CHAPTER 1

Luftwaffe Funkmess-, Jägerleit- and *Funkaufklärungsgeräte.*

Luftwaffe electronic equipment presents somewhat of a problem from a historian's point of view. The preserved documentation is not complete, this to a point where photos of hitherto unknown types and versions were still coming to light as late as 1994. The best description of known equipment is contained in the fine works of Herr F. Trenkle (1). However, photographic and written evidence has surfaced since 1989 proving the past existence of types of equipment not always described in the published sources. On the following pages is depicted the equipment, which is known to have been operated by the *Ln-Dienst* in Denmark. All drawings are based on sources of the first order i.e. photos, original German material or first hand Danish or allied post war reports (2).

Of particular note are the following systems:

- The Freya LZ Verbunkert, FuMG 401 ?. This differs from other LZ versions in being mounted on a concrete foundation and not on the standard cruciform, metal legs (11). Further it has no operators cabin mounted; the display equipment was placed in a nearby operations bunker constructed of concrete or bricks. This radar may have had a PPI display. From photographic evidence it is known, that this system was deployed at LAMA and ROBBE (3). It is noteworthy, that the concrete foundation (chapter 2, drawing 32) is always associated with the building depicted in chapter 2, drawing 21. This foundation/building combination is also found in HABICHT, RINGELNATTER and BÜFFEL although there is no evidence of deployment of the Freya LZ Verbunkert to these sites.

- The Freya LZ, FuMG 401 C (Variant) with an enlarged antenna. It is known from two post-war reports that this system worked on a frequency of 50 - 57 Mcs. (4). This system was deployed at FAUN and AAR (5).

- The Hans *E-mess Geräte* towers. The only published configuration until now was a simple pole with the antenna mounted on the top. Ground photos and field surveys have, however, established the existence of the two configurations depicted (6).

- An unknown version of the Freya-EGON with broad band dipoles photographed by COL (ret) F. G. Tillisch.

- The Naxburg, which has been depicted in the works of Herr F. Trenkle, but which otherwise, has escaped publicity (7).

Part of purpose of this volume is to describe the exact position of the constructions and equipment at the various locations and in this context electronic equipment is in particular difficult. To day all the equipment has been removed, so four avenues of approach have been used. Interview with witnesses, this is a somewhat dubious method, as very few witnesses in the nature of things can remember either the exact location or with a high degree of confidence can identify equipment seen 45 years ago. However, some witnesses have proved to a have a brilliant memory to a point where in depth, correct technical descriptions have been given of various pieces of equipment. Statements by witnesses have, however, only been used in combination with ground or aerial photography.

Ground photos are solid evidence, but often the location given of published photos have turned to be incorrect. Even when the location has been established beyond any doubt, it can still be difficult to pinpoint the position of the equipment depicted. Vegetation has grown or has been removed, and in beach areas the terrain may have changed completely. Houses, which can be seen on a photo, may have been removed or new houses have been built obscuring buildings, which at the time, when the photo was taken, were visible from the point of observation.

Aerial photos are of great value in locating systems of a certain vertical extension. The shadow of many systems is characteristic and conspicuous. As the work progressed, an iterative process resulting from the interaction between statements and ground photos, combined with the study of aerial photos from 1945 and 1954, was instrumental in the creation of a photographic interpretation database.

Based on the photo interpretation it was possible to conduct a field survey of the suspected location to look for the foundation of the equipment in question. Again an interactive process had to be used. The only foundations initially known from ground photos were those of the Würzburg Riese, The Freya-Fahrstuhl and the Heinrich *Peiler*. Although these are made of concrete, they are not mentioned, except with very few exceptions in the *Baufortschrittsplan* (see chapter 2). Furthermore none of the foundations are depicted in the known sources - published or non-published. Through the above method the following foundations were identified:

- Russel.
- See-Elefant.
- Wassermann M.
- Various Freya LZ foundations.
- Two types of Hans *E-mess Geräte* towers.

The identification of the foundations again made it possible to establish the position of electronic equipment in other sites.

Displays, operators manuals and maintenance of German electronic systems.

Before the war there was no knowledge of radar outside the small circle of personnel in the industry, *Luftwaffe* and *Kriegsmarine*, which was involved in development, production, operation and maintenance of radars. In the course of the war tens of thousands of persons were involved in the operation of this sophisticated equipment. Much of this personnel was called up and trained to perform their duties during the war. From volume 1 the reader will have a good impression of the training challenge facing the *Luftwaffe*. Again this problem was addressed in a very systematic way.

Until very late in the war German radarsystems were not equipped with a Plan Position Indicator (PPI) where the air situation is depicted superimposed on a simplified map depicting the geography surrounding the site. Instead a number of Alphascopes were used to present coarse range, fine range, coarse bearing and fine bearing. All the radars described on the following pages except Freya Verbunkert, Dreh-Freya and Jagdschloss, were equipped with the display equipment just described. The display equipment was – needles to say – standardized and of a modular design. It is thus virtually impossible from a picture alone to ascertain the origin in relation to a specific radar of a specific piece of display equipment. The equipment was mounted in a box with a quick-disconnect socket at the back, which was mounted in one or more standard racks. Each box was given a designation and a popular name in order to ease maintenance reporting (12).

All operator's manuals were written with identical tables of content and they were brief and to the point. They gave a general description of the equipment and a complete checklist for performing all functions. Additionally a complete example is given of a correct and an incorrect adherence to the checklist. The manual on the Jagdschloss consist of 16 pages (sic) (13). An operator's manual on a modern video recorder is considerably more complex, than the manual on the most modern *Luftwaffe* air warning radar used during the Second World War. One operator was assigned to operate one piece of equipment. This of course greatly eased the training period, but it was also a necessity due to the way in which the radar was slewed manually by the operator. The operator performing a specific function was always given the same designation irrespective of the type of radar, and when a shift reported for duty they always lined up and entered the operator's cabin in a standardized sequence. In some cabins, like e.g. the Freya LZ, there was simply insufficient room for one operator to pass another.

No documentation has been found in relation to radar maintenance at the Intermediate and Depot level. However a list of ***Feldpost*** numbers clearly indicates the existence of such an organization subordinate to the ***Luftgau***, as several units named ***Sammel-u. Instands.Stelle f.Funkmessger***. are mentioned (14). The "maintenance procedures" at the operator's level was very simple indeed. "Turn the power switch on". "If green light is lit continue operation, if red light is lit switch off and call maintenance". When maintenance was called, the operator would state the codename of "the box", and a technician would arrive carrying a replacement. Thanks to the quick disconnect socket the box would be replaced in seconds and the technician would carry the box to a test station for trouble-shooting. The box was made up of 2 – 4 major subcomponents, and it is assumed, that a test-station would be used to isolate the fault to a specific subcomponent. This would then be replaced and the box would be returned to the store as a serviceable unit. The faulty subcomponent would either be repaired at unit level or sent to an Intermediate or Depot level repair facility. This is the "Line Replaceable Unit" maintenance concept announced with such fanfare by US avionics industry in the 1970'ies with the introduction of the F-16. "If you fail to learn from history . . . "

PERFORMANCE DATA

***Luftwaffe Funkmessgeräte* (Radars)**

POPULAR NAME	DESIGNATION	FREQUENCY (Mhz)	RANGE (km)	RESOLUTION		
				AZ (dg)	EL (dg)	RA (m)
Freya	FuSE 80	125	200	5.0	N/A	150
Freya A/N	FuMG 450	125	200	.5	N/A	150
Freya LZ	FuMG 401 A	121-138	250	.25	N/A	150
Freya LZ	FuMG 401 B	124-144	250	.25	N/A	150
Freya LZ	FuMG 401 C	91-100	250	.25	N/A	150
Freya LZ	FuMG 401 D	162-200	250	.25	N/A	150
Freya LZ Verbunkert	?	90	250	.25	N/A	150
Freya LZ C (var)	?	50-57	?	?	N/A	?
Freya Fahrstuhl	?	125	160	5.0	.3	150
Yagi-Freya/Köthen	?	82-88	150	?	N/A	?
Dreh-Freya	?	120-158	100	8.0	N/A	1000
Freya Flamme	FuMG 451 C	187	500	1.0	N/A	200
Jagdschloss	FuMG 404	120-158 158-240	200	5.0	N/A	500
Wassermann S	?	122-131	300	.3	.75	300
Wassermann M I	FuMG 402	136-149	300	.25	.75	100
Wassermann M II	FuMG 402	120-158	300	.25	.75	100
Wassermann M IV	FuMG 402	120-158	300	.25	.75	100
Mammut	?	120-150	300	.5	N/A	300
Würzburg-Riese	FuSE 65	560	80	.15	.15	35
Elefant/Russel	?	34-38	400	1.0	N/A	1500

Jägerleit Geräte.

POPULAR NAME	DESIGNATION	FREQUENCY (Mhz)	RANGE (km)	RESOLUTION		
				AZ (dg)	EL (dg)	RA (m)
Freya-EGON	FuSAn 731	125/156	250	0.5	N/A	300
Heinrich	FuSAn 733	38 - 42	300	1.0	N/A	N/A
Hans	FuSAn 733	38 - 42	300	N/A	N/A	300

Funkaufklärungs Geräte.

POPULAR NAME	DESIGNATION	FREQUENCY (Mhz)	RANGE (km)	RESOLUTION	
				AZ (dg)	EL (dg)
?	Lorenz UKE 1	21 - 100	N/A	0.5	N/A
Samos	FuPeil 82	90 -470	N/A	1.0	N/A
Fanö	FuPeil 90	400 - 800	N/A	1.0	N/A
Korfu 812	FuPeil 100	2500 - 3750	N/A	3.0	N/A
Korfu 274	FuPeil 100	7500 - 12000	N/A	3.0	N/A
Korfu Zwilling	?	2500 - 3750/ 7500 - 12000	N/A	3.0	N/A
Naxburg	?	2500 - 12000	N/A	0.25	0.25
Freya-Flamme	FuMG 451 e	157 - 212	500	0.5	N/A

Note (9).

Designation cross reference list.

Luftwaffe/ Old technical	*Kriegsmarine*	Popular Name	British Intelligence
FMG 39 G (gB)	FuMO 1 and 2	Calais	Coastwatcher
FMG 40 G (gD)	FuMO 3	Calais Zer-störer-Säule	Coastwatcher
?	FuMO 4	?	?
?	FuMO 5	Boulogne	Large Coastwatcher
FMG 41 G (gA)	FuMO 51	Mammut G	Small Hoarding
FMG 41 G (cF)	FuMO 52	Mammut C	Hoarding
None	FuMO 11	Renner 1	None
None	FuMO 13	Renner 3	None
None	FuMO 15	Scheer	Giant Würzburg
FuMG 41 G (gA)	FuMG 201/202	Flakleit g	
FuMG 39 T A/C/D	FuMO 211/212/213	Würzburg	Small Würzburg
FuMG 39 T-R	FuMO 214	Würzburg Riese	Giant Würzburg
None	FuMO 215	See-Riese	Giant Würzburg
FMG 39 G (fB)	FuMO 301	Freya	Freya
FMG 40 G (fB)	FuMO 302	Freya	Freya
FMG 41 G (fB) FMG 41 G (cB)	FuMO 303 FuMO 311-18	Freiburg I	Freya
FMG 42 A (cB)	FuMO 321-28	Freiburg II	
FuMG 401	?	Freya LZ	Pole Freya
FuMG 402	FuMO 331	Wassermann M I/II	Chimney (Girder type)
?	?	Wassermann M IV	Chimney (Box type)
?	?	Wassermann S	Chimney (Cylinder type)
FuMG 404	FuMO 371	Jagdschloss	Jagdschloss
?	?	See-Elefant	?
?	?	Russel	?

LEGEND

Legend used in the description of the *Stellungen* in chapter 3.

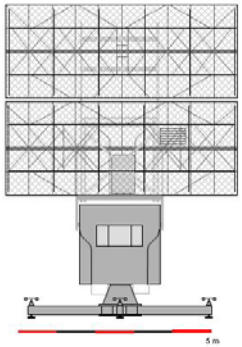
Equipment to	Legend
Dreh-Freya	DF
Freya A/N	FA
Freya LZ	FZ
Freya-EGON	FE
Freya-Fahrstuhl	FF
Freya-Flamme	FL
Freya-Köthen	FZ
Funkaufklärungs Equipment	FU
Hans *E-mess Gerät*	YE
Heinrich *Peiler*	YP
Jagdschloss	JS
Mammut	MM
Russel	RU
See-Elefant	EL
Wassermann M I/II	WM
Wassermann S	WS
Würzburg Riese	WR

Legend to	Equipment
DF	Dreh-Freya
EL	See-Elefant
FA	Freya A/N
FE	Freya-EGON
FF	Freya-Fahrstuhl
FL	Freya-Flamme
FU	*Funkaufklärungs* Equipment
FZ	Freya LZ
FZ	Freya-Köthen
JS	Jagdschloss
MM	Mammut
RU	Russel
WM	Wassermann M I/II
WR	Würzburg Riese
WS	Wassermann S
YE	Hans *E-mess Gerät*
YP	Heinrich *Peiler*

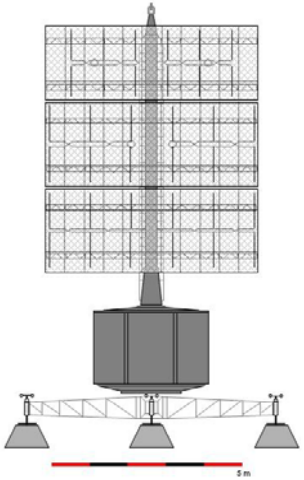
ANNEX

Depiction of the electronic equipment used by the *Ln-Dienst* in Denmark

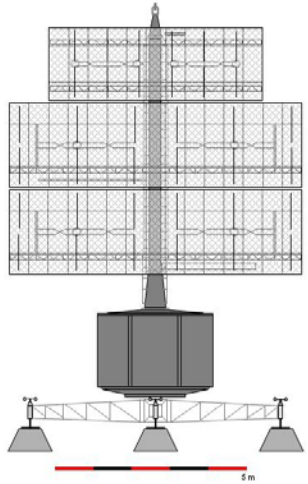
Freya A/N	5
Freya LZ (A)	6
Freya LZ Verbunkert	6
Freya LZ (C)	6
Freya LZ (C var.)	6
Freya-Köthen	7
Dreh-Freya	7
Freya-Fahrstuhl	7
Freya-Flamme	8
Wassermann S	8
Mammut	9
Wassermann M I/II	9
Wassermann M IV	10
See-Elefant and Mammut	10
Russel	11
Jagdschloss	11
Würzburg Riese	12
Freya-EGON	12
Heinrich *Peiler*	12
Hans *E-mess Gerät*	13
Funk-Mess Beobachtung	14
Samos.	14
Fanö	14
Korfu.	14
Naxburg.	14



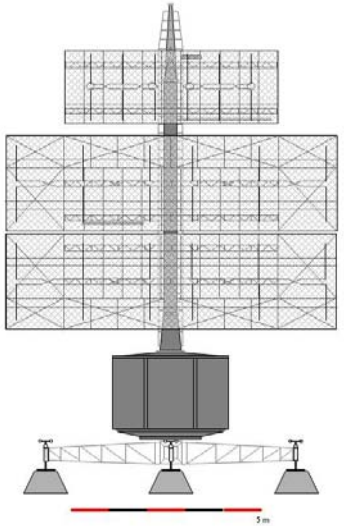
FMG 39 G(fB), Freya.



FuMG 401 A, Freya LZ A.



FuMG 401 C, Freya LZ C.



FuMG 401 ?, Freya LZ C Variant.

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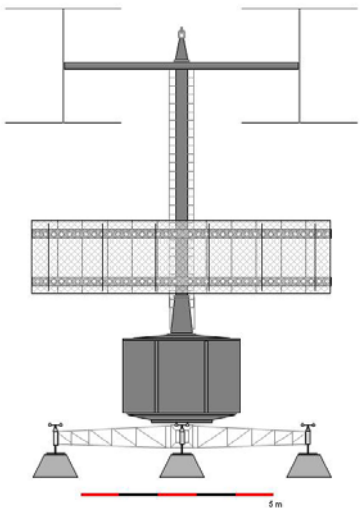
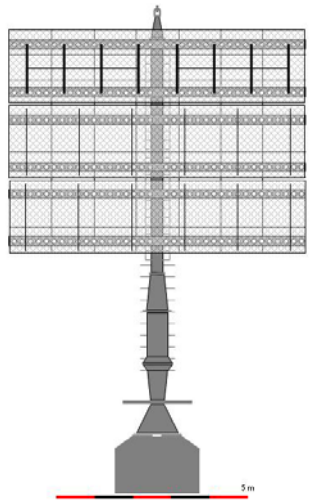


Freya Yagi Köthen.



FuMG 401 ?, Freya LZ Verbunkert.

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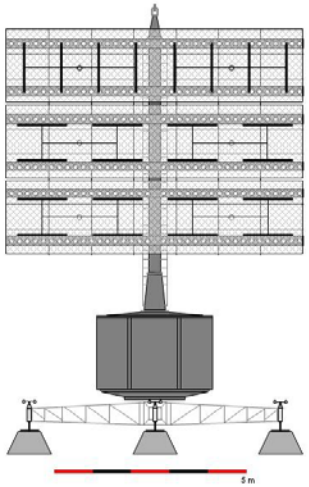
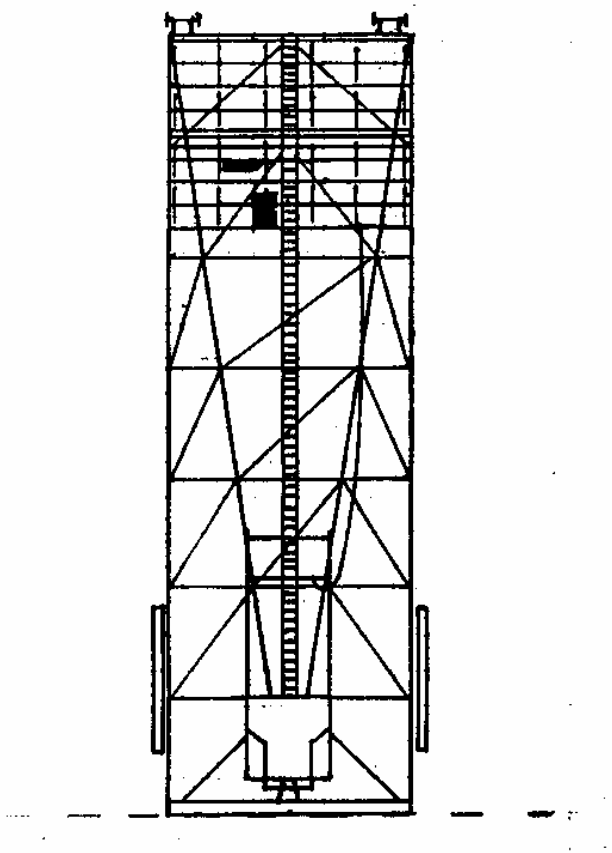


Dreh Freya.

1 : 200



Freya Fahrstuhl.

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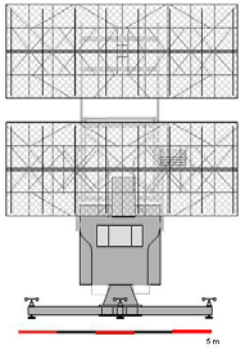
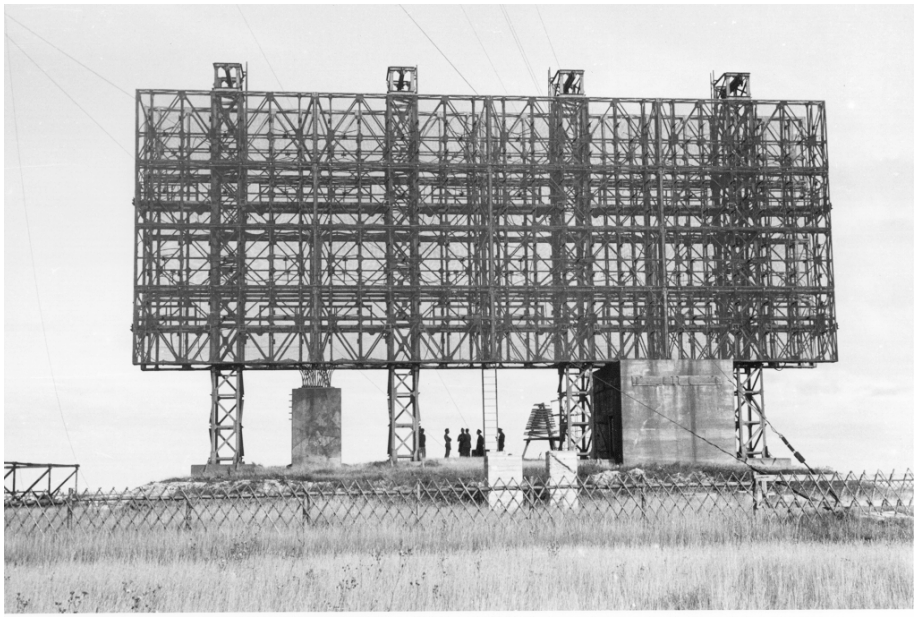


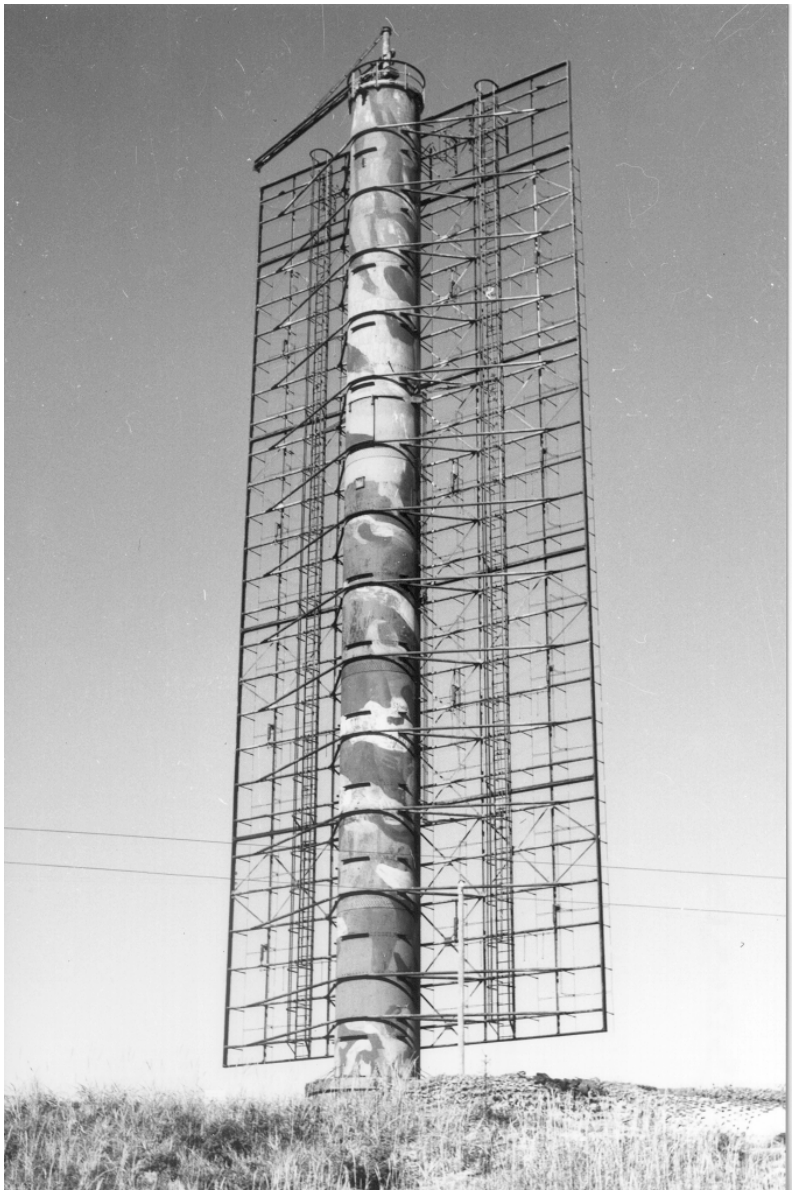
Freya Flamme.

1 : 200

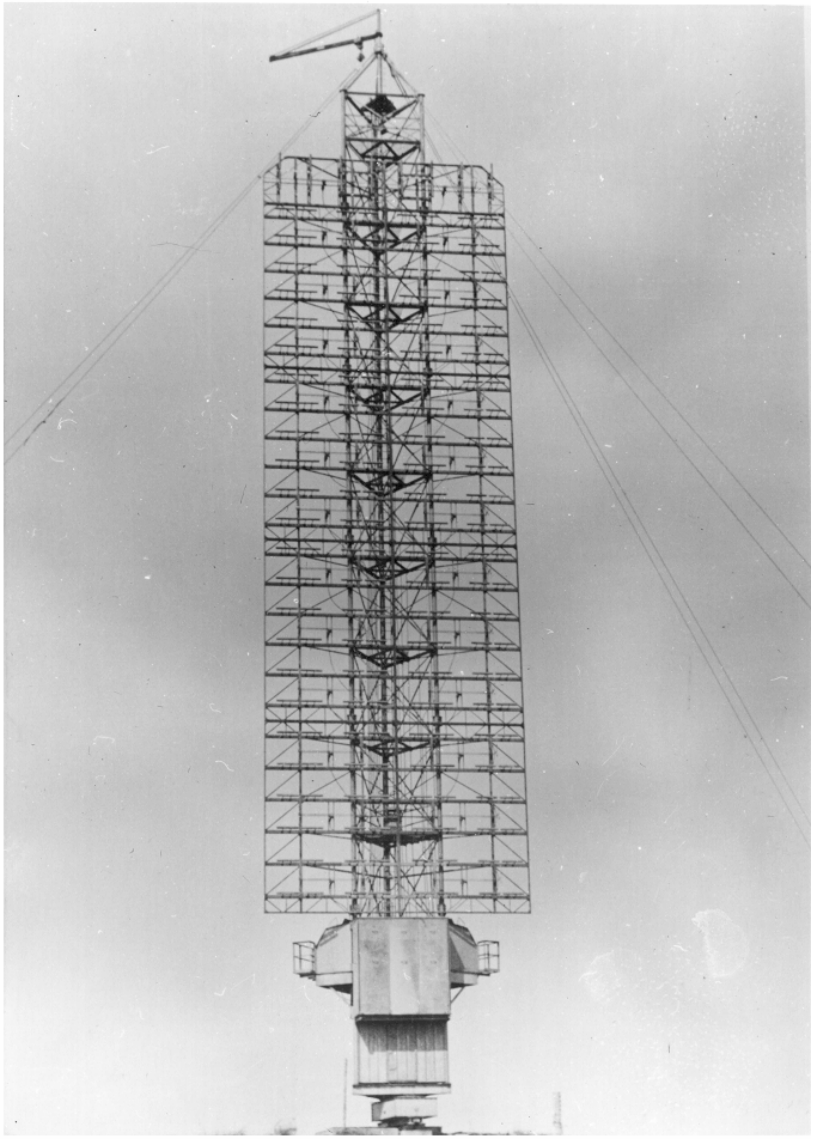
This version of the Freya is easily recognizable by the fact that it is equipped with 8 dipoles in each row as opposed to the normal Freyas, which have 6 dipoles in each row



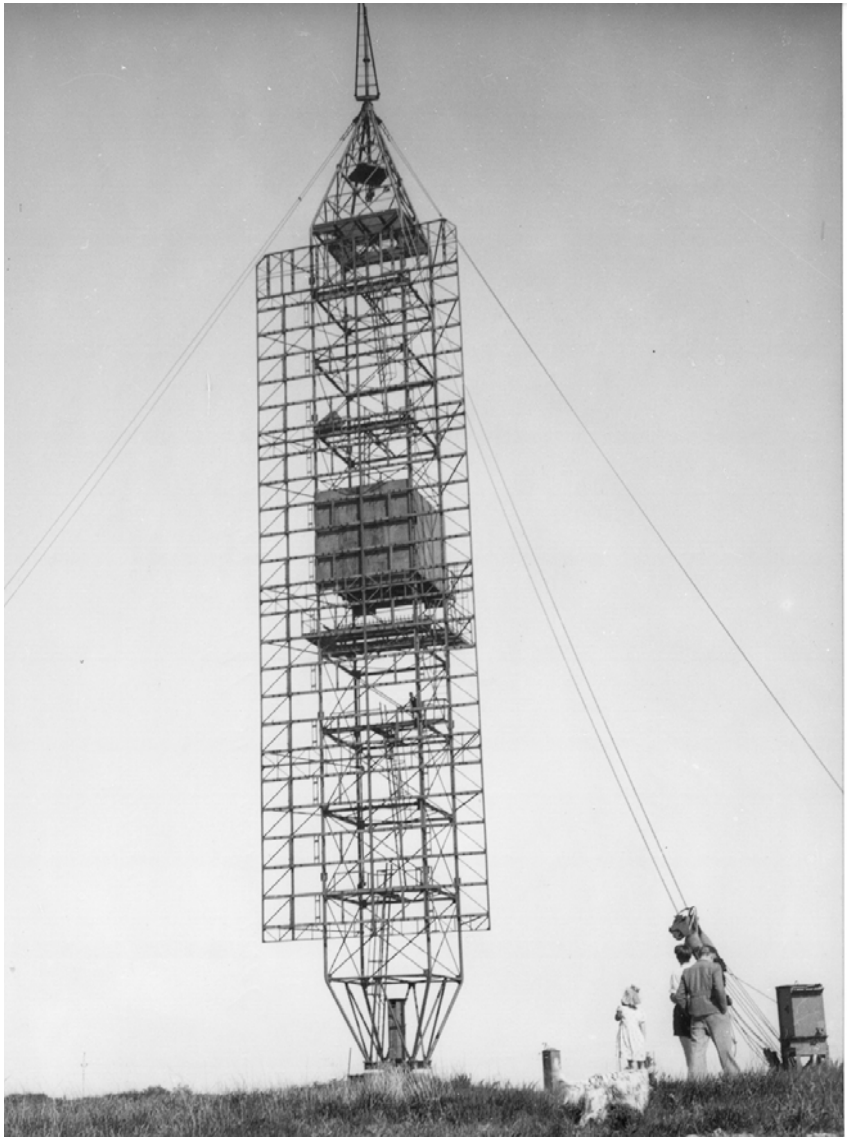
Mammut.



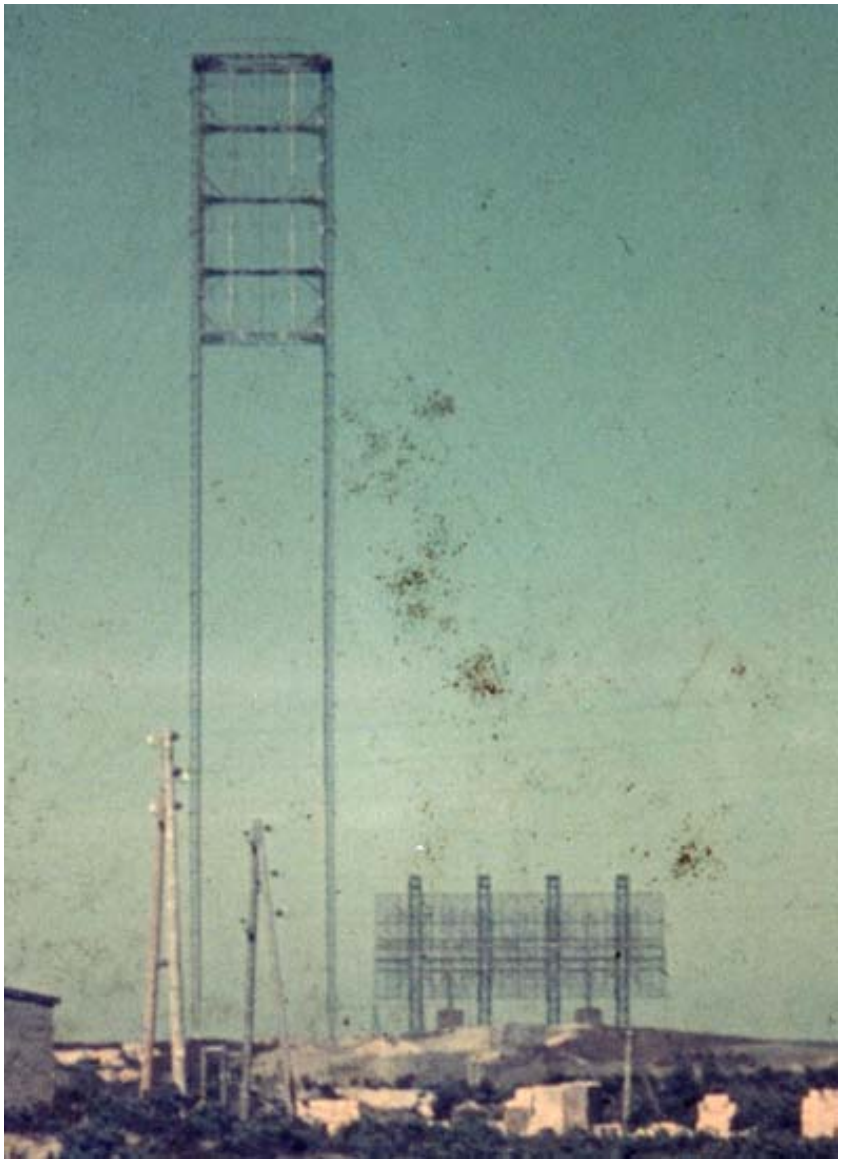
Wassermann S.



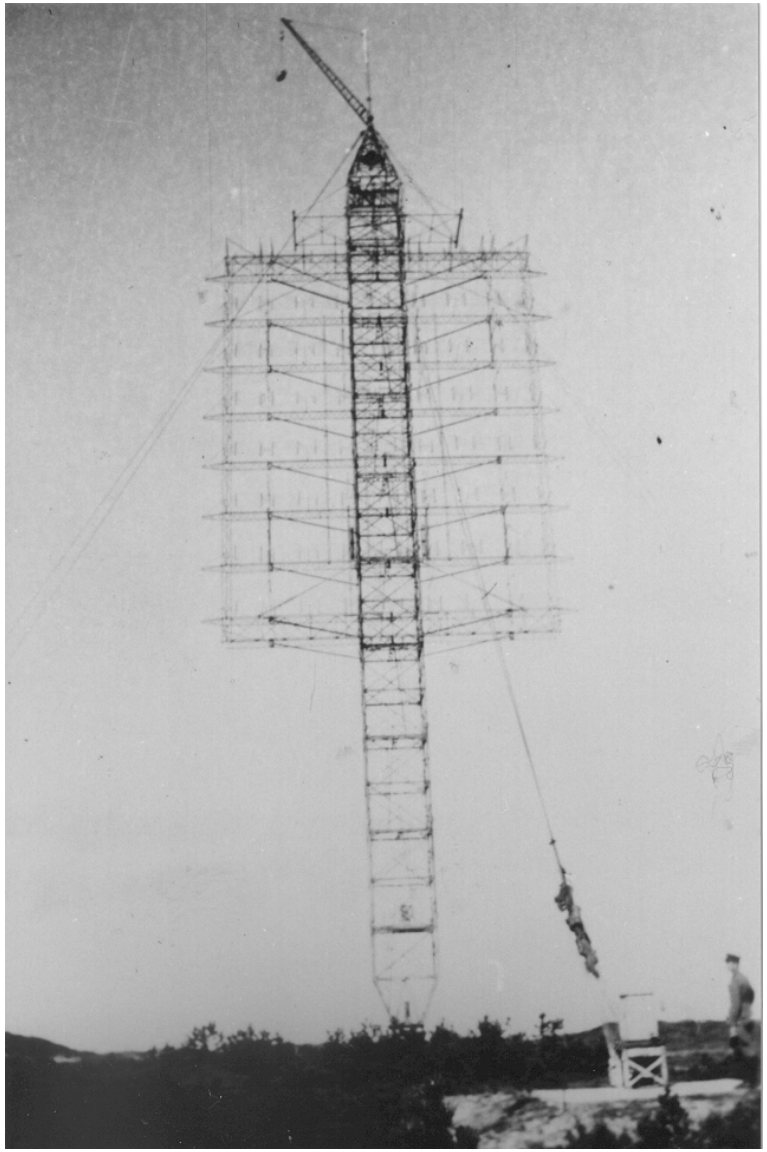
Wassermann M II.



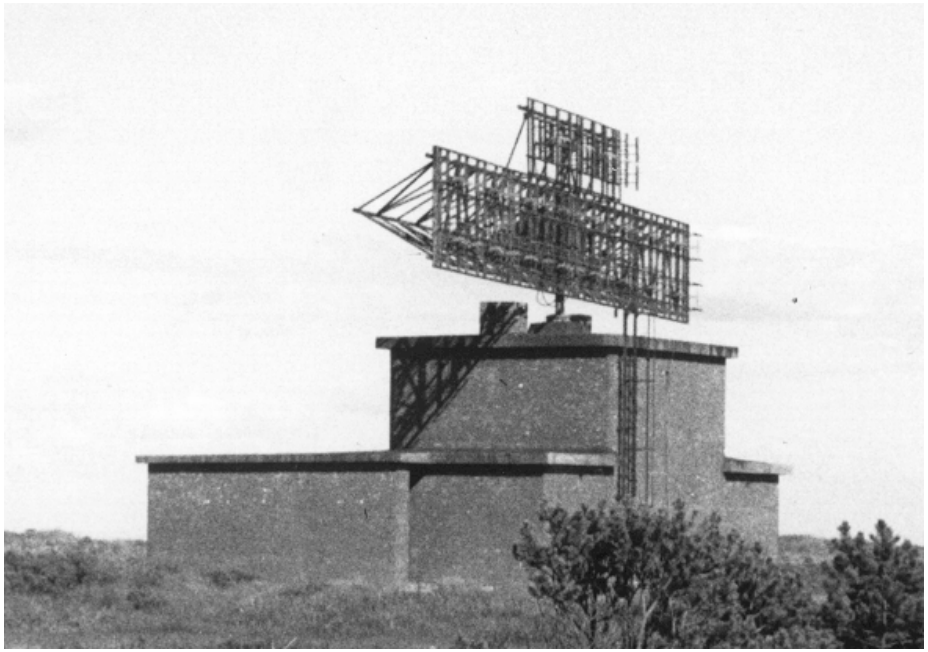
Wassermann M IV



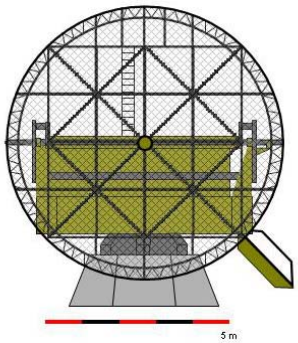
See-Elefant.

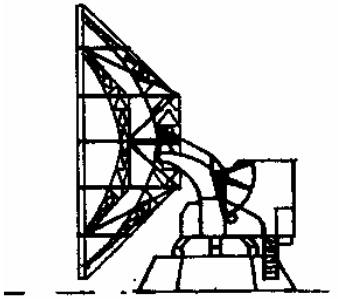


Russel.



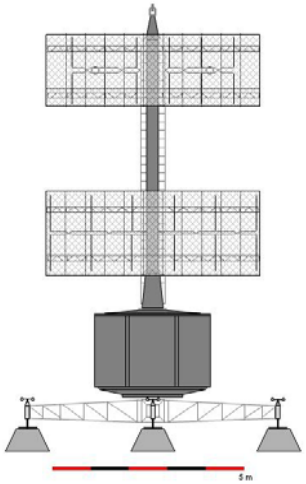
Jagdschloss.



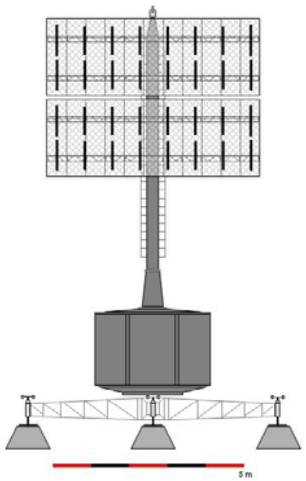


Würzburg Riese

1 : 200



FuS An 730, Freya Egon I.



FuS An 731, Freya Egon II.

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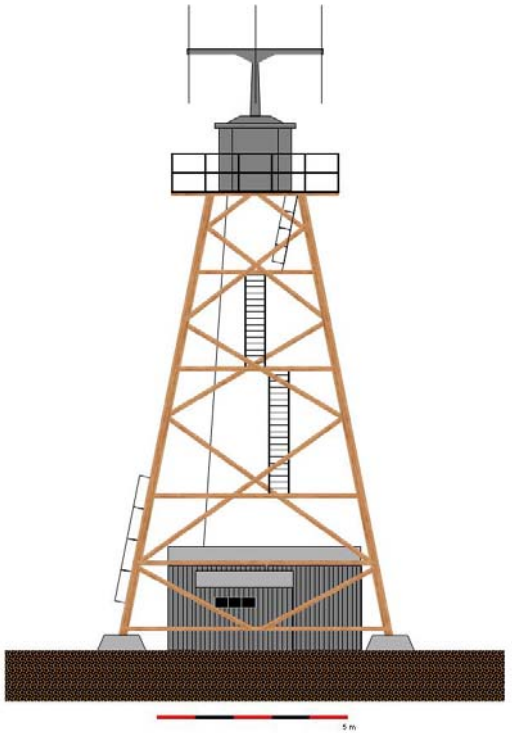
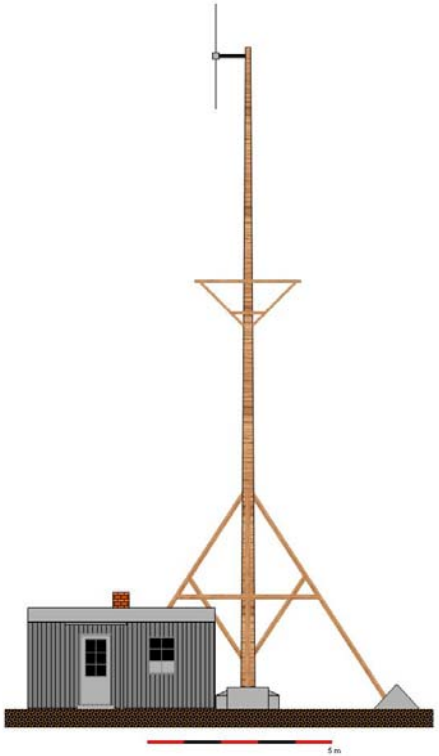
FuS An 733, Y Bodenstelle.



Heinrich Peiler

1 : 200

FuS An 733, Y Bodenstelle.



Hans E-mess mast, normal configuration.

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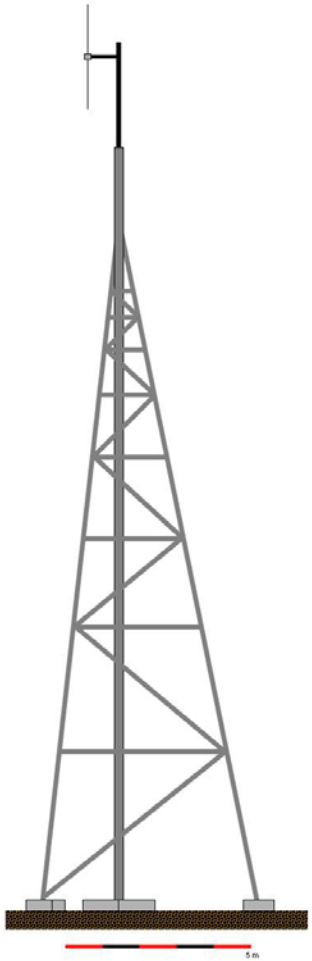
FuS An 733, Y Bodenstelle.

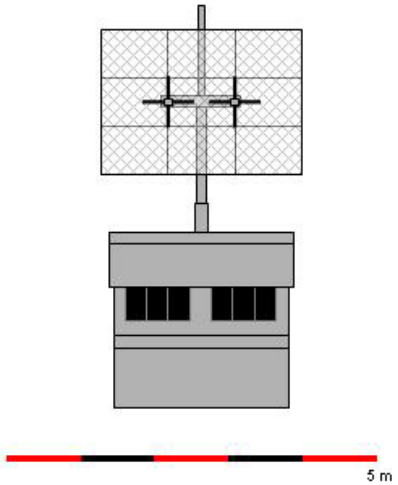


Hans E-mess mast, tall configuration.

1 : 200

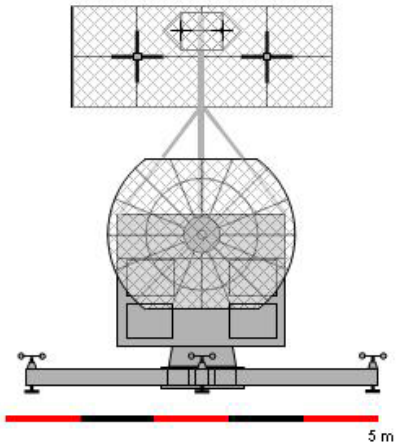
Funk-Mess Beobachtung

SAMOS



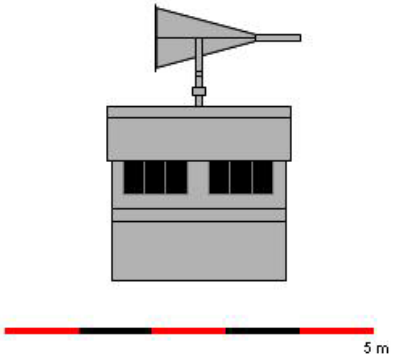
1 : 100

FuMB 21/27



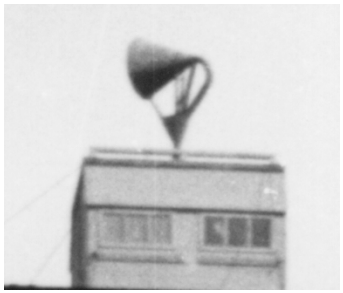
1 : 100

KORFU 812



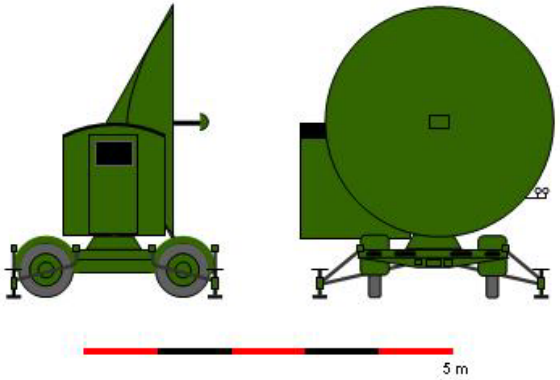
1 : 100

KORFU 274



1 : 100

NAXBURG



1 : 100

Notes to chapter 1.

1. Funkmessverfahren, Funk-Navigation und Funkfürungsverfahern and Funkstörverfahren.

2. Ibid, photos in the files of MfDF, FHS and author collection, G.E. 124, Post Mortem and Tyske UKB-anlæg.

3. Photos in the files of FHS and author collection.

4. G.E. 124, Annex and Post Mortem, Appendix D para. 12 (ii) and Appendix F, Exercise 10, para. 2 “Enemy Jamming”

5. G.E. 124 Annex.

6. Photos from ROBBE, ADLER and JASMIN, field surveys in BÜFFEL, ESCHE and TANNE, interviews of witnesses living close to ESCHE by T. Christensen, Varde.

7. Funkstörverfahren p. 27 ff.

8. Author field surveys, see chapter 3.

9. See note 1 and information in G.E. 124.

10. A.D.I. (Science) report, FEB 1945, in author collection.

11. Although a few photos depicting this version have been published the proper identification was not established until the publication of GEMA-Berlin cf. p. 182.

12. Würzburg-Fibel, Chef des Nachtrichtenverbindungswesen, Oktober 1943, Author collection and Erste vorläufige Beschreibung und Bedienungsanweisung des Flakleitstandes 41 Land, Oberkommando der Kriegsmarine, Berlin 1941, Author collection.

13. Jagdschloss (FuMG 404) Vorläufige Kurzbeschreibung und Bedienungsanweisung, Oberkommando der Luftwaffe, Generalnachrichtenführer, Ln.-Insp – 6-Abt. -. Author collection via Danish Defence Intelligence Service (DDIS). This particular source is a story in itself. A specific building in DDIS was undergoing renovation in the early 1990’ties. During the work this particular manual was found on the attic, along with 6 Enigma machines in immaculate condition.

14. Die deutsche Feldpostübersicht 1939 -1945, Nobert Kannapin, BIBLIO Verlag, Osnabrück 1982.