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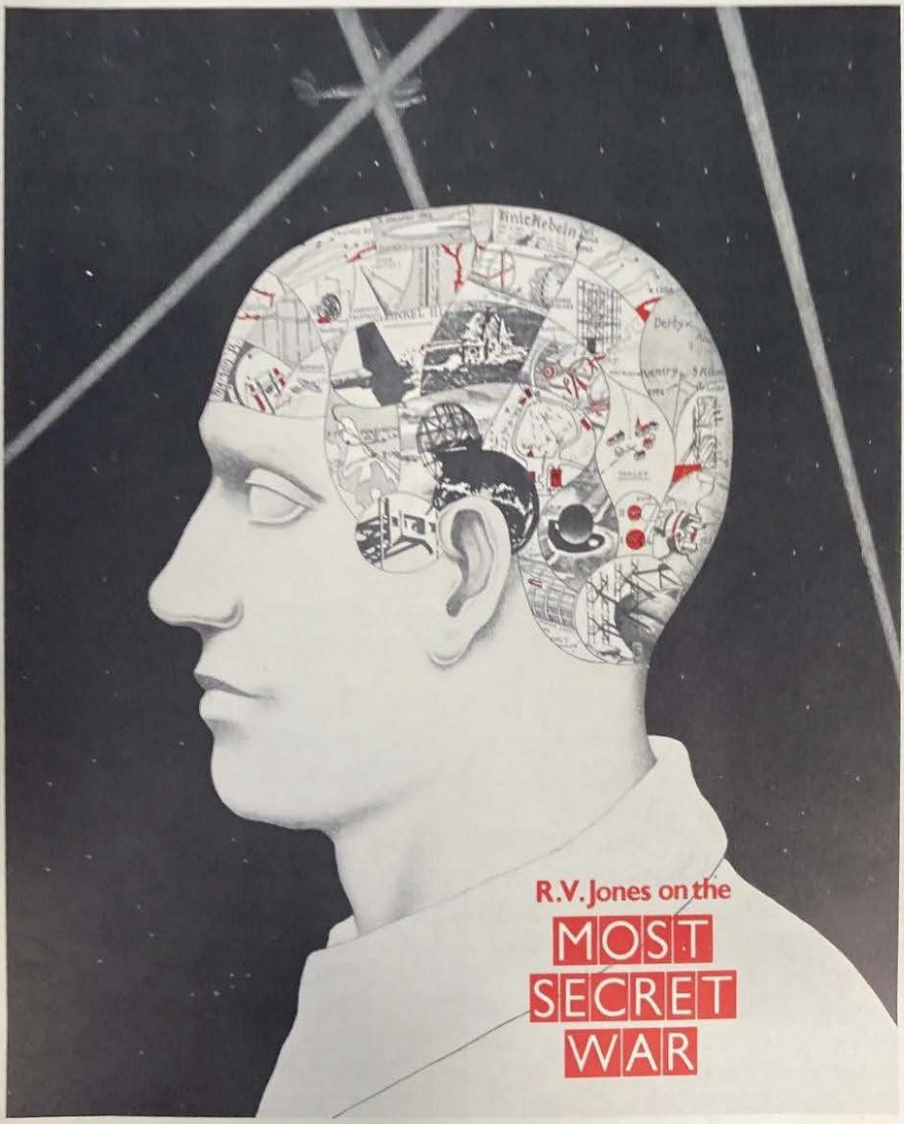


R.V. Jones on the

MOST SECRET WAR

Pulling the crooked leg

Published next week are the memoirs of the wartime head of Air Ministry Scientific Intelligence.

Here he reveals some of the operations of the "most secret" war successfully waged in the backrooms of Whitehall and in scientific laboratories all over Britain against the Germans*

Professor R. V. Jones FRS
is professor of natural philosophy at the University of Aberdeen. At the outbreak of war he was researching infrared spectroscopy at the Clarendon Laboratory, Oxford

I was always aware that, exciting though Intelligence was, and important though its results manifestly were, it was on a lower plane of difficulty than research in pure science. Intelligence is a parasitic activity, in that you are always trying to discover what some other man has already done, in contrast to entering an uncharted field yourself. One of the greatest difficulties in scientific research is to build up your observational experience in this new field, and to develop concepts that have never entered any human mind before. They may even appear to contradict long-established principles, as when Einstein proposed the equivalence of mass and energy, or when de Broglie postulated that material particles could also behave as waves, or when Bohr had to conclude that the radial acceleration of electrons in his orbits did not make them radiate. Sometimes in Intelligence we experienced this kind of difficulty, when for example it was necessary for us to postulate that radio waves bent further round the Earth than our own experts thought, or that rockets could be made with a range greater than 100 miles; but all the time I knew that we were trying to discover something that had already been discovered and formulated in the minds of our German opponents, and that it therefore should be within our mental grasp.

To that extent I felt that we were parasitic, and tackling a basically easier job than that of research in pure science. Even so, we sometimes had difficulties comparable with those of scientific innovators when we had to persuade our experts to abandon some of their hitherto accepted concepts. Moreover, the methods we used in gathering and collating information were much the same in principle as those employed in pure science. Where we could claim to be genuinely creative was in developing new methods of Intelligence, such as listening to radar transmissions, and in welding them into a great system for observing the enemy by as many means as possible, and directing this system and correlating the information that it obtained by these means into a comprehensive reliable estimate of enemy intentions.

We were remarkably fortunate in our opportunity. Just as the impact of radio in the 1920s gave a unique chance for every man to dabble in the "marvels of science" by making his own receiver—a task complex enough to be fascinating without being so complex, as television later was, that it was beyond the competence of the average man—so it was with Scientific Intelligence in the Second World War, and for much the same reason. The very development in science and technology that led to everyday radio in the 1920s also led to the radar and radio navigational systems of the Second World War, and these were relatively simple to understand and, if necessary, frustrate.

Moreover, these developments in radio were of such universal application in military technology that they gave me the entry to fields which at first sight might have seemed quite remote. Radar provided the key to the German night defences, and thus enabled me to attack those defences more fruitfully than through any other channel; and it also enabled me to attack the flying bomb in a positive manner by going for the German radar plots in their V1 trials at Peenemünde. I was therefore able to reduce some of our major Intelligence problems to the field that by good fortune I knew best.

Possibly the opportunity of Enigma might be viewed in the same light, for it involved radio communication at a stage of sophistication that was just within the limits of human ingenuity to "break".

At the outbreak of war, September 1939, I was billeted at Bletchley with Sir Kenneth and Lady Macdonald at Winslow, along with Commander Edward Travis, who happened to be Deputy Head of the Government Code and Cipher School, the cryptographic headquarters that was officially part of MI6. The head of the school was Commander Alexander Denniston, whom Travis was to succeed in 1942, but who had laid the foundations of our brilliant cryptographic successes. In our long evenings together Travis discussed with me his problems in cryptography, and in particular the problem of trying to "break" the German Enigma machine.

*Most Secret War, by R. V. Jones (Hamish Hamilton, £6·95), from which these excerpts have been taken, is published on 27 February.

The Enigma encoder

The Enigma machine was a very ingenious arrangement of cogged wheels, each one of which had a sequence of studs on both sides, with each stud on one side being connected by a wire to a pin on the other side—the exact arrangement of the connections being one of the secrets of the machine—and the pin making contact with one of the studs on the next wheel. The machine had a typewriter keyboard, and it was worked rather like a cyclometer: every time the machine was operated to encode a letter, one wheel would be turned by one space; after this wheel had moved by enough spaces to turn it through one revolution, it would click its neighbouring wheel by one space. The wheels were thus never in the same position twice. The basic encoding was effected by the passage of an electric current through the studs so that when a letter was to be encoded, the appropriate key would be pressed on the keyboard, and the resultant coded letter would be determined by the appropriate conducting path through the studs, the studs on one wheel making suitable contact with the pins on the neighbouring wheel. A further touch of ingenuity was to add a reversing arrangement at the edge of the third wheel, again with studs cross-connected so as to send the current backwards through the wheels by yet another path. The returning current lit a small electric bulb which illuminated a particular letter on a second keyboard, and thus indicated the enciphered equivalent of the letter whose key had originally been pressed.

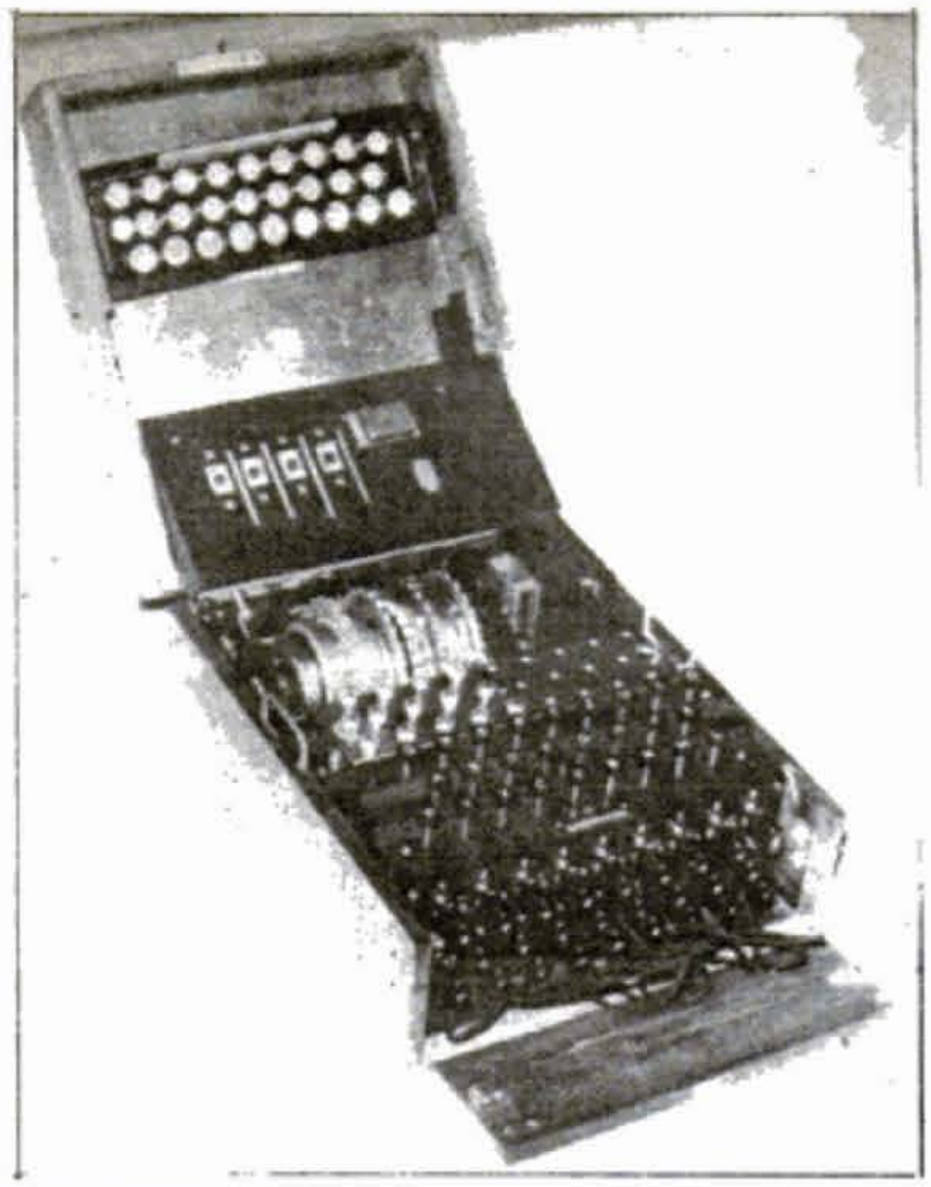


Figure 1 A four-rotor Enigma which the German Navy used. It defied the best efforts of Bletchley Park until 1943

Pic: Courtesy The Secret War, by Brian Johnson (BBC Publications), which is reviewed on p520

Sometimes, as with Knickebein, the German aircraft navigational system, a single short decode provided the clinching evidence. And because there was every likelihood that the Germans felt that they were secure in Enigma, even a single message was likely to provide an anchor of truth on which any explanation of German activity could be confidently based, or a touchstone against which previously formed theories of German intentions could be tested. Care was of course necessary—although any one decode was likely to be 100 per cent reliable, it might well contain much less than the whole truth—a fact that must always be borne in mind regarding information from any source, however reliable. But the confidence with which Enigma decodes could be used in constructing or testing theories of enemy intentions was outstanding among all the sources available to us.

Battle of the beams

On the morning of 12 June, 1940, I visited Group Captain Blandy, the head of the RAF "Y" Service, which intercepted German radio signals. He handed me a scrap of paper saying, "Does this mean anything to you? It doesn't seem to mean much to anybody here." I read:

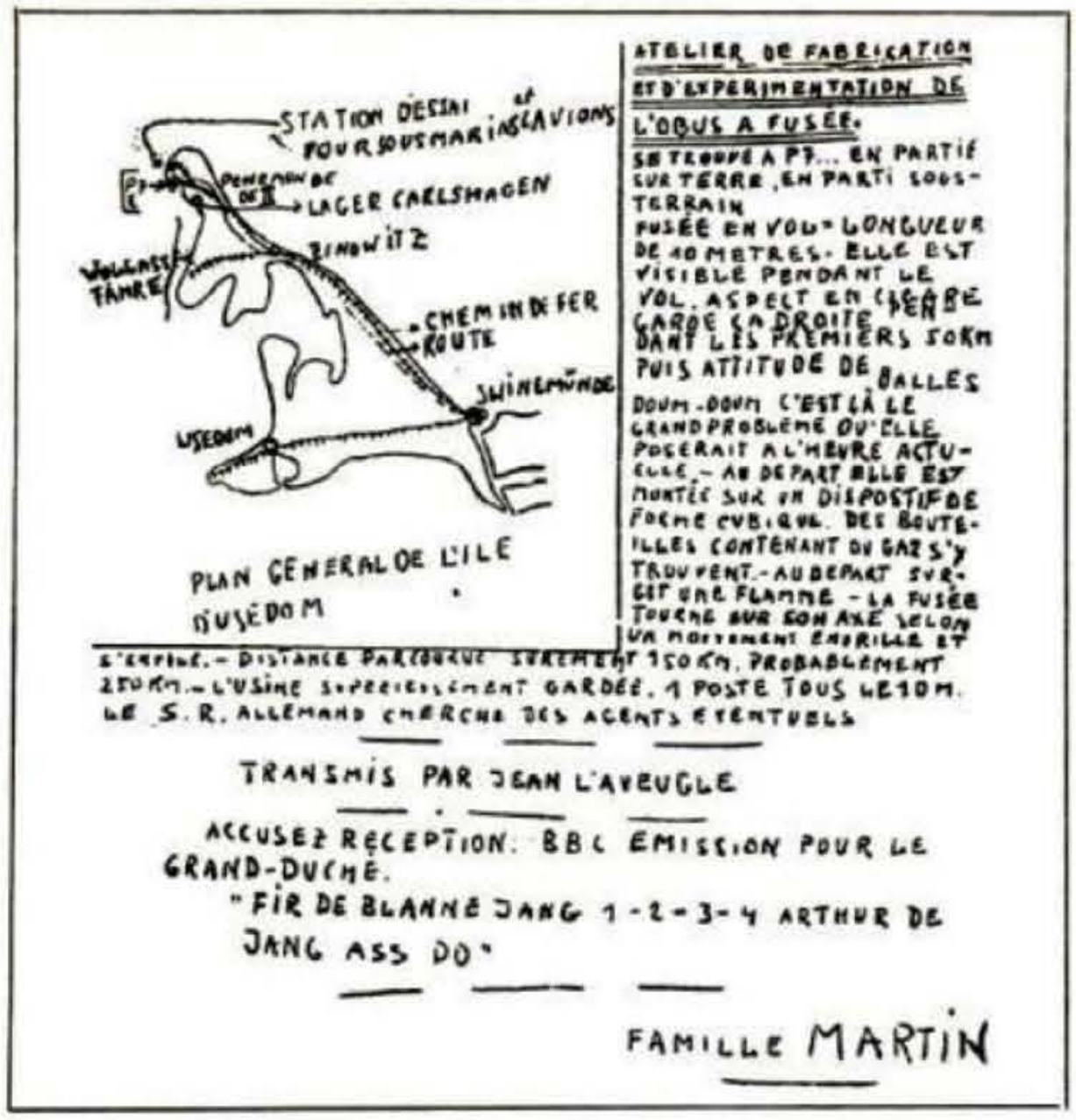
"KNICKEBEIN, KLEVE, IST AUF PUNKT 53 GRAD 24 MINUTEN NORD UND EIN GRAD WEST EINGERICHTET."

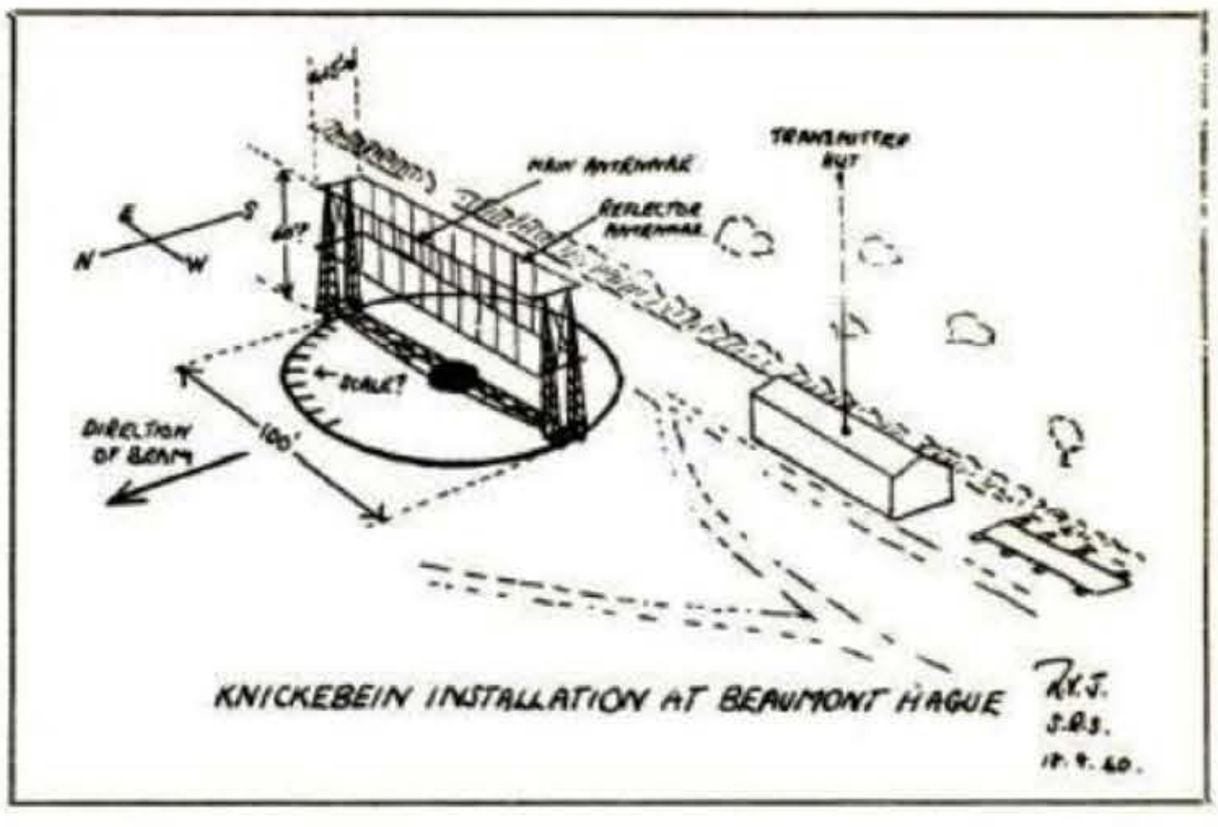
The word "Knickebein" (*crooked leg*) I had earlier noticed in a fragmentary entry on a paper salvaged in March from a shot-down Heinkel aircraft. Information from a German prisoner suggested it to be some sort of beamed beacon. "Kleve" could be the west German town that we knew as Cleves, where Anne came from. If so the translation would run: "Cleves Knickebein is confirmed (or established) at position 53° 24 minutes north and 1° west." The geographical position referred to was a point in England, roughly on the Great North Road a mile or so south of Retford. I immediately told Blandy that it meant everything to me, and that it suggested that the Germans had a radio beam transmitter called Knickebein set up at Cleves, on the nearest German soil to England, and that the existence of the beam had been confirmed one way or another at this position over England. I quickly recognised that it was a decoded message, because I knew that during the preceding two months Bletchley had begun to be successful in decoding some of the Enigma messages. This particular one had been sent by the Chief Signals Officer of Flieger Korps IV at 1455 hours on 5 June, and had been decoded four days later.

I had to go to the Cabinet Office to see Professor Frederick Lindemann, in response to a question about German radar, and told him that I had just received the Knickebein message, and that I was convinced that the Germans had an intersecting beam system for bombing England; and if they could make narrow beams for navigation they could also make narrow beams for radar. Lindemann immediately said that the beams would not work for radionavigation, because they would have to use short waves which would not bend round the curvature of the Earth. Armed with some computations by T. L. Eckersley, I told him that, contrary to what he supposed, they would.

The bombers available to Flieger Korps IV were Heinkel IIIs of Kampf Geschwadern 4 and 27. Whatever equipment was used for receiving the Knickebein beam must be capable of being fitted to this type of aircraft. Squadron Leader Denys Felkin, chief interrogator at Bletchley, had prisoners from the bombers shot down during the preceding few nights, so I briefed him about the information that I needed.

He duly interrogated the prisoners without at first getting anything of value. But when the prisoners were alone one of them said to another that no matter how hard we looked we would never find the equipment. This could not have been a better challenge because it implied that the equipment was in fact under our noses, but that we would not recognise it. I therefore obtained a copy of the full technical examination of the Heinkel III that had been shot down in the Firth of Forth raid, and looked especially at the various items of radio equipment. The only item that could possibly fill the bill was the receiver that was carried in the aircraft for the purpose of blind landing. It was labelled as E.Bl.I (which stood for Empfanger Blind I —blind landing receiver type I) and was ostensibly for the normal purpose of blind landing on the Lorenz beam system, which was by then standard at many aerodromes. N. Cox Walker at Farnborough, who had evaluated the equipment, then told me that although there was nothing





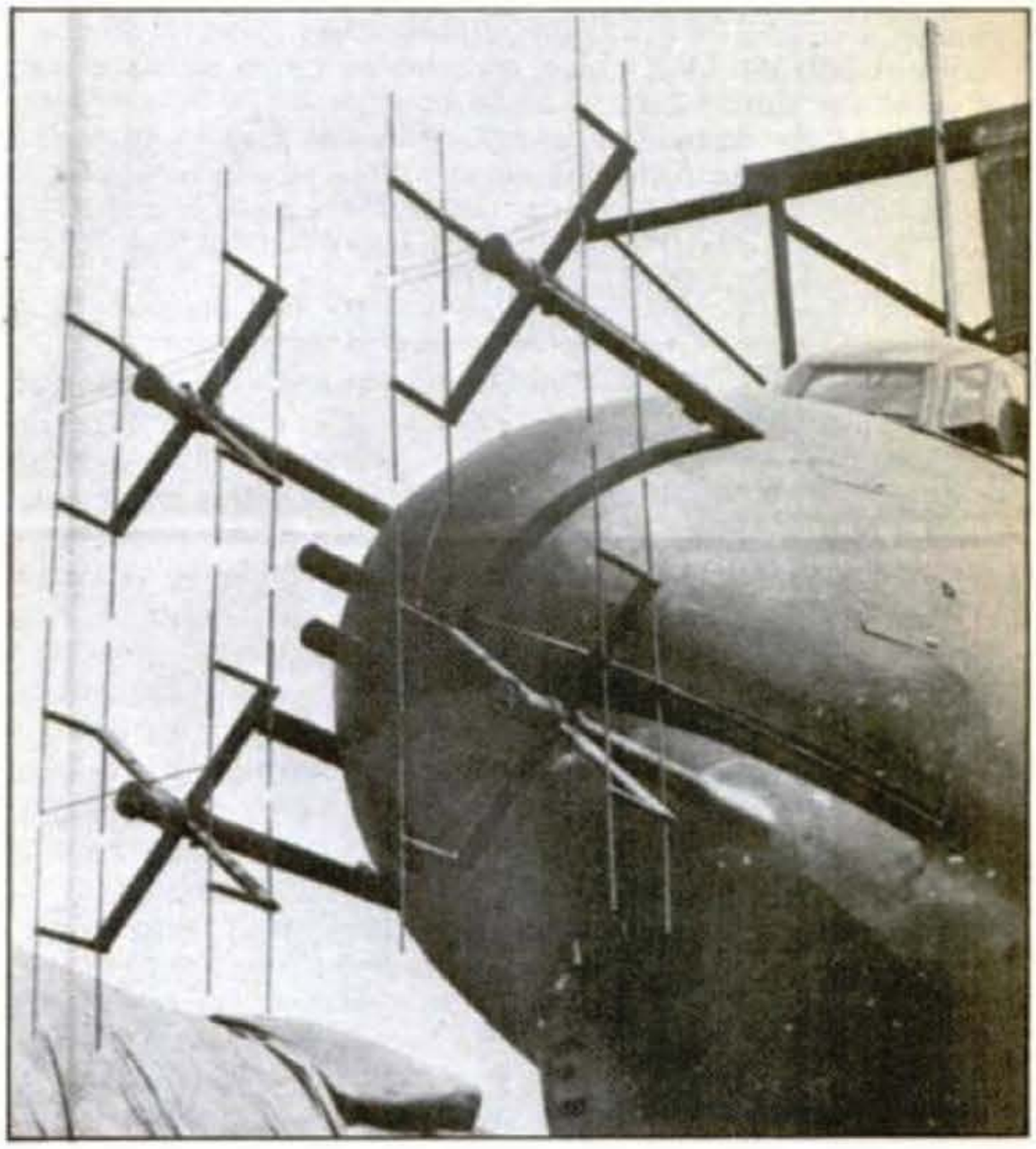


Figure 2 (above) The Luxembourger's message and sketch. Top right R. V. Jones's sketch of the Hague Knickebein. Bottom right Heinkel III with antennae for X-beam guidance

unusual about the blind landing receiver, it was much more sensitive than would ever be needed for blind landing. So that was it. I now knew the receiver, and the frequencies to which it could be tuned, and therefore on which the Knickebein beam must operate. And in a short time we heard the beams for ourselves.

Although it was worth squeezing every drop of information out of the Enigma decodes, it would have been dangerous to rely on them too much, and thus to neglect other sources. In a sense, cryptography was the most vulnerable source of all in that it could have been extinguished at any time by a few simple changes in the Enigma machine. At the end of every investigation I therefore looked back to see how far we could have gone without Enigma. As the outstanding example, it was reassuring to find that we would very probably have raided the rocket-launching sites at Peenemünde without any help from Enigma. This observation is not intended in the slightest to belittle the enormous contribution made by those who broke the Enigma traffic—quite the reverse. And it is a pleasure to know that in a war in which science, and especially physical science, gained great esteem, the contributions of our colleagues in mathematics and in some of the arts subjects can at last be publicly recognised.

Detecting the 'V' Rocket bases

The message about a rocket that we received from a Danish chemical engineer in December 1942 resensitised us to a possibility which, although I had reported it in 1939, had no more than stayed in the background of our thoughts over the intervening hectic years with the beams and German radar. A report received from Oslo had mentioned Peenemünde, where, it had said, radio-controlled rocket gliders were being developed for use against ships under the code name FZ21 (Ferngesteuerte Zielflugzeug). It also said, although it did not mention Peenemünde in this connection, that rocket shells 80 centimetres in diameter were being developed for use against the Maginot Line; these were gyro-stabilised, but were prone to fly in uncontrollable curves, and so radio control was being considered.

The Danish engineer's warning was timely: when he sent his message only three prototype V-2 rockets had in fact been fired at Peenemünde, the first successful firing being on 3 October, 1942. This was as good a warning as we could hope to achieve in view of our lack of Scientific Intelligence before the war, which had forced me to concentrate on detecting the development of new weapons at the trial stage, ie later than the research stage but, hopefully, before the operational.

Over the next three months a few further reports appeared, but none substantially added to our knowledge. Indeed, they could have been no more than rumours, and the turning point, as far as I was concerned, occurred on 27 March, 1943. My colleague Charles Frank (now Sir Charles Frank, FRS) was reading the transcripts of a conversation between two German generals, who had been captured after el Alamein, and who were now at our Interrogation Centre. One was Cruewell, who had been Rommel's Second-in-Command. The other was von Thoma. A remark of von Thoma to Cruewell on 22 March, 1943, caught Frank's attention. Translated, this ran:

> —but no progress whatsoever can have been made in this rocket business. I saw it once with Feldmarschall Brauchitsch, there is a special ground near Kunersdorf

(?) . . . They've got these huge things which they've brought up here . . . They've always said they would go 15 kms. into the stratosphere and then . . . You only aim at an area . . . If one was to . . . every few days . . . frightful . . . The major there was full of hope—he said 'Wait until next year and the fun will start!' . . . There's no limit (to the range).

Von Thoma also said that he knew their prison was somewhere near London and since they had heard no large explosions, there must have been a hold-up in the rocket programme.

His remark transformed the situation. An Intelligence organisation bears many resemblances to the human head, with its various senses. These will generally be on the alert, each searching its own domain and then as soon as the ears, for example, hear a noise and the signals are received in the brain, the latter will direct the eyes in the appropriate direction to supplement the information from the ears by what the eyes can see. So, if one kind of Intelligence source produces an indication, the Intelligence organisation should then direct other kinds of source to focus on the same target.

It was "Pop" Stewart and his colleague Roddie Nicholson from the Assistant Directorate of Intelligence (Photos) who played an essential part in my finding the first rocket, for they provided me with photographs of Peenemünde. Although aerial photographs had first to go to Duncan Sandys, in contrast reports from secret agents had to come through me, so that although I only saw aerial photographs some days after the Sandys organisation, I saw the agents' reports some hours earlier. There were two in particular in June 1943 that remain in my memory. They came from two Luxembourgers whom the Germans had conscripted into the army of foreign construction workers in Peenemünde. One was Leon Henri Roth, a student aged 20, who had been expelled from school for starting a Resistance cell. Along with other Luxembourgers he was sent to Peenemünde, and succeeded in getting letters through to his father, who was a member of a Belgian network, telling of the development of a large rocket which made a noise resembling that of "a squadron at low altitude". The other Luxembourger whose report I remember was Dr Schwagen, afterwards director of the Laboratoire Bacteriologique de l'Etat in Luxembourg, who sent through an organisation known as the "Famille Martin" a report and sketch which reached me on 4 June. It is shown in Figure 2, and it clearly mentioned a rocket of about 10 metres length, and showed where it was assembled. It also stated that for firing it was mounted on a cubical structure. Dr Schwagen survived the war but tragically Roth was killed by fire from an American tank in 1945, while escaping with two Frenchmen in a German military car.

For much of the war, I was concerned that I might have an opposite number in Germany, quite possibly my pre-war Oxford friend Carl Bosch, who might have provided me with false clues, as Bosch himself certainly could have done. This would at minimum have made my task more difficult, and could easily have misled me onto several false trails. As it turned out, though, there was no such cooperation between science and the Services in Germany, and so we were spared this problem—and many others. It was the great contribution of the generation of scientists before mine, headed by Henry Tizard (formerly Secretary of the Department of Scientific and Industrial Research) and Frederick Lindemann (professor of experimental philosophy at Oxford). Accentuated by the emergency in which Britain found itself after 1933, serving officers and scientists worked together to an extent far exceeding that of our opponents.

Further, there was leadership. In Churchill we had a Prime Minister with a genuine and strong interest in the possibilities opened up by science, such as none of his successors has had. Even his controversial dependence on Lindemann was evidence of this interest which, for example, made him anxious to be flown—even at some discomfort—in experimental aircraft to see for himself the state of airborne radar. After our first meeting I felt that there was now so strong an appreciation at the top that in emergency I could have appealed to him with confidence, although I also felt that so long as Charles Portal was Chief of Air Staff no appeal would ever be necessary. "Your name", Churchill once said to me, "will open all doors!"

Right through to the end of the war I was able to keep my immediate Intelligence organisation small, and to use the initiative of individuals to the full. Had we been a little bigger, we should have had to institute an internal communication system, instead of depending on personal contacts to the extent that we did, and this would have slowed our daily working. But there are many tasks in Intelligence that require large numbers of people, and these tasks have multiplied since 1945; there are, for example, many more radar and guidance systems compared with those with which we had to deal, and they require armies of recording operators and interpreters if they are to be unravelled. Scientific Intelligence organisations therefore now have to be larger, and the consequent change of scale from that on which we operated may well involve a different balance of qualities in those heading the organisation.

Enigmatic fruits

Our work was exhilarating. Tragedy, such as the loss of Tony Hill (our outstanding photographic pilot) or the men of the first Rjukan raid on the heavy water plant, was always near; and tension, as in the Blitz or the "V" campaigns, was often acute; but there were moments of tremendous excitement, as in the finding of the Knickebein beams. And these moments continued throughout the war: the first time we knew an X-beam target in advance of the raid; the photographs of the first Freya and Wurzburg German home and coastline defence radar systems; the Bruneval Raid on the Freyas; the searchlight map; the unravelling of the Kammhuber Line in a flash; Window (the "smoke screen" on radar); the finding of the rockets at Peenemünde and Blizna; the first V-1 tracks in the Baltic; D-Day; the true weight of the V-2. I felt matched to the task, with an operational reward awaiting almost everything that I did; and I worked with as brave a company of men and women as anyone might hope to meet.

Even such a simple operation as countering the beams involved a multitude of men and women, every one of whom played an essential part; patiently cataloguing the call signs of German aircraft, poring over innumerable air photographs only a fraction of which had anything interesting on them, working away at breaking the seemingly unbreakable Enigma machine, interrogating prisoners, examining captured equipment, listening to the beams and scouring the country to find suitable jamming transmitters, and setting these onto the right frequencies, all played their part—and the whole system would fail when any one part broke down. When to all this are added the contributions by those who risked and sacrificed their lives, our own efforts may perhaps be seen in a more realistic perspective. We all depended on the efforts of a great body of men and women whose existence in Lord Slim's words, "is only remembered when something for which they are responsible goes wrong".

If any one of these many components had failed, our entire effort would have come to nothing. Just as any one link in a chain is essential to supporting the weight at its end, or as a breakdown in any one component can ruin a machine, so could any one of many agencies have lost us the war. What none of them would have claimed is that it won the war by itself. □