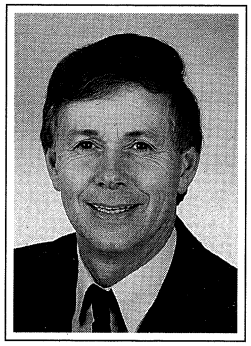


Fixed Service Radio in The Netherlands

By Louis Meulstee PA0PCR

This paper, concluding a series of three, deals with the most colorful and fascinating part of Dutch radio history: the long-distance fixed radio communications service.

A vast number of available historical records and references in this field were reviewed, and the story of Kootwijk radio, the first Dutch long-distance fixed service radio station, was selected as one of the most interesting.

For just a few hours during the night when conditions were unfavorable, the alternator transmitter PCG would give relief.
This was only the start of the very tempestuous development of the shortwave service of Kootwijk radio, which is actually continued up to today.

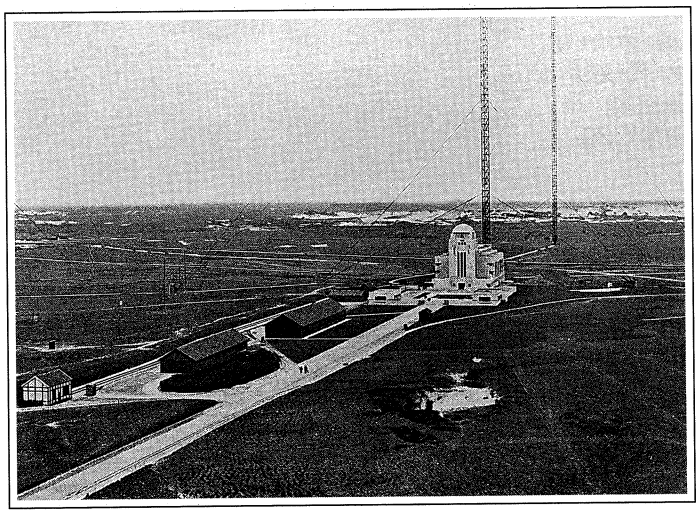
Although the Kootwijk station was built initially for linking the homeland Holland to its former East Indies colonies (now Indonesia), traffic was soon expanded to many other countries.

The initial transmitter, a Telefunken alternator for VLF operation only, was virtually obsolete by the time the station was inaugurated. Much of the traffic was soon taken over by shortwave transmitters operating on a fraction of the alternator's power. Nevertheless, the alternator remained operational for regular traffic (e.g., to the USA) and during some nighttime hours when shortwaves were unreliable on the Dutch East Indies link.

Besides the technical and historical details, other interesting station aspects, such as architectural features, are dealt with. A further reason for selecting Kootwijk as subject for this paper is its present status as a fully operational primary PTT Telecom HF transmitting station and the recent addition the station's main building to the Dutch List of Historical Monuments.

The history of Kootwijk radio would not be complete without mentioning its initial counterpart: Malabar radio in the Dutch East Indies.

Though briefly discussed here, in a future article the author will provide a more comprehensive description of the fascinat-



'...in the middle of an infertile, desert like, plain...' Kootwijk radio was photographed about 1923 from top of the water tower. Five masts are arranged in the corners of a hexahedron, and a sixth mast (near the main building) is located in the center. The masts are connected by copper wires that form the aerial in the shape of a umbrella, which was a configuration Telefunken commonly used at the time. Only three of the huge 212 meter masts are visible. Note the 'B' building, nearest to the main building, which housed the station's first shortwave transmitters.

ing history of the 2.4 Megawatt "big arc" transmitter of Malabar radio and the magnificent work of Dr. ir de Groot.

To provide a wider understanding, it was considered essential to provide relatively more space to the case history and historical background of Kootwijk radio.

The history of radio and of major radio stations is often loaded with (inter)national politics and internal quarrels, and the Kootwijk station history is no exception. Competition among colonial departments in Holland and the Dutch East Indies government made the life of contemporary PTT radio engineers most difficult.

Dutch colonies

During the second Boer War (1899-1902) between England and the two South African republics, cable telegrams to South Africa were censored by the British, who had direct control of the cables where they passed through Aden.

In Holland, which at the time was strongly biased towards the Boers, this obvious measure was especially felt. This incident was, no doubt, the reason why the idea of independent communication from Holland to its colonies was conceived.

After the Boer War, independent communication to the Dutch East Indies was sought by means of the inauguration of the German-Dutch Cable Company, opening way to telegraph from Dutch East Indies to Europe via the USA or via China and Siberia. However, very soon, indications of British influence on the USA cable were apparent, and very early in World War I (after the capture by the Japanese of the Island of Yap), the solution proved to be a failure.

Before World War I, several plans were devised for radio communication between Holland and its East Indies colonies, the scheme by Professor van der Bilt being the most promising and advanced. His ideas were linked with the projected British Imperial Wireless Chain of three intermediate relay stations: Tripoli, Italian East Africa and Ceylon.

In early 1914, the plans were abandoned because World War I made it clear that the intermediate stations would have been as vulnerable as cables.

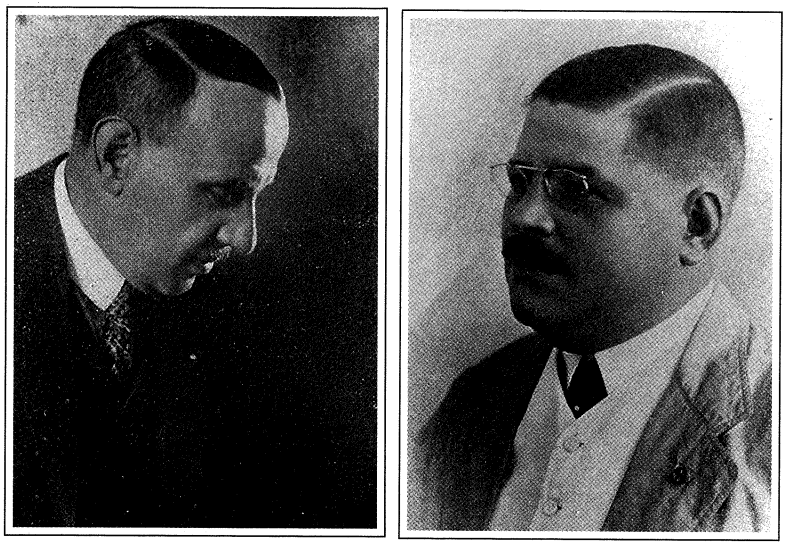
In 1916, as a war-time measure, all British controlled cables (i.e. between neutral Holland and Dutch East Indies) were again censored. As a result, the Dutch East Indies government, which suffered the most, made immediate plans toward the final solution: direct radio communication to its homeland.

Dr. ir de Groot

In 1908, C.J. de Groot, a brilliant *practical* scientist, arrived in the Dutch East Indies, appointed to a function at the Dutch East Indies PTT telegraph department.

However, displaying interests in and possessing sound knowledge of the field of radio, he quite soon was assigned to direct the installation of a chain of radio stations in the Dutch East Indies for local communication. The experience with propagation among the stations, not very much understood in those days, enabled de Groot to obtain a large proportion of knowledge.

This culminated to his famous Ph.D. dissertation "Radio-Telegrafie in de Tropen"[1], which he promoted at the Delft Technical University during his leave in 1916. One of his major (and historically best known) statements of the dissertation was "...direct radio communication between Holland and the Dutch East Indies without the use of intermediate stations is a political necessity and technically feasible..."



Two names are clearly marked in the history of Dutch radio: (left) Prof. dr ir N. Koomans (1879-1945) and (right) Dr. ir. C.J. de Groot (1883-1927). With de Groot in Dutch East Indies and Koomans in the motherland, PTT had two equally gifted and progressive leaders.

In late 1916, just before leaving Holland, de Groot visited the Telefunken Company where he was offered the loan of a receiver to listen to the German radio station at Nauen. On his return trip to the Dutch East Indies, he made a detour to the USA, staying two days

[1] "Radio-Telegraphy in the Tropics", the text of the dissertation printed in a limited edition, was bound in the Dutch East-Indies and prepared on very fine cloth, and is now a highly sought collector's item.

at the Federal Telegraph Company, where he purchased a 100 kW Poulsen arc. There, de Groot received instructions on how to increase the power of this type of arc transmitter, which would enable him to make direct contact with Honolulu Radio and thence via neutral USA to Holland.

However, during de Groot's absence, it was shown that powerful European stations such as Nauen, Eilvese, Bordeau and Carnarvon were received quite regularly in the Dutch East Indies.

This gave de Groot confidence in his initial plan: direct radio communication with Holland. Of course, his ideas were welcomed and backed up by the Dutch Indies Government, which gave his plans almost unlimited credits.

When the Federal Telegraph Company arc transmitter arrived in August 1917, work had already been much advanced on the transmitting station site.

Mountain gorge aerial

Because of the war, no adequate supplies of steel were available for building the planned tall aerial masts. This led to Dr de Groot's splendid idea in using a mountain gorge to suspend an inverted L aerial. In the Malabar area, very near Bandoeng (Java), a suitable site with the right orientation was quickly found.

In November 1917, a temporary installation with an improvised aerial had been completed and was operating on either 8,000 or 16,000 meters. Of course, only one-sided communication would be possible because no suitable transmitter had yet been built in Holland.

The initial power source, a makeshift arrangement including a spare generator of the Batavia Electrical Tramway Company driven by a borrowed aircraft-engine, limited the power of the Federal arc to only 40 kW. From that time onward, regular signals were given on the hours of the day which were regarded as most suitable for communication to Europe.

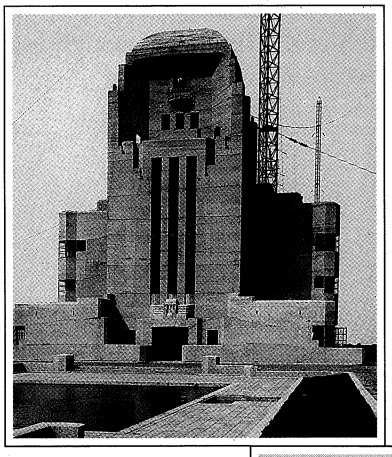
Messages were sent to Holland (i.e. the Dutch Naval Telegraph Service) but as apparently no suitable receiver seemed to be available, none were received.

Naturally the East Indies Government was not very pleased with this excuse, and in an Dutch East Indies paper of that time exceedingly strong language ("treason") was used to describe the failure.[3] According reports of the Dutch East Indies government, the apparent refusal to listen for messages caused a delay of more than a year for the whole project.

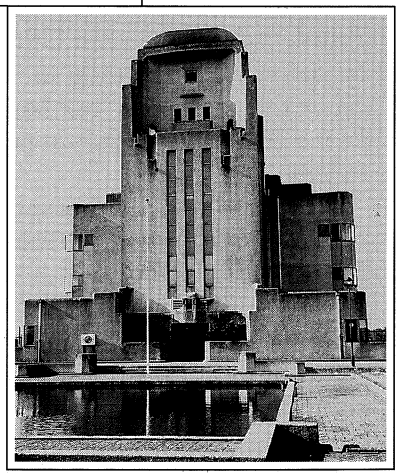
Later on in 1918, because still no steps had been taken in Holland to listen to the transmissions, a 3-valve receiver made in Dr de Groot's workshops was sent to Holland on an armored cruiser of the Royal Dutch Navy. Earlier on, it had been found that the borrowed Telefunken receiver was not really suitable; a new receiver had been developed locally and this type was hurriedly copied and sent to Holland.

During the journey, the Malabar transmitter was heard regularly. Even at the longest distance, the antipodes of Malabar at the crossing of the Panama canal, clear reception was recorded. That was a record distance for reception at the time. A new generator, powered by a water turbine, had been installed by then to increase the transmitter power to about 200 kW.

In mid 1919, upon the receiver's arrival in Holland, a receiving station at De Meent (in the center of Holland) was built, partly as a private venture and partly at the expense of the Dutch East Indies government (!), and almost instantly Dr de Groot's signals were heard.[7] Only after a struggle of one-and-a-half years and the intervention of the East Indies government, the first milestone, a direct radiopath, although one-sided, was achieved. By that time, the war was over and the cable blockade had been lifted.



This is the main building's front entrance and cooling pond at Kootwijk Radio in 1924.



This is the main building's front entrance and cooling pond at Kootwijk Radio in 1993. Apparently, nothing has been changed since 1924 except the tall aerial masts.

Big Arc

Although the original Federal arc had been modified to raise the power to about 200 kW and the provisional mountain aerial had been improved, communication was still considered as not yet very reliable.

Dr de Groot decided to build a more powerful arc transmitter with a primary energy of approximately

2,400 kW and, additionally, to extend the mountain aerial. With this arrangement, he calculated that communication would be possible over a much longer part of the day. Because Dr. de Groot's work is not generally known, except in the Dutch language, the author has made this story a subject for a more extensive future article.

No coal for Holland...

In 1917, the Dutch government had been advised about the purchase of radio equipment for communication with the Dutch East Indies.

Two competitors were considered to have the capability of completing the project: the British Marconi Company and the German Telefunken Company. However, as it happened, one of the Governmental advisers, Le Roy, a former director of the German-Dutch Cable Company who was pro-German and who was connected to Telefunken, the Marconi Company, quit.

In September 1918, the order was given to Telefunken. The whole project included building a transmitting and receiving station in Holland and the same combination in Dutch East Indies, both technically identical to the powerful German radio station at Nauen.

In 1917, anticipating a possible big order, Telefunken had dispatched, at its own expense, a temporary 100 kW alternator transmitter for Dutch East Indies to establish improvised communication for Holland via the German Nauen station.

This measure was not really accepted by East Indies officials, and the transmitter lay dormant at a Surabaya store. After a while, the transmitter was installed because instructions telegraphed from Holland insisted that it be installed and, if it were not, Germany threatened to stop the export of coal to Holland.[5]

The site of the temporary Telefunken alternator transmitter, not very far from Malabar, was ready in late 1918. During the 1919 experiments, the station proved much weaker than the Malabar arc, primarily due to its lack of power and relatively small aerial.

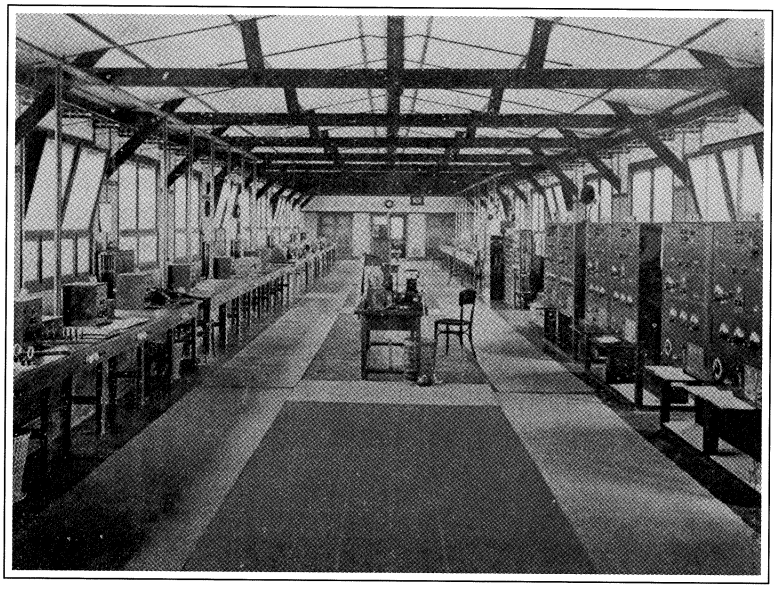
Receiving station

In late 1919, as part of the Telefunken contract, a receiving station had been built under the supervision of Dr. ir Koomans (of whom we will hear more later) at Sambeek, in the southeast of Holland, about 70 km from Kootwijk.

The completion of the Sambeek receiving station started a friendly competition between the Dutch PTT station and the De Meent station of the Dutch Indies government.[7] But as the Sambeek station was gradually improved and modernized, the reception station of De Meent could not keep pace and was forced to close. However, its necessity had been proved by then.

Telegrams received from Dr de Groot's arc or the definite 400 kW Telefunken alternator (which had been installed by then using part of Dr de Groot's Mountain gorge aerial) were further dispatched by line. In 1924, the Sambeek station was transferred to a site near The Hague, much nearer to the radio-office in Amsterdam and providing easier access and, consequently, closer contacts with the PTT radio laboratory.

However, the receiving conditions proved to be quite unfavorable, and quite soon another transfer was made to Noordwijk radio (NORA) on the North Sea coast, where it remained until 1950.



This is the interior of the receiving station Noordwijk Radio (NORA) as it appeared about 1936.

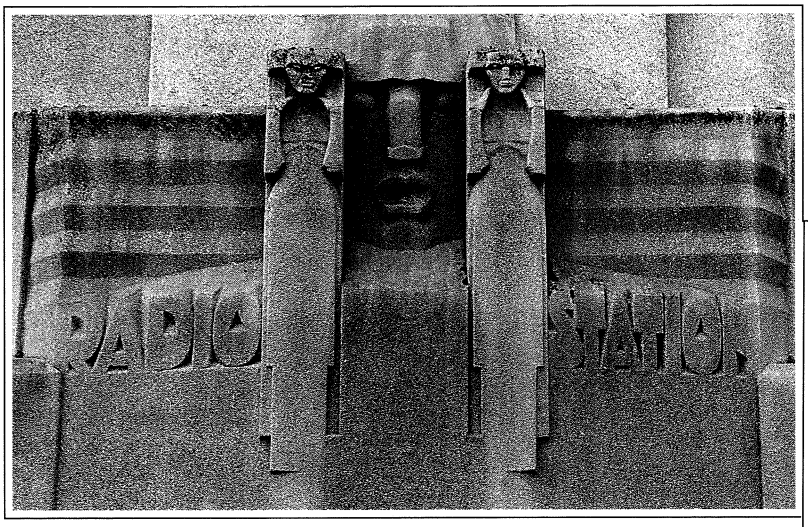
In December 1918, work on the Dutch transmitter station had already been started after a suitable site was found in the center of Holland where the state owned a vast area of land unsuitable for agriculture or forestry. Consequently, the land was very cheap, and work started immediately.

Kootwijk

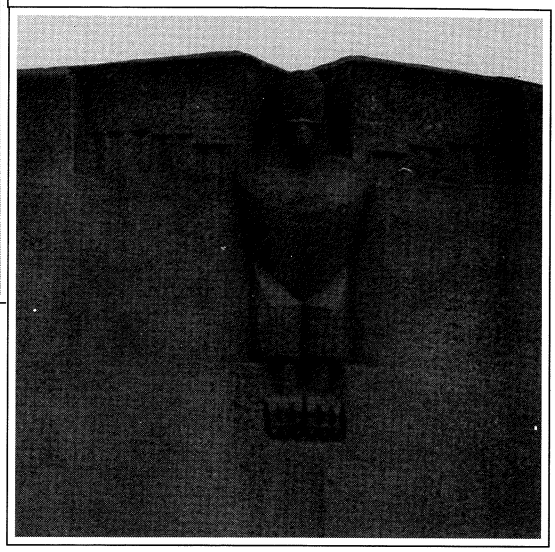
The transmitter site, near the village of Kootwijk, was (and still is) in the middle of an infertile, sandy, desert-like plain. It took six months to have the site leveled and made suitable for building.

The station building was designed by J.M.Luthmann (1890-1973), an architect of the "Amsterdamse school," a variation of the international Art Deco. There were no specific requirements when he took the job of the architectural design.

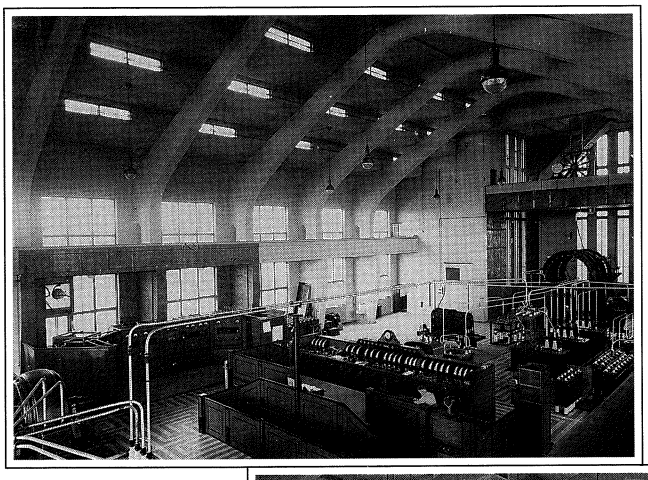
A short visit to the contractor, Telefunken, and to the German high power station at Nauen did not give



Above the Kootwijk station main building entrance is an allegoric sculpture (created by H.A. Van der Eijnde) depicting the transmitting station (the huge 'mouth') accompanied by two receiving stations (small listening figures).



At the back of the main building a stylized Eagle (also created by sculpturer H.A. Van der Eijnde) can be seen. With this sculpture, Van der Eijnde, inspired by German expressionism, paid homage to the alternator transmitter's designers. Particularly after World War II, this sentiment was out of favor. Nowadays, most people explain the eagle as the symbolized free flight of radio waves.



In the late 1920s, the hall in Kootwijk radio's main building housed the Telefunken alternator transmitter for station PCG. By then, valve-technology MF transmitters for European traffic had been installed (far left, beneath the windows).

Visible at the extreme left is one of the two alternators, in the center the control desk. Behind the desk are the saturated core transformer frequency multipliers and aerial inductances. The frequency of the alternator had been changed from 6,000 Hz to 5,600 Hz, and most of the traffic was concentrated on 16,800 kHz. Consequently, some of the frequency-multiplier equipment had been removed as no longer being necessary.

The design of the roofform touches the bows of the beams at right angles, making it possible to put up transom lights. With this configuration, Luthmann transformed the circle into right angles, as is easily seen in this picture.

This is how the hall in Kootwijk radio's main building looks today. Notice the former PCJ broadcast transmitter in the center of the hall with its hatches open, awaiting final restoration.

him anything to go on. Later Luthmann expressed: "...I just had to build a large building with a main hall and tower, definitely no wood or steel nails to be used, and above all it had to be completely dry...."

A design in reinforced concrete seemed to him to be the obvious (and only) choice. It was not really a daring idea because many other contemporary large buildings had been made with this material. It allowed construction of seamless walls and provided broad range construction possibilities of such as wide spans and hanging constructions.

Still, the Kootwijk radio station was Holland's first large building constructed with an architectural design using the skeleton, outer cladding and decoration made of concrete.

A 'cathedral in the desert'

In early 1920, construction work on the station main building commenced, and it took almost two years to complete.

In the meantime, the six 212-meters-tall aerial masts and the huge umbrella-type aerial had been erected and an extensive earth mat had been dug in.

Luthmann's monumental station building (officially known as the "A" building) had a specific style, not an exact example of the "Amsterdamse School," but showing other influences such as expressionism.

Some people compare the building with a Greek temple; others title it as a "concrete cathedral"; and a technical student of the Sudan, posted to the station for a few weeks, spoke of a "moskee."

"...another Dutch building where classical conception determines design, yet where modern structure is expressed, is the Radio Station at Kootwijk, designed by J.M.Luthmann. It is not difficult to see this as a transformed Greek temple where instead of a comparatively heavy stone construction it has a lightness of aspect, seen especially in the treatment of windows, made possible by steel...."— A. Whittick, 1974.[8]

It is remarkable that a great many past and present station visitors are deeply impressed, undoubtedly by the mystic atmosphere of the huge building situated in a remote inhabited area.

When approaching the station from the main road, the station main building can be seen at the end of a long straight lane.

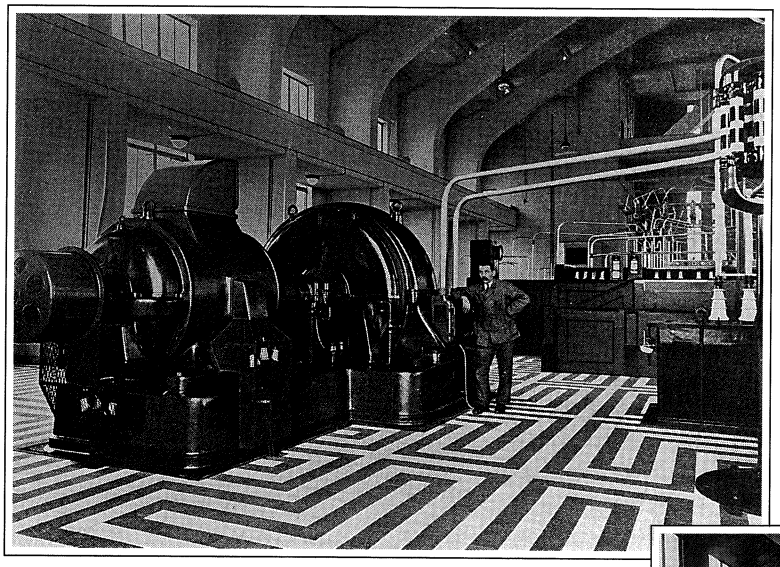
Entering the main entrance, one can still feel the atmosphere of the past, emphasized by the fact that recently, large parts of the interior, painted more than quarter of a century ago, have been restored to their original condition.

A professor of architecture of the Delft University invariably takes his students every year to the Kootwijk station to show them the remarkable architectural details.

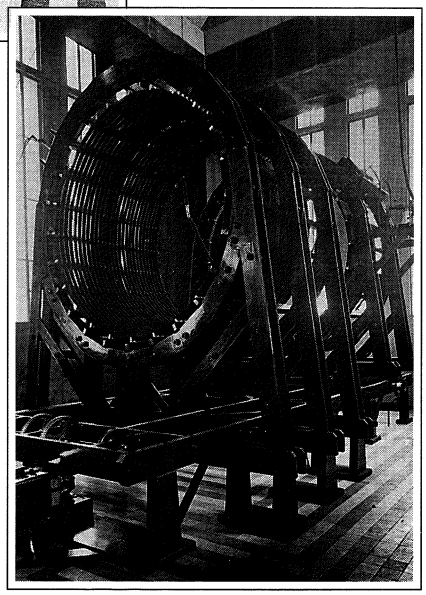
Telefunken alternator

In the early days of radio, VLF (very long waves) were considered as most suitable for long-distance communication. Technically, only a few systems generated enough RF power.

The Telefunken transmitter, station call sign PCG,



This is one of the two Telefunken motor and alternator combinations. Some time after this picture was taken, the PTT fitted the alternator with an electronic device that kept the alternator frequency highly stable, replacing the initial mechanical system. Water pumped through a system of tubes in the stator cools the alternator. Its output is 400 KVA at 800 volts.



The huge aerial inductance and variometer used a sliding construction designed and made by the Dutch PTT. It proved to be a great improvement, enabling a continuously tunable aerial adjustment. Notice the typical period style pattern of the floor tiles. The original tiles were still in use in 1993, as shown in the picture at the bottom of page 14 and the picture on page 20.

included an Alexanderson type alternator with saturated core transformer frequency multipliers providing the choice of a very limited number of frequencies (3x, 4x or 6x the frequency of the alternator). The output power of the alternator was about 400 kW, and the RF current at the feeding point of the aerial was approximately 350 A.

The frequency of the alternator was initially 6,000 Hz, resulting in operating frequencies of 36 kHz (8,333 meters), 24 kHz (12,500 meters) or 18 kHz (16,666 meters). Later, because of international agreements, it was necessary to change the frequency to 5,600 Hz, resulting in 16.8 kHz/17,800m or alternatively 11.2 kHz/26,700m. In practice, the alternator operated on 16.8 kHz for most of its life.

Alternator transmitters are most reliable and easy to maintain, though more expensive and less flexible in frequency coverage compared to an arc transmitter.

The initial frequency stability of the Telefunken alternator was rather poor. In 1925, the PTT radio laboratories had designed an electronic device that increased the stability considerably. Other improvements of the alternator transmitter had by then been accomplished by the PTT radio laboratories.

Obsolete

On Jan. 18, 1923, the first operational two-way contact with the Dutch East Indies was established on a frequency of 36 kHz (8,333 meters).

A few months later, on May 7, public service was inaugurated. Operating times were (as anticipated) only when the radio path was in the dark (Holland about 1900-2400 hrs, East Indies about 0200-0700 hrs, both local time).

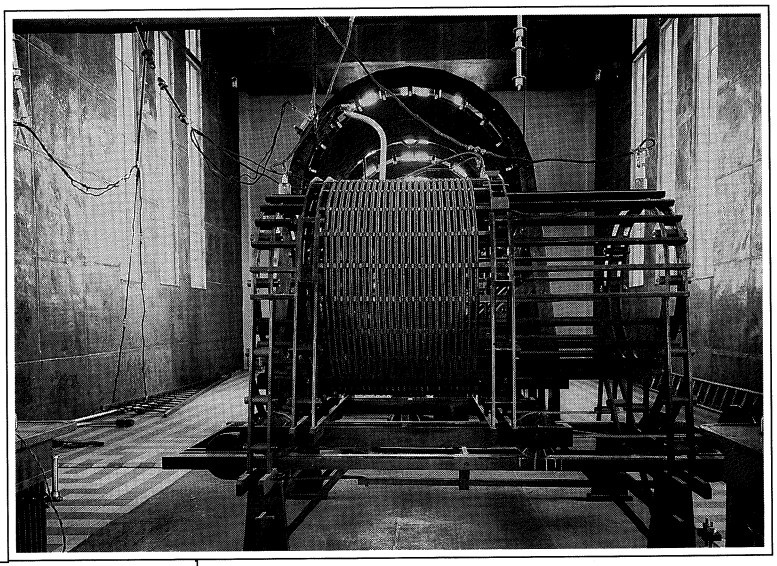
All traffic was concentrated at a central point, the radio terminal in Amsterdam. From there the Kootwijk transmitter was keyed via cable. The reception station at Sambeek (later Noordwijk radio) was similarly connected. This arrangement was quite sensible because many of the telegrams for the Dutch East Indies were addressed to destinations in the Amsterdam business area.

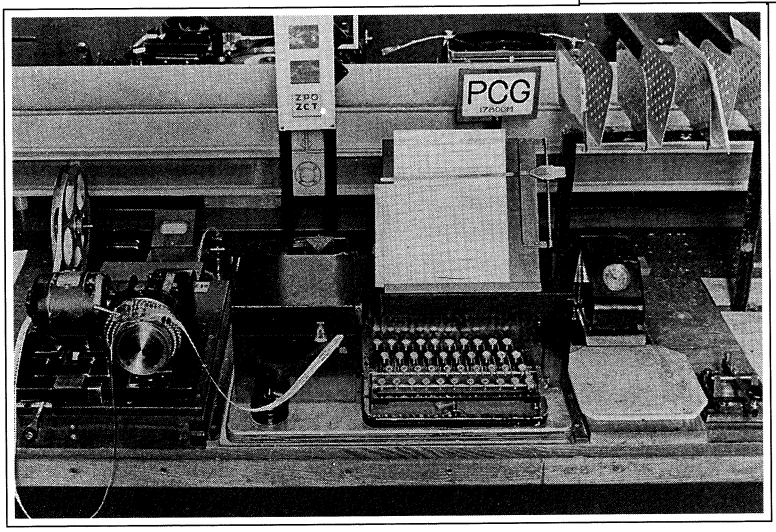
In late 1924, in an attempt to increase the rather limited traffic hours of the Holland-Malabar link, traffic was re-routed by using the Malabar-San Francisco radio route, thence by cable to New York and finally by the New York-Kootwijk radio link.

However, the advent of high-power valves and the discovery of the possibilities of shortwave made the alternator obsolescent. By the late 1920s, the PCG alternator transmitter was only used for transmissions to New York (European traffic on VLF and LF had already been taken over by a number of valve transmitters) and as a stand-by transmitter for the Dutch East-Indies link in case the shortwave link would fail.

Short wave

In December 1921, American amateurs bridged the





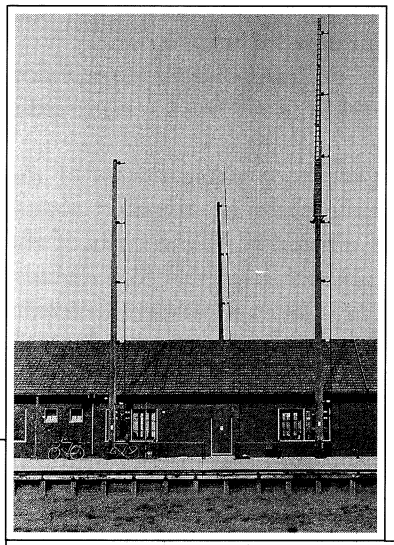
The aerial transformer is in front of the huge aerial tuning/variometer. Notice the copper screening at the walls of the tower.

This is the operating position of PCG alternator transmitter (operating on 17,600 meters, according the indication) at the Amsterdam Radio terminal. The telegrams are first typed by means of a keyboard of the perforator (center) providing a tape which runs through a high-speed Morse transmitter (left). Notice that an ordinary Morse key (right) is available as a stand-by!

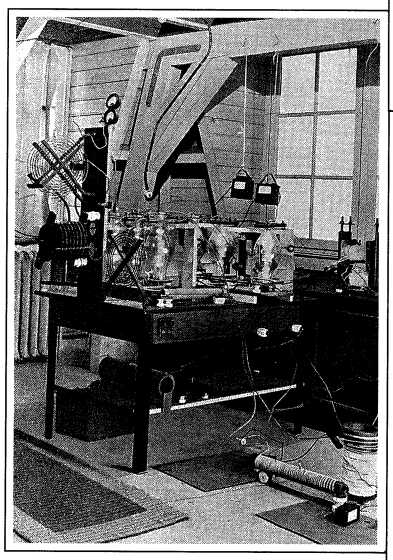
Atlantic Ocean on short waves using very low power.[10]

The first two-way shortwave amateur contact between Holland (call sign PCII) and the USA (2AGB) was established on Dec. 23, 1923.[12] It is interesting to note that the original and complete PCII transmitter used during these contacts is in the PTT museum.

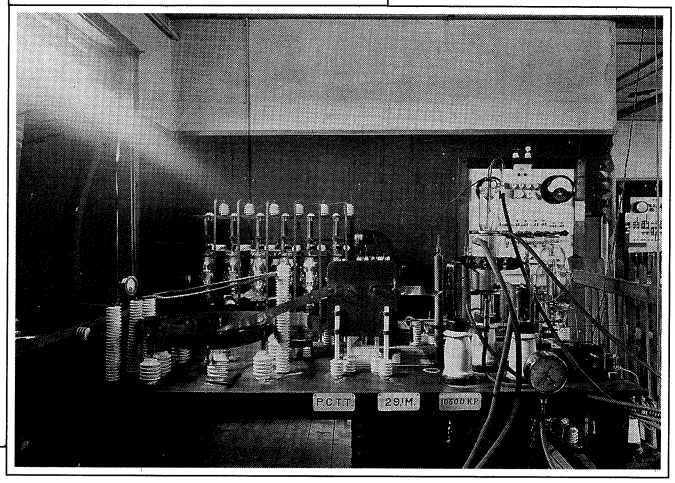
Although contemporary professionals were very skeptical and warned about overoptimism, work on a proposed shortwave link started in 1924. Again, the Dutch East Indies were ahead, and on Feb. 17, 1925, the shortwave transmitter ANE, located in Bandung, Java, was received with a very strong signal in Holland on a wavelength of 95 meters.



In 1925, at the start of the shortwave era Kootwijk radio's 'B' building housed the four initial short wave transmitters. Notice the use of simple vertical aerials. In the 1930s and until its destruction in 1945, the building housed a 1,875 kHz AM broadcast transmitter.



First Dutch telegraphy shortwave transmitter, call sign PCMM, was designed in early 1925 by the PTT radio laboratories in a very short time in order to reply transmissions of Dr de Groot's "ANE" transmitter at Malabar. Notice the provisional construction on a lab workbench. The transmitter power was limited to 2 kW because air-cooled tubes were used. 'PCLL', the radio lab's second provisional shortwave transmitter of, operational a few months later, had a water-cooled tube and allowed more power. Its design stand model for the four initial Kootwijk radio shortwave transmitters in the 'B' building.



This is transmitter PCTT, one of the four provisional shortwave transmitters in the 'B' building.

Only a few months later, Dr. ir Koomans completed the first shortwave transmitter located at the radio-laboratory. It was an instant success. On Aug. 17, 1925, only about two years after the inauguration of the alternator transmitter, this provisional transmitter (call sign PCMM) became operational, keyed from the radio terminal in Amsterdam, and soon to be followed by a second more powerful transmitter (PCLL).

In early 1926, four transmitters of the PCLL type were hurriedly installed in the "B" building at Kootwijk radio. The frequencies of the four transmitters were divided in the wavelengths between 16 to 51 meters.

This division allowed a simple arrangement to switch from one frequency to another, providing a nearly 24-hour radio link. For just a few hours during the night when conditions were unfavorable, the alternator transmitter PCG would give relief.

This was only the start of the very tempestuous development of the shortwave service of Kootwijk radio, which is actually continued up to today.

The simple vertical quarterwave aerials were soon replaced by more complex beams. Dr. ir Koomans has done sterling work in this field and has gained a number of patents: e.g., the Koomans array.

In the late 1920s, a new shortwave site was built, only a few kilometers away from the alternator transmitter site, leaving the obscure B building for a more spacious complex (building C, D,E and F) and enabling the erection of large beam aerials. In 1928, a reliable 24-hour radio link to Dutch East Indies on shortwave was achieved, due to the improvements of both stations.

Threat of privatization

It is little known that the shortwave service saved the VLF link from being discontinued despite high operating losses.

In 1923 and 1924, it was found that the alternator transmitter service was losing money because of high operating costs and a reduced interest in sending expen-

sive telegrams by means of a service which was only available for a limited number of hours a day.

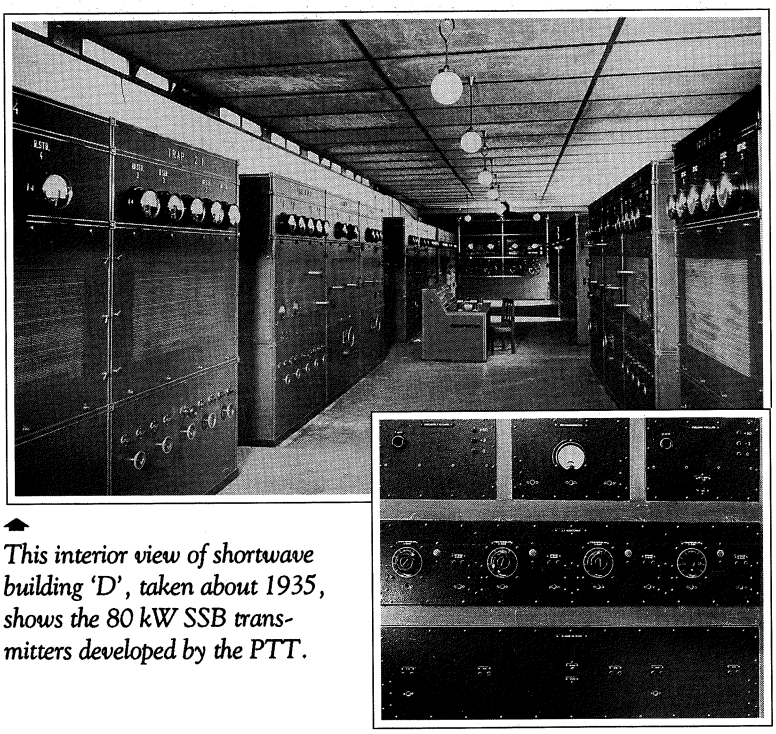
In 1925, a report of an independent commission advocated the privatization of all fixed service radio links.

However, because of the positive results of the shortwave service, which could be operated almost throughout the day at a fraction of the costs of the alternator transmitter, and because the radio laboratories were able to produce reliable shortwave transmitters at only 1/15th of the price of a commercial manufacturer, the board of ministers decided to maintain the fixed service at the PTT.[14]

In addition to transmitters of fixed service, Kootwijk radio housed a number of shortwave transmitters for Scheveningen radio, the Dutch coastal station for maritime services. The limited space at Scheveningen radio's transmitting site (primarily MF transmitters to carry traffic at distances as far as 1000 km) along the Dutch coast did not allow for a large expansion.

In 1927, the first shortwave transmitter for maritime service was installed, and this service gradually expanded to become a large proportion of the station's traffic.

Not mentioned in this paper are the numerous fixed-service, long-distance shortwave links to many countries, including traffic on LF to various European countries.



This interior view of shortwave building 'D', taken about 1935, shows the 80 kW SSB transmitters developed by the PTT.

Single-sideband telephony

In 1927, the first experimental (semi-public) telephony link to the Dutch East Indies was opened.

Feb. 28, 1928, saw the inauguration of a public radio-telephony link to Dutch East Indies, the longest direct radiotelephone link in those days.

In the years that followed, many improvements were carried out, such as extensive aerial arrays, crystal control and, most important of all, the introduction of single-sideband.

The application of single-sideband on shortwave was again a world first in 1933. Only one year later, all the Kootwijk transmitters serving the East Indies had been converted for single-sideband. In 1935, Koomans and his team increased the capacity by putting two telephone circuits and two telegraph circuits over one transmitter. In 1937, experiments showed that this could be increased to four telephone circuits plus a number of telegraph channels over one single-sideband link.[11]

Radio for the Nazis

On the 11th of May 1940, the second day of the of the German invasion of Holland, the Kootwijk station was occupied by the Germans. It was taken over and soon was used for German war purposes.

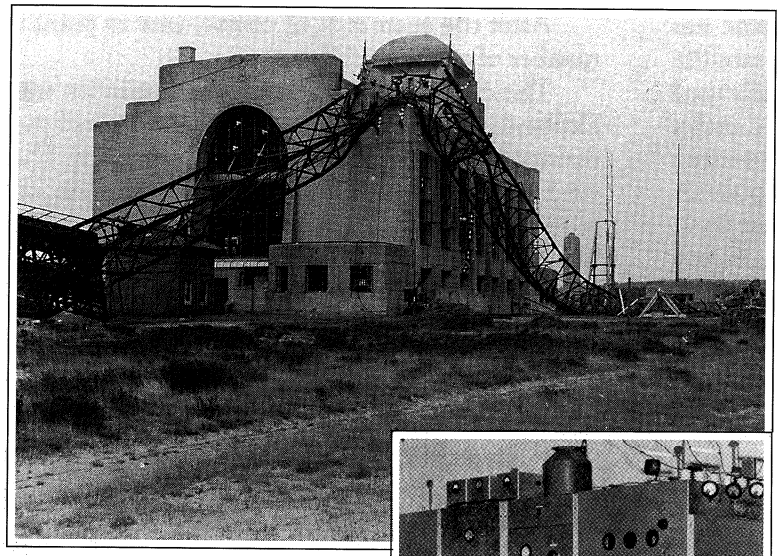
During the war, the VLF alternator transmitter PCG was primarily used for transmitting encoded messages to submerged U-boats in the North Sea and parts of the Atlantic with a range of about 1,000 miles. Many of these messages were decoded by the British, cracking the Enigma code (codename "Ultra").

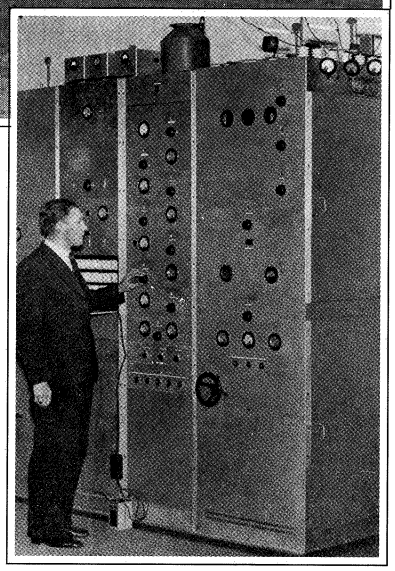
That the code had been cracked might explain the lack of any large scale air attacks on the station during the war—the Allies gained more information when the station was operational!

It was attacked only a few times by low-level long-range RAF aircraft, and a few 2 cm holes in the rails of the crane in the main building hall are sinister marks of a dark period.

The 1,875 KHz broadcast transmitter, located in the "B" building, its aerial slung to one of the PCG aerial masts, was used for propaganda and for relaying Radio Bremen, known as

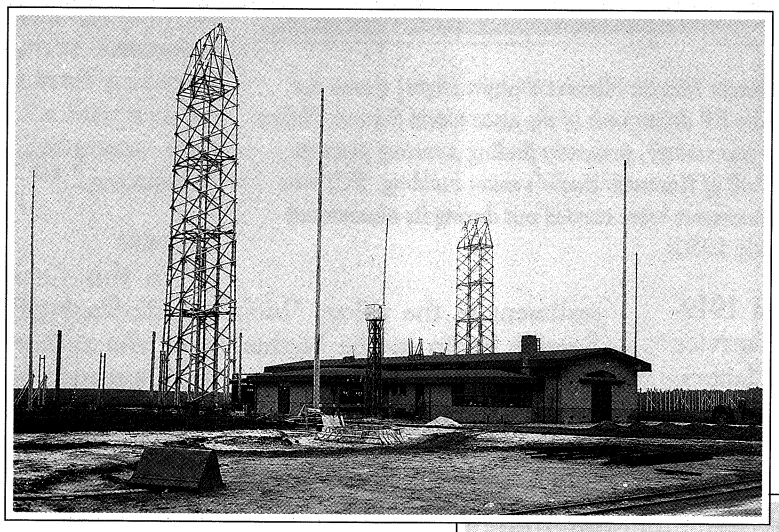
Of the pre-war single-sideband receivers previously used at the NORA receiving station for one the Dutch East Indies fixed service links, this is the only one remaining. Each receiver fills three 6-foot-high cabinets. (Only the RF unit is shown here.) Notice the use of a National HRO-type tuning dial to control the receiver's local oscillator. The receiver has been moved from the PTT Museum to Kootwijk radio to find a place in historic surroundings.

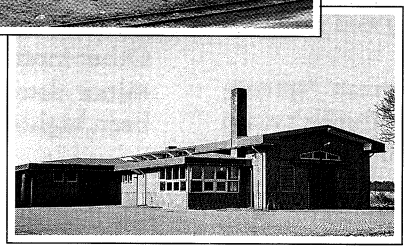




In April 1945, the retreating Germans left the station after destroying most of the technical equipment including the six 212-meter aerial masts. One of the collapsing masts hit the main building. However, thanks to the building's strength, virtually no real damage was done.

Secretly hidden under the eye of the Nazis during World War II, this was Kootwijk radio's first operational transmitter after the war.





This is the exterior of shortwave building 'D' about 1935.

In this 1933 picture of shortwave building 'D' in 1993, virtually nothing has changed, except that the wooden aerial masts have been removed.

"Sender Friesland" (not very appropriately though, because the province of Friesland is in northern Germany).

It is interesting to note that the single-sideband receivers of the reception station at Noordwijk radio (NORA) were extensively used by the Germans for intercepting the secret (scrambled) high-command radiotelephone link between England and the USA.[13]

In April 1945, the Kootwijk station was destroyed by the retreating Germans. The six aerial masts were blown down, and the alternator transmitter PCG was destroyed by explosive charges. In 1944, most of the shortwave transmitters had already been removed and transported to Germany.

Postwar period

In 1945, many of the buildings were damaged, and all the technical equipment had to be entirely rebuilt.

A single 3kW transmitter that had been under construction and that was nearly completed, had hurriedly been disassembled in May 1940 and had been hidden from the Germans during the war. This transmitter was reassembled first and, in October 1945, it was put in operation for traffic to New York.

Two battered 40 kW transmitters were later found on a railway track in Germany and, in 1946 they were put in operation again.

In 1946, fragments of the demolished masts were used to erect two 200-meter masts carrying aerials for two LF transmitters for European traffic. Because the days of VLF and LF were numbered, they were only used until the mid-1950s.

Because they no longer were in use, one of the two huge masts was demolished in 1966 and the other in 1980.

During the early postwar years, Kootwijk radio saw a rapid expansion of the number of transmitters and reached its highest number in the mid-1950's. In 1954, the station had about 53 shortwave transmitters for global communication and two LF transmitters for European traffic.

Kootwijk radio today

The fixed-service radio communication at Kootwijk radio ceased in the 1960s, having been superseded by modern transatlantic cables (after 1956) and a decade later by satellite communication.

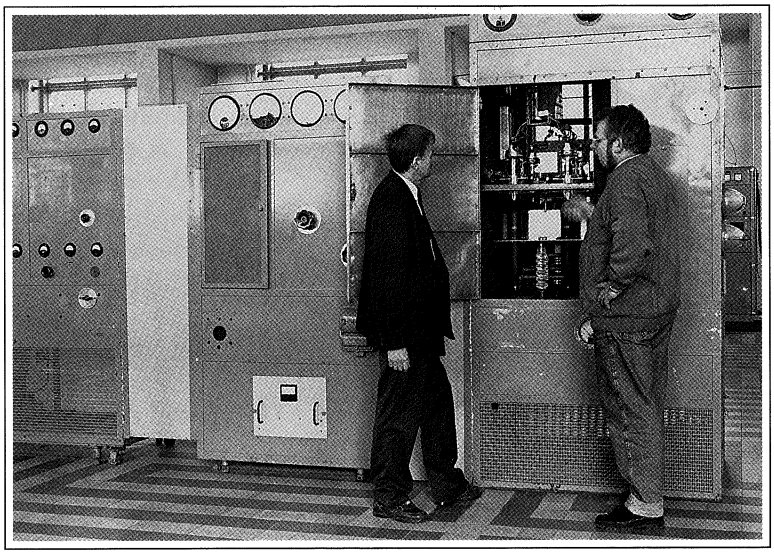
The importance of mobile (maritime) traffic has increased considerably, despite the boom in satellite communication. Kootwijk radio is now primarily used for long-distance (worldwide) maritime traffic under the control of the Dutch coastal station Scheveningen radio. It also serves as a worldwide shortwave maintenance and service link for KLM Dutch Royal airlines.

It is remarkable how much of Kootwijk radio's original buildings are still intact, though nowadays many are not used for their original purpose.

The main "A" building is fairly unaltered. The entrance hall has recently been restored to its original state.

Other buildings by Luthmann, such as the watertower, a former hotel and station personnel houses are apparently unchanged.

Most of the former shortwave buildings of the 1920s are now in use as PTT offices.



Kootwijk radio station manager Martin Nieuwenhuizen (right) shows the author the finer details of the RF driver unit of the once world famous Philips PCJ short wave broadcast transmitter, presently finding a resting place in worthy surroundings: the hall of Kootwijk Radio's main building. PCJ was built in 1927; many improvements were carried out during its operational life, which ended in the early 1950s.

Old meets old

Recently the prewar broadcast transmitter PCJ, which won fame for its historic worldwide broadcasts in the late 1920s and 1930s, has been moved from Philips, Eindhoven, to Kootwijk. It has found a worthy place in the hall of the main building, actually on the same spot where the PCG alternator transmitter was operational for many years.

In retrospect

It is characteristic that during the period 1919-1940, the development and operations of fixed-service radio was done completely in the sphere of the laboratory.

Such laboratory development was not very strange though, because Prof. ir Koomans, as director, had direct control over the radio laboratory and both the Kootwijk and NORA radio stations.

In spite of British air attacks, German "sprengkommando's" and the passage of time, Luthman's main station building is still as strong as ever. Having a unique design, it has recently been put on the Dutch list of National Monuments, which should save the building from destruction.

After the years it is, of course, easy to point out a number of apparent failures.

The choice of the Telefunken alternator was, for Holland, not one of the worst failures, considering its reasonable stability and its extreme reliability. There is no doubt that a powerful arc transmitter with its harmonics, or the synchronized disk, which might have been installed by the Marconi Company, would not have been kept and tolerated until 1945 as the alternator was.

In 1918, when the alternator was purchased, the rapid developments of valve technology and discovery of shortwave's possibilities could not really be foreseen.

It is remarkable that the Telefunken Company gave Dr. ir de Groot a contemporary modern receiver in 1916, but when the Dutch East Indies desperately asked Holland to listen to its improvised arc transmitter in 1917, apparently no receiver was available. The story goes that Telefunken refused to lend a receiver unless the company was contracted to build both stations.

Eventually, it appeared that the Telefunken receivers were unsuitable. Dr. de Groot had constructed his own receiver in early 1918, and Dr. Koomans soon replaced his Telefunken receiver with a "...circuit invented by Armstrong...."[15]

Epilogue

In this final installment in the trilogy "Mobile Radio/Paging/Fixed Service Radio in the Netherlands," the author has highlighted a small but fascinating impression of the role of the Dutch PTT in the field of radio communications.

To keep the stories readable for a wide audience, technical details have been kept to the minimum. Other interesting facts, however, including apparently minor details which are not generally known, have been highlighted.

Acknowledgements:

The author is indebted to Martin Nieuwenhuizen, present station manager of Kootwijk Radio, whose

enthusiasm for the history of his station was a great stimulation in preparing this paper.

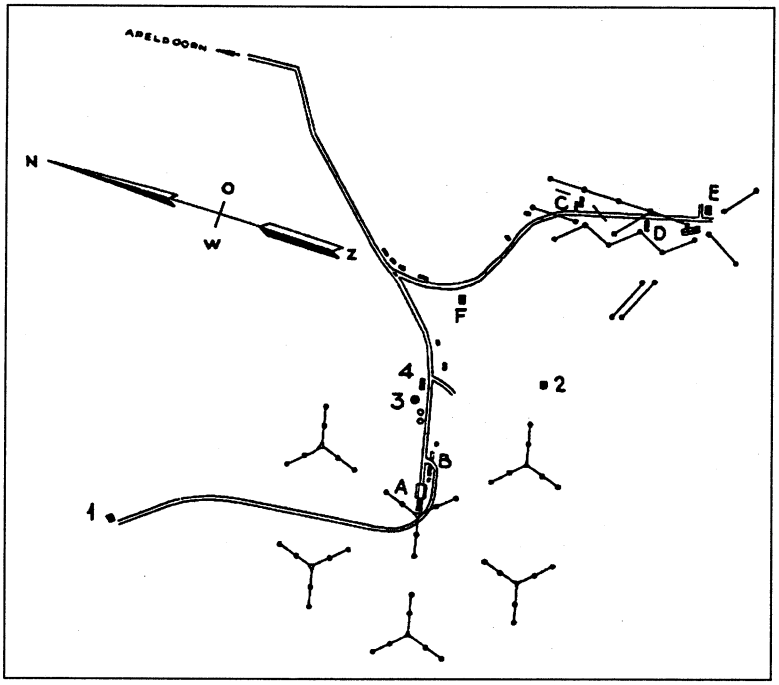
Posthumous thanks go to Kaye Weedon (M), for encouraging the author to undertake further study of the work of Dr. ir de Groot and his contemporaries.

Present-day pictures were ably made by the author's father, Anton Meulstee, who, despite his venerable age, came along during several visits to the station that included long walks along the huge site.

All other photographic work of this and the previous papers in *The Proceedings*, including reproductions of contemporary photographs, was Anton Meulstee's job, and he has turned in sterling results.

Thanks go to the photographic section of the PTT Museum, the Hague, Holland, for providing a great proportion of contemporary photographs used in this paper.

The text of the three parts was read by the author's English friend, John Taylor, G0AKN, and was changed according his valuable advice.



This map shows the Kootwijk radio facility in about 1936, including (A) the main building with the PCG alternator in the center of six aerial masts; (B) the initial shortwave building, at the time housing the 1,875 kHz AM broadcast transmitter; (C, D and E) the shortwave buildings and shortwave (Koomans) arrays; (F) the control building; (3) the water tower; and (4) the hotel.

References:

A complete list of references (mostly written in the Dutch language) would easily fill a number of pages. Only a selection is made of the most essential.

1. Radio-Telegrafie in de Tropen, Dr. ir CJ de Groot, Ph. D. dissertation Technical University Delft, June 5, 1916.
2. PKX-Bandung, the story of de Groot's mountain gorge antenna and giant arc transmitter at Malabar, Java, 1917-1927. Text of a slide sequence by Kaye Weedon (M). 3rd ed, 1981.
3. History of the Establishment of Wireless Communication between the Dutch Indies and the Netherlands, and an account of the work done in this connection, Indie Weerbaar, Vol. 4, Aug 1921, pp 4-33.
4. Radio Telegraphy in the Dutch East Indies, The Radio Review, VolII, Nov. 1921, pp 574-582.
5. German influence over Dutch Wireless, The Wireless World, September 1919, pp 328-329.
6. Over en uit, (75 years of PTT radiocommunication 1900-1975), B.Hoogland/ J.Tours, PTT Telecom BV, Jan. 1989.
7. Radio-leven, W. Vogt, ("Life with Radio, a quarter century pioneer work in a modern trade"), Scheltens & Giltay, Amsterdam, 1931.
8. European Architecture in the 20th Century, Arnold Whittick, New York, 1974, pp109.
9. The Wireless Transmitting Station Malabar, Brochure, Governmental Post-, Telegraph- and Telephone Service, Bandoeng, May 1929.
10. The story of the First Transatlantic Short Wave Message, 1BCG Commemorative Issue of *The Proceedings of the Radio Club of America*, October 1950.
11. Single-Sideband Telephony applied to the radio-link between the Netherlands and the Netherlands East Indies, N.Koomans, Proceedings IRE, 1938, pp 182-206.
12. The history of PCII, brochure PTT Museum, n.d.
13. ...Und lauschten für Hitler. Die Abhörcentralen des Dritten Reiches, G.W.Gellermann, Bernard & Greafe Verlag, Bonn 1991, ISBN 3-7637-5899-2.
14. Geschiedenis van de rijkstelegraaf 1852-1952, Dr E. Ten Brink/C.W.L. Schell, PTT, The Hague, 1954.
15. De ontvangmiddelen te Sambeek (The reception station at Sambeek), Dr ir N.Koomans, Radio Nieuws, 1923, pp 337-344.