraphs in the order in which it appears in the document.

4. According to P/W the document, which is undated, was prepared early in March 1945 and since that date the emergency programme foreshadowed had undergone few, if any changes; such changes as were known to P/W will be mentioned in the present series of reports.

BLIND LANDING EQUIPMENT.

Policy and Trends.

5. A new system of blind landing was recently coming into favour in the G. A. F. and was eventually to replace the established Lorenz system known to the Germans as L. F. F. system. It was considered that the recent poor quality of training of aircrew - particularly fighter pilots - in blind flying left them incapable of executing the necessary steady turn in cloud demanded by the Lorenz system without considerable danger to themselves and their aircraft.

6. The system in process of introduction was known as the J. L. F. F. (Jagd Landevorfahren = fighter blind landing system) and involved both the marker beacon and beam signals being received on a common frequency of the E Bl 3 instead of, as previously, receiving the beam signal on E Bl 3 and the beacon signal on the E Bl 2 component of the Fu Bl 2.

7. Again, with the new system, the outer and main marker beacons, instead of, as with the Lorenz system, being placed respectively 3 km. and 750 metres from the end of the airfield runway, were to be placed at 20 km. and 3 km. from the runway. The L. F. F. (low power airfield beacon) was also to be placed no less than 40 km. distant from the airfield instead of, as formerly, 15 km.

/8. The object

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8. The object of removing the airfield beacon to a distance of 40 km. was to enable an inexperienced pilot to begin the approach flight above cloud and to make a descent through the cloud on a straight course down the beam. As the E Bl 3 receiver was sufficient for this new system, the E Bl 2 receiver was becoming redundant.

Fu Bl 2.

It will be noticed that the only aircraft shown in the list to be equipped with the Fu Bl 2 is the Ju.88 night fighter. As is well known, the Fu Bl 2 is the blind landing apparatus composed of the E Bl 2 and E Bl 3 receivers, the latter giving 34 channels between 30 and 33.3 mc/s.

10. Actually, the E Bl 3 receiver is installed in a considerable number of aircraft mentioned in the list, but it is in combination with other apparatus; in such cases such apparatus, together with the E Bl 3, is known by the new FuGe. number. Thus, the FuGe.125 (Hermine) is composed of the E Bl 3 plus the Telephonszusatzgerät (R/T attachment), by means of which signals on Fu Bl 2 frequencies can be heard by the pilot or on the intercom. Similarly the FuGe. 120a and k are also composed of the E Bl 3 plus a Bernhardine attachment (see L.D.I. (K) 125/1945).

11. Thus, the sole bomber aircraft in the emergency programme (the 8-234), the night fighter aircraft (8-88, 8-335 and 8-262) and all Schlechtwetterjäger - bad weather fighters (8-109, 8-190, 8-152 and 8-262) and reconnaissance aircraft (8-109, 8-152, 8-262 and 8-234) were actually equipped with the E Bl 3.

AWG.1.

12. A new automatic beam control device for use in blind landing in conjunction with the Fu Bl 2 was still under development early in May. This device, the AWG.1 (Auswerte-gerät 1), was to be connected to the automatic pilot and was to convert the blind landing beam signals received in the E Bl 3 into terms of course correction to keep the aircraft automatically on the beam.

13. The AWG.1 was originally intended for employment in night fighters and bad weather fighters but the signals staff considered that, with the comparatively small number of Lorenz blind landings carried out, it was not economical to waste industrial man-hours in an already hard pressed radio industry, and the AWG.1 was given low priority.

14. According to P/N, a few experimental AWG.1's may possibly have been used in operations. They believed that trials had also been made - at Köthen - with a further improvement whereby the height of the aircraft was also automatically controlled in the approach; none of the present P/N, however, knew the actual method employed, either in this improvement or in the AWG.1 itself.

AIRBORNE COMMUNICATIONS SETS.

Policy.

15. The types of airborne communications apparatus in operational use in the G.L.F. were latterly dictated largely by the capacity of the radio industry, by Allied signals countermeasures and from the beginning of the war had been adversely affected by the lack of co-operation between the office of the General der Nachrichtenführung on the operational side, and the Technisches Amt - latterly the Technische Luftrüstung - on the technical development side.

16. General MARTINI has himself already spoken of the continual difficulties with the Technisches Amt and of MILCH's private war against the signals organisation. The present P/N also emphasised that that lack of co-operation was the chief obstacle to development of operational signals, and they added that the Technisches Amt and latterly T.L.R. was continually developing equipment without reference to operational requirements.

/17. A measure

17. A measure of this confusion was to a great extent due to the fact that the Allied lead in radar development had not been foreseen by the Germans and that their radio industry, always suffering from air attack, was additionally overburdened by the rapid changes in types of equipment forced upon it.

18. The present P/W pointed out that this confusion was largely evident in the development of air communications apparatus.

#### FuGe.10 P.

19. The FuGe.10, the stock communications set for multi-engined aircraft since the beginning of the war, had been developed from a frequency coverage of 300 to 600 kc/s and 3 to 6 mc/s to include alternative H.F. coverage of 5 to 10 mc/s, 6 to 12 mc/s or 12 to 18 mc/s with the addition of an R/T attachment, the TZG 10. A later W/F development was to replace the 300 to 600 kc/s receiver by the KZ6 D/F receiver covering three bands of 150 to 300 kc/s., 300 to 600 kc/s., and 600 to 1200 kc/s.; when this arrangement was fitted to the FuGe.10 the installation was known as the FuGe.10 P.

20. In the emergency programme the FuGe.10 P was planned for use in the Ju.88 night fighter only; it could not be operated in single-seat night fighters. That apparatus was to be retained to allow of a wide choice of frequencies for the night fighter commentary to combat the British jamming of signals channels.

#### The FuGe.16 and its Development.

21. The suggestion that an airborne V.H.F. communications set should be produced was first made by General Major MARTINI in 1935 and led to the production of the FuGe.16. This and the later development, the FuGe.16 Z, gave a frequency coverage of 38.5 to 42.3 mc/s. Three additional sub-types, the ZY, ZE and ZS, were later produced for special functions which, for the purposes of the present account, are repeated below.

22. The ZY had the Y attachment for Benito control; the ZE was a modification which allowed the distance of the aircraft from a Tornado D/F station to be measured, so that a form of Benito control giving but little accuracy in azimuth could be employed. The ZS, whose frequency coverage was 40-45 mc/s, allowed communication with both G.A.F. V.H.F. ground stations and with Army units using the 43-48 mc/s band and was installed in Schlacht (ground attack) aircraft. It replaced the FuGe.17 for Army co-operation work as the latter set only allowed communication with Army units.

#### FuGe.17.

23. The FuGe.17 was originally designed by F.F.O., the G.A.F. radio research station at Oberpfaffenhofen, as an R/T transmitter-receiver for use in Army co-operation. It covered the 42.2 to 47.9 mc/s band and was actually in production before the FuGe.16. As stated above it was later replaced for Army co-operation purposes by the FuGe.16 ZS.

24. The FuGe.17 was also employed by the Controllers of K.G.40 from 1941 onwards in anti-shipping operations in the Atlantic because it was then available in large quantities, whereas fighters were still being equipped with the FuGe.16. It had the advantage that it worked on the same band as the Lorenz 10 UK of the Navy and direct communication could be made with ships.

25. K.G.40 constantly pleaded with the Navy to be allowed to communicate directly with U-boats but never got the Navy's permission because the latter did not like the idea of U-boats being directed to a convoy by aircraft, thus loosening their own tactical control of the U-boats. In December 1941 the Navy had agreed that the experiment should be tried but shortly afterwards the United States came into the war and U-boats then operated off the Atlantic coast of America so that no opportunity arose to try out the possibility of direct communication.

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26. In the Atlantic and in northern waters the FuGe.17 was also used for homing on to Schwann buoys dropped by reconnaissance aircraft for marking the positions of convoys for subsequent air attack; these were later modified so that they also operated on the frequency of FuGe.16.

27. No Benito control was possible with FuGe.17 but a version known as FuGe.1; E emitted a tone and so allowed distance measurements to be made by D/F stations.

FuGe.18.

28. The FuGe.18 never got further than the placing of tactical requirements in 1942. It was hoped by General MARTINI that the industry would be able to produce a set operating over the whole band from 30 - 300 mc/s, thus ensuring a large number of channels. The problem was a difficult one and the set produced was much too large and bulky. As the new R/T set had to be suitable for fitting to a single-engined fighter the plan was finally given up in favour of the FuGe.24.

FuGe.15.

29. For some time it had been the intention of the G.L.F. to improve upon the FuGe.16 which, despite the sharpness of its tuning, and with a coverage of 38.5 to 42.3 mc/s, had too narrow a frequency band for the large numbers of V.H.F. frequencies required in operations.

30. In 1942 an operational requirement was put up to the Technisches Amt for a new V.H.F. transmitter-receiver which would operate over a greater range of frequencies and at the same time would be more simple to use and less bulky than the FuGe.16; the new set was to have 100 two-way channels.

31. Whilst the development of the new set was being dealt with by the Technisches Amt the FuGe.16 made considerable progress, notably in the addition of the "Y" attachment for Benito control. The G.L.F. Signals Staff thereupon informed T.A. that the new set under development should likewise be capable of being employed in Benito control.

32. After a delay of nearly two years T.A. finally brought out the FuGe.15, and the apparatus was demonstrated in the summer of 1944. The Signals Staff found that the demand had been fulfilled for a greater frequency coverage in that the FuGe.15 had a range of 38 to 48 mc/s; the set weighed only 25 kg. as against the 40 kg. of the FuGe.16 ZY but this had been achieved by making a single unit of the receiver and transmitter.

33. The Signals Staff realised to their horror that T.A., in fulfilling the weight requirement, had arranged transmission and reception on one and the same frequency and the set therefore only had 100 one-way instead of two-way channels; this meant that the FuGe.15 was incapable of being used for Benito. (NOTE: A misprint in para.95 of A.D.I.(K) 334/1945 related those facts wrongly to the FuGe.16).

34. General MARTINI alleges that T.A., who were prejudiced against the Benito system and favoured Egon (A.D.I.(K) 160 and 187/1944) had done this deliberately, but at all events, according to his Staff, this shortcoming was regarded as one of the major tragedies of the German Air Force in the whole field of radio, besides being the cause of considerable bad feeling between General MARTINI and General Feldmarschall MILCH - and subsequently T.L.R.

35. That incident is typical of the lack of liaison between the T.A. and the operational side. The situation was not further improved when General MARTINI discovered that orders for the FuGe.15 had been placed with industry without his knowledge and that several important parts were already in production.

/36. Meanwhile,

36. Meanwhile, the high-level row continued between the Signals Staff and T.S., the latter sticking to their contention that Benito control was inefficient, firstly, they maintained, because Allied jamming was disturbing the system, secondly because they still favoured Egon, and thirdly because the production of special apparatus for both Benito and Egon was overloading the radio industry.

37. To the first of these contentions the Signals Staff replied that Egon control was equally susceptible to jamming and that both forms of control were therefore equally essential in order to provide greater scope for the evasion of jamming. According to the present P/I, however, T.S., manned by engineers out of touch with operational realities, was incapable of understanding the practical advantage of maintaining both systems.

38. Ultimately a compromise was reached and it was agreed that 30% of fighters should retain the FuGe.16 and the remaining 70% should carry the FuGe.15. In about September 1944, however, Major ACHSEL (one of the present P/I), the newly appointed officer on the Signals Staff in charge of aircraft safety and navigation, pointed out that the FuGe.15 could not be used for the normal safety Service (Flugsicherung), as the whole of that system was based on the use of two separate frequencies for transmission and reception to allow an aircraft to home on to a beacon.

39. On the strength of Major ACHSEL's contention, the FuGe.15 was finally dropped and such sets as had been manufactured were subsequently used as ground transmitters and renumbered BS.15. At this stage General MARTINI finally secured agreement as to the necessity of retaining Benito control; the FuGe.16 ZY was therefore to be retained for day fighter control and was to be superseded by the new FuGe.24 as soon as the latter had a Benito-control attachment.

#### FuGe.24.

40. The Jägerstab plans provided for the production of the single jet 162 fighter in large quantities; the German radio industry was already overburdened with work and it was therefore considered necessary to have an easily mass-produced V.H.F. apparatus available in sufficient numbers to equip the new aircraft. The operational requirements were for a wider frequency band, simple clickstop operation, transmission and reception on different frequencies and small bulk.

41. The FuGe.24 was the set chosen for this purpose and was in production at the capitulation. With the failure of the FuGe.15, it was decided to extend the use of the FuGe.24 to other types of fighters as soon as a Benito control attachment had been produced. The set would then become the future V.H.F. R/T equipment for all fighters in the G.L.F.

42. The set only required 25% of the man-hours involved in the building of the FuGe.16 and weighed only 15 kg. as against the 40 kg. of the latter. It was simple to operate and could easily be remotely controlled by the pilot in a single seater aircraft. Its frequency coverage was about 35 to 45 mc/s.

43. In April 1945 the FuGe.24 still had three disadvantages:-

- (i) It was not very sensitive in D/F for homing on to beacons.
- (ii) Although the receiver and transmitter were separate, it had for the present no "Y" attachment.
- (iii) The tuning was not very sharp and the width of the tuning largely nullified the original requirement for a wider frequency band R/T set which would give more communication channels.

44. It was intended in the first instance to fit the FuGe.24 to all 162's; that aircraft was to operate against Allied day bombers in large numbers with the aid of a commentary similar to that in use in night fighting, and was later to be assisted by a new navigation commentary system to be described in a later report and known as Rübzahl. It was also considered that as the 162 was a fair weather aircraft, Benito control, and therefore a "Y" attachment to its R/T set, would not be needed.

/s/ . . . . .

45. As it was apparent that with the introduction of the FuGe.24 aircraft would be operational with both the FuGe.16 and FuGe.24, a new problem was set for the Safety Service if they were to relieve the congestion on the FuGe.16 band. The ground guard frequency had to be between 38 and 42 mc/s so that emergency calls from aircraft using both FuGe.24 and FuGe.16 could be heard while listening on one frequency.

46. As a temporary solution, and until the FuGe.24 should be universally in use, the frequency for the ground station transmitters was to be duplicated, and all ground safety stations and their V.H.F. beacons were to broadcast on two separate frequencies, one in the 38.5 to 42.3 mc/s band and one outside it for aircraft carrying FuGe.24.

FuGe.29.

47. The FuGe.29 is a long-wave receiver with an approximate waveband of 200 to 2,000 metres; it could thus cover the ordinary broadcasting stations and was intended as a means of receiving fighter commentary on several additional and as yet unjammed frequencies.

48. For more than a year the night fighter commentaries had been seriously jammed, and it was hoped that installation of the FuGe.29 in night fighters would considerably relieve the situation. The jamming menace was recently also spreading to day fighter operations and for that reason the same set was to be built into all day fighters. Thus, as shown in the emergency programme, all fighters were eventually to carry two sets - the FuGe.16 or 24 transmitter-receiver and the FuGe.29 receiver.

49. It will be remembered that the idea of a broadcast receiver for commentaries had already been tried out in the single-engine Wilde Sau night fighters in the spring and summer of 1944, when aircraft carried a small commercial-type Radiome receiver for reception of night fighter commentaries in the M/P band; since mid-1944, however, nothing further was heard of these sets, but the FuGe.29 seems to have been a perpetuation of that original plan.

A.D.I. (K) and  
U.S. Air Interrogation.  
1st July 1945.

*March*  
S.D. Felkin, S/L  
Group Captain.

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This refers to our letter to you dated October 7, 1999, regarding your appeal to the Information Security Oversight Office for 14 documents previously requested under Mandatory Declassification Review procedures. One document (AD346727) was provided to you by our letter dated November 19, 1999.

The review of 11 British documents you requested is complete and there are no objections to release. Titles of these documents are contained on the enclosed sheet and a copy of each is enclosed. We will advise you as soon as the reviews of the remaining two documents are completed.

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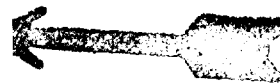
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H. J. McIntyre  
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