

Aviation Industry in Communist Poland – Development Barriers

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Abstract

The paper provides an account of the history of aviation industry in Poland in the communist era (1944–1989). The author analyses development barriers the sector coped with during the period in which the endeavours in the field ended both with success or in failure. The development barriers for the Polish aviation at the time had predominantly political provenance, and stemmed not only from the country's dependence on the USSR, but also from the national-level party bureaucracy. Aside from the literature on the subject, the article heavily relies on data from personal sources of information and recollected by the author.

Introduction

The history of Polish aviation industry has a rich and interesting written record (e.g. Babiejczuk, Grzegorzewski 1974; Glass 1965; Skrzypczak 2008; Gudel 1988; Grzegorzewski, Królikiewicz 2006; Fiszer, Bluj 2007; Rybak, Gruszczyński 2001; Morgała 1980; Mikulski, Glass 1980; Bondaryk et al. 2011; Przedpełski 1997; Zieliński, Mikołajczuk 2010; Zieliński 2011). Nevertheless, I have decided to take up this subject

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for reasons which are, to some extent, personal. My father, Janusz Morawski¹, worked for most of his professional life at the Institute of Aviation. What the stories told by him and his friends add to the general image will not be found in documents examined by historians in the future. The knowledge based on such sources obviously should be subject to the routine source critique, but if this is to happen, it needs to be recorded first. I do realise that the picture presented in this article is subjective and far from being complete. However, it was not meant to be a thorough study.

In the interwar period the Polish aviation industry reached the world highest technological level. Construction teams from PZL, RWD, PWS and LWS production plants created numerous designs and prototypes which were no less advanced than what was worked on in the most developed countries in the world. As a rule, the progress in aircraft design was much faster than that in engine development which, finally resulted in some original projects. Productive capacity, however, was not very big; for instance even, the newest PZL Mielec plant did not really reach the stage of serial production that would create economies of scale. To achieve that it was necessary to have army commissions, which were never given due to financial reasons. In spite of that, there were a great number of outstanding constructors, aware of their value and without any complexes. What they had engineered was used and developed further in the next decades.

After the war, most of Polish aircraft constructors remained in Poland and resumed their careers in two major centres. In 1944 Aircraft Experimental Workshops (LWD) were created in Lublin, Tadeusz Sołtyk took charge of them (Sołtyk 2000). In April 1945 they were relocated to Łódź. Within a few years, a number of interesting constructions were devised within LWD: series of prototype aircraft Szpak and Żuk, a small 10-person passenger plane Miś, utility and liaison military aircraft Żuraw. Trainer aircraft Junak and aerobatic plane Zuch were produced serially. A simple self-assembly plane Skrzat, mail aircraft Goniec and aerobatic plane Bies were never

¹ Prof. dr Janusz Morawski (b. 1930) studied at Wawelberg and Rotwand School of Engineering and next at the Faculty of Power and Aeronautical Engineering at Warsaw University of Technology. In 1953 he began to work at the Institute of Aviation. He worked on, among other projects, the *Diamant* missile, autopilot for the helicopter Sokół, navigating and guiding systems. He prepared his PhD and habilitation theses under the guidance of Professor Finteisen. He left the Institute twice, when involvement in any sensible work there was unavailable for him. First, in 1964–1966 for the State Hydrological and Meteorological Institute (PIHM) and again in 1976–1981 for the Institute of Sport where he specialised in biomechanics. He participated in preparing Polish pole vaulters for the 1980 Summer Olympics.

produced, however. LWD enjoyed a wide range of autonomy because it was under the control of the Ministry of Transport.

The second major team was the Central Aircraft Studies (CSS) established by Franciszek Misztal in 1946 in Włochy, a suburb of Warsaw. It operated in a private apartment first, but soon was relocated to Okęcie airport complex. CSS was subordinated to the Aircraft and Engine Industry Union, created in July 1946, which in turn was supervised by the Ministry of Industry and Trade. CSS team was formed by such constructors as Leszek Dulęba, Stanisław Lasota, Wiktor Narkiewicz – the engine constructor, Czesław Bieniek – the dean of the Aviation Department at the the Warsaw Mechanical-Technical School (in 1951, it was incorporated in to the Warsaw University of Technology). During the period of 1948–1950 the Special Construction Group of CSS headed by Jerzy Teisserye worked in Wrocław. The Wrocław University also ran a the department of aviation, though not for a long time. The special CSS team worked out the first postwar aircraft engine of Wiktor Narkiewicz (WM-1), aerobatic planes CSS-10 of Stanisław Lasota and CSS-11 of Leszek Dulęba, a 10-person passenger plane CSS-12 of Dulęba. Another aircraft, CSS-13 was constructed under the licence of the Russian PO-2, the so-called *Kukuruznik*, and was later produced in the long series of 550 machines. The Wrocław team also worked on their own passenger aircraft project.

The six-year economic plan centralised the sector of aviation. At the conference in Szklarska Poręba an autarkic model of development was presented, according to which the production was to be based on Soviet licences and as a result of which, the Polish aviation industry became a reduced-size copy of its Soviet counterpart. Productive capacity was increased considerably. Different production plants were brought under one label of Transport Equipment Factory (WSK). In the largely expanded factory in Mielec (WSK Mielec) the Polish aircraft LIM-1 was to be constructed under the licence of the Soviet MIG-15 by the team headed by Eugeniusz Stankiewicz (Skrzypczak 2008). The LIS-1 engine² for LIM was to be produced at WSK Rzeszów. WSK Okęcie, which evolved from CSS, produced Junak and CSS-13. It was also there where most construction teams operated. In Świdnik near Lublin the WSK Świdnik was established in 1949. In 1954 it started the Soviet licence based production of helicopters. The less important WSK Kalisz, a former car manufacturer, produced aircraft engines. In 1952 several smaller factories in Praga, a quarter in Warsaw, merged into WSK Warszawa II and took up the production of aircraft accessories. The WSK in Wrocław, which was later renamed as Delta Hydral, produced engine

² The name LIM referred to the licensed fighter and LIS – to the engine.

fuel systems. Glider Experimental Works in Bielsko Biała was an important, though a completely civilian segment of aviation industry. The circle of glider constructors, the central figures of which were Rudolf Weigl and Władysław Nowakowski, never became the focus of Soviet partners' attention and maintained a wide range of independence.

In the first period of the six-year plan the growth of the trade depended mainly on the Soviet licences. In 1952, however, the state authorities became interested again in the development of original Polish construction ideas. The army commissioned ordered a trainer aircraft and several construction offices were established at the Institute of Aviation: for monoplanes headed by Sołtyk, for biplanes headed by Misztal and Dulęba, for engines headed by Narkiewicz and for helicopters headed by Bronisław Żurakowski. The army's order was dealt with by the Sołtyk's team who constructed the trainer aircraft TS-8 Bies³. Aviation industry was supervised by the deputy minister of engineering industry – Julian Gren, whose priority was further development of WSK Mielec (he dismissed a few successive directors) and he left the construction offices free to make their own decisions about their projects. When the Korean war ended and arms limitations were introduced, it turned out that the productive capacity of aviation industry exceeded the current needs. Therefore WSK Mielec began to manufacture refrigerators in 1955 and in 1956 'Mikrus' cars, while WSK Świdnik started the production of WFM motorcycles.

At the time of The October Thaw of 1956, the Polish aviation industry had the advantage of great productive capacity, much bigger than that from before WWII, and a great number of outstanding constructors. There were also other important, though immeasurable factors, such as the hopes for more independence and the enthusiasm they generated. General Jan Frey-Bielecki, who was in command of The Polish Air Force at that time of transition, grew to be one of the heroes of Polish October. He also widely polonised the cadre, dismissing and sending home a large number of Soviet officers. The potential for development of Polish aviation industry seemed to be tremendous.

The great hopes and expectations seemed to be realistic for a few years to come. In 1957 the construction offices were shifted from the Institute of Aviation to WSK Okęcie where the Aircraft Constructions Centre (OKL) was established. The new Centre's construction offices were: for monoplanes headed by Sołtyk, for biplanes headed by Dulęba, for triplanes headed by Lasota, for helicopters headed by Żurakowski, for

³ TS-8 Bies was test-flown in 1957. from 1957 to 1960 250 planes were produced. Bies was in use until 1978.

accessories headed by Grzegorz Szelaąg, for installation headed by Stanisław Madeyski and for engines headed by Narkiewicz. Other OKL's were created in Mielec (led by Stanisław Jarycha) and in Świdnik (led by Jerzy Tyrch).

After the successful launch of Bies, Sołtyk's team designed a trainer jet plane TS-11 Iskra⁴ with an the engine SO-1 from Narkiewicz's team. Riding on the wave of success, the constructors designed projects of a supersonic aircraft TS-16 Grot and a passenger jet plane TS-15 Fregata. In the 1950s the construction office of Dulęba and Misztal worked on twin-engine cargo planes FM-11 and FM-12. In 1954 Franciszek Misztal came up with the concept of supersonic military aircraft FM-13. In the post-October period, the constructors focused their attention on a larger, four engine passenger plane MD-12, the prototype of which was flown in 1959. Lasota's office worked on PZL-101 Gawron and PZL-102 Kos, but it was closed down in 1960. One of the constructors, however, Ryszard Orłowski designed later on a very successful plane PZL-104 Wilga⁵. Żurakowski's construction office created the prototypes of helicopters JK-1 Trzmiel, SM-4 Łątka, BŻ 1 Gil and BŻ-4 Żuk. At the stage of design, were such machines as a tandem rotor helicopter Gil-3, and interesting projects of STOL aircraft by Jan Koźniewski. Narkiewicz's team continued to work on the WN engines, including WN-3 for Bies and MD-12. They also designed SO-1 engine for Iskra. Jan Oderfeld created Tur engines for Koźniewski's STOL aircraft. In 1958 Jerzy Bień's team took up the design of hovercraft. In Mielec a series of aerobatic aircraft M-1, M-2 and M-4 Tarpan were constructed.

As early as in the 1950s Stanisław Wójcicki did research on pulse jet engines from V-1 flying bomb. For a long time his colleagues did not treat them quite seriously and called them 'Wójcicki's thundering pipes'. The pace of the rocket research became faster in 1956 when the Rocket Technology Plant headed by Justyn Sandauer was established. The original name drew too much attention so it was soon changed into Special Constructions Plant (Henzler 2010). In the early 1960s it mainly worked on research made to army orders. The missile ZZ-30 (surface-to-surface, 30 kilometre range), guided anti-tank hand missiles RPP-1, and RPP-Diament, and a series of small unmanned flying objects were constructed at that time. Aviation industry was well publicised and promoted in society by dint of numerous air parades such as the

⁴ TS-11 Iskra was test-flown in 1960 and was serially produced from 1963 to 1987. in total 424 planes were produced including 50 for India on contract from 1976.

⁵ PZL-104 Wilga was produced since 1962, in total around 1000 planes. The licence for Wilga was bought by Indonesia. In 1989 a developmental version was constructed – PZL 105 Flaming.

15 years of Polish aviation industry Exhibition in 1961, the exhibition of helicopters near the Palace of Culture and Science in the centre of Warsaw in 1962.

However, dark clouds gathered on the horizon of technological development of Polish aviation. In 1958 Julian Gren was made to retire. It is said that the reason behind it was his opposition against the idea of making Polish fighter jet planes in Mielec for the GDR army. In accordance with the Soviet system of licence distribution of the time, Poland received licences for MIG-15 and MIG-17. The MIG-19 model was assigned to Czechoslovakia. When the next model, MIG-21, was constructed, there were hopes that this time the licence would go to Poland. However, the situation took a different turn: the MIG-21 licence went to Czechoslovakia and Poland was given the An-2 agricultural aircraft⁶ licence (Kaczkowski 1982). Along with the licence came the directive that Poland should specialise in the production of agricultural aircraft among the CMEA countries (Council for Mutual Economic Assistance, also known as Comecon). Soviet suggestions were difficult to decline for two reasons. Firstly, the licences within CMEA were granted for free, so the economic argument for rejection would not work. Secondly, the USSR ensured that long series would be ordered and only that could secure economies of scale. Having the licence for An-2 secured large long-term orders, which, in turn, ensured development of Polish aviation industry in terms of creating a considerable number of job posts. In terms of technology, however, it was a huge step backwards, by several decades. To produce the An-2 it was not really necessary to employ outstanding constructors. At first, the situation was slightly better at WSK Świdnik. It produced helicopters under Soviet licence which were not so technologically backward. Nevertheless, the expansion of the Soviet licences stifled the search for original ideas in that time.

Meanwhile, the Soviet Union began to realise that it was a mistake to impose on other CMEA countries (at Szklarska Poręba meeting) the copying of its own autarkic model of development. On the turn of 1950s, the CMEA reform plans were created according to a scheme of each country specializing in particular industries⁷.

⁶ Until 1991, when the production was terminated, 13,000 planes were made in Mielec.

⁷ Around that time the aviation industry of the German Democratic Republic (GDR) was practically liquidated. The VEB Flugzeugwerk plant opened in Dresden after the war. It produced passenger aircraft IŁ-14 under Soviet licence. In 1955 Berthold Baade, a constructor from Junkers works, returned from the Soviet captivity and he soon constructed a four engine jet passenger plane BB-152, which was as advanced as the most modern achievements in this field in the world. The crash of one of the prototypes and Baade's escape to the West facilitated the liquidation of aviation industry in GDR and the USSR monopoly on passenger aircraft export to the communist countries (see: Kopenhagen, Beeck 2005: 121).

In the situation of no market verification, the specialisation was bound to be based on political criteria. The industries that were supported by the country's political authorities had chances of surviving, though no success was to be taken for granted. Unfortunately, that was not the case of Polish aviation industry.

Władysław Gomułka, first secretary of the communist party, showed open hostility towards aviation industry. The first sign of it was an incident which occurred during the harvest festival in 1959. The prototype of MD-12 aircraft flew over the site of the central sector attended by the state and party top brass. When Gomułka was told what it was, he could not contain his fury. He shouted that it was an imperialistic chimera, that Poland could not afford it and that he would take strict measures to stop it. Gomułka was afraid of autarkic tendencies in CMEA countries. He thought that the lack of economic integration of socialist countries would eventually lead to political disintegration. Such possibility was dangerous in the context of Polish western border issue still not resolved. Therefore, he strongly supported international division of labour and was eager to take steps showing that Poland was against autarkic tendencies. Aviation industry became his favourite prop in that game. By showing submissiveness to the USSR in this field he tried to strengthen his position in other areas.

Shortly the results became visible. In the spring of 1963 the constructors of the Diament missile were ordered to go to Moscow⁸ to consult the project with the Russians. On arrival they were informed that a decision had already been taken that Poland would produce a similar missile under the Soviet licence. Polish constructors were given access to specification sheets, which they were allowed to study during their one-month stay in Moscow, while their own project was completely ignored. Since then such model of mutual relations became a rule.

On 4th July 1963 general Frey-Bielecki was dismissed. Also on that day the order was issued to burn down the model of Grot aircraft at Okęcie airfield. At the session of Military Council of the Ministry of National Defence general Bordziłowski accused Frey-Bielecki of 'ill-considered, frequent reorganisations of the forces he was in charge of, ... domineering style of management, improper business activity leading to increase in cost ... and practical underestimation of such values as moral-political conduct and ideological attitude' (Królikowski 2010: 410). The situation was made even worse by the fact that the prototype of MD-12 crashed in the summer of 1963. Captain Mieczysław Miłosz and his crew of five were killed.

⁸ I know the story of the meeting from my father, who took part in it.

After 1963, Polish aviation industry was a mere shadow of its past greatness. The army withdrew from the rocket research programme. For some time it could be continued under the umbrella of the the State Hydrological and Meteorological Institute (PIHM), which was interested in the development of meteorological rockets. The team headed by Justyn Sandauer and Jerzy Harażny constructed three new models of Meteor rocket. Jacek Walczewski was in charge of the project on the side of the Institute. In the late 1960s in the English professional publications Poland was ranked sixth in the world in terms of rocket technology development⁹ and launching the first Polish satellite was only a matter of political decision. In 1968, Władysław Gomułka finally discovered that the rocket programme was being continued under the label of research for PIHM and again took strict measures. PIHM was pressurised into withdrawal from the co-operation. Jacek Walczewski was offered a work contract in India. The project was in a state of gradual closure until 1974, when the supply of Meteors was finally used up and Poland joined the CMEA programme Interkosmos.

Many engineers quitted aviation. Tadeusz Sołtyk moved to Industrial Research Institute for Automation and Measurements in 1967, where he worked till his retirement. By the end of that decade the liquidation of aviation industry began to be talked about. Such purpose was attributed to Bolesław Jaszczuk's policy of selective development. This issue requires further explanation. When Julian Gren was dismissed, the deputy minister of engineering industry Józef Talma took charge of aviation industry. The Aircraft and Engine Industry Union 'Delta' was headed by Mieczysław Gronek who had been the director of WSK Mielec during Gren's rule. After embracing 'Delta' Gronek was replaced in Mielec by Tadeusz Ryczaj. Having realised that the situation was not favourable of aviation industry they decided not to oppose openly the policy of selective development. Instead they sought safety in diversification. Thus, 'Delta' became Aircraft and Engine Industry Union and absorbed such plants as Nowotko Works in Warsaw and the Factory of Diesel Engines in Andrychów. The Institute of Aviation worked on the Wankel engine and in Mielec diesel engines were produced under the Leyland licence. Diesel engine was one of selective development creators' favourite idea¹⁰.

At the same time, the aviation component of activity was gradually reduced. At the Institute of Aviation the work on aircraft constructions was banned and the Faculty of Power and Aeronautical Engineering at the Warsaw University of Technology

⁹ I must note here that when I was talking to Professor Sandauer in spring 2012, he distanced himself from that opinion. He thought it had been much exaggerated.

¹⁰ I remember the constructors' ironical remarks about the 'Diesel-engine Republic'.

went into liquidation. The sense of near decline was certainly prevailing in Warsaw circles. However, the picture viewed from a wider perspective looks slightly different. WSK Mielec produced 700 AN-2's annually for the USSR. The total employment in aviation industry was around 100,000 and nobody was going to liquidate on such a large scale¹¹. The blow was aimed at Polish technical ideas.

When it became obvious that Poland would specialise in producing agricultural aircraft, at the Institute of Aviation a team was established to work on aircraft constructions. At the end of the 1960s, under the guidance of Andrzej Frydrychiewicz, a project of PZL-106 Kruk aircraft was engineered. Because of the ban the activity was kept secret and generated no income for the constructors. The M-14 project based on a similar idea was prepared in Mielec.

After the events of December 1970 and Edward Gierek's group coming to power, the atmosphere around aviation industry changed. An agreement with the USSR was signed on the construction of a new type of agricultural aircraft. When the stage of business negotiations was reached, the Polish partners proposed the M-14 project. It turned out, however, that the Soviets had their special demands. They needed an agricultural biplane with jet engine. Nowhere in the world such a combination existed and Polish engineers objected to the idea¹². The argument against was the estimated high fuel consumption. The Soviet partners said that it would not be a big problem especially if the plane used petroleum, the standard aircraft fuel used in Siberia and the Far East. Finally, the expected sale of 3000 aircraft made the scales turn.

At that stage the work on the M-15 aircraft started. Ramir Izmaïłow was the constructor in charge. He was moving fast up the career ladder in his country. At a young age he became the head of a construction office which placed him on par with such bigwigs as Antonow or Tupolew. Rumour spread in Poland had it that he was a relative of Aleksey Kosygin, the then Soviet Prime Minister, and his brilliant career was due to that fact. It also determined strong political support given to the

¹¹ Professor Sandauer would see the situation as a conspiracy of Władysław Kruczek, the party's first secretary in Rzeszów, who in order to protect his own region wanted to finish the competition from Warsaw. In fact, WSK Mielec was not in danger of liquidation. It was the Faculty of Power and Aeronautical Engineering at Warsaw University of Technology that was being closed down while the Aviation Faculty of Rzeszów Technical University was established. In Warsaw WSK Okęcie was not at risk either as there was always one Politburo member or another who was at the same time a member of local party organisation, so they could count on protection in case of emergency.

¹² The then director of WSK Mielec Tadeusz Ryczaj expressed the opinion that the aircraft was meant to be a chemical weapons carrier in case of China – the USSR war would break out (see: Skrzypczak 2008: 155).

project. One of preparatory tasks was the construction of a flying laboratory (Lala). It was an An-2 plane cut in the middle and equipped with a jet engine in the rear part. M-15 was ready in 1975 and was to be presented at the Paris Air Show. It was given the marketing name 'Belphegor'¹³. Soon a short trial series was sent to Maykop for test flights. There one of the planes had a crash. Such things do happen at the test level. This time, however, the event met the social demand, paradoxically. The hitherto used An-2 needed a three-person crew on flight. They enjoyed the status of flying personnel and the privileges related to it. M-15 was operated by one person only. Therefore, as a result of introducing the new aircraft to market 2/3 of the Soviet agricultural flying personnel would lose their privileges¹⁴. At that moment both the crash in Maykop and the argument about high fuel consumption¹⁵ were used to revoke the agreement with Poland. Eventually, instead of the initial 3000 the Soviet Union bought only 175 planes.

The failure of the M-15 project expanded the range of independence of Polish aviation industry from the Soviet partners. It became clear that the prospects for long-term orders and economies of scale had been used by the USSR as a tool for exerting pressure. When the credibility of promises was lost, the Polish side tried to reach for more freedom. Another two agricultural aircraft were constructed: the PZL-106 Kruk and a similar, but three times as big, PZL M-18 Dromader. The latter was designed under the construction of an American company Rockwell and was produced mainly for export to the West. The Russian partners were not very happy about it and called the Dromader sarcastically a hunchback. They did not officially block the project, though.

Years after the Grot had been burned, the idea of Polish trainer aircraft could be reconsidered. In 1976 conceptual work on the PZL I-22 Iryda aircraft began. The chief constructor was Ryszard Orłowski, the creator of Wilga, who was fascinated by Alpha-Jet¹⁶, a 1973 French-German construction. The prototype was flown in the

¹³ The name was suggested by the test-pilot Andrzej Ablamowicz. Everybody remembered the famous French TV series 'Belphegor or the Spectre in the Louvre' so the name was accepted. The choice aptly reflected Polish engineers' attitude to that result of Polish – Soviet co-operation.

¹⁴ Soviet agricultural aviation structurally was a part of Aeroflot and employed several dozen thousand people (see: Babiejczuk, Grzegorzewski 1969: 148–162).

¹⁵ M-15 used 600 litres fuel per hour while An-2 – 175 litres.

¹⁶ In world literature on the subject Iryda is, in fact, referred to as Polish Alpha-Jet.

early 1980s. The weak point of Iryda was its imitative character and the gap between it and its original that widened in time as the building process slowly continued¹⁷.

While the work on Iryda was in progress, the enthusiastic atmosphere of the 1960s returned in a sense but the distance to the rest of the world was incomparably bigger. When the first 'Solidarity' was created in 1980, it was perceived as a chance of restoring the sense of labour. It is in this context that one should consider the sociological phenomenon of creating at the Institute of Aviation the clandestine management after the martial law was imposed. The assumption was that the official authorities would again force the staff into phoney, nonsensical activities but despite that they should try to do something sensible. However, such a scheme was much more difficult to realise than the underground structure of a trade union. It was not meant as a long lasting solution. As time passed by, some employers began to mention the solutions worked out in conspiracy to the official management. In their opinion it was the only way to realize them. Others treated such acts as disloyalty. As a result, the existence of clandestine management gave rise to the conflicts, what disintegrated the hitherto close-knit circle.

During a short period from 1956 to 1963 Polish aviation industry had the potential to reach the World highest level. However, the opportunity was deliberately wasted by Władysław Gomułka, whose vision of modernisation of Poland did not include that sector. Electronic and automotive industries met the same fate. Certain similarities to Japan can be traced in that situation. In the 1960s the MITI facilitated the development of shipbuilding, steel and chemical industries while blocking the automotive sector. When the first oil crisis started, it turned out that the industries supported by the MITI had no future in Japan, unlike the automotive industry, which unexpectedly became popular. The MITI showed the ability to admit and correct the mistake and the priorities were reorganised. However, the power over the economy that Gomułka exercised was much larger than that of the MITI and his personal aversion – more destructive. Interestingly, Gomułka presented the most reluctant attitude towards those branches of economy which presumably were most modern, and had the best capacity for further development. Polish economy in the interwar

¹⁷ The fate of Iryda was decided already in times of the Third Republic (after 1989). The air force representatives whose top priority was combat aircraft feared that if they ordered Iryda, politicians would refuse to finance another type of aircraft. For some time the navy was interested. From their point of view the main benefit of Iryda was the twin engine. It would help with the safe return of the plane to the base in case of one engine failure. However, the 1996 Iryda's crash in which the commander in chief of the navy air force was killed put an end to its career. 17 planes that were waiting for customers in Mielec were finally scrapped in 2008. Only a few were saved as museum artefacts.

period had numerous weaknesses but there was much more trust in the original Polish technological ideas. After 1956 that trust was restored for a short time but it was deliberately ruined. Since then, the only way to modernise was seen in the acquisition of foreign technologies, first from the Soviet Union, and later from the West. As a consequence, Polish economy suffered irreparable loss the effects of which have been lasting till now.

The first secretary's personal aversion is a specific and peculiar case. However, some generalisations are perhaps worth of such attempt. A creative atmosphere of work in a large team of competent and capable specialists is a value which should be protected in any political situation. It is stimulated by two factors: feeling the sense of work and enjoying the freedom of research along with the right to err. It would be crude to think that the whole matter comes down to financing. It certainly is an important factor though not the one which determines success. Even one can imagine a situation in which the use of public funds for support can turn out to be counter-effective. It can happen due to the bureaucratic control system which is usually put to work whenever public money is involved and which can easily stifle the freedom of research.

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