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## PROFESSOR PIOTR WOLAŃSKI – COSMIC AUTHORITY, THE PEARL OF POLISH SCIENCE

PROFESOR PIOTR WOLAŃSKI  
– KOSMICZNY AUTORYTET, PERŁA POLSKIEJ NAUKI

**Prof. dr hab. Piotr Wolański (1942–2023) was one the most outstanding Polish scientists of the recent decades, a visionary who brought the enormous contribution to Polish sector of space science when outlining a series of perspective area of development and hypotheses: those ones concerning the origin of the Moon, or decay of dinosaurs. In his scientific activities, he undertook the subjects connected with the problems of combustion and the methods of diagnostics of combustion processes, explosions and engines, and the collisions with the celestial objects. Space drives, development of multi-use rockets and transfer the discussed knowledge to the students were translated into the defined implementations. The first Polish satellite PW-Sat was constructed under the guidance of the Professor at Warsaw University of Technology and the study direction "Aviation and Space Science" became the permanent specialization in the faculties of Polish technical universities.**

If we had wanted to describe Prof. Piotr Wolański in a few words, it would be a very difficult task at least as much complicated as the field of his interest, or even as space – impenetrable, and at the same time, open to exploration. To get know Professor, it is not enough to reach to the sources; he always was inclined to the facts (as being the engineer) but the real knowledge about him comes from the persons with whom he spent the time, who he could rely on and who appreciated not only his vast knowledge but also his attitude to other persons. His approach was always friendly, non-schematic, and open to different points of view. As being husband, father and grandfather as well as a boss and associate-in-work, he was unusually modest and person, as well as great authority for his students and for the scientists from around the world. How was his way to the stars commenced?

He was born on 16, August, 1942 in a picturesque countryside Milówka, situated among the mountains where the nearness of the heaven seemed to fall nearly on the head. When he was still



Fot. 1. Professor Piotr Wolański. Source: Lukasiewicz – Aviation Institute

a pupil of the primary school, he saw a start of American rocket "Aerobee" during the emission of Polish Film Chronicles in a local cinema "Tęczą" (Rainbow). He undertook then the decision about becoming the constructor of rockets. The fascination with the rocket technology was quickly transformed into construction of model rockets where the flammable cellulose photographic films served as a driving material. – *He came back repeatedly to Milówka eagerly for all his life. He found there rest and respite. It was the place when he discovered his first love to space which occurred to become his greatest hobby and destination* – Ewa Wolańska, Professor's daughter says. When he was a pupil of the Mikołaj Kopernik Secondary School, he has the occasion to observe – in media



Fot. 2. Laboratory Centre of Rocket and Satellite Drives in Łukasiewicz – Aviation Institute, opened on 24.10. 2023; Prof. Piotr Wolański has contributed to its opening. Source – Łukasiewicz – Aviation Institute

– a start of the first artificial satellite of the Earth – “Sputnik-1”. After graduation of the school, he commenced the searches for the appropriate direction of the studies which would satisfy his interests. He chose the Faculty of Aviation at Warsaw University of Technology which became transformed into Faculty of Power and Aeronautical Engineering in 1960 when he commenced his studies. His specialisation was “Aviation engines” although his diploma informed about the specialisation “Mechanical engineering”. The subject of his diploma thesis was construction of anti-tank missile because according to the opinion of his pro-

mote, the space rocket would not fit on the drawing board. He graduated in 1966 and at the same time, he began to work at the parent faculty, at the Institute of Heat Engineering, Chair of Industrial Combustion Engines and Aeroengines. The knowledge which allowed him to develop successfully his talent was based upon the strong foundations of Warsaw University of Technology and, on the other hand, it was a result of his attempts aimed at development of his interest. As early as during the first year of his studies he became the member of Polish Astronautic Society, Department in Warsaw and after few years, he became its President. In 1964, he participated in IAF Astronautic Congress in Warsaw where, for the first time, he got familiarized with the world level of science and technology in this respect. In 1965, during the visit at the Paris Air Show he met personally Yuri Gagarin.

In the seventies, he obtained a scientific title of Doctor (1971), submitting the dissertation entitled: “Stabilisation of dust-carbon flames by unstreamlined bodies”; then, the degree of *doctor habilitatus* (1979) (“Dynamics of ignition of gas mixtures”), occupying the posts of assistant-trainee (1966–1967), assistant (1967–1969), senior assistant (1969–1972), lecturer (1972–1981). In the middle of the seventies, he formulated a hypothesis on formation of the continents as a result of collision of big asteroids and the Earth, or the hypothesis on formation of Moon as an effect of a similar phenomenon. The other catastrophes such as e.g. decay

of dinosaurs could be also the result of the collision of other celestial bodies with our Planet. The mentioned hypothesis was suggested by Professor and published in Polish scientific periodicals much earlier than the recognised and popularized later (after few years) theory of Walter Alvarez. When the quick computers appeared in Poland, Prof. Wolański and Prof. Karol Jach from Military University of Technology performed the numerical calculations of the mentioned type of collisions.

In 1979, he left for 9-month practise at the University of Michigan in Ann Arbour where he cooperated with Prof. W.C. Kauffman, Prof. J.A. Nichols and M. Siechel at the Aerospace Department. During the successive years, he visited the University again,



Fot. 3. The first field tests of rocket BURSZTYN in 2K version and of a mobile rocket launching construction WR-2. Central Polygon of Air Forces in Ustka, October 2022, Photo. Łukasiewicz – Aviation Institute





Fot. 4. Professor Piotr Wolański was the creator of the greatest conference dedicated to space drives – Development Trends in Space Propulsion Systems. Photo. Łukasiewicz – Aviation Institute

including the years 1990–1991 as a visiting professor. The work at the University of Michigan facilitated him to get many American grants, implemented later at Warsaw University of Technology. When he came back in 1979, he became the dean for students' affairs and later on, for general matters. During the next decade, he worked at the post of assistant professor (1981–1989); in 1981, he became the head of the Unit for Aviation Engines and he stayed at this post for more than 30 years (up to 2012). In the eighties, he introduced the elements of rocket drive elements within the subject of "Fuels" included into specialisation "Aviation Engines". The lectures on rocket engines were included to the subject "Aviation Drives". In the years 1987–1990, Professor was the Dean of the Faculty of Power and Aeronautical Engineering; in 1989, he received a title of the associate professor and in 1993 – the title of full professor. He was also the Member of the Senate (1999–2002) and the Senate Commission for Foreign Relations at Warsaw University of Technology (1987–1990 and 1999–2002). The words of the Dean, Prof. Dr hab. Janusz Frączek, Eng., characterize the best the silhouette of Professor Wolański: – *The Faculty of Power and Aeronautical Engineering owes its prestige, recognition and high appreciation to its Great Professors. One of the most outstanding persons was Professor Piotr Wolański. His research and educational activity was always connected with the Faculty where he left the lasting trace in almost every aspect of activity. The achievements of professor in the area of combustion engines, detonation, explosions and aerospace made that he became the world-wide authority in the mentioned domain. The satellites and developments of rocket technology became his recognition sign in Poland as well as all over the world.*

In the years 1990–1994, Professor played a function of the President of Polish Astronautic Society, which he undertook after the cadence of General Mirosław Hermaszewski, the first Pole in the space (1978). In the middle of the seventies, he participated in the lectures of Professor Wolański within the frames of "INTERCOSMOS" space programme at the Military Institute of Aviation Medicine. Since 1994, he had been the Honorary President of Polish Astronautical Society. In 1995, he was elected as the member of the Space Research Centre of Polish Academy of Sciences (PAN) and four years later – the Vice-President of the mentioned Centre (From March 2003 until 2019, he was its President and later, the Honorary President).

In 1994, owing to the attempts of Professor Wolański (Professor of Warsaw University of Technology), the teaching of "astronautics" within the frames of inter-disciplinary studies in this domain was commenced at Warsaw University of Technology. In 1996, the Student Space Association was organized at the Faculty of Power and Aeronautical Engineering. Professor Wolański was its guardian from the beginning until 2016. The mentioned Association has contributed, *inter alia*, to signing the treaty on the associated membership of Poland and ESA (PECS – Plan for European Cooperating States). It was signed on April, 27, 2007 owing to *inter alia*, all-Poland action for collecting the signatures under the open letter addressed to the Minister of Economy of the Republic of Poland. Apart from the rockets and Mars rovers, the most ambitious and known projects of the mentioned Association include a series of satellites PW-Sat, being designed and constructed according to the CubeSat standard, what enables sending them into space in the standardized ejectors as the addi-



Fot. 5. Rocket ILR-33 BURSZTYN ("AMBER") – the first rocket in the world, employing hydrogen peroxide above 98% as antioxidant. The project was initiated by Prof. Piotr Wolański. Photo. Błażej Marciniak. Source: Łukasiewicz – Aviation Institute

tional load of the rockets. Until now, two satellites have been constructed: PW-Sat – the first Polish artificial satellite launched into orbit on 13, February, 2012 during the first flight of Vega rocket within the frames of the educational project developed in the Education Bureau of the European Space Agency; and PW-Sat2 – placed on the orbit on 3 December 2018 by mediation of Falcon 9 rocket. At present the work is carried on the third satellite, the main aim of which is to test the authorial drive of warm-gas type solution. In 1991, Professor Wolański commenced cooperation with the Institute of Aviation (Research Network Łukasiewicz) where he had worked for more than 30 years (in the period of 2000–2002 he was the Chairman of the Scientific Council of the mentioned Institute). At the Institute he had the relationships with the Laboratory of Space Technologies, which was created by him in 2007; he had been its guardian for many years. As Dr Adam Okniński, Eng., director of the Centre for Space Technologies said – *the team consisted of few persons, chosen by professor from his students which – under his guidance – carried out earlier the feasibility studies in the field of rocket technology at Warsaw University of Technology. During the first years of the team functioning, Professor inspired regularly the workers to deal with the most perspective research problems, often effectively anticipating the technological trends and needs of the global sector. Owing to Professor, it was possible to obtain the first foreign grant in respect of ecological space drives what has remained one of the specialisations of the Institute. After the accession of Poland to the European Space Agency in 2012 (with the significant contribution of Professor), the discussed team began to develop. Together with the growing role of the work concerning space technologies, there was created the Centre of Space Technologies (in 2014). To-day, the discussed Centre employs more than 110 persons and is occupied only with the rocket technologies and space drives – the subjects being near for Professor. Coming back to the years spent at Warsaw University of Technology and the first contact with Professor Wolański under the activity of Student Space Association and the subject: "Cosmonautics", and later, on*

*the occasion of doctoral dissertation (promoter: Prof. Wolański), Dr Okniński mentions that – Professor Wolański was undoubtedly professional authority but at the same time, he was very open and shared his knowledge and ideas with others very eagerly. From the time perspective, I think that he allowed us consciously to commit the errors in order to learn on the grounds of our mistakes within the frames of our own projects – he adds.*

At the Aviation Institute, Professor Wolański developed his work on the utilization of ecological driving materials in rocket engines, including the application of highly concentrated and pure hydrogen peroxide. He was also the prominent specialist in the field of the studies on combustion engines and, in particular, those ones utilizing the process of rotating detonation (Rotating Detonation Engine, RDE). He cooperated also with Mitsubishi, Nagoya University (Japan) in the above respect and patented the idea with Prof. T. Fujiwara and with Mitsubishi Heavy Industry Ltd. Dr Paweł Stężycki, Eng., the managing director of the Aviation Institute mentions Professor as a great visionary – *Piotr knew that in technology it is necessary to find a niche and to become the best in this niche. I agree with this opinion, not only in respect of rocket technologies or space problems in general. He helped also to choose a few such directions of the studies, including, inter alia, drives of small rockets for launching of loads to space. He anticipated that scientific experiments or small satellites as well as their launching into space would become more available. Therefore, the research of the scientific team was just oriented to the mentioned problems. To-day, the Centre of Space Technologies at the Aviation Institute is the important R&D centre of rocket and satellite drives. We have implemented many projects of the European Space Agency, in particular in the domain of fuels and drives. It should be stressed that in the previous years, Poland – as the first country in the world – launched a rocket which utilized the phenomenon of spinning detonation in combustion chamber. We avoid detonation under the normal conditions as a sudden increase of pressure and temperature may destroy construction of the engine's combustion chamber. On the other hand, there are the studies which show that if we overcome the discussed phenomenon, its efficiency may be increased by a few or several percent. It is a crucial situation, isn't it? The dimension and, consequently, the weight of the discussed engine may be considerably decreased what is a key condition in the case of space or aviation technologies. A similar attempt was undertaken by Japan but the researchers launched the rocket at the height, speeded it up and started. They did not obtain, however, the engine thrust greater than the weight and in connection with this fact, its start from the earth was not possible. And we have done it! Piotr had the crucial knowledge for development of the mentioned technology. He was, therefore, often invited to foreign symposia to the USA, Japan or China. He was eager in sharing the knowledge but he expected the reciprocity what was not popular in the commercial enterprises. He was also invited by NASA but in China he was more highly estimated.*

Professor Piotr Wolański has also contributed to creation of the study direction: "Aviation and Space Science" which was commenced in 2005 and implemented successfully in Polish techni-





Fot. 6. Prof. P. Wolański receives 39. Medal of Warsaw University of Technology from Prof. Jan Szmidski, the Rector of Warsaw University of Technology (December 2014)



Fot. 7. Prof. Piotr Wolański delivers a speech during the ceremony of awarding with the 39. Medal of Warsaw University of Technology. Photo. Izabela Koptoń-Ryńnic, Warsaw University of Technology

cal universities. In a new Millennium, he played also a function of Pro-Rector for Science Affairs at Warsaw University of Technology (2002–2005), the member of the Programme Committee of A.S. Dekaban Foundation (from 2002; in the years 2002–2016 as its President); the member of the Strategic Advisors of the Rector of WUT (2012–2016); the Chairman of the Council of the Interdisciplinary Education of PhD holders (the post-doctoral studies) in the field of Rocket Technologies (2012–2016), since 2016 – the member of the Council). When presiding to the Committee for Space and Satellite Studies of Polish Academy of Sciences, he was the person, who held the mentioned position for the longest time, i.e. in the years 2003–2019; he represented the Committee at the international forums, in the UN and the International Astronautical Federation (IAF) for the successive four cadencies. In the period of 2012–2014, he played a function of the second vice-chairman of the UN Committee of the Peaceful Uses of Other Space, COPUOS) the member of which Poland has been since 1958. During the initial period of presiding to the Polish delegation to sessions of the Subcommittee and UN COPUOS in Vienna, Professor Wolański was the only one Pole; since the moment of Poland's accession to the European

### THE REMAINING SELECTED ACHIEVEMENTS OF PROFESSOR PIOTR WOLAŃSKI:

- Discovery of the so-called diffusion ignition, that is, the process of self-ignition of gas, flowing out from installation of high-pressure reservoir. The ignition occurs during mixing of hot air (heated up in the shockwave, generated by the flowing gas) with cold gas which is flowing out. At present, the discussed process is tested in aspect of safety in the case of failure of high-pressure reservoirs of hydrogen in the systems of power supply systems in electric cars with fuel batteries.
- The studies of the dust explosions, which brought about to generation of the "School of dust explosions". They also initiated the series of "Dust explosion colloquia". The author and co-author of many pioneering undertakings concerning initiation and propagation of mechanisms of dust explosion. The first statement of the possibilities of detonation of the mixture of the grain dusts and air and the layer of carbon dust at oxygen atmosphere. The manager of many projects in the mentioned area, owing to grant of the US Department of Agriculture. ("Grain Dust Explosion and Control", 1987 – 1993).
- The pioneering experiments concerning the effect of the baffles on the process of passage to the detonation DDT in gas mixtures and detonation of hybrid mixtures. The determination of the effect of the shape and size of the baffles on the acceleration of the flame and the process of passing to detonation as well as illustration of the effect of neutral grains of the sand, corundum etc., on a considerable acceleration of the flame and passage to the detonation. Addition of the relatively great grains to the mixture generates a micro-turbulence what causes a considerable acceleration of the flame. In the case of higher Mach numbers, there are additionally generated the hot spots, facilitating the acceleration of the flame and passage to detonation. The author and co-author of pioneering work on detonation of hybrid mixtures of dusts, gas and drops of liquid fuels and air.
- The studies on the application of Stream Pulse Jet Ignition (PJS) in piston engines. The study oriented to ignition of poor flammable mixtures in piston engines, the experiments and numerical simulations, carried out in cooperation with Professor A.K. Oppenheim from the California University in Berkley, USA.
- Development of optical methods and ultra-rapid photography techniques for testing the flames and explosions. Designing and supervision of performance of 4 Schlieren systems with 150-300 mm diameters, 2 interferometers (Michelson and Mach-Zender), techniques of ultra-rapid stroboscopic laser photography, drum cameras, etc. Also, development of the process of visualization of flames, using Electric Computer Tomography (3-D Electrical Capacitance Tomography, ECT) for the application Pratt&Whitney company, USA and Canada.

Source: P. Wolański, Piotr Wolański . *My space activity – recollections. Scientific Publishing House of the Institute of Aviation, Warsaw, 2019*

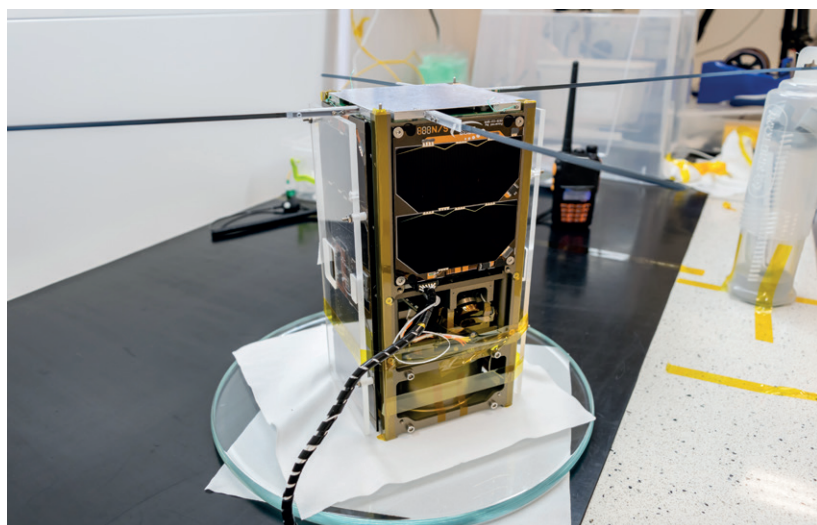


Fot. 8. Prof. P. Wolański with the title of "Golden Engineer" – the third person from the right in the lower row (March 2023). Photo: Janusz Kowalski NOT

Space Agency he was already one from many and he was very happy about it. Professor was also the Member of the International Astronautical Academy (IAA) and in the years 2001–2006 – the Member of the Consulting- Coordinating Team for Cosmic Space at the Prime Minister of the Republic of Poland and the Member of the Council of the National Centre for Research and Development (2014–2018). Professor Wolański made also a significant contribution to the choice of the official name of Polish Space Agency (founded in 2014); in the period of 2015–2020, he was the Member of the Council. The mentioned institution used the abbreviation POLSA, coming from English translation of Polish name (Polish Space Agency). Professor was also one of the initiators of memorizing Mikołaj Kopernik at the seat of the

scientific activity in Poland as well as abroad. The mentioned prestigious distinction was handed during the central ceremonies on the occasion of Aviation Day on 28 August, 2016. – *I remember that when I was a small girl and attended school, our house was always visited by many collaborators of daddy: professors, important persons from the space sector, from Poland as well as from other countries. It was for me an unusually developing and, at the same time... quite normal. I think that owing to such meetings, the thread of understanding which was commenced by my Father in the scientific circles was extremely strong later on – the daughter of Professor reminds.*

Apart from belonging to the elite group of the persons connected with the space, he was the ordinary Member of Warsaw Scientific Society – the VIth Department of Engineering Sciences, the Member of the Committee of Thermodynamics and Combustion of Polish Academy of Sciences (1983–2019), the initiator and the first Chairman of Polish Combustion Institute (PIS) since 1995. In the period of 1995–2004, he was the president and since the honorary President of the mentioned organization. The enormous knowledge, practical approach to solving of the problems and a perfect contact with the people made that he was readily invited to different conferences and lectures. Prof. Wolański was, *inter alia*, a visiting professor in the following places: Northeastern University, Shenyang, China, 1999–2004; University of Michigan, 1982, 1990–1991; NTU, Singapore, 2008; Kunming, University of Science and Technology, China, 2016. His scientific achievements were twice appreciated and he obtained the honorary title of doctor *honoris causa* of the



Fot. 9. Student Satellite PW-Sat2. Photo: PW-Sat2. <https://pw-sat.pl/do-pobrania/>  
<https://www.flickr.com/photos/pwsat2/>  
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UN Organization in Vienna where in June, 2014, the copy of the picture by Jan Matejko, presenting the mentioned outstanding astronomer, was unveiled. There was also shown the model of satellite "LEM". The both exhibits have remained the only one sign of Poland's presence in the UN as the bust of Maria Skłodowska-Curie, shown at the exposition, was offered by the French. In the years 2016–2022, Professor acted as the member of the Executive Committee of Engineering Academy in Poland.

During the 30<sup>th</sup> meeting of the General Assembly of AIP (14, March, 2016), the Aviation Institute honoured professor with the distinction Blue Wings. The award was granted for the whole outstanding aviation-space teaching and scien-





Fot. 10. Funeral of Prof. P. Wolański – the wreath from the students of Student Space Association, Faculty of Power and Aeronautical Engineering, Warsaw University of Technology (August 2023)  
Photo: Izabela Koptoń-Ryniec, Warsaw University of Technology

national University of Petroleum and Industry in Baku (Azerbaijan) in 1997 and Military University of Technology in Warsaw, in 2015. In the delivered then laudation, Professor Bogdan Zygmunt indicated his *talent to inspire the young people to undertake the ambitious tasks and challenges, to effective creative work and courageous confrontation with the achievements of analogical teams all over the world*. Apart from the mentioned above titles, Professor was awarded, inter alia, with the first medal "A.K. Oppenheim Price" ICDERS, in Ann Arbor, USA, for the contribution to the studies of explosions (1989); with the Dionizy Smoleński medal, granted by The Committee of Thermodynamics and Combustion of Polish Academy of Sciences (PAN) (2012), and with the medal of Warsaw University of Technology (no 39) for "significant contribution to space teaching and research at Warsaw University of Technology" (2014). At the state level, he was honoured with the Golden Cross of Merits, granted by the President of the Republic of Poland for "the achievements in 20-years' activity as academic teacher" (1987); with the Medal of the Commission of the National Education (2000); with the Golden Cross of Merits of the Minister of the National Defence (2001); with the Knight's Cross, awarded by the President of the Republic of Poland for "the contribution and achievements in scientific research and education" (2005); with the Award of the Minister of the National Science and Education for the whole activity in respect of scientific studies" (2012). During the 29<sup>th</sup> edition of the plebiscite "Golden Engineer", organized by the editorial house of the Polish Technical Review within the frames of Polish celebration of the International Day of Engineer (March, 3, 2023), he received a title of Golden Engineer in category "Constructions". He was the author of several hundred publications and public appearances. Since 2022, he had been found in the "World's TOP 2% Scientists", evaluated by Stanford University in cooperation with Elsevier and the SciTech Strategies, i.e. in 2% of the most widely cited scientists all over the world.

He passed away on 31, August 2023, due to a chronic disease. Until his last days, he was professionally active. He was buried on 4, September at Military Cemetery at Warsaw Powązki. His funeral was attended by family and friends, numerous group of students, co-mates in work, collaborators, representatives of university authorities from Poland, including Warsaw University of Technology, and from the world, inter alia, from China and Singapore and all those for whom he was the authority. – *I think that the total society of the Faculty (MEiL) feels very strongly the loss, caused by the passing away of professor. He was a part of our scientific and academic identity and it will be very difficult to accept this enormous loss – the Dean of the Faculty of Power and Aeronautical Engineering of WUT, Prof. dr hab. Janusz Frączek, Eng., says. The daughter of Professor, Ewa Wolańska recollects: – Father was active until the end and up to his last moments of life; even during the advanced stage of his disease, he tried to stress a role of Poland in space industry and promoted various Polish projects. During the last week of his life, he still intensively worked on Monday at the Institute of Aviation and he died on Thursday.*

In November 2023, Professor's friend, Adam Bisek, organized a meeting "Memory and honour for Professor Piotr Wolański" in Wrocław. Among the guests, there were inter alia: John F. Hall – long-time NASA director, Dr Paweł Stężycki, Eng., – Director of the Aviation Institute Łukasiewicz, Dr Michał Wierciński – Vice-President of Polish Space Agency. – *It was a nice recognition for us. I think that their presence is the evidence of recognition and memory and, at the same time, a perfect cooperation during his life – Professor's daughter says. And she adds: – Father had a deep belief in a sense of work and further development of science, he always stressed the role of mutual relationships between the people what, in combination with optimism aimed at exceeding the successive borders, has brought fantastic effects. I know that he tried to transfer his enthusiasm to his students. He often repeated that we have very good human reserves, good staff, he spoke about the WUT or the Aviation Institute with a pride. As we knew how he loved his parent faculty, we put the badge of the Faculty of Power and Aeronautical Engineering into the lap of his jacket and he passed away with it into the space, being still not available for us...*

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*The source of quotations from the statements of Prof. dr hab. Janusz Frączek, Dr Paweł Stężycki, Eng., Dr Adam Okniński, Eng., and Ewa Wolańska comes from the talks and own correspondence of the author of the present paper, Izabela Koptoń-Ryniec, as being conducted in October and November 2023.*