The Woody Woodpecker Story, Part 3

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The Part 1 can be found in RA (the Radioamatööri magazine) 12/1998 (pp 18–19) and the Part 2 in RA 1/1999 (pp 6–7). Here I refer to those articles primarily for supplementary information. More references can be found in this text and as listed below. Even here the term *Woodpecker* refers to the high-power OTH (over-the-horizon) radar which operated in Europe during the years 1976–1986 and which used the pulse frequency of 10 Hz. Also in the 2000s on the HF bands, over-the-horizon radars from other countries, using other pulse frequencies, have been audible. The 10-Hz Woodpecker was, and will be remembered as a unique phenomenon that generated more interference reports and speculations than any other radio emission.

The Part 1 showed oscilloscope readouts of the various forms of Woodpecker pulses that were recorded in Laajasalo (YLE Monitoring Station) on 7 October 1976. The professional-grade observations by Canada's National Amateur Radio Society RAC were presented. The Part 2 introduced the spread spectrum hypothesis (PRN, pseudo-random noise code) of Peter Martinez, G3PLX, which, as far as I know, has not been verified. The Part 2 includes a reference list of the related articles of that time, written by hams, and there is not much to add to them. The texts in the PACE (The Planetary Association for Clean Energy, Inc.) and other circular letters that were mentioned are partly rubbish, although reading them may not be a hindrance to all. Issues dealing with radiation phenomena are always problematic; maybe hunting new countries is more productive for the average ham...

The Woodpecker operations ultimately ended on 26 April 1986 at 01:23:40 when the ChNPP (Chernobyl Nuclear Power Plant) Reactor #4 (U4) ran out of control and exploded, causing one of the history's worst ecocatastrophes that has been documented. However, as if by chance, the disaster-related documents completely fail to mention the peculiar OTH radar operations that were practised just in the vicinity of the reactor.

Russian-language discussion forums have hints to even more official opinions. There are persons in these forums that claim to have been designing the station, working there, etc. Some people have been able to take photographs of the OTHR antenna monster that is located 12 km west-northwest of the (now already former) city of Chernobyl. Likewise there are photographs of surrounding buildings, housing schools, clubs, etc. All discarded and corroded, in other words, there has been no activity after the 1980s. A colourful account of some equipment room can be found but no photographs may have not been published. No photographs have been found of other Ukrainian stations – although there are some scenery photographs with a mast in Lyubech, but no radiostation.

Information from the C-2 Station Commander in 2001

Mr Vladimir Musiyets, the Commander of the "Eye that sees top secrets" (in Russian: *vsevidjaschee oko sverhsekretnogo objekta*), i.e. of the (Chernobyl-2, C-2) OTH station, had already in June 2001 given some magazines (Fakti, Kurier Trud) – presumably as the only official exception – clear factual information about the station. He says his job started in the autumn of 1976, "a few months before the station was connected to the EW radar network", and ended in August 1988 when the project was closed down. The goal was to follow the launches of the US intercontinental ballistic missiles.

Within the radius of less than 60 km from this station known as "Chernobyl-2" (C-2) were found two other stations that seem in satellite photographs almost similar in appearance, namely "Lyubech-1" (d = 58 km) and "Goncharovsk-1" (d = 54 km). In connection with Lyubech, there are

mentions of the transmitter but almost nothing else. Musiyets says that C-2 has operated as a receiving station but hardly so big an antenna would have been worth constructing from any lighter material. In the OTHR, the receiving antenna needs to be physically big due to the requirement for a narrow beamwidth! In the electrical network side of C-2, there were two 3600-kVA, 110/10-kV transformers. In the US direction, the Far East OTHR, which was synched in into the network, had more difficulties than the Ukrainian stations just because of its geographical location.

Monitoring the OTHR

IARUMS virtuoso Pekka OH2BLU had during his assignment in the Laajasalo Monitoring Station recorded a real 10-Hz Woodpecker signal for the first time on 27 March 1976. It was hardly originating from the test transmitter that was located west of Nikolayev. There is not much information about its operations; it is said that the test transmissions started in 1971. A huge test field can be seen in satellite photographs. There are no observations of any earlier 10-Hz Woodpecker pulses so presumably there were hardly any transmissions of that format, either.

In addition of the IARU Monitoring System "Intruder Watch", there are ITU observations available. There seems to be some inconsistencies between these two monitoring networks in some cases, for instance, whether the 25-Hz and 50-Hz OTHR pulse signals recorded in the 2000s originated from Cyprus or from France (ONERA, Dreux). The 25-Hz-pulse emission is not as sensational as the 10-Hz pulse, and the 50-Hz emission sounds like an AC mains hum. Not much information can be obtained from the activities on Mount Olympos in Cyprus; however, there is a plenty of information available about the ONERA equipment.

The biggest directional HF antennas in the world

The antennas of the "CHERNOBYL-2" ("C-2") HF OTH radar – according to the information available. The height of the bigger antenna is 150 m, the length appr. 500 m. The height of the smaller antenna is 90 m. The unguyed construction that still stands erect is a masterpiece of mechanical engineering. According to one estimate, which seems reliable, the total weight would be 13,000–14,000 tons.

HRS 4/4/1 Dipole Curtain Antenna

The HRS 4/4/1 is one of the most common directional HF antennas in broadcasting. Many dipole curtains are also used in the Pori-Preiviiki HF site.

In comparison, the HRS 4/4 is 4.5 times smaller than the HRS 12/6.

HRS 12/6/0.5 Dipole Curtain Antenna

"The world's biggest" directional HF broadcasting antenna was used at the VOA Delano site in California. Built by TCI, 1987.

The Delano antennas have been supported with 28 guy wires whose positions were calculated with NEC. No insulators were used in the wires due to mechanical reasons. The dipole elements consist of 6 wires.

A dipole curtain consists of smaller elements that can be used in more or less directive combinations.

Chernobyl Nuclear Power Plant after disaster

In the morning of the nuclear power plant disaster at 11 o'clock, Musiyets and chemical expert, Major Olga Shevchenko had received an order to go to the OTHR station, 9.7 km away from the reactor. They said that, at the station, the air flow systems had been blocked-up, and computers and other electronic devices had been destroyed. After that, the C-2 did not work anymore, says Musiyets. The majority of experts thinks that the entire Soviet Woodpecker Project was regarded to have come to the end of the road. Almost no-one believes that any radiation – or any voltage or current spikes – from the broken nuclear reactor could have destroyed the Soviet electronic devices of that time. The three other Chernobyl reactors remained operational, each for whatever period of time.

Also metal dealers and thieves have been interested in perhaps the most massive antenna construction in the world. The mass of the C-2 antenna is estimated at 14,000 tons when, in comparison, the mass of a 320-meter-tall YLE/Digita TV/FM mast is 170 to 200 tons. No mentions of dismantling the C-2 antennas have been seen, although the other known Soviet OTHR (transmitting) antennas may have been dismantled.

Footnotes

- The Chernobyl RBMK reactors (in Russian: *Реактор Большой Мощности Канальный*, high-power nuclear reactors) according to international reports: U1 started on May 1978 and ended November 1996; U2 was connected to the network on May 1979 and was shut down after fire in 1991; U3 started on June 1982 and ended 15 December 2000; U4 started on April 1984; the reactors U5 and U6 were under construction. In other words, during the years of 1976–1977 the mains power to the OTHR station has come from elsewhere.
- OTHR = Over-the-Horizon Radar, whose operation is mainly based on the backscatter propagation characteristics of HF signals. The accuracy of target location calculations is basically in the hands of the algorithms and computers used – but also of the HF propagation. In Part 2, there was a reference to the failed Anglo-American 'Cobra Mist' OTHR Project, whose pictorial document we wondered at that time e.g. with Olavi OH5BR. With much labour, you may find out many details regarding HF propagation. To summarize, it can be said that building huge OTH radars has not been worth it.
- The Nadenenko dipole (sometimes also Nadenenko-Aizenberg) in its many variations is widely used in Soviet stations and widely discussed in Soviet antenna textbooks [6]. Different kinds of cage dipoles have been in use in most countries. The broad bandwidth comes mainly from the large diameter of the element. It would be so easy to believe that the robust element material shown in the attached photographs has been designed for the purpose of high-power broadcasting. We can just make a guess that the entire construction of the dazzlingly wonderful C-2 is made of steel, including the antenna elements. The Finnish antenna and other experts seem to think that at least the Soviets mastered the art of mechanical engineering.
- A dipole curtain antenna, or just a ”curtain”, is the most commonly used HF directional antenna in broadcasting. Broadband dipoles are placed one on the other as stacks and side by side as bays. The main antenna type even on the Pori HF site, completed in 1986, is an HRS 4/4/1 (H = horizontal, R = reflector, S = slewability), consisting of 4 horizontal and 4 vertical rows of dipoles, altogether 16 pcs. The reflector is an aperiodic, passive screen, made of wires.

  The wire used in Pori is Alumoweld (steel core, aluminum coating), perhaps somewhat thinner than the wires used elsewhere. In transmission lines the choice was an open-wire feedline (except on 963 kHz MF), whereas, for instance, in Wertachtal (also under the threat of demolition) a coaxial cable of 250 mm in diameter was used.

  I introduced the (then) world's biggest curtain in Radioamatööri 3/1995 (pp 30–31), designated as an HRS 12/6/0.5; in other words, a total of 72 dipoles (a maximum gain of 30.6

dBi and a horizontal beamwidth of 7 degrees). The satellite photographs seem to reveal that this monster antenna at VOA Delano has been dismantled, only the masts would seem to stand erect?

In a curtain antenna, the multielement antenna array made of broadband dipoles forms a large radiating plane. With the metal screen behind the array the radiation is directed to the upper half space. With a ground plane, the radiation should take off obliquely – this is familiar to everyone. In theory, an antenna is regarded as ”broadband” if the ratio of its lower and upper operating frequency is greater than 1.5:1. Building a modern curtain antenna with a frequency ratio of 2:1 so that there is no spark formation in its countless fastenings when inconceivably huge transmitting powers are used, is quite an art form. Issues related to occupational health measurements in connection with the Pori antennas can be found in the reference [5], page 415.

The designation code for the larger C-2 antenna could be an HR(S) 30/10/0.2, at least with the following remarks: a) the parallel stacks are overlapping, and the dipole supports are fastened to the sides of the towers at regular intervals; b) slewing differs from that of a broadcasting antenna in a sense that a radar has continuous slewing; c) the dipole lengths are perhaps approximately 22 metres (is the centre frequency even in this case perhaps 0.8 lambdas?), the vertical element spacing is approximately 12 metres (6 metres); d) How is slewing arranged? The feed line would seem to come from the front-side corner of the towers (thin tubes); e) The Russian designation for the curtain antenna is SGD, and not HRS [6].

References

[1] Official Chernobyl documents prepared by Russians also in English at: http://www.ibrae.ac.ru/english/index_eng.html.

[2] V.K. Lehtoranta, Nakke Nakuttajan tarina (*The Woody Woodpecker Story*), the Radioamatööri magazine (RA). *Part 1*: RA 12/1998, pp 18–19; *Part 2*: RA 1/1999, pp 6–7.

[3] V.K. Lehtoranta, Kyseenalaista mainetta saavuttanut lähete, osa II (*The emission of a questionable fame, Part II*). The SRHS member magazine 1/2005, pp 4–6.

[4] V.K. Lehtoranta, OTH-tutka ”Chernobyl-2” (*The OTH radar ”Chernobyl-2”*). The Radiomaailma magazine 10/2006, pp 15–17.

[5] Ionisoimaton säteily – Sähkömagneettiset kentät (*Un-ionized radiation – Electromagnetic fields*). STUK, Series ”Säteily- ja ydinturvallisuus” (*”Radiation and nuclear safety”*), book 6, 555 pages. The five earlier books in the series can also be found as PDF files!

[6] G.Z. Ajzenberg et al, Korotko-volnovnye antenny (*Shortwave antennas*). Moscow 1985, 536 pages.

[7] Day trips from Kiev to the Chernobyl/Pripyat region has been arranged at a price of USD 500. At the address http://www.janikarvonen.com/digicam/10-12.6.2005_Ukraine, there are photographs of the ruins in the region, taken by young Finns – presumably they did not know anything about the Woodpecker antenna. I wonder if not a single OH ham has visited the place?

Photo captions:

1. (no text)
2. The ”Chernobyl-2” OTHR station with the antennas and buildings in a Google Earth photograph.
3. The ”Chernobyl-2” OTHR antennas, seen from the direction of operation, i.e. from the north-west.
4. The north-eastern side of the bigger antenna, seen from behind. A couple of photographs is also available, taken inside of the 760-metre-long superterranean tunnel.
5. The north-eastern side, seen from the front upwards. The Nadenenko dipoles are fed in pairs in the vertical direction.
6. The Nadenenko broadband dipoles are stacked and overlapping. Each tower in the bigger antenna has 10 + 10 dipoles, altogether 300 pcs. The reflector screen, supported by the end towers, is made of a robust wire, and tightening that wire should have required some strength. The wires seem to have not only connected to but also supported at each tower.
7. A Nadenenko broadband dipole. The drawing is from the reference [6].

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