Reason why Nachtfee had been introduced:

- To minimise jamming of operational communications
- Making it impossible that the content of communication can be intercepted
• Jamming can interrupt communication, but cannot corrupt restoring its data content

• Implementing technologies at hand, as far as possible
Nachtftee console with Command ‘compass’
IFF signal combined with the Nachtfee order or command signal @ 124 MHz
Nachtflee Order Compass scale
Nachtfee type phase-shifter technique
At a certain moment I had nothing to add onto our Nachtfee Survey, and considered: that 500 Hz represents a wavelength of 600 km. Then I became tantalised: would the unknown scale stands for the *system range* of 300 km; where ‘0’ stood also for 300km? *Heureka*, we know since where the ominous, next shown, number-scale is to be utilised for.
'Number or degree' scale goniometer (Drehfeldgeber)

Dual beam CRT horizontal deflections

12 rectifiers
A = without scale
B = 'order' compass
C = Range off-set in km

Quartz divider & stages

Phase control

Range control

Nachtfee 'order' control

Nachtfee output data

Nachtfee returning signal in quasi-coherence

Nachtfee feedback downwards
What was the real essence of the Nachtfee system?

The reconstruction of the Nachtfee order phase-shift, at the LB 2 control screen.

Doing so, is actually taking into account the necessary time of signal travel from: Nachtfee – I.F.F. transponder FuG 25a – Nachtfee.

Herewith the actual ‘factor’ range (= time) being taken out of the system control; albeit, ‘Rang offset’ has to be re-adjusted constantly due to the displacement of the aircraft.
Order/command path

Freyza-EGON pulse-shaping transmission & measuring chain \( v < c \)

Range \( v = c \)

B FuG25a IFF \( v < c \)

Aircraft 'order' display time-base \( v < c \)

Nachtfée Console

Gemse Receiver \( v < c \)

Range \( v = c \)

Control path
Phase timing corrected order/command signal (manually)

Aircraft time-base reference signal
A = without scale
B = 'order', compass
C = Range off-set in km

Quartz
divider
& stages

Phase control

Range
off-set
control

Nachtfee
'order'
control

Nachtfee

output
Nachtfee signal
in quasi-
coherence

Returning
Nachtfee data
Upwards

Nachtfee data feedback
downwards

HRP2
Hypothetical Nachtfee system reconstruction
North is the order starting position, south the Freya-Polwender signal
Current Nachtfee peripheral setup
Hypothetical aircraft Nachtfee setup, but fully HF operational
Simulated aircraft command display
Pauke, in German Luftwaffe jargon it stood for ‘attack’, but according to R.V. Jones it meant ‘open your bomb doors’
Aircraft standing next to the Freya-Nachtfee station, both ‘orders’ adjusted equal
The aircraft moved from position ① towards ② without control. For this occasion we consider that each number constitutes 30 km. $10 \times 30 = 300$ km the max. Nachtfee system range $\approx 36^\circ$ per blip rotation.
Our Junkers aircraft took off and has since reached position ③ in the far distance about the target symbolised aircraft ⑧.
The aircraft reached position ④
The Junker aircraft reached position ⑤
Our Junker aircraft reached position ⑥
Reaching point ⑦, may be accompanied with the Pauke order (pointer at South)
My hypothesis what might tactically have been accomplished

Between simulation point ⑦ and ⑧ the Freya-Nachtfee control might have sent the following order:

AUTO could have meant: releasing the computing X-Uhr
Our pathfinder aircraft has reached the location 8 where he should drop his flares.
The main block diagram of the Nachtfee console
Please bear in mind:

Generally speaking: when signals originate from a common source and these later coincide there still remains coherence, whatever their mutual phase-difference might have become.

Because when the source changes its actual signal phase, there still remains coherence, as signal-phase deviations stay equal in both reference channels.

Therefore: sending a ground-signal towards an aircraft I.F.F. transponder and returning at the ground system, there still maintains signal coherence.
A nice example of a combined screen display of a coherent signal spot and a non coherent EGON signal (dashes 2 Hz PRF difference)
Phase

Command compass

Phase-shifters 0-360°

Distance control

Nachtfleece order output

Freya-Polwender switch

Returning signal from aircraft I.F.F.
Please notice the non-linearity of the painted time-base line
LR = HRP2/100/ trace painted left - right
RL = HRP2/100/ trace painted right - left
Smart technique for adjusting the exact timing reference

Two base lines - one written from left to right the other right towards left; simultaneously getting back-to-back the same signals

When signal delays is corresponding exactly with the centre adjustment on the left-hand screen, signals are exactly set against one another on the range-scale
Could Nachtfee successfully have been operated?

- Why not?
  - All our experiments have pointed onto the direction of not yet
    - Likely the required quartz stability wasn’t yet available
    - It should have been in the order of better than $10^{-8}$

Late 2015 and early 2016 we have implemented a Rubidium controlled frequency standard

Now it became apparent that indeed it could have worked well; but these devices weren’t yet invented!
New documents about the implementation and operational matters

I/ KG 66 (Staffel 1) consisted of 9 – 12 airplanes
NO 7657 FROM LUFTFLotte 3, IC, SIGNED HPTN KIRCH, TO
ROBINSON 1A AND IC DATED 15/5 :-

APPRECIATION BY FLIEGERKORPS IX OF THE NIGHT OPERATION
AGAINST BRISTOL ON 14-15/5.

1) WEATHER CONDITIONS AS FORCAST : NO CLOUD, VISIBILITY
OF THE GROUND MUCH HAMPERED BY HAZE. THE BRISTOL CHANNEL
AND THE RIVER AVON WERE ONLY RECOGNIZED BY A FEW CREWS.

2) FLARE-DROPPING OPERATION :

(a) (OCCLUDED): TRANSMISSION WAS JAMMED BY THE
ENEMY FROM THE BEGINNING (CONTINUOUS NOTE BLAUERSTREICH).

(+NACHTFEE (ONE SET OPERATING): NOT USEABLE BECAUSE
OF TOO GREAT DISTANCE.
Conclusions

• In contrast to foregoing information, Nachtfee, throughout the Baby Blitz (January-May ’44), had been, in some respect, kept operational.

  • Did it perform as was once expected?

  • We must consider: partially due to inadequate time-base stabilities.

  • However, driven from our Rb-time standard, it performs rather good.

• Therefore, we may believe that with nowadays techniques it could have performed sufficiently.
  • But atomic timing devices had yet to be invented, more than a decade thereafter.

  • Quite many decades should pass before miniature modules reached application.