



Around the Globe

The First IEEE Milestone in Ukraine Celebrates “Zenit Parabolic Reflector L-band Pulsed Radar, 1938” in Kharkiv

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On 21 November 2019, a commemorative plaque (Figure 1) recognizing the IEEE Milestone “Zenit Parabolic Reflector L-band Pulsed Radar, 1938” was unveiled at the School of Radiophysics, Biomedical Electronics, and Computer Systems at the V.N. Karazin Kharkiv National University (KhNU). The first phase of the IEEE Milestone ceremony was held during the IEEE Ukraine Conference on Electrical and Computer Engineering 2017 in Kyiv as part of the IEEE Ukraine Section’s 25th anniversary celebration [10].

IEEE Milestones represent key historical achievements in electrical and electronic engineering, and the plaque in Kharkiv celebrates the first successful field test of the Zenit radar, a two-parabolic-antenna L-band pulsed radar (Figure 2), which was performed in Kharkiv on 14 October 1938 [1]. The test demonstrated the ability to accurately determine all three coordinates

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of a flying airplane, whereas, at that time, existing systems were able to determine only two coordinates of airborne targets [2], [3]. The Zenit radar succeeded in overcoming this drawback thanks to the skillful combination of two principal innovations: it used a pulsed method and worked with waves of 60–65-cm wavelengths (i.e., shorter than those commonly used up to that point).

The Zenit radar was designed at the Ukrainian Institute of Physics and Technology (UIPT) by a group of prominent microwave scientists and magnetron pioneers led by

Abram Slutskin, a professor at KhNU, and his former students Oleksandr Usikov and Semion Braude. All three were on the staff of the Laboratory of Electromagnetic Oscillations at UIPT, which Prof. Slutskin had headed since 1928 in parallel with his teaching at KhNU. A Milestone proposal for the Zenit radar was submitted in February 2014 by Prof. A.I. Nosich, IEEE Fellow and founder of the East Ukraine Joint Chapter of the IEEE Aerospace and Electronic Systems Society (AEISS), IEEE Microwave Theory and Techniques Society (MTT-S), IEEE Antennas and Propagation Society

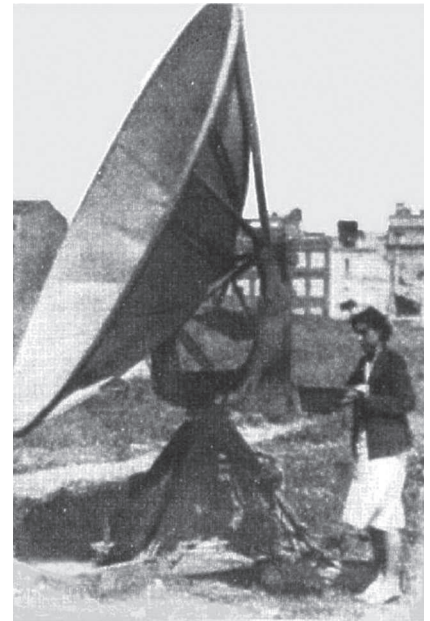


Figure 1. The IEEE Milestone plaque: “Zenit Parabolic Reflector L-band Pulsed Radar, 1938.”

Figure 2. The receiver antenna of the experimental radar Zenit in 1938.

(APS), IEEE Electronic Devices Society (EDS), IEEE Engineering in Medicine and Biology Society (EMBS), IEEE Geoscience and Remote Sensing Society (GRSS), and IEEE Nuclear and Plasma Sciences Society (NPS), along with Dr. Nataliya Sakhnenko, the Chapter chair at that time.

As Prof. Serhii Shulha, dean of the School of Radiophysics, Biomedical Electronics, and Computer Systems of KhNU, noted during the unveiling ceremony, “Such a large-scale scientific development helped Kharkiv become the ‘most radiophysical’ city in our country.” Indeed, Usikov and Braude later founded the Institute of Radiophysics and Electronics, National Academy of Sciences of Ukraine (IRE NASU, since 1955), and Braude was a founder of the Institute of Radio Astronomy NASU (IRA NASU, since 1985). Even earlier, in 1947, the USSR Military Academy of Radio Engineering was established in Kharkiv, largely thanks to the well-known contributions of KhNU and the UIPT to microwave and radar research [4], [5]. Its core staff members now work at the National University of the Air Force. The opening of the School of Radiophysics at KhNU in

1956 was equally influenced by the quality of the work already being done and enabled further strengthening of this research.

The plaque’s dedication ceremony brought together many Ukrainian scientists, engineers, and IEEE representatives and volunteers: Prof. Jan Machac,



Figure 3. Prof. Jan Machac and members of the IEEE from the Ukrainian research community with the IEEE Milestone plaque at the entrance to the School of Radiophysics, Biomedical Electronics, and Computer Systems of KhNU (from left): Prof. N.T. Cherpak, Prof. A.I. Nosich (both with IRE NASU, Kharkiv), Prof. O. Sukharevsky (NUAF, Kharkiv), Dr. Alexei Kostenko (IRE NASU, Kharkiv), Prof. Machac (Czech Technical University, Prague), Prof. Felix Yanovsky (National Aviation University, Kyiv), and Prof. Serhii Shulha (KhNU, Kharkiv).

IEEE MTT-S Region 8 Coordinator from the Czech Technical University in Prague; Prof. Vil Bakirov, rector of KhNU; Prof. Petro Melezhik, director of IRE NASU; Prof. Vyacheslav Zakharenko and Prof. Leonid Litvinenko, present and former directors, respectively, of IRA NASU; Prof. Felix Yanovsky,

IEEE Fellow and IEEE Ukraine Section vice chair; Ievgen Pichkalyov, IEEE Ukraine Section chair; and others (Figure 3). In his welcome address (Figure 4), Yanovsky noted, “It is not only the Kharkiv National University, the alma mater of the radar Zenit developers, that received the award

but, rather, the IEEE Ukraine Section, or it is even better to say that it is Ukraine that received this Milestone. Out of almost 200 IEEE Milestones worldwide, only six have been granted to the developments of radar technologies, and one of them is now located in Ukraine. This was a huge achievement, and, today, this is a great honor.”

Following the unveiling ceremony, Nosich delivered a lecture on the work of the Zenit radar inventors, who had to navigate their lives and research in the turbulent times of pre-World War II totalitarian USSR (Figure 5). A summary of his lecture follows.

A Summary of Prof. A.I. Nosich's Lecture on the Inventors of the Zenit Radar

A major advance in the development of radar in the USSR occurred at the UIPT in Kharkiv in October 1938, when a prototype of the gun-aiming radar Zenit was field-tested. Designed by Abram Slutskin, Oleksandr Usikov, and Semion Braude, microwave scientists and magnetron pioneers, who graduated from KhNU and worked at the UIPT, it established the practicality of the combination of a pulsed method and a shorter waveband in the precise determination of all three coordinates of airborne targets. Ultimately a victim of infighting around radar research in the USSR [1]–[3], this radar remained unknown to the wider public beyond the microwave, electronics, and radar communities in Ukraine until the late 1970s. Its history is closely tied to the invention of high-power decimeter-wave split-anode magnetrons in Kharkiv in the 1920s–1930s. Another crucial point was the discovery of the pulsed-operation regime of the magnetrons.

Still, the obstacles to be overcome on the way to working radar were formidable. Remarkably, the entire USSR research community at that time considered both the pulse method and the shorter waves to be dead ends [2]. The researchers also had to overcome dire working conditions [6], [7]. In 1932–1933, the



Figure 4. Prof. Felix Yanovsky speaking at the IEEE Milestone unveiling ceremony.



Figure 5. Prof. A.I. Nosich talking about the dramatic history and impact of the Zenit radar, which was successfully field-tested for the first time in October 1938.



Figure 6. The defense applications of radar are well known, so representatives from the Ukrainian military, Kharkiv National University of the Air Force, were included in the IEEE Milestone unveiling ceremony. Attendees included (from left) Lt. Col. A. Shevchenko (NUAF, Kharkiv), Dr. M. Antyufeyeva and Prof. O. Bagatskaya (both with KhNU), Lt. Col. A. Dudush (NUAF, Kharkiv), K. Arkhytova (IRE NASU, Kharkiv), Lt. Col. G. Zalevsky (NUAF, Kharkiv), and I. Pichkalyov (IEEE Section Chair, Ukraine, Kyiv).

scientists had to carry on with their work despite the Moscow-ordered genocidal famine that was devastating the Ukrainian countryside [8]. Shortly after that, they had to learn how to navigate their lives and work between the deadly Orwellian torments of the early USSR, which culminated in the Great Terror of 1937–1938 [9]. In the end, Zenit will forever remain a brilliant piece of engineering, and its role in the development of the national Ukrainian microwave, antenna, radar, and remote sensing communities has been outstanding. In 2015, it was awarded the status of an IEEE Milestone.

The event concluded with a small reception organized by the IEEE Ukraine Section; Ukraine Section (East) IEEE AESS/MTT-S/APS/EDS/EMBS/GRSS/NPSS Joint Chapter; and IEEE Ukraine Section (Kharkiv)

APS/IEEE Computer Society/IEEE Electromagnetic Compatibility Society/IEEE Signal Processing Society Joint Chapter (Figure 6). With the final unveiling of this IEEE Milestone, the remarkable achievement of Slutskin, Usikov, and Braude has gained international recognition. This event is of extremely high importance and honor for the Ukrainian microwave and radar communities.

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