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Image data paradox – on the impact of the development of image-based remote sensing on the maps' content in the Eastern Bloc. The case of Poland

Abstract. The authors examine the impact of the development of image-based remote sensing systems on the activities of state administrations in the cartographic production and making of geographical information publicly available in the Eastern Bloc countries. A convergence of cartography, secrecy, and power occurred during the Cold War. Through investigation of facts relevant to the acquisition image data of the Earth surface performed by the USA and the USSR, it aims to examine the key questions of why the logic behind the development of cartography in the Eastern Bloc countries after World War II was distorted. The lack of logic was reflected in the fact that the amount of information actually presented on maps decreased with an increase in the information about the surface of the Earth acquired by the means of remote sensing systems.

It was suggested that image data in the member states of the Eastern Bloc, in spite of their restricted use and a drop in the informational value of maps, was the main factor behind the creation, detail, and geometric accuracy of civilian maps. Proving this thesis involved analyzing the correlations between the achievements in the field of remote sensing and the quality of maps developed during the Cold War in the Eastern Bloc states.

Keywords: secrecy, satellite imagery, cartography, Eastern Bloc, Cold War, censorship

1. Introduction

The knowledge of one's country has always been of strategic importance for the economic and military policy. An amplified accuracy of representing topographical elements on maps has increased their role in running a country. Milestones in this area were passed in the 18th century. These were triangulation surveying, terrestrial photographs and photography as such, which was first used to capture the Earth surface from a balloon in the second half of 18th century, from an aircraft at the beginning of 20th century, to finally reach the orbital altitude in the second half of the 20th century. The image data from aerial photos contributed to improving the level of detail and geometric accuracy of maps, as well as accelerated the process of their development and updating. Today, image data are some of the main information sources used in cartography and geographic analysis.

As can be seen from the literature, methods of using aerial photographs to create and update topographic maps developed in the 1930s in European countries, which put those countries at a similar level of development until the world was divided by the Iron Curtain. On its east side, where Poland, Czechoslovakia, the German Democratic Republic, Hungary and other countries of the Eastern Europe were under the Moscow control, civilian cartography was typically subject army decisions (P. Collier et al. 1996), which regulated the entire domain of image data.

The scope of changes in map production induced by the development of satellite technology may be best demonstrated by the proceedings published following a conference organized by the Central Intelligence Agency (CIA) in May 1995, during which the declassified the CORONA satellite reconnaissance program documents were brought to light. One of their parts was particularly explicit: "Corona eventually became almost the sole source of DMA's

(Defense Mapping Agency) military mapping data" (K.C. Ruffner 1995). To the east of the Iron Curtain was the Zenit, or, as P.A. Gorin (1997) put it, "Corona's Soviet Counterpart". It remains less overt than the CORONA program to this day, but there is no doubt that both programs had a large impact on the contents of civil and military topographic maps on both sides of the Iron Curtain (J. Baclawski 1997; J.G. Cloud 2002).

The governments on the eastern side of the Iron Curtain broadcast the propaganda about the need to protect geographical information so effectively that blank areas on the maps and aerial photography prohibiting signs were not usually questioned. It was only during joint meetings of military and civilian censors that these absurdities were discussed (B. Konopska 2012). Interestingly enough, however, it was only the civilian censors that ever noticed them. Not until the age of the internet and high-resolution satellite data did the problem of declassifying spatial objects spark any wider discussion. The role of satellite imagery in the contestation of government-classified areas was the point of deliberations led by C. Perkins and M. Dodge (2009). They also pointed out the problems caused by classifying locations presented on images available on the Internet.

The participants of the abovementioned discussion were well aware of the long history behind classifying objects, usually due to military reasons. During the Cold War, guidelines for state and military secrecy for the countries of the Eastern Bloc were delineated by Soviet military topographers and communicated during regular conferences on geodesy and cartography. National governments were eager to enact them into applicable laws without undue delay since these opened new sources of funding works on geodesy (I. Joó 2009). Many of the rules regulating geodetic and cartographic works which were introduced between the 1960s and the 1990s pertained to image data, although image data were not commonly employed in the production of civilian maps in any of those countries, especially the publicly accessible ones. This was still the case when the imagery from Landsat and SPOT satellites or from the international Interkosmos program were to hand. Regardless of the skillful efforts of military censorship to impede their use as data sources, it must be admitted that the development of remote sensing methods did have any effect on the production of civilian maps. It was, therefore, suggested that image data in the members of the Eastern Bloc, in spite of their restricted use and a drop in the informational value of maps, was the main factor behind the creation, detail, and geometric accuracy of civilian maps. Proving this thesis involved analyzing the correlations between the achievements in the field of remote sensing and the image quality on topographic maps developed during the Cold War in the Eastern Bloc states.

For this reason, it was crucial to trace the facts relevant to the Earth observation data acquired by the USA and the USSR. It was also necessary to analyze the decisions taken by Moscow on the guidelines for topographic maps and resulting regulations adopted by the Eastern Bloc states, in particular by examining the case of Poland. Specific questions were therefore aimed at indicating the reasons why the logic behind the development of cartography in the Eastern Bloc countries after World War II was distorted, on the example of the maps of Poland produced at that time. The lack of logic was reflected in the fact that the amount of information actually presented on the civil maps at topographic scales decreased with an increase of information about the surface of the Earth acquired by the means of photography.

The attempt to confirm this thesis involved an analysis of cartographic source materials, and namely selected official topographic maps, tourist maps, and city plans issued between 1946 and 1991, as well as written archive documents of the censorship office (the Head Office for Control of Press, Publications and Public Performances), the Head Office of Land Surveys (GUPK) and the Central Office of Geodesy and Cartography (CUGIK), kept in the Central Archives of Modern Records (Archiwum Główne Akt Nowych – AAN) in Warsaw.

2. Auspicious beginning to the use of image data in Polish cartographic works

In the 30s, aerial photographs in Poland were performed mainly by the Aerial Photogrammetric Department of the LOT Polish Airlines. Its resources were used by the army, government, scientific institutions, and industrial plants. The monopoly in this field was secured by the Military Geographic Institute (WIG), which used stereoscopic aerial and terrestrial photographs

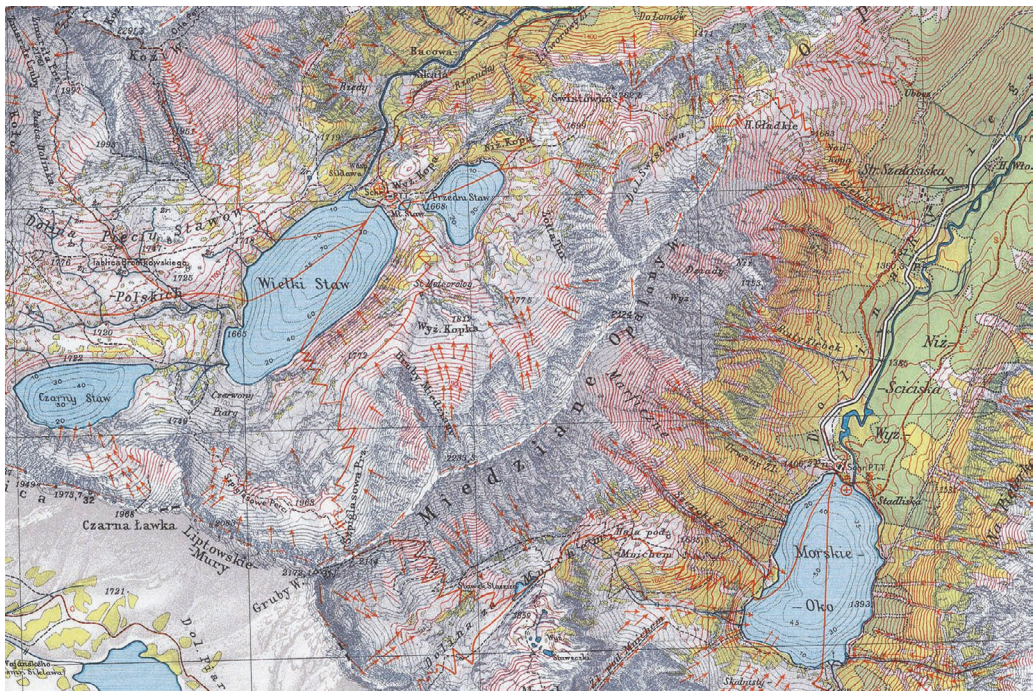

Fig. 1. A part of topographic map of the Tatra Mts. compiled using aerial photographs in the 1930s

to draw topographic maps. The technology developed and implemented by WIG was one of the paramount achievements of Polish cartography and photogrammetry in the interwar period, acclaimed during scientific congresses and photogrammetric exhibitions in Paris, Berlin and Warsaw. The method developed by WIG produced best results in the representation of mountain areas (fig. 1). Notably, it was acknowledged by Gerlach H. Hemmerich, German General of Wehrmacht and Chief of War Mapping and Surveying Matters, who argued in 1942 that the Polish tactical map at the scale of 1:100 000 is equal to the German one in terms of the content quality, whereas its colors and the terrain representation were hailed as better (G.H. Hemmerich 1942).

The maps in question were classified after 1952, withdrawn from circulation, and deposited in archives. They were still to be found among antiquaries until the 1960s, yet their possession was considered illegal. In the 1980s, as the censorship in Poland started to wane, the maps appeared in the form of copy prints. Although substantially outdated, they enjoyed huge popularity due to their cartometric value and topographic detail, superior to the newer maps available on the market. The maps produced by WIG in the 30s are still in demand today, as seen on the example of the web page launched several years ago, which presents their scans in a high resolution.

3. Withdrawal of image data from civilian cartography

When the first V2 Ballistic Missile equipped with a camera was launched from the White Sands Proving Ground in New Mexico in March 1946, the common belief that political advantage is gained by conquering the airspace began to wane. V2 performed the first photography of the Earth surface from an altitude surpassing 100 km and thus ushered in the era of satellite remote sensing (R.W. Lillesand and T.M. Kiefer 1994). The importance of satel-

lite intelligence, which escalated from that moment, was properly recognized in May 1960, when an American U2 aircraft was shot down in the Soviet territory during an aerial reconnaissance flight. It became clear that the existing traditional and aerial military intelligence should be extended so as to include a system that would be undetectable and beyond the reach of the existing defense systems of the opponent.

As a result of these events, image data started to be controlled by the military, also in Poland, which was already under the influence of Moscow. After 1948, the Ministry of National Defense (MON) had the exclusive right to perform Earth photography[1]. It assumed control of the photography equipment and resources of the civil services. The Topographical Department of the Polish Army, a newly established unit under the immediate command of Soviet topographers stationed in Poland, became the sole holder of image data (E. Sobczyński 2010). From this point on, aerial photographs were not available for civilian cartographers, whereas maps compiled using such photographs were deemed classified (fig. 2). This marks the beginning of the age when "misinterpreted ideology triumphed over common sense" (J. Pasławski 1985).

Aware of the opportunities opened up by photography in respect of obtaining information about the geographical environment, the entire Eastern Side of the Iron Curtain became obsessed with the protection of geographical data. The effects of this idée fixe on the cartographic works were noticeable in the aspects of employment, production, and legislation. The first involved more stringent work regulations, which, in the event of breaking, imposed prosecution sanctions on cartographers. The control of map production process was also stricter, while under new legislation, aerial photographs and objects of an industrial, transport, and military nature were covered by state secrecy.

Terrestrial photos were also subject to curtailment. Government-nominated categories of objects or places that were prohibited from aerial photography mainly included objects of a military, industrial, mining, or energy nature, as well as related research institutes, laboratories and design offices, and any state storage facilities. The list also comprised railway loading ramps, steam-depots, electric loco maintenance sheds, general views of the track layout and track nodal points at stations, airports, seaports and river harbors, flyovers, bridges, tunnels,

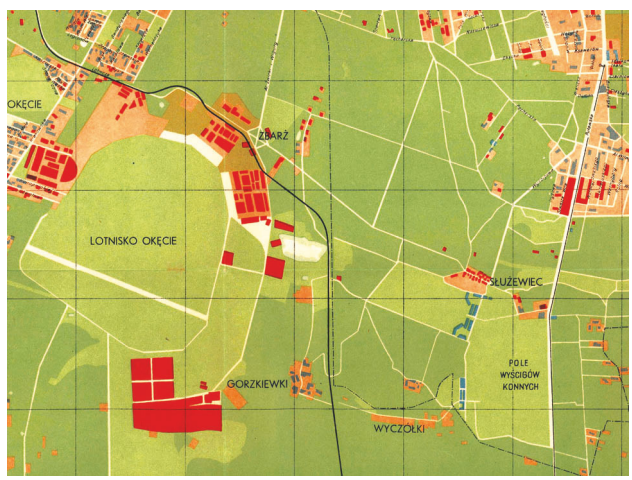

Fig. 2. A part of a city map of Warsaw compiled using aerial photographs in 1948, withdrawn from public circulation following a censorship decision

[1] "Dziennik Ustaw Rzeczypospolitej Polskiej" 1948, No. 24, item 160.

and any hydrotechnical devices. It was also prohibited to capture communication devices, such as radio stations, telephone exchanges, telegraph stations, etc.

4. New approach to the topographic map content

At the beginning of the 1950s, Moscow destroyed the cartographic achievements of the Eastern Bloc countries in a single movement. Under the pretense of harmonizing military topographic maps in all countries of the Eastern Bloc, it eliminated the existing maps and coordinate systems, imposing its own concept of maps together with the "Pulkovo 1942" coordinate system used in the Soviet cartography (P. Collier et al. 1996). In this way, Moscow reached full control over the production of military maps in each of the allied states. The next step was to classify geographical coordinates. Irrespective of these preventive actions, a part of military maps and geodetic data obtained by Germany from the Red Army was already in the hands of the Americans, acquired by the team of Floyd W. Hough in 1945 (I. Fischer 2005). The basis for the American intelligence on Eastern Europe and the Soviet Union also comprised a number of other materials (photographs, documents, maps) captured during the Cold War.

Censor instructions which regulated the content of topographic maps in all countries effectively eliminated a large deal of valuable information, e.g. the status of roads, location of embankments and ditches, details of railway lines, industry sites or locations which could point to the extraction of raw materials, as well as military facilities. The task of censors was to define the general characteristics of areas that required protection, whereas the individual ministers designated particular objects as "classified" or "secret". These were therefore not meant for public mapping. Similarly, the censorship postulated presumptions regarding generalization, leaving them open to interpretation for particular countries. As it results from the map analysis, this "freedom" introduced some extent of heterogeneity in respect of the reduced content, whereby some maps were less elaborate (e.g. Polish) and others more (e.g. Czech, German). They all had to fit within the limits imposed by the Soviet military topographers.

Fig. 3. Comparison of the informative content of maps published in 1947 and 1955

The first autonomous civilian maps of cities and towns issued in Poland in the second half of the 20th century were developed at 1:20,000 to 1:30,000, without the scale explicitly stated on the actual map. A similar reduction of content was used on tourist and official maps. These provided rather little useful information compared with the antebellum maps or even those from the late 40s (fig. 3). Official maps were bestowed with a "confidential" clause, which was a purely psychological maneuver, aimed at cartographers and other persons who used these maps, with the intention to give them a taste of high society, a sense of belonging to a group which enjoyed the confidence of the authorities.

5. Geometric deformations as a part of the mapmaking process

Competition for technological dominance in space exploration between the Soviet Union and the USA became apparent in October 1957, when the USSR launched Sputnik, the first artificial satellite into an elliptical low Earth orbit. Both countries then implemented military programs designed to create advanced Imagery Intelligence systems (R.C. Hall 1996) in order to obtain information about objects which could be the potential target of a nuclear attack (nuclear facilities and air bases). USA had the CORONA program (1958–1972), under the cover of a space technology development program called the Discoverer (R.A. McDonald 1997).

In the first half of the 1960s, USA began to systematically gather satellite photographs within the scope of the CORONA program, subsequently used by American interpreters in producing topographic maps of Eastern Bloc countries (A.D. Day et al. 1998; J.G. Cloud 2002). In one of his interviews, Richard Leghorn, co-founder of Lockheed, a company responsible for designing the Key Hole camera employed in the CORONA program, recalls his visit to the Kremlin in 1960, when the Secretary-General of the Academy of Sciences of the USSR hinted that he knows about the American achievements in the field of satellite research. This explains many of the actions in the Eastern Bloc which influenced or were directly related to the issue of topographic maps.

As already mentioned in the Introduction, the Soviet response to the secret CORONA program was the satellite reconnaissance program called Zenit. In 1962, after several years of attempts, Russians obtained their first satellite intelligence images. Two years later, the Minister of Defense of the Soviet Union declared Zenit to have operational capability of satellite recognition. The acquired data were used by the security service of the USSR. The Zenit program was never definitively complete, but rather it evolved into subsequent programs of military surveillance of the Soviet Union (P.A. Gorin 1998). From the 1970s on, satellite images acquired under the Zenit project were used in source materials for topographic maps of the United States, Western states, and other parts of the world. There is no doubt that the proactive doctrine of the Soviet Union, including the plans of invading countries of Western Europe, was the main purpose of numerous topographical maps created by the USSR. The majority of Eastern Bloc members contributed to those investigations (A.J. Kent and J.M. Davies 2013).

5.1. First intentional distortions of object location on the maps

Research into maps from the 1950s, exhibiting deficient contents, in particular city plans, has not shown any significant distortions of geometry (B. Konopska 2011). Clear geometric deformations of objects shown on multisheet maps were found on a special edition map of Poland intended for civil and research purposes, prepared by the officers of the Topographic Service of the Polish Army, supervised by Soviet officers. This map was designed to replace the source materials classified at the beginning of the 1950s (including aerial photographs and topographic maps), produced in the “Borowa Góra” Polish topographical coordinate system before the war as well as the then-new “Pulkovo 1942” imposed by the Soviet Union. All map sheets show one type of deformation: the further away from the center of the map, the greater the degree of content distortion (W. Grygorenko 2009), so that connecting adjacent sheets directly was impossible. It remained the main source of any civilian mapping for years and was still in use in the 1980s.

The restrictions introduced in the Eastern Bloc in the first half of the 1960s were parallel to the events in the Soviet Union itself. The authorities further suppressed the access to topographical maps which was already heavily restricted in the 1950s. The “confidential” clause included even 1:100,000 scale topographic maps from the years 1930–1954 and maps at the scale of more than 1:100,000 produced between 1920 and 1954. The pretext given for those exacerbations was the need for a greater protection of geographical coordinates, as reading those old but cartometrically and substantially accurate maps allowed for the calibration and interpretation of aerial photographs. Maps available on the market did not have such properties, as they resembled sketches of tourist areas or tourist routes, approved by the Minister of National Defense, as well as

sketch communication maps and schematic plans of cities (A.V. Postnikov 2002).

5.2. First principles of the geometric deformation of maps

In the mid 1960s, during a conference for the geodesy and cartography offices of the Eastern Bloc member states, the head of the Topographic Service of the Soviet Army demonstrated a map at a scale of 1:2,500,000, made according to the new rules on the accuracy of locating objects of national importance on topographical maps intended for public use. Deviations from the actual position were in the range of ±15–20 km (D. Unverhau 2006a). The map presented by the Russians had a variable scale and random distortions in coordinates, to employ a variable scale (D. Unverhau 2006b). A map developed in accordance with these guidelines was cartometrically incorrect. It would have been therefore an exploitation to provide the scale on such maps, hence the word "circa", which kept them closer to the truth.

In connection with the geometric deformation of the map content, the technological process had to involve additional steps, different in each member state. Deformation of geometry in Poland entailed cutting the map into pieces to subsequently move and turn its parts (fig. 4).

Map deformation in Poland had been regulated since the beginning of 1965. The document entitled "Instructions on the state and official secrecy" (1964–1965) introduced three new terms: "general location", "detailed location", and "cartometric location"[2]. A "general location" conveyed the approximate location of

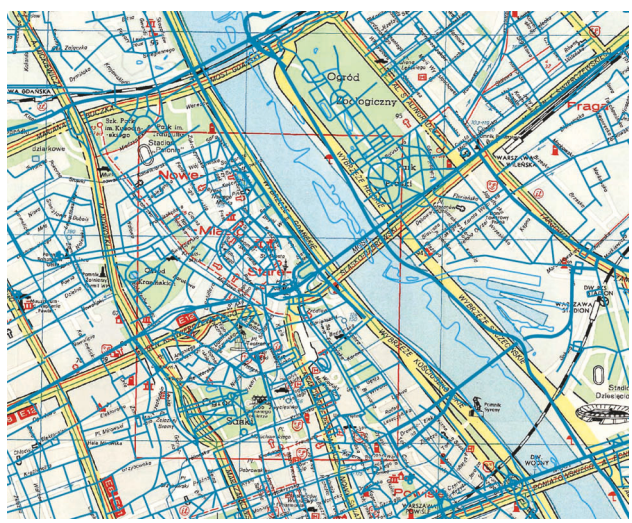

Fig. 4. Geometric deformation (a part of an original map of Warsaw from 1970 with overlay correct line object)

distances, and directions. Misrepresentations of geometric position focused mainly on routes and points of strategic importance. For the maps at the base scale of 1:200,000, it was recommended to introduce deformations of scale and direction, in order for the position of the topographic object in the target publication to diverge ±3 km from their real location. Creators of road maps were strongly recommended an area (e.g. residential estate) or a line. In such case, it was, for instance, possible to broadly delineate the course of a road by giving its endpoints and the towns on its route. A "detailed location" implied presenting the exact position of the object in a descriptive form or on the

[2] Archiwum Akt Nowych, set 1102, sign. 811, SWW–016. GUKPPiW, pp. 20–21.

map but in relation to other objects, such as streets, roads, rivers, forests, or railway tracks. A "cartometric location" referred to a strictly geodetic identification of the object position by providing its coordinates or representing it on the map or an aerial photo corresponding to a national coordinate system[3].

The introduction of three levels of geometric accuracy of maps coincided with the undertaking of the Eastern Bloc members to develop local reference systems. This was due to the obsessive concern of the USSR about accidental imparting data that would facilitate the interpretation of satellite imagery to Americans. The strict policy pursued by the USSR resulted in a new spatial reference system developed for Poland, called the "1965". It divided the country into five zones, disparate and deformed. Converting the coordinates from the "1942" to the "1965" was finalized in 1971. From then on, the possession of maps in the "1942" system was absolutely illegal for civilians (E. Sobczyński 2010).

6. Return to aerial and satellite image data

In 1970, Poland admitted the use of images in updating cartographic documents and in school education, of course after censoring their content. The available technology allowed only for parts of the emulsion to be removed from the surface of photo prints. In the end, such patches on the photo with the emulsion removed indicated the location of the censored facility all the more, as the user could have easily presumed the whereabouts of the secret or classified objects (fig. 5).

After the first images acquired by the ERTS/Landsat civilian satellite (1972) reached European cartographers and were already widespread in the fields of spatial economy, environmental protection, geology, or forestry, the Air and Satellite Images Processing Center (OPOLiS) was founded in Warsaw in 1976. It was the largest center of image data processing in the entire Eastern Bloc and soon became the meeting point for researchers from both sides of the Iron Curtain. This was, however, not a coincidence. Poland in the 1970s was a country of favorable conditions, fairly open to contact with the West in the so-called Gierek decade (1970–80). It was the period when Edward Gierek, the first secretary of the Polish United Workers' Party (PZPR), set out to revitalize the country's economy (C.G. Kennedy 1980). Other beneficial circumstances included a potentially high interest in the civil use of satellite techniques, qualified personnel (with a good command of English and Russian), and a slightly less severe restriction of geographical data obtained from photographs than in the other Eastern Bloc countries. Images acquired by the Landsat satellite were authorized in Poland, in contrast to the neighboring countries (e.g. Czechoslovakia), where they were kept secret for years. The system of multispectral satellite image analysis installed in Warsaw was the only system of this kind in Poland and, according to the installation team, also the only one between the Elbe and Vladivostok (A. Ciołkosz 2015).

In the 1970s, OPOLiS was under the strict supervision of the government. At that time, it was focused on satellite remote sensing and what information could have been read from satellite images, concerned with what others can discern on photographs covering the territory of Poland. This interest was actively stimulated by American satellites, which had systematically acquired image data of the area of Poland for years. The answer to the question how much can be gathered from satellite images was supposed to be found in research projects. These usually pertained to the issue of environmental pollution, while the negative results in this respect were generally classified.

After NASA published an album showing interesting landscapes or phenomena captured by the Landsat satellite, including images of the Upper Silesian Coal Basin area in Poland and the Ostrava-Karviná Coal Basin in Czechoslovakia, the government curiosity rose dramatically (A. Ciołkosz et al. 1981).

Shortly afterwards, OPOLiS received an image of the middle segment of the Vistula River from the United States, also acquired by the Landsat satellite. The program crew asked about the visible objects sharply contrasting with the dark river water, arranged in a regular pattern, with a repeating distance of approximately 1100 m. Unfortunately, this question was never answered, because the institute

[3] Archiwum Akt Nowych, set 1102, sign. 1633 [318/1], p. 46.

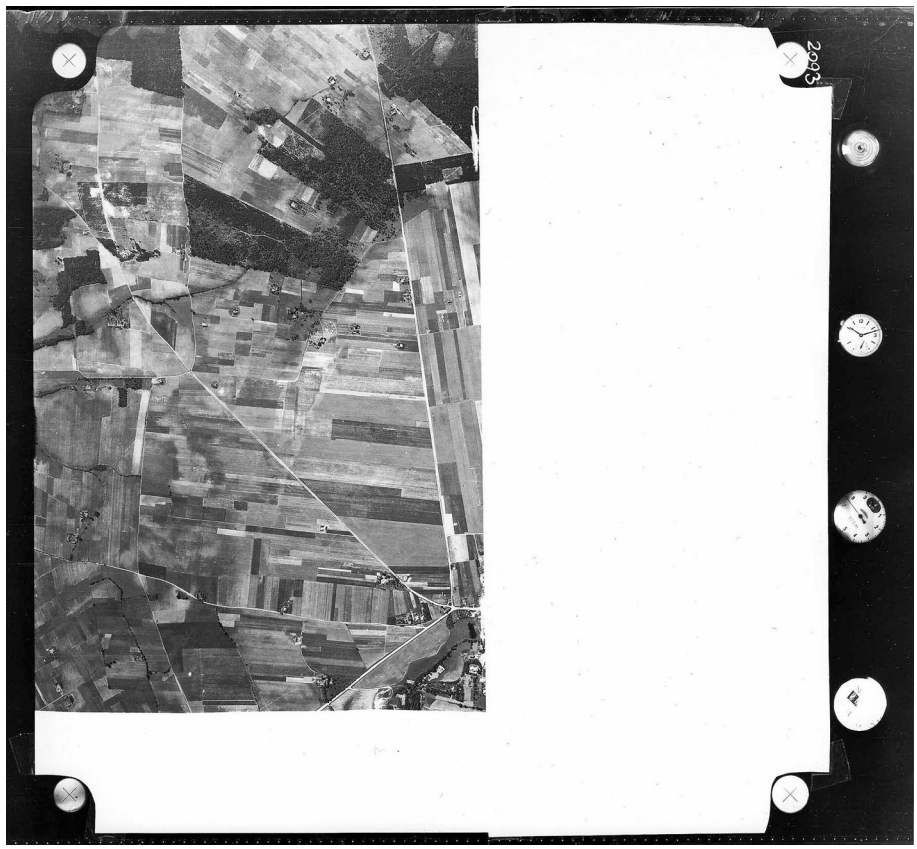

Fig. 5. Censored aerial photo from 1974

was not granted a permission to do so by the authority controlling foreign contacts of OPOLiS. The said objects were mid-channel bars (A. Ciołkosz 2015).

In the 1970s and later in the 1980s, institutions which ensured the protection of state secrets received authorization for the use of aerial photographs for scientific research purposes. Some even received permission to perform them. However, the negatives were not immediately directed to cartographic production, but first forwarded in sealed containers to the Head Office of Geodesy and Cartography for the purposes of development and classification. Informally, this was referred to as declassifying in the sense of removing restricted areas from the photographs.

The catalogue of top secret documents in force since January 1977 included aerial photographs and derivative photogrammetric materials, negatives, slides, photocopies, enlargements and photos of reduced size.

The "secret" clause also covered plans of flights during which photographs were taken, as well as range indices of photographs imparted to national economy units, and the research results of geodetic and cartographic institutions, related in any way to national defense.

The group of "confidential" data encompassed photographs of areas agreed upon by the Ministry of National Defense (MON), intended for use in design, planning, and investment. The aerial photography programs were deemed "confidential" as well. Aerial photographs of selected areas taken before 1953, were, in turn, rated "public".

In 1980, satellite images were released into free circulation, including American satellite ima-

gery, images acquired by the Soviet satellites under the INTERKOSMOS program (C. Burgess and B. Vis 2016; H. Kautzleben et al. 1990), and other images accepted by the General Staff of the Polish Army. Satellite images acquired by the USA (ERTS/Landsat), and later also by France (Spot) were not considered "secret" until the very end of the Polish People's Republic, in contrast to satellite images made by the USSR.

In the field of cartography, the 1970s brought only minor changes to the content of maps. Geometric deformations on particular maps were so large that additional information or greater detail could not raise the value of a map as a cartographic product. 1981 was the year of political changes, which removed the obligation to alter maps[4]. Yet with no access to cartometric source materials, map quality had no possibility of improving. In the case of tourist maps, however, this date is significant. For several years to come, the only maps available on the publishing market were cartometrically inaccurate, and until the Head Office for Control of Press, Publications and Public Performances was closed in May 1990, censor signatures had been printed on them (fig. 6).

Fig. 6. Censor signatures. Head Office for Control of Press, Publications and Public Performances. Approved for printing

In 1980, it was permitted to disclose the information that state coordinate systems "Borowa Góra", "1942", and "1965" existed, but detailed data on these systems were not to be published. The "methods of map distortion and concealing confidential objects on the maps" remained secret. It was, however, possible to confirm the information about the inadequacy of maps and plans in terms of inaccurate location of roads and streets as parts of tourist paths or paths leading to tourist sites and monuments of material culture[5].

The end of the Cold War and the disintegration of the Eastern Bloc were a legal closure to the era when the processes of distortions of map content were applied in quantitative and geometric terms. May 2000 saw the signal degradation (Selective Availability), which limited accuracy of civilian GPS receivers being turned off, which led to an increase in accuracy in civilian applications from several dozen meters to several meters. This brutally exposed the lack of cartometric accuracy in the maps of the Eastern Bloc. These maps were then naturally eliminated from the modern navigation devices. These applications required some investments in mapping, which meant that the development of satellite technology and the availability of image data in Poland was only feasible and allowed for increased geometric accuracy of topographic maps after the year 2000. Image data derived from airborne and spaceborne remote sensing systems began to be one of the main sources for civilian mapping.

7. Conclusions

An analysis of the graphic and written sources allowed the authors to confirm the thesis posed in the introduction, whereby image data derived from airborne and spaceborne remote sensing systems played a key role in shaping the final contents of topographic maps during the Cold War, although they were not directly used in cartography. The relationship between the achievements of remote sensing technology and the degeneration of map quality is clearly visible. This dependency was named the paradox of image data, denoting the phenomenon where an increase in the information acquired from remote sensing images coincides with a decrease in the information presented on the maps, and an increased spatial resolution of

[4] "Dziennik Ustaw Polskiej Rzeczypospolitej Ludowej" 1981, No. 20, item 99.

[5] Archiwum Akt Nowych, set 1102, sign. 1876. GUKPPiW, p. 25.

images coincides with geometrical manipulation of maps.

This relationship could have unfolded only under specific conditions which arose during the Cold War, when the rise of the Iron Curtain enabled Moscow to stir the fear and a sense of danger in the Eastern Bloc states.

Topographic maps intended for public use demonstrated no value whatsoever in terms of cartographic information, to say nothing of geometric inaccuracies. Official civilian maps, despite the "confidential" clause, were also adulterated and did not provide reliable terrain information.

The diminishing value of topographic maps was the result of the "emotions" experienced by the entire Eastern Bloc following the announcement of successive developments in the field of Earth remote sensing. The end of the Cold War and the disintegration of the Eastern Bloc allowed for a step forward towards cartographic reliability, but it was only after the signal interfering with the reception of satellite data in civilian GPS devices was shut down was it possible to eliminate the Cold War era maps from modern navigation devices, virtually forcing new cartographic studies to be carried out.

The development of satellite technology and the availability of image data contributed to improving the geometric accuracy of topographic maps only after 2000. This was particularly the case of road maps, which are the foundation of mobile and navigation cartography. Only then did the image data obtained from aerial or satellite photographs become one of the main sources for civilian mapping. The year 2000 saw the end to the image data paradox in Poland and in the other countries of the Eastern Bloc.

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