DOCUMENT

*High-definition Television, Big Screen Television and Television-guided Missiles, 1945**

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The following excerpt provides an example of immediate post-war technical intelligence reports regarding, among other things, television, generated by BIOS, FIAT (Field Intelligence Agency, Technical Division—a US operation) and CIOS (Combined Intelligence Objectives Sub-Committee—a joint US–UK operation). Based on on-site interrogations and visual inspection often occurring within days of German troop surrender or withdrawal, the reports were often highly technical in nature. The composite picture which emerges from the many scientists and technicians who were interviewed, together with the physical inspections of factories, laboratories and equipment, provides one of the best available views of German television developments after the closing down of trade publications in the early 1940s. Not only do reports such as the following provide some indication of the scale of technical operations and institutional interdependence (amongst Telefunken, Blaupunkt, Fernseh A.G., Siemens), but they also allude to the developmental pressures and constraints which gave German television its distinct character.

The following segment of a report on one of the *Deutsche Reichspost's* (the German Ministry of Posts was charged with the technical development and co-ordination of television) laboratories suggests the range of its television research and development: from projection television for entertainment of troops in hospitals and theatres, to television as a projectile, with missile guidance systems; or from high-definition 1029-line television, to low-definition miniature super-iconoscope cameras for weapons systems. Also, a somewhat less tangible but nonetheless distinct sense of mentality frequently emerges as American, British and German experts, often pre-war colleagues in the then pioneering stage of television's development, catch up on one another's technical advances and solutions to shared problems. This 'flavour' appears as much in the direction and phrasing of questions as it does in on-site demonstrations, as in the targeting of the *Tonne* missile-guidance system on a picture of a girl's face which follows. The document is based on the reports made by E. Redpath (Assistant Director of Radio Production, MAP), J. Dyson, T. M. C. Lance, G. W. Edwards, D. Weighton and P. H. Spagnoletti in the course of BIOS trip number 1892 made between 16

**Television Development and Application in Germany,* British Intelligence Objectives Sub-Committee (BIOS) Final Report No. 867. *Cornell University,* Library access TZ6 G3 G75+ #867.

February and 20 March 1946. the following report is based on an investigation of the *Deutsche Reichspost* laboratories in Aach near Singen, dated 4 March 1946, and is drawn from pages 10 through 15 of the final report.

From: Television Development and Application in Germany, Deutsche Reichspost, Aach

This laboratory was established at Aach in 1943, having been dispersed from Berlin, and there originally a staff of 70 to 75 was employed, only about 30 of whom remained. Work is now confined to the manufacture of school laboratory apparatus and studio equipment for the radio broadcasting station at Baden-Baden. The organisation is shortly to be moved to Rastatt, and the staff will probably be increased to about 50, depending upon policy in regard to German reconstruction. The laboratory appeared to be fairly well equipped.

During the war the group—under Dr Weiss—has worked on the following projects:

(1) Television, including wide-band amplifiers, secondary-emission multipliers, and the establishment and maintenance of the hospital service in Berlin.
(2) *Naxos*, a search receiver for use on submarines to detect enemy radar transmission.
(3) Radar, including aerials and feeders, also copies of American 9 c. m. and 3 c. m. magnetrons and klystrons.
(4) Testing and trial of *Tonne* (television-guided missile, editor).

The following persons were interviewed: Dr Georg Weiss—Chief of the Laboratory; Dr Gossel—Deputy to Dr Weiss; Dr Herman Weber. Captain Munsch of the French Marine Nationale was present throughout the discussion.

Berlin Hospital Television Service (Transmitter)

The Berlin transmitter at Witzleben was operated until it was destroyed by bombing in 943, and supplied a six-hour programme daily—one and a half hours of which was live' programme—for entertainment of troops in hospital. A total of 25 cameras including one super-iconoscope) and three pairs of film scanners were available, ogether with two vans for outside televising.

Studio illumination was normally between 1500 to 2000 lux with a maximum of 000. The super-iconoscope has been found to be five times more sensitive than the ormal iconoscope, and on outside broadcasts had been operated on 180 lux with 10% oise level.

Of the film scanners, one pair were Mechau projectors using iconoscopes. Additional onstant illumination was used to reduce 'tilt' and 'bend'. This combination gave best esults when specially printed light-density films were available. The other film anners were two of the Ernmann system (presumably the double-prism apparatus reviously described in *Fernsehhausmitteilungen*, April 1939) supplied by Fernseh AG, nd two Mechau projectors with cathode-ray tube scanning. The scanning tubes were ade by Telefunken with calcium silicate screens, the afterglow being corrected by a ree-section electrical filter. The maximum attainable frequency with CRT scanning as 2.4 Mc/s.

The larger O. B. van and the installation at the *Deutschlandhaus* were provided with nchronising pulse generators, the synchronising signal being carried on separate

cables. Tests had been made on O. B. using a system in which the synchronising pulses for camera scanning were picked up by radio from the main transmitter by means of a receiver in the van. A variable delay for the synchronising pulses was included in the van equipment to allow for propogation (*sic*) time. This was effected by means of a sine waveform.

Owing to lack of facilities the programme was, on occasion, transmitted back to Witzleben via a 76 cm radio link over distances up to 3 km, thence by cable on 4.2 Mc/s carrier using the lower sideband for a further distance of up to 4 km to the main transmitter. When these arrangments were in use, the modulation was restricted to between 10% and 90%, but quality was stated to have been very good. The bandwidth of all the video apparatus extended to 3 Mc/s, but this was limited for carrier working with vision and sound to a vision bandwidth of 2.2 Mc/s.

In addition to the normal broadcast transmitter, co-axial cables were provided for connection to certain centres. The programme was transmitted on a standard carrier frequency of 4.2 Mc/s (lower side-band only). This was the standard I. F. for receivers and could be fed direct to their I. F. amplifiers. Repeaters built by Siemens were used where necessary, with compensation for cable characteristics. From these centres, connection was sometimes provided to other groups of receivers over normal 600 ohm telephone circuits, provision being made for compensation every 1.7 km of approximately 30/1 over the band. In one particular case, a large cinema equipped with projection apparatus, the signal was supplied by co-axial cable at a carrier frequency of 8.4 Mc/s.

Berlin Hospital Television Service Receivers

When production of receivers was stopped in 1940, approximately 600 Einheits-emfanger (*sic*) were in service and about 1000 other sets of earlier proprietary designs. Details of the Einheits-empfanger and manufacturing arrangements have been described in *Telegraphen—Fernsprech—Funk—und Fernseh Technik*, Vol. 28, July 1939 . . . .

Berlin Hospital Service Projection Apparatus

In order to provide entertainment for the maximum number of troops, several centres in Berlin were fitted with projection equipment. The following information was obtained relative to four types of projectors employed.

(1) The largest cinema (in Turmstrasse) with 800 seats was equipped with the Fernseh apparatus first shown at the Funkaustellung in 1938. The special Fernseh directional lenticular screen measuring 5 m × 4 m was installed here. The projection tube had a water-cooled metal-based screen, approximately 10 cm × 10 cm, with a final anode potential of 80 kV . . . .
(2) A smaller cinema, with seating capacity for 300, was provided with a 2.5 m × 2 m screen (probably Telefunken) formed by bending a glass sheet 8 mm thick to a spherical surface of about 10 m radius. The glass was silvered on the back and no treatment other than slight grinding of the front surface seems to have been attempted, but this apparently gave no improvement in results. Approximately 10–12 lux was measured incident on the screen and the image as seen by the spectators was stated to be about 1/10 of the brightness of a normal cinema

picture. These spectators were accommodated in a particular section of the cinema where the image was satisfactory. As the picture was not visible from the projector, remote control was provided for the operator who occupied a position amongst the spectators....

(3) The next smaller size of projector was made by Fernseh and employed a directional reflecting screen 1 m square with a horizontal angle of 50° and vertical angle of 20°. The screen consisted of a flexible sheet of transparent material, 1.5 mm thick, backed by white linen and embossed on the front surface with horizontal cylindrical lenticules, three per picture line. Small glass 'pearls' were embedded in the screen material, several of them in the height of each lenticule. The cost of this screen was estimated by Dr Weiss to be about 800 RM (£25 sterling). When not in use the screen could be rolled up....

(4) Another small type of projection set was used in Berlin. This employed a ground-glass translucent screen but results were not completely satisfactory, owing to 'flare spot'....

1029-Line Television System

Some experimental work was carried out early in the war on a 1029-line system, but was stopped at an early stage, as it had no direct military application of sufficient importance. Dr Weiss was of the opinion that directly viewed cathode-ray tubes were, in general, good enough to deal satisfactorily with 1000-line definition but that better focus was required on the associated iconoscopes than that normally obtained. The main problem, however, was the loss in sensitivity in the camera. Because of this, 10,000 lux was required in the studio to produce results similar to those obtained on a 441-line system with only 2000 lux in the studio, a normal type of iconoscope being used in both cases. Little work has been done in Germany on orthicon development but the Compagnie des Compteurs in Paris had done some work on these tubes under the direction of D.R.P. (*Deutsche Reichspost*)....

Demonstration of *Tonne*

According to Dr Weiss, the 441-line system was never employed for *Tonne* owing to the difficulties of interlaced scanning. The diagonal scanning system never got beyond the laboratory stage at Fernseh and many difficulties were anticipated by Dr Weiss.

The alignment of the missile equipment with the parent receiver in *Tonne I* was effected, before the release of the missile, by means of a small circle on the iconoscope mosaic which was centred on the receiver cathode ray tube controls which operated, in the case of the line scan, by phase-shift of the synchronising signal and in the frame scan by interruption at some point in the divider chain, until the frame attained the correct position.

The operation of a complete *Tonne I* equipment was demonstrated, the video connection only being employed, but including the *Tonne* synchronising system.

The subject was a picture of a girl's head, about 9 ins square, at a distance of about 6 ft from the head of the projectile, (i.e. the front lens of the camera); the illumination being provided by a 500-watt lamp with reflector placed about 8 ft away from the subject. The standard *Tonne* lens used (f/3.5) (*sic*).

The picture was very steady and phase adjustment appeared to be easy. Contrast on the receiver tube was good, and the focus capable of dealing with at least twice the number of lines used. Definition along the line was estimated to be equivalent to 300-line quality.

It was explained that vertical scanning was preferred since the subject usually consisted of a horizontally divided field, half white and half dark (i.e. the sky and sea divided by the line of the horizon). By scanning vertically, the low-frequency content of the transmitted waveform was kept low with consequent avoidance of large components in the amplifier.

(Although according to most reports, the *Tonne* system was never put into operational field use, reports from the Fernseh and Blaupunkt Laboratories, which employed up to 800 people (BIOS No. 867: Taufkirchen, Nr. Munich), indicated far more positive results than those discussed by Dr Weiss. Indeed, *Tonne* developments reached the point where limited mass production had begun on miniaturised super-iconoscope camera tubes for the missile. An excerpt from that report follows. (William Uricchio)

> During the final months of production 300 tubes per month were being manufactured by semi-skilled labour (women) with a yield of approximately 200 completely satisfactory tubes—i.e., tubes having good definition and contrast, no spots and non-microphonic. In the initial manufacturing stages the 'shrinkage' was 90% (BIOS No. 867, p. 7).

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