ESTABLISHMENTS OF THE FORSCHUNGSANSTALT DER DEUTSCHEN REICHSPOST

COMBINED INTELLIGENCE OBJECTIVES

SUB-COMMITTEE

LONDON - H.M. STATIONERY OFFICE

REPORTS ON CERTAIN ESTABLISHMENTS OF THE FORSCHUNGSANSTALT DER DEUTSCHEN REICHSPOST

(RESEARCH INSTITUTION OF THE GERMAN POST OFFICE)

Reported by:

Report I, IV	S/Ldr. S. Devons	T.R.E.
	Lt/Comdr.R.T.P.Whipple	A.S.E.
	Capt. Verkley	U.S. Sig Corps
	Capt. Ramm	S.D.R.D.E.
Report II, XI	Capt. Verkley	U.S. Sig Corps
	Capt. Ramm	S.R.D.E.
Report III	Capt. Verkley	U.S. Sig Corps
Report V	F/Lt. Palmer	R.A.E.
Report VI	Lt/Cmdr.R.T.P.Whipple	A.S.E.
	Capt. Ramm	S.R.D.E.
Report VII	Dr. M. V. Wilkes	T.R.E.
Report VIII, XIV	Lt/Cmdr.R.T.P.Whipple	A.S.E.
Report IX, X	Lt/Cmdr.R.T.P.Whipple	A.S.E.
Report XII, XIII	Lt/Cmdr.R.T.P.Whipple	A.S.E.
	Capt. Ramm	S.R.D.E.
	Capt. Verkley	U.S. Sig Corps
Report XV	S/Ldr. S. Devons	T.R.E.
	Mr. R. Bender	U.S.
Report XVI	Mr. R. M. Whitmer	O.S.R.D.
	Lt. P. Redgment	R.N.V.R.
	Capt. M. Snowden	R.R.D.E.
	F/Lt. R.G. Silversides	T.R.E.
Report XVII	Mr. C. J. Carter	T.R.E.
	Dr. M. V. Wilkes	

CIOS Items 1 & 7
Radar
Signal Communications

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

TABLE OF CONTENTS

REPORT I

Investigations of Deutch Reich Post Research
Establishments in Munich Area.
From 3rd June, 1945 to 11th June, 1945.

Investigators: S/Ldr. S. Devons (TRE) CIOS Group 1
Lt/Cmdr. R. T. P. Whipple (ASE) CIOS Group 1
Capt. Verkley (U.S. Sigs.Corps) " "
Capt. Ramm (Br. Army) " "

Forschungsanstalt der Deutsche Reichpost (Munich Area) F.d.DRP.

The Munich branch of the F.d.D.R.P. was first formed in 1940 as part of the F.d.D.R.P. Berlin for the primary purposes of studying EM wave propagation as it affected radio communications and allied problems. The work was carried out under the guidance of Dr. Vilbig. It was located at Weisenhaus Strasse S.4, München. In 1943 to escape allied bombing much of the reasearch work was moved to localities near Munich. The following is a list of the sections of the F.d.D.R.P.(Munich) which have been located. Those marked with asterisk have been investigated and details are given in this report.

1. Amt fur Wellenausbreitung Munich (formerly F.d.D.R.P. Munich) Dr. Vilbig - Head of this central coordinating office and in charge of all research stations in Munich area given below.

2.a. F.d.D.R.P. Landshut. (a) Landshut Post Rat Korblein - general laboratory for making of equipment.

(b) Schloss Nieder Aichbach. Recording station for atmospheric disturbances (Dr. Bender)

3. F.d.D.R.P. Grafing. Some communications problems, also ionospheric recording station (Dr. Haase)

4. F.d.D.R.P. Jakobneuharting. Ground wave propagation, aerial problems cm. tube testing (Dipl.Ing.Menzel)

5. F.d.D.R.P. Bernried. Chief Ionosphere research station of D.R.P. (Dr. Beckmann)

6. F.d.D.R.P. Wank, Nr.Garmisch. Propagation of centimeter wavelengths in lower atmosphere (Dipl. Ing. Kettenacker)

7. Predigstuhl Small observation post for Cosmic ray measurement (Phys. Augustine)

There is also a part of the F.d.D.R.P. at Aach, about 10 km. north of Singen near Lake Constance. This is not apparently connected with the Munich section of the D.R.P. under Dr. Vilbig but is probably a part of the Berlin section of F.d.D.R.P. evacuated to Aach.

The work of F.d.D.R.P. in the Munich area appeared to be determined largely by Dr. Vilbig's personal direction although some work initiated by him was subsequently "Sponsored" by the B.H.F.; particularly the work on tube development for mm. wavelengths. The work was centred on problems of propagation - ionospheric measurements, lower atmosphere propagation at Cm. and Mm. wavelengths and ground waves. No trace of any work on television or other systems for controlled missiles was found in the places investigated, and Dr. Vilbig asserted that his department had no connection with or direct knowledge of that work.

Ionospheric stations under D.R.P. control, similar to that at Grafing were also at Weimar, Kühlungsborn-am-Ostsee and Rome.

Dr. Vilbig himself had recently written a paper on speech communication by width-modulated pulse transmissions. No experimental work had yet been done by Vilbig or to his knowledge by anyone else in Germany.

The relation between the radio propagation investigations of the D.R.P. and other German establishments appear, (from interrogation of Dr. Vilbig, and his assistants), to have been as follows.

D.R.P. Observations and Research Stations.
Landshut - Bernreid, etc.

B.H.F. Observations and Research Stations.
Fraunhofer I., (Dieminger) Ferd. Braun I etc. (V.Handel)

Amt für Wellungs ausbreitung (Vilbig) (Beckmann)

Zentralstelle fur Funk beratung (Deiminger - Rawer)

Reich Rundfunk Gesellschaft

Commercial Radio Traffic

Wehrmacht

Additional information on the organisation of Ionosphere work is contained in the report of the Fraunhofer Inst., whose head was also coordinater of German ionosphere work.

REPORT II

Report on visit to the Amt für Wellenaustreitung, München on 4-6-45

A. Capts. Verkley, Ramm.

B. 1. Building in Weisenhause Str., 54. Workshops and vacuum laboratory in basement. Offices ground floor, laboratories first (and some second) floor. Building - slight damage from bombs.
Looting - probably nil, as some staff always present (upper floor residential).

2. Personnel: Only mechanics and caretaker present.

3. Documents: Only office records up to 1943

C. 1. Propagation section of Forschungsanstalt der D.R.P., evacuated from Berlin in 1943. Then, when in same year Munich was bombed, laboratory people moved out to outstations already existing in Munich area. (e.g. Landshut, Bernried etc.), and Munich building only used as administrative office with some work in workshop and vacuum room.

2. Equipment: Very little gear of interest. Some C.R.T. switches used for integrating ionospheric measurements. Two 40" diameter parabolic reflectors with provision for crystal detector.

No guard necessary, no further action.

REPORT III

Note on interrogation of Dr. Führer of D.R.P., Munich

Interrogated by Verkley, Ramm on 4th June, 1945.

Dr. Führer was located in the Postdirection building in Arnulf Str., Munich, near the Hacker Brücke. It was hoped that in his official capacity as head of the local Reichspost Telecommunication Dept., Führer might have information of Dr. Vilbig's section (Amt für Wellenabreitung). Führer stated that his own work consisted solely of control of the telephone and allied working services; his only contacts of intelligence interest were; - 1. Occasionally installation of special secret circuits for Wehrmacht, and 2. one visit paid to Vilbig's Gräfing establishment, where Führer was shown (anti?) jamming system copied from Russian equipment. Führer professed no knowledge of work on cm. wavelengths; he believed some decimetre radiotelephone links had been installed in North East Germany by the Reichspost, as the cables in this region are poor, but had no technical information on these.

It is suggested that Führer might be useful to help locate wanted people in the Munich area. He is very cooperative and speaks good English.

REPORT IV

Investigation of Forschungs Anstalt der Deutsches Reichpost at Landshut

by S/Ldr. Devons, Lt/Cdr. Whipple, Capt. Ramm, Capt. Verkley. June 8th - 10th 1945

(A) Locations (a) at Post Direction Building, Landshut. (32 Km N. of Munich) no bomb damage, some damage by looting.

Research started here in 1943 to escape bombing in Munich. From 1940 to 1943, there was only an atmospheric recording station at Landshut. There were about 6 scientists and 20-25 people altogether in 1944/45. The place is guarded since it is part of the Post Direction building.

(b) At Schloss Neideraichbach (12 miles ENE of Landshut) used as experimental and recording station for atmospherics disturbances. This section came from Landshut in 1943 to avoid artificial disturbances arising from working inside a built-up area. The Schloss has been partly damaged by shelling and there has been some looting. Present staff: 1 scientist and four assistants. Unguarded, private residence.

(B) Personnel: Postrat Korblein. Head of department. Mainly administrative work. Also some work on construction of cm. valves and other equipment for D.R.P. observation stations. Entered D.R.P. 1936. Reichpost Director Regensburg 1939, Munich 1943, Landshut 1943. Interrogated. Cooperative, fair English.

Dr. Rössler. At F.d.D.R.P. Berlin 1937. Landshut 1945. Worked on dielectric constants of gases and liquids. Some work on design of general purpose equipment (e.g. for DRP Wank.) Interrogated, poor English.

Dr. Bender. Recording and analysis of atmospheric disturbances including use of special recording equipment. Worked mainly at Schloss N. At F.d.D.R.P. Berlin till 1941 then F.d.D.R.P. at Prague till 1943, then Landshut. Interrogated. No English.

Dr. Vogt. 1931-34 assistant Phys. Inst. Heidelberg.
1934-36 Telefunken (antennae).
1939 Head of receiving station (propagation and D.F.) of F.d.D.R.P. at Kagel. Evacuated with some equipment to Landshut in Spring 1945. Collaborated with Dr. Grosskopf at Kagel. Main work measurements in connection with H.F. direction finding. Interrogated. Loquacious but no English.

Dipl. Ing. v. Collas. An engineer from the Berliner Physikalischer werkstatten, Berlin. Came to Landshut to collaborate with D.R.P. a few months ago. Particular interest cm. tubes. Interrogated. Cooperative. No English.

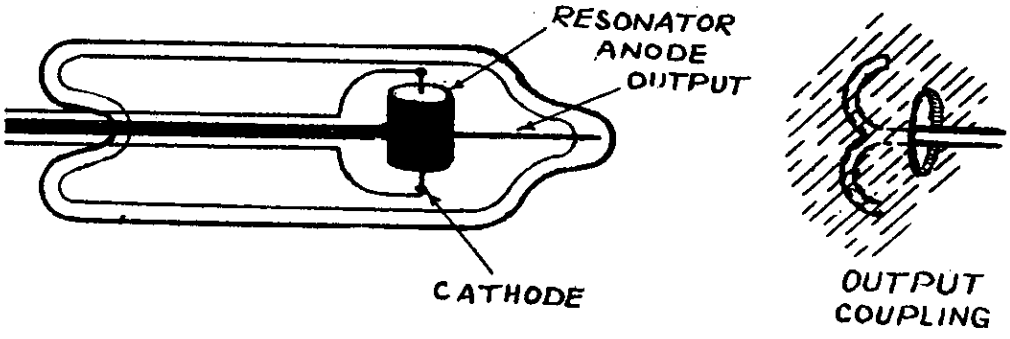
(C) Documents: All secret reports at F.d.D.R.P. Landshut were said to have been destroyed earlier in the year. Copies of some non-secret work, published in T.F.T. and H.F.T. were produced.

(D) General. F.d.D.R.P. was formed in 1943 following a comb out of Reichspost personnel when people holding administrative posts were directed into research work or the services. Chief concern was design and construction of equipment for other D.R.P. propagation observation stations. Considerable difficulty had been experienced in obtaining centimeter tubes from manufacturers (or via B.H.F.), hence work on centimeter valves. This work was also due to Dr. Vilbig's personal interest and suggestions. Recently B.H.F. had officially sponsored the research work on production, reception and propagation of mm. waves and on the design of tubes for this work. There seemed little direct contact between the workers at Landshut and similar personnel under direction of the B.H.F. All reports from Landshut were sent via Munich to F.d.D.R.P. Berlin where they were circulated. A few reports relevant on work of B.H.F. reached Landshut via F.d.D.R.P. Berlin.

Technical

(E) Experimental Magnetrons. (Post Rat Korblein)

Korblein had, apart from general administrative work, chiefly concerned himself with the construction of a cavity-resonator type of magnetron originally suggested by Dr. Vilbig. This work has proceeded in collaboration with Dr. Pollic at Jakobneuharting. The magnetrons so far constructed are only suitable for low power C.W. experimental purposes. The construction was extremely simple, namely a closed cylindrical cavity resonator with a fine tungsten wire cathode along the axis.



The exact mode of operation of the magnetron was not clearly understood but it was stated that for optimum efficiency the length of the cavity should be 0.85 times the diameter (internal dimensions).

The wavelength for peak power was then given by $\lambda = 1.70d$ or $\lambda = 2L$. (e.g. d = 1.8 cm, L = 1.53 cm, λ = 3.07 cm), suggesting a coaxial line resonance with outer just cut off for H_{10} propagation. The output circuit was very crude, a double loop (two parts at right angles) and probe, and there was no knowledge of the E.M. field configuration in the cavity.

The equipment used for testing these tubes was most elementary. No exact knowledge of output power has been made but it was estimated that at 9 cms., the tubes had an output of 300-500 milliwatts for an input of 6-9 ma. at about 2,000 volts. For all tubes the magnetic field used was roughly in accordance with the relation $\lambda H = 10{,}000$, where λ is in cm. and H in gauss. At 3 cm. for similar input the output was estimated at 30-50 mw. and at 1.6 cm. the only tubes which were successful gave an output estimated at 1 mw. but gas troubles had occurred in the smaller tubes due to excessive heating of the anode (resonator).

The wavelength can be altered by some $\pm$ 3% by change in magnetic field or anode voltage, the half power points being about $\pm$ 1½%. When dimensions other than those stated above to be the optimum were used the output power was said to be much smaller and two peaks in the output power at wavelengths of order 1% were observed. No magnetrons had been built with indirectly heated cathodes.

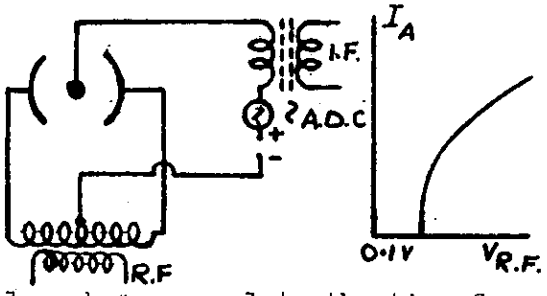
(F) Measurements of Dielectric Constant of Atmosphere. Dr. Rosseler

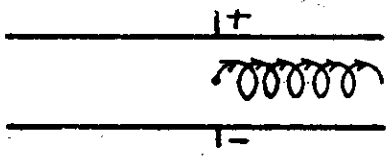
A system was being built for measuring average dielectric constants of the atmosphere over a path of about 15 Km. A 9cm C.W. transmitter was modulated at about 1 mc/s. and the reflected signal from an object about 15 Km away was rectified and the phase of the 1 mc/s modulation compared with that of transmitter. By accurately knowing the distance from the transmitter to the reflecting object, the 1 mc/s. phase-changer could be related to the transmission time and hence the dielectric constant. Dr. Rosseler had also worked previously on the dielectric properties of water at a wavelength of 300 meters from the view point of over-water propagation.

(G) Magnetron Rectifiers for Cm. Waves. Dipl.Ing. v. Collas

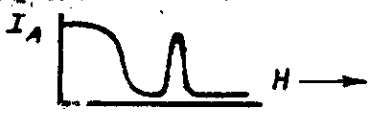
Following a suggestion of Prof. Habaan a magnetron diode detector was being investigated. Earlier experiments had been made with the ordinary split anode magnetrons at longer wavelengths

(few meters). These had shown a restifying action (see circuit below) only for R.F. voltages above a certain threshold value (about 0.1 volt). In the development of the rectifiers for centimeter wavelengths the work had been directed towards reducing this threshold value to a minimum by arranging for a large number of loops in the electronic trajectories, the time taken to travel one loop being equal to the time for one cycle of R.F. This is achieved by placing the cathode between two parallel plates which are perpendicular to the R.F. fields and are parallel to the magnetic field. In this arrangement the threshold voltage is stated to be much lower than in case of the spilt magnetron since the R.F. voltage can produce a cumulative effect over many loops of the electron orbit before the electron reaches the anode.

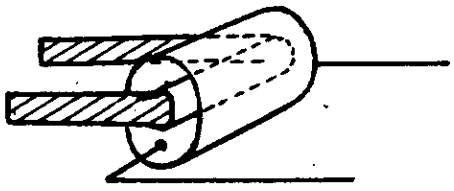




The R.F. circuits being used in this arrangement were now tuned, the device being brought into tune for detection of a pre wavelength by variation of magnetic field. The relation between current and field as shown below.



To avoid end effects it was intended to use the two R.F. plates in the form of two cylinders viz:



Only rough measurements appear to have been made of the D.C. output with about 1/10 mw. R.F. input over a wavelength range (for the same tube) of 2 to 10 cms. Under these conditions it is claimed that the current output is about 100 times that from a standard cm. crystal (R.P. 2 MH.) mixer. (Input impedances unknown in each case). No tests of mixing efficiency or noise level either as detector or mixer have been made. Tubes have been run with about 300 volts between cylinders and with magnetic field given by H λ = 10,000. Reception over a frequency range of 2.10 cm. has been obtained with a single tube.

CIOS CONSOLIDATED ADVANCE FIELD
TEAM ASSESSMENT REPORT

1. TARGET NUMBER: Black List 7/57c.

2. FULL TITLE OF TARGET: Forschungsanstalt der Deutschen Reichpost.

3. LOCATION: Evacuation address, Landshut - in building of Post Direktion.

4. CONDITION OF TARGET: Slightly damaged by artillery, and looted to some extent. Personnel still present. The personnel include:
(1) Postrat Koerblein
(2) Postrat Dr. Bender
(3) Dr. Roesseler

5. DESCRIPTION OF CONTENTS:

This dispersal location, occupied in June, 1943, was operated by a staff of eight to twelve persons. Three were engineers, and the remainder were technicians and laboratory assistants.

Work done:

(a) Study of atmospheric noise for use in "radio weather" prediction. Done principally by Dr. Bender and the listening station was at Landshut till March, 1945, when it was moved to Neider Aichbach with a staff of 5 persons. Here it has suffered some damage from artillery. The recording of noise was done by three methods:

(1) High speed pen recorder.

(2) By a set of ten mechanical counters set to count noise impulses of different intensity levels in 1 db. steps, starting at 0.6 microvolts per metre.

(3) By a novel electrolytic integrating scheme. The receiver output is fed to the "y" plates of a cathode ray tube which possesses a special conducting screen divided into insulated segments. Thus the receiver output voltage will determine which segment receives the beam current. Each screen segment is led to a column of sulphuric acid solution, and beam current thus liberates an amount of gas corresponding to the total noise of any particular level.

These studies of atmospheric noises have been made primarily at 125 Kc/s and at 9 Mc/s with brief studies on other frequencies. Results were passed to Dr. Beckmann at Bernried for analysis.

(b) Production and testing of experimental C.W. magnetrons (2.5 to 3 cm) and other special tubes according to designs of Dr. Vilbig.

(c) Production of magnetrons, and test equipment for these trials. For this work the laboratory was equipped with a small glass-blowing shop and a machine shop.

(d) Work on measurement of dielectric constants. This was primarily the project of Dr. Roesseler, who had devised a scheme for measuring the dielectric constant of a 15-30 kilometer sample of air. Apparently little actual measurement work had been done.

6. ITEMS GUARDED: (a) Equipment. Building is under guard.
(b) Documents. Reported destroyed.
(c) Personnel. None guarded.

7. PRIORITY ASSESSMENT: Investigation.

8. OTHER REMARKS: Also present in building is a Dr. Vogt who arrived as a refugee from Berlin Reichpost, bring considerable equipment for work on short waves Direction finding. This equipment is stored at Landshut. Both Dr. Bender and Postrat Koerblein speak reasonable English.

9. DATE OF ASSESSMENT: 27th May, 1945.

10. ASSESSORS NAMES: F/Lt. Palmer R.A.F.
Capt. Menard U.S. Navy.

Army Group 6.
Item Group 1.

11. DOCUMENTS OR EQUIPMENT REMOVED: None.

12. DOES GROUP RELEASE TARGET? No.

REPORT VI

Interrogation of Dr. Bender

Interrogators: Lt. Cdr. R. T. P. Whipple,
Capt. Ramm.

Date 6 June 1945.

Dr. Bender had been working on the recording of atmospherics at Landshut for the last two years. It was soon found that the artificial noise level was too high at Landshut itself and the apparatus was moved about 20 months ago to Schloss Nieder Aichbach about 10 miles East of Landshut.

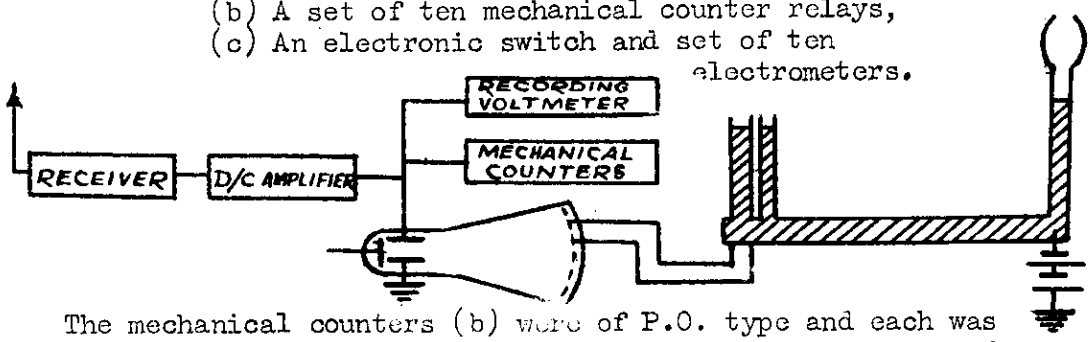
A staff of 11 was employed for these measurements, most of this consisting of part time female labour.

Schloss Niederaichbach has been rather damaged by shell fire and some of the valves in the apparatus have been looted. Most of the essential parts were intact however.

At Niederaichbach some rather unsuccessful work had been carried out on directional recording of atmospherics, but most of the work was concerned with measurements using a non-directional aerial system working at 9 Mc/s. Measurements were made of the number of atmospherics for which the f.s. exceeded given values and also of the time during which the f.s. lay within specified limits.

For the 9 Mc/s experiments a receiver was used having a 4 Kc/s bandwidth with a vertical aerial. The sensitivity of this receiver was checked by means of a test transmitter and portable f.s. measuring equipment. The receiver was connected to a D.C. amplifier and the output of which fed in parallel

(a) A recording voltmeter,
(b) A set of ten mechanical counter relays,
(c) An electronic switch and set of ten electrometers.



The mechanical counters (b) were of P.O. type and each was arranged by means of magnetron relays to operate whenever the f.s. exceeded the specified value corresponding to that particular counter. Specified values corresponded to .5, 1.0 .. 5.0 v/m. The numbers were counted every 15 minutes.

The electronic switch (c) consisted of a cathode ray tube in which the target was a plate consisting of ten parallel strips of graphite separated by narrow insulating strips. These were connected to an array of ten electrometers and the circuit was completed by a suitable biasing battery to earth. Thus, for example, the third electrometer recorded the length of time during which the f.s. was between .1 and .15 v/meter. The electronic switch was suggested by Vilbig. When the apparatus was working an operator listened in to the receiver and if man-made static was evident the frequency was altered slightly and a note made against the voltmeter recording.

Some work was also done on longer wavelengths, but for the most part use was made of the records by Bureau and Failietaz at St. Cyr. (France) at 25 Kc/s. in obtaining data for longer wavelengths.

In working up the results, plots were made both of the number of ionospherics per hour exceeding a given f.s., and also of the "Stormess", that is that field strength which is exceeded by ten atmospherics per hour. It was found that in general these two quantities were not very clearly indicated.

The records go back for 20 months.

It was found that at 9 Mc/s the frequency of atmospherics exceeding .5 v/m was greatest at about sunset and had a smaller maximum at sunrise. During the night the level was generally rather low. Bender thinks that these results were determined rather by ionospheric propagation conditions that by the number of thunder storms in the neighbourhood. For the long wave measurements conditions were almost reversed, with minima in evening and morning, and a maximum at noon.

Three day forecasts of atmospheric noise conditions were published but good results were only obtained during winter months, presumably due to the prevalence of abnormal E in summer.

By comparing the value of the "Stormess" with cosmic ray measurements Dr. Bender has found that on days of abnormal cosmic ray intensity, there is a significant tendency for the "Stormess" to depart from its normal daily run. Dr. Bender hopes to publish an account of this work shortly, but nothing has been published to date.

Some specimen curves showing the number of atmospherics whose field strength at 9 Mc/s for the 4 Kc/s bandwidth exceeded .6 mv/m. were obtained.

REPORT VII

CIOS INVESTIGATORS PRELIMINARY REPORT

TARGET: Dr. Bender at Landshut, and Laboratory equipment at Nieder Aichbach.

PERSONALITIES:

Dr. Bender, who at present lives at Jäger Str. 484 at Landshut, was a student of Dr. Hess at Innsbruck University, and took his PH.D. in 1933. He then joined the Reichpost organisation, and worked on transmitters under Dr. Vilbig at the Reichpost Zentralat in Berlin until 1936. After a period working on general long distance telephone and telegraph problems, and he was put in charge of a group of engineers maintained by Zentralant, and sent out to service broadcast and W-T transmitters as required.

In 1940, he was moved to Prague, where he did similar jobs in German-occupied Czechoslovakia. He later joined the German Army but after about a year was discharged in order to work in Russia on Russian transmitters captured by the Germans. This job came to an end when the German advance was halted, and Dr. Bender returned to Prague. He got in touch with Dr. Vilbig, who was then the Dean of the Munich Technical College, and also "Abteilung Präsident" in the Reichpost, controlling a small organisation of about 100 people, known as Amt für Wellenausbreitung. On 1st April, 1943 Dr. Bender started work under Dr. Vilbig with a staff which varied between 5 to 15 people.

Dr. Vilbig's organisation was originally independent, but in 1942 was put under the larger Forschungsanstalt which employed about 1,000 people. This organisation was also under the Reichpost and its president was Herr Gerwig.

Dr. Vilbig is to be found at the following address:
Waisenhaus Strasse 4, Munich 19.

Technical

The problem which Dr. Vilbig gave to Dr. Bender was to study atmospheric noise on various wavelengths, with a view ultimately to being able to give forecasts to supplement the forecasts of ionosphere conditions provided by Dr. Beckmann (at Bernried, Statnberg See, near Munich).

The technique used was straight forward, the only item of interest being the use of a "bucket" oscilloscope and an electrolytic recorder. The aerial systems used were non-directive, although experiments were being started with a loop automatically rotated through 60 degrees every 15 minutes. An ordinary superhet receiver

with a bandwidth of 4.5 K.cys was used, with a diode rectifier followed by a d.c. amplifier. The output was applied to the plates of a bucket oscilloscope, in which the electron beam was focussed on to a metal plate divided into five or six separate insulated sections. The beam would thus fall on any given section of the plate only when the signal lay between certain limits. These oscilloscopes were made by another section of Dr. Vilbig's group.

Each section of the plate was connected to an electrolytic recorder constructed as follows. A piece of glass tubing about one eight inch diameter, and a piece of capiliary tubing were joined together so as to form a U-tube. The capiliary tube was open at the top and contained a thread of mercury; the other tube was closed at the top by a valve which could be operated at will, and contained aciduated water. Two electrodes were sealed into this tube. A small reservoir whose volume could be varied by a screw was connected to the tube at the base, so as to provide a convenient method of adjusting the zero.

The electrodes were connected direct to one of the sections of the collecting plates of the bucket oscilloscope, and the beam current (about half milliamp) was enough to produce sufficient gas by electrolysis in the wide arm of the U-tube, to cause an appreciable change in the level of the mercury in the space of a few minutes.

In addition to this recorder, a telephone counter was attached to each section of the plate, to record the total number of impulses, and a recording voltmeter was connected to the output of the receiver after the diode. The paper speed was not quite sufficient to show each atmospheric separately. The main use of the recording voltmeter was to enable periods when interference from broadcasting or other stations had been allowed to come in to be detected: normally it was the duty of an operator to retune the receiver when this happened.

Continuous records were obtained as follows:

Wavelength	Period
33m	November 1943 to 1st May 1945 +
2,200m	September 1944 to 1st May 1945
100m	January 1945 to 1st May 1945

+ Note: The electrolytic recorder was not working until September 1944.

It was hoped later to have records of atmospherics over a wide band of frequencies using a receiver with motor-driven tuning, and also to examine the natural waveform of atmospherics as received on a wide band receiver. Apparatus was also being constructed for a system of recording atmospherics on a moving film using a glow discharge lamp.

Dr. Bender was able to recognise two types of diurnal variations of atmospheric intensity (7 Mc/s) normal, in which there were maxima in the morning and evening, and abnormal in which there was a mid-day maximum. He had been provided with rather crude propagation character figures, based on the reception of distant broadcasting stations, by Dr. Beckmann, and claimed that peaks of atmospheric intensity were connected with changes in propagation conditions. I was not very convinced by the sample curves I was shown. He also claimed a correlation between abnormal days and cosmic rays. There was also some correlation with thunderstorms within "ground-wave" distance, but not as close a correlation as he had expected.

Documents

Dr. Bender had prepared a complete account of his work, and I took a copy of this. The diagrams were not ready, but will be forwarded through the local CIC detachment to CAFT 1, 12 Army Group.

General

It is clear that Dr. Vilbig was the moving spirit in this work, Dr. Bender working closely under his guidance. The work may be described as fundamental research, that is, it is of some scientific interest, but of no direct military value. If the policy is to allow fundamental scientific research to be done in Germany, I can see no reason why Dr. Bender should not be allowed to resume his experiments. 405 CIC detachment would appreciate guidance as to the line to be taken in dealing with Dr. Bender and his equipment.

Dr. M. V. Wilkess.
S.D.O. RAF.
7th July, 1945.

Added later

Since writing this report I have discovered that Dr. Bender was interrogated by Lt. Comdr. Whittle and Capt. Ramm on 6th June, 1945, during a survey of the Reichpost organisation in the Munich area.

Interrogation of Dr. K. P. Vogt

by Lt. Cdr. R. T. P. Whipple, at F.D.R. Landshut
on June 7th 1945

A. GENERAL

Dr. Vogt had only evacuated to Landshut in February 1945 and had not had time to reorganise his work there, particularly as most of his apparatus had been lost in the journey. He had spent most of the war working with Dr. J. Grosskopf and nine assistants at the Reichspost research station at Kagel, 36 Km. east of Berlin. His work at Kagel was concerned with problems of propagation in the H/F band. Many measurements were made of the polarisation and angle of descent of radio waves from Daventry and apparatus was built for treating these measurements statistically. Considerable use was made of a "tiltmeter" for deducing effective soil conductivity from the tilt of the electric vector just above the ground.

He had cooperated to a considerable extent with the Navy on D.F. problems and had been used by them in testing H-Adcock installations in Germany, France and Holland etc. The accuracy of the Adcocks was of the order 1 to 2 degs. He had also made some tests on Wullenwerber, a long based Adcock system built by the Navy at Neustadt/Holstein.

During the last year a new direction finder (Dochtkohle) was developed for naval purposes. This was designed so as to be free from polarisation error and yet small and sensitive. It was intended to fit it to the Schnorkel on U-Boats but the war finished before this could be done.

Apart from that on Dochtkohle most of the work done by Grosskopf and Vogt had been published in T.F.T. or H.F.T. and is given in the publications listed below. Some work was also done on homing direction finders for aircraft.

The field of Kagel was flat and sufficiently large to be used as an aerodrome. An airplane was kept there for the purpose of calibrating direction finders.

Dr. Vogt was also able to give useful information on the direction finding research stations for the armed services, particularly the Navy.

B. Propagation of waves received in the 6-12 Mc/s band from Daventry (8)(9)(10)(13).

Many measurements were made of the angle of descent and polarisation of signals from Daventry and twin channel receivers with common I.F. oscillators were built for this purpose together

with integrating machines for treating the observations statistically. The results agreed well with theory.

The first integrating machine the amplifier was connected to a magnetically operated arm whose movement was proportional to the output and which closed one or other of a number of contacts according to its position. The contacts formed parts of circuits with P.O. counter relays supplied with slowly alternating currents so that the reading of the counters was proportional to the time during which the output lay between the corresponding limits.

In the later modification an optical lever and photocells were substituted for the mechanical lever, and condensers were charged by the current flowing through the photocells.

C. Geophysical Instruments

The "tilt Meter" for investigating soil conductivity was originally developed before the war by Barfield in England, and the model built by Dr. Vogt does not appear to have any special features. The dipole is about $1\frac{1}{2}$ meters long and can be rotated about a horizontal axis. It is transformer coupled to a portable receiver, and the whole apparatus stands on a tripod. Effective soil conductivity and dielectric constant are deduced from the tilt for minimum signal and the ratio of the minimum signals as the dipole is rotated, using a transmitter on the ground at any distance exceeding $2\frac{1}{2}$ wavelengths.

Grosskopf and Vogt have shown that the effective soil conductivity and dielectric constant measured by this means are the constants which should be used in determining the "numerical" distance in Sommerfeld's propagation formula and have investigated the effect of underground stratification. They have used the tilt meter for testing transmitter sites and direction finder sites. Efforts to correlate tilt meter readings with D.F. deviations were not in general very successful.

D. Dochtkohle

An experimental model of Dochtkohle was built in September 1944 and the Navy finally decided to apply it to Schnorkel at a meeting on April 5th 1945, the contract to be given to the firm of Siemens. It was estimated that 20-U-Boats could have been fitted by the end of May.

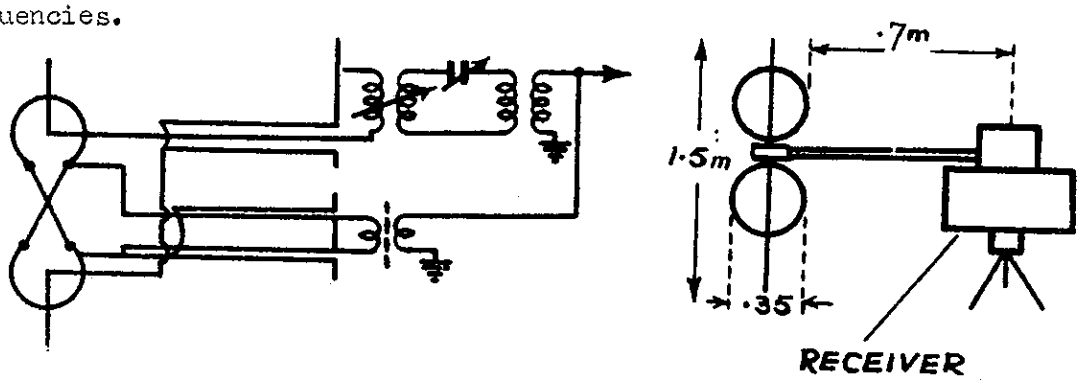
Dochtkohle depends on the principle of the cardioid polar diagram which can be obtained by combining the signals from a vertical aerial and a loop aerial in the correct proportions and which has long been used for obtaining "sense" with direction finders. It was shown that whereas the simple loop gives incorrect results with elliptically polarised waves, the minimum of the cardioid will remain unchanged and will even be improved under these conditions

provided the angle of descent of the incident rays is not too great. This is still true when the aerial system is erected above imperfectly conducting ground.

(With a vertically polarised incident ray the signal when the goniometer is turned through a small angle X is proportional to X^2, so that the zero is too broad for suitable D.F. work. With a horizontally polarised wave it is proportional to X and good bearings can be obtained. With an elliptically polarised wave it is proportional to $AX^2 + BX$ when the first term represents the effect of the vertically polarised component and the second that of the horizontally polarised component. If B/A is finiti, which will in general be the case then for sufficiently small X, the second term will be predominant and a good bearing can be obtained.)

A simple loop suffers from large reradiation errors if a vertical antenna is placed close to it but does not coincide with its vertical diameter. This trouble was avoided by using two loops in parallel one above the other, and using a dipole in place of a vertical antenna. The experimental model is illustrated in the sketch below. The phasing circuit for combining loop and dipole currents was not automatically compensated for all frequencies but had to be adjusted according to calibration charts when frequency was changed. Dr. Vogt did not know whether this difficulty had been overcome in the final model.

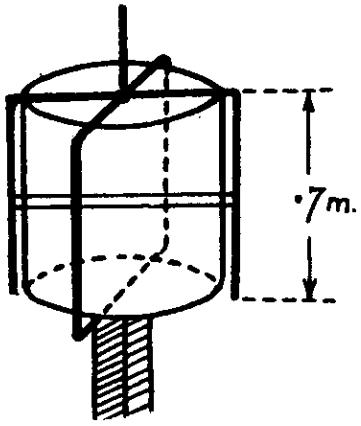
It was found that Dochtkohle gave the largest deviation when the incident rays were nearly vertically polarised. This behaviour is the opposite to that of an Adcock, which gives maximum errors for nearly horizontally polarised waves. Thus by using both types of D/F simultaneously it should always be possible to get good bearings. It is more sensitive that an Adcock of the same size at low frequencies.



The Navy finally decided to adopt Dochtkohle for application to U-Boats on April 5th 1945 and it would probably have been built by the firm of Siemens. It was estimated that 20 U-Boats could have been fitted by the end of May. The Navy had at first been reluctant to use this system as they had previously been working with a twin-channel D/F. with C.R.T. display and this

system cannot be applied to Dochtkohle. Dr. Vogt did not know the details of the first model as he was at that time in Landshut, but he suggested that Dr. Grosskopf would be able to supply details. He is probably now at the naval D/F research station at Neustadt/Holstein. (This station is run by Oberbaurat Dr. Wächtler, and there is an attached experimental field at Pelzerhaken). If he is not there, Dr. Grosskoft is probably at Lübeck (Chemische Werke, Träger).

Dr. Vogt thought that the final model of Dochtkohle appeared somewhat as follows:



Dr. Grosskopt has written an account of his work together with a bibliography, list of apparatus, and names of his colleagues both at Landshut and at Kagel. The account is attached to this report. The bibliography follows: the rest is given in the appendix.

(E) The following is a list of D/F. research stations in Germany as given by Dr. Grosskopt.

Zentralstelle: Bevellmächtiger für Nachrichtenmittel
Head. Glökner.

Army	Air Force	Navy
Herreswaffenamt at Wapruf, Berlin Oberbaurat Dr. Schelchoss	1. Rechlin at Muritzsee Dr. Wäsch. 2. Landsberg Lech Prof.v. Handel (Komet) 3. F.F.O.	Nachrichtenmittel-Versuchskommando der Kriegsmarine (N.V.K. Originally at Kiel now at Wolfehbüttel D/F work at Neustadt/Holstein under Oberbaurat Dr. Wächter Experimental Field at Pelzerhagen, Kellenburen.

(F) List of Publications

A. Reports of the Physical Institute University Heidelberg.

1. Investigation on the movement of electrons in flames.
Untersuchung uber die Elektronenbewegung in Flammen (Dissertation)
Ann.d. Phys. 5. Folge, vol. 12 (1932) P. 433-476.

2. Resistance and density in flames.
Innere Reibung und Dichte in Flammen.
Ann.d. Phys. 5. Folge, vol. 14 (1932) P. 241-258.

3. Measurement of the speed of flames.
Die Messung von Flammengeschwindigkeiten
Zeitschrift f. Physik, vol. 75 (1932) p. 804-808.

4. The hydrodynamic resistance of cylinders.
Zeitschrift f. physik, vol. 83 (1932) p. 164-170.

B. Report of the General Post Office (Reichspostzentralamt).

5. Investigation on vertical antennaes with horizontal top-capacities.

Unterscuchungen an Vertikal-Antennen mit horizontalen Dachkazitaten HET, vol. 50 (1937) p. 58-67.

C. Reports of the Radio Research Board (Forschungsanstalt der Deutschen Reichspost).

6. On the electrical behaviour of vertical antennaes in connection with their diameter.

Über das elektrische Verhalten von Vertikalantennen in Abhängigkeit von ihrem Durchmesser.

TET, vol. 28 (1939) p. 170-178.

7. On the measurement of the conductivity of soil.
Über die Messung der Bodenleitfähigkeit
TFT, vol. 29 (1940) p. 164-172.

8. Measurement of the polarisation in the medium wave range.
Polarisationsmessurgen im Mittelwellenbereinch.
TFT, vol. 29 (1940) p. 291-296.

9. Measurement of the polarisation in the short wave range.
Polarisationsmessungen im Kurzwellenbereich.
TFT, vol. 29 (1940) p. 360-363.

10. Measurement of the angle of sky-waves in the short wave range.
Einfallswinkelmessungen im Kurzwellenbereich.
TFT, vol. 30 (1941) p. 19-22.

11. Description of the equipment of the aeroplane of the Radio Research Board.
Beschreibung der Empfangseinrichtung des Versuchsflugzeuges der Forschungsanstalt der Deutschen Reichspost.
TFT, vol. 30 (1941) p. 247-251.

12. Technical use of the instrument for soil-conductivity.
Technische Anwedungen eines Bodenleitfahigkeitsmessers.
TFT, vol. 30 (1941) p. 352-353.

13. The statistische Verfahren in der Ausbreitungsforschung.
Elecktr. Nachr. Techn. vol. 18 (1941) p. 8-11.

14. On the Doopler-effect in the short waves receiving field.
Über Beobachtungen des Dopplereffektes im Kurzwellenempfangsfeld.
HET, vol. 57 (1941) p. 143-146.

15. The measurement of the electrical conductivity of soil with different layers.
Die Messung der elektrischan Leiftfähigkeit bei geschichtetem Boden. HFT, vol. 58 (1941) p. 52-57.

16. Measurement of the electrical rotating field near a sender.
Die Messung des elektrischen Drehfeldes im Nahfeld eines Sender. HFT. vol. 59 (1942) p. 70-72.

17. A special method for the measurement of soil-conductivity.
Zur Messung der Bodenleitfahigkeit.
TFT, vol. 31 (1942) p. 22-23.

18. A new instrument for the measurement of soil-conductivity.
Ein neuer Leitfähigkeitsmesser
TFT, vol. 31 (1932) p. 112-114.

19. Investigations on umberella-antennaes.
Untersuchungen an Schirmantennen.
TFT, vol. 31 (1942) p. 161-166.

20. Measurement of the propagation over inhomogenious earth.
Ausbreitungsmessungen über inhomogenem Boden.
HFT, vol. 31 (1942) p. 97-99.

21. The Zennecke rotating field near disturbing objects.
Das Zennecksche Drehfeld im Bereich von Rückstrahlern
TFT, vol. 32 (1943) p. 102-104.

22. The connection between the effective soil-conductivity and the diminution of wireless waves.
Der Zusammenhang zwischen der efektiven Bodenleitfähigkeit und der Ausbreitungsdämpfung.
HFT, vol. 62 (1943) p. 14-15.

23. Measurement of the polarisation in the field of a horizontal sending g-Dipol.
Polarisationsmessungen im Feld eines horizantalen Sendedipoles
HFT, vol. 62 (1943) p. 131-133.

24. On the height-dependence of the Zenneck rotating field.
Zur Hohenabhangigkeit des Zenneckschen Drehfeldes.
HFT, vol. 62 (1943) p. 172-173.

25. Influence of the electromagnetic field near earth through inhomogenities of the soil.
Beeinflussung des Bodenwellenfeldes durch Bodeninhomogentitäten
Dutsche Luftfahrtforschung, Unterschungen und Mitteilungen
Nr. 693 p. 1-7.

26. Preparatory investigations of direction finder places with the conductivity apparatus (Dipol-method).
Vornntersuchungen von peilplätzen mit dem Leitfähigkeitsmessgerat (Diplomessverfahern).
Deutsche Luftfahrtforschung, Unterschungen und Mitteilungen (Deutsche Luftfahrtforschung)
Nr. 764 p. 1-23.

27. Experiments on the wireless direction finding free form night effect near disturbing object.
Versuche zur nachteffektfreine Peilung in der Nähe von Rückstrhlern.
Deutsche Luftfahrtforschung, Untersuchungen und Mitteilungen
Nr. 796 p. 1-9.

28. The influence of inhomogenities of the soil on the correction-curve of wireless direction finders.
Der Einfluss von Bodeninhomogenitäten auf die Funkbeschickung.
Deutsche Luftfahrtforschung, Untersuchungen und Mitteilungen at the printers, p. 1-27.

29. Contribution "instruments and methods for measurement" to the note book Hochfrequenztechnick.
Beitrag "Messgeräte and Messmethoden" zum Taschenbuch der Hochfrequenztechnik, in preparation.

30. Contribution "wireless navigation" to the dictionary of the communication technique.
Beitrag "Funknavigation" zum Handwörterbuch der Nachrichtentechnik.

G. List of the staff at Landshut

Saarmann, Erwin	born 15.11.1903, Lichtenow near Berlin Engineer, employed at the Radio Research Board on September 1st 1944.
Hanel, Kurt	born 21.12.1905, Berlin, mecanician, employed at the Radio Research, mecanician, Board on Sept. 1st 1939.
Tauchert, Otto	born 3.12.1892, Berlin near Frankfurt Order chauffeur, employed at the Post Office 1920.

The Receiving Station Kagel had a staff of 11 men; three of them have been left at Kagel as a security guard, there have been born June 16th, 1905 at Kiel, on September 1st 1935 employed at the General Post Office and on July 1st 1937 member of the Radio Research Board, lives near Kiel in the momet.

None of the 11 men has been a member of the Nazi Party.

Investigation of F.d.D.R.P. Grafing and Interrogation of Dr. Haase

Interrogators: S/Ldr. Devon,
Lt. Cdr. Whipple.

Date: June 4th, 1945.

Location: 30 miles E.S.E. of Munich on railway from Munich to Rosenheim.

(a) Small laboratory in attic of P.O. This building is now partially occupied by U.S. troops.

(b) A small hut with ionospheric sounding gear (partly dismantled) just behind the P.O. building. A considerable amount of the apparatus has been looted.

A. Dr. Haase. Co-operative. Little English. Speaks German with a dialect.

In addition to looking after the ionospheric sounding apparatus (which was built at Jakobneuharting and is automatic in operation) and transmitting the results of these observations to Bernried, Dr. Haase had worked on a number of small problems sent to D.R.P. by B.H.F. Chief of these was a system of speech frequency comparison using supersonics and some methods for reducing the susceptibility of communication receiver to jamming.

B. Speech Compression

By halving all the audio frequencies used in ordinary communication it would be possible to halve the bandwidth used in a single channel for carrier telephony so that twice as many channels could be carried by one cable. It was found that if the speech channels of two identical sound films A and B were cut up into small strips of equal lengths, and alternate strips thrown away, the film then being joined up again so that each even strip was separated, the resulting film did not show too much distortion when played in the usual manner. In order to make use of this principle a tank was constructed with glass sides and filled with oil. With the aid of a quartz crystal oscillator travelling ultrasonic waves were sent through the liquid in this tank. On one side of this tank a lamp was modulated by the speech. By this means a diffraction pattern was produced which moved with the velocity of the ultrasonic waves. By scanning this pattern at half this velocity it was hoped to produce the equivalent of the film with alternate segments left out and with the speech frequency bandwidth halved. A rather similar apparatus at the receiving end was to be used for introducing the equivalent of the repeated segments of film. It is understood that this work had been put aside for the last year but Dr. Haase intended to continue as soon as circumstances permitted. Most of the apparatus had been built.

C. Anti-jamming

It was intended to protect a receiver against a jamming station when frequency is wobbled. Two methods were tried. In the first a limiting valve was placed in the I.F. circuit so as to desensitise the receiver when the field strength exceeded a certain value. (This appears to be the convention method of R.I.S.). It is claimed that this worked when the interfering signal was 300 times as great as the desired signal. In the second method a filter with a very sharp cut-off was introduced into the I.F. circuit. This filter apparently consisted of a number of simple band pass filters in parallel.

Dr. Haase claimed that by this means a 50 fold reduction of interference could be obtained.

Dr. Haase had apparently done a certain amount of general work on the construction of filters.

Investigation of Forschungs Anstalt der Deutches Reichpost at Jakobneuharting

Date: June 4th, 1945.

Investigators: Lt. Cdr. Whipple
S/Ldr. Devons.

A. Location: Laboratory at Jakobneuharting which is 7 Km. E.S.E. of Grafing and 40 km. E.S.E. of Munich. Small workshop and experimental laboratory. No bomb damage but considerable looting. One assistant on premises. No guard on premises but road-block guard adjacent.

B. Personnel: Dr. Mentzel, Head of Establishment. Living at the Gasthof, Munster, about 15 Km. S.W., of Grafing and about 30 Km. S.E. of Munich.

Concerned with television before the war. During the war worked mostly on ground propagation in hilly country. 1937 in Reichpost, Berlin. 1940 moved to Munich where terrain was more suitable for his experience. 1943 moved to Jakobsneuharting. Interrogated. Very co-operative. Poor English.

Dr. Pollic. Made equipment for ground propagations measurements. Also worked on testing of cm. valves in conjunction with D.R.P. at Landshut.

Dipl.Ing. Hanisch. Came recently from Phys.Inst. Darmstadt where he was concerned with measurements of dielectric constants of plexiglass, particularly in region between infra-red and centimetre wavelengths. Had recently been concerned with methods of excitation of mm. waves. Interrogated. Limited co-operation.

Dipl.Ing. Rechl and Dipl.Ing. Sellesek. Recent recruits from Technical High Schools. Assistants to above. Interrogated.

C. Ground Propagation in Hilly Country (Drs. Merzel, Pollic)

Experiments were done with a "model valley" 8 metres long by 1 metre wide by 2 metres high and with a wavelength of 50 cm.

The results were in accordance with theoretical expectations; in fact, the experiments were simply open sided wave guide propagation at a long wavelength. (Report on this work published in T.F.T. 23, 4, (1944) p. 63-78). Dr. Mentzel had intended continuing this work by observations in actual valleys (two sites, one near Garmisch and the other between Bad Reichenhall and Berchtesgarten had been chosen) at wavelengths between 20 and 100 metres.

Dr. Mentzel also stated that the reception of Mexico and U.S. on the 20 - 90 metre band at Berlin was poor whereas that at Munich had been much better, there being approximately only one fifth the number of atmospheric disturbances at the latter place. This was explained by the fact that the Great circle from Mexico to Berlin passed nearer the North Pole than that to Munich. As a result of this Mentzel stated that a number of 20-30 meter stations had been built in S. Germany during the war.

He also stated that D.R.P. stations were situated at Rostoch, Weimar and Grafing for measuring ionosphere height (with 30-100 metres wavelengths) and correlating this with long range reception. All correlation of D.R.P. propagation work was stated by Mentzel to have been completed by Dr. Beckmann at Bernreid who had the contacts with the Zentralstelle für Funkberatung and the Reichsrundfunkgesellschaft.

D. Centimeter Tube Development (Dr. G. Pollic) - Pollic was concerned with testing the special magnetrons and magnetron diodes which were made at D.R.P. Landshut, for Reichpost Propagation work. The information he gave regarding the operation of these tubes agreed with that given more fully by Dr. Collas at Landshut and described earlier in this report.

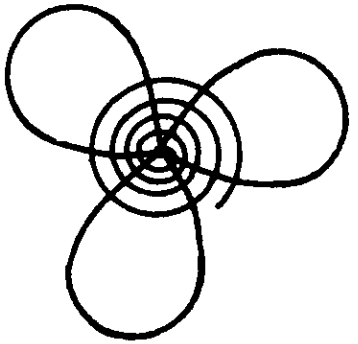
Dipl.Ing. Hamisch. Following a suggestion by Dr. Becker of the publishing firm in Leipzig (now living at Tarnbach/Leithartz near Gotha) attempts were being made to generate wavelengths of a few tenths of a millimeter. The exact methods to be used were not clear, electrical and short wave ultra-sonic excitation being mentioned. Harnisch had previously been working on the measurement of dielectric constants of solids by optical methods at about 3000 and at centimeter wavelengths by transmission line measurements. He had been particularly interested in measurement of dipole moments of polymers and had been looking for resonant absorption phenomena in the 0.1 to 1.0 mm. wavelength. So far most of the work had been theoretical, the only evidence of experimental work being a large 30 cm. paraffin wax lens. It was stated that this work was purely academic, the aim being to link up infra-red technique with centimeter R.F. technique.

E. Spiral Antenna (Dip.Ing. Rechl.)

Rechl had begun elementary work on the design of a broad band antenna which was being done at instigation of B.H.F. The aim was to make an aerial aperiodic from 50 to 200 metres, particularly for vertical transmission.

A model had been made for 50 cms. working with a diam. of 2 metres and spacing between turns of 25 cm (i.e. approx. 4 turns).

Only measurements of polar diagrams had so far been made (no impedance measurements). The spiral antenna in these experiments was placed about 2 metres above the ground. It was found that the polar diagram in the plane of the spiral consisted of three rather irregular lobes. Near the ground the radiation was mostly horizontally polarised but as 3 metres above the ground it was mostly vertically polarised.



The experiments appear to be in a very early state and the design of the antenna so far was purely empirical.

Report on Visit to D.R.P., Bernried, on 4-6-45

A. Verkley, Ramm

B. 1. Scharrer Villa, single storey undamaged country house in Bernried, map reference Sheet X5, Y 660250.

Three small laboratories on first floor, considerably looted. Some disorder of laboratories due to German Army attempting to make a hospital of the house (much hospital furniture on ground floor).

2. Personnel: Dr. Beckmann, of Der Schloss, Bernried. Interrogated. Not enthusiastically co-operative. No English. In charge of station.

Dipl.Ing. Neubauer, not interrogated. Whereabouts not known to Beckmann.

3. Documents: Many records, photographic and graphical, of tests carried out for about 2 years. None removed.

C. 1. Work was observations on ionosphere for determination of best communications frequencies. Laboratories contained conventional equipment for measurements on long and medium wave bands; a large frame aerial and receiver for D.F. on long waves; a Lorenz-built magnetometer for continuous records of earth's magnetic field.

Building guarded by local division.

Suggest personnel should be allowed to collect apparatus together pending resumption of work, which has useful aspect to wireless communications generally. Guard could then be released.

Investigation of F.d.D.R.P. Bernried and Interrogation of Dr. Phil B. Beckmann

Captain Ramm and Capt. Verkley - June 6th, 1945.
Lt. Cdr. Whipple - June 13th, 1945.

Location

On top floor of Scharrer Villa at Bernried on Wurmsee, 10 miles S. of Starmberg.

Personnel. Dr. Phil B. Beckmann and assistants.

General

The station moved out from Munich to Bernried in 1943. It was the chief ionospheric research station of the D.R.P. and besides the measurements which were actually made there it was the co-ordinating centre for all D.R.P. ionospheric stations, e.g. Grafing, Kuhlungsborn, (Baltic), Leggefeld (Weimar). Results from these stations were sent daily by teleprinter to Bernried. Monthly forecasts were made of critical frequencies and broadcasting conditions generally and warnings were given of abnormal conditions. For prediction of abnormal conditions use was made of cosmic ray, sunspot and magnetic data. The forecasts and warnings were sent to the broadcasting stations. Systematic measurements were made at Bernried of field strengths at medium and high frequencies, in order to obtain information about ionospheric absorption. There was also a pulse transmitter for critical frequency measurements, a large D/F loop for scatter measurements on long waves, a Lorenz magnetometer, and a teleprinter.

For the field strength measurements a receiver was tuned automatically through a band equal to 10% of the mid frequency during a period of 5 minutes: at the end of the 5 minutes period it was retuned to the original frequency and the process repeated. The receiver tuning mechanism also moved a small lamp vertically so that the position of the lamp corresponded to the frequency. A beam from this lamp was focussed onto a photographic film which moved past slowly in a horizontal direction. The brightness of this beam was regulated by a diaphragm whose aperture was proportional to the receiver signal strength. Thus any transmitting station whose frequency lay in the band covered left a dark trace and the darkness of this trace was proportional to the strength of the received signal.

The station has been fairly badly looted and is in considerable disorder but there is at present a guard. Dr. Beckmann is not allowed to visit the institute.

It is strongly recommended that Dr. Beckmann should be allowed to enter the institute to collect together his apparatus and to resume work as soon as possible. If the locks were repaired it would be unnecessary to retain the guard.

Interrogation of Dr. Beckmann

Address: Der Schloss, Bernried.

A. General

From 1935 to 1939 he worked for the Heinrich Hertz Institut (Berlin) and made ionospheric measurements at Puscov near Schaamitzelser. Whilst here he took his doctor's degree. In 1939 the H.H. Institute changed its name to "Institut für Schwingungsforschung" and the ionospheric work was taken over by the D.R.P. In 1940 he came to Munich and started to work with Dr. Vilbig. In 1943 he set up the new station at Bernried.

He is very co-operative but speaks little English.

He has written a large number of papers on the ionosphere and has made special studies of absorption, influence of Northern Lights, scattering and so on. A list of his published papers is given below. Besides this he has written a book on the ionosphere. (Der Ausbreitung der Elektromagnetischer Wellen: Akademische Verlagsgesellschaft, Becker und Erler Kom-Ges Leipzig, 1940). A second edition of this work was destroyed in an air raid on Leipzig.

He said that the principal work of the station at Bernried could be listed under the following headings:

1. Warning of Radio disturbances.
2. Forecasting of suitable frequencies for normal conditions.
3. Scattered radiation in the skip zone.
4. Disturbances due to Northern Lights.
5. "Black Out" (Mögel - Dillinger Effect).
6. Abnormal E.

B. Forecasting disturbances

Forecasting of Long (27 day) and Short (3 day) delayed disturbances.

(a) For this purpose a close study was made of intensity and distribution in position and frequency of disturbances. In contrast with other stations observations were made not only of critical frequency but also of absorption at all frequencies. By this means it was possible to distinguish the effects of disturbances above and below the E layers.

(b) The reflection coefficient of the ionosphere was studied both before and during storms. For this purpose use was made both of pulse technique and of the wave form of the leading and trailing edges of noise signals from distant transmitters. The approach of disturbances could be determined by studying transmission from N. and E.

(c) Connection between periodicity and intensity of disturbances. Under certain circumstances disturbances tend to repeat after 27 days. This is particularly so with those which increase and decrease slowly and steadily.

(d) Investigation of disturbances due to ionospheric phenomena, namely contraction of the layers, giving an apparently greater charge density and reflection coefficient.

(e) Investigation of unusual increases in intensity of soft cosmic rays before disturbances, and their use for prognosis.

(f) Investigation of connection between disturbances and scattering.

C. Forecasting of Useful Frequencies for Normal Conditions

(a) Determination of daily and yearly alterations of the ionosphere by means of echo measurements since 1933. The measurements of D.R.P. began in 1938. Material for the years 1933 - 1938 was taken over from the Heinrich Hurtz institute.

(b) Comparison of these measurements with measurements at oblique incidence. This knowledge was required for long distance communication for which satisfactory results were not always available.

(c) From the experience thereby gained and comparison with the Sun spot cycle it was possible to forecast variations in the useful frequencies.

D. Scattering and Skip Zone

The following were measured and worked out.

(a) Field strength of scatter radiation on different circuits.
(b) Dependence on geographical latitude.
(c) Daily, annual, and secular variations.
(d) Oscillograms to determine the duration of scatter pulses.
(e) Connection between scattering and disturbances.
(f) Correction to critical frequencies when scatter intensity is high.

E. Disturbances due to Northern Lights

The effect of Northern lights and Magnetic storms on the ionosphere was investigated, in particular with regard to latitude.

F. Investigation of Dillinger Effect

Continuous observations were made, in particular the different effects on different transmission circuits.

G. PUBLICATIONS

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2) Leithauser und Beckmann
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3) Leithauser und Beckmann
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4) Leithuaser und Beckmann
Uber Beziehung der Ionospharenschichten zu meteorologischen Einflussen Zeitschr.f.t.P. 18 (1937) S.59-61.

5) Beckmann, Menzel und Vilbig
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6) Beckmann B.
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7) Beckmann, Menzel und Vilbig
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8) Beckmann B.
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9) Beckmann, Menzel und Vilbig
Uber die Ausbreitung der Nordlichstorung und den hierdurch entstehenden Breiteneffekt
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13) B.M. und V.
Uber Vorgange in der Ionosphare, die wahrend die Nordlichtausbruches am 25 Jan. 1938 in mittleren Breiten (52°) festgestellt wurden.
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T.F.F. und F. 29 (1940) S.106-117.

15) Beckmann B.
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16) B.M. und V.
Grenzwellen und Streustrahlung in der Funkausbreitung
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17) Beckmann und Grosskopf
Ultrakurzwellenausbreitung Fortschritte der Hochfrequenztechnik Bd. 1 1941 Leipzig Akademische Verlagsges. Herausgegeben von Vilbig und Zenneck Seite 145-186.

18) Beckmann B.
Der Mogel-Dellinger-Effekt
Fortschritte der Hochfrequenztechnik Bd.1 1941 Leipzig Akad. Verlags. S.2-50.

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Fort. der Hochfr. Bd.2 1943
S.1 bis 44.

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21) Vilbig, Beckmann und Menzel
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22) Beckmann B.
Die Ausbreitung der elektromagnetischen Wellen Bucherei der Hochfrequeztechnik Bd. 1
Akad. Verlagsges.Leipzig 1940 1.Aufl. 2.Aufl. - in the press
Herausgegeben von J. Zenneck.

F.d.D.R.P. at Wank

Lt.Cdr. Whipple June 15th, 1945.

Location: Mountain N.E. of Garmisch. Approached by cable railway from Garmisch.

Director: Dip.Ing. Keltenbrucher.

It was learned that all the apparatus from this station has been removed a fortnight previously by the U.S. Army and taken to Augsburg. The officer who had removed the apparatus (Major Hazeon of the Signals Corps) had since left Garmisch and it was not possible to learn any details.

It is believed that experiments were to be carried out at 4 and 1.8 cms. on transmission from Wank to Garmisch. The laboratory was situated in one room of the Berg Hotel, Wank.

Apparently there were no results and the apparatus was of no particular interest. It is believed that Keltenbrucher is in Munich (41 Hofenfels Strasse) but he has not been interrogated.

F.d.D.R.P. (Predigstuhl)

Investigation May 27th. S/Ldr. S. Devons and Mr. R. Bender

Location. At the top of the cable railway from Bad Reichenall, 10 m. South of Salzburg (Alt. about 5,000').
No damage at all. Station in normal operation.

Personnel. Dip.Phys. Augustine assisted by his wife. Lives in premises. Makes most of his own equipment. Very co-operative. A little English.

Technical. This station was operated under the direction of Dr. Beckmann of D.R.P. Bernried. The primary purpose was the continual observation of the soft components of cosmic rays and the correlating of the observed bursts of cosmic ray ionisation with prediction of ionosphere changes. Measurements were made with 4 Geiger counters (about 3" x 30") filled with alcohol vapour at about 8 mm pressure, and with end walls consisting of 2 mm. aluminium sheets. Normal electronic counters and a self-printing relay mechanism record the counts every half-hour. Two counters are connected for coincident measurements.

Two ionisation chambers were used, one about 20 x 10 cm. and the other 30 x 15 cm. Both are filled with Xenon at about 15 atmospheres and shielded from ground radiation by about 1" of lead. An electrometer recording the ionisation is photographically recorded and recharged every fifteen minutes. In general the technique is quite usual.

In addition a short-wave receiver is kept on the station for direct correlation on the spot.

Complete records have been kept for the past two years and it is recommended that the station be kept in operation. Augustine claimed that stray burst of cosmic radiation could be used to predict anomalous ionospheric propagation about 2 days ahead. He transmitted his result to Dr. Beckmann at Bernried.

Dr. Mentzel (Jakobneuharting) stated that these predictions were only qualitatively reliable in about 60% of the cases.

DEUTSCHE REICHPOST, AACH, near RADOLFZELL

(Sheet K3, Schwenningen: 1:100,000. Grid Ref. W.8316)

Investigators' Names: Mr. R. M. Whitmer, O.S.R.D.
Lt. P. Redgment, R.N.V.R.
Capt. M. Snowden, R.R.D.E.
F/Lt. R. G. Silversides, R.A.F.

Date of Investigation: 8.6.45.

Staff Interrogated: Dipl. Ing. Schutte.
Dipl. Ing. Gerhardt Brauer.

The laboratories are in the charge of Dr. Georg Weiss, but he was not present at the interrogation.

Full Name of Establishment:

Forschungs Anstalt der D.R.P., Post Dienstelle. F.

Synopsis of Subjects Discussed

A. Television
B. Control of Glide Bombs
C. Electron Multipliers
D. Klystrons
E. Magnetrons
F. Hela. (Broad band intercept receiver)

A. Television

Work on television was first commenced in 1936 in Berlin, in connection with Fernseh GmbH., on a research basis, production being done at the Fernseh firm. The Post Dienstelle moved to Aach in October 1943. Recent work has been done on television for use in guided missiles. For this purpose a system employing 221 lines, not interlaced, 25 pictures per second, and having a bandwidth of 2.5 mc/s. was developed. The scan was vertical in order to secure improved resolution on the horizon.

The equipment was inspected and later demonstrated, and the colour and definition found to be very good. The commercial system worked on in pre war days however, employed a 441 line scan, interlaced to give 25 pictures and 50 frames per second.

Future work was directed towards the development of a high definition television system, employing a 1000 line picture, and transmissions in the decimetre band. This was undertaken as a war contract, but no immediate application for the war effort was

known. For this work, a lighthouse type triode oscillator had been used as transmitter on a wavelength of 30 cm., and could be used down to 15 cm. At 30 cm., 25 watts at 40% efficiency were obtained, whilst at 15 cm., 25% efficiency was obtained with corresponding reduction in output.

A second project for the future was the development of an ultra small television camera and transmitter for use in an anti-aircraft rocket - intended to guide the rocket into a concentration of bombers.

No work on colour television or single sideband television transmission had been undertaken here. (Colour television research was going on at the D.R.P. Breslau.)

B. Control of Glide Bombs

It was stated that the development of the transmitter and receiver for the HS.293 Glide Bomb had been carried out here. Detailed reports on this have already appeared elsewhere.

C. Electron Multipliers

Development had been carried out on two types of electron multipliers at the Dienstelle. The one employing the familiar "Weiss" plane grid type of construction, the other a system of successive plates as developed by Zworykin. Both types employed purely electrostatic constraint of the electron beam. The Weiss type had been used only with photocathodes, whilst the Zworykin type had been developed to use both photo and thermionic cathodes. It was found that with the photocathode, a tube life of 1000 hours was common, but with the thermionic types, 200 hours was a normal figure, whilst occasionally 500 hours was obtained.

Secondary emitter surfaces were of a silver magnesium alloy, the percentage of magnesium being between 1 & 3% depending on the nature of the cathode employed. Ten to fifteen stages were commonly employed, and a gain of three per stage, (current gain) was obtained. With the secondary emitting surfaces heated to between 400 and 500 degs. C., however, stage gains of up to 15 per stage had been recorded. This work however was still in the experimental stages, and only continuously evacuated tubes had so far been tested. All these measurements were made under static conditions, i.e., with very low frequencies or D.C.

The tubes were designed for use in wide band video amplifiers (up to 10 mc/s.), tests on which were not carried out at the Dienstelle. The Navy had some of these, but what use was made of them was unknown to our informants.

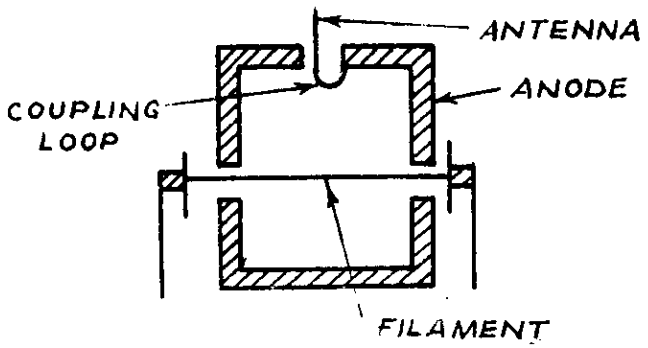
D. Klystrons

A single klystron had been developed here, employing a double internal resonator with inductive coupling between the two sections. Using a voltage of 5 kv. an output of 100 watts at 10% efficiency was obtained. The tube is water cooled. Provision was made for modulating the tube on the accelerating grid (200v modulation). Noise modulation (spectrum 1 to 3 mc/s.) was employed, using variously a hexode mixer tube, a gas discharge tube, and a resistance as sources of noise. Five or six such tubes were constructed at the Dienstelle, no quantity production being carried out anywhere.

The few tubes made were employed by the Luftwaffe in the Feuerballe jammer, used for jamming H2S, the frequency range being 8.6 to 9.3 cm. The whole of the Feuerballe jammer was developed at the Dienstelle, with the exception of the antenna. It was reported that one of these sets had been used at Leuna.

E. Magnetrons

A magnetron had been developed which could be operated at any of several discrete wavelengths between 2.6 and 6.3 cm. The anode is a closed cylinder, the interior of which forms the oscillator cavity. The desired mode of oscillation is selected by adjusting the anode voltage, and the intensity and direction of the magnetic field. For some modes, the angle between the magnetic field and the cathode may be as much as 3 degrees. A small hole in the surface of the anode permits the insertion of a coupling loop, which is extended outside the anode but within the envelope, to form an antenna. The operating voltage is 2 to 3 kv., and the magnetic field 2000 to 5000 gauss. The efficiency of the tube for which the power output is not known, is said to be 0.5%.



This tube has been used as a C.W. oscillator for testing search receivers. Two sample tubes were brought away.

F. Hela

This is a warning receiver which has been used in the range 10 cm. to 2 metres. Three dipole systems were used to cover

the R.F. band, each covering a 3:1 frequency range. The German Navy had apparently produced an additional antenna system which had directional properties.

The receiver employs a crystal detector and an amplifier which covers the band from 30 to 300 kc/s. C.R.T. presentation employing a triggered time base with five available sweep speeds suitable for p.r.f. from 15 per sec. to 2 or 3 kc/s could be used, or a second detector and an audio system. The gain of the amplifier was such that noise could be observed, but the overall sensitivity was very low.

This equipment was inspected and seen working in the laboratory. Further developments of the system were in progress, and examples of experimental models were seen. One incorporated an amplifier of reduced size, particularly for use in aircraft and submarines. In the other, both the upper and lower limits of the amplifier pass band were independently adjustable by the operator, the optimum limits of which had apparently not yet been established. The object of this last development was to obtain some sort of discrimination on the basis of pulse width in addition to that provided by p.r.f.

Target Number or Disignation: Opportunity.

Name of Target: German scientist, Dr. Schaefer.

Type of Target: Radar.

Location: Bad Kissingen.

Date of Investigation: 29th June, 1945.

Physical condition of target: Intact.

Investigators: C. J. Carter,
M. V. Wilkes.

A.T.I. section at Bad Kissingen stated that the actual target was the laboratory for Dr. Schnittger of Alter Muhberg, Gehlberg, Nr. Oberhof in the Erfurt district. Dr. Schnittger is a member of the Reichpost organisation.

On investigation it transpired that Dr. Schnittger was not working on radar camouflage but that another Reichpost section, under Dr. Riedinger had done some work on this subject. Dr. Schnittger knew just sufficient of her colleague's work to indicate that he was not working on a lacquer, but upon the camouflage built up of alternate layers of special dielectric and "lossy" foil, of which we already have considerable information and samples.

The laboratory at Gehlberg was actually concerned with the design of magnetrons and klystrons and was well equipped for this purpose. It was evacuated from Berlin 18 months ago with a staff of three physicists and about 20 assistants, and its staff had been increased by 12 shortly before the fall of Berlin. The aim of the Klystron development appears to have been the jamming of H_2S. At present the Reichpost Klystrons are stated to give 100 watts C.W. output at 9.1 cms. being tuneable from 8.5 cms to 9.8 cms, with not more than 10% loss of power output. This is a water cooled Klystron and would appear to be considerably behind the latest British design. Input power for this Klystron is stated to be 400 m/a at 4KV. Details were obtained of the method used for tuning both rhumbatrons. Work was proceeding on a 3 cm. Klystron but no success had so far been obtained.

The work on magnetrons was initially an attempt to copy British designs slavishly and this would appear to have been reasonably successful, on both 9.1 cms and 3.2 cms. Owing to the high cost of producing these magnetrons, and the demand for large numbers of them for training equipment for NAXOS operators, an alternative design had been developed. This was basically the same as the copper block design, but with the block replaced by cylinders of sheets metal, and the whole magnetron sealed in a glass envelope.

In the magnetron it was claimed that half the output power of the copper block design could be obtained.

With this design a 9mm magnetron had been successfully developed and gave an output of half KW (pulse).

Further magnetron work had been to continue research on the more conventional type of magnetron, and here with a simple cylinder sealed off in a glass tube, 100 micro watts had been obtained on 2 cms.

Dr. Schnittger is packing up his equipment and hoping for instructions to move immediately.