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INTERROGATION OF PROF. SCHERZER OF THE BHF

COMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE

LONDON - H.M. STATIONERY OFFICE

INTERROGATION OF PROF. SCHERZER OF THE BHF (MUNICH, MAY 14TH, 1945.)

Reported by:

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CIOS TARGET NO. 1/718
RADAR

COMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE
G-2 Division, SHAEF (Rear) APO 413

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INTERROGATION OF PROF. DR. HANS SCHERZER OF BHF
14th May, 1945.

1. Dr. Scherzer was scientific controller (Wissenschaftlicher Fuhrung) of the Bevollmachtigter fur Hochfrequenzforschung (BHF). It was understood that he had worked in peace time upon the electron microscope and earlier in the war with the German Navy of which he was a reserve officer. Dr. Scherzer showed complete willingness to give information and had indicated where he had buried a large proportion of his papers. These had been uncovered and he sorted them into classifications to facilitate examination. The interrogation was conducted with reference to particular subjects by:

Lt. Col. R.G. Friend	M. of S.
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2. Radar Camouflage by non reflecting materials

2.1. Work on camouflaging against radar was begun in 1939 but great interest had been shown in the last two years as an outcome of the submarine losses attributable to radar detection. Consideration had also been given to camouflaging aircraft but priority was given to the submarine problem.

2.2. The problem could be approached either for narrow band or broad band use. In the first case the principle was to obtain reflections from two layers a half wavelength apart to produce cancellation. Such a method could give a marked reduction over narrow wave bands. In the second case an absorbing layer (iron particles in a plastic binder), which matched the impedance of air, was used. This could be effective from 3 to 20 cms but in general only reduced the reflection to 30% of its normal value. It was stated that the layer of water on the material, in the case of a surfaced submarine is too thin to reduce the efficiency of the camouflage appreciably.

/2.3.

2.3. Profs. Klemm and Kaufmann had worked in Prague on camouflage paints but so far had not been successful. Dr. Scherzer did not seem very optimistic with regard to this.

2.4. A Prof. Kreuger, believed to have been killed recently, had worked on camouflaging aircraft - on the principle of constructing them of transparent materials (for which $\varepsilon = \mu$) - and surrounding the engines and crew by absorbent materials. Development of the transparent materials was at an early stage.

3. Aerials:

The main problems being investigated were those of beam swinging. Methods being studied were frequency and phase shifting and also, for centimetric waves by means of dielectric materials similar to the transparent materials referred to in para. 2.4 but in which ε or μ could be controlled by an external electric or magnetic field.

4. Centimetric valve development:

4.1. Work had been proceeding in Germany between 1939 and 1941 on centimetric radar and communications but at the latter date confidence in a successful conclusion (for Germany) of the war had lead to closing down all projects which could not be completed in a year. It was not until the Germans discovered we were using 10 cms in 1943, to be followed shortly by our use of 3 cms and reports of 1.5 cms, as well as Russian use of 10 cms (presumably Lease-Lend equipment, but not stated) that a change in policy was made. It was at this date that high frequency research was reorganised by the formation of BHF and a number of new institutes. Apparently, having failed to take the advice of its scientists earlier the Reich was adopting panic measures.

4.2. Development of high power pulsed magnetrons has been active and tubes up to 1 megawatt have been produced in the laboratory. This work was being done mainly at the Telefunken laboratories by Dr. Steimel who was believed to have been captured by the Russians (note that Dr. Scherzer regarded Germans who had crossed from Russian into English or American territory as having escaped!)

/4.3.

4.3. Laboratory magnetrons have been developed tunable from 2 to 11 cms. and capable of producing from 50 milliwatts at the extremes to a few watts at the optimum wave-length. There is also a 10 watt c.w. magnetron alleged to be tunable from 2 to 14 cms. These have been developed by Dr. Huschka in Munich. It was intended to develop higher power tunable magnetrons of 8-9 cms. for R.C.M. purposes. It was believed to be possible to produce 5 kw peak power at 1.6 cms. and a magnetron had been designed on paper for this rating.

4.4. A series of valves similar to "light house" tubes and known as "Scheibenröhren" had been developed for operation as part of resonant cavities. These were for operation on 9 cm waves and longer. They were used as transmitting and local oscillator tubes. These valves take numbers in the LD series.

5.1. Propagation

Propagation had been investigated for waves longer than 3 cm. but between this and infra red was an untested gap. Prof. Hetna, of Jena, had made a theoretical study of this gap based upon the experimental results on each side. While he predicted scattering by rain, no other phenomena seem to have been suspected.

5.2. Observation of echoes from ionised gases have been made at 50 and 80 cms. mainly in connection with observation of rockets and jet-planes during development of the latter. Apparently V2 was observed during trials by radar but errors due to the rocket "tail" had been suspected.

5.3. Although submarines fitted with radar camouflage were tested by observation with typical service radars, no observation had been made of reflection from the submarine exhaust gases.

5.4. It was known that shell bursts could be observed by radar and claims had been made by service units that they could correct fire by observations of bursts. However no official approval had ever been given to such corrections of fire. While a few experiments may have been made by firing specially filled shells Dr. Scherzer knew of no window filled or other regularly used shells which would explain the reported "swarm of bees". Nevertheless they were aware that the British Navy used special fillings for radar ranging.

/6.

6. Receivers:

Centimetric receivers had suffered from the use of magnetron local oscillators and inferior crystals. Measurement techniques seemed to be crude as far as could be judged from discussion on test of receiver noise and crystal performance. Dr. Scherzer was somewhat cynical over the use of magnetron local oscillators because "Telefunken said so". For his part he thought that we used Klystrons for a good reason and stated that frequency jumping with the magnetron was a source of trouble. Dr. Scherzer made frequent complaints of the way in which their technical policy had been dictated by either the manufacturers or general staff, usually incorrectly.

7. Night Fighter Radar:

7.1. Dr. Scherzer said he had advocated the development of radar equipped night fighters in 1939, but as the Reich had been convinced that peace would come with the conquest of Poland he had not been allowed to proceed. Despite the continuance of the war, developments did not commence until "after the failure to invade England" and even when the development was completed it was not put into production until two years later when the bombing of Germany became severe. At this time the General Staff asked for a centimetric equipment, but their limited experience and no developed design forced them to go into production on the longer wave equipment.

8. Radio Counter Measures:

8.1. Germany had started work on "window" jamming in 1940 but after a short interval all work and even discussion of it was forbidden lest we should obtain knowledge of it and use it against Germany! The suggestion had even been made that the stripes of "Düppel" should have propaganda printed upon them to disguise their real purpose, but no risks were taken.

8.2. Dipoles had been flown by German Submarines as decoys. Dipoles on free balloons had been used for testing radars but not as a counter measure. None of our dipoles had ever been found, so apparently our precautions were effective.

/8.3.

8.3. The Germans found they could locate airborne jammers readily when not used in large numbers and accordingly had not developed them for their own use as they felt that with their limited number of bombers against our predominance of night fighters they had more to lose than gain by it. Scherzer recalled how in one case in the Mediterranean they had flown a convoy patrol plane fitted with a jammer to protect itself from detection by night fighters but, as they realised later, it had in fact all the time been disclosing the convoy position.

8.4. The principal A.J. measures in use were Wurzlaus and Windlaus. K-laus which filters out unwanted frequencies from the Doppler, and a supersonic delay line scheme, were in development.

8.5. Experience had shown that while "window" had seriously hampered their use of radar which was only partially overcome by various A.J. measures, the use of noise jamming had been so effective as to make the "window" unnecessary.

9. Fire Control Radar:

9.1. An improvement envisaged in fire control radar was the direct derivation of radial velocity from the Doppler frequency for setting into the Kommando Gerat. This work was being done at the Ernst Lecher Institute (it appeared on subsequent investigation at this place that the application was for coast artillery purposes and not Flak).

9.2. In general it appeared that the Germans were satisfied with their fire control radar for flak. Scherzer stated that as the course fluctuations of the aircraft were greater than those of the radar(!) there was no point in improving the radar. Jamming had however reduced the accuracy seriously as the K.G.40 could not handle erratic data. He believed that in some instances older models of K.G. had been used in preference to K.G.40 when jamming was experienced. He was not however familiar with the K.G. side of the problem and referred to Dr. Kulenkampf. It had been proposed to make F.M.G.S. automatic in operation but he doubted the ability of such equipment to operate at all in conditions of jamming, nor did he expect any improvement in following accuracy without jamming. The General Staff were suspicious of complication and did not seem to want to reduce the number of operators. The operator was also

/regarded

regarded as an intelligent filter who could improve the data observed. Scherzer knew of no trials upon this nor of any devices such as aided lay to improve the following.

9.3. A centimeter flak radar had been developed known as Egerland. This was a 9 cm. set using mirrors, 2 to 3 metres in diameter. It comprised two units, one which scanned continuously to furnish a "panorama" (P.P.I.) while the other was the fire control element. Scherzer thought the name of one part of the system was Rotterbach but was not clear on this. The equipment was designed for installation underground while the aerials were placed above. A number of sets were being constructed but only one had been operated. This was South of Berlin where it had been for 5 or 6 months. Though it had tracked aircraft very well the battery with which it was associated had not fired owing to shortage of ammunition. According to Scherzer since the Russians threatened the safety of Berlin all ammunition had been conserved for ground shooting. "Rotlaus" was fitted as an A.J. measure to Egerland.

9.4. The development of ground radars was Freya in 1938, Wurzburg in 1939 and Mannheim in 1940. The development of the latter was delayed because of the large number of valves used. The reason for developing Mannheim, was that the general staff believed a pointer presentation was easier to operate than CRTs. Scherzer did not agree with this and said radar operators, whom he had questioned, preferred CRTs. When questioned about the radars which we had observed at Halle Flak School, and which had a mirror raised above the cabin roof, to a height of five or six metres, he thought they were a modification of Mannheim, made for sinking into protective pits. He was not however certain of this.

9.5. Early in the war, he had been asked to develop a system operating on one to two metres, which obtained angle of elevation, by comparison of the direct and ground reflected waves (known as Tiefland). It had been designed originally for coast use, where it worked reasonably well, but he was later asked to produce it for inland use. Large wire mats had been erected to give flat reflection conditions, but after two years the work had been abandoned. The purpose to this had been to obtain a greater range than that given by Wurzburg. Scherzer seemed unaware of the British use of this method in G.L.II. The work was done by a Prof. Pungs.

/9.6.

9.6. Improvements to the Wurzburg had steadily increased the range to a satisfactory value and it was now possible to produce peak powers of 1 megawatt from the set.

10. Submarine Radar:

10.1. The earliest radar fitted to submarines was an 80 cm. search radar as fitted to surface vessels, (e.g. Graf Spee, of which Scherzer believed we had full details, having been so informed by the Japs). A small aerial with four or six dipoles, had been developed before the war for submarine use, but the U-Boat staff disdained such gadgets, till its fitting became an operational necessity later in the war. It was mentioned that this form of equipment was used by the German navy for gunnery ranging, although H.M.S. Hood had been sunk using optical ranging.

10.2. The advent of cm waves, after finding H2S, led to the development for submarine of Berlin-U., a centimetric search set operating on 9 cm and using dielectric aerials. This development had only been completed nine months ago, but supply difficulties had limited its introduction. This equipment was intended for tactical observation and navigation. As far as he knew, the aerial had not been fitted on the "Schnorkel". This set had a range of a few kilometers, only on aircraft. The aerial was not affected appreciably by wetting and it was possible to use the equipment as soon as it cleared the surface.

10.3. A 2-4 meter set (Lessing) had been designed for aircraft detection. The design was for intermittent operation to render location difficult.

10.4. Submarines were fitted with Naxos and other search receivers which could cover wave ranges down to three cm. Other search receivers had been designed for shorter waves. It was not a general practice to fit monitoring receivers on all submarines but to equip some specially and scientific personnel made monitoring tripes in them. One of the last such attempts had been when we captured a Dr. Grafen, who was engaged in these duties.

/10.5.

10.5. Dr. Scherzer had no knowledge of acoustics applied to submarines and referred to Prof. Gallach of Munich. He was believed to be in Heidelberg at present.

11. Navigational Systems:

Dr. Scherzer was not very familiar with these.

12. Transmitters:

12.1. Development of centimetric transmitters was delayed by the lack of measuring techniques and instruments, which first had to be produced. No new principles were being explored, as they were trying to follow the lead given by allied technique as found in captured equipment.

12.2. The Germans had found magnetrons to be reliable, and had lives comparable to normal valves. On the other hand they had a lot of trouble with T.R. sparkgaps, and crystals.

13. Fuzes

13.1. Research upon various forms of proximity fuzes, using capacity, acoustic, pulse and Doppler radar (on about 90 cm) methods have been made. The primary application was for rockets, but application to shells was also being considered. Promising results were claimed with all the methods tried, but the capacity fuzes worked particularly well for rocket application. The rocket builds a considerable charge when passing through the air, and it was this which operated the fuze, using gas filled tetrodes, on approach to the earth. It was thought that the charge on an aircraft could be made to operate the fuze on approaching shells or rockets also. This work was being done by Prof. Viewag, of FFO. Special valves to withstand accelerations of several thousand G were being developed by Prof. Klump, in Berlin. Dr. Rottgart of Telefunken had been responsible for development and production of these fuzes and the research had been done by Dr. Urtel, of the same organization.

13.2. Scherzer was not familiar with electric time fuzes, but referred to Dr. Gladenbeck of AEG of Berlin who had worked on this problem.

/14.

14. Foreign Information:

14.1. Dr. Scherzer had been in contact three years ago with a Capt. Ito of the Japanese Navy who was appointed as a H.F. liaison officer between the Japanese and German Navies. At that time Ito had full knowledge of German development and since then as far as Scherzer knew the Japanese had access to all German top secret reports. Some months ago the German Navy had sent a liaison officer on H.F. matters to Japan. As far as he understood Germany had nothing to learn from Japan, but in any case, the Japanese did not give much information, even if it were asked for.

14.2. Italy was always suspected and liaison (technical) was not close with that country.

14.3. Dr. Scherzer was not familiar with Russian radar and H.F. work, though he thought it possible that Dr. Koch of Köthen may have had information. Published accounts of a Russian cavity magnetron made in 1937 reached Germany early in the war but no great interest had been shown till the subsequent discovery of the use of centimetric waves by the allies.

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