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Cold cases from the past, modern forensic tools and police Cold Case Units, or *crimen grave non potest esse impunibile* – part II

Summary

The article addresses the issues relating to the operations of the police Cold Case Units as well as the role of modern forensic tools in solving cases that were dismissed at the pre-trial stage, due to a failure to detect the perpetrators. The second part of the article describes selected methods and tools used at different stages of the X-Files investigations. The innovative solutions described are classified according to the place and purpose of application. Exemplary cases which have been solved with the use of innovative technological solutions are indicated.

Key words: Cold Case Units, police X-Files, modern technologies

Introduction

It is generally considered that reopening the files of discontinued proceedings does not necessarily mean a waste of time. As early as 1998, Tadeusz Hanausek pointed out that "once again, often years later, familiarizing oneself with the archived materials may provide the reader with a new perspective and lead to infer new information, which was contained in the file but had not been noticed before" (Hanausek, 1998, p. 86). This "different perspective" is determined by a number of factors, one of the key ones being the achievements of modern science, technology, and even craftsmanship. Forensic science, which is an interdisciplinary discipline, draws from the achievements of other disciplines, adapting modern methods and solutions resulting from the requirements of criminal proceedings. As a result, these activities contribute to the detection of the perpetrator and to proving his guilt for the act committed. Unfortunately, many of the crimes committed to date have not been solved. The reasons for this include the fact that the then law enforcement authorities did not have the tools and methods to solve the case, which consequently led to the discontinuance of the proceedings. Nowadays, it is increasingly the case that, owing to dynamic development of modern technologies, the old and often forgotten cases are being reopened and successfully solved.

Looking at the origins and the stages of formation of the police Cold Case Units, it is hard to overlook the correlation between the development of modern tools and methods of forensic research and the period of successive successes of the X-Files investigators. For example, the detection of the perpetrator who committed murder of 17-year-old Magda G. – one of the first cases solved by investigators of the later X-Files in Kraków – was possible thanks to the use of forensic genetic tests, which have only just established their position in the Polish criminal trial. One has to agree with Jan Wojtasik's (2008) thesis that more and more often a new perspective on a case is acquired only after applying a different test method than that used during the original investigation. This position is shared by officers of the Cold Case Units, who have consistently identified the need for modern solutions as one of the priorities throughout their activities. In conclusion, it can therefore be concluded that the influence of modern technologies on the successful resolution of previously dismissed cases is undeniable. However, is this a decisive influence?

Modern technologies

Before discussing individual solutions used by the X-Files investigators, it is worth defining the concept of new technology. The Act of 30 May 2008 on Certain Forms of Support for Innovative Activities (Journal of

Laws of 2008, Vol. 116, item 730) states that a new technology is defined as "a technology in the form of an industrial property right or the results of development works or industrial research, or unpatented technical knowledge, which enables the production of new or significantly improved goods, processes or services, compared to those already manufactured in the territory of the Republic of Poland". This broad definition can be supplemented by a simpler but well-explanatory definition. Namely, according to the online version of the Cambridge Dictionary, *high technology* is defined as: "the most advanced and developed tools and methods". Both definitions show that only those products which, according to the current state of knowledge, are at the highest level of technological advancement, can be considered as modern.

It is said that the need for scientific methods of detection of crime and criminals from the perspective of a criminal trial is not diminishing, which leads to continuous development of forensic sciences. However, it should be noted that the process of implementing such modern methods and techniques for the purposes of criminal proceedings is subject to many restrictions. Therefore, it takes a long time for an innovation pioneered in other areas to be used in criminal proceedings and to become accepted by the judiciary. In other words, satisfaction of forensic scientists from successful transformation of a scientific discovery into an instrument of justice is not necessarily shared by lawyers (for more information on this subject see Kwiatkowska-Wójcikiewicz, 2010, pp. 9-11). There are certain exceptions to this rule, e.g. genetic testing has established its position in forensics within a relatively short period of time, and genetic expertise is considered to be one of the strongest types of evidence in the criminal trial (Tomaszewski, 2010). The above statement correlates with Stanisław Waltoś' thesis that: "using new means and techniques in the criminal trial requires (...) great caution (...) Science must not be developed at the expense of the accused; the criminal trial is not the right place for testing scientific hypotheses" (Waltoś, Hofmański, 2016, p. 350). On the other hand, such legal conservatism (or skepticism) often results from stereotypical thinking, lack of knowledge or lack of trust in technological novelties (Waltos, Hofmański, 2016). An example of this is the polygraph testing, worthy of being named an innovation in the 1960s, but despite its significant development and high diagnostic value, some legal decision-makers are still unable to convince themselves of it (Herbowski, 2013). In conclusion, it seems that one should take into account not the duration of the period of application of a given tool in other areas of science, but the moment when the device or method was adapted by forensics and obtained the acceptance of legal decision-makers. For this reason, the following sections of this article will present instruments that despite being functional on the market for several years, have not lost much of their "novelty" due to the continuous process of improvement of the underlying technology.

Analyzing the use and impact of new methods in solving undetected crimes, they were previously divided into three categories, to which the corresponding forensic tools were assigned, both those applicable for use in laboratory tests, and at the scene of the event or the place where the corpse was concealed (these places may be determined or presumed). The first category encompasses the equipment used for visualization and space mapping; the second – instruments used in the search for human corpses, whereas the last one – the latest developments in dactyloscopic and genetic testing. It should be emphasized that some of the tools belonging to the first two categories may have a dual use, e.g. an unmanned submarine can be used both for searching the seabed for corpses and objects and for visualizing underwater areas.

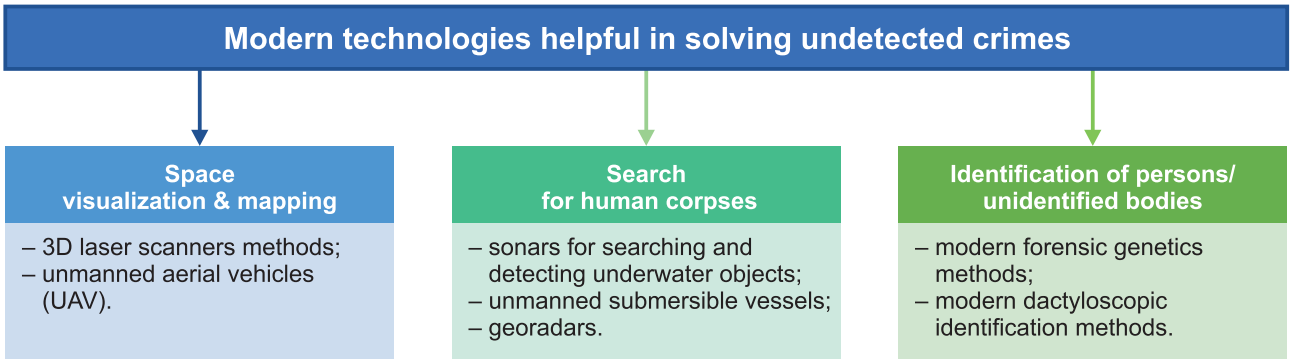

Fig. 1. Modern technologies helpful in solving undetected crimes.

3D laser scanning

3D laser scanning technology is a modern method, which, due to its special features and versatility, is successfully used in many areas, such as: construction, archeology, geodesy, aviation industry or forestry. For several years, it has also been used in forensics. One of the first attempts worldwide to use the scanner (Fig. 2) for police purposes dates back to 2004 (Liscio, Hayden, Moody, 2016). In 2008, at the annual American Academy of Forensic Sciences (AAFS) conference, representatives of the Albuquerque Police Department Crime Laboratory and Leica Geosystems (Hueske, 2016) gave a speech on the use of laser scanning in the reconstruction of firearms incident sites. In the following years, research was carried out which showed and confirmed the multitude of applications for 3D scanners in forensics (e.g. Hołowko et al., 2016; Buck et al., 2011). Today, many police forces around the world have this innovative tool at their disposal and use it in their investigative practice (Wieczorek, Zubańska, Wiciak, Szymczak, 2015).

Simply put, the 3D scanning process is based on transferring the real shape of the 3D model to digital form, i.e. the so-called "point cloud", which enables a "virtual inspection" of the registered location. This is because the point cloud is a kind of spatial documentation that can be returned to at any time to supplement it with additional measurements, analyses or to reconstruct the conditions on the day of scanning. 3D laser scanning of the object is performed from several positions, which minimizes the formation of shadows and dead fields on the three-dimensional model. A point cloud takes the form of raw data that must be processed using special software. In order to visualize the scanned object as closely as possible with the use of a digital camcorder or camera, the scanned colour points can be textured and the actual colours of the object can be reproduced during the processing process (Pilecki, 2012). Selected models of scanners have software designed typically for forensic purposes, which significantly facilitates the work of technicians who operate the equipment. The resulting material provides accurate, realistic, three-dimensional computer graphic models, useful for the analysis of places of mass events, crimes, road accidents and fires.

Fig. 2. Example of a phase scanner used in forensic – Zoller+Fröhlich IMAGER® 5016.

Americans are leading the way in using 3D laser scanning technology to solve undetected crimes. One of the most impressive examples of the use of this method was the attempt to reconstruct the attack on the President of the United States, John F. Kennedy, whose circumstances have not been finally clarified to this day. The researchers decided to confront this mystery and perform laser scanning around Dealey Plaza and inside the Texas School Book Depository, from where the alleged perpetrator of the murder was to shoot. Analyzing the data, an attempt was made to confirm or refute the thesis that the place of shooting was a small grass hill with a wooden fence. The information obtained from the scanner was supported by additional research into traces of ball inlets in the president's body It was finally proved that the shot had been fired from elsewhere. In addition to this attempt at reconstructing the course of events involving the use of firearms and analyzing the trajectory of a ball flight, in another case, the device was intended to help investigators compare how the landscape and terrain have changed over the years, and in yet another case – to identify the probable place where the perpetrator could abandon a body. In one of the cases described in the media, a 3D scanner is even given a prominent role in detecting the offender. Although the perpetrator was eventually identified by genetic tests, it was laser scanning that directly narrowed the circle of suspects.

So far, the Polish Cold Case Units have only incidentally applied the laser scanning technology in their investigations. A unique form of forensic research concerning the ongoing investigation into the murder of a 23-year-old student of religious science in 1998 was conducted by the 3D Analysis Laboratory of Wroclaw Medical University. The task of the experts was to visualize in a three-dimensional environment the probable course of the crime and the order and type of injuries inflicted on the victim. As a result of the

expert study, it was established that a person trained in certain martial arts could inflict blows. It can be said that the opinion issued contributed to the apprehension and accusation of a 52-year-old man who was a friend of the victim and had trained martial arts and worked in the prosectorium in the past. If found guilty, the suspect shall be liable to a penalty of a maximum of 12 years' imprisonment.

The instrument used by the X-Files investigators, which has a similar application as the devices representing 3D laser scanning technology, is an electronic tachometer with software designed for forensic purposes. The device was used by officers to conduct a trial experiment in the case of the murder of 17-year-old Iwona C. According to the information published on the official website of the National Prosecutor's Office (legal proceedings were conducted under the direction of the prosecutors of the Lesser Poland Branch of the Department for Organized Crime and Corruption of the National Prosecutor's Office in Krakow), as a result of the experiment carried out, a coil of steel wire was secured, based on a reasonable assumption that it was from this coil that the perpetrators separated a part and made a loop which was subsequently tightened around the victim's neck. In addition, a subsequent analysis, supported by an expert opinion, led investigators to conclude that the event had at least two phases.

Unmanned aerial vehicles

The unmanned aerial vehicle (UAV), commonly known as the drone (Fig. 3), was an important addition to the experiment carried out. This device that does not require an operator/pilot on board and is capable of autonomous or pre-programmed remote flight (ground or airborne). According to their construction and the principles of operation, drones can be divided into three categories: equipped with wings, rotors and aerostat-like (Merkisz, Nykaza, 2016). Unmanned aircraft may be used for both operational and legal proceedings purposes. Their wide range of capabilities allows them, among others, to support search and rescue or identification and pursuit operations carried out by dedicated services. They also work well in surveilling areas of interest to investigators, facilitate the determination of the extent of the crime scene as well as its observation (Merkisz, Nykaza, 2016). This tool enriches photographic documentation of the scene and, owing to its mobility, allows to reach hard-to-reach areas (Stojer-Polańska, Lisowicz, 2015).

Fig. 3. Exemplary model of a Yuneec Typhoon H unmanned aircraft with interchangeable thermal and 4K cameras.

With regard to the Cold Case Units, the use of drones for detection purposes comes down to two of the above-mentioned activities, the first being the search for corpses. Here, the investigators draw on experiences of archaeologists, who use unmanned robots to search for settlements, castles and cemeteries. It has been observed that the changes in the shape of the ground surface occurring during certain seasons of the year and times of day, can be excellently captured by aerial photographs (Stojer-Polańska, Lisowicz, 2015). The same applies to the sites where human remains were buried. In addition to soil structure anomalies, also the surface anomalies are always noticeable and registrable. A buried body and its decomposition process affect plant vegetation, scavenger activity, geophysical phenomena and the local landscape (Hunter, Cox, 2005). Therefore, based on aerial photographs taken from an airborne camera, these differences can be more easily visualized, detected and selected for more in-depth inspection. Such use of drones supports the first stage of the search for a corpse – a field inspection, whose main objective is to "reveal the place of deposition of a corpse or human remains by observing environmental determinants" (Dobrzański, 2013, p. 19).

When used in investigations reopened after many years, unmanned aircraft make it possible to visualize the scene of the event and determine any topographical changes that have occurred over a period of several or more years and were not related to hidden human remains. Drones can be equipped with additional recording instruments, e.g. airborne laser scanner, thermal camera or infrared filter. With regard to re-analysis and reconstruction of the event, the so-called bird's eye view provides supplementary material, which allows to reconsider the case from another perspective.

Georadar

A tool much more frequently chosen by the X-Files investigators is the Ground Penetrating Radar (GPR) (Fig. 4). This is because they deal with cases, in which as a result of blurring (hiding) all traces by the perpetrators, the victim's body is impossible to find. Georadar belongs to the group of devices using active geophysical prospecting methods, whose main assumption is to register geological anomalies. These include deviations from standard soil characteristics such as electrical resistance, conductivity and magnetic

properties (Ruffel, McKinley, 2005). A characteristic feature of these methods (as in the case of 3D laser scanning) is their non-invasiveness, i.e. the ability to detect and tentatively inspect the site to be examined without digging it up.

The georadar measurement kit consists of a transmitting and a receiving antenna, a central unit and a monitor. The principle of operation consists in sending by the transmitter short electromagnetic impulses in the direction of the ground, which are reflected and intercepted by the receiver when they come across various underground materials. The central unit then creates a wave image (echogram) displayed on the monitor. The most pronounced differences are visible at the point of contact between individual objects (Dobrzański, 2013). The obtained wave image reflects the structure of the geological matter as well as any objects located therein (Karczewski et al., 2011).

When using this method, it is essential to determine as much information as possible that is useful for identifying the areas that could potentially be the place of concealment of the body. The most important are personal sources – testimonies of witnesses or perpetrators (when they cooperate with law enforcement authorities, but are unable to indicate the exact burial site) – however, certain findings can be made e.g. on the basis of monitoring records. Important activities to be carried out prior to using the georadar include determining the geological structure of the ground and estimating the probability of occurrence of other underground infrastructure elements. It is also worth determining the probable degree of decomposition of the remains, as this knowledge may significantly facilitate the interpretation of the echogram (Mazurek, Tomecka-Suchoń, 2013). Appropriate knowledge about the site to be inspected facilitates the selection of appropriate antennas and measurement parameters. The depth and resolution of the measurements is regulated by the frequency range of the transmitting antenna. For example, low-frequency antennas (from 20 MHz to 300 MHz) are used to test deeply embedded lithological layers, but with low accuracy. On the other hand, for finding structures of very small size located at low depths, the antennas with the highest operating frequency (about 2000 MHz) are the most suitable. The most versatile and widely used in forensic archeology are 500 MHz antennas, which allow penetration up to a depth of 5 meters and the detection of small structures. Such properties make it possible, for example, to detect a grave cavity over 1 meter in size, at depths ranging from 1.2 to 18 meters (Konczewski, 2013).

Fig. 4. Sensors & Software FINDAR georadar designed for forensic applications.

The use of the georadar-based method makes it possible to determine, among other things, the presence of underground infrastructure, the existence of empty rooms and underground corridors, as well as damage to the structure of the subsurface layers. If such an observation is confirmed, it is justified to subject the site to further inspections (Stojer-Polańska et al., 2015). Georadar also makes it possible to study horizontal and vertical surfaces, even in small rooms, and thus to penetrate the structure of the walls that may house concreted corpses, secret lockers or bricklayed enclosures. By using this method, assuming the operator's appropriate knowledge and level of experience, the search time and the extent of on-site intervention can be significantly reduced.

The interviews conducted with representatives of the selected Cold Case Units revealed that the georadar has been frequently used at various stages of their investigations. Occasionally, officers are able to precisely determine the place of corpse concealment, and the georadar quickly confirms their version. This was the case with the Gdańsk Cold Case Unit investigators, who attempted to solve the mysterious disappearance of a 40-year-old Rumia resident – Grażyna Ż. After analyzing the case file, the investigators quickly adopted the version that the woman was dead and that her death was probably due to the actions of third parties. Officers started questioning people who claimed that the missing woman would not leave her family home voluntarily, thus abandoning her child. In addition, it became apparent that there had been acts of violence within her family. The next stages of the investigation focused on the husband, who was initially very much involved in the search for his wife, but, after a while, he completely ceased to be interested in her disappearance. Thanks to the cooperation with the District Prosecutor's

Office in Wejherowo, it was possible to initiate an investigation on the basis of Article 189 § 1 of the Penal Code (Journal of Laws of 1997 Vol. 88, item 553, as amended) concerning the imprisonment of the victim. Having an open path to carrying out legal proceedings as well as reliable evidence, the prosecutor issued a decision concerning a search of the property and the house in which the missing person lived together with her spouse. Officers arrived at the site together with an expert in the area of field inspections and forensic experts. The georadar indicated a characteristic anomaly in the backyard garden. It turned out to be the skeleton of the woman sought for. It was found that the perpetrator threw the body into the pit he had dug out and then covered it with lime, concrete slabs and an approximately 15-20 cm thick layer of earth.

Often, geological surveys carried out for forensic purposes do not have the intended effect. It happens that the investigators, on the basis of the collected information, can only very generally indicate the area to be inspected by using the georadar method. The final result may be also influenced by the place and manner in which the corpse was concealed. As Marek Lisowicz points out, if the corpse was buried shallowly and in the area inhabited by forest animals, it can be dug up and eaten by them (http://katowice.wyborcza.pl/katowice/1,35063,20126253,post-10-year-old-prokuratura-i-biegly-ponew-beda-szukac-ciala.html).

In view of the above, the role played by the method of geological imaging of structural anomalies, deriving from archeology, can be considered significant. It is particularly appreciated by law enforcement authorities. However, it should be borne in mind that the successful application of this method is dependent upon the ability to obtain detailed information narrowing the surveyed area. Incidentally, even if the search fails to reveal a corpse in a given place, such a result can provide the X-Files investigators with a clue that may accelerate the process of verifying hypotheses and suggest finding a different solution to the case.

Sonars for searching for and detecting underwater objects

In many cases, the X-Files investigators are faced with cases where no basic evidence – the victim's body – is present (as has already been mentioned). Water reservoirs are often chosen by the perpetrators as the site to conceal corpses or crime objects. By doing so, the offenders believe that they will be able to avoid criminal liability. Indeed, a well-planned crime, involving a body being thrown into the water can pose a significant hurdle for law enforcement authorities. In order to conceal corpses permanently, the perpetrators usually burden them with heavy objects – weights, concrete blocks, stones (http://www.zielona-gora.po.gov.pl/index.php?id=36&ida=3820). The probability of the corpse escaping to the water surface is then close to zero, and, assuming the lack of knowledge about the event, it can only be detected by chance.

In certain situations, water reservoir is re-examined in order to find objects that may be related to the event (e.g. crime tools). Once again, it can be concluded that the key to solving the unexplained riddle lies at the junction of two planes. The first plane is intensive analytical work performed on the case file, supported by operational activities aimed at directing the search towards a specific area, whereas the second is a wide range of modern forensic tools, which are intended to enable or support such a search. Sonars, which represent a group of devices for detecting underwater objects, are useful in this respect. Although these tools have been used for a long time, it is only contemporary systems that are able to detect sunken bodies and small objects.

Generally speaking, the operation of the sonar is based on: "a calculation of the time over which the sound emitted from the transducer reaches the seabed and returns to the receiver located on the hull of the vessel. The time calculated is then used to determine the distance between the transducer and the point of

Fig. 5. Example of a ROV-type vehicle – Video Ray Pro 3 XEGTO with accessories.

reflection of the signal" (Grabiec, 2004, p. 57). The result is processed and displayed on the screen in the form of a continuous line, reproducing the bottom line as well as any object located between the surface and the bottom. Models of sonars used for human body search include side towed sonar, scanning sonar lowered to the bottom and scanning sonar integrated in a submersible vehicle, the latter representing the most innovative group of devices. Remotely Operated Vehicles (ROVs) are unmanned vessels capable of submerging and remaining under the water surface (Fig. 5). The robots function as a platform equipped with a sonar and a camera (or cameras) to visualize the object after it was traced. Due to their mobility, multifunctionality and versatility, these devices are increasingly used in exploratory activities. They can operate in polluted and contaminated water as well as under difficult hydrometeorological conditions, and allow monitoring of effects of underwater works carried out by divers, or even replace divers in performing certain activities. When coupled with an additional mechanical tool, the sonar can help to extract the corpse and minimize contact between the diver and the corpse (Narel, 2015).

As in the case of geological surveys, the use of sonar also requires prior preparation, such as planning the activities and field reconnaissance of the area to be examined. According to Zenon Markowski, a few key issues should be addressed at the outset in order to avoid potential disappointments. One of the most important of these is a reasonable suspicion that the corpse is present the reservoir concerned. When dealing with cold cases, such an assumption is not so obvious, as there is usually no certainty that the search will be successful. When selecting the type of sonar and its optimal parameters, one should acquire as much knowledge as possible about the searched object. Small size and poor ability to reflect acoustic echo make searching difficult, but a particular challenge is to examine the reservoir in order to find any evidence after several or more years of committing a crime. Corpses move with water currents, and unfavorable conditions can accelerate the decomposition processes. Practice has shown that some of the objects accompanying the corpse have better reflective properties towards ultrasonic waves. Therefore, an attempt should be made to determine the last known appearance of the missing person (Narel, 2015).

The planning of the field activities depends on the size of the area to be explored and the characteristics of the reservoir. Such parameters as physical boundaries, wind direction, water level and current directions must be taken into account. Moreover, it is necessary to determine the depth of the reservoir and the topography of the bottom, which will allow for the selection of an appropriate type of device. Working on a flat and muddy bottom, where it is relatively easy to detect the body, will be different than in the case of an uneven bottom covered with rocks, tree trunks and other objects.

In the course of their investigations, the Cold Case Units cooperate with diving squads equipped with specialized equipment used to explore underwater areas. Certainly, such a cooperation is only established when it is necessary to verify a forensic hypothesis or to obtain new evidence. An example of such a case, which resulted in finding a corpse in a water reservoir, is the disappearance of 25-year-old Łukasz Ł. The deceased was last seen at one of the petrol stations in Gniew, where he refueled a car. Initially, the case was handled by officers from regional units, who decided to search the Vistula bottom at the ferry crossing point in Gniew with the help of divers. Due to very poor visibility and high siltiness, the search was unsuccessful. More than three years after the disappearance, the case was taken over by investigators from the X-Files of the X Investigation Department of the Regional Police Headquarters in Gdańsk, who, having familiarized themselves with all the materials collected so far and established cooperation with the Regional Prosecutor's Office in Gdańsk, planned procedural activities, including re-exploration of the previously examined river area with the use of the most modern sonar available. This time, a car covered with a thick layer of mud was found, which could not have been noticed without specialist tooling. The remains of the missing man were found inside the car. Unfortunately, despite numerous hearings held during the course of the investigation, the proceedings were finally discontinued due to the lack of evidence of a criminal offence and inability to confirm any of the hypotheses.

Modern methods of identification of persons

As regards investigations re-opened after years, where the elapsing time is not an ally of law enforcement authorities, any evidence is sought, which is likely to bring the case to a successful conclusion. Of particular relevance is evidence that can be used to confirm a person's identity and to prove with a probability bordering on the certainty that the trace secured at the scene of the event was left by a specific person selected by the police. Biological and dactyloscopic traces are considered to be very valuable because they enable individual identification. Recent developments in forensic genetics and dactyloscopy have been inspiring investigators to re-examine evidence related to cold cases. In particular, in view of the dynamic development of the former discipline, it not surprising that DNA analysis is considered a very reliable method of forensic identification.

The wide range of applications of modern DNA analysis methods leads to the conclusion that the hegemony of genetics in forensics will not end quickly. Currently, experts have a range of various tools at their disposal, which are selected on a case-by-case basis. In addition to STR (Short Tandem Repeat)

markers, also SNP (Single Nucleotide Polimorphism) markers, mitochondrial DNA polymorphism and even markers used to predict external appearance traits or biogeographical origin are being tested. Moreover, research on RNA markers and the degree of DNA methylation is carried out (Branicki, Kupiec, 2017).

It should be remembered, however, that the results of forensic evaluation are significantly influenced by the quality of the material to be tested – this is a "no-exception" principle. In view of the above, reference should be made here to such an important issue as securing forensic traces at the scene of the event. Taking into account the offenses of interest to the X-Files investigators, the borderline is set at the year 1987 (the offenses committed at that time are nearing extinction of liability). The borderline is therefore situated two years before issuing the first genetic expertise in our country and a long time before the dissemination of knowledge about the possibility of identification of a person on the basis of DNA. Still in the early 1990s, forensic technicians did not have sufficient knowledge of all the requirements to be met in order to secure biological material that could, at a later stage, have been subject to genetic identification carried out as part of an expert opinion. The quality and number of secured traces may also have been adversely affected by the lack of due diligence on the part of forensic examiners. According to Piotr Girdwoyń: "There is no perfect crime, there are only imperfect investigators, omissions, oversights, sloppiness" (https://www.wprost.pl/tygodnik/10012576/Zbrodnia-i-kara-Jak-pracuja-policjanci-z-Archiwum-X.html). The issue of handling evidence, both at the stage of on-scene forensic examination (in particular visual inspection) and in the course of subsequent activities, should be seen in a forward-looking perspective, i.e. secured evidence should be usable in the future (if necessary), when new research methods become available. Even if the current forensic identification methods or database resources prove insufficient, the information potential of properly secured and stored material evidence could be exploited years later, at least in the case of some traces, as the passage of time is not always an ally in this respect (Zubańska, 2016).

As has been pointed out several times, the development of science and technology has given forensic tools in the form of databases an influence on criminal proceedings, including re-opened cold cases. As a result, with regard to identification purposes, the implementation of the Automated Fingerprint Identification System (AFIS) in 2000 and the DNA Database seven years later can be considered as breakthroughs. On 23 April 2007, the Polish DNA database was registered in the public register of personal data filing systems kept by GIODO. Within the meaning of the Act of 29 August 1997 on the protection of personal data, the said database is administered by the Commander-in-Chief of the Police (Jurga, Mondzelewski, 2017). This DNA database is located at the Biology Department of the Central Forensic Laboratory of the Police and is maintained on the basis of Article 1 para. 2 subpara. 10 of the Act on Police (Journal of Laws of the General Police Headquarters of 1990, Vol. 30, item 179, as amended) and serves the purpose of matching profiles in the system with those obtained from traces secured during scene examination or linking traces from various scenes. This tool also allows the identification of unidentified bodies and unknown persons, and supports the authorities in the search for missing persons.

Below, the utility of a forensic database is demonstrated by an example of a query submitted by investigators of the Cold Case Unit of the Regional Police Headquarters in Szczecin. In 1999, a woman was raped and killed with particular cruelty in Gryfino. Based on the DNA database search and comparison with the unidentified profile secured in this case (the material was secured from a post-mortem bite on the victim's body), a person registered in 2008 by the District Police Headquarters in Gryfino in connection with the burglary was selected. The person in question turned out to be the victim's neighbor and, as it was later determined, also a killer.

Just as useful as the DNA database is another forensic tool, the above mentioned Automated Fingerprint Identification System (AFIS). When analyzing case file evidence with the help of experts from the police forensic laboratory, the X-Files officers select traces that are suitable for comparison with the database records. AFIS is a non-procedural tool and any results obtained therefrom are of informative value only, however both a positive (referred to as HIT) as well as a negative result determine further actions within the framework of an investigation. Obtaining a positive result often leads to the identification (and, consequently, apprehension) of a person who may be involved in the offense in question. It is up to investigators to decide how the information they obtain is to be used. It certainly needs to be converted into evidence admissible in court (Zubańska, 2016). The above mentioned forensic tool is also worthy of an example. Namely, in 1984, a female resident of Dobre Miasto municipality was murdered. The investigation showed that the cause of death of a woman were, among others, abdominal and chest injuries. Moreover, fingerprints were secured. Despite expeditious investigative activities, the perpetrator was not identified and the investigation was closed. Years later, police officers from the Olsztyn X-Files re-examined materials from the proceedings. They submitted the secured fingerprints to AFIS database and obtained a positive result. Eventually, they were able to identify a person associated with this offense. This has led to a breakthrough in the case, because the officers could focus their activities on the then 47-year-old Zbigniew N. All the proceedings in which this man has

been involved were analysed. It turned out that he had already been convinced of robbery, theft, involvement in a brawl as well as drunk-driving. Police officers had no problem with determining the whereabouts of a man; he was serving a term of imprisonment of one year in the pre-trial detention facility in Olsztyn for road traffic offences. During an interrogation, Zbigniew N. heard the charge and confessed to committing the alleged crime. As a result, he was found guilty and sentenced to 15 years' imprisonment. Thus, justice has reached the perpetrator more than 25 years after the crime was committed.

To sum up the above, it is worth emphasizing that both AFIS system and the DNA database are non-procedural sources of information, however, they have significantly increased the effectiveness of identification of the offenders, including those of interest to the X-Files investigators (Zubańska, 2016).

Conclusions – synergistic activities are the key to success

To conclude the above discussion, it is worth returning to the question asked at the beginning: is the impact of modern technologies on solving undetected cases decisive? The answer cannot be clear, after all, each time the process of reaching the truth progresses differently and depends on many factors, discussed herein. It should be remembered that it is people who analyze evidence, request forensic tests to be carried out as part of the proceedings, issue forensic opinions and determine the direction of activities to be undertaken. Moreover, it is the activities of investigators and experts that lead to the resolution of the case, while modern methods are "only" an attribute in their hands. Some of the discontinued proceedings were re-initiated mainly on the basis of witness evidence. At the same time, modern tools and methods provide significant support to investigators and indirectly influence the direction of their decisions to perform specific activities. At the same time, they are a showcase of the achievements of modern science, setting the limits of its current capabilities. As already mentioned, without their use, it would be difficult to prove the truth, especially several years or decades after the crime was committed. In the context of the adaptation of new methods and techniques for the police X-Files purposes, their usefulness at various stages of the investigation deserves particular attention. For example, when comparing a genetic profile isolated from biological traces secured at the scene with the profiles deposited in the DNA database, obtaining a match can lead to the identification of a person already at the initial stage of the analysis. In turn, georadar or sonar search allow to determine the place where human remains or objects originating from crime are hidden. Finally, the results of certain identification tests confirm the identity of the victim or perpetrator. It should be emphasized once again that during interviews, officers of the Cold Case Units have unanimously identified the use of modern solutions as one of the priority lines of action.

There is no doubt that lawyers should seek support from bridging expertise, while bearing in mind, as J. Gurgul believes, that testimonies and explanations still make up the lion's share of the grounds for the court's ruling (Gurgul, 2012). The above considerations confirm the reflection already expressed that the best results in the form of solved cold cases can be achieved by combining the extremely difficult and arduous work of the X-Files investigators with exploiting the potential of available technologies. What is also relevant is cooperation between forensic technicians, experts and criminologists, and representatives of technical and natural sciences. Therefore, one should not underestimate the role of any of the elements of the process aimed at detecting the perpetrator, but rather strive for continuous professional development of officers (directly or indirectly), as well as enriching the arsenal of forensic means and methods, which broaden the boundaries of knowledge of reality. This in turn leads to the gradual elimination of the so-called "white spots" from forensics. It is important to be aware that the mistakes of judicial authorities, both related to major cases, as well as to those that are seemingly minor and low profile, yet socially onerous, put their reputation at risk. The institution of the X-Files should contribute to the implementation of the *suum cuique* motto (Gurgul, 2012). In other words, no crime should be left unpunished; the perpetrator should be constantly afraid.

Sources of figures:
Figure 1: *authors*
Figure 2: *http://www.archiexpo.co*
Figure 3: *https://aeromind.pl*
Figure 4: *http://www.mansls.com*
Figure 5: *http://topdivingshop.com*

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